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The Waterberg platinum-group element deposit, South Africa

McCreesh, Matthew James Gerard

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Examiner 1: Corrections Report:

Examiner: "et al." should be in italics throughout the document.
Response: All "et al." have been changed to "*et al.*" as suggested by the examiner.

Abstract:

Examiner: Abstract, first sentence: "The Waterberg platinum-group element deposit of the Bushveld Complex is…"
Response: Changed as suggested by the examiner.

Examiner: Abstract, para 1, line 3: "…towards the northwest. The succession is comprised of…"
Response: Changed as suggested by the examiner.

Examiner: Abstract, para 1 last line: "…before the intrusion of a dolerite sill associated…"
Response: Changed as suggested by the examiner.

Examiner: Abstract, 2nd para, 1st line: "The magmatic history of the Waterberg deposit stratigraphy is…"
Response: Changed as suggested by the examiner.

Examiner: Abstract, 2nd para, last line: "…it lacks the magnetitite layers seen…"
Response: Changed as suggested by the examiner.

Examiner: Abstract, 3rd para, line 6: "…suggest that the F zone mineralisation is…"
Response: Changed as suggested by the examiner.

Examiner: Abstract, last para, line 1: "Although there are similarities with the Bushveld…"
Response: Changed as suggested by the examiner.

Examiner: Acknowledgements heading: "Acknowledgements".
Response: Changed as suggested by the examiner.

Table of Contents:

Examiner: Table of contents, first page: the abstract came before the acknowledgements in the document that I examined. Change order in TOC accordingly.
Response: Changed as suggested by the examiner.

Chapter 1:

Examiner: Page 1, first para, 2nd sentence: Rephrase sentence. As it stands, it does not make sense. "For years, the largest layered intrusive known as the Bushveld Complex in the north-eastern parts of South Africa has developed and opened new mining operations along the Merensky Reef and the Upper Group 2 (UG2) of the eastern and western limbs, although in recent years the interest of the northern limb Platreef ore body has surged."
Response: Rephrased as suggested by the examiner "Since the discovery of PGE in the last 1920's, mines have been developed and opened along the Merensky Reef and the Upper Group 2 (UG2) of the eastern and western limbs of the Bushveld Complex and in recent years the exploration and mining activities have increased on the Platreef ore body of the northern limb."

Examiner: Page 1, first para, 3nd sentence: "Anglo American's…"

Response: Changed as suggested by the examiner.

Examiner: Page 1, 2nd para, Line 4: "…are some of the least abundant elements on Earth…"
Response: Changed as suggested by the examiner.

Examiner: Page 1, 2nd para, Line 6: "…are divided into subgroups;…"
Response: Changed as suggested by the examiner.

Examiner: Page 1, 2nd para, Line 9: "…into a high temperature Ir-group (IPGE) consisting of Ru, Os and Ir, and a low temperature Pd-group (PPGE) consisting of Rh, Pd and Pt…"
Response: Changed as suggested by the examiner.

Examiner: Page 2, 2nd para, Line 1: "The Earth's core is believed to be the principle reservoir of PGE…"
Response: Changed as suggested by the examiner.

Examiner: Page 2, 2nd para, Line 3: "…is more abundant than the core…"
Response: Changed as suggested by the examiner.

Examiner: Page 2, 3rd para, Line 1: "The abundance of platinum (Pt) and palladium (Pd) is similar in the Earth's curst at approximately 5 parts per billion (ppb),…"
Response: Changed as suggested by the examiner.

Examiner: Page 2, 3rd para, Line 4: "…Earth's crust…"
Response: Changed as suggested by the examiner

Examiner: Page 2, 3rd para, Line 7: "…into two types of deposits both of which are associated…"
Response: Changed as suggested by the examiner.

Examiner: Page 2, 3rd para, Line 8: "Type I PGE mineralisation occurs as stratiform or stratabound deposits in large layered intrusions with Ni and Cu as by products".
Response: Changed as suggested by the examiner.

Examiner: Page 2, 3rd para, last line, running over onto the next page: "Not a proper sentence. Rewrite.
Response: Rephrased "Type II PGE mineralisation occurs in massive Ni-Cu sulphides deposits, although mined primarily for Ni and Cu with recoverable amounts of PGE, particularly Pd as by products".

Examiner: Page 3, 2nd para, Line 3: "…emplacement of a mantle slab in a subduction/ collision zone…"
Response: Changed as suggested by the examiner.

Examiner: Page 3, 2nd para, Line 4: "…enriched layered intrusions and Ni-Cu sulphides deposits in the Earth's crust."
Response: Changed as suggested by the examiner.

Examiner: Page 4, 1st para, Line 4: "…of a silicate melt; crystallising silicates and oxides…"
Response: Changed as suggested by the examiner.

Examiner: Page 4, 1st para, Line 10: "An increase in oxygen fugacity is a process distinct from the other listed, yet it was not graced by having its own number in the list.
Response: Changed as suggested by the examiner "(iv) Furthermore, an increase in oxygen fugacity may precipitate chromite and magnetite decreasing the FeO content of the magma, which in turn decreases the sulphur carrying capacity of the magma."

Examiner: Page 4, 2nd para, Line 4: "…is low, between 100 and 2000…"
Response: Changed as suggested by the examiner.

Examiner: Page 5, 1st para, Line 3: "...impermeable layers as such a…"
Response: Changed as suggested by the examiner.

Examiner: Page 5, 2nd para heading and throughout document: In the heading to paragraph 2, the abbreviation "PGE" is implied to be the abbreviation for "Platinum-Group Elements" (i.e. the plural). The usage throughout the document is, however, inconsistent. In some place the abbreviation "PGEs" is used and elsewhere, the accompanying verb is in the singular. Kindly ensure consistent usage throughout the document.
Response: Changed as suggested by the examiner, all PGE abbreviation are changed to "PGE" rather than "PGEs".

Examiner: Page 5, 2nd para, Line 1: "…of approximately 90 elements that comprises…"
Response: Changed as suggested by the examiner.

Examiner: Page 5, 2nd para, Line 9: "…resistance to chemical erosion…"
Response: Changed as suggested by the examiner.

Examiner: Page 5, 2nd para, last line: Place full stop at the end of sentence.
Response: Changed as suggested by the examiner.

Examiner: Page 6, 1st para, sentence starting in line 6: "However, some aspects…"
Response: Changed as suggested by the examiner.

Examiner: Page 6, 1st para, line 10, 12 and 15: I cannot recall Seabrook et al. (2005) referring to "T-type" and "U-type" magmas in their contribution. I would suggest removing references to "T-type" and "U-type" magmas in the Lines as indicated if they did not.
Response: Changed as suggested by the examiner.

Examiner: Page 6, 1st para, line 12: "They stressed that the compositions of these cyclic units were the result of mineral mixing rather than magma mixing…"
Response: Changed as suggested by the examiner.

Examiner: Page 7, 2nd para, line 3 (and throughout): "Moorddrift" not "Moordrift"
Response: Changed as suggested by the examiner.

Examiner: Page 7, first bullet point: "…intervals of the Waterberg Project intercepted by drilling."
Response: Changed as suggested by the examiner.

Examiner: Page 7, 3rd bullet point: "Develop a genetic model for the Waterberg Project stratigraphy…"
Response: Changed as suggested by the examiner.

Examiner: Page 9, 1st para, last line: Neither the electronic version of the thesis nor the printed version with which I was supplied contained appendices. This should be included in the final version of the thesis.
Response: The appendix was not printed out due to its size (300 pages), however, an electronic copy of the appendices was submitted to the Faculty of Science at the University of the Witwatersrand and I am not sure why this document was not sent to you.

Chapter 2:

Examiner: Page 11, 1st para, last line: "…of the mineralised intervals within the Waterberg Project area."
Response: Changed as suggested by the examiner.

Examiner: Page 12, Figure 2.1 caption: "tectonomagmatic" not "tectomagmatic"
Response: Changed as suggested by the examiner.

Examiner: Page 12, 1st para, line 3: "…a composite structure that was thrust southwards during the Paleoproterozoic collision between the Zimbabwean and Kaapvaal cratons."
Response: Changed as suggested by the examiner.

Examiner: Page 12, 1st para, line 7: "…to 2.0 Ga. The Limpopo Mobile belt…"
Response: Changed as suggested by the examiner.

Examiner: Page 12, 1st para, last line: "There are several major…"
Response: Changed as suggested by the examiner.

Examiner: Page 13, 3rd para, line 3: I think the more common usage is "Villa Nora Fragment" and not "Segment". Please rectify throughout.
Response: Changed as suggested by the examiner.

Examiner: Page 14, 1st para, line 1: "There are still debates as to whether the…"
Response: Changed as suggested by the examiner.

Examiner: Page 14, Figure 2.2: The abbreviation for "Palala Shear Zone" in the figure is incorrect. It should be "PSZ" and not "PZS".
Response: Changed as suggested by the examiner.

Examiner: Page 15, 2nd para, line 2: "…base of the Bushveld Complex, although, it is not everywhere developed."
Response: Changed as suggested by the examiner.

Examiner: Page 15, 2nd para, last sentence: Poorly phrased. Rewrite.
Response: Changed as suggested by the examiner. "Eales and Cawthorn (1996) indicated that the Marginal Zone does not represent a true chilled margin at the base of the Bushveld Complex and rather formed from rapid crystallisation of the magma."

Examiner: Page 15, 3rd para, line 2: "…divided the Marginal Zone rocks…"
Response: Changed as suggested by the examiner.

Examiner: Page 17, 1st para, line 1: "A Basal Ultramafic Sequence (BUS)…"
Response: Changed as suggested by the examiner.

Examiner: Page 17, 1st para, line 3: "…pyroxenites, harzburgites and dunites. Olivine and orthopyroxene through the BUS have the most magnesian compositions in the Bushveld Complex…"
Response: Changed as suggested by the examiner

Examiner: Page 17, 1st para, line 8: "…than the previously proposed B1 magma…"
Response: Changed as suggested by the examiner.

Examiner: Page 17, 1st para, line 10: "…for the recent discovery of an 800 m thick"
Response: Changed as suggested by the examiner.

Examiner: Page 17, 1st para, line 12: "…indicated that the high Mg# of 91 of olivine cannot…"
Response: Changed as suggested by the examiner.

Examiner: Page 17, 1st para, line 14: Last sentence of the paragraph is poorly written and should be rephrased.
Response: Changed as suggested by the examiner. "The recent discovery of the BUS opens the debate on the origin of the Bushveld parental magma…"

Examiner: Page 17, 2nd para, line 1: "…ultramafic lithologies that include dunite, harzburgite and pyroxenite (Bronzitites)…"
Response: Changed as suggested by the examiner.

Examiner: Page 17, 2nd para, line 6: "…drill-cores. Here the Lower Zone was subdivided into two units: a lower…."
Response: Changed as suggested by the examiner

Examiner: Page 17, 2nd para, line 9: "…in both the eastern and western limbs of the…"
Response: Changed as suggested by the examiner.

Examiner: Page 18, 1st para, line 2: "…to 6 modal %. However, this boundary…"
Response: Changed as suggested by the examiner.

Examiner: Page 18, 1st para, sentence starting with "Teigler et al.": Poorly written. Rephrase
Response: Rephrased as suggested by the examiner "Teigler *et al*. (1992) suggested the boundary between the Lower Zone and Critical Zone to occur where olivine is absent, indicating that the upper feldspathic pyroxenite defined by Cameron (1978) would now form part of the lower Critical Zone."

Examiner: Page 18, 2nd para, line 6-7: "…upper Critical Zone (C_UZ) that is characterised…"
Response: Changed as suggested by the examiner.

Examiner: Page 19, 1st para, line 2: "…emplacement of chromitites suspensions…"
Response: Changed as suggested by the examiner.

Examiner: Page 19, 1st para, line 3: "…in situ crystallisation…"
Response: Changed as suggested by the examiner.

Examiner: Page 19, 1st para, line 7: "The overlying chromitites…." Although (removed)
Response: Changed as suggested by the examiner.

Examiner: Page 19, 2nd para, line 2: "The UG2 chromitite layers represent the largest single…"

Response: Changed as suggested by the examiner.

Examiner: Page 20, 1st line: "The UG2 contains minor…"
Response: Changed as suggested by the examiner.
Examiner: Page 20, 2nd para, 2nd last line: Delete "…this description represents the normal Merensky Reef."
Response: Changed as suggested by the examiner.

Examiner: Page 20, 3rd para, line 1: "…two influxes of magma. These magmas deposited…"
Response: Changed as suggested by the examiner

Examiner: Page 20, 3rd para, line 2: "…basal chromitite followed…"
Response: Changed as suggested by the examiner.

Examiner: Page 21, 1st para, line 2: "…and olivine is the main constituent…"
Response: Changed as suggested by the examiner.

Examiner: Page 22, 1st para, line 2: "…is much greater at between…"
Response: Changed as suggested by the examiner.

Examiner: Page 22, 2nd para, line 1: "In general,…"
Response: Changed as suggested by the examiner.

Examiner: Page 22, 2nd para, line 3: "…in the thin chromitite layers, especially the…"
Response: Changed as suggested by the examiner.

Examiner: Page 22, 4th para, line 1: "There are a number of published ideas that address…"
Response: Changed as suggested by the examiner.

Examiner: Page 23, 1st para, line 1: "Rare earth element data confirms the presence of…"
Response: Changed as suggested by the examiner.

Examiner: Page 23, 2nd para, line 1: "There is an ongoing debate as to whether magma mixing…"
Response: Changed as suggested by the examiner.

