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SOUND AND MUSICAL INSTRUMENTS IN THE HOLOCENE ARCHAEOLOGICAL RECORD OF SOUTH AFRICA.



Joshua Kumbani 1803315

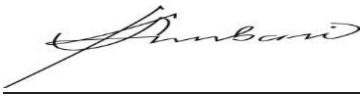
Supervisor: Professor Sarah Wurz

A thesis submitted to the Faculty of Science, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Doctor of Philosophy

2020

DECLARATION

I declare that this thesis is my own work and has not been submitted before for any degree or examination at any other University. It is submitted for the requirements of degree of Doctor of Philosophy at the University of the Witwatersrand by published and submitted articles.

Signature: 

Joshua Kumbani

Signed this 10th day of September 2020 at the University of the Witwatersrand, Johannesburg.

ABSTRACT

This thesis provides the first evidence of music-related and sound producing artefacts from the last 10 000 years in southern Africa. An inventory of artefacts from southern Africa, including an ivory trumpet, whistles, iron gongs or bells, thumb piano keys or lamellophone keys and rock gongs, show that such artefacts are very rare. This is due to poor preservation of instruments that are frequently made of organic material that rarely survive in the archaeological record. Actualistic studies and microscopic analysis have indicated that two Holocene dual holed bone implements, from Klasies River main site and Matjes River, could have been used as spinning disks, artefacts that produce a whirring sound when spun in front of the body. This approach further identified the first archaeological bullroarer from southern Africa, a bone implement previously interpreted as a pendant from Wilton layers at Matjes River. Sounds recorded from replicas of the bullroarer indicate sound qualities and frequencies similar to other bullroarers from the ethnographic and archaeological record. Bone tubes or pipes that could have been used as flutes or whistles also come from these layers from Matjes River. Rock art images of musical bow players from the Maloti Drakensberg Mountains in KwaZulu-Natal and in the Eastern Cape Province of South Africa are discussed and compared to ethnographic and contemporary musical bow playing. Depictions of flute playing from the Klein Karoo as well as the Cederberg are presented and linked to possible similar activities from the South African ethnographic record. It is clear that there is great potential to further music archaeological research in South Africa and the southern African region. This multidisciplinary research into the archaeological evidence for sound and musical expressions from southern Africa adds new knowledge and data to enrich to enrich our understanding of Holocene social practices.

In memory of my father Ben Kumbani

1957-2013

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CHAPTER 1: INTRODUCTION

1.1. INTRODUCTION

This thesis investigates the archaeological and ethnographic evidence of music-related and or sound production activities from the past 10 000 years in South Africa, with examples from the southern Cape Later Stone Age highlighted. Music archaeology or archaeomusicology is the study of music-related artefacts and the effects of sound in the past. Music archaeology also encompasses the study of musical depictions in rock art. It is diverse and it is multidisciplinary in its approach (Morley 2003, 2013; Both 2009; Lawson 2010) employing methods and theories from other disciplines like ethnomusicology, ethnoarchaeology and experimental archaeology (Both 2009: 2). Archaeomusicology is a sub discipline of archaeology (Blench 2013) and started to develop around the 1970s (Lawson 2010: 242; Eichmann 2018). In its early stages it benefited from the experimental work of some individuals such as the musician Laurence Picken's experimental approach with musical instruments. He used his music background to replicate music-related archaeological artefacts and test their acoustic properties (Lawson 2010) which was a leap forward as far as laying the foundation of music archaeology is concerned. As a result, experimental work became one of the approaches that were adopted into music archaeological research (Lawson 2010: 242).

Music is produced, perceived and understood differently among different people and cultures (Cross & Morley 2010; Trehub *et al*. 2015; Montagu 2017) and hence it is difficult to propose an all-encompassing definition of 'music'. As a way of getting around this challenge, Atema (2014: 26) suggests that, "Music is in the ear of the beholder". However, the consensus is that music is universal, and it involves organized sound and intentional body movement or dance (Blacking 1973; Cross 2001; Morley 2003, 2013; Trehub *et al*. 2015). It is also different from speech, animal and bird cries (Montagu 2017). Musical sound comes in various forms that mainly include vocal singing, sound produced by instruments and clapping. Still, the sound should not be random noise but should serve a purpose (Trehub *et al*. 2015) and it is mostly accompanied by dance. Music serves several purposes including dance, ritual, entertainment and personal and communal cohesion (Montagu 2017). Almost every society is believed to have what it calls music and it is hinged on social interactions and construction (Cross 2001: 29). Music is diverse, it imapcts people differently and its meaning or significance is context specific (Blacking 1995; Cross 2001). For example, Blacking (1995) points out that the same music can have different meanings within the same society depending on the context

where the music is being played. It can be noted that music impacts people's emotions differently depending on the context. Therefore, music and sound production can be closely associated with symbolic behaviour among humans since it is a social construct.

Music archaeology in southern Africa is still developing and this work has mainly focused on musical instruments depictions in the rock art. Musical instrument depictions that have been reported from rock art include musical bows (Lee & Woodhouse 1970; Lee 1987; Lewis-Williams 1981), bone flutes and rattles (Rust 2008; Rust *et al*. forthcoming) and recently bullroarers (Rusch & Wurz 2020). Rock art is regarded as a source of music archaeology (Blench 2013). No musical bows have been recovered from the archaeological record thus far but there is evidence of bone tubes that could have been used bone flutes and a bullroarer has been found from Majes River site and these artefacts are described in greater deatail later (see Chapters 3 & 4). The musical instruments depictions from southern Africa have been reported in South Africa, Namibia and in Zimbabwe (see Chapter 5 & 6). In South Africa there are musical bows that are depicted in the Maloti Drakensburg massif in KwaZulu-Natal and Maclear District in the Eastern Cape. Musical bows have also been reported from Namibia mostly from the Daureb region (Vogels 2012; Vogels & Lenssen-Erz 2017). These are the only known areas from southern Africa with known musical bow depictions. Flutes depictions occur in the Klein Karoo and Cederberg regions of South Africa as well as a flute player depiction from Lake Chivero in Zimbabwe (see Chapter 5). Bullroarer depictions have been found at Doring River in the Cederberg in South Africa and an archaeological bullroarer has been recovered from Matjes River site. This available information from rock art is very important because it complements the available ethnographic information on the use of these musical instruments or sound producing implements that are depicted in rock art.

Dancing scenes are also commonly depicted in southern African rock art. The meaning of southern African rock art has been associated with shamanism and ritual perfomances (Blundell 2004; Lewis-Williams & Challis 2011). Therefore, the dancing scenes that are found in the rock art of southern Africa have been associated with trance dances and ritual settings (see Chapter 5). However, dance is understood as an activity that usually accompanies music performance. Dancing scenes in rock art are also found outside southern Africa. For example, dancing scenes have been recorded in the Iberian peninsular in Spain as well as in India. The Iberian Peninsula in Spain has attracted attention interms of analysis of the musical instruments deopictions, acoustic studies of the Upper Palaeolithic caves with rock art (García Benito 2014; Díaz-Andreu & Mattioli 2019). It is even postulated that some of the depictions in the Iberian Peninsula show singing individuals (García Benito 2014).

Acoustic studies have also been researched in South Africa in relation to rock art sites and their surrounding environments. For instance Rifkin (2009) investigated the effects of sound on the location of Klipbak 1 engraving site in the Tswalu Kalahari Reserve in Northern Cape Province of South Africa. An experiment was done to test the echoes of the rock gong that is close to the engravings and the results yielded positive echoes which are clearly audible from the engravings site (Rifkin 2009: 595). Such results are significant in the sense that echoes are usually experienced in enclosed sites like caves unlike on open sites like Klipbak 1. The places with echoes were regarded as dwelling places of the spirits (Dams 1984; Rifkin 2009). As a result Rifkin (2009) considers that the area next to the engravings could have been used for ritual activities and that the engravings were strategically located at a place with acoustic effects showing the importance of sound among the past societies. However, acoustic studies here in southern Africa are lagging behind as compared to other parts of the world like Europe where there are acoustic studies specialists for example, Légor Reznikoff and Rupert Till are some of the leading researchers on the subject in Europe. Rezinkoff (2008) has argued that the placement of rock art motifs in the Upper Palaeolithic caves was influenced by the acoustic considerations. The acoustic properties that were considered for the choice of where to paint include echoes, reverberations and resonance (Rezinkoff 2008; Díaz-Andreu & Mattioli 2019).

Rock gongs are regarded as early evidence of music-related or sound producing implements that were used by people in the past. Rock gongs are natural rocks that produce metallic sound (Fagg 1956). These natural ideophones are found around southern African region and some of them are in close proximity to some archaeological sites for example the GaMohana rock gong in the Northern Cape is located next to an engraved site (Morris *et al*. 2018) and at Ziwa site in eastern Zimbabwe there is a also a rock gong (Soper 2006). In most cases rock gongs are associated with engravings but there are few instances where the rock gongs are not located closer to archaeological sites (Morris *et al*. 2018). In Europe, the presence of some stalactites and lithophones or rock gongs in some Upper Palaeolithic cave sites is believed to have been one of the major reasons why such caves where chosen for painting, for example the Nerja cave in Marlaga, Spain (Dams 1984). In southern Africa there are no similar cases where there is a cave with stalactites and rock gongs as well as having rock art.

Another example of music archaeology research was based on fossil remains. Wurz (2009) investigated the origins of music by focusing on the biological adaptations of the hominins. This research relied on fossil evidence to understand the development of music among the hominins with particular attention to the development of dance (rhythmic entrained body movement) and vocal singing. Some important developments in human evolution like habitual bipedalism, verstibular system

in the ear as well as development of the brain size are some of the most important aspects that led to the development of vocal singing and dance among the hominins (Wurz 2009). Therefore, this reaserch laid a foundation by highlighting some of the important developments of human evoulution which are closely linked with the development of music and dance.

Some music related artefacts have been recorded from archaeological sites in southern Africa. For example musical bells, thumb piano keys and an ivory trumpet (see Chapter 3). However, these artefatcs were reported and not much has been said about them in terms of how they were used in the past in relation to music performance in the past. This research analyses some of these artefacts and desricbe them as well as explaining their possible uses as either musical intstruments or sound producing artefacts. However, there is a huge difference between southern Africa and other regions like Europe as far as the analysis and documentation of music-related artefatcs is concerned. For example, music-related artefatcs from the Upper Palaeolithic have been analysed documented and there is a lot of published materials about these artefacts for example Morley (2013). Music archaeology in Europe is a step ahead in terms of the methods which they use for example they mostly use experimental approach to replicate the music related artefatcs and test their sound producing capacity where as this aspect is yet to be fully developed here is southern Africa.

Music archaeological research has not been only restricted to Europe but other regions like North America and Asia have also been covered. For instance, some music-related artefatcs have been recovered from Mesoamerica in Oaxaca, Mexico dating to the Formative period (1600 BCE–CE 250) (Hepp *et al*. 2014: 380). These artefatcs are clay aerophones that include ocarinas, whistles and flutes. The ocarinas are designed as birds and have sound holes (Hepp *et al*. 2014). These artefatcs have been recovered from sites that include Cerro de la Cruz, Cerro del Chivo, Corozo among other sites. Ethnohistory has played a key role in understanding the musical past of Mesoamerica. These artefatcs have been used as musical instruments and were also used in ritual contexts (Hepp *et al.* 2014). Another example from Asia is that of the bone flutes that have bee recovered from Jiǎhú in China (see chapter 5 Table 2).

1.1.1. Later Stone Age Cape Sites

In this thesis the Holocene Later Stone Age (LSA) from the southern Cape has been selected for detailed empirical research into music archaeology, warranting a description of the archaeology from this area for this time period. The southern Cape encompasses an area of about 650km from Cape Agulhas in the west to Cape Padrone in the east (Deacon 1982: 25). From south to north it covers a

100km area between the coast to the interior edge of the continuous east-west oriented Cape fold ranges of the Riviersonderend, the Lange and the Outeniqua Mountains (Marker & Holmes 2005: 53). The LSA is regarded as the archaeological period from between 40 000 (Ka) and 2 ka and is subdivided into various lithic technocomplexes which are: Early Later Stone Age (18- 40 ka); Robberg (12-18 ka); Oakhurst (8-12 ka); Wilton (4-8 ka); Final Later Stone Age (0.1-4 ka) and the ceramic final Later Stone Age (< 2 ka) (see Lombard *et al*. 2012: 125). Initially, since the inception of seminal work on Stone Age studies in South Africa by Goodwin & van Riet Lowe (1929), the LSA research was lithocentric as it was centered on understanding lithic technologies (Henshilwood 1995). However, LSA research themes have changed over time, for example focusing attention on using ethnography, paleoenvironmental reconstructions and understanding past social relations (Mitchell 2005; Forssman 2019). LSA sequences have also been revised several times (Mitchell 2002; Lombard *et al*. 2012; Forssman 2019).

The archaeology of the southern Cape has been well researched, and several LSA sites have been recorded (e.g. Deacon 1982; Binneman 1995; Henshilwood 1995; Mitchell 2002; Ludwig 2005; Steyn *et al*. 2007; Loftus *et al*. 2016). Most of the sound-producing or music-related archaeological artefacts discussed in this thesis are associated with the Wilton industry, which is characterised by small scrapers, segments and backed tools (e.g. Louw 1960; Deacon 1984; Henshilwood 1995; Binneman 1995; Ludwig 2005). Binneman (1995) investigated the Later Holocene periods of some of the sites on the southern Cape coast namely Kabeljous River Shelter 1, Klasies River Caves 1 and 5 and the Havens Cave. He identified two lithic complexes namely Wilton and the Kabeljous industries which he suggested co-existed from ca 4700 BP- ca. 1900 BP (Binneman 1995: 151). The Kabeljous industry consists of heavy-duty quartzite tools that include large segments whereas the Wilton industry was dominated by microlithic tools (Binneman 1995). As far as the change in lithic technology is concerned, Binneman (1995), questions the earlier assertion that changes in environment could have catalysed changes in the lithic technology and he advocates for social factors to explain this trajectory. He further argues that archaeological cultures change because of social circumstances (Binneman 1995).

Recently Loftus *et al*. (2016) have proposed that for the LSA sequences to be clearly understood there should be a robust redating exercise of the LSA sites within the region. Dating is key to understanding the sequencing of archaeological material (e.g. Loftus *et al*. 2016). Loftus et al. (2016) used the Accelerated Mass Spectrometry carbon 14 dating technique (AMS ^{14}C) and Bayesian modelling to help them understand whether the various LSA lithic technologies coexisted or were introduced in tandem.

They employed these robust dating techniques at Nelson Bay Cave (NBC) and Byneskranskop 1 (BNK1) where there were no clear sequence breaks as far as the lithic technologies were concerned. Another concern was to investigate why the LSA in southern Africa is a late comer as compared to other parts of the continents as well as in Europe (Loftus *et al*. 2016: 366). It was noted that in some cases the ^{14}C dates are not calibrated and the dating results seem to be off range when compared with other dates from around the world. It was found that the new dates from NBC were consistent with the old chronology, but they modified the earlier technological sequence by Deacon (1984) as well the paleoenvironmental reconstructions by Klein (1972a, b). For example, the lowest LSA level at NBC was adjusted by ~500 years to 19, 110 ± 110 BP making it one of the earliest Robberg complexes in southern Africa and almost contemporaneous with the LSA dates from Lesotho (Loftus *et al*. 2016: 372). It was also noted that the Wilton industry was introduced earlier at NBC at around 9, 400–9, 032 cal BP (Loftus *et al*. 2016: 375). The new dates also indicated a quick transition between Oakhurst and Wilton industries. At Byneskranskop 1 there was a clustering of dates from layers 6, 7 and 8 and this was interpreted as a rapid deposition and representing a single phase. The first Oakhurst assemblage from Layer 17 was dated to 14, 320– 13, 860 cal BP making it the earliest AMS ^{14}C Oakhurst date and counted among the four earliest ^{14}C Oakhurst dates in South Africa (Loftus *et al*. 2016: 378). Therefore, the revised dates have changed the understanding of the LSA sequences in the region and demonstrate the importance of using robust dating techniques in archaeology.

Most of the LSA sites have yielded evidence of shellfish exploitation for example, at NBC and Hoffman's or Robberg cave (Nelson-Viljoen & Kyriacou 2017). Fish was also consumed at the southern Cape sites (Binneman 1995). Henshilwood (1995) investigated the coastal shell middens at the Garcia State Forest (GSF) close to Still Bay on the southern Cape coast to understand the subsistence patterns of the people who lived on the coastal areas during the Holocene period. He observed that large quantities of marine resources were consumed. The shellfish species that were consumed include *Turbo sarmaticus, Patella longicosta* and *Patella oculus* which were recovered from GSF 1-4 sites. More recently, Nelson-Viljoen & Kyriacou (2017) researched shellfish exploitation during the LSA period at Pinnacle Point shell midden complex. *P. perna, D. Serra, T. sarmaticus , Scutellastra cochlear , Scutellastra longicosta, Burnupena, H. spadicea* and *Oxystele* were found at the site (Nelson-Viljoen & Kyriacou 2017: 546).

The LSA people also consumed terrestrial resources. Small terrestrial animals like bovid type II species, for example steenbok or steinbok *(Raphicerus campestris)* were exploited whereas larger

bovids are rare in most of the LSA in the southern Cape (Binneman 1995). This pattern was observed at NBC (Inskeep 1987), Matjes River (MR) (Louw 1960), Boomplaas (Deacon *et al*. 1978), Havens Cave, Kabeljous Rock shelter and at Klasies River (Binneman 1995). The inland sites have evidence of plant foods that were consumed especially geophytes (Parkington 1972, 1976; Deacon 1972; Klein 1973).

Besides the lithic variations, Binneman (1995) noted no major subsistence differences between the Wilton and the Kabeljous industries. Both groups exploited terrestrial animals as well as marine resources. The people who occupied the open-air sites as well as the cave sites in the south-eastern Cape relied on shellfish, marine birds and in some cases remains of fish vertebrae were also found (Binneman 1995). Generally, *Perna perna* was the dominant species that was exploited in these coastal sites and other species like *Turbo sarmaticus* were also recovered. In some cases, evidence of plant resources exploitation was found for example, at Havens Cave where hearths were also found with concentrations of black ash and abundant lumps of charcoal (Binneman 1995: 47).

Materials which could have carried symbolic meaning are common in most LSA sites. Painted stones have been recovered from the LSA in southern and eastern Cape sites of South Africa (Binneman & Hall 1993). The Boomplaas site yielded four painted stones found in association with storage pits (Deacon et al. 1976; Deacon 1982). Two painted stones were found by Singer & Wymer (1969) from the Klasies River Mouth cave 5 (KRM 5). One of these has a painting of a human being and four dolphins. This was recovered from a layer dated to 2285 ± 105 (GX-336) (Singer & Wymer 1969). Another stone was found from layers that were beneath and has red grids that are painted on both sides of the stone. Later Binneman carried out some excavations at KRM 5 close to the entrance (KRM 5A) as well as close to the back of the cave (KRM 5B). As a result, another painted stone was found from KRM 5B which had an antelope painting. A charcoal sample from this same layer at KRM 5B was dated to 3900 ± 50 BP (Pta-3906) (Binneman & Hall 1993). It is believed that this painting was found *in situ* and it was associated with shellfish remains with *Patella longicosta* being the dominant species. Roodekranz shelter close to Grahamstown in the Eastern Cape also yielded two painted stones (Binneman & Hall 1993). The first one has four figures, some elongated and stretching out their hands, but one does not have hands. One of the figures has a kaross with white dots. Two animals are depicted on the second painted piece and the other animal is thought to be an eland although its head has faded away. Kommandokloof shelter located north east of Joubertina, has a possible painted stone which could have been drawn on using charcoal. A juvenile burial was also found in this shelter with the body lying on the bed rock and was lying on its right side. The burial was covered with a cairn of fifteen

stones (Binneman & Hall 1993).These painted stones with animals and human figures as well as grids have been interpreted as symbolizing trance elements or shamanism and it is proposed that they should be viewed in the same manner as the painted rock art that is on boulders. Therefore, they are interpreted in terms of shamanism (Binneman & Hall 1993).

Other burials also occur at southern Cape LSA sites, for example at Matjes River rock shelter (e.g. Louw 1960) further discussed in Chapter 7 and NBC (e.g. Inskeep 1987). A mummified male was recovered from the Kouga Mountains rock shelter in the Eastern Cape (Steyn *et al*. 2007), a rare case of mummified human remains. The remains were identified as that of a San hunter-gatherer aged between 30 -40 years. The burial was marked with a flat stone with some San paintings and below the stone were layers of sticks leaves and branches (Steyn *et al*. 2007). *Boophane disticha* was identified as the plant leaves that were right on top of the body. It is believed that the medicinal value of *Boophane disticha* and the conditions in the cave facilitated the preservation of the body. The body was buried in a flexed position and lying on its left side and the head was facing the easterly direction and the back wall of the cave. The upper body, the back of the body, partial right side and the both feet had skin that was still preserved unlike the left side which was poorly preserved with some bones exposed. Thin rope of *cyperus textilis* were tied around the feet, string of seed beads was found on the neck as well as marine shell beads next to the skull. The branches from the grave were radiocarbon dated to 1930 ± 20 BP (Pta-7908) and the right-hand finger bones were dated to 2000 ± 35 BP (Pta -8361) (Steyn *et al*. 2007: 7). X-rays of the body were taken, and they revealed that the distal end of the fifth finger of the left hand was amputated and the pelvis had a fracture which most likely developed during the process of excavation or during the transportation of the body. No deformities or any signatures were further noted on the body. However, the cause of death was not ascertained. With the sensitivity involved in dealing with human remains and all the ethical issues involved this ended up attracting the attention of the media as well as leading to a dialogue between the Khoe-San community leaders and the Eastern Cape local government (Steyn *et al*. 2007).

