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RAW MATERIAL PROCUREMENT ANALYSES AT OLIEBOOMSPOORT ROCK SHELTER AND MWULU'S CAVE (LIMPOPO)

by

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Dissertation

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in

Palaeontology

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Co-supervisors: Dr Zubair Jinnah and Dr Guilhem Mauran

Johannesburg, 11 September 2022

DECLARATION

I declare that this dissertation is my own, unaided work. It is being submitted for the Degree of Master of Science at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

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DPMasia

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(Dineo Puseletso Masia)

11 September 2022

ABSTRACT

The purpose of this study is to determine the provenance of Middle Stone Age lithics, and the procurement strategies employed to obtain them, at Olieboomspoort Rock Shelter (OBP) and Mwulu's Cave. Macroscopic (and stereomicroscopic) analysis, portable X-ray fluorescence, thin section petrography, and Inductive Coupled Plasma Mass Spectrometry are used to achieve this purpose by identifying and comparing the lithics to the geological samples collected from formations around the sites. Quartzite, shale, sandstone, dolerite and quartz lithic raw materials from OBP may have been procured from the Mogalakwena Formation locally and non-locally although the provenance of chert lithics remains unknown. At Mwulu's Cave, quartzite and quartz lithics were possibly made from raw materials procured from local outcrops in the Black Reef Quartzite Formation (BRQF) and chert lithics were possibly made from local or semi-local BRQF raw materials. Duitschland Formation shale raw materials may have been procured semi-locally from Mwulu's Cave. These are preliminary hypotheses on the provenance and procurement of lithics at these sites and more petrography and ICP-MS analyses need to be conducted to verify them.

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Dedicated to my parents

Maud and Cry Masia

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1 INTRODUCTION

This project investigates the relationship between archaeological lithics and geological outcrops around two sites. I aim to determine the provenance of the lithics through raw material analysis in order to question past populations' procurement strategies. The lithics belong to the Middle Stone Age layers at Olieboomspoort Rock Shelter (OBP, Limpopo) and Mwulu's Cave (Limpopo). These sites have chronologies associated with Marine Isotope Stage 6 and 5, respectively, with OBP dated around 150 ka (Val *et al*., 2021) and Mwulu's Cave around 90 ka (Feathers *et al*., 2020). The study areas include outcrops and geological sources within a 30 km distance from OBP and those within a 12 km distance from Mwulu's Cave. To identify the rock types of the lithics and the outcrop samples, petrography and geochemical analyses are applied. From these results, comparisons between lithic and outcrop samples are made in order to determine procurement strategies.

1.1 The Middle Stone Age

The Middle Stone Age (MSA), as defined by Goodwin and van Riet Lowe (1929), is a cultural phase spanning 300 ka to about 40-20 ka (Wadley, 2015). This phase is contemporaneous with a diverse population of hominins in Africa, from archaic species to *Homo sapiens* (Berger *et al*., 2017). South African fossil examples of these species include *Homo naledi* fossils from the Rising Star cave system (335-236 ka; Berger *et al*., 2015) and other hominin artefacts such as a mandible and radius from Cave of Hearths (500-200 ka; Tobias, 1971); a tibia and teeth from Hoedjiespunt (300-200 ka; Buck and Stringer, 2014), and more than 50 remains from Klasies River Main Site (110-80 ka; Rightmire *et al*., 2006; Grine, 2012).

During the MSA, particularly during MIS 5, hominins learned to use and control fire (Schmidt *et al*., 2015), and they transported lithics over vast distances (Porraz *et al*., 2013). This means that they knowingly sourced specific raw materials (Porraz *et al*., 2013) and possessed complex cognition (Wadley, 2013). They had the ability to make natural objects cultural (Val *et al*., 2020) and interacted in social networks across

regions (Soriano *et al*., 2015). According to Porraz *et al*. (2020), these are examples of how new customs emerged independently during this time in southern and northern Africa.

The MSA is represented by the disappearance of large cutting tools, the introduction of prepared core technologies, and the hafting of tools (using compound points and adhesives) (Wadley *et al*., 2009). These novelties are distributed throughout MSA chronology in South Africa.

This project focuses on lithics from sites that were defined as belonging to the Pietersburg Industry (defined in the 1920s by Paterson (Sampson, 1974)). Some researchers still use this terminology (e.g. Lombard *et al*., 2012; Porraz *et al*., 2015), although recently de la Peña *et al*. (2019) and Val *et al*. (2021) contested its use. The Pietersburg Industry was described as occurring in the interior of South Africa and was characterised by hornfels, quartzite and andesite cores, as well as long bifacial points made from local raw materials (Wadley, 2015). In South Africa, these sites include OBP, Mwulu's Cave, Border Cave (Beaumont, 1978), Bushman Rock Shelter (Mason, 1957), Cave of Hearths (Mason, 1988), Wonderkrater (Backwell *et al*., 2014), Rufus Cave, Rooirand, Kalkbank, Steenbokfontein (Wadley *et al*., 2016), and Koedoesrand (Figure 1.1).

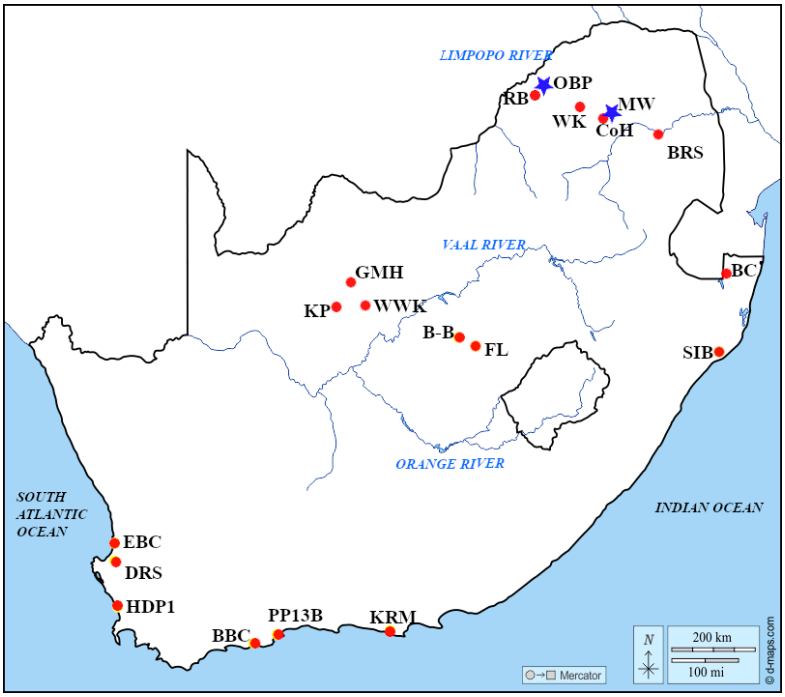

Figure 1.1: Map of South Africa with the locations of Olieboomspoort Rock Shelter and Mwulu's Cave represented by red stars. Other MIS 5 sites indicated by yellow circles include Red Balloon (RB), Wonderwerk (WWK), Elands Bay Cave (EBC), Cave of Hearths (CoH), Bushman Rock Shelter (BRS), Ga-Mohana Hill North Rock Shelter (GMH), Border Cave (BC), Sibudu Cave (SIB), Kathu Pan (KP), Baden-Baden (B-B), Florisbad (FL), Wonderkrater (WK), Klasies River Main site (KRM), Blombos Cave (BBC), Diepkloof Rock Shelter (DRS) and Pinnacle Point Caves (PP13B) (Val *et al*., 2021).

Several technological industries are noted in Africa during the MSA. In South Africa, the transition between the Early Stone Age and the MSA is noted in the Fauresmith Industry (550-300 ka: Chazan, 2015; Wurz, 2013). Examples of sites belonging to this industry include Kathu Pan 1 (Wilkins, 2013) and Wonderwerk Cave (Chazan, 2015). According to Chazan (2015), the Fauresmith is recognised through blades produced from prepared cores and small, rounded bifacial lithics. The Sangoan Industry (242-204 ka) is another old technological industry that occurs in Africa. It spans from northern Africa to southern Africa (Schmid, 2019) at sites like Sai Island in Sudan (Van Peer *et al*., 2003) and Kudu Koppie in South Africa (Kuman *et al*., 2005). The types of tools associated with this industry are bifacial picks, core-axes, denticulates, scrapers, often produced through *Levallois* technologies (McBrearty, 1988). The Still Bay (109 ka; Tribolo *et al*., 2013) and Howiesons Poort (64.8 to 59.5 ka; Wadley, 2013) are also industries noted in South Africa. These are found at sites like Diepkloof Rock Shelter (Porraz *et al*., 2020) and Sibudu Cave (Schmid, 2019).

Occupations at OBP and Mwulu's Cave have been dated to periods coinciding with MIS 6 and 5 respectively. During this time, hominins in South Africa procured local raw materials for lithic production, used *Levallois* and prepared core methods to produce informal tools such as side scrapers, and denticulates (among other tools) (Schmid *et al*., 2016). The MIS 5 has been proposed by Schmid *et al*. (2016) as the transition from triangular blanks to bifacial- and unifacial points (as seen at Bushman Rock Shelter layer '28 and Border Cave).

In South Africa, another example of an archaeological assemblage recorded coinciding with MIS 6 was found at Bundu Farm dating ~394-144 ka (Lombard *et al*., 2013). MIS 5 archaeological assemblages are recorded at sites like Ysterfontein (±132-128ka).

Many other South African sites belong to either both chronological stages or occur continuously from MIS 6 to 5. Examples include Pinnacle Point (~166-160 ka and ~128-110 ka); Duinfontein (~292-125 ka); Wonderwerk (~182-118 ka); and Border Cave (~171-152 ka and ~91-71 ka) (Lombard *et al*., 2013).

1.2 Raw Material Procurement Analysis

Raw material analysis allows us to understand the choices made by hominins to exploit specific raw materials. Through these analyses, we can connect hominin mobility, technologies, choices and social activities to specific places (Clarkson, 2016). Analysing lithics gives us an idea about the material preferences of the hominins who knapped the tools (McHenry and Torrez, 2018). Through material circulation, we can learn about the social and economic networks that existed between populations. These studies look at what material was sourced, from where it was procured, and what this can tell us about the procurement strategies employed at Prehistoric sites.

Here, raw material analysis is used to understand how MSA populations exploited the geological resources available to them. This is investigated through lithological comparison between lithics and geological outcrops around OBP and Mwulu's Cave. This can be done if exploited raw materials were produced from outcrops that can be distinguished by textural or chemical qualities. Through raw material analysis, lithics provide evidence of material selection and transport.

One of the first studies to investigate raw material procurement focussed on Prehistoric behaviours of hominins in the Mediterranean. It was conducted through a comparative analysis between obsidian lithics and regional obsidian outcrops. This information led them to understand Neolithic trade routes and navigation in the area (Dixon *et al*., 1968).

1.2.1 Lithic raw material procurement analyses in southern Africa

A few raw material procurement studies have been conducted in South Africa. An example of a study that is similar to the current project is one conducted by Porraz *et al*. (2020) at Diepkloof Rock Shelter. Raw material procurement analysis was used by Porraz *et al.* (2020) to question technological innovations and behaviours of hominins in the MSA. This was done through Scanning Electron Microscopy coupled to Energy Dispersive X-ray spectrometry (SEM-EDS), X-ray diffractometry (XRD), and macroscopic analyses to analyse lithics from an MIS 5 unit (unit Lynn) at the site. From macroscopic analyses, they identified the lithic rock types as quartzite, quartz, hornfels and other fine-grained materials (Porraz *et al*., 2020). They also found that, from the ochre assemblage, the shale was procured from a geological bed inside the shelter and that the ferricrete was from an unknown source (Dayet *et al*., 2016). From geochemical analyses, they determined that the main raw materials (quartzite, quartz and silcrete) were sourced less than 10 km from the site whereas the finer-grained materials and hornfels were sourced more than 20 km from the shelter (Porraz *et al*., 2020). Through macroscopic and cortical surface analysis they were able to tell that the material was sourced from alluvial terraces in a secondary context (*ex situ*). This means that the primary procurement strategy of the populations who occupied the site during the MIS 5 involved using material that was locally available (Porraz *et al*., 2020). Another point that they made is that because these raw materials are not found in the older Mike stratigraphic unit (only 2% of them were present) but persist throughout the Still Bay and Howiesons Poort, the change in lithic material preference and transport over vast distances was initiated in the MSA (Porraz *et al*., 2020).

Lithic raw material procurement analysis has also been conducted at other South African MSA sites. Examples of these studies include analyses at sites along the Doring and Olifants Rivers (Mackay *et al*., 2022), at Elands Bay Cave (Schmid *et al*., 2016), and at Hoedjiespunt (Will *et al*., 2013). Recently Mackay *et al*. (2022) analysed whether Still Bay foragers used varying materials to knap bifacial points. They also focussed on whether the foragers travelled far to procure these materials, or if local materials were procured. Sites along the Doring River had lithics made from quartzite and those along the Olifants River were made from silcrete. In the East of the Doring River catchment area interbedded layers of shale, quartzite, and sandstone (Bokkeveld Group) were noted. In the West, conglomerates with quartz, chert, quartzite and sandstone pebbles

(Table Mountain Group) were recorded. Silcrete primary sources were noted in both catchment areas. From this information, they conclude that the quartzite used to make bifacial points at sites around the Doring River was procured from the Bokkeveld Group and that the silcrete could have been sourced from five different primary sources (two in the Doring River catchment area and three in the Olifants River catchment area). Based on their findings, they determined that Still Bay foragers indeed travelled far, more than 60 km, to procure raw materials. MSA populations of these sites also used materials available in the catchment area that they occupied. The current study is similar to that of Mackay *et al*. (2022) although more defining methods such as petrography and geochemistry are used.

A study at Elands Bay Cave was carried out to inform on patterns that characterise early hominin behaviours and organisation (Schmid *et al*., 2016). The cave was formed in the quartzitic sandstones of the Table Mountain Group. Conglomerates from the Table Mountain Group are also present around the site (Schmid *et al*., 2016). The archaeological assemblage at the cave is recorded as being composed of coarse- and fine-grained quartzite, quartz, silcrete, and chert. From field surveys and their technological analysis, they found that the early hominins at Elands Bay Cave primarily procured rocks for lithics around the site (98.7% of these lithics being of quartzite). They collected coarse-grained quartzite from inside the cave and raw materials like fine-grained quartzite (pebbles in the conglomerate) and quartz were procured locally (less than 5 km from the cave) (Schmid *et al*., 2016). Silcrete and chert were probably procured semi-locally (5-20 km from the cave) at the Redelinghuys outcrop. This information tells us that procurement of specific rock types was not prioritised, but they preferred quartzite over the equally available quartz (Schmid *et al*., 2016).

At Hoedjiespunt 1 in the Western Cape (South Africa), a study was conducted to reconstruct early hominin activities (Will *et al*., 2013). One of the objectives of the study was to analyse the MSA lithic assemblage in order to shed light on raw material procurement at the site. The principal raw materials identified in the lithic assemblage included quartz, a porphyritic igneous rock with quartz phenocrysts, calcrete, silcrete, and other rock types which occur less frequently (greywacke, hornfels, granite, cryptocrystalline silicates, sandstone, shale and quartzite) (Will *et al*., 2013). Based on cortical analysis and petrography, they discovered that quartz, calcrete and the

porphyritic igneous raw materials were procured locally from primary (directly from the outcrop; *in situ*) and secondary contexts (from depositional environments, not directly from the outcrop; *ex situ*). Using knowledge on regional geology, they concluded that silcrete and 'other' raw materials were procured non-locally. Silcrete was also discovered to have been procured in primary context based on the presence of a similar cortex on outcrops 10-30 km from the site (Will *et al*., 2013).

Raw material studies in South Africa also focus on ochre provenance. Ochre characterisation and provenance studies have been conducted at Nelson Bay Cave (Bernatchez, 2007), Pinnacle Point 5–6 North (McGrath *et al*., 2022), and Diepkloof Rock Shelter (Dayet *et al*., 2016). These studies have demonstrated that ochre at these sites was mainly collected locally with only a few non-local raw materials of possible high value for past populations being noted.

1.2.2 Other lithic raw procurement analyses

In Africa, raw material procurement analyses have been conducted at Olduvai Gorge (Favreau *et al*., 2020), in the Eastern Turkana basin (Braun *et al*., 2009), in the Olorgesailie basin (Brooks *et al*., 2018), as well as at the White Paintings Shelter in Botswana (Nash *et al*., 2013) among others. Similar to the present project, these studies were conducted to determine provenance and procurement strategies at the abovementioned sites.

Favreau *et al*. (2020) conducted a raw material procurement analysis study in the Olduvai Gorge. The study was aimed at determining whether the geological sources of Stone Age stone tools could be found based on their unique mineralogy. They characterised 62 rock samples from 10 outcrops in the Greater Olduvai region using thin section petrography, Electron Probe Microanalysis, as well as SEM coupled with energy dispersive X-ray fluorescence spectrometry (ED-XRF). Their research proves that mineralogical analysis can be a viable technique to source lithic artefacts. It also shows that outcrops of quartzite can be contrasted from one another. This is possible because close to the Olduvai Gorge some outcrops that look macroscopically similar can be differentiated by specific mineralogical characteristics (Favreau *et al*., 2020). They also

found green quartzite in the Olduvai Gorge. Some of the lithics analysed in this study include those made of green quartzite. The green colour of the quartzite lithics is obtained through fuchsite pigmentation and fuchsite is found in quartzites in a neighbouring region- Naibor Soit Ndogo. This means that some sort of transport must have taken place for that green quartzite to be found as a lithic in the Olduvai Gorge. Either the quartzite was procured in Naibor Soit Ndogo or from an unknown outcrop, or the finished tool was transported to the Olduvai Gorge (Favreau *et al*., 2020).

Braun *et al*. (2009) analysed raw material provenance concerning stone availability in the Koobi Fora Formation (Eastern Turkana basin). They used ED-XRF to analyse the trace elements in Oldowan stone tools (basaltic and pantelleritic flakes) found in the area and their source rocks. They concluded that the early hominins procured rocks for lithics along two major river systems that were active in the area during the Plio-Pleistocene (Braun *et al*., 2009).

A raw material analysis was conducted at early MSA sites in the Olorgesailie basin in southern Kenya (Brooks *et al*., 2018). It was noted that obsidian was used to make archaeological artefacts at BOK (Locality B) sites in the Olorgesailie region. They performed portable X-ray Fluorescence Spectrometry and neutron activation analyses on 688 obsidian artefacts from BOK-2 and BOK-4 to find their provenance. From these analyses, they found that 78% of lithics were made from raw materials procured at seven sources 25-50 km from the BOK sites (Brooks *et al*., 2018).

Nash *et al*. (2013) performed geochemical analyses on MSA waste flakes from the White Paintings Shelter. Major and trace elements of lithics and outcrop samples from around the site were analysed through inductively coupled plasma mass spectrometry (ICP-MS) and inductively coupled plasma atomic emission spectrometry (ICP-AES). From these analyses, it seems that instead of procuring silcrete from the Okavango River and the Xaudum Valley, early hominins travelled over 220 km to collect it from Lake Ngami and the Boteti River south of the Okavango Delta (Nash *et al*., 2013). The hominins at the White Paintings Shelter Used Lake Ngami and the Boteti River silcrete throughout the 50 000 years of MSA occupation at the site. This finding suggests that the Lake Ngami and Boteti River silcrete was preferred. It also suggests that early

hominins at the White Paintings Shelter followed a specific procurement strategy to obtain these silcrete raw materials (Nash *et al*., 2013).

1.2.3 Characterising and Defining Archaeological Quartzite

The most abundant raw material at both OBP and Mwulu's Cave is quartzite. For this reason, I present previous studies that performed analyses on quartzite.

Prieto *et al*. (2019) studied the lithics from El Arteu and El Habario in northern Spain to determine the characteristics of quartzite based on petrogenesis. This was done through petrographic analysis (qualitative and quantitative) and XRF.

The term 'quartzite' has been used incorrectly in some archaeological studies. It is important to resolve this issue because without a unanimous definition for quartzite, there is a continued loss of information and a bias in understanding procurement strategies. Prieto *et al*. (2019) overcame this issue through the petrographic characterisation of quartzite. This is important especially when quartzite is one of the most abundant raw materials used to knap tools (Prieto *et al*., 2019). Extensive studies on obsidian and flint raw material procurement analyses have been conducted but only a few on quartzite. In the Cantabrian region (Spain) a study of quartzite has been attempted before but only on a macroscopic scale and not through petrographic means (Alonso *et al*., 2013, as mentioned by Prieto *et al*. (2019)). In 2017, Sunyer *et al*. characterised quartzite according to petrographic characteristics such as grain size, colour, inclusions, foliation, and alterations of the matrix. Prieto *et al*. (2019) used quartzite petrogenesis criteria by authors such as Hirth *et al*. (2001), Folk (1980) and Stipp *et al*. (2010) to characterise quartzite. First, they characterised quartz grains according to the following criteria:

- Detrital quartz grains;
- Grains with concave-convex grain boundaries;
- Undulose extinction in quartz grains;
- Regrowth of quartz syntaxial cement;

- Serrated boundaries or stylolites;
- Presence of Böhm lamellae;
- Presence of recrystallized grains;

The second method they used to define quartzite was the metric characterisation of size, orientation and shape through digital image processing (Manzano *et al*., 2005 as mentioned by Prieto *et al*. (2019)).

Lastly, mineralogical characterisation according to criteria described by Yardley *et al*. (1997) and Perkins and Henke (2002; mentioned by Prieto *et al.*, 2019) was conducted. After obtaining petrographic results, the quartzites were grouped by relating petrographic characteristics to petrogenesis based on geological studies (Folk, 1980; Howard, 2005). From this analysis, six quartzite types were found and characterised as sedimentary, orthoquartzite or metamorphic (Figure 1.2) (Prieto *et al*., 2019).

In my current study, quartzite will be classified based on Howard (2005) as a metamorphosed, quartz-rich rock that fractures through grains and cement, and not around them. Microscopically, it is polycrystalline and shows interlocking crystals with less than 1% intergranular porosity (Howard, 2005). In contrast to quartzite, sandstone is a sedimentary rock composed of sand-sized grains (predominantly quartz, feldspars, and rock fragmemts) surrounded by matrix in the interstitial spaces around them (Boggs, 2009). It fractues around grains and not through them. Shales are defined as siliciclastic sedimentary rocks that are very fine silt grained and are predominantly composed of clay minerals, micas, quartz, and feldspars (Boggs, 2009). Quartz, is a monocrystalline mineral that can be found in veins or as pebbles in conglomerates. Dolerite is a basaltic igneous rock composed of fine to medium sand sized grains. It is usually composed of pyroxene, feldspars, olivine, and opaque minerals (Mckenzie *et al.*, 2017). Chert is a very dense, fine-grained rock composed of silica in the form of mineral quartz (Boggs, 2009).

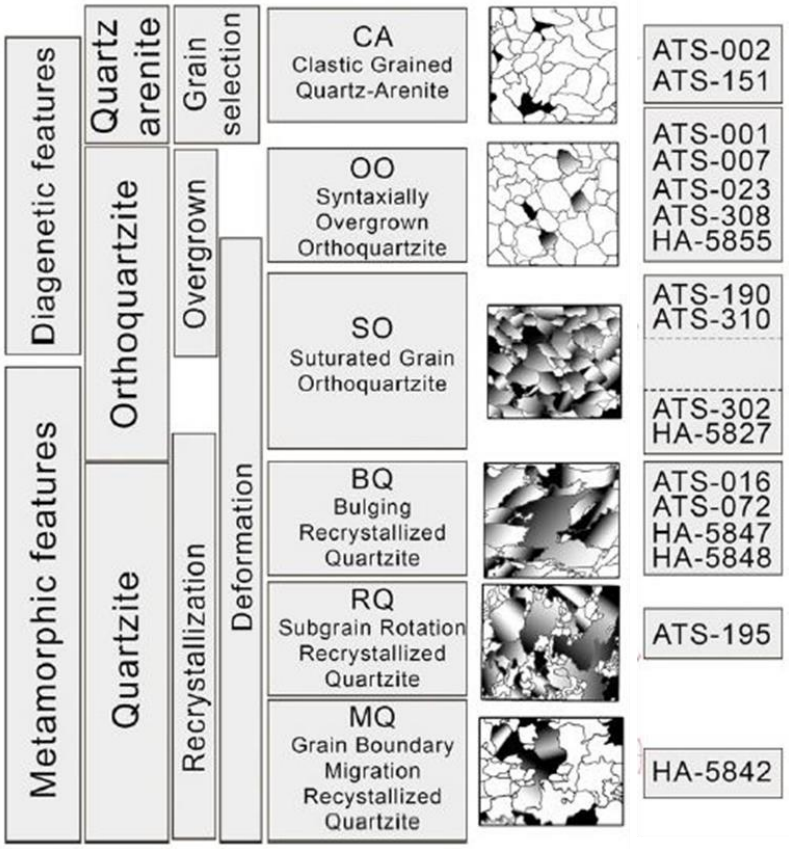

Figure 1.2: Schematic representation of defined quartz-rich rock types (modified from Prieto *et al*., 2019).

1.3 Geographic and Archaeological background of the sites

1.3.1 Olieboomspoort Rock Shelter

OBP is a long and narrow shelter at the base of an almost vertical, red sandstone cliff (Figure 1.3). This cliff is found in a valley in the jagged Waterberg Mountain Range (Figure 1.4), northern Limpopo (23˚52'42" S; 27˚38' 17" E) (Val *et al*., 2021). The slope across the area is described as dipping gently to the north, although large expanses between mountains are relatively flat. OBP is located a few metres from the perennial Rietspruit River. The site formed through weathering of the underlying bedrock and erosion of the roof and walls as a result of fluvial activity by the Rietspruit River (Val *et al*., 2021). Vegetation around the site belongs to the savanna biome. There are C_4 grasses, savanna trees, and Bushveld fauna close to OBP.

An Acheulean to Later Stone Age occupation history is documented at OBP (van der Ryst, 2007). The lithic raw materials identified in the first study at this site are quartzite, quartz, hornfels, and dolerite (van der Ryst, 2007). Felsites, mudrocks, and chalcedony have also been identified as raw materials through previous studies. Other findings at the site include rock art, faunal remains, pollen, and phytoliths (Val *et al*., 2021).

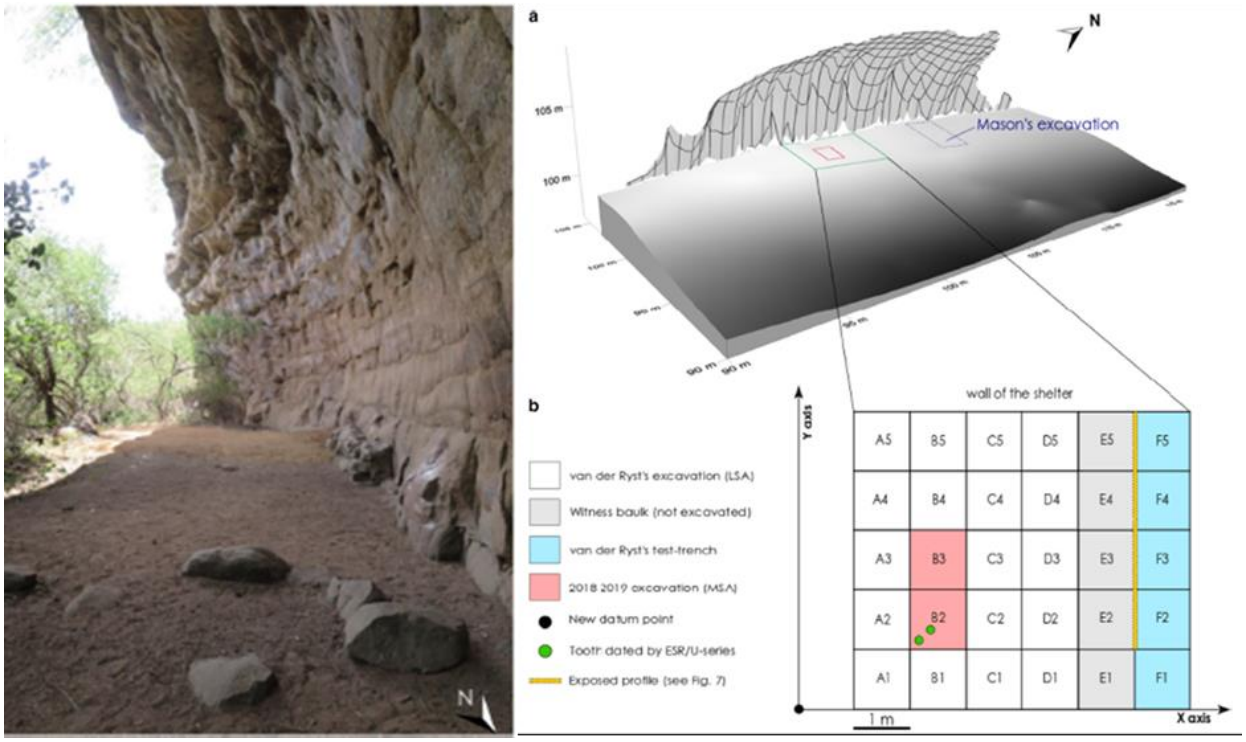

Figure 1.3: Left: North view of the site before the site was reopened by Val *et al*. (2021). Right: Image showing positions of all excavations and associated information. Figure from Val *et al*. (2021).

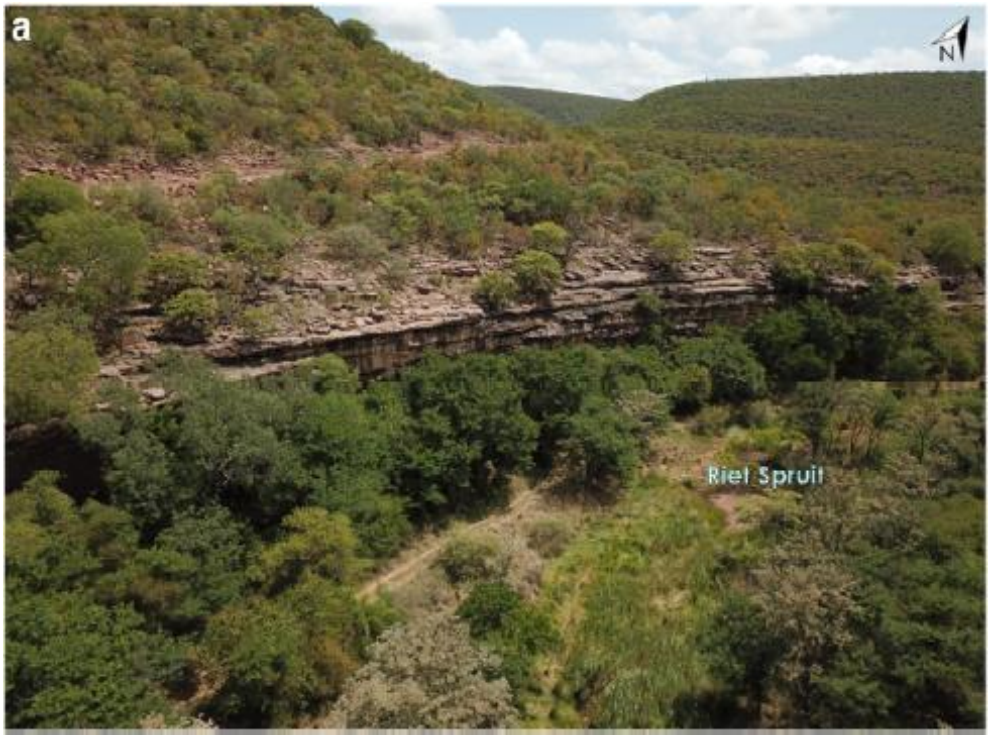

Figure 1.4: Drone image showing vegetation and of the red sandstone cliff (picture courtesy of S. Küsel). Picture from Val *et al*. (2021).

Site Formation Hypothesis

OBP has been reworked by geogenic, biochemical, biogenic and anthropogenic processes. These processes affect OBP due to its size, its open nature, its proximity to a river, and its position in the Mogalakwena Formation (Val *et al*., 2021). These processes are elaborated in order of appearance below.

The Riet Spruit tributary has eroded the quartzites of the Mogalakwena Formation along its cut bank. Gradual weathering has also eroded finer shale material at bedding contacts, depositing angular concave quartzite clasts at the site. These same processes have caused the breakdown of the shelter's roof and walls, depositing fluvial particles and cobbles. Ultimately, a calcified talus formed from this material (Val *et al*., 2021).

In terms of biochemical processes, organic preservation at the site has been affected by the excrement of animals like baboons and hyraxes. Anthropogenic chemical effects from cooking and burning material have also disturbed organic preservation (Val *et al*., 2021). Biogenic and anthropogenic processes like trampling, bioturbation and

burrowing, as well as mechanical accumulation and modification of material by hominins and animals, has affected archaeological material at the site (Val *et al*., 2021).

History of Excavations

OBP has had three main archaeological excavation campaigns since it was discovered by Mason in the 1950s. He conducted the first campaign in 1954, providing initial descriptions of lithic artefacts at the site. A 3.5 m long test trench was dug in spits because the shelter lacked a coherent stratigraphy. This method of excavation continued until what he believed to be the bedrock at 2 m depth (Mason, 1962). This campaign yielded a vast lithic assemblage of over 1495 lithics, 145 of which are cores. Preliminary analyses identify the lithic raw materials as quartzite, quartz, felsite, mudstone, chalcedony and other cryptocrystalline silicates (Val *et al*., 2021). No bone artefacts were excavated, an occurrence Mason (1962) attributes to the ubiquity of rock supply in the area.

In 1997, van der Ryst excavated at OBP to analyse the Holocene layers. Two excavations took place over more than six campaigns. The first was a 1 m x 5 m x 2 m test trench dug to define a general stratigraphy at the site. This was not fulfilled because van der Ryst (2007) could not establish a defined stratigraphy. The second 20 m² excavation (1 m from the test trench) was dug in 5 cm spits until the contact between the Middle Stone Age and the Later Stone Age (1 m deep). This was done to explore Later Stone Age occupations and to recover additional archaeological artefacts from the site (van der Ryst, 2007).

Recently, Val *et al*. (2021) excavated 30 *décapages* in two sedimentary units at OBP using the same square numbering strategy. This excavation had three main objectives. The first was to reopen van der Ryst's principal excavation. The second objective was to see if a more extensive excavation was necessary. The final objective was to exhume van der Ryst's test trench for dating, and for archaeo-botanical and geo-archaeological purposes (Val *et al*., 2021).

Archaeological deposit and stratigraphy

The archaeological sequence at OBP was initially divided into four chrono-cultural beds by Mason (1962) and van der Ryst (2007). The first (Bed 1) overlies the mentioned bedrock and the fourth (Bed 4) is the surface layer. Bed 1 is represented by Early Stone Age, possibly Acheulean, artefacts as recorded by both Mason (1962) and van der Ryst (2007). Mason (1962) exhumed bifaces that belong to the later Acheulean, while van der Ryst (2007) exhumed a sandstone handaxe and cleaver from Bed 1. Bed 2, which represents the MSA, was considered the middle of the Pietersburg Industry by Mason (1962). Bed 3 and 4 are the younger constituents at the top of the archaeological sequence. Together these two beds are only 1 m thick with Bed 3 being the thicker layer and Bed 4 representing Iron Age occupation (Val *et al*., 2021).

Val *et al*. (2021) excavated 20 *décapages* in the Grey-Sand unit (GS) and 10 *décapages* in the Yellow-Reddish Sand unit (YRS) at OBP. The GS unit is comprised of a soft grey matrix with medium to coarse clasts whereas the YRS is comprised of coarse, red, clast-supported sediment (less than 15% matrix). They provide a detailed description of the archaeological sequence. The beds have been grouped into two sedimentary units, namely the Upper unit and the Lower unit. The Upper unit (Bed 3 and 4) is separated from the Lower unit by a sharp unconformity, suggesting an erosive event or a pause in deposition (Val *et al*., 2021). The upper surface of the Upper unit has been eroded and overlies matrix-supported, sandy and silty, stratified and graded strata. The unit is slightly cross-bedded with well-sorted sediment in which a few disseminated, angular to sub-rounded clasts are noted (Val *et al*., 2021). Geogenic, anthropogenic, and chemical processes are evident through the deformation of strata; the presence of faecal matter, roots, ash, coal and rubified sediments; as well as calcite precipitation on some artefacts (Val *et al*., 2021). Unlike the Upper unit, the Lower unit contains fresh artefacts in its upper layers. It does, however, have a sandy to silty sediment nature although the clasts are poorly sorted. These clasts are of varying shapes and sizes. They are large sub-rounded cobbles and angular blocks and boulders near the talus. These become small-medium, angular to sub-rounded clasts towards the centre and eastern regions of the shelter (Val *et al*., 2021). Clasts that have undergone calcification and water saturation were noted at the talus and in the middle layers of this unit. These clasts are oriented in

a planar fabric which slopes W-E before the dripline and E-W towards the shelter wall. At the very bottom, clasts-supported layers that were affected by chemical and mechanical processes bear calcified artefacts and sediments (Val *et al*., 2021). Val *et al*. (2021) uncovered MSA artefacts below the 'bedrock' as noted by Mason (1962) and van der Ryst (2007). Based on this finding, they suggest that the true bedrock may lie a further 1m deeper than previously noted.

Dating

The Val *et al.* (2021) excavation campaigns unearthed teeth from the GS layers (*décapage* 11 and 13) for the purpose of dating through Uranium Series and Electron Spin Resonance techniques. From these methods, they found that the teeth dated around 150 ka, placing the site in Marine Isotope Stage 6 (191 ka to 130 ka) (Val *et al*., 2021).

1.3.2 Mwulu's Cave

Mwulu's Cave is located on a quartzite cliff at the top of one of the Makapansberg Mountains in Mokopane. It is situated 30 m below an overhanging quartzite ledge and 15 m above the base of a north-facing cliff in a mountain pass (de la Peña *et al.*, 2019). The cave is found after a steep, rocky, and heavily vegetated mountain pass (which is known in the area as 'Monkey Pass') above a vertical and narrow climbable path (Figure 1.5). The valley lies right below the cave and the flat plains are seen at a distance. The abundant vegetation in this region predominantly belongs to the savanna biome (Polokwane Plateau Bushveld and Mamabolo Mountain Bushveld) (Rutherford *et al.*, 2006). The savanna biome in this area is represented by small trees, shrubs and succulents on the hills and mountains, and sparse trees and C_4 grasses across the high-lying plains (Rutherford *et al.*, 2006). The raw materials represented in the lithic assemblage at Mwulu's Cave include quartzite, quartz, and chert according to preliminary analyses (de la Peña *et al*., 2019). There are, however, other raw materials that still need to be identified from the lithics collected at the site. Technologically, *Levallois* flakes, flake fragments and blades dominate in this assemblage. Documented

is also a low amount of retouched material such as side-scrapers, notches, denticulates and unifacial points. No faunal remains have been preserved (de la Peña *et al.,* 2019).

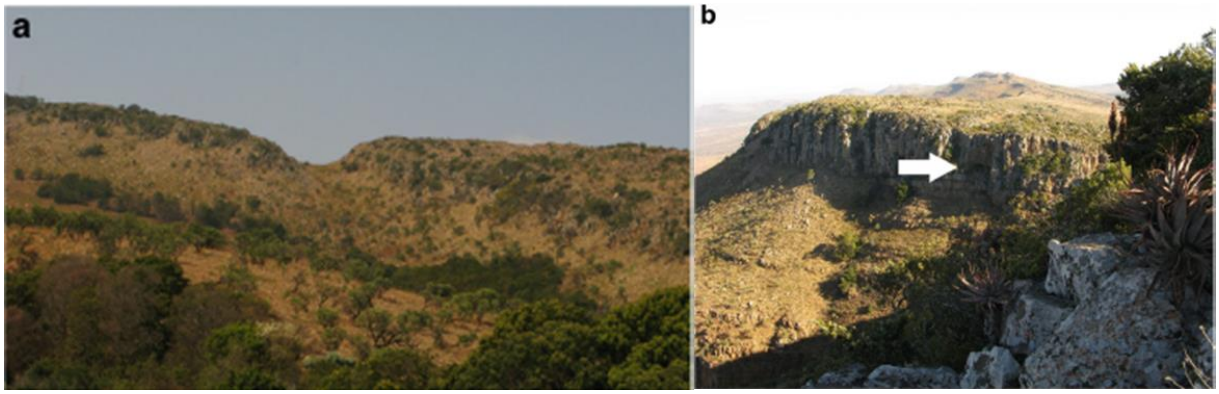

Figure 1.5: a) A picture of Monkey Pass and b) Mwulu's Cave (de la Peña *et al.,* 2019).

Site Formation Hypothesis

Mwulu's Cave is positioned 5 m below two diverging joints in the cliff (A: Figure 1.6). The cave probably formed as a result of the collapse of quartzite (de la Peña *et al*., 2019).). This collapse took place in response to the NE-SW fracturing that formed the steep fault-controlled valley and cliff complex (Maguire, 2009). The breakdown and expansion of the cave are caused by vertical joints in the walls and the roof. It is also caused by the percolation of fluids throughout the cave's expanse (de la Peña *et al*., 2019). The floor of the cave is littered with quartzite boulders (B: Figure 1.6).



Figure 1.6: Left: Photo of two diverging joints above the roof of the cave (courtesy of Dr Zubair Jinnah). Right: View of the interior of the cave. It extends 14 m into the cliff and its entrance is 8 m wide (de la Peña *et al.*, 2019).

History of Excavations

Mwulu's Cave was given its name by Maguire after an elderly hermit called Moholo who lived in the cave in the 1800s (de la Peña *et al*., 2019). The people of the area still refer to the site as 'Moholo' to this day, although the name that has passed to the scientific literature is Mwulu. Since the cave was found, it was excavated over three campaigns.

In 1947, Tobias excavated the cave but left very little information on its location and the spatial data of the findings during his excavation. However, it is known that he used Malan's excavation method (Malan; Cooke; and Wells, 1945), to establish a grid. He used spits to excavate half of the cave's deposits and defined a stratigraphy until the bedrock (de la Peña *et al*., 2019).

De la Peña *et al*. (2019) excavated the site in two different campaigns in 2017.

Archaeological Deposit and Stratigraphy

P.V Tobias excavated the site in 1947 and documented the stratigraphy in 5 layers. These include (from youngest to oldest) 1) the Ash and Sand 3 layer overlain by surface rubble, 2) the Red Sand layer, 3) the Ash and Sand 2 layer, 4) the Red Sand layer, and

finally 5) the Ash and Sand 1 layer (Tobias, 1949). According to Tobias (1949), only the Ash and Sand layers offered archaeological lithic material.

After the de la Peña and colleagues (2019) excavation campaigns, a few major findings concerning site stratigraphy were noted. Stratigraphic units at the site were established before excavations. These units were determined based on colour, content, texture, structure, and clast fabric. They lack clearly visible internal stratigraphy and are very similar to those recorded by Tobias (1954) (Figure 1.7). The only conformable contact that was noted is between stratigraphic layers 1 and 2 (de la Peña *et al*., 2019). Unconsolidated and structureless sediments with sandy to loam textures have been described at the site. Within them, aeolian and autogenic sands (produced by changes in the delta lobe that are controlled by 'internal' processes, e.g. depositional slopes) with ash, organic and faecal material, moisture, and lithics are noted. The colour of the sediments ranges from pale grey to dark brown, and red-brown (de la Peña *et al*., 2019). It is proposed by de la Peña *et al*. (2019) that instead of using sedimentology to divide units, divisions should be based on the archaeologically excavated layers. This produces three main archaeological units based on their lithic spatial statistical analyses. They are the Uppermost Unit 1 (Tobias' Ash and Sand Layer 3), the Middle Unit 2 (Tobias' Red Sand Layer), and the Lower Unit 3, 4 and 5 (Tobias' Ash and Sand Layer 2 and 3 and the Red Sand Layer between them) (de la Peña *et al*., 2019).

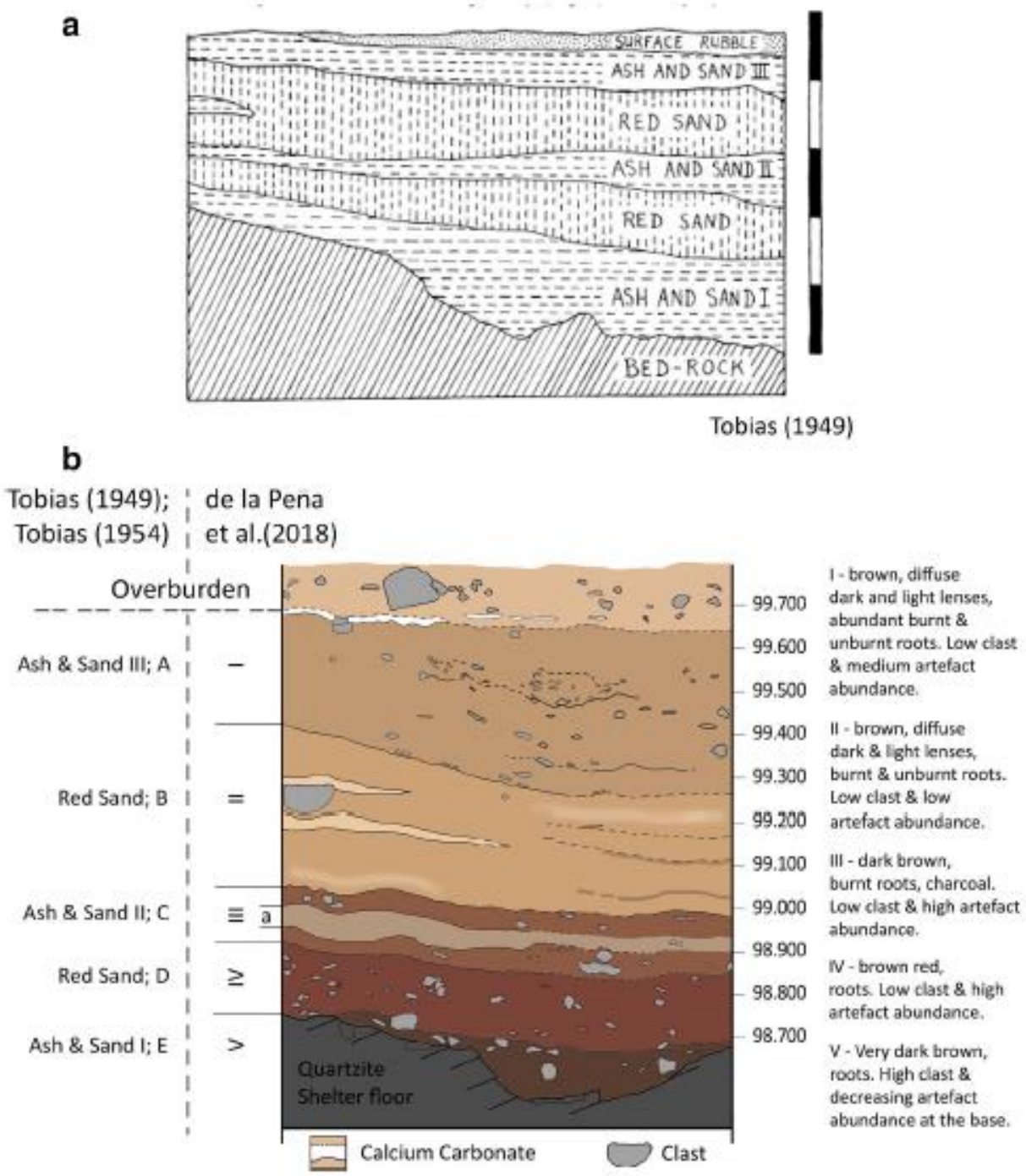

Figure 1.7: Image shows a) Tobias' stratigraphic sequence and b) the de la Peña *et al.* (2019) stratigraphic sequence with depths on the right vertical axis (total station-derived). The left vertical axis shows Tobias' stratigraphic divisions and nomenclature (1949, 1954) and the units identified in the field in 2017 (I–V) (de la Peña *et al.*, 2019).

Dating

Mwulu's Cave was attributed to the Pietersburg Industry by Tobias (1949) and dates back to around 90 ka based on luminescence dating of feldspar lithics (Feathers *et al*., 2020).

1.4 Aims and Objectives

This project focuses on the raw material provenance and procurement analysis of lithic assemblages at OBP and Mwulu's Cave. The aim is to find the provenance of the lithics and to determine the procurement strategies of hominins at OBP and Mwulu's Cave.

The objectives of the project are to identify the rocks used to make stone tools at the sites through petrographic and geochemical analyses. This information is linked to the regional geology of the area. Petrography (stereomicroscopic analysis and thin sections) is used to investigate visual qualities that distinguish the rock types. Elemental analyses (X-ray fluorescence and Induced Coupled Plasma Mass Spectrometry) are used to group materials according to chemical signatures. Geological maps are consulted for locating outcrops and gauging the regional geology around the sites.

Relating the lithics to the regional geology will suggest potential outcrops that were exploited in the MSA.

1.5 Hypothesis

Hominins at OBP and Mwulu's Cave had a local procurement strategy when collecting raw materials for lithic production. They often sourced readily available raw materials close to their sites, similar to hominins at other MSA sites.

2 GEOLOGY OF STUDY AREAS

2.1 Olieboomspoort Rock Shelter Associated Geology

Olieboomspoort Rock Shelter lies at the base of a vertical cliff made of red sandstone between two mountains in the Waterberg Mountain Range. The mountains look jagged due to the persistence of conglomerate/ pebble lag strata that are not easily weathered. The slope across this area dips gently to the north and large expanses between mountains are relatively flat. OBP is located virtually on the bend of the perennial Riet Spruit river channel and is surrounded by abundant vegetation (Figure 1.4).

The shelter is located in the Mogalakwena Formation of the Waterberg Group (Figure 2.1). The stratigraphy and lithology, as well as important geochemical information, associated with the region, are described below.

2.1.1 The Waterberg Group

The Waterberg Group is located in the Waterberg Main Basin (Figure 2.2) in the NNW of South Africa. This basin is fault-controlled and bounded by the Melinda (Palala) fault zone in the north and the Thabazimbi-Murchison Lineament in the south (Eriksson *et al*., 2008). The Waterberg Group is a clastic sedimentary succession that was deposited between 1.95 and 1.7 Ga in the Waterberg Main Basin, in the Kaapvaal Craton (Eriksson *et al.*, 2000; Barker *et al*., 2006). Rocks of the Waterberg Group received sediment from the erosion of the Limpopo Belt (Corcoran *et al*., 2013).

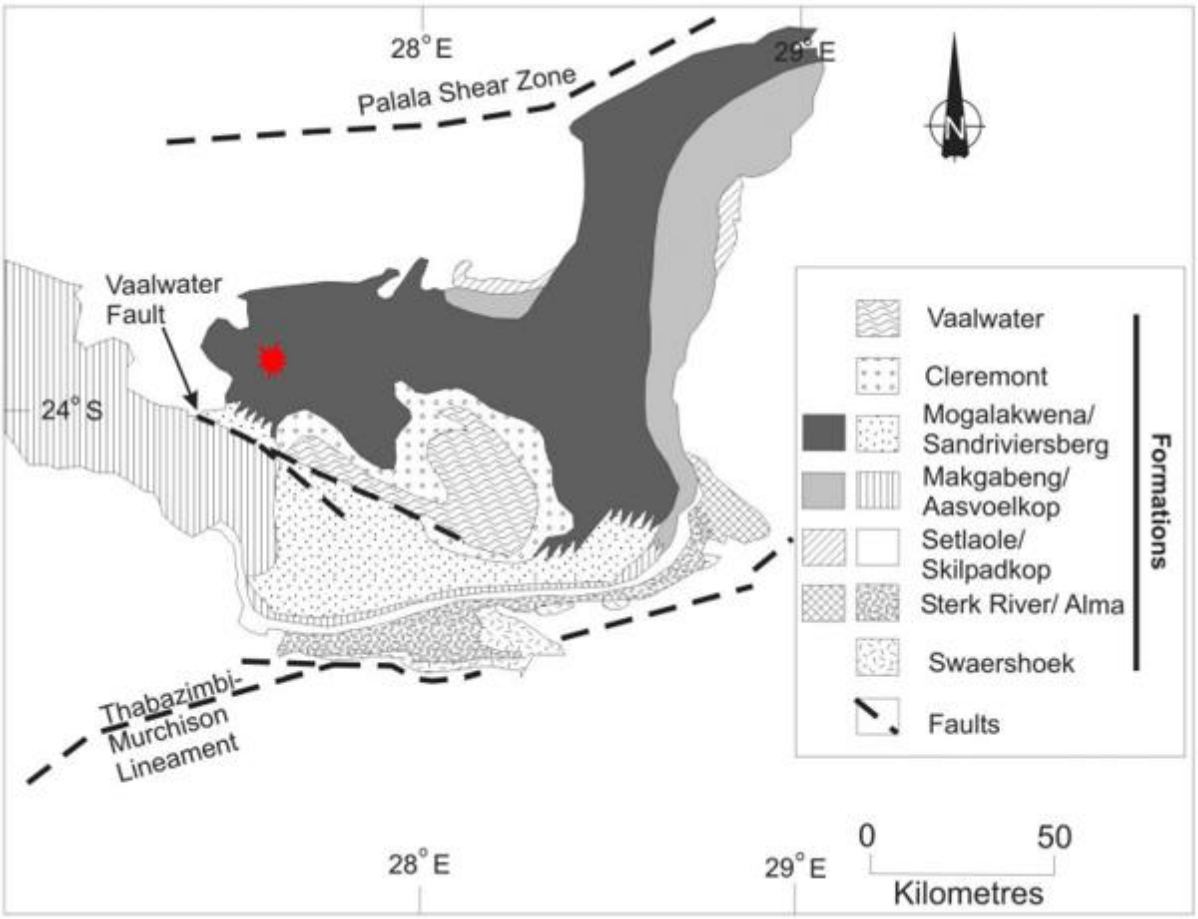

Figure 2.1: Geological sketch map of the Waterberg Group in the Waterberg Main Basin showing the Melinda (Palala) fault zone, the Vaalwater fault, and the Thabazimbi-Murchison Lineament. Formations of the Waterberg Group are represented according to the legend. Olieboomspoort Rock Shelter is represented by the red star. (Eriksson *et al.*, 2008).

It consists of eleven formations (Figure 2.2; Eriksson *et al*., 2008). In this project, formations in the NNE to the centre of the Waterberg Main Basin are briefly discussed and only the Mogalakwena Formation is discussed in detail. These, from oldest to youngest, are the Blouberg Formation, the Setlaole Formation, the Makgabeng Formation, the Mogalakwena Formation, and the youngest Cleremont and Vaalwater Formations (Eriksson *et al*., 2008).

1. The Blouberg Formation is made of 1400 m of mineralogically and texturally immature sandstones and conglomerates (Eriksson *et al*., 2008).

2. The 450 m thick Setlaole Formation is located in the NE of the Waterberg Main Basin and has a lithostratigraphy consisting of arkose- and granule-rich sandstones and conglomerates. Basal tuffs are also noted (Eriksson *et al*., 2008).
3. In the NE of the basin, the 800 m thick Makgabeng Formation conformably overlies the Setlaole Formation. It is characterised by palaeodesert deposits (palaeodune sediments with wadi-fluvial, interdune, and saline pan sediments) (Eriksson *et al*., 2008).
4. The Mogalakwena Formation, which will be discussed in further detail, is a 1250 m thick unit on the NE side of the Vaalwater fault. It consists of sandstones and conglomerates (Eriksson *et al*., 2008).
5. The youngest Cleremont and Vaalwater Formations are found in the centre of the Waterberg Main Basin and have mature sandstones (Eriksson *et al.*, 2008).

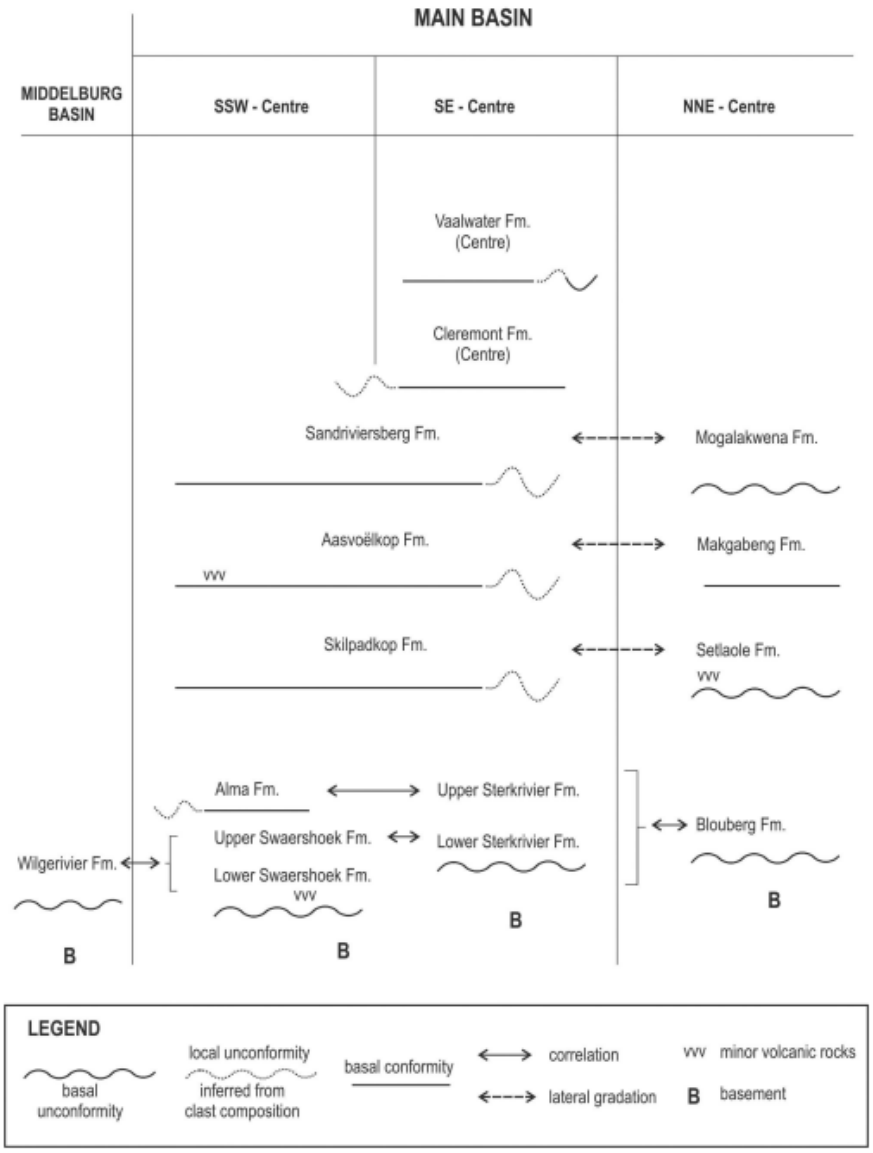

Figure 2.2 The stratigraphic subdivision of the Waterberg Group shows the formations in different areas of the Main Basin. The inferred correlations and contacts are also shown (modified after Eriksson *et al.* (2006)).

2.1.2 The Mogalakwena Formation

The Mogalakwena Formation is comprised of well-sorted red/purple-brown granular/coarse-grained sandstones and quartz-conglomerates (1.9 to 1.7 billion years old (Eriksson *et al.*, 2000)) that dip gently to the north and are interbedded with

micaceous shales (Tickell, 1975; Brandl, 1996). It is unconformably deposited on the Makgabeng Formation and the steeply dipping Blouberg Formation in the north (Corcoran *et al*., 2013). It has also been noted that dolerite dykes (1.92-1.87 Ga: Corcoran *et al*., 2013), that are located south of the Eenzaamheid Fault, are present in the Mogalakwena Formation although they may be difficult to see due to extensive weathering (Fourie *et al*., 2014). The brown sandstones are quartz-rich (Figure 2.3). Tickell (1975) notes quartz wackes and lithic wackes; Callaghan (1987) notes litharenites and sublitharenites; Bumby (2007) notes sandstones with less than 50% quartz in them. They are composed of medium to granule, sub-angular to sub-rounded grains in fine sericite and coarse muscovite matrix (Tickell, 1975; Corcoran et al., 2013). Carbonate and silica cement is also common. The grains in the sandstones are upward fining and a low-angle lamination is noted (Corcoran *et al*., 2013). The conglomerate lithofacies show a variation from massive to planar and trough crossbedding and include well-rounded quartz and quartzite pebbles (3-10 cm) (Tickell, 1975; Eriksson *et al*., 2008; Corcoran *et al*., 2013). Arenite and chert account for over 90% of lithic fragments although minor siliceous gneiss fragments are also noted (Corcoran *et al*., 2013). Eriksson *et al*. (2008) summarise the sandstones as significantly variable with textural and mineralogical immaturity. The lithostratigraphy of the Waterberg Group is shown in Table 2.1.

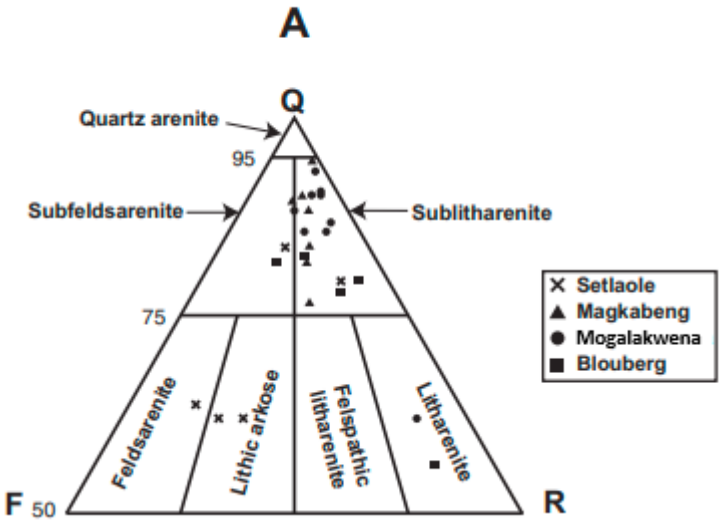

Figure 2.3: Ternary diagrams showing the compositions of samples from the Waterberg Group formations as analysed and plotted by Corcoran *et al*. (2013). (A) QFR diagram of Folk *et al*. (1970), truncated at 50% quartz.

Table 2.1: Lithostratigraphy of the Waterberg Group (Callaghan *et al*., 1991).

GROUP	SUBGROUP	South / southwest & central parts	Southeast & central parts	North / northeast & central parts	Nylstroom area	Middelburg area
WATERBERG GROUP	KRANSBERG	Vaalwater Formation (475m)				
		Cleremont Formation (125m)				
		Sandriviersberg Formation (1250m)	Sandriviersberg/ Mogalakwena Formations	Mogalakwena Formation (1250-1500m)	Sheets of coarse sandstone and granulestone, interbedded with sheets of conglomerate. Fluvial origin	
	MATLABAS	Aasvoelkop Formation (300-600m)	Aasvoelkop/ Makgabeng Formations	Makgabeng Formation (380-1000m)	Large-scale trough and planar cross-beds of fine-/medium-grained sandstone. Aeolian origin	
		Skilpadkop Formation (450-600m)	Skilpadkop Formation (450-600m)	Setlaole Formation (450m)	Coarse sandstone and granule-stone with rare conglomerate. Fluvial origin	
	NYLSTROOM	Alma Formation (3000m)	Sterk River Formation (500-1500m)		Alma Formation	
		Swaershoek Formation			Swaershoek Formation (2500m)	Wilge River Formation

In terms of palaeoenvironments, a fluvial depositional environment is suggested for the Mogalakwena Formation. This suggestion stems from the local conglomerate-filled channels and coarse-grained sandstone sheets (trough cross-bedded) which indicate the migration of low sinuosity braided fluvial channels (Tickell, 1975; Corcoran *et al*., 2013). The sub-rounded nature of some quartz grains in the unit indicates transport of the grains, albeit relatively short. The palaeocurrent patterns described suggest that the rivers flowed from NE to SW (Tickell, 1975; Corcoran *et al*., 2013).

Corcoran *et al*. (2013) analysed the geochemistry of the Mogalakwena Formation green and brown sandstones, as well as its shales. It is mentioned that this formation is unique in that it shows elevated Ti and Zn values and intra-formational differences in Rare Earth Element (REE) patterns (Corcoran *et al*., 2013). The sandstones in the formation are shown, through the study of Corcoran *et al*. (2013), to have undergone a degree of recycling as this could explain the Al_2O_3 enrichment relative to Na_2O_3, CaO and K_2O noted in their results. This observation is supported by the fact that combinations of well-rounded and sub-angular quartz grains are evident in the lithology (Corcoran *et al.*, 2013). Brown sandstones in the formation are reported at 81-89 wt% SiO_2 and the green sandstones have reported abundances of Cr, Ni, V, Ti and Zn as well as a lower Th/Sc ratio than any other sandstone in the Waterberg Group. The sandstones and shales analysed by Corcoran *et al*. (2013) have shown average Ti and Zr compositions of 4098 ppm and 294 ppm respectively, which are the highest values in their sample suite. It is also mentioned that these sandstones and shales have been Light Rare Earth Elements (LREE) enriched with La/Yb values that range from 6.03 to 24.20 ppm (large variation consistent with mixed provenance) (Corcoran *et al*., 2013).

2.2 Mwulu's Cave Associated Geology

Mwulu's Cave is located on a quartzite cliff in a valley within the Makapansberg Mountains (de la Peña *et al*., 2019). The area around the cave is full of boulders and cobbles and vegetation cover is abundant. A valley lies right below the cave and flat plains are seen at a distance.

The cave is situated within the Black Reef Quartzite Formation (BRQF) which is found in the Transvaal Basin of the Transvaal Supergroup. This unit was deposited during the Archaean (Van den Berg, 1994) in a fluvial to shallow marine environment as noted through characteristics in its siliciclastic sediments (mature quartz arenites, lesser conglomerates and dispersed mudrocks) (Mcloughlin, 2015). More on stratigraphy, lithology, and geochemistry associated with the study is discussed below.

2.2.1 The Transvaal Supergroup

The Transvaal Supergroup sedimentary succession is present in three structural basins on the Kaapvaal Craton. These are the Transvaal Basin, in which the BRQF is found, the Griqualand West Basin, and finally the Kanye Basin in Botswana (Figure 2.4). The BRQF is the oldest formation in the Transvaal Supergroup and is located above the basement rocks of the Transvaal Supergroup (Johnson *et al*., 2009). This succession has a well-preserved carbonate platform (with stromatolites) (McLoughlin, 2015). Below is a description of the stratigraphy of the Transvaal Supergroup (Figure 2.5). This is necessary to note because of the possibility of encountering alternative rock material from the archaeological lithic sample set other than from the BRQF itself.

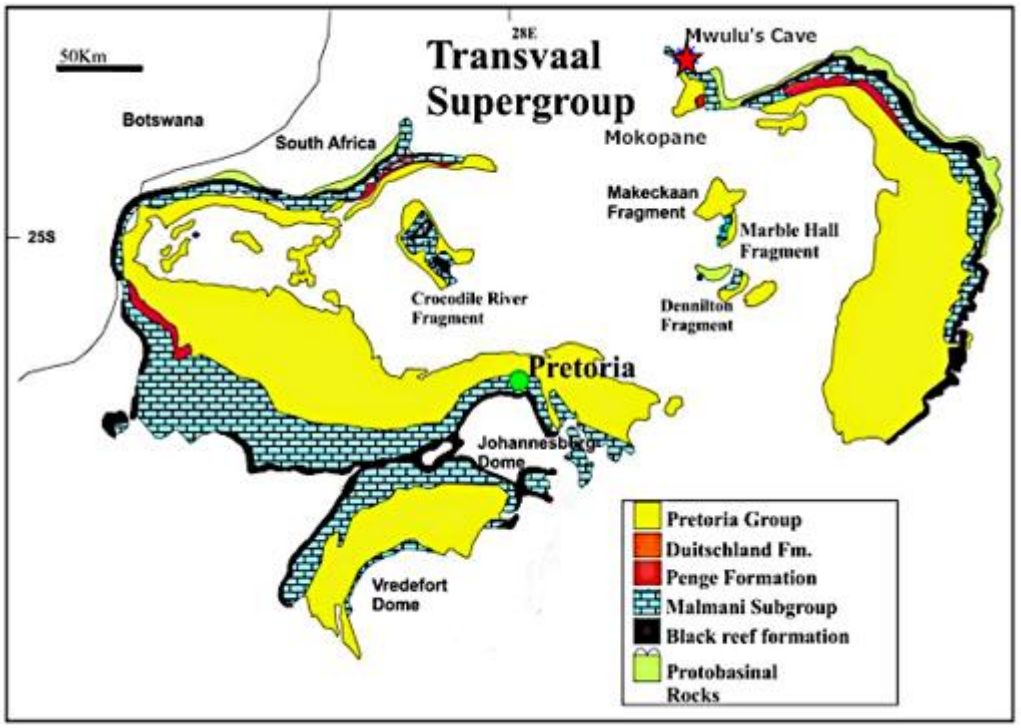

Figure 2.4: A simplified geological map of the Transvaal Supergroup stratigraphy (modified from Mcloughlin (2015)). Mwulu's Cave is on this map. Mwulu's Cave is represented by the red star.

The BQRF overlies the Transvaal Supergroup basement rocks (Wolkberg Group). Above the BRQF, Malmani Subgroup dolomites and limestones are noted (Bose *et al*., 2012). These are overlain by Penge Iron Formation marine sediments (alternating iron-rich and iron poor layers of sediment) and Duitchsland Formation lacustrine sediments (eg. shales). These last two mentioned formations make up the Chuniespoort Group that is underlain by the BRQF and followed by the Pretoria Group (Bose *et al*., 2012).

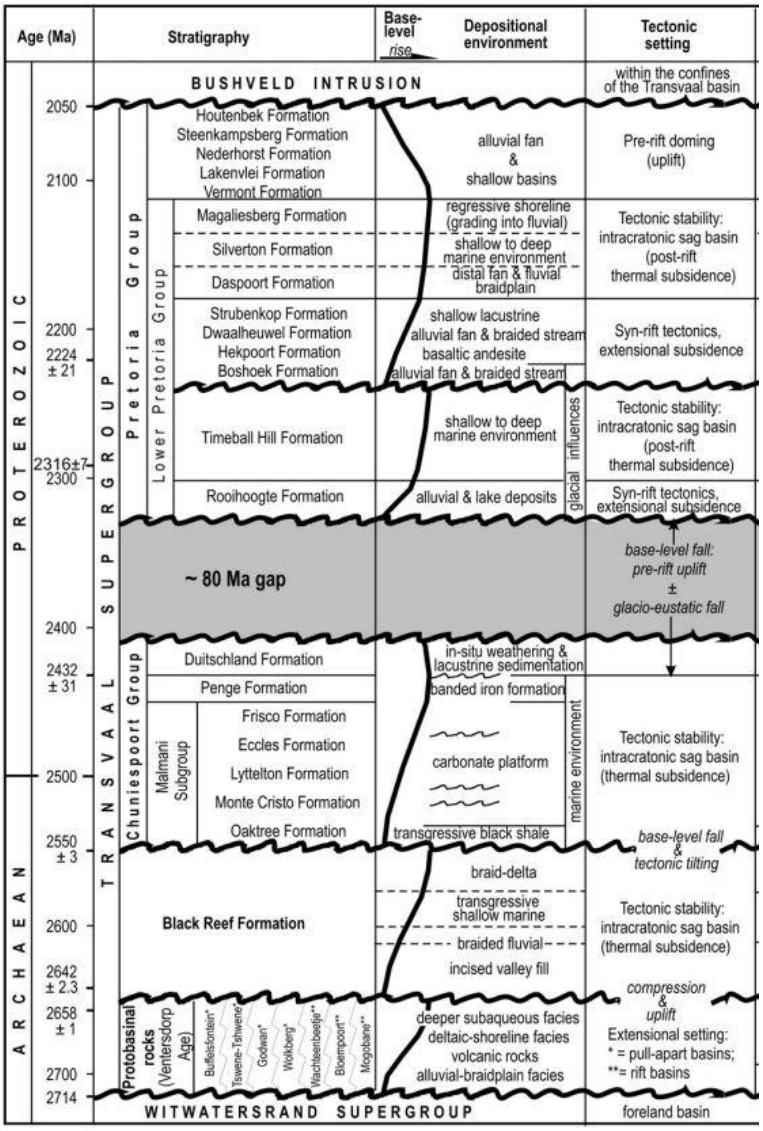

Figure 2.5: Schematic figure of the stratigraphy, depositional palaeoenvironments, tectonic settings for the Transvaal Supergroup (specifically the Transvaal basin) (McLoughlin, 2015; modified after Bose *et al.*, 2012).

2.2.2 The Black Reef Quartzite Formation (BRQF)

Mwulu's Cave is a site included within the beds of the 65 m thick Black Reef Quartzite Formation (Late Archaean to Early Proterozoic quartzites) (Transvaal Supergroup lithostratigraphy shown in Table 2.2) (Eriksson *et al.*, 1995). The BRQF may only be 65 m thick but Crocodile River Dome, Denniton Dome and Marble Hall inliers reach thicknesses of 280 m, 210 m, and 170 m, respectively. This means that the BRQF

thickens towards the centre of the Transvaal basin (Hartzer, 1994). The BRQF lies unconformably (angular) at the base of the Transvaal Supergroup and was deposited 2200- 2700 Ma (Van den Berg, 1994) or between 2460 and 2050 Ma (SACS, 1980). No major faulting or folding has been documented for the formation although it does rest on the pre-Transvaal palaeosurface (Els *et al*., 1995). Due to the limited amount of metamorphism and deformation, it falls within the sub-greenschist facies (Frimmel, 2014). The BRQF is an upward-fining succession with conglomerates at its base grading into quartzites which then grade into mudrocks at the top (Johnson *et al*., 2009). It dips gently to the north and south along the Rand Anticline and shares a gradational contact with the overlying dolomites of the Malmani Subgroup. BRQF outcrops are narrow and geographically limited because it is only 65 m thick (Els *et al*., 1995; Coetzee, 1996).

The general lithology of the BRQF is represented by mature quartzites with erratically-developed conglomerates and basal grits, and shales (Coetzee, 1996). BRQF quartzites are described as having a light grey, glassy lustre and a red-brown weathered surface with trough and planar crossbedding and plane beds (Coetzee, 1996). Oscillation ripple marks are visible across the quartzites and they are interbedded with finely laminated shales. The red-brown conglomerates have poorly sorted but well-cemented quartzite pebbles (well-rounded) of ≤15 mm diameter. Other pebble lithologies are present depending on the underlying palaeosurface (Coetzee, 1996).

According to Coetzee (1996), the depositional environment of the BRQF is of a fluvial nature (braided river channels) in the lower succession and a tidal nature in the upper part of the succession. This suggests that a marine transgression may have taken place (Coetzee, 1996). A more detailed account of the depositional environment is discussed in McLoughlin's dissertation (2015). He mentions that in its initial stages the depositional environment was a river system characterised by anastomosing braided river channels that transported sedimentary material from the Witwatersrand succession in a southward direction (De Bever, 1997). Marine transgression took place as the Transvaal basin enlarged and this caused the submergence of these channel systems. Through the active reworking of the river sediments, primary sedimentary features were lost. Basal conglomerates and quartzites at the bottom of the BRQF are fluvial and the blanket layers at the top of the sequence occur as foreshore and offshore facies (De

Bever, 1997). Therefore, as mentioned by both Coetzee (1996) and McLoughlin (2015), the overall depositional environment is siliciclastic fluvial (predominantly) and shallow marine in nature. The deposition occurred on a deeply incised erosional surface within which boulder beds, quartzites and conglomerates occur in channel facies and blanket conglomerate facies occur on the levees (Frimmel, 2014; McLoughlin, 2015).

Gold- (in-situ hydrothermal origin based on the irregular grain shape of the gold particles and the lack of evidence showing the introduction of external hydrothermal fluids into the BRQF; Frimmel, 2014) and uranium-bearing pyrite-rich oligomictic conglomerates (similar to those from the Witwatersrand) occur in both the channel and levee facies (McLoughlin, 2015). The uranium mentioned is found in the detrital uraninite and in some of the brannerite found in the Buckshot pyrite leader reef samples, which means that it was affected during the lithification of the sediments (McLoughlin, 2015).

Table 2.2: Lithostratigraphy of the Transvaal Supergroup (Coetzee, 1996).

	Groups	Formations	Dominant Lithology
Transvaal Basin	**Pretoria Group**	Magaliesberg Formation	Quartzite
		Silverton Formation	Shale and Limestone
		Daspoort Formation	Quartzite
		Strubenkop Formation	Shale and Quartzite
		Hekpoort Formation	Andesitic Lava
		Timeball Hill Formation	Shale and Quartzite
		Rooihoogte Formation	Shale, Quartzite, and Breccia
	Chuniespoort Group	Duitschland Formation	Lacustrine Sediments (Shale)
		Penge Iron Formation	Banded Iron Formation
		Malmani Subgroup	Dolomite

		Black Reef Quartzite Formation	Quartzite

3 MATERIALS AND METHODOLOGY

3.1 Materials

3.1.1 Archaeological materials

A selection of 65 lithics from OBP and 81 lithics from Mwulu's Cave was analysed. These lithics were selected from the A. Val (2018-2019) collection, and the P. de la Peña (2017) and P. Tobias (1947) collections, respectively. In the selected OBP material, quartzite makes up 43.1% of the lithic assemblage and is followed by shale (30.8%), dolerite (12.3%), sandstone (9.2%), quartz (3.1%), and chert raw materials (1.5%). The Mwulu's Cave lithic selection consists of quartzite (64.2%), shale (12.3%), quartz (13.6%), altered material (6.2%), and chert (3.7%). These lithics are flakes and fragments that were selected because they are not technologically and typologically important and they cover a variety of different rock types. Therefore, they can be analysed with destructive techniques. Table 3.1 sums up the number of lithics that were analysed from each layer at both sites.

Within the OBP collection, lithics from GS *décapages* 1, 4, 10, 13, 14, and 16, as well as those from YRS *décapages* 1, 7, and 15, were analysed.

In the Mwulu's Cave collection 23 of the 81 selected lithics are from Tobias' Bed 1-3, and 58 of the 81 selected lithics are from Layers 1-5 of the de la Peña collection of 2017.

Lithics from both sites were accessed at the Leswika Archaeology Laboratory at the Evolutionary Studies Institute (University of the Witwatersrand). Images of representative samples of the lithics (based on rock types) from both sites are shown in Figures 3.1 and 3.2. Descriptions and pictures of all the lithics can be found in APPENDIX A. Permits (ID: 3281; 3299) from the South African Heritage Resources Agency were received for the destructive analyses that were conducted on a few carefully selected lithics (unretouched flakes).

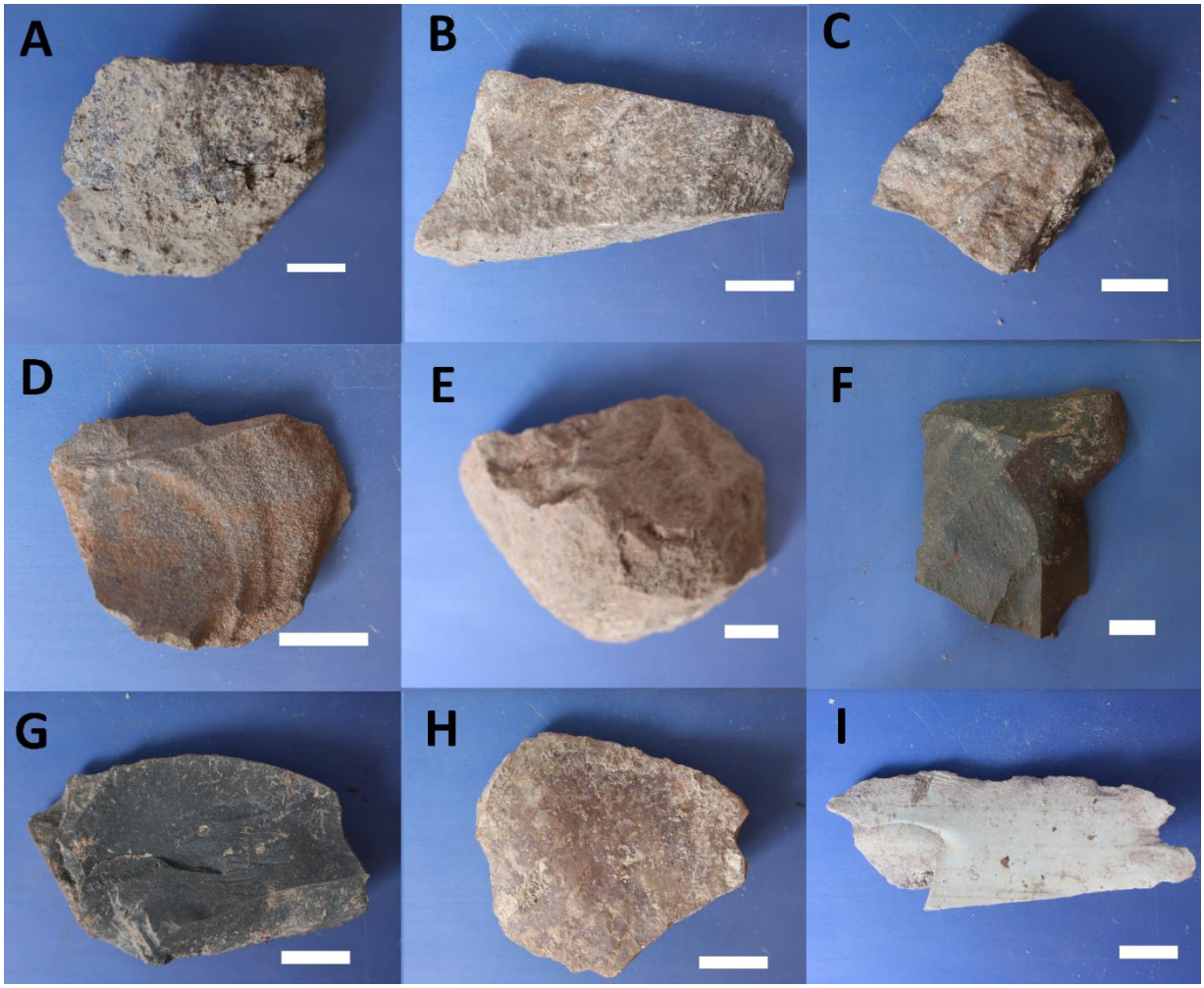

Figure 3.1: Representative samples of OBP lithics. A) No. 2402 (sandstone), B) No. 1194 (sandstone), C) No. 486 (quartzite), D) No. 458 (dolerite), E) No. 3478 (quartzite), F) YRS 1-D (shale), G) No. 164 (shale), H) No. 493 (quartz), and I) No. 412 (chert). These are all unretouched flakes. The white bar represents 1 cm.

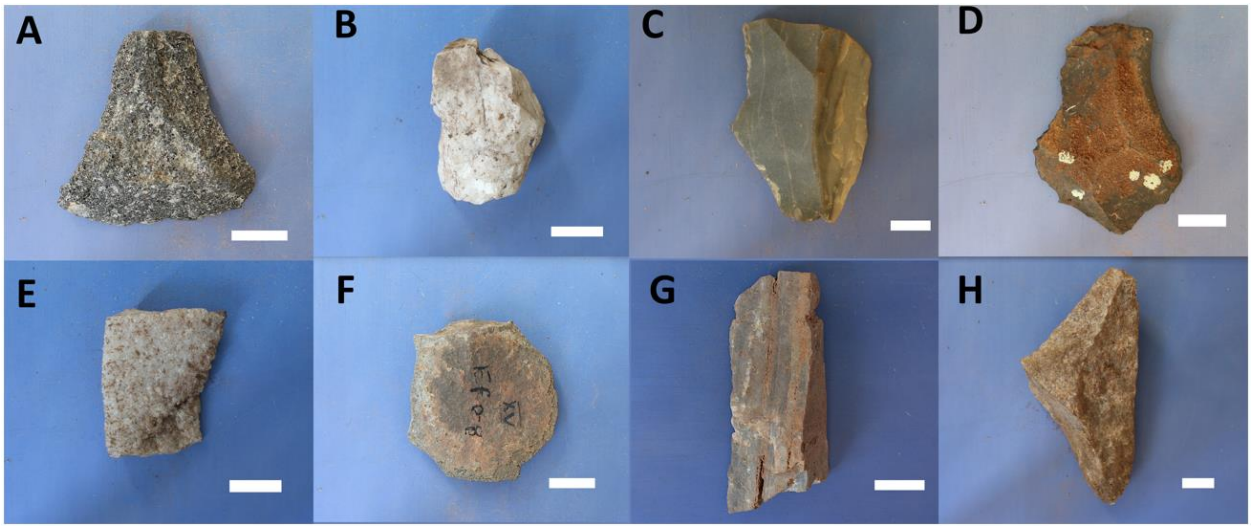

Figure 3.2: Representative sample of Mwulu's Cave lithics. A) M1-J (quartzite), B) PA-8 (quartz), C) M1-K (chert), D) M3-E (shale), E) No. 1021 (quartzite), F) M3-B (shale), G) No. 674 (banded chert), H) No. 640 (quartzite). These are all unretouched flakes. The white bar represents 1 cm.

Table 3.1: Number of lithics analysed from each archaeological stratigraphic unit.

Site	**Collection**	**Layer**	**No. of Lithics**
OBP	A. Val (2018-2019)	GS 1	**15**
	A. Val (2018-2019)	GS 4	**12**
	A. Val (2018-2019)	GS 10	**5**
	A. Val (2018-2019)	GS 13	**4**
	A. Val (2018-2019)	GS 14	**1**
	A. Val (2018-2019)	GS 16	**9**
	A. Val (2018-2019)	YRS 1	**5**
	A. Val (2018-2019)	YRS 7	**3**
	A. Val (2018-2019)	YRS 15	**11**
Total			**65**
Site	**Collection**	**Layer**	**No. of Lithics**
Mwulu's Cave	P. Tobias (1947)	Bed 1	**13**
	P. Tobias (1947)	Bed 2	**4**
	P. Tobias (1947)	Bed 3	**6**
	P. de la Peña (2017)	Layer 1	**7**
	P. de la Peña (2017)	Layer 2	**11**
	P. de la Peña (2017)	Layer 3	**6**

	P. de la Peña (2017)	Layer 4	**13**
	P. de la Peña (2017)	Layer 5	**21**
Total			**81**

3.1.2 Geological materials

The areas chosen for prospection surveys around OBP and Mwulu's Cave are based on the rock types of the representative samples that were selected for this study from the A. Val (2018-2019), the P. de la Peña (2017), and the P. Tobias (1947) lithic collections. This was done to link lithics to possible outcrops. Promising locations were identified using geological literature, the 2326 Ellisras Basin and 2428 Nylstroom maps (Geological Survey (South Africa)), and satellite images of the areas around the sites (Google Earth). Based on the rock types noted in the lithic assemblage and geological research, prospection areas of a 12 km radius around both sites were expected to be sufficient for geological sampling although this was not the case around OBP because of flat areas without outcrops and a lack of access to some private properties. Geological samples were taken from both primary and secondary contexts at OBP and mostly from primary contexts around Mwulu's Cave. The primary contexts are *in situ* outcrops. The secondary contexts are samples like pebbles collected along the road or river, and *ex situ* samples with the same lithology as outcrops surrounding the sites

At OBP, preliminary assessments show that the selected lithic assemblage consists of quartzite, shale, sandstone, dolerite, and quartz. These rock types (except quartzite) are expected in the Mogalakwena Formation based on geological literature (Corcoran *et al*., 2013; Geological Survey (South Africa)). Geological samples representing these rock types were collected within 30 km SSE of the site and within about 13 km NNW of OBP in the Mogalakwena Formation and the Cleremont Formation. The geological assemblage consists of 15 quartzite samples, two shale samples, five sandstone samples, four dolerite samples, and 22 quartz samples. Most of the geological samples were collected in secondary context (89.7%; *ex situ*) as pebbles and cobbles along the Rietspruit River, roads, and on a mountain at the Zandrivier Farm (Figure 3.3) although some were sampled from primary context (10.3%; *in situ*) outcrops. This was due to the lack of *in situ* outcrops in the area around OBP. Samples from *in situ* outcrops were

photographed and then removed with a geological hammer. These were then labelled and their geographical coordinates were recorded using the Garmin eTrex® GPS.

From the preliminary assessment of the Mwulu's Cave lithic assemblage, quartzite, shale, quartz, and chert rock types are noted. Based on Eriksson *et al.*, 1995, Eriksson *et al.*, 2008, and the 2428 Nylstroom map, these rock types are found in the BRQF (quartzite, quartz, shale), the Malmani Subgroup (shale and chert), and in the Duitschland Formation (shale and chert). The collection of outcrop samples around Mwulu's Cave occurred within a 12 km distance from the site within these formations. It consists of 13 quartzite samples, 16 shale samples, five quartz samples, and four chert samples, 7.9% of which are secondary context samples. Many *in situ* samples were collected around the site. The samples were collected along the road (Outcrop 1 to 10) and up the mountain towards Mwulu's Cave (Outcrop 11 to G4). Outcrop 20 and 21 samples were collected on a mountain close to the site (Figure 3.4). Similar to OBP, samples from *in situ* outcrops were photographed, removed with a geological hammer, labelled, and their GPS coordinates were recorded using the Garmin eTrex®.

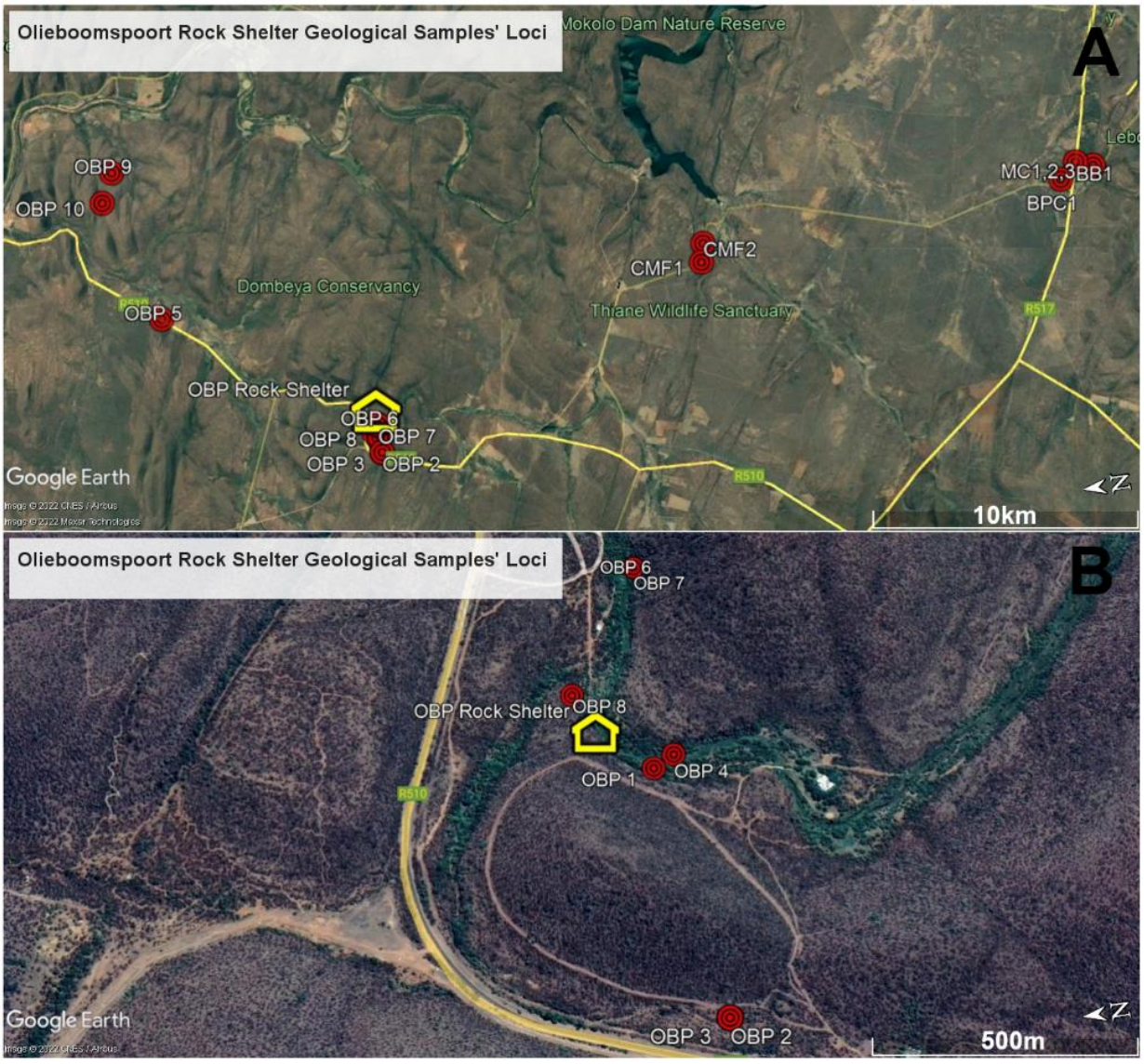

Figure 3.3: Map showing the locations from which OBP geological samples were collected, as well as the site itself (yellow house). Map A) shows all of the locations of the geological samples around OBP and B) shows locations of the geological samples that are closer to OBP. OBP is represented by the yellow house and the geological sample localities are represented by the red circles.

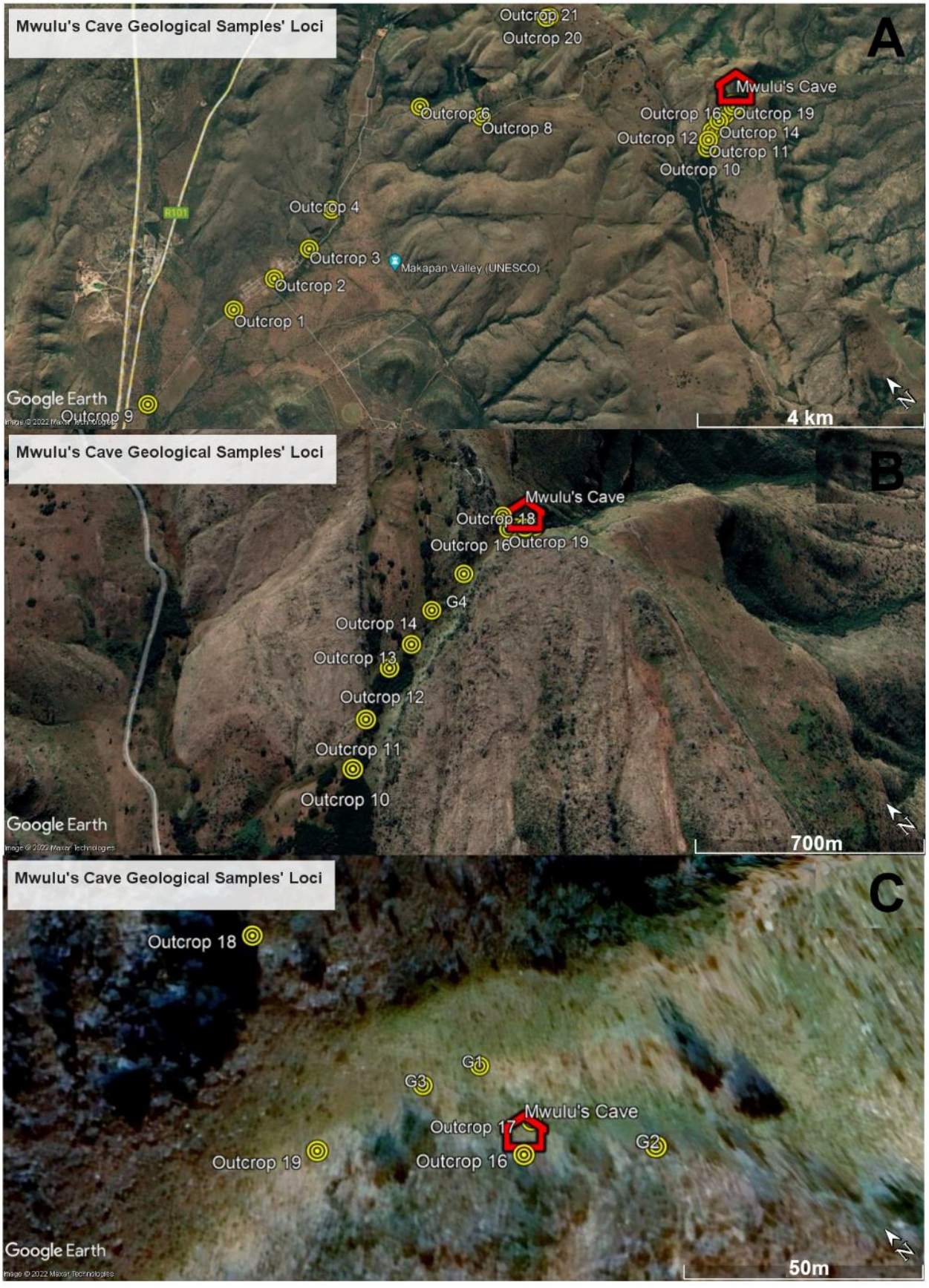
Mwulu's Cave Geological Samples' Loci
A
Outcrop 21
Outcrop 20
Mwulu's Cave
Outcrop 6
Outcrop 8
Outcrop 16
Outcrop 19
Outcrop 12
Outcrop 14
Outcrop 11
Outcrop 10
R101
Outcrop 4
Outcrop 3
Makapan Valley (UNESCO)
Outcrop 2
Outcrop 1
Outcrop 9
Google Earth
4 km
N
Mwulu's Cave Geological Samples' Loci
B
Mwulu's Cave
Outcrop 18
Outcrop 16
Outcrop 19
G4
Outcrop 14
Outcrop 13
Outcrop 12
Outcrop 11
Outcrop 10
Google Earth
700m
N
Mwulu's Cave Geological Samples' Loci
C
Outcrop 18
G1
G3
Mwulu's Cave
Outcrop 17
G2
Outcrop 19
Outcrop 16
Google Earth
50m
N

Figure 3.4: Maps showing the locations around Mwulu's Cave where the geological samples were collected. Map A) shows all the locations of the geological samples, B) shows Outcrop 10 at the bottom corner and G4 before the cluster around Mwulu's Cave, and C) shows the locations of outcrops immediately around Mwulu's Cave. Mwulu's Cave is represented by the red house and the outcrop/geological sample localities are represented by the yellow circles.

Each potential source is described as a 'locality' in Table 3.2. A collection of 48 geological samples from 17 localities was collected around OBP (Table 3.2). Around Mwulu's Cave, 38 geological samples from 25 localities were collected. During the prospection, general descriptions (APPENDIX A) of the outcrops were recorded and images were taken for reference.

Table 3.2: The number of samples collected at each stop, their rock types and the distance at which they were collected.

OBP Localities	**Rock Types**	**Context**	**No. of Outcrop samples**	**Distance from site**
MC1	Quartz conglomerate	Primary	**1**	28-29 km
MC2	Quartz conglomerate	Primary	**1**	28-29 km
MC3	Quartz conglomerate	Primary	**1**	28-29 km
CMF1	Quartzite	Primary	**1**	14.5 km
CMF2	Quartzite	Primary	**1**	14.5 km
BPC1	Quartzite, quartz	Secondary	**6**	28-29 km
BB 1	Quartz conglomerate	Primary	**1**	28-29 km
OBP 1	Quartz and quartzite conglomerate	Secondary	**1**	130 m
OBP 2	Quartz conglomerate	Primary	**1**	615 m
OBP 3	Quartz, sandstone	Primary	**3**	615 m
OBP 4	Quartzite, quartz, dolerite	Secondary	**7**	175 m
OBP 5	Quartzite, quartz, dolerite	Secondary	**6**	9 km
OBP 6	Quartzite, quartz	Secondary	**6**	485 m
OBP 7	Sandstone	Secondary	**1**	485 m
OBP 8	Sandstone	Primary	**3**	155 m
OBP 9	Quartz	Secondary	**2**	13-14 km
OBP 10	Quartzite, quartz, shale/meta-sedimentary	Secondary	**6**	13-14 km
			48	
Mwulu's Cave Localities	**Rock Types**	**Context**	**No. of Outcrop samples**	
Outcrop 1	Meta-sedimentary	Primary	**1**	9.9 km

Outcrop 2	Shale	Primary	**3**	9 km
Outcrop 3	Shale, chert	Primary	**2**	8.2 km
Outcrop 4	Shale, chert	Primary	**3**	7.6 km
Outcrop 6	Shale	Secondary	**1**	5.7 km
Outcrop 8	Shale, quartzite	Secondary	**2**	4.6 km
Outcrop 9	Shale	Primary	**1**	12 km
Outcrop 10	Meta-sedimentary	Primary	**1**	900 m
Outcrop 11	Chert conglomerate	Primary	**1**	760 m
Outcrop 12	Shale	Primary	**1**	600 m
Outcrop 13	Quartzite	Primary	**1**	500 m
Outcrop 14	Shale	Primary	**2**	378 m
Outcrop 16	Quartzite, quartz, chert	Primary	**6**	At the cave
Outcrop 17	Quartzite	Primary	**1**	8.5 m
Outcrop 18	Quartzite, shale	Primary	**2**	86 m
Outcrop 19	Quartzite, quartz	Primary	**2**	51 m
Outcrop 20	Quartz	Primary	**1**	3.7 km
Outcrop 21	Quartzite, quartz	Primary	**2**	3.7 km
Outcrop G1	Quartzite	Primary	**1**	25 m
Outcrop G2	Quartzite	Primary	**2**	32 m
Outcrop G3	Shale	Primary	**1**	31 m
Outcrop G4	Quartzite	Primary	**1**	240 m
			38	

3.2 Methods

3.2.1 Macroscopic (including stereomicroscopic) analysis

Stereomicroscopic analysis of the samples was conducted with the use of an Olympus SZX16 stereomicroscope (magnification range: 0.7x -11.5x) at the Leswika Archaeology Laboratory (Evolutionary Studies Institute, University of the Witwatersrand). Petrological features that aid in rock identification and could help form general rock groups were studied. These include:

- The colour of the rock
- Lustre
- Inclusions and foliations
- Grain size
- Grain shape

- Intergranular relationships (interlocking, disseminated, etc.)
- Nature of the cortex was analysed to establish the contexts of the samples (primary or secondary)

3.2.2 Portable X-ray Fluorescence Spectrometry

Portable X-ray Fluorescence Spectrometry (pXRF) spectrometry is an analysis that quantifies the concentration of elements in a sample. It is used in this project to identify and group samples according to rock types. From these results, preliminary information about lithics and their geological sources is provided.

This method does not require much sample preparation and it produces elemental compositions relatively fast. Not only that, but it is also inexpensive and very easy to use. A few drawbacks of pXRF spectrometry are that it is unable to register light elements like Na and has low sensitivity. These drawbacks could lead to the misidentification of a rock. However, pXRF spectrometry remains a good non-destructive method (Shackley, 2011). Especially in a study such as this one because archaeological samples are being analysed and it is a priority not to destroy them. For that reason, pXRF is used to see if it can link lithics to geological samples.

Samples were analysed with no preparation using the Olympus Vanta™ pXRF instrument (40 kV beam) at the Leswika Archaeology Laboratory. The instrument is industrial and was commercially calibrated (factory calibration). The instrument was considered reliable because it provided results that were supported by ICP-MS analysis. I am, however, aware that this is not an absolute measure of accuracy. PXRF errors were provided for each analysed element although I am not certain how they were calculated since this an industrial instrument. I have included them in Appendix B (Table B3 and Table B4). Smaller lithics that could fit in the instrument were analysed while it was fixed on a stand. The larger lithics and outcrop samples that could not fit into the instrument underwent hand-held analyses. Each sample was analysed three times (45 second reading for each analysis: 15 seconds for the minor elements and 30 seconds for major elements). The beam from the pXRF instrument travelled through the air before penetrating the rock because the analyses were not conducted in a vacuum/

controlled environment. The following elements with concentrations generally above the level of detection were recorded: Al, Si, P, S, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, As, Rb, Sr, Y, Zr, Nb, Mo, Pb, and Th.

Principal Component Analysis

Principal Component Analysis is an unsupervised, multivariate statistical analysis. It reduces the number of variables in a dataset and maximiases variability within that dataset (Mauran *et al*., 2022).

PCA was conducted on the raw data obtained through pXRF analysis. Columns from the raw pXRF data in which more than 10% of the samples showed elemental amounts below the level of detection (LoD) were deleted. The LOD readings in the remaining columns were replaced with a constant number that is half of the minimum reading for the element. From there, PCA code (Mauran *et al*., 2022; Baxter, 1994)), and the packages ggplot2, ade4, MASS, MVN, and plyr, were used in R Studio to produce the plots to differentiate formations and to link lithics to these formations.

3.2.3 Thin section petrography

Thin section analysis provides the mineral compositions and estimates of mineral proportions in a sample. It offers the most accurate petrographic information in primary analyses (Andrefsky, 1998). This is important because mineral modal abundance estimates are pivotal in rock analysis and identification (Chaves, 1949).

The petrography of the lithics and geological samples was analysed by looking at features such as:

- Granular nature (morphology, sizes, relationships)
- Textures (trachytic, ophitic, foliations)
- Extinction angles
- Colour

These are features used to identify and group rocks. Quartzite samples were identified and compared by the presence of undulose extinction and Bohm lamellae in addition to the abovementioned features. The presence of interlocking grains, stylolites and syntaxial cement; as well as the shape of grain boundaries (convex-concave), was also used to describe quartzites.

From the studied sample set, 21 samples (12 lithics and nine geological samples, see Table 3.3) were cut in half with a rock cutter at the School of Geosciences (University of the Witwatersrand) for thin sections and ICP-MS powders.

To make the thin sections, the rocks were cut using a diamond saw; embedded in resin, ground flat with corundum 600 and 1200 and water. These were then polished using a polishing machine.

The representative sample of OBP includes the following rock types: dolerite/andesite, shale/meta-sedimentary rocks, white quartzite, black quartzite, red quartzite and quartz. Mwulu's Cave's representative sample includes shale/meta-sedimentary rocks, quartz, black quartzite, white quartzite, and chert (Table 3.5). The rock types analysed are those represented in both the lithic assemblage and the geological assemblage. Chert and quartz samples were not analysed through thin section analysis because no grains would be visible using a microscope. As mentioned, three different types of quartzites (black, white, and red) were selected for the representative sample for grouping, however, red quartzite geologic samples were not found during the prospection survey.

3.2.4 Inductively Coupled Plasma Mass Spectrometry

Inductively Coupled Plasma Mass Spectrometry (ICP-MS) is a highly sensitive element detection analysis. It is also used to quantify elemental concentrations. ICP-MS provides more refined, and accurate, elemental results in comparison to pXRF spectrometry. The error limits for the elements analysed were not provided with the results because the analysis was conducted in the EarthLab (University of the Witwatersrand). This is the final analysis in this project used to identify rocks and link lithics to geological samples.

ICP-MS is reliable because it can detect elements at low detection limits. It also detects multi-element isotopes at high spectral resolutions (Thomas, 2013). This analysis is preferable because, unlike pXRF spectrometry, it can quanitify and detect a larger range of elements, including lighter elements like Na (Thomas, 2013).

Of the 232 samples in this study, 26 underwent ICP-MS preparation and analysis. As shown in Table 3.3, 13 samples from OBP and 13 samples from Mwulu's Cave were analysed using ICP-MS. The samples were prepared using a rock crusher and miller at the School of Geosciences (University of the Witwatersrand) and the powders were sent to the EarthLab (University of the Witwatersrand). They were analysed using a Thermo Scientific iCAP RQ. The Calibration Standards were made at 10, 30, 50, 75 and 100ppb with elements purchased from International Certified Reference Materials (Li, P, Sc, Ti, V, Cr, Co, Ni, Cu, Zn, Ga, Rb, Sr, Y, Zr, Nb, Sn, Sb, Cs, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, W, Tl, Pb, U, and Th). From this method, trace element and rare-earth element concentrations were obtained.

3.2.5 Thin Section and Inductive Coupled Plasma Mass Spectrometry Analytical strategy

Only a few representative samples were chosen, based on rock groups that were established through macroscopic analysis, to undergo thin section and ICP-MS analysis to minimise damage to archaeological material (Table 3.4 and Table 3.5). In this table, the localities are given numbers and the samples from each locality are identified using the alphabet (i.e. OBP 8 is the locality and A, B, and C are the samples from that locality).

Table 3.3: Number of lithics and geological samples that underwent each analytical method at OBP and Mwulu's Cave.

	OBP		**Mwulu's Cave**		
Analytical method	**Lithics**	**Geological samples**	**Lithics**	**Outcrops**	**Total**
Macroscopic Analysis	65	48	81	38	232
pXRF	65	48	81	38	232
Thin section petrography	7	5	5	4	21

ICP-MS	8	5	7	6	26

All samples in this project (lithic and geological) were macroscopically and stereomicroscopically analysed. Then they were analysed through pXRF. PXRF was prioritised before making thin sections and performing ICP-MS analyses because it is non-destructive, and it is fast and easy to use on all samples, providing quick preliminary results.

Table 3.4: Number of samples, from each rock type, that underwent destructive analyses. The second and third columns show the total number of lithics and outcrop samples in each rock type from the assemblages of both sites. The fourth and fifth columns show the number of lithics and geological samples that underwent destructive analyses in each rock type (i.e. of the eight dolerite lithics at OBP, 2 underwent destructive analyses). *Chert and altered samples were not analysed further than macroscopic analyses they do not occur in both lithic and outcrop assemblages.

Olieboomspoort Rock Shelter				
	Total		**Destructive Analyses**	
Rock Type	**Lithics**	**Outcrops**	**Lithics**	**Outcrops**
Dolerite	8	4	2	1
Quartz	2	22	0	0
Quartzite	28	15	2	1
Shale/meta-sedimentary	20	2	2	1
Sandstone	6	5	2	2
*Chert	1	0	0	0
Total analysed	65	48	8	5
Mwulu's Cave				
	Total		**Destructive Analyses**	
Rock Type	**Lithics**	**Outcrops**	**Lithics**	**Outcrops**
Shale/meta-sedimentary	10	16	2	1
Quartz	11	5	0	0
Quartzite	52	13	3	4
Chert	3	4	2	1
*Altered	5	0	0	0
Total analysed	81	38	7	6

Table 3.5: OBP samples analysed through thin section and ICP-MS analyses, and the rock types that they are made of.

OBP Analysed Geological Samples			
Sample No.	**Rock/Mineral type**	**Analysed through Thin section petrography**	**Analysed through ICP-MS**
CMF1	White quartzite	X	X
OBP 4G	Dolerite	X	X
OBP 7	Black sandstone	X	X
OBP 8A	Black sandstone (with red layers)	X	X
OBP 10A	Shale/meta-sedimentary	X	X
OBP Analysed Lithic Samples			
Sample No.	**Rock/Mineral type**	**Analysed through Thin section petrography**	**Analysed through ICP-MS**
No. 164	Shale/meta-sedimentary	X	X
No. 486	White quartzite	X	X
No. 488	White quartzite		X
No. 1194	Sandstone	X	X
No. 2402	Black sandstone	X	X
No. 3478	Red quartzite	X	X
No. 458	Dolerite	X	X
YRS 1-D	Shale	X	X

Table 3.6: Mwulu’s Cave samples analysed through thin section and ICP-MS analyses, and the rock types they are made of.

Mwulu's Analysed Outcrop Samples			
Sample No.	**Rock/Mineral type**	**Analysed through Thin section petrography**	**Analysed through ICP-MS**
Outcrop 4A	Shale/meta-sedimetary	X	X
Outcrop 16A	White quartzite	X	X
Outcrop 16C	Chert		X
Outcrop 16D	Black quartzite		X
Outcrop G2A	Black quartzite	X	X
Outcrop G2B	White quartzite	X	X
Mwulu's Analysed Lithic Samples			

Sample No.	Rock/Mineral type	Analysed through Thin section petrography	Analysed through ICP-MS
No. 640	White quartzite	X	X
No. 674	Chert		X
No. 1021	White quartzite	X	X
M1-J	Black quartzite	X	X
M1-K	Chert		X
M3-B	Sandstone	X	X
M3-E	Shale/meta-sedimetary	X	X

4 RESULTS

4.1 Macroscopic results

The following sections present macroscopic results for each rock type at OBP and Mwulu's Cave. Detailed macroscopic descriptions of OBP and Mwulu's Cave samples are found in APPENDIX A.

4.1.1 OBP and nearby localities' macroscopic rock descriptions

Quartzite

Quartzite is the most abundant raw material used for lithics at OBP (n=28, see Table 3.4). The lithic quartzite from the site, although noted as different colours (white, red, and black), is generally represented by similar macroscopic characteristics such as rounded to sub-angular grains that range from fine-grained (0.1 mm) to coarse-grained (4 mm). The quartzite lithic samples are well-sorted and have annealed or interlocking quartz grains (e.g. No. 143, No. 468; No. 488; No. 2374; No. 3474, No. 2332; No. 2364; No. 2395; No. 1795; YRS1-C; YRS1-E) with minimal visible matrix (roughly 25% based on visual comparison to the amount of grains present in the sample). Generally, the texture of the samples is rough and they have a dull lustre although some annealed samples have a smooth, glassy texture. Because of these common characteristics, they are considered as being part of the same group of quartzite. Six samples from the OBP assemblage (No. 488; No. 1195; No. 488; No. 143; No. 3474; and No. 3478) present a visible cortex (Figure 4.1 A and B). These samples have a brown, orange, and black predominantly dull cortex. These are either smooth or rough. There is no evidence of sedimentary structures in the observed samples.

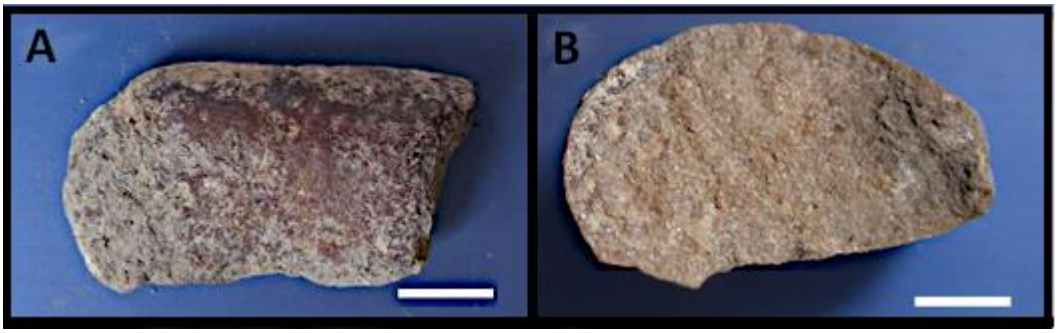

Figure 4.1: A) No. 1195 shows a smooth, red cortical surface. B) No.488 is an image of the white quartzite at OBP. It is also a sample with a cortex. The white bar represents 1 cm.

The reference quartzite collected around OBP is white, black, or red in colour. Two types of quartzite are noted around OBP in the Mogalakwena and the Cleremont Formations. The general characteristics of quartzite from the Mogalakwena Formation include medium to coarse (>3 mm) quartz grains that are sub-rounded to sub-angular and are generally well-sorted. These grains are usually either white, pink-white, or black. This quartzite has a smooth, glassy fresh surface and the grains are interlocked. The quartzite samples from the Cleremont Formation are similar to those from the Mogalakwena Formation although matrix is noted in samples from localities CMF1 and CMF2 (10%). Quartzite pebbles from both the Mogalakwena Formation and the Cleremont Formation have orange, brown, or pinkish brown cortices. These are usually smooth and have a dull lustre. No sedimentary structures are noted in the collected samples.

Shale

Shales are the second most abundant rock type used at this site (n=20, see Table 3.4). Three shale groups are noted at OBP. The shales in the general group are mostly dark coloured (black, red-black, brown) and have a smooth surface and dull lustre. These shale lithics are very fine silt-grained (not visible to the bare eye (Figure 4.2 A)). The second shale group is also dark coloured (brown, black, and grey) and fine-grained although these samples are foliated (e.g. No. 142: Figure 4.2 B). The third group is similar to the previous two groups in terms of colour and grain size, but white, black, or red grain inclusions are present (e.g. No. 106 A2; Figure 4.2 C).

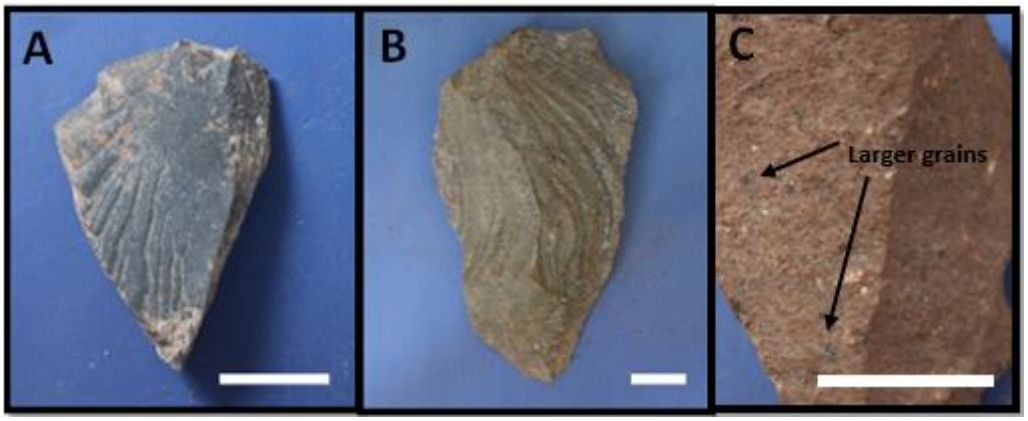

Figure 4.2: A) No. 143 showing fine-grained texture, B) No. 4677 showing foliation (mica minerals are noted along the lighter foliations), and C) No. 106A2 showing larger grain inclusions. The white bar represents 1 cm.

Only one shale locality was noted around OBP. The shales sampled from OBP 10 are very fine-grained (grains cannot be seen with the naked eye) and black in colour. They are smooth to touch and have a dull lustre. OBP 10B has a foliation noted on its edges.