Examiner: Page 23, 2nd para, 2nd last line: "(Maier, 2005). This would lead to progressive enrichment of sulphides in highly chalcophile elements such as PGE, Ni and Cu…"
Response: Changed as suggested by the examiner.

Examiner: Page 23, 3rd para, second sentence: Poorly written. Rewrite.
Response: Changed as suggested by the examiner. "Cawthorn (2005) and Mavrogenes and O'Neil (1999) suggested that sulphur immiscibility as well as the formation of chromitite layers is a result of negative effect from the increase in pressure on sulphide solubility."

Examiner: Page 24, 2nd para, line 1: "…is the thickest zone in the…"
Response: Changed as suggested by the examiner.

Examiner: Page 24, 2nd para, line 6: "However, a more recent study by…"
Response: Changed as suggested by the examiner.

Examiner: Page 24, 2nd para, line 10: "…into three subzones based on the appearance of primary orthopyroxene and pigeonite."
Response: Changed as suggested by the examiner.

Examiner: Page 24, 3rd para, 2nd sentence: "The base of the Zone is defined by the appearance of cumulus magnetite. The Upper Zone is approximately 2000 m thick (SACS, 1980)."
Response: Changed as suggested by the examiner.

Examiner: Page 24, 3rd para, line 3: "The Upper Zone contains 24 magnetitite layers in the eastern limb and they are divided into four groups with up to seven magnetitite layers per group."
Response: Changed as suggested by the examiner.

Examiner: Page 24, 3rd para, line 5: "The thickest of these magnetitite layers is 6 m thick, with others…"
Response: Changed as suggested by the examiner.

Examiner: Page 24, 3rd para, line 9: "…the appearance of cumulus minerals."
Response: Changed as suggested by the examiner.

Examiner: Page 26, 1st para, line 8: "…and identified by large amounts of biotite."
Response: Changed as suggested by the examiner.

Examiner: Page 26, 1st para, line 10: "…and xenoliths of both Nebo and Klipkloof Granite."
Response: Changed as suggested by the examiner.

Examiner: Page 26, 2nd para, line 1: "The emplacement age of the Bushveld Complex has been investigated by a number of authors."
Response: Changed as suggested by the examiner.

Examiner: Page 26, 2nd para, line 3: "More recently, Buick *et al*. (2001) presented U-Pd isotope data from newly grown titanite from within a calc-silicate xenolith in the Upper Zone of the eastern limb that yield an age of 2058.9 ± 0.8 Ma."
Response: Changed as suggested by the examiner.

Examiner: Page 26, 2nd para, line 9: "However, more recently, high precision U-Pb zircon dating of the Merensky Reef of the western limb, revealed a significantly younger age of 2054.4 ± 1.3 Ma."
Response: Changed as suggested by the examiner.

Examiner: Page 27, 2nd para, last sentence line: Rephrase
Response: Changed as suggested by the examiner. "Sulphide inclusions from ~2.0 Ga diamonds recovered from the Premier and Venetia kimberlite on opposite sides of the igneous complex, show initial Os isotope ratios which are more radiogenic than those found in the ore deposits of the Bushveld Complex (Richardson and Shirey, 2008)."

Examiner: Page 27, 3rd para, third sentence: Rephrase
Response: Changed as suggested by the examiner. "It has been assumed that areas displaying positive gravity anomalies may represent pipe-like feeders (Sharpe *et al*., 1981)."

Examiner: Page 28, 1st para, line 3: "…that can only be interpreted…"
Response: Changed as suggested by the examiner.

Examiner: Page 28, 3rd para, 3rd last sentence: Poorly written. Rephrase
Response: Changed as suggested by the examiner. "These authors also proposed that other large shear zones and faults separating compartments in the Bushveld Complex may represent linear feeders or magma conduits."

Examiner: Page 28, last line: "…Barberton-Magaliesberg Lineament as magma conduits, where he suggested that…"
Response: Changed as suggested by the examiner. Barberton-Magaliesburg Lineament is spelt incorrectly by the examiner.

Chapter 3:

Examiner: Page 30, 1st para: Please ensure consistency in capitalisation of "Northern Limb" vs "northern limb". The same should also apply for "western limb", "eastern limb" etc.…
Response: The Northern Limb is capitalised in the heading of the chapter, however, throughout the text northern, western and eastern limbs are consistently not capitalised.

Examiner: Page 30, 2nd para, 1st sentence: Rephrased.
Response: Changed as suggested by the examiner. "To the north, the northern limb is covered by younger Waterberg Group sediments and to the south the Karoo sediments are juxtaposed against the layered mafic rocks and the Zebediela and Ysterberg-Planknek faults, which are subordinate branches of the Thabazimbi-Murchison Lineament (TML)…"

Examiner: Page 30, 2nd para, line 6: "…northern part of the…"
Response: Changed as suggested by the examiner.

Examiner: Page 30, 3rd para, line 9: "…or as a permanent / temporary barrier…"
Response: Changed as suggested by the examiner.

Examiner: Page 30, 3rd para, line 10: "Van der Merwe (1978) suggested that the…"
Response: Changed as suggested by the examiner.

Examiner: Page 31, Figure 3.1, Legend: "Archean granite gneisses" – Please also ensure consistency of usage throughout the remainder of the document.
Response: Changed as suggested by the examiner.

Examiner: Page 32, 1st para, line 4: "…structures that divided the rock types and setting of…"
Response: Changed as suggested by the examiner.

Examiner: Page 32, 1st para, line 6: "NE-striking faults that are assumed to have occurred post-Waterberg; (iv) the NE trending Zebediela and Ysterberg-Planknek Faults that are considered to mark the final stages of faulting in the southern sector of the northern limb, which occurred post-Karoo deposition."
Response: Changed as suggested by the examiner.

Examiner: Page 32, 3rd bullet point, line 4: "…strike slip system. Friese (2004) states that these structures developed in both the Transvaal Supergroup and the Bushveld Complex. It is noteworthy that the Bushveld Complex did not exist at the time of the Limpopo Orogeny (2.7-2.6 Ga) (Armitage, 2011)."
Response: Changed as suggested by the examiner.

Examiner: Page 33, 1st para, line 6: "The present magnitude and sense of displacement is…"
Response: Changed as suggested by the examiner.

Examiner: Page 33, 2nd para, line 3: "…north of the Zebediela Fault, a branch of the TML."
Response: Changed as suggested by the examiner.

Examiner: Page 34, Figure 3.3: Alignment of "Sandstone" in the cell to the right of the cell containing "Dwaalheuwel Fm." Should be rectified.
Response: Changed as suggested by the examiner.

Examiner: Page 34, Figure 3.3 caption, 2nd last line: "…Mokopane area. The image was redrawn from Kinnaird and Nex (2015)."
Response: Changed as suggested by the examiner.

Examiner: Page 35, 2nd para, line 1: "The Lower Zone cumulates are comprises at least 1600 m of 37 cyclic units of pyroxenite, dunite, harzburgite and chromitite on the Grasvally, Volspruit and Zoetveld farms."
Response: Changed as suggested by the examiner.

Examiner: Page 35, 2nd para, 2nd last line: "…(Fig. 3.4) that crop out over…"
Response: Changed as suggested by the examiner.

Examiner: Page 36, 2nd para, line 2: "South of Mokopane, between the Ysterberg-Plankneck fault and the Zebediela fault, is a succession…"
Response: Changed as suggested by the examiner.

Examiner: Page 36, 2nd para, last line: "…Mottled Anorthosite Unit (MANO)."
Response: Changed as suggested by the examiner.

Examiner: Page 36, 3rd para, line 7: "…Ysterberg-Planknek fault…"
Response: Changed as suggested by the examiner.

Examiner: Page 37, 2nd para, line 1: "In 1925, Merensky described an ultramafic body at the base of the Bushveld Complex north of Mokopane and referred to it as a "Pyroxenite body" composed mainly of pyroxenite and olivine-bearing pyroxenite that was highly serpentinised."
Response: Changed as suggested by the examiner.
Examiner: Page 37, 2nd para, line 4: "…pyroxenite, norite, serpentinite and xenoliths of…"
Response: Changed as suggested by the examiner.

Examiner: Page 37, 2nd para, 2nd last line: "…a porphyritic appearance that grades upwards…"
Response: Changed as suggested by the examiner.

Examiner: Page 37, 4th para, line 4: "…is amenable to open pit mining."
Response: Changed as suggested by the examiner.

Examiner: Page 37, 4th para, line 5: "…collectively known as the Mogalakwena Mine Complex."
Response: Changed as suggested by the examiner.

Examiner: Page 39, 1st para, line 4: "…along strike based on…"
Response: Changed as suggested by the examiner.

Examiner: Page 39, 2nd para, line 2: "…have different styles of mineralisation. Kinnaird (2005) indicated that the Platreef consists of several sill-like intrusions…"
Response: Changed as suggested by the examiner.

Examiner: Page 39, 2nd para, last two sentences: Poorly written. Rewrite.
Response: Changed as suggested by the examiner. "Where the lowest sills are overlying granite-gneiss basement lithologies towards the north, there is less contamination close to the footwall, however, dolomite rafts within the middle sill may be the source of the contamination in the northern sector (Sharman-Harris *et al*., 2005; Holwell *et al*., 2007). This reinforces the importance of the host rock for the different sectors of the Platreef."

Examiner: Page 40, 1st para, line 3: "…major difference is a high degree of contamination…"
Response: Changed as suggested by the examiner.

Examiner: Page 40, 1st para, line 5: "As a result of the contamination, the Platreef lacks the cyclicity typical for much of the Bushveld Complex. Regular occurrences of chromitite and…"
Response: Changed as suggested by the examiner.

Examiner: Page 40, 2nd para, line 5: "…(2010), located downdip of Akanani, west of…"
Response: Changed as suggested by the examiner.

Examiner: Page 41, line 2: "…in the eastern limb…"
Response: Changed as suggested by the examiner.

Examiner: Page 41, 3rd para, line 4: "…next influx of magmas. These observations were, however, only recorded…"
Response: Changed as suggested by the examiner.

Examiner: Page 41, 4th para, line 3: "…with textures that exhibit eroded Platreef,…"
Response: Changed as suggested by the examiner.

Examiner: Page 41, last para, line 2: "Ysterberg Planknek fault"
Response: Changed as suggested by the examiner.

Examiner: Page 42, line 2: "In general, there is little to no…"
Response: Changed as suggested by the examiner.

Examiner: Page 42, line 3: "Rare earth element patterns…"
Response: Changed as suggested by the examiner.

Examiner: Page 42, line 5: "…a Critical Zone origin as proposed by Ashwal *et al*. (2005)."
Response: Changed as suggested by the examiner.

Examiner: Page 42, 1st para, last sentence: Poorly written. Rewrite.
Response: Changed as suggested by the examiner. "However, Maier and Barnes (2010) have correlated this pyroxene-rich layer in the northern limb with the Pyroxenite Marker seen in the eastern and western limbs."

Examiner: Page 42, 2nd para: The work of Mangwegape *et al*. (2016) in JAES can also be referred to here.
Response: Reference added as suggested by the examiner.

Examiner: Page 43, 2nd para, line 1: "The Upper Zone also outcrops in the Villa Nora fragment. The main lithologies in this area include leuconorite…"
Response: Changed as suggested by the examiner.

Examiner: Page 43, 2nd para, line 3: "…in the Villa Nora fragment are truncated by the Abbottspoort Fault. Research on the Upper Zone thus far…"
Response: Changed as suggested by the examiner.

Examiner: Page 43, 3rd para, line 3: "…with the highest Cr content in the Bushveld Complex."
Response: Changed as suggested by the examiner.

Examiner: Page 43, 4th para, line 1: "…Ysterberg Planknek Fault…"
Response: Changed as suggested by the examiner.

Examiner: Page 43, 4th para, line 3: "…(Fig. 3.1) contain PGE-Ni-Cu and Cr mineralisation."
Response: Changed as suggested by the examiner.

Examiner: Page 43, 4th para, line 4: "…have identified PGE sulphide mineralisation…"
Response: Changed as suggested by the examiner.

Examiner: Page 43, 4th para, line 6: "…mineralisation zone in the Grasvally area."
Response: Changed as suggested by the examiner.

Examiner: Page 44, 2nd para, line 4: "…, 2005). These large occurrences of sulphides are…"
Response: Changed as suggested by the examiner.

Examiner: Page 44, 3rd para, last line: "…0.25 %, respectively."
Response: Changed as suggested by the examiner.

Examiner: Page 45, line 2: "…mineralisation along the strike of the Platreef."
Response: Changed as suggested by the examiner.

Examiner: Page 45, line 7: "…significantly lower tenor…"
Response: Changed as suggested by the examiner.

Examiner: Page 45, 2nd para, line 3: "…were also present."
Response: Changed as suggested by the examiner.

Examiner: Page 45, 2nd para, 2nd last line: "…activity is present and the…"
Response: Changed as suggested by the examiner.

Examiner: Page 47, section 3.4.3 heading: In paragraph 2 on page 43 it is suggested that the UZ is barren in terms of PGE. However, this heading would suggest that the UZ is mineralised. This is somewhat confusing at this point in the document.
Response: Changed as suggested by the examiner. The sentence has been deleted "Research on the Upper Zone thus far has indicated that the entire Upper Zone is barren in terms of PGE (Barnes *et al*., 2004)."

Examiner: Page 47, 2nd para, line 1: "…Ysterberg Planknek Fault…"
Response: Changed as suggested by the examiner.

Examiner: Page 47, 2nd para, line 4: "…package of mineralisation below…"
Response: Changed as suggested by the examiner.

Examiner: Page 48, 3rd para, line 2: "…indicator minerals: at the base, Unit 1, consisting…"
Response: Changed as suggested by the examiner.