Some of LSA sites in the southern Cape have evidence of the introduction of sheep/goat post 2000 BP (Klein 1986; Henshilwood 1995; Sadr 2013). It is believed that the sheep was introduced in the southern Cape by the herders who came from the northern parts of Botswana (Elphick 1985). The introduction of herding in the southern Cape resulted in herders coexisting with the hunter gatherers. LSA studies are diverse and have interesting debates (Forssman 2019). There has been a debate on whether we have a Neolithic in southern Africa (e.g. see Sadr 2003). For example, Kasteelberg and

Boomplaas had evidence of calcined dung (Klein 1986), GSF 8 (Henshilwood 1995) and at NBC (Inskeep 1987) sheep bones were also recovered.

The last phases of the Holocene period have evidence of pottery and this phase has been referred to as the ceramic Final Later Stone Age (see Lombard *et al*. 2012). Pottery could have been used for storing milk by the herders as well as food preparation among other uses and it has been found in association with sheep bones from the southern Cape sites. For example, at Garcia State Forest (GSF) eight sheep bones in association with pottery were dated to 1960 ± 50 B.P (Henshilwood 1995: 64). However, there is a debate as to how best the Khoekhoe and the San hunter gatherers can be distinguished using archaeological evidence during the later phases of the Holocene period (Henshilwood 1995; Forssman 2019).

Seasonality and mobility have also been researched during the LSA of the southern Cape of South Africa to determine which times were the sites occupied by using archaeological material. Following Shackleton (1973), who did oxygen isotopic analysis using 2 *Patella tabularis* from the early Holocene period at Nelson Bay Cave, Henshilwood (1995) used the same approach to determine what times of the year were the GSF sites occupied. The isotopic results obtained from *Turbo opercula* from sites GSF 1-4 indicated that they were collected in winter, GSF 2 and 5 were intermediate and could have been collected during spring or autumn (Henshilwood 1995: 217). Therefore, some activities can be pinned with various times of the year and it helps to understand the time of accumulation of such material in the archaeological record.

1.1.2. Background on different approaches used to study music archaeology

Ethnographic accounts do show that sound production and music is fundamental to all human societies (Cross 2001). Archaeomusicology could benefit from this literature to construct hypotheses and possible analogies on sound production and music making from the distant past (Blench 2013). In this research ethnographic records that have documented sound making and musical practices have been consulted. For example, early travelers (e.g. Stow 1905) recorded the use of musical instruments like reed flutes, musical bows and depictions of musical bow players in the rock art. Stow (1905) mentions that the Bushman in South Africa used the bow for musical purposes, and they would tap the string with a stick and produce various musical tones. He further mentions that the Bushman women played reed flutes during competitions that were held among various groups and would even last for a few days. Another traveler, Thunberg (1775), came across a group of Khoekhoe people in what is today the Eastern Cape Province who practised music. These groups played a drum called *Su Koa,* which was made of a pot which they would fill with water and cover it with sheepskin and was tied well around the

edge of the pot with a leather thong. However, Thunberg was not amused with the sound of the *Su Koa* and mentions that, “this produced a dull heavy sound that has nothing pleasing on it” (Thunberg 1775: 193). In contrast the Khoekhoe enjoyed the sound and danced for a considerable time and sometimes the performance would throw the dancer into a wild perspiration (possibly trance) (Thunberg 1775: 193). Ethnomusicological texts like those by Kirby ([1934] 2013), "*Musical instruments of the indigenous people of South Africa*" also informed this current research. The book has a section on the ethnographic use of some aerophones like spinning disks, bullroarers and flutes which also happen to occur in the archaeological record of the southern Cape. Furthermore, the ethnographic uses of musical bows, also discussed in this thesis, are also recorded in Kirby’s book.

The use of ethnographic sources is based on the “comparative method” which refers to the use of contemporary or recent past societies to understand the archaeological cultures from the deep past (Currie 2016; Charlin 2018). Currie suggests that since the method has proved useful in biology it can also be employed in archaeological research without any misgivings. Archaeologists rely on ethnographies usually documented by anthropologists in trying to interpret the archaeological record (Currie 2016). Analogies can be either direct or indirect. Direct analogy is when both the archaeological and the ethnographical data share the same geographical and the same cultural background (Berrocal 2011). For instance, the use of the San ethnography related to shamanism in interpreting the South African rock art is one example of using direct ethnography whereas using the San ethnography to interpret the European rock art is regarded as indirect analogy (Currie 2016). In another example, Charlin (2018) used the ethnographic approach or the “comparative approach” to study the ethnographic Ona arrows from northern Tierra del Fuego from various museums in Argentina and compared them with Late Holocene archaeological projectile points from Patagonia. Based on her morphometric analysis, she observed differences in designs between both the archaeological and ethnographic points. Charlin (2018), also noted that the archaeological pieces were smaller in size as a result of their long cycle of use while the ethnographic pieces were bigger because they did not go through much reduction processes since some were just meant for exchange. Besides the size differences, Charlin (2018) believes that the results can be useful in understanding the function of the archaeological stone tools. This comparative approach seems to be useful in that some possible functions of the archaeological tools maybe inferred based on their sizes and any visible forms of modification (reduction process) may hint at the history of use of the artefact. In another example, Chirikure *et al*. (2018) used the Shona ethnography and philosophies to investigate the archaeology of class and inequality at the Great Zimbabwe site since there has been a tendency of regarding elaborate artefacts and stone walls as representing the elite in the archaeological record. Political power rotated

between the elders of the ruling lineage and it followed descent and each king ruled from their own home. It was realised that it is multifaceted to separate between the elite or the rich and the commoner based on the archaeologically visible stone walls and the material culture. They argue that 'status' is fluid and the elite, and the commoners sometimes use the same material culture and sometimes lived together making it difficult to draw the line between the elite and the commoners based on material culture (Chirikure *et al*. 2018). They thus encourage the use of available ethnographies to understand the past societies. Currie (2016) notes that ethnographic accounts have loopholes which may include for example, unreliable information and emphasize that even though the archaeological record is also not complete ethnography and archaeology complement each other in reconstructing the past. But there are still some archaeologists who have strong reservations aboutthe use of ethnographic analogies. For example, Berrocal (2011: 11) has some reservations on how San ethnography has been used to interpret the European rock art and Hayter (1994: 42) holds the sentiment that ethnography does not provide solutions to archaeological questions.

Actualistic studies refer to controlled experiments that are done in trying to produce wear patterns that are as a result of some possible activities that were done in the past (see Kumbani *et al*. 2019, Rifkin 2012). Actualistic studies are synonymous with experimental archaeology (Outram 2008). Conducting actualistic studies is a way of testing a hypothesis and examining if it can be falsified (Outram 2008: 1). Also, actualistic studies provide room for modifying and exploring a hypothesis to get new perspectives and ideas on the broader research question (Comendador *et al*. 2018: 8). The experiments are usually modelled around the concept of *Chaîne Opératoire* which is broadly the examining of the thought processes involved in the manufacture and use of artefacts (Comendador *et al*. 2018: 8). Actualistic studies involve replicating the former conditions and circumstances based on the questions which the researcher seeks to answer through experimentation (Coles 1979: 1). As a result, experimental work can bring both positive and negative results. However, even when positive results are obtained, they should be treated with caution since actualistic studies can hardly replicate the exact conditions and all the procedures that people in the past employed or were operating in when they were undertaking certain activities (Outram 2008; Lawson 2010).

Backwell *et al.* (2012), conducted an actualistic study of investigating what taphonomic signatures are introduced on bone materials by the harvester termite (*Trinervitermes trinervoides*). Some fresh bones of *gallus domesticus, ovies aries,* medium and large bovid remains were planted in termite mounts in the Sterkfontein Valley, South Africa for six months and some were left for a year (Backwell *et al*. 2012). The level of preservation of the bones was recorded before and after the experiments. After six

months, twelve bone specimens were removed from the mounts and did not have many modifications since the termites were small and inactive and hence posed less threat to the bones. After a year elapsed, some of modifications like bore holes, destruction, etched surface texture and residue were macroscopically visible. For further analysis, microanalysis was carried out on each bone specimen and it was observed that the *Trinervitermes trinervoides* had caused some considerable damage on the bones. The overall modifications that were noted include bore holes, destruction, striations, etched surface texture, star shaped marks, striations and surface residue (Backwell *et al.* 2012). After the twelve months the star shaped marks and pits were the most visible and were observed on the *gallus domesticus* humeri*, ovies aries* phalanges. As a result, it was noted that all the experimental signatures left by the termites on the bones were also present on the archaeological bones from MSA sites of Sibudu, Plovers Lake, Porc Epic caves and from the LSA layers from Jubilee shelter. Therefore, it became clear that *Trinervitermes trinervoides* are also responsible for some taphonomic bone modifications and even bone disappearance.

Ochre actualistic experiments have been carried out by Rifkin (2012) in trying to replicate the methods that were used to extract ochre powder and to infer past human behaviour. This program also aimed at increaing the reference collection of ochre processing methods that already exist. The experimental ochre was sourced from four geographical locations and the choice of experimental blocks was based on colour and hardness that resemble those from the archaeological record (Rifkin 2012: 177). Experimental methods of extracting ochre included grinding, scraping and cutting with shell, bone and lithic implements and it was observed that grinding ochre against hard and coarse-grained grinding stones yield better results. This production stage produces most of the primary wear that include for example, striations, grooves and edge flaking. Secondary wear occurs when specimens are employed for additional purposes following the initial extraction of pigment powder and in this case the ochre pieces were rubbed on to tanned animal hide, human skin and drawing linear designs on the tanned skin and on stone surfaces (Rifkin 2012). Microscopic analysis was conducted soon after the secondary experiments to describe the unusual primary and the secondary use-wear. Primary wear features that were noted include grooves, fine striae, smoothing and polishing of ridges and some of the secondary wear features that were noted included slight polish as a result of rubbing the ochre on the hide. Residual greasy and glossy matter was observed after rubbing the ochre against the human skin. Overall, it was observed that some of the use-wear signatures on the archaeological ochre pieces from Blombos Cave like prehensile wear (polish and smoothing) as well as some residues match the experimental use-wear patterns (Rifkin 2012: 190). Some Blombos ochre pieces from Still Bay layers attest to having been used crayons. Therefore, the experimental microscopic use-wear analysis on

ochre pieces by Rifkin (2012) has shed more light on both the primary and secondary types of use-wear that are formed as a result of different extraction processes and secondary use of ochre.

Another example of actualistic studies was conducted by Bradfield (2013) who wanted to understand the internal damage or stress that bones can experience when they are used as arrow points and when they are trampled upon and exposed to natural weather conditions. He used micro-focus Computed Tomography (CT scanning) which does 3D scanning of the interior to assess microdamage. The first point was scanned before the experiment and was used as a control reference. *Aepyceros melampus* (impala) bone points were mounted with 125g load and dropped on to hard ground surface from a height of 70cm and one of them fractured on its 42nd throw (Bradfield 2013). The second point was dropped 20 times and did not fracture. The other two points were previously used in a goat trampling experiment and were fractured in the process. The fifth point was exposed to natural weather conditions for 2 years. The weathered bone developed a different crack from the other bone points. Microcracks are easily seen on the longitudinal section and usually emanate from bone voids which are part of the physical structure of bones (Bradfield 2013). As a result, Bradfield (2013) observed that micro-cracks are a cumulative aspect that develops as a result of the force or load that would have been exerted on to the bone point and different breakage conditions will result in different micro-cracks. Micro CT scanning results were the same with observations that were made on thin sections that were microscopically analysed. This actualistic study has set a comparative basis of analysing the archaeological bone points from the archaeological record to assess if they happen to have any form internal damage that can attest if they were used as arrows.

Actualistic studies are important in understanding past societies and they are employed in various research such as lithic studies, use-wear studies, ancient metalworking technologies, pottery making as well as in music archaeological research (e.g. Lund 1985; Binneman & Deacon 1986; Barham 1987; Skibo *et al*. 1989; Atema 2004; Timberlake 2007; Birch *et al.* 2015). In the context of music archaeology, to test the hypotheses of whether artefacts could have been a musical instrument or used as sound-producing implements, replicas must be made and then played.

An example of an actualistic study in archaeomusicology is that of Turk (1997) and Atema (2014), who replicated the Divje Babe bone flute from Slovenia. This putative flute, with three holes, dates to 50-60 ky BP and is associated with Neanderthal occupation of the Divje Babe cave (Atema 2014: 29). The focal point of replicating the Divje Babe flute was to investigate whether the replica was playable as a flute and what kind of sound it produced. Atema (2014) used a fossilised cave bear (*Ursus spelaeus*)

femur to replicate the archaeological implement and reconstructed the flute by using its actual dimensions in terms of its length, distance between holes and the size of the holes. He assumed that the original piece had 3 holes and he made his replica as a fipple flute (a straight tubular structure blown end wise). Turk (1997) replicated a quena flute (flute with a V- notch at the end) of the same archaeological implement. Both produced audible sound (Atema 2014). The replica made by Atema produced a, "hauntingly sweet and clear bell-like sound in the range of our current notation of D5-A5" (Atema 2014: 30). The actualistic study demonstrated that the Divje Babe implement could produce musical tones when played as a flute by opening and closing the holes while blowing the air on the other end of the bone tube (Atema 2014).

Another Palaeolithic sound production study used wear analysis in the context of a lithoacoustics project, investigating sounds made by Upper Palaeolithic lithic blades (Cross *et al*. 2002; Blake & Cross 2008). Blake & Cross (2008) replicated the Aurignacian-type flint blades and played them as portable lithophones or "sound tools". The lithophones were played using flint, bone and antler while they were held in hand or suspended on elastic bands and the sound was recorded. About 70 flint blades were made but only six flint blades were analysed microscopically. Micrographs were taken before and after experiments using a low power binocular microscope which was connected to a computer with a digital camera. As a result, some clustered depressions and some polish were noted on the replicas that were played using bone and antler (Blake & Cross 2008: 13). It was observed that use-wear patterns formed as a result of percussion are different to any form of use-wear that is associated with other uses of stone tools (Blake & Cross 2008).

Iconography in the form of rock art is useful in studying music archaeology (Blench 2013). This approach hinges on the hypothesis that music depictions in the rock art may be analogous to music and sound producing practices of the people of the past. For example, there are musical bow players' depictions in the Maloti Drakensberg in KwaZulu-Natal (Lewis-Williams 1981) and in Maclear in the Eastern Cape of South Africa (Lee & Woodhouse 1970). These musical bow players in the rock art are linked with shamanistic rituals and the *medicine men* (Lewis-Williams 1981: 8; Lewis-Williams & Challis 2011). In some cases, these musical bow players are associated with clapping figures. Recently, a rock art depiction of some bullroarer players from Doring River in the Cederberg in the Western Cape has been reported (Rusch & Wurz 2020). This is the first report of bullroarers from rock art from this region.

1.2. RATIONALE AND RESEARCH PROBLEM

Archaeomusicology is under-researched in Africa as a whole (Blench 2013), in comparison with other studies in archaeology such as lithic analysis, faunal studies, archaeobotany and archaeometallurgy. Since the inception of archaeology in South Africa music archaeology was not on the research agenda. Instead, most LSA research has been dedicated to sequencing lithic technologies, understanding burial practices and subsistence strategies and to rock art studies (e.g. see Mitchell 2005; Forssman 2019). Some limited research has been conducted on archaeological sound production and the effects of sound in the past societies. Rifkin (2009) investigated how sound production, art and environment are interlinked and suggested that the proximity of the engravings at Klipbak I site, the rock gongs and the associated space could have served as an area for performance involving sound and perhaps music. . He also considers that rock gongs could have influenced the choice of making rock engravings near the gongs which are a sound source. Other sound and music related archaeological research from South Africa is that by Mazel (2011) who conducted an extensive study of rock art in the Ndidima Gorge and he links the art to acoustic phenomena of the gorge in sound transmission. Other examples include discussions of musical instrument depictions in the rock art (Lewis-Williams 1981; Lee 1987; Vogels & Lenssen-Erz 2017). Even though there has been some focus on the social dynamics of Later Stone Age populations, specifically from the southern Cape, especially in the context of burials and lithic artefacts (e.g. Louw 1960; Hall & Binneman 1987; Ludwig 2005), musical expression and sound production received virtually no attention apart from a mention in passing by Rusch (2017). This multidisciplinary research into the archaeological evidence for sound and musical expressions from the southern Cape and South Africa bridges this research gap and adds new knowledge and data to enrich the basis from which past social practices can be understood.

1.3. RESEARCH QUESTION AND AIMS

The research question investigated is whether there is any evidence for archaeological musical expression and sound production in South Africa during the last 10 000 years.The aims for this thesis include to:

- Catalogue archaeologically known southern African archaeological sound producing and musical instruments;
- Investigate the Holocene archaeological record from the southern Cape for music-related and sound producing instruments;
- Describe the music related rock art depictions found in rock art of the Cape area;

- Investigate the phenomenon of musical bows in the rock art from two regions from South Africa.

1.4. THESIS OUTLINE

This thesis is composed of one single authored and two co-authored papers as well as four chapters that link and expand upon the publications. All the published papers are presented in the original form in which they are published.

Chapter 1 introduces the study by way of an extensive literature review, and presents the research problem and aims, whereas Chapter 2 describes the materials and methods used to investigate archaeomusicology and sound production from the past.

Chapter 3 is a single authored article (Kumbani 2020):

Kumbani, J. 2020. Music and sound-related archaeological artefacts from southern Africa from the last 10 000 years. *Azania: Archaeological research in Africa* 55: 217-241.

Kumbani (2020) catalogues evidence of music-related artefacts from southern Africa. It discusses evidence from the latter part of the Later Stone Age, the Early and, Later Iron Age as well as the historical period. I undertook the research and wrote the article.

Chapter 4 is a published paper (Kumbani *et al.* 2019):

Kumbani, J., Bradfield, J., Rusch, N. & Wurz, S. 2019. A functional investigation of southern Cape Later Stone Age artefacts resembling aerophones. *Journal of Archaeological Science: Reports* 24: 693-711.

This paper focuses on anactualistic approach to identify sound-producing elements in the southern Cape LSA archaeological record. Double and single perforated bone implements from the southern Cape sites of Klasies River Main Site (KRM) and Matjes River (MR) were investigated, experimentally reproduced and microscopically studied, and identified as sound producing implements.

My contributions to the paper were to write the introduction, and some sections in the Materials and Methods section (experimental protocol), results and the discussion. I helped Neil Rusch to make the double perforated replicas of the KRM implement at Origins centre, Wits University. I conducted the spinning experiments of the KRM that involved spinning disk replicas for six hours each. I further undertook the microscopic use-wear analysis of the KRM spinning disk replicas as well as the single perforated archaeological bone implements from MR.

Chapter 5 is a submitted paper:

Rust. R, Kumbani. J, Rusch. N. & Wurz. S. (submitted). Flute playing in the rock art of the Klein Karoo and Cederberg; a link to ancient sound. *Rock Art Research*

Rust *et al*. (submitted), highlights one type of musical implement, the flute, that occurs in the rock art of Attakwas Kloof and Ezeljagdzpoort in the Klein Karoo in the southern Cape as well as from Zimri rock shelter and the Procession rock shelter located in the Cederberg in the Western Cape of South Africa. I wrote some sections of the introduction (flute definition), background on the archaeological flutes and a section on the ethnography of the flutes in South Africa. I compiled a table with examples of some known archaeological bone flutes from around the world and wrote some sections of the discussion.

Chapter 6 is a single authored paper by me and will be soon submitted for publication. The chapter expands on the presence of musical instruments in rock art and discusses musical bow players' depictions in the rock art of South Africa. The chapter describes musical bows as one of the early chordophones that were used in the past although no evidence of musical bows has been recovered from the archaeological record yet.

In Chapter 7 the wider relevance of the results are discussed including concluding remarks and suggestions for future research.

CHAPTER 2: METHODS

2.1. INTRODUCTION

This research employed a multi-facetted approach approach including desktop research, use of ethnographic records, and morphological analysis of the music-related artefacts, actualistic studies, microscopic use-wear analysis and analysis of depictions in the rock art specifically from the Maloti Drakensberg, Klein Karoo and the Cederberg in South Africa as a source of music archaeology.

2.2. DESKTOP SURVEY

Desktop research laid the foundation of this research. It involved the reading of published and unpublished materials on the southern Cape Later Stone Age and music archaeology globally. The main aim was to look for references on any reported artefacts that could have been used as sound-producing implements or musical instruments in the past from the southern African region but more specifically from the southern Cape of South Africa which is the focus study area of this research. The information found for the southern Cape was related to that from wider geographical areas to put the sound related archaeological phenomena from this area into wider geographical context. Social media platforms like Facebook were utilized to gather information from archaeologists who work in the southern African region. The response was positive, and I received some leads to other archaeological materials that might have been used as musical instruments. Leads on some rock gongs and clay whistles were provided via Facebook. Information on spinning disks, bullroarers, musical bells, an ivory trumpet, bone tubes that could have been used as flutes was gathered from literature review.