Sandstone

Generally, two sandstone groups are noted in the OBP lithic assemblage. The first is the general group and the second branches off the general group due to the presence of quartz phenoclasts (No. 2402; Figure 4.3 A, and No. 1194). The sandstone lithics (n=6, see Table 3.4) in both groups are light brown, red, and/or black in colour. They have rough textures and dull lustres (No. 1286; Figure 4.3 B) with the exception of No. 1194 (smooth texture) and No. 2366 (glassy lustre Figure 4.3 C). The quartz grains in the OBP lithic sandstones range from medium to coarse (0.4-1.5 mm) and they show a range of grain shapes (angular to sub-rounded). The quartz grains are well-sorted, and the matrix percentage is low (≤10%). Sedimentary structures are not visible due to the small size of the lithics.



Figure 4.3: A) No. 2402 showing a coarse-grained texture and quartz phenoclasts. B) No. 1286 and C) No. 2366 are examples of the general characteristics of OBP sandstone lithics. The white bar represents 1 cm.

Samples OBP 3C, OBP 7, OBP 8A, OBP 8B, and OBP 8C are sandstones collected around the shelter (OBP 8 is a large outcrop and the divisions are based on the layers). Three sandstone groups are noted around OBP. Generally, all the sandstones are red or black. They have a rough and dull brown weathered surface with a glassy fresh surface. The grains are coarse (0.7-5 mm), sub-rounded to sub-angular, and they are well-sorted. A group is formed by OBP 3C and OBP 8A because they are banded and have fine oxidised layers (grains: 0.5 mm). OBP 8B and OBP 8C form another group because they are friable sandstones (sandstones sensu stricto). Matrix is only clearly noted in OBP 8C.

Dolerite

No. 182; No. 1241; No. 130; No. 408; No. 458; No. 489; No. 4672; and No. 4688 (n=8, see Table 3.4) are dolerites. These are aphanitic to medium-grained and have scattered white plagioclase laths (up to 1 mm long) in black matrices (Figure 4.4). They have a smooth texture and a dull lustre.



Figure 4.4: No. 1241 shows the medium-grained texture of OBP dolerite samples and fine plagioclase laths. This sample is coated in calcium carbonate. The white bar represents 1 cm.

Ex situ dolerite around OBP is aphanitic and has a brown weathered surface and a black, fresh surface (OBP 4G; OBP 5A, D and, E). Plagioclase laths are only visible in OBP 5D (~10%).

Quartz

No. 493 (pink) and No. 1290 (pink-white) are the only two quartz (monocrystalline) samples noted in OBP lithics (Figure 4.5). They both have smooth fresh surfaces although No. 493 has a dull lustre and No. 1290 has a glassy one.

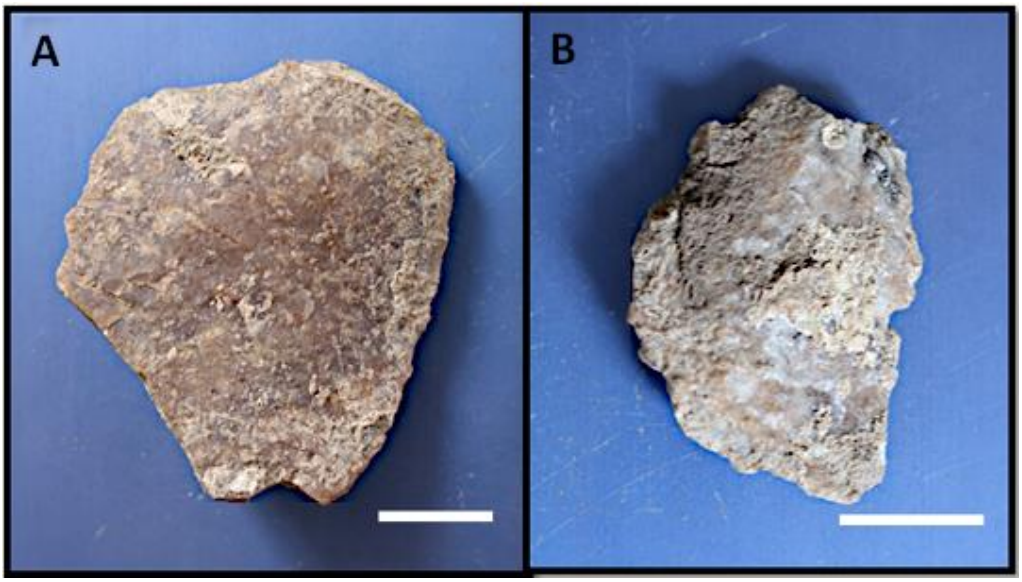

Figure 4.5: A) No. 493 and B) No.1290 showing their colours, surface textures and lustres. The white bar represents 1 cm.

Most quartz samples are generally pink-white (like the pebbles) but vein quartz, like that sampled at OBP 4D, is pure white. Unlike quartzite pebbles, quartz pebbles have a more pitted and striated cortical surface.

Chert

Very fine-grained, cream white chert (No. 412) also forms part of the OBP lithic assemblage (Figure 4.6). This sample will not be analysed through any other methods because no chert sources could be sampled near OBP.



Figure 4.6: Image of the only chert in the OBP assemblage, No. 412. The white bar represents 1 cm.

4.1.2 Mwulu's Cave lithic macroscopic descriptions

Quartzite

The majority of Mwulu's Cave lithics are quartzite (n=52, see Table 3.4). These are generally either white or black in colour although M3-C is a red quartzite. Three quartzite groups are recognised in this assemblage. These are the general group, the quartzite with pore spaces, and the plane bedded quartzite. Generally, samples have dull, smooth textures while others are rough to the touch. Grain sizes throughout the assemblage range from fine (0.1 mm) to coarse (1 mm). Quartz grains are rounded, sub-rounded, or sub-angular depending on the sample. They are also predominantly interlocked (crystal boundaries touching) or annealed (crystals recrystallised to form larger grains) although annealing is more prominent in black quartzite samples. The grains in the quartzite lithics are well-sorted and have minimal matrix. The lithics in the first group to branch off the general group have pore spaces throughout them (e.g. M1-B; Figure 4.7 A). The second group to branch off the general group has grey and white plane beds as noted in No. 673 (Figure 4.7 B). There is no evidence of other sedimentary structures in the observed samples.

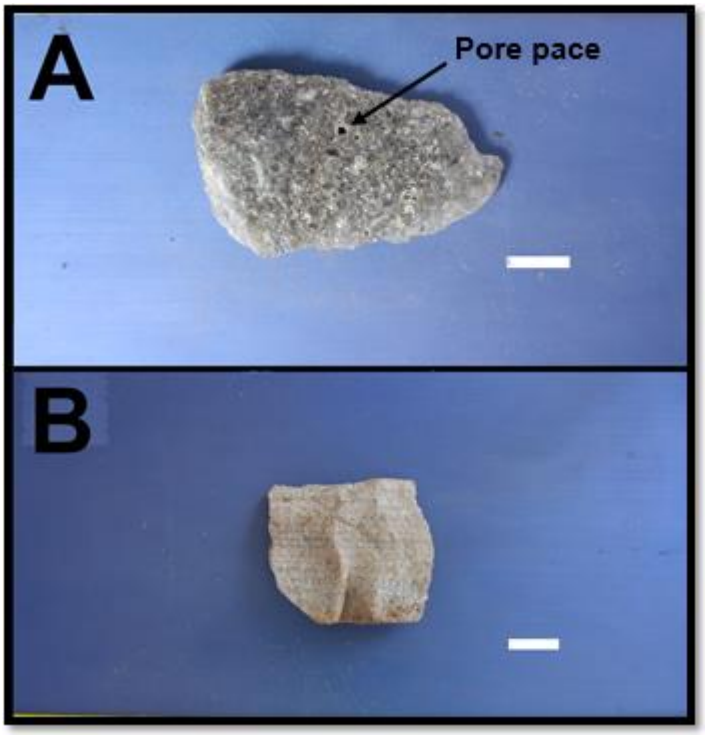

Figure 4.7: A) M1-B shows annealed texture and pore spaces. B) Plane beds are shown in No.673. The white bar represents 1 cm.

Generally, quartzite around Mwulu's Cave is either a variation of white or black (white-grey-black spectrum). This colour distinction has no influence/effect on the kinds of characteristics found in a quartzite. They all have a rough orange or brown weathered surface and a dull texture. The quartzite is coarse-grained (>5 mm) with sub-rounded to sub-angular quartz grains. The samples are well-sorted (minimal matrix) and have interlocking grains. Plane bedded quartzite around Mwulu's Cave occurs as Outcrop 17 (white and grey) and Outcrop G2B.

Shale

The shale in this lithic assemblage (n=10, see Table 3.4) is dark in colour and its lustre is dull on the weathered surface and shiny on the fresh surface. It is very fine-grained (Figure 4.8). There is no evidence of sedimentary structures in the observed samples.



Figure 4.8: M3-E showing the dark colour and fine-grained texture of Mwulu's Cave shale. The white bar represents 1 cm.

The shale around Mwulu's Cave forms part of the BRQF, the Duitchsland Formation and the Malmani Subgroup. Generally, the shales are dark coloured (grey, black, and brown) and their weathered surface is grey and/or red-orange in colour. They have a smooth texture and a dull lustre. They are also very fine-grained. Some BRQF shale samples are bedded and mica (gold-brown) is noted along these bedding planes. The only noted difference between shales from the remaining formations is that the Malmani Subgroup shales are generally darker (dark grey and black) than those from the Duitschland Formation (green-grey and brown).

Quartz

Eleven quartz samples form part of the lithic assemblage at Mwulu's Cave (Table 3.4). Two types of quartz are noted at this site, fresh white vein quartz and weathered, iron-stained quartz (Figure 4.9). The white quartz is smooth to tough and has a glassy lustre. It also has orange staining along its cracks. The translucent quartz (No. 2073) is matte, has a grainy texture and a dull lustre.

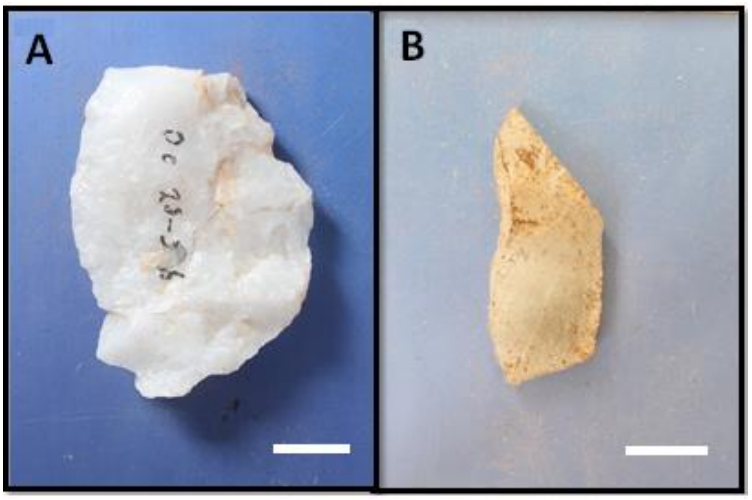

Figure 4.9: A) M1-F is white and has a glassy lustre. Orange staining is seen along the cracks. B) No.2073 is a weathered quartz sample with iron-staining. The white bar represents 1 cm.

Quartz outcrop samples (xenomorphic: lacking its characteristic crystal shape) are either light grey (Outcrop 16B), white (Outcrop 19A), or white and red (Outcrop 20). These samples are smooth and glassy. At the cave, automorphic quartz (presenting its characteristic crystal shape) was also sampled in a little cave besides Mwulu's Cave (Outcrop 16F).

Chert

The three chert samples (Table 3.4) in this assemblage are grey and very fine-grained (M1-K; No. 674; PALO49). They are smooth to touch and have a dull lustre. They are also banded (grey and dark grey) (Figure 4.10).



Figure 4.10: A) M1-K and No. 674 showing grey banding. The white bar represents 1 cm.

Chert is regularly seen interbedded with the Malmani dolomite. It is grey and has a red or brown weathered surface. It has a smooth texture and a dull lustre. The chert samples collected around Mwulu's are very fine-grained (grains are not visible to the naked eye).

Taphonomically Altered samples

Some lithic samples made of taphonomically altered rock types (will just be written as 'altered' throughout the text) also form part of Mwulu's Cave lithics (M1-E; M1-G; M2-B (Figure 4.11); M2-C (Figure 4.11); PA-11). These have pore spaces throughout them. They will not be analysed further because their rock type is difficult to establish due to the alteration and therefore no possible source outcrops can be determined.

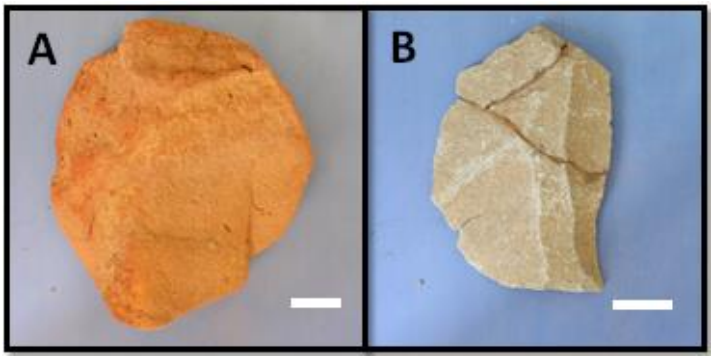

Figure 4.11: A) M2-B and M2-C showing the altered samples. The white bar represents 1 cm.

4.2 Portable X-ray fluorescence Results

As shown in the materials and methods section, lithics from OBP were divided into five rock types and those from Mwulu's Cave into four rock types. All the lithics and geological samples were analysed using pXRF to provide preliminary provenance possibilities. The results are shown in principal component analysis plots ('PCA'; multivariate analysis) and scatterplots below. The full pXRF raw data can be found in APPENDIX B.

4.2.1 Olieboomspoort Rock Shelter Portable X-ray Fluorescence data

Olieboomspoort Rock Shelter Scatterplots

Quartzite

After screening several reference materials scatterplots, it appeared that scatterplots Ti/Fe and Si/Al were the most useful to discriminate the reference outcrops. Samples collected from secondary contexts nearby Cleremont Formation all have an Fe content under 1.0% and a Ti content over 700 ppm (Figure 4.12 A). Samples collected from secondary contexts nearby Mogalakwena Formation appear to be more diverse but present higher Fe content. Two localities (OBP 1 and OBP 4) are very different from the rest of the samples collected nearby the Mogalakwena Formation because they have higher Fe content than the rest. From the Si/Al scatterplot (Figure 4.12 B) it is evident that all samples close to the Cleremont Formation have an Al content above 1.1% and an Si content between 32.0% and 44.6%. The *in situ* Cleremont Formation outcrop samples, in particular, have a higher Al content than the secondary samples. Similar to the Ti/Fe scatterplot, the Si/Al scatterplot shows that samples collected from secondary contexts near the Mogalakwena Formation are more diverse than those near the Cleremont Formation. They present higher Al content and lower Si content in comparison to the Cleremont Formation samples. It is observed that some Mogalakwena Formation and Cleremont Formation samples overlap (OBP 6B and BPC1F, and CMF1,

OBP 4E, and OBP 6A). Among these overlapping geological samples, CMF1 is the only *in situ* quartzite.

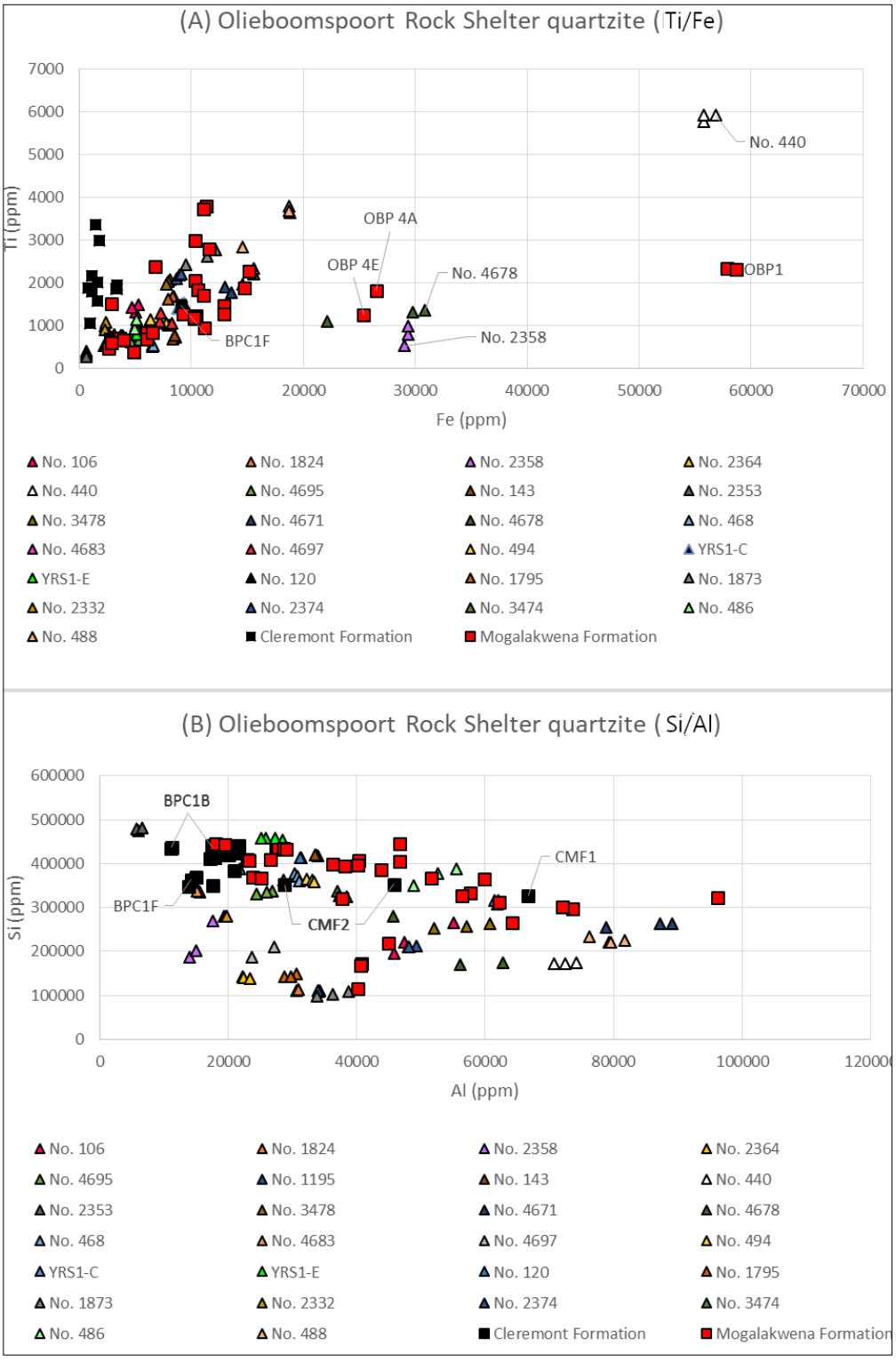

Figure 4.12: A) Ti/Fe scatterplot of quartzite samples at OBP. B) Si/Al scatterplot of quartzite samples at OBP.

Shale

Scatterplot K/Al (Figure 4.13) shows that shale samples collected in secondary context around the Mogalakwena Formation have an Al content between 1.9% and 11.0%. The K content of these samples is below 9500 ppm. Secondary sample OBP 10B has an Al content that is significantly higher than that of OBP 10A.

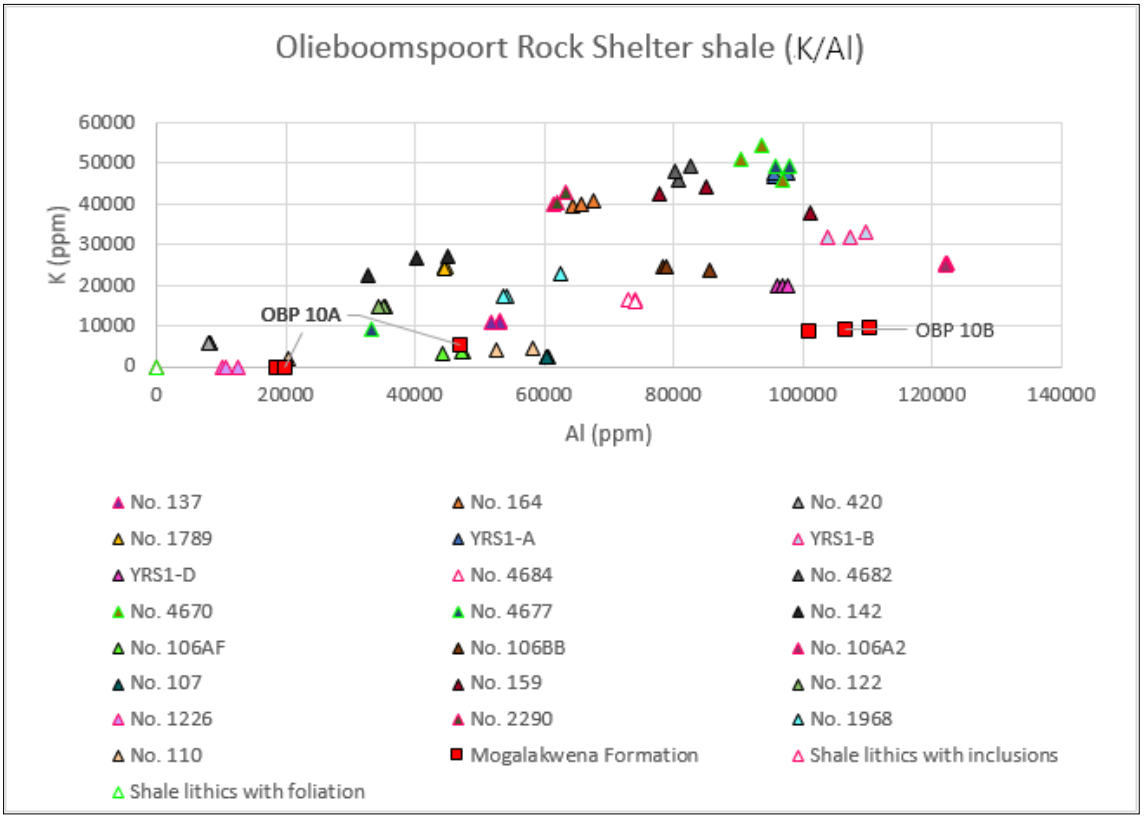

Figure 4.13: A) K/Al scatterplot showing shale samples at OBP.

Sandstone

The most useful scatterplots to discriminate OBP sandstone samples were Ti/Fe (Figure 4.14 A), and Si/Al (Figure 4.14 B). The secondary context sandstone samples collected around the Mogalakwena Formation have a Fe content below 3% and a Ti content below 2400 ppm. Their Al content lies between 2.8% and 7.6% while their Si content is over 18.6%.

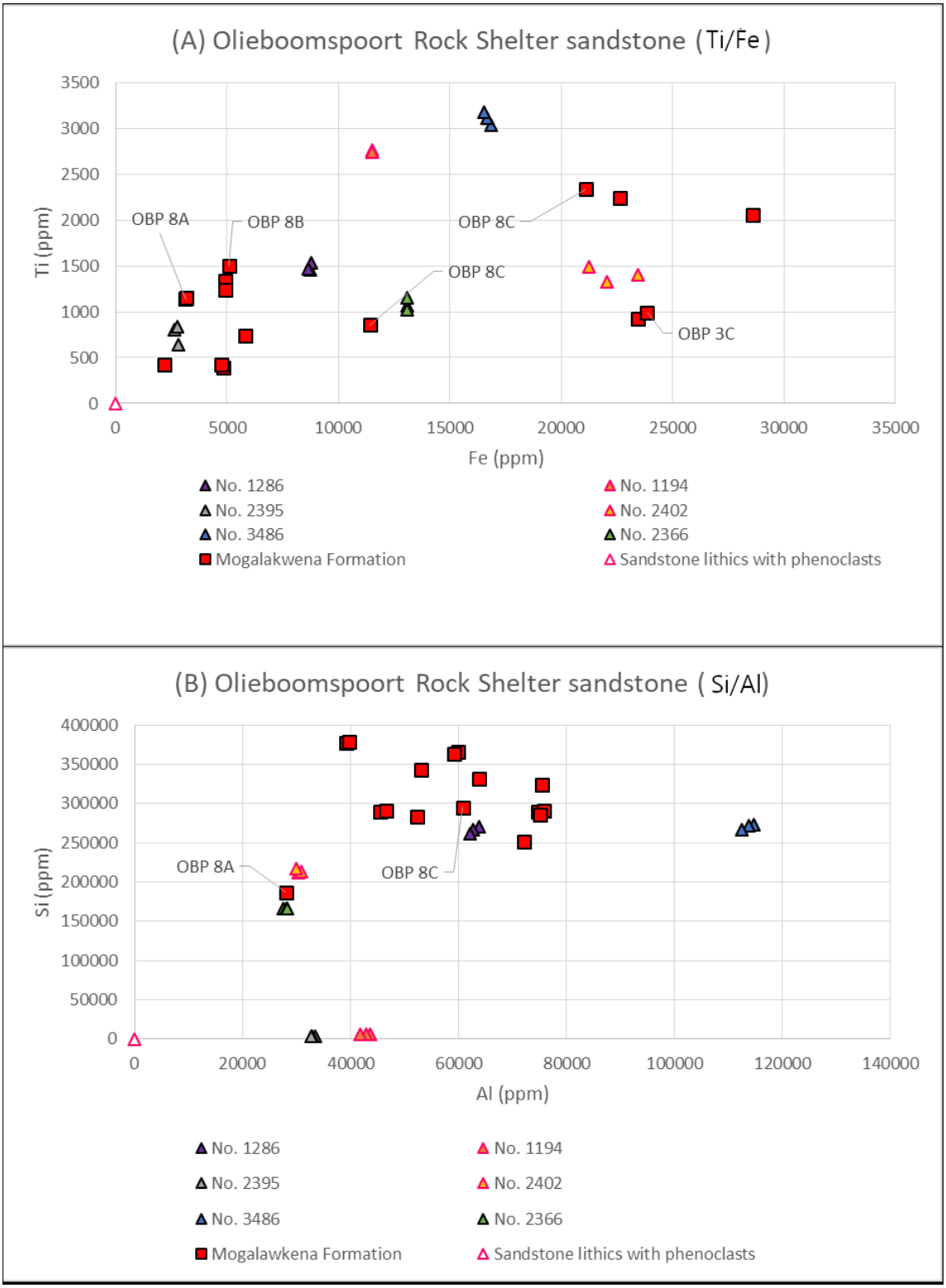

Figure 4.14: A) Ti/Fe scatterplot of sandstone samples at OBP. B) Si/Al scatterplot of sandstone samples at OBP.

Dolerite

Scatterplots Ti/Fe (Figure 4.15 A) and Si/Al (Figure 4.15 B) are the most informative when it comes to comparing OBP dolerite samples. The reference samples collected in secondary contexts around the Mogalakwena Formation have a Fe content between 12.1% and 15.9% and a Ti content between 1.5% and 1.8%. The Al content of these samples is between 7.4% and 12.5%, and the Si content is between 20.2% and 28.7%. *Ex situ* sample OBP 5A plots outside of the Ti range (1.1%) and the Si range (16.5%).

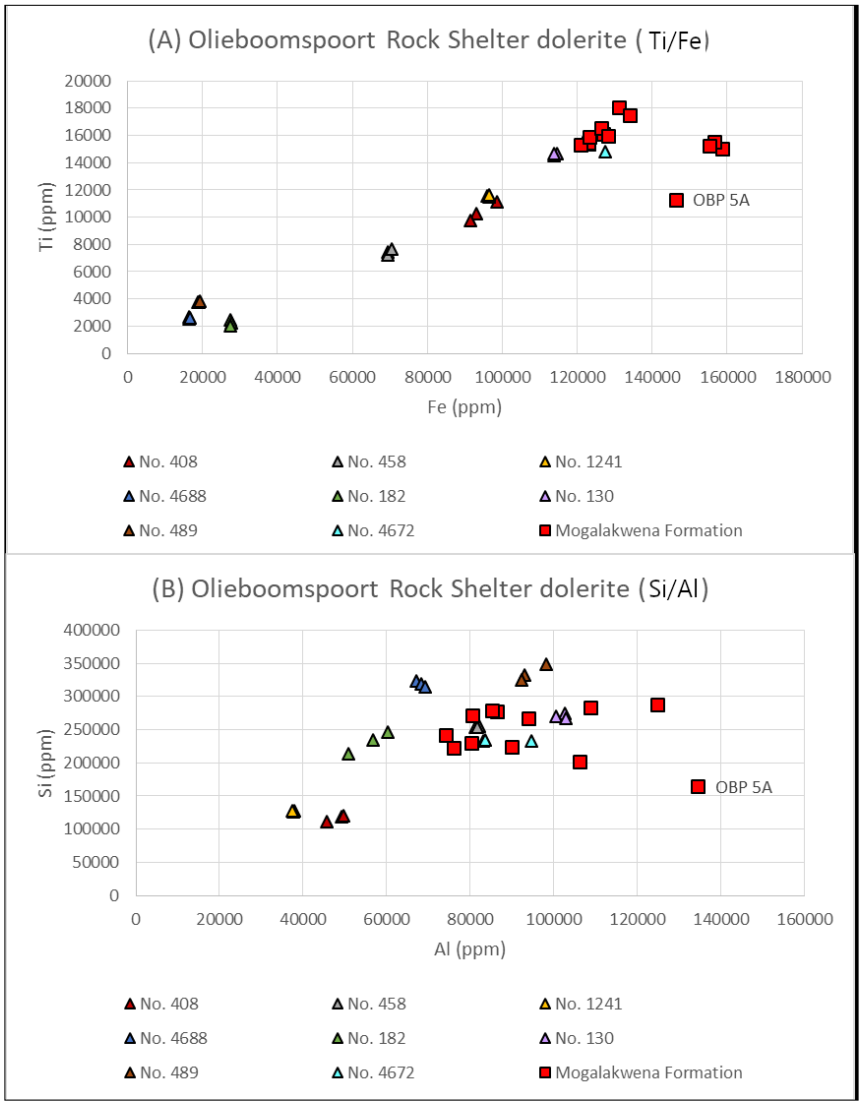

Figure 4.15: A) Ti/Fe scatterplot of dolerite samples at OBP. B) Si/Al scatterplot of dolerite samples at OBP.

Quartz

The Ti/Fe (Figure 4.16 A) and Si/Al (Figure 4.16 B) scatterplots are the most useful graphs for making comparisons between geological samples from the Cleremont Formation and those from the Mogalakwena Formation. Samples from both formations plot very close to one another. The Fe content in the geological samples collected around the Cleremont Formation is less than 4000 ppm and the Ti content is less than 1880 ppm. The Al content of these samples ranges from 1.8% to 3.1% while the Si content ranges from 38.3% to 43.4%. The geological samples collected around the Mogalakwena Formation are more diverse in both scatterplots and generally have higher Fe and Ti contents, as well as Al and Si contents, compared to the Cleremont Formation samples.

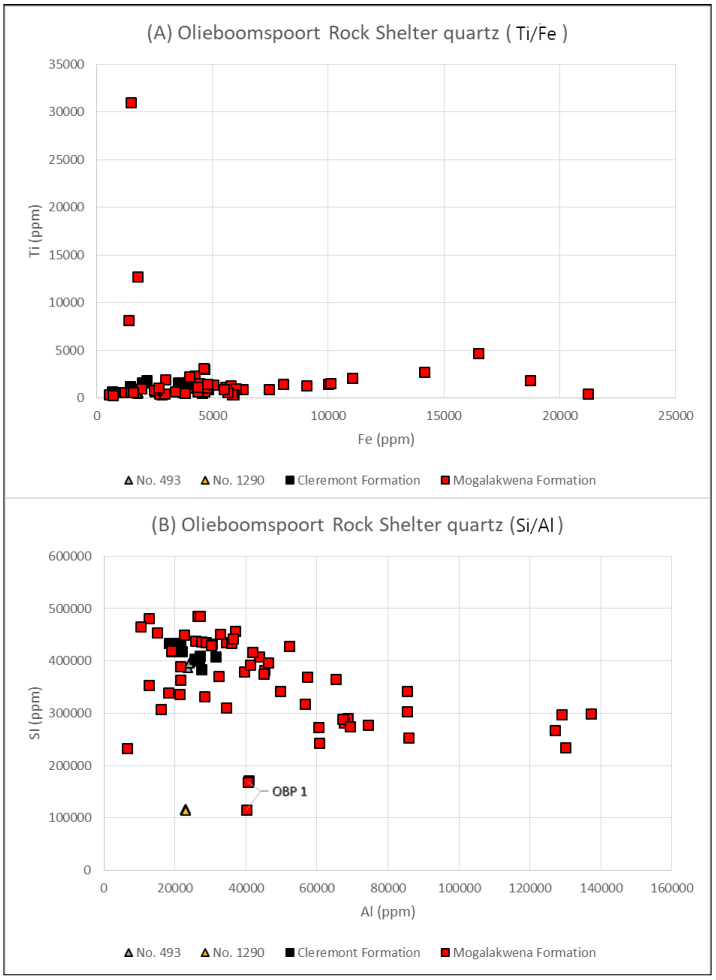

Figure 4.16: A) Ti/Fe scatterplot of quartz samples at OBP. B) Si/Al scatterplot of quartz samples at OBP.

Principal Component Analysis of Olieboomspoort Rock Shelter Samples

A total of 48 geological source samples and 65 lithics from around OBP were analysed through pXRF in this project. The results of this analysis were used to differentiate between the different rock types found around the site, and to to see how lithics grouped with the rock types and different foramtions within these rock types. The following elements were used in different PCA plots for this purpose: Al, Si, S, K, Ti, V, Cr, Mn, Cu, Zn, Fe, Ni, RB, Sr, Y, Zr, Nb, Pb, and Th. In all of the following biplots, the first two principle components are plotted. The PCA results are given below and tables with the element coordinates for PC1 and PC2 can be found in Appendix B.

Differentiation of Rock Types

In Figure 4.17, PC1 and PC2 show 61.6% of the total variation obtained through using elements Al, Si, S, Ti, V, Cr, Mn, and Fe. The best projected elements on PC1 (47.5% variation) are Fe, Mn, and V. The best projected elements on PC2 (14.1% variation) are S, Cr, and Si.

Two distinct groups are noted from the Rock Types PCA plot. One with dolerite, and the other with quartzite, quartz, sandstone, and shale. There is less variability in elements best projected by PC2 (S, Cr, and Si) across the different rock types in comparison to those best projected by PC1 (Fe, Mn, and V). Dolerite is richer in Fe, Mn, and V in comparison to quartzite, quartz, sandstone, and shale as seen on the PC1 axis. It can be clearly distinguished from the rest of the OBP rock types. All the rock types, with the exception of dolerite, overlap their 80% significance level ellipses (fill) and their 95% significance ellipses (dash). These rock types cannot be well differentiated from one another based on this plot.

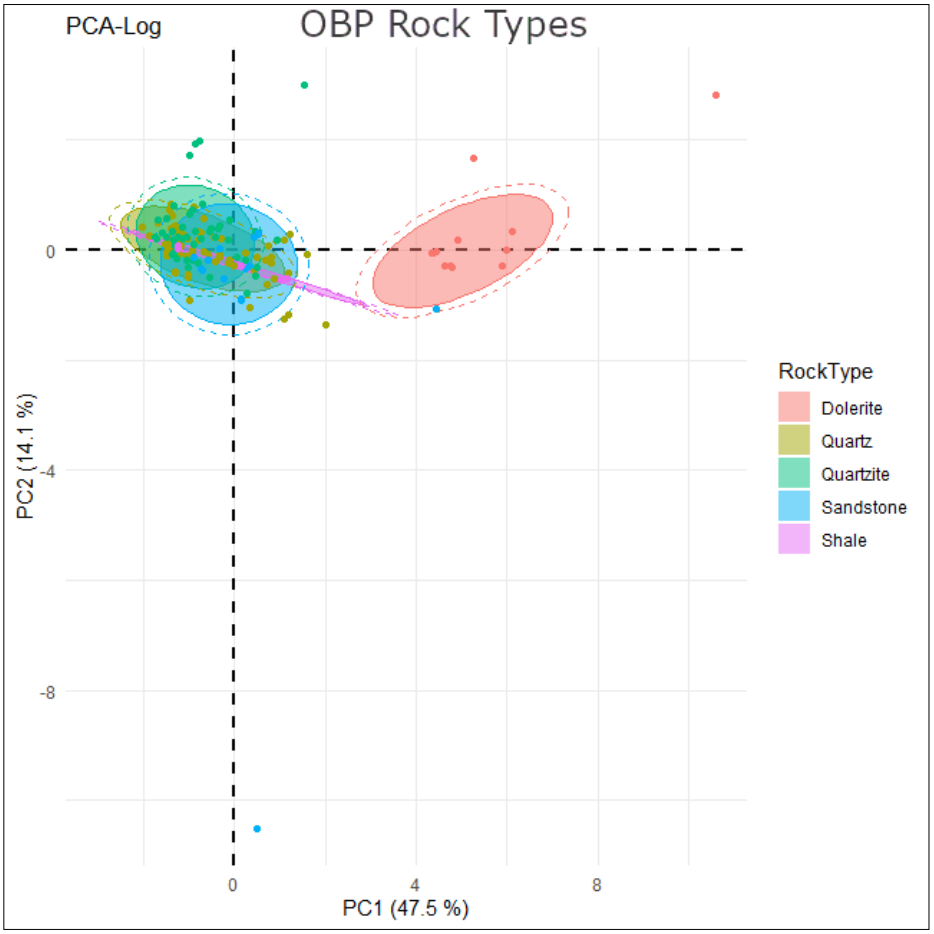

Figure 4.17: The PCA of overlapping OBP rock types (except dolerite) from pXRF data showing 80% significance level ellipses (fill) and 95% significance ellipses (dash).

PCA plots of OBP quartzite samples

In the 'Quartzite Formations' PCA plot, PC1 and PC2 show 53.9% of the total variation (Figure 4.18A). These variations were obtained by using elements Al, Si, Ti, Mn, Fe, Rb, Sr, Y, and Zr. The best projected elements for the quartzite formations on PC1 (35.2% variation) are Si, Fe, Mn and those on PC2 (18.7% variation) are Y, Rb, and Zr.

The Mogalakwena Fm and Cleremont Fm geological samples cannot be differentiated from each other using this plot. Instead the Mogalakwena Fm samples enclose the Cleremont Fm samples with a 100% overlap of its 80% significance level ellipse. The Mogalakwena Fm is more diverse in elements best projected by PC1 and PC2 compared to the Cleremont Fm. Because these formations are overlapping, it is difficult to determine to which the quartzite lithics belong.

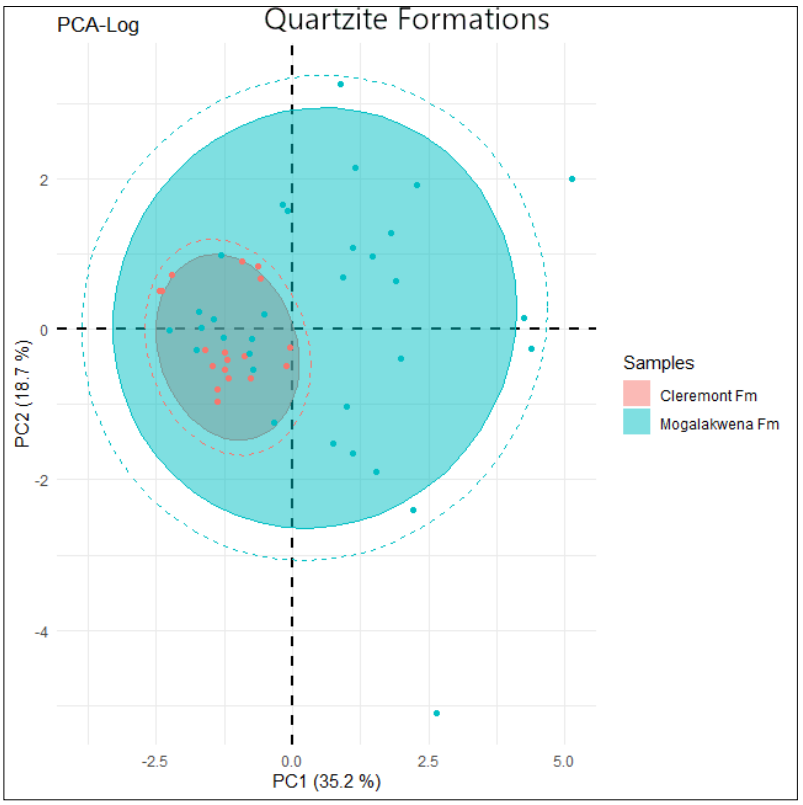

Figure 4.18: The PCA of overlapping OBP quartzite formations from pXRF data showing 80% significance level ellipses (fill) and 95% significance ellipses (dash).

PCA plot of all the OBP shale samples

Only one formation could be studies for shale around OBP. In the ‘ All shale samples’ (outcrops and archaeological samples) PCA plot (Figure 4.19), PC1 and PC2 show 56.4% of the total variation obtained through using elements Al, Si, P, S, K, Ti, V, Mn, Fe, Zn, Rb, Sr, Y, Zr, Nb, and Pb. The best projected elements on PC1 (34.5% variation) are Zr, Nb, and Y. The best projected elements on PC2 (21.9% variation) are S, Zn, and K.

None of the shale lithics, with the exception of No. 420, lie within the the 80% significance level ellipse of the Mogalakwena Fm samples. Instead the lithic assemblage is more diverse along the PC2 axis. This is because insufficient shale geological samples were able to be collected.

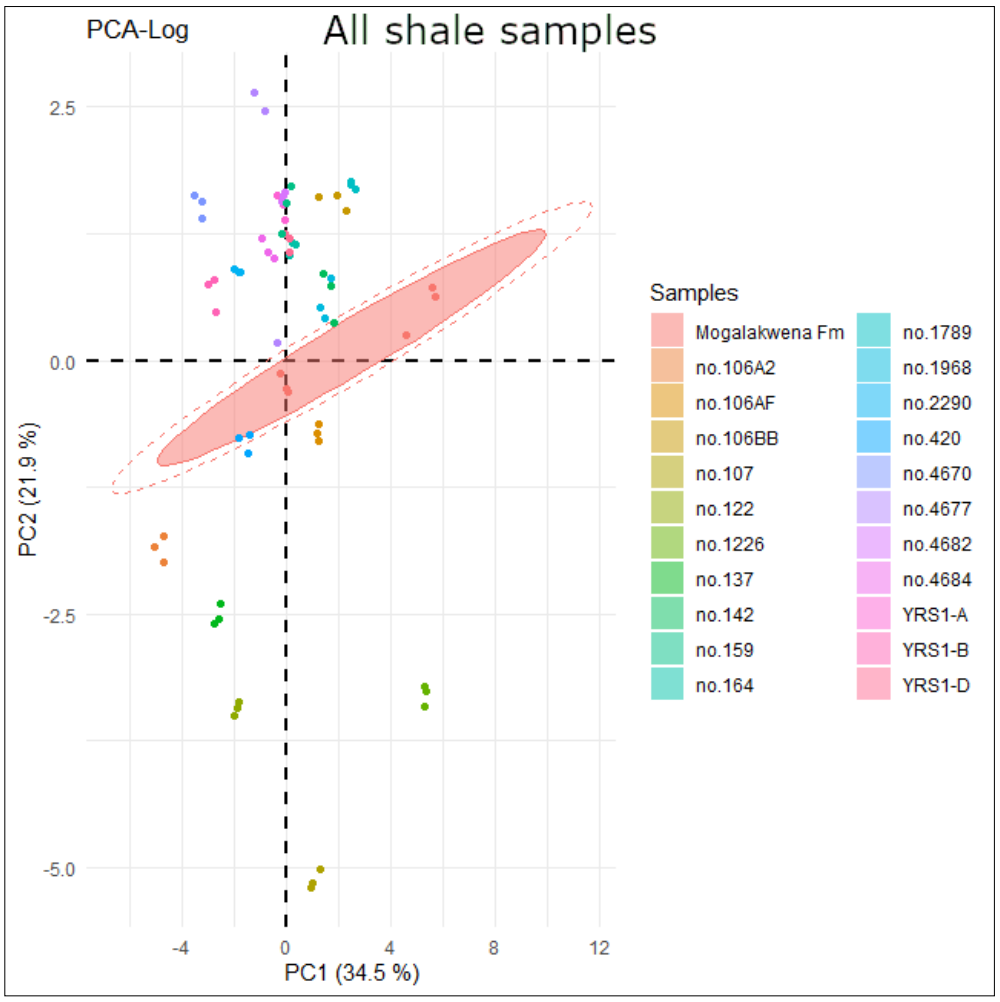

Figure 4.19: The PCA of OBP shale samples from pXRF data showing 80% significance level ellipses (fill) and 95% significance ellipses (dash). It shows the unrelatedness of Mogalakwena Fm samples and the lithics.

PCA plot of sandstone samples

Onlys sandstones from one formation (Mogalakwena Fm) were analysed in this study. In the 'All sandstone samples' (outcrops and archaeological samples) PCA plot (Figure 4.20), PC1 and PC2 account for 57.3% of the total variation obtained through using elements Al, Si, S, K, Ti, V, Mn, Fe, Cu, Zn, Rb, Sr, Y, and Zr. The best projected elements on PC1 (35.2% variation) are Zn, Zr, and V. The best projected elements on PC2 (22.1% variation) are K, Y, and Rb.

All the OBP sanstone lithics fall within the Mogalakwena Fm 80% significance level ellipse except for No. 1194. No. 1194 is richer in Zn, Zr, and V compared to the rest of

the lithics and the geological samples From the Mogalakwena Fm. For this reason, its provenance cannot be determined.

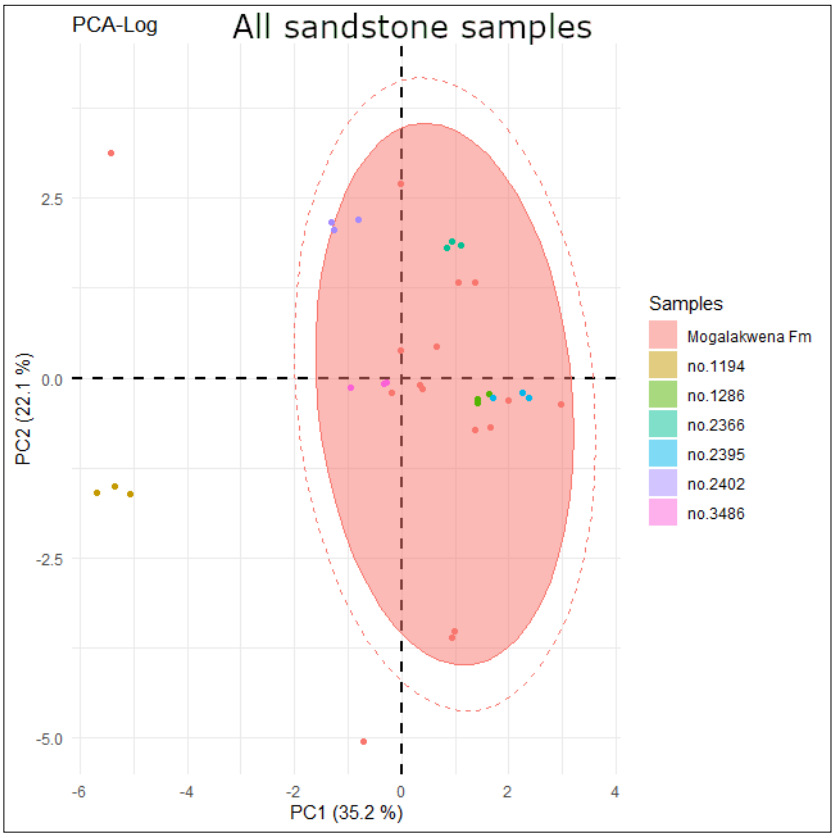

Figure 4.20: The PCA of OBP sandstone samples from pXRF data showing 80% significance level ellipses (fill) and 95% significance ellipses (dash). Most lithics fall within the ellipse of the Mogalakwena Fm samples.

PCA plot of all the OBP dolerite samples

Only dolerites from the Mogalakwena Fm could be analysed in this study. In the ‘ All dolerite samples’ (outcrops and archaeological samples) PCA plot (Figure 4.21), PC1 and PC2 show 50.5% of the total variation obtained through using elements Al, Si, P, S, Ti, V, Mn, Fe, Ni, Zn, Rb, Sr, Y, and Zr. The best projected elements on PC1 (36.2% variation) are Fe, Ti, and Rb. The best projected elements on PC2 (14.3% variation) are P, Si, and Al.

From this PCA plot, it is noted that the majority of the lithics are not similar to the dolerite geological samples collected from the Mogalakwena Fm. Only No. 130 lies

slightly on the 80% significance level ellipse of this formation. No. 458, No. 182, No. 4688, and No. 489 are poorer in Fe and Ti, and richer in Rb compared to Mogalakwena shale geological samples. No. 4672, No. 408, and No. 1241 are richer in P and poorer in Si and Al compared to the Mogalakwena shale geological samples. Based on these results it is difficult to determine the provenance of most OBP dolerite lithics.

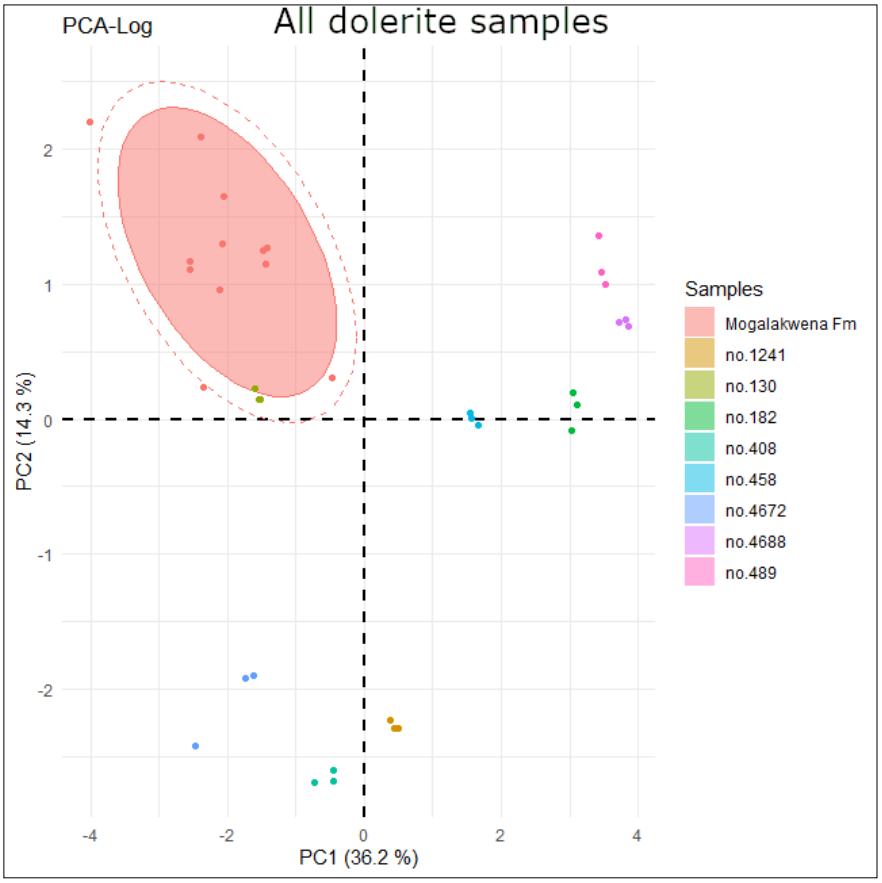

Figure 4.21: The PCA of OBP dolerite samples from pXRF data showing 80% significance level ellipses (fill) and 95% significance ellipses (dash). It shows the disparity between Mogalakwena Fm samples and the lithcs.

PCA plots of OBP quartz samples

In the 'Quartz Formations' PCA plot, PC1 and PC2 show 58.9% of the total variation (Figue 4.22). These variations were obtained by using elements Al, Si, S, Ti, V, Cr, Mn, and Fe. The best projected elements for quartz formations on PC1 (33.6% variation) are Fe, Mn, and Si and those on PC2 (25.3% variation) are V, Ti, and Al.

The Mogalakwena Fm and Cleremont Fm geological samples cannot be differentiated from each other using this plot. Instead the Mogalakwena Fm samples enclose the Cleremont Fm samples with a 100% overlap of its 80% significance level ellipse, similar to the quartzite geological samples. The Mogalakwena Fm, however, is more diverse in elements best projected by PC1 and PC2 compared to the Cleremont Fm. Due to this overlap, it is difficult to determine the provenance of the quartz lithics from OBP.

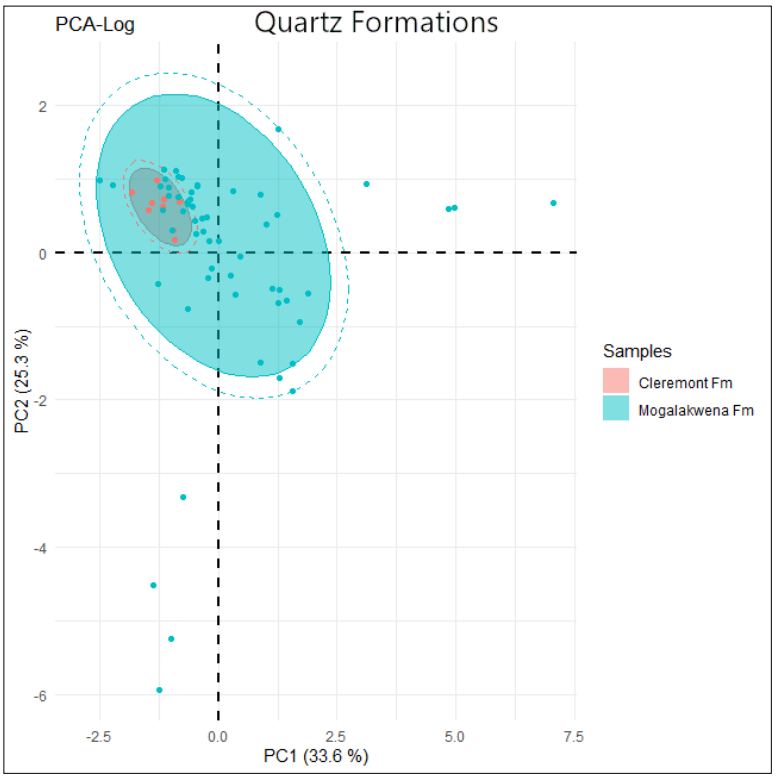

Figure 4.22: The PCA of overlapping OBP quartz formations from pXRF data showing 80% significance level ellipses (fill) and 95% significance ellipses (dash).

4.2.2 Mwulu's Cave Portable X-ray Fluorescence data

Mwulu's Cave Scatterplots

Quartzite

After screening the scatterplots of the reference materials, the most informative scatterplots to compare Mwulu's Cave samples were Ti/Fe (Figure 4.23 A) and Si/Al (Figure 4.23 B). Generally, the outcrop samples collected around the BRQF have a Fe

content below 5100 ppm although some samples have a higher Fe content (e.g. Outcrop 16A: 1.8%). The Ti content of most outcrop samples collected from the BRQF is below 5800 ppm but that of Outcrop 19B is much higher (2.3%). These outcrop samples have an Al content below 6.9% and a Si content that ranges between 21.9% and 42.5%.

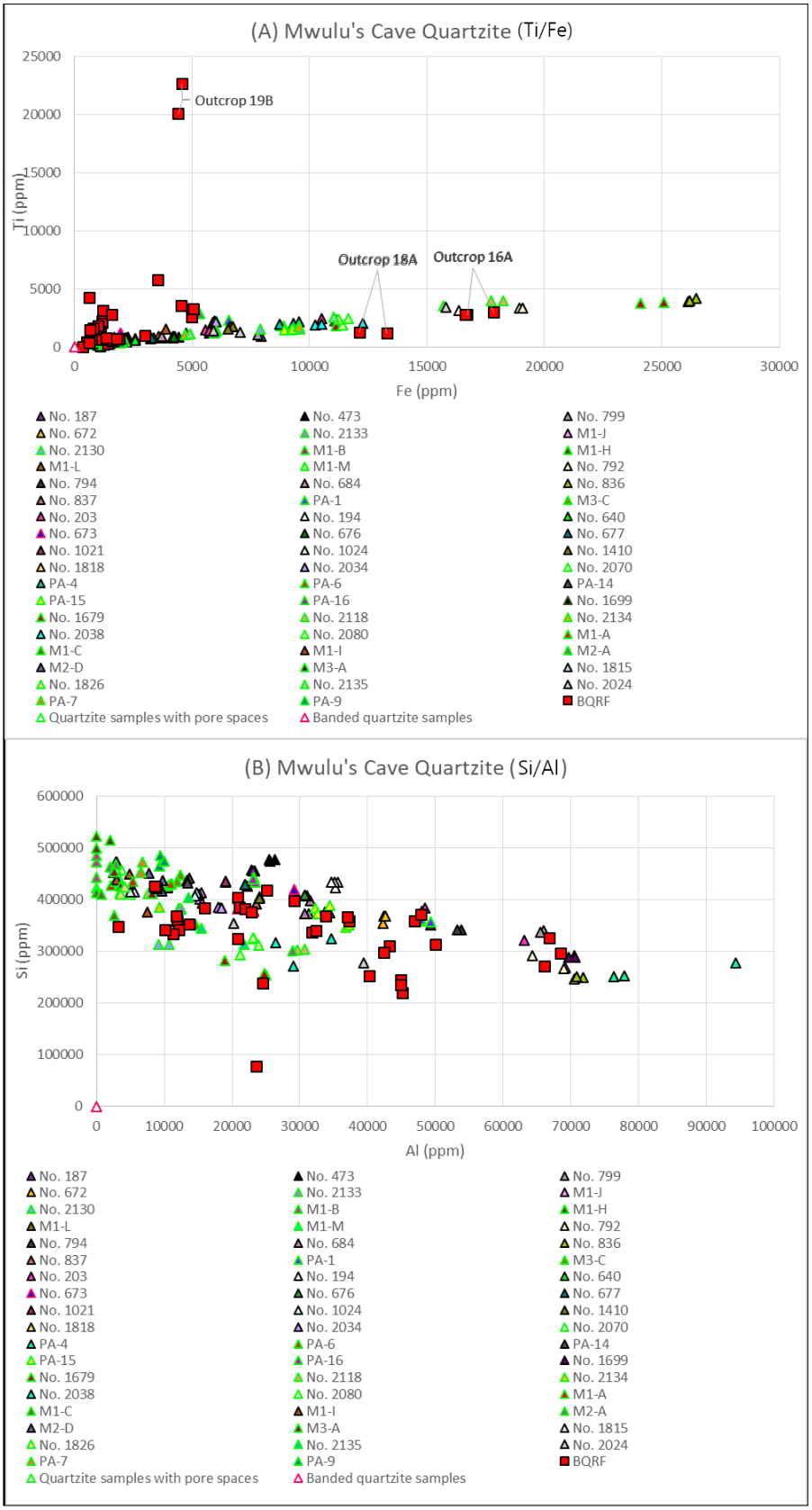

Figure 4.23: A) Ti/Fe scatterplot of quartzite samples at Mwulu's Cave. B) Si/Al scatterplot of quartzite samples at Mwulu's Cave.

Shale

The K/Al (Figure 4.24 A) and Zr/K (Figure 4.24 B) scatterplots offered the most useful results to discriminate the geological samples collected around the BRQF, the Duitschland Formation and the Malmani Subgroup. The shale outcrop samples collected from the BRQF have an Al content that ranges between 6% and 15.8%, and a K content from 1.1% to 4.5%. The outcrop samples collected from the Duitschland Formation generally have lower K/Al ratios than those from the BRQF. The Malmani Subgroup geological samples are more diverse than those from BRQF and the Duitschland Formation. They also have higher K contents compared to those from the BRQF and the Duitschland Formation. In terms of Zr/K ratios, all the outcrop samples collected from the BRQF have a K content below 4.3% and a Zr content over 130 ppm. The Zr content in these BRQF samples is more diverse than in the Duitschland Formation and the Malmani Subgroup. Outcrop samples collected from the Duitschland Formation are concentrated between 2725 ppm and 1.2% K content while a Zr content between 32 ppm and 123 ppm is noted. The Malmani Subgroup geological samples have a more diverse and higher K content than both the BRQF and Duitschland Formation samples, and they have a Zr content below 170 ppm.

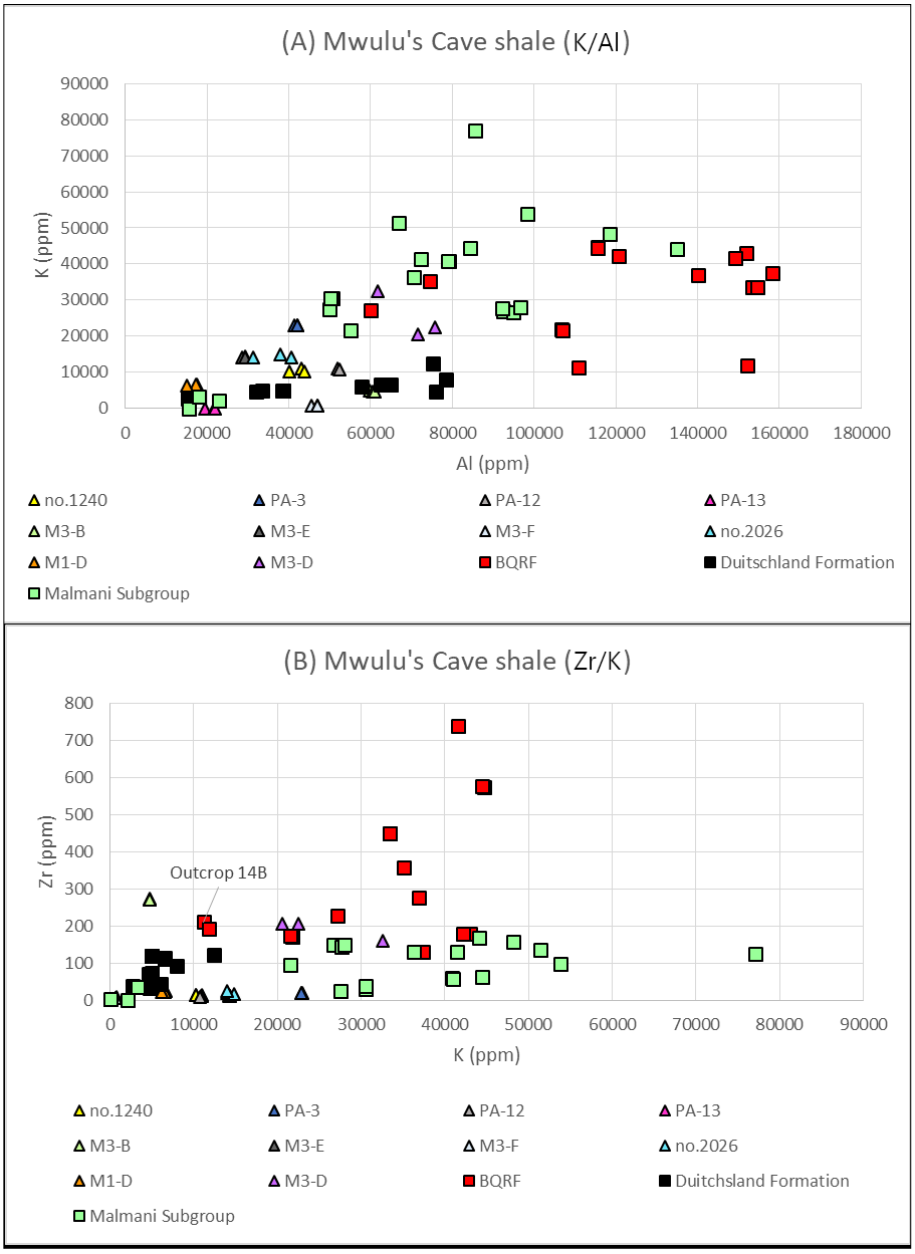

Figure 4.24: A) K/Al scatterplot of shale samples at Mwulu's cave. B) Zr/K scatterplot of shale samples at Mwulu's Cave.

Quartz

The most informative graphs for comparing Mwulu's Cave quartz samples are scatterplots Ti/Fe (Figure 4.25 A) and Si/Al (Figure 4.25 B). The Ti/Fe ratios of the quartz outcrop samples collected from the BRQF are diverse. These samples also have diverse Al contents and they have Si contents below 40%.

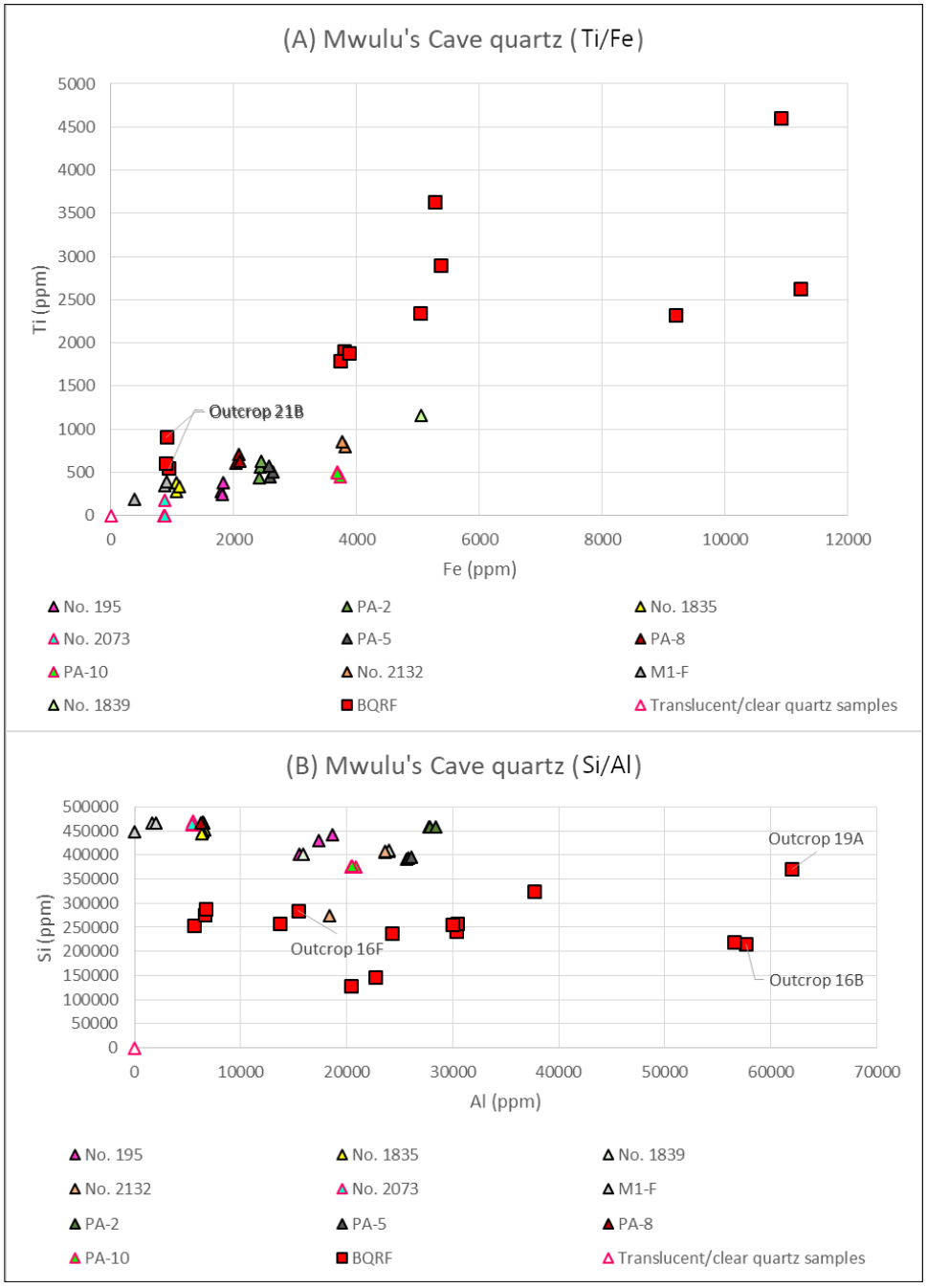

Figure 4.25: A) Ti/Fe scatterplot of quartz samples at Mwulu's Cave. B) Si/Al scatterplot of qaurzt samples at Mwulu's Cave.

Chert

Scatterplots Ti/Fe (Figure 4.26 A) and Si/Al (Figure 4.26 B) provide the most useful information for discriminating between chert samples collected from the BRQF and those collected from the Malmani Subgroup. The chert outcrop samples collected from the BRQF show diverse Ti/Fe and Si/Al ratios. The Fe content of the samples collected from the Malmani Subgroup is below 3000 ppm and the Ti content is below 800 ppm. They have an Al content below 2.1% and their Si content is between 33.9% and 41.3%.

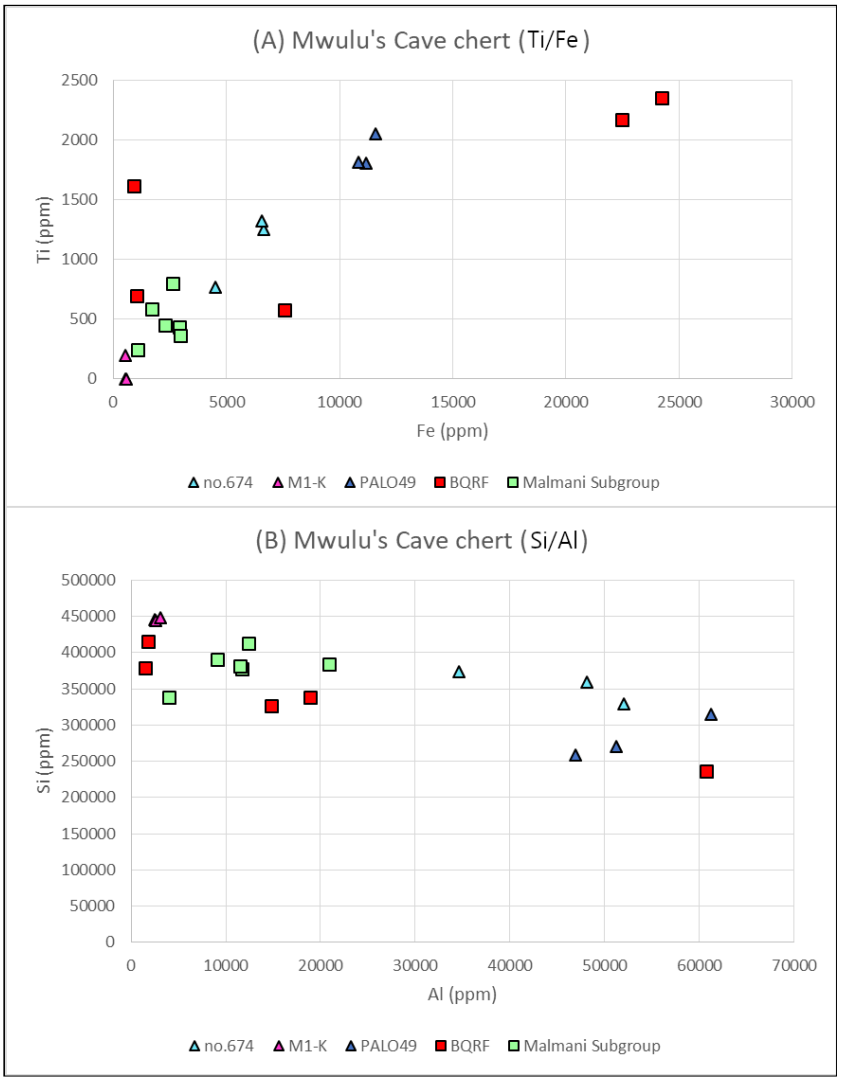

Figure 4.26: A) Ti/Fe scatterplot of chert samples at Mwulu's Cave. B) Si/Al scatterplot of chert samples at Mwulu's Cave.

Principal Component Analysis of Mwulu's Cave Samples

A total of 38 outcrop samples and 81 lithics from Mwulu's Cave were analysed through pXRF in this project. The results of this analysis were used to differentiate between the different rock types found around the site, and to to see how lithics grouped with the rock types and different foramtions within these rock types. The following elements were used in different PCA plots for this purpose: Al, Si, S, K, Ti, V, Cr, Mn, Cu, Zn, Fe, Ni, Rb, Sr, Y, Zr, Nb, Pb, Mo, and Th. As mentioned, only the first two principle components are plotted. The PCA results are given below and tables of the element coordinates for PC1 and PC2 can be found in Appendix B.

Differentiation of Rock Types

In the 'MW Rock Types' PCA plot (Figure 4.27), PC1 and PC2 show 53.7% of the total variation obtained through using elements Al, Si, P, S, K, Ti, Cr, Mn, Fe, Rb, Sr, Zr, and Nb. The best projected elements on PC1 (41.6% variation) are Rb, Nb, and K. The best projected elements on PC2 (12.1% variation) are Mn, S, and Fe.

As with the OBP rock types, two distinct groups are noted from the PCA plot (Figure 4.27). One with shale, and the other with quartzite, quartz, and chert. Although the shale samples show greater diversity in the elements best projected by PC1 and PC2, quartzite quartz, and chert have less Rb, Nb, and K. Many samples in these rock types are also poorer in Mn and Fe and richer in S in comparison to the shale samples. Shale can be clearly distinguished from the rest of the Mwulu's Cave rock types. It has minimal overlap with quartzite on the 80% significance level ellipse (fill) and partial overlap on the 95% significance ellipse (dash). All the rock types, with the exception of shale, overlap their 80% significance level ellipses.These rock types cannot be well differentiated from one another based on this plot.

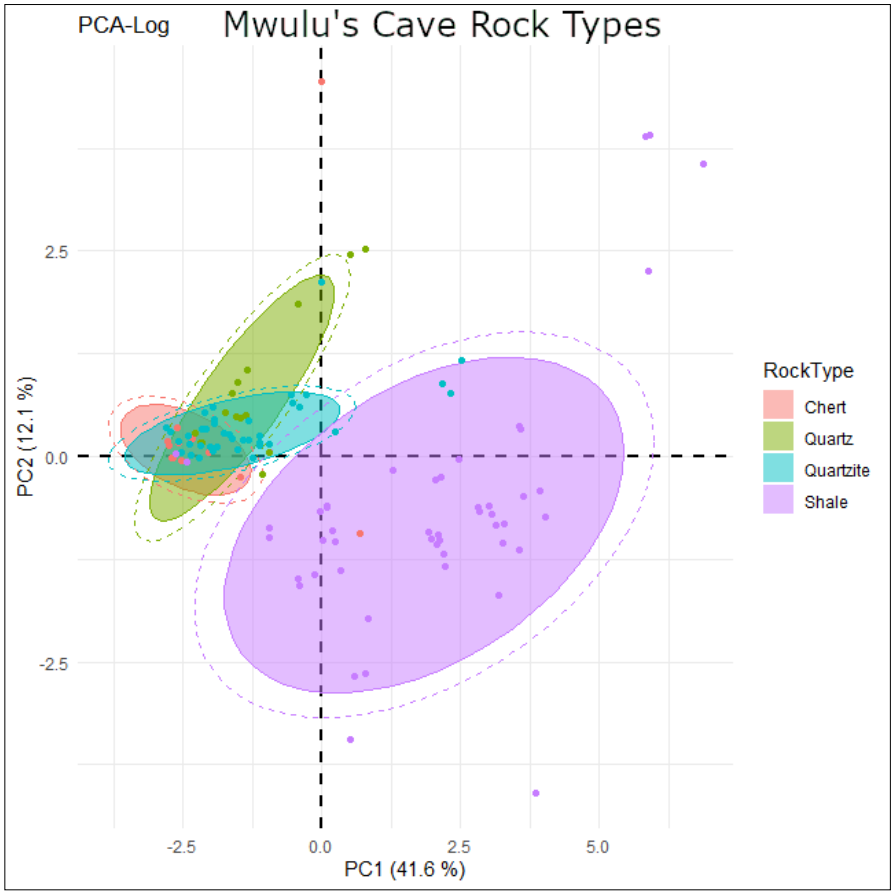

Figure 4.27: The PCA of Mwulu's Cave rock types from pXRF data showing 80% significance level ellipses (fill) and 95% significance ellipses (dash). Shale is well distinguished from the rest of the rock types.

PCA plot of Mwulu's Cave quartzite samples

The 'All quartzite samples' (outcrops and archaeological samples) PC1 and PC2 axes account for 67.5% of the total variation obtained by using elements Al, Si, P, Ti, Fe, Rb, Sr, and Zr (Figure 4.28). The best projected elements for the quartzite samples on PC1 (50.9% variation) are Fe, Sr, and Rb. and those on PC2 (16.6% variation) are P, Si, and Rb.

The BRQF and Malmani Fm geological samples cannot be confidently differentiated from each other using this plot because not enough Malmani Fm outcrop samples could be collected. Most quartzite lithics, however, lie within the BRQF 80% significance level ellipse or close to it. The rest of the lithics have more P, and less Si and Rb than

the samples from the BRQF and the lithics associated with it. The provenance of these lithics cannot be determined based on this plot.

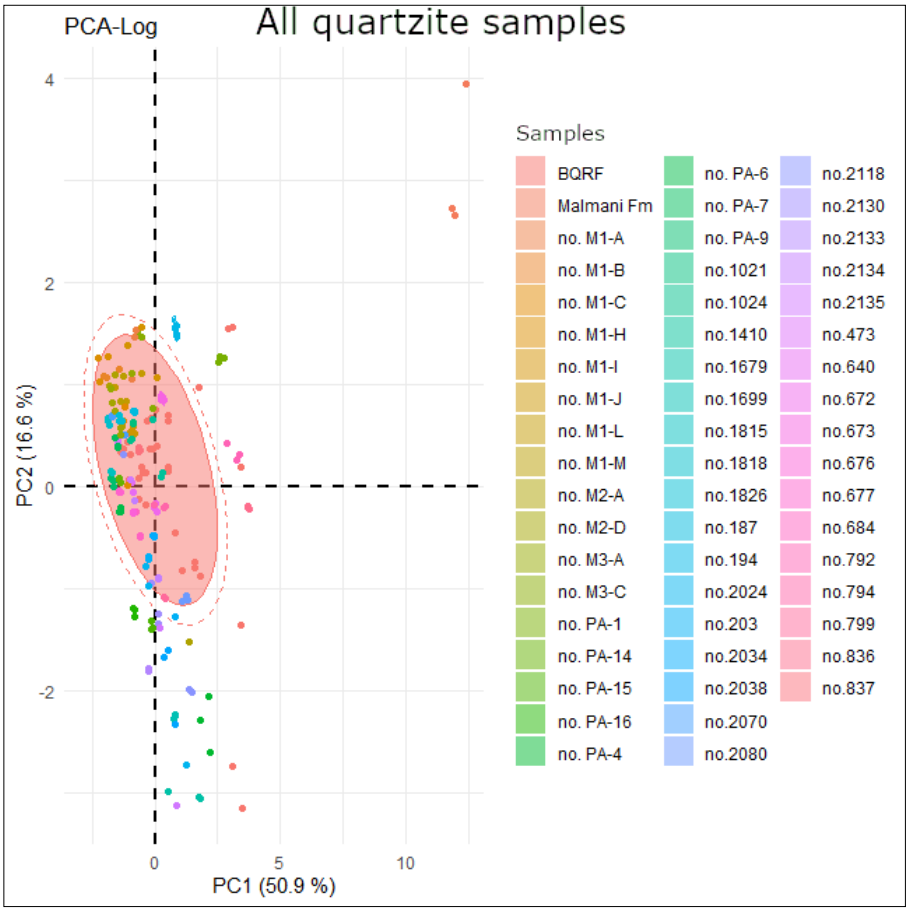

Figure 4.28: The PCA of Mwulu's Cave quartzite samples from pXRF data showing 80% significance level ellipses (fill) and 95% significance ellipses (dash). Most lithics plot within or close to the BRQF ellipse.

PCA plot of Mwulu's Cave shale samples

The 'Shale Formations' PCA plot shows that PC1 and PC2 account for 51.5% of the total variation obtained by using elements Al, Si, P, S, K, Ti, V, Cr, Mn, Fe, Cu, As, Rb, Sr, Y, Zr, Nb, and Th (Figure 4.29). The best projected elements for the shale formations on PC1 (35.6% variation) are Nb, Zr, and Ti and those on PC2 (15.9% variation) are As, Fe, and Th.

The BRQF, Duitschland Fm and Malmani Fm geological samples 80% significance level ellipses are all overlapping and most of the BRQF samples are noted in the Malmani Fm ellipse. Therefore these formations cannot be differentiated from each other using this plot. The Duitschland Fm is more diverse and richer in elements best projected by PC2 (As, Fe, and Th) compared to the other two formations. This plot canot tell us anything about the provenance of shale lithics because the formations overlap.

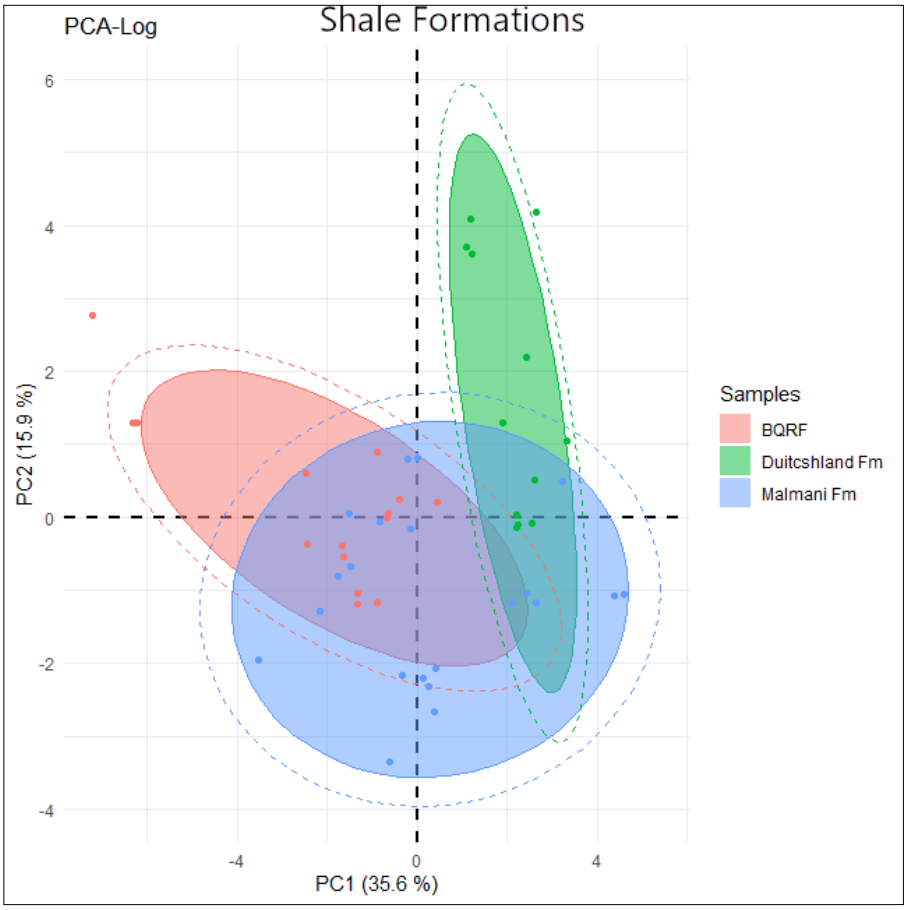

Figure 4.29: The PCA of overlapping Mwulu's Cave shale formations from pXRF data showing 80% significance level ellipses (fill) and 95% significance ellipses (dash).

PCA plot of Mwulu's Cave quartz samples

Only quartz raw materials from the BRQF were analysed. In the 'All quartz samples' (outcrops and archaeological samples) PCA plot (Figure 4.30), PC1 and PC2 show

71.1% of the total variation obtained through using elements Al, Si, P, Ti, and Fe. The best projected elements on PC1 (51.5% variation) are Fe, Al, and Si. The best projected elements on PC2 (19.6% variation) are P, Ti, and Al.

All of the quartz lithics lie within the the 80% significance level ellipse of the BRQF.

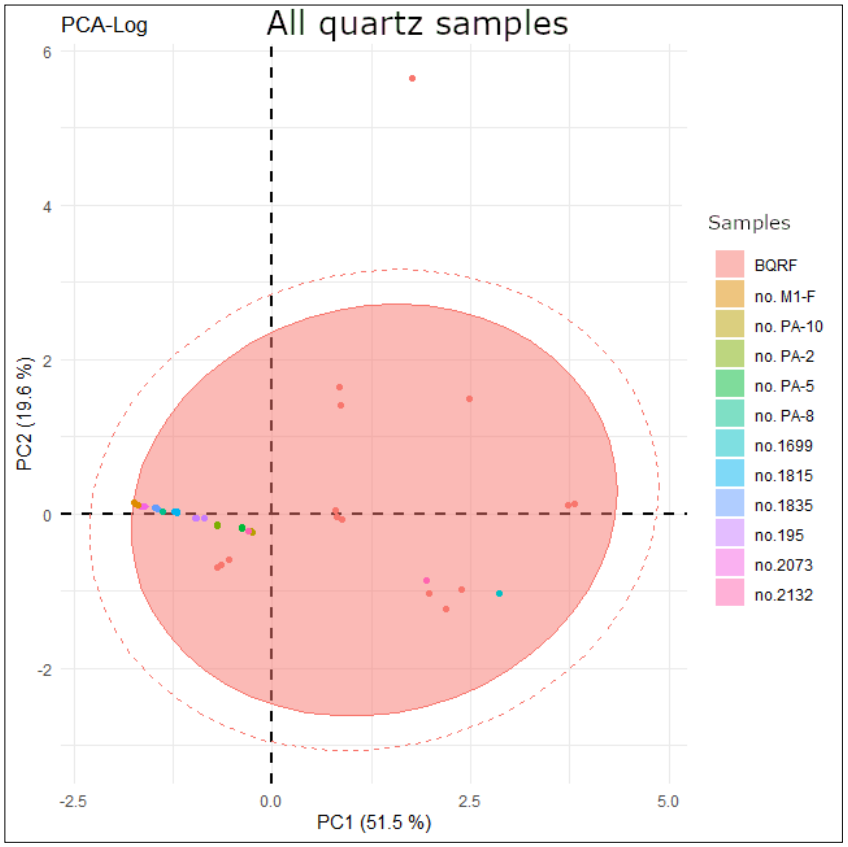

Figure 4.30: The PCA of Mwulu's Cave quartz samples from pXRF data showing 80% significance level ellipses (fill) and 95% significance ellipses (dash). All lithics plot within the BRQF ellipse.

PCA plots of Mwulu's Cave chert samples

The 'Chert Formations' PCA plot (Figure 4.31) shows that PC1 and PC2 account for 77.9% of the total variation obtained through using elements Al, Si, P, S, K, Ti, Cr, Mn, Fe, Rb, Sr, Zr, Nb, and Mo. The best projected elements on PC1 (50.7% variation) are Si, Zr, and Nb. The best projected elements on PC2 (27.2% variation) are P, S, and Sr.

The provenance of the chert lithics cannot be determined due to the overlap of the BRQF and Malmani Subgroup samples.

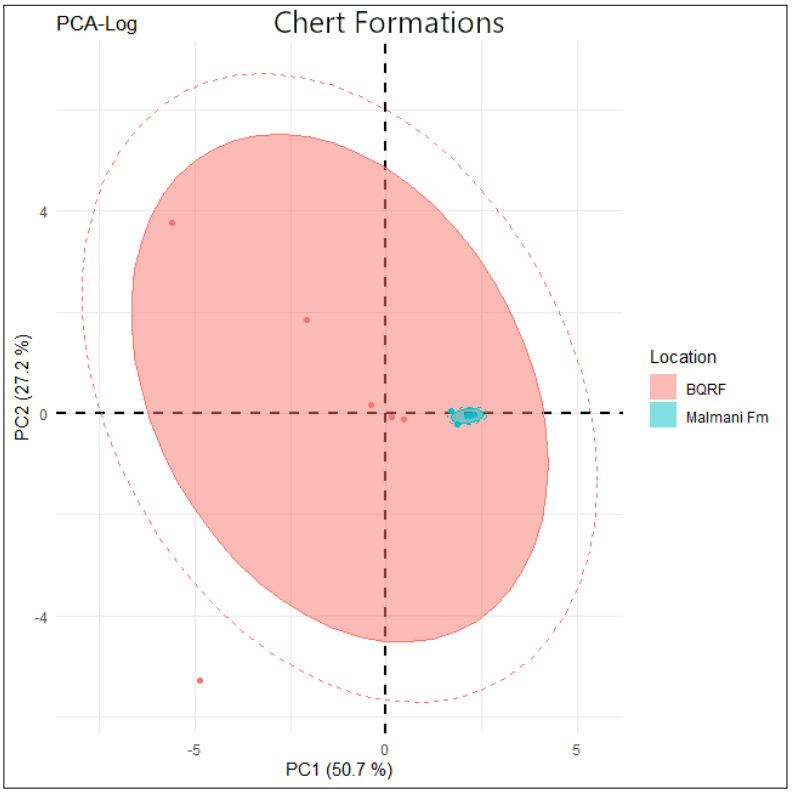

Figure 4.31: The PCA of overlapping Mwulu's Cave chert formations from pXRF data showing 80% significance level ellipses (fill) and 95% significance ellipses (dash).

4.3 Thin section descriptions

In the following sections, petrographic descriptions of samples associated with OBP and Mwulu's Cave are given. Discriminating characteristics between the quartzite samples are tabulated in Tables 4.1 and 4.2 showing their presence in each sample. Detailed petrographic descriptions of OBP and Mwulu's Cave's thin sections are found in APPENDIX C.

4.3.1 Olieboomspoort Rock shelter thin section descriptions

Quartzite (possibly quartz arenite)

No. 486 and No. 3478 (Figure 4.32) are the only two thin sectioned samples that represent quartzite lithics at OBP. They are predominantly composed of quartz grains (~ 90%) in a dark, microcrystalline matrix (<10%). Minor minerals (<5%) such as muscovite are noted in No. 486. The quartz grains in both samples are coarse and have shapes ranging from angular to sub-rounded. Their birefringence is low (grey) and the grains in No. 3478 show both uniform and undulose extinction. The quartz grains in No. 486 only have uniform extinction. The muscovite is colourless under PPL and its cleavage is evident. Under XPL it has high birefringence. Moderate to good sorting is noted in these quartzite samples and they are clast supported. Both samples have interlocking grains with no visible pore spaces. Syntaxial quartz cement in both samples occurs in 40-50% of the quartz grains. The grains in No. 3478 are pitted and fractured and those in No. 486 have deformation lamellae (30-40%). Quartz characteristics used to group quartzite samples are shown in Table 4.1.

Only CMF1 (Figure 4.32 C) has quartzite characteristics. It has around 90% quartz grains in a minimal matrix. They have a low birefringence and 20-30% of them show undulose extinction while the rest show uniform extinction. This quartzite is well-sorted and has interlocking quartz grains. 45% of the grains have quartz syntaxial cement outside of their original boundaries. The grains are pitted and about 25% of them have embayments. Black staining is noted throughout the sample and very little deformation lamellae are present. Quartz characteristics used to group quartzite samples are shown in Table 4.1.

Table 4.1: Quartz characteristics of quartzite samples at Olieboomspoort Rock Shelter.

OBP Quartz Characteristics						
Sample no.	**Undulose extinction**	**Deformation lamellae**	**Concave-convex boundary relationships**	**Syntaxial cement**	**Stylolites**	**Interloc-king quartz**
No. 486	25%	30-40%	85%	40%	-	90%
No. 3478	20%	-	70%	40-50%	-	>90%
CMF1	20-30%	<10%	75%	45%	-	>90%

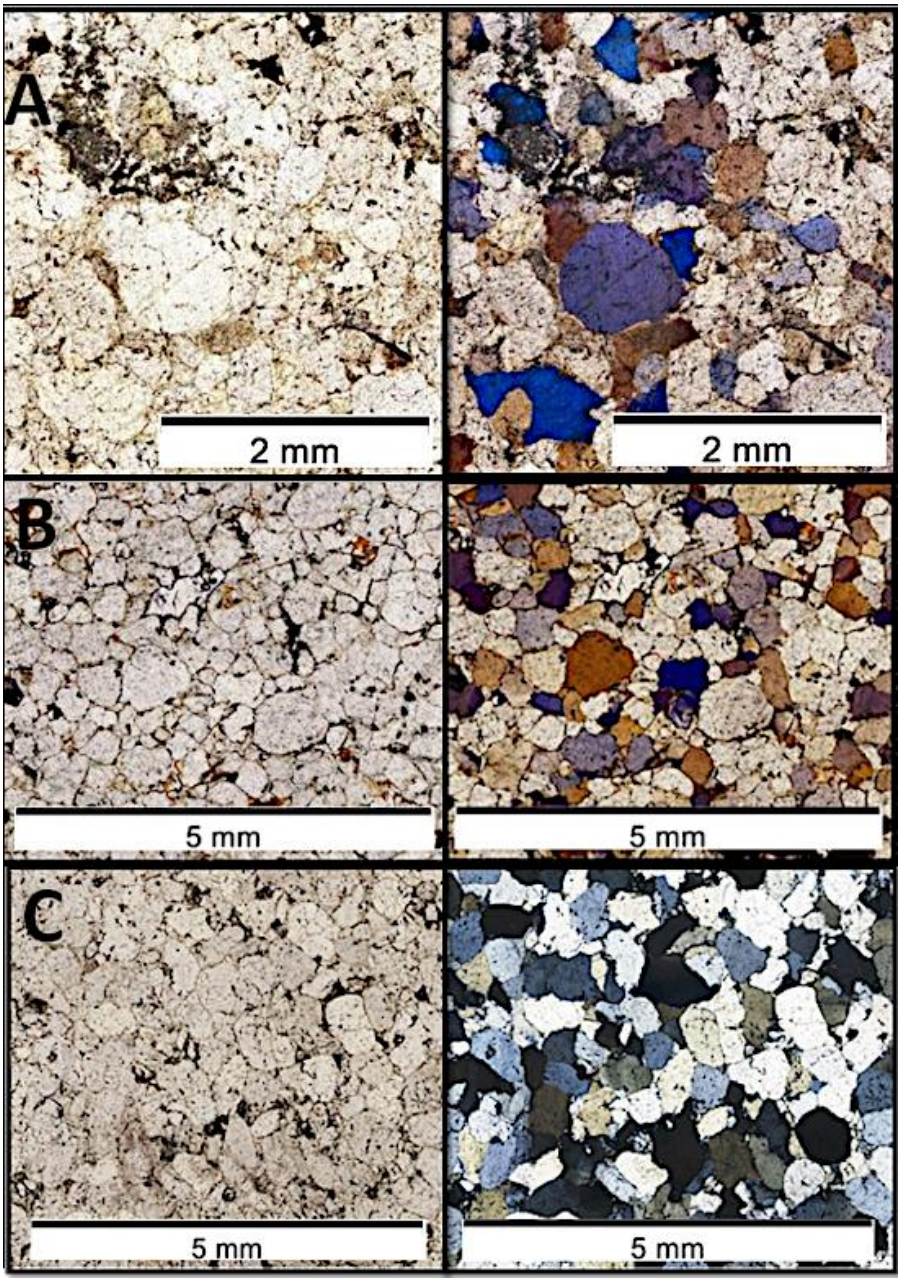

Figure 4.32: Light microscope image of A) No. 486 showing interlocking quartz grains, B) No. 3478 showing sub-rounded and interlocking quartz grains, and C) CMF1 showing its interlocking and annealing quartz grains in PPL (left) and XPL (right).

Sandstone

No. 1194 is a greywacke and No. 2402 is a sub-litharenite (Figure 4.33). Both samples have 60-80% quartz grains in a visible matrix (20% in 1194). Other minerals like muscovite and lithic fragments are noted in No. 2402, and opaque minerals are present

in No. 1194. No. 1194 has quartz phenoclasts. The quartz grains in this rock type are angular, sub-angular, and sub-rounded. They have low grey interference colours and show both undulose and uniform extinction. Both samples have recrystallized quartz grains (10-40%). The muscovite in No. 2402 has visible cleavages and bright interference colours under XPL. The lithic fragments are multi-coloured under XPL. These sandstones are poorly sorted. The quartz grains are pitted and fractured, and those in no. 2402 have deformation lamellae (20%).

Two sandstones are identified in the geology around OBP. These are arkose (OBP 7; Figure 4.33 C) and greywacke (OBP 8A; Figure 4.33 D). A similar amount of quartz is noted in both sandstones (55-60%). Alkali feldspar (40%) is a component of the arkose, whereas muscovite (20%) and opaque minerals (5%) in a significant matrix (20%) form part of the greywacke mineralogy. Both samples have a degree of irregularly shaped quartz grains amidst the sub-rounded, or angular to sub-angular grains. All of these have a low birefringence and uniform extinction although OBP 8A shows undulose extinction too (55%). 45% of the quartz grains in OBP 7 have been recrystallised. The alkali feldspar in OBP 7 is a cloudy brown under PPL and has a low birefringence. The muscovite in OBP 7 has a high birefringence and becomes extinct parallel to its perfect cleavage. Both samples are poorly sorted. In OBP 7, the alkali feldspar has a perthitic texture. Black and orange staining, is noted in association with the grains throughout the sample (OBP 7). The grains in OBP 7 are pitted (90%) and fractured (40-50%). In OBP 8A, 25% of the quartz grains have deformation lamellae.

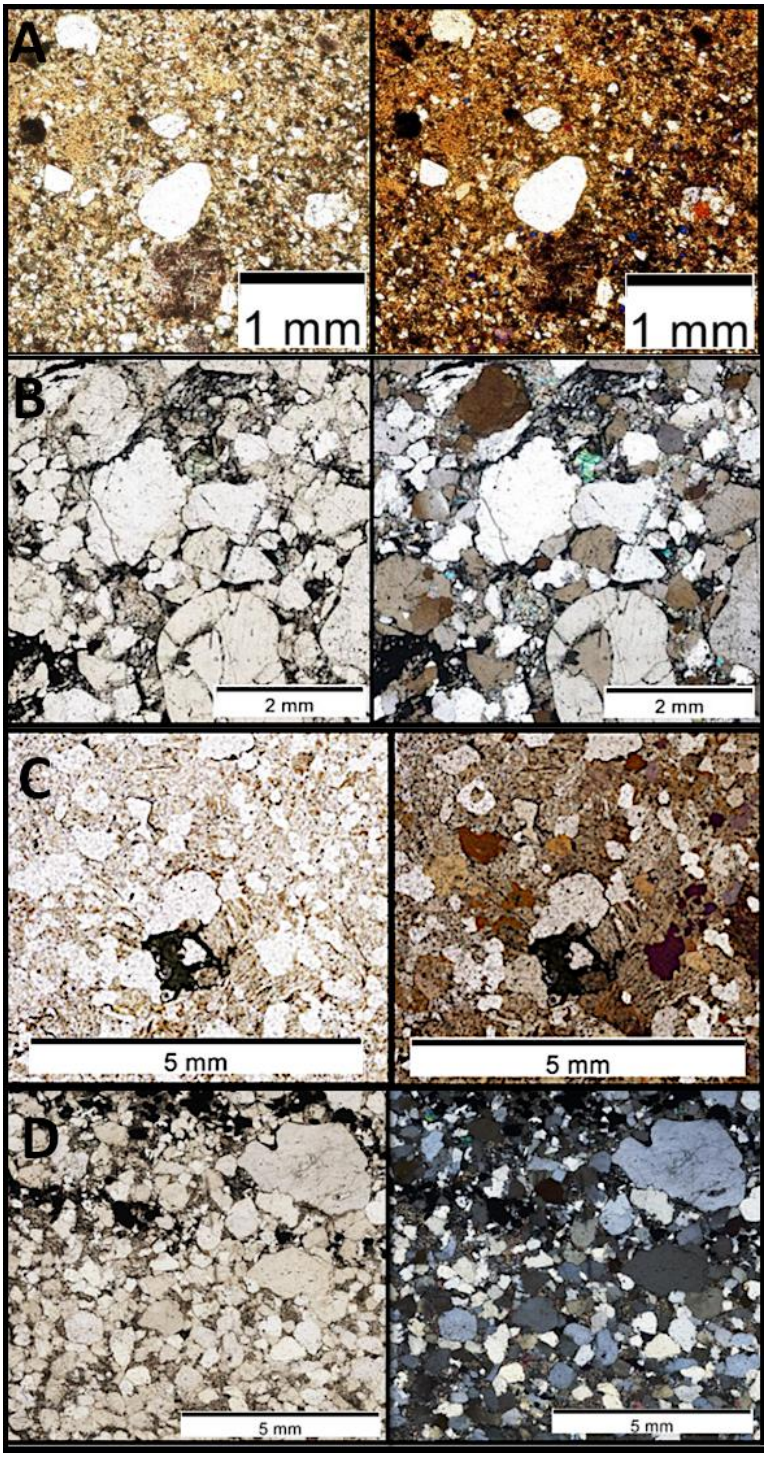

Figure 4.33: Light microscope image of A) No. 1194 showing its poor sorting and quartz phenoclasts, and B) No. 2402 showing the poorly sorted nature of the sandstone in PPL (left) and XPL (right). C) OBP 7 shows the relationship between quartz grains and alkali feldspar grains in PPL and D) is OBP 8A showing its porosity and sorting of grains in PPL (left) and XPL (right).

Shale

No. 164 and YRS1-D (Figure 4.34) are very fine-grained shale samples. The only minerals large enough to analyse in both these samples are opaque minerals (10-15%) and chlorite (20-25%). The chlorite has a low birefringence (brown anomalous interference colour) under XPL. Chlorite occurs in clusters in both samples. In No. 164, it surrounds the opaque minerals throughout the sample.

OBP 10A (Figure 4.34 C) is composed of 20% opaque minerals in a very fine-grained, green-brown matrix (80%). It has cloudy patches of opaque mineralisations in some parts of the sample.

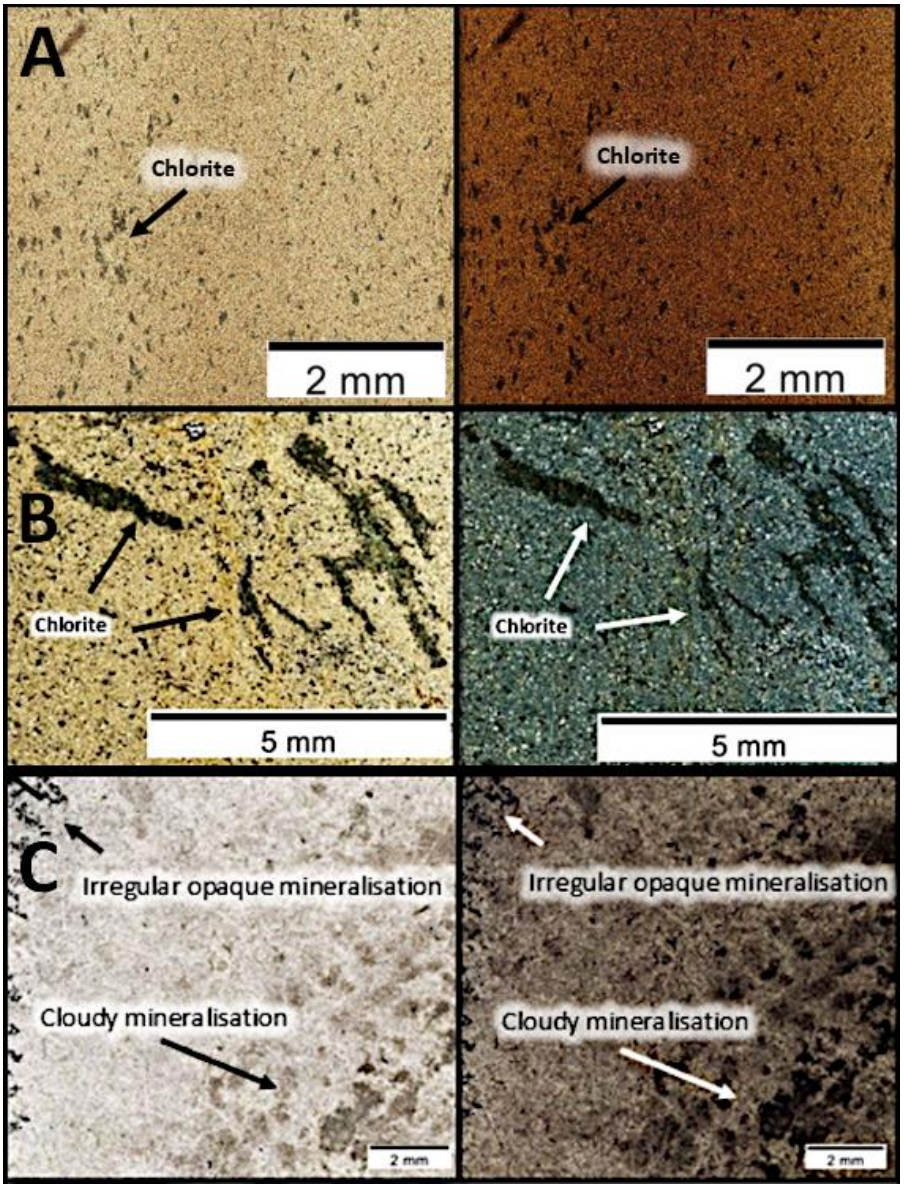

Figure 4.34: Light microscope image of A) No. 164, B) YRS1-D showing cryptocrystalline texture and chlorite, and C) OBP 10A showing its cryptocrystalline texture, and cloudy, opaque mineralisation in PPL (left) and XPL (right).

Dolerite

The only thin sectioned dolerite sample is No. 458 (Figure 4.35 A). It has white plagioclase laths (80%) in a black matrix. Other finer minerals like hornblende and augite are also noted in this sample through their bright blue, yellow, and green

interference colours under XPL. The plagioclase laths have a low birefringence and are randomly oriented throughout the sample.

OBP 4G (Figure 4.35 B) has mineralogy consisting of plagioclase laths (80%), white euhedral phenocrysts (5%), and brown biotite (15%). The plagioclase laths and phenocrysts have a low birefringence whereas the biotite shows third-order orange-yellow interference colours under XPL. These minerals are randomly orientated throughout the sample. The phenocrysts are altered and have brown mineralisation along their grain boundaries.

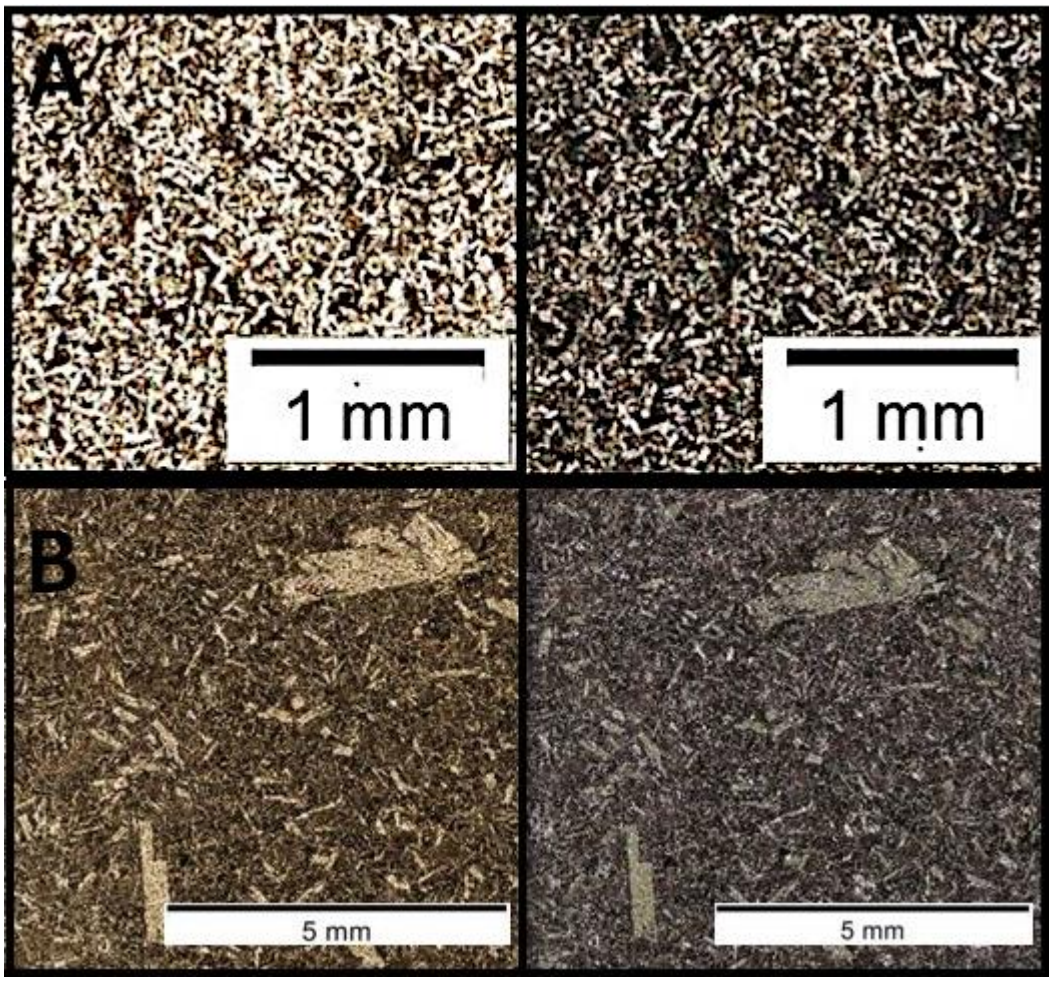

Figure 4.35: Light microscope image of A) No. 458 and B) OBP 4G showing randomly oriented plagioclase laths in PPL (left) and PXPL (right).

4.3.2 Mwulu's Cave thin section descriptions

Quartzite (possibly quartz arenite)

No. 640 (Figure 4.36 A); No. 1021 (Figure 4.36 B); and M1-J (Figure 4.36 C) are quartzites with 90% or more quartz grains in their mineralogy. The dark matrix in No. 640 and M1-J (~10%) is dark and multi-coloured under XPL. Quartz grains from all three samples have first-order grey and white interference colours. They also have undulose extinction (45-80%) and uniform extinction. Sorting varies across these quartzite samples from poor to well-sorted. No. 640 and M1-J have interlocking quartz grains whereas the grains in No. 1021 are annealing. Only No. 640 and M1-J have grains with quartz syntaxial cement. Pitting is evident in quartz grains in all three samples and no deformation lamellae are noted. Quartz characteristics used to group quartzite samples are shown in Table 4.2.

Outcrop 16A (Figure 4.36 D) and G2A (Figure 4.36 E) are quartzite samples composed of quartz grains (90%) in a dark, microcrystalline matrix (10%). G2B (Figure 4.36 F), on the other hand, has coarse quartz grains (65%) as well as finer quartz grains (35%) in its mineralogy. These quartzite samples have quartz grains of varying shapes ranging from angular to sub-rounded. The quartz grains have low grey interference colours and a significant amount of them undergo undulose extinction (70-75%). The microcrystalline matrix is dark and multi-coloured under XPL. G2A and G2B are poorly sorted unlike the moderately to well-sorted Locality 16A. However, Locality 16A and G2B have more interlocking quartz grains in comparison to G2A. In fact, G2B has a high degree of annealing between the grains. Locality 16A and G2B have quartz syntaxial cement outside of 15-40% of their quartz grains. Pitting is noted in the quartz grains of all three samples and embayments in the grains are only seen in G2A (5%). Deformation lamellae are scarce across all of the quartzite samples. Quartz characteristics used to group quartzite samples are shown in Table 4.2.

Table 4.2: Quartz characteristics of quartzite samples at Mwulu's Cave

Mwulu's Cave Quartz Characteristics						
Sample no.	**Undulose extinction**	**Deformation lamellae**	**Concave-convex boundary relationships**	**Syntaxial cement**	**Stylolites**	**Interlock-ing quartz**
No. 640	80%	-	>90%	85%	-	>90%
No. 1021	45%	-	65%	-	-	>95%
M1-J	65%	-	75%	35%	-	80%
Outcrop 16A	75%	-	>90%	30-40%	-	>90%
Outcrop G2A	70%	-	40-50%	-	-	60%
Outcrop G2B	70%	-	70%	15%	-	>90%

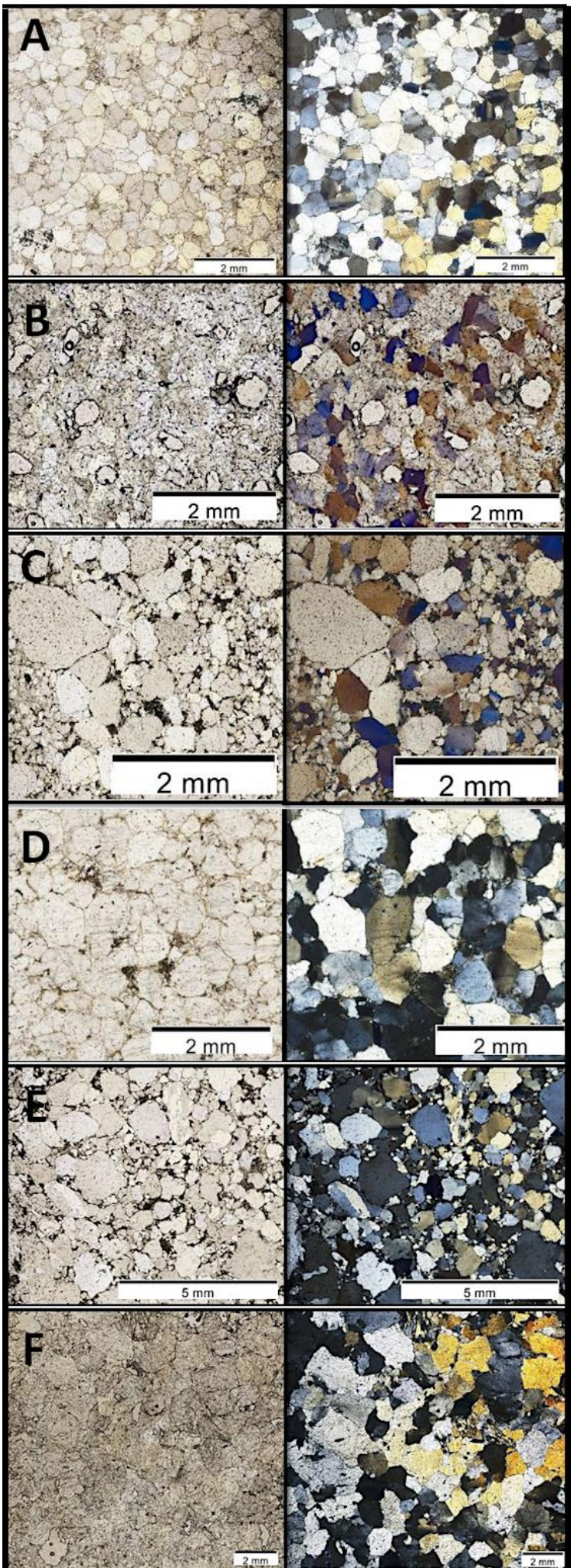
A
2 mm
2 mm
B
2 mm
2 mm
C
2 mm
2 mm
D
2 mm
2 mm
E
5 mm
5 mm
F
2 mm
2 mm

Figure 4.36: Light microscope images of A) No. 640 showing interlocking quartz grains, and undulose extinction in PPL (left) and XPL (right). B) No. 1021 shows the porous nature of the rock and its coarse quartz grains, while C) M1-J shows its poorly sorted quartz grains in PPL (left) and XPL (right). D) Outcrop 16A shows interlocking and annealed quartz grains (PPL; left), and undulose extinction (XPL; right). E) Outcrop G2A shows poorly sorted quartz grains. Some of the grains show undulose extinction in XPL (right). F) G2B shows interlocking and annealed quartz grains in PPL (left) and XPL (right). Undulose extinction is also noted under XPL.

Sandstone

M3-B (Figure 4.37) is made of detrital quartz grains (60%); biotite (30%); and sedimentary lithic fragments in a dark matrix (10%). The quartz grains are round to sub-rounded and have first-order white and grey interference colours. Most of them undergo uniform extinction while about 10% of them undergo undulose extinction. Some of the biotite minerals are euhedral and show cleavage. They have a bright yellow interference colour and go extinct parallel to their cleavage. This sandstone is well-sorted although 20% of the rock is of pore spaces. The biotite and matrix fill the spaces between the quartz grains.

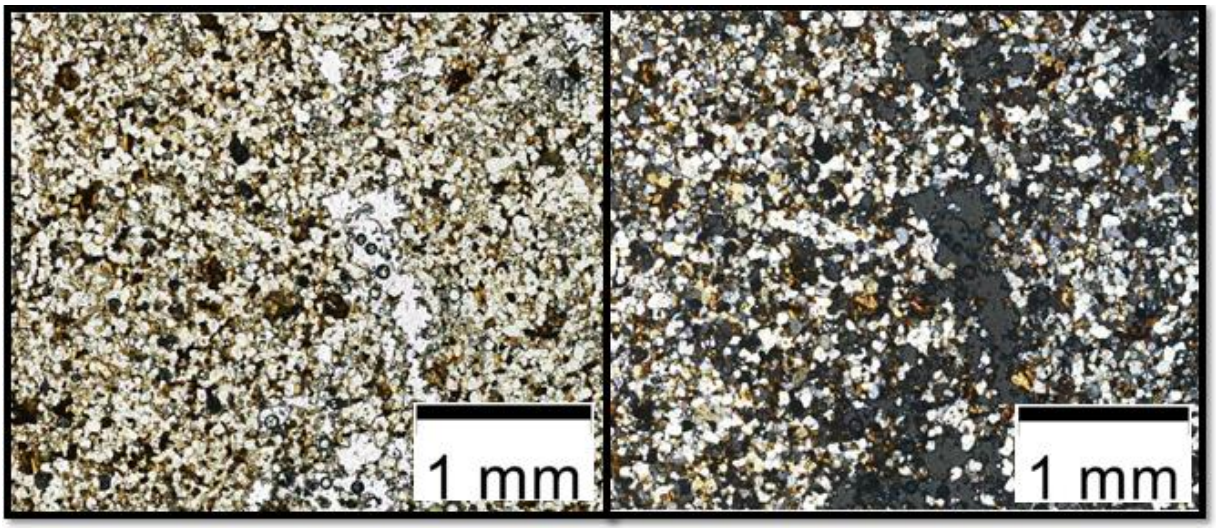

Figure 4.37: Light microscope images of M3-B showing its fine-grained texture and pore spaces in PPL (left) and XPL (right).