Examiner: Page 48, 3rd para, line 7: "…with the gabbroic rocks in Unit 2."
Response: Changed as suggested by the examiner.

Examiner: Page 48, 3rd para, 2nd last line: "Most of the PGM are associated with silicate minerals such as plagioclase and clinopyroxene. Where PGM are associated with sulphides, they are generally associated with chalcopyrite and pyrite (Harmer and McDonald, 2010)."
Response: Changed as suggested by the examiner.

Examiner: Page 48, section 3.5 heading: "Age of the Northern Limb"
Response: Changed as suggested by the examiner.

Examiner: Page 48, last para, line 4: "…northern limb happened later than the rest of the complex."
Response: Changed as suggested by the examiner.

Examiner: Page 49, line 3: "…magnetisation is observed…"
Response: Changed as suggested by the examiner.

Examiner: Page 49, last para, 3rd last line: "…Archean granites in the far…"
Response: Changed as suggested by the examiner.

Examiner: Page 49, last sentence: Here it is again claimed that mineralisation occurs in the Upper Zone, whereas on page 43, paragraph 2, the opposite was claimed. This is confusing as the reader has not yet seen the author's arguments for a mineralised Upper Zone in the form of the T zone. Also, "continuous mineralisation" is perhaps somewhat of an overstatement.
Response: Changed as suggested by the examiner and so that the confusion is erased. The sentence has been deleted "Research on the Upper Zone thus far has indicated that the entire Upper Zone is barren in terms of PGE (Barnes *et al*., 2004)."

Chapter 4:

Examiner: Page 50, section 4.1 heading: "Candidate's contribution"
Response: Changed as suggested by the examiner.

Examiner: Page 50, 5th bullet point: "…susceptibility measurements conducted…"
Response: Changed as suggested by the examiner.

Examiner: Page 50, 6th bullet point: "…polished thin sections were analysed…"
Response: Changed as suggested by the examiner.

Examiner: Page 51, line 3: "…that extends 24 km northeast…"
Response: Changed as suggested by the examiner.

Examiner: Page 51, 1st para, last line: "…except in one drillcore from…"
Response: Changed as suggested by the examiner.

Examiner: Page 55, line 1: "…of the Magaliesberg formation, near…"
Response: Magaliesburg Formation is spelt incorrectly by the examiner and the capitalised F for Formation is correct in my geological understanding.
Examiner: Page 55, line 8: "…[Mg/(Mg + Fe)] up to 91…"
Response: Changed as suggested by the examiner.

Examiner: Page 57, 2nd para, line 4: "…the Zimbabwean and Kaapvaal cratons…"
Response: This document is already published.

Examiner: Page 57, 3rd para, line 5: "I am not convinced that the Waterberg platinum veins have been dated. If not, change your statement accordingly.
Response: This document is already published.

Examiner: Page 59, figure 4.3: "The spelling of "epidotised" differs between the figure and the figure caption.
Response: This document is already published. The spelling has been change in the figure caption as suggested by the examiner.

Examiner: Page 57, 2nd para, line 17: "…weakly mineralized intervals…"
Response: Changed as suggested by the examiner.

Examiner: Page 63, line 3: "(<72 wt. % SiO_2)"
Response: Changed as suggested by the examiner.

Examiner: Page 68, Table 4.1: Subscripts should be used for numbers in oxide formulae in the first column. The meaning of abbreviation used in the heading rows should be given.
Response: Changed as suggested by the examiner.

Examiner: Page 74, 2nd para, line 10, Sentence starting with "Ultramafic sequence": Is there perhaps a heading missing here?
Response: Changed as suggested by the examiner. The sentence need to have started on a new line and no there was no heading missing.

Examiner: Page 75, line 2: "…chromite-pyroxene lamellae, which…"
Response: Changed as suggested by the examiner.

Examiner: Page 75, line 5: I do not think the usage of the term "typomorphic" is correct in this instance.
Response: This document is already published.

Examiner: Page 75, line 11: "Cr_2O_3"
Response: Changed as suggested by the examiner.

Examiner: Page 75, line 13, Sentence starting with "Troctolite-gabbronorite-anorthosite sequence": Is there perhaps a heading missing here?
Response: Changed as suggested by the examiner. The sentence need to have started on a new line and no there was no heading missing.

Examiner: Page 77, line 19 and subsequent lines: Poorly written and duplicated. Please fix
Response: Changed as suggested by the examiner.

Examiner: Page 79, line 1: "Upper Zone." should also be indicated as a sub-heading
Response: There are no sub-headings for the stratigraphy of the Waterberg Project in this section of the published paper.

Examiner: Page 79, line 18: "SiO_2"
Response: Changed as suggested by the examiner.

Examiner: Page 79, line 23: "Geochemical comparison with other Bushveld mafic-ultramafic rocks" should also be indicated as a sub-heading
Response: There are no sub-headings for the stratigraphy of the Waterberg Project in this section of the published paper.

Examiner: Page 80, line 6: "…is ~100 m below the Pyroxenite Marker based…"
Response: Changed as suggested by the examiner.

Examiner: Page 81, 2nd para, line 1: "Mineralisation" should also be indicated as a sub-heading
Response: There are no sub-headings for the stratigraphy of the Waterberg Project in this section of the published paper.

Examiner: Page 83, table heading: "…with those in the eastern and western limbs of the Complex."
Response: Changed as suggested by the examiner.

Chapter 5:

Examiner: Page 87, section 5.1: "Candidate's contribution"
Response: Changed as suggested by the examiner.

Examiner: Page 90, Figure 5.1: "Archaean granite gneiss". On page 91 "Archean" is used along with "Archaean". Please check for consistency in usage
Response: Changed as suggested by the examiner.

Examiner: Page 91, line 16: "…hosts a 100 m thick troctolitic horizon, 100 m above the base, which does not occur in the Main Zone in the rest of the BC…"
Response: This document is already published.

Examiner: Page 91, 1st para, 2nd last line: "…between borehole cores in the…"
Response: Changed as suggested by the examiner.

Examiner: Page 91, 2nd para, line 5: "…exoskarns as well as reef style…"
Response: Changed as suggested by the examiner.

Examiner: Page 92, 1st para, line 10: "…by a significantly lower tenor,…"
Response: Changed as suggested by the examiner.

Examiner: Page 92, 2nd para, line 5: "…Harriet's Wish…"
Response: Changed as suggested by the examiner.

Examiner: Page 92, last para, line 3, sentence starting with "The Southern Marginal Zone": Poorly phrased. Rewrite.
Response: This document is already published.

Examiner: Page 92, last line: "exposed parts of the complexes" – which complexes are being referred to here?
Response: This document is already published.

Examiner: Page 93, 2nd para, line 3: "…and dips at 34-38° NW…"
Response: Changed as suggested by the examiner.

Examiner: Page 93, 4th para: Here "Archean" See comment above and change where necessary to improve consistency of usage.
Response: Changed as suggested by the examiner. "Archaean" is changed to "Archean" throughout the document.

Examiner: Page 96, 3rd para, line 16: "I am not sure what is meant by "…in the ALS Minerals…". Please clarify.
Response: "…by ALS Minerals…" as seen in final published document.

Examiner: Page 98, 3rd para, line 4: I am not convinced that the usage of the term "granoblastic" is appropriate here. Was the orthopyroxenite metamorphosed?
Response: "Fragments of granoblastic orthopyroxenite with well-defined contacts within the overlying feldspathic harzburgite are interpreted as xenoliths trapped by a later magma influx." As seen in the published document. The granoblastic orthopyroxenite are xenoliths so there is a degree of metamorphism.

Examiner: Page 100, line 3: "perfect correlation" may be an overly strong statement
Response: This document is already published.

Examiner: Page 100, 3rd para, line 2: "…much higher Cu/Pd ratio and are likely…"
Response: Changed as suggested by the examiner.

Examiner: Page 103, 2nd para, line 9: I cannot figure out what the "an." refers to in the reference to Supplementary Table 5.5. Analysis? But this not make sense. Please clarify.
Response: The "an." stands for the analysis and refers to the 2nd analysis in that specific supplementary table. This document is already published.

Examiner: Page 103, 3rd para, line 2: "…covellite [CuS] are secondary…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 103, 4th para, line 4: I cannot figure out what the "an." refers to in the reference to Supplementary Table 5.5. Analysis? But this not make sense. Please clarify.
Response: The "an." stands for the analysis and refers to the 12th and 36th analysis in that specific supplementary table. This document is already published.

Examiner: Page 106, line 6: "Both valleriite-like minerals reveal features…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 106, 2nd para, line 1: "Primary sulphide blebs in the F zone…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 106, 2nd para, line 1: The formula for stichtite is incorrect. Please Fix
Response: Changed as suggested by the examiner and as seen in the final published document. "Stichtite [$Mg_6Cr_2CO_3$ (OH) 16x4H_2O]".

Examiner: Page 106, 2nd para, line 7: "…complete psuedomorphs after chromite…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 106, 4th para, first sentence: Poorly written. Rewrite.
Response: This document is already published.

Examiner: Page 106, last line: "…arsenopyrite [FeAsS], secondary millerite [NiS], pyrite…"
Response: This document is already published.

Examiner: Page 107, line 4: "…through the whole zone…"
Response: Changed as suggested by the examiner.

Examiner: Page 107, 2nd para, line 2: "…migration of immiscible sulphide melts…"
Response: Changed as suggested by the examiner.

Examiner: Page 107, 2nd para, line 4: "…and as flames-like exsolutions in pyrrhotite"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 107, 3rd para, line 2: "…new crusts, pseudomorphs after silicates and…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 109, 2nd para, last line: "(Table 5.1 and 5.2)"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 110, 2nd para, line 2: Here it stated that Pt-Pd-Bi-Te phases account for 9-34% of PGMs. However, Table 5.1 suggests a maximum values of 32%. Which is correct?
Response: Changed as suggested by the examiner and as seen in the final published document. 9-32% is correct.

Examiner: Page 110, last para, line 4: "…Pt-Fe alloy. Euhedral isoferroplatinum and cooperite…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 111, 2nd para, line 4: "…be explained by an assumed Pd…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 111, Table 5.2: The table does not show what the caption claims. Fix
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 114: Table is not correct. Fix
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 114, line 2: "Eighty-seven grains, mostly…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 116, Figure 5.11: This figure clearly does not show images of the mineral separates. I suspect the figure caption is incorrect and should in fact have been the figure caption for Figure 5.12. The same problem is therefore encountered with Figure 5.12 on page 117.
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 116: This table is also not correctly referenced. Fix.

Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 119, 2nd para, line 11: I do not agree with the fact that the correlations are "perfect"
Response: This document is already published.
Examiner: Page 119, last para, line 2: "The chromitite seams bounding the stratiform…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 120, line 2: "…whereas chromitite seams 1-20 cm thick…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 120, 2nd para, line 14: "…of the Platreef are the thickest reefs in the BC…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 120, 3rd para, last line: "…and not a stratiform reef."
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 120, last para, line 1: "The recent discovery of high-grade PGE mineralisation…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 128, Figure 5.15 caption: Here again the usage is "Archaean". Please ensure consistency of usage.
Response: Changed as suggested above.

Chapter 6

Examiner: Page 132, section 6.1 heading: "Candidate's contribution:"
Response: Changed as suggested by the examiner.

Examiner: Page 133, abstract, 5th line from the bottom: "…and the stratigraphic position of…"
Response: Changed as suggested by the examiner.

Examiner: Page 134, first line of text: "…of the Bushveld Complex…"
Response: Changed as suggested by the examiner.

Examiner: Page 134, 1st para, 2nd last line: "…in the apparent Main Zone of the Aurora project…"
Response: Changed as suggested by the examiner.

Examiner: Page 134, 2nd para, line 5 and 7: Decide between "Archean" and "Archaean", here and throughout.
Response: Changed as suggested by the examiner. Changed to "Archean throughout the document.

Examiner: Page 134, 2nd para, line 6: "…into a lower Chuniespoort Group and an upper Pretoria Group…"
Response: Changed as suggested by the examiner.

Examiner: Page 135, 2nd para, line 4: "…was emplaced in trough-like depressions…"
Response: Changed as suggested by the examiner.

Examiner: Page 135: I would suggest moving the section on the Platreef to between paragraphs 2 and 3 on this page. As it currently stands, you jump from the LZ straight on to the MZ, which can be confusing to uninitiated readers.

Response: Reference added as suggested by the examiner.

Examiner: Page 135, 3rd para, line 4: Ashwal et al. (2005) only studied the upper Main Zone in the Northern Limb. If you want to make a general statement on the stratigraphy of the Main Zone in the Northern Limb, you'll also have to include Roelofse and Ashwal (2012), who described the lower Main Zone, as a reference.
Response: Reference added as suggested by the examiner.

Examiner: Page 136, line 1: "The Platreef is a complex PGE-, Cu- and Ni-bearing body situated…"
Response: Changed as suggested by the examiner.

Examiner: Page 136, line 3: "The Platreef is not a simple tabular deposit. The orientation varies from south to north, generally dipping at 45^{o} to the west, and flattens with depth where it is then termed the Flatreef, dipping at 10^{o} to 15^{o} southwest…"
Response: Changed as suggested by the examiner.

Examiner: Page 136, 2nd para, 2nd last line: "In addition, the Waterberg mineralisation…"
Response: Changed as suggested by the examiner.

Examiner: Page 136, 3rd para, line 1: "…a >3.5 x 24 km lobate body north…"
Response: Changed as suggested by the examiner.

Examiner: Page 136, 3rd para, line 3: "The Waterberg PGE deposit, discovered by Platinum Group Metals (Ltd) (RSA) in 2011, has a NE-SW…"
Response: Changed as suggested by the examiner.