2.3. ETHNOGRAPHIC RESOURCES

The Kirby collection at the South African College of Music at the University of Cape Town, an ethnographic repository of musical instruments from the southern African region (http://www.sacm.uct.ac.za/sacm/kirbycollection) was also consulted. It is a repository made up of instruments which Kirby collected from different cultural groups in the southern African region during the 20th century. These are instruments which form the backbone of his seminal publication discussed above. The repository has all the four categories of musical instruments which include aerophones, chordophones, membranophones and idiophones when one follows the von Hornbostel & Sachs (1961) classification scheme. The collection consists of more than 600 musical instruments. It also has a small section of musical instruments from Western Europe as well as Asia

(http://www.sacm.uct.ac.za/sacm/kirbycollection). The instruments have the information of which cultural group did they belong to.

Both the book and the Kirby collection online repository provided a useful resource for ethnographic references in this current study. For instance, interpreting the single and double perforated implements from KRM and MR sites (Kumbani *et al*. 2019, chapter 4) was informed by similar implements in the Kirby collection. The wooden spinning disk that was included as part of the actualistic studies of this research was collected from the San Haruchas in Namibia. The research also draws current ethnographic examples of the use of some musical instruments that also occur in the archaeological record. For example, use of flutes, thumb pianos and musical bells.

2.4. INVENTORISATION AND MORPHOLOGICAL ANALYSIS

The recording and cataloguing of musical instruments is a common phenomenon in music archaeology as well as other disciplines like ethnomusicology. For example, the work of Morley (2003) comprises a catalogue of the music-related artefacts from the Middle and Upper Palaeolithic of Europe. This thesis includes a catalogue of sound producing and music-related artefacts based on a desktop survey (Kumbani 2020).

A descriptive analysis of implements included in catalogues and databases are a routine aspect of archaeomusicological studies. For example, Conard *et al.* (2009) provide a morphometric and descriptive analysis of the archaeological flutes from south western German and Morley (2003; 2013) provides a detailed descriptive analysis of music-related artefacts from the European Middle and Upper Palaeolithic in addition to a catalogue of some bone flutes. I have thus undertaken a morphological study of music-related archaeological artefacts from Matjes River and compared this to other available data in the literature (Kumbani *et al*. 2019; Kumbani 2020). The artefacts that were analysed in this way include a spinning disk, single perforated bone implements and bone tubes (See Chapter 3). Attributes recorded in the physical analysis of the archaeological artefacts included the length, width and breadth in millimeters and weight in grams of the archaeological artefacts. A digital caliper was used to measure the dimensions of the artefacts and a digital scale to weigh the artefacts. The data were captured into Excel for further basic descriptive analysis. The state of preservation of the artefacts was noted, for example, if they were well preserved or they were disintegrating, cracked or broken.. Clay whistles from K2 and Mapungubwe were also analaysed at University of Pretoria Museums where the Sofala trumpet is also housed but I was not able to analyse it because it is broken and it is poor condition and it has to be resuscitated through conservation means.

2.5. ACTUALISTIC STUDIES

A part of this thesis employed an actualistic approach to infer the sound production qualities of Holocene artefacts from Klasies River (KRM) and Matjes River (MR).

In Chapter 4 the single and double perforated implements from KRM and MR sites were replicated and spun to test their sound-producing capabilities. An ethnographic spinning disk from the Kirby collection was also replicated as part of this actualistic research and as a way of broadening the hypotheses on sound-production in the past. In this case, the actualistic studies facilitated understanding the organology, or science of musical instruments and their classifications, and the acoustics of the artefacts (Both 2009: 7). The actualistic studies or the experiments that were conducted were thus informed by the ethnographic information on the use of spinning disks and bullroarers (e.g. Nurse 1972; Kirby [1934] 2013).

Musical acoustics is the scientific study of the principles of musical sound and this involves physics and mathematical calculations (Rogers 2004; Meyer 2009). The aspects that are examined and analysed include for example, musical tones, sound waves, timbre, pitch, tuning systems, instrumental and vocal tone production (Rogers 2004: 26; Meyer 2009). Some of the investigations that were conducted in this research focused on describing the audible frequency of the sounds generated by the replicas of the archaeological implements from KRM and MR sites (see Kumbani *et al*. 2019, Chapter 4). Frequency refers to sound vibrations occurring within a certain time period and it is measured in Hertz (Hz) which means vibration per second (Meyer 2009: 4). It has been established that standard frequency, which a human ear can sense ranges between 16 Hz – 20 Hz and frequencies above 20 Hz are referred to as ultrasound whereas frequencies below 16 Hz are called infrasound (Meyer 2009). Sound wave output is usually captured by recording the sound and this can be displayed in the form of a spectrogram which provides a visual impression of the frequencies. This approach was employed in this research. The sound of the aerophone replicas was recorded in the field sound studio in Cape Town by Simon Kolher. The studio is equipped with Logic Pro and as a result some spectrograms of the single and the double perforated implements from KRM and MR sites were produced (see Kumbani *et al*. 2019, Chapter 4).

The spinning experiments of the aerophones replicas were followed by microscopic use-wear analysis around the holes of the replicas to examine the use-wear placement and characterization of the use-wear that had developed as a result of the spinning. An Olympus BX41 high power binocular microscope and an Olympus SZX16 low power binocular microscope were used. Both microscopes

were mounted with a DP72 digital camera connected to a computer equipped with Stream Basic software. Micrographs of both the replicas and archaeological implements were taken for further analysis. The use-wear analysis is further described in detail in chapter 4.

2.6. ANALYSIS OF MUSIC DEPICTIONS IN THE SAN ROCK ART OF SOUTH AFRICA

This research analysed and described some music depictions that are found in the rock art of South Africa as a source to augment the scarce music-related archaeological artefacts and broaden the discussion on the music archaeology of this region. In this thesis possible flute players in the rock art in the Klein Karoo in the southern Cape and the Cederberg of Western Cape (Rust *et al*. submitted) are discussed. Sites studied include Attakwas and Ezeljagdzpoort in the Klein Karoo, and Zimri shelter and the Procession shelter in the Cederberg. To further augment this promising research avenue Chapter 6 discusses musical bow players' depictions from the Maloti Drakensberg and the Maclear region in South Africa. Three sites from the Maloti Drakensberg in Natal and three sites from the Eastern Cape region were investigated. Some of the rock art depictions were accessed from the SARADA website (http://www.sarada.co.za/#/library/) where as others were accessed from published sources. SARADA website is a rock art database of the southern African rock art and beyond that is administered by the Rock Art Research Institute (RARI) at the University of the Witwatersrand and it is an open-access database.

Attention was focused on the postures of the the musical instrument players and well as their form for example, if they are human beings or therianthropic figures. Positions and handling of intruments are also described as well as the type of instrument for example bow with and without resonators. Desription of the general panel of where the musical instrument players are depicted is also provided as a way of providing full detail of the panel which may expand on context where the musical instruments were

2.7. CONCLUSION

This chapter described the methods that were employed in the research undertaken for this thesis. This multidisciplinary methodologoical approach proved to be useful in this music archaeological research. For instance, the use of ethnography, actualistic studies and thes study of musical depictions in the rock art seem to complement each other in developing hypotheses that can be used in the study of music archaeology.

CHAPTER 3: PUBLISHED PAPER # 1

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Music and sound-related archaeological artefacts from southern Africa from the last 10,000 years

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ABSTRACT

This paper discusses archaeological evidence of sound- and music-related artefacts from the southern African archaeological record, from Later Stone Age, Iron Age and historic contexts. The artefacts described fall within two groups, aerophones and idiophones. They include a bullroarer, spinning disks, bone tubes that might have been used as flutes, a trumpet, whistles, bells and mbira keys. The artefacts are made of bone, clay and metal. Original research and information gained through a literature review are reported. Ethnographic sources were also consulted in order to attempt to provide a broader contextual background against which knowledge of the archaeological implements could be expanded. This research is one of the first reports on southern African sound- and music-related artefacts. It is not exhaustive, but is intended as the basis for further development through collaboration.

RÉSUMÉ

Cet article présente les données relatives aux artefacts provenant des archives archéologiques d'Afrique australe qui sont liés au son et à la musique, issus de contextes datant du Late Stone Age, de l'âge du fer et des périodes historiques. Les artefacts décrits se répartissent en deux groupes, les aérophones et les idiophones. Ils comprennent un rhombe, des disques rotatifs, des tubes en os qui auraient pu être utilisés comme flûtes, une trompette, des sifflets, des cloches et des clés mbira. Les artefacts sont en os, en argile ou en métal. Des recherches originales et des informations obtenues par une revue de la littérature sont présentées. Les sources ethnographiques ont également été consultées dans le but de fournir un contexte contextuel pour élargir notre connaissance des objets archéologiques. Cette recherche représente l'un des premiers rapports sur les artefacts liés au son et à la musique en Afrique australe. Ce travail n'est pas exhaustif, mais est destiné à servir de fondation à un développement collaboratif ultérieur.

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Introduction

Music archaeology is the study of past musical behaviours and sound (Both 2009). It encompasses both the analysis of music-related archaeological artefacts and archaeoacoustics, i.e. the investigation of the effects of sound on past societies (Scarre and Lawson 2006;

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Díaz-Andreu and Mattioli 2019). Music archaeology seems to have started around the nineteenth century (Eichmann 2018), but became more prominent from the 1970s (Lawson 2010; Eichmann 2018). Lawson (2010), in particular, was influential in employing experimental work to test the organology of music-related artefacts from the archaeological record. The subject is now a fully fledged research field with several specialised research groups, including the International Study Group on Music Archaeology (ISGMA) (http://www.musicarchaeology.org/) and the International Council for Traditional Music (ICTM) Study Group on Music Archaeology (http://ictmusic.org/group/music-archaeology). Recent music archaeological work has been undertaken mostly in Eurasia and Scandinavia. For instance, Morley (2003, 2013) discusses music-related artefacts from the Middle and Upper Palaeolithic of Europe, while Conard et al. (2009) have analysed the ivory and bone flutes recovered from early Aurignacian contexts in southwestern Germany. In Scandinavia researchers like Lund (1981, 1985, 2010) have also made great strides in music archaeological research.

Compared to other areas of the world, the study of music archaeology in southern Africa is still in its infancy (Kumbani et al. 2019). Although there is the possibility that excavated material may relate to music and sound production, many researchers are not conscious of this. Music archaeology may not have attracted as much attention as other fields of archaeological research because of the poor preservation of most musical instruments given that the majority are likely to have been made of organic materials, which seldom survive in the archaeological record (Morley 2003; Blench 2013; Atema 2014). As yet, there has been little attempt to document the music-related artefacts known from the archaeological record in southern Africa. The aim of this paper is thus to report on archaeological artefacts from southern Africa that might be related to music and sound making between c. 10 000 years ago and historical times. While many may have been used as musical instruments, this is provisional and should be confirmed through further research. Given that identifications of archaeological artefacts as musical instruments are sometimes controversial (e.g. d'Errico and Lawson 2006; Scarre and Lawson 2006), in Tables 1 and 2 the objects discussed are presented with a confidence index, noting them as confident (1), likely to be music- and sound-related (2) or ambiguous (3).

Information was gathered from both primary and secondary sources on possible musical and sound-related instruments from the archaeological record. Ethnographic sources were also consulted and additional leads obtained via postings on Facebook and the Association of Southern African Professional Archaeologists' (ASAPA) mailing list platform requesting further information: as a result, two academics contacted me regarding the Ga-Mohana rock gong and the clay whistles from K2 and Mapungubwe. I have also drawn on examples of current and recent musicians who happen to use some of the instruments that have been recovered from the archaeological record.

This paper discusses artefacts from the Later Stone Age (LSA; 40-<2 kya) (Lombard et al. 2012), the Early Iron Age (AD 310-1060), the Later Iron Age (AD 1080-1850) (Phillipson 1975) and the historical period (from 500 years ago) from southern Africa. It is not an exhaustive list and is intended as an initial document that can be extended. The locations of the major sites discussed are shown in Figure 1. Different types of manufactured instruments are discussed below, but rock gongs and rock art depictions are also briefly mentioned as they form such an important part of the known collection of

Table 1. Music- and sound-related archaeological artefacts from southern Africa. Confidence levels are expressed as follows: 1 confident; 2 likely to be music and sound related; 3 ambiguous.

Implement	Number of artefacts	Confidence level *	Site	Country and region	Date	Reference
Spinning disk	1	1	Klasies River Main site	Southern Cape, South Africa	2525 ± 85 BP (GX-0969) - 2795 ± 85 BP (GX-0971)	Singer and Wymer (1982: 190)
Spinning disk	3	2	Matjes River Rock shelter	Southern Cape, South Africa	5400 ± 250 BP (L-336F) - 9580 ± 85 BP (GrN-5872)	Louw (1960); Protsch and Oberholzer (1975: 40)
Bullroarer	1	1	Matjes River	Southern Cape, South Africa	5400 ± 250 BP (L-336F) - 9580 ± 85 BP (GrN-5872)	Protsch and Oberholzer (1975: 40); Kumbani et al. (2019)
Bone tubes	36	2	Matjes River	Southern Cape, South Africa	5400 ± 250 BP (L-336F) - 9580 ± 85 BP (GrN-5872)	Louw (1960); Protsch and Oberholzer (1975: 40)
Bone tubes	8	3	Nelson Bay Cave	Southern Cape, South Africa	3350± 60 BP (Pta-2910)	Inskeep (1987: 166)
Bone tubes	5	3	Boomplaas	Western Cape, South Africa	1510 ± 75 BP (UW-307) - 1630 ± 50 BP (UW-337)	Deacon et al. (1978)
Bone tubes	10	3	Oudepost 1	Western Cape, South Africa	AD 1669 -1732	Schrire and Deacon (1989: 105)
Bone tubes	3	3	Die Kelders	Western Cape, South Africa	1960 ± 85 BP (GX-1688)	Schweitzer (1979)
Ceramic whistle	1	3	K2	Limpopo, South Africa	880 ± 50 BP (Pta-6064) - 1010 ± 50 BP (Pta-6576)	Meyer (1998: 298)
Ceramic whistle	1	3	Mapungubwe	Limpopo, South Africa	840 ± 40 BP (Pta-1159)	Meyer (1998: 298)
Ivory trumpet	1	1	Sofala	Coastal, Mozambique	Sixteenth century AD	Fagan and Kirkman (1967: 369)
Bone whistle?	1	2	Chondwe	Ndola, Zambia	1060 ± 95 BP (GX-1010)	Mills and Filmer (1972)
Thumb piano key	1	1	Chedzurgwe	Mashonaland West, Zimbabwe	210 ± 90 BP (SR-162)	Sheppard and Swart (1971: 421)
Thumb piano Key	2	1	Goosebay	Masvingo, Zimbabwe	Later Iron Age	Great Zimbabwe Conservation Centre records (accessed 15 August 2015)
Thumb piano key	2	1	Great Zimbabwe	Masvingo, Zimbabwe	Later Iron Age	Great Zimbabwe Conservation Centre records (accessed 15 August 2015)
Thumb piano key	3	1	Dhlodhlo/ Danamombe	Midlands, Zimbabwe	Later Iron Age	Mapuranga (2014)

Table 2. Matjes River bone tubes.

Artefact	#	Confidence Level	Layer	Weight (g)	Length (mm)	Breadth (mm)	Description
Bone tube	1	1	B	3.8	67.1	8.2	Neat cross-hatching and chevron pattern decorations
Bone tube	2	1	B	5.8	97	7.52	Neat cross-hatching decoration
Bone tube	3	1	C	4.8	73.11	8.2	No decoration
Bone tube	4	1	C	2.1	54.74	8.55	Broken on the other end; no decoration, but has visible striations
Bone tube	5	2	C	1.5	40.19	6.45	Broken on the other end; no decoration
Bone tube	6	1	C	3.5	75.55	7.76	Broken on the other end; has incisions that are spaced at approximately 2 mm intervals
Bone tube	7	3	C	0.7	47.83	5.27	Well preserved
Bone tube	8	3	C	1.6	26.64	6.39	The pipe is short
Bone tube	9	2	C	0.9	49.45	4.07	The bone flute is thin
Bone tube	10	3	C	0.3	27.55	9.77	Damaged and poorly preserved
Bone tube	11	3	C	0.4	19.38	6.02	The pipe is short and well preserved
Bone tube	12	2	C	2.7	40.89	8.14	Well preserved
Bone tube	13	3	C	1.1	28.96	5.51	Broken and glued together
Bone tube	14	3	C	1.4	24.06	5.32	Well preserved
Bone tube	15	3	C	3.3	19.82	13.25	Few incisions close to the opened end and the other side was never cut
Bone tube	16	3	C	1.3	16.98	8.23	Has two lines of almost evenly spaced incisions
Bone tube	17	1	C	11.5	167.27	9.42	The longest bone tube; shiny outside; has double incisions spaced all over the flute
Bone tube	18	2	C	1.5	55.59	7.01	Broken at the other end
Bone tube	19	3	C	0.7	32.98	5.89	Broken at both ends and has a crack
Bone tube	20	3	C	5	25.24	18.32	Well preserved; the bone has black stains. Only cut on one side
Bone tube	21	1	C	2.5	74.75	6.79	Well preserved bird bone
Bone tube	22	2	C	1	26.52	9.73	Cut on one side and the other side is naturally closed
Bone tube	23	2	C	4.4	55.89	11.51	Broken on the other end
Bone tube	24	2	C	0.6	24.59	5.63	Well preserved and short
Bone tube	25	2	C	1	40.97	5.69	Notched at one end
Bone tube?	26	3	C	2	50.94	8.38	Blackened and burnt. The marrow has not been removed
Bone tube	27	2	C	1.5	39.98	17.39	Not cut on the other end and it is blackened and shiny on the outside
Bone tube	28	3	C	0.8	28.27	6.26	Cracked and broken
Bone tube	29	3	C	0.6	21.33	10.01	Phalange that is cut on one side only
Bone tube	30	2	C	0.6	30.2	6.03	Well preserved
Bone tube	31	2	C	0.5	37.39	3.46	Well preserved and broken on the other end
Bone tube	32	3	C	0.9	28.41	5.62	Well preserved and shiny outside. Cut on one side only
Bone tube	33	3	C	1.6	18.46	8.79	Well preserved and the other side was never cut
Bone tube	34	3	C	0.6	29.17	6.06	Cracked and broken on both sides
Bone tube	35	1	C	19.2	105.63	19.32	Well preserved; a tibia of a Bovid Size Class I animal
Bone tube	36	3	C	0.4	24.14	5.57	Well preserved

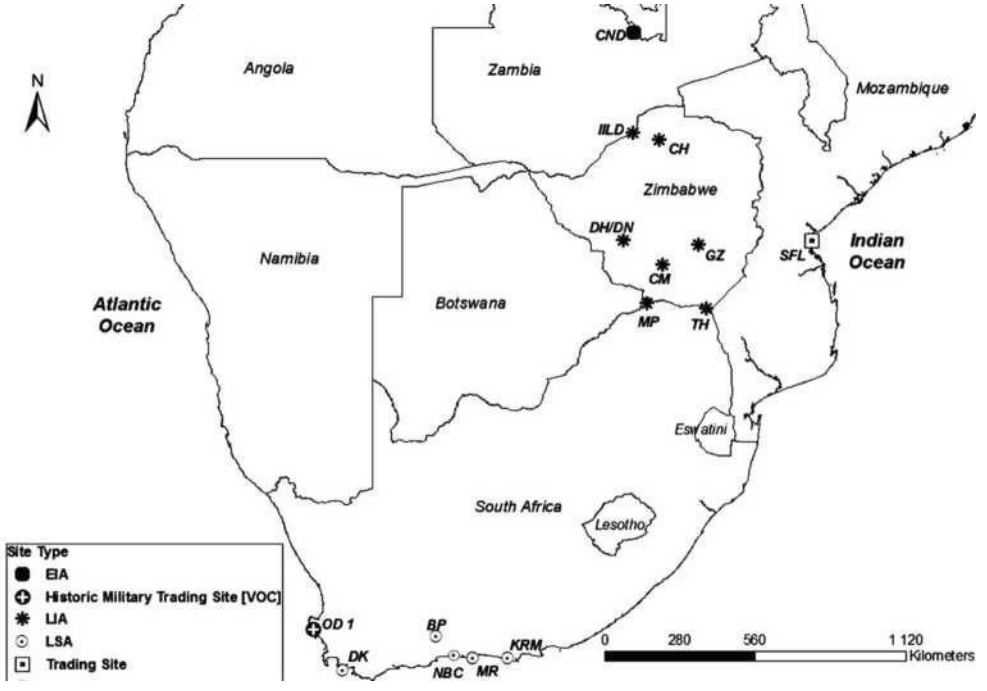


Figure 1. Map of Southern Africa showing the major sites discussed in the text. Site names are abbreviated thus: BP Boomplaas; CH Chedzurgwe; CM Chomunungwa; CND Chondwe; DH/DN Dhlodhlo/Danamombe; ; DK Die Kelders; GZ Great Zimbabwe; IILD Ingombe Ilede; KRM Klasies River Main site; MP Mapungubwe; MR Matjes River; NBC Nelson Bay Cave; OD1 Oudepost 1; SFL Sofala; TH Thulamela.

archaeological musical instruments. Thereafter current archaeological data for possible manufactured musical instruments are outlined, including relevant information from ethnographic contexts where this exists. This preliminary paper therefore extends to the southern part of the continent previous work undertaken by Blench (2013, 2014) for North and West Africa and the Indian Ocean area, work that likewise highlights the value of combining archaeological, textual sources and ethnographic information as useful tools for understanding the musical behaviours of past and contemporary societies.