Shale

M3-E (Figure 4.38 A) is a green-brown shale with about 20% opaque minerals in its matrix. This matrix is very fine-grained and is dark and multi-coloured under XPL. Within this matrix, pore spaces are noted. These occupy about 10% of the rock.

The shale at Outcrop 4A (Figure 4.38 B) has opaque minerals (5%) that have white rims in a very fine-grained matrix. A single orange mineral (isotropic in XPL) is noted in the thin section. This shale has a foliation running across it. White and grey grains are evident within this foliation.

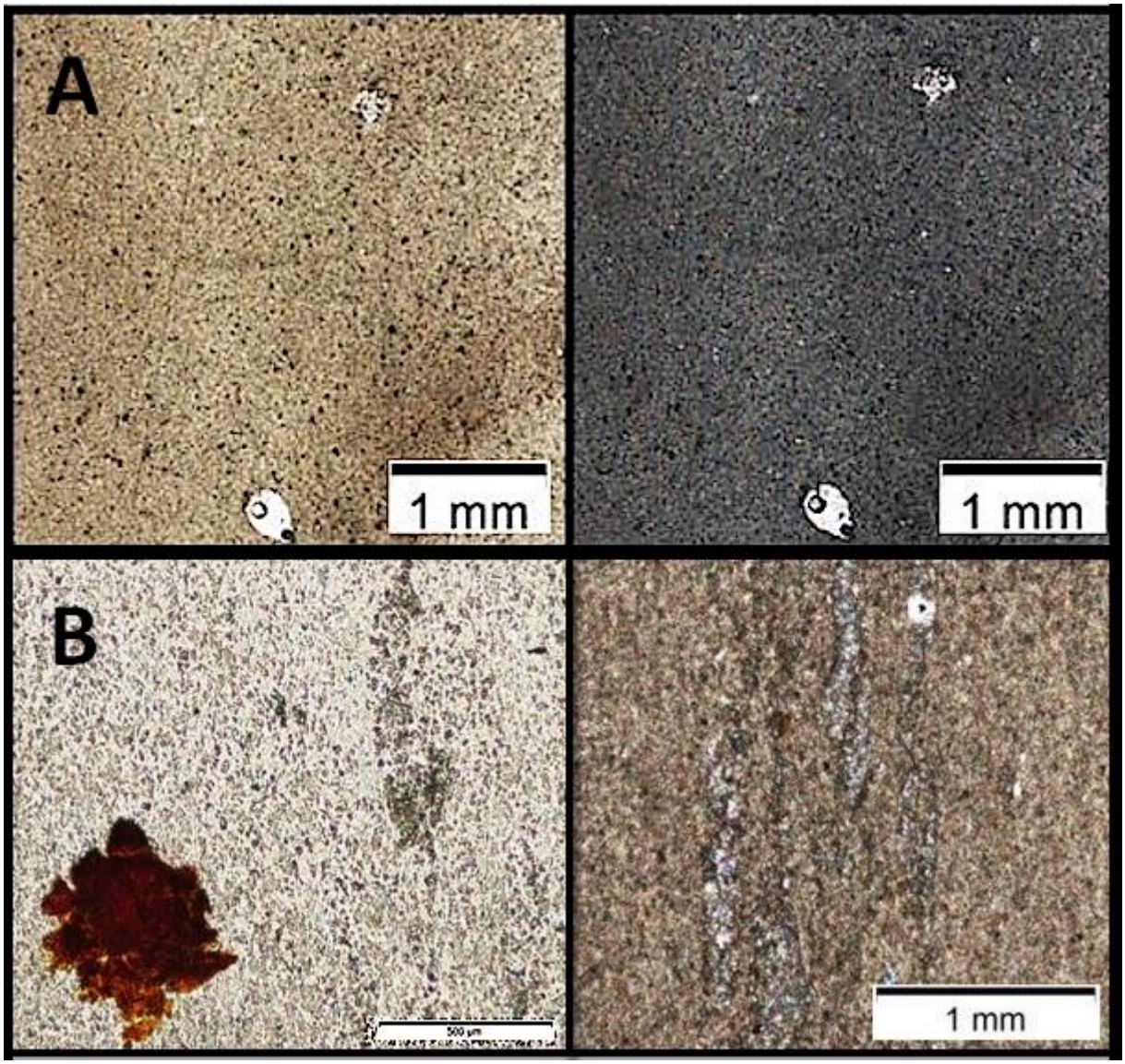

Figure 4.38: Light microscope images of A) M3-E showing its cryptocrystalline texture in PPL (left) and XPL (right). B) Outcrop 4A shows its cryptocrystalline texture and orange mineral in PPL (left) and foliated minerals in XPL (right).

4.4 Inductive Coupled Plasma Mass Spectrometry Results

Only a few lithic samples were analysed using ICP-MS due to its destructive nature. Quartzite, shale, sandstone, and dolerite samples from OBP and the geology around it were analysed (Table 3.5). Quartzite, shale, and chert samples from Mwulu's Cave and the geology around it were analysed (Table 3.5). Due to the small number of samples

being analysed, the point of this analysis is to refine some of the results obtained through pXRF. Full ICP-MS data and standards can be found in APPENDIX D.

4.4.1 Olieboomspoort Rock Shelter Inductive Coupled Plasma Mass Spectrometry data

Quartzite

The most informative scatterplots to compare quartzite lithics from OBP and a quartzite outcrop sample from the Cleremont Formation are Zn/Cu (Figure 4.39 A), Zr/La (Figure 4.39 B), Sr/Rb (Figure 4. 39 C), and Ba/Ti (Figure 4. 39 D). The Cleremont Formation quartzite sample has a Cu content of 2.1 ppm, and a Zn content of 4.5 ppm. The La content of this sample is 6.5 and its Zr content is 31.3 ppm. It has an Rb content of 10.0 ppm and a Sr content of 3.678 ppm. Lastly, its Ti content is 191.6 ppm and its Ba content is 124.2 ppm.

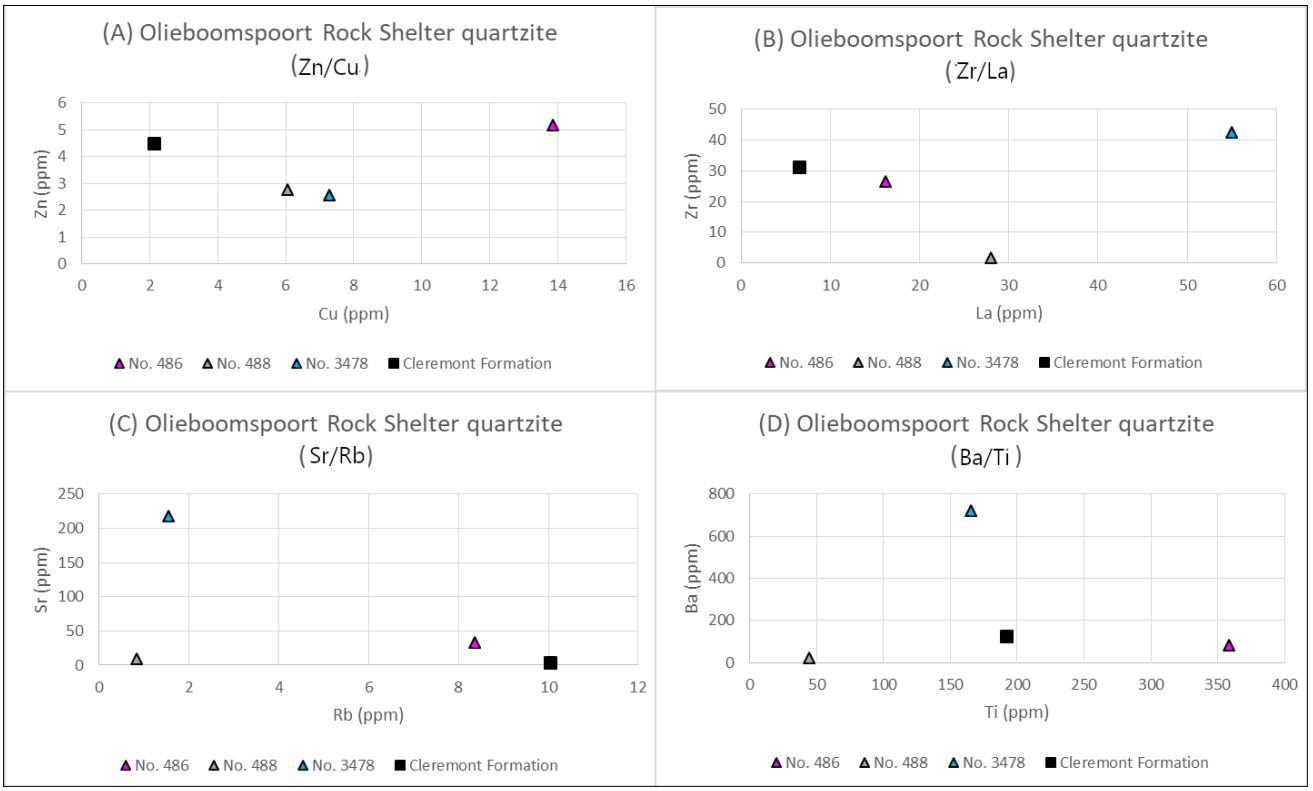

Figure 4.39: A) Zn/Cu, B) Zr/La, C) Sr/Rb, and D) Ba/Ti scatterplots of quartzite samples from OBP.

Shale

The Zr/La (Figure 4. 40 A) and Ni/Cr scatterplots (Figure 4. 40 B) offer the most useful information for comparing shale lithics from OBP with the geological sample collected around the Mogalakwena Formation. The geological sample has a La content of 1.7 ppm and a Zr content of 1.1 ppm. Its Cr content is 4.1 ppm and its Ni content is 6.0 ppm.

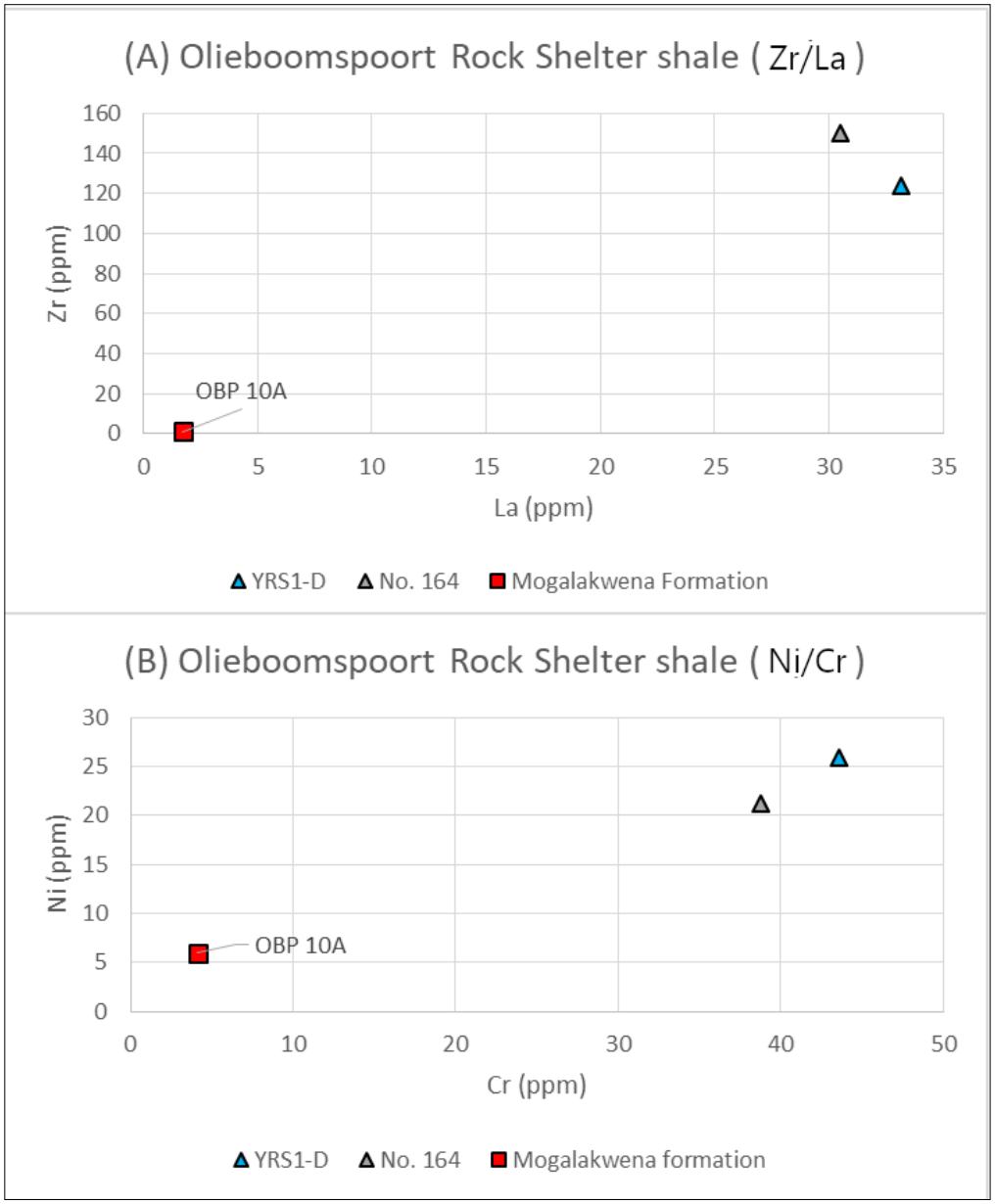

Figure 4.40: A) Zr/La scatterplot of shale samples at OBP. B) Ni/Cr scatterplot of shale samples at OBP.

Sandstone

Four scatterplots are useful in comparing OBP lithics to geological samples collected near the Mogalakwena Formation. The Zn/Cu scatterplot (Figure 4.41 A) shows that the geological samples have a Cu and Zn content between 2.9 ppm and 7.3 ppm, and 16.7 ppm and 20.1 ppm, respectively. They have a La and Zr (Figure 4.41 B) content between 44.3 ppm and 83.9 ppm, and 122.8 ppm and 175.5 ppm, respectively. The samples have a Th content between 26.3 ppm and 36.5 ppm, and an Sc content between 0.3 ppm and 4.3 ppm (Figure 4. 41 C). The Ti content of these samples is between 487.2 ppm and 1477.8 ppm, and their Ba content is between 114.1 ppm and 210.0 ppm (Figure 4. 41 D).

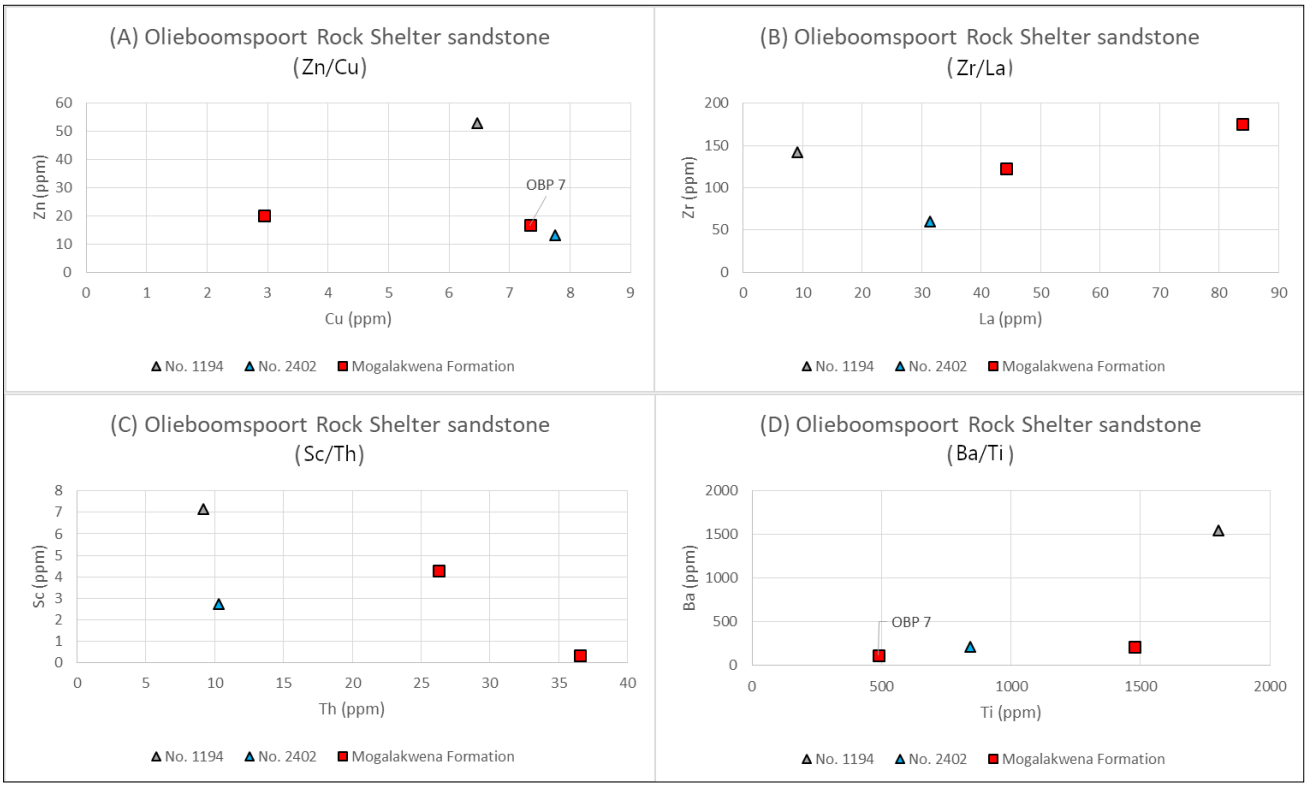

Figure 4.41: A) Zn/Cu, B) Zr/La, C) Th/Sc, and D) Ba/Ti scatterplots of sandstone scatterplots at OBP.

Dolerite

The Mogalakwena Formation dolerite geological sample (OBP 4G) has a Cr content of 14.6 ppm and a Ni content of 103.4 ppm on the Ni/Cr scatterplot (Figure 4.42).

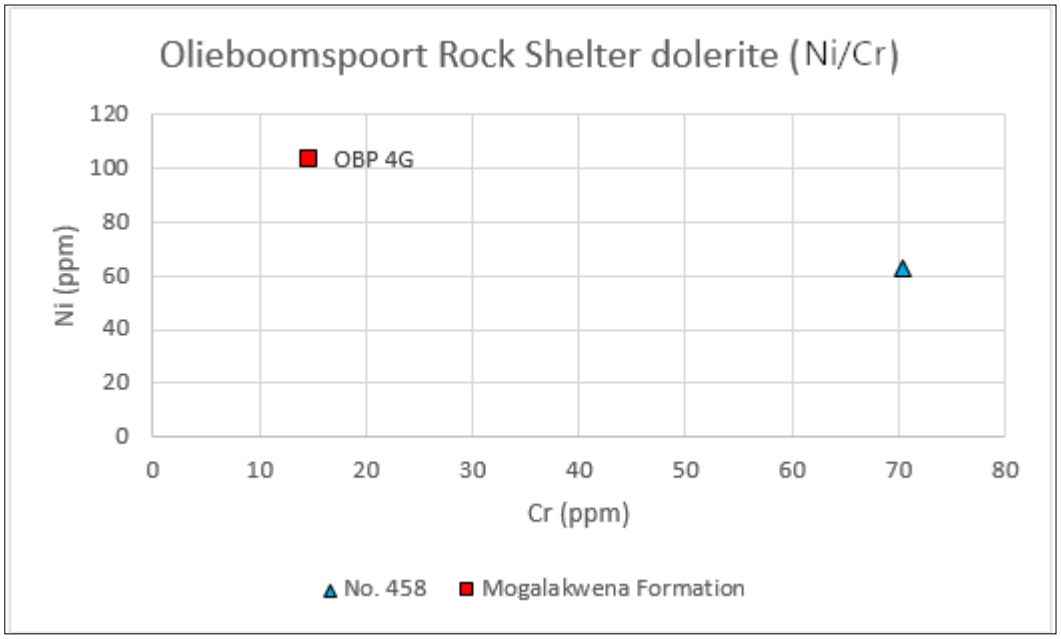

Figure 4.42: Ni/Cr scatterplot of dolerite samples at OBP.

4.4.2 Mwulu's Cave Inductive Coupled Plasma Mass Spectrometry data

Quartzite

The most informative scatterplots for comparing quartzite lithics from Mwulu's Cave with outcrop samples from the BRQF are Zn/Cu (Figure 4. 43 A), Zr/La (Figure 4.43 B), Sr/Rb (Figure 4.43 C), and Ba/Ti (Figure 4.43 D). The outcrop samples have a Cu content between 2.3 ppm and 12.5 ppm, and a Zn content between 3.2 ppm and 5.2 ppm. The rest of the scatterplots show that the BRQF quartzite samples have diverse ratios.

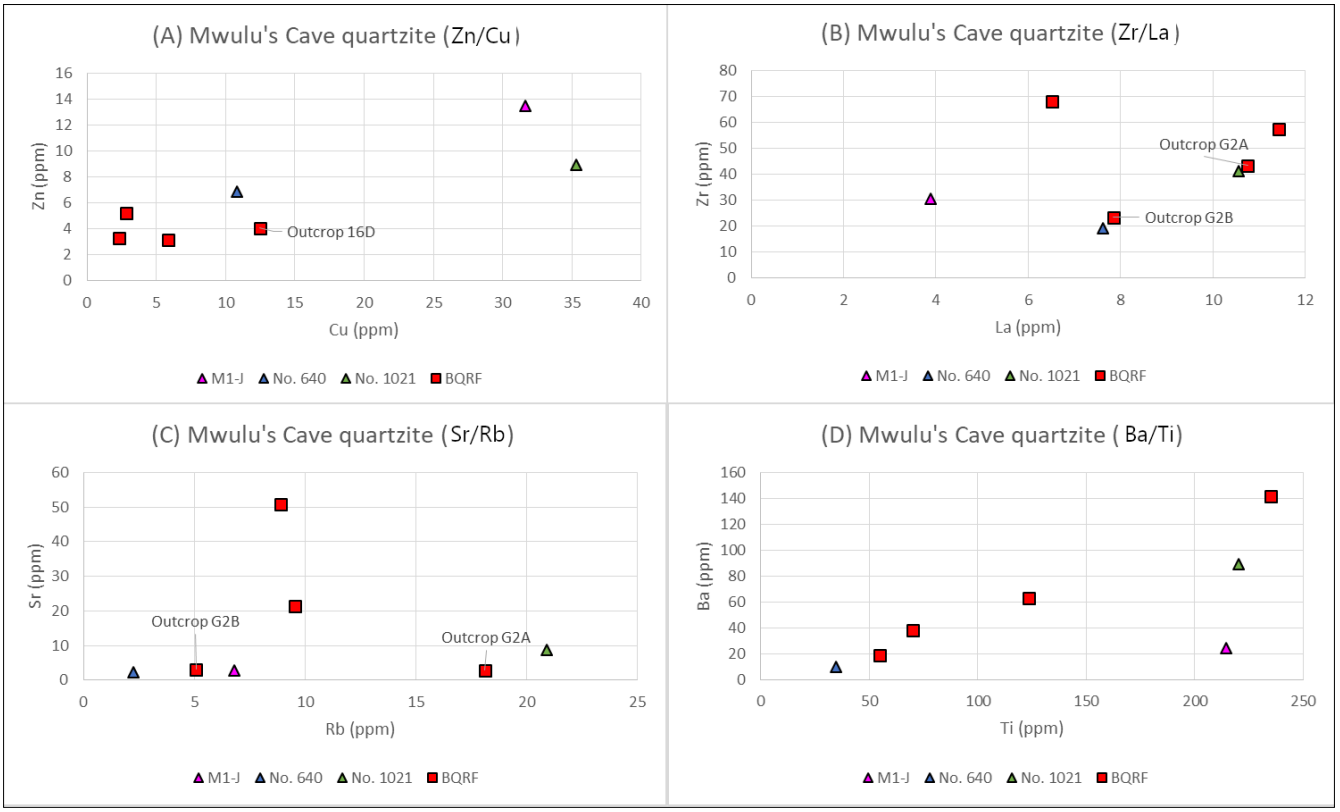

Figure 4.43: A) Zn/Cu, B) Zr/La, C) Sr/Rb, and D) Ba/Ti scatterplots of quartzite samples at Mwulu's Cave.

Shale

Scatterplots Zr/La (Figure 4.44 A) and Ni/Cr (Figure 4.44 B) are the most useful in comparing Outcrop 4A of the Malmani Subgroup and the shale lithics from Mwulu's Cave. The outcrop sample has a La content of 4.2 ppm and a Zr content of 61.9 ppm. It also has a Cr content of 543.7 ppm and a Ni content of 52.873 ppm.

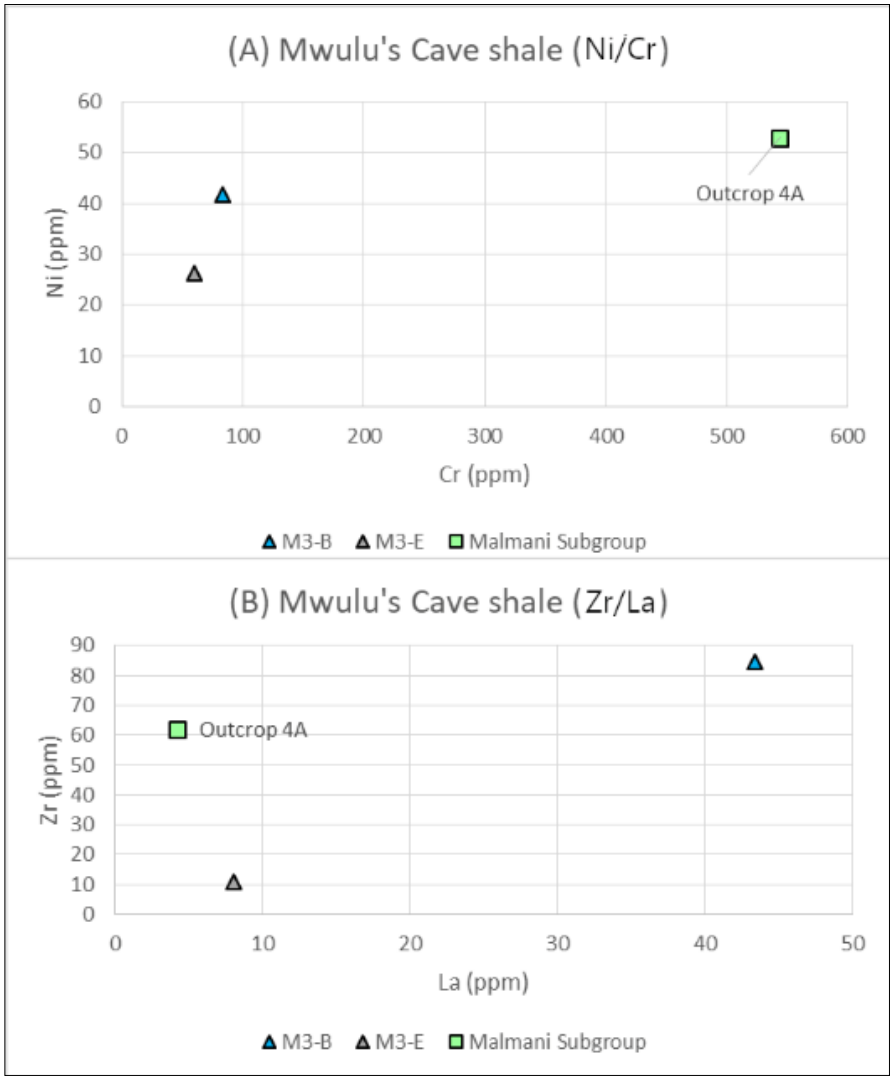

Figure 4.44: A) Zr/La and B) Ni/Cr scatterplots of shale samples at Mwulu's Cave.

Chert

The Zn/Cu (Figure 4. 45 A), U/La (Figure 4.45B), and Ti/P (Figure 4.45 C) scatterplots are the most useful to compare Mwulu's Cave chert lithics and the chert outcrop sample collected from the BRQF. The chert outcrop sample has a Cu content of 10.5 ppm, a Zn content of 3.9 ppm, a La content of 4.3 ppm, a U content of 0.9 ppm, a P content of 533.2 ppm, and a Ti content of 97.8 ppm.

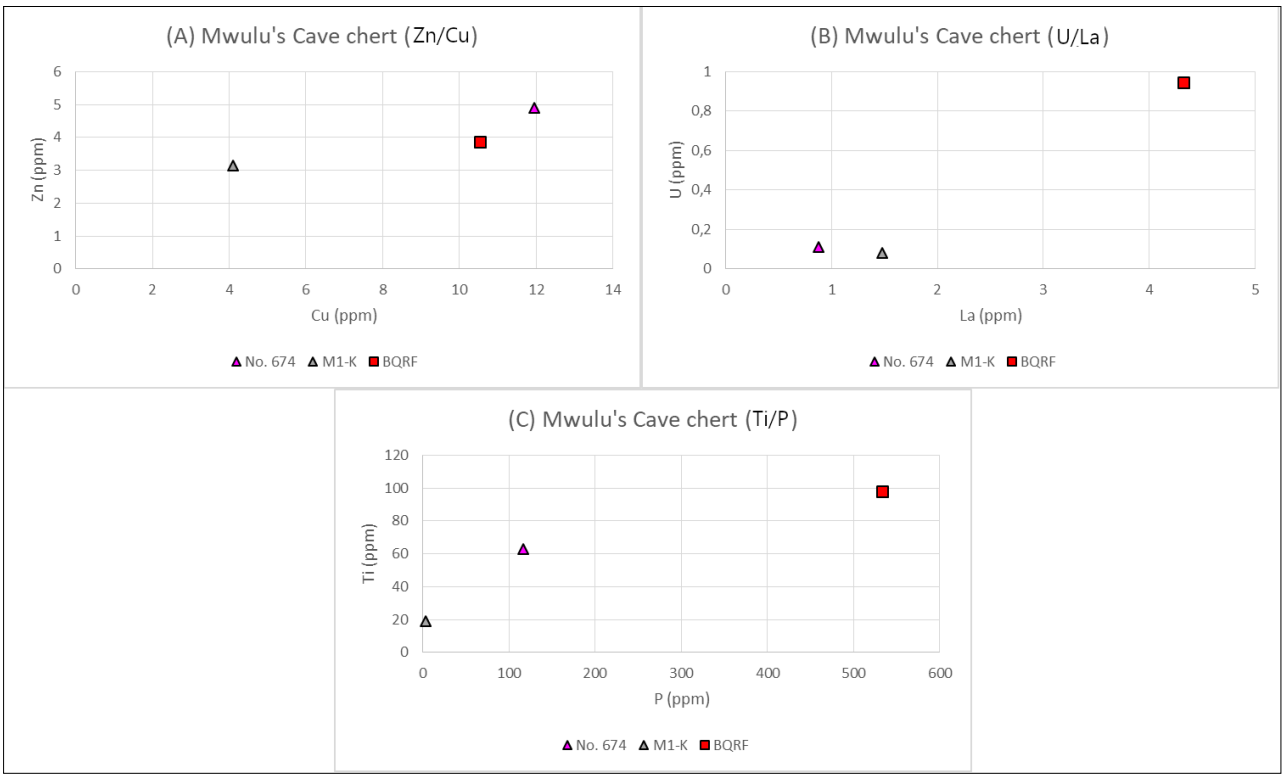

Figure 4.45: A) Zn/Cu, B) U/La, C) Ti/P scatterplots of chert samples at Mwulu's Cave.

5 DISCUSSION

5.1 Provenance

Lithic provenance is defined as the place of origin of a lithic raw material such as a specific outcrop or the geological formation it may belong to. Its provenance also includes the context in which the raw material was obtained. This study uses geochemical analyses (pXRF and ICP-MS) alomg with multivariate PCA analysis to link lithics to formations around OBP and Mwulu's Cave. As mentioned in the results, pXRF is the primary sourcing analysis in this study because it does not damage archaeological material. ICP-MS on the other hand is used in this study to refine some of the pXRF results.

PXRF analysis is the most useful method for determining the provenance of lithics in this study. All the samples (geological and lithic) were analysed through pXRF and comparisons between geological samples from different formations can be made. This makes it possible to see which lithic samples may be closely related to each of the formations. Unfortunately, thin section analysis and ICP-MS, methods that were meant to verify pXRF results, are not as useful as pXRF in this study because only a few samples could be analysed through them. As seen in the discussion below, these methods only support limited results determined through pXRF.

5.1.1 Olieboomspoort Rock Shelter

Rock types

From PCA analyses, only dolerite could be clearly differentiated from the rest of the rock types found around OBP. Quartzite, shale, sandstone, and quartz overlap and are very similar.

Quartzite

The quartzite geological samples around the Mogalakwena Formation and the Cleremont Formation are very similar although CMF samples from the Cleremont Formation have a visible matrix, a characteristic that is not noted in Mogalakwena Formation samples. Based on the pXRF results, it is evident that Mogalakwena Formation geological samples have more diverse Fe, Si, and Mn amounts (PCA) as well as Ti/Fe and Si/Al ratios compared to the Cleremont Formation samples. Mogalakwena Formation samples also have higher Al contents in comparison to the Cleremont Formation samples.

Quartzite is the most abundant raw material in the selected OBP lithic assemblage. Most of the quartzite lithics from OBP seem to relate closer to secondary geological samples collected around the Mogalakwena Formation. The rest of the lithics (<17.9%) seem similar to Cleremont Formation geological samples (CMF and BPC1). This is not supported by PCA which shows an overlap of the two formations. This makes it impossible to determine their exact provenance.

Shale

As mentioned, shale lithics make up about a third of the lithics selected from the OBP assemblage. This observation does not go hand in hand with the number of geological samples noted within the 30 km search area around the shelter. Instead, only two shale samples from OBP 10 near the Mogalakwena Formation were found. Differences between the two geological samples OBP 10A and OBP 10B are noted from macroscopic and pXRF results. OBP 10B is foliated while OBP 10A is not, and pXRF results show that OBP 10B has a higher Al content than OBP 10A (Figure 4.19).

Macroscopic and pXRF results are also similar when it comes to comparing lithics to these outcrop samples. Macroscopic analyses show that lithics No. 4670 and No. 4677 are foliated, which makes them possibly similar to OBP 10B. This is also noted through pXRF because these lithics have high Al contents like OBP 10B and could be closer

related to it than they are to OBP 10A (Figure 4.19). Also based on pXRF results, OBP lithic samples No. 110, No. 1226, No. 106AF, and No. 107 seem to relate to OBP 10A while the rest of the shale lithics may be from either OBP 10A or OBP 10B. Thin section results show that OBP lithics No. 164 and YRS1-D relate closer to one another than they do with OBP 10A because they have chlorite and OBP 10B does not (Figure 4.34). These lithics also lack the cloudy patches and opaque, lichen-like mineralisation noted in OBP 10A. Through ICP-MS analysis we see that lithics No. 164 and YRS1-D relate closer to one another than they do with OBP 10A in scatterplots Zr/La (Figure 4.40 A) and Ni/Cr (Figure 4.40 B). This suggests that they may either be from an outcrop similar to OBP 10B, or a different source entirely. PCA results, however, show that the lithics may not be related to either of these outcrop samples although this is largely affected by the lack of geological samples.

Sandstone

Macroscopically, sandstone geological samples collected around the Mogalakwena Formation can be distinguished from one another because they fall under the 'general', 'friable', or with 'phenoclasts' sandstone groups. PXRF results, however, do not present clear groups within the sandstone geological samples.

Based on the macroscopic results, it is expected that sandstone lithics with phenoclasts (No. 1194 and No. 2402) may be similar to OBP 8B because it also has phenoclasts. This observation is not supported by the pXRF results in scatterplots Ti/Fe (Figure 4.20 A) and Si/Al (Figure 4.20 B). PXRF results also show that the sandstone lithics (especially No. 1286 and No. 2402) may be more closely related to OBP 8 compared to all the other Mogalakwena Formation geological samples. The similarity of the lithics to OBP 8B and OBP 8C is unlikely due to the friable nature of the outcrop samples. They seem to be impractical raw materials for the knapping of tools. Based on thin-section results, No. 1194 and OBP 8A seem similar because they are both greywackes. No. 2402 is a sub-litharenite and cannot be linked to either OBP 7 or OBP 8A using petrography. ICP-MS results contrast the similarity between No. 1194 and OBP 8A and show that No. 2402 may be similar to OBP 7 (Figure 4.41 A to D). PCA results show

that all sandstone lithics, with the exception of No. 1194, may be related to the Mogalakwena Formation.

Dolerite

From the selected OBP lithics, 12.3% are made of dolerite raw materials yet no dolerite intrusions were found within the 30 km search area. Instead, four secondary context geological samples were collected along the Rietspruit River (OBP 4G) and the road (OBP 5A, OBP 5D, and OBP 5E). Macroscopically, only one dolerite group is noted in the OBP lithic selection. This is also presented in the pXRF Ti/Fe (Figure 4.21 A) and Si/Al (Figure 4.21 B) scatterplots.

It is difficult to link most of the dolerite lithics to potential sources through the methods used in this study. PXRF results show that No. 130 and No. 4672 may be closely related to secondary context geological samples collected around the Mogalakwena Formation. This is supported by PCA. Other lithics do not show a possible relation with these geological samples in both the Ti/Fe and Si/Al scatterplots. PCA also shows us that most of the lithics seem unrelated to the Mogalakwena Formation samples. Thin section results only show that No. 458 and OBP 4G are both dolerites. It does not suggest similar provenance because No. 458 has augite and hornblende minerals while biotite is noted in OBP 4G. The textures of the two samples are also different because No. 458 has a uniform texture with laths throughout it while OBP 4G is very fine-grained and has phenocrysts. ICP-MS results support the thin section results because there is not enough information to link the two samples (Figure 4.42).

Quartz

Quartz geological samples from the Mogalakwena Formation and the Cleremont Formation have similar characteristics and are difficult to distinguish from one another. This observation is also noted in the pXRF results because the Mogalakwena Formation sand Cleremont Formation geological samples overlap in both Ti/Fe (Figure 4.22 A)

and Si/Al (Figure 4.22 B) scatterplots. PCA results also support this observation. Mogalakwena Formation samples, however, are more diverse, with higher Fe, Ti, and Al contents.

From pXRF analyses of the two quartz samples (No. 493 and No. 1290) from the selected OBP lithic assemblage and the geological samples found around the site, it is noted that the lithics are likely linked to Mogalakwena Formation pebbles and that they are less likely sourced from pebbles of the Cleremont Formation. Based on PCA, no conclusions on provenance can be reached.

Chert

Chert only covers 1.5% of the selected lithics from OBP. Finding its provenance during the field campaign was unsuccessful therefore no links to the geology can be made. Corcoran *et al.* (2013) does, however, acknowledge over 90% of chert fragments in all Waterberg formations and mentions that it occurs as clasts in Mogalakwena Formation conglomerates.

5.1.2 Mwulu's Cave

Rock Types

Through PCA analyses, it is evident that shale is the most distinguishable of the rock types found around Mwulu's Cave. Quartzite, chert, and quartz overlap and are very similar.

Quartzite

BRQF and Malmani Subgroup quartzite samples are macroscopically similar. In the BRQF quartzite samples, however, one group of banded quartzite made of Outcrop 17 and Outcrop G2B is noted. This is also noted through PCA. This group is not presented in the pXRF scatterplot results. Instead, the BRQF outcrop samples are generally

uniform in the Ti/Fe (Figure 4.28 A and B) and Si/Al (Figure 4.28 C) scatterplots. They can be distinguished from the Malmani Subgroup sample because it has a higher Fe and Al content.

Macroscopically, No. 673 is expected to be similar to the banded quartzite outcrop samples. The pXRF scatterplot results only show that it may be similar to outcrop samples from the BRQF. PXRF results also show that quartzite lithics relate more to BRQF outcrop samples than they do to the Malmani Subgroup outcrop sample. This is also seen in PCA results. It is difficult to link No. 640, No. 1021, and M1-J to outcrop samples using petrography. ICP-MS results do show that Outcrop G2 (especially Outcrop G2A) is a probable provenance for quartzite lithics like No. 640 and No. 1021.

Shale

BRQF, Duitschland Formation, and Malmani Subgroup geological shale samples can be distinguished from one another macroscopically and in pXRF K/Al (Figure 4.29 A) and Zr/K (Figure 4.29 B) scatterplots. PCA results contrasts this observation as these formations are overalapping. BRQF samples have bedding and mica minerals, and Malmani Subgroup samples are darker than Duitschland Formation samples. PXRF shows that the BRQF geological samples have the highest Al and Zr content compared to the other two formations. The Malmani Subgroup samples have diverse Al contents, and the Duitschland Formation samples have the lowest K/Al and Zr/K ratios compared to the other two formations.

Only 12.3% of the selected Mwulu's Cave lithic assemblage is composed of shale. Shale outcrops around the site are abundant, especially to the west of Mwulu's Cave. According to pXRF results, more than 50% of the shale lithics are closely related to Duitschland Formation Shale outcrops compared to those belonging to the Malmani Subgroup and the BRQF. Only M3-D may be closely associated with the BRQF shale. PA-3 may be similar to Malmani Subgroup outcrop samples and M3-B seems similar to Duitschland Formation samples. Thin section analysis shows that M3-E and Outcrop 4A of the Malmani Subgroup are different because M3-E has no foliations and inclusions. It is therefore possible that M3-E may belong to the Duitschland Formation shales as seen

in pXRF results. ICP-MS results are not informative due to the lack of shale samples analysed. PCA results cannot suggest provenance because the formations overlap.

Quartz

Xenomorphic and automorphic quartz is noted from macroscopic analyses although these groups are not presented in pXRF Ti/Fe (Figure 4.30 A) and Si/Al (Figure 4.30 B) scatterplots. The pXRF results only show that BRQF quartz samples have diverse Ti/Fe and Si/Al ratios.

Quartz is the second most used raw material in the selected lithics from Mwulu's Cave (13.6%). Based on pXRF and PCA results, the quartz lithic samples from Mwulu's Cave may have been made from BRQF quartz. The BRQF quartz samples are all *in situ* outcrop samples that are probable provenances for the lithics at Mwulu's Cave.

Chert

BRQF and Malmani Subgoup chert outcrop samples in this study can only be macroscopically distinguished from each other through their occurrences. The chert outcrop samples collected from the BRQF are chert pebbles from conglomerates. Chert outcrop samples from the Malmani Subgroup occur as beds associated with Malmani dolomites. Chert samples from these two formations can also be distinguished from each other through Ti/Fe and Si/Al pXRF scatterplots. The BRQF samples have diverse Ti/Fe and Si/Al ratios compared to the Malmani Subgroup samples, and they have a higher Ti content. PCA results show that the BRQF and Malmani Subgroup samples are similar.

Only 3.7% of the selected lithics from Mwulu's Cave are made of chert. It is difficult to determine through pXRF and ICP-MS whether Mwulu's Cave chert lithics were made from raw materials from the BRQF or the Malmani Subgroup. This is because the Ti/Fe pXRF scatterplot shows that they may be similar to Malmani Subgroup samples while the Si/Al scatterplot shows that they may be similar to the BRQF samples. ICP-MS

results mostly show that the lithics relate more to each other than they do with the BRQF outcrop sample. However, PCA results show that it is difficult to determine the provenance of these lithics.

5.2 Procurement strategies

Raw material procurement involves the strategies employed and the processes that took place for that raw material to be collected. Examples of these processes are the transport of the lithic raw material and distance travelled by hominins to collect it. To establish the procurement strategies used by MSA hominins at OBP and Mwulu's Cave, the distances of the outcrops/geological samples from the sites are used (Table 3.2). I have used similar distances as Schmid *et al*. (2016) to differentiate between local, semi-local, and non-local geological outcrops because their system is based on ethnographic and archaeological obseravtions. Porraz *et al*. (2008) and Will *et al*. (2013) also used similar systems. Local outcrops are 0-5 km from the site, while semi-local and non-local outcrops/geological sources are 6-20 km and more than 20 km from the site, respectively (from Schmid *et al.*, 2016).

5.2.1 Olieboomspoort Rock Shelter

Quartzite

It is important to note that of the quartzite geological and outcrop samples, CMF samples are the only *in situ* sources we came across during the field campaign. Overlapping is noted between Cleremont Formation samples and Mogalakwena Formation samples like those from OBP 4 cobbles. These cobbles may have undergone fluvial transportation down the Rietspruit River from CMF, or similar Cleremont Formation outcrops, to the area immediately around OBP. Considering the presence of quartzite lithics that have visible cortices (No. 1195; No. 488; No. 143; No. 3474; and No. 3478) and the abundance of rounded quartzite pebbles and cobbles observed and collected close to OBP, I assume that the majority of quartzite raw material was

procured along the Rietspruit River in the MSA. This assumption is also based on the fact that over 80% of the quartzite lithics are closely related to Mogalakwena Formation secondary sources, the formation in which OBP is found.

Secondary context geological samples from the Mogalakwena Formation like OBP 1 and OBP 4 are less than 1 km from the site with the closest sample being only 130 m from the shelter. The CMF outcrop of the Cleremont Formation lies about 14.4 km from the site. BPC1 pebbles (A, B, C, and F), possibly the least used quartzite raw material, are located 28-29 km from the site. From this quartzite analysis, we can see that MSA hominins who occupied OBP may have mostly procured secondary context quartzite raw materials within a distance of about 1 km from the site. This procurement strategy is similar to that of MSA hominins who collected quartzite raw materials less than 10 km from Diepkloof Rock Shelter during MIS 5. They also procured quartzite raw materials from alluvial terraces in secondary contexts (Porraz *et al*., 2020).

Shale

OBP 10 shale geological samples were located 13-14 km from the shelter. Due to the absence of *in situ* shale outcrops, the scarcity of shale geological sources around the site, and the distance at which they were located from the site, the provenance of the raw material is difficult to establish. The MSA hominins at OBP may have procured the shale raw materials from localities beyond the OBP search area in the Mogalakwena Formation. Non-local raw materials were also procured to make shale lithics (low frequency) at Hoedjiespunt 1 in the MSA (Will *et al*., 2013).

Sandstone

OBP 8 is an *in situ* sandstone outcrop on the same Mogalakwena Formation hill as OBP. It is located within a 1 km distance from the site (155 m from the shelter). From these observations, we can assume that MSA hominins at OBP often procured sandstone raw materials from primary contexts close to the shelter in the Mogalakwena Formation.

Dolerite

Considering No. 130 and No. 4672, there is a possibility that the secondary context samples collected near the Mogalakwena Formation are similar to these lithics. OBP 5 samples were collected 9 km from the site while OBP 4G is the only dolerite sample found within 1 km of the shelter. Fourie *et al*. (2014) mentioned the difficulty of locating dolerite outcrops but does not claim it to be impossible. Based on the dolerite observations at OBP, MSA hominins either found an inconspicuous dolerite outcrop close to OBP 5 (9 km away) and collected secondary context dolerite around it, or they procured the raw material from secondary contexts along the river close to the site.

Quartz

Of the quartz pebbles that are possible provenance of No. 493 and No. 1290 lithics, OBP 3B is the only pebble collected from an *in situ* conglomerate in the Mogalakwena Formation. For this reason, quartz pebbles around this outcrop may have come from it. These pebbles, including the *in situ* outcrop, are located within 1 km from the site while OBP 5C and OBP 10E were collected 9 km and 13-14 km from the site, respectively. No. 493 has a cortical surface resembling that of the quartz pebbles found along the Rietspruit River close to OBP. Based on these observations, MSA hominins occupying OBP may have procured quartz pebbles along the Rietspruit River as a raw material for quartz lithics. Quartz raw materials from Hoedjiespunt 1 were also procured locally from secondary contexts in the MSA (Will *et al.,* 2013).

Chert

The low amount of lithics in the selected assemblage (and the full assemblage: Val *et al*., 2021) may suggest that the MSA hominins at OBP may have also had difficulty procuring chert raw materials or that they just did not prefer it.

5.2.2 Mwulu's Cave

Quartzite

BRQF quartzite outcrop samples were located in *in situ* contexts and none of the selected quartzite lithics in the Mwulu's Cave assemblage have visible cortical surfaces (de la Peña *et al*., 2019). For this reason, it is deduced that the raw material for lithics was procured in primary contexts (*in situ* outcrops). Outcrop 16, Outcrop 17, and Outcrop G2 are located within 1 km of Mwulu's Cave with the closest being Outcrop 16 at the cave and the furthest being Outcrop G2 only 32 m away. Outcrop 21A was sampled 3.7 km from the site. Based on these findings, MSA hominins at Mwulu's Cave mostly procured quartzite raw materials from *in situ* outcrops at the site and/or very close to it. The same procurement strategy was used by MSA hominins at Elands Bay Cave (Schmid *et al*., 2016). They procured quartzite raw materials from the cave itself and less than 5 km around it (Schmid *et al*. 2016).

Shale

All of the shale sources around Mwulu's Cave, except Outcrop 6 and Outcrop 8, are *in situ* outcrops, and none of the 10 shale lithics in the selected sample have a visible cortical surface. Therefore, the shale used to make the lithics could have been obtained from primary contexts. The Duitschland Formation shale outcrops Outcrop 1 and Outcrop 2 are 9.9 km and 9 km away from Mwulu's Cave respectively. The Malmani Subgroup shale outcrops that like Outcrop 3, Outcrop 4, and Outcrop 8 are located 8.2 km, 7.6 km, and 4.6 km from the site, respectively, although Outcrop 8B is a secondary context sample and an unlikely source. The only probable BRQF shale samples, based on pXRF results, are from Outcrop 14 (A and B). Outcrop 14 is only 378 m away from the cave. Based on these observations, MSA hominins at Mwulu's Cave may have preferred and procured Duitschland Formation shales from almost 10 km away from the site even though shales from other formations were closer to the site.

Quartz

As mentioned, the outcrop BRQF samples were collected from primary contexts. The samples from Outcrop 16 were collected from the cave, those from Outcrop 19 from 51 m from the site, and those from Outcrop 20 and Outcrop 21 were collected 3.7 km from Mwulu's Cave. These observations suggest that the MSA hominins at Mwulu's Cave probably procured *in situ* quartz raw materials either from the cave or from the mountain adjacent to it less than 5 km away. Quartz raw materials at Elands Bay Cave were procured using the same strategy in the MSA. They were procured locally from primary contexts (Schmid *et al.*, 2016).

Chert

The chert outcrop samples from around Mwulu's Cave were collected from *in situ* contexts. Malmani Subgroup samples were collected 8.2 km and 7.6 km from Mwulu's Cave while those from the BRQF were collected 760 m from the site as well as at the site itself. The low number of chert lithics in this study's selection makes it difficult to determine if MSA hominins at Mwulu's Cave procured the chert raw materials close to the site or if they travelled to Malmani Subgroup to get them. Therefore they may be collected locally or semi-locally from *in situ* chert sources. At Elands Bay Cave a similar procurement strategy is noted. MSA hominins procured chert raw materials semi-locally at the Redelinghuys outcrop five to 20 km from the site (Schmid *et al*., 2016). This finding, however, is contrasted by that of Will *et al.* (2013). They found that chert raw materials at Hoedjiespunt 1 were procured non-locally in the MSA.

5.3 Closing remarks for provenance and procurement strategies at Olieboomspoort Rock Shelter and Mwulu's Cave

A few questions on the provenance and procurement of shale and chert raw materials at OBP remain unanswered in this study. Shale occurs as the second most used raw

material at OBP but its outcrops and geological sources seem few and/or far. Chert, albeit the least used raw material, occurs in the lithic assemblage but we were unable to locate any geological sources. Perhaps these raw materials, especially shale, were collected from areas beyond the search area used in this study. Another observation is that quartzite was preferred over quartz raw materials even though quartz pebbles were equally available along the Rietspruit River close to the site. This is also seen at Elands Bay Cave where the MSA hominins of 'MSA1' preferred quartzite over quartz because of its characteristics (hardness, durability, etc.) (Schmid *et al*., 2016). The same is possible for the MSA hominins at OBP. Generally, however, the MSA hominins of OBP procured quartzite and quartz raw materials locally from along the Rietspruit River. Sandstone may have been procured locally close to the site. Dolerite raw materials may have been collected along the Rietsprit River in a secondary context although it is more likely that they procured this raw material from unknown dolerite outcrops. Shale may have been procured semi-locally and/or non-locally from outcrops that are unknown and the provenance of chert lithics is also unknown.

The Rietspruit River may have provided many of the lithic raw materials that were used at OBP in the MSA. It is a left-bank tributary of the Mokolo River which flows in a northerly direction towards the Limpopo River. The Rietspruit River flows over the Waterberg Group (particularly the Mogalakwena Formation) conglomerates, shales (Barker *et al*., 2006) sandstone sheets (Eriksson *et al*., 2008). Quartzite, quartz, and chert from conglomerates, as well as shale and sandstone raw materials, could have been transported downstream towards the site and procured along the river by MSA hominins at OBP. Based on measurements from the sketch map of the Mokolo River catchment area (Figure 5.1) and the 2326 Ellisras geological map (Figure 5.2), the dolerite outcrop is situated about 3 km (local) outside the catchment area. This means that MSA hominins at OBP possibly travelled to dolerite outcrops to procure it.

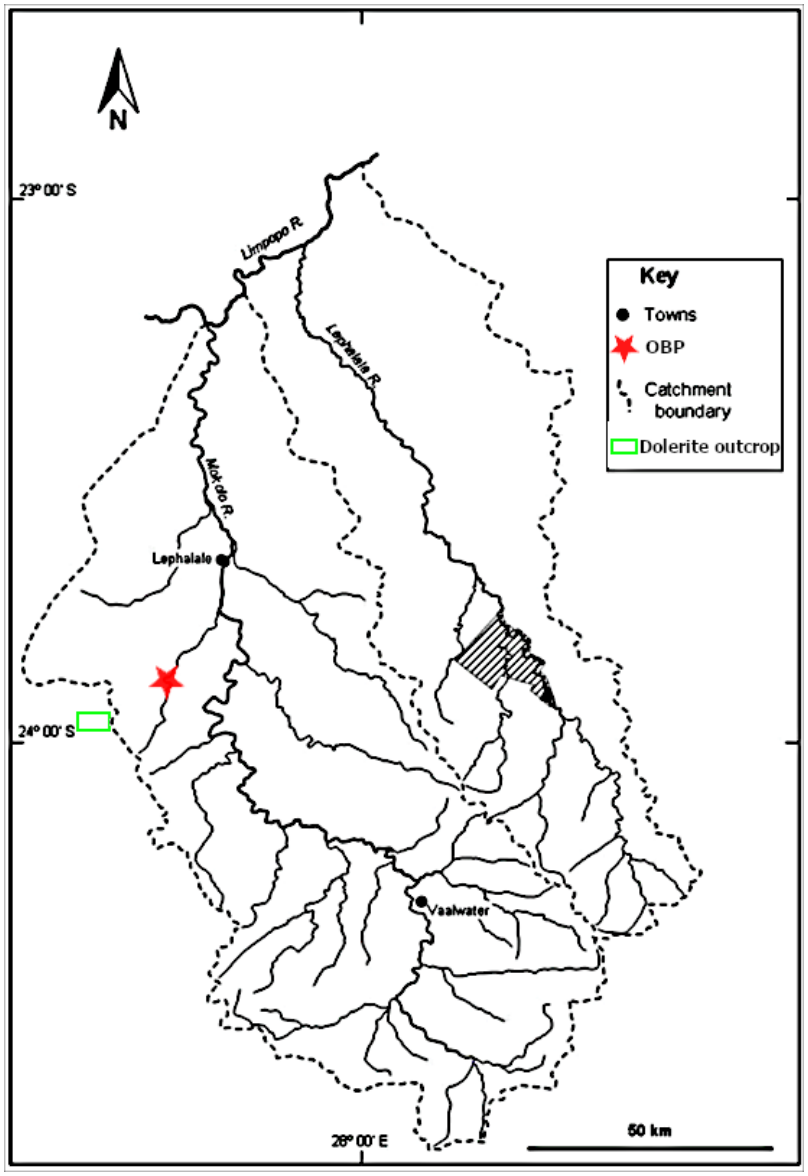

Figure 5.1: Sketch map of the Lephalale and Mokolo River catchments. OBP is represented by the red star and the location of the closest dolerite outcrop is in the green box (modified from Oberholster *et al.*, 2010).

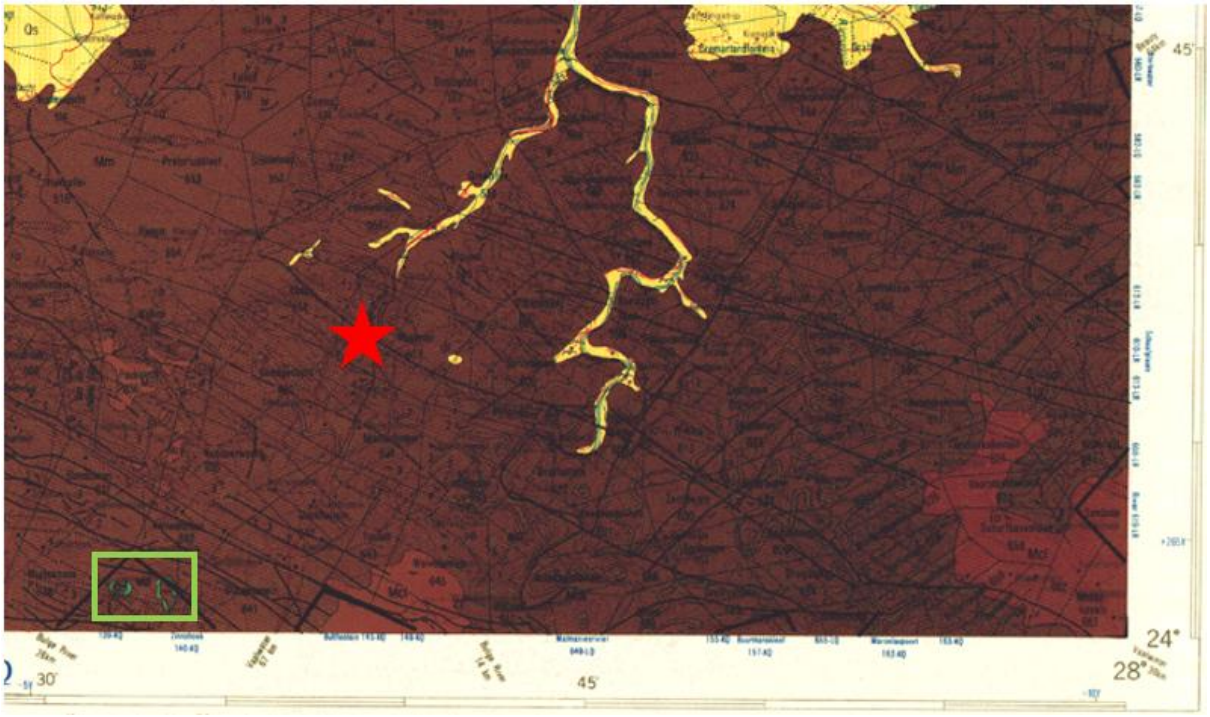

Figure 5.2: Section of the 2326 Ellisras geological map showing the position of the dolerite outcrop in relation to OBP in the Moloko River catchment area (red star) (Geological Survey (South Africa) and Besaans, 1959).

Based on the selected lithic assemblage from Mwulu's cave, quartzite may have been used more than shale at the site in the MSA. This could be due to the abundance of quartzite at the cave and close to it. Quartz is also prominent in the assemblage, although not many outcrop sources were located around the site. This study shows us that MSA hominins at Mwulu's Cave predominantly procured local, *in situ*, lithic raw materials. Chert and shale, however, may have been procured semi-locally.

Mwulu's Cave is 15 m above the base of a cliff in a valley and no rivers are noted near the site. Therefore, lithic raw materials (i.e. quartzite, quartz, shale, and chert) must have been brought to the site by MSA hominins.

A few lithic raw material procurement analysis studies have been conducted at sites in South Africa. Some examples of these studies are those of Porraz *et al*. (2020), Mackay *et al*. (2022), Schmid *et al*. (2016), and Will *et al*. (2013) among others. The current study is similar to these although a combination of petrologic, petrographic, and

geochemical methods is used to analyse both lithics and outcrop samples from OBP and Mwulu's Cave.

OBP and Mwulu's Cave are sites once placed under the Pietersburg Industry. According to Wadley (2015), this industry is characterised by quartzite raw materials, among others, that can be determined by local geology. This statement is supported by the results of the current study. Both OBP and Mwulu's Cave have lithic assemblages dominated by the quartzite raw material and this raw material is indeed represented in the local geology around the sites. Schmid *et al.* (2016) stated that during MIS 6 and MIS 5 hominins procured local raw materials for lithic production and this statement is partially true for OBP and Mwulu's Cave. Based on the selected lithic samples in this study, possibly more than 50% of the lithic raw materials at OBP and Mwulu's Cave were procured locally within 5 km of the sites. Similar procurement strategies are noted at MSA sites like Elands Bay Cave (Schmid *et al*., 2016), Diepkloof Rock Shelter (Porraz *et al*., 2020), and Hoedjiespunt 1 (Will *et al*., 2013) in South Africa. The MSA sites beyond South Africa (those cited in this study), however, show generally non-local procurement strategies. Examples of these African sites include those in the Olduvai Gorge (Favreau *et al*., 2020), the Olorgesailie basin (Brooks *et al.,* 2018), and at the White Paintings Shelter (Nash *et al*., 2013).

5.4 Limits of the study and recommendations for future studies

Unfortunately, this study could not determine the exact provenance of each of the lithics from OBP and Mwulu's Cave. Only preliminary provenance results and procurement hypotheses are available. These are obtained from macroscopic and pXRF analyses because not enough materials could be analysed using thin section and ICP-MS destructive methods- methods that were meant to verify the pXRF results. In future studies, more samples will have to be analysed through thin sections and ICP-MS to fulfil the aim of this study.

Shale, dolerite, and chert outcrops around OBP were not located during the prospection survey of this study. This makes it difficult to determine the provenance (and therefore procurements strategies) of some lithics from OBP. A more extensive search area

around the site may be required to locate these outcrops. This may also require organising access to some of the private properties around OBP. I acknowledge that one of the reasons for inconclusive results in this study was the lack of samples to analyse. Therefore more geological samples should also be collected in future studies in order to obtain more robust and reliable results. This study may have not produced positive results, but the methodology will be useful for future studies.

6 CONCLUSION

Raw material macroscopic, pXRF, thin section, and ICP-MS analyses determined that hominins at OBP and Mwulu's Cave may have predominantly procured lithic raw materials locally (following the definition of Schmid *et al*., 2016). This is a common observation at other MSA sites in South Africa too (Elands Bay Cave (Schmid *et al*., 2016), Diepkloof Rock Shelter (Porraz *et al*., 2020), and Hoedjiespunt 1 (Will *et al*., 2013)).

At OBP, all of the raw materials (except chert) may have been procured around the Mogalakwena Formation. Quartzite and quartz were possibly procured locally in secondary context from the Rietspruit River. Sandstone may have been collected locally from *in situ* outcrops within the Mogalakwena Formation. Shale seems to have had a non-local procurement, while dolerite may have been sourced from the Rietspruit River, although an unknown outcrop may be the source. Chert raw materials are unknown.

At Mwulu's Cave, quartzite, and quartz may have been procured from the BRQF, and shale from the Duitschland Formation. All the raw materials were probably procured from *in situ* outcrops. Quartzite and quartz from Mwulu's Cave were procured locally while shale may have been procured semi-locally. It is uncertain whether chert was procured locally or semi-locally.

This study has provided preliminary provenance and procurement information about lithics from OBP and Mwulu's Cave although more petrographic and ICP-MS analyses are required to verify these findings in future studies.

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8 APPENDICES

APPENDIX A

8.1 Detailed macroscopic results

8.1.1 OBP lithic and geological samples

Table A1: All lithic and geological samples from OBP, as well as their descriptions and rock types. The lithics we collected by A. Val (2018-2019).

OBP lithics collected by A. Val (2018-2019)				
Square	**Layer**	**Sample No.**	**Description**	**Rock type**
B2C	Déc 4	412	Unretouched Flake	Chert
B2A	Déc 1	130	Unretouched Flake	Dolerite
B2D	Déc 1	182	Flake	Dolerite
B2C	Déc 4	408	Unretouched Flake	Dolerite
B2C	Déc 4	458	Unretouched Flake	Dolerite
B2D	Déc 4	489	Unretouched Flake	Dolerite
B2B	Déc 10	1241	Unretouched Flake	Dolerite
B2	YRS 15	4672	Unretouched Flake	Dolerite
B2	YRS 15	4688	Unretouched Flake	Dolerite
B2d	Déc 4	493	Flake	Quartz
B2D	Déc 10	1290	Unretouched Flake	Quartz
B2D	Déc 1	106	Unretouched Flake	Black Quartzite
B2B	Déc 4	440	Unretouched Flake	Black Quartzite
B2D	Déc 16	2358	Unretouched Flake	Black Quartzite
B2A	Déc 16	2364	Unretouched Flake	Black Quartzite
B3D	Déc 13	1824	Unretouched Flake	Black Quartzite
B2C	Déc 4	468	Unretouched Flake	Red Quartzite
B2A	Déc 11	1195	Unretouched Flake	Red Quartzite
B2D	Déc 16	2353	Unretouched Flake	Red Quartzite
	YRS 1	YRS-C	Unretouched Flake	Red Quartzite
	YRS 1	YRS-E	Unretouched Flake	Red Quartzite
B2C	YRS 7	3478	Unretouched Flake	Red Quartzite
B2	YRS 15	4671	Flake	Red Quartzite
B2	YRS 15	4683	Unretouched Flake	Red Quartzite
B2	YRS 15	4697	Unretouched Flake	Red Quartzite
B2	YRS 15	4695	Unretouched Flake	Red Quartzite

B2	YRS 15	4678	Unretouched Flake	Red Quartzite
B2A	Dec 1	143	Unretouched Flake	White Quartzite
B2D	Dec 4	488	Unretouched Flake	White Quartzite
B2D	Dec 4	486	Unretouched Flake	White Quartzite
B2D	Dec 4	494	Unretouched Flake	White Quartzite
B2B	Dec 16	2332	Unretouched Flake	White Quartzite
B3C	Dec 13	1795	Unretouched Flake	White Quartzite
B2A	Dec 13	1873	Unretouched Flake	White Quartzite
B2C	YRS 7	3474	Unretouched Flake	White Quartzite
B3	Dec 1	120	Unretouched Flake	White Quartzite
B2A	Dec 16	2374	Unretouched Flake	White Quartzite
B2D	Dec 10	1286	Unretouched Flake	Sandstone
B2A	Dec 10	1194	Unretouched Flake	Sandstone
B2A	Dec 16	2366	Unretouched Flake	Sandstone
B3C	Dec 16	2402	Unretouched Flake	Sandstone
B3C	Dec 16	2395	Unretouched Flake	Sandstone
B2C	YRS 7	3486	Unretouched Flake	Sandstone
	Dec 16	2290*	Unretouched Flake	Shale
B3A	Dec 1	110	Unretouched Flake	Shale
B2C	Dec 1	164	Unretouched Flake	Shale
B2A	Dec 1	142	Unretouched Flake	Shale
B2C	Dec 1	159	Flake	Shale
B2A	Dec 1	137	Unretouched Flake	Shale
B2D	Dec 4	420	Unretouched Flake	Shale
B2B	Dec 10	1226	Unretouched Flake	Shale
B3C	Dec 13	1789	Unretouched Flake	Shale
	YRS 1	YRS-A	Unretouched Flake	Shale
	YRS 1	YRS-B	Unretouched Flake	Shale
	YRS 1	YRS-D	Unretouched Flake	Shale
B2	YRS 15	4684	Unretouched Flake	Shale
B3D	Dec 1	122	Flake	Shale/Metased
B2D	Dec 1 Af	106	Unretouched Flake	Shale/Metased
B2D	Dec 1 BB	106	Flake	Shale/Metased
B2D	Dec 1 A2	106	Flake	Shale/Metased
B3D	Dec 1 Au	107	Flake	Shale/Metased
B2B	Dec 14	1968	Unretouched Flake	Shale/Metased
B2	YRS 15	4670	Flake	Shale/Metased
B2	YRS 15	4677	Flake	Shale/Metased
B2	YRS 15	4682	Flake	Shale/Metased

Outcrop samples collected around OBP in Lephalale	
Sample No.	**Rock type**
OBP4 G	Dolerite

OBP5 A	Dolerite
OBP5 D	Dolerite
OBP5 E	Dolerite
BPC1D	Quartz
BPC1E	Quartz
OBP3 B	Quartz
OBP4 B	Quartz
OBP5 C	Quartz
OBP5 F	Quartz
OBP6 D	Quartz
OBP9 A	Quartz
OBP9 B	Quartz
OBP10 C	Quartz
OBP10 E	Quartz
OBP10 F	Quartz
MC1	Quartz
MC2	Quartz
MC3	Quartz
BB1	Quartz
OBP1	Quartz
OBP2	Quartz
OBP3 A	Quartz
OBP6 C	Quartz
OBP6 E	Quartz
OBP4 D	Quartz
BPC1F	Black Quartzite
OBP6 F	Black Quartzite
BPC1A	Red Quartzite
BPC1C	Red Quartzite
OBP4 A	Red Quartzite
OBP4 C	Red Quartzite
OBP4 E	Red Quartzite
CMF1	White Quartzite
CMF2	White Quartzite
BPC1B	White Quartzite
OBP4 F	White Quartzite
OBP5 B	White Quartzite
OBP6 A	White Quartzite
OBP6 B	White Quartzite
OBP10 D	White Quartzite
OBP3 C	Sandstone
OBP7	Sandstone
OBP8 B	Sandstone

OBP8 C	Sandstone
OBP8 A	Sandstone
OBP10 A	Shale
OBP10 B	Shale

White quartzite (Figure A1)

No. 143

A fine to medium-grained white quartzite with a smooth, polished texture and shiny lustre. It has a dull, red-brown cortex. The grains are annealed and no matrix is visible. 5% of the rock is represented by sub-angular black grains (0.25 mm).

No. 488

A white quartzite with a smooth texture and shiny lustre. Its weathered surface is red and its fresh surface is white. The quartz crystals are annealed and no matrix is noted.

No. 494

A crystalline, fine-grained quartzite with a red weathered surface. It has a smooth texture and a shiny lustre. Sub-angular quartz crystals are noted in a white matrix (5%).

No. 468

A coarse-grained quartzite pebble with a smooth red weathered surface and pink fresh surface. It has a dull lustre through which some grain foliation is noted. The quartz crystals are annealed and no matrix is noted.

No. 1873

A white quartzite rock with heavy calcite coating. It is rough and has a dull texture.

No. 1795

A heavily coated sample that appears to be a brown-white quartzite. The fine to medium (0.2-0.5 mm) quartz grains are rounded and no visible matrix is noted.

No. 486

A grey-white quartzite with a rough texture and shiny lustre. It is fine-grained (<1 mm) with sub-rounded white and clear grains in a white matrix (10%).

No. 2332

A grey-white quartzite with fine to medium (0.2-0.5 mm) quartz grains. It has a smooth texture and dull lustre. The crystals are sub-rounded to rounded and no visible matrix is noted.

No. 3478

A very heavily coated, quartzite with sub-angular and sub-rounded, medium sized quartz grains.

No. 4678

A crystalline, red-brown (white fresh surface) quartzite with a rough texture and dull lustre. It has sub-angular, medium to coarse quartz grains that are interlocking. Less than 15% matrix is noted. Clear, yellowish staining is present around some grains.

No. 2374

Grey-white quartzite that is heavily coated in calcite. It has a smooth texture and a dull lustre. The sample is coarse-grained (2-4 mm) with sub-angular to angular, annealed quartz grains.

No. 120

A pink-white quartzite with medium to coarse-grained (0.5- 1 mm) in a black and white matrix (15%). The quartz and microcrystalline grains are mostly sub-rounded to rounded although the larger grains are generally sub-angular.

CMF1

A white quartzite sample with an orange weathered surface. It has medium to coarse (0.5-1 mm) quartz grains that are rounded, and pink and grey in colour. A white matrix is noted (10%). There is a 1-1.5 cm coarser banding through the finer material (2-4 mm) which brings in an orange and purple colour.

CMF2

A white quartzite with an orange weathered surface, sampled from the Cleremont Formation. It has a granular texture and an upward coarsening trend is noted. It is coarse-grained (1-3 mm) with rounded quartz grains in a white matrix (10%).

BPC1B

A white quartzite with a smooth surface and a dull lustre. It is a rounded pebble, around 6.5 cm, with a pink-brown weathered surface. The medium to coarse (0.5 mm) quartz grains are annealed and no matrix is noted.

OBP4 F

A smooth and dull quartzite pebble (3.5 cm) with an orange cortex. The white grains are annealed and no matrix is visible.

OBP5 B

A rounded, quartzite cobble with a rough, orange weathered surface. The grains are coarse (0.6-1 mm) and interlocking. No matrix is noted

OBP6 A

A rounded, white quartzite cobble (10 cm) with a smooth texture and a dull lustre. The weathered surface of this sample is orange and its coarse grains (1-3 mm) are interlocking. No matrix is noted.

OBP6 B

This coarse-grained (1 mm), white quartzite cobble (7.8 cm) has a rough, red cortex and a dull lustre. Its grains are sub-rounded to sub-angular and are interlocking with each other. No matrix is noted

OBP10 D

A black and white quartzite pebble that is rounded and has a smooth cortex. It has a dull lustre and has coarse quartz grains (0.8-1 mm) that are annealed. No matrix is noted.

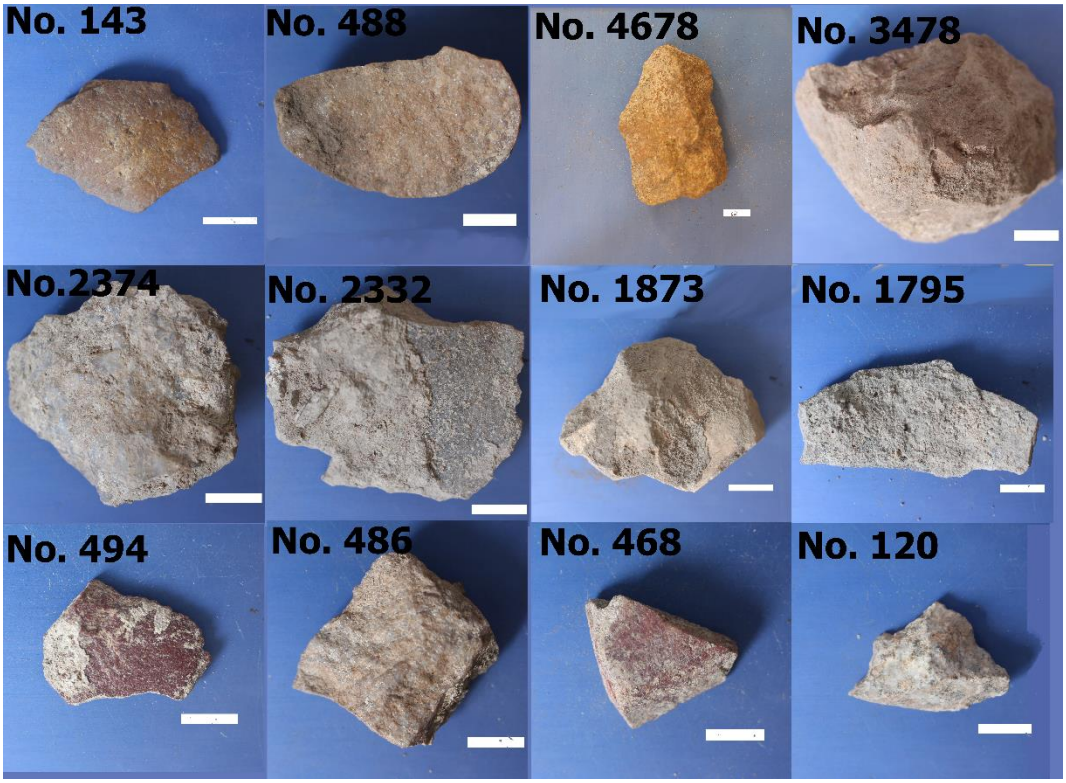

Figure A1*: White quartzite lithics from OBP.*

Red quartzite (Figure A2)

No. 2353

A red quartzite sample with a smooth texture and a shiny, crystalline lustre. The grains are interlocking and no matrix is noted. There is calcite coating

No. 3474

A red quartzite with a rough texture and shiny, crystalline lustre. The fine to medium sized (~0.2 mm) quartz grains are annealed and no matrix is visible.

No. 4671

A red quartzite with a smooth red weathered surface (pebble cortex) and a rough, crystalline fresh surface. The sample has a dull lustre and is coarse-grained with grain sizes going from 0.5 mm to 1mm. It has red, pink, white and black (in decreasing order), sub-rounded grains in a brown matrix (30%).

No. 4683

A dark red quartzite with a rough, crystalline texture and a shiny lustre. It has interlocking, angular, medium sized quartz grains (<0.5 mm) and no matrix is noted.

No. 4697

A red-brown quartzite with a rough, crystalline texture and a shiny lustre. It has annealed quartz grains (the grain boundaries are not visible under the binocular microscope) and no matrix is noted.

No. 4695

A crystalline, red quartzite with a rough texture and shiny lustre. It is fine to medium-grained (0.1-0.3 mm). The grain shape is angular and a few grains are dark red. No matrix is noted.

YRS1-C

The rock is generally red with a rough texture and a dull lustre. It has fine to medium, sub-rounded grains that grade from black, to white, to red across the sample. No matrix is noted.

YRS1-E

A dark, red-brown quartzite pebble with a smooth cortex. It has a smooth texture and dull luste. The medium to coarse (0.3-0.7 mm) quartz grains are glassy, angular, and interlocking. No matrix is noted.

No. 1195

The fresh surface of this sample is heavily coated with calcite. The weathered surface, however, is clear and shows a smooth, red cortex. The grains in this rock are sub-angular, coarse, and interlocking. No matrix is noted.

BPC1A

A rounded quartzite pebble that spans up to 6.5 cm longitudinally and has a smooth, orange weathered surface and a dull lustre. It looks crystalline on the fresh surface. The pink/red quartz grains are coarse (0.7 mm) and annealed. No matrix is noted.

BPC1C

A red, rounded quartzite pebble (6.5 cm) with a smooth texture and a dull lustre. It has a white and dull brown cortex. The quartz grains are coarse (0.5-0.9 mm) and sub-rounded. They are also interlocking and annealed in some places. No matrix noted.

OBP4 A

A large, rounded, quartzite cobble (ex situ; 15 cm) with a brown weathered surface and a pink fresh surface (red and white). It has medium to coarse (0.5-1 mm) quartz grains that are annealed. No matrix is noted

OBP4 C

Quartzite pebble (5 cm) with an orange, pitted, weathered surface and a red fresh surface. The grains are annealed (cannot see grain boundaries) and no matrix is noted.

OBP4 E

A rounded, quartzite cobble (10.5 cm) with a rough, orange cortex and red, coarse (1-2 mm), annealed quartz grains. The cortex is weathered and dull. No matrix is noted.

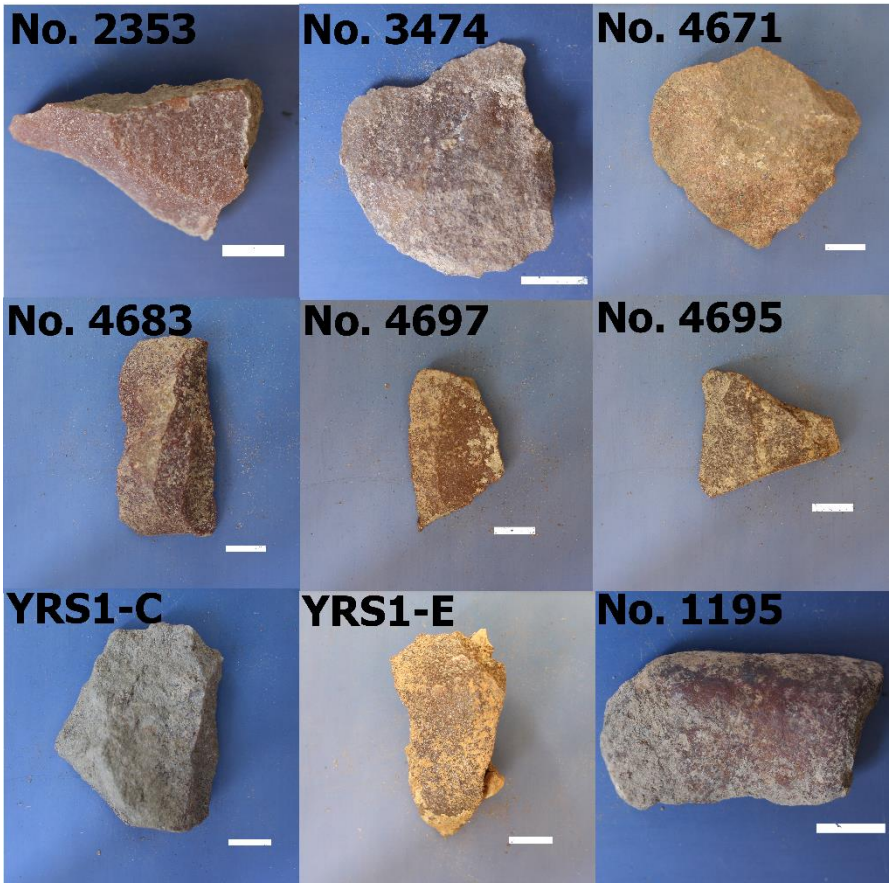

Figure A2*: Red quartzite lithics from OBP.*

Black quartzite (Figure A3)

No. 440

A black quartzite with calcite coating on one side. The rock has a shiny lustre with annealed black and grey, medium to coarse (<2 mm) quartz crystals. Green minerals (possibly chlorite) are noted across the sample. No matrix is noted.

No. 1824

A red-black, coarse-grained (0.5-1 mm) quartzite that is heavily coated in calcite. It has a rough texture and dull lustre.

No. 2358

A coarse-grained (>4 mm), multi-coloured quartzite (red, black and white crystals) sample with calcite coating. It has a rough texture and glassy lustre. The grains are sub-rounded and poorly sorted in a white matrix (25%)

No. 2364

A black quartzite sample that is rough to touch and has a glassy lustre. It has coarse (0.5-1 mm) sub-angular to sub-rounded interlocking quartz grains. No matrix is noted.

No. 106

A heavily coated, red-black quartzite with a dull lustre and rough texture where visible. The grains are fine and sub-angular in a brown matrix (15%).

BPC1F

A rounded, black quartzite pebble (4.5 cm) with a smooth texture and a dull lustre. It has black and grey quartz grains that are sub-angular and coarse (1-2 mm). These grains are annealed and interlocking. No matrix noted.

OBP6 F

A black, coarse-grained (1 mm) quartzite with a smooth, crystalline, fresh surface and a dark, greenish-grey weathered surface. The quartz grains are angular and annealed. No matrix is noted.

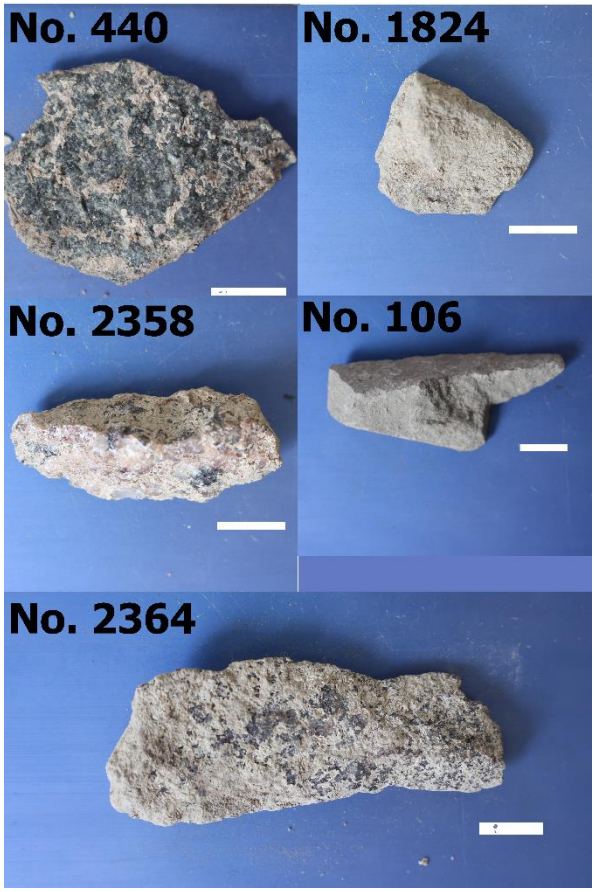

Figure A3*: Black quartzite lithics from OBP.*

Shale/meta-sedimentary samples (General) (Figure A4)

No. 106 Af

A coated red-brown meta-sedimentary rock with a smooth texture and dull lustre. The weathered surface is orange and dark brown patches are visible throughout the rock. The rock is very fine-grained and the grains cannot be seen under the binocular microscope.

No. 106 BB

A brown meta-sedimentary rock with a smooth texture and dull lustre. The rock is very fine-grained and the grains cannot be seen under the binocular microscope.

No. 1968

A very fine-grained, brown meta-sedimentary rock with a smooth texture and dull lustre.

No. 107 Au

A red-purple-brown very fine-grained meta-sedimentary rock with a rough texture and dull lustre.

No. 4682

A dark green-grey meta-sedimentary rock with an orange-brown weathered surface. It is very smooth to touch and has a dull lustre. The grains in the sample cannot be seen.

No. 122

A crystalline, grey-black, meta-sedimentary rock that is heavily coated with calcite precipitation. It has a rough texture and dull lustre with coarse (0.5- 1 mm), sub-rounded grains. Not much is visible about the relationship between the grains due to coating.

No. 1789

A red-brown, very fine-grained meta-sedimentary rock with a smooth texture and dull lustre. Looks like a river calcrete in ferruginous coating.

No. 110

A coarse-grained (0.5-1 mm) sample with a purple and green-black weathered surface. It is very hard to see the fresh surface although the grains seem rounded and no matrix is noted.

No. 164

A very fine-grained (cannot see individual grains), black rock. The sample has a smooth surface and dull lustre. There is calcite coating on the cortex of the rock.

No. 159

A black, light weight shale that is very fine-grained, has a smooth texture and a dull lustre.

YRS1-D

A red-brown, very fine-grained sample with a black weathered surface. The sample is smooth textured and has a dull lustre.

No. 142

A calcite coated, black shale with foliation noted in the sample. Its texture is very fine-grained (silt sized grains) and smooth with a dull lustre.

No. 420

A very fine-grained (grains cannot be seen with the naked eye), red-black shale with calcite coating. It has a rough texture and dull lustre.

YRS1-A

A black, very fine-grained (grains are not visible) shale with a smooth texture and a dull lustre.

OBP10 A

A very fine-grained, purple-grey, meta-sedimentary rock that has a smooth texture and a dull lustre.



Figure A4: Shale (general) lithics from OBP.

Shale with inclusions (Figure A5)

No. 106 A2

A red-brown meta-sedimentary rock with a smooth texture and dull lustre. The grains are very fine although sparse white (0.5-1 mm) and black angular (0.5-2 mm) grains are noted throughout the sample (10%).

No. 1226

A red-brown fine-grained rock with a rough texture and a dull lustre. Dull, black patches are noted throughout the sample (45%).

No. 2290

A very fine-grained, dark green-grey rock with a smooth texture and dull lustre. The sample has black crystals dispersed throughout the sample (5%).

No. 137

A heavily coated rock that appears to be a black shale in places where the coating has cracked. It has very fine grains that are barely visible with the naked eye and has a dull lustre. Red grains are noted within the black matrix.

YRS1-B

A red-black, very fine-grained shale with a smooth texture and dull lustre. It seems there are red sub-angular grains in a black matrix (40%).

No. 4684

A very fine-grained, grey-black shale with a smooth texture and dull lustre. It has red-orange coating/staining in some areas. The sample is speckled with pitch-black crystals.

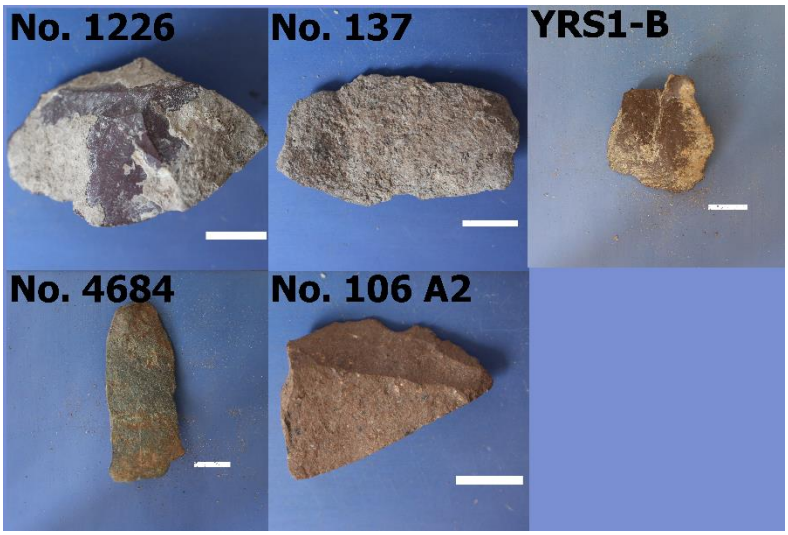

Figure A5: Shale lithics with inclusions from OBP.

Shale with foliation (Figure A6)

No. 4670

A meta-sedimentary rock with an orange-brown fresh surface and a red-brown weathered surface. It is very fine-grained (silt sized), has a smooth texture, and a dull

lustre. A foliation that almost looks like cleaving is noted on the sides of the sample (where it is not coated in calcite).

No. 4677

A very fine-grained shale or meta-sedimentary sample with a smooth texture and dull lustre. The sample has alternating banding (black, brown and light grey) on its fresh surface and is all black on its weathered surface. Small, shiny micas are noted throughout the sample (20%).

OBP10 B

A black, very fine-grained shale with a rough texture and a dull lustre. Some foliation is noted on the edges of the sample.

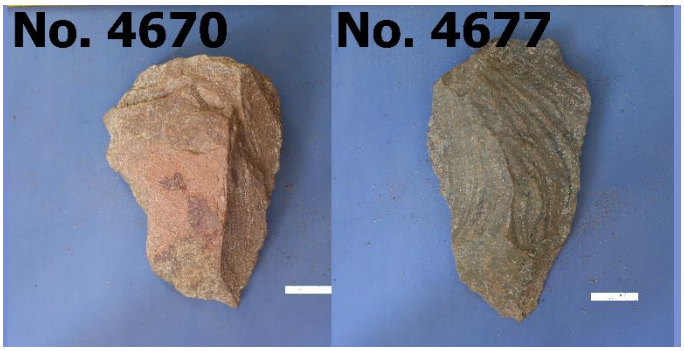

Figure A6: Shale lithics with foliations from OBP.

Sandstone (General) (Figure A7)

No. 1286

A light brown (possibly stained by sand) sandstone with a rough texture and dull lustre. It has fine to medium (0.5 mm) sub-rounded grains in a brown matrix (10%).

No. 2395

A heavily coated (calcite), light brown sandstone with a rough texture and dull lustre. The fine to medium (0.1-0.5 mm), sub-angular grains interlock in a barely visible matrix (<5%). Some black crystals (0.05 mm) are noted in small clusters throughout the sample.

No. 3486

A heavily coated, red sandstone with a rough texture and dull lustre. It has medium-grained (0.4-0.6 mm), sub-angular quartz crystals and no matrix is noted.

No. 2366

A coarse-grained, black sandstone (0.5-2 mm, with a few red and white grains) with a rough texture and glassy lustre. It has sub-rounded grains in a white matrix (5%).

OBP3 C

A sandstone sample that has coarse-grained beds alternating with a black oxidised beds. The first coarse (1-5 mm) sandstone bed has black, pink and grey quartz grains in a white matrix (15%). These are sub-rounded to sub-angular. The second sandstone bed is uniform and has finer, quartz grains (0.5 mm) in a white matrix (10%). These grains are sub-angular and red in colour. The black oxidised bed is similar to second sandstone.

OBP7

A black, coarse-grained (0.7-1 mm) sandstone with a glassy quartz, fresh surface and a dull, brown weathered surface. The quartz grains are angular and interlocking. No matrix is noted.

OBP8 A

A banded sandstone with a rough texture and a dull weathered surface lustre. It was sampled from a 1m thick, in situ, outcrop. The fresh surface has a glassy lustre. This sample has black (2 cm) and red (1 cm) banding. The black layers are fine-grained and the red layers have a coarse texture (2-8 mm). The grains throughout the sample are sub-angular and interlocking, and no matrix is noted.

OBP8 C

An oxidised sandstone sample that is friable and has a rough texture and a dull lustre. It is composed of coarse (3-5 mm), sub-angular, grains in a brown matrix (10%).

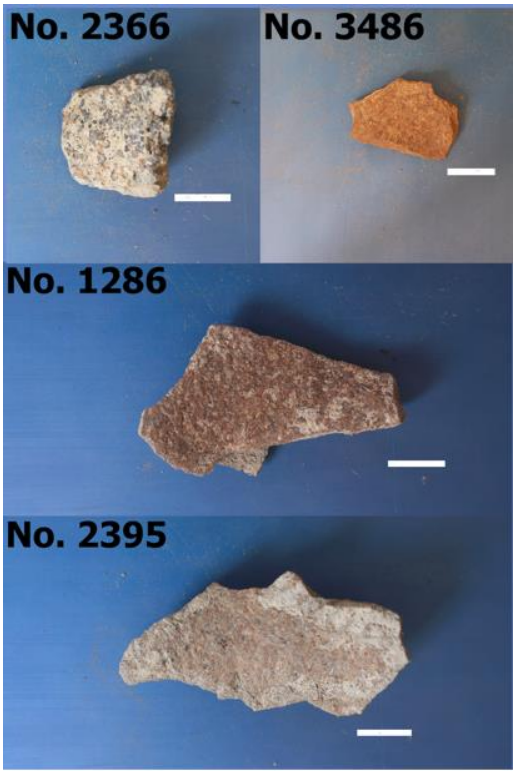

Figure A7: Sandstone (general) lithics from OBP.

Sandstone with phenoclasts (Figure A8)

No. 1194

A dark, red-brown sandstone that is smooth to touch and has a dull lustre. The sample is heavily coated with calcium carbonate. It is very fine-grained (grains are not visible to the naked eye) with a larger grey quartz grain (<1 mm) and black, shiny mica crystals (0.5 mm).

No. 2402

A red-black sandstone with a rough texture and a dull lustre. The grains are mostly black but red and white grains are evident. These are angular and interlock tightly, leaving no visible matrix. Larger quartz grains (phenoclasts) noted among the interlocking grains.

OBP8 B

A friable sandstone sample with an oxidised layer and red sandstone layer. These are both coarse-grained (0.5-2 mm) and a few quartz pebbles (5-8 mm) are caught in sandstone.



Figure A8: Sandstone lithics with phenoclasts from OBP.

Banded sandstone

OBP3 C

A sandstone sample that has coarse-grained beds alternating with a black oxidised beds. The first coarse (1-5 mm) sandstone bed has black, pink and grey quartz grains in a white matrix (15%). These are sub-rounded to sub-angular. The second sandstone bed is uniform and has finer, quartz grains (0.5 mm) in a white matrix (10%). These grains are sub-angular and red in colour. The black oxidised bed is similar to second sandstone.

OBP8 A

A banded sandstone with a rough texture and a dull weathered surface lustre. It was sampled from a 1m thick, in situ, outcrop. The fresh surface has a glassy lustre. This sample has black (2 cm) and red (1 cm) banding. The black layers are fine-grained and the red layers have a coarse texture (2-8 mm). The grains throughout the sample are sub-angular and interlocking, and no matrix is noted.

Friable sandstone

OBP8 B

A friable sandstone sample with an oxidised layer and red sandstone layer. These are both coarse-grained (0.5-2 mm) and a few quartz pebbles (5-8 mm) are caught in sandstone.

OBP8 C

An oxidised sandstone sample that is friable and has a rough texture and a dull lustre. It is composed of coarse (3-5 mm), sub-angular, grains in a brown matrix (10%).

Dolerite/igneous (Figure A9)

No. 1241

A heavily coated, aphanitic, black dolerite with a rough texture and dull lustre. White plagioclase feldspar laths are speckled across the black matrix.

No. 4672

An aphanitic, black dolerite with a rough texture and dull lustre. It has white plagioclase feldspar laths throughout the sample that are more than 2 mm long.

No. 458

A dark grey rock with a smooth texture and dull lustre. It is probably igneous in nature. This aphanitic rock has fine white plagioclase feldar laths (55%) in a black matrix (45%).

No. 408

A heavily coated (calcite) black rock with a rough texture and dull lustre. The grains are very fine to medium-grained but white plagioclase feldspar laths (1 mm, 30%) are noted in the black matrix.

No. 489

N aphanitic, green-black rock (possibly igneous) with a rough texture and dull lustre. It has some degree of foliation throughout the sample.

No. 182

An aphanitic rock with a red-brown weathered surface and black fresh surface. The lustre is dull and the texture of the rock is smooth. Cream white plagioclase feldspar laths (0.2-0.5 mm) are noted throughout the rock (20%).

No. 4688

A red-black rock with a rough texture and a dull lustre. It has coarse (-0.6 mm), angular grains and no matrix is noted.

No. 130

A heavily coated, black rock with a rough (bumpy) texture and dull lustre. The grains are coarse and rounded. As with the previous rock, the relationship between grains is difficult to see.

OBP4 G

An aphanitic, dolerite sample with a black fresh surface and a rough, dull brownish-black weathered surface. The fresh surface is black and smooth.

OBP5 A

An aphanitic, dolerite sample with a black fresh surface and a dull, orange weathered surface. The fresh surface is black and smooth.

OBP5 D

A black dolerite sample with a black, rough weathered surface and a dull lustre. It seems coarse-grained (1 mm) on the weathered surface but is aphanitic on the inside. White, plagioclase laths are noted throughout the sample (10%).

OBP5 E

This dolerite has a brown weathered surface and an aphanitic, black fresh surface. Its lustre is dull and it has a smooth texture.

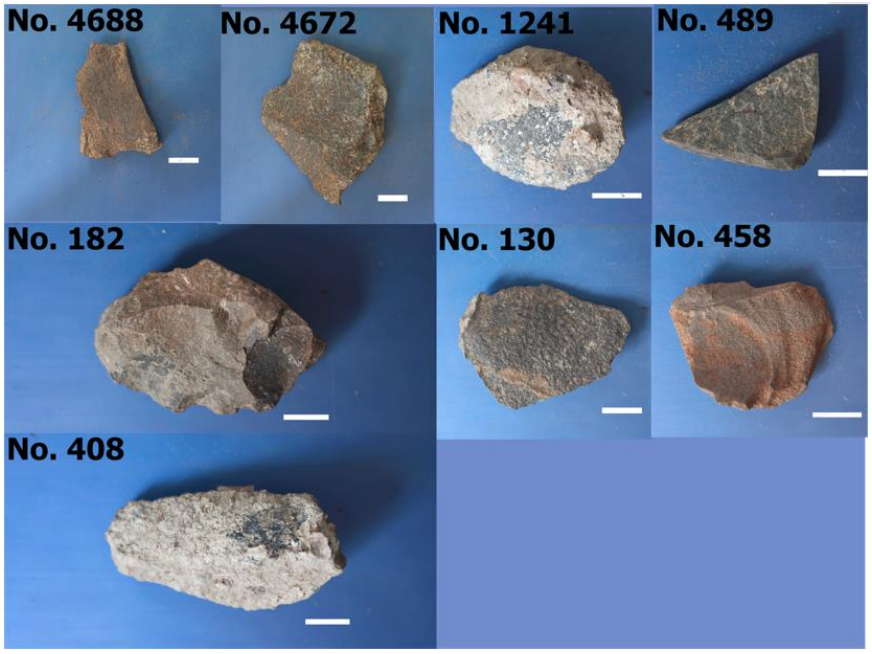

Figure A9: Dolerite lithics from OBP.

Quartz (Figure A10)

No. 493

A calcite coated, pink quartz pebble with a rough cortex.

No. 1290

A pink-white quartz sample with heavy calcite coating. The texture is smooth and it has a glassy lustre. A black fluid/oxidisation is noted in the sample.

MC1

A quartz conglomerate with rounded quartz pebbles (15%; 0.5-4.5 cm). The quartz pebbles have a purple and orange weathered surface, and a white fresh surface. The matrix of conglomerate is sandstone. It is coarse-grained (<2 mm) and has sub-rounded quartz grains (purple and white) in a white matrix (20%). Chlorite in association with the quartz grains is noted.

MC2

A conglomerate similar to MC1 with rounded quartz pebbles (10-15%; 1-7 cm) that have a purple and orange weathered surface and are white on the inside. The matrix is

coarse with purple and white sub-rounded to rounded quartz grains in a white matrix (20%). It has a brown, orange and purple weathered surface.

MC3

A conglomerate sampled at the contact between the Mogalakwena Formation and the Cleremont Formation (contact between a conglomerate and a pebbly sandstone). It has sub-rounded to rounded quartz pebbles and shows an upward coarsening trend throughout the sample. The sandstone section of the sample is coarse-grained (0.3-0.5 mm) with pink, sub-rounded grains in a white matrix (a band of black matrix is noted being 2-2.5 cm thick) (10%).

BPC1D

A rounded, red quartz pebble (4 cm) with a smooth texture and a dull lustre.

BPC1E

A rounded, white and pink quartz pebble (5 cm) with striations across the sample. It has a pitted and dull lustred cortex.

BB1

A conglomerate with rounded white quartz pebbles (1-3.5 cm) that have red, purple and white, smooth and dull cortices. The matrix is coarse-grained (1-10 mm) and the grains are sub-rounded.

OBP1

A conglomerate with red, rounded, and sub-angular quartz and quartzite pebbles (0.3-2 cm), found ex situ at the shelter. The quartzite pebbles have medium to coarse quartz grains. All pebbles have smooth, dull weathered surfaces. The matrix looks muddy (red-brown) and brittle. Could be a pebble lag.

OBP2

A monomictic conglomerate with sub-angular white quartz clasts (1-2.4 cm) (7%). There are black, muddy layers between clast beds which are 1 cm thick (banding/ mineralic cross-bedding). The matrix made of quartz grains (1 mm) in a white matrix (40%). Oxidation patches across the sample may be evidence of it being digenetic.

OBP3 A

A red euhedral quartz crystal (3cm).

OBP3 B

A sample of conglomerate grading into sandstone. The white quartz pebbles (0.5-1 cm) in the conglomerate pebble lag are rounded and cover 50% of pebble lag. They have an orange weathered surface and are in a sandstone matrix. This sandstone matrix is made of quartz grains (1 mm) in a white groundmass. Black oxidation patches noted throughout the sample.

OBP4 B

A rounded quartz pebble (4.5 cm) with an orange cortex and a grey fresh surface. It is smooth to touch and has a dull lustre.

OBP4 D

A milky white quartz vein (3.4 cm).

OBP5 C

A white quartz sample with orange weathering on its rounded cortex. It is smooth and has a dull lustre.

OBP5 F

A milky white quartz pebble sample with an orange weathered surface. The texture is smooth and the lustre is dull.

OBP6 C

A white quartz pebble (4 cm) with a smooth texture and a dull lustre. The weathered cortex is orange.

OBP6 D

A white quartz pebble (4 cm) with a smooth texture and a dull lustre. Its weathered surface is orange.

OBP6 E

A dull, red, quartz pebble (3.5 cm) with a smooth, orange cortex.

OBP9 A

A white, translucent quartz sample found at the top of a hill on the Zandrivier farm. It has a smooth texture and a dull lustre. The weathered surface is orange.

OBP9 B

A white, translucent quartz sample with an orange weathered surface. The sample is smooth and has a dull lustre.

OBP10 C

A smooth, rounded, red quartz pebble with a dull lustre.

OBP10 E

A pink-white quartz sample that is smooth to touch and has a dull lustre.

OBP10 F

A white quartz sample with a smooth, orange cortex that has a dull lustre.



Figure A10: Quartz lithics from OBP.

Chert (Figure A11)

No. 412

A cream white chert with calcite coating on one side. Elongate striations are noted across the sample.



Figure A11: A chert lithic (No. 412) from OBP.

7.1.2 Mwulu's Cave lithic and geological samples

Table A2: All lithic and geological samples from Mwulu's Cave, as well as their descriptions and rock types. The lithics were collected by either P. Tobias (1947) or P. de la Peña (2017).

Mwulu's Cave samples collected by P. Tobias (1947)				
Bed	**Layer**	**Sample No.**	**Description**	**Rock type**
1	Dec 25-36	M1-E	Unretouched Flake	Altered
1	Dec 25-36	M1-G	Unretouched Flake	Altered
2	Dec 25-36	M2-B	Unretouched Flake	Altered
2	Dec 25-36	M2-C	Unretouched Flake	Altered
1	Dec 25-36	M1-K	Unretouched Flake	Chert
1	Dec 25-36	M1-F	Flake	Quartz
1	Dec 25-36	M1-B	Flake	Black Quartzite
1	Dec 25-36	M1-H	Flake	Black Quartzite
1	Dec 25-36	M1-J	Unretouched Flake	Black Quartzite
1	Dec 25-36	M1-L	Flake	Black Quartzite
1	Dec 35-36	M1-M	Flake	Black Quartzite
3	Spit 0-8	M3-C	Unretouched Flake	Red Quartzite
1	Dec 25-36	M1-A	Flake	White Quartzite
1	Dec 25-36	M1-C	Flake	White Quartzite
1	Dec 25-36	M1-I	Flake	White Quartzite
2	Dec 25-36	M2-A	Flake	White Quartzite
2	Dec 25-36	M2-D	Unretouched Flake	White Quartzite
3	Spit 0-8	M3-A	Unretouched Flake	White Quartzite
1	Dec 25-36	M1-D	Flake	Shale
3	Spit 0-8	M3-B	Unretouched Flake	Shale

3	Spit 8-12	M3-D	Unretouched Flake	Shale
3	Spit 0-12	M3-E	Unretouched Flake	Shale
3	Spit 0-12	M3-F	Unretouched Flake	Shale
Mwulu's Cave samples collected by P. de la Peña (2017)				
Layer	**Plan**	**Sample No.**	**Description**	**Rock type**
5	Spit 4	PA-11	Unretouched Flake	Altered
1	5	PALO49	Unretouched Flake	Chert
2	1	674	Unretouched Flake	Chert
1	5	195	Unretouched Flake	Quartz
3	14	PA-2	Unretouched Flake	Quartz
4	13	1839	Unretouched Flake	Quartz
4	13	2132	Unretouched Flake	Quartz
4	13	1835	Unretouched Flake	Quartz
5	4	2073	Unretouched Flake	Quartz
5	Spit 4	PA-5	Unretouched Flake	Quartz
5	Spit 4	PA-8	Unretouched Flake	Quartz
5	Spit 4	PA-10	Unretouched Flake	Quartz
1	5	187	Unretouched Flake	Black Quartzite
1	15	473	Unretouched Flake	Black Quartzite
2	12	799	Unretouched Flake	Black Quartzite
2	12	792	Unretouched Flake	Black Quartzite
2	12	794	Unretouched Flake	Black Quartzite
2	1	684	Unretouched Flake	Black Quartzite
2	1	672	Unretouched Flake	Black Quartzite
2	16	837	Unretouched Flake	Black Quartzite
2	16	836	Unretouched Flake	Black Quartzite
3	2	PA-1	Unretouched Flake	Black Quartzite
4	13	2130	Unretouched Flake	Black Quartzite
4	13	2133	Unretouched Flake	Black Quartzite
1	5	194	Unretouched Flake	White Quartzite
1	5	203	Unretouched Flake	White Quartzite
1	24	640	Unretouched Flake	White Quartzite
2	1	673	Unretouched Flake	White Quartzite
2	1	676	Unretouched Flake	White Quartzite
2	1	677	Unretouched Flake	White Quartzite
3	6	1024	Unretouched Flake	White Quartzite
3	6	1021	Unretouched Flake	White Quartzite
3	22	1410	Unretouched Flake	White Quartzite
4	4	1679	Unretouched Flake	White Quartzite
4	5	1699	Unretouched Flake	White Quartzite
4	13	2118	Unretouched Flake	White Quartzite
4	13	2134	Unretouched Flake	White Quartzite

4	13	2135	Unretouched Flake	White Quartzite
4	13	1818	Unretouched Flake	White Quartzite
5	3	2024	Unretouched Flake	White Quartzite
5	3	2038	Unretouched Flake	White Quartzite
5	3	2080	Unretouched Flake	White Quartzite
5	3	2034	Unretouched Flake	White Quartzite
5	4	2070	Unretouched Flake	White Quartzite
5	Spit 4	PA-4	Unretouched Flake	White Quartzite
5	Spit 4	PA-6	Unretouched Flake	White Quartzite
5	Spit 4	PA-7	Unretouched Flake	White Quartzite
5	Spit 4	PA-9	Unretouched Flake	White Quartzite
5	Spit 4	PA-14	Unretouched Flake	White Quartzite
5	Spit 4	PA-15	Unretouched Flake	White Quartzite
5	Spit 4	PA-16	Unretouched Flake	White Quartzite
4	13	1815	Unretouched Flake	White Quartzite
4	13	1826	Unretouched Flake	White Quartzite
3	14	1240	Unretouched Flake	Shale
5	3	2026	Unretouched Flake	Shale
5	Spit 4	PA-3	Unretouched Flake	Shale
5	Spit 4	PA-12	Unretouched Flake	Shale/Mudstone
5	Spit 4	PA-13	Unretouched Flake	Shale/Mudstone

Outcrop samples collected in Mokopane around Mwulu's Cave

Sample	Rock type
Outcrop 3B	Chert
Outcrop 4C	Chert
Outcrop 16C	Chert
Outcrop 11	Chert Conglomerate
Outcrop 3A	Dolomite
Outcrop 16B	Quartz
Outcrop 16F	Quartz
Outcrop 19A	Quartz
Outcrop 20	Quartz
Outcrop 21B	Quartz
Outcrop 8A	Black Quartzite
Outcrop 16D	Black Quartzite
Outcrop 18A	Black Quartzite
Outcrop G2A	Black Quartzite
Outcrop 13	White Quartzite
Outcrop 16A	White Quartzite
Outcrop 16E	White Quartzite
Outcrop 17	White Quartzite
Outcrop 19B	White Quartzite

Outcrop 21A	White Quartzite
Outcrop G1	White Quartzite
Outcrop G2B	White Quartzite
Outcrop G4	White Quartzite
Outcrop 2A	Shale
Outcrop 2B	Shale
Outcrop 3C	Shale
Outcrop 4A	Shale
Outcrop 4B	Shale
Outcrop 6	Shale
Outcrop 8B	Shale
Outcrop 9	Shale
Outcrop 12	Shale
Outcrop 14A	Shale
Outcrop 14B	Shale
Outcrop 18B	Shale
Outcrop G3	Shale
Outcrop 2C	Shale Conglomerate
Outcrop 1	Shale/Metasedimentary
Outcrop 10	Shale/Metasedimentary

White quartzite (Figure A12)

M1-I

A milky white quartzite with pink and yellow staining along grain boundaries. The weathered surface is brown and the texture of the sample is granular. The fine to medium sized grains (0.1-0.5 mm) are sub-angular and the smaller grains are white whereas the larger ones are more transparent and glassy. Grains are interlocking and no matrix is noted.

M2-D

A white quartzite with a granular texture and a shiny lustre. The weathered surface is an orange-stained white. It has sub-angular, medium (0.3-0.5 mm) quartz grains that are generally white but grey grains are also noted. These grains are interlocking and well-sorted in most parts of the sample. A white matrix is noted (10-15%).

No. 194

A clast-supported, white quartzite with a rough texture and a dull lustre. It has rounded to sub-rounded grains that are medium sized (0.2 mm). No matrix is noted.

No. 203

A coarse-grained (1-2 mm) milky white quartzite with a dull white weathered surface that is rough to touch. It has angular quartz crystals in a white matrix (15%).

No. 640

A coarse-grained (1-2 mm), clast-supported, white quartzite with a rough texture and a brownish-white, dull weathered surface. The quartz crystals are rounded to sub-rounded and the matrix is not clearly seen under the binocular microscope.

No. 676

A white quartzite with a rough texture and a dull lustre. The white (and a few grey) quartz grains are rounded to sub-rounded in a white matrix (5%).

No. 677

A coarse-grained (1-2 mm) pure white quartzite with a smooth texture and a glassy lustre. The sub-angular, glassy quartz crystals are annealed and no matrix is noted.

No. 1024

A pure white quartzite with a smooth texture and a glassy lustre. The quartz grained are medium sized (0.4 mm) and annealed. No matrix or pore spaces are noted.

No. 1021

A sample very similar to No. 1024. A pure white quartzite with medium to coarse (0.5-1.5 mm) quartz grains that are annealing. No matrix is noted.

No. 1410

A grey-white quartzite with a rough texture and a glassy lustre. The weathered surface is red. It has medium to coarse (0.5-2 mm) quartz grains that are sub-rounded and annealed. No matrix is noted.

No. 1699

A very fine-grained, crystalline, and white sample that is difficult to identify due to the heavy calcite coating. It does however have a smooth texture and a dull lustre (from small area under the coating).

No. 1815

A coarse-grained (1-2 mm) grey-white quartzite with a rough texture and a dull lustre. It has angular to sub-rounded quartz grains that are interlocking. No matrix is noted.

No. 1818

A white quartzite sample with a smooth texture and a glassy lustre. The grains are tightly interlocked and no matrix is noted. It is covered in calcite precipitate.

No. 2024

A coarse-grained (1-1.5 mm), white quartzite that is heavily covered with calcite precipitate, giving it a rough texture. From areas without the precipitate, rounded to sub-rounded grains are noted in about 10-15% matrix.

No. 2038

A grey-white quartzite sample with a rough texture and a glassy lustre. The quartz grains in this samples are medium to coarse-grained (0.4-1 mm). They are annealed, and no matrix is noted. Pore spaces are evident in 40% of the sample.

No. 2034

A coarse-grained (1-2 mm) greyish white quartzite that has a rough texture and a dull lustre. It is covered in precipitate quite heavily. The quartz grains are sub-angular and interlocking, and no matrix is noted.

PA-4

A highly weathered, grey-white sample with a rough texture and a dull lustre. Of the grains that can be seen, many seem to be fine to medium-grained (~0.2 mm).

PA-14

A grey-white quartzite with a rough texture and a dull lustre. The quartz grains are coarse (0.5-3 mm). They are also sub-angular and interlocking. No matrix is noted.

Outcrop 13

A white, coarse-grained (1-3 mm) quartzite sample with an orange weathered surface. The texture of the sample is gritty and rough with a dull lustre. The quartzite is friable. The crystals in this sample are sub-rounded and it is clast-supported.

Outcrop 16A

This quartzite sample is from the central fracture right above the opening of the cave. It is grey-white in colour and is heavily weathered. The grains are coarse (1 mm) and sub-angular. No matrix is noted. It has a gritty texture and a shiny lustre.

Outcrop 16E

A brittle, coarse-grained (1 mm) quartzite outcrop sample that has a green-grey and orange weathered surface. The grains in this sample are white and no matrix is noted.

Outcrop 19B

A grey-white, coarse-grained (1-1.5 mm) quartzite with a brittle texture and a dull lustre. No matrix is noted in this sample.

Outcrop 21A

A grey, coarse-grained (1 mm) quartzite with a gritty texture and a dull lustre. The quartz grains in this sample are sub-rounded and classify the rock as clast-supported. No matrix is noted.

G1

A coarse-grained (1-3 mm), light grey-white quartzite with a rough texture and a dull lustre. The quartz grains are sub-rounded and no matrix is noted.

G4

A coarse-grained (0.5-1 mm), grey-white quartzite with a rough texture and a shiny lustre. The grains in this sample are sub-rounded. No matrix is noted.



Figure A12: White quartzite lithics from Mwulu's Cave.

Black quartzite (Figure A13)

M1-J

A black quartzite with a rough, crystalline texture and a shiny lustre. It has angular to sub-angular black and white grains that are interlocking and no matrix is noted. These grains are medium to coarse-grained (0.5-1 mm).

M1-L

A medium to coarse-grained (0.2-2 mm) black quartzite with a granular texture and dull, orange weathered surface. It has sub-rounded to sub-angular grains that are interlocking (no matrix) and well-sorted. These are generally black but white and dark grey grains are also noted, as well as milky white larger grains (5 mm). A 0.5 mm thick quartz vein with orange staining runs through the sample.

No. 187

A coarse-grained (1-2 mm) black quartzite with a rough texture and a shiny lustre. It is clast-supported and has interlocking, sub-angular quartz grains. No matrix is noted.

No. 473

A coarse-grained (1-3 mm) black quartzite with a dull brownish-white weathered surface. The quartz grains are sub-rounded to sub-angular and the matrix consists of finer grains.

No. 799

A heavily weathered (also coated in calcite) black quartzite with a smooth texture and a dull lustre. The grains are coarse (<4 mm) and angular to sub-angular in shape. No matrix is noted.