Examiner: Page 136, 3rd para, line 7: "…depending on structural and tectonic controls…"
Response: Changed as suggested by the examiner.

Examiner: Page 136, 3rd para, line 8: "…gives intrusion ages of…"
Response: Changed as suggested by the examiner.

Examiner: Page 136, 3rd para, last line: "…rest of the Bushveld Complex."
Response: Changed as suggested by the examiner.

Examiner: Page 137, 2nd para, line 3: "(McCreesh and Kinnaird, 2014)"
Response: Changed as suggested by the examiner.

Examiner: Page 137, last line: "A dolerite sill with a maximum thickness of 200 m, but typically ~80 m thick, is intercepted…"
Response: Changed as suggested by the examiner.

Examiner: Page 139, 1st para, line 3: "The footwall rocks are composed of granofels and pyroxenite,…" Is this correct? Would suggest making a choice between listing minerals / lithologies.
Response: Changed as suggested by the examiner.

Examiner: Page 139, 1st para, 4th last line: "…units have gradational contacts…"
Response: Changed as suggested by the examiner.

Examiner: Page 139, 2nd para, line 2: "…at the base that is approximately 23 m thick, which grades upwards into…"

Response: Changed as suggested by the examiner.

Examiner: Page 139, 2nd para, line 8: "…sulphide-bearing gabbronorite. This is the mineralised…"
Response: Changed as suggested by the examiner.
Examiner: Page 139, 2nd para, 2nd last line: "…and the underlying T2 that is composed of…"
Response: Changed as suggested by the examiner.

Examiner: Page 139, 3rd para, line 1: "…in this core. The boundary was determined by magnetic susceptibility and the appearance of fine-grained, disseminated titanomagnetite."
Response: Changed as suggested by the examiner.

Examiner: Page 139, last line: "…at a depth of 176.73 m."
Response: Changed as suggested by the examiner.

Examiner: Page 140, first line: "banded arkose"
Response: Changed as suggested by the examiner.

Examiner: Page 140, 1st para, line 3: "…sill that crosscuts…"
Response: Changed as suggested by the examiner.

Examiner: Page 140, 2nd para, line 1: "…from the north-eastern portion of the farm Ketting 368LR…"
Response: Changed as suggested by the examiner.

Examiner: Page 140, 2nd para, line 2: "…has alternating felsic-rich and pyroxenite-rich bands. The pyroxenite-rich…"
Response: Changed as suggested by the examiner.

Examiner: Page 140, 3rd para, last line: "…towards the base, coarse, blebby sulphides…"
Response: Changed as suggested by the examiner.

Examiner: Page 140, 4th para, line 1: "The UZ is marked by the appearance of fine-grained interstitial magnetite, the presence of which is supported…"
Response: Changed as suggested by the examiner.

Examiner: Page 140, 4th para, line 2: "…in this borehole (Fig. 6.2) and is predominately…"
Response: Changed as suggested by the examiner.

Examiner: Page 140, 5th para, line 1: "The Waterberg (WB) sedimentary rocks have a sharp contact with the underlying Bushveld rocks and have an apparent thickness of 520.97 m."
Response: Changed as suggested by the examiner.

Examiner: Page 141, line 1: "…chocolate-coloured mudstone…"
Response: Changed as suggested by the examiner.

Examiner: Page 141, line 3: "…of the two sills occurs from 361.59 m to 443.20 m in this borehole (Fig. 6.2) and the other, thinner sill…"
Response: Changed as suggested by the examiner.

Examiner: Page 141, line 4: "The dolerite sills have well-defined chilled margins on both their upper and lower contacts and are generally coarse-grained towards the centre, with extensive chloritisation and epidotisation."

Response: Changed as suggested by the examiner.

Examiner: Page 141, Figure 6.2 caption: "Lithological columns of boreholes (a) WB017 and (b) WB099 showing the stratigraphy and lithologies intercepted at depth…"
Response: Changed as suggested by the examiner.

Examiner: Page 141, 2nd last line: "…were done along the lengths of…"
Response: Changed as suggested by the examiner.

Examiner: Page 142, 2nd para, line 2: "…for polished sections, geochemical…"
Response: Changed as suggested by the examiner.

Examiner: Page 142, 2nd para, line 4: "…boreholes. Visually estimated modal abundances…."
Response: Changed as suggested by the examiner.

Examiner: Page 142, 2nd para, line 5: "…classification of rock types were based on the cumulus and intercumulus minerals present as per…"
Response: Changed as suggested by the examiner.

Examiner: Page 142, 3rd para: This paragraph is in need of significant improvement, both in terms of content and language.
Response: Rephrased "Samples were crushed, milled in a tungsten carbide mill, and analysed at the Earth laboratory, Bernard Price Building, University of the Witwatersrand. Whole-rock major elements were analysed by PANalytical PW2404 X-ray fluorescence (XRF) using the fused disk method. Trace elements content were also determined by the PANalytical PW2404 X-ray fluorescence (XRF) using pressed pellets and matrix-matched standards, and a detailed description of analytical procedure can be found in Wilson (2012). The Pt, Pd and Au data was provided by Platinum Group Metals Ltd RSA (PTM)."

Examiner: Page 142, 4th para, line 1: "Electron probe microanalysis data acquisition took place at Department of Geology, Rhodes University, utilising…"
Response: Changed as suggested by the examiner.

Examiner: Page 142, 4th para, line 3: "…were: acceleration voltage…"
Response: Changed as suggested by the examiner.

Examiner: Page 142, 4th para, line 5: "…with a beam spot of 1 μm in diameter. The standards used for quantifying the characteristic…"
Response: Changed as suggested by the examiner.

Examiner: Page 142, 4th para, line 5: "…albite standard (sd) for Na…"
Response: sd – standard

Examiner: Page 143, 1st para, line 2: "…through the two boreholes (Fig. 6.2). The granofels…"
Response: Changed as suggested by the examiner.

Examiner: Page 143, 1st para, line 7: "…content decreases. Above the olivine-bearing lithologies, the susceptibility values are very low (0.05 SI units), consistent…"
Response: Changed as suggested by the examiner.

Examiner: Page 143, 1st para, line 11: "…thin olivine-rich intervals (Fig. 6.2)."

Response: Changed as suggested by the examiner.

Examiner: Page 143, 1st para, line 15: "…associated with incoming disseminated titanomagnetite of the UZ (Fig. 6.2)."
Response: Changed as suggested by the examiner.

Examiner: Page 143, 2nd para, line 1: "…a banded granofels consisting of alternating felsic and mafic-rich units, similar to that seen in the northern limb where Bushveld lithologies overlie Achaean granite gneiss (Cawthorn *et al*., 1985). This interval is sometimes overlain by fine-grained gabbronorite…"
Response: Changed as suggested by the examiner.

Examiner: Page 144, 2nd para, line 1: "The base of the TGA…"
Response: Changed as suggested by the examiner.
Examiner: Page 144, 2nd para, line 3: "…has disseminations and clusters…"
Response: Changed as suggested by the examiner.

Examiner: Page 144, 2nd para, line 9: "The T1 is generally coarse-grained and composed…"
Response: Changed as suggested by the examiner.

Examiner: Page 144, 2nd para, 3rd last line: "…to pegmatoidal and composed of plagioclase…"
Response: Changed as suggested by the examiner.

Examiner: Page 144, 3rd para, last line: "…although this was not identified…"
Response: Changed as suggested by the examiner.

Examiner: Page 145, Figure 6.3 caption: Kindly add something like "Image taken in cross polarised, transmitted light.
Response: Changed as suggested by the examiner.

Examiner: Page 146, 1st para, line 2: "…6.7. The data are also shown on relevant classification diagrams in Fig. 6.4."
Response: Changed as suggested by the examiner.

Examiner: Page 146, 1st para, line 7: "…82). These values are similar…"
Response: Changed as suggested by the examiner.

Examiner: Page 146, 1st para, line 9: "…the UmS ranges from…"
Response: Changed as suggested by the examiner.

Examiner: Page 146, Figure 6.4 caption: It is stated here that compositions are for mineral separates. The analytical methods section makes no mention of how mineral separates were prepared. Were mineral chemistry data not collected on polished sections by EPMA? If so, correct caption. If not, mention in analytical methods sections how mineral separates were prepared and analysed.
Response: Changed as suggested by the examiner. A paragraph has been added to the methodology explaining the preparation for mineral separates. "The remaining portion of the quarter-core samples were crushed, milled and sieved to an approximate size (250-100 μm). These samples were then cleaned with water and dried in an oven at 80^{o}C. Mineral grains of orthopyroxene, clinopyroxene, plagioclase and olivine were picked under the microscope and placed on double-sided tapes in rows according to the sample. A circular mold is placed over the grains and an Epofix

Resin is poured into the mold to make ore blocks. The ore blocks sent for carbon-coating and the samples are ready to undergo the microprobe analysis."

Examiner: Page 147, first two sentences: Poorly written. Rewrite
Response: Changed as suggested by the examiner. Rephrased "The UmS contains minor amounts of clinopyroxene as this stratigraphic unit is dominated by orthopyroxene. The clinopyroxene values obtained from the UmS sequence have an Mg# between 82 and 89 which are slight higher than the low-Ca pyroxene values (Fig. 6.6)."

Examiner: Page 147, 2nd para, lines 6 and 7: should "Mg" not be "Mg#" in both lines?
Response: Yes**,** Changed as suggested by the examiner.

Examiner: Page 147, 2nd para, lines 7: "…6.6). Similar features are seen…"
Response: Changed as suggested by the examiner.

Examiner: Page 147, 3rd para, lines 5: "The plagioclase in the T zone has compositions…"
Response: Changed as suggested by the examiner.

Examiner: Page 148, Figure 6.5 caption: Again, were mineral separates used for mineral chemistry? Also, the figure does not show any purple or red lines at the caption suggests. Add them.
Response: The mineral separates method has been add to the methodology. The caption has been amended.

Examiner: Page 148, last sentence running onto next page: Poorly written. Rewrite
Response: Changed as suggested by the examiner. Rephrased "The overlying troctolite unit at the base of the TGA sequence from 1270.16 m to 1208.00 m, has a restricted composition for olivine (Fo_{76-80}, average Fo_{77}, NiO wt. % 0.23 to 0.27) (Fig. 6.7)."
Examiner: Page 149, lines 4:"…olivine with a restricted compositional range…"
Response: Changed as suggested by the examiner.

Examiner: Page 149, Figure 6.6 caption: Again, were mineral separates used for mineral chemistry? Also, the figure does not show any purple or red lines at the caption suggests. Add them.
Response: The mineral separates method has been add to the methodology. The caption has been amended.

Examiner: Page 149, Figure 6.7: The figure caption is poorly written. Rewrite.
Response: Rephrased "Figure 6.7: The proportions of olivine, orthopyroxene (Opx), clinopyroxene (Cpx), plagioclase and Quartz (Qtz) and orthoclase (Or) through the stratigraphy of WB099. The olivine (Mg#) and plagioclase (An#) are also shown through the stratigraphy of borehole WB099."
Also, the anorthosite intervals in the lithology log do not coincide with the most plagioclase-rich intervals as shown in the mineral proportions log. Is this an artefact of sample spacing or is something wrong with the diagram.
Response: This was an artefact of sample as at the time we were not sure if we were going to include plagioclase in the microprobe study.

Examiner: Page 150, 1st para, lines 4: "very low or high geochemical data have been omitted." Poorly phrased. Rewrite.
Response: Rephrased "Therefore, some of the extremely altered lithologies, xenoliths or quartz-feldspathic veins are omitted on many diagrams either because of their very low or very high values."

Examiner: Page 150, 1st para, lines 5: "have any compositional constraints" – What does this mean?
Response: "have any compositional similarities,…"

Examiner: Page 150, 2nd para, lines 3: "…with an Mg# of 78 at the base that decreases upwards…"
Response: Changed as suggested by the examiner.

Examiner: Page 150, 2nd para, last lines: New paragraph before sentence starting with "The CaO/Al_2O_3 ratio…"
Response: Changed as suggested by the examiner.

Examiner: Page 151, lines 1: "Pure plagioclase has a ratio of 0.6 and orthopyroxene contains minimal amounts of either element, therefore amounts above or below 0.6 suggest the presence of clinopyroxene or possible reactions with dolomite."
Response: Changed as suggested by the examiner.

Examiner: Page 151, 2nd para, first sentence: This sentence should be add to end of the previous paragraph.
Response: Changed as suggested by the examiner.

Examiner: Page 151, 2nd para, line 7: Sentence starting with "There is a sudden" is poorly written and should be rewritten. The same applies to the two subsequent sentences as well.
Response: Changed as suggested by the examiner. Rephrased "At the base of the T2 there is an increase in the $Sr:Al_2O_3$ ratio that decrease gradually towards the top of the T1, from 18 to 10. The UZ samples show a range from 2 to 8 associated with the $Sr:Al_2O_3$ ratio. According to Kinnaird (2005) the Al_2O_3:FeO+MgO ratio varies with changing pyroxene to plagioclase proportions and sudden changes may indicate whether more than one magma involved in forming the Bushveld succession. There is only one significant change in the Al_2O_3:FeO+MgO ratio at the contact between the UmS and TGA sequence in the Waterberg stratigraphy."

Examiner: Page 151, 2nd para, line 16: "The Fe_2O_3 values…"
Response: Changed as suggested by the examiner.

Examiner: Page 151, 2nd para, line 18: Sentence starting with "The TiO_2 vary…" is poorly written and should be rewritten.
Response: Changed as suggested by the examiner. Rephrased "The TiO_2 content in the UmS varies depending on the lithologies, the feldspathic orthopyroxenite samples have higher TiO_2 values (0.14 and 0.23 wt. %) and the TiO_2 content ranges between 0.06 to 0.08 wt. % for the harzburgite and mela-troctolite samples."