Music-related archaeological artefacts from southern Africa

The inventory used here follows the classification of von Hornbostel and Sachs (1961) in broadly dividing musical instruments into four categories, namely aerophones, idiophones, chordophones and membranophones. Aerophones are musical instruments for which 'the air itself is the vibrator in the primary sense' (von Hornbostel and Sachs 1961: 24). They consist of two types: free aerophones and wind instruments proper. Free aerophones, for example, bullroarers and spinning disks, do not enclose the body of air, whereas wind instruments, for example whistles, trumpets and flutes, do confine it (Brown and Palmer 2001). Idiophones are instruments that make sound as a result of the vibration made by the instrument itself (von Hornbostel and Sachs 1961: 14). Idiophones are also sub-divided into a number of categories according to how they are played. These categories include percussion (such as xylophones), scraped (rasps),

shaken (rattles) and plucked idiophones (lamellophone or thumb piano). Chordophones produce sound through the vibration of strings and examples include harps, musical bows and lyres. The fourth category, membranophones, consists of instruments that produce sound as a result of the vibration of a stretched membrane or skin, for example drums and tambourines (von Hornbostel and Sachs 1961). No archaeological examples of chordophones or membranophones could be identified from southern Africa.

Depictions of musical instruments such as bows occur in southern African rock art (e.g. Stow 1905; Lewis-Williams 1981; Lewis-Williams and Challis 2011; Vogels and Lenssen-erz 2014). The region's rock engravings and rock paintings also show dancing scenes and clapping figures, possibly related to musical performances or ritual ceremonies. Rock art is therefore considered an important source for reconstructing music in the past (Lewis-Williams 1981; Blench 2013). Additionally, lithophones or rock gongs are some of the best known archaeological sound-producing implements (Fagg 1956; Goodwin 1957; Soper 2006; Rifkin 2009; Blench 2013; Rusch 2016; Morris et al. 2018) and could also have been used for ritual purposes (Parkington et al. 2008). In some cases, rock gongs are associated with rock engravings (Ouzman 2001; Rifkin 2009; Morris et al. 2018) and rock paintings (Fagg 1956; Godwin 1957). As this paper discusses manufactured archaeological implements, however, rock gongs and rock art will not be discussed in further detail here.

Aerophones from the southern African archaeological record

Free aerophones

The earliest aerophones recorded thus far from southern Africa may be spinning disks from Klasies River and Matjes River in the southern Cape, along with a bullroarer from the latter site. A spinning disk is usually a shaped implement with two holes in the middle (Kirby 2013) (Figures 2 and 3). It is played by rotating it in front of the body with both hands in either a clockwise or anticlockwise direction by alternately relaxing the string inwards and pulling the string outwards (Zhao et al. 2017). A bullroarer can be spun above the head or in a position that is perpendicular or adjacent to the body (Bullroarer 2014).

The Klasies River spinning disk

The implement from Klasies River that most likely represents a spinning disk was recovered from the lower levels of Later Stone Age Midden (LSA) II in Cave I dating to around 4800 BP (Singer and Wymer 1982; Nami et al. 2016). The LSA middens at this site are associated with a variant of the Wilton technocomplex, the Kabeljous industry which is characterised by unretouched quartzite artefacts and a few thick-backed scraper-knives or giant crescents (Binneman 1995). The artefact was broken during excavation, but it was possible to glue it together afterwards (Singer and Wymer 1982). It is made on a flat bone, most probably a rib, is oval shaped and has two small perforations in the middle (Figure 2). Singer and Wymer (1982: 127-128) suggest that it could have been a child's toy (wirra wirra) or a 'pendant'.

Unfortunately, the artefact is currently missing from the Iziko Museums of South Africa. Following Marreiros et al. (2015) an experimental study was undertaken to

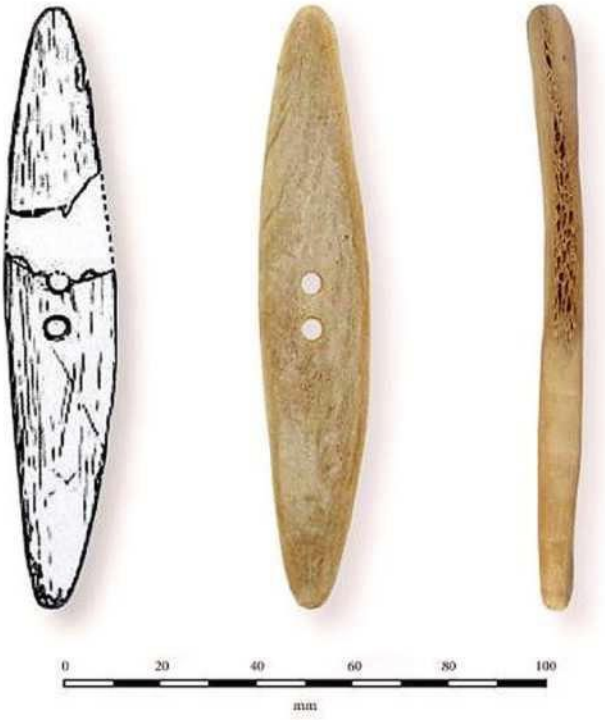


Figure 2. Klasies River spinning disk and replica (photograph courtesy of Neil Rusch).



Figure 3. Matjes River 5135 spinning disk from Layer C.

better understand the sound producing qualities and use wear associated with it using a replica made after Singer and Wymer's (1982: Figure 9.5) illustration. The replicas were 110.6 mm long, 20.4 mm wide and 6.6 mm thick and the distance between its holes is 4.6 mm (Kumbani et al. 2019). They were spun using various types of strings made from plant (jute, hemp and sisal) and animal (tanned leather thongs and rawhide thongs) fibres. The replicas produced whirring and pulsed sounds at frequencies of between 52 Hz and 142.85 Hz (Kumbani et al. 2019). The pulsed sound was generated by the alternation of clockwise and anti-clockwise spinning (Wurz et al. 2019).

The Matjes River spinning disk

MR 5135, an implement similar to that from Klasies River, comes from Matjes River rock-shelter just east of the Robberg Peninsula on the southern Cape coast. It was recovered from the Site 4 area of the excavation in Layer C (Louw 1960: 109), which is dated to between 9580 ± 85 BP (GrN-5872) and 5400 ± 250 BP (L-336F) (Protsch and Oberholzer 1975: 40). This layer is associated with Wilton assemblages and was rich in human burials and ornaments made of bone, shell and ostrich eggshell (Louw 1960: 17; Ludwig 2005). Louw (1960: 109) refers to the implement as a 'woer woer' ('bullroarer').

Morphologically, MR 5135 (Figure 3) and the Klasies River implement are similar, but the former also has two small holes in the middle with diameters of 2.8 and 2.9 mm (Kumbani et al. 2019). The MR 5135 spinning disk is 125 mm long, 31.7 mm wide and 3 mm thick and has a distance between the holes of 7.4 mm (Kumbani et al. 2019). A replica of it proved to be asymmetrical and did not produce sound. This probably means that it was still a work in progress when abandoned since modification of the replica by relocating the two holes and slightly altering the object's shape did succeed in producing a sound similar to that of the Klasies River implement (Kumbani et al. 2019).

Ethnographically spinning disks are called by various names depending on the group to which they belong (Kumbani et al. 2019: 696). A spinning disk (KK 058) from a San group at Haruchas, Namibia, was collected in 1932 by Kirby and now forms part of the Kirby collection at the South African College of Music of the University of Cape Town (Figure 4). KK 058 was also part of the actualistic study undertaken by Kumbani et al. (2019). When spun by hand its frequency ranged from 57 Hz to 200 Hz, most probably

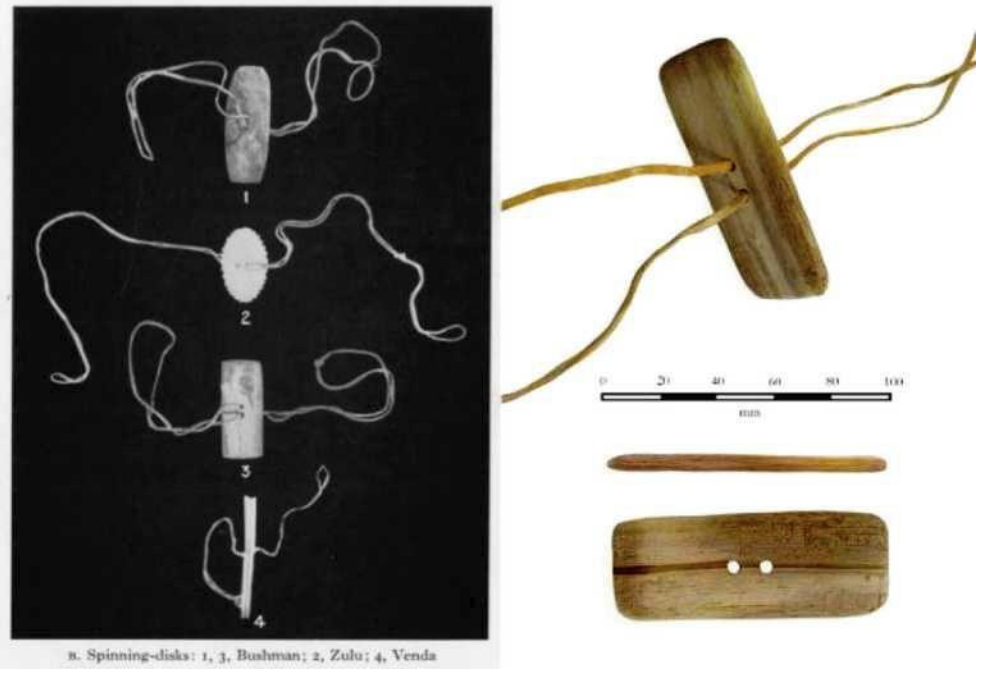


Figure 4. Kirby collection ethnographic spinning disks and KK058 replica. KK058 is number 3 on the photograph (The figure on the left was adapted from Kirby [1934] 2013: 101).

spinning faster than the Klasies River example because of its smaller size (Kumbani et al. 2019: 702).

Spinning disks have thus been recovered from two southern Cape sites and they are also widely documented in the ethnographic record, with Kirby (2013) observing their use by San, Zulu and Venda, among others, often as toys that are mostly played by children. It is possible that the archaeological examples were also used as toys, but they could also have played vital roles in ritual settings as sound-producing devices (Kumbani et al. 2019).

Bullroarers

By definition, a bullroarer is often a flat oblong implement made of wood, bone or stone that is leaf- to oval-shaped and usually has a perforation on the tapered end through which a string is attached (Dundes 1976; Morley 2003). There are two ways in which bullroarers can be played, either by spinning them above the head using one hand or by spinning them in a perpendicular fashion adjacent to the body (Kumbani et al. 2019). In overall shape, bullroarers resemble pendants (Ludwig 2005) and spatulas (Dietrich and Notroff 2016). Kumbani et al. (2019) investigated whether artefacts termed 'pendants' from Matjes River Layer C could have functioned as bullroarers. Spinning replicas of the pendants resulted in microscopically visible use-wear developing on the lateral sides of the perforations, but this was apparent on only one of the four archaeological artefacts examined (MR 40) with the others having use-wear restricted to the top, similar to that found on ethnographic pendants made of peccary canines that form part of the so-called Bará necklace (Falci et al. 2018: 782). MR 40 thus appears to have been a bullroarer that was spun and is described further below.

The Matjes River bullroarer

Previously described as a pendant (Ludwig 2005), the MR 40 implement from Matjes River (Figure 5) comes from Layer C, which is associated with the Wilton technocomplex and features several burials. The artefact is made from bone and its oval- to pear-shaped form resembles that of other known bullroarers from the European Upper Palaeolithic (see Morley 2003: 36). MR 40 is 88.2 mm long, 26.9 mm wide and 5 mm thick



Figure 5. Matjes River (MR) 40 bullroarer recovered from Layer C.

(Kumbani et al. 2019). A replica of this implement was spun mechanically and produced a whirring and pulsed sound. Its acoustic properties are similar to that of known bullroarers (Kumbani et al. 2019). Spinning the MR 40 replica using a leather string produced a maximum frequency of 76.92 Hz, while spinning it using a fibre string produced a maximum frequency of 55.55 Hz.

In southern African ethnography, bullroarers have been associated with music and other purposes. For example, Kirby (2013: 101) observed their use in musical contexts and Nurse (1972: 26) mentions that Kalahari San used the bullroarer for musical purposes. Bleek and Lloyd (2001: 353) noted that the /Xam used bullroarers to scare away bees so that people could gather honey, while among the !Kung (Ju/'hoansi) bullroarers (!xoe) are used during initiation and elderly men regard them as secret instruments that are subsequently burnt (England 1995). Their sound indicates the presence of God (Mans and Olivier 2005: 60).

Given the available information on spinning disks and bullroarers it can be suggested that they played a definite role in sound production, and perhaps even the music, of people in the past, although Kirby (2013: 99-101) mentions that, like spinning disks, they were frequently used as toys.

Wind aerophones

Flutes

According to Porter (2002: 1), a flute is any wind instrument that confines air in its hollow body which is then activated by the air from the player's lips striking against the opening of the flute. Bone pipes or tubes have been found in the southern African record in both Later Stone Age and Iron Age contexts. Similar implements also occur in the Upper Palaeolithic of Europe where hollow tubes with or without holes have variously been referred to as pipes, flutes or whistles (Morley 2003; Conard et al. 2009).

Later Stone Age bone tubes

Sixty-two bone tubes that might have been 'flutes' have been recovered from Later Stone Age sites in the southern and western Cape of South Africa (Inskeep 1987) (Table 1). Bird bone is the dominant material used to make them (Ludwig 2005: 46). Decoration occurs on some of the pipes as discussed below. Some of these bone tubes have previously been interpreted as beads and pendants (Inskeep 1987) or sucking tubes (e.g. Meiring 1953). Here, on the other hand, it is postulated that they might have been used as flutes on the basis of their shape and dimensions, although this hypothesis needs to be investigated further. Most of the bone tubes are smoothed on their ends, which might suggest contact with the lips of a person blowing them to produce sound. Arguably, a bone tube that is long enough to be held in a hand can be played as either a whistle or flute. Variation in their length and breadth may have been deliberately intended to produce different tones, although they do not have finger holes. However, this needs to be confirmed through microscopic and actualistic research. Only the bone tubes from Matjes River are described in detail here (Table 2), due to difficulties in accessing the other implements listed in Table 1.

Nelson Bay Cave

Eight bone tubes have been found at Nelson Bay Cave in the southern Cape. They come from unit 64 dated to around 3660 BP (Inskeep 1987: 166) and are associated with the Final Later Stone Age of Lombard et al. (2012: 132). Inskeep (1987: 167) refers to these hollow bones as bone tubes and suggests that they could have been used as beads or pendants. Their sizes vary from 11 to 76 mm in length (Ludwig 2005: 47). Two are decorated with cross-hatched incisions. One of the decorated pieces is broken at one end. Of the six undecorated tubes only two have smoothed ends, whereas the other four have rough ends. Ludwig (2005: 47) found four more undecorated bone tubes from Nelson Bay Cave that were not reported by Inskeep (1987), all of them made using the ring-and-snap method. He did not report any dates for them, but they are likely to come from the same Final LSA contexts as the others.

Die Kelders

Five bone tubes were recovered from this site on the coast east of Cape Town (Schweitzer 1979: 142). Four come from Layer 12, dated to 1960 ± 85 BP (GX-1688) (Schweitzer 1979: 127) and are associated with a Ceramic Final LSA assemblage (Lombard et al. 2012: 128). The tubes are made from both bird and mammal bones (Schweitzer 1979) and show evidence of having been cut using the ring-and-snap method (e.g. Figure 8). A bone ring from Layer 12 that Schweitzer (1979: 142, Figure 18 item D) suggests could have been used as a bead may also result from using this method to cut bone tubes.

A bone tube from Layer 5 that can be broadly dated between 1960 ± 95 BP (GX-1687) and 2020 ± 95 BP (GX-1686) has notches (Schweitzer 1979: 133, Figure 11 E), although the function of these incisions was left unexplained (Schweitzer 1979: 141). It is, however, similar to other notched hollow bones from Holocene LSA sites in the Western Cape Province, such as Bonteberg Shelter (Maggs and Speed 1967: 83) and Boomplaas (Deacon et al. 1978: 52, Figure 10 number 18). In other contexts, for example, the Upper Palaeolithic of Europe it has been suggested that such notched bones could have been used as rasps (Morley 2003).

Boomplaas

The site of Boomplaas near Oudtshoorn in the southern Cape has yielded three bone tubes. Two were recovered from Layer BLD, which has radiocarbon dates of 1510 ± 75 BP (UW-307) and 1700 ± 55 BP (UW-338) (Deacon et al. 1978: 57) and is associated with a Ceramic Final LSA industry (Lombard et al. 2012: 131). Neither has any decoration, but both are polished. It is not known from which animal they were made, but bird bone is possible. The third tube was recovered from the overlying layer DGL, which is dated to 1630 ± 50 BP (UW-337) (Deacon et al. 1978: 57), and is incised. This layer is also associated with a ceramic Final LSA industry, but additionally has extensive evidence for the keeping of sheep within the site (Deacon et al. 1978).

Oudepost 1

Another site that has yielded bone tubes is Oudepost 1 (OD1) near Saldanha in the Western Cape (Schrire and Deacon 1989). The site was occupied in the late seventeenth and early eighteenth centuries (Schrire and Deacon 1989: 105) as an outpost of the Dutch East India Company and has evidence for coexistence and contact between its staff and

local Khoekhoen. Buttons, combs and bone beads are considered as colonial artefacts, whereas bone points and ostrich eggshell are considered to have Khoekhoe origins, along with poorly fired, undecorated, quartz-tempered pottery. Ten tubes made from flamingo bone (Schrire and Deacon 1989: 109) were recovered, of which two are intact and respectively 15 mm and 162 mm long. Schrire and Deacon (1989) mention that these bone tubes lacked any evidence of tobacco stains, which makes it unlikely that they were used as smoking pipes.

Matjes River

Matjes River yielded a total of 36 bone tubes (Louw 1960). Two come from Layer B, dated to around 2050 ± 120 BP (Louw 1960: 20) and linked to the Ceramic LSA (Lombard et al. 2012: 128). Both are decorated with cross-hatching (Louw 1960; Ludwig 2005) (Figure 6). One of the tubes has a single strand of cross-hatching that is about 2 mm wide and runs longitudinally along it. The other has three separate strands of cross-hatching with small gaps separating the strands. This tube also has a single strand of chevron pattern decoration (Figure 7). The decoration runs longitudinally along the bone. Both tubes are shiny on the outside.



Figure 6. Bone tube from Matjes River Layer B with cross-hatched decoration.



Figure 7. Bone tube from Matjes River Layer B with chevron pattern.

The rest of the tubes (N = 34) come from Layer C, the same burial-rich layer that yielded the bullroarer (MR 40) and the spinning disk (MR 5135) discussed above. During the analysis of the Matjes River bone tubes I noted that the ring-and-snap method was used to cut them (Figure 8). Three of the Layer C tubes have incisions. One has double incisions that are randomly spaced on the body of the bone tube, another single, evenly spaced incisions and the third has single incisions that are randomly spaced. A sharp object was used to cut the bone tubes as well as to make the decoration.

All 36 of the bone tubes were measured and weighed. Most (N = 30) are open at both ends. Twenty-five of the tubes are less than 50 mm in length, with the shortest tube having a length of just 17 mm. Their mean length is 45.2 mm and their mean weight 2.6 g (Table 2). The longest tube has a length of 167.3 mm, has double incisions around its body, is shiny on the outside and has smoothed ends (Figure 9). All but two of the tubes are made of bird bone. One of the exceptions is made from the tibia of a small animal, probably from a Class I bovid (Figure 10); this piece has smoothed ends. The other is a phalange from what was probably a Class III bovid; it is cut only at one end (Figure 11) and has also been smoothed. This item may have functioned as a whistle by analogy with Kirby's (1933, 2013: 127) description of natural plugs of reeds that were left intact at one end, but cut open at the other to make a whistle. One of the 36 bone tubes had not been properly cleared as it still has some bone marrow inside (Figure 12). This bone is also blackened, indicating that it was exposed to fire, and may not have been finished. Three of the tubes are broken at both ends, but these breaks are ancient, as is also the case with those on the six bone tubes broken only at one end.



Figure 8. Ring and snap method employed to cut the tubes. The cuttings also show the multiple attempts to make a ring.



Figure 9. The longest bone tube from Matjes River site Layer C.

Hollow bone pipes or tubes from various South African sites have been interpreted in various ways as either beads or pendants (e.g. Inskeep 1987). However, they may have been used as musical instruments. At a museum conference held in Bloemfontein in May 1957, the late Professor Kirby demonstrated that musical tunes could be played on the bone tubes from Matjes River (Louw 1960: 109). A musical function may thus also hold for similar hollow bones from Nelson Bay Cave, Boomplaas, Oudepost 1 and Die Kelders. Common to all of these bone tubes is the fact that they lack finger holes and would thus have produced a single tone (Morley 2003: 45).

The Kirby collection of musical instruments includes flutes collected from South Africa, Namibia and Botswana (https://digitalcollections.lib.uct.ac.za/percival-kirby-musical-instruments). Some do not have finger holes and thus resemble the LSA bone tubes just described. Other specimens, however, do have finger holes, including the tshitiringo used by the Venda in South Africa. Mans and Olivier (2005: 57) also record the use of



Figure 10. Matjes River bone tube made from a tibia from Layer C.



Figure 11. Matjes River phalange from Layer C that is cut on one side.

flutes by the Nama and Damara in Namibia that come in various sizes and are called by a variety of names (e.g. gamab/s, !arob). They include examples made from papaya tree leaf stem and reeds (Mans and Olivier 2005).