No. 792

A black quartzite with a rough texture and a shiny lustre. Its weathered surface is orange. The medium to coarse (0.5-2 mm) quartz grains are sub-rounded to sub-angular and no matrix is noted.

No. 794

A black quartzite that has a rough and dull (heavily-) weathered surface that is orange. It has medium to coarse (0.5-4 mm), black and grey, sub-rounded quartz grains. No matrix is noted.

No. 684

A coarse-grained (1-5 mm), black quartzite with a rough texture and a shiny lustre (under calcite coating). The quartz grains are sub-rounded to sub-angular and they are annealed. No matrix is noted.

No. 672

A black quartzite with a rough texture and shiny lustre. It has medium to coarse (0.5-1 mm) quartz grains that are sub-rounded to sub-angular and are interlocked with each other. No matrix is noted.

No. 837

A glassy, smooth-textured, black quartzite with interlocking, medium to coarse (0.5-4 mm), sub-angular quartz grains (black and grey). No matrix is noted

No. 836

A black quartzite with a smooth texture and a glassy lustre. It has black, grey and white (in decreasing proportion) rounded to sub-rounded quartz grains. These are medium to coarse (0.5-2 mm). No matrix is noted.

Outcrop 8A

A black, medium to coarse-grained (0.6-2 mm) sample with no visible matrix or layering. It is crystalline and covered in red sand.

Outcrop 16D

A coarse-grained (1-2 mm) quartzite that is black in colour. It is rough to touch and has a dull lustre. The grains are sub-rounded and no matrix is noted.

Outcrop 18A

A dark grey-black quartzite with coarse (0.6-1 mm), rounded quartz grains. The sample is clast-supported and rough to touch. The lustre is dull. No matrix is noted.

G2A

A black quartzite that is rough to touch and has a dull lustre. The grains are coarse (1-2 mm) and sub-angular. No matrix is noted.

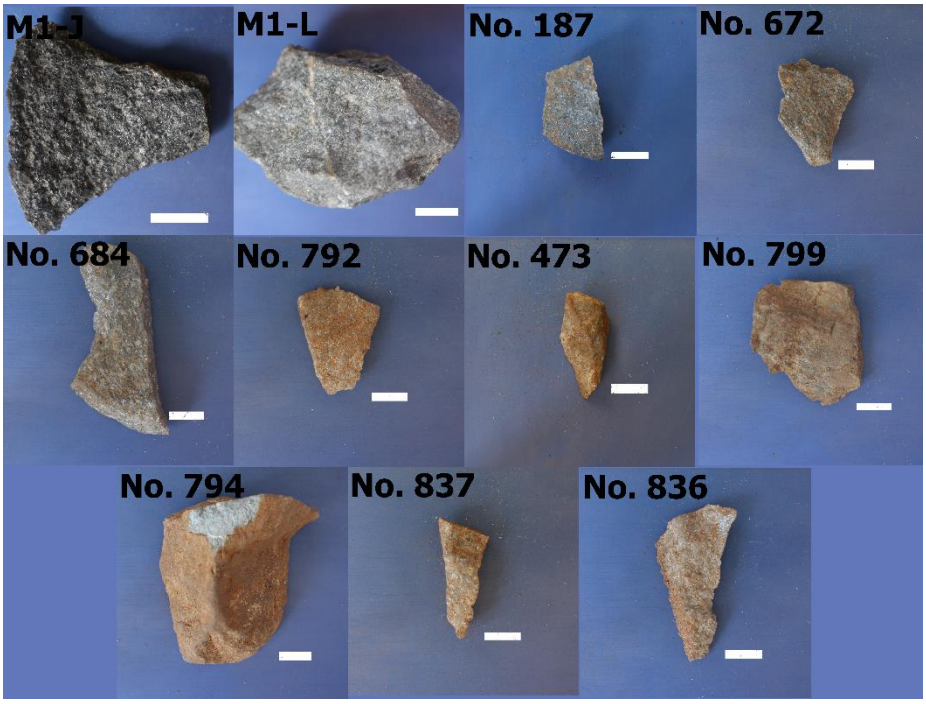

Figure A13: Black quartzite lithics from Mwulu's Cave

Quartzite with pore spaces (Figure A14)

M1-A

A white quartzite with a rough texture and a glassy lustre. It has a cream white weathered surface. The grains are medium sized (0.5 mm) and they interlock and anneal in some areas of the sample. These grains are milky white (rounded), while others are glassy (interlocking and annealing; making sample look like porridge under the binocular microscope). The sample has pore spaces (15%) the size of the grains throughout it and no matrix is noted.

M1-C

A coarse-grained (0.6-2.4 mm), white quartzite with a rough texture and a glassy lustre. Green chlorite clusters (5%), and pore spaces (5%) are noted throughout sample. The quartz grains in this sample are rounded and formed in a white matrix (30%).

M2-A

A coarse-grained (1-2.5 mm) white quartzite with a rough texture and shiny lustre. The weathered surface is orange. Generally, it has rounded quartz grains (some as large as 0.7 cm). It also has some areas with quartz grains that are annealed. The sample is covered in pores paces (30%). Orange staining is noted along grain boundaries and no matrix is evident.

M3-A

A very coarse-grained (1-3 mm) milky white quartzite with a smooth texture and glassy lustre. It has a cream white weathered surface with some orange staining. The grains in this sample are mostly milky white while some grey grains are also noted (10%). All these grains are sub-rounded to sub-angular and there is a high degree of annealing on half of the rock (other half has about 15% matrix). Pore spaces are noted throughout the sample (15%) (some pore spaces look filled by sand).

M3-C

A very fine (cannot see individual sand grain boundaries) red quartzite with a smooth texture and a shiny lustre. It has a pinkish-orange weathered surface and pore spaces cover 15-20% of the sample. No matrix is noted.

No. 1679

A medium-grained (0.2-0.3 mm), white quartzite sample with a rough texture and a glassy lustre. It has a brown weathered surface. The quartz grains are sub-rounded and interlocking. There are pore spaces throughout the sample (10%) and no matrix is noted.

No. 2118

A white quartzite with a smooth texture and glassy lustre. The quartz crystals in this sample are medium to coarse-grained (0.3-0.6 mm), and annealed. There are pore spaces the size of the grains throughout the sample. No matrix is noted.

No. 2134

A medium-grained (0.3 mm), white quartzite with a rough texture and a glassy lustre. The quartz crystals in this sample are interlocking. Pore spaces are noted (same shape and size as grains) throughout the sample (30%).

No. 2135

A grey-white quartzite with a rough texture and a dull lustre. Its weathered surface is cream white and, rough and dull. It has medium to coarse (0.3-1 mm) quartz grains that are interlocking. 20% of the sample is covered in pore spaces.

No. 1826

A coarse-grained (1-2 mm), white quartzite with a rough texture and shiny lustre. Its quartz grains are rounded and annealed. 40% of the sample is covered in pore spaces and no matrix is noted.

No. 2080

A medium-grained (0.5 mm), white quartzite sample with a rough texture and a glassy lustre. The quartz grains in this sample are sub-rounded to sub-angular, and are interlocked. 30% of the samples is characterised by pore spaces and there is a degree of foliation in the alignment of the quartz grains.

No. 2070

A pure white, coarse-grained (1-2 mm) quartzite with a rough texture and a shiny lustre. The quartz grains in this sample are sub-rounded to sub-angular and are interlocking. pore spaces are noted throughout the sample (5%).

PA-6

A coarse-grained (1-1.5 mm), grey-white quartzite with a smooth texture and a glassy lustre. It has pore spaces covering about 20% of its surface. The quartzite grains are sub-rounded and interlocking. No matrix is noted.

PA-7

A grey-white, coarse-grained (1-1.5 mm) quartzite sample with a rough texture and a dull lustre. The quartz grains are sub-rounded and interlocking. There are pore spaces smaller than the grains (0.5 mm) throughout the sample (10%). No matrix is noted.

PA-9

A white quartzite with a smooth texture and a glassy lustre. Pore spaces are noted throughout the sample (5%). The quartzite grains are strongly annealed and no matrix is noted.

PA-15

A medium-grained (0.5 mm), grey-white quartzite with a rough texture and dull lustre. Pore spaces are noted throughout the sample (5%). The quartz grains are sub-angular and interlocking.

PA-16

A pure white quartzite with a rough texture and glassy lustre. The quartz grains are sub-rounded and interlocking, and pore spaces are noted throughout the sample (7%). No matrix is noted.

M1-B

A coarse-grained (1-4 mm), black quartzite with a smooth texture and a glassy lustre. It has sub-angular grains that are annealed and pore spaces are noted throughout the sample (5%). No matrix is noted.

M1-H

A coarse-grained (0.5-1 mm), black quartzite with a smooth texture and a glassy lustre. Some grains are glassy (quartz) while others are clayey (5%). The quartz crystals are annealed, and no matrix is noted. Pore spaces are seen throughout the sample (5%).

M1-M

A coarse-grained (0.5-2.5 mm) black quartzite with a smooth texture and a glassy lustre. The weathered surface of this sample is dull and has red staining. The quartz grains are mostly annealed, while some are just interlocking. A clayey grain is noted in 20% of the sample whereas pore spaces cover 5% of it. No matrix is noted.

PA-1

A black quartzite with a rough texture and a glassy lustre. The sample has pore spaces throughout it (10%) and no matrix is noted. It is medium to coarse-grained (0.5-1.5 mm) and made of interlocking, sub-angular quartz grains.

No. 2130

A black quartzite with a rough texture and glassy lustre. There is some calcite coating on the sample. Its quartz crystals are coarse-grained (0.5-2 mm), angular and interlocking (no matrix). Pore spaces of the same size as the grains are noted throughout the sample (10%). Rounded, white grains (same size as quartz grains) whose surfaces are easily scratched off are also noted throughout the sample (2%).

No. 2133

A coarse-grained (1 mm) black quartzite with a smooth texture and a shiny lustre. Pore spaces are noted throughout the sample (5-10%) and the quartz grains (black and grey) are annealed. No matrix is noted.



Figure A14: Quartzite lithics with pore spaces from Mwulu's Cave.

Quartzite with plane beds (Figure A15)

No. 673

A plane bedded quartzite with a rough texture and a shiny lustre. The white beds are around 2 mm thick and the grey beds 0.8mm thick. The quartz grains are medium sized (0.5 mm) and have a sub-rounded shape. Grains are interlocking and no matrix is noted.

Outcrop 17

A medium to coarse-grained (0.5-2 mm) quartzite with white and dark grey banding. The grains are sub-rounded and interlocking. No matrix is noted. The sample is rough (almost gritty) and has a shiny lustre.

Outcrop G2B

A white and grey banded quartzite with a rough texture and a dull lustre. The quartz grains are coarse (1-4 mm), and sub-rounded to sub-angular. No matrix is noted.

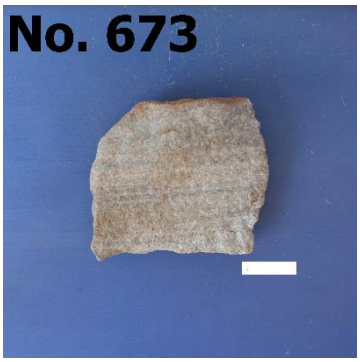

Figure A15: A plane bedded quartzite lithic (No. 673) from Mwulu's Cave.

Shale (Figure A16)

M1-D

A very fine-grained (can’t see individual grains), dark grey shale with a smooth texture and a dull lustre.

M3-B

A very fine-grained (<0.2 mm) grey shale with a dull weathered surface and a rough, crystalline fresh surface (shiny lustre). Grains can only be identified by reflective surfaces under the binocular microscope but their boundaries cannot be seen. Most of these grains are black but a few white ones are noted.

M3-D

A very fine-grained (cannot see individual grains), dark grey shale with a smooth texture and a dull lustre.

M3-E

A very fine-grained (cannot see individual grains), black shale with a smooth texture and a dull lustre. It has pore spaces (0.6 mm) dispersed across the sample (10%).

M3-F

A very fine-grained (cannot see individual grains), dark brown to black sample with a smooth texture and dull lustre. Its fresh surface seems red and crystalline and its weathered surface seems brown with black staining under the binocular microscope.

No. 1240

A very fine-grained (cannot see individual grains), black shale with a smooth texture and a dull lustre. The weathered surface is dark brown.

No. 2026

A very fine-grained (cannot see individual grains), dark grey shale with a smooth texture and a dull lustre.

PA-3

A very fine-grained (cannot see individual grains) grey-black shale with a smooth texture and a dull lustre.

PA-12

A very fine-grained (cannot see individual grains) black shale sample with a smooth texture and a dull lustre.

PA-13

A fine-grained, red-brown shale that is smooth to touch and has a dull lustre. A lighter red band is noted below quartz fluid inclusions.

Outcrop 1

A meta-sedimentary rock with a dull, red-brown weathered surface. This sample is layered with a black fluid crystallisation found through and along the meta-sedimentary bed. The black layers are 0.7-1 cm thick and have a smooth, shiny lustre, and no crystals. The meta-sedimentary layers are medium-grained (<0.5 mm).

Outcrop 2A

A green-grey, very fine-grained shale with a smooth texture and a dull lustre.

Outcrop 2B

A very fine-grained, dark grey shale with a smooth texture and a dull lustre.

Outcrop 2C

A medium to coarse-grained (0.3-1.5 cm) breccia with shale and dolomite sub-angular clasts in a red muddy matrix. The clasts are randomly orientated

Outcrop 3C

A dark grey shale that has a very fine-grained, smooth texture and a dull lustre. It is layered within Malmani dolomites that have stromatolites on them.

Outcrop 4A

A very fine-grained, black shale that is smooth to touch and has a dull lustre. No visible layers are noted.

Outcrop 4B

A very fine-grained, dark grey shale with no noted bedding. It has a smooth texture and a dull lustre.

Outcrop 6

A dark grey shale from the Cave of Hearths. It has very fine grains, smooth and has a dull lustre.

Outcrop 8B

A very fine-grained, green-grey sample that looks red on the inside. No bedding is noted. It is smooth to touch and has a dull lustre.

Outcrop 9

A very fine-grained, green-grey shale. It has no bedding, and it has a smooth texture and dull lustre.

Outcrop 10

A very fine-grained, purple-red meta-sedimentary sample with some grey patches throughout the sample. The sample is smooth to touch and has a dull texture.

Outcrop 12

A very fine-grained, grey shale with an orange to red weathered surface. There is fine bedding on the edges of the sample and mica (light gold) is noted along these bedding planes.

Outcrop 14A

A sample that looks like metamorphosed shale. It is black in some areas and light green-grey in others. This meta-sedimentary sample has very fine grains (not visible with the naked eye) and thin bedding is noted on the edge of the sample.

Outcrop 14B

A light grey, very fine-grained shale with a smooth texture and a dull lustre.

Outcrop 18B

A light green-grey shale with a very fine-grained texture. It has a smooth, orange and grey weathered surface, and a dull lustre. No bedding is noted.

G3

A very fine-grained, grey (4 mm) and red-grey (6 mm) banded shale with shiny mica along the bedding planes. It is smooth to touch and has a dull lustre.

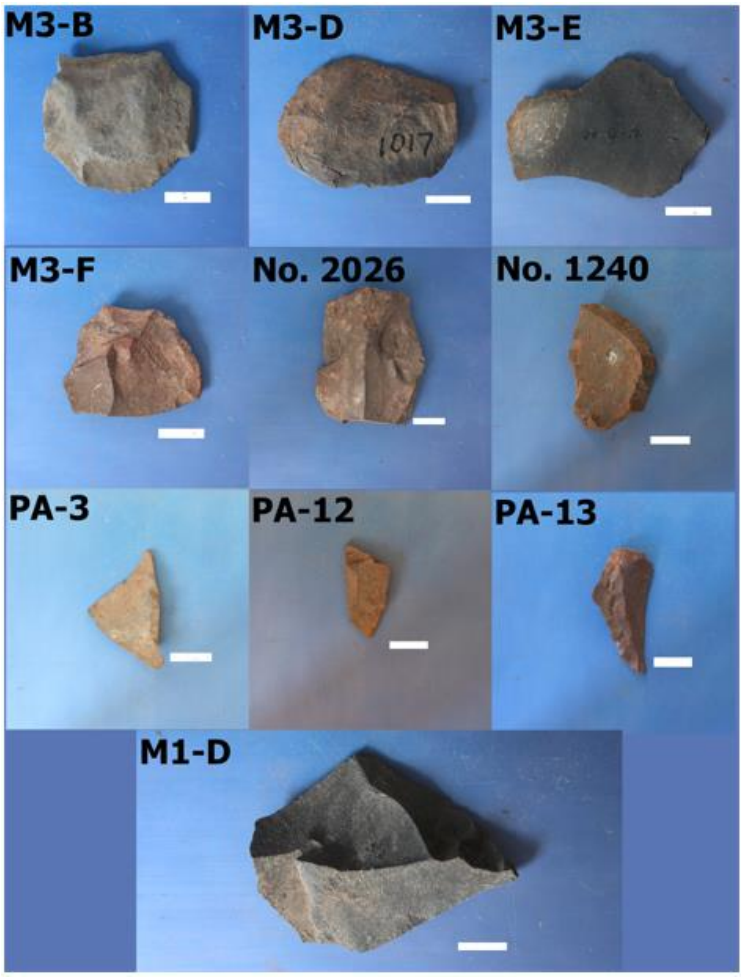

Figure A16: Shale lithics from Mwulu's Cave.

White Quartz (Figure A17)

M1-F

A white quartz sample with a smooth texture and glassy lustre. There is orange staining in the cracks of the sample.

No. 195

A white quartz crystal with a smooth texture and a glassy lustre.

PA-2

A white quartz sample with a smooth texture and a dull lustre.

No. 1839

A white quartz sample with a smooth texture and a glassy lustre. It is covered in calcite precipitate in most areas.

No. 2132

A white quartz sample that is smooth to touch and has a glassy lustre. Orange staining is noted along cracks.

No. 1835

A milky quartz sample with a smooth texture and a glassy lustre. Cracking is noted along the length of the sample.

PA-5

A white quartz sample with orange staining. The texture is rough and it has a dull lustre.

PA-8

A milky white quartz sample with a smooth texture and a dull lustre. Pits and cracks are noted throughout the sample.

Outcrop 16B

A light grey-white silica vein sample from the wall of the cave. It has a smooth texture and a glassy lustre.

Outcrop 19A

A white quartz vein with a smooth texture and dull lustre.

Outcrop 20

A white and red quartz vein with a smooth texture and a glassy lustre.

Outcrop 21B

A dull, white, quartz vein with a dull lustre and a smooth texture.

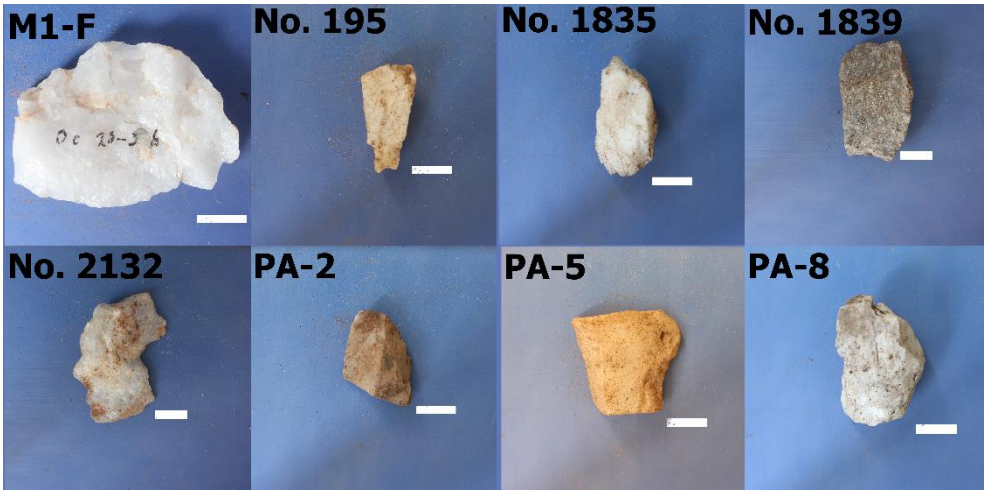

Figure A17: White quartz lithics from Mwulu's Cave.

Translucent Quartz (Figure A18)

No. 2073

A translucent, white quartz sample with a smooth texture and a dull lustre.

PA-10

White translucent quartz sample with a smooth texture and a glassy lustre.

Outcrop 16F

A clear quartz sample with orange staining.

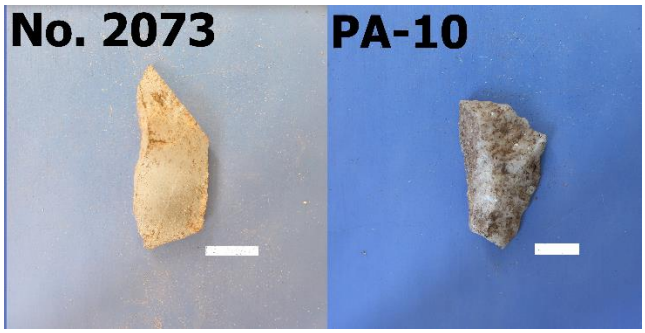

Figure 5.18: Translucent/clear quartz lithics from Mwulu's Cave.

Chert (Figure A19)

M1-K

A very fine-grained (cannot see individual grains) and banded chert that is smooth to touch and has a dull, powdery lustre. Half of it is dark grey and the other half is light grey.

PALO49

A grey chert with a rough texture and a dull lustre. It is heavily coated with calcite.

No. 674

A very fine-grained (no visible grains) chert with a smooth texture and a dull lustre. It has dark grey (4 mm thick) and light grey (8 mm thick) banding.

Outcrop 3B

A dark grey, chert sample with a smooth texture and a dull lustre.

Outcrop 4C

A very fine-grained, grey chert with what looks like ooids in single layer. This sample is smooth to touch and has a dull lustre.

Outcrop 11

A conglomerate with sub-rounded and angular, grey chert clasts (0.5-2.3 cm) in a sandy matrix composed of sandstone. The sample has a red weathered surface and is rough to touch. Its lustre is dull.

Outcrop 16C

A milky, grey-white chert with a smooth, fine silt grained texture, and a dull lustre. This sample was also collected from the wall of the cave.



Figure A19: Chert lithics from Mwulu's Cave.

Altered samples (Figure A20)

M1-E

A red-brown, altered rock/pyroclastic pumice that is rough to touch, has a dull lustre, and feels very light weight. It is very porous with a few pore spaces (~15) noted on its surface (1 mm). Some brown staining is noted throughout the sample.

M1-G

A yellow, altered rock/pyroclastic pumice that is gritty and brittle to touch and has a dull lustre. It is also light weight although no pore spaces are noted on its surface. A brown coating is noted with black spotting (<1 mm) across the surface.

M2-B

A sample very similar to M1-E. It is red-brown, fine-grained, porous, and light weight altered rock/pumice with a few elongate pore spaces throughout it. It is gritty to touch and has a dull lustre.

M2-C

A brittle, light green-grey altered rock that scratches easily. It has a smooth, fine-grained texture and a dull lustre. This sample is also light weight, although a little heavier that the other mentioned altered samples.

PA-11

A very weathered and light weight sample that may be an altered meta-sedimentary rock. It has an orange-brown, rough, and dull weathered surface.



Figure A20: Altered lithics from Mwulu's Cave.

APPENDIX B

8.2 Portable X-ray Fluorescence Results Spreadsheets

Table B1: PXRF spreadsheet of Olieboomspoort Rock Shelter (OBP) lithic and outcrop samples. Concentrations of major elements Mg, Al, Si, P, S, K, Ca, Ti, and Fe are measured in weight percentage while the rest of the elements' concentrations are measured in ppm.

Analysis ID	Sample ID	Rock type	Location	Geo/Arcl piece?	Latitude (˚)	Longitude (˚)	Mg	Al	Si	P	S	K	Ca	Ti
OBP-110-1	no.110	shale	OBP	Arcl			ND	2,0348	10,9595	0,1029	0,1253	0,2008	16,6255	1,1552
OBP-110-2	no.110	shale	OBP	Arcl			9048	5,2628	21,567	0,2402	0,2259	0,4023	8,0005	1,1787
OBP-110-3	no.110	shale	OBP	Arcl			7425	5,8245	23,3618	0,2732	0,2588	0,4291	7,7016	1,2044
OBP-120-1	no.120	white quartzite	OBP	Arcl			ND	2,175	38,8575	0,1193	0,0421	0,0771	3,2501	0,0536
OBP-120-2	no.120	white quartzite	OBP	Arcl			ND	3,1382	41,2976	0,1527	0,0513	0,177	2,4041	0,072
OBP-120-3	no.120	white quartzite	OBP	Arcl			ND	3,122	41,2757	0,1539	0,051	0,1808	2,522	0,0786
OBP-143-1	no.143	white quartzite	OBP	Arcl			ND	3,3893	41,735	0,0338	ND	0,2981	ND	0,0726
OBP-143-2	no.143	white quartzite	OBP	Arcl			ND	3,371	41,8737	0,0211	ND	0,2837	ND	0,0687
OBP-143-3	no.143	white quartzite	OBP	Arcl			ND	3,3545	41,8887	0,0242	ND	0,2842	ND	0,077

OBP-137-1	no.137	shale	OBP	Arcl	ND	5,328	19,4407	0,3068	0,0642	1,1218	6,9622	0,4188
OBP-137-2	no.137	shale	OBP	Arcl	ND	5,3274	19,0054	0,3028	0,0646	1,101	7,1041	0,4166
OBP-137-3	no.137	shale	OBP	Arcl	ND	5,193	18,3653	0,2916	0,0748	1,0858	7,6743	0,4363
OBP-164-1	no.164	shale	OBP	Arcl	ND	6,4305	27,9791	0,1202	0,0426	3,9302	2,6862	0,3028
OBP-164-2	no.164	shale	OBP	Arcl	ND	6,5856	28,3807	0,1129	0,0405	3,9826	2,2077	0,3182
OBP-164-3	no.164	shale	OBP	Arcl	ND	6,7606	29,0961	0,1086	0,0392	4,0591	1,608	0,3072
OBP-1968-1	no.1968	shale/metased	OBP	Arcl	ND	6,2566	29,6898	0,0675	0,0465	2,2636	1,8648	0,2861
OBP-1968-2	no.1968	shale/metased	OBP	Arcl	ND	5,4165	23,352	0,1194	0,049	1,7421	6,194	0,2637
OBP-1968-3	no.1968	shale/metased	OBP	Arcl	ND	5,3786	22,9654	0,1219	0,0444	1,74	6,4669	0,244
OBP-420-1	no.420	shale	OBP	Arcl	ND	0,8372	3,8977	0,5753	0,0242	0,5701	21,3409	0,1128
OBP-420-2	no.420	shale	OBP	Arcl	ND	0,8327	3,9009	0,5776	0,0259	0,5682	21,3457	0,1069
OBP-420-3	no.420	shale	OBP	Arcl	ND	0,7963	3,9171	0,5872	0,025	0,5777	21,3929	0,0933
OBP-408-1	no.408	dolerite	OBP	Arcl	5439	4,9172	11,8514	1,2625	0,1	0,4112	12,7572	1,1095
OBP-408-2	no.408	dolerite	OBP	Arcl	ND	4,9622	11,9904	1,1922	0,1167	0,4374	14,8765	1,0241
OBP-408-3	no.408	dolerite	OBP	Arcl	ND	4,5737	11,102	1,0107	0,127	0,409	15,3282	0,975

OBP-412-1	no.412	chert	OBP	Arcl	ND	6,889	32,6534	0,4256	0,0152	4,9016	0,4165	0,3469
OBP-412-2	no.412	chert	OBP	Arcl	ND	6,8985	32,6584	0,4299	0,0131	4,9092	0,4222	0,3355
OBP-412-3	no.412	chert	OBP	Arcl	ND	7,0763	33,2164	0,4417	0,0133	4,9843	0,4053	0,3362
OBP-494-1	no.494	white quartzite	OBP	Arcl	ND	3,2225	36,5251	0,6903	0,0145	0,1387	2,7119	0,1057
OBP-494-2	no.494	white quartzite	OBP	Arcl	ND	3,3088	36,1707	0,7348	0,0168	0,149	3,0114	0,1013
OBP-494-3	no.494	white quartzite	OBP	Arcl	ND	3,3417	35,7585	0,7324	0,0177	0,1508	3,0726	0,1139
OBP-458-1	no.458	dolerite	OBP	Arcl	5247	8,2178	25,5113	0,2131	0,0104	1,5196	2,9302	0,7476
OBP-458-2	no.458	dolerite	OBP	Arcl	4334	8,1191	25,3849	0,2096	0,015	1,5153	2,9263	0,7248
OBP-458-3	no.458	dolerite	OBP	Arcl	4518	8,1783	25,4123	0,2057	0,0171	1,5142	2,9372	0,7655
OBP-488-1	no.488	white quartzite	OBP	Arcl	ND	7,6254	23,3774	0,7628	0,0313	0,6984	3,0538	0,2845
OBP-488-2	no.488	white quartzite	OBP	Arcl	ND	7,9268	22,1522	0,6745	0,0387	0,7642	3,2208	0,3797
OBP-488-3	no.488	white quartzite	OBP	Arcl	ND	7,9577	22,0338	0,6818	0,0396	0,7409	3,1664	0,3641
OBP-488-4	no.488	white quartzite	OBP	Arcl	ND	8,1772	22,4192	0,7007	0,0398	0,7458	3,2028	0,3687
OBP-486-1	no.486	white quartzite	OBP	Arcl	ND	5,5532	38,8573	0,616	0,0045	0,4107	0,3486	0,0998
OBP-486-2	no.486	white quartzite	OBP	Arcl	ND	5,2675	37,8197	0,5873	0,0062	0,3888	0,3569	0,092

OBP-486-3	no.486	white quartzite	OBP	Arcl	ND	4,8912	35,0581	0,5677	0,0075	0,3946	0,4549	0,1152
OBP-440-1	no.440	black quartzite	OBP	Arcl	13054	7,4153	17,5035	0,141	0,0129	0,2825	10,1284	0,5923
OBP-440-2	no.440	blackquartzite	OBP	Arcl	12057	7,2385	17,2903	0,1304	0,0132	0,2754	10,1433	0,5935
OBP-440-3	no.440	black quartzite	OBP	Arcl	11743	7,0722	17,2049	0,1356	0,0136	0,278	10,4203	0,5787
OBP-1286-1	no.1286	sandstone	OBP	Arcl	ND	6,3794	27,0161	0,1938	0,0138	1,0572	1,7922	0,1456
OBP-1286-2	no.1286	sandstone	OBP	Arcl	ND	6,2628	26,6255	0,2119	0,0077	1,0394	1,6944	0,1535
OBP-1286-3	no.1286	sandstone	OBP	Arcl	ND	6,2075	26,1425	0,1941	0,0105	1,0245	1,6371	0,1471
OBP-1194-1	no.1194	sandstone	OBP	Arcl	ND	4,3688	22,5263	0,6296	0,0305	2,1608	7,9036	0,2763
OBP-1194-2	no.1194	sandstone	OBP	Arcl	ND	4,2973	22,3541	0,641	0,0309	2,1325	7,9927	0,2742
OBP-1194-3	no.1194	sandstone	OBP	Arcl	ND	4,1745	22,1214	0,6303	0,0333	2,126	7,8341	0,274
OBP-1241-1	no.1241	dolerite	OBP	Arcl	ND	3,7897	12,7468	1,0619	0,0238	0,4152	15,8223	1,1497
OBP-1241-2	no.1241	dolerite	OBP	Arcl	ND	3,7614	12,6969	1,0441	0,0246	0,4109	15,9996	1,1583
OBP-1241-3	no.1241	dolerite	OBP	Arcl	ND	3,7551	12,8077	1,0464	0,0209	0,4156	15,7576	1,1628
OBP-1195-1	no.1195	red quartzite	OBP	Arcl	5953	3,4183	11,0086	0,5785	0,1424	0,5132	23,9539	0,2946
OBP-1195-2	no.1195	red quartzite	OBP	Arcl	ND	3,4024	10,9116	0,567	0,1475	0,4923	23,422	0,319

OBP-1195-3	no.1195	red quartzite	OBP	Arcl	ND	3,398	11,046	0,5463	0,1432	0,4827	24,0788	0,3173
OBP-1795-1	no.1795	white quartzite	OBP	Arcl	4360	2,866	14,2756	0,2629	0,0554	0,5505	10,6332	0,1697
OBP-1795-2	no.1795	white quartzite	OBP	Arcl	ND	3,0599	14,8818	0,2698	0,0575	0,5544	10,6219	0,169
OBP-1795-3	no.1795	white quartzite	OBP	Arcl	3336	2,9716	14,2424	0,2367	0,0683	0,4881	11,9172	0,1612
OBP-1789-1	no.1789	shale	OBP	Arcl	ND	4,4617	37,1825	ND	0,0304	2,4385	1,5927	0,1596
OBP-1789-2	no.1789	shale	OBP	Arcl	ND	4,4947	37,4794	ND	0,0293	2,471	1,598	0,1636
OBP-1789-3	no.1789	shale	OBP	Arcl	ND	4,4521	36,843	ND	0,0276	2,4249	1,6699	0,1743
OBP-2395-1	no.2395	sandstone	OBP	Arcl	ND	3,3485	31,7417	0,2967	0,0252	0,1292	2,0393	0,0809
OBP-2395-2	no.2395	sandstone	OBP	Arcl	ND	3,2907	31,7403	0,2993	0,0224	0,1372	2,1347	0,084
OBP-2395-3	no.2395	sandstone	OBP	Arcl	ND	3,2726	31,3182	0,2986	0,0237	0,1362	2,1756	0,0642
OBP-2332-1	no.2332	whitequartzite	OBP	Arcl	ND	1,9677	28,0932	0,0723	0,0222	ND	5,7607	0,0909
OBP-2332-2	no.2332	white quartzite	OBP	Arcl	ND	1,9295	28,0255	0,0722	0,0152	ND	5,7862	0,0984
OBP-2332-3	no.2332	white quartzite	OBP	Arcl	ND	1,9542	27,9921	0,0709	0,0182	ND	5,5783	0,1069
OBP-2402-1	no.2402	sandstone	OBP	Arcl	ND	3,0371	21,2138	0,2438	0,0487	0,4451	8,2176	0,1493
OBP-2402-2	no.2402	sandstone	OBP	Arcl	ND	3,0859	21,3396	0,24	0,0522	0,4332	8,3826	0,1322

OBP-2402-3	no.2402	sandstone	OBP	Arcl	ND	3,0039	21,7196	0,2349	0,0502	0,4385	8,3483	0,1401
OBP-2374-1	no.2374	white quartzite	OBP	Arcl	ND	4,7963	21,125	0,2392	0,029	0,5159	6,8679	0,2099
OBP-2374-2	no.2374	white quartzite	OBP	Arcl	ND	4,9259	21,309	0,2318	0,0274	0,5143	6,6394	0,2183
OBP-2374-3	no.2374	white quartzite	OBP	Arcl	ND	4,8163	20,955	0,2308	0,0252	0,5036	6,4194	0,2209
OBP-YRS1A-1	YRS1-A	shale	OBP	Arcl	ND	9,549	29,6618	0,0856	0,0199	4,6902	ND	0,3172
OBP-YRS1A-2	YRS1-A	shale	OBP	Arcl	ND	9,7592	30,6587	0,0822	0,0193	4,7655	ND	0,3236
OBP-YRS1A-3	YRS1-A	shale	OBP	Arcl	ND	9,5596	30,4834	0,0756	0,0206	4,7468	ND	0,3225
OBP-YRS1B-1	YRS1-B	shale	OBP	Arcl	ND	10,9851	29,395	0,4685	0,0258	3,3183	0,4822	0,2892
OBP-YRS1B-2	YRS1-B	shale	OBP	Arcl	ND	10,7408	28,4149	0,4608	0,0255	3,1982	0,4902	0,2911
OBP-YRS1B-3	YRS1-B	shale	OBP	Arcl	ND	10,3943	27,9091	0,4626	0,0248	3,1643	0,503	0,2932
OBP-YRS1C-1	YRS1-C	red quartzite	OBP	Arcl	ND	6,186	30,7501	1,5957	0,0082	0,5853	2,203	0,1527
OBP-YRS1C-2	YRS1-C	red quartzite	OBP	Arcl	ND	6,1437	31,5936	1,5425	0,0107	0,5595	2,0609	0,1518
OBP-YRS1C-3	YRS1-C	red quartzite	OBP	Arcl	ND	6,2017	31,514	1,5275	0,0097	0,539	1,9789	0,1398
OBP-YRS1D-1	YRS1-D	shale	OBP	Arcl	ND	9,6134	25,4704	0,2077	0,0211	1,9739	0,1753	0,3428
OBP-YRS1D-2	YRS1-D	shale	OBP	Arcl	ND	9,6873	25,7394	0,2132	0,0172	1,9825	0,1762	0,3431

OBP-YRS1D-3	YRS1-D	shale	OBP	Arcl	ND	9,7629	25,6726	0,2115	0,0204	1,9717	0,1765	0,3498
OBP-3474-1	no.3474	red quartzite	OBP	Arcl	ND	3,6925	33,813	0,3552	0,0217	0,1666	2,6694	0,0695
OBP-3474-2	no.3474	red quartzite	OBP	Arcl	ND	3,7307	32,6022	0,365	0,0195	0,1792	2,6294	0,0777
OBP-3474-3	no.3474	red quartzite	OBP	Arcl	ND	3,8489	32,4671	0,3656	0,0197	0,1907	2,6623	0,0775
OBP-3478-1	no.3478	white quartzite	OBP	Arcl	ND	6,0702	26,3012	1,467	0,0348	0,4754	4,1226	0,2081
OBP-3478-2	no.3478	white quartzite	OBP	Arcl	ND	5,7104	25,6875	1,3896	0,0311	0,4372	4,2419	0,2045
OBP-3478-3	no.3478	white quartzite	OBP	Arcl	ND	5,2081	25,2687	1,3092	0,0291	0,3731	4,6548	0,1965
OBP-4684-1	no.4684	shale	OBP	Arcl	9531	7,3964	28,2424	0,5309	0,008	1,6344	3,6897	0,3383
OBP-4684-2	no.4684	shale	OBP	Arcl	11598	7,298	27,998	0,5205	0,0088	1,6383	3,6557	0,3387
OBP-4684-3	no.4684	shale	OBP	Arcl	10988	7,4139	28,0743	0,5293	0,0088	1,6212	3,6974	0,3246
OBP-4688-1	no.4688	dolerite	OBP	Arcl	ND	6,6767	32,2135	0,0816	0,0123	1,3707	ND	0,2496
OBP-4688-2	no.4688	dolerite	OBP	Arcl	ND	6,7152	32,3014	0,0819	0,0171	1,387	ND	0,2656
OBP-4688-3	no.4688	dolerite	OBP	Arcl	ND	6,8249	31,9268	0,0806	0,0194	1,3794	ND	0,2546
OBP-4688-4	no.4688	dolerite	OBP	Arcl	ND	6,9339	31,493	0,0901	0,0179	1,406	ND	0,2612
OBP-4683-1	no.4683	red quartzite	OBP	Arcl	ND	1,5455	33,7042	0,0533	ND	ND	4,0849	0,1019

OBP-4683-2	no.4683	red quartzite	OBP	Arcl	ND	1,5617	33,5794	0,0474	ND	ND	3,9746	0,1085
OBP-4683-3	no.4683	red quartzite	OBP	Arcl	ND	1,5081	33,8052	0,0517	ND	ND	3,9353	0,0916
OBP-4695-1	no.4695	red quartzite	OBP	Arcl	ND	2,4326	33,0423	0,5922	0,0187	ND	3,5192	0,0619
OBP-4695-2	no.4695	red quartzite	OBP	Arcl	ND	2,6881	33,6307	0,5699	0,023	0,0099	2,5695	0,0783
OBP-4695-3	no.4695	red quartzite	OBP	Arcl	ND	2,5981	33,5683	0,573	0,0216	ND	2,6672	0,0663
OBP-4678-1	no.4678	red quartzite	OBP	Arcl	ND	6,2697	17,4482	2,0862	0,0253	0,5258	3,9415	0,1365
OBP-4678-2	no.4678	red quartzite	OBP	Arcl	ND	4,567	28,0706	0,892	0,0058	0,2238	0,8719	0,1098
OBP-4678-3	no.4678	red quartzite	OBP	Arcl	ND	5,6035	17,0669	1,7361	0,0164	0,4591	3,1245	0,1321
OBP-4697-1	no.4697	red quartzite	OBP	Arcl	ND	2,7151	21,0435	2,6331	0,0367	0,1156	11,3151	0,1097
OBP-4697-2	no.4697	red quartzite	OBP	Arcl	ND	2,3687	18,7289	1,4662	0,0439	0,1526	10,4823	0,1051
OBP-4697-3	no.4697	red quartzite	OBP	Arcl	ND	2,858	36,1613	1,4483	0,0163	0,1187	1,841	0,1296
OBP-4672-1	no.4672	dolerite	OBP	Arcl	6948	8,3189	23,2564	1,8837	0,0225	0,7495	1,9759	1,5338
OBP-4672-2	no.4672	dolerite	OBP	Arcl	7487	8,3515	23,4557	1,8963	0,0238	0,7488	2,0084	1,5511
OBP-4672-3	no.4672	dolerite	OBP	Arcl	7256	9,4755	23,3603	2,5962	0,0242	0,7574	2,8277	1,4805
OBP-106-1	no.106	black quartzite	OBP	Arcl	ND	4,7397	22,0224	2,0103	0,0862	1,0055	6,4276	0,1317

OBP-106-2	no.106	black quartzite	OBP	Arcl	ND	4,5747	19,6556	2,4293	0,0844	0,8722	7,5792	0,1489
OBP-106-3	no.106	black quartzite	OBP	Arcl	ND	5,5056	26,6382	1,5457	0,096	1,1785	4,7105	0,142
OBP-YRS1E-1	YRS1-E	red quartzite	OBP	Arcl	ND	2,8398	45,4256	0,0192	ND	0,2642	ND	0,0805
OBP-YRS1E-2	YRS1-E	red quartzite	OBP	Arcl	ND	2,7239	45,6982	ND	ND	0,2595	ND	0,0935
OBP-YRS1E-3	YRS1-E	red quartzite	OBP	Arcl	ND	2,5893	45,8222	0,0093	ND	0,2484	ND	0,1049
OBP-YRS1E-4	YRS1-E	red quartzite	OBP	Arcl	ND	2,5141	45,7334	ND	ND	0,2311	ND	0,0976
OBP-3486-1	no.3486	sandstone	OBP	Arcl	ND	11,4677	27,3526	1,3941	0,0298	1,3418	1,5016	0,3035
OBP-3486-2	no.3486	sandstone	OBP	Arcl	ND	11,3775	27,1453	1,2933	0,0314	1,3565	1,408	0,311
OBP-3486-3	no.3486	sandstone	OBP	Arcl	ND	11,2494	26,7045	1,2553	0,0263	1,3453	1,3669	0,3173
OBP-4671-1	no.4671	red quartzite	OBP	Arcl	ND	8,913	26,3541	0,2907	0,0151	0,7867	0,1679	0,1969
OBP-4671-2	no.4671	red quartzite	OBP	Arcl	ND	8,722	26,2827	0,2933	0,0108	0,6673	0,1257	0,1904
OBP-4671-3	no.4671	red quartzite	OBP	Arcl	ND	7,8756	25,4867	0,2968	0,0082	0,6601	0,152	0,1776
OBP-4682-1	no.4682	shale	OBP	Arcl	ND	8,2777	33,9871	0,085	0,0136	4,9381	ND	0,3504
OBP-4682-2	no.4682	shale	OBP	Arcl	ND	8,0713	31,9384	0,0664	0,0135	4,5793	ND	0,3306
OBP-4682-3	no.4682	shale	OBP	Arcl	ND	8,0314	33,11	0,0737	0,0116	4,7953	ND	0,3536

OBP-4670-1	no.4670	shale	OBP	Arcl	5853	9,0503	23,2513	0,903	0,0184	5,0818	0,9804	0,6151
OBP-4670-2	no.4670	shale	OBP	Arcl	6266	9,3699	24,3875	0,9401	0,0201	5,4363	1,0373	0,6116
OBP-4670-3	no.4670	shale	OBP	Arcl	6739	9,6871	23,2916	0,7356	0,0235	4,5932	0,749	0,5822
OBP-4677-1	no.4677	shale	OBP	Arcl	ND	9,7965	28,39	0,4845	0,018	4,9156	0,4275	0,3371
OBP-4677-2	no.4677	shale	OBP	Arcl	ND	9,5832	28,1857	0,4665	0,0236	4,9376	0,438	0,3313
OBP-4677-3	no.4677	shale	OBP	Arcl	ND	3,3198	7,6821	1,3421	0,0257	0,9348	21,689	0,2086
OBP-142-1	no.142	shale	OBP	Arcl	ND	3,2795	19,5647	1,0639	0,0367	2,2247	8,8452	0,2138
OBP-142-2	no.142	shale	OBP	Arcl	ND	4,029	23,9222	0,741	0,0426	2,6887	7,4042	0,2354
OBP-142-3	no.142	shale	OBP	Arcl	ND	4,5161	25,5139	0,5522	0,0514	2,7262	6,3534	0,245
OBP-106AF-1	no.106AF	shale	OBP	Arcl	ND	4,4271	17,7942	0,8799	0,0725	0,3099	11,654	0,3017
OBP-106AF-2	no.106AF	shale	OBP	Arcl	ND	4,7535	18,8933	1,0056	0,0825	0,3616	10,4571	0,3067
OBP-106AF-3	no.106AF	shale	OBP	Arcl	ND	4,7185	18,8682	1,0135	0,0811	0,3665	10,4846	0,2996
OBP-106BB-1	no.106BB	shale	OBP	Arcl	ND	8,574	29,2528	1,1698	0,101	2,3846	2,0832	0,1839
OBP-106BB-2	no.106BB	shale	OBP	Arcl	ND	7,85	31,3101	1,0127	0,0863	2,4381	1,6083	0,1605
OBP-106BB-3	no.106BB	shale	OBP	Arcl	ND	7,8865	31,2549	1,0152	0,0834	2,4338	1,5487	0,1546

OBP-106A2-1	no.106A2	shale	OBP	Arcl	ND	12,234	29,5334	0,5584	0,082	2,5527	0,58	0,5584
OBP-106A2-2	no.106A2	shale	OBP	Arcl	ND	12,2181	29,5512	0,5619	0,08	2,5409	0,5967	0,5517
OBP-106A2-3	no.106A2	shale	OBP	Arcl	ND	12,2206	29,4577	0,5604	0,0827	2,5107	0,5959	0,5656
OBP-107-1	no.107	shale	OBP	Arcl	16518	6,0443	19,8623	0,187	0,2135	0,2565	9,3273	0,5812
OBP-107-2	no.107	shale	OBP	Arcl	15213	6,0591	19,7915	0,1911	0,2092	0,2577	9,2216	0,5794
OBP-107-3	no.107	shale	OBP	Arcl	13615	6,0492	19,7236	0,1942	0,2075	0,254	9,3102	0,5654
OBP-159-1	no.159	shale	OBP	Arcl	ND	8,5104	30,4484	0,5018	0,0217	4,4052	0,4692	0,3078
OBP-159-2	no.159	shale	OBP	Arcl	ND	7,7931	29,4443	1,1988	0,0233	4,242	1,4054	0,3129
OBP-159-3	no.159	shale	OBP	Arcl	ND	10,1109	28,096	0,6054	0,0378	3,7686	1,0086	0,3412
OBP-182-1	no.182	dolerite	OBP	Arcl	ND	6,0259	24,64	0,4488	0,0679	1,9077	5,0341	0,2455
OBP-182-2	no.182	dolerite	OBP	Arcl	ND	5,6868	23,4499	0,4342	0,0595	1,8532	4,8329	0,2219
OBP-182-3	no.182	dolerite	OBP	Arcl	ND	5,0917	21,3634	0,4212	0,0523	1,7939	4,6298	0,2048
OBP-130-1	no.130	dolerite	OBP	Arcl	20875	10,2725	27,4423	0,2071	0,0523	0,5549	0,6198	1,4523
OBP-130-2	no.130	dolerite	OBP	Arcl	20191	10,0571	26,9491	0,2032	0,0532	0,5325	0,6093	1,4682
OBP-130-3	no.130	dolerite	OBP	Arcl	22248	10,3026	26,7515	0,209	0,05	0,5668	0,6609	1,4693

OBP-122-1	no.122	shale	OBP	Arcl	6035	3,5552	15,466	0,436	0,089	1,474	11,3346	0,484
OBP-122-2	no.122	shale	OBP	Arcl	6946	3,5169	15,2289	0,4395	0,0884	1,4633	11,2901	0,4702
OBP-122-3	no.122	shale	OBP	Arcl	5092	3,4474	15,0931	0,4317	0,0885	1,4544	11,4513	0,4919
OBP-489-1	no.489	dolerite	OBP	Arcl	ND	9,8231	34,8221	0,0828	0,0442	5,3795	ND	0,3794
OBP-489-2	no.489	dolerite	OBP	Arcl	ND	9,3036	33,2642	0,0884	0,0473	5,2052	ND	0,373
OBP-489-3	no.489	dolerite	OBP	Arcl	ND	9,2423	32,4595	0,0842	0,042	5,0753	ND	0,3803
OBP-493-1	no.493	quartz	OBP	Arcl	ND	2,3634	38,631	0,8916	ND	0,0571	1,7274	0,0476
OBP-493-2	no.493	quartz	OBP	Arcl	ND	2,4392	39,87	0,917	ND	0,0568	1,7043	0,0417
OBP-493-3	no.493	quartz	OBP	Arcl	ND	2,4023	39,5703	0,8941	ND	0,0523	1,6273	0,0519
OBP-486-1	no.468	white quartzite	OBP	Arcl	ND	3,0349	37,6525	1,665	0,0331	ND	1,9452	0,0557
OBP-486-2	no.468	white quartzite	OBP	Arcl	ND	3,0755	37,0988	1,6391	0,0326	ND	1,8903	0,0517
OBP-486-3	no.468	white quartzite	OBP	Arcl	ND	3,1063	36,0877	1,5869	0,0299	ND	1,8238	0,0541
OBP-412-1	no.412	chert	OBP	Arcl	ND	6,9837	32,6587	0,2372	0,0175	4,9704	0,1391	0,3639
OBP-412-2	no.412	chert	OBP	Arcl	ND	6,9267	32,0093	0,3032	0,0122	4,9212	0,211	0,3507
OBP-412-3	no.412	chert	OBP	Arcl	ND	6,6945	31,3701	0,622	0,021	4,7465	0,61	0,3285

OBP-453-1	no.453	quartzite roof sample	OBP	Arcl	ND	3,3889	35,2	0,9782	ND	0,4218	1,411	0,0789
OBP-453-2	no.453	quartzite roof sample	OBP	Arcl	ND	3,4911	39,3449	0,9844	ND	0,3524	1,3959	0,0845
OBP-453-3	no.453	quartzite roof sample	OBP	Arcl	ND	3,7384	36,9555	0,9638	ND	0,42	1,4367	0,0868
OBP-1290-1	no.1290	quartz	OBP	Arcl	ND	2,2903	11,6128	0,4545	0,0129	0,1096	16,974	0,0982
OBP-1290-2	no.1290	quartz	OBP	Arcl	ND	2,3049	11,6368	0,4486	0,0147	0,1119	16,9458	0,1087
OBP-1290-3	no.1290	quartz	OBP	Arcl	ND	2,2979	11,4064	0,454	0,012	0,108	17,0023	0,1034
OBP-1226-1	no.1226	shale	OBP	Arcl	ND	1,2672	30,8602	0,2286	0,18	ND	6,3381	0,0641
OBP-1226-2	no.1226	shale	OBP	Arcl	ND	1,0338	25,2179	0,1862	0,157	ND	5,6244	0,0521
OBP-1226-3	no.1226	shale	OBP	Arcl	ND	1,0641	26,3812	0,192	0,1623	ND	6,0273	0,0586
OBP-1873-1	no.1873	white quartzite	OBP	Arcl	ND	3,375	9,749	0,5183	0,064	0,4865	16,0679	0,2419
OBP-1873-2	no.1873	white quartzite	OBP	Arcl	ND	3,8648	10,8927	0,6146	0,0669	0,4791	17,6922	0,2614
OBP-1873-3	no.1873	white quartzite	OBP	Arcl	ND	3,6283	10,3243	0,6951	0,0596	0,4674	17,5314	0,2785
OBP-1824-1	no.1824	black quartzite	OBP	Arcl	7326	3,0591	11,174	0,2746	0,0596	0,3155	14,0061	0,222
OBP-1824-2	no.1824	black quartzite	OBP	Arcl	8275	3,0903	11,2588	0,2715	0,0631	0,3128	14,0751	0,2215
OBP-1824-3	no.1824	black quartzite	OBP	Arcl	6642	3,094	11,2936	0,2716	0,0598	0,3162	13,8567	0,2344

OBP-2353-1	no.2353	red quartzite	OBP	Arcl	ND	0,6047	47,5064	ND	ND	ND	0,1394	0,0401
OBP-2353-2	no.2353	red quartzite	OBP	Arcl	ND	0,5696	47,9395	ND	ND	ND	0,0959	0,0333
OBP-2353-3	no.2353	red quartzite	OBP	Arcl	ND	0,6597	48,184	ND	ND	ND	0,0796	0,0282
OBP-2366-1	no.2366	sandstone	OBP	Arcl	ND	2,7561	16,6011	0,3285	0,0347	0,2038	13,611	0,1066
OBP-2366-2	no.2366	sandstone	OBP	Arcl	ND	2,8062	16,6119	0,3376	0,0315	0,2031	13,5193	0,1017
OBP-2366-3	no.2366	sandstone	OBP	Arcl	ND	2,8235	16,6651	0,3275	0,0341	0,2017	13,5308	0,1151
OBP-2364-1	no.2364	black quartzite	OBP	Arcl	ND	2,2188	14,2445	0,1863	0,0237	0,2536	13,7437	0,1006
OBP-2364-2	no.2364	black quartzite	OBP	Arcl	ND	2,2344	14,0675	0,1868	0,0247	0,2617	13,4736	0,1008
OBP-2364-3	no.2364	black quartzite	OBP	Arcl	ND	2,332	13,9282	0,1851	0,0255	0,2719	13,1697	0,106
OBP-2358-1	no.2358	black quartzite	OBP	Arcl	ND	1,3886	18,7609	0,1763	0,0335	0,0527	14,2309	0,0805
OBP-2358-2	no.2358	black quartzite	OBP	Arcl	ND	1,4966	20,0901	0,1997	0,0343	0,0499	15,7777	0,0991
OBP-2358-3	no.2358	black quartzite	OBP	Arcl	ND	1,7567	26,8665	0,138	0,0254	ND	9,5849	0,0533
OBP-2290-1	no.2290	shale	OBP	Arcl	ND	6,1344	22,0545	0,7307	0,0263	3,9904	2,4034	0,3844
OBP-2290-2	no.2290	shale	OBP	Arcl	ND	6,2131	22,222	0,708	0,0281	4,0471	2,3978	0,4114
OBP-2290-3	no.2290	shale	OBP	Arcl	ND	6,3303	22,9072	0,5462	0,0236	4,2853	2,4683	0,3999

OBP-MC1-1	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	13,7143	29,9116	0,0434	0,0444	1,2297	ND	0,1144
OBP-MC1-2	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	12,899	29,8357	0,06	0,0429	1,1437	ND	0,1288
OBP-MC1-3	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	1,2562	48,1101	ND	0,0043	ND	ND	0,0342
OBP-MC1-4	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	1,4936	45,3656	ND	0,0149	ND	ND	0,0278
OBP-MC2-1	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	5,7203	37	ND	0,0304	0,7614	ND	0,0871
OBP-MC2-2	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	8,5472	30,406	ND	0,0699	0,8532	ND	0,273
OBP-MC2-3	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	6,5239	36,4945	ND	0,0277	0,7623	ND	0,088
OBP-MC3-1	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	12,9985	23,3953	0,0246	0,0365	1,3966	ND	0,1435
OBP-MC3-2	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	8,5892	25,3822	0,0584	0,0974	0,7926	ND	0,2065
OBP-MC3-3	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	12,7095	26,7971	0,023	0,0358	1,0071	ND	0,0967
OBP-CMF1-1	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	ND	2,2926	40,9241	ND	ND	0,5932	ND	0,0706
OBP-CMF1-2	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	ND	1,4543	32,6856	ND	ND	0,5934	ND	0,0659
OBP-CMF1-3	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	ND	1,7618	35,0637	ND	ND	0,6503	ND	0,0695
OBP-CMF2-1	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	ND	2,878	35,1567	ND	ND	1,0819	ND	0,1571
OBP-CMF2-2	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	ND	2,085	38,338	ND	ND	0,4558	ND	0,1883

OBP-CMF2-3	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	ND	4,5788	35,2794	ND	0,0059	1,6124	ND	0,2994
OBP-BPC1A-1	BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	1,7662	41,5523	0,0142	0,1283	ND	ND	0,187
OBP-BPC1A-2	BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	1,7189	41,0724	0,0117	0,1248	ND	ND	0,194
OBP-BPC1A-3	BPC1A	redquartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	1,7873	41,2854	0,0124	0,1235	ND	ND	0,186
OBP-BPC1B-1	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	1,1143	43,6987	ND	ND	ND	ND	0,1066
OBP-BPC1B-2	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	1,1123	43,4075	ND	ND	ND	ND	0,1063
OBP-BPC1B-3	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	1,7406	43,997	ND	0,0474	ND	ND	0,2017
OBP-BPC1C-1	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	2,008	41,9713	ND	ND	ND	ND	0,2164
OBP-BPC1C-2	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	2,0865	42,3358	ND	ND	ND	ND	0,3364
OBP-BPC1C-3	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	2,169	44,1694	ND	ND	ND	ND	0,1789
OBP-BPC1D-1	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	2,5656	40,446	ND	0,0188	0,1487	ND	0,161
OBP-BPC1D-2	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	2,7359	38,3385	ND	0,0155	0,2112	ND	0,1658
OBP-BPC1D-3	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	1,8418	43,432	ND	ND	ND	ND	0,1247
OBP-BPC1E-1	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	2,6921	40,0525	ND	0,064	0,0182	ND	0,1586
OBP-BPC1E-2	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	3,1445	40,775	ND	0,0551	0,0524	ND	0,1879

OBP-BPC1E-3	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	2,7118	41,0025	ND	0,0568	0,0144	ND	0,1579
OBP-BPC1F-1	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	1,3767	34,8369	0,0202	0,0739	ND	ND	0,1482
OBP-BPC1F-2	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	1,4194	36,3606	0,0132	0,077	ND	ND	0,1458
OBP-BPC1F-3	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	1,4991	36,8399	0,0136	0,0806	ND	ND	0,1332
OBP-BB1-1	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	ND	2,1603	43,1612	ND	0,0566	ND	ND	0,0581
OBP-BB1-2	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	ND	2,1257	43,3783	ND	0,0529	ND	ND	0,0673
OBP-BB1-3	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	ND	2,1953	41,7484	ND	0,0415	ND	ND	0,0402
OBP-OBP1-1	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	ND	4,0774	17,1718	0,1204	0,1676	0,3285	ND	0,2342
OBP-OBP1-2	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	ND	4,0556	16,9078	0,1122	0,1731	0,3326	ND	0,2315
OBP-OBP1-3	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	ND	4,0095	11,5361	0,1337	0,1801	0,3988	0,039	0,2011
OBP-OBP2-1	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	ND	6,875	29,0609	0,018	0,1102	1,2641	ND	0,2314
OBP-OBP2-2	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	ND	6,762	28,1484	0,0188	0,1171	1,1652	ND	0,2254
OBP-OBP2-3	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	ND	6,057	24,2569	0,0187	0,0545	1,6286	ND	0,4705
OBP-OBP3A-1	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	3,2291	37,036	0,0124	0,2986	ND	ND	0,0698
OBP-OBP3A-2	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	7,4413	27,6894	0,029	0,0244	0,3415	ND	0,1871

OBP-OBP3A-3	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	1,2583	35,3907	0,0209	0,0876	ND	ND	0,091
OBP-OBP3B-1	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	6,937	27,4588	ND	0,0074	1,3907	ND	0,1403
OBP-OBP3B-2	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	8,532	34,1856	ND	0,0085	1,8717	ND	0,1456
OBP-OBP3B-3	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	5,6602	31,8104	ND	ND	1,5545	ND	0,1134
OBP-OBP3C-1	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	4,544	28,9443	0,0408	0,2542	0,0428	ND	0,0919
OBP-OBP3C-2	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	4,6613	29,1369	0,045	0,2553	0,0652	ND	0,0991
OBP-OBP3C-3	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	6,3755	33,2122	ND	ND	ND	ND	0,0422
OBP-OBP3D-1	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	11,143	17,8451	0,0529	0,0758	0,7223	0,2124	0,164
OBP-OBP3D-2	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	5001	11,2565	17,7778	0,0566	0,0798	0,7134	0,1996	0,1797
OBP-OBP3D-3	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	10614	5,9038	7,8921	0,049	0,2871	0,3505	0,1602	0,0999
OBP-OBP4A-1	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	7,3672	29,6474	0,0878	0,0362	0,4172	ND	0,2286
OBP-OBP4A-2	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	7,1963	30,2327	0,1534	0,0367	0,3296	ND	0,182
OBP-OBP4A-3	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	2,3844	36,8584	0,0877	0,0485	ND	ND	0,1279
OBP-OBP4B-1	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	1,6109	30,725	0,0598	0,0485	ND	ND	0,0539
OBP-OBP4B-2	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	4,3742	40,7879	0,1093	0,0686	0,0825	ND	0,1574

OBP-OBP4B-3	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	2,5786	43,8934	0,0184	0,1077	ND	ND	0,0676
OBP-OBP4C-1	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	2,6527	40,9547	0,0767	0,0528	ND	ND	0,1175
OBP-OBP4C-2	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	2,5143	36,6283	0,1666	0,07	ND	ND	0,0957
OBP-OBP4C-3	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	2,3199	40,7017	0,081	0,0586	ND	ND	0,1178
OBP-OBP4D-1	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	5,2099	42,8511	0,182	0,0717	0,0201	ND	0,1015
OBP-OBP4D-2	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	4,1925	41,7397	0,0207	0,0631	0,1405	ND	0,3064
OBP-OBP4D-3	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	4,1834	41,6399	0,0215	0,0644	0,1338	ND	0,3115
OBP-OBP4E-1	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	1,7972	44,5705	ND	0,0144	ND	ND	0,0465
OBP-OBP4E-2	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	1,9444	44,2106	ND	0,0238	ND	ND	0,0596
OBP-OBP4E-3	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	4,4927	21,7802	0,0761	0,1149	0,23	ND	0,126
OBP-OBP4F-1	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	4,6671	40,4415	0,0351	0,0511	ND	ND	0,184
OBP-OBP4F-2	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	4,3788	38,6147	0,0627	0,0494	ND	ND	0,1718
OBP-OBP4F-3	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	3,7632	32,1041	0,0787	0,0509	0,0171	ND	0,1887
OBP-OBP4G-1	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	22162	8,0306	23,0096	0,0753	0,0311	ND	ND	1,5066
OBP-OBP4G-2	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	11996	7,4212	24,1671	0,0777	0,069	ND	ND	1,8085

OBP-OBP4G-3	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	23579	7,6165	22,3239	0,0696	0,0261	ND	ND	1,5514
OBP-OBP5A-1	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	29632	9,3913	26,6936	0,1164	0,0337	ND	ND	1,5456
OBP-OBP5A-2	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	10,6334	20,1676	0,1414	0,1413	0,503	ND	1,5278
OBP-OBP5A-3	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	13,4435	16,4807	0,7015	0,0537	0,2135	ND	1,1295
OBP-OBP5B-1	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	4,034	40,7205	0,0515	0,0308	ND	ND	0,2789
OBP-OBP5B-2	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	9,6224	32,1954	0,0122	0,0297	0,2257	ND	0,2061
OBP-OBP5B-3	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	5,1637	36,6617	ND	0,1471	ND	ND	0,238
OBP-OBP5C-1	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	3,4407	43,5419	ND	0,039	ND	ND	0,0656
OBP-OBP5C-2	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	2,1498	36,4007	ND	0,0497	ND	ND	0,8186
OBP-OBP5C-3	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	3,2662	45,1408	ND	0,0184	ND	ND	0,0664
OBP-OBP5D-1	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	28772	12,4932	28,7059	0,1257	0,0552	ND	ND	1,6109
OBP-OBP5D-2	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	29235	10,8793	28,2617	0,1203	0,0563	ND	ND	1,7518
OBP-OBP5D-3	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	27884	8,9991	22,3829	0,1387	0,1397	ND	ND	1,5306
OBP-OBP5E-1	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	29766	8,6572	27,7946	0,1001	0,0145	ND	ND	1,5873
OBP-OBP5E-2	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	27320	8,5289	27,9407	0,1074	0,0125	ND	ND	1,6566

OBP-OBP5E-3	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	25489	8,0553	27,1292	0,0819	0,0151	ND	ND	1,5966
OBP-OBP5F-1	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	0	6,0457	27,2831	0	0,0403	0,0963	0	0,1331
OBP-OBP5F-2	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	0	3,9576	37,8824	0	0,0598	0	0	0,0579
OBP-OBP5F-3	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	0	4,5188	38,1673	0	0,064	0	0	0,0548
OBP-OBP6A-1	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	1,9475	44,2127	ND	0,0642	ND	ND	0,0711
OBP-OBP6A-2	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	2,7486	43,245	ND	0,0153	ND	ND	0,0838
OBP-OBP6A-3	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	2,7637	43,3097	ND	0,0146	ND	ND	0,0682
OBP-OBP6A-4	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	2,8629	43,4066	ND	0,0163	ND	ND	0,0836
OBP-OBP6B-1	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	5,7737	33,3822	0,0246	0,2024	0,6343	ND	0,1221
OBP-OBP6B-2	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	6,2174	31,1958	ND	0,0225	0,6094	ND	0,1277
OBP-OBP6B-3	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	6,423	26,4941	ND	0,0251	0,8222	ND	0,1463
OBP-OBP6C-1	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	1,0257	46,5723	ND	0,0525	ND	ND	0,0765
OBP-OBP6C-2	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	0,6521	23,2588	ND	0,0266	ND	ND	0,1923
OBP-OBP6C-3	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	2,13	33,5739	0,0172	0,0578	ND	ND	1,2718
OBP-OBP6D-1	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	1,9021	41,8146	ND	0,091	0,0122	ND	0,0555

OBP-OBP6D-2	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	1,9036	41,9988	ND	0,0928	0,0125	ND	0,063
OBP-OBP6D-3	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	6,7151	28,8526	0,0781	0,2984	0,6111	ND	0,1083
OBP-OBP6E-1	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	2,2619	45,0303	ND	0,0957	ND	ND	0,0381
OBP-OBP6E-2	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	2,6467	48,5915	ND	0,0981	ND	ND	0,0384
OBP-OBP6E-3	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	2,7131	48,5068	ND	0,1006	ND	ND	0,0601
OBP-OBP6F-1	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	4,0132	39,6663	ND	0,1042	1,4101	ND	0,3807
OBP-OBP6F-2	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	3,8094	39,4522	ND	0,1172	1,3598	ND	0,3741
OBP-OBP6F-3	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	3,6317	39,7705	ND	0,1324	1,2818	ND	0,2999
OBP-OBP7-1	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	5,986	36,5701	ND	0,09	2,8485	ND	0,0389
OBP-OBP7-2	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	5,9118	36,3954	ND	0,0909	2,787	ND	0,0421
OBP-OBP7-3	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	7,5486	32,4268	ND	0,0936	3,618	ND	0,0744
OBP-OBP8A-1	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	2,8099	18,6817	2,4947	2,8875	0,5673	2,0491	0,2058
OBP-OBP8A-2	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	7,2106	25,144	0,4585	0,3212	0,7874	ND	0,5496
OBP-OBP8A-3	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	3,919	37,7882	ND	0,0541	0,759	ND	0,1141
OBP-OBP8A-4	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	3,9733	37,9017	ND	0,0546	0,7659	ND	0,1155

OBP-OBP8B-1	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	7,4795	28,9157	ND	ND	0,8773	ND	0,1505
OBP-OBP8B-2	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	7,5823	29,0557	ND	ND	0,8763	ND	0,1336
OBP-OBP8B-3	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	7,5087	28,62	ND	ND	0,8696	ND	0,1241
OBP-OBP8C-1	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	6,0769	29,513	ND	0,0054	0,8879	ND	0,2246
OBP-OBP8C-2	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	5,2308	28,2912	ND	ND	0,7319	ND	0,2338
OBP-OBP8C-3	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	5,3027	34,2613	ND	ND	0,5246	ND	0,0858
OBP-OBP9A-1	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	2,1599	38,9217	ND	0,1428	ND	ND	0,038
OBP-OBP9A-2	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	1,8265	33,9397	ND	0,0895	ND	ND	0,0671
OBP-OBP9A-3	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	2,8385	33,2588	ND	0,1074	ND	ND	0,047
OBP-OBP9B-1	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	4,9603	34,2439	0,0297	0,0968	0,3975	ND	0,1492
OBP-OBP9B-2	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	4,5068	37,4834	ND	0,0772	0,2679	ND	0,1537
OBP-OBP9B-3	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	4,6282	39,6078	ND	0,0816	0,2473	ND	0,0931
OBP-OBP10A-1	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	1,8555	43,539	ND	0,059	ND	ND	0,0232
OBP-OBP10A-2	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	1,9803	45,2385	ND	0,065	ND	ND	0,0287
OBP-OBP10A-3	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	4,7046	31,6813	0,0183	0,0621	0,5457	ND	0,3346

OBP-OBP10B-1	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	ND	11,044	26,047	ND	0,087	0,948	ND	0,495
OBP-OBP10B-2	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	ND	10,084	23,804	ND	0,074	0,893	ND	0,504
OBP-OBP10B-3	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	ND	10,652	26,170	ND	0,096	0,903	ND	0,460
OBP-OBP10C-1	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	2,754	43,692	ND	0,044	ND	ND	0,043
OBP-OBP10C-2	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	2,8806	43,501	ND	0,038	ND	ND	0,046
OBP-OBP10C-3	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	4,1286	39,248	ND	0,035	0,187	ND	0,064
OBP-OBP10D-1	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	ND	4,6708	44,544	ND	0,090	0,076	ND	0,065
OBP-OBP10D-2	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	ND	2,9008	43,21	ND	0,016	0,274	ND	0,151
OBP-OBP10D-3	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	ND	5,6419	32,640	0,009	0,038	0,233	ND	1,794
OBP-OBP10E-1	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	3,0407	43,206	ND	0,079	ND	ND	0,057
OBP-OBP10E-2	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	3,0184	42,984	ND	0,077	ND	ND	0,061
OBP-OBP10E-3	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	3,4489	31,006	ND	0,053	ND	ND	3,104
OBP-OBP10F-1	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	3,7064	45,649	ND	0,038	0,039	ND	0,082
OBP-OBP10F-2	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	3,5865	43,379	ND	0,041	0,070	ND	0,083
OBP-OBP10F-3	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	3,6407	44,289	ND	0,045	0,094	ND	0,105

Analysis ID	Sample ID	Rock type	Location	Geo/Arcl piece?	Latitude (˚)	Longitude (˚)	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
OBP-110-1	no.110	shale	OBP	Arcl			328	896	1422	16,0882	ND	897	ND	280
OBP-110-2	no.110	shale	OBP	Arcl			336	913	1657	16,7949	ND	882	27	280
OBP-110-3	no.110	shale	OBP	Arcl			345	875	1688	16,9506	ND	899	ND	277
OBP-120-1	no.120	white quartzite	OBP	Arcl			37	ND	141	0,2215	ND	ND	ND	7
OBP-120-2	no.120	white quartzite	OBP	Arcl			56	36	95	0,2988	ND	ND	ND	8
OBP-120-3	no.120	white quartzite	OBP	Arcl			63	40	110	0,3127	ND	ND	6	8
OBP-143-1	no.143	white quartzite	OBP	Arcl			ND	ND	40	0,8635	ND	ND	ND	5
OBP-143-2	no.143	white quartzite	OBP	Arcl			ND	ND	61	0,8368	ND	ND	ND	ND
OBP-143-3	no.143	white quartzite	OBP	Arcl			ND	ND	42	0,8481	ND	ND	ND	5
OBP-137-1	no.137	shale	OBP	Arcl			180	43	1585	4,333	ND	22	27	125
OBP-137-2	no.137	shale	OBP	Arcl			167	48	1631	4,3539	ND	28	20	122
OBP-137-3	no.137	shale	OBP	Arcl			185	ND	1593	4,4975	ND	32	22	122
OBP-164-1	no.164	shale	OBP	Arcl			193	ND	444	2,2422	ND	26	10	15
OBP-164-2	no.164	shale	OBP	Arcl			209	ND	430	2,1817	ND	28	13	14

OBP-164-3	no.164	shale	OBP	Arcl	202	48	421	2,2568	ND	27	ND	19	
OBP-1968-1	no.1968	shale/metased	OBP	Arcl	128	164	209	4,0287	ND	21	21	27	
OBP-1968-2	no.1968	shale/metased	OBP	Arcl	112	134	265	4,0792	ND	22	20	27	
OBP-1968-3	no.1968	shale/metased	OBP	Arcl	141	136	217	4,0543	ND	22	19	31	
OBP-420-1	no.420	shale	OBP	Arcl	65	ND	408	1,5574	ND	ND	15	80	
OBP-420-2	no.420	shale	OBP	Arcl	77	ND	450	1,5608	67	15	10	79	
OBP-420-3	no.420	shale	OBP	Arcl	72	ND	430	1,575	ND	ND	14	82	
OBP-408-1	no.408	dolerite	OBP	Arcl	155	ND	706	9,8632	ND	64	27	183	
OBP-408-2	no.408	dolerite	OBP	Arcl	143	ND	682	9,2928	ND	54	34	168	
OBP-408-3	no.408	dolerite	OBP	Arcl	189	ND	654	9,1377	ND	56	23	168	
OBP-412-1	no.412	chert	OBP	Arcl	142	58	265	1,6338	ND	ND	12	18	
OBP-412-2	no.412	chert	OBP	Arcl	148	ND	259	1,6268	ND	ND	10	16	
OBP-412-3	no.412	chert	OBP	Arcl	127	60	295	1,6498	ND	15	15	17	
OBP-494-1	no.494	white quartzite	OBP	Arcl	ND	ND	70	0,6169	ND	ND	ND	7	
OBP-494-2	no.494	white quartzite	OBP	Arcl	ND	ND	62	0,6211	ND	ND	ND	6	

OBP-494-3	no.494	white quartzite	OBP	Arcl	ND	ND	58	0,6327	ND	ND	ND	6
OBP-458-1	no.458	dolerite	OBP	Arcl	114	57	760	6,9304	ND	64	105	91
OBP-458-2	no.458	dolerite	OBP	Arcl	112	85	787	6,9427	ND	49	98	94
OBP-458-3	no.458	dolerite	OBP	Arcl	110	62	773	7,0407	ND	50	93	100
OBP-488-1	no.488	white quartzite	OBP	Arcl	61	34	546	1,4543	ND	19	18	23
OBP-488-2	no.488	white quartzite	OBP	Arcl	66	58	667	1,8759	ND	22	21	31
OBP-488-3	no.488	white quartzite	OBP	Arcl	69	66	654	1,8812	ND	22	22	29
OBP-488-4	no.488	white quartzite	OBP	Arcl	73	89	687	1,8722	ND	20	25	31
OBP-486-1	no.486	white quartzite	OBP	Arcl	52	36	133	0,4989	ND	ND	7	7
OBP-486-2	no.486	white quartzite	OBP	Arcl	46	63	154	0,497	ND	ND	7	7
OBP-486-3	no.486	white quartzite	OBP	Arcl	39	45	142	0,5097	ND	ND	ND	5
OBP-440-1	no.440	black quartzite	OBP	Arcl	107	ND	844	5,6839	ND	165	85	71
OBP-440-2	no.440	blackquartzite	OBP	Arcl	92	ND	795	5,578	ND	155	88	68
OBP-440-3	no.440	black quartzite	OBP	Arcl	97	ND	871	5,5789	ND	150	97	67
OBP-1286-1	no.1286	sandstone	OBP	Arcl	ND	39	105	0,8734	ND	ND	8	10

OBP-1286-2	no.1286	sandstone	OBP	Arcl	ND	45	108	0,8767	ND	ND	9	7
OBP-1286-3	no.1286	sandstone	OBP	Arcl	30	40	95	0,8663	ND	ND	ND	10
OBP-1194-1	no.1194	sandstone	OBP	Arcl	167	77	152	1,1537	ND	24	15	56
OBP-1194-2	no.1194	sandstone	OBP	Arcl	152	66	137	1,15	ND	20	8	56
OBP-1194-3	no.1194	sandstone	OBP	Arcl	150	ND	165	1,1512	ND	20	15	50
OBP-1241-1	no.1241	dolerite	OBP	Arcl	212	ND	606	9,6389	ND	35	21	86
OBP-1241-2	no.1241	dolerite	OBP	Arcl	166	ND	592	9,6057	ND	36	17	81
OBP-1241-3	no.1241	dolerite	OBP	Arcl	180	ND	602	9,6363	ND	28	23	86
OBP-1195-1	no.1195	red quartzite	OBP	Arcl	205	560	1938	28,8556	ND	ND	ND	95
OBP-1195-2	no.1195	red quartzite	OBP	Arcl	175	559	1846	28,2739	ND	ND	ND	89
OBP-1195-3	no.1195	red quartzite	OBP	Arcl	140	498	1760	26,9391	506	ND	19	106
OBP-1795-1	no.1795	white quartzite	OBP	Arcl	48	42	461	0,8442	ND	12	18	24
OBP-1795-2	no.1795	white quartzite	OBP	Arcl	58	55	482	0,8382	ND	ND	9	26
OBP-1795-3	no.1795	white quartzite	OBP	Arcl	58	40	265	0,7891	ND	13	13	26
OBP-1789-1	no.1789	shale	OBP	Arcl	149	42	207	1,0006	ND	13	ND	16

OBP-1789-2	no.1789	shale	OBP	Arcl	153	ND	208	0,9966	ND	12	ND	17
OBP-1789-3	no.1789	shale	OBP	Arcl	162	ND	235	0,9894	ND	ND	ND	15
OBP-2395-1	no.2395	sandstone	OBP	Arcl	37	ND	129	0,2645	ND	ND	ND	8
OBP-2395-2	no.2395	sandstone	OBP	Arcl	33	ND	127	0,2781	ND	ND	11	9
OBP-2395-3	no.2395	sandstone	OBP	Arcl	27	ND	120	0,2821	ND	ND	ND	7
OBP-2332-1	no.2332	whitequartzite	OBP	Arcl	ND	ND	41	0,2283	ND	ND	9	7
OBP-2332-2	no.2332	white quartzite	OBP	Arcl	ND	ND	73	0,232	ND	ND	9	7
OBP-2332-3	no.2332	white quartzite	OBP	Arcl	ND	ND	58	0,2348	ND	ND	11	6
OBP-2402-1	no.2402	sandstone	OBP	Arcl	48	ND	702	2,1247	ND	16	10	23
OBP-2402-2	no.2402	sandstone	OBP	Arcl	54	41	734	2,204	ND	ND	14	25
OBP-2402-3	no.2402	sandstone	OBP	Arcl	67	ND	725	2,3468	ND	ND	11	24
OBP-2374-1	no.2374	white quartzite	OBP	Arcl	46	56	239	0,8668	ND	16	9	12
OBP-2374-2	no.2374	white quartzite	OBP	Arcl	32	50	272	0,8923	ND	ND	11	10
OBP-2374-3	no.2374	white quartzite	OBP	Arcl	65	40	268	0,9094	ND	ND	11	14
OBP-YRS1A-1	YRS1-A	shale	OBP	Arcl	184	ND	446	2,2345	ND	14	10	20

OBP-YRS1A-2	YRS1-A	shale	OBP	Arcl	184	ND	412	2,2689	ND	19	11	20	
OBP-YRS1A-3	YRS1-A	shale	OBP	Arcl	176	73	418	2,2626	ND	14	13	18	
OBP-YRS1B-1	YRS1-B	shale	OBP	Arcl	124	47	545	3,2441	ND	17	16	72	
OBP-YRS1B-2	YRS1-B	shale	OBP	Arcl	124	57	578	3,336	ND	23	19	78	
OBP-YRS1B-3	YRS1-B	shale	OBP	Arcl	113	63	550	3,3158	ND	21	18	76	
OBP-YRS1C-1	YRS1-C	red quartzite	OBP	Arcl	37	42	153	0,9384	ND	ND	7	12	
OBP-YRS1C-2	YRS1-C	red quartzite	OBP	Arcl	55	40	144	0,92	ND	11	11	10	
OBP-YRS1C-3	YRS1-C	red quartzite	OBP	Arcl	39	40	119	0,875	ND	ND	6	10	
OBP-YRS1D-1	YRS1-D	shale	OBP	Arcl	98	75	916	3,4351	ND	34	27	56	
OBP-YRS1D-2	YRS1-D	shale	OBP	Arcl	90	94	938	3,4479	ND	39	30	52	
OBP-YRS1D-3	YRS1-D	shale	OBP	Arcl	104	99	957	3,4238	ND	38	22	56	
OBP-3474-1	no.3474	red quartzite	OBP	Arcl	27	ND	47	0,3644	ND	ND	ND	4	
OBP-3474-2	no.3474	red quartzite	OBP	Arcl	ND	41	35	0,366	ND	ND	ND	5	
OBP-3474-3	no.3474	red quartzite	OBP	Arcl	33	ND	44	0,3846	ND	ND	ND	ND	
OBP-3478-1	no.3478	white quartzite	OBP	Arcl	92	72	292	0,8119	ND	21	12	15	

OBP-3478-2	no.3478	white quartzite	OBP	Arcl	78	46	277	0,7904	ND	19	10	17
OBP-3478-3	no.3478	white quartzite	OBP	Arcl	75	45	267	0,774	ND	15	12	15
OBP-4684-1	no.4684	shale	OBP	Arcl	52	127	338	4,0773	ND	63	16	25
OBP-4684-2	no.4684	shale	OBP	Arcl	70	115	365	4,031	ND	44	15	30
OBP-4684-3	no.4684	shale	OBP	Arcl	69	120	352	4,0296	ND	60	14	28
OBP-4688-1	no.4688	dolerite	OBP	Arcl	50	67	124	1,6297	ND	14	18	7
OBP-4688-2	no.4688	dolerite	OBP	Arcl	49	53	139	1,625	ND	ND	16	13
OBP-4688-3	no.4688	dolerite	OBP	Arcl	43	81	139	1,6409	ND	ND	14	11
OBP-4688-4	no.4688	dolerite	OBP	Arcl	66	48	151	1,6723	ND	17	15	14
OBP-4683-1	no.4683	red quartzite	OBP	Arcl	ND	ND	ND	0,612	ND	ND	ND	ND
OBP-4683-2	no.4683	red quartzite	OBP	Arcl	ND	ND	31	0,6242	ND	ND	ND	ND
OBP-4683-3	no.4683	red quartzite	OBP	Arcl	27	ND	ND	0,6285	ND	ND	8	5
OBP-4695-1	no.4695	red quartzite	OBP	Arcl	ND	ND	68	0,4598	ND	ND	ND	ND
OBP-4695-2	no.4695	red quartzite	OBP	Arcl	ND	ND	68	0,5299	ND	ND	7	7
OBP-4695-3	no.4695	red quartzite	OBP	Arcl	ND	ND	56	0,5359	ND	ND	9	6

OBP-4678-1	no.4678	red quartzite	OBP	Arcl	52	52	547	3,0887	ND	40	10	41	
OBP-4678-2	no.4678	red quartzite	OBP	Arcl	44	84	466	2,2109	ND	28	9	17	
OBP-4678-3	no.4678	red quartzite	OBP	Arcl	45	70	500	2,979	ND	44	10	36	
OBP-4697-1	no.4697	red quartzite	OBP	Arcl	ND	34	159	0,7217	ND	ND	6	32	
OBP-4697-2	no.4697	red quartzite	OBP	Arcl	ND	ND	120	0,8248	ND	ND	9	24	
OBP-4697-3	no.4697	red quartzite	OBP	Arcl	39	65	74	0,7225	ND	ND	ND	12	
OBP-4672-1	no.4672	dolerite	OBP	Arcl	217	ND	1505	12,3241	ND	103	23	177	
OBP-4672-2	no.4672	dolerite	OBP	Arcl	197	ND	1447	12,3148	ND	96	17	173	
OBP-4672-3	no.4672	dolerite	OBP	Arcl	237	ND	1673	12,7316	ND	139	23	187	
OBP-106-1	no.106	black quartzite	OBP	Arcl	64	ND	152	0,4982	ND	ND	8	42	
OBP-106-2	no.106	black quartzite	OBP	Arcl	50	38	187	0,5287	ND	ND	10	52	
OBP-106-3	no.106	black quartzite	OBP	Arcl	40	50	103	0,4698	ND	ND	7	26	
OBP-YRS1E-1	YRS1-E	red quartzite	OBP	Arcl	ND	ND	46	0,5142	ND	ND	6	4	
OBP-YRS1E-2	YRS1-E	red quartzite	OBP	Arcl	29	45	26	0,5051	ND	ND	ND	ND	
OBP-YRS1E-3	YRS1-E	red quartzite	OBP	Arcl	30	ND	33	0,5084	ND	ND	ND	ND	

OBP-YRS1E-4	YRS1-E	red quartzite	OBP	Arcl	ND	ND	26	0,5088	ND	ND	ND	ND
OBP-3486-1	no.3486	sandstone	OBP	Arcl	74	50	181	1,6873	ND	13	15	15
OBP-3486-2	no.3486	sandstone	OBP	Arcl	50	74	167	1,6663	ND	13	9	15
OBP-3486-3	no.3486	sandstone	OBP	Arcl	28	76	171	1,6564	ND	13	12	13
OBP-4671-1	no.4671	red quartzite	OBP	Arcl	34	82	300	1,4571	ND	13	11	12
OBP-4671-2	no.4671	red quartzite	OBP	Arcl	ND	96	121	1,3033	ND	16	7	8
OBP-4671-3	no.4671	red quartzite	OBP	Arcl	37	92	157	1,3589	ND	ND	9	10
OBP-4682-1	no.4682	shale	OBP	Arcl	196	70	327	2,0501	ND	20	40	18
OBP-4682-2	no.4682	shale	OBP	Arcl	191	49	346	2,1608	ND	27	44	15
OBP-4682-3	no.4682	shale	OBP	Arcl	187	73	300	2,1289	ND	24	40	20
OBP-4670-1	no.4670	shale	OBP	Arcl	235	108	518	3,684	ND	41	27	41
OBP-4670-2	no.4670	shale	OBP	Arcl	266	118	532	3,4656	ND	36	28	39
OBP-4670-3	no.4670	shale	OBP	Arcl	176	166	460	4,9031	ND	38	34	49
OBP-4677-1	no.4677	shale	OBP	Arcl	188	151	187	1,7275	ND	32	81	22
OBP-4677-2	no.4677	shale	OBP	Arcl	182	150	182	1,7105	ND	33	77	23

OBP-4677-3	no.4677	shale	OBP	Arcl	139	58	197	0,9658	ND	31	28	33
OBP-142-1	no.142	shale	OBP	Arcl	124	ND	258	1,2614	ND	ND	11	10
OBP-142-2	no.142	shale	OBP	Arcl	146	ND	310	1,4306	ND	ND	ND	14
OBP-142-3	no.142	shale	OBP	Arcl	125	ND	280	1,4625	ND	ND	ND	14
OBP-106AF-1	no.106AF	shale	OBP	Arcl	ND	ND	159	1,5243	ND	ND	16	34
OBP-106AF-2	no.106AF	shale	OBP	Arcl	37	ND	160	1,5714	ND	ND	21	35
OBP-106AF-3	no.106AF	shale	OBP	Arcl	32	ND	161	1,5761	ND	ND	20	37
OBP-106BB-1	no.106BB	shale	OBP	Arcl	110	ND	190	1,2098	ND	ND	ND	21
OBP-106BB-2	no.106BB	shale	OBP	Arcl	102	ND	146	1,008	ND	ND	ND	15
OBP-106BB-3	no.106BB	shale	OBP	Arcl	105	ND	140	1,0023	ND	ND	ND	13
OBP-106A2-1	no.106A2	shale	OBP	Arcl	219	119	4592	4,5658	ND	64	23	109
OBP-106A2-2	no.106A2	shale	OBP	Arcl	208	131	4446	4,5521	ND	57	25	102
OBP-106A2-3	no.106A2	shale	OBP	Arcl	224	121	4624	4,5641	ND	68	25	112
OBP-107-1	no.107	shale	OBP	Arcl	270	213	348	8,5339	ND	153	52	157
OBP-107-2	no.107	shale	OBP	Arcl	266	202	355	8,4924	ND	156	46	162

OBP-107-3	no.107	shale	OBP	Arcl	289	211	346	8,5143	ND	152	55	165
OBP-159-1	no.159	shale	OBP	Arcl	185	50	347	2,0256	ND	17	9	20
OBP-159-2	no.159	shale	OBP	Arcl	167	78	373	2,104	ND	21	7	26
OBP-159-3	no.159	shale	OBP	Arcl	167	69	476	2,2471	ND	14	13	25
OBP-182-1	no.182	dolerite	OBP	Arcl	84	ND	445	2,7392	ND	ND	13	117
OBP-182-2	no.182	dolerite	OBP	Arcl	85	ND	474	2,7608	ND	ND	16	109
OBP-182-3	no.182	dolerite	OBP	Arcl	94	ND	442	2,735	ND	16	12	115
OBP-130-1	no.130	dolerite	OBP	Arcl	199	ND	1370	11,3692	ND	77	ND	235
OBP-130-2	no.130	dolerite	OBP	Arcl	198	ND	1331	11,468	ND	73	ND	240
OBP-130-3	no.130	dolerite	OBP	Arcl	183	ND	1357	11,3731	ND	68	12	239
OBP-122-1	no.122	shale	OBP	Arcl	352	79	887	5,5685	ND	30	84	125
OBP-122-2	no.122	shale	OBP	Arcl	370	69	882	5,5951	ND	31	75	130
OBP-122-3	no.122	shale	OBP	Arcl	341	98	867	5,5988	ND	34	84	128
OBP-489-1	no.489	dolerite	OBP	Arcl	195	76	428	1,9128	ND	23	21	18
OBP-489-2	no.489	dolerite	OBP	Arcl	189	76	438	1,8858	ND	20	19	17

OBP-489-3	no.489	dolerite	OBP	Arcl	185	65	459	1,9158	ND	16	18	17
OBP-493-1	no.493	quartz	OBP	Arcl	ND	ND	44	0,1782	ND	ND	9	5
OBP-493-2	no.493	quartz	OBP	Arcl	ND	ND	59	0,175	ND	ND	7	6
OBP-493-3	no.493	quartz	OBP	Arcl	ND	43	38	0,1743	ND	ND	9	4
OBP-486-1	no.468	white quartzite	OBP	Arcl	38	51	56	0,6535	ND	ND	ND	4
OBP-486-2	no.468	white quartzite	OBP	Arcl	37	47	53	0,6538	ND	ND	ND	4
OBP-486-3	no.468	white quartzite	OBP	Arcl	28	40	59	0,6602	ND	ND	ND	4
OBP-412-1	no.412	chert	OBP	Arcl	145	55	320	1,6759	ND	22	10	18
OBP-412-2	no.412	chert	OBP	Arcl	145	51	263	1,6686	ND	23	13	17
OBP-412-3	no.412	chert	OBP	Arcl	131	54	302	1,6193	ND	20	12	15
OBP-453-1	no.453	quartzite roof sample	OBP	Arcl	39	ND	71	0,2827	ND	12	6	10
OBP-453-2	no.453	quartzite roof sample	OBP	Arcl	ND	ND	89	0,2917	ND	15	ND	10
OBP-453-3	no.453	quartzite roof sample	OBP	Arcl	ND	ND	69	0,2977	ND	16	7	9
OBP-1290-1	no.1290	quartz	OBP	Arcl	40	ND	137	0,4049	ND	ND	9	8
OBP-1290-2	no.1290	quartz	OBP	Arcl	ND	40	150	0,4017	ND	ND	8	8

OBP-1290-3	no.1290	quartz	OBP	Arcl	ND	38	135	0,3975	ND	ND	ND	9	
OBP-1226-1	no.1226	shale	OBP	Arcl	84	ND	683	20,2976	ND	ND	ND	9	
OBP-1226-2	no.1226	shale	OBP	Arcl	87	ND	701	20,0527	ND	ND	ND	10	
OBP-1226-3	no.1226	shale	OBP	Arcl	94	ND	771	20,9119	ND	ND	ND	ND	
OBP-1873-1	no.1873	white quartzite	OBP	Arcl	93	69	281	0,9549	ND	ND	17	20	
OBP-1873-2	no.1873	white quartzite	OBP	Arcl	111	74	313	1,1439	ND	17	26	27	
OBP-1873-3	no.1873	white quartzite	OBP	Arcl	109	66	389	1,2208	ND	23	25	29	
OBP-1824-1	no.1824	black quartzite	OBP	Arcl	82	76	605	1,5551	ND	37	18	53	
OBP-1824-2	no.1824	black quartzite	OBP	Arcl	84	73	621	1,5547	ND	37	20	48	
OBP-1824-3	no.1824	black quartzite	OBP	Arcl	85	59	598	1,5546	ND	43	19	51	
OBP-2353-1	no.2353	red quartzite	OBP	Arcl	25	67	29	0,0599	ND	ND	ND	ND	
OBP-2353-2	no.2353	red quartzite	OBP	Arcl	36	54	ND	0,0592	ND	ND	ND	ND	
OBP-2353-3	no.2353	red quartzite	OBP	Arcl	ND	46	38	0,0594	ND	ND	ND	ND	
OBP-2366-1	no.2366	sandstone	OBP	Arcl	45	42	209	1,3089	ND	ND	ND	11	
OBP-2366-2	no.2366	sandstone	OBP	Arcl	36	46	238	1,3075	ND	ND	9	9	

OBP-2366-3	no.2366	sandstone	OBP	Arcl			34	ND	262	1,3094	ND	ND	6	11	
OBP-2364-1	no.2364	black quartzite	OBP	Arcl			29	ND	123	0,8123	ND	17	7	13	
OBP-2364-2	no.2364	black quartzite	OBP	Arcl			47	ND	94	0,7912	ND	16	ND	15	
OBP-2364-3	no.2364	black quartzite	OBP	Arcl			26	ND	142	0,7756	ND	14	12	14	
OBP-2358-1	no.2358	black quartzite	OBP	Arcl			ND	ND	235	2,9401	ND	ND	ND	12	
OBP-2358-2	no.2358	black quartzite	OBP	Arcl			ND	ND	201	2,9397	ND	ND	ND	11	
OBP-2358-3	no.2358	black quartzite	OBP	Arcl			ND	ND	168	2,9061	ND	ND	ND	7	
OBP-2290-1	no.2290	shale	OBP	Arcl			242	57	574	2,0789	ND	39	22	33	
OBP-2290-2	no.2290	shale	OBP	Arcl			224	ND	528	2,0902	ND	31	15	30	
OBP-2290-3	no.2290	shale	OBP	Arcl			240	ND	665	2,043	ND	36	16	30	
OBP-MC1-1	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	106	125	62	0,5544	ND	ND	ND	6	
OBP-MC1-2	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	110	105	56	0,5779	ND	ND	ND	3	
OBP-MC1-3	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	ND	ND	0,0532	ND	ND	ND	ND	
OBP-MC1-4	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	ND	ND	0,0699	ND	ND	ND	ND	
OBP-MC2-1	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	54	74	44	0,7423	ND	ND	ND	ND	

OBP-MC2-2	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	97	106	77	1,4155	ND	12	ND		6
OBP-MC2-3	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	76	61	42	0,6309	ND	ND	ND		4
OBP-MC3-1	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	54	59	62	0,8071	ND	18	26		6
OBP-MC3-2	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	117	42	61	1,1034	ND	ND	8		5
OBP-MC3-3	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	37	70	36	0,6024	ND	ND	28		7
OBP-CMF1-1	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	54	ND	ND	0,2674	ND	ND	ND	ND	
OBP-CMF1-2	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	51	ND	ND	0,2898	ND	24	8	ND	
OBP-CMF1-3	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	ND	ND	ND	0,2926	ND	ND	8	ND	
OBP-CMF2-1	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	49	52	ND	0,1579	ND	16	13	ND	
OBP-CMF2-2	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	49	46	44	0,0826	ND	ND	ND	ND	
OBP-CMF2-3	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	67	66	34	0,18	ND	ND	16		4
OBP-BPC1A-1	BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	25	80	33	0,3311	ND	ND	9	ND	
OBP-BPC1A-2	BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	33	56	ND	0,3338	ND	ND	ND	ND	
OBP-BPC1A-3	BPC1A	redquartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	54	34	0,333	ND	ND	6	ND	
OBP-BPC1B-1	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	26	0,0963	ND	ND	ND	ND	

OBP-BPC1B-2	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	28	0,0952	ND	ND	ND	ND		
OBP-BPC1B-3	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	44	35	ND	0,1585	ND	ND	ND	ND		
OBP-BPC1C-1	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	28	46	26	0,1109	ND	ND	ND	ND		
OBP-BPC1C-2	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	34	ND	42	0,145	ND	ND	6	ND		
OBP-BPC1C-3	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	78	27	0,1094	ND	ND	ND	ND		
OBP-BPC1D-1	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	35	ND	45	0,3516	ND	ND	ND	ND		
OBP-BPC1D-2	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	32	59	37	0,3979	ND	ND	7		4	
OBP-BPC1D-3	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	48	39	44	0,1444	ND	ND	ND	ND		
OBP-BPC1E-1	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	34	ND	31	0,1971	ND	ND	ND	ND		
OBP-BPC1E-2	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	36	59	31	0,2156	ND	ND	6	ND		
OBP-BPC1E-3	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	37	47	0,2101	ND	ND	6	ND		
OBP-BPC1F-1	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	39	36	92	0,9068	ND	ND	6		9	
OBP-BPC1F-2	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	46	101	0,916	ND	ND	6		7	
OBP-BPC1F-3	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	85	0,9263	ND	12	ND		9	
OBP-BB1-1	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	52	ND	41	0,0719	ND	ND	ND	ND		

OBP-BB1-2	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	45	ND	ND	0,0674	ND	ND	ND	ND
OBP-BB1-3	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	29	40	27	0,0697	ND	ND	ND	ND
OBP-OBP1-1	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	36	61	126	5,7864	ND	22	11	6
OBP-OBP1-2	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	ND	63	113	5,8706	ND	35	9	5
OBP-OBP1-3	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	58	74	152	8,8726	ND	ND	ND	10
OBP-OBP2-1	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	170	70	75	0,4234	ND	19	11	10
OBP-OBP2-2	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	195	82	65	0,3991	ND	ND	ND	11
OBP-OBP2-3	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	83	ND	68	1,6499	ND	30	12	15
OBP-OBP3A-1	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	43	53	0,4626	ND	ND	ND	ND
OBP-OBP3A-2	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	32	80	97	1,8737	ND	12	7	7
OBP-OBP3A-3	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	ND	0,482	ND	33	ND	ND
OBP-OBP3B-1	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	63	ND	143	0,5042	ND	21	ND	14
OBP-OBP3B-2	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	74	ND	108	0,4782	ND	24	ND	11
OBP-OBP3B-3	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	58	ND	107	0,4366	ND	ND	14	11
OBP-OBP3C-1	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	64	62	83	2,3431	ND	ND	10	ND

OBP-OBP3C-2	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	76	63	66	2,3856	ND	19	ND	ND
OBP-OBP3C-3	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	30	ND	ND	0,2206	ND	ND	ND	ND
OBP-OBP3D-1	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	2079	ND	705	69,3633	ND	ND	ND	ND
OBP-OBP3D-2	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	2093	ND	640	68,8234	ND	ND	ND	ND
OBP-OBP3D-3	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	1616	ND	401	69,2291	ND	ND	ND	ND
OBP-OBP4A-1	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	41	159	77	1,5121	ND	16	9	6
OBP-OBP4A-2	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	40	660	180	2,6515	ND	29	13	8
OBP-OBP4A-3	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	214	54	1,2913	ND	19	ND	6
OBP-OBP4B-1	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	34	0,4568	ND	ND	ND	ND
OBP-OBP4B-2	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	45	133	71	0,4419	ND	ND	11	ND
OBP-OBP4B-3	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	76	36	0,3799	ND	ND	7	3
OBP-OBP4C-1	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	38	159	42	1,0252	ND	ND	ND	ND
OBP-OBP4C-2	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	32	131	31	1,1129	ND	17	ND	5
OBP-OBP4C-3	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	31	151	49	1,0229	ND	13	9	ND
OBP-OBP4D-1	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	59	68	55	0,1935	ND	44	ND	3

OBP-OBP4D-2	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	46	74	60	0,4649	ND	12	6	8
OBP-OBP4D-3	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	41	52	50	0,4624	ND	10	9	7
OBP-OBP4E-1	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	77	ND	0,2621	ND	ND	ND	ND
OBP-OBP4E-2	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	43	34	0,2903	ND	ND	ND	ND
OBP-OBP4E-3	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	75	66	2,539	ND	23	ND	5
OBP-OBP4F-1	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	55	85	78	1,0607	ND	ND	6	ND
OBP-OBP4F-2	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	54	93	50	1,1082	ND	ND	ND	5
OBP-OBP4F-3	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	66	115	61	1,4774	ND	ND	7	4
OBP-OBP4G-1	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	228	ND	259	15,8715	ND	136	ND	203
OBP-OBP4G-2	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	275	ND	235	13,1186	ND	114	32	176
OBP-OBP4G-3	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	228	ND	265	15,6705	ND	134	ND	211
OBP-OBP5A-1	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	298	49	331	12,288	ND	108	22	219
OBP-OBP5A-2	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	169	504	136	15,5353	ND	40	39	74
OBP-OBP5A-3	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1107	375	663	14,6277	ND	71	26	134
OBP-OBP5B-1	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	35	45	57	1,1588	ND	ND	ND	ND

OBP-OBP5B-2	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	40	62	1,0324	ND	14	8	9
OBP-OBP5B-3	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	31	ND	52	0,6794	ND	ND	ND	8
OBP-OBP5C-1	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	73	123	73	0,4637	ND	ND	6	4
OBP-OBP5C-2	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	52	ND	0,1359	ND	ND	6	6
OBP-OBP5C-3	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	43	44	46	0,4366	ND	ND	ND	ND
OBP-OBP5D-1	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	253	ND	608	12,7003	ND	96	19	208
OBP-OBP5D-2	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	291	75	569	13,4048	ND	92	25	202
OBP-OBP5D-3	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	262	72	620	12,0995	ND	100	22	237
OBP-OBP5E-1	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	209	ND	321	12,3297	ND	91	15	223
OBP-OBP5E-2	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	209	ND	323	12,6408	ND	86	23	204
OBP-OBP5E-3	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	229	ND	279	12,8134	ND	86	18	215
OBP-OBP5F-1	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	34	69	33	0,9071	0	0	0	0
OBP-OBP5F-2	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	33	43	42	0,3694	0	0	0	0
OBP-OBP5F-3	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	0	38	0	0,3817	0	0	0	0
OBP-OBP6A-1	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	27	158	41	0,3648	ND	ND	ND	ND

OBP-OBP6A-2	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	45	303	ND	0,6003	ND	ND	ND	ND
OBP-OBP6A-3	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	41	342	45	0,5997	ND	15	6	4
OBP-OBP6A-4	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	63	343	33	0,6531	ND	ND	9	ND
OBP-OBP6B-1	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	152	76	136	1,0448	ND	ND	ND	7
OBP-OBP6B-2	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	63	40	89	0,9239	ND	13	ND	ND
OBP-OBP6B-3	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	66	ND	125	1,2899	ND	21	10	8
OBP-OBP6C-1	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	33	68	42	0,2554	ND	ND	ND	3
OBP-OBP6C-2	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	41	106	47	0,2973	ND	ND	10	6
OBP-OBP6C-3	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	44	40	0,177	ND	ND	ND	7
OBP-OBP6D-1	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	39	40	0,115	ND	13	7	4
OBP-OBP6D-2	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	31	ND	32	0,1197	ND	15	8	4
OBP-OBP6D-3	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	77	60	109	0,4737	ND	ND	ND	9
OBP-OBP6E-1	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	30	135	36	0,591	ND	ND	ND	4
OBP-OBP6E-2	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	47	120	39	0,5864	ND	ND	ND	5
OBP-OBP6E-3	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	34	148	46	0,5667	ND	13	ND	ND

OBP-OBP6F-1	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	68	151	123	1,1375	ND	38	12	67
OBP-OBP6F-2	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	39	143	95	1,1097	ND	40	13	69
OBP-OBP6F-3	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	59	152	104	1,0375	ND	24	10	45
OBP-OBP7-1	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	41	0,4834	ND	ND	7	10
OBP-OBP7-2	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	44	0,4731	ND	18	7	10
OBP-OBP7-3	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	55	0,5832	ND	16	11	12
OBP-OBP8A-1	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	ND	55	2,8593	ND	22	ND	13
OBP-OBP8A-2	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	107	66	958	5,2273	ND	ND	10	24
OBP-OBP8A-3	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	48	ND	33	0,3142	ND	ND	7	11
OBP-OBP8A-4	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	44	ND	39	0,3168	ND	12	ND	11
OBP-OBP8B-1	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	95	120	84	0,5107	ND	34	8	20
OBP-OBP8B-2	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	96	103	66	0,4917	ND	40	ND	16
OBP-OBP8B-3	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	109	114	75	0,4921	ND	42	ND	14
OBP-OBP8C-1	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	58	ND	96	2,2663	ND	17	13	10
OBP-OBP8C-2	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	51	ND	96	2,1117	ND	ND	ND	11

OBP-OBP8C-3	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	48	39	72	1,1426	ND	ND	ND	7	
OBP-OBP9A-1	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	48	ND	ND	0,2795	ND	17	ND	ND	
OBP-OBP9A-2	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	38	ND	44	0,2512	ND	17	10	ND	
OBP-OBP9A-3	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	88	87	50	2,1209	ND	ND	12	4	
OBP-OBP9B-1	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	74	39	99	0,9999	ND	29	ND	18	
OBP-OBP9B-2	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	82	ND	107	1,0085	ND	36	ND	18	
OBP-OBP9B-3	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	76	ND	89	0,5494	ND	24	ND	13	
OBP-OBP10A-1	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	4,162	ND	ND	ND	ND	
OBP-OBP10A-2	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	4,6621	ND	ND	ND	ND	
OBP-OBP10A-3	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	51	110	2,9714	ND	ND	9	8	
OBP-OBP10B-1	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	78	40	69	0,4967	ND	16	26	44	
OBP-OBP10B-2	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	52	56	59	0,4934	ND	14	25	45	
OBP-OBP10B-3	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	68	44	84	0,4989	ND	14	21	43	
OBP-OBP10C-1	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	40	43	78	0,2708	ND	ND	ND	ND	
OBP-OBP10C-2	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	38	ND	69	0,2946	ND	ND	ND	ND	

OBP-OBP10C-3	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	48	ND	52	0,3394	ND	ND	ND		4
OBP-OBP10D-1	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	24	55	44	0,3909	ND	ND	ND	ND	
OBP-OBP10D-2	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	34	56	72	0,2895	ND	ND	8		5
OBP-OBP10D-3	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	ND	105	51	0,579	ND	15	ND	ND	
OBP-OBP10E-1	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	29	ND	36	0,1474	ND	ND	ND	ND	
OBP-OBP10E-2	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	43	30	0,1557	ND	ND	ND	ND	
OBP-OBP10E-3	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	74	25	0,1465	ND	ND	ND		3
OBP-OBP10F-1	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	39	34	63	0,2579	ND	ND	ND		3
OBP-OBP10F-2	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	48	36	69	0,2491	ND	ND	ND	ND	
OBP-OBP10F-3	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	29	46	64	0,2678	ND	ND	ND		3

Analysis ID	**Sample ID**	**Rock type**	**Location**	**Geo/Arcl piece?**	**Latitude (˚)**	**Longitude (˚)**	**Se**	**Rb**	**Sr**	**Y**	**Zr**	**Nb**	**Mo**	**Ag**
OBP-110-1	no.110	shale	OBP	Arcl			ND	22	167	36	152	14	8	ND
OBP-110-2	no.110	shale	OBP	Arcl			ND	23	174	35	149	12	11	ND
OBP-110-3	no.110	shale	OBP	Arcl			ND	23	169	36	150	10	ND	ND
OBP-120-1	no.120	white quartzite	OBP	Arcl			ND	3	20	4	8	ND	ND	ND

OBP-120-2	no.120	white quartzite	OBP	Arcl	ND	3	22	3	11	ND	ND	ND
OBP-120-3	no.120	white quartzite	OBP	Arcl	ND	3	25	3	9	ND	ND	ND
OBP-143-1	no.143	white quartzite	OBP	Arcl	ND	14	6	4	123	3	ND	ND
OBP-143-2	no.143	white quartzite	OBP	Arcl	ND	14	6	4	122	3	ND	ND
OBP-143-3	no.143	white quartzite	OBP	Arcl	ND	14	5	5	120	3	ND	ND
OBP-137-1	no.137	shale	OBP	Arcl	ND	117	202	45	438	22	ND	ND
OBP-137-2	no.137	shale	OBP	Arcl	ND	118	203	42	446	23	ND	ND
OBP-137-3	no.137	shale	OBP	Arcl	ND	112	207	42	443	23	ND	ND
OBP-164-1	no.164	shale	OBP	Arcl	ND	166	62	23	188	17	ND	ND
OBP-164-2	no.164	shale	OBP	Arcl	ND	168	61	24	185	16	5	ND
OBP-164-3	no.164	shale	OBP	Arcl	ND	171	60	23	183	15	6	ND
OBP-1968-1	no.1968	shale/metased	OBP	Arcl	ND	176	45	27	178	10	ND	ND
OBP-1968-2	no.1968	shale/metased	OBP	Arcl	ND	172	55	27	182	11	ND	ND
OBP-1968-3	no.1968	shale/metased	OBP	Arcl	ND	176	57	29	184	12	ND	ND
OBP-420-1	no.420	shale	OBP	Arcl	ND	135	122	66	399	27	ND	ND

OBP-420-2	no.420	shale	OBP	Arcl	ND	134	122	64	393	22	ND	ND
OBP-420-3	no.420	shale	OBP	Arcl	ND	135	120	65	403	22	ND	ND
OBP-408-1	no.408	dolerite	OBP	Arcl	ND	24	126	29	213	16	11	ND
OBP-408-2	no.408	dolerite	OBP	Arcl	ND	25	145	29	208	15	12	ND
OBP-408-3	no.408	dolerite	OBP	Arcl	ND	26	148	28	215	17	14	ND
OBP-412-1	no.412	chert	OBP	Arcl	2	297	62	20	207	18	ND	ND
OBP-412-2	no.412	chert	OBP	Arcl	ND	295	65	17	207	17	ND	ND
OBP-412-3	no.412	chert	OBP	Arcl	ND	299	64	18	212	17	ND	ND
OBP-494-1	no.494	white quartzite	OBP	Arcl	ND	8	20	9	58	ND	ND	ND
OBP-494-2	no.494	white quartzite	OBP	Arcl	ND	8	19	7	58	ND	ND	ND
OBP-494-3	no.494	white quartzite	OBP	Arcl	ND	9	19	7	63	ND	ND	ND
OBP-458-1	no.458	dolerite	OBP	Arcl	ND	165	171	31	183	15	11	ND
OBP-458-2	no.458	dolerite	OBP	Arcl	ND	166	173	30	177	12	6	ND
OBP-458-3	no.458	dolerite	OBP	Arcl	ND	168	175	31	181	17	10	ND
OBP-488-1	no.488	white quartzite	OBP	Arcl	ND	9	22	ND	60	ND	ND	ND

OBP-488-2	no.488	white quartzite	OBP	Arcl	ND	12	33	6	113	ND	ND	ND
OBP-488-3	no.488	white quartzite	OBP	Arcl	ND	13	34	5	109	ND	ND	ND
OBP-488-4	no.488	white quartzite	OBP	Arcl	ND	13	33	5	112	ND	ND	ND
OBP-486-1	no.486	white quartzite	OBP	Arcl	ND	11	18	10	77	ND	ND	ND
OBP-486-2	no.486	white quartzite	OBP	Arcl	ND	11	19	10	78	ND	ND	ND
OBP-486-3	no.486	white quartzite	OBP	Arcl	ND	11	21	7	53	ND	ND	ND
OBP-440-1	no.440	black quartzite	OBP	Arcl	ND	19	308	19	82	7	11	ND
OBP-440-2	no.440	blackquartzite	OBP	Arcl	ND	21	301	15	82	6	7	ND
OBP-440-3	no.440	black quartzite	OBP	Arcl	ND	20	304	17	81	7	13	ND
OBP-1286-1	no.1286	sandstone	OBP	Arcl	ND	44	12	5	61	5	8	ND
OBP-1286-2	no.1286	sandstone	OBP	Arcl	ND	44	11	5	59	4	9	ND
OBP-1286-3	no.1286	sandstone	OBP	Arcl	ND	44	11	5	58	3	6	ND
OBP-1194-1	no.1194	sandstone	OBP	Arcl	ND	350	122	12	203	13	ND	ND
OBP-1194-2	no.1194	sandstone	OBP	Arcl	ND	353	119	13	207	13	ND	ND
OBP-1194-3	no.1194	sandstone	OBP	Arcl	ND	353	123	12	201	12	ND	ND

OBP-1241-1	no.1241	dolerite	OBP	Arcl	3	90	190	29	169	12	ND	ND
OBP-1241-2	no.1241	dolerite	OBP	Arcl	ND	88	193	28	160	12	ND	ND
OBP-1241-3	no.1241	dolerite	OBP	Arcl	3	89	191	28	162	13	9	ND
OBP-1195-1	no.1195	red quartzite	OBP	Arcl	ND	29	227	11	95	14	28	ND
OBP-1195-2	no.1195	red quartzite	OBP	Arcl	ND	29	230	11	101	16	25	ND
OBP-1195-3	no.1195	red quartzite	OBP	Arcl	ND	31	244	9	105	15	26	ND
OBP-1795-1	no.1795	white quartzite	OBP	Arcl	ND	18	56	4	62	ND	ND	ND
OBP-1795-2	no.1795	white quartzite	OBP	Arcl	ND	18	55	5	58	ND	ND	ND
OBP-1795-3	no.1795	white quartzite	OBP	Arcl	ND	18	64	ND	56	ND	ND	ND
OBP-1789-1	no.1789	shale	OBP	Arcl	ND	136	44	12	64	9	ND	ND
OBP-1789-2	no.1789	shale	OBP	Arcl	ND	139	44	11	66	12	ND	ND
OBP-1789-3	no.1789	shale	OBP	Arcl	ND	137	44	11	65	9	ND	ND
OBP-2395-1	no.2395	sandstone	OBP	Arcl	ND	7	15	8	67	5	ND	ND
OBP-2395-2	no.2395	sandstone	OBP	Arcl	ND	7	17	8	67	5	7	ND
OBP-2395-3	no.2395	sandstone	OBP	Arcl	ND	8	17	9	67	5	7	ND

OBP-2332-1	no.2332	whitequartzite	OBP	Arcl	ND	8	19	ND	77	5	6	ND
OBP-2332-2	no.2332	white quartzite	OBP	Arcl	ND	9	18	ND	80	5	5	ND
OBP-2332-3	no.2332	white quartzite	OBP	Arcl	ND	9	19	ND	80	4	5	ND
OBP-2402-1	no.2402	sandstone	OBP	Arcl	ND	21	62	3	90	ND	ND	ND
OBP-2402-2	no.2402	sandstone	OBP	Arcl	ND	20	65	5	89	ND	ND	ND
OBP-2402-3	no.2402	sandstone	OBP	Arcl	ND	22	73	5	98	3	ND	ND
OBP-2374-1	no.2374	white quartzite	OBP	Arcl	ND	8	24	ND	48	ND	ND	ND
OBP-2374-2	no.2374	white quartzite	OBP	Arcl	ND	7	24	2	48	ND	ND	ND
OBP-2374-3	no.2374	white quartzite	OBP	Arcl	ND	8	28	3	48	ND	ND	ND
OBP-YRS1A-1	YRS1-A	shale	OBP	Arcl	ND	198	73	24	196	14	ND	ND
OBP-YRS1A-2	YRS1-A	shale	OBP	Arcl	ND	199	74	24	196	14	ND	ND
OBP-YRS1A-3	YRS1-A	shale	OBP	Arcl	ND	199	72	25	199	16	ND	ND
OBP-YRS1B-1	YRS1-B	shale	OBP	Arcl	ND	195	107	62	437	24	ND	ND
OBP-YRS1B-2	YRS1-B	shale	OBP	Arcl	ND	202	107	64	447	23	ND	ND
OBP-YRS1B-3	YRS1-B	shale	OBP	Arcl	ND	198	108	64	444	25	ND	ND