Examiner: Page 151, 2nd para, line 22: "Both the UmS and the T zone show large variations in Sr values, whereas…"
Response: Changed as suggested by the examiner.

Examiner: Page 152, Figure 6.8 caption: "Whole-rock major and trace element…"
Response: Changed as suggested by the examiner.
Examiner: Page 153, Figure 6.8 caption: "Whole-rock trace element geochemical …"
Response: Changed as suggested by the examiner.

Examiner: Page 153, 1st para, line 2: "…as do one of the overlying harzburgite samples 2200 ppm Cr (Fig. 6.9a)."
Response: Changed as suggested by the examiner.

Examiner: Page 153, 1st para, line 4: It is stated that the Cr content is fairly constant over the TGA sequence. From Fig 6.9a, I would actually suggest that we see an upward decrease in Cr content.
Response: Agreed, changed as suggested by the examiner. "The TGA sequence shows an upward decrease in Cr content (Fig. 6.9a)."

Examiner: Page 153, 1st para, line 6: It is stated that the UZ has Cr up to 700 ppm. The data in Fig 6.9a show a sample with higher Cr. Was this assumed to be an outlier and for that reason not discussed?
Response: Agreed, changed as suggested by the examiner. "The overlying UZ has the largest variation in terms of Cr between 50 to 2400 ppm (Fig. 6.9a)."

Examiner: Page 154, line 1: "…harzburgite sample, although there is…"
Response: Changed as suggested by the examiner.

Examiner: Page 154, 2nd para, line 3: "…by Pd. The mineralised interval is approximately…"
Response: Changed as suggested by the examiner.

Examiner: Page 154, 2nd para, line 8: "…and Cr. Where there are grade maxima, these correspond with Cr minima (Fig. 6.10)."
Response: Changed as suggested by the examiner.

Examiner: Page 154, 2nd para, line 12: "There is generally a good correlation with…"
Response: Changed as suggested by the examiner.

Examiner: Page 154, 2nd para, 5th last to last line: Poorly written. Rewrite.
Response: Changed as suggested by the examiner. Rephrased "The Cu/Pd values is a good indicator of sulphide melt enrichment due to a contrast in Cu and Pd partitioning coefficient into sulphide melt during the exchange with silicate melts (Barnes and Maier 2002; Naldrett *et al*. 2009). The Cu/Pd values are between 250 and 600 associated with grades greater than 2 g/t of 2PGE+Au. The F mineralised zone hosts disseminated, blebby and semi-massive sulphides with accessory chromite, the PGE comprise 65% Pd, 30% Pt, and 5% Au with 0.07% Ni and 0.17% Cu (Table 6.1) (PTM 2016). The dominant PGM that occur in the F zone are sperrylite (up to 82%) and Pt-Pd bismuthotellurides (up to 32%) and there is a lack of PGE sulphides (McCreesh *et al*., 2018)."

Examiner: Page 155, Figure 6.10: What is the purpose of the "F zone" labels on the Cu/Pd plots?
Response: If you look closer there are orange dashed lines showing where the F Zone mineralisation occurs in both the FH and FP sections of the UmS.

Examiner: Page 155, line 3: "…in WB017 with narrow intervals with <2 g/t."
Response: Changed as suggested by the examiner.

Examiner: Page 155, line 4: What is meant by "ascents of olivine?"
Response: Changed as suggested by the examiner. "ascents" to"…the absence of olivine,…"

Examiner: Page 155, line 6: "…is extremely low (<300 ppm) and there is…"
Response: Changed as suggested by the examiner.

Examiner: Page 156, Figure 6.11: What is the purpose of the "T zone" labels on the Cu/Pd plots?
Response: If you look closer there are orange dashed lines showing where the T1 and T2 subzone mineralisation occurs in both the TGA sequence and the UZ.

Examiner: Page 156, Table 6.1: There is no reference to this table in the text. Include in-text reference and discuss the contents of the table where appropriate.
Response: Table 6.1 has been reference in the text.

Examiner: Page 156, 2nd last line: "…chemistry, which may indicate two…"
Response: Changed as suggested by the examiner.

Examiner: Page 157, 1st para, line 5: "…with the floor rocks to produce a granofels unit similar to the floor rocks on Overysel."
Response: Changed as suggested by the examiner.

Examiner: Page 157, 1st para, line 8: "…orthopyroxenites are primitive…"
Response: Changed as suggested by the examiner.

Examiner: Page 157, 1st para, line 9: "…where the whole-rock Mg# of 82 mirrors the Mg# of 82.5…"
Response: Changed as suggested by the examiner.

Examiner: Page 157, 1st para, line 10: "The uppermost harzburgite…"
Response: Changed as suggested by the examiner.

Examiner: Page 157, 2nd para, line 1: "…Olivine decrease upwards resulting in olivine-gabbronorite and appears…"
Response: Changed as suggested by the examiner.

Examiner: Page 157, 2nd para, line 5: "…the Mg# of 73 for large oikocryst of orthopyroxene…"
Response: Changed as suggested by the examiner.

Examiner: Page 157, 2nd para, last line: "…sequence of between 62 and 77."
Response: Changed as suggested by the examiner.

Examiner: Page 157, last para, line 3: "We suggest that the…"
Response: Changed as suggested by the examiner.

Examiner: Page 158, 1st para, line 3: "The T zone has a slightly lower Pt:Pd ratio of 0.55 and Ni:Cu ratio of 0.8. The olivine composition (Fo_{64-69}) is also low associated with the T1 zone."
Response: Changed as suggested by the examiner.

Examiner: Page 158, 1st para, line 6: "…concentration is similar to the basal F zone. The whole-rock geochemistry and mineral chemistry…"
Response: Changed as suggested by the examiner.

Examiner: Page 158, 2nd para, line 1: "…Complex hosts a significant Ni-Cu-PGE deposit that has sparked global interest…"
Response: Changed as suggested by the examiner.

Examiner: Page 158, 2nd para, sentence starting on line 4: Poorly written. Rewrite.
Response: Changed as suggested by the examiner. Rephrased "Hence, it is important to determine whether the Waterberg mineralisation is related to the Platreef-style (Kinnaird, 2005; Maier *et al*., 2008) or the Main Zone type of mineralisation found on their the Moorddrift farm (Maier and Barnes, 2010) or on the Aurora project (McDonald and Harmer, 2010; McDonald *et al*., 2017)."

Examiner: Page 158, 2nd para, 2nd last line: "…mineralisation in the upper Main Zone on the farm Moorddrift farm."
Response: Changed as suggested by the examiner.

Examiner: Page 158, 2nd last line: "However, Unit 1 on the Aurora project lacks the olivine-rich package and olivine is present only as a minor…"
Response: Changed as suggested by the examiner.

Examiner: Page 159, line 2: "…WB027. The Unit 1 sequence on Aurora…"
Response: Changed as suggested by the examiner.

Examiner: Page 159, line 6: "…however, the Cr-content (2500-4300 ppm) of low-Ca pyroxene in the overlying…"
Response: Changed as suggested by the examiner.

Examiner: Page 159, line 10: "…disseminations, clusters or stringers of chromites associated with Unit 1…"
Response: Changed as suggested by the examiner.

Examiner: Page 159, 1st para, last sentence: I do not concur that there is an anti-correlation between PGE and Cr.
Response: Where there are picks in PGE there is an extremely low Cr values. Although, directly above or below there is generally a pick in Cr. Therefore, the Cr shows an anti-correlation with PGE. A similar pattern was observed on the Aurora Project and the same terminology was used.

Examiner: Page 159, 2nd para, line 10: The sentence starting with "The An-content" and the subsequent 2 sentences are poorly written and in need of rewriting.
Response: Rephrased "The An content of plagioclase in the troctolite horizon and the F zone show similar irregular decreasing upward trends, although An values are slightly higher in the F zone. There is no record of sulphides mineralisation hosted in the troctolite horizon Ashwal *et al*. (2005). However, elevated Cr concentrations associated with pyroxenite layers above the troctolite horizon may suggest an influx of new magma and may have potential for PGE exploration Tanner *et al*. (2014). Ashwal *et al*. (2005), Roelofse and Ashwal (2012) and Tanner *et al*. (2014) provided a detailed stratigraphy of the northern limb, although there is an estimated ~490 m of the lower troctolite horizon unaccounted for (Roelofse and Ashwal, 2012)."

Examiner: Page 160, line 1: "…Waterberg project. Currently no published data on this portion of the troctolite horizon exist."
Response: Changed as suggested by the examiner.

Examiner: Page 160, 2nd para, line 5: "…and the overlying troctolite package…"
Response: Changed as suggested by the examiner.

Examiner: Page 160, 2nd para, line 6: "However, caution must be exercised when…"
Response: Changed as suggested by the examiner.

Examiner: Page 160, 2nd para, line 11: "The low-Ca pyroxene shows remarkable…"
Response: Changed as suggested by the examiner.

Examiner: Page 160, 2nd para, line 15: "…the UmS. Olivine associated with the mineralised…"

Response: Changed as suggested by the examiner.

Examiner: Page 160, 2nd para, line 20: "…noticeable differences as well."
Response: Changed as suggested by the examiner.

Examiner: Page 160, 2nd para, line 23: "…The mineralisation of the UmS is…"
Response: Changed as suggested by the examiner.

Examiner: Page 160, 2nd para, line 26: "However, according to Kinnaird *et al*. (2005), basal…"
Response: Changed as suggested by the examiner.

Examiner: Page 161, 1st para, last sentence: Poorly written. Rewrite.
Response: Rephrased "However, the F zone has some unique features, rather than indicating that this mineralised zone is directly related to the Platreef, we suggest that the F zone formed from a Critical Zone type melt (i.e. Platreef).

Examiner: Page 161, line 1: "…to be a common feature of mineralised zones associated with the higher stratigraphy of the northern limb, as seen in the Aurora project (Harmer *et al*., 2004; Maier *et al*., 2008; McDonald and Harmer, 2010; McDonald *et al*., 2017), and on Moordrift (Maier and Barnes, 2010; Holwell *et al*., 2013)."
Response: Changed as suggested by the examiner.

Examiner: Page 162, 1st para, line 4: "Yudovskaya *et al*. (2017) also recorded elevated…"
Response: Changed as suggested by the examiner.

Examiner: Page 162, 2nd para, line 3: "The sulphide mineralisation…"
Response: Changed as suggested by the examiner.

Examiner: Page 162, 2nd para, line 7: "In addition, parameters such as whole-rock Mg#, MgO and Cr for the Moorddrift are slightly higher compared to the T zone…"
Response: Changed as suggested by the examiner.

Examiner: Page 162, 3rd para, line 8: "…and both show magmatic sulphur…"
Response: Changed as suggested by the examiner.

Examiner: Page 162, 3rd para, line 9: "McDonald *et al*. (2017) showed the presence of a high abundance of inverted pigeonite in Unit 3,…"
Response: Changed as suggested by the examiner.

Examiner: Page 162, 2nd last line: "Unit 2 on Aurora has Low Cr (<250 ppm) concentrations, comparable…"
Response: Changed as suggested by the examiner.

Examiner: Page 163, line 1: "…higher within the T zone…"
Response: Changed as suggested by the examiner.

Examiner: Page 163, line 1: "The Mg# of 55-73 of Low-Ca pyroxene is slightly lower than the values obtained for the T-zone (Mg# 66-77), which increase…"
Response: Changed as suggested by the examiner.

Examiner: Page 163, line 3: "The MnO content in low-Ca pyroxene is significantly higher in Unit 2 compared with the T zone, being 0.30-0.73 wt. % and 0.30-0.43 wt. %, respectively. The Cr content…"
Response: Changed as suggested by the examiner.

Examiner: Page 163, line 6: Rewrite sentence starting with "The olivine-rich…"
Response: Rephrased "The olivine-rich lithologies within Unit 2 have forsterite values between 63 and 68 (McDonald *et al*., 2017) which are similar forsterite values for olivine-bearing lithologies in the T1 mineralised zone."

Examiner: Page 163, line 9: "…and the T zone, being 60-79 and 66-82, respectively. Although the An…"
Response: Changed as suggested by the examiner.

Examiner: Page 163, line 13: "…6.13). PGE grade maxima correspond invariably with Cr minima…"
Response: Changed as suggested by the examiner.

Examiner: Page 163, line 17: "…than the ratios obtained for the Platreef (McDonald and Harmer, 2010). All the observations on the mineralisation…"
Response: Changed as suggested by the examiner.

Examiner: Page 163, 1st para, last sentence: I do not agree with this statement. If there is a relationship between the T zone and the upper mineralisation at the Aurora project, why would that necessarily imply that Aurora is a southern facies of the T zone? Why not the other way round?
Response: This sentence has been removed

Examiner: Page 163, 2nd para, line 2: "…the approximately 4000 m thick…"
Response: Changed as suggested by the examiner.

Examiner: Page 163, 2nd para, line 4: "…and the UZ. These results were…"
Response: Changed as suggested by the examiner.

Examiner: Page 164, line 3: "…is different at the two boundary locations, we suggest that the T zone is…"
Response: Changed as suggested by the examiner.

Examiner: Page 164, figure 6.13 caption, line 2: "Aurora Project (both the ultramafic unit and the upper Main Zone mineralised zones)…"
Response: Changed as suggested by the examiner.

Examiner: Page 165, line 6: "The T2 hosts sporadic…"
Response: Changed as suggested by the examiner.