Figure 12. Matjes River blackened bone tube with marrow from Layer C.

It should be noted that there is a very thin line between what are called flutes, pipes and whistles since these terms are sometimes used interchangeably (Morley 2003: 44). For example, hollow bones are sometimes referred to as flutes (Morley 2003) and on the other hand are also referred to as whistles (Mills and Filmer 1972; Kirby 2013). Kirby (2013: 127) mentions that whistles in South Africa were made from materials such as river reeds, small antelope horns, hollow bones or even quills. These hollow bones could have been flutes since sometimes there is no clear-cut distinction between flutes and whistles as highlighted above with reference to whistles made of reeds that are cut in such a way that the knots of the reed form a natural plug (Kirby (2013: 127). The bone specimens that are only cut at one end from Matjes River were perhaps therefore used as whistles. It seems that the bone tubes from this site were found in association with each other during excavation (Louw 1960) and it may therefore be hypothesised that they were tuned sets of one-note pipes such as the reed-pipe ensembles mentioned by Kirby (1933). Blench (2013) also discusses this type of wind polyphony. Further work is necessary, however, to test the hypothesis that the Matjes River bone pipes could have formed part of a tuned set.

Ethnographically, flutes made from reeds are the earliest musical instruments to be described by early travellers to the Cape (Kirby 1933, 2013). For example, when Vasco da Gama arrived at Mossel Bay on 2 December 1497 he was welcomed by a flute orchestra (Olivier 2006: 165). Stow (1905: 115) describes San women playing flutes for musical purposes and that women from different groups would meet for one or two days, playing their flutes, singing and dancing. Kirby (1933, 2013: 193-230) likewise records their use among a variety of Bantu-speaking groups, including the Pedi, Tswana, Tsonga, Zulu, Swazi, Sotho and Venda, who used flutes that were mostly made from reeds and both with and without finger holes. While reeds are unlikely to survive in most archaeological contexts, the presence of bone tubes in the archaeological record that could have been used as flutes may suggest that other materials were also used to make flutes in the past, not least because reeds are easier to acquire than bird bone.

In the following section I turn to possible musical instruments associated with Iron Age Farming Communities.

Clay implements from K2 and Mapungubwe

The famous Iron Age sites of Mapungubwe and K2 in the far north of South Africa's Limpopo Province have each yielded a single example of a ceramic whistle, both of which now form part of the collections of the University of Pretoria (Sian Tiley-Nel pers. comm., 23 January 2019). The implements have been described by Meyer (1998: 243, 244) as 'pendant shaped ceramic whistles', but he did not go into further detail. Both have been declared National Heritage objects because of their rarity (Sian Tiley-Nel pers. comm., 16 July 2019). The whistles are shaped like pots and have small openings at the top for blowing the air into their opening chambers. Their bases are not flat, but tapered at the end and each has a hole drilled across its base. The N321 clay whistle from K2 (Figure 13) was recovered from a burial context. Broken in half and with the other part missing, it dates to around AD 1030-1220 (Meyer 1998: 297). N321 is greyish in colour and may have been exposed to fire, although not for long. It has a single strand of comb-stamping decoration on its body and measures 45 mm long, 42 mm wide and 29 mm high.

The Mapungubwe N320 clay whistle (Figure 14) is complete and intact. It was recovered from square A4, Layer 11 excavation Mk 1 on Mapungubwe Hill (Meyer 1998: 243) and is dated to around AD 1220-1250 (Meyer 1998: 297). Poorly fired, its surface has a number of black and brown spots and it measures 38 mm long, 37 mm wide and 36 mm high. It is decorated with oblique lines of incisions and faint cross-hatching on both sides of its lower part. However, the decoration is not as clearly visible as that on the example from K2. It is not clear whether the decoration of either artefact carried any meaning or was just made for aesthetic purposes. Similar clay implements are used as whistles today by Basotho herders in Lesotho (Sian Tiley-Nel pers. comm., 23 January, 2019), but in general there seems to be a lack of discussion of similar implements

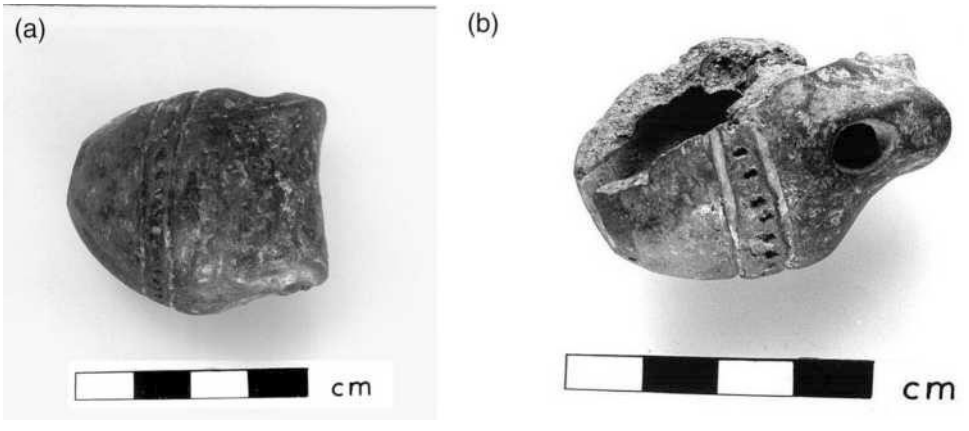


Figure 13. N321 clay whistle from K2 from a burial context (copyright: Mapungubwe Archives and University of Pretoria Museums).



Figure 14. N320 clay whistle from Mapungubwe.

in southern Africa. Perhaps the clay whistles from K2 and Mapungubwe were used in various contexts, such as signalling implements, during music and dance performances and to help herd livestock.

Early Iron Age whistle from Chondwe, Zambia

This is a bone tube recovered from Level 5 of Trench II in the excavation of Chondwe, an Early Iron Age site in Zambia. It is dated to around 1060 ± 95 BP (GX-1010; Mills and Filmer 1972: 133). Mills and Filmer (1972) refer to this piece as a whistle (Figure 15). It is 50 mm long and has a mean external diameter of 13 mm, while its longitudinal perforation is 4 mm in diameter. The whistle has an embouchure and was associated with other materials that included an ivory bangle and grinding stones. I am not aware of the tube's current repository.

Although Mills and Filmer (1972: 136) describe this artefact as a whistle, the presence of an embouchure suggests that it could be a bone flute. Ethnographically known bone whistles from South Africa are made of a single stopped pipe from various materials such as river reeds, small antelope horns, hollow bones or even the quills of ostrich feathers and were employed by a diversity of groups, including Kalahari San, Khoekhoen,

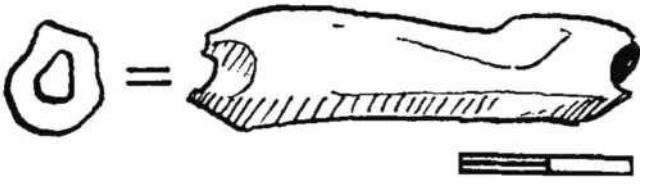


Figure 15. Bone tube from the Chondwe Early Iron Age site, Zambia (adapted from Mills and Filmer 1972: 137).

Xhosa, Pedi and Zulu, as signalling devices and during music and dance performances (Kirby 2013).

The Sofala trumpet

The Portuguese trading fort site of Sofala on the coast of Mozambique has yielded a trumpet (Fagan and Kirkman 1967). Trumpets categorically belong to the aerophone family because of their capacity to enclose a body of the air inside their body. There is no accurate date for this instrument, but it is estimated to date from the sixteenth century onward, following Portuguese annexation of Sofala in 1505. When found by a Mr Brian Christie, the trumpet had one end protruding from the ground close to wall foundations where it was associated with imported Chinese ceramics and locally made pottery (Fagan and Kirkman 1967: 369). When recovered it was in a fragmentary state, but was subsequently reassembled. Mr Christie donated it to the University of Pretoria Museum in 2008 and it was subsequently conserved and stabilised. Further conservation and analysis is pending (Sian Tiley-Nel pers. comm., 16 July 2019).

The trumpet is 48.3 cm long and made from an elephant tusk and has its mouthpiece on one side (Figure 16). The tusk has been carved and scraped as a way of reducing or trimming down the size of the instrument, while its hollow interior has been enlarged closer to the mouthpiece (Fagan and Kirkman 1967). The trumpet has a figurine curved on its head and has four notches that were cut into the ivory at an angle of 45°. According to Fagan and Kirkman (1967), it was probably once sheathed with metal because it has six rivet holes near the mouth, as well as metal residues elsewhere. The trumpet is decorated with circle-dots that are engraved on the main part of the horn. It also has three cruciform motifs, made by double lines of circular drilling, and pairs of a double, opposed circle-segment motif. It is of a type known as a proclamation horn or mbiu used by the Swahili of the East African coast to announce the arrival of a great person and thus has élite associations (Fagan and Kirkman 1967).

It seems as if trumpets are not a common occurrence in the archaeological record of southern Africa, though they have a long history elsewhere. In Ghana, for example, the Asante, for whom trumpets have spiritual significance, have the Ntahera, an ivory trumpet ensemble comprising seven trumpets that is associated with the royal court (Kaminski 2007). Similar instruments are also well known in Central Africa, for example in Congo-Kinshasa (Hen 2015: 1), as well as on the East African coast (Fagan



Figure 16. Ivory trumpet from Sofala in Mozambique (copyright: University of Pretoria Museums).

and Kirkman 1967: 372). Where present in southern Africa, as among the Tswana, Sotho, Swazi, Tsonga and — rarely — the Zulu, they are mostly made from the horns of sable antelope (Hippotragus niger); they do not seem to have been used by either San or Khoekhoen (Kirby 2013). One primary function was in signalling, for example among the Karanga of Masvingo province in Zimbabwe (Kumbani 2016) or among the Venda, where they were used to call subjects to the chief's place (Kirby 2013), but they are also likely to have been used for musical purposes, for example to accompany dances or, nowadays, even in churches.

Idiophones from the southern African archaeological record

Thumb piano (mbira)

A thumb piano or mbira is an idiophone musical instrument present in several areas of Sub-Saharan Africa since at least the Later Iron Age (Kubik and Cooke 2001). It consists of a set of flattened iron bars (Figure 17) that are fixed on to a wooden bar and it is sometimes enclosed in an open gourd that also functions as a resonator to amplify the sound. A few Later Iron Age sites, namely Great Zimbabwe, Dhlodhlo (now Danamombe) and Goose Bay, have yielded thumb piano keys (Kumbani 2016). The seven pieces recovered from these three sites range in length from 70 mm to 110 mm (Kumbani 2016). A fourth site — Chedzurgwe — in northern Zimbabwe yielded a flattened iron bar previously described as 'a square-sectioned copper rod, 55 mm long and 2 mm across, [that] may simply be a further length of wire, but the flattening of one end suggests that it was a pin' (Garlake 1970: 31). This may also be a thumb piano key because of its distinctive shape since these are flattened on one end to allow the musician's fingers to play the keys (Kubik and Cooke 2001). Other examples may be represented by strips of iron, identified as lamellaphone tongues, from fifth- to seventh-century AD contexts at Kumadzulo and tenth/eleventh-century ones at Kalomo and Kalundu, all in Zambia (Kubik and Cooke 2001: 8).

The mbira has a long history, with Kubik and Cooke (2001) suggesting that it was made using the raffia palm in Gabon, southern Cameroon and possibly eastern Nigeria before the start of the Bantu dispersal in the first millennium BC. Metal versions of mbira were then introduced with the advent of iron technology. A detailed description is given by the Portuguese missionary Frei João dos Santos of a nine-note lamellaphone



Figure 17. Thumb piano key from Great Zimbabwe (Photograph courtesy of Foreman Bandama)

termed 'ambira' in what is now eastern Zimbabwe in 1586 (Kubik and Cooke 2001: 8). Such instruments retain a significant role in linking the living and the dead on modern Karanga society, being used during ancestral veneration ceremonies in which people sing and dance and spirit mediums enter trance to become the ancestors' mouthpiece (Kumbani 2016). They play the same role among the Venda (R. Hulisani Thomas pers. comm., 15 June 2019) and their possession was therefore discouraged for a time by Christian missionaries (Zindi 2010). Now modified into an electric instrument, the mbira is also played by contemporary musicians in both Zimbabwe and beyond.

Musical bells or gongs

Musical bells (Vansina 1969) or gongs (Walton 1955) have also survived in the southern African archaeological record (Figure 18). These iron musical bells occur in two types, double and single, and are known from Thulamela in South Africa (Steyn et al. 1998), Great Zimbabwe, Dhlodhlo, Chomnungwa and Shamrock Mine in Zimbabwe (Walton 1955) and Ingombe Ilede in Zambia (McIntosh and Fagan 2017). All the double bells have U-shaped handles, except for the single bell from Great Zimbabwe (Walton 1955: 20). Two double gongs along with a single iron gong and an iron striker were recovered from Enclosure 1 (Renders Ruins) at Great Zimbabwe, while the other two pairs of double bells were recovered from the outer enclosure of the Mauch Ruins (Walton 1955). The locations of these artefacts indicate that they likely had associations with the ruling élite of Great Zimbabwe.

The Zimbabwe Culture site of Thulamela in northern Limpopo Province, South Africa, which dates to between the mid-thirteenth and mid-seventeenth centuries, has also yielded a double music bell, which was recovered from Enclosure 13 in association with human skeletal remains and gold bangles that again point to élite associations (Loots 1998; Steyn et al. 1998). The single iron gong or bell from Ingombe Ilede was likewise recovered from a burial context (Burial 8) that also contained gold beads, wound bronze wire bangles on the fore arms and ankles, three layers of preserved cotton cloth, four copper ingots, two wire drawing plates and two hoes and is dated to 370 ± 30 BP (Beta-415034, cal. AD 1465-1635; McIntosh and Fagan 2017: 1073). Less detail is available on the contexts of the bells from Dhlodhlo, Chomnungwa and Shamrock Mine.



Figure 18. Iron gong from Great Zimbabwe on display at the Natural History Museum in Bulawayo adapted from Chirikure 2019).

Iron bells and gongs are believed to originate in south-central Africa and reflect a sophisticated manufacturing technology, as well as widespread sharing of musical ideas (Vansina 1969). That most of those known in southern Africa come from high status sites of the Zimbabwe Culture and/or rich burials supports the view that, just as is the case north of the Zambezi where they are played to announce the arrival of kings or other influential people, they carried élite associations. Like the thumb pianos discussed above, today they also continue to be used by contemporary musicians.

Conclusion

This paper has reviewed the archaeological evidence for possible sound- and music-related artefacts in southern Africa in both Later Stone Age and Iron Age contexts, drawing tentative links with ethnographic data where this is possible. Examples discussed include spinning disks, a bullroarer, bone tubes that could have been used as flutes, whistles, a trumpet, thumb piano/ lamellophone (mbira) keys and iron bells and gongs. The recorded artefacts can be broadly categorised into two groups, aerophones and idiophones. This limited range of possible sound related artefacts is probably due to the poor preservation of organic materials that were also used in the past and to the restricted nature of research on the subject. The artefacts discussed here are certainly not a complete representation of all the available possible sound- and music-related artefacts and further research at museums would very likely turn up more such implements, including examples that have previously been overlooked or misinterpreted.

Some of the sound-producing implements discussed have been recovered from burial contexts, including the spinning disks from Klasies River and Matjes River, the bullroarer from the second of these sites, the K2 whistle and the iron gongs/bells from Ingombe Ilede and Thulamela. In at least these cases it is thus likely that sound played a vital role during rituals (e.g. Ouzman 2001; Parkington et al. 2008). The artefacts discussed therefore present an important further avenue of research into the role that sound may have held in past socio-cultural beliefs and practices.

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A functional Investigation of the southern Cape Later Stone Age artefacts resembling aerophones.

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A functional investigation of southern Cape Later Stone Age artefacts resembling aerophones

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ABSTRACT

This paper describes possible sound-producing artefacts from two Later Stone Age deposits in the southern Cape, South Africa. Implements previously described as a 'wirra wirra' or 'pendant' from Klasies River main site (KRM), a 'woer woer' or 'bullroarer' and four 'pendants' from Matjes River (MR) are analysed and their sound producing qualities assessed through an actualistic research programme. For comparative purposes, a replica of an ethnographic 'spinning disk' was also spun and its sound recorded. All of the implements, except the MR 'woer woer' produced a sustained, pulsed, whirring sound when spun. Minor adjustments to the MR 5135 replica resulted in successful sound production. The frequency range of the KRM replica and ethnographic KK058 implement produced a frequency variation of between 52 Hz and 200 Hz. The frequency range of the pendant replicas varied from 55.55 to 250 Hz, comparable to other bullroarers. Spinning produces use-wear predominantly on the left laterals of the perforations, whereas pendant use produces use-wear along the upper sector of the perforation, thus allowing us to distinguish these two uses based on the placement of use-wear. We conclude that one of the bone artefacts previously thought to be a pendant, MR 40, most likely functioned as an instrument to produce sound. This investigation thus experimentally confirms that earlier hypotheses that the 'wirra wirra' from KRM and the 'bullroarer' from MR were aerophones are judicious. In addition we demonstrate for the first time that some archaeological pendants, such as MR 40, may have been used as free aerophones or bullroarers.

1. Introduction

Music is a highly pervasive form of social and symbolic expression found in all human societies. An encompassing definition of 'music' is that it entails expression through organized sound as well as intentional rhythmical movement or dance. From this perspective music is much more than a Western concept of concert hall performances by trained individuals, it constitutes intentional action of sound production combined with entrained body movement (Wurz, 2009, see also Cross and Morley, 2008). Yet, despite its cultural importance, archaeomusicology and its components are under-researched in South Africa, indeed in Africa as a whole. In the southern Cape, for example, archaeological evidence for musical expression and sound production has received virtually no attention. While there is an intensive research focus on the origins and development of complex cognition and symbolic expression within the Middle Stone Age (MSA) (Wurz, 2018), and on social dynamics within the Later Stone Age (LSA), the role of sound and musical expression within these frameworks is infrequently addressed. This is undoubtedly because musical instruments are often made of organic materials, which easily decompose (Morley, 2003; Atema, 2014), but also because it has not been a prominent research question.

Aerophones are musical instruments that produce sound through "setting up vibrations in a body of air" (Brown and Palmer, 2001: 40). The air is propelled in various ways to set up a vibration (Cohen, 2015: 10). In terms of Von Hornbostel and Sachs' (1961) classification of musical instruments, aerophones are one of the four main classes of musical instruments, including idiophones, membranophones and chordophones (Brown and Palmer, 2001). Aerophones occur in two types, either as free aerophones or wind instruments. Free aerophones are whirring instruments that do not confine the vibrating air, whereas wind instruments enclose the body of air inside a tube or vessel (Brown and Palmer, 2001). This paper discusses two types of free aerophones: bullroarers and spinning disks. These instruments produce sound by creating vibrations in the air when they are spun around their axes (Montagu, 1971). A bullroarer is often a flat, oblong, piece of bone, wood or stone with a hole at one side, through which the string is

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attached (Dundes, 1976: 220; Morley, 2003: 33) whereas a whirring disk or spinning disk is a flat piece of, for example, wood or bone with two perforations in the middle (Kirby, 2013: 101).

Bullroarer shapes vary from oval to, rectangular, and sometimes have serrated edges (Wachsmann, 2001). Spinning disks also come in different shapes, for example rectangular, oval or circular (Kirby, 2013). A bullroarer is strung with a string and is sometimes attached to a stick that functions as a handle providing leverage and additional torque. The whip-action (torque) adds a means to manipulate sound output since the sound produced by a bullroarer is a function of air-speed. The bullroarer is spun above the head using one hand, or perpendicular and adjacent to the body. Spinning disks are also strung with string and played by spinning it in front of the whole body with both hands in either a clockwise or anticlockwise direction by alternately relaxing the string inwards and pulling the string outwards. Both bullroarers and spinning disks produce a whirring sound (Montagu, 1971).

Two bone artefacts that morphologically resemble bullroarers and spinning disks have been found in the Later Stone Age layers from Klasies River main site (KRM) and Matjes River (MR) in the southern Cape (Fig. 1) (Singer and Wymer, 1982; Louw, 1960). Singer and Wymer (1982: 127) say of the KRM implement "It was unfortunately broken in the course of excavation, but it was broken in such a way that we were able to reconstruct. It is made on a flat bone, probably part of a rib, tapering to a rounded point at both ends and having two small perforations in the middle. It could have been a child's toy (wirra wirra) or a pendant" (Singer and Wymer, 1982: 128). This implement was recovered from the lower levels of the Upper Midden, Later Stone Age (LSA) II dating to around 4800 BP (Singer and Wymer, 1982; Nami et al., 2016). According to Wymer's notebooks (Iziko Museums, Cape Town) the 'wirra wirra' was found in the same context as a human partial left mandible (SAM-AP6102, KRM 614). The LSA middens at KRM are associated with a variant of the Wilton techno-complex, the Kabeljous industry (Lombard et al., 2012; Binneman, 1995) and are characterised by unretouched quartzite artefacts and a few thick backed scrapers-knives, or giant crescents.