OBP-YRS1C-1	YRS1-C	red quartzite	OBP	Arcl	ND	15	11	4	36	ND	ND	ND
OBP-YRS1C-2	YRS1-C	red quartzite	OBP	Arcl	ND	16	11	4	38	ND	ND	ND
OBP-YRS1C-3	YRS1-C	red quartzite	OBP	Arcl	1	15	10	4	35	ND	ND	ND
OBP-YRS1D-1	YRS1-D	shale	OBP	Arcl	ND	247	41	23	173	16	ND	ND
OBP-YRS1D-2	YRS1-D	shale	OBP	Arcl	ND	246	43	26	171	14	6	ND
OBP-YRS1D-3	YRS1-D	shale	OBP	Arcl	ND	245	42	27	173	13	ND	ND
OBP-3474-1	no.3474	red quartzite	OBP	Arcl	ND	2	4	ND	17	ND	ND	ND
OBP-3474-2	no.3474	red quartzite	OBP	Arcl	ND	3	3	ND	17	ND	ND	ND
OBP-3474-3	no.3474	red quartzite	OBP	Arcl	ND	2	4	ND	16	ND	ND	ND
OBP-3478-1	no.3478	white quartzite	OBP	Arcl	ND	4	282	9	85	ND	ND	ND
OBP-3478-2	no.3478	white quartzite	OBP	Arcl	ND	5	242	6	86	ND	ND	ND
OBP-3478-3	no.3478	white quartzite	OBP	Arcl	ND	6	234	6	81	ND	ND	ND
OBP-4684-1	no.4684	shale	OBP	Arcl	ND	197	197	49	194	21	5	ND
OBP-4684-2	no.4684	shale	OBP	Arcl	2	199	196	49	196	20	6	ND
OBP-4684-3	no.4684	shale	OBP	Arcl	ND	194	198	52	192	17	ND	ND

OBP-4688-1	no.4688	dolerite	OBP	Arcl	ND	116	107	18	259	12	ND		ND
OBP-4688-2	no.4688	dolerite	OBP	Arcl	ND	117	108	21	255	10	ND		ND
OBP-4688-3	no.4688	dolerite	OBP	Arcl	ND	116	109	19	260	12	ND		ND
OBP-4688-4	no.4688	dolerite	OBP	Arcl	ND	117	108	19	267	12	ND		ND
OBP-4683-1	no.4683	red quartzite	OBP	Arcl	ND	3	17	3	69	4		4	ND
OBP-4683-2	no.4683	red quartzite	OBP	Arcl	ND	4	17	2	72	3		5	ND
OBP-4683-3	no.4683	red quartzite	OBP	Arcl	ND	4	18	3	69	3		6	ND
OBP-4695-1	no.4695	red quartzite	OBP	Arcl	ND	10	53	6	38	ND	ND		ND
OBP-4695-2	no.4695	red quartzite	OBP	Arcl	ND	11	53	8	74	ND		6	ND
OBP-4695-3	no.4695	red quartzite	OBP	Arcl	ND	12	54	9	75	4		9	ND
OBP-4678-1	no.4678	red quartzite	OBP	Arcl	ND	8	53	5	45	ND	ND		ND
OBP-4678-2	no.4678	red quartzite	OBP	Arcl	ND	5	10	ND	29	ND	ND		ND
OBP-4678-3	no.4678	red quartzite	OBP	Arcl	ND	8	43	4	47	ND		9	ND
OBP-4697-1	no.4697	red quartzite	OBP	Arcl	ND	19	54	4	184	ND	ND		ND
OBP-4697-2	no.4697	red quartzite	OBP	Arcl	ND	22	53	4	171	4	ND		ND

OBP-4697-3	no.4697	red quartzite	OBP	Arcl	ND	18	19	5	177	ND	ND	ND
OBP-4672-1	no.4672	dolerite	OBP	Arcl	ND	53	61	35	216	17	10	ND
OBP-4672-2	no.4672	dolerite	OBP	Arcl	ND	53	58	35	215	16	ND	ND
OBP-4672-3	no.4672	dolerite	OBP	Arcl	ND	42	63	34	215	12	ND	ND
OBP-106-1	no.106	black quartzite	OBP	Arcl	ND	46	25	6	155	ND	ND	ND
OBP-106-2	no.106	black quartzite	OBP	Arcl	ND	45	31	7	150	5	ND	ND
OBP-106-3	no.106	black quartzite	OBP	Arcl	ND	50	17	5	138	ND	ND	ND
OBP-YRS1E-1	YRS1-E	red quartzite	OBP	Arcl	ND	16	5	2	39	ND	ND	ND
OBP-YRS1E-2	YRS1-E	red quartzite	OBP	Arcl	ND	16	5	2	39	ND	ND	ND
OBP-YRS1E-3	YRS1-E	red quartzite	OBP	Arcl	ND	17	5	3	39	ND	ND	ND
OBP-YRS1E-4	YRS1-E	red quartzite	OBP	Arcl	ND	17	5	2	37	ND	ND	ND
OBP-3486-1	no.3486	sandstone	OBP	Arcl	ND	53	27	3	96	ND	ND	ND
OBP-3486-2	no.3486	sandstone	OBP	Arcl	ND	51	27	3	94	ND	ND	ND
OBP-3486-3	no.3486	sandstone	OBP	Arcl	ND	51	27	3	92	ND	ND	ND
OBP-4671-1	no.4671	red quartzite	OBP	Arcl	ND	9	7	4	33	4	4	ND

OBP-4671-2	no.4671	red quartzite	OBP	Arcl	ND	8	7	3	31	ND	ND		ND
OBP-4671-3	no.4671	red quartzite	OBP	Arcl	ND	8	8	4	35	ND		4	ND
OBP-4682-1	no.4682	shale	OBP	Arcl	ND	226	50	26	204	14	ND		ND
OBP-4682-2	no.4682	shale	OBP	Arcl	ND	233	53	27	202	14	ND		ND
OBP-4682-3	no.4682	shale	OBP	Arcl	ND	230	54	26	205	13	ND		ND
OBP-4670-1	no.4670	shale	OBP	Arcl	2	436	120	39	346	24	ND		ND
OBP-4670-2	no.4670	shale	OBP	Arcl	ND	429	119	38	340	21	ND		ND
OBP-4670-3	no.4670	shale	OBP	Arcl	ND	415	105	42	377	26	ND		ND
OBP-4677-1	no.4677	shale	OBP	Arcl	ND	334	59	43	200	17	ND		ND
OBP-4677-2	no.4677	shale	OBP	Arcl	ND	334	58	38	201	17	ND		ND
OBP-4677-3	no.4677	shale	OBP	Arcl	ND	231	159	37	218	16	ND		ND
OBP-142-1	no.142	shale	OBP	Arcl	ND	132	70	18	147	10	ND		ND
OBP-142-2	no.142	shale	OBP	Arcl	ND	138	57	20	149	10	ND		ND
OBP-142-3	no.142	shale	OBP	Arcl	ND	137	55	18	150	10	ND		ND
OBP-106AF-1	no.106AF	shale	OBP	Arcl	ND	43	137	16	183	20	ND		ND

OBP-106AF-2	no.106AF	shale	OBP	Arcl	ND	43	130	16	185	20	ND	ND
OBP-106AF-3	no.106AF	shale	OBP	Arcl	ND	44	131	15	185	20	ND	ND
OBP-106BB-1	no.106BB	shale	OBP	Arcl	ND	145	41	13	89	14	ND	ND
OBP-106BB-2	no.106BB	shale	OBP	Arcl	ND	144	36	10	87	10	ND	ND
OBP-106BB-3	no.106BB	shale	OBP	Arcl	ND	142	37	10	88	11	ND	ND
OBP-106A2-1	no.106A2	shale	OBP	Arcl	ND	241	223	64	480	24	ND	ND
OBP-106A2-2	no.106A2	shale	OBP	Arcl	ND	238	222	65	478	23	ND	ND
OBP-106A2-3	no.106A2	shale	OBP	Arcl	ND	239	224	62	478	22	ND	ND
OBP-107-1	no.107	shale	OBP	Arcl	ND	26	125	22	131	4	ND	ND
OBP-107-2	no.107	shale	OBP	Arcl	ND	25	125	20	133	7	ND	ND
OBP-107-3	no.107	shale	OBP	Arcl	ND	25	126	21	134	7	ND	ND
OBP-159-1	no.159	shale	OBP	Arcl	ND	207	52	21	191	13	ND	ND
OBP-159-2	no.159	shale	OBP	Arcl	ND	207	56	22	201	13	ND	ND
OBP-159-3	no.159	shale	OBP	Arcl	ND	204	56	23	192	13	ND	ND
OBP-182-1	no.182	dolerite	OBP	Arcl	ND	156	98	54	424	28	ND	ND

OBP-182-2	no.182	dolerite	OBP	Arcl	ND	158	99	56	431	31	8	ND
OBP-182-3	no.182	dolerite	OBP	Arcl	ND	155	98	55	433	26	10	ND
OBP-130-1	no.130	dolerite	OBP	Arcl	ND	35	95	34	203	13	ND	ND
OBP-130-2	no.130	dolerite	OBP	Arcl	ND	35	72	34	205	15	ND	ND
OBP-130-3	no.130	dolerite	OBP	Arcl	ND	33	93	34	202	15	8	ND
OBP-122-1	no.122	shale	OBP	Arcl	ND	125	324	31	207	16	ND	ND
OBP-122-2	no.122	shale	OBP	Arcl	ND	126	322	29	205	14	9	ND
OBP-122-3	no.122	shale	OBP	Arcl	ND	127	327	32	207	12	8	ND
OBP-489-1	no.489	dolerite	OBP	Arcl	ND	212	70	25	213	13	ND	ND
OBP-489-2	no.489	dolerite	OBP	Arcl	ND	210	70	24	210	13	ND	ND
OBP-489-3	no.489	dolerite	OBP	Arcl	ND	213	69	23	213	14	ND	ND
OBP-493-1	no.493	quartz	OBP	Arcl	ND	17	10	ND	6	ND	ND	ND
OBP-493-2	no.493	quartz	OBP	Arcl	ND	17	11	2	6	ND	ND	ND
OBP-493-3	no.493	quartz	OBP	Arcl	ND	17	11	ND	6	ND	ND	ND
OBP-486-1	no.468	white quartzite	OBP	Arcl	ND	ND	9	ND	ND	ND	ND	ND

OBP-486-2	no.468	white quartzite	OBP	Arcl	ND	ND	8	ND	ND	ND	ND	ND
OBP-486-3	no.468	white quartzite	OBP	Arcl	ND	ND	9	ND	ND	ND	ND	ND
OBP-412-1	no.412	chert	OBP	Arcl	ND	301	64	21	213	18	ND	ND
OBP-412-2	no.412	chert	OBP	Arcl	ND	301	64	19	209	18	5	ND
OBP-412-3	no.412	chert	OBP	Arcl	ND	293	65	20	204	16	ND	ND
OBP-453-1	no.453	quartzite roof sample	OBP	Arcl	ND	28	28	3	54	ND	ND	ND
OBP-453-2	no.453	quartzite roof sample	OBP	Arcl	ND	29	27	3	57	ND	ND	ND
OBP-453-3	no.453	quartzite roof sample	OBP	Arcl	ND	26	31	4	60	4	6	ND
OBP-1290-1	no.1290	quartz	OBP	Arcl	ND	5	52	4	18	ND	ND	ND
OBP-1290-2	no.1290	quartz	OBP	Arcl	ND	5	52	3	17	ND	ND	ND
OBP-1290-3	no.1290	quartz	OBP	Arcl	ND	4	52	3	17	ND	ND	ND
OBP-1226-1	no.1226	shale	OBP	Arcl	ND	6	56	3	4	ND	ND	ND
OBP-1226-2	no.1226	shale	OBP	Arcl	ND	8	52	ND	ND	ND	ND	ND
OBP-1226-3	no.1226	shale	OBP	Arcl	ND	8	61	ND	7	ND	9	ND
OBP-1873-1	no.1873	white quartzite	OBP	Arcl	ND	95	103	29	154	12	ND	ND

OBP-1873-2	no.1873	white quartzite	OBP	Arcl	ND	77	148	25	176	8	ND	ND	
OBP-1873-3	no.1873	white quartzite	OBP	Arcl	ND	69	177	23	179	9	ND	ND	
OBP-1824-1	no.1824	black quartzite	OBP	Arcl	1	20	95	4	55	ND	ND	ND	
OBP-1824-2	no.1824	black quartzite	OBP	Arcl	ND	19	95	4	56	ND	ND	ND	
OBP-1824-3	no.1824	black quartzite	OBP	Arcl	ND	19	94	4	56	ND	ND	ND	
OBP-2353-1	no.2353	red quartzite	OBP	Arcl	ND	1	30	3	25	ND	ND	ND	
OBP-2353-2	no.2353	red quartzite	OBP	Arcl	ND	ND	29	4	26	ND	ND	ND	
OBP-2353-3	no.2353	red quartzite	OBP	Arcl	ND	ND	30	4	27	ND	ND	ND	
OBP-2366-1	no.2366	sandstone	OBP	Arcl	ND	16	68	ND	29	ND	ND	ND	
OBP-2366-2	no.2366	sandstone	OBP	Arcl	ND	16	67	ND	28	ND	ND	ND	
OBP-2366-3	no.2366	sandstone	OBP	Arcl	ND	17	68	ND	28	ND	ND	ND	
OBP-2364-1	no.2364	black quartzite	OBP	Arcl	ND	22	74	4	37	3	ND	ND	
OBP-2364-2	no.2364	black quartzite	OBP	Arcl	ND	23	70	3	35	ND	ND	ND	
OBP-2364-3	no.2364	black quartzite	OBP	Arcl	ND	23	67	4	39	ND	5	ND	
OBP-2358-1	no.2358	black quartzite	OBP	Arcl	ND	11	77	7	39	5	8	ND	

OBP-2358-2	no.2358	black quartzite	OBP	Arcl			ND	13	83	5	37	5	7	ND
OBP-2358-3	no.2358	black quartzite	OBP	Arcl			ND	10	50	3	33	ND	ND	ND
OBP-2290-1	no.2290	shale	OBP	Arcl			ND	206	90	27	232	21	9	ND
OBP-2290-2	no.2290	shale	OBP	Arcl			ND	209	92	28	229	22	10	ND
OBP-2290-3	no.2290	shale	OBP	Arcl			ND	213	95	30	242	21	15	ND
OBP-MC1-1	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	3	14	ND	ND	ND	ND	ND
OBP-MC1-2	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	3	14	ND	ND	ND	ND	ND
OBP-MC1-3	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	ND	ND	ND	ND	ND	ND	ND
OBP-MC1-4	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	ND	ND	ND	ND	ND	ND	ND
OBP-MC2-1	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	4	15	5	106	ND	ND	ND
OBP-MC2-2	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	5	21	9	190	ND	ND	ND
OBP-MC2-3	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	3	18	3	130	ND	ND	ND
OBP-MC3-1	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	8	15	6	35	3	7	ND
OBP-MC3-2	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	3	9	12	19	3	9	ND
OBP-MC3-3	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	6	10	9	33	ND	8	ND

OBP-CMF1-1	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	ND	11	4	3	45	ND	ND	ND
OBP-CMF1-2	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	ND	14	4	5	39	6	16	ND
OBP-CMF1-3	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	ND	13	4	4	43	6	14	ND
OBP-CMF2-1	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	ND	20	5	3	97	4	12	ND
OBP-CMF2-2	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	ND	10	6	3	87	3	7	ND
OBP-CMF2-3	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	ND	22	4	3	103	4	5	ND
OBP-BPC1A-1	BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	3	3	4	78	ND	ND	ND
OBP-BPC1A-2	BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	3	2	4	94	ND	ND	ND
OBP-BPC1A-3	BPC1A	redquartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	3	2	4	88	ND	ND	ND
OBP-BPC1B-1	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	8	ND	4	ND
OBP-BPC1B-2	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	9	ND	ND	ND
OBP-BPC1B-3	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	9	ND	7	ND	ND	ND
OBP-BPC1C-1	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	1	ND	3	87	ND	ND	ND
OBP-BPC1C-2	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	3	ND	4	74	ND	ND	ND
OBP-BPC1C-3	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	6	68	ND	ND	ND

OBP-BPC1D-1	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	2	8	4	6	4	5	ND
OBP-BPC1D-2	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	3	7	3	6	ND	5	ND
OBP-BPC1D-3	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	15	24	6	ND	ND	ND
OBP-BPC1E-1	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	1	7	ND	15	ND	ND	ND
OBP-BPC1E-2	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	6	ND	7	ND	ND	ND
OBP-BPC1E-3	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	1	6	ND	13	ND	ND	ND
OBP-BPC1F-1	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	2	ND	2	42	ND	ND	ND
OBP-BPC1F-2	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	2	2	ND	46	ND	ND	ND
OBP-BPC1F-3	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	2	1	ND	28	ND	ND	ND
OBP-BB1-1	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	ND	ND	4	ND	ND	ND	ND	ND
OBP-BB1-2	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	ND	ND	3	ND	ND	ND	ND	ND
OBP-BB1-3	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	ND	ND	2	ND	ND	ND	ND	ND
OBP-OBP1-1	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	ND	12	12	8	136	9	8	ND
OBP-OBP1-2	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	ND	11	13	10	138	6	11	ND
OBP-OBP1-3	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	ND	12	14	4	95	ND	6	ND

OBP-OBP2-1	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	ND	29	91	7	76	9	18	ND
OBP-OBP2-2	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	ND	29	91	6	64	9	15	ND
OBP-OBP2-3	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	ND	46	117	23	166	17	20	ND
OBP-OBP3A-1	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	2	ND	3	ND	6	ND
OBP-OBP3A-2	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	6	4	ND	22	ND	ND	ND
OBP-OBP3A-3	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	3	ND	18	9	17	ND
OBP-OBP3B-1	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	31	40	3	44	5	8	ND
OBP-OBP3B-2	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	32	38	3	46	9	12	ND
OBP-OBP3B-3	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	28	25	4	72	8	11	ND
OBP-OBP3C-1	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	6	64	ND	35	4	14	ND
OBP-OBP3C-2	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	6	68	2	34	6	13	ND
OBP-OBP3C-3	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	7	18	4	39	3	8	ND
OBP-OBP3D-1	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	109	11	ND	58	ND	ND	ND
OBP-OBP3D-2	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	101	ND	ND	53	ND	ND	ND
OBP-OBP3D-3	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	91	ND	ND	17	ND	21	ND

OBP-OBP4A-1	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND		6		14		4		40		3		4	ND
OBP-OBP4A-2	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND		7		5		ND		38		3		7	ND
OBP-OBP4A-3	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND		4		5		4		40		ND		4	ND
OBP-OBP4B-1	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND		2		2		3		29		6		15	ND
OBP-OBP4B-2	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917		1		2		64	ND		34		ND		ND	ND
OBP-OBP4B-3	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND		ND		3		ND		32		ND		ND	ND
OBP-OBP4C-1	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND		6		3		6		48		ND		ND	ND
OBP-OBP4C-2	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND		4		4		5		37		ND		ND	ND
OBP-OBP4C-3	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		1	6		3		4		67		ND		ND	ND
OBP-OBP4D-1	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND		ND		ND		ND		ND		ND		ND	ND
OBP-OBP4D-2	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND		4		4		2		69		ND		ND	ND
OBP-OBP4D-3	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917		1	3		3		ND		67		ND		ND	ND
OBP-OBP4E-1	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND		3		1		2		28		ND		ND	ND
OBP-OBP4E-2	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND		3	ND			4		29		ND		ND	ND
OBP-OBP4E-3	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND		6		2		3		35		6		11	ND

OBP-OBP4F-1	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	23	ND	3	ND	ND	ND
OBP-OBP4F-2	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	32	2	3	ND	ND	ND
OBP-OBP4F-3	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	57	3	8	ND	ND	ND
OBP-OBP4G-1	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	6	114	61	198	15	12	ND
OBP-OBP4G-2	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	7	187	53	221	12	ND	ND
OBP-OBP4G-3	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	7	115	63	206	14	18	ND
OBP-OBP5A-1	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	10	100	85	223	15	ND	ND
OBP-OBP5A-2	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	33	28	36	246	16	12	ND
OBP-OBP5A-3	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	14	528	66	185	16	19	ND
OBP-OBP5B-1	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	7	10	7	167	5	ND	ND
OBP-OBP5B-2	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	8	11	8	76	ND	ND	ND
OBP-OBP5B-3	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	8	10	8	163	7	7	ND
OBP-OBP5C-1	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	32	ND	3	ND	ND	ND
OBP-OBP5C-2	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP5C-3	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	1	ND	8	ND	ND	ND	ND	ND

OBP-OBP5D-1	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	12	230	34	234	11	ND	ND
OBP-OBP5D-2	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	11	210	33	217	11	ND	ND
OBP-OBP5D-3	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	10	262	36	207	13	8	ND
OBP-OBP5E-1	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	16	98	45	214	13	ND	ND
OBP-OBP5E-2	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	15	109	47	221	16	ND	ND
OBP-OBP5E-3	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	14	94	46	213	13	8	ND
OBP-OBP5F-1	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	2	0	20	5	11	0	0	ND
OBP-OBP5F-2	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	2	0	3	0	5	0	0	ND
OBP-OBP5F-3	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	1	0	2	3	4	0	0	ND
OBP-OBP6A-1	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	3	6	2	31	ND	ND	ND
OBP-OBP6A-2	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	4	5	3	27	ND	ND	ND
OBP-OBP6A-3	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	4	3	4	31	ND	ND	ND
OBP-OBP6A-4	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	3	5	3	28	ND	ND	ND
OBP-OBP6B-1	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	21	32	3	41	ND	ND	ND
OBP-OBP6B-2	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	19	9	3	39	3	6	ND

OBP-OBP6B-3	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	23	7	5	35	7	11	ND
OBP-OBP6C-1	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	1	2	3	ND	ND	ND	ND
OBP-OBP6C-2	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	2	4	8	4	7	20	ND
OBP-OBP6C-3	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	3	ND	ND	ND	5	ND
OBP-OBP6D-1	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	3	3	ND	ND	4	ND
OBP-OBP6D-2	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	4	4	ND	ND	5	ND
OBP-OBP6D-3	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	2	5	9	7	ND	ND	ND
OBP-OBP6E-1	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP6E-2	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP6E-3	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP6F-1	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	46	11	14	113	7	ND	ND
OBP-OBP6F-2	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	46	11	11	105	7	ND	ND
OBP-OBP6F-3	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	42	10	8	75	5	ND	ND
OBP-OBP7-1	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	250	23	14	61	25	ND	ND
OBP-OBP7-2	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	251	23	16	58	23	ND	ND

OBP-OBP7-3	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	288	26	31	109	55	4	ND
OBP-OBP8A-1	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	30	56	4	144	8	15	ND
OBP-OBP8A-2	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	31	78	12	325	11	ND	ND
OBP-OBP8A-3	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	25	39	4	110	3	5	ND
OBP-OBP8A-4	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	26	41	4	109	6	ND	ND
OBP-OBP8B-1	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	25	87	4	73	6	8	ND
OBP-OBP8B-2	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	25	85	3	75	7	11	ND
OBP-OBP8B-3	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	25	85	3	73	6	10	ND
OBP-OBP8C-1	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	2	22	23	4	103	6	ND	ND
OBP-OBP8C-2	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	21	22	7	101	5	12	ND
OBP-OBP8C-3	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	18	26	6	60	ND	7	ND
OBP-OBP9A-1	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	ND	4	ND	ND	4	16	ND
OBP-OBP9A-2	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	2	4	ND	9	6	15	ND
OBP-OBP9A-3	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	1	6	ND	ND	ND	ND	ND
OBP-OBP9B-1	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	3	7	ND	26	3	ND	ND

OBP-OBP9B-2	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	3	8	ND	27	ND	6	ND	
OBP-OBP9B-3	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	2	6	ND	18	ND	ND	ND	
OBP-OBP10A-1	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	6	ND	5	4	8	ND	
OBP-OBP10A-2	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	7	4	ND	ND	7	ND	
OBP-OBP10A-3	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	4	7	3	37	ND	5	ND	
OBP-OBP10B-1	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	ND	87	74	36	204	20	ND	ND	
OBP-OBP10B-2	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	ND	89	73	36	209	21	ND	ND	
OBP-OBP10B-3	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	ND	85	79	33	205	20	ND	ND	
OBP-OBP10C-1	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	15	ND	ND	ND	ND	ND	
OBP-OBP10C-2	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	16	ND	ND	ND	ND	ND	
OBP-OBP10C-3	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	2	19	2	ND	ND	ND	ND	
OBP-OBP10D-1	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	12	ND	ND	ND	ND	ND	
OBP-OBP10D-2	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	ND	12	2	4	146	3	ND	ND	
OBP-OBP10D-3	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	25	ND	ND	ND	ND	ND	
OBP-OBP10E-1	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	ND	ND	

OBP-OBP10E-2	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP10E-3	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	3	ND	ND
OBP-OBP10F-1	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP10F-2	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP10F-3	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	ND	ND
Analysis ID	**Sample ID**	**Rock type**	**Location**	**Geo/Arcl piece?**	**Latitude (°)**	**Longitude (°)**	**Cd**	**Sn**	**Sb**	**W**	**Hg**	**Pb**	**Bi**	**Th**
OBP-110-1	no.110	shale	OBP	Arcl			ND	ND	ND	ND	ND	34	ND	21
OBP-110-2	no.110	shale	OBP	Arcl			ND	ND	ND	ND	ND	49	ND	19
OBP-110-3	no.110	shale	OBP	Arcl			ND	ND	ND	ND	ND	39	ND	16
OBP-120-1	no.120	white quartzite	OBP	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
OBP-120-2	no.120	white quartzite	OBP	Arcl			ND	ND	ND	ND	ND	ND	18	ND
OBP-120-3	no.120	white quartzite	OBP	Arcl			ND	ND	ND	ND	ND	ND	13	ND
OBP-143-1	no.143	white quartzite	OBP	Arcl			ND	ND	ND	ND	ND	ND	ND	8
OBP-143-2	no.143	white quartzite	OBP	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
OBP-143-3	no.143	white quartzite	OBP	Arcl			ND	ND	ND	ND	ND	ND	ND	ND

OBP-137-1	no.137	shale	OBP	Arcl	ND	ND	ND	ND	ND	25	ND	24
OBP-137-2	no.137	shale	OBP	Arcl	ND	ND	ND	ND	ND	30	ND	22
OBP-137-3	no.137	shale	OBP	Arcl	ND	ND	ND	12	ND	28	ND	27
OBP-164-1	no.164	shale	OBP	Arcl	ND	ND	ND	ND	ND	20	ND	23
OBP-164-2	no.164	shale	OBP	Arcl	ND	ND	ND	ND	ND	15	ND	21
OBP-164-3	no.164	shale	OBP	Arcl	ND	ND	ND	ND	6	16	ND	20
OBP-1968-1	no.1968	shale/metased	OBP	Arcl	ND	ND	ND	ND	ND	5	ND	12
OBP-1968-2	no.1968	shale/metased	OBP	Arcl	ND	ND	ND	ND	ND	8	ND	15
OBP-1968-3	no.1968	shale/metased	OBP	Arcl	ND	ND	ND	ND	ND	5	ND	17
OBP-420-1	no.420	shale	OBP	Arcl	ND	ND	ND	ND	ND	18	ND	29
OBP-420-2	no.420	shale	OBP	Arcl	ND	ND	ND	ND	ND	14	ND	29
OBP-420-3	no.420	shale	OBP	Arcl	ND	ND	ND	ND	ND	19	ND	27
OBP-408-1	no.408	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	31	ND	28
OBP-408-2	no.408	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	31	ND	22
OBP-408-3	no.408	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	37	ND	29

OBP-412-1	no.412	chert	OBP	Arcl	ND	ND	ND	ND	ND	26	ND	22	
OBP-412-2	no.412	chert	OBP	Arcl	ND	ND	ND	ND	ND	27	ND	24	
OBP-412-3	no.412	chert	OBP	Arcl	ND	ND	ND	ND	5	27	ND	26	
OBP-494-1	no.494	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-494-2	no.494	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-494-3	no.494	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-458-1	no.458	dolerite	OBP	Arcl	ND	ND	ND	ND	11	22	ND	22	
OBP-458-2	no.458	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	25	ND	23	
OBP-458-3	no.458	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	22	ND	25	
OBP-488-1	no.488	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	3	ND	ND	
OBP-488-2	no.488	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	3	12	ND	
OBP-488-3	no.488	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	13	ND	
OBP-488-4	no.488	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	6	19	ND	
OBP-486-1	no.486	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	10	ND	
OBP-486-2	no.486	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	18	ND	

OBP-486-3	no.486	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	11	ND	
OBP-440-1	no.440	black quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	16	
OBP-440-2	no.440	blackquartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	18	
OBP-440-3	no.440	black quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	19	
OBP-1286-1	no.1286	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-1286-2	no.1286	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	12	
OBP-1286-3	no.1286	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	10	
OBP-1194-1	no.1194	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	5	ND	18	
OBP-1194-2	no.1194	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	20	
OBP-1194-3	no.1194	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	21	
OBP-1241-1	no.1241	dolerite	OBP	Arcl	ND	ND	ND	ND	11	28	ND	16	
OBP-1241-2	no.1241	dolerite	OBP	Arcl	ND	ND	ND	ND	13	28	ND	ND	
OBP-1241-3	no.1241	dolerite	OBP	Arcl	ND	ND	ND	ND	10	30	ND	16	
OBP-1195-1	no.1195	red quartzite	OBP	Arcl	ND	ND	ND	ND	27	40	ND	68	
OBP-1195-2	no.1195	red quartzite	OBP	Arcl	ND	ND	ND	ND	41	40	ND	70	

OBP-1195-3	no.1195	red quartzite	OBP	Arcl	ND	41	ND	ND	29	39	ND	80	
OBP-1795-1	no.1795	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	3	ND	ND	
OBP-1795-2	no.1795	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	3	ND	ND	
OBP-1795-3	no.1795	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	13	ND	
OBP-1789-1	no.1789	shale	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	19	
OBP-1789-2	no.1789	shale	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	20	
OBP-1789-3	no.1789	shale	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	22	
OBP-2395-1	no.2395	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-2395-2	no.2395	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	10	
OBP-2395-3	no.2395	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	14	
OBP-2332-1	no.2332	whitequartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-2332-2	no.2332	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-2332-3	no.2332	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-2402-1	no.2402	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	7	ND	17	
OBP-2402-2	no.2402	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	8	ND	ND	

OBP-2402-3	no.2402	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	9	ND	12	
OBP-2374-1	no.2374	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-2374-2	no.2374	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-2374-3	no.2374	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	13	ND	
OBP-YRS1A-1	YRS1-A	shale	OBP	Arcl	ND	ND	ND	ND	ND	22	ND	16	
OBP-YRS1A-2	YRS1-A	shale	OBP	Arcl	ND	ND	ND	ND	ND	22	ND	24	
OBP-YRS1A-3	YRS1-A	shale	OBP	Arcl	ND	ND	ND	ND	ND	21	ND	17	
OBP-YRS1B-1	YRS1-B	shale	OBP	Arcl	ND	ND	ND	ND	ND	25	ND	28	
OBP-YRS1B-2	YRS1-B	shale	OBP	Arcl	ND	ND	ND	ND	6	27	ND	23	
OBP-YRS1B-3	YRS1-B	shale	OBP	Arcl	ND	ND	ND	ND	7	25	ND	31	
OBP-YRS1C-1	YRS1-C	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	3	ND	ND	
OBP-YRS1C-2	YRS1-C	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-YRS1C-3	YRS1-C	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-YRS1D-1	YRS1-D	shale	OBP	Arcl	ND	ND	ND	ND	ND	8	ND	25	
OBP-YRS1D-2	YRS1-D	shale	OBP	Arcl	ND	ND	ND	ND	7	9	ND	22	

OBP-YRS1D-3	YRS1-D	shale	OBP	Arcl	ND	ND	ND	ND	ND	9	ND	21
OBP-3474-1	no.3474	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND
OBP-3474-2	no.3474	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND
OBP-3474-3	no.3474	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND
OBP-3478-1	no.3478	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	104	ND	ND
OBP-3478-2	no.3478	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	88	ND	13
OBP-3478-3	no.3478	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	88	ND	17
OBP-4684-1	no.4684	shale	OBP	Arcl	ND	ND	ND	ND	8	5	ND	31
OBP-4684-2	no.4684	shale	OBP	Arcl	ND	ND	ND	ND	8	ND	ND	26
OBP-4684-3	no.4684	shale	OBP	Arcl	ND	ND	ND	ND	7	ND	ND	24
OBP-4688-1	no.4688	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	9	ND	23
OBP-4688-2	no.4688	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	8	ND	18
OBP-4688-3	no.4688	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	7	ND	18
OBP-4688-4	no.4688	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	8	ND	12
OBP-4683-1	no.4683	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	4	ND	8

OBP-4683-2	no.4683	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND
OBP-4683-3	no.4683	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	14
OBP-4695-1	no.4695	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND
OBP-4695-2	no.4695	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND
OBP-4695-3	no.4695	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	12
OBP-4678-1	no.4678	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	10
OBP-4678-2	no.4678	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND
OBP-4678-3	no.4678	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND
OBP-4697-1	no.4697	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND
OBP-4697-2	no.4697	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND
OBP-4697-3	no.4697	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND
OBP-4672-1	no.4672	dolerite	OBP	Arcl	ND	36	ND	ND	ND	42	ND	24
OBP-4672-2	no.4672	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	36	ND	22
OBP-4672-3	no.4672	dolerite	OBP	Arcl	ND	ND	ND	ND	10	41	ND	ND
OBP-106-1	no.106	black quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND

OBP-106-2	no.106	black quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND		ND
OBP-106-3	no.106	black quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND		11	ND
OBP-YRS1E-1	YRS1-E	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND		ND
OBP-YRS1E-2	YRS1-E	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND		ND
OBP-YRS1E-3	YRS1-E	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND		ND
OBP-YRS1E-4	YRS1-E	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND		ND
OBP-3486-1	no.3486	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	ND		16	ND
OBP-3486-2	no.3486	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	ND		17	ND
OBP-3486-3	no.3486	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	ND		15	ND
OBP-4671-1	no.4671	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND		ND
OBP-4671-2	no.4671	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND		ND
OBP-4671-3	no.4671	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND		ND
OBP-4682-1	no.4682	shale	OBP	Arcl	ND	ND	ND	ND	ND	24	ND		16
OBP-4682-2	no.4682	shale	OBP	Arcl	ND	ND	ND	ND	6	26	ND		19
OBP-4682-3	no.4682	shale	OBP	Arcl	ND	ND	ND	ND	6	25	ND		19

OBP-4670-1	no.4670	shale	OBP	Arcl	ND	ND	ND	ND	8	18	ND	25	
OBP-4670-2	no.4670	shale	OBP	Arcl	ND	ND	ND	ND	ND	18	ND	20	
OBP-4670-3	no.4670	shale	OBP	Arcl	ND	ND	ND	ND	ND	18	ND	21	
OBP-4677-1	no.4677	shale	OBP	Arcl	ND	26	ND	11	ND	9	ND	26	
OBP-4677-2	no.4677	shale	OBP	Arcl	ND	ND	ND	ND	ND	8	ND	19	
OBP-4677-3	no.4677	shale	OBP	Arcl	ND	ND	ND	ND	ND	6	ND	18	
OBP-142-1	no.142	shale	OBP	Arcl	ND	ND	ND	ND	ND	14	ND	ND	
OBP-142-2	no.142	shale	OBP	Arcl	ND	ND	ND	ND	ND	11	ND	18	
OBP-142-3	no.142	shale	OBP	Arcl	ND	ND	ND	ND	ND	13	ND	14	
OBP-106AF-1	no.106AF	shale	OBP	Arcl	ND	ND	ND	ND	ND	15	ND	14	
OBP-106AF-2	no.106AF	shale	OBP	Arcl	ND	ND	ND	ND	5	14	ND	11	
OBP-106AF-3	no.106AF	shale	OBP	Arcl	ND	ND	ND	ND	5	10	ND	13	
OBP-106BB-1	no.106BB	shale	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	31	
OBP-106BB-2	no.106BB	shale	OBP	Arcl	ND	ND	ND	ND	ND	4	ND	25	
OBP-106BB-3	no.106BB	shale	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	14	

OBP-106A2-1	no.106A2	shale	OBP	Arcl	ND	ND	ND	ND	6	25	ND	24		
OBP-106A2-2	no.106A2	shale	OBP	Arcl	ND	ND	ND	ND	ND	22	ND	20		
OBP-106A2-3	no.106A2	shale	OBP	Arcl	ND	ND	ND	ND	ND	23	ND	19		
OBP-107-1	no.107	shale	OBP	Arcl	ND	ND	ND	ND	ND	24	ND	ND		
OBP-107-2	no.107	shale	OBP	Arcl	ND	28	ND	ND	8	30	ND	ND		
OBP-107-3	no.107	shale	OBP	Arcl	ND	ND	ND	ND	ND	30	16	ND		
OBP-159-1	no.159	shale	OBP	Arcl	ND	ND	ND	ND	ND	16	ND	19		
OBP-159-2	no.159	shale	OBP	Arcl	ND	ND	ND	ND	ND	17	ND	16		
OBP-159-3	no.159	shale	OBP	Arcl	ND	ND	ND	ND	7	21	ND	20		
OBP-182-1	no.182	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	18	ND	28		
OBP-182-2	no.182	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	15	ND	29		
OBP-182-3	no.182	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	21	ND	43		
OBP-130-1	no.130	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	43	ND	13		
OBP-130-2	no.130	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	45	ND	14		
OBP-130-3	no.130	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	46	ND	19		

OBP-122-1	no.122	shale	OBP	Arcl	ND	ND	ND	ND	8	24	ND		24
OBP-122-2	no.122	shale	OBP	Arcl	ND	ND	ND	ND	ND	20	ND		26
OBP-122-3	no.122	shale	OBP	Arcl	ND	ND	ND	ND	ND	19	ND		27
OBP-489-1	no.489	dolerite	OBP	Arcl	ND	ND	ND	ND	5	19	ND		16
OBP-489-2	no.489	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	19	ND		9
OBP-489-3	no.489	dolerite	OBP	Arcl	ND	ND	ND	ND	ND	22	ND		19
OBP-493-1	no.493	quartz	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-493-2	no.493	quartz	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-493-3	no.493	quartz	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-486-1	no.468	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	15	ND	
OBP-486-2	no.468	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	10	ND	
OBP-486-3	no.468	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	11	ND	
OBP-412-1	no.412	chert	OBP	Arcl	ND	ND	ND	ND	ND	26	ND		23
OBP-412-2	no.412	chert	OBP	Arcl	ND	ND	ND	ND	ND	29	ND		22
OBP-412-3	no.412	chert	OBP	Arcl	ND	ND	ND	ND	ND	26	ND		27

OBP-453-1	no.453	quartzite roof sample	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	14	
OBP-453-2	no.453	quartzite roof sample	OBP	Arcl	ND	ND	ND	ND	ND	4	ND	8	
OBP-453-3	no.453	quartzite roof sample	OBP	Arcl	ND	ND	ND	ND	ND	4	ND	15	
OBP-1290-1	no.1290	quartz	OBP	Arcl	ND	ND	ND	ND	ND	ND	14	ND	
OBP-1290-2	no.1290	quartz	OBP	Arcl	ND	ND	ND	ND	ND	ND	15	ND	
OBP-1290-3	no.1290	quartz	OBP	Arcl	ND	ND	ND	ND	ND	ND	11	ND	
OBP-1226-1	no.1226	shale	OBP	Arcl	ND	ND	ND	ND	18	28	ND	ND	
OBP-1226-2	no.1226	shale	OBP	Arcl	ND	ND	ND	ND	15	23	ND	ND	
OBP-1226-3	no.1226	shale	OBP	Arcl	ND	ND	ND	ND	17	21	ND	ND	
OBP-1873-1	no.1873	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	5	ND	23	
OBP-1873-2	no.1873	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	6	ND	ND	
OBP-1873-3	no.1873	white quartzite	OBP	Arcl	ND	ND	ND	ND	ND	4	ND	11	
OBP-1824-1	no.1824	black quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	32	ND	
OBP-1824-2	no.1824	black quartzite	OBP	Arcl	ND	ND	ND	ND	ND	3	32	ND	
OBP-1824-3	no.1824	black quartzite	OBP	Arcl	ND	20	ND	ND	ND	4	32	ND	

OBP-2353-1	no.2353	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-2353-2	no.2353	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	3	12	ND	
OBP-2353-3	no.2353	red quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	16	ND	
OBP-2366-1	no.2366	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	5	12	ND	
OBP-2366-2	no.2366	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	4	ND	ND	
OBP-2366-3	no.2366	sandstone	OBP	Arcl	ND	ND	ND	ND	ND	4	ND	ND	
OBP-2364-1	no.2364	black quartzite	OBP	Arcl	ND	ND	ND	ND	ND	4	ND	11	
OBP-2364-2	no.2364	black quartzite	OBP	Arcl	ND	ND	ND	ND	ND	5	ND	13	
OBP-2364-3	no.2364	black quartzite	OBP	Arcl	ND	ND	ND	ND	ND	6	ND	18	
OBP-2358-1	no.2358	black quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	11	
OBP-2358-2	no.2358	black quartzite	OBP	Arcl	ND	ND	ND	ND	ND	6	ND	13	
OBP-2358-3	no.2358	black quartzite	OBP	Arcl	ND	ND	ND	ND	ND	ND	ND	13	
OBP-2290-1	no.2290	shale	OBP	Arcl	ND	ND	ND	ND	8	26	ND	34	
OBP-2290-2	no.2290	shale	OBP	Arcl	ND	ND	ND	ND	ND	26	ND	31	
OBP-2290-3	no.2290	shale	OBP	Arcl	ND	ND	ND	15	ND	28	ND	34	

OBP-MC1-1	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	ND	ND	ND	ND	4	28	ND	
OBP-MC1-2	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	ND	ND	ND	ND	3	ND	10	
OBP-MC1-3	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-MC1-4	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-MC2-1	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	ND	ND	ND	ND	3	ND	ND	
OBP-MC2-2	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	ND	ND	ND	ND	6	14	ND	
OBP-MC2-3	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	ND	ND	ND	ND	5	ND	ND	
OBP-MC3-1	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	ND	ND	ND	ND	14	ND	41	
OBP-MC3-2	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	ND	ND	ND	ND	ND	ND	12	
OBP-MC3-3	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	ND	ND	ND	ND	14	ND	30	
OBP-CMF1-1	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-CMF1-2	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	ND	ND	ND	ND	ND	ND	ND	20	
OBP-CMF1-3	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	ND	ND	ND	ND	ND	ND	ND	21	
OBP-CMF2-1	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	ND	ND	ND	ND	ND	16	ND	19	
OBP-CMF2-2	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	ND	ND	ND	ND	ND	17	ND	12	

OBP-CMF2-3	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	ND	ND	ND	ND	ND	20	ND		9
OBP-BPC1A-1	BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	ND		11	ND
OBP-BPC1A-2	BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	ND	ND		ND
OBP-BPC1A-3	BPC1A	redquartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	ND	ND		ND
OBP-BPC1B-1	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	ND	ND		8
OBP-BPC1B-2	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	ND	ND		ND
OBP-BPC1B-3	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	17	ND		ND
OBP-BPC1C-1	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	ND	ND		ND
OBP-BPC1C-2	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	ND	ND		8
OBP-BPC1C-3	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	ND	ND		ND
OBP-BPC1D-1	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	8	ND		ND
OBP-BPC1D-2	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	7	ND		ND
OBP-BPC1D-3	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	11	ND		ND
OBP-BPC1E-1	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	5	ND		ND
OBP-BPC1E-2	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	5	ND		ND

OBP-BPC1E-3	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	6	ND	ND
OBP-BPC1F-1	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	ND	ND	ND
OBP-BPC1F-2	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	3	ND	ND
OBP-BPC1F-3	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	ND	ND	ND	ND	ND	ND	ND
OBP-BB1-1	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	ND	ND	ND	ND	ND	3	ND	ND
OBP-BB1-2	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	ND	ND	ND	ND	ND	ND	ND	ND
OBP-BB1-3	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP1-1	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	ND	ND	ND	ND	ND	7	ND	15
OBP-OBP1-2	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	ND	ND	ND	ND	ND	ND	ND	17
OBP-OBP1-3	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	ND	ND	ND	ND	ND	7	ND	ND
OBP-OBP2-1	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	ND	ND	ND	ND	ND	4	ND	52
OBP-OBP2-2	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	ND	ND	ND	ND	ND	5	ND	38
OBP-OBP2-3	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	ND	ND	ND	ND	ND	8	ND	88
OBP-OBP3A-1	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP3A-2	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	ND	ND	ND	3	ND	ND

OBP-OBP3A-3	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	ND	ND	ND	ND	ND		13
OBP-OBP3B-1	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	ND	ND	ND	4	ND		22
OBP-OBP3B-2	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	ND	ND	ND	ND	ND		34
OBP-OBP3B-3	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	ND	ND	ND	4	ND		27
OBP-OBP3C-1	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	ND	ND	ND	ND	ND		25
OBP-OBP3C-2	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	ND	ND	ND	ND	ND		32
OBP-OBP3C-3	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	ND	ND	ND	ND	ND		13
OBP-OBP3D-1	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	ND	ND	ND	531	648	ND	
OBP-OBP3D-2	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	ND	ND	ND	496	667	ND	
OBP-OBP3D-3	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	ND	ND	ND	ND	526	577	ND	
OBP-OBP4A-1	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	10	ND	ND	
OBP-OBP4A-2	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	ND	ND		10
OBP-OBP4A-3	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	4	ND	ND	
OBP-OBP4B-1	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	ND	ND		18
OBP-OBP4B-2	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	13	17		24

OBP-OBP4B-3	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	ND	18	ND
OBP-OBP4C-1	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP4C-2	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP4C-3	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP4D-1	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	ND	34	ND
OBP-OBP4D-2	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	ND	15	ND
OBP-OBP4D-3	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	ND	17	ND
OBP-OBP4E-1	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP4E-2	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP4E-3	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	ND	ND	12
OBP-OBP4F-1	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	3	29	ND
OBP-OBP4F-2	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	7	19	ND
OBP-OBP4F-3	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	9	ND	ND
OBP-OBP4G-1	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	35	ND	28
OBP-OBP4G-2	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	68	ND	16

OBP-OBP4G-3	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	ND	ND	ND	ND	36	ND		24
OBP-OBP5A-1	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	34	ND	ND	
OBP-OBP5A-2	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	128	ND	29	ND		45
OBP-OBP5A-3	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	48	ND	408	ND		19
OBP-OBP5B-1	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	4	ND	ND	
OBP-OBP5B-2	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-OBP5B-3	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	ND	ND		12
OBP-OBP5C-1	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	15		26	ND
OBP-OBP5C-2	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	3	ND	ND	
OBP-OBP5C-3	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	4		20	ND
OBP-OBP5D-1	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	39	ND	ND	ND	100	ND	ND	
OBP-OBP5D-2	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	99	ND	ND	
OBP-OBP5D-3	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	79	ND		17
OBP-OBP5E-1	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	29	ND		15
OBP-OBP5E-2	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	26	ND		18

OBP-OBP5E-3	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	23	ND	17
OBP-OBP5F-1	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP5F-2	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP5F-3	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP6A-1	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	4	ND	ND
OBP-OBP6A-2	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	3	ND	ND
OBP-OBP6A-3	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	4	ND	ND
OBP-OBP6A-4	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP6B-1	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	11	ND	8
OBP-OBP6B-2	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	5	ND	ND
OBP-OBP6B-3	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	ND	ND	11
OBP-OBP6C-1	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	15	ND	ND	ND	ND	ND	ND	ND
OBP-OBP6C-2	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	ND	ND	18
OBP-OBP6C-3	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP6D-1	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	ND	ND	ND

OBP-OBP6D-2	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-OBP6D-3	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-OBP6E-1	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	ND	12	ND	
OBP-OBP6E-2	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	ND	22	ND	
OBP-OBP6E-3	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	ND	31	ND	
OBP-OBP6F-1	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	10	ND	ND	
OBP-OBP6F-2	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	8	ND	10	
OBP-OBP6F-3	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	4	ND	ND	
OBP-OBP7-1	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	12	ND	30	
OBP-OBP7-2	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	ND	9	ND	29	
OBP-OBP7-3	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	ND	ND	ND	5	14	ND	35	
OBP-OBP8A-1	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	37	ND	ND	ND	5	ND	71	
OBP-OBP8A-2	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	ND	ND	ND	ND	18	ND	71	
OBP-OBP8A-3	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	ND	ND	ND	ND	4	ND	24	
OBP-OBP8A-4	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	ND	ND	ND	ND	5	ND	21	

OBP-OBP8B-1	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	ND	ND	ND	ND	6	ND	31
OBP-OBP8B-2	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	ND	ND	ND	ND	8	ND	31
OBP-OBP8B-3	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	ND	ND	ND	ND	7	ND	32
OBP-OBP8C-1	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	ND	ND	ND	ND	9	ND	13
OBP-OBP8C-2	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	ND	ND	ND	ND	9	ND	25
OBP-OBP8C-3	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	ND	ND	ND	ND	6	ND	9
OBP-OBP9A-1	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	ND	ND	ND	ND	ND	ND	19
OBP-OBP9A-2	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	ND	ND	ND	ND	4	ND	20
OBP-OBP9A-3	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP9B-1	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	ND	ND	ND	ND	5	ND	12
OBP-OBP9B-2	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	ND	ND	ND	ND	6	ND	14
OBP-OBP9B-3	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	ND	ND	ND	ND	4	ND	ND
OBP-OBP10A-1	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	ND	ND
OBP-OBP10A-2	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	ND	13
OBP-OBP10A-3	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	ND	ND

OBP-OBP10B-1	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	21	ND	15	
OBP-OBP10B-2	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	22	ND	21	
OBP-OBP10B-3	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	22	ND	18	
OBP-OBP10C-1	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	7	ND	ND	
OBP-OBP10C-2	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	9	ND	ND	
OBP-OBP10C-3	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	9	ND	ND	
OBP-OBP10D-1	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	14	18	ND	
OBP-OBP10D-2	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-OBP10D-3	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	13	21	ND	
OBP-OBP10E-1	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-OBP10E-2	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	ND	ND	
OBP-OBP10E-3	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	13	ND	
OBP-OBP10F-1	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	18	ND	
OBP-OBP10F-2	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	24	ND	
OBP-OBP10F-3	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	ND	ND	ND	ND	ND	17	ND	

Analysis ID	Sample ID	Rock type	Location	Geo/Arcl piece?	Latitude (˚)	Longitude (˚)	U	LE
OBP-110-1	no.110	shale	OBP	Arcl			ND	522801
OBP-110-2	no.110	shale	OBP	Arcl			ND	449663
OBP-110-3	no.110	shale	OBP	Arcl			ND	428009
OBP-120-1	no.120	white quartzite	OBP	Arcl			ND	551819
OBP-120-2	no.120	white quartzite	OBP	Arcl			ND	523830
OBP-120-3	no.120	white quartzite	OBP	Arcl			ND	522752
OBP-143-1	no.143	white quartzite	OBP	Arcl			ND	535874
OBP-143-2	no.143	white quartzite	OBP	Arcl			ND	535241
OBP-143-3	no.143	white quartzite	OBP	Arcl			ND	535038
OBP-137-1	no.137	shale	OBP	Arcl			ND	617385
OBP-137-2	no.137	shale	OBP	Arcl			ND	620343
OBP-137-3	no.137	shale	OBP	Arcl			ND	620966
OBP-164-1	no.164	shale	OBP	Arcl			7	561467
OBP-164-2	no.164	shale	OBP	Arcl			ND	560709

OBP-164-3	no.164	shale	OBP	Arcl		ND	556428
OBP-1968-1	no.1968	shale/metased	OBP	Arcl		ND	553938
OBP-1968-2	no.1968	shale/metased	OBP	Arcl		ND	586784
OBP-1968-3	no.1968	shale/metased	OBP	Arcl		ND	588792
OBP-420-1	no.420	shale	OBP	Arcl		ND	709480
OBP-420-2	no.420	shale	OBP	Arcl		6	709324
OBP-420-3	no.420	shale	OBP	Arcl		ND	708965
OBP-408-1	no.408	dolerite	OBP	Arcl		ND	570218
OBP-408-2	no.408	dolerite	OBP	Arcl		ND	559509
OBP-408-3	no.408	dolerite	OBP	Arcl		ND	571765
OBP-412-1	no.412	chert	OBP	Arcl		ND	526033
OBP-412-2	no.412	chert	OBP	Arcl		ND	525979
OBP-412-3	no.412	chert	OBP	Arcl		ND	517570
OBP-494-1	no.494	white quartzite	OBP	Arcl		ND	559573
OBP-494-2	no.494	white quartzite	OBP	Arcl		ND	558699

OBP-494-3	no.494	white quartzite	OBP	Arcl	ND	561634
OBP-458-1	no.458	dolerite	OBP	Arcl	ND	532122
OBP-458-2	no.458	dolerite	OBP	Arcl	ND	535452
OBP-458-3	no.458	dolerite	OBP	Arcl	ND	532948
OBP-488-1	no.488	white quartzite	OBP	Arcl	ND	626327
OBP-488-2	no.488	white quartzite	OBP	Arcl	ND	628626
OBP-488-3	no.488	white quartzite	OBP	Arcl	ND	630307
OBP-488-4	no.488	white quartzite	OBP	Arcl	ND	623624
OBP-486-1	no.486	white quartzite	OBP	Arcl	ND	535749
OBP-486-2	no.486	white quartzite	OBP	Arcl	ND	549434
OBP-486-3	no.486	white quartzite	OBP	Arcl	ND	579676
OBP-440-1	no.440	black quartzite	OBP	Arcl	ND	567612
OBP-440-2	no.440	blackquartzite	OBP	Arcl	ND	573664
OBP-440-3	no.440	black quartzite	OBP	Arcl	ND	573692
OBP-1286-1	no.1286	sandstone	OBP	Arcl	ND	624990

OBP-1286-2	no.1286	sandstone	OBP	Arcl	ND	630967
OBP-1286-3	no.1286	sandstone	OBP	Arcl	ND	637392
OBP-1194-1	no.1194	sandstone	OBP	Arcl	ND	608288
OBP-1194-2	no.1194	sandstone	OBP	Arcl	6	610098
OBP-1194-3	no.1194	sandstone	OBP	Arcl	5	615421
OBP-1241-1	no.1241	dolerite	OBP	Arcl	ND	552010
OBP-1241-2	no.1241	dolerite	OBP	Arcl	ND	551566
OBP-1241-3	no.1241	dolerite	OBP	Arcl	ND	552508
OBP-1195-1	no.1195	red quartzite	OBP	Arcl	ND	303060
OBP-1195-2	no.1195	red quartzite	OBP	Arcl	ND	321410
OBP-1195-3	no.1195	red quartzite	OBP	Arcl	ND	326839
OBP-1795-1	no.1795	white quartzite	OBP	Arcl	ND	698319
OBP-1795-2	no.1795	white quartzite	OBP	Arcl	ND	694705
OBP-1795-3	no.1795	white quartzite	OBP	Arcl	ND	687353
OBP-1789-1	no.1789	shale	OBP	Arcl	ND	530628

OBP-1789-2	no.1789	shale	OBP	Arcl	ND	526992
OBP-1789-3	no.1789	shale	OBP	Arcl	ND	533489
OBP-2395-1	no.2395	sandstone	OBP	Arcl	ND	620462
OBP-2395-2	no.2395	sandstone	OBP	Arcl	ND	619832
OBP-2395-3	no.2395	sandstone	OBP	Arcl	ND	624006
OBP-2332-1	no.2332	whitequartzite	OBP	Arcl	ND	637476
OBP-2332-2	no.2332	white quartzite	OBP	Arcl	ND	638207
OBP-2332-3	no.2332	white quartzite	OBP	Arcl	ND	640253
OBP-2402-1	no.2402	sandstone	OBP	Arcl	ND	644198
OBP-2402-2	no.2402	sandstone	OBP	Arcl	ND	640248
OBP-2402-3	no.2402	sandstone	OBP	Arcl	ND	636128
OBP-2374-1	no.2374	white quartzite	OBP	Arcl	ND	653041
OBP-2374-2	no.2374	white quartzite	OBP	Arcl	ND	651960
OBP-2374-3	no.2374	white quartzite	OBP	Arcl	ND	658698
OBP-YRS1A-1	YRS1-A	shale	OBP	Arcl	5	533196

OBP-YRS1A-2	YRS1-A	shale	OBP	Arcl	ND	520027
OBP-YRS1A-3	YRS1-A	shale	OBP	Arcl	ND	524027
OBP-YRS1B-1	YRS1-B	shale	OBP	Arcl	ND	516213
OBP-YRS1B-2	YRS1-B	shale	OBP	Arcl	ND	528640
OBP-YRS1B-3	YRS1-B	shale	OBP	Arcl	ND	537580
OBP-YRS1C-1	YRS1-C	red quartzite	OBP	Arcl	ND	575486
OBP-YRS1C-2	YRS1-C	red quartzite	OBP	Arcl	ND	569833
OBP-YRS1C-3	YRS1-C	red quartzite	OBP	Arcl	ND	571866
OBP-YRS1D-1	YRS1-D	shale	OBP	Arcl	ND	585864
OBP-YRS1D-2	YRS1-D	shale	OBP	Arcl	ND	582146
OBP-YRS1D-3	YRS1-D	shale	OBP	Arcl	ND	582301
OBP-3474-1	no.3474	red quartzite	OBP	Arcl	ND	588377
OBP-3474-2	no.3474	red quartzite	OBP	Arcl	ND	600200
OBP-3474-3	no.3474	red quartzite	OBP	Arcl	ND	599737
OBP-3478-1	no.3478	white quartzite	OBP	Arcl	ND	604101

OBP-3478-2	no.3478	white quartzite	OBP	Arcl	ND	614186
OBP-3478-3	no.3478	white quartzite	OBP	Arcl	ND	621003
OBP-4684-1	no.4684	shale	OBP	Arcl	ND	529964
OBP-4684-2	no.4684	shale	OBP	Arcl	ND	532167
OBP-4684-3	no.4684	shale	OBP	Arcl	ND	530690
OBP-4688-1	no.4688	dolerite	OBP	Arcl	ND	576835
OBP-4688-2	no.4688	dolerite	OBP	Arcl	ND	575262
OBP-4688-3	no.4688	dolerite	OBP	Arcl	ND	577905
OBP-4688-4	no.4688	dolerite	OBP	Arcl	ND	580403
OBP-4683-1	no.4683	red quartzite	OBP	Arcl	ND	598869
OBP-4683-2	no.4683	red quartzite	OBP	Arcl	ND	600906
OBP-4683-3	no.4683	red quartzite	OBP	Arcl	ND	599639
OBP-4695-1	no.4695	red quartzite	OBP	Arcl	ND	598558
OBP-4695-2	no.4695	red quartzite	OBP	Arcl	ND	598775
OBP-4695-3	no.4695	red quartzite	OBP	Arcl	ND	599450

OBP-4678-1	no.4678	red quartzite	OBP	Arcl	ND	663915
OBP-4678-2	no.4678	red quartzite	OBP	Arcl	ND	629784
OBP-4678-3	no.4678	red quartzite	OBP	Arcl	ND	688002
OBP-4697-1	no.4697	red quartzite	OBP	Arcl	ND	612599
OBP-4697-2	no.4697	red quartzite	OBP	Arcl	ND	657868
OBP-4697-3	no.4697	red quartzite	OBP	Arcl	ND	566633
OBP-4672-1	no.4672	dolerite	OBP	Arcl	ND	489886
OBP-4672-2	no.4672	dolerite	OBP	Arcl	ND	486637
OBP-4672-3	no.4672	dolerite	OBP	Arcl	ND	457536
OBP-106-1	no.106	black quartzite	OBP	Arcl	ND	630285
OBP-106-2	no.106	black quartzite	OBP	Arcl	ND	640696
OBP-106-3	no.106	black quartzite	OBP	Arcl	ND	596689
OBP-YRS1E-1	YRS1-E	red quartzite	OBP	Arcl	ND	508447
OBP-YRS1E-2	YRS1-E	red quartzite	OBP	Arcl	ND	507035
OBP-YRS1E-3	YRS1-E	red quartzite	OBP	Arcl	ND	507047

OBP-YRS1E-4	YRS1-E	red quartzite	OBP	Arcl	ND	509064
OBP-3486-1	no.3486	sandstone	OBP	Arcl	ND	548672
OBP-3486-2	no.3486	sandstone	OBP	Arcl	ND	553586
OBP-3486-3	no.3486	sandstone	OBP	Arcl	ND	560284
OBP-4671-1	no.4671	red quartzite	OBP	Arcl	ND	617669
OBP-4671-2	no.4671	red quartzite	OBP	Arcl	ND	623744
OBP-4671-3	no.4671	red quartzite	OBP	Arcl	ND	639478
OBP-4682-1	no.4682	shale	OBP	Arcl	ND	501748
OBP-4682-2	no.4682	shale	OBP	Arcl	ND	527144
OBP-4682-3	no.4682	shale	OBP	Arcl	5	513730
OBP-4670-1	no.4670	shale	OBP	Arcl	6	556308
OBP-4670-2	no.4670	shale	OBP	Arcl	9	539031
OBP-4670-3	no.4670	shale	OBP	Arcl	6	545670
OBP-4677-1	no.4677	shale	OBP	Arcl	8	537637
OBP-4677-2	no.4677	shale	OBP	Arcl	5	541906

OBP-4677-3	no.4677	shale	OBP	Arcl	5	637146
OBP-142-1	no.142	shale	OBP	Arcl	ND	634309
OBP-142-2	no.142	shale	OBP	Arcl	ND	594186
OBP-142-3	no.142	shale	OBP	Arcl	ND	584977
OBP-106AF-1	no.106AF	shale	OBP	Arcl	11	629712
OBP-106AF-2	no.106AF	shale	OBP	Arcl	11	624991
OBP-106AF-3	no.106AF	shale	OBP	Arcl	12	625229
OBP-106BB-1	no.106BB	shale	OBP	Arcl	4	549750
OBP-106BB-2	no.106BB	shale	OBP	Arcl	ND	544681
OBP-106BB-3	no.106BB	shale	OBP	Arcl	ND	545648
OBP-106A2-1	no.106A2	shale	OBP	Arcl	ND	487133
OBP-106A2-2	no.106A2	shale	OBP	Arcl	ND	487429
OBP-106A2-3	no.106A2	shale	OBP	Arcl	6	488170
OBP-107-1	no.107	shale	OBP	Arcl	ND	531889
OBP-107-2	no.107	shale	OBP	Arcl	ND	535203

OBP-107-3	no.107	shale	OBP	Arcl	ND	536625
OBP-159-1	no.159	shale	OBP	Arcl	ND	531948
OBP-159-2	no.159	shale	OBP	Arcl	ND	533558
OBP-159-3	no.159	shale	OBP	Arcl	ND	536546
OBP-182-1	no.182	dolerite	OBP	Arcl	5	587439
OBP-182-2	no.182	dolerite	OBP	Arcl	5	605488
OBP-182-3	no.182	dolerite	OBP	Arcl	7	635550
OBP-130-1	no.130	dolerite	OBP	Arcl	ND	457105
OBP-130-2	no.130	dolerite	OBP	Arcl	ND	464142
OBP-130-3	no.130	dolerite	OBP	Arcl	ND	461611
OBP-122-1	no.122	shale	OBP	Arcl	ND	607572
OBP-122-2	no.122	shale	OBP	Arcl	ND	609819
OBP-122-3	no.122	shale	OBP	Arcl	ND	612016
OBP-489-1	no.489	dolerite	OBP	Arcl	ND	474227
OBP-489-2	no.489	dolerite	OBP	Arcl	ND	497009

OBP-489-3	no.489	dolerite	OBP	Arcl	ND	506673
OBP-493-1	no.493	quartz	OBP	Arcl	ND	560945
OBP-493-2	no.493	quartz	OBP	Arcl	ND	547852
OBP-493-3	no.493	quartz	OBP	Arcl	ND	552148
OBP-486-1	no.468	white quartzite	OBP	Arcl	ND	549428
OBP-486-2	no.468	white quartzite	OBP	Arcl	ND	555423
OBP-486-3	no.468	white quartzite	OBP	Arcl	ND	566360
OBP-412-1	no.412	chert	OBP	Arcl	ND	528298
OBP-412-2	no.412	chert	OBP	Arcl	ND	534792
OBP-412-3	no.412	chert	OBP	Arcl	ND	538696
OBP-453-1	no.453	quartzite roof sample	OBP	Arcl	ND	582120
OBP-453-2	no.453	quartzite roof sample	OBP	Arcl	ND	540310
OBP-453-3	no.453	quartzite roof sample	OBP	Arcl	ND	560760
OBP-1290-1	no.1290	quartz	OBP	Arcl	ND	680142
OBP-1290-2	no.1290	quartz	OBP	Arcl	ND	679971

OBP-1290-3	no.1290	quartz	OBP	Arcl	ND	681916
OBP-1226-1	no.1226	shale	OBP	Arcl	ND	406751
OBP-1226-2	no.1226	shale	OBP	Arcl	ND	475862
OBP-1226-3	no.1226	shale	OBP	Arcl	ND	451039
OBP-1873-1	no.1873	white quartzite	OBP	Arcl	ND	684522
OBP-1873-2	no.1873	white quartzite	OBP	Arcl	ND	648832
OBP-1873-3	no.1873	white quartzite	OBP	Arcl	ND	656829
OBP-1824-1	no.1824	black quartzite	OBP	Arcl	ND	684932
OBP-1824-2	no.1824	black quartzite	OBP	Arcl	ND	682151
OBP-1824-3	no.1824	black quartzite	OBP	Arcl	ND	685463
OBP-2353-1	no.2353	red quartzite	OBP	Arcl	ND	516314
OBP-2353-2	no.2353	red quartzite	OBP	Arcl	ND	512859
OBP-2353-3	no.2353	red quartzite	OBP	Arcl	ND	509730
OBP-2366-1	no.2366	sandstone	OBP	Arcl	ND	650059
OBP-2366-2	no.2366	sandstone	OBP	Arcl	ND	650359

OBP-2366-3	no.2366	sandstone	OBP	Arcl			ND	649498
OBP-2364-1	no.2364	black quartzite	OBP	Arcl			ND	683820
OBP-2364-2	no.2364	black quartzite	OBP	Arcl			ND	688272
OBP-2364-3	no.2364	black quartzite	OBP	Arcl			ND	691691
OBP-2358-1	no.2358	black quartzite	OBP	Arcl			ND	622962
OBP-2358-2	no.2358	black quartzite	OBP	Arcl			ND	592747
OBP-2358-3	no.2358	black quartzite	OBP	Arcl			ND	586407
OBP-2290-1	no.2290	shale	OBP	Arcl			ND	620350
OBP-2290-2	no.2290	shale	OBP	Arcl			ND	617349
OBP-2290-3	no.2290	shale	OBP	Arcl			ND	608280
OBP-MC1-1	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	543530
OBP-MC1-2	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	552814
OBP-MC1-3	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	505421
OBP-MC1-4	MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	530281
OBP-MC2-1	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	556278

OBP-MC2-2	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	583804
OBP-MC2-3	MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	554383
OBP-MC3-1	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	611620
OBP-MC3-2	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	637401
OBP-MC3-3	MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	ND	586995
OBP-CMF1-1	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	ND	558404
OBP-CMF1-2	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	ND	648922
OBP-CMF1-3	CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	ND	621508
OBP-CMF2-1	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	ND	605377
OBP-CMF2-2	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	ND	588218
OBP-CMF2-3	CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	ND	580081
OBP-BPC1A-1	BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	559964
OBP-BPC1A-2	BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	565252
OBP-BPC1A-3	BPC1A	redquartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	562534
OBP-BPC1B-1	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	549794

OBP-BPC1B-2	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	552750
OBP-BPC1B-3	BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	538436
OBP-BPC1C-1	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	556743
OBP-BPC1C-2	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	550793
OBP-BPC1C-3	BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	533555
OBP-BPC1D-1	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	562967
OBP-BPC1D-2	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	581184
OBP-BPC1D-3	BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	544385
OBP-BPC1E-1	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	568078
OBP-BPC1E-2	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	555544
OBP-BPC1E-3	BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	ND	558348
OBP-BPC1F-1	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	626144
OBP-BPC1F-2	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	610466
OBP-BPC1F-3	BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	ND	604936
OBP-BB1-1	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	ND	544819

OBP-BB1-2	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	ND	543036
OBP-BB1-3	BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	ND	558951
OBP-OBP1-1	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	ND	720665
OBP-OBP1-2	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	ND	722729
OBP-OBP1-3	OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	ND	745852
OBP-OBP2-1	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	ND	619532
OBP-OBP2-2	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	ND	631029
OBP-OBP2-3	OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	ND	657945
OBP-OBP3A-1	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	588808
OBP-OBP3A-2	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	623867
OBP-OBP3A-3	OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	626601
OBP-OBP3B-1	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	635214
OBP-OBP3B-2	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	547389
OBP-OBP3B-3	OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	603879
OBP-OBP3C-1	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	637015

OBP-OBP3C-2	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	633127
OBP-OBP3C-3	OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	ND	601373
OBP-OBP3D-1	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	70	ND
OBP-OBP3D-2	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	81	ND
OBP-OBP3D-3	OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	51	146368
OBP-OBP4A-1	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	606645
OBP-OBP4A-2	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	591177
OBP-OBP4A-3	OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	591664
OBP-OBP4B-1	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	670342
OBP-OBP4B-2	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	539359
OBP-OBP4B-3	OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	529370
OBP-OBP4C-1	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	550899
OBP-OBP4C-2	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	593857
OBP-OBP4C-3	OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	556642
OBP-OBP4D-1	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	513439

OBP-OBP4D-2	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	530421
OBP-OBP4D-3	OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	531571
OBP-OBP4E-1	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	532982
OBP-OBP4E-2	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	534601
OBP-OBP4E-3	OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	706164
OBP-OBP4F-1	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	535323
OBP-OBP4F-2	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	555881
OBP-OBP4F-3	OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	622870
OBP-OBP4G-1	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	491296
OBP-OBP4G-2	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	519981
OBP-OBP4G-3	OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	ND	502520
OBP-OBP5A-1	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	468187
OBP-OBP5A-2	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	511946
OBP-OBP5A-3	OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	529729
OBP-OBP5B-1	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	536916

OBP-OBP5B-2	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	566524
OBP-OBP5B-3	OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	570791
OBP-OBP5C-1	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	524136
OBP-OBP5C-2	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	604387
OBP-OBP5C-3	OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	510549
OBP-OBP5D-1	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	412472
OBP-OBP5D-2	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	424180
OBP-OBP5D-3	OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	517265
OBP-OBP5E-1	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	464112
OBP-OBP5E-2	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	462512
OBP-OBP5E-3	OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	476342
OBP-OBP5F-1	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND
OBP-OBP5F-2	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND
OBP-OBP5F-3	OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	ND	ND
OBP-OBP6A-1	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	533125

OBP-OBP6A-2	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	532681
OBP-OBP6A-3	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	531943
OBP-OBP6A-4	OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	529288
OBP-OBP6B-1	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	587664
OBP-OBP6B-2	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	608744
OBP-OBP6B-3	OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	647665
OBP-OBP6C-1	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	520008
OBP-OBP6C-2	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	755453
OBP-OBP6C-3	OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	627625
OBP-OBP6D-1	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	559982
OBP-OBP6D-2	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	557994
OBP-OBP6D-3	OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	628348
OBP-OBP6E-1	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	519615
OBP-OBP6E-2	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	480156
OBP-OBP6E-3	OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	480256

OBP-OBP6F-1	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	532213
OBP-OBP6F-2	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	537171
OBP-OBP6F-3	OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	537921
OBP-OBP7-1	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	539353
OBP-OBP7-2	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	542505
OBP-OBP7-3	OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	ND	555888
OBP-OBP8A-1	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	673990
OBP-OBP8A-2	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	601305
OBP-OBP8A-3	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	570201
OBP-OBP8A-4	OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	568405
OBP-OBP8B-1	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	620062
OBP-OBP8B-2	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	618036
OBP-OBP8B-3	OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	623259
OBP-OBP8C-1	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	609885
OBP-OBP8C-2	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	633646

OBP-OBP8C-3	OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	ND	586531
OBP-OBP9A-1	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	584471
OBP-OBP9A-2	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	638092
OBP-OBP9A-3	OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	616027
OBP-OBP9B-1	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	590910
OBP-OBP9B-2	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	564719
OBP-OBP9B-3	OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	ND	547693
OBP-OBP10A-1	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	503588
OBP-OBP10A-2	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	480222
OBP-OBP10A-3	OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	ND	596583
OBP-OBP10B-1	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	ND	608065
OBP-OBP10B-2	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	4	640733
OBP-OBP10B-3	OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	4	611438
OBP-OBP10C-1	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	531759
OBP-OBP10C-2	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	532257

OBP-OBP10C-3	OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	559828
OBP-OBP10D-1	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	ND	501439
OBP-OBP10D-2	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	ND	531233
OBP-OBP10D-3	OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	ND	590401
OBP-OBP10E-1	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	534609
OBP-OBP10E-2	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	536960
OBP-OBP10E-3	OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	622287
OBP-OBP10F-1	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	502100
OBP-OBP10F-2	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	525709
OBP-OBP10F-3	OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	ND	515407

Table B2: PXRF spreadsheet of Mwulu's Cave lithic and outcrop samples. Concentrations of major elements Mg, Al, Si, P, S, K, Ca, Ti, and Fe are measured in weight percentage while the rest of the elements' concentrations are measured in ppm.

Analysis ID	Sample ID	Rock Type	Location	Geo/Arcl Piece?	Latitude (°)	Longitude (°)	Mg	Al	Si	P	S	K	Ca	Ti
MW-187-1	no.187	quartzite black	Mwulu's Cave	Arcl			ND	2,2815	45,7183	0,2435	ND	0,3002	ND	0,0726
MW-187-2	no.187	quartzite black	Mwulu's Cave	Arcl			ND	2,3285	45,4885	0,2429	ND	0,3031	ND	0,0676
MW-187-3	no.187	quartzite black	Mwulu's Cave	Arcl			ND	2,305	45,5546	0,2402	ND	0,2941	ND	0,083
MW-194-1	no.194	quartzite white	Mwulu's Cave	Arcl			ND	3,5282	42,1927	0,2748	ND	2,1485	ND	0,0832
MW-194-2	no.194	quartzite white	Mwulu's Cave	Arcl			ND	3,5585	43,3134	0,2728	0,0063	2,1376	ND	0,0724
MW-194-3	no.194	quartzite white	Mwulu's Cave	Arcl			ND	3,5163	43,2805	0,2647	0,0041	2,1227	ND	0,0787
MW-194-4	no.194	quartzite white	Mwulu's Cave	Arcl			ND	3,4629	43,2741	0,2614	ND	2,1128	ND	0,086
MW-195-1	no.195	quartz	Mwulu's Cave	Arcl			ND	1,5534	40,1317	0,2162	0,0089	ND	ND	0,0274
MW-195-2	no.195	quartz	Mwulu's Cave	Arcl			ND	1,8646	44,2631	0,2259	0,0116	ND	0,1668	0,0377
MW-195-3	no.195	quartz	Mwulu's Cave	Arcl			ND	1,7348	43,0483	0,2186	0,0132	ND	0,1783	0,024
MW-203-1	no.203	quartzite white	Mwulu's Cave	Arcl			ND	4,8493	38,2873	0,5351	0,0142	0,276	ND	0,1506
MW-203-2	no.203	quartzite white	Mwulu's Cave	Arcl			ND	4,7968	37,7554	0,5373	0,0128	0,2762	ND	0,1425
MW-203-3	no.203	quartzite white	Mwulu's Cave	Arcl			ND	6,319	32,0354	0,6451	0,0199	0,6144	ND	0,2455
MW-PALO49-1	PALO49	chert	Mwulu's Cave	Arcl			ND	6,1249	31,5316	0,4366	0,0309	0,9874	ND	0,1806
MW-PALO49-2	PALO49	chert	Mwulu's Cave	Arcl			ND	4,6933	25,8431	0,3471	0,0819	0,79	1,1369	0,1816
MW-PALO49-3	PALO49	chert	Mwulu's Cave	Arcl			ND	5,1247	27,0906	0,3842	0,0859	0,9311	1,1627	0,2052
MW-473-1	no.473	quartzite black	Mwulu's Cave	Arcl			ND	2,5494	47,6295	0,2342	ND	0,0441	ND	0,0416
MW-473-2	no.473	quartzite black	Mwulu's Cave	Arcl			ND	2,6361	47,6804	0,2329	ND	0,0319	ND	0,0459
MW-473-3	no.473	quartzite black	Mwulu's Cave	Arcl			ND	2,5542	47,3679	0,2288	ND	0,0375	ND	0,0457
MW-640-1	no.640	quartzite white	Mwulu's Cave	Arcl			ND	2,1229	38,5136	0,2645	0,0096	0,2156	ND	0,0718
MW-640-2	no.640	quartzite white	Mwulu's Cave	Arcl			ND	2,0856	38,2305	0,2588	0,0069	0,2152	ND	0,0709
MW-640-3	no.640	quartzite white	Mwulu's Cave	Arcl			ND	2,3167	37,6813	0,3076	0,0151	0,3091	ND	0,0616
MW-792-1	no.792	quartzite black	Mwulu's Cave	Arcl			ND	6,9183	26,8146	0,2506	ND	1,4458	ND	0,3331
MW-792-2	no.792	quartzite black	Mwulu's Cave	Arcl			ND	6,8934	26,6148	0,2518	ND	1,4629	ND	0,3335
MW-792-3	no.792	quartzite black	Mwulu's Cave	Arcl			ND	6,4341	29,1167	0,2136	ND	1,5306	ND	0,3135
MW-794-1	no.794	quartzite black	Mwulu's Cave	Arcl			ND	5,3896	34,1481	0,1903	0,0055	0,4943	ND	0,12

MW-794-2	no.794	quartzite black	Mwulu's Cave	Arcl			ND	5,3274	34,0633	0,1869	0,0059	0,4808	ND	0,1222
MW-794-3	no.794	quartzite black	Mwulu's Cave	Arcl			ND	4,9307	35,0768	0,1617	0,0082	0,4403	ND	0,089
MW-799-1	no.799	quartzite black	Mwulu's Cave	Arcl			ND	6,5984	33,7698	0,6306	0,0206	0,5965	ND	0,1034
MW-799-2	no.799	quartzite black	Mwulu's Cave	Arcl			ND	6,5948	33,9998	0,6342	0,0204	0,6063	ND	0,0958
MW-799-3	no.799	quartzite black	Mwulu's Cave	Arcl			ND	6,5476	33,7008	0,6241	0,0239	0,6056	ND	0,1073
MW-672-1	no.672	quartzite black	Mwulu's Cave	Arcl			ND	4,2329	35,4291	0,4017	ND	0,9353	ND	0,0904
MW-672-2	no.672	quartzite black	Mwulu's Cave	Arcl			ND	4,2453	36,7077	0,4125	0,0057	0,8483	ND	0,0814
MW-672-3	no.672	quartzite black	Mwulu's Cave	Arcl			ND	4,2699	36,7362	0,4246	0,0054	0,8425	ND	0,0866
MW-673-1	no.673	quartzite white	Mwulu's Cave	Arcl			ND	2,9144	41,9799	0,3458	0,0057	1,3487	ND	0,1165
MW-673-2	no.673	quartzite white	Mwulu's Cave	Arcl			ND	2,7409	40,5951	0,3223	ND	1,3377	ND	0,1168
MW-673-3	no.673	quartzite white	Mwulu's Cave	Arcl			ND	2,8509	41,1962	0,3433	ND	1,3518	ND	0,1137
MW-673-4	no.673	quartzite white	Mwulu's Cave	Arcl			ND	2,761	40,2389	0,3371	ND	1,3331	ND	0,1185
MW-674-1	no.674	chert	Mwulu's Cave	Arcl			ND	5,1989	32,8521	0,587	0,0113	0,3865	ND	0,1248
MW-674-2	no.674	chert	Mwulu's Cave	Arcl			ND	4,8089	35,8914	0,5212	0,017	0,3666	ND	0,1324
MW-674-3	no.674	chert	Mwulu's Cave	Arcl			ND	3,4629	37,3777	0,3933	0,0063	0,1491	ND	0,0769
MW-676-1	no.676	quartzite white	Mwulu's Cave	Arcl			ND	3,1035	40,7123	0,4461	0,0155	0,0853	ND	0,0915
MW-676-2	no.676	quartzite white	Mwulu's Cave	Arcl			ND	3,0946	40,7368	0,4495	0,0166	0,0885	ND	0,0845
MW-676-3	no.676	quartzite white	Mwulu's Cave	Arcl			ND	3,0756	40,8531	0,449	0,0119	0,0892	ND	0,087
MW-677-1	no.677	quartzite white	Mwulu's Cave	Arcl			ND	2,1892	42,8606	0,3451	0,0155	ND	ND	0,0754
MW-677-2	no.677	quartzite white	Mwulu's Cave	Arcl			ND	2,2315	42,5749	0,3213	0,0185	ND	ND	0,0775
MW-677-3	no.677	quartzite white	Mwulu's Cave	Arcl			ND	2,1862	42,8006	0,3225	0,0173	ND	ND	0,0824
MW-684-1	no.684	quartzite black	Mwulu's Cave	Arcl			ND	3,1339	37,1977	0,4857	ND	0,1854	ND	0,1126
MW-684-2	no.684	quartzite black	Mwulu's Cave	Arcl			ND	3,0711	37,2178	0,4774	ND	0,1845	ND	0,1197
MW-684-3	no.684	quartzite black	Mwulu's Cave	Arcl			ND	3,1557	39,6583	0,4161	0,0071	0,1244	ND	0,0957
MW-836-1	no.836	quartzite black	Mwulu's Cave	Arcl			ND	7,0554	24,5353	0,4867	0,0134	1,1103	ND	0,3945
MW-836-2	no.836	quartzite black	Mwulu's Cave	Arcl			ND	7,19	24,9029	0,4868	0,0162	1,1295	ND	0,4161
MW-836-3	no.836	quartzite black	Mwulu's Cave	Arcl			ND	7,0901	25,0507	0,4954	0,0156	1,1475	ND	0,3995
MW-837-1	no.837	quartzite black	Mwulu's Cave	Arcl			ND	2,3605	39,1318	0,1756	ND	0,0837	ND	0,08
MW-837-2	no.837	quartzite black	Mwulu's Cave	Arcl			ND	2,4105	40,4979	0,1873	ND	0,0834	ND	0,0943
MW-837-3	no.837	quartzite black	Mwulu's Cave	Arcl			ND	2,3609	39,0406	0,1825	ND	0,0962	ND	0,0853
MW-PA1-1	PA-1	quartzite black	Mwulu's Cave	Arcl			ND	4,7658	35,9055	0,3978	0,004	1,7127	ND	0,216

MW-PA1-2	PA-1	quartzite black	Mwulu's Cave	Arcl			ND	4,7928	36,1471	0,4043	0,0058	1,7246	ND	0,215
MW-PA1-3	PA-1	quartzite black	Mwulu's Cave	Arcl			ND	4,9352	35,6896	0,4212	0,0058	1,7321	ND	0,2352
MW-PA2-1	PA-2	quartz	Mwulu's Cave	Arcl			ND	2,7773	45,8572	0,5903	ND	ND	ND	0,0561
MW-PA2-2	PA-2	quartz	Mwulu's Cave	Arcl			ND	2,7865	45,9013	0,5961	ND	ND	ND	0,0629
MW-PA2-3	PA-2	quartz	Mwulu's Cave	Arcl			ND	2,8351	45,7456	0,5972	ND	ND	ND	0,0435
MW-1021-1	no.1021	quartzite white	Mwulu's Cave	Arcl			ND	1,9078	43,3263	0,2303	0,0051	0,1635	ND	0,0706
MW-1021-2	no.1021	quartzite white	Mwulu's Cave	Arcl			ND	1,9024	43,4833	0,2366	ND	0,1607	ND	0,0802
MW-1021-3	no.1021	quartzite white	Mwulu's Cave	Arcl			ND	1,9018	43,4142	0,2257	ND	0,1695	ND	0,0797
MW-1024-1	no.1024	quartzite white	Mwulu's Cave	Arcl			ND	1,5126	40,9124	0,2805	ND	0,0188	ND	0,0367
MW-1024-2	no.1024	quartzite white	Mwulu's Cave	Arcl			ND	1,4802	41,2905	0,293	ND	0,0182	ND	0,0303
MW-1024-3	no.1024	quartzite white	Mwulu's Cave	Arcl			ND	1,4574	40,6139	0,2797	ND	0,0159	ND	0,0346
MW-1240-1	no.1240	shale	Mwulu's Cave	Arcl			ND	4,017	37,4185	0,5489	0,0097	1,0234	ND	0,1183
MW-1240-2	no.1240	shale	Mwulu's Cave	Arcl			ND	4,305	40,3844	0,5998	0,0119	1,0957	ND	0,1233
MW-1240-3	no.1240	shale	Mwulu's Cave	Arcl			ND	4,3736	39,9174	0,6001	0,0127	1,0249	ND	0,1251
MW-1410-1	no.1410	quartzite white	Mwulu's Cave	Arcl			ND	3,3752	37,5357	0,386	ND	0,5516	ND	0,1789
MW-1410-2	no.1410	quartzite white	Mwulu's Cave	Arcl			ND	3,4448	37,4324	0,3874	ND	0,5443	ND	0,1728
MW-1410-3	no.1410	quartzite white	Mwulu's Cave	Arcl			ND	2,4102	40,1443	0,1717	ND	0,4039	ND	0,154
MW-1818-1	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	0,2987	47,2936	0,3111	ND	ND	ND	ND
MW-1818-2	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	0,2804	47,2989	0,2879	ND	ND	ND	0,0162
MW-1818-3	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	0,2891	46,6034	0,3007	ND	ND	ND	0,0215
MW-1835-1	no.1835	quartz	Mwulu's Cave	Arcl			ND	0,6622	45,2616	0,2826	ND	ND	ND	0,0278
MW-1835-2	no.1835	quartz	Mwulu's Cave	Arcl			ND	0,6447	44,7191	0,2862	ND	ND	ND	0,0382
MW-1835-3	no.1835	quartz	Mwulu's Cave	Arcl			ND	0,6369	44,4692	0,2854	ND	ND	ND	0,0332
MW-2133-1	no.2133	quartzite black	Mwulu's Cave	Arcl			ND	1,2214	38,0938	1,8657	ND	0,5189	ND	0,1759
MW-2133-2	no.2133	quartzite black	Mwulu's Cave	Arcl			ND	1,2145	38,2591	1,8845	ND	0,52	ND	0,1628
MW-2133-3	no.2133	quartzite black	Mwulu's Cave	Arcl			ND	1,2496	38,1529	1,8612	ND	0,5188	ND	0,1578
MW-2034-1	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	1,8189	38,3852	0,8477	ND	0,18	ND	0,2138
MW-2034-2	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	1,7947	38,4463	0,8583	ND	0,1776	ND	0,2244
MW-2034-3	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	1,8404	38,3884	0,8633	ND	0,1814	ND	0,2206
MW-2070-1	no.2070	quartzite white	Mwulu's Cave	Arcl			ND	0,4969	40,9795	0,2157	0,0328	ND	0,7749	0,0614
MW-2070-2	no.2070	quartzite white	Mwulu's Cave	Arcl			ND	0,3689	45,686	0,1527	ND	ND	ND	0,0821

MW-2070-3	no.2070	quartzite white	Mwulu's Cave	Arcl			ND	0,284	46,0004	0,1539	ND	ND	ND	0,081
MW-2073-1	no.2073	quartz	Mwulu's Cave	Arcl			ND	0,5413	46,1669	0,2803	ND	ND	ND	0,0174
MW-2073-2	no.2073	quartz	Mwulu's Cave	Arcl			ND	0,5476	46,2436	0,2807	ND	ND	ND	ND
MW-2073-3	no.2073	quartz	Mwulu's Cave	Arcl			ND	0,548	46,9354	0,2857	ND	ND	ND	ND
MW-2073-4	no.2073	quartz	Mwulu's Cave	Arcl			ND	0,5381	46,5025	0,2862	ND	ND	ND	ND
MW-PA3-1	PA-3	shale	Mwulu's Cave	Arcl			ND	4,2144	36,1569	3,0856	0,0137	2,2926	ND	0,1212
MW-PA3-2	PA-3	shale	Mwulu's Cave	Arcl			ND	4,1406	36,1736	3,068	0,0129	2,2866	ND	0,1228
MW-PA3-3	PA-3	shale	Mwulu's Cave	Arcl			ND	4,2119	36,3425	3,1211	0,0129	2,2886	ND	0,1162
MW-PA4-1	PA-4	quartzite white	Mwulu's Cave	Arcl			ND	9,436	27,684	1,6313	0,4756	0,7258	ND	0,22
MW-PA4-2	PA-4	quartzite white	Mwulu's Cave	Arcl			ND	7,7913	25,2712	1,3626	0,3264	0,6822	ND	0,1992
MW-PA4-3	PA-4	quartzite white	Mwulu's Cave	Arcl			ND	7,638	25,1119	1,3654	0,4295	0,673	0,2346	0,2023
MW-PA5-1	PA-5	quartz	Mwulu's Cave	Arcl			ND	2,5672	39,085	1,1448	0,0112	0,0775	ND	0,0452
MW-PA5-2	PA-5	quartz	Mwulu's Cave	Arcl			ND	2,5837	39,3533	1,1414	0,0085	0,0716	ND	0,0508
MW-PA5-3	PA-5	quartz	Mwulu's Cave	Arcl			ND	2,6071	39,4637	1,1293	0,0085	0,067	ND	0,0568
MW-PA6-1	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	1,0533	42,6995	0,7559	ND	ND	ND	0,0275
MW-PA6-2	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	1,1032	42,9489	0,7785	ND	ND	ND	0,0308
MW-PA6-3	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	1,0946	43,0263	0,7703	ND	ND	ND	0,024
MW-PA7-1	PA-7	quartzite white	Mwulu's Cave	Arcl			ND	0,6485	45,2901	0,4453	ND	ND	ND	0,0456
MW-PA7-2	PA-7	quartzite white	Mwulu's Cave	Arcl			ND	0,6523	45,1948	0,4408	ND	ND	ND	0,0448
MW-PA7-3	PA-7	quartzite white	Mwulu's Cave	Arcl			ND	0,6793	47,2918	0,4479	ND	ND	ND	0,0507
MW-PA8-1	PA-8	quartz	Mwulu's Cave	Arcl			ND	0,6559	46,5521	1,2165	ND	ND	ND	0,0605
MW-PA8-2	PA-8	quartz	Mwulu's Cave	Arcl			ND	0,6442	46,7661	1,2263	ND	ND	ND	0,0706
MW-PA8-3	PA-8	quartz	Mwulu's Cave	Arcl			ND	0,6281	46,6057	1,2246	ND	ND	ND	0,0625
MW-PA9-1	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	0,9394	48,4586	0,708	ND	ND	ND	0,0413
MW-PA9-2	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	0,9236	46,5191	0,6805	ND	ND	ND	0,0452
MW-PA9-3	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	0,9961	47,308	0,6878	ND	ND	ND	0,0397
MW-PA10-1	PA-10	quartz	Mwulu's Cave	Arcl			ND	2,0444	37,4465	2,5653	ND	ND	ND	0,0503
MW-PA10-2	PA-10	quartz	Mwulu's Cave	Arcl			ND	2,0848	37,5149	2,5787	ND	ND	ND	0,0451
MW-PA10-3	PA-10	quartz	Mwulu's Cave	Arcl			ND	2,0533	37,8039	2,5749	ND	ND	ND	0,0498
MW-PA11-1	PA-11	altered	Mwulu's Cave	Arcl			ND	6,4451	29,1096	2,0834	0,047	0,8132	1,8501	0,7732
MW-PA11-2	PA-11	altered	Mwulu's Cave	Arcl			ND	6,504	29,2922	2,0893	0,0453	0,8269	1,8591	0,7658

MW-PA11-3	PA-11	altered	Mwulu's Cave	Arcl			ND	6,4083	29,2823	2,0871	0,0448	0,8188	1,8542	0,7468
MW-PA12-1	PA-12	shale	Mwulu's Cave	Arcl			ND	5,182	38,0871	3,1456	0,018	1,0958	ND	0,0827
MW-PA12-2	PA-12	shale	Mwulu's Cave	Arcl			ND	5,251	38,2655	3,1752	0,0185	1,0818	ND	0,0862
MW-PA12-3	PA-12	shale	Mwulu's Cave	Arcl			ND	5,2768	38,0528	3,2077	0,0221	1,0726	ND	0,0739
MW-PA13-1	PA-13	shale	Mwulu's Cave	Arcl			ND	1,9581	42,6607	1,3124	ND	ND	ND	0,0499
MW-PA13-2	PA-13	shale	Mwulu's Cave	Arcl			ND	2,175	41,5733	1,4597	0,0053	ND	ND	0,0655
MW-PA13-3	PA-13	shale	Mwulu's Cave	Arcl			ND	2,1977	40,8949	1,453	0,0069	ND	ND	0,0668
MW-PA14-1	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	1,3678	44,0734	0,5662	ND	0,09	ND	0,0197
MW-PA14-2	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	1,3372	43,6495	0,5544	ND	0,0734	ND	0,019
MW-PA14-3	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	1,3396	43,2129	0,5622	ND	0,0803	ND	0,0159
MW-PA15-1	PA-15	quartzite white	Mwulu's Cave	Arcl			ND	3,228	38,3519	1,2652	ND	0,2815	ND	0,1494
MW-PA15-2	PA-15	quartzite white	Mwulu's Cave	Arcl			ND	3,4387	38,7995	1,3363	ND	0,2851	ND	0,1471
MW-PA15-3	PA-15	quartzite white	Mwulu's Cave	Arcl			ND	3,2656	37,1949	1,2484	ND	0,2751	ND	0,1584
MW-PA16-1	PA-16	quartzite white	Mwulu's Cave	Arcl			ND	2,3441	43,2636	1,4202	ND	0,2248	ND	0,1382
MW-PA16-2	PA-16	quartzite white	Mwulu's Cave	Arcl			ND	2,3158	44,2386	1,4333	ND	0,2218	ND	0,1356
MW-PA16-3	PA-16	quartzite white	Mwulu's Cave	Arcl			ND	2,3079	43,9779	1,4133	ND	0,2219	ND	0,1193
MW-M1-E-1	M1-E	altered	Mwulu's Cave	Arcl			ND	1,6291	35,657	0,2448	0,0268	0,0635	ND	0,4511
MW-M1-E-2	M1-E	altered	Mwulu's Cave	Arcl			ND	1,6198	36,1123	0,2522	0,0268	0,0737	ND	0,4579
MW-M1-E-3	M1-E	altered	Mwulu's Cave	Arcl			ND	1,6477	36,1882	0,2465	0,0259	0,067	ND	0,4497
MW-M1-G-1	M1-G	altered	Mwulu's Cave	Arcl			4153	4,7819	9,7486	8,343	0,1964	0,3739	0,3115	1,2203
MW-M1-G-2	M1-G	altered	Mwulu's Cave	Arcl			ND	4,7675	9,7365	8,3167	0,1989	0,3721	0,2959	1,2304
MW-M1-G-3	M1-G	altered	Mwulu's Cave	Arcl			ND	4,8387	10,0007	8,5349	0,2048	0,3764	0,3071	1,2384
MW-M1-K-1	M1-K	chert	Mwulu's Cave	Arcl			ND	0,2494	44,5518	0,0744	0,1336	ND	ND	0,0194
MW-M1-K-2	M1-K	chert	Mwulu's Cave	Arcl			ND	0,2612	44,4085	0,0787	0,1369	ND	ND	ND
MW-M1-K-3	M1-K	chert	Mwulu's Cave	Arcl			ND	0,3042	44,8419	0,0812	0,132	ND	ND	ND
MW-M1-J-1	M1-J	quartzite black	Mwulu's Cave	Arcl			ND	1,5196	40,1091	0,192	0,0989	0,4128	ND	0,0639
MW-M1-J-2	M1-J	quartzite black	Mwulu's Cave	Arcl			ND	1,5434	41,3121	0,1943	0,0988	0,4278	ND	0,0601
MW-M1-J-3	M1-J	quartzite black	Mwulu's Cave	Arcl			ND	1,5585	39,2979	0,0779	0,0775	0,4908	ND	0,0478
MW-M2-B-1	M2-B	altered	Mwulu's Cave	Arcl			ND	4,0645	35,2523	0,2861	0,0249	0,461	ND	0,5013
MW-M2-B-2	M2-B	altered	Mwulu's Cave	Arcl			ND	4,2154	36,2271	0,3001	0,0282	0,4808	ND	0,506
MW-M2-B-3	M2-B	altered	Mwulu's Cave	Arcl			ND	4,1013	35,5895	0,2917	0,0266	0,4717	ND	0,5082

MW-M2-C-1	M2-C	altered	Mwulu's Cave	Arcl			5095	9,2449	29,9992	0,5216	0,0973	2,9219	ND	0,5182
MW-M2-C-2	M2-C	altered	Mwulu's Cave	Arcl			4972	9,1397	29,8905	0,5172	0,0963	2,9033	ND	0,5296
MW-M2-C-3	M2-C	altered	Mwulu's Cave	Arcl			4296	9,2016	30,0901	0,5209	0,0947	2,9155	ND	0,5252
MW-M3-B-1	M3-B	shale	Mwulu's Cave	Arcl			ND	5,981	34,1461	0,7693	0,1327	0,4766	ND	0,268
MW-M3-B-2	M3-B	shale	Mwulu's Cave	Arcl			ND	6,0441	34,2931	0,7738	0,1307	0,4725	ND	0,2672
MW-M3-B-3	M3-B	shale	Mwulu's Cave	Arcl			ND	6,0903	34,2387	0,7829	0,1289	0,4729	ND	0,2765
MW-M3-E-1	M3-E	shale	Mwulu's Cave	Arcl			ND	2,9405	40,7992	0,0699	0,0762	1,4391	ND	0,0556
MW-M3-E-2	M3-E	shale	Mwulu's Cave	Arcl			ND	2,8605	40,3451	0,0753	0,074	1,4191	ND	0,0375
MW-M3-E-3	M3-E	shale	Mwulu's Cave	Arcl			ND	2,9421	40,6822	0,0835	0,0734	1,4208	ND	0,0505
MW-M3-F-1	M3-F	shale	Mwulu's Cave	Arcl			ND	4,5488	37,6037	0,8283	0,2656	0,0684	ND	0,0604
MW-M3-F-2	M3-F	shale	Mwulu's Cave	Arcl			ND	4,6943	36,9745	0,8827	0,253	0,0708	ND	0,0555
MW-M3-F-3	M3-F	shale	Mwulu's Cave	Arcl			ND	4,691	38,7439	0,8401	0,2452	0,0591	ND	0,0505
MW-1699-1	no.1699	quartzite white	Mwulu's Cave	Arcl			ND	7,0581	29,1479	1,0753	0,0043	0,4924	ND	0,2308
MW-1699-2	no.1699	quartzite white	Mwulu's Cave	Arcl			ND	7,0623	28,7443	1,0549	0,006	0,4888	ND	0,2217
MW-1699-3	no.1699	quartzite white	Mwulu's Cave	Arcl			ND	6,97	28,793	1,0543	ND	0,4917	ND	0,2321
MW-1679-1	no.1679	quartzite white	Mwulu's Cave	Arcl			ND	1,8882	28,188	2,3477	ND	0,883	ND	0,1833
MW-1679-2	no.1679	quartzite white	Mwulu's Cave	Arcl			ND	2,5026	25,3657	2,3043	ND	1,1872	ND	0,3746
MW-1679-3	no.1679	quartzite white	Mwulu's Cave	Arcl			ND	2,4733	25,6637	2,3535	ND	1,2688	ND	0,3856
MW-1815-1	no.1815	quartzite white	Mwulu's Cave	Arcl			ND	0,5381	41,5257	0,2953	ND	ND	ND	0,0465
MW-1815-2	no.1815	quartzite white	Mwulu's Cave	Arcl			ND	0,5552	41,3781	0,2958	ND	ND	ND	0,0395
MW-1815-3	no.1815	quartzite white	Mwulu's Cave	Arcl			ND	0,4988	41,4399	0,2932	ND	ND	ND	0,0349
MW-1826-1	no.1826	quartzite white	Mwulu's Cave	Arcl			ND	0,4119	42,3267	0,1222	ND	ND	ND	0,0396
MW-1826-2	no.1826	quartzite white	Mwulu's Cave	Arcl			ND	0,3414	41,2517	0,1251	ND	ND	ND	0,0223
MW-1826-3	no.1826	quartzite white	Mwulu's Cave	Arcl			ND	0,3537	40,9191	0,1286	ND	ND	ND	0,0326
MW-1839-1	no.1839	quartz	Mwulu's Cave	Arcl			ND	2,4015	40,7552	0,6508	ND	0,2712	ND	0,1107
MW-1839-2	no.1839	quartz	Mwulu's Cave	Arcl			ND	2,3955	40,8876	0,6488	ND	0,2668	ND	0,1158
MW-1839-3	no.1839	quartz	Mwulu's Cave	Arcl			ND	1,5853	40,2483	0,5021	ND	0,0434	ND	0,0844
MW-2118-1	no.2118	quartzite white	Mwulu's Cave	Arcl			ND	2,9712	30,2288	1,5895	ND	1,3371	ND	0,3969
MW-2118-2	no.2118	quartzite white	Mwulu's Cave	Arcl			ND	3,0682	30,3118	1,6459	ND	1,3763	ND	0,3999
MW-2118-3	no.2118	quartzite white	Mwulu's Cave	Arcl			ND	0,7604	41,2074	0,2837	ND	0,0179	ND	0,073
MW-2130-1	no.2130	quartzite black	Mwulu's Cave	Arcl			ND	2,326	32,4594	0,7804	ND	0,3869	ND	0,1526

MW-2130-2	no.2130	quartzite black	Mwulu's Cave	Arcl			ND	0,9204	31,2683	1,2313	ND	0,4856	ND	0,1816
MW-2130-3	no.2130	quartzite black	Mwulu's Cave	Arcl			ND	1,0645	31,3575	1,2792	ND	0,493	ND	0,1827
MW-2134-1	no.2134	quartzite white	Mwulu's Cave	Arcl			ND	0,9247	38,4552	0,5512	ND	0,0881	ND	0,1096
MW-2134-2	no.2134	quartzite white	Mwulu's Cave	Arcl			ND	3,6768	34,5979	0,7535	ND	0,3932	ND	0,1761
MW-2134-3	no.2134	quartzite white	Mwulu's Cave	Arcl			ND	3,7289	34,9995	0,7692	ND	0,3905	ND	0,175
MW-2132-1	no.2132	quartz	Mwulu's Cave	Arcl			ND	2,358	40,563	0,3785	ND	0,0955	ND	0,0795
MW-2132-2	no.2132	quartz	Mwulu's Cave	Arcl			ND	2,3632	40,6771	0,3766	ND	0,0947	ND	0,086
MW-2132-3	no.2132	quartz	Mwulu's Cave	Arcl			ND	1,8409	27,3567	1,6908	ND	0,9765	ND	0,2909
MW-2135-1	no.2135	quartzite white	Mwulu's Cave	Arcl			ND	2,1768	31,3122	2,4759	ND	1,0839	ND	0,3557
MW-2135-2	no.2135	quartzite white	Mwulu's Cave	Arcl			ND	1,3612	40,3636	0,3683	ND	0,0711	ND	0,1144
MW-2135-3	no.2135	quartzite white	Mwulu's Cave	Arcl			ND	1,549	34,3908	1,337	ND	0,5455	ND	0,262
MW-2024-1	no.2024	quartzite white	Mwulu's Cave	Arcl			ND	2,0251	35,4248	0,835	ND	0,3992	ND	0,1308
MW-2024-2	no.2024	quartzite white	Mwulu's Cave	Arcl			ND	3,9407	27,7495	1,8609	ND	1,2083	ND	0,3461
MW-2024-3	no.2024	quartzite white	Mwulu's Cave	Arcl			ND	2,1025	32,4666	0,7962	ND	0,4552	ND	0,1397
MW-2026-1	no.2026	shale	Mwulu's Cave	Arcl			ND	4,0581	31,8852	4,8279	ND	1,4029	ND	0,1094
MW-2026-2	no.2026	shale	Mwulu's Cave	Arcl			ND	3,7796	35,3178	2,5269	ND	1,4871	ND	0,0949
MW-2026-3	no.2026	shale	Mwulu's Cave	Arcl			ND	3,1162	25,9135	1,5024	ND	1,3995	ND	0,2715
MW-2038-1	no.2038	quartzite white	Mwulu's Cave	Arcl			ND	2,911	27,115	1,0725	ND	0,3671	ND	0,1934
MW-2038-2	no.2038	quartzite white	Mwulu's Cave	Arcl			ND	2,6405	31,624	2,0975	ND	0,6799	ND	0,2045
MW-2038-3	no.2038	quartzite white	Mwulu's Cave	Arcl			ND	3,4636	32,3776	1,2892	ND	0,4079	ND	0,1996
MW-2080-1	no.2080	quartzite white	Mwulu's Cave	Arcl			ND	2,3909	31,1627	1,3932	ND	0,5804	ND	0,2457
MW-2080-2	no.2080	quartzite white	Mwulu's Cave	Arcl			ND	2,1195	29,3285	1,3232	ND	0,5805	ND	0,1879
MW-2080-3	no.2080	quartzite white	Mwulu's Cave	Arcl			ND	2,3069	32,5152	1,4558	ND	0,5383	ND	0,2404
MW-M1-A-1	M1-A	quartzite white	Mwulu's Cave	Arcl			ND	0,2111	42,7142	ND	0,1658	0,1345	ND	0,0272
MW-M1-A-2	M1-A	quartzite white	Mwulu's Cave	Arcl			ND	0,5302	43,5283	0,2032	0,0735	ND	ND	0,0431
MW-M1-A-3	M1-A	quartzite white	Mwulu's Cave	Arcl			ND	0,2657	43,5246	0,0441	0,1321	0,1328	ND	0,0338
MW-M1-B-1	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	ND	47,294	ND	0,0229	ND	ND	0,0205
MW-M1-B-2	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	ND	48,4711	ND	0,0209	ND	ND	0,0237
MW-M1-B-3	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	ND	44,2637	ND	0,0433	ND	ND	0,0277
MW-M1-C-1	M1-C	quartzite white	Mwulu's Cave	Arcl			ND	ND	41,2746	0,1508	0,0975	ND	ND	0,0763
MW-M1-C-2	M1-C	quartzite white	Mwulu's Cave	Arcl			ND	0,2546	36,9577	0,4337	0,2976	ND	ND	0,0523

MW-M1-C-3	M1-C	quartzite white	Mwulu's Cave	Arcl			ND	0,0662	40,9337	0,1071	0,06	ND	ND	0,0492
MW-M1-D-1	M1-D	shale	Mwulu's Cave	Arcl			ND	1,7412	41,7165	0,2424	0,0877	0,6649	ND	0,0948
MW-M1-D-2	M1-D	shale	Mwulu's Cave	Arcl			ND	1,7226	41,6559	0,2468	0,087	0,6577	ND	0,1018
MW-M1-D-3	M1-D	shale	Mwulu's Cave	Arcl			ND	1,4993	42,5121	0,1212	0,2216	0,6171	ND	0,0791
MW-M1-F-1	M1-F	quartz	Mwulu's Cave	Arcl			ND	ND	44,8448	ND	0,0397	ND	ND	0,0185
MW-M1-F-2	M1-F	quartz	Mwulu's Cave	Arcl			ND	0,1639	46,5685	0,1686	0,0477	ND	ND	0,0343
MW-M1-F-3	M1-F	quartz	Mwulu's Cave	Arcl			ND	0,2005	46,5214	0,1771	0,0512	ND	ND	0,0391
MW-M1-H-1	M1-H	quartzite black	Mwulu's Cave	Arcl			ND	ND	52,1743	ND	0,0118	ND	ND	0,0168
MW-M1-H-2	M1-H	quartzite black	Mwulu's Cave	Arcl			ND	ND	49,7993	ND	0,0653	ND	ND	0,0325
MW-M1-H-3	M1-H	quartzite black	Mwulu's Cave	Arcl			ND	0,2038	51,4336	0,1151	0,0187	ND	ND	0,0261
MW-M1-I-1	M1-I	quartzite white	Mwulu's Cave	Arcl			ND	0,2478	45,2321	0,0122	0,0461	ND	ND	0,0497
MW-M1-I-2	M1-I	quartzite white	Mwulu's Cave	Arcl			ND	0,745	37,5772	0,0824	0,1445	0,1173	0,5348	0,1525
MW-M1-I-3	M1-I	quartzite white	Mwulu's Cave	Arcl			ND	0,3004	43,7658	ND	0,0264	ND	ND	0,0807
MW-M1-L-1	M1-L	quartzite black	Mwulu's Cave	Arcl			ND	1,0516	42,2152	ND	0,0814	0,2292	ND	0,1276
MW-M1-L-2	M1-L	quartzite black	Mwulu's Cave	Arcl			ND	0,9525	42,1304	ND	0,0484	0,1546	ND	0,0768
MW-M1-L-3	M1-L	quartzite black	Mwulu's Cave	Arcl			ND	0,4841	44,9598	ND	0,0936	ND	ND	0,0381
MW-M1-M-1	M1-M	quartzite black	Mwulu's Cave	Arcl			ND	ND	42,2938	0,1025	0,2045	ND	ND	0,0297
MW-M1-M-2	M1-M	quartzite black	Mwulu's Cave	Arcl			ND	0,2763	42,8697	ND	0,3131	0,1404	ND	0,0385
MW-M1-M-3	M1-M	quartzite black	Mwulu's Cave	Arcl			ND	0,3262	44,1367	0,4017	0,1136	0,1137	ND	0,0362
MW-M2-A-1	M2-A	quartzite white	Mwulu's Cave	Arcl			ND	0,196	46,3127	ND	0,0535	ND	ND	0,0424
MW-M2-A-2	M2-A	quartzite white	Mwulu's Cave	Arcl			ND	2,895	30,1215	1,5981	1,1729	0,3133	ND	0,2903
MW-M2-A-3	M2-A	quartzite white	Mwulu's Cave	Arcl			ND	0,2793	46,8282	ND	0,0717	ND	ND	0,0692
MW-M2-D-1	M2-D	quartzite white	Mwulu's Cave	Arcl			ND	0,962	41,6824	0,0478	0,3485	ND	ND	0,0709
MW-M2-D-2	M2-D	quartzite white	Mwulu's Cave	Arcl			ND	0,7689	45,0839	ND	0,1052	ND	ND	0,0301
MW-M2-D-3	M2-D	quartzite white	Mwulu's Cave	Arcl			ND	0,9718	43,6815	ND	0,1795	ND	ND	0,0376
MW-M3-A-1	M3-A	quartzite white	Mwulu's Cave	Arcl			ND	0,354	42,5868	0,0289	0,1889	ND	ND	0,0536
MW-M3-A-2	M3-A	quartzite white	Mwulu's Cave	Arcl			ND	0,8225	41,0671	0,1478	0,1859	ND	ND	0,0437
MW-M3-A-3	M3-A	quartzite white	Mwulu's Cave	Arcl			ND	0,2618	45,3685	0,012	0,1946	ND	ND	0,0229
MW-M3-C-1	M3-C	quartzite red	Mwulu's Cave	Arcl			ND	1,4605	35,043	0,1968	0,1851	1,521	ND	0,0378
MW-M3-C-2	M3-C	quartzite red	Mwulu's Cave	Arcl			ND	1,2381	44,6898	ND	0,1264	1,6365	ND	0,0379
MW-M3-C-3	M3-C	quartzite red	Mwulu's Cave	Arcl			ND	1,1931	43,4009	ND	0,1276	1,6448	ND	0,0396

MW-M3-D-1	M3-D	shale	Mwulu's Cave	Arcl			5516	6,1838	37,8121	0,3827	0,3192	3,2523	ND	0,3049
MW-M3-D-2	M3-D	shale	Mwulu's Cave	Arcl			ND	7,1615	27,7765	0,9222	0,4419	2,0529	ND	0,2751
MW-M3-D-3	M3-D	shale	Mwulu's Cave	Arcl			ND	7,5659	29,6888	0,9564	0,4555	2,245	ND	0,2753
MW- 1-1	Outcrop 1	shale-meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	9582	7,5954	21,2208	0,1755	0,0946	0,4758	0,1073	0,108
MW- 1-2	Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	ND	5,788	31,6111	0,0794	0,0442	0,6025	ND	0,1236
MW- 1-3	Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	ND	7,5268	28,8104	0,0606	0,0599	1,2449	ND	0,375
MW- 2A-1	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	ND	3,8714	11,3622	0,023	0,0392	0,4977	20,8542	0,3341
MW- 2A-2	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	ND	3,8533	11,3567	0,0195	0,0362	0,501	20,8381	0,3361
MW- 2A-3	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	ND	3,8368	11,2718	0,023	0,0342	0,4998	21,0342	0,3165
MW- 2B-1	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	16622	7,855	23,5648	0,0661	0,0231	0,7949	0,1836	0,3129
MW- 2B-2	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	ND	6,4872	19,1125	0,1025	0,0419	0,652	0,3899	0,3751
MW- 2B-3	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	4886	6,2445	18,8455	0,105	0,0383	0,6586	0,39	0,3738
MW- 2C-1	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	4134	3,2073	12,6924	0,0172	ND	0,4661	17,3983	0,2564
MW- 2C-2	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	ND	3,353	14,8267	ND	ND	0,4999	17,7191	0,2721
MW- 2C-3	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	ND	1,5236	11,3181	ND	ND	0,2725	20,4294	0,1564
MW- 3A-1	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	67918	1,1175	11,213	0,6898	0,02	2,3956	13,2183	0,5778
MW- 3A-2	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	71258	1,19	11,875	0,4994	0,0142	2,4976	13,3091	0,6587
MW- 3A-3	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	76698	1,3928	11,7558	0,3074	0,0167	2,4923	13,3322	0,7503
MW- 3B-1	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	ND	2,0907	38,3708	0,069	0,0798	0,0734	ND	0,0797
MW- 3B-2	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	ND	0,9065	39,062	ND	0,0622	ND	ND	0,0581
MW- 3B-3	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	ND	1,2393	41,3125	0,0232	0,0729	ND	ND	0,045
MW- 3C-1	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	ND	1,5449	37,4656	0,0172	0,0457	ND	ND	0,0649
MW- 3C-2	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	ND	1,8104	18,6994	0,1102	0,0464	0,325	0,3577	0,1754
MW- 3C-3	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	ND	2,2858	36,5798	0,0462	0,053	0,2112	ND	0,0816
MW- 4A-1	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	5367	7,0614	25,8939	0,1366	0,1391	3,6321	0,2929	0,3724
MW- 4A-2	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	5997	5,5048	26,4444	0,1095	0,1106	2,155	0,4022	0,3482
MW- 4A-3	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	9208	9,8445	24,8956	0,13	0,1314	5,3768	0,1042	0,4488
MW- 4B-1	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	9953	7,9213	26,1413	0,1102	0,1944	4,0902	ND	0,322
MW- 4B-2	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	8495	7,9007	26,0254	0,1067	0,1964	4,0947	ND	0,3191
MW- 4B-3	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	8440	8,4318	27,6993	0,0624	0,1017	4,4464	ND	0,3278
MW- 4C-1	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	ND	1,1696	37,7993	ND	0,0241	ND	ND	0,0433

MW- 4C-2	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	ND	1,1533	38,174	ND	0,0275	ND	ND	0,0359
MW- 4C-3	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	18799	0,4	33,8628	ND	ND	ND	4,9961	0,024
MW- 6-1	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	21147	6,6935	14,7744	0,1926	0,1328	5,1445	5,518	0,4388
MW- 6-2	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	20907	8,5551	17,9415	0,0726	2,2297	7,709	2,5419	0,4671
MW- 6-3	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	23333	7,2247	15,1475	0,2358	0,1199	4,1416	0,9478	0,3888
MW- 8A-1	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	9125	9,3827	18,5403	0,2483	0,0421	1,369	0,4393	0,8605
MW- 8A-2	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	9348	9,1441	17,8746	0,2307	0,0393	1,3018	0,4363	0,8384
MW- 8A-3	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	6163	9,8122	19,4672	0,1653	0,0448	1,6112	0,7094	0,6067
MW- 8B-1	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	66731	5,0757	13,0452	0,0192	0,0411	3,0515	14,4816	0,1795
MW- 8B-2	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	72106	4,996	12,4528	0,0276	0,0372	2,7579	14,6555	0,1581
MW- 8B-3	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	61200	5,0195	14,1205	0,0211	0,0337	3,0537	12,9734	0,2023
MW- 9-1	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	9484	9,2523	23,4036	0,0212	0,0198	2,6984	ND	0,3689
MW- 9-2	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	11199	9,4948	23,1313	0,0255	0,0234	2,6646	ND	0,3837
MW- 9-3	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	11181	9,2256	23,3376	0,0215	0,0189	2,7706	ND	0,3548
MW- 10-1	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	ND	9,6583	13,6298	0,0656	0,3057	2,8009	ND	0,9758
MW- 10-2	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	ND	11,8379	15,3514	0,0125	0,0343	4,8209	ND	0,9212
MW- 10-3	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	ND	13,505	17,7935	0,0228	0,0648	4,4144	ND	1,0545
MW- 11-1	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	ND	1,483	32,6609	0,0264	ND	0,451	ND	0,0573
MW- 11-2	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	ND	6,0754	23,6608	0,0089	0,0318	3,0077	ND	0,1617
MW- 11-3	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	ND	1,8937	33,8937	0,013	0,0834	0,1978	ND	0,0692
MW- 12-1	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	7197	15,192	21,7527	ND	0,0149	4,3001	ND	0,3861
MW- 12-2	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	5978	15,833	20,4764	ND	0,0224	3,7331	ND	0,3759
MW- 12-3	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	ND	11,0982	12,2711	0,0932	0,1218	1,1176	ND	0,4942
MW- 13-1	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	ND	2,9182	39,7252	ND	ND	0,7735	ND	0,1027
MW- 13-2	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	ND	2,0774	40,4046	ND	0,0681	ND	ND	0,2777
MW- 13-3	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	ND	2,4553	23,8358	0,0803	0,1638	0,0944	ND	0,3307
MW- 14A-1	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	ND	5,9953	10,971	0,2141	0,3256	2,7165	0,0817	0,419
MW- 14A-2	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	5457	14,0234	19,276	0,1294	0,0975	3,6913	ND	0,4729
MW- 14A-3	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	7497	12,0765	18,6432	0,0932	0,1287	4,2138	ND	0,3278
MW- 14B-1	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	ND	10,6656	17,8952	ND	0,0244	2,1808	ND	0,4039
MW- 14B-2	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	ND	10,6992	17,7569	0,0161	0,0255	2,1561	ND	0,3695