Examiner: Page 165, line 12: Rewrite sentence starting with "Although…"
Response: Rephrased "However, the mineral chemistry results for Unit 1 on Aurora project suggested that this unit is situated within the Main Zone, when comparing mineral chemistry to the Main Zone of the Bellevue drillcore (McDonald *et al*., 2017)."

Examiner: Page 165, 2nd para, line 1: "When considering the emplacement of the Waterberg magma, any…"
Response: Changed as suggested by the examiner.

Examiner: Page 165, 2nd para, line 4: "…dip in a completely different…"
Response: Changed as suggested by the examiner.

Examiner: Page 166, line 1: "These ultramafic lithologies were emplaced…"
Response: Changed as suggested by the examiner.

Examiner: Page 166, line 7: "…Au-poor (<5%) mineralisation with an uneven distribution of chromite observed as disseminations, clusters or seams, similar to…"
Response: Changed as suggested by the examiner.

Examiner: Page 166, line 9: "Calc-silicates are absent and there is…"
Response: Changed as suggested by the examiner.

Examiner: Page 166, line 12: "…that magma was contaminated by…"
Response: Changed as suggested by the examiner.

Examiner: Page 166, 2nd para, line 1: "…suggested a hiatus between the Platreef and Main Zone, implying that the Main Zone magma…"
Response: Changed as suggested by the examiner.

Examiner: Page 166, 2nd para, last two sentences: Poorly written. Rewrite.
Response: Rephrased "A better understanding of this contact will be revealed once underground mining operations begin. This contact may be a fundamental factor to the formation of the mineralisation in the upper TGA sequence."

Examiner: Page 166, last para, line 1: "The troctolite unit…"
Response: Changed as suggested by the examiner.

Examiner: Page 166, last para, 2nd last line: What do you mean by "impregnation" and by "peridotitic-rich and gabbroic-rich melt"?
Response: "Impregnation" changed to "intrusion"

Examiner: Page 167, line 1: "Subsequently, fractionation of…"
Response: Changed as suggested by the examiner.

Examiner: Page 167, 2nd para, line 6: "…to S^{-2} that contributed to sulphur saturation being attained…"
Response: Changed as suggested by the examiner.

Examiner: Page 167, 2nd para, line 8: "…as high as 1500 ppm…"
Response: Changed as suggested by the examiner.

Examiner: Page 167, 2nd para, 4th last line: "Therefore, the formation of the T1 zone…"
Response: Changed as suggested by the examiner.

Examiner: Page 168, (3): "The T zone is located at the boundary…"
Response: Changed as suggested by the examiner.

Chapter 7:

Examiner: Page 169, section 7.1 heading: "Candidate's contribution"
Response: Changed as suggested by the examiner.

Examiner: Page 169, 2nd bullet point: "…and the writing of the paper…"
Response: Changed as suggested by the examiner.

Examiner: Page 169, 3rd bullet point: "…in discussions during…"
Response: Changed as suggested by the examiner.

Examiner: Page 170, 1st para, line 6: "…close to the footwall, there are a few contaminated isotopic signatures which may be related to remobilisation of sulphides during later hydrothermal processes…"
Response: Changed as suggested by the examiner.

Examiner: Page 170, last sentence of the abstract: Poorly written. Rewrite
Response: Rephrased "The contribution of the sulphur isotopic signatures aided in determining the mantle origin of the mineralised zones and shows unqiue characteristic compared with the rest of the northern limb. There is little to no carbonate-rich or other sedimentary contamination to upgrade the sulphur in the mineralisation of the Waterberg deposit."

Examiner: Page 170, 2nd para, line 1: "Sulphur isotopic systematics have…"
Response: Changed as suggested by the examiner.
Examiner: Page 170, 2nd para, line 3: "…factors in producing sulphide mineralisation…"
Response: Changed as suggested by the examiner.

Examiner: Page 171, line 1: "Regardless of local contamination, the parental magmas of…"
Response: Changed as suggested by the examiner.

Examiner: Page 171, line 11: "…Limpopo belt, is not well…"
Response: Changed as suggested by the examiner.

Examiner: Page 171, 1st para, last sentence: Rephrase.
Response: Rephrased "Our findings also shed a light on a style mineralisation in the Waterberg area when comparing with the rest of the mineralised zones associated with the Bushveld Complex."

Examiner: Page 171, 2nd para, line 3: "…West Basins, preserved…"
Response: Changed as suggested by the examiner.

Examiner: Page 171, 2nd para, line 11: "…Formations. Successively northwards the Platreef…"
Response: Changed as suggested by the examiner.

Examiner: Page 172, 1st para, line 1: "…are hosted by three of…"
Response: Changed as suggested by the examiner.

Examiner: Page 172, 1st para, line 4: "…all outcrop at surface, and the southern limb (Bethal limb) is buried…"
Response: Changed as suggested by the examiner.

Examiner: Page 172, 1st para, line 5: This is an oversimplification of reality. Expand upon this statement or remove it.
Response: Changed as suggested by the examiner. The sentence "The five limbs of the Bushveld Igneous Complex generally dip at approximately 15° (Du Toit, 1929)" has been removed.

Examiner: Page 172, 1st para, line 9: "…into the Marginal, Lower, Critical, Main and Upper Zones based on lithologies and the appearance or disappearance of indicator minerals…"
Response: Changed as suggested by the examiner.

Examiner: Page 172, 2nd para, line 4: "…is exposed as a northwest striking sequence over 110 km in length and…"
Response: Changed as suggested by the examiner.

Examiner: Page 172, 2nd para, line 7: "…are recognised. The Platreef in the…"
Response: Changed as suggested by the examiner.

Examiner: Page 172, 2nd para, 4th last line (and throughout): "autoliths" not "autholiths"
Response: Changed as suggested by the examiner.

Examiner: Page 172, 2nd para, 2nd last line: "The Upper Zone-Main Zone boundary is determined…"
Response: Changed as suggested by the examiner.

Examiner: Page 173, 2nd para, line 1: "…composition, and contains autoliths and xenoliths of floor material,…"
Response: Changed as suggested by the examiner.

Examiner: Page 173, 3rd para, line 1: "…that down dip, where the Platreef gradually flattens, its sequence…"
Response: Changed as suggested by the examiner.

Examiner: Page 173, 3rd para, 2nd last line: "…reefs resemble closely that of the Merensky Reef…"
Response: Changed as suggested by the examiner.

Examiner: Page 173, last para, line 1: "…of discussion with regards to…"
Response: Changed as suggested by the examiner.

Examiner: Page 174, 1st para, last line: "…(and their mixtures) may…"
Response: Changed as suggested by the examiner.

Examiner: Page 174, 2nd para, line 1: "…north of the exposed northern limb…"
Response: Changed as suggested by the examiner.

Examiner: Page 175, line 1: "…intrusion is generally comprises of fine-grained pyroxenitic to gabbroic rocks that partially…"
Response: Changed as suggested by the examiner.

Examiner: Page 175, line 5: "…(i.e. elongated, irregular or tube-like bodies propagating as finger-like injections)…"
Response: Changed as suggested by the examiner.

Examiner: Page 176, 2nd para, line 5: "…magnetite-gabbronorite, but lacks magnetitite layers…"

Response: Changed as suggested by the examiner.

Examiner: Page 176, 2nd para, line 7: "…n the UZ may be difficult to identify. Therefore, a magnetic…"
Response: Changed as suggested by the examiner.

Examiner: Page 176, 3rd para, line 2: "…<10 m thick, although it can be up to 60 m…"
Response: Changed as suggested by the examiner.

Examiner: Page 176, last para, line 4: "…resulted in the supply…"
Response: Changed as suggested by the examiner.

Examiner: Page 177, 2nd para, last line: "…-11.6 and…"
Response: Changed as suggested by the examiner.

Examiner: Page 177, 3rd para, line 4: "…on Turfspruit yielded values…"
Response: Changed as suggested by the examiner.

Examiner: Page 177, 3rd para, 2nd last line: "…Buchanan and Rouse (1984) also reported…"
Response: Changed as suggested by the examiner.

Examiner: Page 177, 4th para, line 1: "…in sulphides from the GNPA…"
Response: Changed as suggested by the examiner.

Examiner: Page 177, 4th para, 2nd last line: "…later reported a similar…"
Response: Changed as suggested by the examiner.
Examiner: Page 177, last para, line 3: "…the primary sulphide assemblage…"
Response: Changed as suggested by the examiner.

Examiner: Page 179, last para, line 1: "Sulphur isotope data…"
Response: Changed as suggested by the examiner.

Examiner: Page 179, last para, line 2: Rewrite this sentence as it stands does not make sense.
Response: Rephrased "Holwell *et al*. (2007) sampled pyrite, chalcopyrite and millerite from granite-gneiss on the La Pucella farm and obtained $\delta^{34}S$ values ranging from -1.5 to 0.8 ‰.

Examiner: Page 181, line 2: "…that indicate a significant…"
Response: Changed as suggested by the examiner.

Examiner: Page 181, 2nd para, line 1: "…compositions have also been investigated…"
Response: Changed as suggested by the examiner.

Examiner: Page 181, 2nd para, 4th last line: "…Main Zone whole-rock samples in the eastern…"
Response: Changed as suggested by the examiner.

Examiner: Page 181, 3rd para, 2nd last line: "…the massive sulphide body showed a range of…"
Response: Changed as suggested by the examiner.

Examiner: Page 181, last para, 2nd last line: "The lower parts have…"
Response: Changed as suggested by the examiner.

Examiner: Page 182, 3rd para, line 1: "Samples were crushed and then sieved…"
Response: Changed as suggested by the examiner.

Examiner: Page 182, 3rd para, line 2: "Samples were then placed in the magnetic separator, to separate according to minerals magnetic properties…"
Response: Changed as suggested by the examiner.

Examiner: Page 182, 3rd para, line 5: "…to a powder. These samples were…"
Response: Changed as suggested by the examiner.

Examiner: Page 182, 3rd para, line 7: "…were made per batch. Standards included;…"
Response: Changed as suggested by the examiner.

Examiner: Page 182, last para, line 1: "…we report $\delta^{34}S$ isotope compositions of 36 sulphide separates from the…"
Response: Changed as suggested by the examiner.

Examiner: Page 182, last line: "…semi-massive occurrences associated with…"
Response: Changed as suggested by the examiner.

Examiner: Page 183, 5th para, line 1: "…zone hosts a typical…"
Response: Changed as suggested by the examiner.

Examiner: Page 183, 5th para, line 4: "Anomalous $\delta^{34}S$ values were obtained…"
Response: Changed as suggested by the examiner.

Examiner: Page 183, last para, line 1: "…*sequence:* disseminated chalcopyrite was sampled…"
Response: Changed as suggested by the examiner.

Examiner: Page 183, last para, 2nd last line: "…+0.21 ‰. A sulphide sample from anorthosite yielded a…"
Response: Changed as suggested by the examiner.

Examiner: Page 184, Table 7.1: What standard was used in the calculation of $\delta^{34}S$ values? Mention this in the table. V-CDT?
Response: Changed as suggested by the examiner. Add to the Methodology

Examiner: Page 186, line 3: "…forming a secondary sulphide assemblage…"
Response: Changed as suggested by the examiner.

Examiner: Page 186, last para, line 2: "…suggest that the immiscible…"
Response: Changed as suggested by the examiner.

Examiner: Page 186, last para, line 3: "…as an "R-factor"…"
Response: Changed as suggested by the examiner.

Examiner: Page 186, last line: "…mass of sulphide liquid…"
Response: Changed as suggested by the examiner.

Examiner: Page 187, line 3: "…higher, up to 10^6, compared to previously assumed lower values…"
Response: Changed as suggested by the examiner.

Examiner: Page 187, line 5: "…deposits as seen in the Waterberg…"
Response: Changed as suggested by the examiner.

Examiner: Page 187, 2nd para, line 1: "…of the Bushveld Complex were contaminated…"
Response: Changed as suggested by the examiner.

Examiner: Page 187, 2nd para, line 6: "…local floor rock contamination."
Response: Changed as suggested by the examiner.

Examiner: Page 188, line 1: "…and autoliths provides fluids with…"
Response: Changed as suggested by the examiner.

Examiner: Page 188, last para, line 1: "…is characterised by a homogenous…"
Response: Changed as suggested by the examiner.

Examiner: Page 188, last para, line 2: "…upgrade the sulphur budget. Contamination in a crustal chamber…"
Response: Changed as suggested by the examiner.

Examiner: Page 188, last para, line 7: "…shows a restricted range of sulphur isotopic variations as is seen elsewhere in the northern limb where the footwall is composed…"
Response: Changed as suggested by the examiner.

Chapter 8:

Examiner: Chapter 8: In this entire chapter, there is a tendency not to leave a space between a number and unit of the number. I have made no attempt to list all occurrences of this in the chapter. This has to be addressed, however, in the revised version of the thesis.
Response: There are no space between a number and unit of the number as this paper was published in Ore Geology Reviews and this is the standard of this journal. However, the changes have been made to the thesis as suggested by the examiner.

Examiner: Page 189, line 4: There is no Appendix A2.
Response: The appendix was not printed out due to its size (300 pages), however, an electronic copy of the appendices was submitted to the Faculty of Science at the University of the Witwatersrand and I am not sure why this document was not sent to you.

Examiner: Page 189, section 8.1 heading: "Candidate's contribution"
Response: Changed as suggested by the examiner.

Examiner: Page 191,2nd para, line 1: "…mafic to ultramafic…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 192, line 6: I might have mentioned this already, but I think the more common usage is "Villa Nora fragment" and not "Segment".
Response: This is a published document and "Segment" was used rather than "fragment".