Louw (1960: 109) referring to the MR 5135 implement, mentions that 'the most perfect bone tool recovered from site 4 is an oval-shaped bone "*woer woer*" ("bullroarer")' and that "the edges of this artefact are well rounded and polished". The Matjes River implement was recovered from Layer C with dates ranging between 9580 ± 85 and 5400 ± 250 BP (Protsch and Oberholzer, 1975: 40, see also Sealy et al., 2006: 99). Layer C is associated with the Wilton industry in which small scrapers and backed tools occur. This layer was rich in human burials and ornaments made of bone, shell and ostrich eggshell (Louw, 1960: 17; Ludwig, 2005). Four pendants made of bone were also recovered from Layer C of Matjes River. Although they are described as pendants, we are investigating their possible functional use as aerophones due to their morphological and dimensional similarity to bullroarers, as discussed below.

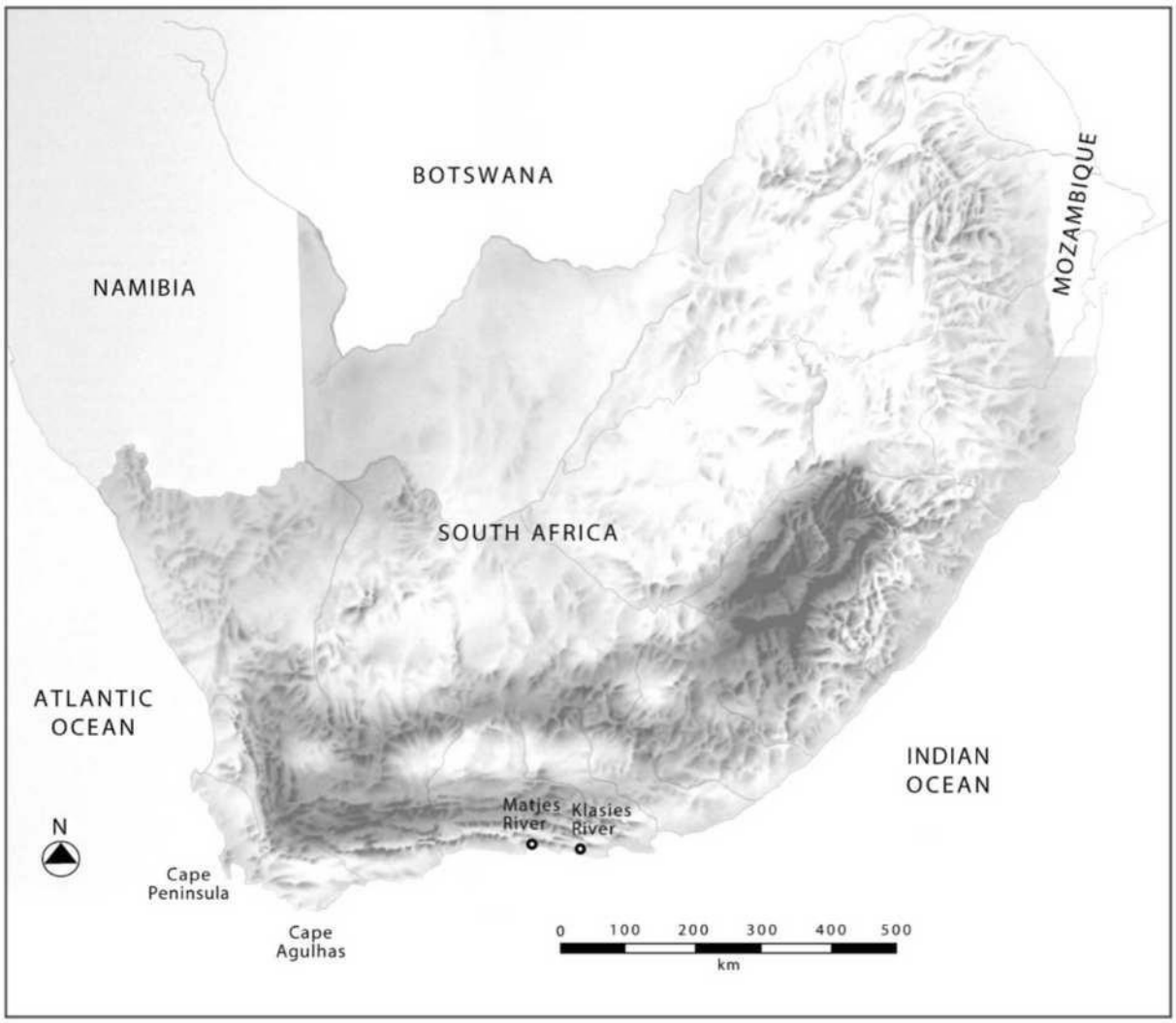


Fig. 1. Map of South Africa showing Klasies River and Matjes River sites.

Aerophones are also known from the southern African ethnographic record. One of these form part of this study, a 'spinning disk' KK058, (Kirby, 2013: 101, Fig. 4, 3. number 3) was collected in 1932 from the 'red dune San' at Haruchas in Namibia and is now archived in the Kirby Collection of Musical Instruments at The South African College of Music.

In this paper we investigate the hypothesis that the archaeological artefacts from Klasies River and Matjes River were used for sound-making and perhaps musical purposes. We report on our actualistic approach to study the sound and use-wear patterns that we reproduced on experimental replicas of these implements. The use-wear results are compared to the archaeological pieces.

1.1. Free aerophones from the archaeological record

'Spinning disks' (Kirby, 2013) are free aerophones consisting of rounded disks with two holes in the centre. Other labels for similar implements include "buzzing disks" (Montagu, 1971: 107), "whirring disks" (Von Hornbostel and Sachs, 1961: 24), "woer woer" (Louw, 1960: 109) and "wirra wirra" (Singer and Wymer, 1982: 125). These names are just convenient labels and do not necessarily describe the function of the implements (van Beek, 1989). Artefacts traditionally referred to as 'buttons' or 'perforated disks' (van Beek, 1989) may also be mechanically suitable to produce sound.

Two-holed disks dating to around 3000 years ago, made from pot-sherds, chalk and stone (van Beek, 1989: 53) occur in sites from Israel, Lebanon, Pakistan and India. For example, 17 two-holed disks have been recovered from the Tell Jemmeh site in Israel, dated to Early Hellenistic period (van Beek, 1989: 55), 323 BCE-31 BCE (McLean, 2002: 4). It is mentioned that these disks may have been used as toys (van Beek, 1989) but their sound producing quality is hinted at by Kelso and Albright (1968: 58, cited in van Beek, 1989: 53) who considered them to have been "bullroarers".

Engraved examples of Magdalenian perforated bone disks have been cited as evidence to demonstrate an early form of animation, combined with sound (Azéma and Rivère, 2012). A convincing case is that of a 31 mm diameter bone disk excavated at Laugerie-Basse in the Dordogne strung through a single perforation and engraved on both sides with an antelope image. The disk produces audible sound (150-320 Hz) when rotated or spun, plus, as the disk spins, the alternating and juxtaposing images become an effective thaumatrope, creating the illusion of movement (Azéma and Rivère, 2012).

Another type of free aerophone is the bullroarer that is swung above the head or alongside the body (Fletcher et al., 2002; Morley, 2005; Kirby, 2013). Of the earliest free aerophones recorded by researchers like Dams and Scothern (see Morley, 2003: 45; Morley, 2005) are from the Magdalenian sites of La Roche de Birol, in Dordogne and Abri de Laugre Basse in southern France, dating to 17,000-11,000 years ago (Morley, 2003: 45). The iconic La Roche de Birol bullroarer is 180 mm in length (Table 1) and is made from a reindeer antler. It has linear incision motifs and is covered with red ochre. The bullroarer is oval in shape and has a hole near one end. Morley (2003: 34) infers the use of these implements as bullroarers based on the shape and the positioning of the perforation. The Solutrean period, broadly dating to between 22,000-17,000 years ago (Morley, 2003: 45), yielded two bullroarers from the sites of Lespugue and Badegoule in France (Table 1). Another, much younger bullroarer from the Kongemose site, Denmark, dated to 6000 BCE, has been recovered from the Mesolithic (Jørgensen, 1956: 30; Morley, 2005).

There are also 13 Pre Pottery Neolithic (PPN) (7200-6000 BCE, David Kingery et al., 1988) perforated bone implements interpreted as bullroarers (Dietrich and Notroff, 2016: 28). They are from Göbekli Tepe, Hasankeyf Höyük and Körtik Tepe in Turkey and Nahal Hemar Cave in Israel (Dietrich and Notroff, 2016: 19). In appearance they resemble spatulas and the complete pieces are leaf shaped with flat-tened edges with the narrow edge perforated (Dietrich and Notroff,

Table 1
Table of examples of archaeological free aerophones.

Description	Site	Period/age	Available size parameters	Reference
Spinning disk	Klasies River	Later Stone Age (Late Wilton, Kabeljous industry)	126 mm length, 22.5 mm width	Singer and Wymer, 1982: 125, Fig. 9.6 no 9
Spinning disk	Matjes River	Later Stone Age (Wilton)	125.3 mm length, 31.7 mm width, 2.2 mm thick, 11.55 g	Louw, 1960: 109
Bullroarer	Lespugue, Haute Garonne (France)	Solutrean	90 mm length	Dauvois, 1989: 10 cited in Morley, 2003: 36
Bullroarer	Badegoule, Dordogne (France)	Solutrean	190 mm length	Dauvois, 1989: 10 cited in Morley, 2003: 36
Bullroarer	Tuv (Norway)	ca 2800 cal. BCE	64 mm length, 27 mm width, 2-4 mm thick, 9 g	Bjerck, 2010
Bullroarer	Kongemose, Denmark	Mesolithic (6000 BCE)	111 mm	Jørgensen, 1956: 30
Bullroarer	Stelmoor (Northern Germany)	Final Paleolithic (Ahrensburg culture)		Salmen, 1970: 10 cited in Lund, 1981: 256

Table 2
Examples of ethnographic names of bullroarers and spinning disks from Southern Africa.

Term	Type of aerophone	Group (if available) and reference
Buzzing disk	Spinning disk	Montagu (1971)
Whirring disk	Spinning disk	Von Hornbostel and Sachs (1961)
Spinning-disk	Spinning disk	Kirby (2013: 101)
Wirra wirra	Spinning disk	Singer and Wymer (1982: 125)
Woer woer	Spinning disk	Louw (1960: 109)
Fur-fur	Spinning disk	KK058, (Kirby, 2013)
Tshivhilivhili/luvuvu	Spinning disk	Venda, (Kirby, 2013: 101)
Uvuru	Spinning disk	Xhosa (Kirby, 2013: 101)
Gig/ù	Bullroarer (with feather)	Bushmen (Nurse, 1972: 26)
Burubush	Bullroarer	Korana, (Kirby, 2013: 100).
!Xoe	Bullroarer	!Kung (Mans and Olivier, 2005: 60)
n≠ ábí	Bullroarer	Ju|'hoansi (Mans and Olivier, 2005: 60)
odila.	Bullroarer	Kwanyama and Kwaluudhi (Mans and Olivier, 2005: 60)
Whizzing-stick	Bullroarer	Kirby (2013: 99)
!Goin !goin	Bullroarer	Bushmen (Bleek and Lloyd, 1911)
Whirligig	Bullroarer (feather attached to a rope)	!Xun, Swarts (2008: 63)
Hisi	Bullroarer	Naro (Guenther, 1986: 277)
Schwirrgeriit	Bullroarer	Jørgensen (1956: 31)

2016: 26-27). All the implements are decorated with geometric motifs, some depicting animals like goats, spiders and scorpions. The seven implements from Körtik Tepe were recovered from burial contexts (Özkaya and Coşkun, 2011: 99 cited in Dietrich and Notroff, 2016: 29) and the two from Nahal Hemar Cave came from a dump layer (Bar-Yosef and Alon, 1988 cited in Dietrich and Notroff, 2016: 29). A 64 mm long bullroarer in polished slate from Tuv in northern Norway dating to ca. 2800 cal. BCE is a fascinating addition to this group of archaeological aerophones (Bjerck, 2010: 11). These archaeological pieces have different sizes with their lengths ranging from 64 mm to 190 mm (see Table 1 for the available dimensions). Owing to their morphological and dimensional similarity to bullroarers, we are investigating the possible functional use of similar single holed bone implements from Matjes River site as bullroarers. They have previously been interpreted as 'pendants' (Louw, 1960; Ludwig, 2005) (see Table 2 for the dimensions). Function is often assumed on the basis of form, but such assumptions have been shown to be potentially misleading (Bradfield, 2016b). Sound is seldom, if ever, studied; therefore we include in our study the analysis of use wear and the sound-making capacities of these implements.

1.2. Free aerophones from the southern African ethnographic record

Kirby recorded ethnographic musical instruments from South Africa and devoted a chapter to "Bullroarers and Spinning Disks" (Kirby, 2013: 99-102). He discusses various types of spinning disks and bullroarers. There is much less information on the ethnographic use of spinning disks compared to bullroarers and to confound matters they are sometimes referred to as a type of bullroarer (Kirby, 2013: 101; Louw, 1960: 109). Kirby (2013:101, Fig. 4.3) illustrates spinning disks made by, for example, Bushmen, Zulu and Venda groups. Spinning disks are called by different names depending on the cultural group to which they belong (Table 2). The Xhosa, for example, name their spinning disk '*uvuru*' while the Venda refer to it as '*tshivhilivhi*'. Kirby (2013) mentions that among the Venda, Zulu and Xhosa spinning disks are played by the children. The spinning disks illustrated by Kirby have different shapes ranging from rectangular, semi oval, to circular with serrated edges. The disks seem to have been made of wood. Buchner (1973, in Hagens, 2005: 4) illustrates a copy of a "Bushman buzzer from South Africa" with 12 symmetrical openings and a sharp serrated edge. As mentioned above, a replica of KK058 (Kirby, 2013 Fig. 4.3 no 3) was made using the original as a reference for accuracy (Fig. 4). The sound of the ethnographic instrument KK058 was recorded as a benchmark against which to compare the sounds produced by the archaeological spinning disks.

The bullroarer is much better known than the spinning disk, and its use has been recorded for groups as far apart as the Australian Aborigines and Malayans (Morley, 2005). As early as 1881, Edward Burnett Tylor remarked that the bullroarer was used in South Africa and that "the extraordinary correspondence in its ceremonial use" between widely different groups in South Africa, and Australia "calls for a careful enquiry" (Tylor, 1881: 265 cited in Dundes, 1976: 222). The bullroarers have a wide range of names. They are, for example, labelled as "whizzing sticks" (Kirby, 2013: 99), whereas the |Xam Bushmen refer to such implements as *!goin !goin* (Bleek and Lloyd, 1911: 354-355; Hollmann, 2004: 172; Wurz and Keene, 2008; Rusch, 2017). Other terms include '*hisi*', '*burubush*', '*!xoe*' '*kgabududu*' and '*sevuruvuru*' (Table 2). According to ethnographic records children frequently took part in musical activities. Blacking (1973) and Kirby (2013) have recorded a few instances in which children in South Africa played musical instruments. The artefacts were frequently smaller in size, for example the small hand rattles used by the Venda children (Kirby, 2013: 13). The Tswana children also played hand clappers known as *marapo* and the bullroarers. For example, Kirby (2013: 98) has a picture of a Tswana boy with a bullroarer. Nurse (1972) noted the Kalahari Bushmen children playing bullroarers in Botswana.

The bullroarers illustrated by Kirby (2013: 100, Fig. 4.2) vary in shape from rectangular to oval. Most of the bullroarers comprise a single piece made of wood, but sometime it consists of a feather fastened to a stick (Kirby, 2013: 100; Swarts, 2008). Nurse (1972: 26) provides a detailed description of such bullroarers from the G/wi and G//ana of the central Kalahari as consisting "of a slender stick, about 30 cm long, with about 5 cm of free riem (leather lace) attaching a thinner (15 cm) stick to the end of which a carefully trimmed korhaan tail-feather was fastened".

Lewis-Williams and Dowson (2000) discuss 'buzzing in the ears', a phenomena that is experienced by shamans when entering into altered states of consciousness (ASC): "All five senses, not just vision, hallucinate in trance, and the aural hallucination of buzzing is variously construed by people around the world as bees, rushing wind, falling water and so forth" (Lewis-Williams and Dowson, 2000: 63). The sound made by the *!goin !goin* is positively identified with buzzing and bees (Bleek and Lloyd, 1911: 354-355), and thus a strong association is made with ASC, synesthesia and enhanced states of association (ESA) (Keeney, 2003; Rusch, 2017), which aid entry into the spirit world. Spirit world encounters and spirits-of-the-dead ensure death's abiding presence (Rusch, 2016: 16-17; Blundell, 2004: 89-112). The significance that is accorded to the sounds of water (ocean), buzzing and wind (breath) and that produced by the replicas tested are discussed in Section 5, where we include evidence provided by ethnographic



Fig. 2. Klasies River spinning disk and replica.

testimony, biopsychological data, plus the archaeological/burial context from which the artefacts were recovered.

2. Materials and methods

This study employed an actualistic approach (e.g. Marreiros et al., 2015). The investigation focus was the sound-producing potential and resultant use-wear characteristics of the artefacts. To these ends the Klasies River and Matjes River spinning disks and, an ethnographic example of a spinning disk from the Kirby Collection (KK058), and the four pendants from Matjes River were replicated.

The Klasies River spinning disk is missing from the collections at the Iziko Museum, and therefore the illustration by Singer and Wymer (1982: 125) was used to produce the replicas (see Fig. 2). For all of the replicas the exact profile plus the hole positions were transferred from the archaeological artefacts using templates that captured the shape and dimensions of the original (see Table 3). Modern machinery, including a portable electric saw, drill and grinder, were used to cut and shape blanks from cow rib, sheep bone, Karee (*Searsia lancea*) wood and the lower jaw-bone of a giraffe.

It was noted that all the replicas made sound when strung and spun, except the replica of MR 5135 because of its asymmetry. In line with the experimental approach two modifications were made to the Matjes River disk replica, which corrected the asymmetry (Fig. 3). The asymmetry of the implement is attributable to two causes; either the holes were drilled in the wrong place or the artefact was a work-in-progress. Relocating the holes allowed the replica to spin and produce sound. It is likely, however, that the Matjes River spinning disk was a work-in-progress. Two lines of evidence support the latter supposition. Firstly, the manufacturing procedure would probably have been to first

Table 3
Archaeological spinning disk and pendant dimensions analysed in this study.

ID	Length	Width max.	Thickness max.	Mass	Hole diameters
Matjes River Cat # 41 Layer C Plot # 5135	125.3 mm	31.7 mm	3.0 mm	12.0 g (11.55 g)	2.8 mm and 2.9 mm
Klasies River 'wirra wirra' (estimated: replica was used for measurements)	110.6 mm	20.4 mm	6.6 mm	13.4 g	2.8 mm and 2.7 mm
KK058 Red dune San Collection date 1932 Haruchas, Namibia	96.0 mm	39.0 mm	6.0 mm	Not recorded	4 mm
Matjes River Cat # 40 Layer C Plot # 5-1	88.2 mm (refit ± 99%)	26.9 mm	5.0 mm	9.8 g (9.0 g)	3.0 mm + counter-sunk
Matjes River Cat # 39 Layer C Plot # 205	71. 5 mm	13.0 mm	2.5 mm	3.1 g (3.0 g)	3.5 mm + counter-sunk
Matjes River Cat # 39 Layer C Plot # -	58.0 mm (refit 100%)	18.2 mm	2.0 mm	2.4 g (2.0 g)	4.0 mm
Matjes River Cat # 37 Layer C Plot # -	59.0 mm (broken) interpreted as 93.0 mm	15.5 mm	4.0 mm	4.6 g (4.0 g)	3.8 mm

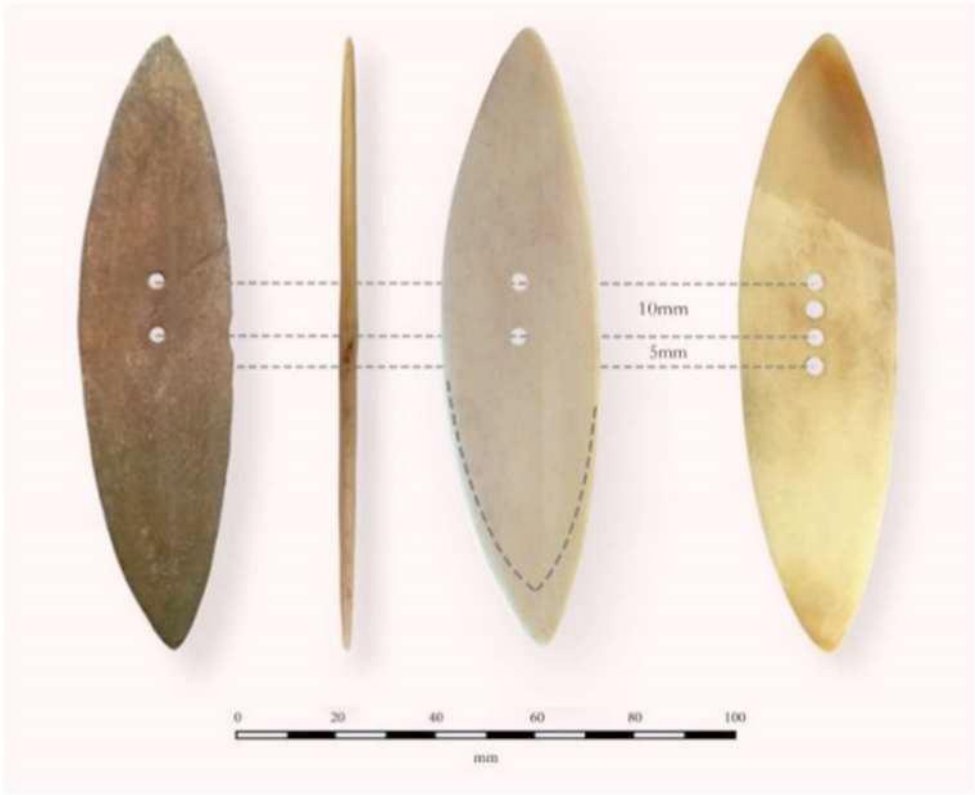


Fig. 3. Matjes River 5135 spinning disk and replicas showing the asymmetry and the modified position of the perforations.