MW- 14B-3	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	ND	15,2169	18,2761	0,0594	0,0876	1,1783	ND	0,3422
MW- 16A-1	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	4,4942	24,4392	0,3618	0,081	0,6755	ND	0,2776
MW- 16A-2	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	4,5142	21,8898	0,3764	0,0974	0,7015	ND	0,3011
MW- 16A-3	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	4,4963	23,5738	0,3624	0,0901	0,6798	ND	0,2805
MW- 16B-1	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	ND	5,7638	21,5219	0,0997	0,1676	0,2583	ND	2,4537
MW- 16B-2	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	ND	5,6542	21,8727	0,0974	0,1794	0,2433	ND	2,4387
MW- 16B-3	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	ND	3,7719	32,5666	0,6561	0,1599	0,8402	ND	0,2348
MW- 16C-1	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	ND	0,1812	41,5949	0,0521	ND	ND	ND	0,2172
MW- 16C-2	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	ND	0,151	37,8593	0,0546	ND	ND	ND	0,2348
MW- 16C-3	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	ND	7,1383	17,4757	4,6154	0,5124	0,2873	ND	0,2504
MW- 16D-1	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	ND	2,0883	32,3843	0,0923	0,0167	0,244	ND	0,0787
MW- 16D-2	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	ND	1,37	35,1859	0,0123	0,0137	0,324	ND	0,1507
MW- 16D-3	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	ND	2,5107	41,8304	0,0856	0,0324	0,3267	ND	0,0734
MW- 16E-1	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	2,1044	38,5571	0,401	0,0265	0,3289	ND	0,1634
MW- 16E-2	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	2,1891	38,1189	0,2392	0,0232	0,3718	ND	0,1488
MW- 16E-3	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	2,2872	37,5955	0,0884	0,0223	0,3785	ND	0,4245
MW- 16F-1	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	ND	2,4231	23,6893	0,1786	0,2319	0,1327	ND	2,6928
MW- 16F-2	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	ND	1,3725	25,8892	0,2402	0,2785	0,0548	ND	0,2894
MW- 16F-3	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	ND	1,5391	28,4469	0,2608	0,3145	0,0626	ND	0,3635
MW- 17-1	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	1,1938	35,8122	0,2456	ND	0,1801	ND	0,0292
MW- 17-2	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	0,8825	42,2287	0,1702	ND	0,0095	ND	0,1312
MW- 17-3	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	0,8547	42,4797	0,1674	ND	0,0142	ND	0,1012
MW- 18A-1	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	ND	4,3231	31,0094	0,2373	0,2431	0,6303	ND	0,1193
MW- 18A-2	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	ND	4,2369	29,7613	0,2414	0,2724	0,7365	ND	0,131
MW- 18A-3	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	ND	2,3541	7,8066	0,158	0,3052	0,8875	2,6916	0,2566
MW- 18B-1	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	ND	11,5661	24,8626	0,4657	1,189	4,4676	ND	0,7552
MW- 18B-2	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	ND	11,5438	24,7068	0,4632	1,1748	4,446	ND	0,7683
MW- 18B-3	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	ND	14,9244	18,052	0,4413	1,1383	4,1551	ND	1,0134
MW- 19A-1	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	ND	2,0357	12,9017	0,0443	0,0514	0,0364	ND	0,2324
MW- 19A-2	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	ND	2,2696	14,7526	0,0539	0,057	0,0277	ND	0,4609
MW- 19A-3	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	ND	6,1973	37,0689	0,0508	0,274	0,1922	ND	0,263

MW- 19B-1	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	ND	6,6858	32,5657	0,0235	0,0164	ND	ND	0,5758
MW- 19B-2	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	ND	6,8536	29,5927	0,0268	0,0185	ND	ND	2,0076
MW- 19B-3	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	ND	6,6105	27,0843	0,0245	0,0175	ND	ND	2,2627
MW- 20-1	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	ND	3,0362	24,1579	0,1037	0,3696	0,303	ND	0,1903
MW- 20-2	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	ND	3,043	25,7245	0,1137	0,4033	0,3228	ND	0,1792
MW- 20-3	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	ND	2,9953	25,5799	0,1056	0,3758	0,3023	ND	0,188
MW- 21A-1	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	ND	1,5926	38,3768	ND	0,0418	ND	ND	0,0464
MW- 21A-2	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	ND	3,7312	35,7877	ND	0,0385	0,2501	ND	0,0697
MW- 21A-3	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	ND	3,7082	36,555	ND	0,0318	0,2437	ND	0,0668
MW- 21B-1	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	0,5605	25,4523	0,0228	0,2133	0,2172	ND	0,0545
MW- 21B-2	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	0,6644	27,5478	0,0156	0,2049	0,1777	ND	0,0609
MW- 21B-3	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	0,6666	28,8112	0,0111	0,2189	0,1812	ND	0,0907
MW- G1-1	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	ND	4,6988	35,8259	0,0528	0,1296	1,0137	ND	0,0493
MW- G1-2	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	ND	4,7859	37,0488	0,0575	0,1334	0,9553	ND	0,0586
MW- G1-3	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	ND	5,0006	31,2546	0,0658	0,1005	0,8391	ND	0,0711
MW- G2A-1	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	ND	4,0233	25,2393	1,8163	0,1623	0,872	ND	0,3585
MW- G2A-2	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	ND	1,2175	34,0415	0,061	0,1443	0,1272	ND	0,21
MW- G2A-3	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	ND	1,1337	33,2951	0,0575	0,1469	0,1092	ND	0,2276
MW- G2B-1	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	ND	0,3199	34,7247	ND	ND	ND	ND	ND
MW- G2B-2	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	ND	1,1822	36,8078	ND	ND	0,3328	ND	0,0422
MW- G2B-3	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	ND	1,0102	34,1897	ND	ND	0,3151	ND	0,0398
MW- G3-1	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	ND	15,3407	23,8917	0,0535	0,0301	3,3453	ND	0,3973
MW- G3-2	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	ND	15,4662	24,0773	0,0585	0,0339	3,3461	ND	0,3987
MW- G3-3	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	ND	7,4606	18,1782	0,098	0,0169	3,5153	ND	0,281
MW- G4-1	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	ND	3,1763	33,6833	0,0637	ND	1,0799	ND	0,2967
MW- G4-2	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	ND	3,2417	34,0323	0,0657	ND	1,0909	ND	0,3172
MW- G4-3	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	ND	3,3847	36,7815	0,0148	ND	1,0874	ND	0,182
Analysis ID	**Sample ID**	**Rock Type**	**Location**	**Geo/Arcl Piece?**	**Latitude (˚)**	**Longitude (˚)**	**V**	**Cr**	**Mn**	**Fe**	**Co**	**Ni**	**Cu**	**Zn**
MW-187-1	no.187	quartzite black	Mwulu's Cave	Arcl			ND	87	25	0,1711	ND	ND	6	ND
MW-187-2	no.187	quartzite black	Mwulu's Cave	Arcl			ND	86	24	0,1737	ND	ND	ND	ND
MW-187-3	no.187	quartzite black	Mwulu's Cave	Arcl			ND	74	ND	0,1688	ND	ND	8	ND

MW-194-1	no.194	quartzite white	Mwulu's Cave	Arcl			46	44	ND	0,2287	ND	ND	ND	ND
MW-194-2	no.194	quartzite white	Mwulu's Cave	Arcl			42	38	25	0,2278	ND	ND	6	ND
MW-194-3	no.194	quartzite white	Mwulu's Cave	Arcl			47	44	27	0,2225	ND	ND	ND	ND
MW-194-4	no.194	quartzite white	Mwulu's Cave	Arcl			50	36	33	0,2225	ND	ND	ND	ND
MW-195-1	no.195	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,1792	ND	ND	ND	5
MW-195-2	no.195	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,1823	ND	ND	ND	7
MW-195-3	no.195	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,1809	ND	ND	ND	ND
MW-203-1	no.203	quartzite white	Mwulu's Cave	Arcl			24	62	40	0,5594	ND	ND	13	ND
MW-203-2	no.203	quartzite white	Mwulu's Cave	Arcl			ND	78	46	0,5765	ND	ND	9	3
MW-203-3	no.203	quartzite white	Mwulu's Cave	Arcl			35	59	59	1,0512	ND	12	19	4
MW-PALO49-1	PALO49	chert	Mwulu's Cave	Arcl			ND	64	57	1,1176	ND	ND	18	4
MW-PALO49-2	PALO49	chert	Mwulu's Cave	Arcl			ND	61	48	1,0853	ND	ND	25	12
MW-PALO49-3	PALO49	chert	Mwulu's Cave	Arcl			ND	49	67	1,157	ND	ND	27	16
MW-473-1	no.473	quartzite black	Mwulu's Cave	Arcl			ND	53	ND	0,2221	ND	ND	ND	3
MW-473-2	no.473	quartzite black	Mwulu's Cave	Arcl			ND	49	22	0,2208	ND	ND	ND	ND
MW-473-3	no.473	quartzite black	Mwulu's Cave	Arcl			ND	35	22	0,2209	ND	ND	ND	ND
MW-640-1	no.640	quartzite white	Mwulu's Cave	Arcl			ND	67	33	0,2606	ND	ND	ND	9
MW-640-2	no.640	quartzite white	Mwulu's Cave	Arcl			ND	64	26	0,2604	ND	ND	9	9
MW-640-3	no.640	quartzite white	Mwulu's Cave	Arcl			ND	56	31	0,2574	ND	ND	ND	8
MW-792-1	no.792	quartzite black	Mwulu's Cave	Arcl			28	83	127	1,8953	ND	ND	13	8
MW-792-2	no.792	quartzite black	Mwulu's Cave	Arcl			34	87	146	1,9076	ND	ND	17	10
MW-792-3	no.792	quartzite black	Mwulu's Cave	Arcl			36	51	108	1,6378	ND	ND	15	9
MW-794-1	no.794	quartzite black	Mwulu's Cave	Arcl			32	58	62	0,5738	ND	13	9	ND
MW-794-2	no.794	quartzite black	Mwulu's Cave	Arcl			ND	61	57	0,5805	ND	ND	7	ND
MW-794-3	no.794	quartzite black	Mwulu's Cave	Arcl			26	48	42	0,4432	ND	ND	6	ND
MW-799-1	no.799	quartzite black	Mwulu's Cave	Arcl			24	45	52	0,7875	ND	ND	12	ND
MW-799-2	no.799	quartzite black	Mwulu's Cave	Arcl			ND	37	40	0,796	ND	ND	9	ND
MW-799-3	no.799	quartzite black	Mwulu's Cave	Arcl			23	39	42	0,7818	ND	ND	12	ND
MW-672-1	no.672	quartzite black	Mwulu's Cave	Arcl			ND	ND	44	0,3602	ND	ND	ND	ND
MW-672-2	no.672	quartzite black	Mwulu's Cave	Arcl			ND	ND	38	0,3727	ND	ND	ND	ND
MW-672-3	no.672	quartzite black	Mwulu's Cave	Arcl			ND	38	37	0,3704	ND	ND	ND	ND

MW-673-1	no.673	quartzite white	Mwulu's Cave	Arcl			26	41	ND	0,1966	ND	ND	6	ND
MW-673-2	no.673	quartzite white	Mwulu's Cave	Arcl			ND	65	25	0,1984	ND	ND	ND	ND
MW-673-3	no.673	quartzite white	Mwulu's Cave	Arcl			28	ND	28	0,1931	ND	ND	ND	ND
MW-673-4	no.673	quartzite white	Mwulu's Cave	Arcl			26	50	ND	0,1979	ND	ND	ND	ND
MW-674-1	no.674	chert	Mwulu's Cave	Arcl			ND	64	35	0,667	ND	ND	7	ND
MW-674-2	no.674	chert	Mwulu's Cave	Arcl			ND	67	55	0,6556	ND	15	8	ND
MW-674-3	no.674	chert	Mwulu's Cave	Arcl			ND	ND	32	0,4508	ND	ND	ND	ND
MW-676-1	no.676	quartzite white	Mwulu's Cave	Arcl			ND	39	51	0,4191	ND	ND	ND	3
MW-676-2	no.676	quartzite white	Mwulu's Cave	Arcl			25	38	26	0,4161	ND	ND	ND	ND
MW-676-3	no.676	quartzite white	Mwulu's Cave	Arcl			ND	ND	28	0,4226	ND	ND	ND	ND
MW-677-1	no.677	quartzite white	Mwulu's Cave	Arcl			ND	58	30	0,3229	ND	ND	ND	ND
MW-677-2	no.677	quartzite white	Mwulu's Cave	Arcl			ND	ND	48	0,3373	ND	ND	ND	3
MW-677-3	no.677	quartzite white	Mwulu's Cave	Arcl			ND	38	39	0,3291	ND	ND	ND	ND
MW-684-1	no.684	quartzite black	Mwulu's Cave	Arcl			28	45	32	0,4744	ND	ND	ND	4
MW-684-2	no.684	quartzite black	Mwulu's Cave	Arcl			ND	39	33	0,4758	ND	ND	7	5
MW-684-3	no.684	quartzite black	Mwulu's Cave	Arcl			ND	40	29	0,3712	ND	ND	ND	5
MW-836-1	no.836	quartzite black	Mwulu's Cave	Arcl			41	124	218	2,6112	ND	ND	29	10
MW-836-2	no.836	quartzite black	Mwulu's Cave	Arcl			50	101	209	2,6468	ND	ND	33	11
MW-836-3	no.836	quartzite black	Mwulu's Cave	Arcl			45	120	219	2,6193	ND	ND	27	10
MW-837-1	no.837	quartzite black	Mwulu's Cave	Arcl			ND	ND	42	0,4207	ND	ND	7	4
MW-837-2	no.837	quartzite black	Mwulu's Cave	Arcl			ND	ND	48	0,428	ND	ND	8	ND
MW-837-3	no.837	quartzite black	Mwulu's Cave	Arcl			ND	ND	40	0,4211	ND	ND	ND	ND
MW-PA1-1	PA-1	quartzite black	Mwulu's Cave	Arcl			47	49	61	0,6027	ND	ND	7	5
MW-PA1-2	PA-1	quartzite black	Mwulu's Cave	Arcl			38	55	67	0,6059	ND	ND	6	4
MW-PA1-3	PA-1	quartzite black	Mwulu's Cave	Arcl			55	40	46	0,6576	ND	ND	7	6
MW-PA2-1	PA-2	quartz	Mwulu's Cave	Arcl			ND	35	24	0,2434	ND	11	ND	ND
MW-PA2-2	PA-2	quartz	Mwulu's Cave	Arcl			ND	ND	23	0,2439	ND	ND	ND	ND
MW-PA2-3	PA-2	quartz	Mwulu's Cave	Arcl			ND	ND	32	0,2409	ND	ND	ND	3
MW-1021-1	no.1021	quartzite white	Mwulu's Cave	Arcl			ND	ND	32	0,2225	ND	ND	7	ND
MW-1021-2	no.1021	quartzite white	Mwulu's Cave	Arcl			ND	ND	28	0,2245	ND	ND	ND	ND
MW-1021-3	no.1021	quartzite white	Mwulu's Cave	Arcl			31	ND	29	0,2175	ND	ND	ND	ND

MW-1024-1	no.1024	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1552	ND	ND	ND	ND
MW-1024-2	no.1024	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1513	ND	ND	ND	ND
MW-1024-3	no.1024	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1489	ND	ND	ND	ND
MW-1240-1	no.1240	shale	Mwulu's Cave	Arcl			ND	76	ND	0,5698	ND	ND	6	ND
MW-1240-2	no.1240	shale	Mwulu's Cave	Arcl			ND	83	44	0,5441	ND	ND	9	ND
MW-1240-3	no.1240	shale	Mwulu's Cave	Arcl			ND	89	36	0,5355	ND	ND	10	ND
MW-1410-1	no.1410	quartzite white	Mwulu's Cave	Arcl			ND	67	67	0,6632	ND	ND	12	ND
MW-1410-2	no.1410	quartzite white	Mwulu's Cave	Arcl			27	41	66	0,6738	ND	ND	9	5
MW-1410-3	no.1410	quartzite white	Mwulu's Cave	Arcl			ND	ND	72	0,654	ND	ND	11	ND
MW-1818-1	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1107	ND	ND	7	ND
MW-1818-2	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1026	ND	ND	ND	ND
MW-1818-3	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1053	ND	ND	ND	ND
MW-1835-1	no.1835	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,1058	ND	ND	ND	ND
MW-1835-2	no.1835	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,1058	ND	ND	ND	ND
MW-1835-3	no.1835	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,1106	ND	ND	ND	ND
MW-2133-1	no.2133	quartzite black	Mwulu's Cave	Arcl			27	45	34	0,9551	ND	ND	13	ND
MW-2133-2	no.2133	quartzite black	Mwulu's Cave	Arcl			ND	49	46	0,9438	ND	ND	12	4
MW-2133-3	no.2133	quartzite black	Mwulu's Cave	Arcl			34	ND	46	0,9606	ND	ND	15	ND
MW-2034-1	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	63	35	0,5903	ND	ND	19	ND
MW-2034-2	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	54	35	0,5942	ND	ND	18	ND
MW-2034-3	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	54	40	0,6032	ND	ND	22	ND
MW-2070-1	no.2070	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1997	ND	ND	9	10
MW-2070-2	no.2070	quartzite white	Mwulu's Cave	Arcl			ND	39	ND	0,0952	ND	ND	6	ND
MW-2070-3	no.2070	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,0939	ND	ND	ND	ND
MW-2073-1	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,0866	ND	ND	ND	ND
MW-2073-2	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,0871	ND	ND	ND	ND
MW-2073-3	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,0861	ND	ND	ND	ND
MW-2073-4	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,0878	ND	ND	ND	ND
MW-PA3-1	PA-3	shale	Mwulu's Cave	Arcl			46	107	ND	0,4429	ND	ND	8	ND
MW-PA3-2	PA-3	shale	Mwulu's Cave	Arcl			32	107	32	0,4414	ND	ND	10	ND
MW-PA3-3	PA-3	shale	Mwulu's Cave	Arcl			36	97	ND	0,4428	ND	ND	9	ND

MW-PA4-1	PA-4	quartzite white	Mwulu's Cave	Arcl			55	94	64	0,9568	ND	ND	ND	7
MW-PA4-2	PA-4	quartzite white	Mwulu's Cave	Arcl			46	65	70	0,8724	ND	ND	ND	4
MW-PA4-3	PA-4	quartzite white	Mwulu's Cave	Arcl			62	75	76	0,933	ND	ND	13	14
MW-PA5-1	PA-5	quartz	Mwulu's Cave	Arcl			29	ND	28	0,2594	ND	ND	ND	ND
MW-PA5-2	PA-5	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,2639	ND	ND	6	ND
MW-PA5-3	PA-5	quartz	Mwulu's Cave	Arcl			ND	ND	40	0,258	ND	ND	ND	ND
MW-PA6-1	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	ND	26	0,112	ND	ND	ND	ND
MW-PA6-2	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1122	ND	ND	ND	ND
MW-PA6-3	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1135	ND	ND	ND	ND
MW-PA7-1	PA-7	quartzite white	Mwulu's Cave	Arcl			ND	ND	29	0,1476	ND	ND	6	ND
MW-PA7-2	PA-7	quartzite white	Mwulu's Cave	Arcl			27	37	27	0,1472	ND	ND	ND	ND
MW-PA7-3	PA-7	quartzite white	Mwulu's Cave	Arcl			ND	43	ND	0,1483	ND	ND	ND	ND
MW-PA8-1	PA-8	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,2034	ND	ND	ND	ND
MW-PA8-2	PA-8	quartz	Mwulu's Cave	Arcl			ND	36	ND	0,2081	ND	ND	ND	ND
MW-PA8-3	PA-8	quartz	Mwulu's Cave	Arcl			ND	38	ND	0,2104	ND	ND	ND	ND
MW-PA9-1	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1993	ND	ND	ND	ND
MW-PA9-2	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1979	ND	ND	ND	ND
MW-PA9-3	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1976	ND	ND	8	ND
MW-PA10-1	PA-10	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,3684	ND	ND	6	ND
MW-PA10-2	PA-10	quartz	Mwulu's Cave	Arcl			26	ND	ND	0,3736	ND	ND	ND	ND
MW-PA10-3	PA-10	quartz	Mwulu's Cave	Arcl			26	ND	ND	0,3688	ND	ND	ND	ND
MW-PA11-1	PA-11	altered	Mwulu's Cave	Arcl			109	48	598	6,6555	ND	56	32	54
MW-PA11-2	PA-11	altered	Mwulu's Cave	Arcl			101	48	579	6,709	ND	70	35	49
MW-PA11-3	PA-11	altered	Mwulu's Cave	Arcl			95	100	581	6,6948	ND	75	35	53
MW-PA12-1	PA-12	shale	Mwulu's Cave	Arcl			ND	59	ND	0,3515	ND	ND	8	ND
MW-PA12-2	PA-12	shale	Mwulu's Cave	Arcl			ND	67	31	0,3511	ND	ND	ND	ND
MW-PA12-3	PA-12	shale	Mwulu's Cave	Arcl			29	51	22	0,3512	ND	ND	7	ND
MW-PA13-1	PA-13	shale	Mwulu's Cave	Arcl			ND	ND	97	1,7243	ND	ND	32	8
MW-PA13-2	PA-13	shale	Mwulu's Cave	Arcl			24	35	138	2,4076	ND	ND	52	11
MW-PA13-3	PA-13	shale	Mwulu's Cave	Arcl			ND	ND	156	2,6561	ND	ND	61	13
MW-PA14-1	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1297	ND	ND	ND	ND

MW-PA14-2	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1287	ND	ND	ND	ND
MW-PA14-3	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1292	ND	ND	ND	ND
MW-PA15-1	PA-15	quartzite white	Mwulu's Cave	Arcl			ND	ND	50	0,8939	ND	ND	13	5
MW-PA15-2	PA-15	quartzite white	Mwulu's Cave	Arcl			ND	ND	50	0,9208	ND	ND	10	ND
MW-PA15-3	PA-15	quartzite white	Mwulu's Cave	Arcl			ND	ND	32	0,9288	ND	ND	11	3
MW-PA16-1	PA-16	quartzite white	Mwulu's Cave	Arcl			37	49	37	0,6071	ND	ND	6	ND
MW-PA16-2	PA-16	quartzite white	Mwulu's Cave	Arcl			46	ND	48	0,5993	ND	ND	8	3
MW-PA16-3	PA-16	quartzite white	Mwulu's Cave	Arcl			45	63	44	0,5953	ND	12	8	ND
MW-M1-E-1	M1-E	altered	Mwulu's Cave	Arcl			ND	ND	373	4,8234	ND	ND	28	39
MW-M1-E-2	M1-E	altered	Mwulu's Cave	Arcl			ND	ND	351	4,8834	ND	16	24	39
MW-M1-E-3	M1-E	altered	Mwulu's Cave	Arcl			ND	ND	361	4,8636	ND	ND	23	40
MW-M1-G-1	M1-G	altered	Mwulu's Cave	Arcl			130	161	495	17,6918	ND	ND	30	34
MW-M1-G-2	M1-G	altered	Mwulu's Cave	Arcl			110	170	479	17,6622	ND	ND	25	37
MW-M1-G-3	M1-G	altered	Mwulu's Cave	Arcl			137	172	481	17,6754	ND	ND	37	34
MW-M1-K-1	M1-K	chert	Mwulu's Cave	Arcl			ND	ND	26	0,0541	ND	ND	ND	ND
MW-M1-K-2	M1-K	chert	Mwulu's Cave	Arcl			ND	ND	ND	0,0551	ND	ND	ND	ND
MW-M1-K-3	M1-K	chert	Mwulu's Cave	Arcl			ND	ND	ND	0,0563	ND	ND	ND	ND
MW-M1-J-1	M1-J	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	0,1048	ND	ND	ND	ND
MW-M1-J-2	M1-J	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	0,1068	ND	ND	ND	4
MW-M1-J-3	M1-J	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	0,0727	ND	ND	ND	6
MW-M2-B-1	M2-B	altered	Mwulu's Cave	Arcl			78	85	302	6,3431	ND	ND	77	115
MW-M2-B-2	M2-B	altered	Mwulu's Cave	Arcl			66	63	293	6,2967	ND	ND	79	118
MW-M2-B-3	M2-B	altered	Mwulu's Cave	Arcl			74	73	289	6,2393	ND	ND	87	113
MW-M2-C-1	M2-C	altered	Mwulu's Cave	Arcl			87	101	198	3,7925	ND	60	19	46
MW-M2-C-2	M2-C	altered	Mwulu's Cave	Arcl			97	142	188	3,8054	ND	64	14	46
MW-M2-C-3	M2-C	altered	Mwulu's Cave	Arcl			84	121	205	3,7852	ND	54	18	42
MW-M3-B-1	M3-B	shale	Mwulu's Cave	Arcl			60	89	700	2,8881	ND	30	30	60
MW-M3-B-2	M3-B	shale	Mwulu's Cave	Arcl			50	85	709	2,8956	ND	31	28	55
MW-M3-B-3	M3-B	shale	Mwulu's Cave	Arcl			57	108	693	2,8809	ND	24	30	57
MW-M3-E-1	M3-E	shale	Mwulu's Cave	Arcl			ND	46	26	0,1791	ND	ND	13	ND
MW-M3-E-2	M3-E	shale	Mwulu's Cave	Arcl			ND	ND	ND	0,1812	ND	12	11	ND

MW-M3-E-3	M3-E	shale	Mwulu's Cave	Arcl			ND	ND	ND	0,179	ND	ND	12	4
MW-M3-F-1	M3-F	shale	Mwulu's Cave	Arcl			ND	ND	80	12,9845	ND	ND	ND	12
MW-M3-F-2	M3-F	shale	Mwulu's Cave	Arcl			ND	ND	108	15,0856	ND	ND	ND	11
MW-M3-F-3	M3-F	shale	Mwulu's Cave	Arcl			ND	ND	96	15,828	ND	ND	ND	11
MW-1699-1	no.1699	quartzite white	Mwulu's Cave	Arcl			39	82	93	1,116	ND	ND	17	ND
MW-1699-2	no.1699	quartzite white	Mwulu's Cave	Arcl			36	77	80	1,1076	ND	ND	21	5
MW-1699-3	no.1699	quartzite white	Mwulu's Cave	Arcl			28	79	84	1,1135	ND	ND	20	5
MW-1679-1	no.1679	quartzite white	Mwulu's Cave	Arcl			69	54	41	1,1127	ND	ND	11	ND
MW-1679-2	no.1679	quartzite white	Mwulu's Cave	Arcl			120	115	106	2,4104	ND	ND	30	7
MW-1679-3	no.1679	quartzite white	Mwulu's Cave	Arcl			114	120	131	2,5087	ND	ND	27	7
MW-1815-1	no.1815	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1754	ND	ND	ND	ND
MW-1815-2	no.1815	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1671	ND	ND	ND	ND
MW-1815-3	no.1815	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1648	ND	ND	ND	ND
MW-1826-1	no.1826	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1254	ND	ND	ND	ND
MW-1826-2	no.1826	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1254	ND	ND	ND	ND
MW-1826-3	no.1826	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1278	ND	ND	ND	ND
MW-1839-1	no.1839	quartz	Mwulu's Cave	Arcl			ND	ND	30	0,5002	ND	ND	10	ND
MW-1839-2	no.1839	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,5053	ND	ND	6	ND
MW-1839-3	no.1839	quartz	Mwulu's Cave	Arcl			ND	ND	34	0,3827	ND	ND	11	ND
MW-2118-1	no.2118	quartzite white	Mwulu's Cave	Arcl			63	141	94	1,7728	ND	ND	15	5
MW-2118-2	no.2118	quartzite white	Mwulu's Cave	Arcl			79	160	105	1,8256	ND	ND	19	5
MW-2118-3	no.2118	quartzite white	Mwulu's Cave	Arcl			ND	ND	34	0,1983	ND	ND	ND	ND
MW-2130-1	no.2130	quartzite black	Mwulu's Cave	Arcl			34	60	57	0,7928	ND	ND	9	ND
MW-2130-2	no.2130	quartzite black	Mwulu's Cave	Arcl			30	49	34	0,8762	ND	ND	13	ND
MW-2130-3	no.2130	quartzite black	Mwulu's Cave	Arcl			ND	57	44	0,8918	ND	ND	17	ND
MW-2134-1	no.2134	quartzite white	Mwulu's Cave	Arcl			ND	45	30	0,4728	ND	ND	9	ND
MW-2134-2	no.2134	quartzite white	Mwulu's Cave	Arcl			ND	66	70	0,9535	ND	ND	13	ND
MW-2134-3	no.2134	quartzite white	Mwulu's Cave	Arcl			31	78	62	0,956	ND	ND	18	ND
MW-2132-1	no.2132	quartz	Mwulu's Cave	Arcl			ND	ND	44	0,3806	ND	ND	8	ND
MW-2132-2	no.2132	quartz	Mwulu's Cave	Arcl			ND	34	37	0,3768	ND	ND	ND	ND
MW-2132-3	no.2132	quartz	Mwulu's Cave	Arcl			30	63	70	1,3701	ND	ND	14	ND

MW-2135-1	no.2135	quartzite white	Mwulu's Cave	Arcl			87	82	91	1,5721	ND	ND	17	4
MW-2135-2	no.2135	quartzite white	Mwulu's Cave	Arcl			ND	74	47	0,4908	ND	ND	8	ND
MW-2135-3	no.2135	quartzite white	Mwulu's Cave	Arcl			53	85	71	1,1039	ND	12	16	5
MW-2024-1	no.2024	quartzite white	Mwulu's Cave	Arcl			ND	83	41	0,7069	ND	16	20	ND
MW-2024-2	no.2024	quartzite white	Mwulu's Cave	Arcl			50	150	80	1,5823	ND	ND	39	ND
MW-2024-3	no.2024	quartzite white	Mwulu's Cave	Arcl			ND	90	36	0,5911	ND	ND	14	ND
MW-2026-1	no.2026	shale	Mwulu's Cave	Arcl			26	99	26	0,625	ND	ND	9	ND
MW-2026-2	no.2026	shale	Mwulu's Cave	Arcl			ND	102	ND	0,4455	ND	ND	13	ND
MW-2026-3	no.2026	shale	Mwulu's Cave	Arcl			ND	77	51	1,0698	ND	ND	23	ND
MW-2038-1	no.2038	quartzite white	Mwulu's Cave	Arcl			31	58	47	1,026	ND	ND	22	ND
MW-2038-2	no.2038	quartzite white	Mwulu's Cave	Arcl			43	58	57	1,2292	ND	ND	18	ND
MW-2038-3	no.2038	quartzite white	Mwulu's Cave	Arcl			32	78	61	1,0523	ND	ND	22	6
MW-2080-1	no.2080	quartzite white	Mwulu's Cave	Arcl			ND	64	94	1,1658	ND	ND	21	6
MW-2080-2	no.2080	quartzite white	Mwulu's Cave	Arcl			ND	ND	46	1,1414	ND	ND	16	ND
MW-2080-3	no.2080	quartzite white	Mwulu's Cave	Arcl			30	46	97	1,1235	ND	ND	21	ND
MW-M1-A-1	M1-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,0774	ND	ND	9	6
MW-M1-A-2	M1-A	quartzite white	Mwulu's Cave	Arcl			23	ND	31	0,1505	ND	ND	10	6
MW-M1-A-3	M1-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,0776	ND	ND	10	5
MW-M1-B-1	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	0,0504	ND	ND	8	6
MW-M1-B-2	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	0,0482	ND	ND	ND	6
MW-M1-B-3	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	39	ND	0,0721	ND	ND	ND	ND
MW-M1-C-1	M1-C	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1027	ND	ND	10	7
MW-M1-C-2	M1-C	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,2132	ND	ND	15	12
MW-M1-C-3	M1-C	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1034	ND	ND	10	8
MW-M1-D-1	M1-D	shale	Mwulu's Cave	Arcl			ND	38	ND	0,1701	ND	ND	8	4
MW-M1-D-2	M1-D	shale	Mwulu's Cave	Arcl			ND	ND	ND	0,1698	ND	ND	10	ND
MW-M1-D-3	M1-D	shale	Mwulu's Cave	Arcl			ND	ND	ND	0,129	ND	ND	10	ND
MW-M1-F-1	M1-F	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,0381	ND	ND	ND	ND
MW-M1-F-2	M1-F	quartz	Mwulu's Cave	Arcl			ND	ND	ND	0,088	ND	ND	6	3
MW-M1-F-3	M1-F	quartz	Mwulu's Cave	Arcl			23	ND	ND	0,0903	ND	ND	6	4
MW-M1-H-1	M1-H	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	0,0383	ND	ND	ND	3

MW-M1-H-2	M1-H	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	0,0468	ND	ND	ND	4
MW-M1-H-3	M1-H	quartzite black	Mwulu's Cave	Arcl			27	ND	34	0,0571	ND	ND	ND	ND
MW-M1-I-1	M1-I	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1162	ND	ND	ND	ND
MW-M1-I-2	M1-I	quartzite white	Mwulu's Cave	Arcl			ND	ND	36	0,3901	ND	ND	11	11
MW-M1-I-3	M1-I	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1355	ND	ND	ND	ND
MW-M1-L-1	M1-L	quartzite black	Mwulu's Cave	Arcl			ND	123	ND	0,077	ND	ND	11	5
MW-M1-L-2	M1-L	quartzite black	Mwulu's Cave	Arcl			27	101	27	0,0897	ND	ND	7	ND
MW-M1-L-3	M1-L	quartzite black	Mwulu's Cave	Arcl			ND	76	ND	0,0411	ND	ND	7	6
MW-M1-M-1	M1-M	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	0,0532	ND	ND	ND	ND
MW-M1-M-2	M1-M	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	0,0562	ND	ND	ND	5
MW-M1-M-3	M1-M	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	0,122	ND	ND	ND	ND
MW-M2-A-1	M2-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1103	ND	ND	ND	ND
MW-M2-A-2	M2-A	quartzite white	Mwulu's Cave	Arcl			592	433	191	0,5325	ND	ND	7	4
MW-M2-A-3	M2-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	25	0,1184	ND	ND	ND	4
MW-M2-D-1	M2-D	quartzite white	Mwulu's Cave	Arcl			ND	ND	47	0,1385	ND	ND	9	7
MW-M2-D-2	M2-D	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,08	ND	ND	ND	4
MW-M2-D-3	M2-D	quartzite white	Mwulu's Cave	Arcl			ND	ND	27	0,0925	ND	ND	ND	4
MW-M3-A-1	M3-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	0,1544	ND	ND	8	ND
MW-M3-A-2	M3-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	29	0,1012	ND	ND	7	6
MW-M3-A-3	M3-A	quartzite white	Mwulu's Cave	Arcl			28	ND	32	0,0538	ND	ND	ND	5
MW-M3-C-1	M3-C	quartzite red	Mwulu's Cave	Arcl			33	ND	49	0,1016	ND	ND	8	6
MW-M3-C-2	M3-C	quartzite red	Mwulu's Cave	Arcl			32	ND	26	0,0705	ND	ND	7	5
MW-M3-C-3	M3-C	quartzite red	Mwulu's Cave	Arcl			ND	ND	ND	0,107	ND	ND	8	ND
MW-M3-D-1	M3-D	shale	Mwulu's Cave	Arcl			64	85	86	4,134	ND	44	16	54
MW-M3-D-2	M3-D	shale	Mwulu's Cave	Arcl			65	90	216	3,8125	ND	39	22	67
MW-M3-D-3	M3-D	shale	Mwulu's Cave	Arcl			76	79	229	3,8552	ND	40	21	60
MW- 1-1	Outcrop 1	shale-meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	ND	228	2692	43,0699	ND	ND	129	ND
MW- 1-2	Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	ND	290	5295	9,561	ND	30	67	20
MW- 1-3	Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	74	189	8207	19,6657	ND	89	96	32
MW- 2A-1	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	54	139	3090	2,9647	ND	52	24	34
MW- 2A-2	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	74	130	3114	2,9246	ND	62	22	35

MW- 2A-3	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	93	155	3144	3,0171	ND	52	25	26
MW- 2B-1	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	71	87	2387	16,6604	ND	69	46	91
MW- 2B-2	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	115	90	16660	15,9167	ND	120	76	16
MW- 2B-3	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	128	108	16443	15,7878	ND	125	81	21
MW- 2C-1	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	121	90	10268	4,3031	ND	63	35	34
MW- 2C-2	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	115	136	10531	4,3512	ND	88	43	34
MW- 2C-3	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	60	ND	5424	3,683	ND	33	30	27
MW- 3A-1	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	135	530	2352	3,1931	ND	2833	55	33
MW- 3A-2	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	166	602	2205	3,3102	ND	1986	42	27
MW- 3A-3	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	157	560	2220	3,1791	ND	593	24	32
MW- 3B-1	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	68	ND	275	0,262	ND	ND	ND	ND
MW- 3B-2	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	63	ND	150	0,1712	ND	ND	ND	ND
MW- 3B-3	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	54	ND	156	0,2278	ND	ND	ND	ND
MW- 3C-1	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	444	0,4717	ND	ND	6	7
MW- 3C-2	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	56	ND	9384	1,0671	ND	79	ND	32
MW- 3C-3	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	ND	38	1252	0,3654	ND	ND	ND	6
MW- 4A-1	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	93	633	3980	3,2067	ND	99	21	13
MW- 4A-2	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	64	557	1214	3,9336	ND	81	28	13
MW- 4A-3	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	69	499	654	0,561	ND	44	15	ND
MW- 4B-1	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	140	399	1983	2,1993	ND	106	46	31
MW- 4B-2	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	140	405	2009	2,2613	ND	102	43	33
MW- 4B-3	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	111	443	831	1,9678	ND	72	42	20
MW- 4C-1	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	ND	ND	617	0,2905	ND	ND	ND	14
MW- 4C-2	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	ND	40	657	0,2947	ND	ND	ND	13
MW- 4C-3	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	ND	ND	188	0,1074	ND	ND	ND	ND
MW- 6-1	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	118	436	1966	3,6119	ND	152	35	32
MW- 6-2	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	122	474	558	3,1107	ND	164	36	33
MW- 6-3	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	141	352	37952	4,794	ND	216	35	43
MW- 8A-1	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	106	105	1971	12,0915	ND	113	63	149
MW- 8A-2	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	116	76	1877	11,761	ND	109	63	153
MW- 8A-3	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	120	117	1586	10,7837	ND	83	75	173

MW- 8B-1	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	50	197	3406	1,5743	ND	88	23	29
MW- 8B-2	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	40	178	3346	1,5411	ND	88	25	27
MW- 8B-3	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	88	160	2739	1,6564	ND	94	37	30
MW- 9-1	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	102	194	492	7,4193	ND	88	62	34
MW- 9-2	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	99	170	434	7,9127	ND	84	91	29
MW- 9-3	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	93	182	592	7,9719	ND	102	74	29
MW- 10-1	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	176	195	185	7,2238	ND	142	81	31
MW- 10-2	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	236	218	106	7,2772	ND	149	54	24
MW- 10-3	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	241	228	131	7,9769	ND	159	64	22
MW- 11-1	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	ND	142	30	2,2464	ND	ND	16	ND
MW- 11-2	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	68	342	78	2,4226	ND	18	15	ND
MW- 11-3	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	32	67	33	0,7583	ND	14	ND	ND
MW- 12-1	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	93	357	118	2,5863	ND	85	93	24
MW- 12-2	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	67	341	123	3,456	ND	107	125	38
MW- 12-3	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	141	213	306	5,7801	ND	105	100	35
MW- 13-1	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	28	106	ND	0,299	ND	ND	ND	ND
MW- 13-2	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	36	ND	ND	0,1601	ND	ND	ND	ND
MW- 13-3	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	58	51	101	0,5062	ND	ND	9	6
MW- 14A-1	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	123	475	461	4,1113	ND	239	139	90
MW- 14A-2	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	82	342	231	3,4268	ND	334	98	81
MW- 14A-3	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	79	292	354	2,9849	ND	141	59	58
MW- 14B-1	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	73	301	179	2,3267	ND	585	93	102
MW- 14B-2	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	82	271	180	2,3213	ND	592	84	99
MW- 14B-3	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	75	184	154	2,9214	ND	173	91	36
MW- 16A-1	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	86	114	102	1,671	ND	19	49	9
MW- 16A-2	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	63	134	95	1,7854	ND	15	45	8
MW- 16A-3	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	63	125	88	1,6634	ND	14	47	8
MW- 16B-1	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	132	58	97	0,7016	ND	15	15	8
MW- 16B-2	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	87	95	99	0,6833	ND	19	16	7
MW- 16B-3	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	34	65	46	0,5037	ND	ND	17	7
MW- 16C-1	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	0,093	ND	ND	12	ND

MW- 16C-2	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	ND	59	ND	0,1037	ND	ND	ND	ND
MW- 16C-3	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	175	63	120	0,5561	ND	ND	10	7
MW- 16D-1	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	29	41	ND	0,1351	ND	ND	7	ND
MW- 16D-2	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	ND	41	ND	0,0668	ND	ND	ND	ND
MW- 16D-3	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	28	45	30	0,1815	ND	ND	ND	ND
MW- 16E-1	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	40	ND	0,0804	ND	ND	ND	ND
MW- 16E-2	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	74	ND	0,0662	ND	ND	ND	ND
MW- 16E-3	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	60	36	0,0642	ND	ND	ND	ND
MW- 16F-1	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	ND	58	51	0,332	ND	ND	11	8
MW- 16F-2	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	ND	ND	76	0,536	ND	ND	14	6
MW- 16F-3	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	ND	ND	54	0,5273	ND	ND	ND	6
MW- 17-1	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	32	79	96	0,1427	ND	ND	7	ND
MW- 17-2	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	44	53	0,1097	ND	ND	ND	ND
MW- 17-3	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	58	0,1052	ND	ND	ND	ND
MW- 18A-1	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	34	62	50	1,3303	ND	31	24	14
MW- 18A-2	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	43	53	56	1,2135	ND	20	21	13
MW- 18A-3	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	ND	211	126	0,5005	ND	15	13	22
MW- 18B-1	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	112	234	106	1,362	ND	64	86	23
MW- 18B-2	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	149	231	91	1,3598	ND	66	93	23
MW- 18B-3	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	115	260	75	2,5986	ND	91	87	30
MW- 19A-1	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	70	72	49	0,9197	ND	ND	48	8
MW- 19A-2	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	ND	ND	86	1,0914	ND	ND	43	12
MW- 19A-3	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	105	52	115	1,1221	ND	ND	47	9
MW- 19B-1	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	ND	212	42	0,3562	ND	17	14	ND
MW- 19B-2	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	ND	258	40	0,4417	ND	24	23	ND
MW- 19B-3	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	ND	229	32	0,4568	ND	22	27	ND
MW- 20-1	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	80	74	73	0,3788	ND	ND	11	18
MW- 20-2	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	80	122	42	0,3733	ND	ND	12	17
MW- 20-3	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	76	113	58	0,3877	ND	ND	14	18
MW- 21A-1	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	27	ND	ND	0,0533	ND	ND	ND	4
MW- 21A-2	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	43	51	30	0,1318	ND	ND	9	ND

MW- 21A-3	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	ND	ND	28	0,1171	ND	ND	ND	ND
MW- 21B-1	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	35	28	0,0939	ND	ND	ND	5
MW- 21B-2	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	53	ND	0,0896	ND	ND	ND	7
MW- 21B-3	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	ND	ND	0,0899	ND	ND	ND	4
MW- G1-1	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	28	43	47	0,1618	ND	11	ND	4
MW- G1-2	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	29	38	32	0,1623	ND	13	ND	4
MW- G1-3	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	56	84	40	0,1891	ND	25	10	7
MW- G2A-1	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	76	135	42	0,4563	ND	17	2169	59
MW- G2A-2	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	ND	63	ND	0,1185	ND	ND	ND	ND
MW- G2A-3	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	ND	46	ND	0,1193	ND	ND	10	ND
MW- G2B-1	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	ND	ND	ND	0,0371	ND	19	ND	ND
MW- G2B-2	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	31	59	ND	0,0635	ND	ND	ND	4
MW- G2B-3	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	37	67	ND	0,0638	ND	18	ND	ND
MW- G3-1	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	82	255	76	1,6427	ND	61	37	16
MW- G3-2	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	86	237	90	1,6475	ND	63	37	16
MW- G3-3	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	72	214	528	3,1502	ND	75	37	10
MW- G4-1	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	ND	98	105	0,1207	ND	ND	7	ND
MW- G4-2	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	ND	109	109	0,1232	ND	ND	10	ND
MW- G4-3	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	33	103	95	0,1015	ND	ND	ND	4
Analysis ID	**Sample ID**	**Rock Type**	**Location**	**Geo/Arcl Piece?**	**Latitude (˚)**	**Longitude (˚)**	**As**	**Se**	**Rb**	**Sr**	**Y**	**Zr**	**Nb**	**Mo**
MW-187-1	no.187	quartzite black	Mwulu's Cave	Arcl			ND	ND	13	3	2	64	ND	ND
MW-187-2	no.187	quartzite black	Mwulu's Cave	Arcl			ND	ND	12	4	ND	65	ND	ND
MW-187-3	no.187	quartzite black	Mwulu's Cave	Arcl			ND	ND	13	3	2	64	ND	ND
MW-194-1	no.194	quartzite white	Mwulu's Cave	Arcl			ND	ND	58	35	2	35	ND	ND
MW-194-2	no.194	quartzite white	Mwulu's Cave	Arcl			ND	ND	58	37	3	34	ND	ND
MW-194-3	no.194	quartzite white	Mwulu's Cave	Arcl			ND	ND	58	35	4	35	ND	ND
MW-194-4	no.194	quartzite white	Mwulu's Cave	Arcl			ND	ND	58	35	3	33	ND	ND
MW-195-1	no.195	quartz	Mwulu's Cave	Arcl			ND	ND	ND	5	2	ND	ND	9
MW-195-2	no.195	quartz	Mwulu's Cave	Arcl			ND	ND	ND	4	ND	4	3	14
MW-195-3	no.195	quartz	Mwulu's Cave	Arcl			ND	ND	1	4	ND	3	4	9
MW-203-1	no.203	quartzite white	Mwulu's Cave	Arcl			ND	ND	5	2	ND	24	ND	ND

MW-203-2	no.203	quartzite white	Mwulu's Cave	Arcl			2	ND	5	1	ND	23	ND	ND
MW-203-3	no.203	quartzite white	Mwulu's Cave	Arcl			ND	ND	6	2	ND	41	ND	ND
MW-PALO49-1	PALO49	chert	Mwulu's Cave	Arcl			2	ND	19	3	2	80	ND	ND
MW-PALO49-2	PALO49	chert	Mwulu's Cave	Arcl			3	ND	17	6	6	83	3	7
MW-PALO49-3	PALO49	chert	Mwulu's Cave	Arcl			4	ND	19	7	6	88	6	6
MW-473-1	no.473	quartzite black	Mwulu's Cave	Arcl			ND	ND	2	2	ND	24	ND	ND
MW-473-2	no.473	quartzite black	Mwulu's Cave	Arcl			ND	ND	2	2	ND	23	ND	ND
MW-473-3	no.473	quartzite black	Mwulu's Cave	Arcl			ND	ND	1	1	ND	24	ND	ND
MW-640-1	no.640	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	3	3	31	ND	5
MW-640-2	no.640	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	4	3	30	ND	4
MW-640-3	no.640	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	3	ND	32	ND	4
MW-792-1	no.792	quartzite black	Mwulu's Cave	Arcl			5	ND	55	36	4	61	ND	5
MW-792-2	no.792	quartzite black	Mwulu's Cave	Arcl			6	ND	57	37	3	64	3	5
MW-792-3	no.792	quartzite black	Mwulu's Cave	Arcl			4	ND	54	34	5	56	3	7
MW-794-1	no.794	quartzite black	Mwulu's Cave	Arcl			2	ND	13	2	3	54	4	6
MW-794-2	no.794	quartzite black	Mwulu's Cave	Arcl			ND	ND	12	2	ND	54	4	ND
MW-794-3	no.794	quartzite black	Mwulu's Cave	Arcl			ND	ND	11	ND	ND	35	ND	4
MW-799-1	no.799	quartzite black	Mwulu's Cave	Arcl			ND	ND	6	3	ND	26	ND	ND
MW-799-2	no.799	quartzite black	Mwulu's Cave	Arcl			ND	ND	6	2	ND	28	ND	ND
MW-799-3	no.799	quartzite black	Mwulu's Cave	Arcl			ND	ND	6	2	ND	28	ND	ND
MW-672-1	no.672	quartzite black	Mwulu's Cave	Arcl			ND	ND	12	4	ND	52	ND	ND
MW-672-2	no.672	quartzite black	Mwulu's Cave	Arcl			ND	ND	13	5	ND	50	ND	ND
MW-672-3	no.672	quartzite black	Mwulu's Cave	Arcl			ND	ND	13	4	ND	49	ND	ND
MW-673-1	no.673	quartzite white	Mwulu's Cave	Arcl			ND	ND	33	21	2	58	3	ND
MW-673-2	no.673	quartzite white	Mwulu's Cave	Arcl			ND	ND	33	21	ND	57	4	ND
MW-673-3	no.673	quartzite white	Mwulu's Cave	Arcl			ND	ND	34	21	3	59	3	ND
MW-673-4	no.673	quartzite white	Mwulu's Cave	Arcl			ND	ND	34	21	ND	60	4	ND
MW-674-1	no.674	chert	Mwulu's Cave	Arcl			2	ND	2	ND	ND	4	ND	7
MW-674-2	no.674	chert	Mwulu's Cave	Arcl			2	ND	3	ND	ND	3	3	6
MW-674-3	no.674	chert	Mwulu's Cave	Arcl			3	ND	1	ND	ND	3	3	7
MW-676-1	no.676	quartzite white	Mwulu's Cave	Arcl			2	ND	3	ND	ND	24	ND	ND

MW-676-2	no.676	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	1	ND	23	ND	ND
MW-676-3	no.676	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	ND	ND	23	ND	ND
MW-677-1	no.677	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-677-2	no.677	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-677-3	no.677	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-684-1	no.684	quartzite black	Mwulu's Cave	Arcl			2	ND	2	3	ND	26	ND	ND
MW-684-2	no.684	quartzite black	Mwulu's Cave	Arcl			ND	ND	2	3	ND	26	ND	ND
MW-684-3	no.684	quartzite black	Mwulu's Cave	Arcl			ND	ND	2	3	ND	29	ND	ND
MW-836-1	no.836	quartzite black	Mwulu's Cave	Arcl			5	ND	56	34	ND	60	ND	ND
MW-836-2	no.836	quartzite black	Mwulu's Cave	Arcl			7	ND	57	34	4	59	ND	4
MW-836-3	no.836	quartzite black	Mwulu's Cave	Arcl			5	ND	56	35	3	60	3	ND
MW-837-1	no.837	quartzite black	Mwulu's Cave	Arcl			2	ND	10	6	3	35	5	7
MW-837-2	no.837	quartzite black	Mwulu's Cave	Arcl			ND	ND	10	7	3	35	3	10
MW-837-3	no.837	quartzite black	Mwulu's Cave	Arcl			2	ND	11	7	ND	35	5	8
MW-PA1-1	PA-1	quartzite black	Mwulu's Cave	Arcl			ND	ND	51	37	7	150	ND	ND
MW-PA1-2	PA-1	quartzite black	Mwulu's Cave	Arcl			ND	ND	52	38	7	153	ND	ND
MW-PA1-3	PA-1	quartzite black	Mwulu's Cave	Arcl			2	ND	52	39	8	165	ND	ND
MW-PA2-1	PA-2	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA2-2	PA-2	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA2-3	PA-2	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1021-1	no.1021	quartzite white	Mwulu's Cave	Arcl			ND	ND	11	9	3	43	ND	ND
MW-1021-2	no.1021	quartzite white	Mwulu's Cave	Arcl			ND	ND	12	9	4	43	ND	ND
MW-1021-3	no.1021	quartzite white	Mwulu's Cave	Arcl			ND	ND	11	8	3	42	ND	ND
MW-1024-1	no.1024	quartzite white	Mwulu's Cave	Arcl			ND	ND	11	6	4	39	3	8
MW-1024-2	no.1024	quartzite white	Mwulu's Cave	Arcl			ND	ND	10	6	5	39	4	6
MW-1024-3	no.1024	quartzite white	Mwulu's Cave	Arcl			ND	ND	11	7	5	39	6	9
MW-1240-1	no.1240	shale	Mwulu's Cave	Arcl			ND	ND	35	ND	3	14	3	ND
MW-1240-2	no.1240	shale	Mwulu's Cave	Arcl			2	ND	35	2	4	14	ND	4
MW-1240-3	no.1240	shale	Mwulu's Cave	Arcl			ND	ND	34	ND	2	13	ND	ND
MW-1410-1	no.1410	quartzite white	Mwulu's Cave	Arcl			3	ND	18	14	14	48	ND	ND
MW-1410-2	no.1410	quartzite white	Mwulu's Cave	Arcl			3	ND	20	13	13	51	ND	ND

MW-1410-3	no.1410	quartzite white	Mwulu's Cave	Arcl			3	ND	19	14	16	50	ND	ND
MW-1818-1	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	2	ND	33	ND	ND
MW-1818-2	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	2	ND	35	ND	ND
MW-1818-3	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	2	ND	33	ND	ND
MW-1835-1	no.1835	quartz	Mwulu's Cave	Arcl			ND	ND	ND	1	ND	ND	ND	ND
MW-1835-2	no.1835	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1835-3	no.1835	quartz	Mwulu's Cave	Arcl			ND	ND	ND	1	ND	ND	ND	ND
MW-2133-1	no.2133	quartzite black	Mwulu's Cave	Arcl			ND	ND	8	2	9	52	ND	ND
MW-2133-2	no.2133	quartzite black	Mwulu's Cave	Arcl			ND	ND	8	3	8	51	ND	ND
MW-2133-3	no.2133	quartzite black	Mwulu's Cave	Arcl			ND	ND	7	3	7	51	ND	ND
MW-2034-1	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	2	5	102	4	ND
MW-2034-2	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	3	4	103	4	ND
MW-2034-3	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	3	5	106	3	ND
MW-2070-1	no.2070	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	5	5	47	6	4
MW-2070-2	no.2070	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	1	2	40	ND	ND
MW-2070-3	no.2070	quartzite white	Mwulu's Cave	Arcl			ND	ND	1	1	ND	39	ND	ND
MW-2073-1	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2073-2	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2073-3	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2073-4	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA3-1	PA-3	shale	Mwulu's Cave	Arcl			ND	ND	60	1	ND	19	ND	ND
MW-PA3-2	PA-3	shale	Mwulu's Cave	Arcl			ND	ND	58	2	ND	20	ND	ND
MW-PA3-3	PA-3	shale	Mwulu's Cave	Arcl			ND	ND	58	ND	3	19	ND	ND
MW-PA4-1	PA-4	quartzite white	Mwulu's Cave	Arcl			5	ND	4	36	ND	31	ND	ND
MW-PA4-2	PA-4	quartzite white	Mwulu's Cave	Arcl			3	ND	4	29	2	34	ND	5
MW-PA4-3	PA-4	quartzite white	Mwulu's Cave	Arcl			4	ND	5	43	ND	35	ND	ND
MW-PA5-1	PA-5	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA5-2	PA-5	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA5-3	PA-5	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA6-1	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	ND	5	2	ND	27	ND	ND
MW-PA6-2	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	ND	4	2	ND	29	ND	ND

MW-PA6-3	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	2	ND	27	ND	ND
MW-PA7-1	PA-7	quartzite white	Mwulu's Cave	Arcl			ND	ND	2	3	ND	48	ND	ND
MW-PA7-2	PA-7	quartzite white	Mwulu's Cave	Arcl			ND	ND	2	3	ND	45	ND	ND
MW-PA7-3	PA-7	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	2	ND	46	ND	ND
MW-PA8-1	PA-8	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA8-2	PA-8	quartz	Mwulu's Cave	Arcl			ND	ND	2	ND	ND	ND	ND	ND
MW-PA8-3	PA-8	quartz	Mwulu's Cave	Arcl			2	ND	ND	ND	ND	ND	ND	ND
MW-PA9-1	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	31	ND	ND
MW-PA9-2	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	30	ND	ND
MW-PA9-3	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	ND	2	ND	ND	29	ND	ND
MW-PA10-1	PA-10	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	5
MW-PA10-2	PA-10	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	5
MW-PA10-3	PA-10	quartz	Mwulu's Cave	Arcl			ND	ND	ND	1	ND	ND	ND	6
MW-PA11-1	PA-11	altered	Mwulu's Cave	Arcl			11	ND	63	85	29	187	11	ND
MW-PA11-2	PA-11	altered	Mwulu's Cave	Arcl			8	ND	63	89	30	185	12	ND
MW-PA11-3	PA-11	altered	Mwulu's Cave	Arcl			10	ND	66	86	27	191	14	ND
MW-PA12-1	PA-12	shale	Mwulu's Cave	Arcl			ND	ND	41	ND	4	11	ND	ND
MW-PA12-2	PA-12	shale	Mwulu's Cave	Arcl			ND	ND	39	ND	4	11	ND	ND
MW-PA12-3	PA-12	shale	Mwulu's Cave	Arcl			ND	ND	39	ND	4	9	ND	ND
MW-PA13-1	PA-13	shale	Mwulu's Cave	Arcl			3	ND	ND	ND	ND	ND	ND	ND
MW-PA13-2	PA-13	shale	Mwulu's Cave	Arcl			5	ND	2	ND	ND	ND	ND	ND
MW-PA13-3	PA-13	shale	Mwulu's Cave	Arcl			5	ND	2	ND	ND	ND	ND	ND
MW-PA14-1	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	ND	4	2	ND	32	ND	ND
MW-PA14-2	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	ND	4	ND	ND	32	ND	ND
MW-PA14-3	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	2	ND	32	ND	ND
MW-PA15-1	PA-15	quartzite white	Mwulu's Cave	Arcl			2	ND	5	2	2	43	ND	ND
MW-PA15-2	PA-15	quartzite white	Mwulu's Cave	Arcl			ND	ND	6	2	2	40	ND	ND
MW-PA15-3	PA-15	quartzite white	Mwulu's Cave	Arcl			ND	ND	5	2	3	39	ND	ND
MW-PA16-1	PA-16	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	ND	ND	32	ND	ND
MW-PA16-2	PA-16	quartzite white	Mwulu's Cave	Arcl			2	ND	5	ND	ND	31	ND	ND
MW-PA16-3	PA-16	quartzite white	Mwulu's Cave	Arcl			ND	ND	4	ND	ND	31	ND	ND

MW-M1-E-1	M1-E	altered	Mwulu's Cave	Arcl			10	ND	21	5	112	998	54	ND
MW-M1-E-2	M1-E	altered	Mwulu's Cave	Arcl			9	ND	20	4	116	1007	55	ND
MW-M1-E-3	M1-E	altered	Mwulu's Cave	Arcl			9	ND	21	4	117	1009	55	ND
MW-M1-G-1	M1-G	altered	Mwulu's Cave	Arcl			22	ND	59	21	24	371	18	ND
MW-M1-G-2	M1-G	altered	Mwulu's Cave	Arcl			25	ND	59	20	23	366	18	ND
MW-M1-G-3	M1-G	altered	Mwulu's Cave	Arcl			26	ND	58	19	25	366	16	ND
MW-M1-K-1	M1-K	chert	Mwulu's Cave	Arcl			ND	ND	2	ND	ND	ND	ND	4
MW-M1-K-2	M1-K	chert	Mwulu's Cave	Arcl			ND	ND	2	ND	ND	ND	ND	ND
MW-M1-K-3	M1-K	chert	Mwulu's Cave	Arcl			ND	ND	2	ND	ND	ND	ND	6
MW-M1-J-1	M1-J	quartzite black	Mwulu's Cave	Arcl			2	ND	6	3	3	72	ND	ND
MW-M1-J-2	M1-J	quartzite black	Mwulu's Cave	Arcl			ND	ND	7	3	2	69	ND	ND
MW-M1-J-3	M1-J	quartzite black	Mwulu's Cave	Arcl			2	ND	8	3	3	43	ND	9
MW-M2-B-1	M2-B	altered	Mwulu's Cave	Arcl			10	ND	124	5	125	907	47	ND
MW-M2-B-2	M2-B	altered	Mwulu's Cave	Arcl			9	ND	123	4	124	913	46	ND
MW-M2-B-3	M2-B	altered	Mwulu's Cave	Arcl			10	ND	121	4	122	906	48	ND
MW-M2-C-1	M2-C	altered	Mwulu's Cave	Arcl			3	ND	162	14	22	187	9	ND
MW-M2-C-2	M2-C	altered	Mwulu's Cave	Arcl			5	ND	162	13	21	191	11	ND
MW-M2-C-3	M2-C	altered	Mwulu's Cave	Arcl			5	2	162	13	21	189	11	ND
MW-M3-B-1	M3-B	shale	Mwulu's Cave	Arcl			5	ND	106	97	21	271	15	ND
MW-M3-B-2	M3-B	shale	Mwulu's Cave	Arcl			6	ND	104	95	21	274	14	ND
MW-M3-B-3	M3-B	shale	Mwulu's Cave	Arcl			5	ND	106	96	24	272	15	ND
MW-M3-E-1	M3-E	shale	Mwulu's Cave	Arcl			3	ND	63	ND	ND	12	ND	ND
MW-M3-E-2	M3-E	shale	Mwulu's Cave	Arcl			2	ND	62	2	3	12	ND	ND
MW-M3-E-3	M3-E	shale	Mwulu's Cave	Arcl			ND	ND	63	2	ND	13	ND	4
MW-M3-F-1	M3-F	shale	Mwulu's Cave	Arcl			ND	ND	3	6	4	7	ND	ND
MW-M3-F-2	M3-F	shale	Mwulu's Cave	Arcl			ND	ND	5	8	3	9	ND	ND
MW-M3-F-3	M3-F	shale	Mwulu's Cave	Arcl			ND	ND	5	7	ND	6	ND	ND
MW-1699-1	no.1699	quartzite white	Mwulu's Cave	Arcl			2	ND	2	ND	ND	4	ND	ND
MW-1699-2	no.1699	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	ND	ND	4	ND	ND
MW-1699-3	no.1699	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	ND	ND	6	ND	ND
MW-1679-1	no.1679	quartzite white	Mwulu's Cave	Arcl			ND	ND	9	3	2	45	ND	6

MW-1679-2	no.1679	quartzite white	Mwulu's Cave	Arcl			4	ND	21	4	2	53	ND	ND
MW-1679-3	no.1679	quartzite white	Mwulu's Cave	Arcl			3	ND	22	4	3	57	ND	ND
MW-1815-1	no.1815	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	1	ND	ND	ND	8
MW-1815-2	no.1815	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	1	2	ND	ND	7
MW-1815-3	no.1815	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	6
MW-1826-1	no.1826	quartzite white	Mwulu's Cave	Arcl			ND	ND	4	3	4	44	ND	5
MW-1826-2	no.1826	quartzite white	Mwulu's Cave	Arcl			ND	ND	4	2	6	43	3	10
MW-1826-3	no.1826	quartzite white	Mwulu's Cave	Arcl			ND	ND	5	2	5	46	4	9
MW-1839-1	no.1839	quartz	Mwulu's Cave	Arcl			ND	ND	13	8	ND	43	ND	ND
MW-1839-2	no.1839	quartz	Mwulu's Cave	Arcl			ND	ND	14	9	2	43	ND	ND
MW-1839-3	no.1839	quartz	Mwulu's Cave	Arcl			ND	ND	12	7	ND	41	ND	ND
MW-2118-1	no.2118	quartzite white	Mwulu's Cave	Arcl			3	ND	16	2	3	80	ND	ND
MW-2118-2	no.2118	quartzite white	Mwulu's Cave	Arcl			3	ND	18	2	3	84	3	ND
MW-2118-3	no.2118	quartzite white	Mwulu's Cave	Arcl			ND	ND	1	ND	ND	49	ND	ND
MW-2130-1	no.2130	quartzite black	Mwulu's Cave	Arcl			ND	ND	2	2	4	48	3	9
MW-2130-2	no.2130	quartzite black	Mwulu's Cave	Arcl			2	ND	7	3	3	71	4	9
MW-2130-3	no.2130	quartzite black	Mwulu's Cave	Arcl			ND	ND	8	2	2	66	4	9
MW-2134-1	no.2134	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	ND	2	56	ND	ND
MW-2134-2	no.2134	quartzite white	Mwulu's Cave	Arcl			ND	ND	5	2	2	49	ND	ND
MW-2134-3	no.2134	quartzite white	Mwulu's Cave	Arcl			ND	ND	5	2	3	53	ND	ND
MW-2132-1	no.2132	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2132-2	no.2132	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2132-3	no.2132	quartz	Mwulu's Cave	Arcl			ND	ND	8	ND	ND	30	4	7
MW-2135-1	no.2135	quartzite white	Mwulu's Cave	Arcl			ND	ND	14	2	ND	45	ND	ND
MW-2135-2	no.2135	quartzite white	Mwulu's Cave	Arcl			ND	ND	2	3	3	39	ND	ND
MW-2135-3	no.2135	quartzite white	Mwulu's Cave	Arcl			ND	ND	12	ND	4	57	ND	ND
MW-2024-1	no.2024	quartzite white	Mwulu's Cave	Arcl			2	ND	5	2	3	44	3	6
MW-2024-2	no.2024	quartzite white	Mwulu's Cave	Arcl			ND	ND	10	2	3	54	ND	ND
MW-2024-3	no.2024	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	ND	3	43	ND	ND
MW-2026-1	no.2026	shale	Mwulu's Cave	Arcl			2	ND	50	ND	ND	19	ND	ND
MW-2026-2	no.2026	shale	Mwulu's Cave	Arcl			ND	ND	52	1	ND	16	3	ND

MW-2026-3	no.2026	shale	Mwulu's Cave	Arcl			ND	ND	49	3	5	25	8	14
MW-2038-1	no.2038	quartzite white	Mwulu's Cave	Arcl			ND	ND	7	3	2	44	ND	ND
MW-2038-2	no.2038	quartzite white	Mwulu's Cave	Arcl			2	ND	20	7	2	48	3	8
MW-2038-3	no.2038	quartzite white	Mwulu's Cave	Arcl			2	ND	7	3	2	43	ND	ND
MW-2080-1	no.2080	quartzite white	Mwulu's Cave	Arcl			3	ND	25	10	5	102	8	9
MW-2080-2	no.2080	quartzite white	Mwulu's Cave	Arcl			ND	ND	26	13	4	69	7	10
MW-2080-3	no.2080	quartzite white	Mwulu's Cave	Arcl			ND	ND	23	9	5	118	8	7
MW-M1-A-1	M1-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	28	20	2	40	4	ND
MW-M1-A-2	M1-A	quartzite white	Mwulu's Cave	Arcl			2	ND	21	15	2	33	ND	ND
MW-M1-A-3	M1-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	29	19	2	30	ND	ND
MW-M1-B-1	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	ND	5	3	3	25	ND	ND
MW-M1-B-2	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	ND	3	3	ND	25	ND	ND
MW-M1-B-3	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	ND	9	9	2	42	ND	6
MW-M1-C-1	M1-C	quartzite white	Mwulu's Cave	Arcl			ND	ND	2	1	4	67	5	10
MW-M1-C-2	M1-C	quartzite white	Mwulu's Cave	Arcl			ND	ND	2	2	3	50	6	12
MW-M1-C-3	M1-C	quartzite white	Mwulu's Cave	Arcl			ND	ND	2	2	4	78	6	8
MW-M1-D-1	M1-D	shale	Mwulu's Cave	Arcl			3	ND	45	2	2	26	6	7
MW-M1-D-2	M1-D	shale	Mwulu's Cave	Arcl			4	ND	44	2	ND	22	6	6
MW-M1-D-3	M1-D	shale	Mwulu's Cave	Arcl			4	ND	45	2	2	22	7	7
MW-M1-F-1	M1-F	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	6
MW-M1-F-2	M1-F	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-M1-F-3	M1-F	quartz	Mwulu's Cave	Arcl			ND	ND	ND	1	ND	ND	ND	ND
MW-M1-H-1	M1-H	quartzite black	Mwulu's Cave	Arcl			ND	ND	2	3	3	24	ND	ND
MW-M1-H-2	M1-H	quartzite black	Mwulu's Cave	Arcl			ND	ND	3	4	2	48	ND	ND
MW-M1-H-3	M1-H	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	26	ND	ND
MW-M1-I-1	M1-I	quartzite white	Mwulu's Cave	Arcl			ND	ND	16	11	5	60	3	ND
MW-M1-I-2	M1-I	quartzite white	Mwulu's Cave	Arcl			3	ND	20	17	7	94	10	17
MW-M1-I-3	M1-I	quartzite white	Mwulu's Cave	Arcl			ND	ND	19	13	7	101	3	ND
MW-M1-L-1	M1-L	quartzite black	Mwulu's Cave	Arcl			ND	ND	8	4	4	119	3	ND
MW-M1-L-2	M1-L	quartzite black	Mwulu's Cave	Arcl			ND	ND	6	4	3	57	ND	ND
MW-M1-L-3	M1-L	quartzite black	Mwulu's Cave	Arcl			ND	ND	3	2	5	51	ND	ND

MW-M1-M-1	M1-M	quartzite black	Mwulu's Cave	Arcl			ND	ND	4	6	3	51	4	8
MW-M1-M-2	M1-M	quartzite black	Mwulu's Cave	Arcl			ND	ND	13	8	3	39	4	7
MW-M1-M-3	M1-M	quartzite black	Mwulu's Cave	Arcl			ND	ND	9	8	ND	39	ND	6
MW-M2-A-1	M2-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	1	ND	38	ND	ND
MW-M2-A-2	M2-A	quartzite white	Mwulu's Cave	Arcl			8	ND	8	52	5	44	ND	ND
MW-M2-A-3	M2-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	4	2	3	58	ND	ND
MW-M2-D-1	M2-D	quartzite white	Mwulu's Cave	Arcl			3	ND	2	4	2	29	ND	6
MW-M2-D-2	M2-D	quartzite white	Mwulu's Cave	Arcl			ND	ND	2	2	ND	28	ND	ND
MW-M2-D-3	M2-D	quartzite white	Mwulu's Cave	Arcl			ND	ND	2	3	ND	27	ND	ND
MW-M3-A-1	M3-A	quartzite white	Mwulu's Cave	Arcl			3	ND	1	ND	2	119	ND	ND
MW-M3-A-2	M3-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	5	4	3	29	ND	6
MW-M3-A-3	M3-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	3	2	ND	37	ND	ND
MW-M3-C-1	M3-C	quartzite red	Mwulu's Cave	Arcl			ND	ND	32	18	ND	32	3	8
MW-M3-C-2	M3-C	quartzite red	Mwulu's Cave	Arcl			ND	ND	33	16	ND	34	ND	ND
MW-M3-C-3	M3-C	quartzite red	Mwulu's Cave	Arcl			ND	ND	32	15	4	44	ND	ND
MW-M3-D-1	M3-D	shale	Mwulu's Cave	Arcl			4	ND	195	131	25	160	10	ND
MW-M3-D-2	M3-D	shale	Mwulu's Cave	Arcl			6	ND	186	137	26	205	13	ND
MW-M3-D-3	M3-D	shale	Mwulu's Cave	Arcl			5	ND	189	137	26	206	16	ND
MW- 1-1	Outcrop 1	shale-meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	41	ND	34	15	ND	32	ND	14
MW- 1-2	Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	40	ND	9	7	8	43	12	20
MW- 1-3	Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	68	ND	39	19	11	123	12	29
MW- 2A-1	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	8	ND	41	12	15	120	11	9
MW- 2A-2	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	7	ND	41	13	13	119	11	ND
MW- 2A-3	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	6	ND	42	13	14	120	8	7
MW- 2B-1	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	8	ND	59	8	17	91	11	ND
MW- 2B-2	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	68	ND	68	12	20	115	12	15
MW- 2B-3	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	61	ND	67	10	21	112	9	17
MW- 2C-1	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	16	ND	45	15	12	70	6	ND
MW- 2C-2	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	11	ND	47	14	13	74	5	5
MW- 2C-3	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	11	ND	30	12	12	38	8	15
MW- 3A-1	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	6	ND	46	2481	6	523	118	ND

MW- 3A-2	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	50	2517	4	759	133	8
MW- 3A-3	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	5	ND	53	2732	ND	1924	225	ND
MW- 3B-1	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	2	ND	ND	ND	ND	ND
MW- 3B-2	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	ND	1	ND	ND	ND	ND
MW- 3B-3	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	2	ND	ND	2	ND	ND	ND	ND
MW- 3C-1	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	2	ND	ND	4	ND	ND
MW- 3C-2	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	16	15	6	35	11	29
MW- 3C-3	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	3	1	ND	ND	ND	ND
MW- 4A-1	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	13	2	253	6	6	130	13	ND
MW- 4A-2	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	15	ND	226	7	6	96	13	ND
MW- 4A-3	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	ND	1	267	6	ND	99	15	ND
MW- 4B-1	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	9	ND	190	8	ND	61	11	ND
MW- 4B-2	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	7	ND	191	7	ND	58	10	ND
MW- 4B-3	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	5	ND	200	4	ND	63	10	ND
MW- 4C-1	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	ND	ND	2	ND	ND	2	ND	4
MW- 4C-2	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	ND	ND	3	ND	2	4	4	8
MW- 4C-3	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	ND	ND	ND	5	ND	ND	ND	ND
MW- 6-1	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	6	ND	217	61	31	136	21	ND
MW- 6-2	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	5	ND	213	46	32	126	18	ND
MW- 6-3	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	7	ND	220	69	39	131	14	ND
MW- 8A-1	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	7	ND	105	147	21	194	12	7
MW- 8A-2	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	ND	ND	102	153	19	195	11	ND
MW- 8A-3	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	ND	ND	118	208	18	158	10	ND
MW- 8B-1	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	8	ND	47	13	11	31	5	ND
MW- 8B-2	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	6	ND	44	13	11	25	4	ND
MW- 8B-3	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	5	ND	50	12	12	38	6	ND
MW- 9-1	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	10	ND	193	14	26	149	16	ND
MW- 9-2	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	15	ND	188	14	28	150	14	ND
MW- 9-3	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	14	ND	196	15	25	144	14	ND
MW- 10-1	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	10	ND	141	6	11	148	10	7
MW- 10-2	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	7	ND	143	5	10	158	18	15

MW- 10-3	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	7	ND	139	5	13	169	15	9
MW- 11-1	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	118	ND	20	2	9	80	7	11
MW- 11-2	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	86	ND	81	3	10	81	7	7
MW- 11-3	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	34	ND	11	3	4	40	4	13
MW- 12-1	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	5	ND	178	24	31	178	14	ND
MW- 12-2	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	8	ND	217	20	31	130	14	ND
MW- 12-3	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	15	ND	120	27	33	210	13	7
MW- 13-1	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	3	ND	4	4	3	94	3	ND
MW- 13-2	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	ND	ND	2	8	5	115	7	6
MW- 13-3	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	ND	ND	5	17	3	56	7	14
MW- 14A-1	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	18	ND	206	23	39	227	20	10
MW- 14A-2	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	10	ND	218	28	41	277	18	ND
MW- 14A-3	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	9	ND	195	24	26	179	13	ND
MW- 14B-1	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	12	ND	149	13	20	172	25	14
MW- 14B-2	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	12	ND	150	13	19	174	26	13
MW- 14B-3	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	11	ND	68	16	20	191	7	ND
MW- 16A-1	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	6	ND	17	7	ND	65	3	ND
MW- 16A-2	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	4	ND	18	9	5	63	3	4
MW- 16A-3	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	5	ND	18	7	ND	61	ND	ND
MW- 16B-1	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	ND	ND	13	116	2	61	8	11
MW- 16B-2	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	4	ND	12	125	ND	65	10	9
MW- 16B-3	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	ND	ND	12	8	3	45	ND	9
MW- 16C-1	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	ND	ND	7	4	3	48	4	10
MW- 16C-2	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	ND	ND	7	5	ND	37	5	8
MW- 16C-3	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	ND	ND	6	49	4	47	6	14
MW- 16D-1	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	ND	ND	7	9	2	41	ND	ND
MW- 16D-2	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	ND	ND	11	4	5	123	7	9
MW- 16D-3	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	ND	ND	7	4	ND	44	ND	ND
MW- 16E-1	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	3	3	2	57	5	ND
MW- 16E-2	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	3	3	2	61	4	ND
MW- 16E-3	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	3	2	ND	51	ND	ND

MW- 16F-1	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	4	1	4	19	ND	35	9	ND
MW- 16F-2	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	5	ND	4	31	4	38	6	16
MW- 16F-3	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	6	ND	5	31	3	35	9	19
MW- 17-1	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	2	4	ND	31	ND	ND
MW- 17-2	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	2	4	ND	23	ND	ND
MW- 17-3	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	1	4	ND	26	ND	ND
MW- 18A-1	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	11	ND	78	28	11	117	8	4
MW- 18A-2	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	9	ND	79	30	12	127	6	ND
MW- 18A-3	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	ND	ND	58	36	13	111	5	ND
MW- 18B-1	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	29	2	184	143	40	574	23	ND
MW- 18B-2	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	31	2	182	141	39	576	22	ND
MW- 18B-3	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	69	ND	186	91	51	738	27	ND
MW- 19A-1	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	3	ND	3	9	ND	9	10	21
MW- 19A-2	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	ND	ND	3	10	4	18	13	31
MW- 19A-3	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	4	ND	4	11	ND	16	ND	ND
MW- 19B-1	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	ND	ND	11	5	ND	40	ND	ND
MW- 19B-2	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	2	ND	13	4	ND	37	5	ND
MW- 19B-3	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	4	ND	12	4	ND	39	6	ND
MW- 20-1	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	ND	ND	4	11	ND	11	ND	ND
MW- 20-2	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	3	ND	4	11	ND	14	3	5
MW- 20-3	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	ND	ND	5	12	ND	14	ND	ND
MW- 21A-1	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	ND	ND	7	3	2	36	ND	ND
MW- 21A-2	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	ND	ND	6	4	2	35	5	9
MW- 21A-3	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	ND	ND	7	4	ND	33	6	11
MW- 21B-1	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	ND	1	4	ND	5	ND	ND
MW- 21B-2	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	ND	1	4	ND	5	ND	ND
MW- 21B-3	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	ND	1	4	ND	7	ND	ND
MW- G1-1	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	ND	ND	34	5	2	64	ND	ND
MW- G1-2	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	3	ND	34	5	2	67	ND	ND
MW- G1-3	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	3	ND	43	9	5	147	ND	ND
MW- G2A-1	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	19	2	15	11	12	319	7	ND

MW- G2A-2	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	ND	ND	13	4	2	73	4	5
MW- G2A-3	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	ND	ND	13	5	3	79	4	4
MW- G2B-1	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	ND	ND	2	3	ND	27	4	15
MW- G2B-2	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	ND	ND	4	3	4	35	3	11
MW- G2B-3	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	3	ND	3	4	4	35	4	15
MW- G3-1	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	7	ND	167	39	34	450	15	ND
MW- G3-2	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	9	ND	169	39	33	450	15	ND
MW- G3-3	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	24	ND	157	38	24	358	12	9
MW- G4-1	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	ND	ND	8	3	5	123	4	6
MW- G4-2	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	ND	ND	8	2	4	124	5	8
MW- G4-3	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	ND	ND	9	2	3	99	5	ND
Analysis ID	**Sample ID**	**Rock Type**	**Location**	**Geo/Arcl Piece?**	**Latitude (˚)**	**Longitude (˚)**	**Ag**	**Cd**	**Sn**	**Sb**	**W**	**Hg**	**Pb**	**Bi**
MW-187-1	no.187	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-187-2	no.187	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-187-3	no.187	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-194-1	no.194	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	7	ND
MW-194-2	no.194	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	8	ND
MW-194-3	no.194	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	9	ND
MW-194-4	no.194	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	10	ND
MW-195-1	no.195	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-195-2	no.195	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-195-3	no.195	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-203-1	no.203	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	15
MW-203-2	no.203	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-203-3	no.203	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PALO49-1	PALO49	chert	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PALO49-2	PALO49	chert	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PALO49-3	PALO49	chert	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-473-1	no.473	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	14
MW-473-2	no.473	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	19
MW-473-3	no.473	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	17

MW-640-1	no.640	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-640-2	no.640	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-640-3	no.640	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-792-1	no.792	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	11	ND
MW-792-2	no.792	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	8	ND
MW-792-3	no.792	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	11	ND
MW-794-1	no.794	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-794-2	no.794	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-794-3	no.794	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-799-1	no.799	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-799-2	no.799	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-799-3	no.799	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-672-1	no.672	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-672-2	no.672	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-672-3	no.672	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-673-1	no.673	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-673-2	no.673	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	5	ND
MW-673-3	no.673	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-673-4	no.673	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-674-1	no.674	chert	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-674-2	no.674	chert	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-674-3	no.674	chert	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-676-1	no.676	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	11
MW-676-2	no.676	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-676-3	no.676	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	10
MW-677-1	no.677	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-677-2	no.677	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	10
MW-677-3	no.677	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-684-1	no.684	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-684-2	no.684	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-684-3	no.684	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND

MW-836-1	no.836	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	12	ND
MW-836-2	no.836	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	9	ND
MW-836-3	no.836	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	12	ND
MW-837-1	no.837	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-837-2	no.837	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-837-3	no.837	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA1-1	PA-1	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	8	ND
MW-PA1-2	PA-1	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	9	11
MW-PA1-3	PA-1	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	9	ND
MW-PA2-1	PA-2	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	17
MW-PA2-2	PA-2	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	17
MW-PA2-3	PA-2	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	17
MW-1021-1	no.1021	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1021-2	no.1021	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1021-3	no.1021	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1024-1	no.1024	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1024-2	no.1024	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1024-3	no.1024	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1240-1	no.1240	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	6	ND
MW-1240-2	no.1240	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-1240-3	no.1240	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	5	ND
MW-1410-1	no.1410	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1410-2	no.1410	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-1410-3	no.1410	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-1818-1	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1818-2	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1818-3	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1835-1	no.1835	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1835-2	no.1835	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1835-3	no.1835	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2133-1	no.2133	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND

MW-2133-2	no.2133	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-2133-3	no.2133	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-2034-1	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2034-2	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2034-3	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2070-1	no.2070	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-2070-2	no.2070	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-2070-3	no.2070	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2073-1	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2073-2	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2073-3	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2073-4	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA3-1	PA-3	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA3-2	PA-3	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA3-3	PA-3	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA4-1	PA-4	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	8	ND
MW-PA4-2	PA-4	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	10	ND
MW-PA4-3	PA-4	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	14	ND
MW-PA5-1	PA-5	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA5-2	PA-5	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA5-3	PA-5	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA6-1	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA6-2	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA6-3	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-PA7-1	PA-7	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA7-2	PA-7	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA7-3	PA-7	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA8-1	PA-8	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA8-2	PA-8	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA8-3	PA-8	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA9-1	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND

MW-PA9-2	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	12
MW-PA9-3	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	12
MW-PA10-1	PA-10	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA10-2	PA-10	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA10-3	PA-10	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA11-1	PA-11	altered	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	9	ND
MW-PA11-2	PA-11	altered	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	14	ND
MW-PA11-3	PA-11	altered	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	10	ND
MW-PA12-1	PA-12	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA12-2	PA-12	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	12
MW-PA12-3	PA-12	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA13-1	PA-13	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA13-2	PA-13	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA13-3	PA-13	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA14-1	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA14-2	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA14-3	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA15-1	PA-15	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-PA15-2	PA-15	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-PA15-3	PA-15	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-PA16-1	PA-16	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	24
MW-PA16-2	PA-16	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	19
MW-PA16-3	PA-16	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	26
MW-M1-E-1	M1-E	altered	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	12	ND
MW-M1-E-2	M1-E	altered	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	9	14	ND
MW-M1-E-3	M1-E	altered	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	11	14	ND
MW-M1-G-1	M1-G	altered	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	24	ND
MW-M1-G-2	M1-G	altered	Mwulu's Cave	Arcl			ND	ND	37	ND	ND	ND	23	ND
MW-M1-G-3	M1-G	altered	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	21	ND
MW-M1-K-1	M1-K	chert	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-M1-K-2	M1-K	chert	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND

MW-M1-K-3	M1-K	chert	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-M1-J-1	M1-J	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-M1-J-2	M1-J	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-M1-J-3	M1-J	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-M2-B-1	M2-B	altered	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	8	15	ND
MW-M2-B-2	M2-B	altered	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	16	ND
MW-M2-B-3	M2-B	altered	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	6	9	ND
MW-M2-C-1	M2-C	altered	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	8	6	ND
MW-M2-C-2	M2-C	altered	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	8	4	ND
MW-M2-C-3	M2-C	altered	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	11	4	ND
MW-M3-B-1	M3-B	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	6	13	ND
MW-M3-B-2	M3-B	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	5	12	ND
MW-M3-B-3	M3-B	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	14	ND
MW-M3-E-1	M3-E	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-M3-E-2	M3-E	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-M3-E-3	M3-E	shale	Mwulu's Cave	Arcl			15	ND	ND	ND	ND	ND	ND	ND
MW-M3-F-1	M3-F	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	15	ND	7	ND
MW-M3-F-2	M3-F	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	20	7	ND	ND
MW-M3-F-3	M3-F	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	8	8	ND
MW-1699-1	no.1699	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1699-2	no.1699	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1699-3	no.1699	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1679-1	no.1679	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-1679-2	no.1679	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	6	ND
MW-1679-3	no.1679	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	6	ND
MW-1815-1	no.1815	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1815-2	no.1815	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1815-3	no.1815	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1826-1	no.1826	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1826-2	no.1826	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-1826-3	no.1826	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND

MW-1839-1	no.1839	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-1839-2	no.1839	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-1839-3	no.1839	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2118-1	no.2118	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	5	ND
MW-2118-2	no.2118	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	7	ND
MW-2118-3	no.2118	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2130-1	no.2130	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2130-2	no.2130	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2130-3	no.2130	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-2134-1	no.2134	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2134-2	no.2134	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2134-3	no.2134	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2132-1	no.2132	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2132-2	no.2132	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2132-3	no.2132	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-2135-1	no.2135	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-2135-2	no.2135	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2135-3	no.2135	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-2024-1	no.2024	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-2024-2	no.2024	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-2024-3	no.2024	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2026-1	no.2026	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2026-2	no.2026	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2026-3	no.2026	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2038-1	no.2038	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-2038-2	no.2038	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	5	ND
MW-2038-3	no.2038	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-2080-1	no.2080	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	5	ND
MW-2080-2	no.2080	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	8	ND
MW-2080-3	no.2080	quartzite white	Mwulu's Cave	Arcl			17	ND	ND	ND	ND	ND	5	ND
MW-M1-A-1	M1-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	7	ND

MW-M1-A-2	M1-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-M1-A-3	M1-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	8	ND
MW-M1-B-1	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-M1-B-2	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-M1-B-3	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	7	ND
MW-M1-C-1	M1-C	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	8	ND
MW-M1-C-2	M1-C	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	8	ND
MW-M1-C-3	M1-C	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	7	ND
MW-M1-D-1	M1-D	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	9	ND	4	ND
MW-M1-D-2	M1-D	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	15	ND	5	ND
MW-M1-D-3	M1-D	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-M1-F-1	M1-F	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-M1-F-2	M1-F	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-M1-F-3	M1-F	quartz	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-M1-H-1	M1-H	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-M1-H-2	M1-H	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	10
MW-M1-H-3	M1-H	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	20
MW-M1-I-1	M1-I	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	5	ND
MW-M1-I-2	M1-I	quartzite white	Mwulu's Cave	Arcl			25	ND	ND	ND	ND	ND	8	ND
MW-M1-I-3	M1-I	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	5	ND
MW-M1-L-1	M1-L	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-M1-L-2	M1-L	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	3	ND
MW-M1-L-3	M1-L	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-M1-M-1	M1-M	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-M1-M-2	M1-M	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	6	ND
MW-M1-M-3	M1-M	quartzite black	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-M2-A-1	M2-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-M2-A-2	M2-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	24	10
MW-M2-A-3	M2-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	5	ND
MW-M2-D-1	M2-D	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	6	ND
MW-M2-D-2	M2-D	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND

MW-M2-D-3	M2-D	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-M3-A-1	M3-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-M3-A-2	M3-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-M3-A-3	M3-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	ND	ND
MW-M3-C-1	M3-C	quartzite red	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	7	ND
MW-M3-C-2	M3-C	quartzite red	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	5	ND
MW-M3-C-3	M3-C	quartzite red	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	4	ND
MW-M3-D-1	M3-D	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	ND	20	ND
MW-M3-D-2	M3-D	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	ND	7	19	ND
MW-M3-D-3	M3-D	shale	Mwulu's Cave	Arcl			ND	ND	ND	ND	13	ND	24	ND
MW- 1-1	Outcrop 1	shale-meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	ND	ND	ND	ND	ND	ND	139	154
MW- 1-2	Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	ND	ND	ND	ND	ND	ND	15	ND
MW- 1-3	Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	ND	ND	ND	ND	ND	ND	49	ND
MW- 2A-1	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	ND	ND	ND	ND	ND	ND	7	ND
MW- 2A-2	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	ND	ND	ND	ND	ND	ND	10	ND
MW- 2A-3	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	ND	ND	ND	ND	ND	ND	13	ND
MW- 2B-1	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	ND	ND	ND	ND	ND	ND	17	ND
MW- 2B-2	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	ND	ND	ND	ND	ND	ND	91	ND
MW- 2B-3	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	ND	ND	ND	ND	ND	ND	88	ND
MW- 2C-1	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	ND	ND	ND	ND	ND	ND	13	ND
MW- 2C-2	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	ND	ND	ND	ND	ND	ND	18	ND
MW- 2C-3	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	ND	ND	ND	ND	ND	9	14	ND
MW- 3A-1	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	ND	ND	ND	ND	25	ND
MW- 3A-2	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	ND	ND	ND	ND	26	ND
MW- 3A-3	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	ND	ND	ND	ND	18	ND
MW- 3B-1	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	ND	ND	ND	ND	ND	ND
MW- 3B-2	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	ND	ND	ND	ND	ND	ND
MW- 3B-3	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	ND	ND	ND	ND	ND	ND
MW- 3C-1	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	ND	ND	ND	ND	ND	ND
MW- 3C-2	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	ND	ND	ND	ND	7	ND
MW- 3C-3	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	ND	ND	ND	ND	ND	ND

MW- 4A-1	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	ND	ND	ND	ND	ND	6	ND	ND
MW- 4A-2	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	ND	ND	ND	ND	ND	6	5	ND
MW- 4A-3	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	ND	ND	ND	ND	ND	ND	ND	ND
MW- 4B-1	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	ND	ND	ND	ND	ND	ND	11	ND
MW- 4B-2	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	ND	ND	ND	ND	ND	ND	13	ND
MW- 4B-3	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	ND	ND	ND	ND	ND	ND	13	ND
MW- 4C-1	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	ND	ND	ND	ND	ND	ND	ND	ND
MW- 4C-2	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	ND	ND	ND	ND	ND	ND	ND	ND
MW- 4C-3	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	ND	ND	ND	ND	ND	ND	ND	ND
MW- 6-1	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	ND	ND	31	ND	ND	6	ND	ND
MW- 6-2	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	ND	ND	ND	ND	ND	6	ND	ND
MW- 6-3	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	ND	ND	ND	ND	ND	ND	ND	ND
MW- 8A-1	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	ND	ND	ND	ND	ND	ND	56	ND
MW- 8A-2	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	ND	ND	ND	ND	ND	ND	56	ND
MW- 8A-3	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	ND	ND	ND	ND	ND	ND	48	ND
MW- 8B-1	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	ND	ND	ND	ND	ND	ND	ND	ND
MW- 8B-2	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	ND	ND	ND	ND	ND	ND	ND	ND
MW- 8B-3	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	ND	ND	ND	ND	ND	ND	ND	ND
MW- 9-1	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	ND	ND	ND	ND	13	6	6	ND
MW- 9-2	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	ND	ND	ND	ND	16	ND	ND	ND
MW- 9-3	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	ND	ND	ND	ND	ND	ND	ND	ND
MW- 10-1	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	ND	ND	ND	ND	ND	ND	ND	ND
MW- 10-2	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	ND	ND	ND	ND	ND	ND	ND	ND
MW- 10-3	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	ND	ND	ND	ND	ND	7	ND	ND
MW- 11-1	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	ND	ND	ND	ND	ND	ND	ND	ND
MW- 11-2	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	ND	ND	ND	ND	ND	ND	5	ND
MW- 11-3	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	ND	ND	ND	ND	ND	ND	4	ND
MW- 12-1	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	ND	ND	ND	ND	ND	7	6	ND
MW- 12-2	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	ND	ND	ND	ND	ND	ND	5	ND
MW- 12-3	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	ND	ND	ND	ND	ND	ND	12	ND
MW- 13-1	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	ND	ND	ND	ND	ND	ND	ND	ND

MW- 13-2	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	ND	ND	ND	ND	ND	ND	8	ND
MW- 13-3	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	ND	ND	ND	ND	ND	ND	8	ND
MW- 14A-1	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	ND	ND	ND	ND	ND	ND	10	ND
MW- 14A-2	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	ND	ND	ND	ND	ND	ND	ND	ND
MW- 14A-3	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	ND	ND	ND	ND	ND	ND	ND	ND
MW- 14B-1	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	ND	ND	ND	ND	ND	ND	ND	ND
MW- 14B-2	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	ND	ND	ND	ND	ND	ND	ND	ND
MW- 14B-3	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	ND	ND	ND	ND	ND	ND	5	ND
MW- 16A-1	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	ND	ND
MW- 16A-2	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	4	ND
MW- 16A-3	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	ND	ND
MW- 16B-1	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	21	ND
MW- 16B-2	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	21	ND
MW- 16B-3	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	4	ND
MW- 16C-1	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	ND	ND
MW- 16C-2	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	ND	ND
MW- 16C-3	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	7	ND
MW- 16D-1	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	ND	ND
MW- 16D-2	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	ND	ND
MW- 16D-3	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	ND	ND
MW- 16E-1	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	4	ND
MW- 16E-2	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	4	ND
MW- 16E-3	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	5	ND
MW- 16F-1	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	15	16
MW- 16F-2	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	41	ND
MW- 16F-3	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	38	ND
MW- 17-1	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	3	ND
MW- 17-2	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	ND	ND
MW- 17-3	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	ND	ND	ND	ND	ND	ND
MW- 18A-1	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	ND	ND	ND	ND	ND	ND	7	ND
MW- 18A-2	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	ND	ND	ND	ND	ND	ND	9	ND

MW- 18A-3	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	ND	ND	ND	ND	ND	ND	10	ND
MW- 18B-1	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	ND	ND	ND	ND	ND	6	16	ND
MW- 18B-2	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	ND	ND	ND	ND	ND	ND	14	ND
MW- 18B-3	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	ND	ND	ND	ND	ND	ND	12	ND
MW- 19A-1	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	ND	ND	ND	ND	ND	ND	ND	ND
MW- 19A-2	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	ND	ND	ND	ND	ND	ND	ND	ND
MW- 19A-3	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	ND	ND	ND	ND	ND	ND	ND	ND
MW- 19B-1	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	ND	ND	ND	ND	ND	ND	7	ND
MW- 19B-2	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	ND	ND	ND	ND	ND	ND	5	ND
MW- 19B-3	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	ND	ND	ND	ND	ND	ND	3	ND
MW- 20-1	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	ND	ND	ND	ND	ND	ND	7	ND
MW- 20-2	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	ND	ND	ND	ND	ND	ND	7	ND
MW- 20-3	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	ND	ND	ND	ND	ND	ND	7	ND
MW- 21A-1	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	ND	ND	ND	ND	ND	ND	ND	ND
MW- 21A-2	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	ND	ND	ND	ND	ND	ND	ND	ND
MW- 21A-3	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	ND	ND	ND	ND	ND	ND	3	ND
MW- 21B-1	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	ND	ND	ND	ND	ND	ND	ND
MW- 21B-2	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	ND	ND	ND	ND	ND	ND	ND
MW- 21B-3	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	ND	ND	ND	ND	ND	3	ND
MW- G1-1	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	ND	ND	ND	ND	ND	ND	ND	ND
MW- G1-2	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	ND	ND	ND	ND	ND	ND	ND	ND
MW- G1-3	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	ND	ND	ND	ND	ND	ND	ND	ND
MW- G2A-1	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	ND	ND	ND	ND	ND	ND	6	ND
MW- G2A-2	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	ND	ND	ND	ND	ND	ND	ND	ND
MW- G2A-3	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	ND	ND	ND	ND	ND	ND	5	ND
MW- G2B-1	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	ND	ND	ND	ND	ND	ND	ND	ND
MW- G2B-2	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	ND	ND	ND	ND	ND	ND	ND	ND
MW- G2B-3	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	ND	ND	ND	ND	ND	ND	ND	ND
MW- G3-1	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	ND	ND	ND	ND	ND	ND	9	ND
MW- G3-2	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	ND	ND	ND	ND	ND	ND	ND	ND
MW- G3-3	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	ND	ND	ND	ND	ND	ND	12	ND

MW- G4-1	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	ND	ND	ND	ND	ND	ND	ND	ND
MW- G4-2	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	ND	ND	ND	ND	ND	ND	ND	ND
MW- G4-3	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	ND	ND	ND	ND	ND	ND	ND	ND

Analysis ID	**Sample ID**	**Rock Type**	**Location**	**Geo/Arcl Piece?**	**Latitude (˚)**	**Longitude (˚)**	**Th**	**U**	**LE**
MW-187-1	no.187	quartzite black	Mwulu's Cave	Arcl			ND	ND	511926
MW-187-2	no.187	quartzite black	Mwulu's Cave	Arcl			ND	ND	513767
MW-187-3	no.187	quartzite black	Mwulu's Cave	Arcl			ND	ND	513376
MW-194-1	no.194	quartzite white	Mwulu's Cave	Arcl			ND	ND	515211
MW-194-2	no.194	quartzite white	Mwulu's Cave	Arcl			ND	ND	503862
MW-194-3	no.194	quartzite white	Mwulu's Cave	Arcl			ND	ND	504846
MW-194-4	no.194	quartzite white	Mwulu's Cave	Arcl			ND	ND	505546
MW-195-1	no.195	quartz	Mwulu's Cave	Arcl			18	ND	578793
MW-195-2	no.195	quartz	Mwulu's Cave	Arcl			13	ND	532432
MW-195-3	no.195	quartz	Mwulu's Cave	Arcl			11	ND	545987
MW-203-1	no.203	quartzite white	Mwulu's Cave	Arcl			ND	ND	553097
MW-203-2	no.203	quartzite white	Mwulu's Cave	Arcl			ND	ND	558859
MW-203-3	no.203	quartzite white	Mwulu's Cave	Arcl			ND	ND	590456
MW-PALO49-1	PALO49	chert	Mwulu's Cave	Arcl			ND	ND	595656
MW-PALO49-2	PALO49	chert	Mwulu's Cave	Arcl			16	ND	658119
MW-PALO49-3	PALO49	chert	Mwulu's Cave	Arcl			18	ND	638276
MW-473-1	no.473	quartzite black	Mwulu's Cave	Arcl			ND	ND	492692
MW-473-2	no.473	quartzite black	Mwulu's Cave	Arcl			ND	ND	491404
MW-473-3	no.473	quartzite black	Mwulu's Cave	Arcl			ND	ND	495349
MW-640-1	no.640	quartzite white	Mwulu's Cave	Arcl			ND	ND	585261
MW-640-2	no.640	quartzite white	Mwulu's Cave	Arcl			ND	ND	588565
MW-640-3	no.640	quartzite white	Mwulu's Cave	Arcl			ND	ND	590373
MW-792-1	no.792	quartzite black	Mwulu's Cave	Arcl			12	ND	622975
MW-792-2	no.792	quartzite black	Mwulu's Cave	Arcl			ND	ND	624883
MW-792-3	no.792	quartzite black	Mwulu's Cave	Arcl			13	ND	607131
MW-794-1	no.794	quartzite black	Mwulu's Cave	Arcl			ND	ND	590527
MW-794-2	no.794	quartzite black	Mwulu's Cave	Arcl			ND	ND	592132

MW-794-3	no.794	quartzite black	Mwulu's Cave	Arcl			ND	ND	588328
MW-799-1	no.799	quartzite black	Mwulu's Cave	Arcl			ND	ND	574763
MW-799-2	no.799	quartzite black	Mwulu's Cave	Arcl			ND	ND	572404
MW-799-3	no.799	quartzite black	Mwulu's Cave	Arcl			ND	ND	575933
MW-672-1	no.672	quartzite black	Mwulu's Cave	Arcl			ND	ND	585388
MW-672-2	no.672	quartzite black	Mwulu's Cave	Arcl			ND	ND	573159
MW-672-3	no.672	quartzite black	Mwulu's Cave	Arcl			ND	ND	572503
MW-673-1	no.673	quartzite white	Mwulu's Cave	Arcl			ND	ND	530734
MW-673-2	no.673	quartzite white	Mwulu's Cave	Arcl			ND	ND	546677
MW-673-3	no.673	quartzite white	Mwulu's Cave	Arcl			ND	ND	539330
MW-673-4	no.673	quartzite white	Mwulu's Cave	Arcl			ND	ND	549937
MW-674-1	no.674	chert	Mwulu's Cave	Arcl			ND	ND	601604
MW-674-2	no.674	chert	Mwulu's Cave	Arcl			ND	ND	575907
MW-674-3	no.674	chert	Mwulu's Cave	Arcl			8	ND	580773
MW-676-1	no.676	quartzite white	Mwulu's Cave	Arcl			ND	ND	551135
MW-676-2	no.676	quartzite white	Mwulu's Cave	Arcl			ND	ND	551017
MW-676-3	no.676	quartzite white	Mwulu's Cave	Arcl			ND	ND	550053
MW-677-1	no.677	quartzite white	Mwulu's Cave	Arcl			ND	ND	541823
MW-677-2	no.677	quartzite white	Mwulu's Cave	Arcl			ND	ND	544329
MW-677-3	no.677	quartzite white	Mwulu's Cave	Arcl			ND	ND	542543
MW-684-1	no.684	quartzite black	Mwulu's Cave	Arcl			ND	ND	583961
MW-684-2	no.684	quartzite black	Mwulu's Cave	Arcl			13	ND	584409
MW-684-3	no.684	quartzite black	Mwulu's Cave	Arcl			ND	ND	561603
MW-836-1	no.836	quartzite black	Mwulu's Cave	Arcl			ND	ND	637344
MW-836-2	no.836	quartzite black	Mwulu's Cave	Arcl			ND	ND	631538
MW-836-3	no.836	quartzite black	Mwulu's Cave	Arcl			ND	ND	631225
MW-837-1	no.837	quartzite black	Mwulu's Cave	Arcl			ND	ND	577354
MW-837-2	no.837	quartzite black	Mwulu's Cave	Arcl			13	ND	562849
MW-837-3	no.837	quartzite black	Mwulu's Cave	Arcl			17	ND	578008
MW-PA1-1	PA-1	quartzite black	Mwulu's Cave	Arcl			ND	ND	563533
MW-PA1-2	PA-1	quartzite black	Mwulu's Cave	Arcl			ND	ND	560605

MW-PA1-3	PA-1	quartzite black	Mwulu's Cave	Arcl			ND	ND	562804
MW-PA2-1	PA-2	quartz	Mwulu's Cave	Arcl			ND	ND	504670
MW-PA2-2	PA-2	quartz	Mwulu's Cave	Arcl			ND	ND	504055
MW-PA2-3	PA-2	quartz	Mwulu's Cave	Arcl			ND	ND	505325
MW-1021-1	no.1021	quartzite white	Mwulu's Cave	Arcl			ND	ND	540634
MW-1021-2	no.1021	quartzite white	Mwulu's Cave	Arcl			ND	ND	539025
MW-1021-3	no.1021	quartzite white	Mwulu's Cave	Arcl			ND	ND	539791
MW-1024-1	no.1024	quartzite white	Mwulu's Cave	Arcl			8	ND	570757
MW-1024-2	no.1024	quartzite white	Mwulu's Cave	Arcl			14	ND	567281
MW-1024-3	no.1024	quartzite white	Mwulu's Cave	Arcl			14	ND	574405
MW-1240-1	no.1240	shale	Mwulu's Cave	Arcl			ND	ND	562800
MW-1240-2	no.1240	shale	Mwulu's Cave	Arcl			9	ND	529148
MW-1240-3	no.1240	shale	Mwulu's Cave	Arcl			ND	ND	533918
MW-1410-1	no.1410	quartzite white	Mwulu's Cave	Arcl			ND	ND	572853
MW-1410-2	no.1410	quartzite white	Mwulu's Cave	Arcl			ND	ND	573193
MW-1410-3	no.1410	quartzite white	Mwulu's Cave	Arcl			ND	ND	560429
MW-1818-1	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	ND	519818
MW-1818-2	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	ND	520102
MW-1818-3	no.1818	quartzite white	Mwulu's Cave	Arcl			ND	ND	526766
MW-1835-1	no.1835	quartz	Mwulu's Cave	Arcl			ND	ND	536599
MW-1835-2	no.1835	quartz	Mwulu's Cave	Arcl			ND	ND	542059
MW-1835-3	no.1835	quartz	Mwulu's Cave	Arcl			ND	ND	544646
MW-2133-1	no.2133	quartzite black	Mwulu's Cave	Arcl			ND	ND	571499
MW-2133-2	no.2133	quartzite black	Mwulu's Cave	Arcl			ND	ND	569969
MW-2133-3	no.2133	quartzite black	Mwulu's Cave	Arcl			ND	ND	570823
MW-2034-1	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	ND	579407
MW-2034-2	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	ND	578820
MW-2034-3	no.2034	quartzite white	Mwulu's Cave	Arcl			ND	ND	578792
MW-2070-1	no.2070	quartzite white	Mwulu's Cave	Arcl			12	ND	572288
MW-2070-2	no.2070	quartzite white	Mwulu's Cave	Arcl			ND	ND	536058
MW-2070-3	no.2070	quartzite white	Mwulu's Cave	Arcl			ND	ND	533825

MW-2073-1	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	529074
MW-2073-2	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	528410
MW-2073-3	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	521449
MW-2073-4	no.2073	quartz	Mwulu's Cave	Arcl			ND	ND	525855
MW-PA3-1	PA-3	shale	Mwulu's Cave	Arcl			ND	ND	536487
MW-PA3-2	PA-3	shale	Mwulu's Cave	Arcl			ND	ND	537281
MW-PA3-3	PA-3	shale	Mwulu's Cave	Arcl			ND	ND	534419
MW-PA4-1	PA-4	quartzite white	Mwulu's Cave	Arcl			ND	ND	588401
MW-PA4-2	PA-4	quartzite white	Mwulu's Cave	Arcl			ND	ND	634674
MW-PA4-3	PA-4	quartzite white	Mwulu's Cave	Arcl			ND	ND	633783
MW-PA5-1	PA-5	quartz	Mwulu's Cave	Arcl			ND	ND	568039
MW-PA5-2	PA-5	quartz	Mwulu's Cave	Arcl			ND	ND	565263
MW-PA5-3	PA-5	quartz	Mwulu's Cave	Arcl			ND	ND	564057
MW-PA6-1	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	ND	553458
MW-PA6-2	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	ND	550229
MW-PA6-3	PA-6	quartzite white	Mwulu's Cave	Arcl			ND	ND	549677
MW-PA7-1	PA-7	quartzite white	Mwulu's Cave	Arcl			ND	ND	534140
MW-PA7-2	PA-7	quartzite white	Mwulu's Cave	Arcl			ND	ND	535060
MW-PA7-3	PA-7	quartzite white	Mwulu's Cave	Arcl			ND	ND	513725
MW-PA8-1	PA-8	quartz	Mwulu's Cave	Arcl			ND	ND	513116
MW-PA8-2	PA-8	quartz	Mwulu's Cave	Arcl			ND	ND	510809
MW-PA8-3	PA-8	quartz	Mwulu's Cave	Arcl			ND	ND	512647
MW-PA9-1	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	ND	496503
MW-PA9-2	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	ND	516296
MW-PA9-3	PA-9	quartzite white	Mwulu's Cave	Arcl			ND	ND	507656
MW-PA10-1	PA-10	quartz	Mwulu's Cave	Arcl			ND	ND	575240
MW-PA10-2	PA-10	quartz	Mwulu's Cave	Arcl			ND	ND	573997
MW-PA10-3	PA-10	quartz	Mwulu's Cave	Arcl			ND	ND	571460
MW-PA11-1	PA-11	altered	Mwulu's Cave	Arcl			15	ND	520919
MW-PA11-2	PA-11	altered	Mwulu's Cave	Arcl			18	ND	517784
MW-PA11-3	PA-11	altered	Mwulu's Cave	Arcl			12	ND	519272

MW-PA12-1	PA-12	shale	Mwulu's Cave	Arcl			ND	ND	520249
MW-PA12-2	PA-12	shale	Mwulu's Cave	Arcl			ND	ND	517542
MW-PA12-3	PA-12	shale	Mwulu's Cave	Arcl			ND	ND	519268
MW-PA13-1	PA-13	shale	Mwulu's Cave	Arcl			ND	ND	522806
MW-PA13-2	PA-13	shale	Mwulu's Cave	Arcl			ND	ND	522871
MW-PA13-3	PA-13	shale	Mwulu's Cave	Arcl			ND	ND	527010
MW-PA14-1	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	ND	537493
MW-PA14-2	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	ND	542343
MW-PA14-3	PA-14	quartzite white	Mwulu's Cave	Arcl			ND	ND	546561
MW-PA15-1	PA-15	quartzite white	Mwulu's Cave	Arcl			ND	ND	558179
MW-PA15-2	PA-15	quartzite white	Mwulu's Cave	Arcl			ND	ND	550612
MW-PA15-3	PA-15	quartzite white	Mwulu's Cave	Arcl			ND	ND	569190
MW-PA16-1	PA-16	quartzite white	Mwulu's Cave	Arcl			ND	ND	519832
MW-PA16-2	PA-16	quartzite white	Mwulu's Cave	Arcl			ND	ND	510393
MW-PA16-3	PA-16	quartzite white	Mwulu's Cave	Arcl			ND	ND	513410
MW-M1-E-1	M1-E	altered	Mwulu's Cave	Arcl			55	11	569327
MW-M1-E-2	M1-E	altered	Mwulu's Cave	Arcl			66	14	563994
MW-M1-E-3	M1-E	altered	Mwulu's Cave	Arcl			58	9	563385
MW-M1-G-1	M1-G	altered	Mwulu's Cave	Arcl			ND	ND	567783
MW-M1-G-2	M1-G	altered	Mwulu's Cave	Arcl			ND	ND	572806
MW-M1-G-3	M1-G	altered	Mwulu's Cave	Arcl			15	ND	566829
MW-M1-K-1	M1-K	chert	Mwulu's Cave	Arcl			ND	ND	549142
MW-M1-K-2	M1-K	chert	Mwulu's Cave	Arcl			ND	ND	550595
MW-M1-K-3	M1-K	chert	Mwulu's Cave	Arcl			ND	ND	545836
MW-M1-J-1	M1-J	quartzite black	Mwulu's Cave	Arcl			9	ND	574891
MW-M1-J-2	M1-J	quartzite black	Mwulu's Cave	Arcl			ND	ND	562481
MW-M1-J-3	M1-J	quartzite black	Mwulu's Cave	Arcl			12	ND	583684
MW-M2-B-1	M2-B	altered	Mwulu's Cave	Arcl			58	9	528703
MW-M2-B-2	M2-B	altered	Mwulu's Cave	Arcl			53	8	517544
MW-M2-B-3	M2-B	altered	Mwulu's Cave	Arcl			47	10	525796
MW-M2-C-1	M2-C	altered	Mwulu's Cave	Arcl			12	ND	523012

MW-M2-C-2	M2-C	altered	Mwulu's Cave	Arcl			14	ND	525225
MW-M2-C-3	M2-C	altered	Mwulu's Cave	Arcl			9	ND	523422
MW-M3-B-1	M3-B	shale	Mwulu's Cave	Arcl			20	ND	551861
MW-M3-B-2	M3-B	shale	Mwulu's Cave	Arcl			18	ND	549722
MW-M3-B-3	M3-B	shale	Mwulu's Cave	Arcl			17	ND	549773
MW-M3-E-1	M3-E	shale	Mwulu's Cave	Arcl			ND	ND	544242
MW-M3-E-2	M3-E	shale	Mwulu's Cave	Arcl			ND	ND	549969
MW-M3-E-3	M3-E	shale	Mwulu's Cave	Arcl			ND	ND	545572
MW-M3-F-1	M3-F	shale	Mwulu's Cave	Arcl			11	ND	436259
MW-M3-F-2	M3-F	shale	Mwulu's Cave	Arcl			ND	ND	419667
MW-M3-F-3	M3-F	shale	Mwulu's Cave	Arcl			16	ND	395264
MW-1699-1	no.1699	quartzite white	Mwulu's Cave	Arcl			ND	ND	608511
MW-1699-2	no.1699	quartzite white	Mwulu's Cave	Arcl			ND	ND	612919
MW-1699-3	no.1699	quartzite white	Mwulu's Cave	Arcl			ND	ND	613230
MW-1679-1	no.1679	quartzite white	Mwulu's Cave	Arcl			ND	ND	653727
MW-1679-2	no.1679	quartzite white	Mwulu's Cave	Arcl			ND	ND	658085
MW-1679-3	no.1679	quartzite white	Mwulu's Cave	Arcl			ND	ND	652972
MW-1815-1	no.1815	quartzite white	Mwulu's Cave	Arcl			9	ND	574171
MW-1815-2	no.1815	quartzite white	Mwulu's Cave	Arcl			ND	ND	575633
MW-1815-3	no.1815	quartzite white	Mwulu's Cave	Arcl			ND	ND	575678
MW-1826-1	no.1826	quartzite white	Mwulu's Cave	Arcl			ND	ND	569682
MW-1826-2	no.1826	quartzite white	Mwulu's Cave	Arcl			ND	ND	581272
MW-1826-3	no.1826	quartzite white	Mwulu's Cave	Arcl			13	ND	584298
MW-1839-1	no.1839	quartz	Mwulu's Cave	Arcl			ND	ND	552995
MW-1839-2	no.1839	quartz	Mwulu's Cave	Arcl			ND	ND	551727
MW-1839-3	no.1839	quartz	Mwulu's Cave	Arcl			ND	ND	571434
MW-2118-1	no.2118	quartzite white	Mwulu's Cave	Arcl			ND	ND	616611
MW-2118-2	no.2118	quartzite white	Mwulu's Cave	Arcl			ND	ND	613236
MW-2118-3	no.2118	quartzite white	Mwulu's Cave	Arcl			ND	ND	574509
MW-2130-1	no.2130	quartzite black	Mwulu's Cave	Arcl			ND	ND	630790
MW-2130-2	no.2130	quartzite black	Mwulu's Cave	Arcl			12	ND	650128

MW-2130-3	no.2130	quartzite black	Mwulu's Cave	Arcl			14	ND	647085
MW-2134-1	no.2134	quartzite white	Mwulu's Cave	Arcl			ND	ND	593838
MW-2134-2	no.2134	quartzite white	Mwulu's Cave	Arcl			ND	ND	594284
MW-2134-3	no.2134	quartzite white	Mwulu's Cave	Arcl			ND	ND	589559
MW-2132-1	no.2132	quartz	Mwulu's Cave	Arcl			ND	ND	561396
MW-2132-2	no.2132	quartz	Mwulu's Cave	Arcl			ND	ND	560183
MW-2132-3	no.2132	quartz	Mwulu's Cave	Arcl			ND	ND	664511
MW-2135-1	no.2135	quartzite white	Mwulu's Cave	Arcl			ND	ND	609888
MW-2135-2	no.2135	quartzite white	Mwulu's Cave	Arcl			ND	ND	572132
MW-2135-3	no.2135	quartzite white	Mwulu's Cave	Arcl			ND	ND	607800
MW-2024-1	no.2024	quartzite white	Mwulu's Cave	Arcl			11	ND	604543
MW-2024-2	no.2024	quartzite white	Mwulu's Cave	Arcl			ND	ND	632730
MW-2024-3	no.2024	quartzite white	Mwulu's Cave	Arcl			ND	ND	634299
MW-2026-1	no.2026	shale	Mwulu's Cave	Arcl			ND	ND	570684
MW-2026-2	no.2026	shale	Mwulu's Cave	Arcl			ND	ND	563295
MW-2026-3	no.2026	shale	Mwulu's Cave	Arcl			22	ND	666993
MW-2038-1	no.2038	quartzite white	Mwulu's Cave	Arcl			ND	ND	672932
MW-2038-2	no.2038	quartzite white	Mwulu's Cave	Arcl			11	ND	614962
MW-2038-3	no.2038	quartzite white	Mwulu's Cave	Arcl			ND	ND	611842
MW-2080-1	no.2080	quartzite white	Mwulu's Cave	Arcl			20	ND	630241
MW-2080-2	no.2080	quartzite white	Mwulu's Cave	Arcl			17	ND	652973
MW-2080-3	no.2080	quartzite white	Mwulu's Cave	Arcl			10	ND	617802
MW-M1-A-1	M1-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	566583
MW-M1-A-2	M1-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	554565
MW-M1-A-3	M1-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	557791
MW-M1-B-1	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	ND	526069
MW-M1-B-2	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	ND	514320
MW-M1-B-3	M1-B	quartzite black	Mwulu's Cave	Arcl			ND	4	555813
MW-M1-C-1	M1-C	quartzite white	Mwulu's Cave	Arcl			ND	ND	582865
MW-M1-C-2	M1-C	quartzite white	Mwulu's Cave	Arcl			13	ND	617787
MW-M1-C-3	M1-C	quartzite white	Mwulu's Cave	Arcl			ND	ND	586679

MW-M1-D-1	M1-D	shale	Mwulu's Cave	Arcl			ND	ND	552670
MW-M1-D-2	M1-D	shale	Mwulu's Cave	Arcl			14	4	553453
MW-M1-D-3	M1-D	shale	Mwulu's Cave	Arcl			ND	7	548095
MW-M1-F-1	M1-F	quartz	Mwulu's Cave	Arcl			ND	ND	550576
MW-M1-F-2	M1-F	quartz	Mwulu's Cave	Arcl			ND	ND	529281
MW-M1-F-3	M1-F	quartz	Mwulu's Cave	Arcl			ND	ND	529166
MW-M1-H-1	M1-H	quartzite black	Mwulu's Cave	Arcl			ND	ND	477550
MW-M1-H-2	M1-H	quartzite black	Mwulu's Cave	Arcl			ND	ND	500487
MW-M1-H-3	M1-H	quartzite black	Mwulu's Cave	Arcl			ND	ND	481345
MW-M1-I-1	M1-I	quartzite white	Mwulu's Cave	Arcl			9	ND	542849
MW-M1-I-2	M1-I	quartzite white	Mwulu's Cave	Arcl			20	ND	602284
MW-M1-I-3	M1-I	quartzite white	Mwulu's Cave	Arcl			ND	ND	556764
MW-M1-L-1	M1-L	quartzite black	Mwulu's Cave	Arcl			ND	ND	561899
MW-M1-L-2	M1-L	quartzite black	Mwulu's Cave	Arcl			ND	ND	565242
MW-M1-L-3	M1-L	quartzite black	Mwulu's Cave	Arcl			ND	ND	543681
MW-M1-M-1	M1-M	quartzite black	Mwulu's Cave	Arcl			12	ND	573071
MW-M1-M-2	M1-M	quartzite black	Mwulu's Cave	Arcl			11	ND	562963
MW-M1-M-3	M1-M	quartzite black	Mwulu's Cave	Arcl			10	ND	547423
MW-M2-A-1	M2-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	532808
MW-M2-A-2	M2-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	629385
MW-M2-A-3	M2-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	526231
MW-M2-D-1	M2-D	quartzite white	Mwulu's Cave	Arcl			ND	ND	567384
MW-M2-D-2	M2-D	quartzite white	Mwulu's Cave	Arcl			ND	ND	539281
MW-M2-D-3	M2-D	quartzite white	Mwulu's Cave	Arcl			ND	ND	550308
MW-M3-A-1	M3-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	566201
MW-M3-A-2	M3-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	576224
MW-M3-A-3	M3-A	quartzite white	Mwulu's Cave	Arcl			ND	ND	540757
MW-M3-C-1	M3-C	quartzite red	Mwulu's Cave	Arcl			ND	ND	614345
MW-M3-C-2	M3-C	quartzite red	Mwulu's Cave	Arcl			ND	ND	521850
MW-M3-C-3	M3-C	quartzite red	Mwulu's Cave	Arcl			ND	ND	534765
MW-M3-D-1	M3-D	shale	Mwulu's Cave	Arcl			13	ND	469686

MW-M3-D-2	M3-D	shale	Mwulu's Cave	Arcl			26	6	574444
MW-M3-D-3	M3-D	shale	Mwulu's Cave	Arcl			31	ND	548426
MW- 1-1	Outcrop 1	shale-meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	24	19	258423
MW- 1-2	Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	39	ND	516007
MW- 1-3	Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	41	ND	413488
MW- 2A-1	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	12	5	596904
MW- 2A-2	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	18	ND	597676
MW- 2A-3	Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	16	ND	595931
MW- 2B-1	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	26	ND	485780
MW- 2B-2	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	26	ND	551716
MW- 2B-3	Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	29	ND	553358
MW- 2C-1	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	15	ND	601655
MW- 2C-2	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	ND	ND	578644
MW- 2C-3	Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	31	ND	620418
MW- 3A-1	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	19	ND	598668
MW- 3A-2	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	32	ND	586645
MW- 3A-3	Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	24	ND	582469
MW- 3B-1	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	589401
MW- 3B-2	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	597186
MW- 3B-3	Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	570581
MW- 3C-1	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	603436
MW- 3C-2	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	29	ND	764384
MW- 3C-3	Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	ND	ND	602468
MW- 4A-1	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	16	ND	581997
MW- 4A-2	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	ND	ND	601588
MW- 4A-3	Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	ND	ND	574199
MW- 4B-1	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	ND	ND	577266
MW- 4B-2	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	ND	ND	579442
MW- 4B-3	Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	ND	ND	559372
MW- 4C-1	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	ND	ND	606093
MW- 4C-2	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	9	ND	602407

MW- 4C-3	Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	ND	ND	587106
MW- 6-1	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	16	ND	610526
MW- 6-2	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	20	ND	550966
MW- 6-3	Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	11	ND	607437
MW- 8A-1	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	22	ND	558061
MW- 8A-2	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	24	ND	571436
MW- 8A-3	Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	18	ND	559100
MW- 8B-1	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	10	ND	554669
MW- 8B-2	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	ND	ND	557824
MW- 8B-3	Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	ND	ND	564724
MW- 9-1	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	21	5	557248
MW- 9-2	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	32	ND	551074
MW- 9-3	Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	39	ND	550293
MW- 10-1	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	18	ND	652241
MW- 10-2	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	24	ND	596279
MW- 10-3	Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	15	ND	550456
MW- 11-1	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	ND	ND	630315
MW- 11-2	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	ND	ND	645509
MW- 11-3	Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	16	ND	630633
MW- 12-1	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	11	ND	549259
MW- 12-2	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	ND	ND	553827
MW- 12-3	Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	18	ND	688882
MW- 13-1	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	ND	ND	561568
MW- 13-2	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	13	ND	569922
MW- 13-3	Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	16	ND	724986
MW- 14A-1	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	22	7	749548
MW- 14A-2	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	14	ND	581593
MW- 14A-3	Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	10	ND	606383
MW- 14B-1	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	23	5	663268
MW- 14B-2	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	25	ND	664815
MW- 14B-3	Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	12	ND	618139

MW- 16A-1	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	9	ND	679510
MW- 16A-2	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	702873
MW- 16A-3	Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	9	ND	688091
MW- 16B-1	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	12	ND	689764
MW- 16B-2	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	11	ND	687732
MW- 16B-3	Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	ND	ND	612419
MW- 16C-1	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	15	ND	578513
MW- 16C-2	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	13	ND	615833
MW- 16C-3	Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	24	ND	691113
MW- 16D-1	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	9	ND	649461
MW- 16D-2	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	19	ND	628547
MW- 16D-3	Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	ND	ND	549435
MW- 16E-1	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	583269
MW- 16E-2	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	588277
MW- 16E-3	Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	591237
MW- 16F-1	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	ND	ND	702963
MW- 16F-2	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	13	ND	713140
MW- 16F-3	Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	17	ND	684628
MW- 17-1	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	623710
MW- 17-2	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	564556
MW- 17-3	Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	ND	ND	562688
MW- 18A-1	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	10	ND	620581
MW- 18A-2	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	ND	5	633588
MW- 18A-3	Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	11	4	849763
MW- 18B-1	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	12	6	551659
MW- 18B-2	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	10	ND	553702
MW- 18B-3	Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	17	11	574908
MW- 19A-1	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	22	ND	837460
MW- 19A-2	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	30	ND	812621
MW- 19A-3	Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	ND	ND	547955
MW- 19B-1	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	ND	ND	597415

MW- 19B-2	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	9	ND	610171
MW- 19B-3	Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	9	ND	635049
MW- 20-1	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	ND	ND	714315
MW- 20-2	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	ND	ND	698081
MW- 20-3	Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	ND	ND	700339
MW- 21A-1	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	ND	ND	598812
MW- 21A-2	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	ND	ND	599715
MW- 21A-3	Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	12	ND	592670
MW- 21B-1	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	ND	733777
MW- 21B-2	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	ND	712321
MW- 21B-3	Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967	ND	ND	699283
MW- G1-1	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	ND	ND	580443
MW- G1-2	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	ND	ND	567756
MW- G1-3	Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	9	4	624352
MW- G2A-1	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	15	9	667806
MW- G2A-2	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	ND	ND	640636
MW- G2A-3	Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	9	ND	648929
MW- G2B-1	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	13	4	649095
MW- G2B-2	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	ND	ND	615560
MW- G2B-3	Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	17	ND	643608
MW- G3-1	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	19	ND	551719
MW- G3-2	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	21	5	548448
MW- G3-3	Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	24	ND	671405
MW- G4-1	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	10	ND	615425
MW- G4-2	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	9	5	610896
MW- G4-3	Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	ND	ND	584129

Table B3: PXRF spreadsheet of Olieboomspoort Rock Shelter lithics and outcrop samples' concentration errors for all analysed elements. All errors measured in ppm.