Examiner: Page 194, Figure 8.2 caption, line 3: "Red rectangle highlights the…"
Response: This is a published document.

Examiner: Page 195, line 2: "…zone by Tanner *et al*. (2014)."
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 195, para 2, line 6: "…with the Main Zone. It has lower average…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 196, line 2: "…at surface and is in direct…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 196, para 2, line 9: "…N-S directed, long-lived tectonothermal…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 197, para 3, last line: "Calc-silicate xenoliths are absent."
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 197, last para, line 4: "The enigmatic troctolite has a…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 197, last line: "…non-deposition, structural…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 199, line 4: "…Upper Zone elsewhere in the Complex,…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 199, para 2, line 1: "…is a remarkable erosional unconformity overlain…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 199, 4th para, line 6: "…and will be the subject of…"
Response: Changed as suggested by the examiner.

Examiner: Page 200, line 3: "…of greater than 0.5 g/t over…"
Response: Changed as suggested by the examiner.

Examiner: Page 200, para 2, line 1: "…NQ size quartered core were…"
Response: Changed as suggested by the examiner.

Examiner: Page 200, para 2, last line: "…the University of the Witwatersrand…"
Response: Changed as suggested by the examiner.

Examiner: Page 200, para 3 and 4: Decide on the usage – "Sulphur" vs "Sulfide"
Response: Changed as suggested by the examiner.

Examiner: Page 200, last para, line 3: "…Ni-sulfide fire assay…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 200, last para, line 4: "Accuracy for all whole-rock geochemistry…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 200, last para, 2nd last line: "…for fire assays was estimated…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 200, figure 8.4 caption: "It has a 30º dip to the west."
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 201, 1st para, line 5: "…drill holes difficult…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 202, 3rd para, line 4: "…a generally decreasing crystal size…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 202, 5th para, line 4: "…Pyroxene may occur interstitially, as small…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 202, 5th para, line 5: "…altered by very fine-grained mineral…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 203, 2nd para, line 5: I am not familiar with the fact that "meso" can be used as a prefix to rock names. Darker varieties than usual can get the "mela" prefix and lighter than usual varieties the "leuco" prefix, but anything in between should in my opinion just be "troctolite" in this case.
Response: The candidate agrees with the examiner. However, the candidate is not the leading author of the paper and this paper is already in the public domain.

Examiner: Page 206, 2nd para, line 2: "…amounts of clino- and orthopyroxene."
Response: Changed as suggested by the examiner and as seen in the final published document.
Examiner: Page 207, line 3: "…that the rock types follow…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 207, 4th para, line 4: "…mean Ce/Sm_N for the TGA Sequence and marginal gabbronorite at 2.7 and 2.2, respectively."
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 208, last para, line 1: "…for fire assay…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 209, Table 8.1: Give meanings for the rock type abbreviations used. Also, used subscripts for numerals in oxide formulae.
Response: Changed as suggested by the examiner

Examiner: Page 212, para 3, line 3: "…versus Cu, Pt and Pt."
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 212, para 4, line 1: "…used to assess the validity of the…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 213, Figure 8.8: Move forward, closer to first in-text reference to it.
Response: This is a final published document.

Examiner: Page 214, para 3, line 1: "…the sections show a SW to NE-oriented,…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 215, Figure 8.9: Move forward, closer to first in-text reference to it.

Response: This is a final published document.

Examiner: Page 215, last line 1: Not sure what you wanted to say with "resources and resources,…"
Response: Deleted, and resources now the sentence stands as "It is important to stress, that this grade shell was not developed by Platinum Group Metals to indicate resources, but rather models our understanding of PGE distribution."

Examiner: Page 216, Figure 8.10: Move forward, closer to first in-text reference to it.
Response: This is a final published document.

Examiner: Page 217, line 4: "…to south magma flow) have been…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 217, para 2, line 10: "These place the succession…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 217, last para, 3rd last line: "Contrary to what has been described…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 219, Figure 8.11: Move forward, closer to first in-text reference to it.
Response: This is a final published document.

Examiner: Page 219, 2nd last line: "…REE patterns show near…"
Response: Changed as suggested by the examiner and as seen in the final published document.
Examiner: Page 221, Figure 8.12: Move forward, closer to first in-text reference to it.
Response: This is a final published document.

Examiner: Page 223, Figure 8.13: Move forward, closer to first in-text reference to it.
Response: This is a final published document.

Examiner: Page 224, Figure 8.14: Move forward, closer to first in-text reference to it.
Response: This is a final published document.

Examiner: Page 225, line 4: "…their space is taken…"
Response: Changed as suggested by the examiner and as seen in the final published document.

Examiner: Page 226, Figure 8.15: Move forward, closer to first in-text reference to it.
Response: This is a final published document.

Examiner: Page 227, Figure 8.16: Move forward, closer to first in-text reference to it.
Response: This is a final published document.

Examiner: Page 230, last para, line 1: "…a simple strike extension of…"
Response: Changed as suggested by the examiner and as seen in the final published document.

<u>Chapter 9:</u>

Examiner: Page 231, 3rd para, line 3: "…in Zimbabwe (2575 Ma)…"
Response: Changed as suggested by the examiner.

Examiner: Page 232, line 9: "…magmas interacted with the…"

Response: Changed as suggested by the examiner.

Examiner: Page 232, 2nd para, line 13: "…of the UmS. Similar features are seen in the…"
Response: Changed as suggested by the examiner.

Examiner: Page 232, 2nd para, line 15: "…e.g. the Rum and Muskox…"
Response: Changed as suggested by the examiner.

Examiner: Page 232, 2nd para, last line: "…lamellae are a common…"
Response: Changed as suggested by the examiner.

Examiner: Page 233, line 4: I think the reference to Figure 4.20 here is incorrect. The sentence should also be rephrased.
Response: The figure reference has been change to Fig. 4.21 seen in chapter 4. The sentence has been rephrased "The multi-element chondrite-normalised plots of the UmS lithologies show similar trends as the Lower Zone pyroxenites beneath the Platreef on Turfspruit which show a negative Nb-Ta anomaly, a variable negative Ti anomaly and a gently sloped Y and HREE pattern (Fig. 4.21)."

Examiner: Page 233, line 7: "…an average forsterite value of Fo_{82}."
Response: Changed as suggested by the examiner.

Examiner: Page 233, 2nd para, line 9: "…section hosts regular chromitite seams…"
Response: Changed as suggested by the examiner.

Examiner: Page 233, 2nd para, line 12: "…Furthermore, the Lower Zone is not known…"
Response: Changed as suggested by the examiner.

Examiner: Page 234, 2nd para, line 1: What do you mean by 89% modal orthopyroxenite. Do you mean the orthopyroxenite consist of 89% modal orthopyroxene, or that 89% of the LCZ consist of orthopyroxene? Please clarify
Response: 89% of the LCZ consists of orthopyroxenite. Removed "modal" as this suggests minerals of orthopyroxene. "The lower Critical Zone of the eastern and western limb is predominately orthopyroxenite, up to 89%..."

Examiner: Page 234, 3rd para, 2nd sentence: Poorly written. Rewrite.
Response: "Although in recent years thick succession of ultramafic lithologies have been discovered beneath the Platreef in certain localities, they have been correlated with the Lower Zone (Yudovskaya *et al*., 2013)."

Examiner: Page 234, 3rd para, last sentence: Poorly written. Rewrite.
Response: Rephrased "The Platreef is dominated by feldspathic pyroxenite (Armitage *et al*., 2002; Kinnaird *et al*., 2005; Nex *et al*., 2006; Holwell and McDonald, 2006), and down dip of the Platreef, more olivine-rich lithologies have been intercepted on the farms Akanani, Sandsloot and Turfspruit (Fig. 3.1), where the Platreef is composed of feldspathic pyroxenite, pyroxenite, feldspathic harzburgite, harzburgite and minor norite and gabbronorite (Yudovskaya *et al*., 2011; Mitchell and Scoon, 2012). Yudovskaya *et al*. (2011) indicate that the feldspathic pyroxenite consists of cumulus orthopyroxene, with up to 90 modal %, and the harzburgite has a poikilitic texture and may be plagioclase free, as well as been highly serpentinised, which are similar features seen in the UmS."

Examiner: Page 234, 4th para, line 5: "…of the UmS is highest…"
Response: Changed as suggested by the examiner.

Examiner: Page 235, last para, line 4: "…This occurs in a similar setting to the…"
Response: Changed as suggested by the examiner.

Examiner: Page 236, 2nd para, line 2: "…northern limb first described by…"
Response: Changed as suggested by the examiner.

Examiner: Page 236, 2nd para, line 3: "…similarities in terms of the…"
Response: Changed as suggested by the examiner.

Examiner: Page 236, 2nd para, line 4: "However, the orthopyroxene compositions of the UmS are more primitive and the Cr contents are significantly…."
Response: Changed as suggested by the examiner.

Examiner: Page 236, 3rd para, line 2: "…is the absence of calc-silicate…"
Response: Changed as suggested by the examiner.

Examiner: Page 236, 3rd para, line 3: "…hornfels xenoliths are common (Kinnaird and Nex, 2015), and in the central sector…"
Response: Changed as suggested by the examiner.

Examiner: Page 236, 3rd para, line 5: "…there are granitic xenoliths and dolomitic rafts…"
Response: Changed as suggested by the examiner.

Examiner: Page 236, last para, line 2: "…grades into a thick succession of…"
Response: Changed as suggested by the examiner.

Examiner: Page 237, line 1: "…susceptibility values, which resulted…"
Response: Changed as suggested by the examiner.

Examiner: Page 237, line 6: "…rather than being a true troctolite."
Response: Changed as suggested by the examiner.

Examiner: Page 237, line 9: "…xenoliths of medium-grained pyroxenite or feldspathic pyroxenite…"
Response: Changed as suggested by the examiner.

Examiner: Page 237, Table 9.2, columns 2 and 3, last row: "Generally"
Response: Changed as suggested by the examiner.

Examiner: Page 237, last para, line 1: "…is dominated by medium- to coarse-grained gabbronorite, norite and gabbro with minor layers of…"
Response: Changed as suggested by the examiner.

Examiner: Page 237, last para, 2nd last line: "…and low Cr concentrations compared to…"
Response: Changed as suggested by the examiner.

Examiner: Page 238, line 1: "…4.15). There is also…"
Response: Changed as suggested by the examiner.

Examiner: Page 238, line 2: Here it is stated that the MZ is well fractionated. This is not true. Roelofse and Ashwal (2012) described ~1000 m of lower MZ in the Northern Limb that shows

virtually no fractionation. It is true that the upper part of the MZ show well developed fractionation trends. Please adjust your statement to take what I have said into account.
Response: This section is talking about the TGA sequence and not the Main Zone of the northern limb and the rest of the Bushveld Complex. It states that the TGA sequence shows a fractionating trend upwards and indicates that these characteristics are similar to the Main Zone of the Bushveld Complex.

Examiner: Page 238, line 5: "…and it is ~3110 m the thick in the northern limb…"
Response: Changed as suggested by the examiner.

Examiner: Page 238, line 7: "The maximum thickness of the TGA sequence in the Waterberg area is ~850 m…"
Response: Changed as suggested by the examiner.

Examiner: Page 238, 1st para, 2nd last line: "…this may be directly associated…"
Response: Changed as suggested by the examiner.

Examiner: Page 238, Figure 9.1: The depths and positioning of the horizons within zones in this diagram is incorrect. The Main Zone in the Northern Limb north of Mokopane is much thicker than what you indicate. The position of the troctolite horizon within the MZ is also wrong. This Figure has to be fixed. Also, the caption should read: "…in the magmatic stratigraphy across…"
Response: Figure 9.1 has been edited to show that the Main Zone in the northern limb has a thickness of ~3110 m as suggested by the examiner and seen in Roelofse and Ashwal (2012), Ashwal *et al*. (2005) and Tanner *et al*. (2014). The position of the troctolite has been moved upwards as it is ~1000 m above the Platreef – Main Zone contact, this is a schematic diagram so the measurement are not 100 %, however, gives the readers a rough estimate to where the position of each unit.