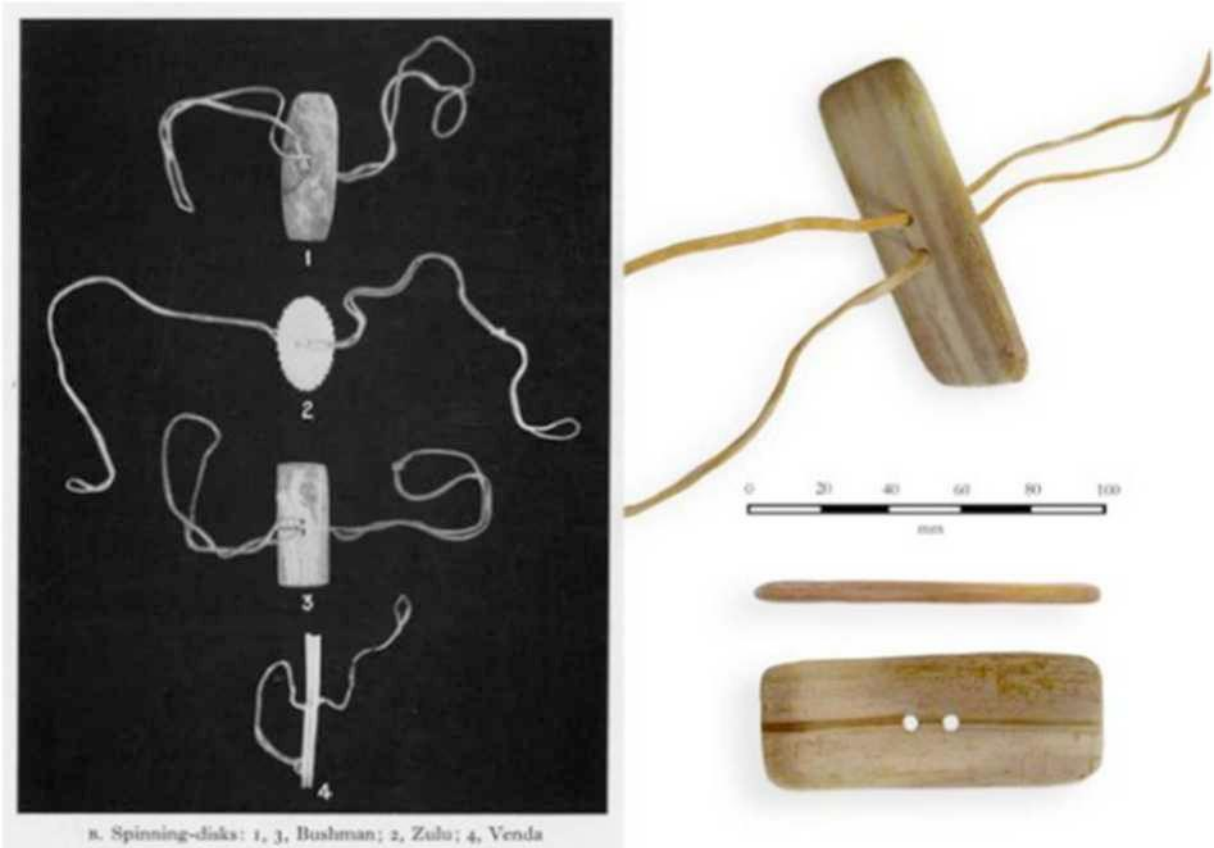


Fig. 4. KK058 spinning disk and replica. The replica is of number 3 in the figure on the left from Kirby (2013, p. 101 Fig. 4.3).

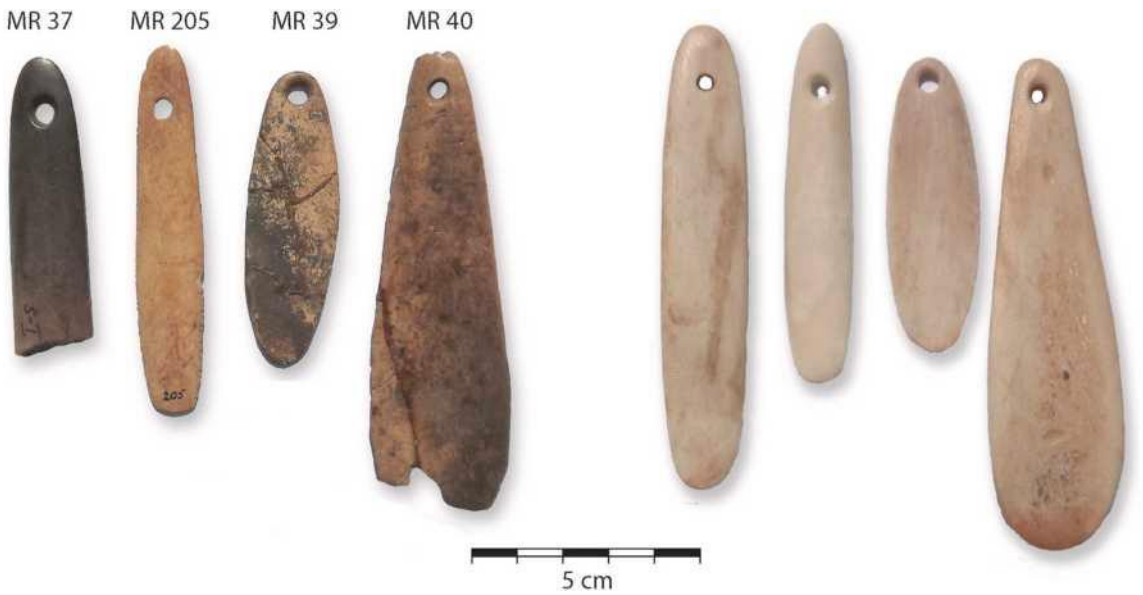


Fig. 5. The archaeological pendants analysed in this paper and our replicas.



Fig. 6. Wave pattern of the Klasies River spinning disk replica.

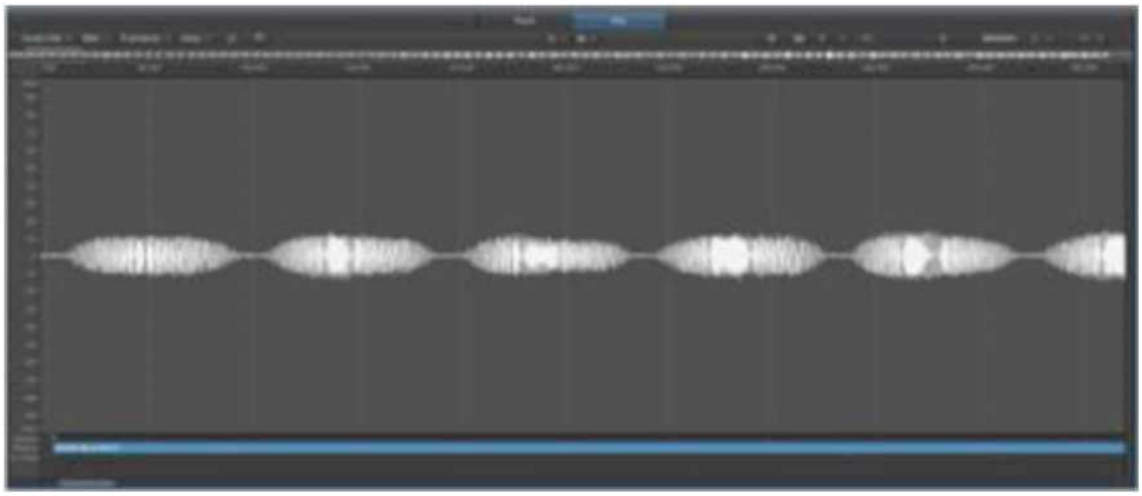


Fig. 7. Wave pattern of KK058 spinning disk replica.

produce a blank and then bore the holes, leaving final shaping of the implement to last, allowing for the requisite symmetry to be achieved relative to the holes. And secondly, no significant use-wear was identified along the perimeter of the holes.

As the original Matjes River 5135 replica spinning disk did not produce sound, only the Klasies River replicas were involved in further

PENDANT MR 37 replica - leather string

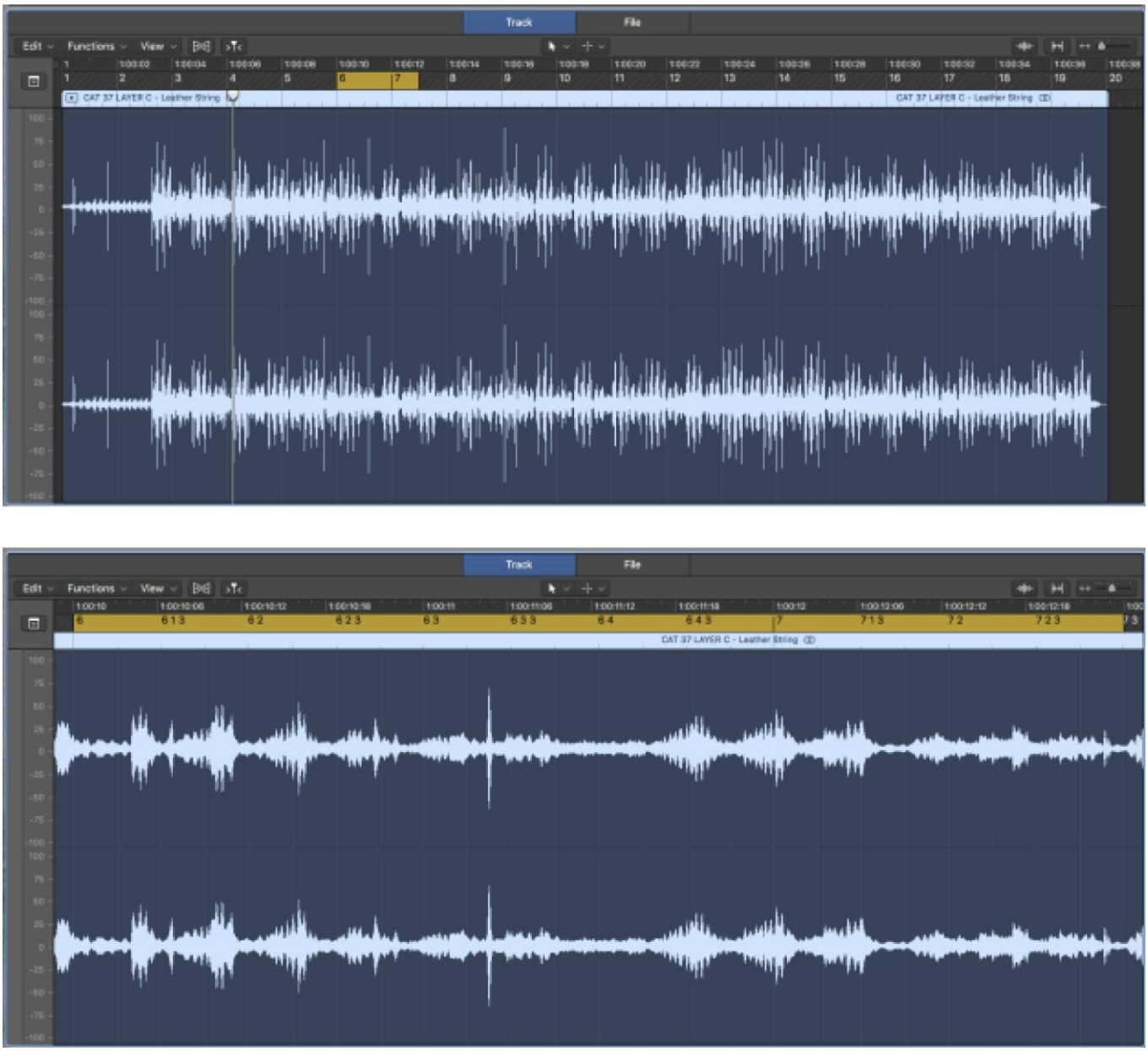


Fig. 8. Wave output of MR 37 replica, illustrating below in detail a section of the soundtrack above, highlighted in orange. The frequency output maximum measured 250 Hz using Logic Pro. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

use-wear experimentation. Five replicas of the KRM implement were made. One replica of each of the four 'pendants' from Matjes River were made with the further aim to establish whether this categorisation was accurate and to investigate their sound producing potential.

2.1. Sound production

The KRM replica spinning disks were each strung with a different type of string made from plant and animal fibres. Plant-fibre string included jute, hemp and sisal, while the animal fibre string included tanned leather thongs and rawhide thongs. The rawhide was soaked in water overnight to increase its flexibility prior to the experiments. String length was 940 mm, as determined by the specifications provided for the ethnographic model KK058. Each of the five KRM spinning disks replicas was spun by hand for 6 h.

The Matjes River pendant replicas (Fig. 5) were each spun mechanically for 15 h, using a 40 W electric motor, with speed (rpm) adjusted so that each produced sound. They were spun in the same manner as described for bullroarer aerophones (Fletcher et al., 2002) using a 900 mm string, of which 250 mm was wrapped around the hand. First, a laser-cut plywood disk, 320 mm in diameter, was attached to a sleeve into which the drive-shaft of the motor was inserted and fixed. The plywood disk was designed to match an ergonomic proportion - elbow to wrist. The aim was to impart to the apparatus a movement approximating the rotational swing of forearm and hand. The plywood disk was made to spin with a slight wobble, again to

PENDANT MR 39 replica - leather string

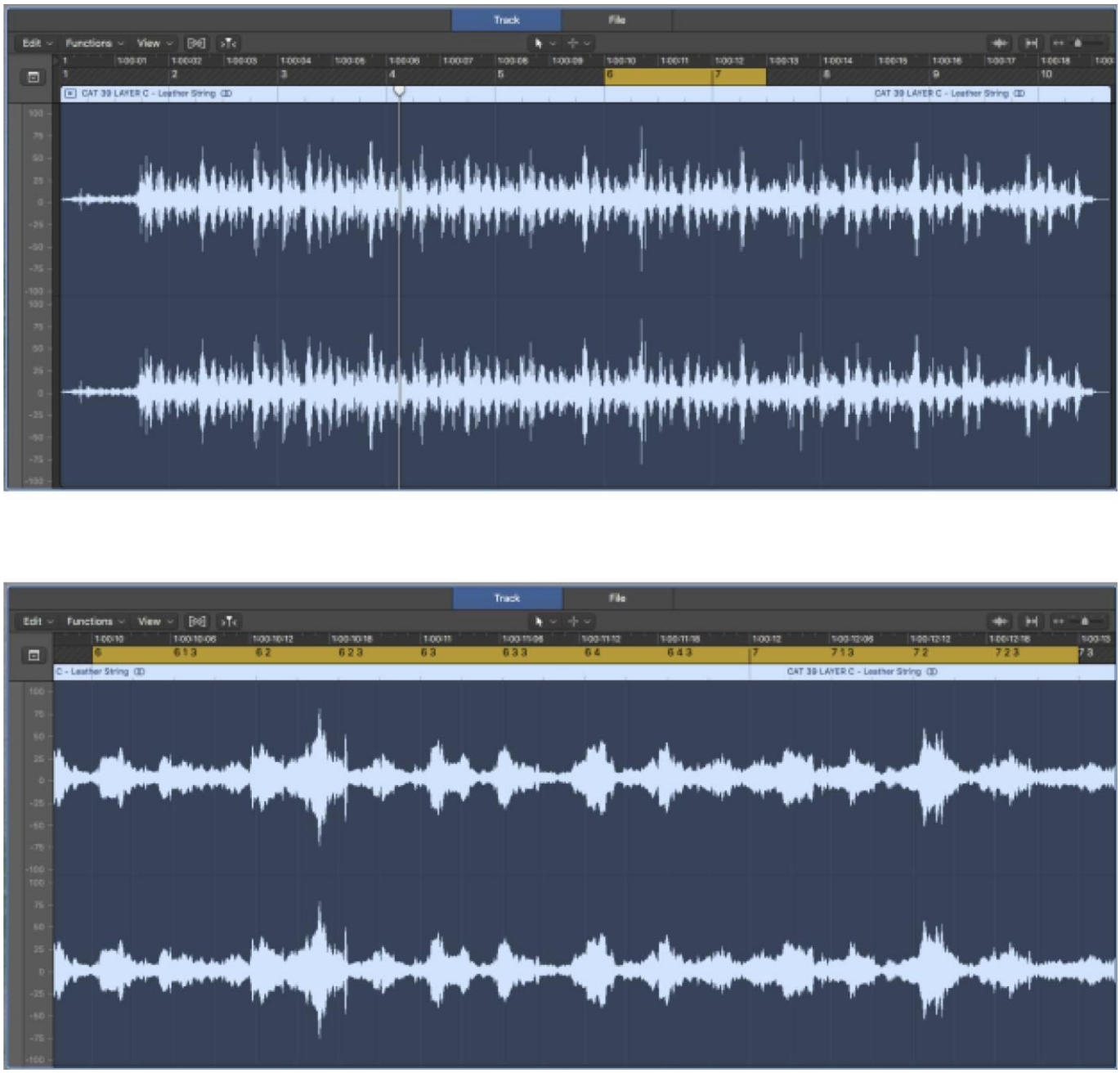


Fig. 9. Wave output of MR 39 replica, illustrating in detail below a section of the soundtrack above, highlighted in orange. The frequency output maximum measured 142.86 Hz using Logic Pro. This pendant had an unusual sound anomaly, which we discuss below. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

simulate the arm's swinging motion. This wobble was induced via the sleeve, which was intentionally made to fit off-centre on the drive shaft. Pendant replicas were attached at one end of the string and the other end was fixed to a point on the circumference of the plywood disk. The rotational speed of the motor (rpm) was regulated by a variable rheostat such that the pendants produced sound when rotated as if they were bullroarer aerophones.

The rpm of the motor was regulated to the audible frequency range of the four pendant replicas as they might have been deployed in practice i.e. 12 h at minimum rpm and a lower sound frequency; followed by 3 h at maximum rpm and higher frequency. The Pitch Analyzer app has proved successful as a tool in archaeological contexts and for archaeoacoustic assessment (Martorano, 2018) and was used in these experiments to measure frequency and set the speed of the motor.

In general the output of an aerophone, such as spinning disk or bullroarer, is a function of airspeed. The rpm required in order for the pendants to make sound was in the range 90 to 145 rpm, whether rotated by hand or mechanically. The sound produced by each pendant was recorded in the Field Sound Studio using both leather and plant fibre string (see Table 4 below). The wave patterns were captured in Logic Pro and the frequencies measured. One of the pendants manifested an unusual sound anomaly, which we discuss below.

PENDANT MR 205 replica - organic string

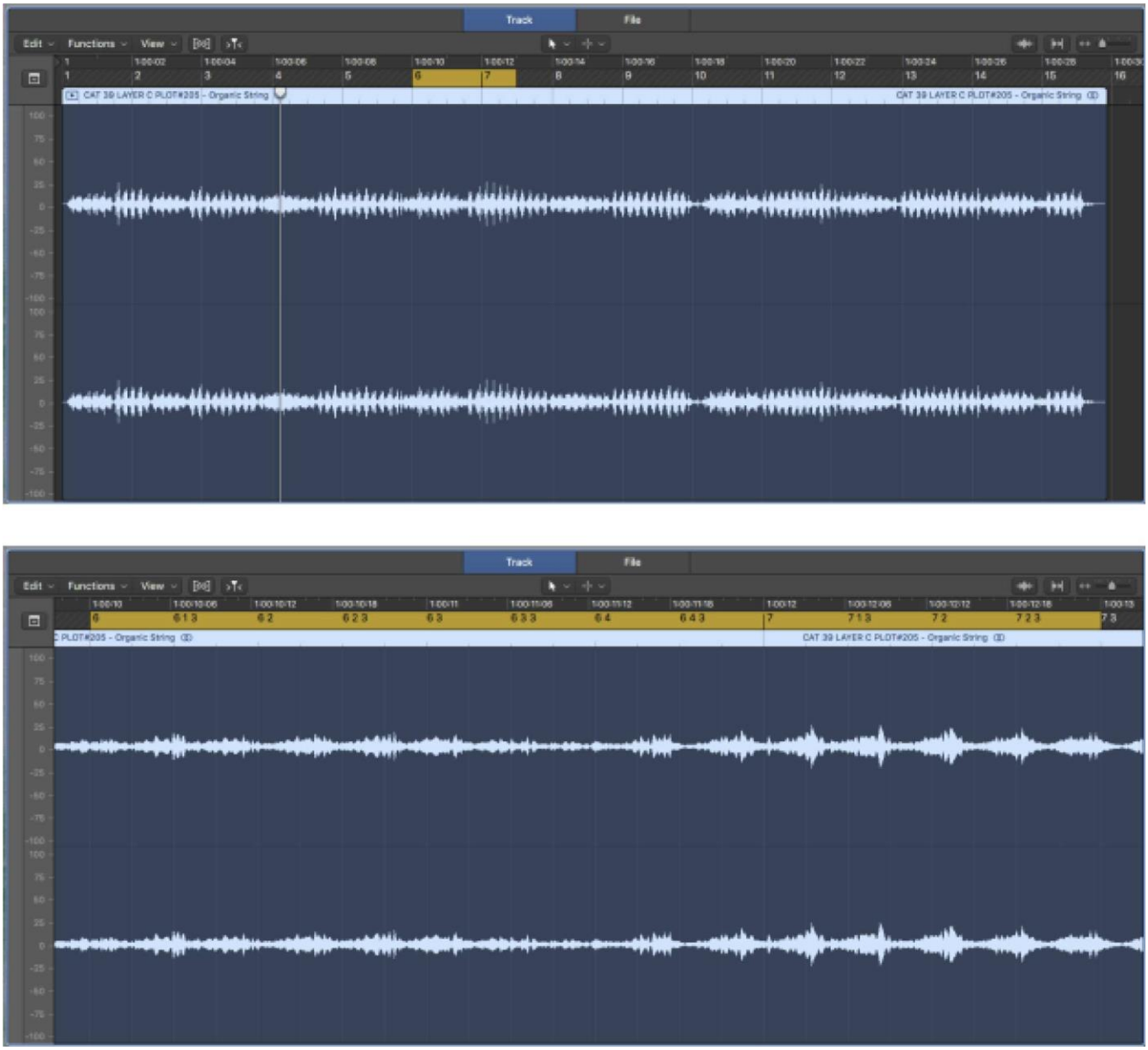


Fig. 10. Wave output of MR 205 replica, illustrating in detail below a section of the soundtrack above, highlighted in orange. The frequency output maximum measured 71.43 Hz using Logic Pro. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

3. Results of the sound production experiments

The KRM andKK058 artefact replicas functioned well as spinning disks and produced a sustained pulsed whirring sound (Supplementary material Files 1 and 2). The Klasies River artefact replica has a range variation of 52 Hz to 142.85 Hz (Table 4). The frequency of the KK058 replica by comparison was approximately 57 Hz at the bottom of its range and 200 Hz at the top (Table 4). What is audibly and visually noticeable, in the sound and the wave pattern graphics, is the pulsed output that is generated by the alternating clockwise and anti-clockwise spinning. The KK058 replica spins faster than the KRM replica, 5 pulses as opposed to 4 in the time frame, as illustrated in Figs. 6 and 7.