Sample ID	Rock type	Location	Geo/Arcl piece?	Latitude (˚)	Longitude (˚)	Mg	Al	Si	P	S	K	Ca	Ti	V	Cr
no.110	shale	OBP	Arcl				315	447	40	19	24	582	159	17	29
no.110	shale	OBP	Arcl			1417	448	769	47	25	34	274	151	16	27
no.110	shale	OBP	Arcl			1320	452	771	47	25	35	246	149	15	26
no.120	white quartzite	OBP	Arcl				237	784	34	14	23	77	50	7	
no.120	white quartzite	OBP	Arcl				252	760	33	14	24	58	50	7	10
no.120	white quartzite	OBP	Arcl				252	761	34	14	24	60	51	8	10
no.143	white quartzite	OBP	Arcl				303	900	31		32		58		
no.143	white quartzite	OBP	Arcl				299	892	29		31		57		
no.143	white quartzite	OBP	Arcl				298	890	29		31		58		
no.137	shale	OBP	Arcl				392	605	42	16	48	206	93	11	14
no.137	shale	OBP	Arcl				394	598	42	16	48	212	93	11	14
no.137	shale	OBP	Arcl				397	595	43	17	48	234	97	12	
no.164	shale	OBP	Arcl				453	797	38	18	125	89	93	12	
no.164	shale	OBP	Arcl				456	802	37	18	126	77	95	13	
no.164	shale	OBP	Arcl				459	811	36	18	127	62	93	12	15
no.1968	shale/metased	OBP	Arcl				402	770	30	15	75	61	81	10	15
no.1968	shale/metased	OBP	Arcl				387	670	35	15	63	175	81	10	15
no.1968	shale/metased	OBP	Arcl				395	678	36	16	65	187	82	11	15
no.420	shale	OBP	Arcl				230	193	50	13	31	722	71	10	
no.420	shale	OBP	Arcl				229	193	50	13	31	721	70	10	
no.420	shale	OBP	Arcl				228	193	51	13	31	724	69	10	
no.408	dolerite	OBP	Arcl			1459	447	519	87	20	34	496	162	15	
no.408	dolerite	OBP	Arcl				468	519	88	23	37	561	171	16	
no.408	dolerite	OBP	Arcl				449	490	80	22	35	583	166	17	
no.412	chert	OBP	Arcl				437	817	50	16	138	38	95	12	15
no.412	chert	OBP	Arcl				436	815	50	16	138	38	93	12	
no.412	chert	OBP	Arcl				438	819	51	16	138	38	94	11	15

no.494	white quartzite	OBP	Arcl				275	786	55	14	25	71	59		
no.494	white quartzite	OBP	Arcl				275	773	56	14	25	76	58		
no.494	white quartzite	OBP	Arcl				274	765	55	14	25	77	59		
no.458	dolerite	OBP	Arcl			1308	547	893	45	19	71	110	132	13	16
no.458	dolerite	OBP	Arcl			1302	543	889	45	19	71	110	130	13	17
no.458	dolerite	OBP	Arcl			1300	544	888	44	19	71	110	132	13	16
no.488	white quartzite	OBP	Arcl				404	598	54	13	35	83	74	9	11
no.488	white quartzite	OBP	Arcl				425	597	52	14	37	90	83	9	12
no.488	white quartzite	OBP	Arcl				417	582	51	13	36	87	81	9	12
no.488	white quartzite	OBP	Arcl				416	580	51	13	35	87	80	9	12
no.486	white quartzite	OBP	Arcl				331	786	52	13	32	28	58	8	11
no.486	white quartzite	OBP	Arcl				328	787	51	13	31	27	57	8	11
no.486	white quartzite	OBP	Arcl				337	799	52	14	32	29	62	8	12
no.440	black quartzite	OBP	Arcl			1309	499	641	41	16	31	344	120	12	
no.440	blackquartzite	OBP	Arcl			1306	495	639	41	16	31	347	120	12	
no.440	black quartzite	OBP	Arcl			1334	496	646	42	17	31	362	121	13	
no.1286	sandstone	OBP	Arcl				444	775	41	17	51	64	72		13
no.1286	sandstone	OBP	Arcl				442	771	42	17	51	61	73		13
no.1286	sandstone	OBP	Arcl				445	769	41	17	51	60	73	9	13
no.1194	sandstone	OBP	Arcl				369	665	57	16	76	226	88	12	15
no.1194	sandstone	OBP	Arcl				367	662	57	16	75	229	87	12	15
no.1194	sandstone	OBP	Arcl				364	660	57	16	76	226	87	12	
no.1241	dolerite	OBP	Arcl				372	478	74	16	31	520	159	16	
no.1241	dolerite	OBP	Arcl				368	472	73	16	31	521	159	15	
no.1241	dolerite	OBP	Arcl				367	476	73	16	31	513	158	15	
no.1195	red quartzite	OBP	Arcl			1569	396	413	63	22	36	721	124	16	29
no.1195	red quartzite	OBP	Arcl				378	369	60	21	33	608	120	15	28
no.1195	red quartzite	OBP	Arcl				376	372	59	21	33	626	120	14	27
no.1795	white quartzite	OBP	Arcl			1033	288	471	38	14	30	318	67	8	12
no.1795	white quartzite	OBP	Arcl				281	445	37	13	28	287	65	8	11
no.1795	white quartzite	OBP	Arcl			896	269	431	34	13	26	325	62	8	11

no.1789	shale	OBP	Arcl				322	802		14	72	51	67	10	13
no.1789	shale	OBP	Arcl				324	806		14	73	52	68	10	
no.1789	shale	OBP	Arcl				324	803		14	72	53	69	10	
no.2395	sandstone	OBP	Arcl				321	832	45	17	28	66	62	9	
no.2395	sandstone	OBP	Arcl				328	854	47	18	29	70	64	9	
no.2395	sandstone	OBP	Arcl				330	852	47	18	29	71	62	9	
no.2332	whitequartzite	OBP	Arcl				258	755	34	15		157	62		
no.2332	white quartzite	OBP	Arcl				257	760	34	15		159	63		
no.2332	white quartzite	OBP	Arcl				261	767	35	16		156	65		
no.2402	sandstone	OBP	Arcl				302	634	40	15	30	235	69	9	
no.2402	sandstone	OBP	Arcl				304	637	40	15	29	240	68	9	13
no.2402	sandstone	OBP	Arcl				301	645	40	15	30	238	69	9	
no.2374	white quartzite	OBP	Arcl				345	590	38	14	31	185	72	9	12
no.2374	white quartzite	OBP	Arcl				340	579	37	13	30	174	71	8	11
no.2374	white quartzite	OBP	Arcl				337	575	36	13	29	170	71	9	11
YRS1-A	shale	OBP	Arcl				516	787	34	17	138		92	12	
YRS1-A	shale	OBP	Arcl				508	781	33	16	136		91	12	
YRS1-A	shale	OBP	Arcl				502	778	32	16	135		91	12	15
YRS1-B	shale	OBP	Arcl				507	730	49	15	98	36	84	10	14
YRS1-B	shale	OBP	Arcl				499	712	47	15	95	35	82	10	14
YRS1-B	shale	OBP	Arcl				498	715	48	15	96	35	83	10	14
YRS1-C	red quartzite	OBP	Arcl				361	709	80	14	34	63	64	8	11
YRS1-C	red quartzite	OBP	Arcl				352	707	77	14	33	58	63	8	11
YRS1-C	red quartzite	OBP	Arcl				351	699	76	13	33	56	61	8	11
YRS1-D	shale	OBP	Arcl				532	755	39	17	75	29	91	10	14
YRS1-D	shale	OBP	Arcl				534	760	40	17	76	29	91	10	15
YRS1-D	shale	OBP	Arcl				535	758	40	17	75	29	92	11	15
no.3474	red quartzite	OBP	Arcl				290	758	43	14	25	71	54	8	
no.3474	red quartzite	OBP	Arcl				292	743	42	14	25	70	55		11
no.3474	red quartzite	OBP	Arcl				299	750	43	14	26	72	55	8	
no.3478	white quartzite	OBP	Arcl				377	676	79	15	32	111	73	9	13

no.3478	white quartzite	OBP	Arcl				367	666	76	15	31	114	72	9	12
no.3478	white quartzite	OBP	Arcl				355	665	74	15	29	125	71	9	13
no.4684	shale	OBP	Arcl			1166	474	861	57	17	68	120	96	11	16
no.4684	shale	OBP	Arcl			1192	475	863	57	17	69	120	96	11	16
no.4684	shale	OBP	Arcl			1193	479	866	58	17	69	122	95	11	16
no.4688	dolerite	OBP	Arcl				429	846	33	17	58		82	10	14
no.4688	dolerite	OBP	Arcl				431	849	33	17	58		84	10	13
no.4688	dolerite	OBP	Arcl				434	842	33	17	58		83	10	14
no.4688	dolerite	OBP	Arcl				439	839	34	17	59		83	10	13
no.4683	red quartzite	OBP	Arcl				242	856	34			112	64		
no.4683	red quartzite	OBP	Arcl				242	854	34			110	65		
no.4683	red quartzite	OBP	Arcl				242	862	34			109	63	9	
no.4695	red quartzite	OBP	Arcl				270	814	55	16		96	57		
no.4695	red quartzite	OBP	Arcl				289	848	56	17	25	77	61		
no.4695	red quartzite	OBP	Arcl				292	866	57	17		80	61		
no.4678	red quartzite	OBP	Arcl				441	584	106	17	36	128	69	9	13
no.4678	red quartzite	OBP	Arcl				330	717	60	13	26	35	58	8	12
no.4678	red quartzite	OBP	Arcl				419	577	94	16	33	105	66	8	13
no.4697	red quartzite	OBP	Arcl				245	515	97	13	19	261	56		10
no.4697	red quartzite	OBP	Arcl				265	547	77	15	22	286	61		
no.4697	red quartzite	OBP	Arcl				267	798	78	15	25	54	62	8	12
no.4672	dolerite	OBP	Arcl			1259	535	807	107	18	46	77	163	15	
no.4672	dolerite	OBP	Arcl			1253	533	805	107	18	46	78	163	15	
no.4672	dolerite	OBP	Arcl			1034	501	688	115	15	41	89	146	14	
no.106	black quartzite	OBP	Arcl				349	606	94	17	43	173	66	9	
no.106	black quartzite	OBP	Arcl				344	559	104	17	40	205	67	9	12
no.106	black quartzite	OBP	Arcl				346	643	77	16	45	118	63	8	11
YRS1-E	red quartzite	OBP	Arcl				270	857	28		29		56		
YRS1-E	red quartzite	OBP	Arcl				268	864			29		58	8	11
YRS1-E	red quartzite	OBP	Arcl				264	871	28		29		59	8	
YRS1-E	red quartzite	OBP	Arcl				261	868			28		58		

no.3486	sandstone	OBP	Arcl				446	581	68	12	45	45	71	8	10
no.3486	sandstone	OBP	Arcl				451	587	66	13	46	44	72	8	11
no.3486	sandstone	OBP	Arcl				452	587	66	12	46	43	73	8	11
no.4671	red quartzite	OBP	Arcl				484	705	41	15	42	25	71	8	13
no.4671	red quartzite	OBP	Arcl				462	680	40	14	37	23	68		12
no.4671	red quartzite	OBP	Arcl				474	717	42	16	40	24	71	9	13
no.4682	shale	OBP	Arcl				462	801	33	15	132		92	12	15
no.4682	shale	OBP	Arcl				468	796	32	16	129		90	12	14
no.4682	shale	OBP	Arcl				460	800	32	15	131		92	12	15
no.4670	shale	OBP	Arcl			1123	522	713	65	15	160	48	112	13	16
no.4670	shale	OBP	Arcl			1159	539	749	69	16	172	51	116	14	17
no.4670	shale	OBP	Arcl			1104	536	712	59	15	146	42	107	12	16
no.4677	shale	OBP	Arcl				509	730	51	16	138	38	91	12	16
no.4677	shale	OBP	Arcl				507	734	50	16	140	38	91	12	16
no.4677	shale	OBP	Arcl				348	308	78	15	44	684	87	12	16
no.142	shale	OBP	Arcl				333	597	69	15	77	255	79	11	
no.142	shale	OBP	Arcl				366	697	62	17	90	212	85	11	
no.142	shale	OBP	Arcl				383	730	56	18	91	182	86	11	
no.106AF	shale	OBP	Arcl				333	510	59	15	25	306	81		
no.106AF	shale	OBP	Arcl				348	542	64	16	27	278	83	9	
no.106AF	shale	OBP	Arcl				347	541	64	16	27	279	82	9	
no.106BB	shale	OBP	Arcl				474	747	77	20	80	68	75	10	
no.106BB	shale	OBP	Arcl				415	715	65	17	73	53	67	9	
no.106BB	shale	OBP	Arcl				415	712	65	17	73	51	66	9	
no.106A2	shale	OBP	Arcl				519	705	51	17	78	36	100	12	15
no.106A2	shale	OBP	Arcl				518	705	51	17	78	36	100	11	15
no.106A2	shale	OBP	Arcl				517	702	51	17	77	36	100	12	15
no.107	shale	OBP	Arcl			1059	390	595	37	19	25	264	100	12	16
no.107	shale	OBP	Arcl			1056	391	595	37	19	25	261	100	12	16
no.107	shale	OBP	Arcl			1038	390	593	37	19	25	264	99	12	16
no.159	shale	OBP	Arcl				472	771	52	16	126	38	89	12	15

no.159	shale	OBP	Arcl				453	750	75	16	122	55	89	11	15
no.159	shale	OBP	Arcl				509	727	56	17	112	47	91	11	15
no.182	dolerite	OBP	Arcl				435	746	53	19	73	154	87	11	
no.182	dolerite	OBP	Arcl				440	750	53	19	74	156	86	11	
no.182	dolerite	OBP	Arcl				454	761	55	20	78	164	88	11	
no.130	dolerite	OBP	Arcl			1318	581	878	41	19	42	38	157	14	
no.130	dolerite	OBP	Arcl			1295	570	861	40	18	40	37	155	14	
no.130	dolerite	OBP	Arcl			1313	578	857	41	18	41	38	156	14	
no.122	shale	OBP	Arcl			1311	374	598	52	18	66	404	112	15	18
no.122	shale	OBP	Arcl			1329	374	594	52	18	66	405	111	15	18
no.122	shale	OBP	Arcl			1336	375	597	52	19	67	417	114	15	18
no.489	dolerite	OBP	Arcl				456	748	31	15	131		91	12	14
no.489	dolerite	OBP	Arcl				470	773	32	16	136		94	12	15
no.489	dolerite	OBP	Arcl				472	769	32	16	135		94	12	15
no.493	quartz	OBP	Arcl				260	844	64		25	53	54		
no.493	quartz	OBP	Arcl				260	848	65		25	52	53		
no.493	quartz	OBP	Arcl				259	845	64		25	50	54		12
no.468	white quartzite	OBP	Arcl				261	771	80	14		54	51	7	11
no.468	white quartzite	OBP	Arcl				261	763	79	14		52	50	7	11
no.468	white quartzite	OBP	Arcl				264	759	78	14		52	51	7	11
no.412	chert	OBP	Arcl				450	838	42	17	143	35	98	12	15
no.412	chert	OBP	Arcl				451	833	45	17	143	36	97	12	15
no.412	chert	OBP	Arcl				444	820	59	17	139	42	94	12	15
no.453	quartzite roof sample	OBP	Arcl				308	835	69		33	49	60	9	
no.453	quartzite roof sample	OBP	Arcl				306	871	70		33	48	61		
no.453	quartzite roof sample	OBP	Arcl				318	854	69		34	49	62		
no.1290	quartz	OBP	Arcl				248	357	43	11	17	448	57	8	
no.1290	quartz	OBP	Arcl				248	356	42	11	17	445	58		11
no.1290	quartz	OBP	Arcl				248	351	42	11	17	448	57		11
no.1226	shale	OBP	Arcl				235	775	41	20		163	70	9	
no.1226	shale	OBP	Arcl				219	739	36	18		164	65	8	

no.1226	shale	OBP	Arcl				233	778	39	20		177	70	9	
no.1873	white quartzite	OBP	Arcl				327	358	49	15	29	493	83	11	14
no.1873	white quartzite	OBP	Arcl				339	380	53	15	29	522	86	11	15
no.1873	white quartzite	OBP	Arcl				340	377	57	15	30	539	90	11	15
no.1824	black quartzite	OBP	Arcl			779	243	316	31	10	18	342	60	7	10
no.1824	black quartzite	OBP	Arcl			790	245	319	32	10	18	344	60	7	10
no.1824	black quartzite	OBP	Arcl			780	245	320	32	10	19	339	61	7	10
no.2353	red quartzite	OBP	Arcl				186	894				24	51	8	12
no.2353	red quartzite	OBP	Arcl				184	895				24	50	8	11
no.2353	red quartzite	OBP	Arcl				187	894				24	49		11
no.2366	sandstone	OBP	Arcl				266	474	40	13	20	354	59	8	11
no.2366	sandstone	OBP	Arcl				267	472	40	12	20	350	58	8	12
no.2366	sandstone	OBP	Arcl				267	473	40	13	20	350	60	8	
no.2364	black quartzite	OBP	Arcl				274	472	38	14	23	407	64	9	
no.2364	black quartzite	OBP	Arcl				273	464	38	14	23	397	64	9	
no.2364	black quartzite	OBP	Arcl				277	462	38	14	23	389	64	9	
no.2358	black quartzite	OBP	Arcl				261	643	44	17	22	454	71		
no.2358	black quartzite	OBP	Arcl				264	658	46	17	23	483	75		
no.2358	black quartzite	OBP	Arcl				241	716	38	14		250	58		
no.2290	shale	OBP	Arcl				503	767	68	20	147	94	109	14	18
no.2290	shale	OBP	Arcl				506	772	68	20	149	94	112	14	
no.2290	shale	OBP	Arcl				513	792	61	20	156	97	113	15	
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775		501	639	25	14	47		58	9	13
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775		499	656	27	14	46		61	9	13
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775		212	881		14			50		
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775		229	900		15			51		
MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775		367	824		15	40		59	8	13
MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775		419	701		15	39		73	9	12
MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775		378	796		15	39		58	9	12
MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775		603	666	28	17	59		70	10	14
MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775		501	729	30	20	44		77	10	13

MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775		593	731	30	18	52		66	9	14
CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111		266	892			36		58	8	
CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111		328	1070			49		74	11	
CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111		304	996			45		67		
CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944		354	995			56		81	11	15
CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944		289	960			37		79	10	14
CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944		362	862		16	61		87	10	14
BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833		228	852	26	18			67	8	12
BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833		231	864	26	18			69	8	12
BPC1A	redquartzite	Cleremont Fm	Geo	-24.127194	27.699833		230	855	26	18			67		11
BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833		223	942					64		
BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833		222	936					63		
BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833		232	888		16			71	9	11
BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833		246	889					73	9	12
BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833		256	917					87	10	
BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833		243	876					68		12
BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833		293	956		18	31		74	9	
BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833		298	925		17	31		73	9	13
BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833		244	914					65	9	12
BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833		278	892		17	25		69	9	
BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833		286	876		17	26		71	9	12
BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833		275	889		17	25		68		12
BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833		228	854	26	17			65	8	11
BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833		234	886	27	18			67		12
BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833		232	872	26	17			64		
BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972		251	892		16			55	8	
BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972		256	917		17			58	9	
BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972		267	927		18			55	8	12
OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583		416	696	33	23	32		78	9	13
OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583		415	688	32	23	32		78		13
OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583		401	513	29	21	30	15	67	8	12

OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028		544	965	38	29	69		99	14	19
OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028		520	909	35	27	63		94	14	18
OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028		552	930	37	26	84		126	14	
OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222		310	897	29	27			60		12
OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222		428	733	25	15	31		69	8	12
OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222		317	1161	42	30			81		
OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222		451	770		16	59		71	10	
OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222		517	923		20	77		81	11	
OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222		441	908			68		74	10	
OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222		416	896	33	28	29		68	9	14
OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222		420	902	33	29	30		69	10	15
OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222		461	906					62	9	
OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222		638	380	31	20	41	27	92	20	
OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	1645	663	479	31	20	43	27	92	21	
OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	2210	594	373	30	30	35	22	85	19	
OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		450	790	32	17	35		77	9	14
OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		427	781	34	16	31		69	8	20
OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		291	928	34	18			68		15
OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917		333	1028	41	26			70		
OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917		319	849	33	17	27		67	9	14
OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917		249	836	27	17			53		11
OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		270	878	31	16			62	8	13
OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		289	904	38	19			63	8	14
OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		254	869	31	16			61	8	13
OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917		295	760	33	14	23		54	7	10
OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917		288	795	26	14	25		75	8	11
OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917		287	793	26	14	25		75	8	11
OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		238	900		15			53		12
OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		243	895		15			55		11
OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		418	755	32	22	31		69		13
OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		288	766	25	13			62	8	11

OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		296	788	27	14			63	8	11
OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		314	799	29	16	23		68	9	13
OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	1669	603	946	35	21			167	15	
OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	1244	495	841	29	18			162	14	
OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	1730	600	953	35	21			172	15	
OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1349	553	870	34	17			155	15	16
OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361		646	760	36	23	41		160	14	22
OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361		789	698	69	22	37		147	21	24
OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361		305	868	29	15			78	9	12
OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361		452	745	25	15	31		71		12
OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361		392	933		24			84	10	
OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361		255	793		13			50	8	12
OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361		249	828		15			116		11
OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361		247	790		12			50	7	10
OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1138	564	778	32	16			146	13	
OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1211	548	814	32	17			155	14	16
OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1419	567	816	34	22			156	14	16
OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1311	519	876	32	16			154	14	
OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1263	506	864	32	15			155	14	
OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1350	520	906	32	17			159	14	
OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	1606	664	411	34	20	31		84	10	
OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	1588	659	406	33	20	30		83	10	18
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528		245	911		17			58	8	14
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528		264	880		14			58	8	16
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528		266	886		14			56	8	16
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528		269	885		14			58	8	16
OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528		378	813	27	22	38		64	10	13
OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528		415	824		17	40		68	9	13
OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528		466	816		19	48		74	10	
OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528		203	903		16			57	8	12
OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528		300	940		28			95	12	18

OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528		266	842	27	17			146		12
OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528		272	984		21	29		61		13
OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528		267	969		21	28		61	9	
OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528		386	698	27	23	35		58	8	12
OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528		232	845		16			49	7	12
OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528		230	818		15			48	7	12
OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528		231	814		15			50	7	12
OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528		323	888		19	54		91	10	15
OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528		318	890		19	54		91	10	14
OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528		310	885		20	51		83	10	14
OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528		390	850		19	87		57		
OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528		387	846		19	85		57		
OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528		439	799		19	106		62		
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395		365	703	134	120	43	84	87		
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395		454	764	48	26	43		101	11	14
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395		341	918		19	44		68	10	
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395		343	920		19	44		69	9	
OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395		493	846			51		77	11	16
OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395		496	849			51		75	11	16
OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395		496	844			51		74	11	16
OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395		414	820		15	46		78	9	
OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395		433	891			46		86	10	
OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395		381	870			38		63	9	13
OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75		320	1071		27			65	10	
OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75		323	1047		26			71	10	
OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75		289	860		19			55	8	13
OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75		362	849	29	19	34		69	9	13
OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75		346	892		19	32		70	10	
OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75		324	846		17	30		59	9	
OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74		249	987		18			56		
OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74		247	975		17			56		

OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74		346	816	25	16	35		82		12
OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74		499	660		17	44		96	10	12
OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74		506	655		17	44		99	10	13
OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74		475	642		16	42		90	10	12
OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74		261	860		15			51	8	11
OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74		266	865		15			52	8	
OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74		329	891		17	30		59	9	
OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74		284	787		15	25		51	7	10
OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74		277	897		15	31		67	8	12
OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74		322	693	22	12	25		147		11
OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74		271	867		17			54	8	
OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74		270	865		17			54		11
OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74		286	736		14			203		11
OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74		269	823		14	25		54	8	10
OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74		267	811		14	24		54	8	10
OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74		275	834		14	26		58	8	11
Sample ID	**Rock type**	**Location**	**Geo/Arcl piece?**	**Latitude (˚)**	**Longitude (˚)**	**Mn**	**Fe**	**Co**	**Ni**	**Cu**	**Zn**	**As**	**Se**	**Rb**	**Sr**
no.110	shale	OBP	Arcl			33	588		17		7			1	2
no.110	shale	OBP	Arcl			33	583		17	6	7			1	2
no.110	shale	OBP	Arcl			32	549		17		6			1	2
no.120	white quartzite	OBP	Arcl			10	22				1			0	1
no.120	white quartzite	OBP	Arcl			8	24				1			0	1
no.120	white quartzite	OBP	Arcl			9	25			2	1			0	1
no.143	white quartzite	OBP	Arcl			9	48				1			1	0
no.143	white quartzite	OBP	Arcl			9	46							1	0
no.143	white quartzite	OBP	Arcl			9	47				1			1	0
no.137	shale	OBP	Arcl			26	156		5	3	3	1		1	2
no.137	shale	OBP	Arcl			27	158		5	3	3			1	2
no.137	shale	OBP	Arcl			27	166		5	3	3			1	2
no.164	shale	OBP	Arcl			17	99		5	3	2			2	1
no.164	shale	OBP	Arcl			17	97		5	3	2	1		2	1

no.164	shale	OBP	Arcl			17	98		5		2			2	1
no.1968	shale/metased	OBP	Arcl			13	135		5	3	2	1		2	1
no.1968	shale/metased	OBP	Arcl			14	144		5	3	2	1		2	1
no.1968	shale/metased	OBP	Arcl			14	147		5	3	2	1		2	1
no.420	shale	OBP	Arcl			17	86			3	3			2	1
no.420	shale	OBP	Arcl			17	86	20	5	3	3	1		2	1
no.420	shale	OBP	Arcl			17	86			3	3			2	1
no.408	dolerite	OBP	Arcl			24	412		8	4	5	2		1	2
no.408	dolerite	OBP	Arcl			26	387		8	5	5			1	2
no.408	dolerite	OBP	Arcl			25	383		8	4	5			1	2
no.412	chert	OBP	Arcl			14	76			3	2		1	2	1
no.412	chert	OBP	Arcl			14	76			2	2			2	1
no.412	chert	OBP	Arcl			15	77		4	3	2			2	1
no.494	white quartzite	OBP	Arcl			9	38				1			0	1
no.494	white quartzite	OBP	Arcl			8	38				1			0	1
no.494	white quartzite	OBP	Arcl			8	38				1			0	1
no.458	dolerite	OBP	Arcl			23	265		7	5	4	1		2	2
no.458	dolerite	OBP	Arcl			23	265		7	5	4			2	2
no.458	dolerite	OBP	Arcl			23	268		7	5	4	1		2	2
no.488	white quartzite	OBP	Arcl			15	63		4	2	1			0	1
no.488	white quartzite	OBP	Arcl			17	76		4	2	2			1	1
no.488	white quartzite	OBP	Arcl			16	75		4	2	2	1		1	1
no.488	white quartzite	OBP	Arcl			16	74		4	2	2			1	1
no.486	white quartzite	OBP	Arcl			10	33			2	1			0	1
no.486	white quartzite	OBP	Arcl			10	33			2	1			0	1
no.486	white quartzite	OBP	Arcl			10	35				1			0	1
no.440	black quartzite	OBP	Arcl			23	225		8	5	3	1		1	3
no.440	blackquartzite	OBP	Arcl			23	223		8	5	3	1		1	2
no.440	black quartzite	OBP	Arcl			24	226		8	5	3			1	3
no.1286	sandstone	OBP	Arcl			11	53			2	1			1	1
no.1286	sandstone	OBP	Arcl			11	53			2	1			1	1

no.1286	sandstone	OBP	Arcl			11	53				1			1	1
no.1194	sandstone	OBP	Arcl			12	64		5	3	2	1		2	1
no.1194	sandstone	OBP	Arcl			12	64		5	2	2	1		2	1
no.1194	sandstone	OBP	Arcl			12	64		5	3	2	1		2	1
no.1241	dolerite	OBP	Arcl			22	350		7	4	4		1	2	2
no.1241	dolerite	OBP	Arcl			22	345		7	4	4	2		2	2
no.1241	dolerite	OBP	Arcl			22	346		7	4	4		1	2	2
no.1195	red quartzite	OBP	Arcl			42	887				5			2	3
no.1195	red quartzite	OBP	Arcl			39	754				5			2	3
no.1195	red quartzite	OBP	Arcl			39	724	89		6	5			2	3
no.1795	white quartzite	OBP	Arcl			15	50		4	2	2			1	1
no.1795	white quartzite	OBP	Arcl			15	47			2	2			1	1
no.1795	white quartzite	OBP	Arcl			11	45		3	2	1			1	1
no.1789	shale	OBP	Arcl			12	51		4		1			1	1
no.1789	shale	OBP	Arcl			12	51		4		1			1	1
no.1789	shale	OBP	Arcl			12	51				1			1	1
no.2395	sandstone	OBP	Arcl			11	27				1			0	1
no.2395	sandstone	OBP	Arcl			11	28			2	1			1	1
no.2395	sandstone	OBP	Arcl			11	29				1			1	1
no.2332	whitequartzite	OBP	Arcl			9	25			2	1			0	1
no.2332	white quartzite	OBP	Arcl			9	25			2	1			1	1
no.2332	white quartzite	OBP	Arcl			9	26			2	1			1	1
no.2402	sandstone	OBP	Arcl			19	92		4	2	2			1	1
no.2402	sandstone	OBP	Arcl			19	94			2	2			1	1
no.2402	sandstone	OBP	Arcl			19	98			2	2			1	1
no.2374	white quartzite	OBP	Arcl			12	49		4	2	1			0	1
no.2374	white quartzite	OBP	Arcl			12	49			2	1			0	1
no.2374	white quartzite	OBP	Arcl			12	49			2	1			0	1
YRS1-A	shale	OBP	Arcl			17	95		5	3	2			2	1
YRS1-A	shale	OBP	Arcl			16	94		5	3	2			2	1
YRS1-A	shale	OBP	Arcl			16	93		5	3	2			2	1

YRS1-B	shale	OBP	Arcl			17	113		4	3	3	1		2	1
YRS1-B	shale	OBP	Arcl			17	115		4	3	3	1		2	1
YRS1-B	shale	OBP	Arcl			17	116		4	3	3	1		2	1
YRS1-C	red quartzite	OBP	Arcl			10	49			2	1			1	0
YRS1-C	red quartzite	OBP	Arcl			10	47		4	2	1			1	0
YRS1-C	red quartzite	OBP	Arcl			10	45			2	1		0	1	0
YRS1-D	shale	OBP	Arcl			22	130		5	3	2			2	1
YRS1-D	shale	OBP	Arcl			22	131		5	3	2			2	1
YRS1-D	shale	OBP	Arcl			22	130		5	3	2			2	1
no.3474	red quartzite	OBP	Arcl			8	29				1			0	0
no.3474	red quartzite	OBP	Arcl			8	29				1			0	0
no.3474	red quartzite	OBP	Arcl			8	30							0	0
no.3478	white quartzite	OBP	Arcl			13	47		4	2	1			0	2
no.3478	white quartzite	OBP	Arcl			13	46		4	2	1			0	2
no.3478	white quartzite	OBP	Arcl			13	46		4	2	1			0	2
no.4684	shale	OBP	Arcl			16	156		6	3	2	1		2	2
no.4684	shale	OBP	Arcl			17	156		6	3	2	1	1	2	2
no.4684	shale	OBP	Arcl			17	156		6	3	2	1		2	2
no.4688	dolerite	OBP	Arcl			11	75		4	3	1			1	1
no.4688	dolerite	OBP	Arcl			12	75			2	2			1	1
no.4688	dolerite	OBP	Arcl			12	76			2	1			1	1
no.4688	dolerite	OBP	Arcl			12	77		4	2	2			1	1
no.4683	red quartzite	OBP	Arcl				42							0	1
no.4683	red quartzite	OBP	Arcl			9	42							0	1
no.4683	red quartzite	OBP	Arcl				43			2	1			0	1
no.4695	red quartzite	OBP	Arcl			9	35							1	1
no.4695	red quartzite	OBP	Arcl			10	38			2	1			1	1
no.4695	red quartzite	OBP	Arcl			10	39			2	1			1	1
no.4678	red quartzite	OBP	Arcl			17	125		5	3	2	1		1	1
no.4678	red quartzite	OBP	Arcl			14	83		4	2	1	1		0	0
no.4678	red quartzite	OBP	Arcl			16	121		5	2	2	1		1	1

no.4697	red quartzite	OBP	Arcl			10	41			2	2	1		1	1
no.4697	red quartzite	OBP	Arcl			10	49			2	2	1		1	1
no.4697	red quartzite	OBP	Arcl			9	42				1			1	1
no.4672	dolerite	OBP	Arcl			29	429		8	4	5			1	1
no.4672	dolerite	OBP	Arcl			28	425		8	4	5	2		1	1
no.4672	dolerite	OBP	Arcl			27	376		8	4	5			1	1
no.106	black quartzite	OBP	Arcl			11	37			2	2			1	1
no.106	black quartzite	OBP	Arcl			11	38			2	2			1	1
no.106	black quartzite	OBP	Arcl			9	34			2	2			1	1
YRS1-E	red quartzite	OBP	Arcl			8	34			2	1			1	0
YRS1-E	red quartzite	OBP	Arcl			8	33							1	0
YRS1-E	red quartzite	OBP	Arcl			8	34							1	0
YRS1-E	red quartzite	OBP	Arcl			8	34							1	0
no.3486	sandstone	OBP	Arcl			10	62		3	2	1	1		1	1
no.3486	sandstone	OBP	Arcl			10	62		3	2	1			1	1
no.3486	sandstone	OBP	Arcl			10	62		3	2	1			1	1
no.4671	red quartzite	OBP	Arcl			13	66		4	2	1	1		0	0
no.4671	red quartzite	OBP	Arcl			10	60		4	2	1	1		0	0
no.4671	red quartzite	OBP	Arcl			11	65			2	1			0	1
no.4682	shale	OBP	Arcl			15	85		4	3	2			2	1
no.4682	shale	OBP	Arcl			15	89		5	3	2			2	1
no.4682	shale	OBP	Arcl			14	87		5	3	2			2	1
no.4670	shale	OBP	Arcl			18	139		5	3	2	1	1	3	1
no.4670	shale	OBP	Arcl			18	136		5	3	2	1		3	1
no.4670	shale	OBP	Arcl			17	173		5	3	2	1		3	1
no.4677	shale	OBP	Arcl			13	78		5	4	2	1		2	1
no.4677	shale	OBP	Arcl			13	78		5	4	2	1		2	1
no.4677	shale	OBP	Arcl			14	64		5	3	2			2	2
no.142	shale	OBP	Arcl			14	67			2	1			1	1
no.142	shale	OBP	Arcl			15	74				2	1		2	1
no.142	shale	OBP	Arcl			15	75				2			2	1

no.106AF	shale	OBP	Arcl			11	70			2	2	1		1	1
no.106AF	shale	OBP	Arcl			11	72			2	2	1		1	1
no.106AF	shale	OBP	Arcl			11	72			2	2	1		1	1
no.106BB	shale	OBP	Arcl			12	62				2			1	1
no.106BB	shale	OBP	Arcl			11	52				1			1	1
no.106BB	shale	OBP	Arcl			10	51				1			1	1
no.106A2	shale	OBP	Arcl			42	140		5	3	3	1		2	2
no.106A2	shale	OBP	Arcl			41	139		5	3	3	1		2	2
no.106A2	shale	OBP	Arcl			42	139		5	3	3	1		2	2
no.107	shale	OBP	Arcl			15	264		7	4	4	1		1	1
no.107	shale	OBP	Arcl			15	263		7	3	4			1	1
no.107	shale	OBP	Arcl			15	264		7	4	4			1	1
no.159	shale	OBP	Arcl			15	86		4	2	2			2	1
no.159	shale	OBP	Arcl			15	88		5	2	2			2	1
no.159	shale	OBP	Arcl			17	92		4	2	2			2	1
no.182	dolerite	OBP	Arcl			17	115			3	3			2	1
no.182	dolerite	OBP	Arcl			18	120			3	3	1		2	1
no.182	dolerite	OBP	Arcl			19	128		5	3	4			2	1
no.130	dolerite	OBP	Arcl			27	374		8		5			1	1
no.130	dolerite	OBP	Arcl			27	376		7		5			1	1
no.130	dolerite	OBP	Arcl			27	374		7	4	5			1	1
no.122	shale	OBP	Arcl			24	230		6	4	4	1		2	3
no.122	shale	OBP	Arcl			24	232		6	4	4	1		2	3
no.122	shale	OBP	Arcl			24	235		6	5	4	1		2	3
no.489	dolerite	OBP	Arcl			15	77		4	3	2			2	1
no.489	dolerite	OBP	Arcl			16	80		4	3	2			2	1
no.489	dolerite	OBP	Arcl			16	81		4	3	2			2	1
no.493	quartz	OBP	Arcl			8	21			2	1			1	0
no.493	quartz	OBP	Arcl			9	21			2	1			1	0
no.493	quartz	OBP	Arcl			8	20			2	1			1	0
no.468	white quartzite	OBP	Arcl			8	38				1				0

no.468	white quartzite	OBP	Arcl			8	38				1				0
no.468	white quartzite	OBP	Arcl			8	38				1				0
no.412	chert	OBP	Arcl			15	79		5	3	2	1		2	1
no.412	chert	OBP	Arcl			14	79		5	3	2			2	1
no.412	chert	OBP	Arcl			15	78		5	3	2			2	1
no.453	quartzite roof sample	OBP	Arcl			9	27		4	2	1			1	1
no.453	quartzite roof sample	OBP	Arcl			10	28		4		1			1	1
no.453	quartzite roof sample	OBP	Arcl			10	28		4	2	1			1	1
no.1290	quartz	OBP	Arcl			10	32			2	1			0	1
no.1290	quartz	OBP	Arcl			10	31			2	1			0	1
no.1290	quartz	OBP	Arcl			10	31				1			0	1
no.1226	shale	OBP	Arcl			21	510				2			1	1
no.1226	shale	OBP	Arcl			20	575				2			1	1
no.1226	shale	OBP	Arcl			22	605							1	1
no.1873	white quartzite	OBP	Arcl			14	59			3	2	1		1	1
no.1873	white quartzite	OBP	Arcl			15	65		5	3	2	1		1	1
no.1873	white quartzite	OBP	Arcl			16	70		5	3	2	1		1	2
no.1824	black quartzite	OBP	Arcl			14	61		3	2	2	1	0	1	1
no.1824	black quartzite	OBP	Arcl			14	61		3	2	2	1		1	1
no.1824	black quartzite	OBP	Arcl			14	61		3	2	2	1		1	1
no.2353	red quartzite	OBP	Arcl			8	12							0	1
no.2353	red quartzite	OBP	Arcl				12								1
no.2353	red quartzite	OBP	Arcl			8	12								1
no.2366	sandstone	OBP	Arcl			11	62				1			1	1
no.2366	sandstone	OBP	Arcl			12	62			2	1			1	1
no.2366	sandstone	OBP	Arcl			12	62			2	1			1	1
no.2364	black quartzite	OBP	Arcl			11	52		4	2	1			1	1
no.2364	black quartzite	OBP	Arcl			10	50		4		2			1	1
no.2364	black quartzite	OBP	Arcl			11	50		4	2	1			1	1
no.2358	black quartzite	OBP	Arcl			15	132				2			1	1
no.2358	black quartzite	OBP	Arcl			15	130				2			1	1

no.2358	black quartzite	OBP	Arcl			12	108				1			1	1
no.2290	shale	OBP	Arcl			21	106		6	3	2			2	1
no.2290	shale	OBP	Arcl			20	106		6	3	2			2	1
no.2290	shale	OBP	Arcl			22	106		6	3	2			2	1
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	8	34				1			0	0
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	9	36				1	1		0	0
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775		11								
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775		13								
MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	9	43					1		0	1
MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	9	60		4		1	1		0	1
MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	9	39				1	1		0	1
MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	10	49		4	3	1	1		1	1
MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	10	59			2	1	1		0	1
MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	10	43			3	1			0	1
CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111		26							1	0
CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111		34		5	3				1	1
CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111		31			2				1	1
CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944		23		5	3				1	1
CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	10	16							1	1
CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	9	22			2	1	1		1	0
BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	8	27			2				0	0
BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833		27							0	0
BPC1A	redquartzite	Cleremont Fm	Geo	-24.127194	27.699833	8	27			2				0	0
BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	8	16								
BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	8	16								
BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833		19								0
BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	8	16							0	
BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	9	19			2				0	
BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	8	16								
BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	9	32							0	1
BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	9	33			2	1			0	0

BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	9	19								1
BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	8	22					1		0	0
BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	8	23			2					0
BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833	9	23			2				0	0
BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	9	49			2	1			0	
BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	10	50			2	1			0	0
BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	9	49		4		1			0	0
BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	8	13								0
BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972		13								0
BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972	8	14								0
OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	12	240		6	3	2	1		1	1
OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	12	244		6	3	2	1		1	1
OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	12	365				2	1		1	1
OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	13	42		5	3	2			1	1
OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	12	39				2			1	1
OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	14	98		6	3	2			1	2
OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	9	35								0
OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	10	77		4	2	1			0	0
OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222		46		6						1
OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	11	38		4		1			1	1
OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	12	41		5		2	1		1	1
OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	12	39			3	2			1	1
OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	11	104			3		1		1	1
OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	11	105		5			1		1	1
OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222		26							1	1
OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	33	599							6	2
OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	32	1283							6	
OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222	32	2096							6	
OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	10	70		4	2	1	1		0	1
OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	13	98		4	2	1	1		0	0
OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	10	64		4		1			0	0

OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	11	42							1	1
OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	9	32			2		1	0	0	1
OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	8	28			2	1				0
OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	9	51							0	0
OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	9	57		4		1			0	0
OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	9	50		4	2		1	0	0	0
OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	8	19		4		1				
OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	8	31		3	2	1			0	0
OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	8	31		3	2	1		0	0	0
OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		25							0	0
OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	8	26							0	
OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	11	112		5		1	1		1	0
OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	8	47			2					1
OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	8	50				1				1
OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	9	65			2	1				1
OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	19	638		11		6			1	2
OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	16	455		8	4	5	2		1	2
OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	19	652		11		6			1	2
OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	17	407		8	4	5			1	2
OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	18	560		9	5	4	2		1	1
OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	24	575		10	5	5	5		1	4
OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	9	55					1		0	0
OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	9	52		4	2	1	1		0	0
OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	10	46				1	1		1	1
OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	8	30			2	1				1
OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361		18			2	1				
OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	7	29						0		0
OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	19	353		7	3	5			1	2
OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	19	392		7	4	5	2		1	2
OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	20	438		8	4	6			1	2
OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	17	397		8	4	5			1	1

OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	17	398		7	4	5	2		1	2
OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	17	434		8	4	5			1	2
OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361		1337							7	2
OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361	29	1328							7	2
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	9	30							0	0
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528		38							0	0
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	9	38		4	2	1			0	0
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	9	40			2				0	0
OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	11	54				1	1		1	1
OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	10	53		4					1	1
OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	12	70		5	2	1	1		1	1
OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	8	24				1	1		0	0
OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	12	36			3	2			1	1
OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	9	21				1				0
OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	9	18		4	2	1				0
OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	9	18		4	2	1				0
OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	9	33				1			0	0
OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	8	36				1				
OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	8	34				1				
OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	8	33		3						
OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	11	57		4	2	2	1		1	1
OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	11	57		4	2	2	1		1	1
OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	11	54		4	2	2	1		1	1
OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	9	37			2	1	1		2	1
OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	9	36		4	2	1	1		2	1
OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	10	41		4	2	1	1		2	1
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	12	134		6		2			1	1
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	21	181			3	2			1	1
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	9	30			2	1			1	1
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	9	30		4		1			1	1
OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	11	41		5	2	2			1	1

OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	11	40		5		2			1	1
OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	11	40		5		2			1	1
OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	11	94		4	2	1		0	1	1
OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	12	99				2			1	1
OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	10	60				1			1	1
OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75		31		5						1
OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	11	31		5	3				1	1
OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	9	85			2	1			0	0
OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	10	54		4		2			0	0
OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	10	54		4		2			0	1
OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	9	36		4		1			0	0
OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74		132					1			1
OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74		139								1
OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	10	106			2	1	1		0	1
OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	9	35		4	2	2			1	1
OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	9	36		4	2	2			1	1
OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	9	34		4	2	2			1	1
OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	9	25					1			1
OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	9	26								1
OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	9	30				1			0	1
OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	8	28								0
OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	9	27			2	1			1	0
OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	8	34		3						1
OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	8	18								
OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	8	19								
OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	8	18				1				
OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	8	23				1				
OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	8	23								
OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	8	24				1				
Sample ID	**Rock type**	**Location**	**Geo/Arcl piece?**	**Latitude (˚)**	**Longitude (˚)**	**Y**	**Zr**	**Nb**	**Mo**	**Cd**	**Sn**	**W**	**Hg**	**Pb**	**Bi**
no.110	shale	OBP	Arcl			1	2	2	2					3	

no.110	shale	OBP	Arcl			1	2	2	2					4	
no.110	shale	OBP	Arcl			1	2	2						3	
no.120	white quartzite	OBP	Arcl			1	1								
no.120	white quartzite	OBP	Arcl			1	1								3
no.120	white quartzite	OBP	Arcl			1	1								3
no.143	white quartzite	OBP	Arcl			1	1	1							
no.143	white quartzite	OBP	Arcl			1	1	1							
no.143	white quartzite	OBP	Arcl			1	1	1							
no.137	shale	OBP	Arcl			1	3	1						2	
no.137	shale	OBP	Arcl			1	3	1						2	
no.137	shale	OBP	Arcl			1	3	1				4		2	
no.164	shale	OBP	Arcl			1	2	1						2	
no.164	shale	OBP	Arcl			1	2	1	2					2	
no.164	shale	OBP	Arcl			1	2	1	2				2	2	
no.1968	shale/metased	OBP	Arcl			1	2	1						1	
no.1968	shale/metased	OBP	Arcl			1	2	1						1	
no.1968	shale/metased	OBP	Arcl			1	2	1						1	
no.420	shale	OBP	Arcl			1	3	1						2	
no.420	shale	OBP	Arcl			1	3	1						2	
no.420	shale	OBP	Arcl			1	3	1						2	
no.408	dolerite	OBP	Arcl			1	3	2	2					3	
no.408	dolerite	OBP	Arcl			1	3	2	2					3	
no.408	dolerite	OBP	Arcl			1	3	2	2					3	
no.412	chert	OBP	Arcl			1	2	1						2	
no.412	chert	OBP	Arcl			1	2	1						2	
no.412	chert	OBP	Arcl			1	2	1					2	2	
no.494	white quartzite	OBP	Arcl			1	1								
no.494	white quartzite	OBP	Arcl			1	1								
no.494	white quartzite	OBP	Arcl			1	1								
no.458	dolerite	OBP	Arcl			1	2	1	2				2	2	
no.458	dolerite	OBP	Arcl			1	2	1	2					2	

no.458	dolerite	OBP	Arcl			1	2	1	2					2	
no.488	white quartzite	OBP	Arcl				1							1	
no.488	white quartzite	OBP	Arcl			1	1							1	3
no.488	white quartzite	OBP	Arcl			1	1								3
no.488	white quartzite	OBP	Arcl			1	1							1	3
no.486	white quartzite	OBP	Arcl			1	1								3
no.486	white quartzite	OBP	Arcl			1	1								3
no.486	white quartzite	OBP	Arcl			1	1								3
no.440	black quartzite	OBP	Arcl			1	2	1	2						
no.440	blackquartzite	OBP	Arcl			1	2	1	2						
no.440	black quartzite	OBP	Arcl			1	2	1	2						
no.1286	sandstone	OBP	Arcl			1	1	1	1						
no.1286	sandstone	OBP	Arcl			1	1	1	1						
no.1286	sandstone	OBP	Arcl			1	1	1	1						
no.1194	sandstone	OBP	Arcl			1	2	1						1	
no.1194	sandstone	OBP	Arcl			1	2	1							
no.1194	sandstone	OBP	Arcl			1	2	1							
no.1241	dolerite	OBP	Arcl			1	2	1					3	2	
no.1241	dolerite	OBP	Arcl			1	2	1					3	2	
no.1241	dolerite	OBP	Arcl			1	2	1	2				3	2	
no.1195	red quartzite	OBP	Arcl			1	3	2	3				6	5	
no.1195	red quartzite	OBP	Arcl			1	3	2	3				6	5	
no.1195	red quartzite	OBP	Arcl			1	3	2	3		13		6	5	
no.1795	white quartzite	OBP	Arcl			1	1							1	
no.1795	white quartzite	OBP	Arcl			1	1							1	
no.1795	white quartzite	OBP	Arcl				1								3
no.1789	shale	OBP	Arcl			1	1	1							
no.1789	shale	OBP	Arcl			1	1	1							
no.1789	shale	OBP	Arcl			1	1	1							
no.2395	sandstone	OBP	Arcl			1	1	1							
no.2395	sandstone	OBP	Arcl			1	1	1	1						

no.2395	sandstone	OBP	Arcl			1	1	1	1						
no.2332	whitequartzite	OBP	Arcl				1	1	1						
no.2332	white quartzite	OBP	Arcl				1	1	1						
no.2332	white quartzite	OBP	Arcl				1	1	1						
no.2402	sandstone	OBP	Arcl			1	1							1	
no.2402	sandstone	OBP	Arcl			1	1							1	
no.2402	sandstone	OBP	Arcl			1	1	1						1	
no.2374	white quartzite	OBP	Arcl				1								
no.2374	white quartzite	OBP	Arcl			1	1								
no.2374	white quartzite	OBP	Arcl			1	1								3
YRS1-A	shale	OBP	Arcl			1	2	1						2	
YRS1-A	shale	OBP	Arcl			1	2	1						2	
YRS1-A	shale	OBP	Arcl			1	2	1						2	
YRS1-B	shale	OBP	Arcl			1	2	1						2	
YRS1-B	shale	OBP	Arcl			1	2	1					2	2	
YRS1-B	shale	OBP	Arcl			1	2	1					2	2	
YRS1-C	red quartzite	OBP	Arcl			1	1							1	
YRS1-C	red quartzite	OBP	Arcl			1	1								
YRS1-C	red quartzite	OBP	Arcl			1	1								
YRS1-D	shale	OBP	Arcl			1	2	1						1	
YRS1-D	shale	OBP	Arcl			1	2	1	2				2	1	
YRS1-D	shale	OBP	Arcl			1	2	1						1	
no.3474	red quartzite	OBP	Arcl				1								
no.3474	red quartzite	OBP	Arcl				1								
no.3474	red quartzite	OBP	Arcl				1								
no.3478	white quartzite	OBP	Arcl			1	1							2	
no.3478	white quartzite	OBP	Arcl			1	1							2	
no.3478	white quartzite	OBP	Arcl			1	1							2	
no.4684	shale	OBP	Arcl			1	2	1	2				2	2	
no.4684	shale	OBP	Arcl			1	2	1	2				2		
no.4684	shale	OBP	Arcl			1	2	1					2		

no.4688	dolerite	OBP	Arcl			1	2	1						1	
no.4688	dolerite	OBP	Arcl			1	2	1						1	
no.4688	dolerite	OBP	Arcl			1	2	1						1	
no.4688	dolerite	OBP	Arcl			1	2	1						1	
no.4683	red quartzite	OBP	Arcl			1	1	1	1					1	
no.4683	red quartzite	OBP	Arcl			1	1	1	1						
no.4683	red quartzite	OBP	Arcl			1	1	1	1						
no.4695	red quartzite	OBP	Arcl			1	1								
no.4695	red quartzite	OBP	Arcl			1	1		1						
no.4695	red quartzite	OBP	Arcl			1	1	1	1						
no.4678	red quartzite	OBP	Arcl			1	1								
no.4678	red quartzite	OBP	Arcl				1								
no.4678	red quartzite	OBP	Arcl			1	1		1						
no.4697	red quartzite	OBP	Arcl			1	1								
no.4697	red quartzite	OBP	Arcl			1	2	1							
no.4697	red quartzite	OBP	Arcl			1	1								
no.4672	dolerite	OBP	Arcl			1	2	1	2		12			3	
no.4672	dolerite	OBP	Arcl			1	2	1						3	
no.4672	dolerite	OBP	Arcl			1	2	1					2	3	
no.106	black quartzite	OBP	Arcl			1	1								
no.106	black quartzite	OBP	Arcl			1	1	1							
no.106	black quartzite	OBP	Arcl			1	1								3
YRS1-E	red quartzite	OBP	Arcl			1	1								
YRS1-E	red quartzite	OBP	Arcl			1	1								
YRS1-E	red quartzite	OBP	Arcl			1	1								
YRS1-E	red quartzite	OBP	Arcl			1	1								
no.3486	sandstone	OBP	Arcl			1	1								3
no.3486	sandstone	OBP	Arcl			1	1								3
no.3486	sandstone	OBP	Arcl			1	1								3
no.4671	red quartzite	OBP	Arcl			1	1	1	1						
no.4671	red quartzite	OBP	Arcl			1	1								

no.4671	red quartzite	OBP	Arcl			1	1		1						
no.4682	shale	OBP	Arcl			1	2	1						2	
no.4682	shale	OBP	Arcl			1	2	1					2	2	
no.4682	shale	OBP	Arcl			1	2	1					2	2	
no.4670	shale	OBP	Arcl			1	2	1					2	2	
no.4670	shale	OBP	Arcl			1	2	1						2	
no.4670	shale	OBP	Arcl			1	2	1						2	
no.4677	shale	OBP	Arcl			1	2	1			9	3		1	
no.4677	shale	OBP	Arcl			1	2	1						1	
no.4677	shale	OBP	Arcl			1	2	1						1	
no.142	shale	OBP	Arcl			1	2	1						1	
no.142	shale	OBP	Arcl			1	2	1						1	
no.142	shale	OBP	Arcl			1	2	1						1	
no.106AF	shale	OBP	Arcl			1	2	1						1	
no.106AF	shale	OBP	Arcl			1	2	1					2	1	
no.106AF	shale	OBP	Arcl			1	2	1					2	1	
no.106BB	shale	OBP	Arcl			1	1	1							
no.106BB	shale	OBP	Arcl			1	1	1						1	
no.106BB	shale	OBP	Arcl			1	1	1							
no.106A2	shale	OBP	Arcl			1	3	1					2	2	
no.106A2	shale	OBP	Arcl			1	3	1						2	
no.106A2	shale	OBP	Arcl			1	3	1						2	
no.107	shale	OBP	Arcl			1	2	1						2	
no.107	shale	OBP	Arcl			1	2	1			9		2	2	
no.107	shale	OBP	Arcl			1	2	1						2	4
no.159	shale	OBP	Arcl			1	2	1						1	
no.159	shale	OBP	Arcl			1	2	1						2	
no.159	shale	OBP	Arcl			1	2	1					2	2	
no.182	dolerite	OBP	Arcl			1	3	1						2	
no.182	dolerite	OBP	Arcl			1	3	1	2					2	
no.182	dolerite	OBP	Arcl			1	3	1	2					2	

no.130	dolerite	OBP	Arcl			1	2	1						3	
no.130	dolerite	OBP	Arcl			1	2	1						3	
no.130	dolerite	OBP	Arcl			1	2	1	2					3	
no.122	shale	OBP	Arcl			1	2	1					2	2	
no.122	shale	OBP	Arcl			1	2	1	2					2	
no.122	shale	OBP	Arcl			1	2	1	2					2	
no.489	dolerite	OBP	Arcl			1	2	1					2	1	
no.489	dolerite	OBP	Arcl			1	2	1						1	
no.489	dolerite	OBP	Arcl			1	2	1						2	
no.493	quartz	OBP	Arcl				1								
no.493	quartz	OBP	Arcl			1	1								
no.493	quartz	OBP	Arcl				1								
no.468	white quartzite	OBP	Arcl												3
no.468	white quartzite	OBP	Arcl												3
no.468	white quartzite	OBP	Arcl												3
no.412	chert	OBP	Arcl			1	2	1						2	
no.412	chert	OBP	Arcl			1	2	1	2					2	
no.412	chert	OBP	Arcl			1	2	1						2	
no.453	quartzite roof sample	OBP	Arcl			1	1								
no.453	quartzite roof sample	OBP	Arcl			1	1							1	
no.453	quartzite roof sample	OBP	Arcl			1	1	1	1					1	
no.1290	quartz	OBP	Arcl			1	1								3
no.1290	quartz	OBP	Arcl			1	1								3
no.1290	quartz	OBP	Arcl			1	1								3
no.1226	shale	OBP	Arcl			1	1						3	4	
no.1226	shale	OBP	Arcl										3	4	
no.1226	shale	OBP	Arcl				1		2				4	4	
no.1873	white quartzite	OBP	Arcl			1	2	1						1	
no.1873	white quartzite	OBP	Arcl			1	2	1						1	
no.1873	white quartzite	OBP	Arcl			1	2	1						1	
no.1824	black quartzite	OBP	Arcl			1	1								3

no.1824	black quartzite	OBP	Arcl			1	1							1	3
no.1824	black quartzite	OBP	Arcl			1	1				7			1	3
no.2353	red quartzite	OBP	Arcl			1	1								
no.2353	red quartzite	OBP	Arcl			1	1							1	3
no.2353	red quartzite	OBP	Arcl			1	1								3
no.2366	sandstone	OBP	Arcl				1							1	4
no.2366	sandstone	OBP	Arcl				1							1	
no.2366	sandstone	OBP	Arcl				1							1	
no.2364	black quartzite	OBP	Arcl			1	1	1						1	
no.2364	black quartzite	OBP	Arcl			1	1							1	
no.2364	black quartzite	OBP	Arcl			1	1		1					1	
no.2358	black quartzite	OBP	Arcl			1	1	1	2						
no.2358	black quartzite	OBP	Arcl			1	1	1	2					1	
no.2358	black quartzite	OBP	Arcl			1	1								
no.2290	shale	OBP	Arcl			1	2	1	2				2	2	
no.2290	shale	OBP	Arcl			1	2	1	2					2	
no.2290	shale	OBP	Arcl			1	2	1	2			4		2	
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775									1	3
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775									1	
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775										
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775										
MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	1	1							1	
MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	1	1							1	3
MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	1	1							1	
MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	1	1	1	1					1	
MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	1	1	1	1						
MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	1	1		1					1	
CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	1	1								
CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	1	1	1	2						
CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	1	1	1	1						
CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	1	1	1	2					1	

CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	1	1	1	1					1	
CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	1	1	1	1					1	
BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	1	1								3
BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	1	1								
BPC1A	redquartzite	Cleremont Fm	Geo	-24.127194	27.699833	1	1								
BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833		1		1						
BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833		1								
BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833		1							1	
BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	1	1								
BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	1	1								
BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	1	1								
BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	1	1	1	1					1	
BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	1	1		1					1	
BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833	1	1							1	
BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833		1							1	
BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833		1							1	
BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833		1							1	
BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833	1	1								
BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833		1							1	
BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833		1								
BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972									1	
BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972										
BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972										
OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	1	2	1	2					2	
OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	1	2	1	2						
OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	1	2		2					2	
OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	1	2	1	2					1	
OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	1	1	1	2					1	
OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	1	2	1	2					2	
OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222		1		1						
OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222		1							1	

OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222		1	1	2						
OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	1	1	1	1					1	
OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	1	1	1	2						
OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	1	1	1	1					1	
OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222		1	1	2						
OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	1	1	1	2						
OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	1	1	1	1						
OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222		3							25	21
OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222		3							24	21
OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222		3		4					27	24
OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	1	1	1	1					1	
OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		1	1	1						
OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	1	1		1					1	
OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	1	1	1	2						
OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917		1							1	4
OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917		1								3
OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	1	1								
OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	1	1								
OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	1	1								
OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917										3
OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	1	1								3
OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917		1								3
OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	1	1								
OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	1	1								
OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	1	1	1	1						
OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917		1							1	3
OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	1	1							1	3
OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	1	1							1	
OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	2	3	2	2					4	
OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	1	2	1						3	
OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	2	3	2	2					4	

OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	2	2	1						3	
OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1	3	2	2			9		3	
OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	2	3	2	2			8		7	
OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	1	1	1						1	
OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	1	1								
OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	1	2	1	1						
OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361		1							1	3
OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361									1	
OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361									1	3
OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1	2	1			10			3	
OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1	2	1						3	
OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1	2	1	2					3	
OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1	2	1						3	
OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1	2	1						3	
OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	1	2	1	2					3	
OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361		3		4					28	24
OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361		3		4		21			29	24
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1							1	
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1							1	
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1							1	
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1								
OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1							1	
OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1	1	1					1	
OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1	1	1						
OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	1				5					
OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1	1	2						
OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528				1						
OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	1			1						
OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	1			1						
OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1								
OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528										3

OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528										3
OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528										3
OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1	1						1	
OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1	1						1	
OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1	1						1	
OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1	1						1	
OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1	1						1	
OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	1	1	1	1				2	1	
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	1	2	1	2		11			2	
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	1	2	1						2	
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	1	1	1	1					1	
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	1	1	1						1	
OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	1	1	1	1					1	
OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	1	1	1	1					1	
OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	1	1	1	1					1	
OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	1	1	1						1	
OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	1	1	1	2					1	
OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	1	1		1					1	
OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75			1	1						
OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75		1	1	2					1	
OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75										
OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75		1	1						1	
OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75		1		1					1	
OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75		1							1	
OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74		1	1	1						
OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	1			1						
OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	1	1		1						
OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	1	2	1						1	
OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	1	2	1						1	
OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	1	1	1						1	
OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74									1	

OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74									1	
OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74	1								1	
OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74									1	3
OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74	1	1	1							
OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74									1	3
OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74										
OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74										
OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74			1							3
OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74										3
OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74										3
OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74										3

Sample ID	**Rock type**	**Location**	**Geo/Arcl piece?**	**Latitude (˚)**	**Longitude (˚)**	**Th**	**U**	**LE**
no.110	shale	OBP	Arcl			5		1657
no.110	shale	OBP	Arcl			5		1748
no.110	shale	OBP	Arcl			4		1662
no.120	white quartzite	OBP	Arcl					893
no.120	white quartzite	OBP	Arcl					863
no.120	white quartzite	OBP	Arcl					866
no.143	white quartzite	OBP	Arcl			3		991
no.143	white quartzite	OBP	Arcl					980
no.143	white quartzite	OBP	Arcl					978
no.137	shale	OBP	Arcl			3		1113
no.137	shale	OBP	Arcl			3		1115
no.137	shale	OBP	Arcl			3		1142
no.164	shale	OBP	Arcl			3	2	1193
no.164	shale	OBP	Arcl			3		1187
no.164	shale	OBP	Arcl			3		1185
no.1968	shale/metased	OBP	Arcl			3		1112
no.1968	shale/metased	OBP	Arcl			3		1121
no.1968	shale/metased	OBP	Arcl			3		1146
no.420	shale	OBP	Arcl			4		998

no.420	shale	OBP	Arcl			4	2	997
no.420	shale	OBP	Arcl			4		999
no.408	dolerite	OBP	Arcl			4		1749
no.408	dolerite	OBP	Arcl			5		1652
no.408	dolerite	OBP	Arcl			5		1624
no.412	chert	OBP	Arcl			3		1138
no.412	chert	OBP	Arcl			3		1135
no.412	chert	OBP	Arcl			3		1139
no.494	white quartzite	OBP	Arcl					932
no.494	white quartzite	OBP	Arcl					926
no.494	white quartzite	OBP	Arcl					920
no.458	dolerite	OBP	Arcl			4		1587
no.458	dolerite	OBP	Arcl			4		1581
no.458	dolerite	OBP	Arcl			4		1583
no.488	white quartzite	OBP	Arcl					916
no.488	white quartzite	OBP	Arcl					953
no.488	white quartzite	OBP	Arcl					931
no.488	white quartzite	OBP	Arcl					927
no.486	white quartzite	OBP	Arcl					923
no.486	white quartzite	OBP	Arcl					923
no.486	white quartzite	OBP	Arcl					945
no.440	black quartzite	OBP	Arcl			4		1532
no.440	blackquartzite	OBP	Arcl			4		1531
no.440	black quartzite	OBP	Arcl			4		1556
no.1286	sandstone	OBP	Arcl					1049
no.1286	sandstone	OBP	Arcl			3		1044
no.1286	sandstone	OBP	Arcl			3		1043
no.1194	sandstone	OBP	Arcl			3		1094
no.1194	sandstone	OBP	Arcl			3	2	1091
no.1194	sandstone	OBP	Arcl			3	2	1086
no.1241	dolerite	OBP	Arcl			4		1462

no.1241	dolerite	OBP	Arcl					1450
no.1241	dolerite	OBP	Arcl			4		1447
no.1195	red quartzite	OBP	Arcl			6		1785
no.1195	red quartzite	OBP	Arcl			6		1702
no.1195	red quartzite	OBP	Arcl			6		1693
no.1795	white quartzite	OBP	Arcl					1128
no.1795	white quartzite	OBP	Arcl					840
no.1795	white quartzite	OBP	Arcl					1027
no.1789	shale	OBP	Arcl			3		988
no.1789	shale	OBP	Arcl			3		993
no.1789	shale	OBP	Arcl			3		993
no.2395	sandstone	OBP	Arcl					984
no.2395	sandstone	OBP	Arcl			3		1011
no.2395	sandstone	OBP	Arcl			3		1012
no.2332	whitequartzite	OBP	Arcl					953
no.2332	white quartzite	OBP	Arcl					960
no.2332	white quartzite	OBP	Arcl					965
no.2402	sandstone	OBP	Arcl			3		1012
no.2402	sandstone	OBP	Arcl					1021
no.2402	sandstone	OBP	Arcl			3		1028
no.2374	white quartzite	OBP	Arcl					924
no.2374	white quartzite	OBP	Arcl					902
no.2374	white quartzite	OBP	Arcl					894
YRS1-A	shale	OBP	Arcl			3	2	1175
YRS1-A	shale	OBP	Arcl			3		1159
YRS1-A	shale	OBP	Arcl			3		1152
YRS1-B	shale	OBP	Arcl			3		1130
YRS1-B	shale	OBP	Arcl			3		1113
YRS1-B	shale	OBP	Arcl			3		1118
YRS1-C	red quartzite	OBP	Arcl					949
YRS1-C	red quartzite	OBP	Arcl					935

YRS1-C	red quartzite	OBP	Arcl					922
YRS1-D	shale	OBP	Arcl			3		1170
YRS1-D	shale	OBP	Arcl			3		1177
YRS1-D	shale	OBP	Arcl			3		1175
no.3474	red quartzite	OBP	Arcl					909
no.3474	red quartzite	OBP	Arcl					897
no.3474	red quartzite	OBP	Arcl					910
no.3478	white quartzite	OBP	Arcl					979
no.3478	white quartzite	OBP	Arcl			3		964
no.3478	white quartzite	OBP	Arcl			3		961
no.4684	shale	OBP	Arcl			4		1397
no.4684	shale	OBP	Arcl			4		1410
no.4684	shale	OBP	Arcl			4		1412
no.4688	dolerite	OBP	Arcl			3		1086
no.4688	dolerite	OBP	Arcl			3		1091
no.4688	dolerite	OBP	Arcl			3		1087
no.4688	dolerite	OBP	Arcl			3		1090
no.4683	red quartzite	OBP	Arcl			3		1004
no.4683	red quartzite	OBP	Arcl					1001
no.4683	red quartzite	OBP	Arcl			3		1007
no.4695	red quartzite	OBP	Arcl					973
no.4695	red quartzite	OBP	Arcl					999
no.4695	red quartzite	OBP	Arcl			3		1019
no.4678	red quartzite	OBP	Arcl			3		1053
no.4678	red quartzite	OBP	Arcl					927
no.4678	red quartzite	OBP	Arcl					998
no.4697	red quartzite	OBP	Arcl					886
no.4697	red quartzite	OBP	Arcl					935
no.4697	red quartzite	OBP	Arcl					942
no.4672	dolerite	OBP	Arcl			4		1637
no.4672	dolerite	OBP	Arcl			4		1626

no.4672	dolerite	OBP	Arcl					1430
no.106	black quartzite	OBP	Arcl					965
no.106	black quartzite	OBP	Arcl					958
no.106	black quartzite	OBP	Arcl					935
YRS1-E	red quartzite	OBP	Arcl					919
YRS1-E	red quartzite	OBP	Arcl					923
YRS1-E	red quartzite	OBP	Arcl					929
YRS1-E	red quartzite	OBP	Arcl					925
no.3486	sandstone	OBP	Arcl					899
no.3486	sandstone	OBP	Arcl					907
no.3486	sandstone	OBP	Arcl					909
no.4671	red quartzite	OBP	Arcl					992
no.4671	red quartzite	OBP	Arcl					947
no.4671	red quartzite	OBP	Arcl					991
no.4682	shale	OBP	Arcl			3		1119
no.4682	shale	OBP	Arcl			3		1126
no.4682	shale	OBP	Arcl			3	1	1122
no.4670	shale	OBP	Arcl			3	2	1332
no.4670	shale	OBP	Arcl			3	2	1367
no.4670	shale	OBP	Arcl			3	2	1342
no.4677	shale	OBP	Arcl			3	2	1122
no.4677	shale	OBP	Arcl			3	2	1126
no.4677	shale	OBP	Arcl			4	2	1157
no.142	shale	OBP	Arcl					1045
no.142	shale	OBP	Arcl			3		1121
no.142	shale	OBP	Arcl			3		1131
no.106AF	shale	OBP	Arcl			3	1	977
no.106AF	shale	OBP	Arcl			3	1	996
no.106AF	shale	OBP	Arcl			3	1	996
no.106BB	shale	OBP	Arcl			3	1	1094
no.106BB	shale	OBP	Arcl			3		996

no.106BB	shale	OBP	Arcl			3		992
no.106A2	shale	OBP	Arcl			3		1137
no.106A2	shale	OBP	Arcl			3		1137
no.106A2	shale	OBP	Arcl			3	2	1133
no.107	shale	OBP	Arcl					1318
no.107	shale	OBP	Arcl					1317
no.107	shale	OBP	Arcl					1313
no.159	shale	OBP	Arcl			3		1128
no.159	shale	OBP	Arcl			3		1128
no.159	shale	OBP	Arcl			3		1130
no.182	dolerite	OBP	Arcl			3	2	1188
no.182	dolerite	OBP	Arcl			4	2	1201
no.182	dolerite	OBP	Arcl			4	2	1237
no.130	dolerite	OBP	Arcl			4		1572
no.130	dolerite	OBP	Arcl			4		1560
no.130	dolerite	OBP	Arcl			4		1564
no.122	shale	OBP	Arcl			4		1521
no.122	shale	OBP	Arcl			4		1530
no.122	shale	OBP	Arcl			4		1544
no.489	dolerite	OBP	Arcl			3		1066
no.489	dolerite	OBP	Arcl			3		1108
no.489	dolerite	OBP	Arcl			3		1110
no.493	quartz	OBP	Arcl					949
no.493	quartz	OBP	Arcl					950
no.493	quartz	OBP	Arcl					946
no.468	white quartzite	OBP	Arcl					906
no.468	white quartzite	OBP	Arcl					899
no.468	white quartzite	OBP	Arcl					897
no.412	chert	OBP	Arcl			3		1162
no.412	chert	OBP	Arcl			3		1163
no.412	chert	OBP	Arcl			3		1157

no.453	quartzite roof sample	OBP	Arcl			3		978
no.453	quartzite roof sample	OBP	Arcl			3		1002
no.453	quartzite roof sample	OBP	Arcl			3		1000
no.1290	quartz	OBP	Arcl					859
no.1290	quartz	OBP	Arcl					856
no.1290	quartz	OBP	Arcl					853
no.1226	shale	OBP	Arcl					1399
no.1226	shale	OBP	Arcl					1444
no.1226	shale	OBP	Arcl					1519
no.1873	white quartzite	OBP	Arcl			3		989
no.1873	white quartzite	OBP	Arcl					1052
no.1873	white quartzite	OBP	Arcl			3		1071
no.1824	black quartzite	OBP	Arcl					918
no.1824	black quartzite	OBP	Arcl					925
no.1824	black quartzite	OBP	Arcl					919
no.2353	red quartzite	OBP	Arcl					909
no.2353	red quartzite	OBP	Arcl					908
no.2353	red quartzite	OBP	Arcl					909
no.2366	sandstone	OBP	Arcl					918
no.2366	sandstone	OBP	Arcl					913
no.2366	sandstone	OBP	Arcl					914
no.2364	black quartzite	OBP	Arcl			3		953
no.2364	black quartzite	OBP	Arcl			3		934
no.2364	black quartzite	OBP	Arcl			3		929
no.2358	black quartzite	OBP	Arcl			3		1203
no.2358	black quartzite	OBP	Arcl			4		1242
no.2358	black quartzite	OBP	Arcl			3		1057
no.2290	shale	OBP	Arcl			4		1256
no.2290	shale	OBP	Arcl			4		1264
no.2290	shale	OBP	Arcl			4		1287
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775			921

MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	2		935
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775			903
MC1	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775			930
MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775			973
MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775			934
MC2	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775			954
MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	3		1050
MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	3		1017
MC3	quartz	Mogalakwena Fm	Geo	-24.132778	27.69775	3		1076
CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111			958
CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	3		1153
CMF1	white quartzite	Cleremont Fm	Geo	-23.996694	27.684111	3		1075
CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	3		1112
CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	3		1029
CMF2	white quartzite	Cleremont Fm	Geo	-23.998222	27.690944	3		1014
BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833			900
BPC1A	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833			913
BPC1A	redquartzite	Cleremont Fm	Geo	-24.127194	27.699833			904
BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833	3		970
BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833			964
BPC1B	white quartzite	Cleremont Fm	Geo	-24.127194	27.699833			928
BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833			937
BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833	3		970
BPC1C	red quartzite	Cleremont Fm	Geo	-24.127194	27.699833			922
BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833			1028
BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833			1007
BPC1D	quartz	Cleremont Fm	Geo	-24.127194	27.699833			956
BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833			958
BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833			950
BPC1E	quartz	Cleremont Fm	Geo	-24.127194	27.699833			954
BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833			916

BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833			948
BPC1F	black quartzite	Cleremont Fm	Geo	-24.127194	27.699833			933
BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972			937
BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972			963
BB1	quartz	Cleremont Fm	Geo	-24.127139	27.699972			977
OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	4		1093
OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583	4		1089
OBP1	quartz	Mogalakwena Fm	Geo	-24.879417	27.637583			1048
OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	4		1243
OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	3		1174
OBP2	quartz	Mogalakwena Fm	Geo	-23.879861	27.637028	4		1287
OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222			991
OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222			975
OBP3A	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	4		1227
OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	3		1007
OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	3		1186
OBP3B	quartz	Mogalakwena Fm	Geo	-23.879861	27.632222	3		1115
OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	3		1111
OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	3		1122
OBP3C	sandstone	Mogalakwena Fm	Geo	-23.879861	27.632222	3		1077
OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222		7	
OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222		7	
OBP3D	magnetite	Mogalakwena Fm	Geo	-23.879861	27.632222		8	1670
OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917			1027
OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	3		1030
OBP4A	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917			1023
OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	3		1109
OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917	3		948
OBP4B	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917			891
OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917			957
OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917			997

OBP4C	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917			941
OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917			851
OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917			884
OBP4D	quartz	Mogalakwena Fm	Geo	-23.879694	27.637917			882
OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917			940
OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917			938
OBP4E	red quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917	3		1008
OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917			869
OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917			896
OBP4F	white quartzite	Mogalakwena Fm	Geo	-23.879694	27.637917			932
OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	5		1945
OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	4		1598
OBP4G	dolerite	Mogalakwena Fm	Geo	-23.879694	27.637917	5		1992
OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361			1585
OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	5		1680
OBP5A	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	5		1771
OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361			975
OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361			975
OBP5B	white quartzite	Mogalakwena Fm	Geo	-23.812194	27.693361	3		1080
OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361			859
OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361			899
OBP5C	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361			849
OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361			1381
OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361			1458
OBP5D	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	4		1666
OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	4		1546
OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	4		1521
OBP5E	dolerite	Mogalakwena Fm	Geo	-23.812194	27.693361	4		1621
OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361		8	
OBP5F	quartz	Mogalakwena Fm	Geo	-23.812194	27.693361		8	
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528			958

OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528			944
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528			951
OBP6A	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528			953
OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	3		989
OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528			1020
OBP6B	white quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	3		1070
OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528			928
OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528	4		1005
OBP6C	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528			934
OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528			1034
OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528			1018
OBP6D	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528			886
OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528			896
OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528			867
OBP6E	quartz	Mogalakwena Fm	Geo	-23.879806	27.642528			864
OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528			1031
OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528	3		1029
OBP6F	black quartzite	Mogalakwena Fm	Geo	-23.879806	27.642528			1014
OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	3		1045
OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	3		1039
OBP7	sandstone	Mogalakwena Fm	Geo	-23.879806	27.642528	3		1059
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	4		1161
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	4		1165
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	3		1035
OBP8A	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	3		1038
OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	3		1093
OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	3		1097
OBP8B	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	3		1093
OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	3		1064
OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	3		1136
OBP8C	sandstone	Mogalakwena Fm	Geo	-23.878083	27.6395	3		1037

OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	3		1141
OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	3		1120
OBP9A	quartz	Mogalakwena Fm	Geo	-23.803111	27.75			986
OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	3		1003
OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75	3		1024
OBP9B	quartz	Mogalakwena Fm	Geo	-23.803111	27.75			955
OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74			1111
OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74	3		1104
OBP10A	shale/metasedimentary	Mogalakwena Fm	Geo	-23.798556	27.74			1021
OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	3		957
OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	3	1	959
OBP10B	shale	Mogalakwena Fm	Geo	-23.798556	27.74	3	1	922
OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74			916
OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74			925
OBP10C	quartz	Mogalakwena Fm	Geo	-23.798556	27.74			991
OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74			869
OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74			966
OBP10D	white quartzite	Mogalakwena Fm	Geo	-23.798556	27.74			856
OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74			928
OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74			927
OBP10E	quartz	Mogalakwena Fm	Geo	-23.798556	27.74			889
OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74			888
OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74			879
OBP10F	quartz	Mogalakwena Fm	Geo	-23.798556	27.74			904

Table B4: PXRF spreadsheet of Mwulu's Cave lithics and outcrop samples' concentration errors for all analysed elements. All errors measured in ppm.

Sample ID	Rock Type	Location	Geo/Arcl Piece?	Latitude (°)	Longitude (°)	Mg	Al	Si	P	S	K	Ca	Ti
no.187	quartzite black	Mwulu's Cave	Arcl				252	854	39		29		54
no.187	quartzite black	Mwulu's Cave	Arcl				253	852	39		29		54
no.187	quartzite black	Mwulu's Cave	Arcl				252	852	39		29		56
no.194	quartzite white	Mwulu's Cave	Arcl				293	812	39		62		56
no.194	quartzite white	Mwulu's Cave	Arcl				291	814	39	13	62		55
no.194	quartzite white	Mwulu's Cave	Arcl				289	814	39	13	61		55
no.194	quartzite white	Mwulu's Cave	Arcl				287	814	39		61		56
no.195	quartz	Mwulu's Cave	Arcl				302	1066	51	23			61
no.195	quartz	Mwulu's Cave	Arcl				322	1126	55	25		32	65
no.195	quartz	Mwulu's Cave	Arcl				307	1089	52	23		30	61
no.203	quartzite white	Mwulu's Cave	Arcl				325	791	49	14	28		63
no.203	quartzite white	Mwulu's Cave	Arcl				316	772	48	13	28		61
no.203	quartzite white	Mwulu's Cave	Arcl				371	729	52	14	34		71
PALO49	chert	Mwulu's Cave	Arcl				402	786	48	16	46		70
PALO49	chert	Mwulu's Cave	Arcl				457	872	55	25	51	53	85
PALO49	chert	Mwulu's Cave	Arcl				502	951	62	28	59	58	94
no.473	quartzite black	Mwulu's Cave	Arcl				252	855	39		25		50
no.473	quartzite black	Mwulu's Cave	Arcl				252	848	39		25		50
no.473	quartzite black	Mwulu's Cave	Arcl				249	846	38		25		50
no.640	quartzite white	Mwulu's Cave	Arcl				278	917	44	17	30		60
no.640	quartzite white	Mwulu's Cave	Arcl				277	915	43	17	30		60
no.640	quartzite white	Mwulu's Cave	Arcl				289	914	46	17	33		59
no.792	quartzite black	Mwulu's Cave	Arcl				433	729	38		57		83
no.792	quartzite black	Mwulu's Cave	Arcl				437	732	39		58		84
no.792	quartzite black	Mwulu's Cave	Arcl				423	776	38		59		84
no.794	quartzite black	Mwulu's Cave	Arcl				388	856	39	16	37		67
no.794	quartzite black	Mwulu's Cave	Arcl				384	851	39	16	37		67
no.794	quartzite black	Mwulu's Cave	Arcl				372	865	38	17	36		63

no.799	quartzite black	Mwulu's Cave	Arcl				371	746	52	14	35		58
no.799	quartzite black	Mwulu's Cave	Arcl				371	749	52	14	35		57
no.799	quartzite black	Mwulu's Cave	Arcl				371	748	52	14	35		58
no.672	quartzite black	Mwulu's Cave	Arcl				347	857	48		46		62
no.672	quartzite black	Mwulu's Cave	Arcl				339	854	48	16	43		60
no.672	quartzite black	Mwulu's Cave	Arcl				339	854	49	16	43		61
no.673	quartzite white	Mwulu's Cave	Arcl				280	863	44	14	51		62
no.673	quartzite white	Mwulu's Cave	Arcl				283	876	44		52		64
no.673	quartzite white	Mwulu's Cave	Arcl				286	877	45		52		63
no.673	quartzite white	Mwulu's Cave	Arcl				286	879	45		52		64
no.674	chert	Mwulu's Cave	Arcl				384	841	57	17	35		68
no.674	chert	Mwulu's Cave	Arcl				372	890	56	18	36		70
no.674	chert	Mwulu's Cave	Arcl				327	909	50	17	30		62
no.676	quartzite white	Mwulu's Cave	Arcl				271	828	46	14	25		57
no.676	quartzite white	Mwulu's Cave	Arcl				270	829	46	14	25		56
no.676	quartzite white	Mwulu's Cave	Arcl				270	832	46	14	25		56
no.677	quartzite white	Mwulu's Cave	Arcl				246	866	44	15			56
no.677	quartzite white	Mwulu's Cave	Arcl				243	851	42	14			55
no.677	quartzite white	Mwulu's Cave	Arcl				242	854	42	14			56
no.684	quartzite black	Mwulu's Cave	Arcl				305	886	52		30		65
no.684	quartzite black	Mwulu's Cave	Arcl				303	885	52		29		66
no.684	quartzite black	Mwulu's Cave	Arcl				287	861	47	15	27		60
no.836	quartzite black	Mwulu's Cave	Arcl				424	677	46	14	47		84
no.836	quartzite black	Mwulu's Cave	Arcl				432	691	47	14	48		87
no.836	quartzite black	Mwulu's Cave	Arcl				429	694	47	14	49		86
no.837	quartzite black	Mwulu's Cave	Arcl				302	983	43		31		65
no.837	quartzite black	Mwulu's Cave	Arcl				312	1023	45		33		69
no.837	quartzite black	Mwulu's Cave	Arcl				307	996	44		32		67
PA-1	quartzite black	Mwulu's Cave	Arcl				332	791	44	13	57		71
PA-1	quartzite black	Mwulu's Cave	Arcl				333	795	44	13	58		71
PA-1	quartzite black	Mwulu's Cave	Arcl				335	785	45	13	58		73

PA-2	quartz	Mwulu's Cave	Arcl				235	788	48				48
PA-2	quartz	Mwulu's Cave	Arcl				235	788	48				49
PA-2	quartz	Mwulu's Cave	Arcl				236	785	48				46
no.1021	quartzite white	Mwulu's Cave	Arcl				245	897	40	15	28		57
no.1021	quartzite white	Mwulu's Cave	Arcl				245	899	40		28		58
no.1021	quartzite white	Mwulu's Cave	Arcl				246	900	40		28		58
no.1024	quartzite white	Mwulu's Cave	Arcl				252	948	45		27		55
no.1024	quartzite white	Mwulu's Cave	Arcl				254	965	47		28		55
no.1024	quartzite white	Mwulu's Cave	Arcl				258	977	47		28		57
no.1240	shale	Mwulu's Cave	Arcl				331	865	54	16	47		65
no.1240	shale	Mwulu's Cave	Arcl				337	889	57	16	49		67
no.1240	shale	Mwulu's Cave	Arcl				319	837	53	15	45		63
no.1410	quartzite white	Mwulu's Cave	Arcl				290	825	44		34		67
no.1410	quartzite white	Mwulu's Cave	Arcl				291	820	44		34		66
no.1410	quartzite white	Mwulu's Cave	Arcl				271	896	37		33		68
no.1818	quartzite white	Mwulu's Cave	Arcl				179	894	43				
no.1818	quartzite white	Mwulu's Cave	Arcl				182	910	43				48
no.1818	quartzite white	Mwulu's Cave	Arcl				179	899	43				48
no.1835	quartz	Mwulu's Cave	Arcl				205	925	43				51
no.1835	quartz	Mwulu's Cave	Arcl				205	925	44				53
no.1835	quartz	Mwulu's Cave	Arcl				206	931	44				53
no.2133	quartzite black	Mwulu's Cave	Arcl				225	848	91		33		68
no.2133	quartzite black	Mwulu's Cave	Arcl				225	848	91		33		66
no.2133	quartzite black	Mwulu's Cave	Arcl				226	850	91		33		66
no.2034	quartzite white	Mwulu's Cave	Arcl				255	881	64		28		74
no.2034	quartzite white	Mwulu's Cave	Arcl				253	880	64		28		75
no.2034	quartzite white	Mwulu's Cave	Arcl				254	880	64		28		74
no.2070	quartzite white	Mwulu's Cave	Arcl				237	1058	50	22		40	65
no.2070	quartzite white	Mwulu's Cave	Arcl				186	920	37				58
no.2070	quartzite white	Mwulu's Cave	Arcl				182	923	37				58
no.2073	quartz	Mwulu's Cave	Arcl				196	925	44				49

no.2073	quartz	Mwulu's Cave	Arcl				198	933	45				
no.2073	quartz	Mwulu's Cave	Arcl				199	941	45				
no.2073	quartz	Mwulu's Cave	Arcl				196	933	45				
PA-3	shale	Mwulu's Cave	Arcl				312	749	115	15	67		61
PA-3	shale	Mwulu's Cave	Arcl				310	749	114	15	67		61
PA-3	shale	Mwulu's Cave	Arcl				312	751	116	15	67		60
PA-4	quartzite white	Mwulu's Cave	Arcl				444	650	81	28	38		69
PA-4	quartzite white	Mwulu's Cave	Arcl				453	682	80	26	39		72
PA-4	quartzite white	Mwulu's Cave	Arcl				574	862	103	40	52	34	91
PA-5	quartz	Mwulu's Cave	Arcl				271	851	72	16	26		53
PA-5	quartz	Mwulu's Cave	Arcl				273	859	73	16	26		54
PA-5	quartz	Mwulu's Cave	Arcl				272	857	72	16	26		55
PA-6	quartzite white	Mwulu's Cave	Arcl				222	923	62				52
PA-6	quartzite white	Mwulu's Cave	Arcl				224	927	63				53
PA-6	quartzite white	Mwulu's Cave	Arcl				223	926	63				52
PA-7	quartzite white	Mwulu's Cave	Arcl				200	930	50				54
PA-7	quartzite white	Mwulu's Cave	Arcl				199	928	50				54
PA-7	quartzite white	Mwulu's Cave	Arcl				199	931	50				55
PA-8	quartz	Mwulu's Cave	Arcl				190	863	72				53
PA-8	quartz	Mwulu's Cave	Arcl				190	865	72				54
PA-8	quartz	Mwulu's Cave	Arcl				188	861	72				53
PA-9	quartzite white	Mwulu's Cave	Arcl				202	879	57				51
PA-9	quartzite white	Mwulu's Cave	Arcl				196	854	55				50
PA-9	quartzite white	Mwulu's Cave	Arcl				200	857	55				49
PA-10	quartz	Mwulu's Cave	Arcl				269	872	116				57
PA-10	quartz	Mwulu's Cave	Arcl				270	872	116				56
PA-10	quartz	Mwulu's Cave	Arcl				270	879	116				57
PA-11	altered	Mwulu's Cave	Arcl				446	831	109	19	46	66	123
PA-11	altered	Mwulu's Cave	Arcl				448	835	109	19	46	66	123
PA-11	altered	Mwulu's Cave	Arcl				445	836	109	19	46	66	122
PA-12	shale	Mwulu's Cave	Arcl				323	744	114	15	44		55

PA-12	shale	Mwulu's Cave	Arcl				325	745	115	15	44		55
PA-12	shale	Mwulu's Cave	Arcl				324	739	115	15	43		53
PA-13	shale	Mwulu's Cave	Arcl				253	915	80				56
PA-13	shale	Mwulu's Cave	Arcl				255	893	81	15			57
PA-13	shale	Mwulu's Cave	Arcl				253	885	80	15			57
PA-14	quartzite white	Mwulu's Cave	Arcl				229	899	54		27		49
PA-14	quartzite white	Mwulu's Cave	Arcl				227	893	53		26		49
PA-14	quartzite white	Mwulu's Cave	Arcl				235	919	55		27		50
PA-15	quartzite white	Mwulu's Cave	Arcl				286	826	74		29		64
PA-15	quartzite white	Mwulu's Cave	Arcl				283	803	73		28		62
PA-15	quartzite white	Mwulu's Cave	Arcl				279	792	71		28		62
PA-16	quartzite white	Mwulu's Cave	Arcl				229	787	71		25		58
PA-16	quartzite white	Mwulu's Cave	Arcl				227	789	71		26		58
PA-16	quartzite white	Mwulu's Cave	Arcl				225	783	70		25		56
M1-E	altered	Mwulu's Cave	Arcl				265	998	43	18	26		98
M1-E	altered	Mwulu's Cave	Arcl				266	1008	44	18	27		99
M1-E	altered	Mwulu's Cave	Arcl				267	1008	43	18	27		98
M1-G	altered	Mwulu's Cave	Arcl			1371	437	441	353	25	33	26	131
M1-G	altered	Mwulu's Cave	Arcl				430	421	334	25	32	24	130
M1-G	altered	Mwulu's Cave	Arcl				431	426	338	25	33	25	131
M1-K	chert	Mwulu's Cave	Arcl				187	958	34	21			52
M1-K	chert	Mwulu's Cave	Arcl				185	948	34	21			
M1-K	chert	Mwulu's Cave	Arcl				191	962	35	21			
M1-J	quartzite black	Mwulu's Cave	Arcl				247	918	39	20	34		59
M1-J	quartzite black	Mwulu's Cave	Arcl				247	927	40	20	34		58
M1-J	quartzite black	Mwulu's Cave	Arcl				269	975	36	21	39		60
M2-B	altered	Mwulu's Cave	Arcl				323	878	40	14	33		93
M2-B	altered	Mwulu's Cave	Arcl				329	891	41	15	34		95
M2-B	altered	Mwulu's Cave	Arcl				323	876	40	14	33		93
M2-C	altered	Mwulu's Cave	Arcl			867	456	755	48	16	88		95
M2-C	altered	Mwulu's Cave	Arcl			866	453	754	47	16	88		96

M2-C	altered	Mwulu's Cave	Arcl			852	452	754	47	16	88		95
M3-B	shale	Mwulu's Cave	Arcl				398	869	63	21	37		82
M3-B	shale	Mwulu's Cave	Arcl				400	872	63	21	37		82
M3-B	shale	Mwulu's Cave	Arcl				400	869	64	21	37		83
M3-E	shale	Mwulu's Cave	Arcl				300	906	33	19	56		57
M3-E	shale	Mwulu's Cave	Arcl				297	903	33	18	55		55
M3-E	shale	Mwulu's Cave	Arcl				299	906	34	19	55		57
M3-F	shale	Mwulu's Cave	Arcl				345	912	63	24	26		65
M3-F	shale	Mwulu's Cave	Arcl				342	872	62	23	25		64
M3-F	shale	Mwulu's Cave	Arcl				336	861	60	22	25		64
no.1699	quartzite white	Mwulu's Cave	Arcl				414	713	68	14	33		72
no.1699	quartzite white	Mwulu's Cave	Arcl				413	705	67	14	33		71
no.1699	quartzite white	Mwulu's Cave	Arcl				411	707	67		33		72
no.1679	quartzite white	Mwulu's Cave	Arcl				281	773	111		43		71
no.1679	quartzite white	Mwulu's Cave	Arcl				277	668	99		45		79
no.1679	quartzite white	Mwulu's Cave	Arcl				293	713	106		50		85
no.1815	quartzite white	Mwulu's Cave	Arcl				222	989	48				59
no.1815	quartzite white	Mwulu's Cave	Arcl				222	983	48				57
no.1815	quartzite white	Mwulu's Cave	Arcl				219	985	48				57
no.1826	quartzite white	Mwulu's Cave	Arcl				215	995	39				57
no.1826	quartzite white	Mwulu's Cave	Arcl				216	1010	40				56
no.1826	quartzite white	Mwulu's Cave	Arcl				220	1019	41				58
no.1839	quartz	Mwulu's Cave	Arcl				255	831	53		28		59
no.1839	quartz	Mwulu's Cave	Arcl				258	842	54		28		60
no.1839	quartz	Mwulu's Cave	Arcl				248	906	53		26		60
no.2118	quartzite white	Mwulu's Cave	Arcl				299	764	83		51		87
no.2118	quartzite white	Mwulu's Cave	Arcl				300	761	84		52		86
no.2118	quartzite white	Mwulu's Cave	Arcl				212	918	43		24		58
no.2130	quartzite black	Mwulu's Cave	Arcl				312	905	68		35		74
no.2130	quartzite black	Mwulu's Cave	Arcl				255	911	85		38		78
no.2130	quartzite black	Mwulu's Cave	Arcl				253	883	84		36		76

no.2134	quartzite white	Mwulu's Cave	Arcl				214	877	52		25		61
no.2134	quartzite white	Mwulu's Cave	Arcl				318	827	59		32		69
no.2134	quartzite white	Mwulu's Cave	Arcl				319	829	60		32		69
no.2132	quartz	Mwulu's Cave	Arcl				260	861	46		26		57
no.2132	quartz	Mwulu's Cave	Arcl				259	861	46		26		58
no.2132	quartz	Mwulu's Cave	Arcl				282	788	93		47		83
no.2135	quartzite white	Mwulu's Cave	Arcl				254	742	102		43		80
no.2135	quartzite white	Mwulu's Cave	Arcl				239	924	47		26		65
no.2135	quartzite white	Mwulu's Cave	Arcl				239	824	76		33		76
no.2024	quartzite white	Mwulu's Cave	Arcl				283	910	67		34		69
no.2024	quartzite white	Mwulu's Cave	Arcl				314	690	86		46		79
no.2024	quartzite white	Mwulu's Cave	Arcl				280	849	63		34		68
no.2026	shale	Mwulu's Cave	Arcl				323	739	161		53		62
no.2026	shale	Mwulu's Cave	Arcl				320	807	110		56		61
no.2026	shale	Mwulu's Cave	Arcl				373	832	97		65		90
no.2038	quartzite white	Mwulu's Cave	Arcl				298	730	68		29		69
no.2038	quartzite white	Mwulu's Cave	Arcl				312	861	108		41		78
no.2038	quartzite white	Mwulu's Cave	Arcl				317	816	78		33		73
no.2080	quartzite white	Mwulu's Cave	Arcl				320	909	91		41		86
no.2080	quartzite white	Mwulu's Cave	Arcl				308	872	88		40		78
no.2080	quartzite white	Mwulu's Cave	Arcl				298	880	88		38		81
M1-A	quartzite white	Mwulu's Cave	Arcl				199	991		23	29		55
M1-A	quartzite white	Mwulu's Cave	Arcl				191	904	38	17			52
M1-A	quartzite white	Mwulu's Cave	Arcl				200	990	34	22	29		56
M1-B	quartzite black	Mwulu's Cave	Arcl					952		16			51
M1-B	quartzite black	Mwulu's Cave	Arcl					948		16			51
M1-B	quartzite black	Mwulu's Cave	Arcl					1008		19			56
M1-C	quartzite white	Mwulu's Cave	Arcl					1020	42	23			65
M1-C	quartzite white	Mwulu's Cave	Arcl				225	1043	59	32			65
M1-C	quartzite white	Mwulu's Cave	Arcl				194	1011	39	21			60
M1-D	shale	Mwulu's Cave	Arcl				263	949	43	20	40		65

M1-D	shale	Mwulu's Cave	Arcl				262	949	44	20	40		66
M1-D	shale	Mwulu's Cave	Arcl				246	925	36	24	38		60
M1-F	quartz	Mwulu's Cave	Arcl					1000		19			54
M1-F	quartz	Mwulu's Cave	Arcl				171	917	37	16			51
M1-F	quartz	Mwulu's Cave	Arcl				170	901	37	16			51
M1-H	quartzite black	Mwulu's Cave	Arcl					914		14			48
M1-H	quartzite black	Mwulu's Cave	Arcl					906		16			50
M1-H	quartzite black	Mwulu's Cave	Arcl				159	862	33	13			47
M1-I	quartzite white	Mwulu's Cave	Arcl				194	978	32	18			56
M1-I	quartzite white	Mwulu's Cave	Arcl				296	1196	49	33	40	41	90
M1-I	quartzite white	Mwulu's Cave	Arcl				191	956		17			60
M1-L	quartzite black	Mwulu's Cave	Arcl				232	960		20	31		68
M1-L	quartzite black	Mwulu's Cave	Arcl				222	940		18	28		60
M1-L	quartzite black	Mwulu's Cave	Arcl				201	968		20			55
M1-M	quartzite black	Mwulu's Cave	Arcl					1027	39	26			58
M1-M	quartzite black	Mwulu's Cave	Arcl				205	1003		29	30		58
M1-M	quartzite black	Mwulu's Cave	Arcl				195	961	50	21	28		55
M2-A	quartzite white	Mwulu's Cave	Arcl				175	927		17			53
M2-A	quartzite white	Mwulu's Cave	Arcl				278	727	81	46	28		77
M2-A	quartzite white	Mwulu's Cave	Arcl				181	940		18			57
M2-D	quartzite white	Mwulu's Cave	Arcl				229	963	33	29			61
M2-D	quartzite white	Mwulu's Cave	Arcl				203	921		19			52
M2-D	quartzite white	Mwulu's Cave	Arcl				218	937		22			54
M3-A	quartzite white	Mwulu's Cave	Arcl				187	929	30	22			56
M3-A	quartzite white	Mwulu's Cave	Arcl				225	971	39	24			58
M3-A	quartzite white	Mwulu's Cave	Arcl				185	952	30	23			52
M3-C	quartzite red	Mwulu's Cave	Arcl				279	940	42	25	63		59
M3-C	quartzite red	Mwulu's Cave	Arcl				232	914		19	57		54
M3-C	quartzite red	Mwulu's Cave	Arcl				231	909		19	57		54
M3-D	shale	Mwulu's Cave	Arcl			860	378	870	45	24	93		82
M3-D	shale	Mwulu's Cave	Arcl				476	825	71	33	79		88

M3-D	shale	Mwulu's Cave	Arcl				478	840	72	33	83		88
Outcrop 1	shale-meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	1694	596	745	41	23	41	25	85
Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985		460	996	36	21	44		76
Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985		505	862	31	19	57		95
Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017		387	443	40	17	34	692	109
Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017		387	443	40	17	34	692	109
Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017		388	442	40	17	35	701	107
Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	1315	528	823	29	16	46	25	84
Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017		527	767	34	19	44	30	90
Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	1503	532	817	34	19	46	31	91
Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	1339	354	506	37		33	617	94
Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017		362	540			34	577	99
Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017		312	499			30	781	96
Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	1887	314	509	65	17	108	530	131
Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	1837	312	519	57	17	109	517	136
Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	1686	299	478	45	15	101	480	134
Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333		253	855	31	17	25		57
Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333		209	881		17			55
Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333		225	906	29	18			54
Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333		244	894	28	17			57
Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333		526	1089	65	43	60	43	113
Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333		284	904	32	19	30		61
Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	1089	462	791	33	20	121	32	91
Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	1123	419	835	32	19	82	31	89
Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	1049	515	705	32	19	158	33	99
Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	998	451	721	29	20	122		82
Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	991	450	720	29	20	122		82
Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	972	458	739	27	17	128		84
Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175		238	937		17			57
Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175		250	982		19			58
Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175	1122	191	911				142	52

Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	1332	493	547	37	19	182	192	103
Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	1373	558	627	32	88	257	98	112
Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	1283	500	555	35	18	148	46	83
Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	1350	605	730	41	18	67	33	123
Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	1332	593	706	39	17	64	32	119
Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	1333	619	754	37	18	75	42	110
Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	1553	428	475	34	16	110	463	81
Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	1513	413	445	33	15	98	456	75
Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	1499	420	502	33	15	109	411	82
Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	1100	526	741	24	14	96		87
Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	1093	527	726	24	14	94		87
Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	1136	532	750	25	14	100		87
Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633		617	549	28	27	113		131
Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633		757	658	30	21	198		152
Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633		688	620	27	18	153		141
Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783		264	930	29		35		60
Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783		431	707	23	15	100		70
Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783		300	974	32	23	33		66
Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	1015	633	633		14	131		91
Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	987	645	604		14	116		88
Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725		641	494	29	19	55		95
Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217		291	889			41		63
Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217		287	995		21			90
Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217		368	859	38	28	32		102
Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367		568	527	41	32	126	26	104
Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	1146	668	643	33	19	128		102
Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	1261	652	661	31	21	151		93
Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367		706	721		23	100		112
Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367		702	712	32	22	99		108
Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367		632	547	26	17	51		82
Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083		373	726	44	18	39		80

Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083		386	692	45	19	40		83
Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083		367	696	43	18	38		78
Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083		450	713	33	23	32		214
Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083		437	708	32	23	31		210
Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083		377	928	65	26	49		88
Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083		218	1094	39				88
Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083		215	1057	38				90
Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083		561	663	213	43	41		96
Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083		280	855	32	17	30		61
Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083		264	945	31	18	34		74
Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083		265	880	32	15	31		57
Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083		274	918	50	17	33		73
Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083		262	865	39	15	31		67
Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083		261	849	31	15	31		91
Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083		272	665	31	21	22		196
Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083		342	992	55	37	35		107
Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083		349	1049	57	39	37		116
Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083		225	856	39		26		51
Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083		219	949	39		26		68
Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083		218	952	39		26		64
Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917		370	859	42	26	40		68
Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917		370	838	42	26	43		69
Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917		323	330	31	24	42	96	76
Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917		508	624	45	46	121		116
Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917		508	622	45	46	121		116
Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917		606	520	44	46	121		129
Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427		491	735	47	35	40		110
Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427		645	1004	69	53	60		171
Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427		423	935	36	29	35		88
Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427		398	782	27	15			103
Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427		398	733	25	14			173

Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427		396	699	24	14			181
Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533		324	713	31	28	29		72
Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533		339	776	34	31	32		75
Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533		326	751	32	29	30		74
Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967		246	903		17			56
Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967		349	922		19	34		63
Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967		346	927		19	33		63
Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967		208	736	25	23	26		55
Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967		212	771	25	23	25		56
Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967		211	787	25	23	25		60
Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315		344	828	29	19	46		55
Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315		338	824	29	19	44		56
Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315		395	848	33	21	46		63
Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333		374	763	100	23	46		94
Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333		248	901	32	22	28		78
Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333		243	889	31	22	27		80
Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333		253	1108					
Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333		272	1019			37		63
Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333		285	1050			39		67
Outcrop G3	shale	BQRF	Geo	-24,1757	29,243		613	636	28	15	101		94
Outcrop G3	shale	BQRF	Geo	-24,1757	29,243		616	640	29	16	101		94
Outcrop G3	shale	BQRF	Geo	-24,1757	29,243		557	685	33	18	136		92
Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075		342	911	34		52		91
Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075		347	924	34		53		94
Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075		325	895	29		50		75
Sample ID	**Rock Type**	**Location**	**Geo/Arcl Piece?**	**Latitude (˚)**	**Longitude (˚)**	**V**	**Cr**	**Mn**	**Fe**	**Co**	**Ni**	**Cu**	**Zn**
no.187	quartzite black	Mwulu's Cave	Arcl				12	8	19			2	
no.187	quartzite black	Mwulu's Cave	Arcl				12	8	19				
no.187	quartzite black	Mwulu's Cave	Arcl				12		19			2	
no.194	quartzite white	Mwulu's Cave	Arcl			8	11		22				
no.194	quartzite white	Mwulu's Cave	Arcl			8	11	8	22			2	

no.194	quartzite white	Mwulu's Cave	Arcl			8	11	8	22				
no.194	quartzite white	Mwulu's Cave	Arcl			8	11	8	22				
no.195	quartz	Mwulu's Cave	Arcl						25				1
no.195	quartz	Mwulu's Cave	Arcl						26				1
no.195	quartz	Mwulu's Cave	Arcl						25				
no.203	quartzite white	Mwulu's Cave	Arcl			8	11	8	35			2	
no.203	quartzite white	Mwulu's Cave	Arcl				11	8	35			2	1
no.203	quartzite white	Mwulu's Cave	Arcl			8	11	8	50		3	2	1
PALO49	chert	Mwulu's Cave	Arcl				12	9	56			2	1
PALO49	chert	Mwulu's Cave	Arcl				15	11	68			3	2
PALO49	chert	Mwulu's Cave	Arcl				16	12	75			3	2
no.473	quartzite black	Mwulu's Cave	Arcl				11		22				1
no.473	quartzite black	Mwulu's Cave	Arcl				10	7	22				
no.473	quartzite black	Mwulu's Cave	Arcl				10	7	22				
no.640	quartzite white	Mwulu's Cave	Arcl				13	9	26				1
no.640	quartzite white	Mwulu's Cave	Arcl				13	9	26			2	1
no.640	quartzite white	Mwulu's Cave	Arcl				13	9	26				1
no.792	quartzite black	Mwulu's Cave	Arcl			9	13	11	80			2	1
no.792	quartzite black	Mwulu's Cave	Arcl			9	13	11	81			2	1
no.792	quartzite black	Mwulu's Cave	Arcl			9	13	11	73			2	1
no.794	quartzite black	Mwulu's Cave	Arcl			9	13	10	40		4	2	
no.794	quartzite black	Mwulu's Cave	Arcl				13	9	40			2	
no.794	quartzite black	Mwulu's Cave	Arcl			9	13	9	35			2	
no.799	quartzite black	Mwulu's Cave	Arcl			8	11	8	43			2	
no.799	quartzite black	Mwulu's Cave	Arcl				11	8	43			2	
no.799	quartzite black	Mwulu's Cave	Arcl			8	11	8	43			2	
no.672	quartzite black	Mwulu's Cave	Arcl					9	31				
no.672	quartzite black	Mwulu's Cave	Arcl					9	31				
no.672	quartzite black	Mwulu's Cave	Arcl				12	9	31				
no.673	quartzite white	Mwulu's Cave	Arcl			8	12		22			2	
no.673	quartzite white	Mwulu's Cave	Arcl				12	8	22				

no.673	quartzite white	Mwulu's Cave	Arcl			8		8	22				
no.673	quartzite white	Mwulu's Cave	Arcl			8	12		22				
no.674	chert	Mwulu's Cave	Arcl				13	9	44			2	
no.674	chert	Mwulu's Cave	Arcl				13	10	44		4	2	
no.674	chert	Mwulu's Cave	Arcl					9	35				
no.676	quartzite white	Mwulu's Cave	Arcl				11	8	30				1
no.676	quartzite white	Mwulu's Cave	Arcl			8	11	8	30				
no.676	quartzite white	Mwulu's Cave	Arcl					8	30				
no.677	quartzite white	Mwulu's Cave	Arcl				11	8	27				
no.677	quartzite white	Mwulu's Cave	Arcl					8	27				1
no.677	quartzite white	Mwulu's Cave	Arcl				11	8	27				
no.684	quartzite black	Mwulu's Cave	Arcl			9	12	9	36				1
no.684	quartzite black	Mwulu's Cave	Arcl				12	9	35			2	1
no.684	quartzite black	Mwulu's Cave	Arcl				12	8	30				1
no.836	quartzite black	Mwulu's Cave	Arcl			9	13	12	97			2	1
no.836	quartzite black	Mwulu's Cave	Arcl			9	13	12	99			3	1
no.836	quartzite black	Mwulu's Cave	Arcl			9	13	12	98			3	1
no.837	quartzite black	Mwulu's Cave	Arcl					9	36			2	1
no.837	quartzite black	Mwulu's Cave	Arcl					10	37			2	
no.837	quartzite black	Mwulu's Cave	Arcl					10	36				
PA-1	quartzite black	Mwulu's Cave	Arcl			9	12	9	38			2	1
PA-1	quartzite black	Mwulu's Cave	Arcl			8	12	9	38			2	1
PA-1	quartzite black	Mwulu's Cave	Arcl			9	12	8	40			2	1
PA-2	quartz	Mwulu's Cave	Arcl				10	7	21		3		
PA-2	quartz	Mwulu's Cave	Arcl					7	21				
PA-2	quartz	Mwulu's Cave	Arcl					7	21				1
no.1021	quartzite white	Mwulu's Cave	Arcl					8	23			2	
no.1021	quartzite white	Mwulu's Cave	Arcl					8	23				
no.1021	quartzite white	Mwulu's Cave	Arcl			8		8	23				
no.1024	quartzite white	Mwulu's Cave	Arcl						20				
no.1024	quartzite white	Mwulu's Cave	Arcl						21				

no.1024	quartzite white	Mwulu's Cave	Arcl						21				
no.1240	shale	Mwulu's Cave	Arcl				13		39			2	
no.1240	shale	Mwulu's Cave	Arcl				13	9	38			2	
no.1240	shale	Mwulu's Cave	Arcl				12	8	36			2	
no.1410	quartzite white	Mwulu's Cave	Arcl				12	9	40			2	
no.1410	quartzite white	Mwulu's Cave	Arcl			8	11	9	40			2	1
no.1410	quartzite white	Mwulu's Cave	Arcl					9	41			2	
no.1818	quartzite white	Mwulu's Cave	Arcl						16			2	
no.1818	quartzite white	Mwulu's Cave	Arcl						16				
no.1818	quartzite white	Mwulu's Cave	Arcl						16				
no.1835	quartz	Mwulu's Cave	Arcl						16				
no.1835	quartz	Mwulu's Cave	Arcl						16				
no.1835	quartz	Mwulu's Cave	Arcl						17				
no.2133	quartzite black	Mwulu's Cave	Arcl			8	12	8	49			2	
no.2133	quartzite black	Mwulu's Cave	Arcl				11	9	49			2	1
no.2133	quartzite black	Mwulu's Cave	Arcl			8		9	49			2	
no.2034	quartzite white	Mwulu's Cave	Arcl				12	8	39			2	
no.2034	quartzite white	Mwulu's Cave	Arcl				12	8	39			2	
no.2034	quartzite white	Mwulu's Cave	Arcl				12	9	39			2	
no.2070	quartzite white	Mwulu's Cave	Arcl						26			2	1
no.2070	quartzite white	Mwulu's Cave	Arcl				11		15			2	
no.2070	quartzite white	Mwulu's Cave	Arcl						15				
no.2073	quartz	Mwulu's Cave	Arcl						15				
no.2073	quartz	Mwulu's Cave	Arcl						15				
no.2073	quartz	Mwulu's Cave	Arcl						15				
no.2073	quartz	Mwulu's Cave	Arcl						15				
PA-3	shale	Mwulu's Cave	Arcl			8	12		32			2	
PA-3	shale	Mwulu's Cave	Arcl			8	12	8	32			2	
PA-3	shale	Mwulu's Cave	Arcl			8	12		32			2	
PA-4	quartzite white	Mwulu's Cave	Arcl			8	12	9	48				1
PA-4	quartzite white	Mwulu's Cave	Arcl			9	12	9	49				1