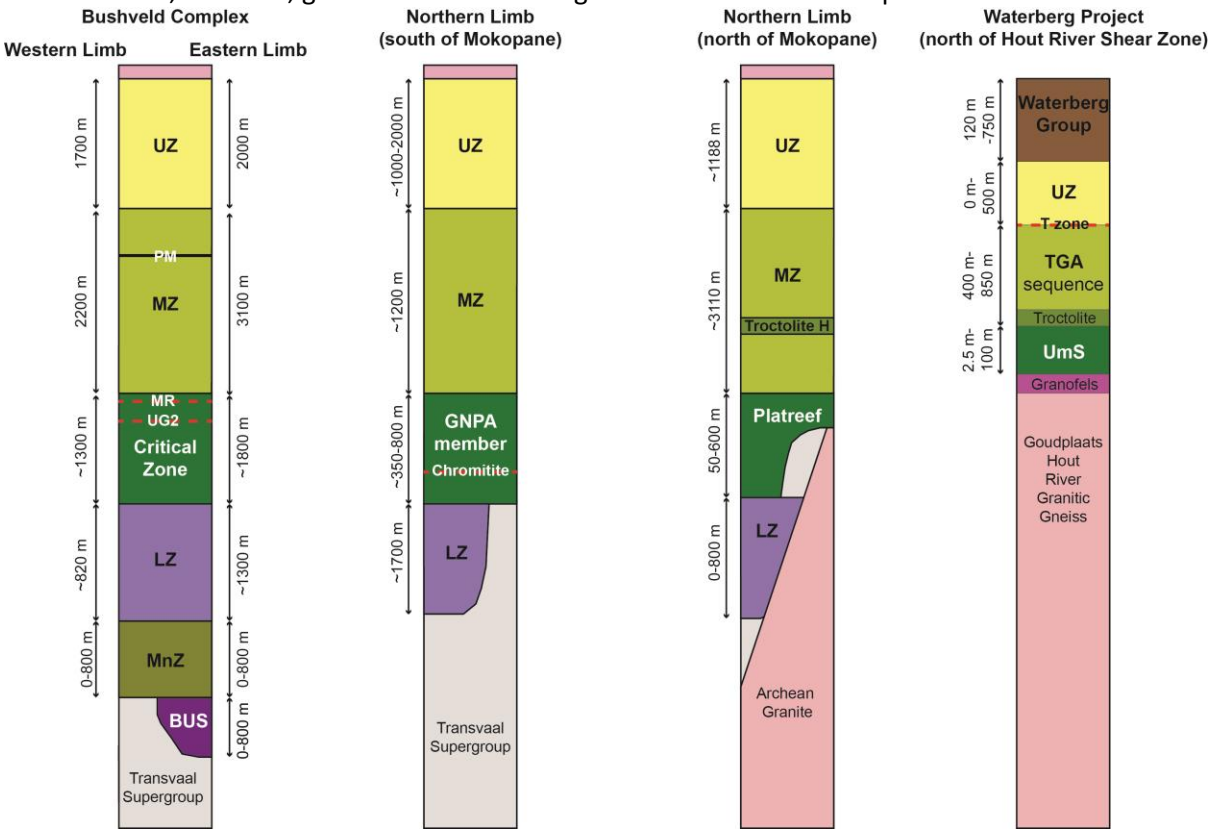


Figure 9.1: A schematic diagram of the differences and similarities in the magmatic stratigraphy across the Bushveld Complex. (Data from von Gruenewaldt, 1973; Molyneux, 1974; Cameron, 1978; Hulbert, 1983; Hulbert and von Gruenewaldt, 1985; Mitchell, 1990; Teigler *et al*., 1992; Eales and Cawthorn, 1996; Ashwal *et*

al., 2005; Kinnaird *et al*., 2005; Cawthorn *et al*., 2006; Maier and Barnes, 2010; Yudovskaya *et al*., 2011; Roelofse and Ashwal, 2012; Smith, 2014; Wilson, 2015).

Examiner: Page 239, line 4: "…position as the Pyroxenite Marker…"
Response: Changed as suggested by the examiner.

Examiner: Page 239, line 6: "…based on mineralogical contrasts…"
Response: Changed as suggested by the examiner.

Examiner: Page 239, line 9: "…in the TGA sequence (only thin layers that are discontinuous) and they are not…"
Response: Changed as suggested by the examiner.

Examiner: Page 239, 2nd para, line 6: "…In the western Bushveld, in the Marikana area,…"
Response: Changed as suggested by the examiner.

Examiner: Page 240, last para, line 6: "…Waterberg stratigraphy, with values ranging from An_{78} to…"
Response: Changed as suggested by the examiner.

Examiner: Page 241, line 2: "…show a similar upward fractionation trend from…"
Response: Changed as suggested by the examiner.

Examiner: Page 241, 1st para, last line: "…could not settle to form magnetite layers…"
Response: Changed as suggested by the examiner.

Examiner: Page 241, last para, line 7: "…although it lacks the magnetitite layers…"
Response: Changed as suggested by the examiner.

Examiner: Page 242, 1st para, line 4: "…is complex. While often very sharp and mylonitised, it is commonly…"
Response: Changed as suggested by the examiner.

Examiner: Page 242, 1st para, line 6: "…sediments is represented by a sharp…"
Response: Changed as suggested by the examiner.

Examiner: Page 242, 1st para, line 9: "…with subordinate chlorite and gibbsite…"
Response: Changed as suggested by the examiner.

Examiner: Page 242, 1st para, line 10: "…assemblages, indicate that the…"
Response: Changed as suggested by the examiner.

Examiner: Page 242, 2nd para, line 3: "…granite sheet capping the…"
Response: Changed as suggested by the examiner.

Examiner: Page 242, 2nd para, line 5: "…preserved the granitic roof…"
Response: Changed as suggested by the examiner.

Examiner: Page 242, 2nd para, line 6: "If we accept the argument by Dorland *et al*. (2006) that the preserved felsic rocks below the lower Swaershoek Formation of the Waterberg Group in the central Bushveld have not experienced much erosion and deformation, then serval kilometres of roof rock and Upper Zone are interpreted to have been eroded north of the Hout River Shear Zone…"
Response: Changed as suggested by the examiner.

Examiner: Page 243, line 5: "…within the sedimentary Waterberg…"
Response: Changed as suggested by the examiner.

Examiner: Page 243, 2nd para, line 4: "…with evidence of channel flows…"
Response: Changed as suggested by the examiner.

Examiner: Page 243, 2nd para, line 6: "The abundance of zircons of Archean age in the samples may indicate that the…"
Response: Changed as suggested by the examiner.

Examiner: Page 243, last para, line 4: "…although it is usually intercepted…"
Response: Changed as suggested by the examiner.

Examiner: Page 244, 2nd para, line 11: "…Waterberg stratigraphy, namely a basal F mineralised…"
Response: Changed as suggested by the examiner.

Examiner: Page 244, 2nd para, line 13: "…similar characteristics to mineralised intervals found elsewhere in the Bushveld Complex, although it simultaneously shows unique features."
Response: Changed as suggested by the examiner.

Examiner: Page 244, last para, line 2: "…feldspathic orthopyroxenite and…"
Response: Changed as suggested by the examiner.

Examiner: Page 245, 2nd para, line 10: "The chromitite seams bound…"
Response: Changed as suggested by the examiner.

Examiner: Page 245, 2nd para, line 15: "…on significant differences in…"
Response: Changed as suggested by the examiner.

Examiner: Page 245, 2nd para, line 19: "…Recent down dip drilling on the farms Turfspruit, Akanani and Sandsloot, have intercepted Pt-rich stratiform reef-style mineralisation in the upper part of the Platreef, which has a remarkable resemblance to the upper Critical Zone and Merensky Reef…."
Response: Changed as suggested by the examiner.

Examiner: Page 246, line 6: "…stratabound deposit similar…"
Response: Changed as suggested by the examiner.

Examiner: Page 246, line 8: "…occurs interstitially to orthopyroxene…"
Response: Changed as suggested by the examiner.

Examiner: Page 246, line 9: "…in the F zone. Only two chromitite stringers…"
Response: Changed as suggested by the examiner.

Examiner: Page 246, last para, line 5: "The primary sulphide mineralisation in…"
Response: Changed as suggested by the examiner.

Examiner: Page 246, last para, 2nd last line: "Similar sulphide textures have been…"
Response: Changed as suggested by the examiner.

Examiner: Page 247, line 2: "…Cu and Pd partition coefficients into…"

Response: Changed as suggested by the examiner.

Examiner: Page 247, 2nd para, line 1: "…show significant differences to the other…"
Response: Changed as suggested by the examiner.

Examiner: Page 247, 2nd para, line 7: "…found on Turfspruit shows that it is dominated…"
Response: Changed as suggested by the examiner.

Examiner: Page 248, 2nd para, line 5: "…both of the deposits have a strong correlation with the Ni, Cu…"
Response: Changed as suggested by the examiner.

Examiner: Page 248, 2nd para, line 6: "Both mineralised intervals are associated with disseminated…"
Response: Changed as suggested by the examiner.

Examiner: Page 248, 3rd para, line 6: "…of each unit is marked by a chromitite stringer…"
Response: Changed as suggested by the examiner.
Examiner: Page 248, 3rd para, line 6: "…ultramafic succession. These sulphides are (<100 μm)…"
Response: Changed as suggested by the examiner.

Examiner: Page 248, last line: I suspect the reference should be to Table 9.3? "…in the Waterberg area (Table 9.3)."
Response: Changed as suggested by the examiner.

Examiner: Page 249, 3rd para, line 10: "…the pyroxenite layer is a correlative to the true…"
Response: Changed as suggested by the examiner.

Examiner: Page 249, last para, line 2: "…and pentlandite that is heavily overprinted by…"
Response: Changed as suggested by the examiner.

Examiner: Page 250, 2nd para, 2nd last line: "…(sperrylite) mineralisation, it is unlikely…"
Response: Changed as suggested by the examiner.

Examiner: Page 250, 3rd para, line 10: "…However, recent logging and a magnetic susceptibility survey down borehole LAP 30…."
Response: Changed as suggested by the examiner.

Examiner: Page 251, Figure 9.2 caption: "…was taken from McDonald *et al*., 2017, the third and fourth columns were produced using the magnetic susceptibility results obtained in this study)."
Response: Changed as suggested by the examiner.

Examiner: Page 251, line 4: "…Cr-PGE relationships are noted in the Waterberg…"
Response: Changed as suggested by the examiner.

Examiner: Page 251, line 7: "…although both are still within…"
Response: Changed as suggested by the examiner.

Examiner: Page 251, last line: "…more primitive in the T zone in the Waterberg…"
Response: Changed as suggested by the examiner.

Examiner: Page 252, line 3: "…sulphides have a magmatic sulphur isotope signature…"

Response: Changed as suggested by the examiner.

Examiner: Page 254, Figure 9.5 caption: "A summary of the differences and similarities…"
Response: Changed as suggested by the examiner.

Examiner: Page 254, last para, line 4: "…In addition, Yudovskaya…"
Response: Changed as suggested by the examiner.

Examiner: Page 254, last para, 2nd last line: "…Hence, elevated Au concentrations may be a feature associated with mineralised intervals higher in the stratigraphy…"
Response: Changed as suggested by the examiner.

Examiner: Page 255, last para, line 5: "…Fault, a branch of the TML, which van der Merwe (1976)…"
Response: Changed as suggested by the examiner.

Examiner: Page 255, 3rd last line: "…suggested the Steelpoort Fault to have been a linear feeder…"
Response: Changed as suggested by the examiner.

Examiner: Page 256: Figure caption on next page should accompany the figure on this page. Also, place this figure after its in-text reference.
Response: Agreed and changed

Examiner: Page 257, line 1: "…we propose a possible feeder zone associated…"
Response: Changed as suggested by the examiner.

Examiner: Page 257, 1st para, 3rd last line: "…structurally controlled basin fed from a different…"
Response: Changed as suggested by the examiner.

Examiner: Page 258, last bullet point, 1st line: "…in the uppermost parts of the…"
Response: Changed as suggested by the examiner.

Examiner: Page 259, 1st para, line 7: "…magnetite on the liquidus triggered…"
Response: Changed as suggested by the examiner.

Examiner: Page 259, 1st para, line 13: "…but are hosted in very different…"
Response: Changed as suggested by the examiner.

Examiner: Page 259, 2nd last line: "…where the Platreef rests on…"
Response: Changed as suggested by the examiner.

Examiner: Page 260, 2nd para, line 4: "…hydrothermal activity resulted in the deposition…"
Response: Changed as suggested by the examiner.

Examiner: Page 260, 2nd para, Last two sentences: Poorly written. Rewrite.
Response: Rephrased"The secondary assemblage involved a progressive change in mineralogy, element deportment and mobilisation, alongside a significant mass loss. Base and precious metals may have concentrated in the hydrothermal fluid (Ni, Cu and Pd) and be deposited elsewhere (Holwell *et al.*, 2017). Similar features observed in the T1 mineralised zone are possibly responsible for the general poor PGE grades and extensively altered."

Examiner: Page 260, 3rd para, line 6: "…from the granitic gneiss show mantle-derived…"

Response: Changed as suggested by the examiner.

Examiner: Page 260, 3rd last line: Somewhere you mentioned the presence of a single calc-silicate xenolith in the Waterberg rocks but here you deny it in it's entirely. Rephrase to state the correct facts.
Response: Rephrased "Furthermore, there has only one calc-silicate xenolith identified in the Waterberg project area and no other kind of sedimentary xenoliths have been reported."

Examiner: Page 261, 2nd para, last line: "…before the intrusion of the dolerite sill…"
Response: Changed as suggested by the examiner.

Examiner: Page 261, bullet point 1, line 2: "…overlain by harzburgite that is typically 100 m thick."
Response: Changed as suggested by the examiner.

Examiner: Page 261, bullet point 2, line 2: "…with minor anorthosite layers with sporadic occurrences…"
Response: Changed as suggested by the examiner.

Examiner: Page 262, line 1: "…a maximum thickness of 500 m and is completely absent in certain areas…"
Response: Changed as suggested by the examiner.

Examiner: Page 262, line 2: "…In addition, the Upper Zone lacks magnetitite layers and…"
Response: Changed as suggested by the examiner.

Examiner: Page 262, 2nd bullet point, line 1: "…chapters that magmatic and hydrothermal processes…"
Response: Changed as suggested by the examiner.

Examiner: Page 262, 2nd bullet point, 2nd last line: "…isotopic signatures all suggest that the mineralisation is mantle-derived, which is significantly different from certain other localities in the northern limb."
Response: Changed as suggested by the examiner.

Examiner: Page 262, last para, 2nd sentence: Poorly written. Rewrite.
Response: Rephrased ". This could provide a better understanding of the lateral relationship between the Waterberg project and the northern limb and whether the proposed hypothesis that the Waterberg intruded into a separate, structural controlled basin north of the Hout River Shear Zone."

Examiner: References: I did not check referencing in detail. In many instances it would be necessary to have XXXa and XXXb style references. Please go through the list and fix where necessary. An example is for instance Naldrett et al. (2008). See also Wilson and Chunnett (2006) – I guess it should be "South African Journal of Geology".
Response: Changed as suggested by the examiner.