PA-4	quartzite white	Mwulu's Cave	Arcl			11	16	12	64			3	2
PA-5	quartz	Mwulu's Cave	Arcl			8		8	25				
PA-5	quartz	Mwulu's Cave	Arcl						25			2	
PA-5	quartz	Mwulu's Cave	Arcl					8	25				
PA-6	quartzite white	Mwulu's Cave	Arcl					8	17				
PA-6	quartzite white	Mwulu's Cave	Arcl						17				
PA-6	quartzite white	Mwulu's Cave	Arcl						17				
PA-7	quartzite white	Mwulu's Cave	Arcl					8	19			2	
PA-7	quartzite white	Mwulu's Cave	Arcl			8	12	8	19				
PA-7	quartzite white	Mwulu's Cave	Arcl				12		19				
PA-8	quartz	Mwulu's Cave	Arcl						21				
PA-8	quartz	Mwulu's Cave	Arcl				11		21				
PA-8	quartz	Mwulu's Cave	Arcl				11		21				
PA-9	quartzite white	Mwulu's Cave	Arcl						21				
PA-9	quartzite white	Mwulu's Cave	Arcl						20				
PA-9	quartzite white	Mwulu's Cave	Arcl						20			2	
PA-10	quartz	Mwulu's Cave	Arcl						31			2	
PA-10	quartz	Mwulu's Cave	Arcl			8			31				
PA-10	quartz	Mwulu's Cave	Arcl			8			31				
PA-11	altered	Mwulu's Cave	Arcl			12	15	19	217		6	3	3
PA-11	altered	Mwulu's Cave	Arcl			12	15	19	219		6	4	3
PA-11	altered	Mwulu's Cave	Arcl			12	16	19	219		6	4	3
PA-12	shale	Mwulu's Cave	Arcl				11		27			2	
PA-12	shale	Mwulu's Cave	Arcl				11	8	27				
PA-12	shale	Mwulu's Cave	Arcl			7	11	7	27			2	
PA-13	shale	Mwulu's Cave	Arcl					10	71			3	1
PA-13	shale	Mwulu's Cave	Arcl			8	11	11	86			3	1
PA-13	shale	Mwulu's Cave	Arcl					11	92			3	1
PA-14	quartzite white	Mwulu's Cave	Arcl						18				
PA-14	quartzite white	Mwulu's Cave	Arcl						17				
PA-14	quartzite white	Mwulu's Cave	Arcl						18				

PA-15	quartzite white	Mwulu's Cave	Arcl					8	47			2	1
PA-15	quartzite white	Mwulu's Cave	Arcl					8	46			2	
PA-15	quartzite white	Mwulu's Cave	Arcl					8	46			2	1
PA-16	quartzite white	Mwulu's Cave	Arcl			7	10	7	35			2	
PA-16	quartzite white	Mwulu's Cave	Arcl			7		8	34			2	1
PA-16	quartzite white	Mwulu's Cave	Arcl			7	10	7	34		3	2	
M1-E	altered	Mwulu's Cave	Arcl					16	167			3	2
M1-E	altered	Mwulu's Cave	Arcl					16	169		5	3	2
M1-E	altered	Mwulu's Cave	Arcl					16	168			3	2
M1-G	altered	Mwulu's Cave	Arcl			11	15	19	695			5	3
M1-G	altered	Mwulu's Cave	Arcl			11	15	19	652			4	3
M1-G	altered	Mwulu's Cave	Arcl			12	16	19	646			5	3
M1-K	chert	Mwulu's Cave	Arcl					8	12				
M1-K	chert	Mwulu's Cave	Arcl						12				
M1-K	chert	Mwulu's Cave	Arcl						13				
M1-J	quartzite black	Mwulu's Cave	Arcl						17				
M1-J	quartzite black	Mwulu's Cave	Arcl						17				1
M1-J	quartzite black	Mwulu's Cave	Arcl						15				1
M2-B	altered	Mwulu's Cave	Arcl			10	14	14	186			4	3
M2-B	altered	Mwulu's Cave	Arcl			10	13	14	185			4	3
M2-B	altered	Mwulu's Cave	Arcl			10	13	14	182			4	3
M2-C	altered	Mwulu's Cave	Arcl			10	13	12	124		5	3	2
M2-C	altered	Mwulu's Cave	Arcl			10	14	12	125		5	2	2
M2-C	altered	Mwulu's Cave	Arcl			10	13	12	124		5	2	2
M3-B	shale	Mwulu's Cave	Arcl			10	14	19	107		5	3	2
M3-B	shale	Mwulu's Cave	Arcl			9	14	19	108		5	3	2
M3-B	shale	Mwulu's Cave	Arcl			10	14	19	107		5	3	2
M3-E	shale	Mwulu's Cave	Arcl				12	9	22			2	
M3-E	shale	Mwulu's Cave	Arcl						22		4	2	
M3-E	shale	Mwulu's Cave	Arcl						22			2	1
M3-F	shale	Mwulu's Cave	Arcl					13	338				2

M3-F	shale	Mwulu's Cave	Arcl					14	374				2
M3-F	shale	Mwulu's Cave	Arcl					14	372				2
no.1699	quartzite white	Mwulu's Cave	Arcl			8	12	9	54			2	
no.1699	quartzite white	Mwulu's Cave	Arcl			8	12	9	53			2	1
no.1699	quartzite white	Mwulu's Cave	Arcl			8	12	9	53			2	1
no.1679	quartzite white	Mwulu's Cave	Arcl			9	12	9	58			2	
no.1679	quartzite white	Mwulu's Cave	Arcl			9	12	10	88			2	1
no.1679	quartzite white	Mwulu's Cave	Arcl			10	13	11	96			2	1
no.1815	quartzite white	Mwulu's Cave	Arcl						22				
no.1815	quartzite white	Mwulu's Cave	Arcl						22				
no.1815	quartzite white	Mwulu's Cave	Arcl						22				
no.1826	quartzite white	Mwulu's Cave	Arcl						19				
no.1826	quartzite white	Mwulu's Cave	Arcl						19				
no.1826	quartzite white	Mwulu's Cave	Arcl						20				
no.1839	quartz	Mwulu's Cave	Arcl					8	33			2	
no.1839	quartz	Mwulu's Cave	Arcl						34			2	
no.1839	quartz	Mwulu's Cave	Arcl					8	31			2	
no.2118	quartzite white	Mwulu's Cave	Arcl			9	13	10	73			2	1
no.2118	quartzite white	Mwulu's Cave	Arcl			9	14	10	74			2	1
no.2118	quartzite white	Mwulu's Cave	Arcl					8	22				
no.2130	quartzite black	Mwulu's Cave	Arcl			9	13	10	50			2	
no.2130	quartzite black	Mwulu's Cave	Arcl			9	14	10	54			2	
no.2130	quartzite black	Mwulu's Cave	Arcl				13	10	53			2	
no.2134	quartzite white	Mwulu's Cave	Arcl				12	8	34			2	
no.2134	quartzite white	Mwulu's Cave	Arcl				12	9	50			2	
no.2134	quartzite white	Mwulu's Cave	Arcl			8	12	9	50			2	
no.2132	quartz	Mwulu's Cave	Arcl					8	30			2	
no.2132	quartz	Mwulu's Cave	Arcl				11	8	29				
no.2132	quartz	Mwulu's Cave	Arcl			9	13	10	67			2	
no.2135	quartzite white	Mwulu's Cave	Arcl			9	12	9	65			2	1
no.2135	quartzite white	Mwulu's Cave	Arcl				13	9	36			2	

no.2135	quartzite white	Mwulu's Cave	Arcl			9	12	9	54		4	2	1
no.2024	quartzite white	Mwulu's Cave	Arcl				14	9	46		4	2	
no.2024	quartzite white	Mwulu's Cave	Arcl			9	13	9	66			2	
no.2024	quartzite white	Mwulu's Cave	Arcl				13	9	40			2	
no.2026	shale	Mwulu's Cave	Arcl			8	13	8	40			2	
no.2026	shale	Mwulu's Cave	Arcl				13		34			2	
no.2026	shale	Mwulu's Cave	Arcl				15	11	64			3	
no.2038	quartzite white	Mwulu's Cave	Arcl			8	12	9	53			2	
no.2038	quartzite white	Mwulu's Cave	Arcl			9	13	10	64			2	
no.2038	quartzite white	Mwulu's Cave	Arcl			9	12	9	55			2	1
no.2080	quartzite white	Mwulu's Cave	Arcl				14	11	65			3	1
no.2080	quartzite white	Mwulu's Cave	Arcl					10	64			2	
no.2080	quartzite white	Mwulu's Cave	Arcl			9	13	11	60			2	
M1-A	quartzite white	Mwulu's Cave	Arcl						15			2	1
M1-A	quartzite white	Mwulu's Cave	Arcl			8		8	19			2	1
M1-A	quartzite white	Mwulu's Cave	Arcl						15			2	1
M1-B	quartzite black	Mwulu's Cave	Arcl						12			2	1
M1-B	quartzite black	Mwulu's Cave	Arcl						12				1
M1-B	quartzite black	Mwulu's Cave	Arcl				13		15				
M1-C	quartzite white	Mwulu's Cave	Arcl						18			2	1
M1-C	quartzite white	Mwulu's Cave	Arcl						27			3	2
M1-C	quartzite white	Mwulu's Cave	Arcl						18			2	1
M1-D	shale	Mwulu's Cave	Arcl				12		22			2	1
M1-D	shale	Mwulu's Cave	Arcl						22			2	
M1-D	shale	Mwulu's Cave	Arcl						18			2	
M1-F	quartz	Mwulu's Cave	Arcl						11				
M1-F	quartz	Mwulu's Cave	Arcl						15			2	1
M1-F	quartz	Mwulu's Cave	Arcl			8			15			2	1
M1-H	quartzite black	Mwulu's Cave	Arcl						10				1
M1-H	quartzite black	Mwulu's Cave	Arcl						11				1
M1-H	quartzite black	Mwulu's Cave	Arcl			7		7	11				

M1-I	quartzite white	Mwulu's Cave	Arcl						18				
M1-I	quartzite white	Mwulu's Cave	Arcl					11	42			3	2
M1-I	quartzite white	Mwulu's Cave	Arcl						19				
M1-L	quartzite black	Mwulu's Cave	Arcl				14		15			2	1
M1-L	quartzite black	Mwulu's Cave	Arcl			8	13	9	16			2	
M1-L	quartzite black	Mwulu's Cave	Arcl				13		11			2	1
M1-M	quartzite black	Mwulu's Cave	Arcl						13				
M1-M	quartzite black	Mwulu's Cave	Arcl						13				1
M1-M	quartzite black	Mwulu's Cave	Arcl						18				
M2-A	quartzite white	Mwulu's Cave	Arcl						16				
M2-A	quartzite white	Mwulu's Cave	Arcl			14	19	12	35			2	1
M2-A	quartzite white	Mwulu's Cave	Arcl					8	17				1
M2-D	quartzite white	Mwulu's Cave	Arcl					9	20			2	1
M2-D	quartzite white	Mwulu's Cave	Arcl						14				1
M2-D	quartzite white	Mwulu's Cave	Arcl					8	16				1
M3-A	quartzite white	Mwulu's Cave	Arcl						20			2	
M3-A	quartzite white	Mwulu's Cave	Arcl					9	17			2	1
M3-A	quartzite white	Mwulu's Cave	Arcl			8		8	12				1
M3-C	quartzite red	Mwulu's Cave	Arcl			9		10	18			2	1
M3-C	quartzite red	Mwulu's Cave	Arcl			8		8	14			2	1
M3-C	quartzite red	Mwulu's Cave	Arcl						17			2	
M3-D	shale	Mwulu's Cave	Arcl			9	13	11	130		5	3	2
M3-D	shale	Mwulu's Cave	Arcl			10	15	14	144		5	3	3
M3-D	shale	Mwulu's Cave	Arcl			10	15	14	142		5	3	3
Outcrop 1	shale-meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985		19	42	1348			11	
Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985		18	51	323		7	5	2
Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	10	17	62	581		10	6	3
Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	12	18	45	142		6	3	2
Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	13	19	45	140		7	3	2
Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	13	19	46	144		7	4	2
Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	9	15	32	566		8	5	4

Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	10	15	100	608		10	6	3
Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	10	16	103	655		10	6	3
Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	12	17	81	190		6	4	2
Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	12	19	83	183		7	4	2
Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	13		65	186		7	4	3
Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	14	25	40	164		27	6	3
Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	15	26	38	164		21	6	2
Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	14	24	36	148		11	4	2
Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	8		12	25				
Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	8		10	20				
Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	8		11	24				
Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333			15	35			2	1
Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333	15		106	100		10		3
Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333		12	24	32				1
Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	10	21	42	126		6	3	2
Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	10	20	24	150		6	3	2
Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	11	20	19	41		4	2	
Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	10	18	28	89		5	3	2
Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	10	18	28	90		5	3	2
Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	10	18	20	82		5	3	2
Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175			18	28				1
Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175		13	19	30				1
Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175			12	17				
Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	12	20	32	153		7	3	2
Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	13	22	21	136		7	4	2
Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	10	17	164	185		8	3	2
Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	12	16	31	461		8	5	5
Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	11	15	30	449		8	5	5
Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	11	16	29	411		8	5	5
Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	10	17	43	85		6	3	2
Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	10	16	41	82		6	3	2

Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	11	16	38	87		6	3	2
Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	10	15	17	248		6	4	2
Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	10	15	16	259		6	4	2
Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	10	15	18	267		6	4	2
Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	13	17	14	281		8	5	2
Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	16	21	16	309		9	5	3
Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	14	18	15	280		8	4	2
Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783		14	10	95			3	
Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	9	17	11	99		4	2	
Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	9	14	10	51		4		
Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	10	18	12	102		5	4	2
Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	9	17	12	124		5	4	2
Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	10	15	15	223		6	4	2
Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	8	13		28				
Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	10			22				
Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	12	15	12	44			3	1
Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	12	21	19	198		9	5	4
Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	11	18	14	136		8	4	3
Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	11	18	16	129		7	4	3
Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	12	21	15	121		12	5	4
Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	12	20	15	120		12	5	4
Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	9	14	11	107		6	4	2
Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	10	14	10	76		4	3	1
Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	9	14	10	82		4	3	1
Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	9	13	10	74		4	3	1
Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	17	15	11	49		4	3	1
Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	16	15	11	47		4	2	1
Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	10	14	10	41			3	1
Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083				18			3	
Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083		14		19				
Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083	13	17	13	47			3	2

Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	9	13		19			2	
Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083		13		15				
Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083	8	12	8	21				
Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083		13		15				
Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083		12		13				
Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083		12	8	13				
Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083		12	8	28			2	1
Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083			12	49			3	2
Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083			12	49				2
Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083	8	12	10	19			2	
Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083		12	9	17				
Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083			9	17				
Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	9	13	10	67		5	3	2
Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	9	13	10	64		4	3	2
Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917		15	11	37		4	2	2
Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	12	16	11	63		5	3	2
Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	12	16	11	63		5	4	2
Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	12	16	11	99		5	4	2
Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	14	19	13	79			4	2
Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427			18	108			5	3
Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	11	14	11	62			3	1
Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427		15	9	30		4	2	
Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427		15	9	33		4	2	
Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427		15	9	33		4	2	
Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	9	13	9	31			2	1
Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	10	15	9	33			2	2
Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	10	14	9	32			2	1
Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	8			12				1
Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967	9	13	9	20			2	
Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967			9	19				
Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967		11	8	15				1

Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967		12		15				1
Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967				15				1
Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	8	12	9	20		4		1
Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	8	12	8	20		4		1
Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	9	14	9	23		4	2	1
Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	11	15	10	37		4	15	3
Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333		13		18				
Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333		13		18			2	
Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333				13		5		
Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	10	14		15				1
Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	10	16		16		5		
Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	10	17	11	74		5	3	2
Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	11	17	11	74		5	3	2
Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	11	17	19	141		6	3	2
Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075		15	11	19			2	
Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075		15	11	20			2	
Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075	9	14	10	17				1
Sample ID	**Rock Type**	**Location**	**Geo/Arcl Piece?**	**Latitude (˚)**	**Longitude (˚)**	**As**	**Se**	**Rb**	**Sr**	**Y**	**Zr**	**Nb**	**Mo**
no.187	quartzite black	Mwulu's Cave	Arcl					0	0	1	1		
no.187	quartzite black	Mwulu's Cave	Arcl					0	0		1		
no.187	quartzite black	Mwulu's Cave	Arcl					0	0	1	1		
no.194	quartzite white	Mwulu's Cave	Arcl					1	1	1	1		
no.194	quartzite white	Mwulu's Cave	Arcl					1	1	1	1		
no.194	quartzite white	Mwulu's Cave	Arcl					1	1	1	1		
no.194	quartzite white	Mwulu's Cave	Arcl					1	1	1	1		
no.195	quartz	Mwulu's Cave	Arcl						1	1			1
no.195	quartz	Mwulu's Cave	Arcl						1		1	1	2
no.195	quartz	Mwulu's Cave	Arcl					0	1		1	1	1
no.203	quartzite white	Mwulu's Cave	Arcl					0	0		1		
no.203	quartzite white	Mwulu's Cave	Arcl			1		0	0		1		
no.203	quartzite white	Mwulu's Cave	Arcl					0	0		1		

PALO49	chert	Mwulu's Cave	Arcl			1		1	0	1	1		
PALO49	chert	Mwulu's Cave	Arcl			1		1	1	1	1	1	2
PALO49	chert	Mwulu's Cave	Arcl			1		1	1	1	2	1	2
no.473	quartzite black	Mwulu's Cave	Arcl					0	0		1		
no.473	quartzite black	Mwulu's Cave	Arcl					0	0		1		
no.473	quartzite black	Mwulu's Cave	Arcl					0	0		1		
no.640	quartzite white	Mwulu's Cave	Arcl					0	0	1	1		1
no.640	quartzite white	Mwulu's Cave	Arcl					0	0	1	1		1
no.640	quartzite white	Mwulu's Cave	Arcl					0	0		1		1
no.792	quartzite black	Mwulu's Cave	Arcl			1		1	1	1	1		1
no.792	quartzite black	Mwulu's Cave	Arcl			1		1	1	1	1	1	1
no.792	quartzite black	Mwulu's Cave	Arcl			1		1	1	1	1	1	1
no.794	quartzite black	Mwulu's Cave	Arcl			1		1	0	1	1	1	1
no.794	quartzite black	Mwulu's Cave	Arcl					1	0		1	1	
no.794	quartzite black	Mwulu's Cave	Arcl					1			1		1
no.799	quartzite black	Mwulu's Cave	Arcl					0	0		1		
no.799	quartzite black	Mwulu's Cave	Arcl					0	0		1		
no.799	quartzite black	Mwulu's Cave	Arcl					0	0		1		
no.672	quartzite black	Mwulu's Cave	Arcl					1	0		1		
no.672	quartzite black	Mwulu's Cave	Arcl					1	0		1		
no.672	quartzite black	Mwulu's Cave	Arcl					1	0		1		
no.673	quartzite white	Mwulu's Cave	Arcl					1	1	1	1	1	
no.673	quartzite white	Mwulu's Cave	Arcl					1	1		1	1	
no.673	quartzite white	Mwulu's Cave	Arcl					1	1	1	1	1	
no.673	quartzite white	Mwulu's Cave	Arcl					1	1		1	1	
no.674	chert	Mwulu's Cave	Arcl			1		0			1		1
no.674	chert	Mwulu's Cave	Arcl			1		0			1	1	1
no.674	chert	Mwulu's Cave	Arcl			1		0			1	1	1
no.676	quartzite white	Mwulu's Cave	Arcl			1		0			1		
no.676	quartzite white	Mwulu's Cave	Arcl					0	0		1		
no.676	quartzite white	Mwulu's Cave	Arcl					0			1		

no.677	quartzite white	Mwulu's Cave	Arcl										
no.677	quartzite white	Mwulu's Cave	Arcl										
no.677	quartzite white	Mwulu's Cave	Arcl										
no.684	quartzite black	Mwulu's Cave	Arcl			1		0	0		1		
no.684	quartzite black	Mwulu's Cave	Arcl					0	0		1		
no.684	quartzite black	Mwulu's Cave	Arcl					0	0		1		
no.836	quartzite black	Mwulu's Cave	Arcl			1		1	1		1		
no.836	quartzite black	Mwulu's Cave	Arcl			1		1	1	1	1		1
no.836	quartzite black	Mwulu's Cave	Arcl			1		1	1	1	1	1	
no.837	quartzite black	Mwulu's Cave	Arcl			1		1	1	1	1	1	1
no.837	quartzite black	Mwulu's Cave	Arcl					1	1	1	1	1	1
no.837	quartzite black	Mwulu's Cave	Arcl			1		1	1		1	1	1
PA-1	quartzite black	Mwulu's Cave	Arcl					1	1	1	1		
PA-1	quartzite black	Mwulu's Cave	Arcl					1	1	1	1		
PA-1	quartzite black	Mwulu's Cave	Arcl			1		1	1	1	1		
PA-2	quartz	Mwulu's Cave	Arcl										
PA-2	quartz	Mwulu's Cave	Arcl										
PA-2	quartz	Mwulu's Cave	Arcl										
no.1021	quartzite white	Mwulu's Cave	Arcl					0	0	1	1		
no.1021	quartzite white	Mwulu's Cave	Arcl					1	0	1	1		
no.1021	quartzite white	Mwulu's Cave	Arcl					0	0	1	1		
no.1024	quartzite white	Mwulu's Cave	Arcl					1	0	1	1	1	1
no.1024	quartzite white	Mwulu's Cave	Arcl					1	0	1	1	1	1
no.1024	quartzite white	Mwulu's Cave	Arcl					1	1	1	1	1	1
no.1240	shale	Mwulu's Cave	Arcl					1		1	1	1	
no.1240	shale	Mwulu's Cave	Arcl			1		1	0	1	1		1
no.1240	shale	Mwulu's Cave	Arcl					1		1	1		
no.1410	quartzite white	Mwulu's Cave	Arcl			1		1	1	1	1		
no.1410	quartzite white	Mwulu's Cave	Arcl			1		1	1	1	1		
no.1410	quartzite white	Mwulu's Cave	Arcl			1		1	1	1	1		
no.1818	quartzite white	Mwulu's Cave	Arcl						0		1		

no.1818	quartzite white	Mwulu's Cave	Arcl						0		1		
no.1818	quartzite white	Mwulu's Cave	Arcl						0		1		
no.1835	quartz	Mwulu's Cave	Arcl						0				
no.1835	quartz	Mwulu's Cave	Arcl										
no.1835	quartz	Mwulu's Cave	Arcl						0				
no.2133	quartzite black	Mwulu's Cave	Arcl					0	0	1	1		
no.2133	quartzite black	Mwulu's Cave	Arcl					0	0	1	1		
no.2133	quartzite black	Mwulu's Cave	Arcl					0	0	1	1		
no.2034	quartzite white	Mwulu's Cave	Arcl					0	0	1	1	1	
no.2034	quartzite white	Mwulu's Cave	Arcl					0	0	1	1	1	
no.2034	quartzite white	Mwulu's Cave	Arcl					0	0	1	1	1	
no.2070	quartzite white	Mwulu's Cave	Arcl					0	1	1	1	1	1
no.2070	quartzite white	Mwulu's Cave	Arcl						0	1	1		
no.2070	quartzite white	Mwulu's Cave	Arcl					0	0		1		
no.2073	quartz	Mwulu's Cave	Arcl										
no.2073	quartz	Mwulu's Cave	Arcl										
no.2073	quartz	Mwulu's Cave	Arcl										
no.2073	quartz	Mwulu's Cave	Arcl										
PA-3	shale	Mwulu's Cave	Arcl					1	0		1		
PA-3	shale	Mwulu's Cave	Arcl					1	0		1		
PA-3	shale	Mwulu's Cave	Arcl					1		1	1		
PA-4	quartzite white	Mwulu's Cave	Arcl			1		0	1		1		
PA-4	quartzite white	Mwulu's Cave	Arcl			1		0	1	1	1		1
PA-4	quartzite white	Mwulu's Cave	Arcl			1		1	1		1		
PA-5	quartz	Mwulu's Cave	Arcl										
PA-5	quartz	Mwulu's Cave	Arcl										
PA-5	quartz	Mwulu's Cave	Arcl										
PA-6	quartzite white	Mwulu's Cave	Arcl					0	0		1		
PA-6	quartzite white	Mwulu's Cave	Arcl					0	0		1		
PA-6	quartzite white	Mwulu's Cave	Arcl					0	0		1		
PA-7	quartzite white	Mwulu's Cave	Arcl					0	0		1		

PA-7	quartzite white	Mwulu's Cave	Arcl					0	0		1		
PA-7	quartzite white	Mwulu's Cave	Arcl					0	0		1		
PA-8	quartz	Mwulu's Cave	Arcl										
PA-8	quartz	Mwulu's Cave	Arcl					0					
PA-8	quartz	Mwulu's Cave	Arcl			1							
PA-9	quartzite white	Mwulu's Cave	Arcl								1		
PA-9	quartzite white	Mwulu's Cave	Arcl								1		
PA-9	quartzite white	Mwulu's Cave	Arcl					0			1		
PA-10	quartz	Mwulu's Cave	Arcl										1
PA-10	quartz	Mwulu's Cave	Arcl										1
PA-10	quartz	Mwulu's Cave	Arcl						0				1
PA-11	altered	Mwulu's Cave	Arcl			1		1	1	1	2	1	
PA-11	altered	Mwulu's Cave	Arcl			1		1	1	1	2	1	
PA-11	altered	Mwulu's Cave	Arcl			1		1	1	1	2	1	
PA-12	shale	Mwulu's Cave	Arcl					1		1	1		
PA-12	shale	Mwulu's Cave	Arcl					1		1	1		
PA-12	shale	Mwulu's Cave	Arcl					1		1	1		
PA-13	shale	Mwulu's Cave	Arcl			1							
PA-13	shale	Mwulu's Cave	Arcl			1		0					
PA-13	shale	Mwulu's Cave	Arcl			1		0					
PA-14	quartzite white	Mwulu's Cave	Arcl					0	0		1		
PA-14	quartzite white	Mwulu's Cave	Arcl					0			1		
PA-14	quartzite white	Mwulu's Cave	Arcl					0	0		1		
PA-15	quartzite white	Mwulu's Cave	Arcl			1		0	0	1	1		
PA-15	quartzite white	Mwulu's Cave	Arcl					0	0	1	1		
PA-15	quartzite white	Mwulu's Cave	Arcl					0	0	1	1		
PA-16	quartzite white	Mwulu's Cave	Arcl					0			1		
PA-16	quartzite white	Mwulu's Cave	Arcl			1		0			1		
PA-16	quartzite white	Mwulu's Cave	Arcl					0			1		
M1-E	altered	Mwulu's Cave	Arcl			1		1	1	1	4	1	
M1-E	altered	Mwulu's Cave	Arcl			1		1	1	2	4	1	

M1-E	altered	Mwulu's Cave	Arcl			1		1	1	2	4	1	
M1-G	altered	Mwulu's Cave	Arcl			2		2	1	1	3	2	
M1-G	altered	Mwulu's Cave	Arcl			2		2	1	1	3	2	
M1-G	altered	Mwulu's Cave	Arcl			2		2	1	1	3	2	
M1-K	chert	Mwulu's Cave	Arcl					0					1
M1-K	chert	Mwulu's Cave	Arcl					0					
M1-K	chert	Mwulu's Cave	Arcl					0					1
M1-J	quartzite black	Mwulu's Cave	Arcl			1		0	0	1	1		
M1-J	quartzite black	Mwulu's Cave	Arcl					0	0	1	1		
M1-J	quartzite black	Mwulu's Cave	Arcl			1		1	0	1	1		1
M2-B	altered	Mwulu's Cave	Arcl			1		1	1	2	4	1	
M2-B	altered	Mwulu's Cave	Arcl			1		1	1	2	4	1	
M2-B	altered	Mwulu's Cave	Arcl			1		1	1	2	4	1	
M2-C	altered	Mwulu's Cave	Arcl			1		2	1	1	2	1	
M2-C	altered	Mwulu's Cave	Arcl			1		2	1	1	2	1	
M2-C	altered	Mwulu's Cave	Arcl			1	0	1	1	1	2	1	
M3-B	shale	Mwulu's Cave	Arcl			1		1	1	1	2	1	
M3-B	shale	Mwulu's Cave	Arcl			1		1	1	1	2	1	
M3-B	shale	Mwulu's Cave	Arcl			1		1	1	1	2	1	
M3-E	shale	Mwulu's Cave	Arcl			1		1			1		
M3-E	shale	Mwulu's Cave	Arcl			1		1	0	1	1		
M3-E	shale	Mwulu's Cave	Arcl					1	0		1		1
M3-F	shale	Mwulu's Cave	Arcl					1	1	1	1		
M3-F	shale	Mwulu's Cave	Arcl					1	1	1	1		
M3-F	shale	Mwulu's Cave	Arcl					1	1		1		
no.1699	quartzite white	Mwulu's Cave	Arcl			1		0			1		
no.1699	quartzite white	Mwulu's Cave	Arcl					0			1		
no.1699	quartzite white	Mwulu's Cave	Arcl					0			1		
no.1679	quartzite white	Mwulu's Cave	Arcl					1	0	1	1		1
no.1679	quartzite white	Mwulu's Cave	Arcl			1		1	0	1	1		
no.1679	quartzite white	Mwulu's Cave	Arcl			1		1	0	1	1		

no.1815	quartzite white	Mwulu's Cave	Arcl						0				1
no.1815	quartzite white	Mwulu's Cave	Arcl						0	1			1
no.1815	quartzite white	Mwulu's Cave	Arcl										1
no.1826	quartzite white	Mwulu's Cave	Arcl					0	0	1	1		1
no.1826	quartzite white	Mwulu's Cave	Arcl					0	0	1	1	1	1
no.1826	quartzite white	Mwulu's Cave	Arcl					0	0	1	1	1	1
no.1839	quartz	Mwulu's Cave	Arcl					0	0		1		
no.1839	quartz	Mwulu's Cave	Arcl					1	0	1	1		
no.1839	quartz	Mwulu's Cave	Arcl					1	0		1		
no.2118	quartzite white	Mwulu's Cave	Arcl			1		1	0	1	1		
no.2118	quartzite white	Mwulu's Cave	Arcl			1		1	0	1	1	1	
no.2118	quartzite white	Mwulu's Cave	Arcl					0			1		
no.2130	quartzite black	Mwulu's Cave	Arcl					0	0	1	1	1	1
no.2130	quartzite black	Mwulu's Cave	Arcl			1		1	0	1	1	1	1
no.2130	quartzite black	Mwulu's Cave	Arcl					1	0	1	1	1	1
no.2134	quartzite white	Mwulu's Cave	Arcl					0		1	1		
no.2134	quartzite white	Mwulu's Cave	Arcl					0	0	1	1		
no.2134	quartzite white	Mwulu's Cave	Arcl					0	0	1	1		
no.2132	quartz	Mwulu's Cave	Arcl										
no.2132	quartz	Mwulu's Cave	Arcl										
no.2132	quartz	Mwulu's Cave	Arcl					1			1	1	1
no.2135	quartzite white	Mwulu's Cave	Arcl					1	0		1		
no.2135	quartzite white	Mwulu's Cave	Arcl					0	0	1	1		
no.2135	quartzite white	Mwulu's Cave	Arcl					1		1	1		
no.2024	quartzite white	Mwulu's Cave	Arcl			1		0	0	1	1	1	1
no.2024	quartzite white	Mwulu's Cave	Arcl					0	0	1	1		
no.2024	quartzite white	Mwulu's Cave	Arcl					0		1	1		
no.2026	shale	Mwulu's Cave	Arcl			1		1			1		
no.2026	shale	Mwulu's Cave	Arcl					1	0		1	1	
no.2026	shale	Mwulu's Cave	Arcl					1	1	1	1	1	1
no.2038	quartzite white	Mwulu's Cave	Arcl					0	0	1	1		

no.2038	quartzite white	Mwulu's Cave	Arcl			1		1	1	1	1	1	1
no.2038	quartzite white	Mwulu's Cave	Arcl			1		0	0	1	1		
no.2080	quartzite white	Mwulu's Cave	Arcl			1		1	1	1	1	1	1
no.2080	quartzite white	Mwulu's Cave	Arcl					1	1	1	1	1	1
no.2080	quartzite white	Mwulu's Cave	Arcl					1	1	1	1	1	1
M1-A	quartzite white	Mwulu's Cave	Arcl					1	1	1	1	1	
M1-A	quartzite white	Mwulu's Cave	Arcl			1		1	1	1	1		
M1-A	quartzite white	Mwulu's Cave	Arcl					1	1	1	1		
M1-B	quartzite black	Mwulu's Cave	Arcl					0	0	1	1		
M1-B	quartzite black	Mwulu's Cave	Arcl					0	0		1		
M1-B	quartzite black	Mwulu's Cave	Arcl					1	1	1	1		1
M1-C	quartzite white	Mwulu's Cave	Arcl					0	0	1	1	1	1
M1-C	quartzite white	Mwulu's Cave	Arcl					0	0	1	1	1	1
M1-C	quartzite white	Mwulu's Cave	Arcl					0	0	1	1	1	1
M1-D	shale	Mwulu's Cave	Arcl			1		1	0	1	1	1	1
M1-D	shale	Mwulu's Cave	Arcl			1		1	0		1	1	1
M1-D	shale	Mwulu's Cave	Arcl			1		1	0	1	1	1	1
M1-F	quartz	Mwulu's Cave	Arcl									1	1
M1-F	quartz	Mwulu's Cave	Arcl										
M1-F	quartz	Mwulu's Cave	Arcl						0				
M1-H	quartzite black	Mwulu's Cave	Arcl					0	0	1	1		
M1-H	quartzite black	Mwulu's Cave	Arcl					0	0	1	1		
M1-H	quartzite black	Mwulu's Cave	Arcl								1		
M1-I	quartzite white	Mwulu's Cave	Arcl					1	1	1	1	1	
M1-I	quartzite white	Mwulu's Cave	Arcl			1		1	1	1	2	1	2
M1-I	quartzite white	Mwulu's Cave	Arcl					1	1	1	1	1	
M1-L	quartzite black	Mwulu's Cave	Arcl					0	0	1	1	1	
M1-L	quartzite black	Mwulu's Cave	Arcl					0	0	1	1		
M1-L	quartzite black	Mwulu's Cave	Arcl					0	0	1	1		
M1-M	quartzite black	Mwulu's Cave	Arcl					0	1	1	1	1	1
M1-M	quartzite black	Mwulu's Cave	Arcl					1	1	1	1	1	1

M1-M	quartzite black	Mwulu's Cave	Arcl					0	0		1		1
M2-A	quartzite white	Mwulu's Cave	Arcl					0	0		1		
M2-A	quartzite white	Mwulu's Cave	Arcl			1		0	1	1	1		
M2-A	quartzite white	Mwulu's Cave	Arcl					0	0	1	1		
M2-D	quartzite white	Mwulu's Cave	Arcl			1		0	0	1	1		1
M2-D	quartzite white	Mwulu's Cave	Arcl					0	0		1		
M2-D	quartzite white	Mwulu's Cave	Arcl					0	0		1		
M3-A	quartzite white	Mwulu's Cave	Arcl			1		0		1	1		
M3-A	quartzite white	Mwulu's Cave	Arcl					0	0	1	1		1
M3-A	quartzite white	Mwulu's Cave	Arcl					0	0		1		
M3-C	quartzite red	Mwulu's Cave	Arcl					1	1		1	1	1
M3-C	quartzite red	Mwulu's Cave	Arcl					1	1		1		
M3-C	quartzite red	Mwulu's Cave	Arcl					1	1	1	1		
M3-D	shale	Mwulu's Cave	Arcl			1		2	1	1	2	1	
M3-D	shale	Mwulu's Cave	Arcl			1		2	1	1	2	1	
M3-D	shale	Mwulu's Cave	Arcl			1		2	1	1	2	1	
Outcrop 1	shale-meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	7		3	2		2		3
Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	2		1	1	1	1	1	2
Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985	3		1	1	1	2	2	2
Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	1		1	1	1	2	1	2
Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	1		1	1	1	2	1	
Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017	1		1	1	1	2	1	2
Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	2		1	1	1	2	1	
Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	3		2	1	1	2	2	2
Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017	3		2	1	1	2	2	2
Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	1		1	1	1	1	1	
Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	1		1	1	1	2	1	2
Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017	1		1	1	1	2	1	2
Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	1		1	12	1	4	2	
Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333			1	12	1	5	2	2
Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333	1		1	12		9	2	

Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333			0					
Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333				0				
Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333	1			0				
Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333			0			1		
Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333			1	1	1	2	2	2
Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333			0	0				
Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	1	1	2	1	1	2	1	
Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175	1		2	1	1	1	1	
Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175		0	2	1		1	1	
Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	1		2	1		1	1	
Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	1		2	1		1	1	
Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175	1		2	0		1	1	
Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175			0			1		1
Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175			0		1	1	1	1
Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175				0				
Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	1		2	1	1	2	1	
Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	1		2	1	1	2	1	
Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833	1		2	1	1	2	1	
Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083	2		2	2	1	2	1	2
Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083			2	2	1	2	1	
Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083			2	2	1	2	1	
Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	1		1	1	1	1	1	
Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	1		1	1	1	1	1	
Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083	1		1	1	1	1	1	
Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	1		2	1	1	2	1	
Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	1		2	1	1	2	1	
Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276	1		2	1	1	2	1	
Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	1		2	1	1	2	1	2
Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	1		2	1	1	2	2	2
Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633	1		2	1	1	2	1	2
Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	2		1	0	1	1	1	1

Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	2		1	0	1	1	1	1
Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783	1		1	0	1	1	1	1
Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	1		2	1	1	2	1	
Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	1		2	1	1	1	1	
Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725	1		2	1	1	2	1	2
Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217	1		0	0	1	1	1	
Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217			0	1	1	1	1	1
Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217			1	1	1	1	1	2
Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	1		2	1	1	2	1	2
Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	1		2	1	1	2	1	
Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367	1		2	1	1	2	1	
Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	1		2	1	1	2	1	2
Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	1		2	1	1	2	1	2
Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367	1		1	1	1	2	1	
Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	1		1	0		1	1	
Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	1		1	1	1	1	1	1
Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083	1		1	0		1		
Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083			1	1	1	1	1	1
Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083	1		1	1		1	1	1
Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083			1	1	1	1		1
Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083			1	1	1	1	1	1
Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083			1	1		1	1	1
Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083			1	1	1	1	1	2
Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083			0	0	1	1		
Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083			1	0	1	1	1	1
Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083			0	0		1		
Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083			0	0	1	1	1	
Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083			0	0	1	1	1	
Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083			0	0		1		
Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	1	0	0	1		1	1	
Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	1		1	1	1	1	1	2

Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083	1		1	1	1	1	1	2
Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083			0	0		1		
Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083			0	0		1		
Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083			0	0		1		
Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	1		1	1	1	1	1	1
Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917	1		1	1	1	1	1	
Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917			1	1	1	1	1	
Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	1	0	2	1	1	3	1	
Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	1	0	2	1	1	3	1	
Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917	2		2	1	1	3	1	
Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	1		1	1		1	1	2
Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427			1	1	1	2	2	3
Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427	1		0	1		1		
Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427			1	0		1		
Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	1		1	0		1	1	
Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427	1		1	0		1	1	
Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533			0	1		1		
Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533	1		0	1		1	1	1
Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533			0	1		1		
Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967			0	0	1	1		
Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967			0	0	1	1	1	1
Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967			0	0		1	1	1
Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967			0	0		1		
Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967			0	0		1		
Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967			0	0		1		
Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315			1	0	1	1		
Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	1		1	0	1	1		
Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315	1		1	1	1	1		
Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333	1	0	1	1	1	2	1	
Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333			1	0	1	1	1	1
Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333			1	0	1	1	1	1

Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333			1	1		1	1	2	
Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333			0	0	1	1	1	1	
Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333	1		1	1	1	1	1	2	
Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	1		2	1	1	2	1		
Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	1		2	1	1	2	1		
Outcrop G3	shale	BQRF	Geo	-24,1757	29,243	1		2	1	1	3	1	2	
Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075			1	0	1	1	1	1	
Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075			1	0	1	1	1	1	
Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075			1	0	1	1	1		

Sample ID	**Rock Type**	**Location**	**Geo/Arcl Piece?**	**Latitude (˚)**	**Longitude (˚)**	**Ag**	**Sn**	**W**	**Hg**	**Pb**	**Bi**	**Th**	**U**	**LE**
no.187	quartzite black	Mwulu's Cave	Arcl											905
no.187	quartzite black	Mwulu's Cave	Arcl											904
no.187	quartzite black	Mwulu's Cave	Arcl							1				904
no.194	quartzite white	Mwulu's Cave	Arcl							1				919
no.194	quartzite white	Mwulu's Cave	Arcl							1				917
no.194	quartzite white	Mwulu's Cave	Arcl							1				916
no.194	quartzite white	Mwulu's Cave	Arcl							1				915
no.195	quartz	Mwulu's Cave	Arcl									3		1119
no.195	quartz	Mwulu's Cave	Arcl							1		3		1184
no.195	quartz	Mwulu's Cave	Arcl									3		1144
no.203	quartzite white	Mwulu's Cave	Arcl								3			911
no.203	quartzite white	Mwulu's Cave	Arcl											890
no.203	quartzite white	Mwulu's Cave	Arcl											913
PALO49	chert	Mwulu's Cave	Arcl											989
PALO49	chert	Mwulu's Cave	Arcl									3		1136
PALO49	chert	Mwulu's Cave	Arcl									4		1246
no.473	quartzite black	Mwulu's Cave	Arcl								3			903
no.473	quartzite black	Mwulu's Cave	Arcl								3			897
no.473	quartzite black	Mwulu's Cave	Arcl								3			894
no.640	quartzite white	Mwulu's Cave	Arcl											985
no.640	quartzite white	Mwulu's Cave	Arcl											983

no.640	quartzite white	Mwulu's Cave	Arcl											991
no.792	quartzite black	Mwulu's Cave	Arcl							1		3		998
no.792	quartzite black	Mwulu's Cave	Arcl							1				1006
no.792	quartzite black	Mwulu's Cave	Arcl							1		3		1023
no.794	quartzite black	Mwulu's Cave	Arcl											1015
no.794	quartzite black	Mwulu's Cave	Arcl											1007
no.794	quartzite black	Mwulu's Cave	Arcl											1005
no.799	quartzite black	Mwulu's Cave	Arcl											921
no.799	quartzite black	Mwulu's Cave	Arcl											923
no.799	quartzite black	Mwulu's Cave	Arcl							1				923
no.672	quartzite black	Mwulu's Cave	Arcl							1				992
no.672	quartzite black	Mwulu's Cave	Arcl											982
no.672	quartzite black	Mwulu's Cave	Arcl											983
no.673	quartzite white	Mwulu's Cave	Arcl											955
no.673	quartzite white	Mwulu's Cave	Arcl							1				970
no.673	quartzite white	Mwulu's Cave	Arcl							1				971
no.673	quartzite white	Mwulu's Cave	Arcl							1				974
no.674	chert	Mwulu's Cave	Arcl											1008
no.674	chert	Mwulu's Cave	Arcl											1038
no.674	chert	Mwulu's Cave	Arcl									3		1013
no.676	quartzite white	Mwulu's Cave	Arcl								3			907
no.676	quartzite white	Mwulu's Cave	Arcl											907
no.676	quartzite white	Mwulu's Cave	Arcl								3			909
no.677	quartzite white	Mwulu's Cave	Arcl											921
no.677	quartzite white	Mwulu's Cave	Arcl								3			906
no.677	quartzite white	Mwulu's Cave	Arcl											908
no.684	quartzite black	Mwulu's Cave	Arcl											985
no.684	quartzite black	Mwulu's Cave	Arcl									3		982
no.684	quartzite black	Mwulu's Cave	Arcl							1				945
no.836	quartzite black	Mwulu's Cave	Arcl							1				972
no.836	quartzite black	Mwulu's Cave	Arcl							1				992

no.836	quartzite black	Mwulu's Cave	Arcl							1				992
no.837	quartzite black	Mwulu's Cave	Arcl											1058
no.837	quartzite black	Mwulu's Cave	Arcl									3		1100
no.837	quartzite black	Mwulu's Cave	Arcl									3		1074
PA-1	quartzite black	Mwulu's Cave	Arcl							1				945
PA-1	quartzite black	Mwulu's Cave	Arcl							1	3			949
PA-1	quartzite black	Mwulu's Cave	Arcl							1				945
PA-2	quartz	Mwulu's Cave	Arcl								3			844
PA-2	quartz	Mwulu's Cave	Arcl								3			844
PA-2	quartz	Mwulu's Cave	Arcl								3			841
no.1021	quartzite white	Mwulu's Cave	Arcl											947
no.1021	quartzite white	Mwulu's Cave	Arcl											949
no.1021	quartzite white	Mwulu's Cave	Arcl											950
no.1024	quartzite white	Mwulu's Cave	Arcl									3		994
no.1024	quartzite white	Mwulu's Cave	Arcl									3		1010
no.1024	quartzite white	Mwulu's Cave	Arcl									3		1023
no.1240	shale	Mwulu's Cave	Arcl							1				998
no.1240	shale	Mwulu's Cave	Arcl							1		3		1020
no.1240	shale	Mwulu's Cave	Arcl							1				962
no.1410	quartzite white	Mwulu's Cave	Arcl											930
no.1410	quartzite white	Mwulu's Cave	Arcl							1				927
no.1410	quartzite white	Mwulu's Cave	Arcl							1				975
no.1818	quartzite white	Mwulu's Cave	Arcl											907
no.1818	quartzite white	Mwulu's Cave	Arcl											922
no.1818	quartzite white	Mwulu's Cave	Arcl											912
no.1835	quartz	Mwulu's Cave	Arcl											946
no.1835	quartz	Mwulu's Cave	Arcl											946
no.1835	quartz	Mwulu's Cave	Arcl											952
no.2133	quartzite black	Mwulu's Cave	Arcl							1				945
no.2133	quartzite black	Mwulu's Cave	Arcl							1				944
no.2133	quartzite black	Mwulu's Cave	Arcl							1				947

no.2034	quartzite white	Mwulu's Cave	Arcl											960
no.2034	quartzite white	Mwulu's Cave	Arcl											959
no.2034	quartzite white	Mwulu's Cave	Arcl											960
no.2070	quartzite white	Mwulu's Cave	Arcl							1		3		1103
no.2070	quartzite white	Mwulu's Cave	Arcl							1				934
no.2070	quartzite white	Mwulu's Cave	Arcl											935
no.2073	quartz	Mwulu's Cave	Arcl											943
no.2073	quartz	Mwulu's Cave	Arcl											951
no.2073	quartz	Mwulu's Cave	Arcl											959
no.2073	quartz	Mwulu's Cave	Arcl											950
PA-3	shale	Mwulu's Cave	Arcl											935
PA-3	shale	Mwulu's Cave	Arcl											933
PA-3	shale	Mwulu's Cave	Arcl											936
PA-4	quartzite white	Mwulu's Cave	Arcl							1				928
PA-4	quartzite white	Mwulu's Cave	Arcl							1				958
PA-4	quartzite white	Mwulu's Cave	Arcl							1				1220
PA-5	quartz	Mwulu's Cave	Arcl											934
PA-5	quartz	Mwulu's Cave	Arcl											942
PA-5	quartz	Mwulu's Cave	Arcl											940
PA-6	quartzite white	Mwulu's Cave	Arcl											963
PA-6	quartzite white	Mwulu's Cave	Arcl											968
PA-6	quartzite white	Mwulu's Cave	Arcl							1				966
PA-7	quartzite white	Mwulu's Cave	Arcl											955
PA-7	quartzite white	Mwulu's Cave	Arcl											954
PA-7	quartzite white	Mwulu's Cave	Arcl											955
PA-8	quartz	Mwulu's Cave	Arcl											898
PA-8	quartz	Mwulu's Cave	Arcl											901
PA-8	quartz	Mwulu's Cave	Arcl											896
PA-9	quartzite white	Mwulu's Cave	Arcl											909
PA-9	quartzite white	Mwulu's Cave	Arcl								3			884
PA-9	quartzite white	Mwulu's Cave	Arcl								3			888

PA-10	quartz	Mwulu's Cave	Arcl											979
PA-10	quartz	Mwulu's Cave	Arcl											980
PA-10	quartz	Mwulu's Cave	Arcl											986
PA-11	altered	Mwulu's Cave	Arcl							2		4		1297
PA-11	altered	Mwulu's Cave	Arcl							2		4		1304
PA-11	altered	Mwulu's Cave	Arcl							2		4		1302
PA-12	shale	Mwulu's Cave	Arcl											911
PA-12	shale	Mwulu's Cave	Arcl								3			913
PA-12	shale	Mwulu's Cave	Arcl											907
PA-13	shale	Mwulu's Cave	Arcl											1012
PA-13	shale	Mwulu's Cave	Arcl											1011
PA-13	shale	Mwulu's Cave	Arcl											1009
PA-14	quartzite white	Mwulu's Cave	Arcl											940
PA-14	quartzite white	Mwulu's Cave	Arcl											934
PA-14	quartzite white	Mwulu's Cave	Arcl											961
PA-15	quartzite white	Mwulu's Cave	Arcl											940
PA-15	quartzite white	Mwulu's Cave	Arcl							1				918
PA-15	quartzite white	Mwulu's Cave	Arcl							1				906
PA-16	quartzite white	Mwulu's Cave	Arcl								3			864
PA-16	quartzite white	Mwulu's Cave	Arcl								3			863
PA-16	quartzite white	Mwulu's Cave	Arcl								3			857
M1-E	altered	Mwulu's Cave	Arcl							2		4	2	1188
M1-E	altered	Mwulu's Cave	Arcl						2	2		4	2	1199
M1-E	altered	Mwulu's Cave	Arcl						2	2		4	2	1199
M1-G	altered	Mwulu's Cave	Arcl							4				1740
M1-G	altered	Mwulu's Cave	Arcl				12			4				1546
M1-G	altered	Mwulu's Cave	Arcl							4		4		1549
M1-K	chert	Mwulu's Cave	Arcl											970
M1-K	chert	Mwulu's Cave	Arcl											960
M1-K	chert	Mwulu's Cave	Arcl											975
M1-J	quartzite black	Mwulu's Cave	Arcl							1		3		971

M1-J	quartzite black	Mwulu's Cave	Arcl											979
M1-J	quartzite black	Mwulu's Cave	Arcl									3		1032
M2-B	altered	Mwulu's Cave	Arcl						2	2		4	2	1143
M2-B	altered	Mwulu's Cave	Arcl							2		4	2	1155
M2-B	altered	Mwulu's Cave	Arcl						2	2		3	2	1137
M2-C	altered	Mwulu's Cave	Arcl						2	1		3		1160
M2-C	altered	Mwulu's Cave	Arcl						2	1		3		1160
M2-C	altered	Mwulu's Cave	Arcl						2	1		3		1155
M3-B	shale	Mwulu's Cave	Arcl						2	1		3		1112
M3-B	shale	Mwulu's Cave	Arcl						2	1		3		1116
M3-B	shale	Mwulu's Cave	Arcl							1		3		1113
M3-E	shale	Mwulu's Cave	Arcl											1002
M3-E	shale	Mwulu's Cave	Arcl											998
M3-E	shale	Mwulu's Cave	Arcl			5								1002
M3-F	shale	Mwulu's Cave	Arcl					4		2		4		1311
M3-F	shale	Mwulu's Cave	Arcl					5	2					1306
M3-F	shale	Mwulu's Cave	Arcl						2	3		4		1280
no.1699	quartzite white	Mwulu's Cave	Arcl											936
no.1699	quartzite white	Mwulu's Cave	Arcl											928
no.1699	quartzite white	Mwulu's Cave	Arcl											929
no.1679	quartzite white	Mwulu's Cave	Arcl							1				937
no.1679	quartzite white	Mwulu's Cave	Arcl							1				880
no.1679	quartzite white	Mwulu's Cave	Arcl							1				942
no.1815	quartzite white	Mwulu's Cave	Arcl									3		1015
no.1815	quartzite white	Mwulu's Cave	Arcl											1009
no.1815	quartzite white	Mwulu's Cave	Arcl											1009
no.1826	quartzite white	Mwulu's Cave	Arcl											1013
no.1826	quartzite white	Mwulu's Cave	Arcl											1028
no.1826	quartzite white	Mwulu's Cave	Arcl									3		1038
no.1839	quartz	Mwulu's Cave	Arcl							1				905
no.1839	quartz	Mwulu's Cave	Arcl							1				917

no.1839	quartz	Mwulu's Cave	Arcl											961
no.2118	quartzite white	Mwulu's Cave	Arcl							1				952
no.2118	quartzite white	Mwulu's Cave	Arcl							1				953
no.2118	quartzite white	Mwulu's Cave	Arcl											948
no.2130	quartzite black	Mwulu's Cave	Arcl											1024
no.2130	quartzite black	Mwulu's Cave	Arcl									3		1016
no.2130	quartzite black	Mwulu's Cave	Arcl							1		3		989
no.2134	quartzite white	Mwulu's Cave	Arcl											925
no.2134	quartzite white	Mwulu's Cave	Arcl											959
no.2134	quartzite white	Mwulu's Cave	Arcl											962
no.2132	quartz	Mwulu's Cave	Arcl											927
no.2132	quartz	Mwulu's Cave	Arcl											927
no.2132	quartz	Mwulu's Cave	Arcl							1				954
no.2135	quartzite white	Mwulu's Cave	Arcl							1				908
no.2135	quartzite white	Mwulu's Cave	Arcl											977
no.2135	quartzite white	Mwulu's Cave	Arcl							1				932
no.2024	quartzite white	Mwulu's Cave	Arcl							1		3		1010
no.2024	quartzite white	Mwulu's Cave	Arcl							1				895
no.2024	quartzite white	Mwulu's Cave	Arcl											953
no.2026	shale	Mwulu's Cave	Arcl											966
no.2026	shale	Mwulu's Cave	Arcl											977
no.2026	shale	Mwulu's Cave	Arcl									3		1055
no.2038	quartzite white	Mwulu's Cave	Arcl							1				876
no.2038	quartzite white	Mwulu's Cave	Arcl							1		3		1034
no.2038	quartzite white	Mwulu's Cave	Arcl											967
no.2080	quartzite white	Mwulu's Cave	Arcl							1		3		1068
no.2080	quartzite white	Mwulu's Cave	Arcl							1		3		1024
no.2080	quartzite white	Mwulu's Cave	Arcl			5				1		3		1025
M1-A	quartzite white	Mwulu's Cave	Arcl							1				1007
M1-A	quartzite white	Mwulu's Cave	Arcl							1				925
M1-A	quartzite white	Mwulu's Cave	Arcl							1				1007

M1-B	quartzite black	Mwulu's Cave	Arcl							1				954
M1-B	quartzite black	Mwulu's Cave	Arcl							1				950
M1-B	quartzite black	Mwulu's Cave	Arcl							1			1	1011
M1-C	quartzite white	Mwulu's Cave	Arcl							1				1030
M1-C	quartzite white	Mwulu's Cave	Arcl							1		3		1080
M1-C	quartzite white	Mwulu's Cave	Arcl							1				1023
M1-D	shale	Mwulu's Cave	Arcl					3		1				1012
M1-D	shale	Mwulu's Cave	Arcl					3		1		3	1	1012
M1-D	shale	Mwulu's Cave	Arcl							1			1	980
M1-F	quartz	Mwulu's Cave	Arcl							1				1002
M1-F	quartz	Mwulu's Cave	Arcl											926
M1-F	quartz	Mwulu's Cave	Arcl							1				911
M1-H	quartzite black	Mwulu's Cave	Arcl							1				915
M1-H	quartzite black	Mwulu's Cave	Arcl							1	3			909
M1-H	quartzite black	Mwulu's Cave	Arcl							1	3			868
M1-I	quartzite white	Mwulu's Cave	Arcl							1		3		989
M1-I	quartzite white	Mwulu's Cave	Arcl			6				1		4		1264
M1-I	quartzite white	Mwulu's Cave	Arcl							1				969
M1-L	quartzite black	Mwulu's Cave	Arcl							1				996
M1-L	quartzite black	Mwulu's Cave	Arcl							1				970
M1-L	quartzite black	Mwulu's Cave	Arcl							1				982
M1-M	quartzite black	Mwulu's Cave	Arcl							1		3		1036
M1-M	quartzite black	Mwulu's Cave	Arcl							1		3		1023
M1-M	quartzite black	Mwulu's Cave	Arcl							1		3		984
M2-A	quartzite white	Mwulu's Cave	Arcl											936
M2-A	quartzite white	Mwulu's Cave	Arcl							1	3			883
M2-A	quartzite white	Mwulu's Cave	Arcl							1				950
M2-D	quartzite white	Mwulu's Cave	Arcl							1				998
M2-D	quartzite white	Mwulu's Cave	Arcl							1				941
M2-D	quartzite white	Mwulu's Cave	Arcl											963
M3-A	quartzite white	Mwulu's Cave	Arcl											947

M3-A	quartzite white	Mwulu's Cave	Arcl							1				1002
M3-A	quartzite white	Mwulu's Cave	Arcl											964
M3-C	quartzite red	Mwulu's Cave	Arcl							1				1030
M3-C	quartzite red	Mwulu's Cave	Arcl							1				971
M3-C	quartzite red	Mwulu's Cave	Arcl							1				968
M3-D	shale	Mwulu's Cave	Arcl							2		3		1158
M3-D	shale	Mwulu's Cave	Arcl						2	2		3	2	1214
M3-D	shale	Mwulu's Cave	Arcl					4		2		4		1225
Outcrop 1	shale-meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985					12	13	7	4	1893
Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985					2		4		1466
Outcrop 1	shale/meta-sedimentary	Duitcshland Fm	Geo	-24,148067	29,14985					4		5		1625
Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017					2		4	2	1344
Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017					2		4		1344
Outcrop 2A	shale	Duitcshland Fm	Geo	-24,148367	29,159017					2		4		1354
Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017					3		4		1659
Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017					4		5		1662
Outcrop 2B	shale	Duitcshland Fm	Geo	-24,148367	29,159017					4		5		1873
Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017					2		4		1541
Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017					2				1369
Outcrop 2C	shale conglomerate	Duitcshland Fm	Geo	-24,148367	29,159017				3	2		4		1459
Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333					2		5		1834
Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333					2		5		1792
Outcrop 3A	dolomite	Malmani Fm	Geo	-24,148217	29,167333					2		5		1663
Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333									913
Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333									910
Outcrop 3B	chert	Malmani Fm	Geo	-24,148217	29,167333									941
Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333									946
Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333					2		5		1378
Outcrop 3C	shale	Malmani Fm	Geo	-24,148217	29,167333									981
Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175				2			3		1305
Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175				2	1				1321

Outcrop 4A	shale	Malmani Fm	Geo	-24,1455	29,175									1214
Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175					1				1185
Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175					1				1184
Outcrop 4B	shale	Malmani Fm	Geo	-24,1455	29,175					1				1174
Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175									977
Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175							3		1024
Outcrop 4C	chert	Malmani Fm	Geo	-24,1455	29,175									1191
Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833		10		2			3		1455
Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833				2			4		1493
Outcrop 6	shale	Malmani Fm	Geo	-24,141533	29,199833							3		1443
Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083					3		4		1675
Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083					3		4		1646
Outcrop 8A	quartzite black	Malmani Fm	Geo	-24,149867	29,207083					3		4		1652
Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083							3		1514
Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083									1470
Outcrop 8B	shale	Malmani Fm	Geo	-24,149867	29,207083									1480
Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276			4	2	2		3	2	1374
Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276			4				3		1370
Outcrop 9	shale	Malmani Fm	Geo	-24,15115	29,1276							4		1406
Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633							4		1269
Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633							4		1553
Outcrop 10	meta-sedimentary	Malmani Fm	Geo	-24,178133	29,234633				2			4		1401
Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783									1046
Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783					1				1028
Outcrop 11	chert conglomerate	BQRF	Geo	-24,177283	29,235783					1		3		1061
Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725				2	1		3		1246
Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725					1				1243
Outcrop 12	shale	BQRF	Geo	-24,17655	29,23725					2		3		1134
Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217									975
Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217					1		3		1056
Outcrop 13	quartzite white	BQRF	Geo	-24,176383	29,238217					1		3		1000

Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367					2		4	2	1115
Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367							3		1366
Outcrop 14A	shale	BQRF	Geo	-24,175967	29,239367							3		1422
Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367							4	2	1282
Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367							4		1270
Outcrop 14B	shale	BQRF	Geo	-24,175967	29,239367					1		3		1048
Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083							3		942
Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083					1				929
Outcrop 16A	quartzite white	BQRF	Geo	-24,175967	29,243083							3		911
Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083					1		3		1013
Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083					1		3		997
Outcrop 16B	quartz	BQRF	Geo	-24,175967	29,243083					1				1094
Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083							3		1111
Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083							3		1076
Outcrop 16C	chert	BQRF	Geo	-24,175967	29,243083					1		3		1111
Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083							3		929
Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083							3		1000
Outcrop 16D	quartzite black	BQRF	Geo	-24,175967	29,243083									943
Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083					1				989
Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083					1				932
Outcrop 16E	quartzite white	BQRF	Geo	-24,175967	29,243083					1				921
Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083					1	3			832
Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083					2		4		1107
Outcrop 16F	quartz crystals	BQRF	Geo	-24,175967	29,243083					2		4		1167
Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083					1				901
Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083									978
Outcrop 17	quartzite white	BQRF	Geo	-24,175967	29,243083									980
Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917					1		3		1039
Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917					1			1	1021
Outcrop 18A	quartzite black	BQRF	Geo	-24,1752	29,242917					1		3	1	597
Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917				2	1		3	1	1047

Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917					1		3		1045
Outcrop 18B	shale	BQRF	Geo	-24,1752	29,242917					1		3	2	1093
Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427							4		965
Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427							5		1319
Outcrop 19A	quartz vein	BQRF	Geo	-24,175667	29,2427									1119
Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427					1				954
Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427					1		3		949
Outcrop 19B	quartzite white	BQRF	Geo	-24,175667	29,2427					1		3		927
Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533					1				847
Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533					1				913
Outcrop 20	quartz	BQRF	Geo	-24,144333	29,228533					1				883
Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967									945
Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967									1028
Outcrop 21A	quartzite white	BQRF	Geo	-24,144133	29,227967					1		3		1029
Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967									778
Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967									813
Outcrop 21B	quartz	BQRF	Geo	-24,144133	29,227967					1				827
Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315									959
Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315									950
Outcrop G1	quartzite white	BQRF	Geo	-24,17575	29,24315							3	1	1011
Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333					1		3	1	990
Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333									955
Outcrop G2A	quartzite black	BQRF	Geo	-24,176133	29,243333					1		3		941
Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333							3	1	1126
Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333									1067
Outcrop G2B	quartzite white	BQRF	Geo	-24,176133	29,243333							3		1099
Outcrop G3	shale	BQRF	Geo	-24,1757	29,243					1		3		1098
Outcrop G3	shale	BQRF	Geo	-24,1757	29,243							3	1	1103
Outcrop G3	shale	BQRF	Geo	-24,1757	29,243					2		4		1179
Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075							3		1035
Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075							3	1	1051

Outcrop G4	quartzite white	BQRF	Geo	-24,175833	29,24075									1005

8.2.1 Principal Component Analysis Element Coordinates Tables

Table B5: Olieboomspoort Rock Shelter rock types element coordinates.

OBP All rock types					
Element	PC1	PC2	PC3	PC4	PC5
Al	0.7413822	0.014044164	-0.09031444	0.56650128	0.02838221
Si	-0.7286026	0.360554794	0.12853439	-0.40162437	0.18521097
S	0.0505042	-0.852432488	-0.41103650	-0.27393745	0.06706362
Ti	0.7455073	0.018053065	0.28880727	-0.27765918	-0.46443122
V	0.8075119	0.194740363	-0.05586460	-0.09983914	0.38687719
Cr	0.2312471	0.482218318	-0.81178722	-0.14368140	-0.17164710
Mn	0.8268182	0.018041683	0.10671575	-0.19033424	0.31219949
Fe	0.8798798	-0.002048174	0.12576651	-0.25067922	-0.08420950

Table B6: Olieboomspoort Rock Shelter sandstone element coordinates.

OBP Sandstone all samples					
Element	PC1	PC2	PC3	PC4	PC5
Al	-0.07123175	-0.29381023	-0.71784092	-0.38151892	0.35735641
Si	0.42315474	-0.60237011	-0.25362875	-0.08661724	0.15229568
S	-0.03512709	0.29784661	-0.02991877	0.82008036	0.35638158
K	-0.43531056	-0.81229962	-0.17242541	0.16818791	-0.05174692
Ti	-0.73327297	0.27656549	-0.50825436	-0.08049723	0.25453133
V	-0.78164880	0.03373179	0.32069023	-0.34874899	0.31639430
Mn	-0.45823995	0.57159920	-0.20262047	-0.01856160	-0.53558778
Fe	-0.46725470	0.64652242	-0.42554206	0.23665154	-0.04418768
Cu	-0.61717096	-0.07898543	-0.25142409	-0.23239800	-0.43100546
Zn	-0.90211533	-0.11470039	0.32113855	-0.07647644	0.02346011
Rb	-0.62919909	-0.69280808	0.20516544	0.16354775	-0.04960540
Sr	-0.73289411	0.19683312	0.53635865	-0.10384911	0.17202497
Y	-0.34677486	-0.72744468	-0.11331910	0.38009082	-0.27565063
Zr	-0.85627782	0.01415979	-0.21464338	0.20072665	0.14794955

Table B7: Olieboomspoort Rock Shelter dolerite element coordinates.

OBP Dolerite all samples					
Element	PC1	PC2	PC3	PC4	PC5
Al	-0.3986472	0.648314865	0.26760520	-0.29858617	-0.274862080
Si	0.3399320	0.710169387	-0.05852747	-0.56599266	-0.109484665
P	-0.2387850	-0.807260135	0.06409394	-0.09056293	-0.422706683
S	-0.1733349	-0.196115036	-0.22436134	0.48614536	0.139112500
Ti	-0.9274114	-0.011378675	-0.07238922	-0.19651553	0.216652538
V	-0.5713362	0.286209576	0.45551446	0.41476408	-0.393211184
Mn	-0.3539249	-0.483044366	0.16192399	-0.49731974	-0.495881003
Fe	-0.9592458	-0.013899213	-0.01343952	-0.01917751	0.165052559
Ni	-0.8805944	0.079695215	-0.08384697	-0.27337459	0.052749846
Cu	0.1485904	-0.072426181	0.62895528	-0.11057684	0.309146008
Zn	-0.8518485	0.005784158	-0.32438008	-0.11722039	-0.007336193
Rb	0.8920082	0.027282537	0.24178389	-0.10439465	-0.173174062
Sr	-0.3295207	0.144105695	0.62217735	0.60062141	-0.103711939

Y	-0.4682908	0.409728300	-0.33106220	0.35722119	-0.213688090
Zr	0.4379890	0.136645380	-0.61365927	0.29791759	-0.400904997

Table B8: Olieboomspoort Rock Shelter quartz formations element coordinates.

OBP Quartz Formations					
Element	PC1	PC2	PC3	PC4	PC5
Al	0.41279084	-0.56343343	0.46852972	0.42213989	0.284327807
Si	-0.78158380	0.38910211	0.21777867	-0.21710453	0.003641341
S	0.59211441	0.35779451	-0.19781858	-0.39724631	0.567674325
Ti	-0.09299627	-0.76388218	-0.39990076	-0.28652051	-0.085197081
V	-0.10918476	-0.82110915	-0.21997795	-0.06746806	0.125304371
Cr	0.32170942	-0.32590243	0.67635671	-0.54480383	-0.162714574
Mn	0.84107021	0.22485511	0.03626317	0.06855001	-0.122516735
Fe	0.85007536	0.09396452	-0.25334105	-0.02955535	-0.340557746

Table B9: Olieboomspoort Rock Shelter quartzite formations element coordinates.

OBP Quartzite Formations					
Element	PC1	PC2	PC3	PC4	PC5
Al	0.6560345	0.08366448	-0.43117509	-0.05110184	0.57894826
Si	-0.8404146	-0.29592014	-0.22533220	0.07395888	0.01739895
Ti	0.2035519	0.28183815	-0.37375680	0.82120438	-0.07755888
Mn	0.7712543	0.24388119	0.16795819	-0.09804487	0.10482489
Fe	0.7785927	0.25448473	0.42782990	-0.10476115	-0.25065907
Rb	0.3351668	-0.64830066	-0.46171833	-0.26585112	-0.13691997
Sr	0.4422390	0.27927770	-0.64170068	-0.10326673	-0.37422955
Y	0.5517780	-0.75487440	-0.07693339	0.09285022	-0.05423159
Zr	0.4192082	-0.56506777	0.44826490	0.40373049	0.01485653

Table B10: Olieboomspoort Rock Shelter shale element coordinates.

OBP Shale all samples					
Element	PC1	PC2	PC3	PC4	PC5
Al	-0.5420886	0.36610101	-0.51694505	0.28788289	-0.250041319
Si	0.3758623	0.45366782	-0.59760766	0.35486202	-0.117097059
P	-0.2828919	0.10436856	0.44474771	-0.43733727	-0.633011721
S	0.3423807	-0.82645366	-0.21266018	-0.01931845	-0.193312284
K	-0.4092675	0.66405095	-0.48192751	-0.28070941	0.098024145
Ti	-0.6692391	-0.25727520	-0.45741668	-0.12138125	-0.153348108
V	-0.4755872	-0.29021335	-0.51874995	-0.55026150	0.126767943
Mn	-0.5356931	-0.33563622	-0.21434576	0.41722040	-0.335936658
Fe	0.3464411	-0.61674288	-0.22712838	0.06074676	-0.003308646
Zn	-0.5192847	-0.75207374	-0.01682615	0.01102552	0.039277710
Rb	-0.6483478	0.56754836	-0.21139135	-0.18515984	-0.115944441
Sr	-0.6092965	-0.56118457	0.17688528	-0.11351874	-0.101085575
Y	-0.8414253	-0.03573182	0.27193788	0.30947031	0.092648945
Zr	-0.9032503	-0.08800414	0.16612238	0.24155314	0.056926175
Nb	-0.8635295	0.16683973	0.30773260	0.13808628	0.052256431
Pb	-0.4481317	-0.50720606	-0.32975380	-0.03693561	0.349075446
Th	-0.6723844	0.32928843	0.27421866	-0.07137978	0.254149602

Table B11: Mwulu's Cave rock type element coordinates.

MW All Rock types					
Element	PC1	PC2	PC3	PC4	PC5
Al	0.86744343	-0.03404111	0.01738481	-0.10271365	0.044538561
Si	-0.63598931	0.18268910	0.37035967	-0.06832035	-0.302385332
P	0.06346973	0.45278478	-0.24472380	0.68091102	0.424276608
S	0.45566647	0.53844825	0.10892497	0.28125414	-0.239448684
K	0.86862673	-0.09678495	0.34079668	0.08020840	0.008636192
Ti	0.34182525	0.32390165	-0.40304165	-0.59973634	0.372647668
Cr	0.77696667	-0.28072150	0.32112848	0.02336721	0.251489018
Mn	0.17669200	-0.54705137	-0.47042189	0.29825077	-0.116187318
Fe	0.31046670	-0.46441923	-0.51489619	0.06211246	-0.237137519
Rb	0.90202767	-0.19891873	0.25811145	0.02471494	0.019725995
Sr	0.52567034	0.44413182	-0.48730071	-0.10997506	-0.278905226
Zr	0.74436320	0.32347252	0.03030733	0.01302191	-0.313213333
Nb	0.88867351	0.01026038	0.02515685	-0.06156150	-0.025806035

Table B12: Mwulu's Cave quartzite element coordinates.

MW Quartzite all samples					
Element	PC1	PC2	PC3	PC4	PC5
Al	0.7694186	-0.2518996	0.31403195	-0.17688092	0.34229551
Si	-0.7751449	0.4160759	-0.02301462	-0.09150154	-0.28907763
P	0.1700621	-0.7894471	-0.52446843	-0.15846902	-0.13572536
Ti	0.5976582	-0.3346276	0.50222297	0.35265029	-0.37565181
Fe	0.8663338	0.0917183	-0.11680177	-0.24707826	-0.27899356
Rb	0.8135173	0.3891832	-0.07201161	-0.09240979	0.10379267
Sr	0.8477806	0.3813603	-0.07190505	-0.23946240	-0.15309393
Zr	0.5995508	0.2188430	-0.41647083	0.62312406	0.07872899

Table B13: Mwulu's Cave Shale formations element coordinates.

MW Shale Formations					
Element	PC1	PC2	PC3	PC4	PC5
Al	-0.72047055	-0.03735677	0.41875194	-0.14722714	0.27321728
Si	0.05492729	-0.07954806	-0.11964988	-0.79889020	-0.06647447
P	-0.69577979	0.26918740	-0.49227216	-0.14742098	-0.22431278
S	-0.63825217	0.01412509	-0.39836993	-0.06804980	-0.12801682
K	-0.73014535	-0.50027756	0.09522615	-0.04304814	-0.22416632
Ti	-0.76004781	0.05460766	0.21365168	0.33570352	-0.01159469
V	-0.51011698	-0.07727123	0.32707982	0.57108096	-0.28282424
Cr	-0.48093144	-0.49808055	0.23086926	-0.33805055	-0.43635072
Mn	0.20162009	0.30269391	-0.23747885	0.36089902	-0.62490574
Fe	0.19449443	0.67476386	0.36261362	-0.23182098	-0.33438421
Cu	-0.45962788	0.50868168	0.48139398	-0.16073096	0.08265223
As	-0.20518378	0.81804506	-0.02084714	-0.18962105	-0.23913088
Rb	-0.73693397	-0.43459172	0.24560971	-0.16497397	-0.22588625
Sr	-0.75454635	0.21680484	-0.54671641	0.01272639	0.02772849
Y	-0.75672392	0.24758237	-0.10527579	0.16191815	0.25189560
Zr	-0.82730638	0.22791327	-0.23078562	-0.02432290	0.31811926

Nb	-0.83179016	0.03844594	0.12238317	0.00544885	0.09452915
Th	0.04700907	0.67284637	0.32565407	-0.02625989	0.06254590

Table B14: Mwulu's Cave quartz element coordinates.

MW Quartz all samples					
Element	PC1	PC2	PC3	PC4	PC5
Al	0.8353231	-0.12113757	0.2745280	-0.40343575	-0.22233969
Si	-0.8177610	0.04920142	0.1768370	-0.52095611	0.16180083
P	0.2400131	0.94170504	0.2329232	0.03434316	0.01235456
Ti	0.6462162	0.16407333	-0.6962762	-0.24344193	0.10686496
Fe	0.8555974	-0.22279686	0.3615382	0.07019061	0.28753801

Table B15: Mwulu's Cave chert element coordinates.

MW Chert Formations					
Element	PC1	PC2	PC3	PC4	PC5
Al	-0.8470054	-0.24411806	-0.43524966	0.083676800	0.01223749
Si	0.8806492	0.26643637	0.29708006	0.031646036	-0.11788719
P	-0.5499494	-0.81878876	-0.13456806	-0.003094976	0.03225656
S	-0.5041522	-0.82432399	-0.19193753	0.030453383	0.11238915
K	-0.7226756	0.56259089	-0.31132499	0.211144208	-0.10754399
Ti	-0.5987924	-0.34697820	0.43377625	0.369559642	-0.43391038
Cr	-0.7872635	0.58436894	-0.17265402	0.051488938	-0.04135672
Mn	0.4478069	-0.06900537	-0.63056025	-0.458112730	-0.42712702
Fe	-0.7311375	0.56479293	-0.08215271	-0.241320327	0.23367526
Rb	-0.7328666	0.61696421	-0.19388105	0.157443066	-0.11248124
Sr	-0.5689316	-0.80920058	-0.08275511	0.032786237	0.03009122
Zr	-0.8558335	0.29198530	0.38614992	-0.123942537	0.02926090
Nb	-0.8896338	0.15746775	0.26283736	-0.254819713	-0.08884742
Mo	-0.6550172	-0.27047568	0.46530134	-0.459599361	-0.09356848

APPENDIX C

8.3 Detailed thin section descriptions

8.3.1 OBP detailed thin section descriptions

Quartzite

No. 486

A quartzite with quartz grains (90%) in a very fine microcrystalline matrix (5%). The quartz grains are angular to sub-rounded and have convex-concave crystal boundaries. Under XPL the quartz grains have low light and dark grey interference colours. They become extinct every 90˚ (only 25% have undulose extinction). The lesser minerals in the sample are the following: muscovite minerals with similar colour as quartz in PPL but have bright orange interference colours and uniform extinction in XPL (3%); blue laths that have light blue, orange, white, purple interference colours in XPL (1%); and purple minerals that are isotropic under XPL (1%). This rock is moderately sorted and clast supported. Most of the grains are interlocking. About 40% quartz syntaxial cement is noted and black dissolution is present in association with the matrix. Deformation lamellae (Bohm lamellae) are noted in the quartz grains (30-40%).

No. 3478

This quartzite is composed of quartz grains (90%). The quartz grains have a sub-rounded shape with iron oxide orange staining on the grain boundaries (concave-convex). They have a low grey interference colour whereas the iron oxide staining is a bright pink-orange. Under XPL some grains show undulose extinction (20%) whereas the rest show uniform extinction. This quartzite is well-sorted. These minerals are tightly interlocking and two bands of finer quartz grains are noted. Pitting is evident in most grains although no deformation lamellae are noted on the grains. Instead, quartz syntaxial cement is present outside of some grain boundaries (40-50%). An opaque fluid is scattered throughout the sample on the quartz grains, particularly at their boundaries.

CMF1

This quartzite has yellow-white quartz grains that are sub-rounded to sub-angular (90%). Opaque minerals (5%; isotropic in XPL) are also noted in the black matrix (5%). The interference colours of the quartz grains are a first-order light grey and dark grey. It is noted that the quartz grains in the sample generally have a uniform extinction although undulose extinction is also seen (20-30%). This quartzite is well-sorted and the grains are interlocking although some of the grains are annealed. About 45% of the quartz grains have quartz

synatxial cement outside of their original grain boundaries. Black dissolution is noted throughout the samples especially along grain boundaries. About the 25% of the grains are pitted and have embayments filled with matrix material. The quartz grains have very few deformation lamellae.

Shale

No. 164

This is a brown, cryptocrystalline shale. It has chlorite occurring in clusters throughout the sample (20%), as well as rounded opaque minerals (10%) that are chloritised. The chlorite has a low birefringence and a dark green-brown anomalous interference colour In XPL. The matrix is a yellow-brown and dark green colour under crossed polars. The birefringence is low and the yellow minerals show uniform extinction.

YRS1-D

A green-brown, cryptocrystalline shale with chlorite minerals in random clusters and disseminated throughout the sample (25%). This chlorite is a dull blue-green-brown interference colour under XPL. Other minerals include irregularly shaped opaque grains (15%), liquid inclusions (10%); and orange laths (2%) in a green-brown matrix (48%). The orange laths have a bright orange interference colour and a uniform extinction angle under XPL.

OBP 10A

A greenish grey shale sample. 20% of the sample is covered by sub-rounded to rounded opaque minerals that are isotropic under XPL. The sample is predominantly composed of a cryptocrystalline matrix (80%). Darker green-grey cloudy patches are noted towards the bottom right corner of the image. These are also isotropic under XPL. Towards the left edge of the image irregular opaque masses that look like lichens are visible.

Sandstone

No. 2402

This sandstone (sub-litharenite) is made of detrital quartz grains of different sizes (60%), lithic fragments (20%) muscovite (10%), and augite (2%) in an opaque matrix (8%). The quartz grains are angular to sub-angular. They have a low grey to dark grey interference colour. Under XPL, it is noted that about 40% of the quartz grains undergo undulose extinction while the rest show uniform extinction. Other minerals noted in

this sample include microcrystalline lithic fragments that are multi-coloured with no general extinction in XPL. The irregularly shaped muscovite minerals (visible cleavage and colourless) have bright orange, pink, green, and blue interference colours in XPL. The augite in this sandstone has an obvious cleavage and is green in PPL. Under XPL it shows bright third-order interference colours (blue and green). Lastly, another irregularly shaped grain similar to quartz is noted although it is isotropic in XPL. The matrix is isotropic in XPL and the sample is poorly sorted. The quartz grains have many fractures and about 20% of them have deformation lamellae.

No. 1194

This rock is a green-brown greywacke (sandstone). It is composed of white, angular to sub-rounded, detrital quartz grains and quartz phenoclasts (80%) in a green-brown matrix (20%). They have first-order grey and white interference colours and uniform extinction although a few of the grains show undulose extinction. Rounded quartz grains are also noted. A large, dark brown lithic fragment that is rounded and has with white plagioclase laths is present in the sample. A few more similar grains without the laths (3%), as well as opaque minerals (2%), are also noted. The lithic fragment shows undulose extinction and its laths are multi-coloured but dull under XPL. Lastly, the opaque grains are isotropic and their rims are a dull brown under XPL. The sample is poorly sorted and the minerals are disseminated throughout it. The quartz grains in this sample show a degree of pitting and fracturing (40%), especially the larger grains.

OBP 7

OBP 7 is an arkose with 60% of its composition being of sub-rounded and irregularly shaped quartz grains. The remaining 40% of the rock consists of perthitic alkali feldspar. The quartz grains are brown-white in colour. Under XPL, they go extinct every 90˚ and have a low grey interference colour. The alkali feldspars are altered and are a cloudy brown in PPL. Under XPL. They have low white and brown interference colours. Overall, the arkose is poorly sorted and the alkali feldspar grains are older than the quartz grains, all of which are interlocking. The quartz grains also have black dissolution on some of their grain boundaries and orange fluid running over them. The orange fluid remains orange under XPL. Most grains look pitted (90%) and some have fractures (40-50%) running through them.

OBP 8A

The mineralogy of this sandstone (greywacke) includes quartz (55%), muscovite (20%), and opaque minerals (5%) in a microcrystalline matrix (20%). The quartz grains are light yellow-white in colour and have an angular to sub-angular (some irregular) shape. Under XPL, these quartz grains have a first-order grey interference colour and a uniform extinction. Undulose extinction is noted (55%). The matrix is multi-coloured in XPL. Muscovite grains have bright orange, blue, green, and pink interference colours and an extinction parallel to cleavage under XPL. The opaque minerals are isotropic under XPL. The grains are

poorly to moderately sorted and a few concave-convex relationships are evident (25%). There are two foliations (bands) of opaque minerals towards the top of the image. A few deformation lamellae are noted in the quartz grains (25%).

Dolerite

No. 458

In PPL, the fine-grained andesite has a black matrix and white plagioclase feldspar laths (80%). In XPL, the plagioclase laths are white and grey (first-order interference colours) although they are too fine for twinning to be noted. Aphanitic brown and yellow-brown minerals are noted surrounding the plagioclase laths (10%). Under XPL these are blue, yellow and green suggesting augite and hornblende mineralogy. The plagioclase laths are randomly oriented in the matrix.

OBP 4G

This dolerite is composed of white plagioclase laths (80%), white euhedral phenocrysts (5%), and augite (15%). The plagioclase laths are euhedral and have a low birefringence under XPL. It is difficult to see their multiple twinning under XPL due to their size and altered nature. The phenocrysts are a low grey and white in XPL whereas the augite looks orange-yellow (third-order interference colour). These minerals are randomly orientated in the matrix (made of the same minerals). The phenocrysts are highly altered and have a brown mineralisation along their grain boundaries.

8.3.2 Mwulu's Cave detailed thin section descriptions

Quartzite

No. 640

No. 640 is a quartzite made of rounded to sub-rounded quartz grains (90%) in a dark brown matrix (10%). The quartz grains have first-order grey interference colours and the matrix is multi-coloured under XPL. Most quartz grains undergo undulose extinction (80%) although some undergo uniform extinction. This quartzite is very well-sorted and clast-supported. Most of the grains are interlocking and have convex-concave grain boundary relationships. Under XPL, it is evident that many grains (85%) have quartz

syntaxial overgrowths. The quartz grains are highly pitted and fractured although a no deformation lamellae are noted.

No. 1021

This sample is a porous (30%) quartzite predominantly composed of coarse quartz. The grains have first-order grey interference colours and some of them have blue staining under XPL. Many of the grains undergo undulose extinction (45%) while the rest show uniform extinction. The grains are of irregular shapes and they are annealed. These grains have no syntaxial cement. They are pitted and highly fractured but no deformation lamellae are noted.

M1-J

A quartzite with quartz grains (90%) in a dark, microcrystalline matrix (10%; multi-coloured in XPL). The quartz grains are a light yellow-white in PPL and a first-order grey in XPL. About 65% of the grains show undulose extinction and the rest uniform. The quartz grains vary in size, ranging from fine to coarse (a band of coarser grains with finer grains on either side). For that reason, this quartzite is poorly sorted. The smaller quartz grains are interlocking and some have concave-convex boundary relationships (45%). Pitting is noted (30%) and about 35% of the quartz grains have quartz syntaxial cement.

Outcrop 16A

This quartzite is composed of quartz grains (95%) in a dark microcrystalline matrix (multi-coloured under XPL; 5%). The quartz grains are rounded, sub-rounded, and sub-angular. Under XPL, the quartz grains have a first-order interference colours (grey). About 75% of the grains show undulose extinction. This quartzite has moderate to well sorting and most of the grains are interlocking with concave-convex boundary relationships. A band of finer quartz grains runs through the rock. The quartz grains are bordered by a thin film of orange mineralisation (iron oxide). Quartz syntaxial cement is visible outside of some of the quartz grain boundaries (30-40%). Moderate pitting and fracturing is noted throughout the sample, as well as a large crack. Deformation lamellae are absent.

Outcrop G2A

A quartzite with quartz grains (90%) in a dark, microcrystalline matrix (10%). The quartz grains are light yellow-white in colour and have an angular to sub-angular shape. Under XPL, the grains have light grey and dark grey first-order interference colours. About 70% of the grains have undulose extinction. The matrix is dark and multi-coloured under XPL. Overall, this quartzite is poorly sorted. The grains are pitted and some have embayments incorporating the same material as the matrix (5%). No fracturing is noted.

Outcrop G2B

A quartzite with large quartz grains (65%) and finer, rounded grains (35%). The larger quartz grains are vary in shape (angular to sub-rounded). Under XPL, all the quartz grains show a first-order light and dark grey interference colour. Many (70%) of the grains show undulose extinction and rest have a uniform extinction. This quartzite is poorly sorted and the different quartz types are concentrated in different parts of the rock. The grains are highly interlocked and annealed. A low degree of quartz syntaxial cement is noted (15%). The larger quartz grains are more pitted and fractured than the grains and no deformation lamellae are noted.

Shale

M3-E

A cryptocrystalline, green-brown shale. Opaque minerals are scattered throughout the sample (20%). These are isotropic under XPL. The whole rock is multi-coloured but very dark under XPL. Pore spaces are evident throughout the sample (10%).

Outcrop 4A

This is a grey, very fine-grained shale. There are opaque minerals with white rims scattered across the sample (5%). A single orange mineral that is isotropic under XPL is noted in this sample. The shale has a foliated section running across it. The grains along this foliation are white and grey. They also show oblique extinction under XPL.

Sandstone

M3-B

A fine-grained, brown sandstone composed of quartz (60%), biotite (30%), and multi-coloured minerals (10%). The detrital quartz grains are sub-rounded to sub-angular. These are a low white and grey under XPL. Undulose extinction is noted (10%) although most quartz grains show uniform extinction. Yellow-brown biotite is identified through its cleavage and second-order yellow interference colour under XPL. It also has an extinction pattern that is parallel to this cleavage. The multi-coloured (blue, green, pink) minerals are too fine to identify. This sandstone is well-sorted although large areas of the sample are pore spaces (20% of the rock). The biotite and multi-coloured minerals occupy the spaces between the quartz grains.

APPENDIX D

8.4 Inductive Coupled Mass Spectrometry Results Spreadsheet

8.4.1 Olieboomspoort Rock Shelter

Table D1: ICP-MS spreadsheet of Olieboomspoort Rock Shelter (OBP) lithic and outcrop samples. Concentrations of the elements are measured in ppm.

Olieboomspoort Rock Shelter																								
Samples	**Archaeologic**	**Rock Type**	**Site**	**Formation**	**Latitude (°)**	**Longitude (°)**	**Li**	**P**	**Sc**	**Ti**	**V**	**Cr**	**Co**	**Ni**	**Cu**	**Zn**								
OBP 4G	Geological	Dolerite	OBP	Mogalakwena Fm	-23.798559	27.739364	169,497	959,571	24,206	15021,29	386,739	14,558	86,221	103,407	14,641	157,195								
No. 458	Archaeological	Dolerite	OBP				24,034	711,699	28,883	5939,246	225,585	70,364	38,679	62,467	124,278	96,017								
OBP 10C	Geological	Quartz	OBP	Mogalakwena Fm	-23.798558	27.739363	0,843	0,822	0,065	31,382	1,231	5,242	1,344	6,349	4,28	2,071								
MC2	Geological	Quartz	OBP	Mogalakwena Fm	-24.132778	27.69775	0,21	26,861	0,588	69,048	6,719	13,736	1,261	6,03	5,021	3,226								
CMF1	Geological	Quartzite White	OBP	Cleremont Fm	-23.996694	27.684111	2,851	30,139	0,522	191,581	4,503	6,216	0,658	3,717	2,131	4,487								
No. 486	Archaeological	Quartzite White	OBP				3,158	1051,01	0,528	358,377	4,879	16,888	3,12	15,776	13,845	5,191								
No. 488	Archaeological	Quartzite White	OBP				0,39	459,342	0,146	44,679	2,722	3,891	2,083	8,508	6,054	2,774								
No. 3478	Archaeological	Quartzite White	OBP				1,893	1076,493	1,404	165,248	20,477	19,015	1,557	7,313	7,274	2,556								
OBP 7	Geological	Sandstone	OBP	Mogalakwena Fm	-23.879806	27.642528	2,726	11,333	0,341	487,231	1,317	3,313	1,696	6,595	7,336	16,719								
OBP 8A	Geological	Sandstone	OBP	Mogalakwena Fm	-23.878083	27.6395	4,303	335,48	4,285	1477,795	50,363	31,323	7,146	18,738	2,946	20,106								
No. 1194	Archaeological	Sandstone	OBP				27,509	923,888	7,168	1799,825	53,557	63,736	11,211	39,876	6,463	52,943								
No. 2402	Archaeological	Sandstone	OBP				4,439	526,337	2,712	842,475	26,502	17,738	4,612	12,634	7,752	13,156								
OBP 10A	Geological	Shale	OBP	Mogalakwena Fm	-23.798558	27.739363	0,871	70,442	0,098	26,026	1,612	4,102	1,091	6,013	5,675	3,687								
YRS1-D	Archaeological	Shale	OBP				7,03	328,809	6,992	1943,29	35,639	43,624	10,699	25,866	34,105	46,729								
No. 164	Archaeological	Shale	OBP				9,798	401,943	8,522	1939,985	45,734	38,739	7,783	21,17	14,779	20,388								

Olieboomspoort Rock Shelter																								
Samples	**Archaeologic**	**Rock Type**	**Site**	**Formation/Laye**	**Latitude (°)**	**Longitude (°)**	**Ga**	**Rb**	**Sr**	**Y**	**Zr**	**Nb**	**Sn**	**Sb**	**Cs**	**Ba**								
OBP 4G	Geological	Dolerite	OBP	Mogalakwena Fm	-23.798559	27.739364	25,06	7,669	136,575	39,201	169,793	9,618	2,734	0,747	0,389	1109,162								
No. 458	Archaeological	Dolerite	OBP				19,231	62,795	151,86	27,191	159,511	8,309	3,706	0,17	1,359	389,886								
OBP 10C	Geological	Quartz	OBP	Mogalakwena Fm	-23.798558	27.739363	0,6	0,618	2,1	0,638	0,363	0,579	0,284	0,067	0,014	11,45								
MC2	Geological	Quartz	OBP	Mogalakwena Fm	-24.132778	27.69775	1,206	0,784	4,052	12,117	348,881	0,181	1,141	0,178	0,016	19,649								
CMF1	Geological	Quartzite White	OBP	Cleremont Fm	-23.996694	27.684111	2,117	10,037	3,678	2,881	31,298	0,752	0,964	0,101	0,066	124,224								
No. 486	Archaeological	Quartzite White	OBP				3,923	8,351	33,685	4,391	26,458	1,618	2,133	0,742	0,093	84,045								
No. 488	Archaeological	Quartzite White	OBP				2,799	0,833	9,905	3,121	1,75	0,086	0,403	0,084	0,024	21,174								
No. 3478	Archaeological	Quartzite White	OBP				9,769	1,549	218,053	4,02	42,468	0,468	1,053	0,278	0,043	722,37								
OBP 7	Geological	Sandstone	OBP	Mogalakwena Fm	-23.879806	27.642528	29,119	319,505	21,32	44,476	175,457	43,491	12,324	0,954	1,698	114,139								
OBP 8A	Geological	Sandstone	OBP	Mogalakwena Fm	-23.878083	27.6395	12,693	31,84	39,265	3,983	122,762	4,278	7,831	0,083	0,23	210,063								
No. 1194	Archaeological	Sandstone	OBP				11,45	146,924	85,224	10,286	142,48	6,305	3,781	0,677	3,625	1547,867								
No. 2402	Archaeological	Sandstone	OBP				9,738	23,13	54,48	4,117	59,545	2,229	4,036	0,126	0,21	212,377								
OBP 10A	Geological	Shale	OBP	Mogalakwena Fm	-23.798558	27.739363	0,538	0,486	4,588	2,086	1,104	0,166	0,486	1,268	0,116	11,286								
YRS1-D	Archaeological	Shale	OBP				14,746	144,858	26,507	18,317	123,969	8,896	4,601	0,958	3,265	895,275								
No. 164	Archaeological	Shale	OBP				16,313	157,644	50,149	16,381	149,915	8,866	5,121	0,856	2,879	1751,292								

Oliebomspoort Rock Shelter																
Samples	**Archaeologica**	**Rock Type**	**Site**	**Formation/Laye**	**Latitude (°)**	**Longitude (°)**	**La**	**Ce**	**Pr**	**Nd**	**Sm**	**Eu**	**Gd**	**Tb**	**Dy**	**Ho**
OBP 4G	Geological	Dolerite	OBP	Mogalakwena Fm	-23.798559	27.739364	43,852	83,054	11,337	46,109	9,773	2,661	10,417	1,43	7,925	1,48
No. 458	Archaeological	Dolerite	OBP				25,154	51,883	6,047	24,544	5,226	1,329	5,382	0,804	5,121	1,044
OBP 10C	Geological	Quartz	OBP	Mogalakwena Fm	-23.798558	27.739363	4,962	4,496	0,865	2,994	0,445	0,088	0,329	0,036	0,164	0,027
MC2	Geological	Quartz	OBP	Mogalakwena Fm	-24.132778	27.69775	16,041	15,276	1,944	6,431	1,044	0,318	1,633	0,265	1,793	0,401
CMF1	Geological	Quartzite White	OBP	Cleremont Fm	-23.996694	27.684111	6,518	14,465	1,525	5,773	1,04	0,185	0,84	0,107	0,626	0,118
No. 486	Archaeological	Quartzite White	OBP				16,132	33,438	3,325	12,393	2,013	0,398	1,742	0,197	1,066	0,2
No. 488	Archaeological	Quartzite White	OBP				27,96	19,986	5,129	18,576	2,731	0,581	2,415	0,259	1,118	0,166
No. 3478	Archaeological	Quartzite White	OBP				55,026	99,782	11,717	51,052	9,021	1,959	7,432	0,675	2,356	0,293
OBP 7	Geological	Sandstone	OBP	Mogalakwena Fm	-23.879806	27.642528	83,972	143,672	14,252	43,735	7,214	0,152	6,393	0,975	6,637	1,488
OBP 8A	Geological	Sandstone	OBP	Mogalakwena Fm	-23.878083	27.6395	44,246	83,899	8,525	30,155	4,834	0,568	2,61	0,214	0,897	0,165
No. 1194	Archaeological	Sandstone	OBP				9,157	20,132	2,222	8,935	1,968	0,557	2,028	0,302	1,935	0,406
No. 2402	Archaeological	Sandstone	OBP				31,373	56,847	5,89	21,487	3,408	0,508	2,391	0,22	1,009	0,182
OBP 10A	Geological	Shale	OBP	Mogalakwena Fm	-23.798558	27.739363	1,73	3,149	0,354	1,353	0,252	0,051	0,256	0,036	0,246	0,057
YRS1-D	Archaeological	Shale	OBP				33,134	63,582	7,011	26,785	4,936	0,934	4,477	0,597	3,504	0,708
No. 164	Archaeological	Shale	OBP				30,478	61,201	6,841	25,868	4,716	1,063	4,235	0,568	3,41	0,685

Oliebomspoort Rock Shelter																
Samples	**Archaeologica**	**Rock Type**	**Site**	**Formation/Laye**	**Latitude (°)**	**Longitude (°)**	**Er**	**Tm**	**Yb**	**Lu**	**Hf**	**Ta**	**W**	**Tl**	**Pb**	**Th**	**U**
OBP 4G	Geological	Dolerite	OBP	Mogalakwena Fm	-23.798559	27.739364	3,857	0,516	3,131	0,443	4,673	0,603	1,205	0,048	48,674	4,183	2,356
No. 458	Archaeological	Dolerite	OBP				2,968	0,453	2,951	0,432	4,288	0,531	0,691	0,39	23,099	8,032	1,688
OBP 10C	Geological	Quartz	OBP	Mogalakwena Fm	-23.798558	27.739363	0,066	0,007	0,047	0,006	0,014	0,076	0,095	0,002	1,488	0,194	0,068
MC2	Geological	Quartz	OBP	Mogalakwena Fm	-24.132778	27.69775	1,192	0,186	1,27	0,195	13,586	0,017	0,144	0,029	2,596	2,92	2,644
CMF1	Geological	Quartzite White	OBP	Cleremont Fm	-23.996694	27.684111	0,338	0,05	0,355	0,051	1,289	0,062	0,166	0,03	1,663	2,9	0,458
No. 486	Archaeological	Quartzite White	OBP				0,556	0,08	0,509	0,074	0,899	0,174	0,261	0,05	1,744	2,701	0,511
No. 488	Archaeological	Quartzite White	OBP				0,373	0,041	0,217	0,026	0,074	0,015	0,239	0,011	0,84	0,351	0,253
No. 3478	Archaeological	Quartzite White	OBP				0,626	0,065	0,404	0,056	1,553	0,042	0,117	0,024	19,097	1,811	0,683
OBP 7	Geological	Sandstone	OBP	Mogalakwena Fm	-23.879806	27.642528	4,8	0,856	6,153	0,892	9,322	4,513	0,428	1,129	12,913	36,543	7,324
OBP 8A	Geological	Sandstone	OBP	Mogalakwena Fm	-23.878083	27.6395	0,501	0,077	0,586	0,09	4,641	0,434	0,368	0,207	12,32	26,267	2,8
No. 1194	Archaeological	Sandstone	OBP				1,21	0,202	1,368	0,21	4,148	0,488	0,611	0,876	6,397	9,174	3,545
No. 2402	Archaeological	Sandstone	OBP				0,512	0,074	0,493	0,074	1,918	0,24	0,396	0,284	12,454	10,303	1,944
OBP 10A	Geological	Shale	OBP	Mogalakwena Fm	-23.798558	27.739363	0,163	0,025	0,179	0,027	0,024	0,026	0,185	0,002	0,577	0,109	0,325
YRS1-D	Archaeological	Shale	OBP				1,998	0,308	2,103	0,31	3,987	0,636	1,031	0,621	10,067	11,695	3,474
No. 164	Archaeological	Shale	OBP				1,998	0,309	2,067	0,305	4,289	0,632	1,118	1,718	17,491	10,681	3,272

8.4.2 Mwulu's Cave

Table D2: ICP-MS spreadsheet of Mwulu's Cave lithic and outcrop samples. Concentrations of the elements are measured in ppm.

Mwulu's Cave																			
Samples	**Archaeological**	**Rock Type**	**Site**	**Formation**	**Latitude (°)**	**Longitude (°)**	**Li**	**P**	**Sc**	**Ti**	**V**	**Cr**	**Co**	**Ni**	**Cu**	**Zn**
Outcrop 16C	Geological	Chert	Mwulu's Cave	BQRF	-24,175967	29,243083	0,403	533,203	1,558	97,777	1,53	25,393	1,6	7,937	10,531	3,874
674	Archaeological	Chert	Mwulu's Cave				3,067	117,04	0,261	62,764	4,388	10,487	5,87	19,8	11,946	4,889
M1-K	Archaeological	Chert	Mwulu's Cave				0,389	3,517	0,02	19,153	0,884	2,896	1,264	5,648	4,099	3,139
Outcrop 16D	Geological	Quartzite Black	Mwulu's Cave	BQRF	-24,175967	29,243083	0,423	281,262	1,025	235,045	3,031	36,207	2,041	8,936	12,469	4,069
M1-J	Archaeological	Quartzite Black	Mwulu's Cave				0,239	38,424	0,641	214,357	4,657	43,207	9,008	35,915	31,65	13,496
Outcrop G2B	Geological	Quartzite White	Mwulu's Cave	BQRF	-24,176133	29,243333	0,29	40,796	0,886	54,752	2,219	72,912	0,415	2,501	2,824	5,225
Outcrop 16A	Geological	Quartzite White	Mwulu's Cave	BQRF	-24,175967	29,243083	0,259	153,981	1,09	123,686	3,001	46,054	0,553	4,084	5,878	3,176
640	Archaeological	Quartzite White	Mwulu's Cave				-0,066	33,766	0,228	34,759	1,309	29,295	2,383	11,379	10,804	6,894
1021	Archaeological	Quartzite White	Mwulu's Cave				0,172	55,821	0,304	220,068	3,051	38,918	7,997	40,321	35,304	8,965
Outcrop G2A	Geological	Quarzite Black	Mwulu's Cave	BQRF	-24,176133	29,243333	0,324	39,938	0,533	70,034	3,161	17,674	0,401	2,235	2,305	3,28
Outcrop 4A	Geological	Shale	Mwulu's Cave	Malmani Subgroup	-24,1455	29,175	60,173	420,388	13,021	3165,489	123,77	543,74	4,62	52,873	5,035	5,257
M3-B	Archaeological	Shale	Mwulu's Cave				72,99	2749,796	6,487	2457,997	52,146	83,685	17,93	41,634	15,958	66,466
M3-E	Archaeological	Shale	Mwulu's Cave				14,796	195,835	2,428	470,491	28,423	60,265	4,538	26,102	23,896	6,008

Mwulu's Cave																
Samples	**Archaeological**	**Rock Type**	**Site**	**Formation**	**Latitude (°)**	**Longitude (°)**	**Ce**	**Pr**	**Nd**	**Sm**	**Eu**	**Gd**	**Tb**	**Dy**	**Ho**	**Er**
Outcrop 16C	Geological	Chert	Mwulu's Cave	BQRF	-24,175967	29,243083	7,621	0,825	3	0,548	0,157	0,512	0,076	0,484	0,102	0,319
674	Archaeological	Chert	Mwulu's Cave				1,684	0,187	0,736	0,148	0,024	0,116	0,014	0,081	0,014	0,042
M1-K	Archaeological	Chert	Mwulu's Cave				2,119	0,04	0,139	0,023	0,006	0,029	0,003	0,016	0,003	0,008
Outcrop 16D	Geological	Quartzite Black	Mwulu's Cave	BQRF	-24,175967	29,243083	10,653	1,17	4,095	0,733	0,222	0,695	0,106	0,652	0,134	0,425
M1-J	Archaeological	Quartzite Black	Mwulu's Cave				8,044	0,738	2,583	0,403	0,074	0,328	0,043	0,259	0,054	0,171
Outcrop G2B	Geological	Quartzite White	Mwulu's Cave	BQRF	-24,176133	29,243333	11,671	1,012	2,978	0,399	0,067	0,319	0,043	0,31	0,065	0,186
Outcrop 16A	Geological	Quartzite White	Mwulu's Cave	BQRF	-24,175967	29,243083	18,89	2,235	8,041	1,338	0,302	1,099	0,14	0,756	0,144	0,419
640	Archaeological	Quartzite White	Mwulu's Cave				12,319	1,359	4,423	0,656	0,133	0,462	0,05	0,245	0,044	0,13
1021	Archaeological	Quartzite White	Mwulu's Cave				20,263	2,136	7,474	1,211	0,178	1,055	0,146	0,937	0,198	0,57
Outcrop G2A	Geological	Quarzite Black	Mwulu's Cave	BQRF	-24,176133	29,243333	20,622	2,086	7,433	1,116	0,287	0,728	0,077	0,324	0,053	0,164
Outcrop 4A	Geological	Shale	Mwulu's Cave	Malmani Subgroup	-24,1455	29,175	7,931	0,794	3,047	0,598	0,141	0,611	0,078	0,483	0,105	0,335
M3-B	Archaeological	Shale	Mwulu's Cave				88,382	9,883	38,832	7,583	1,031	5,647	0,643	3,326	0,605	1,567
M3-E	Archaeological	Shale	Mwulu's Cave				11,035	1,062	3,497	0,469	0,091	0,385	0,045	0,263	0,055	0,172

Mwulu's Cave																	
Samples	**Archaeologica**	**Rock Type**	**Site**	**Formation**	**Latitude (°)**	**Longitude (°)**	**Ga**	**Rb**	**Sr**	**Y**	**Zr**	**Nb**	**Sn**	**Sb**	**Cs**	**Ba**	**La**
Outcrop 16C	Geological	Chert	Mwulu's Cave	BQRF	-24,175967	29,243083	1,346	3,583	8,78	2,216	37,808	0,541	1,414	0,623	0,097	48,189	4,327
674	Archaeological	Chert	Mwulu's Cave				1,486	3,194	1,854	0,351	2,024	0,252	0,734	0,421	0,177	29,418	0,875
M1-K	Archaeological	Chert	Mwulu's Cave				0,412	1,002	0,423	0,084	0,593	0,055	0,177	0,146	0,024	5,744	1,478
Outcrop 16D	Geological	Quartzite Black	Mwulu's Cave	BQRF	-24,175967	29,243083	1,876	8,883	50,781	3,007	68,059	1,66	2,379	0,56	0,115	141,811	6,505
M1-J	Archaeological	Quartzite Black	Mwulu's Cave				3,329	6,794	2,916	1,307	30,453	0,826	3,132	1,637	0,116	24,33	3,88
Outcrop G2B	Geological	Quartzite White	Mwulu's Cave	BQRF	-24,176133	29,243333	3,217	5,081	3,104	1,522	23,483	0,306	0,918	0,357	0,145	18,753	7,841
Outcrop 16A	Geological	Quartzite White	Mwulu's Cave	BQRF	-24,175967	29,243083	2,179	9,522	21,266	3,322	57,506	0,695	1,664	0,286	0,13	62,826	11,418
640	Archaeological	Quartzite White	Mwulu's Cave				1,47	2,268	2,384	1,024	19,274	0,164	1,253	0,571	0,073	10,038	7,622
1021	Archaeological	Quartzite White	Mwulu's Cave				3,468	20,904	8,607	5,277	41,144	2,412	4,214	2,032	0,525	89,034	10,553
Outcrop G2A	Geological	Quarzite Black	Mwulu's Cave	BQRF	-24,176133	29,243333	3,317	18,12	2,806	1,23	43,302	0,284	0,718	0,182	0,205	37,872	10,749
Outcrop 4A	Geological	Shale	Mwulu's Cave	Malmani Subgroup	-24,1455	29,175	22,296	258,278	5,314	2,816	61,959	10,471	4,671	0,758	6,151	223,978	4,173
M3-B	Archaeological	Shale	Mwulu's Cave				19,152	128,321	60,352	15,178	84,74	11,672	10,248	0,453	7,635	167,51	43,34
M3-E	Archaeological	Shale	Mwulu's Cave				7,997	68,36	5,227	1,751	11,069	0,836	2,406	1,121	1,654	103,595	8,038

Mwulu's Cave																
Samples	**Archaeologica**	**Rock Type**	**Site**	**Formation**	**Latitude (°)**	**Longitude (°)**	**Tm**	**Yb**	**Lu**	**Hf**	**Ta**	**W**	**Tl**	**Pb**	**Th**	**U**
Outcrop 16C	Geological	Chert	Mwulu's Cave	BQRF	-24,175967	29,243083	0,056	0,422	0,062	1,267	0,066	0,1	0,043	4,484	2,854	0,944
674	Archaeological	Chert	Mwulu's Cave				0,006	0,042	0,006	0,066	0,022	0,104	0,023	3,395	0,345	0,113
M1-K	Archaeological	Chert	Mwulu's Cave				0	0,008	0	0,02	0,018	0,08	0,003	0,578	0,067	0,079
Outcrop 16D	Geological	Quartzite Black	Mwulu's Cave	BQRF	-24,175967	29,243083	0,073	0,551	0,088	2,195	0,308	0,195	0,115	4,049	6,549	1,102
M1-J	Archaeological	Quartzite Black	Mwulu's Cave				0,029	0,23	0,036	1,09	0,083	0,231	0,043	4,36	1,283	0,52
Outcrop G2B	Geological	Quartzite White	Mwulu's Cave	BQRF	-24,176133	29,243333	0,03	0,202	0,029	0,86	0,033	0,083	0,033	2,058	2,396	0,724
Outcrop 16A	Geological	Quartzite White	Mwulu's Cave	BQRF	-24,175967	29,243083	0,066	0,482	0,076	2,03	0,09	0,097	0,102	3,264	4,967	0,829
640	Archaeological	Quartzite White	Mwulu's Cave				0,02	0,14	0,022	0,683	0,018	0,127	0,02	1,609	1,289	0,397
1021	Archaeological	Quartzite White	Mwulu's Cave				0,089	0,58	0,085	1,516	0,262	0,325	0,126	4,529	3,101	0,834
Outcrop G2A	Geological	Quarzite Black	Mwulu's Cave	BQRF	-24,176133	29,243333	0,028	0,228	0,038	1,526	0,043	0,066	0,101	1,374	2,228	0,784
Outcrop 4A	Geological	Shale	Mwulu's Cave	Malmani Subgroup	-24,1455	29,175	0,061	0,443	0,072	2,134	0,846	1,321	1,043	1,532	6,834	1,768
M3-B	Archaeological	Shale	Mwulu's Cave				0,224	1,5	0,206	2,66	1,029	1,118	0,842	7,455	19,147	3,293
M3-E	Archaeological	Shale	Mwulu's Cave				0,028	0,203	0,033	0,377	0,095	0,431	0,334	2,809	1,058	0,638

8.4.3 ICP-MS standards

Table D3: ICP-MS spreadsheet of standards (measured in ppm).

	Standards	Li	P	Sc	Ti	V	Cr	Co	Ni	Cu	Zn	Ga	Rb	Sr	Y	Zr	Nb	Sn	Sb	Cs	Ba	La
Obs	BCR	9,927	1542,8	31,93	12844	423,14	15,787	37,469	12,085	18,822	142,755	22,394	50,342	326,532	31,63	184,7	11,92	3,308	0,559	1,244	640,72	25,157
Obs	BHVO	4,987	1200	31,07	15823	322,07	308,75	44,999	118,01	146,509	110,292	21,292	9,839	375,651	22,55	168,5	17,71	1,978	0,18	0,104	128,79	15,203
Obs	BIR	3,388	100,35	43,08	5674	337,92	414,12	53,324	172,41	139,844	77,462	14,222	0,215	102,925	13,3	12,95	0,516	2,756	1,036	0,004	6,335	0,61
Recom	BCR	9,9	1571	32	13005	414	17	35,8	12,7	19,4	147	22,7	49	321	31	194	12,8	2,1	0,62	1,17	641	24,5
Recom	BHVO	5	1178	31	15621	329	285	47	112	142	107	21	10,1	382	23	160	16,4	2,7	0,16	0,11	128,7	15,6
Recom	BIR	3,4	100	44	5755	313	382	51,4	166	126	71		0,25	108	16	15,5	0,6	0,65	0,58		7	0,62

	Standards	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Tl	Pb	Th	U
Obs	BCR	51,11	6,373	27,68	6,308	1,918	6,512	0,973	5,989	1,211	3,338	0,47	3,351	0,476	4,812	0,707	0,437	0,3	10,3	5,696	1,755
Obs	BHVO	36,57	4,944	23,42	5,793	1,992	5,89	0,84	4,909	0,902	2,274	0,294	1,933	0,257	4,267	1,049	0,272	0,021	1,486	1,141	0,434
Obs	BIR	1,78	0,34	2,227	1,044	0,501	1,63	0,315	2,317	0,514	1,487	0,217	1,592	0,222	0,549	0,063	0,089	0	3,173	0,025	0,01
Recom	BCR	50,5	6,3	27	6,3	1,91	6,5	0,95	6	1,2	3,3	0,46	3,2	0,47	5	0,78	0,44	0,3	10,9	5,5	1,73
Recom	BHVO	37	5	24	5,8	2	5,9	0,86	4,9	0,91	2,3	0,3	2,02	0,26	4,1	0,94	0,27	0,058	1,4	1,18	0,44
Recom	BIR	1,95	0,38	2,5	1,1	0,54	1,85	0,36	2,5	0,57	1,7	0,26	1,65	0,26	0,6	0,04	0,007	0,01	3	0,03	0,01

	Standards	Li	P	Sc	Ti	V	Cr	Co	Ni	Cu	Zn	Ga	Rb	Sr	Y	Zr	Nb	Sn	Sb	Cs	Ba	La
Obs	BCR2	10,06	1564,3	31,84	12955	421,7	16,029	37,661	12,138	19,476	144,921	22,711	50,255	323,734	31,67	185,5	11,92	2,1	0,56	1,228	640,2	24,971
Obs	BHVO2	4,923	1183,3	31,16	15683	323,11	303,44	44,792	117,45	141,449	108,567	20,993	9,855	378,859	22,53	167,7	17,72	1,956	0,179	0,105	128,86	15,312
Obs	BIR1	3,316	89,155	42,65	5435	328,3	410,54	52,592	168,53	137,856	74,364	13,245	0,228	100,742	12,8	12,3	0,512	0,732	1,048	0,006	6,15	0,611
Recom	BCR2	9,9	1571	32	13005	414	17	35,8	12,7	19,4	147	22,7	49	321	31	194	12,8	2,1	0,62	1,17	641	24,5
Recom	BHVO2	5	1178	31	15621	329	285	47	112	142	107	21	10,1	382	23	160	16,4	2,7	0,16	0,11	128,7	15,6
Recom	BIR1	3,4	100	44	5755	313	382	51,4	166	126	71		0,25	108	16	15,5	0,6	0,65	0,58		7	0,62

	Standards	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Tl	Pb	Th	U
Obs	BCR2	51,25	6,335	27,49	6,265	1,924	6,492	0,963	5,973	1,211	3,327	0,469	3,31	0,473	4,821	0,715	0,47	0,3	9,902	5,706	1,739
Obs	BHVO2	36,47	4,972	23,58	5,833	1,985	5,907	0,849	4,923	0,902	2,281	0,295	1,955	0,259	4,258	1,033	0,254	0,04	1,557	1,139	0,438
Obs	BIR1	1,769	0,341	2,225	1,028	0,494	1,596	0,31	2,281	0,507	1,449	0,216	1,56	0,219	0,541	0,076	0,103	0,001	3,228	0,026	0,011
Recom	BCR2	50,5	6,3	27	6,3	1,91	6,5	0,95	6	1,2	3,3	0,46	3,2	0,47	5	0,78	0,44	0,3	10,9	5,5	1,73
Recom	BHVO2	37	5	24	5,8	2	5,9	0,86	4,9	0,91	2,3	0,3	2,02	0,26	4,1	0,94	0,27	0,058	1,4	1,18	0,44
Recom	BIR1	1,95	0,38	2,5	1,1	0,54	1,85	0,36	2,5	0,57	1,7	0,26	1,65	0,26	0,6	0,04	0,007	0,01	3	0,03	0,01