The graphics below reflect the sound produced by the stringing procedure i.e. MR 37 replica and MR 39 replica were strung with leather while MR 205 replica and MR 40 replica were strung with plant fibre string. The pendants were thereafter submitted for use-wear analysis (Table 5).

The wave patterns generated by Logic Pro display the frequency output of the replicas in a graph, showing amplitude on the vertical axis and frequency spectrum on the horizontal axis. A correlation between the sound data and the physical variability of the replicas, such as their morphology, mass and minor dimensional differences can be inferred from the wave pattern. In other words the sound of each replica is related to its physical character, although the pulsed wave form is recognizable as that of a bullroarer aerophone in each graph.

The frequency range across the sample of pendant replicas varied from 250 to 55.55 Hz, which is comparable to other bullroarers previously tested (Fletcher et al., 2002; Rusch, 2017). Irvine (2007) notes

PENDANT MR 40 replica - organic string



Fig. 11. Wave output of MR 40 replica, illustrating in detail below a section of the soundtrack above, highlighted in orange. The frequency output maximum measured 55.55 Hz using Logic Pro. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

that string-stretch impacts the aerodynamics of bullroarers and their acoustics. The test results confirm this observation, indicating that the string with which the pendants were strung had an influence on their sound output. Leather string consistently generated higher frequencies as compared to organic string.

Of the four examples in this experiment, MR 40 replica proved to be the easiest to make sound with (see Supplementary material Files 3 and 4). It was also the heaviest of the four and is morphologically comparable to known ethnographic and archaeological models (Morley, 2003: 36, Fig. 3.2).

The smallest pendant (MR 39 replica) manifested an unusual sound anomaly, namely a 250 Hz frequency burst in an output that was otherwise between 125 and 142.86 Hz. This feature can be heard on the sound track that is provided as supplementary material to this article (Supplementary material File 5). With no increase in rpm the pendant hits a higher frequency, seemingly unpredictably. This may be attributed to cavitation, whereby the resulting aerodynamic condition permits the pendant to suddenly spin faster for short periods. Alternatively, the airfoil shape of the pendant, cutting through the air at a specific angle could generate lift. This may allow the pendant to spin faster at the end of the string and cause it to emit a higher frequency without any appreciable increase in arm rotation. It is not possible to say if this attribute of the pendant - to 'animate' itself - is intentional or accidental, although once heard it could well have been cherished within a cosmology situated in animistic beliefs.

An unforeseen result of the experiment was the stroboscopic effect

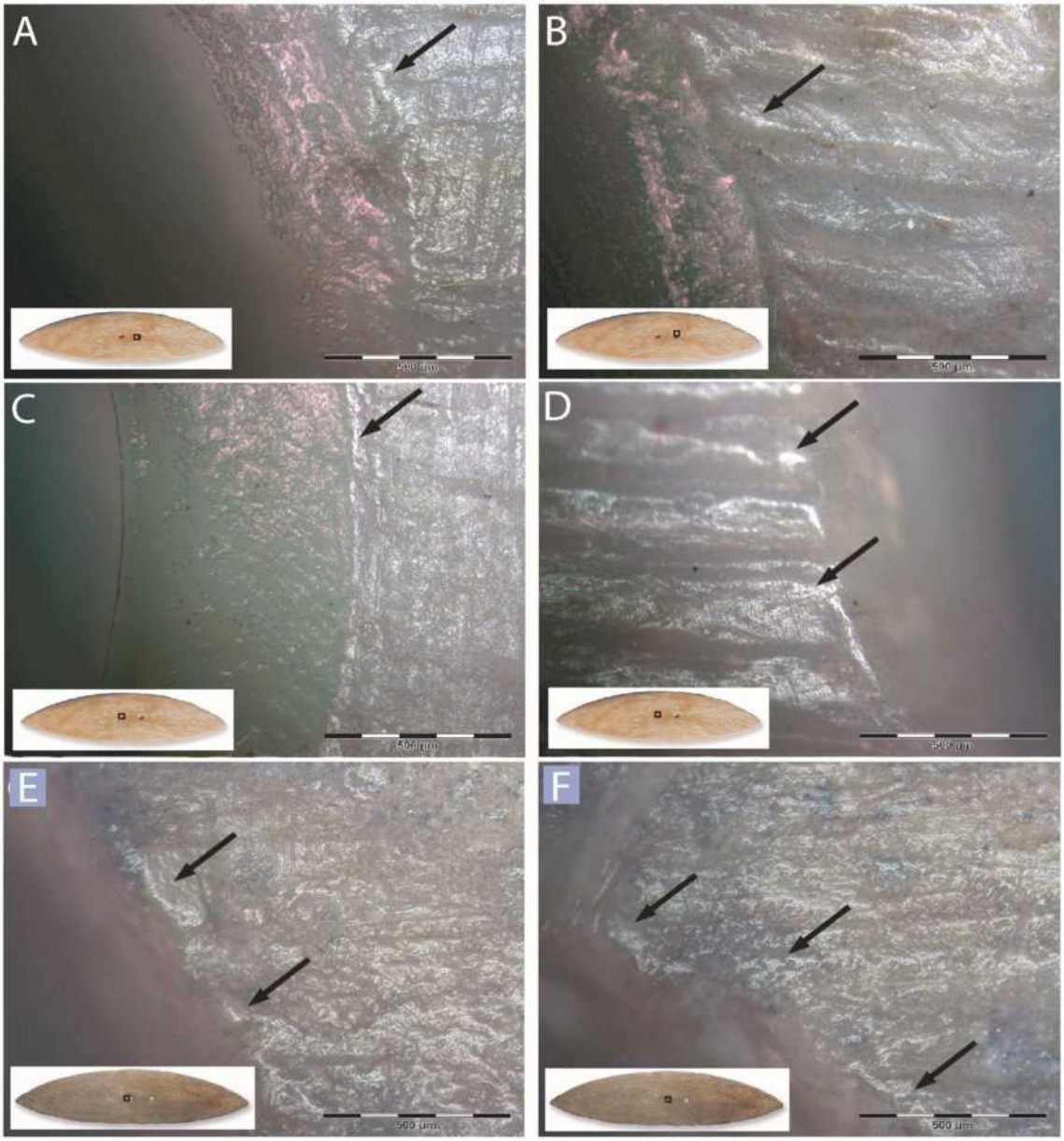


Fig. 12. Showing mild surface deformations and rounding that developed from the Klasies River spinning disk replicas and the use-wear on the archaeological artefact from Matjes River site (MR 5135). Hand spun using: (A) sisal thread, (B) hemp thread, (C) tanned leather thong, (D) moistened rawhide Showing minor indeterminate polishing that developed along the outer left rim of MR 5135 (E, F).

observed when the aerophones - spinning disks and bullroarers - were spun at night (see the Supplementary material Files 6 and 7). Filmed in low light conditions the stroboscopic effect was in this case created by an LED beam but could feasibly be produced by flickering firelight. This characteristic of aerophones should be investigated further, particularly in view of the work done on the so-called perforated buttons and their thaumatropic features. As both examples demonstrate, aerophones combine aural as well as notable visual attributes, which begs for closer study.

4. Use-wear experimental protocol

Use-wear develops on bone relatively quickly (van Gijn, 2007; Legrand and Sidéra, 2007) with sufficiently diagnostic wear typically developing after 30 min of prolonged fricative contact (Bradfield, 2015). Although there is some degree of overlap between different contact materials, there are distinct differences between categories such as plant, ceramic and hide working (Griffitts, 1997; Backwell and d'Errico, 2004). Polish and striations usually develop along a continuum, and different stages of a tool's life may show different degrees of wear, even when the same contact material is involved (Buc and Loponte, 2007).

Use wear was observed following standard protocols (see Bradfield, 2015; Évora, 2015) using a low- and high-powered florescent microscopy. An Olympus BX41, mounted with a DP72 digital camera was employed for magnifications ranging from 50×-100×, and an Olympus SZX16, mounted with same camera, was used for lower magnifications. Results were compared against our experimental sample and existing descriptions in the literature (see Bradfield, 2015 for a summary). The low-powered microscope allows for tools to be freely manipulated under magnification and is useful for establishing whether and where use-wear is present on a tool's surface. The detailed characterisation of that wear is then achieved under high-power, typically at 100× magnification.

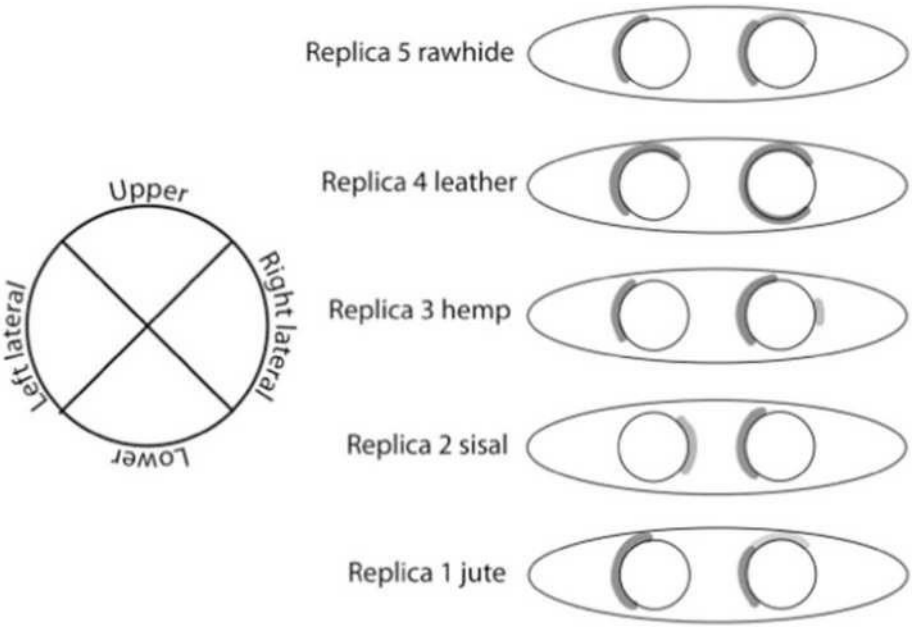


Fig. 13. Diagram showing the division of the perforation circumference into four sectors and the location of use-wear on the hand-spun 'woer woer' replicas. The darker areas represent better developed use-wear than the lighter areas.

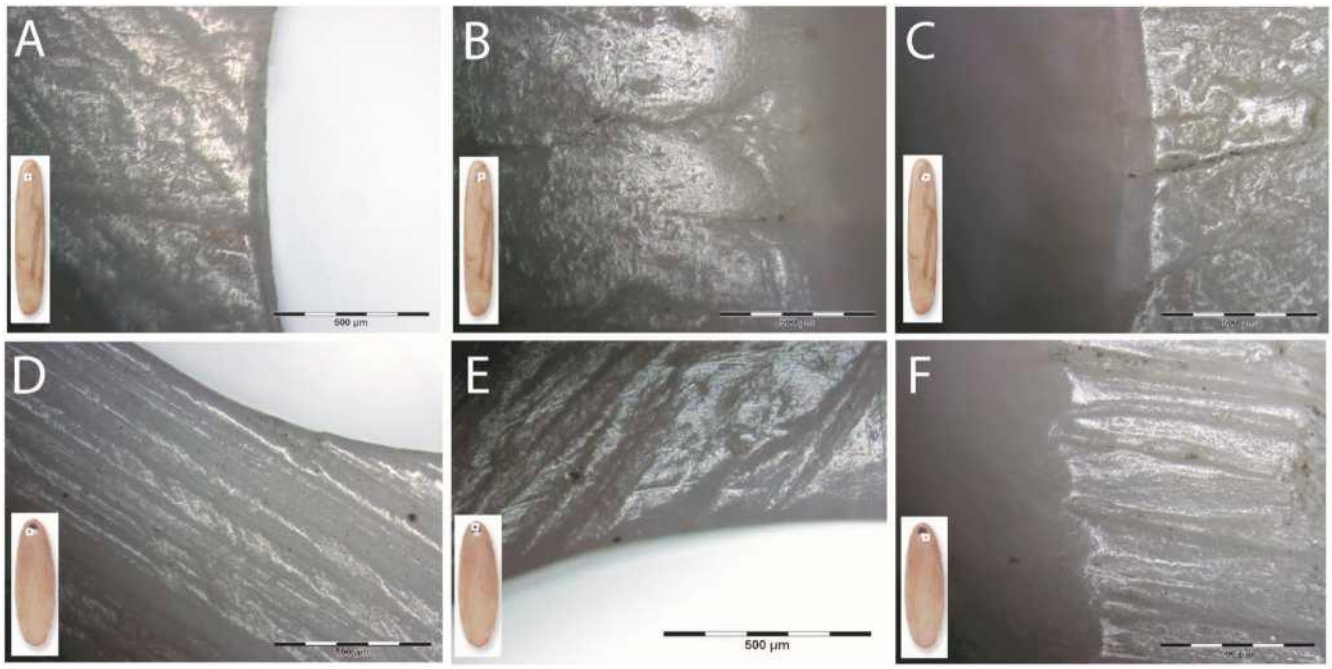


Fig. 14. Location of use-wear that developed on selected 'pendant' replicas that were mechanically spun using hemp thread (A-C; replica of MR 205) and leather thong (D-F; replica of MR 39).

4.1. Use wear results

4.1.1. Spinning disks

Fig. 12 shows some of the use-wear that developed on the spinning disk replicas after being spun with different threads. Of the five replicas, all of which were spun by hand, the most pronounced use-wear was produced by hemp thread and moistened rawhide (Fig. 12B and D). Use-wear consisted of mild surface deformations in the form of rounding and indeterminate polish, roughly commensurate with Mărgărit's (2016) second stage of bead wear. In no cases was it possible for us to identify the string material based on the characteristics of the polish, as it was not sufficiently well developed. The placement of use-wear is shown in Fig. 13. Wear appears to be concentrated primarily on the left lateral edges. The archaeological artefact from Matjes River (MR 5135) displayed minimal rounding on the left outer lateral (Fig. 12E-F).

4.1.2. 'Pendants'

The Matjes River pendant replicas developed use-wear in the form of rounding and polishing. The invasiveness of the wear differed between specimens. Fig. 14 shows the use-wear that developed on two of the replicas (MR 205 replica and MR 39 replica), while Fig. 15 shows the placement of use-wear on the individual replicas. Hemp string produced the most pronounced and pervasive edge rounding; resulting

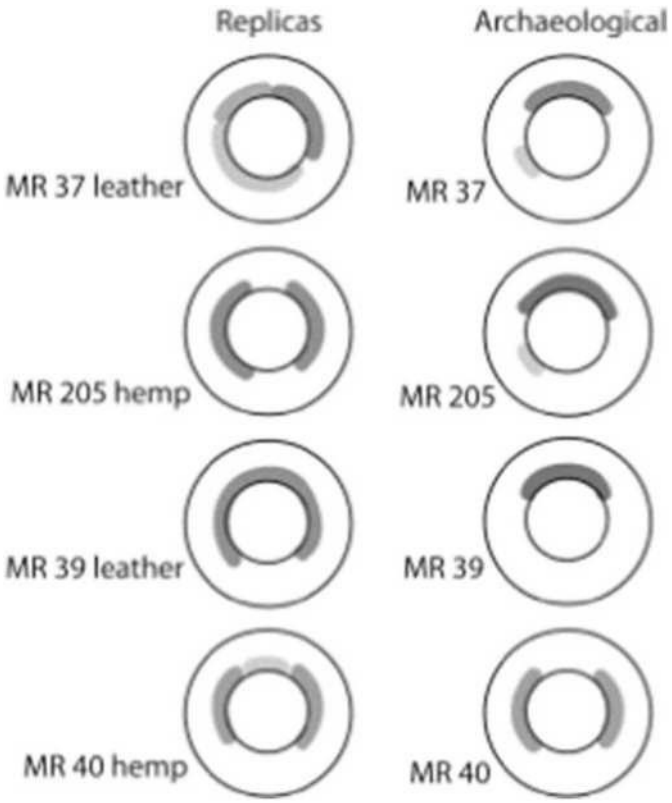


Fig. 15. Diagram showing the placement and relative degree of use-wear on the archaeological 'pendants' and our machine-spun replicas. The darker areas represent better developed use-wear than the lighter areas.

in the reduction of manufacturing marks (Fig. 14B) and is commensurate with the third stage of wear recorded on strung beads (Mărgărit, 2016). Use-wear placement occurred primarily along the lateral edges, with minimal, poorly developed rounding along the edge in the upper sector (Fig. 15). The replica of MR 40 may be taken as an example of typical wear. Here we find rounding along the lateral edges, with faint, indeterminate wear on the upper sector edge. Minimal bone surface flaking developed along the rim in the bottom sector of the perforation on the MR 37 replica. Similar flaking, or notching, may be seen on ethnological beads where the string has been placed in opposing directions (Falci et al., 2018), although we suspect that in our case this feature may have resulted from the velocity at which the artefact was spun. In no cases was the placement of use-wear perfectly identical, although lateral edge rounding was present in all cases.

The use wear results of the archaeological 'pendants' from Matjes River are presented in Fig. 16 and the location of use-wear in Fig. 15. MR 37 displayed pervasive rounding along the upper sector of the perforation (Fig. 16A and B), and appears, based on comparison to experimental and ethnographic examples, to have been produced by contact with leather (see Bradfield, 2015; Falci et al., 2018). There is less wear compared to the replica of this specimen, with only a small patch of poorly developed wear on the left lateral edge. Similar pervasive polish, suggestive of prolonged contact with skin, is present on the ventral surface of the pendant (Fig. 16C), intensifying towards the proximal fracture.

MR 205 displayed the same use-wear features as MR 37. Two residues were present on this piece: 1) specks of minerals that fluoresced green under ultraviolet light on the inner wall of the perforation (Fig. 16E) and 2) ochre powder slightly behind the outer rim of the perforation (Fig. 16F).

MR 39 displayed poorly developed indeterminate use-wear behind the outer rim in the upper sector of the perforation (Fig. 16H); no other use-wear was visible on this artefact. Compared to the machine-spun replica of this artefact, there was less use-wear coverage and a complete absence of use-wear along the lateral edges.

MR 40 displayed weakly formed rounding along the rims in both lateral sectors (Figs. 15 and 16I) with traces of ochre and a fatty substance on the outer edge of the perforation. These residues and the ones identified on MR 205 may have attached to the bone artefacts via the string, as grit, dirt and a host of other substances can get trapped in the fibres of the thread and thus transferred to the artefact (Falci et al., 2018). The use-wear on this piece is strikingly different from the other pendants, being less pronounced, absent along the upper sector and developed along both lateral edges. The placement and degree of use-wear on this artefact resembles most closely the replicas that were spun. The use-wear on the other artefacts was generally better developed than MR 40.

5. Discussion

Dual and singly perforated bone artefacts are occasionally recovered from Later Stone Age contexts in southern Africa and are usually interpreted as items of bodily adornment related to symbolic meaning and ritual (e.g. Deacon and Deacon, 1999). There is virtually no discussion of the possible sound producing qualities of such implements from this region. However, Singer and Wymer (1982) and Louw (1960) suggested the artefacts with double centred perforations may have been sound-generating toys used by children, similar to those from the historical and ethnographic periods (van Beek, 1989; Langley, 2018; Langley and Litster, 2018). Here an actualistic study has been undertaken to investigate whether replicas of the ethnographic and the late Holocene Klasies River 'spinning disks' and the Wilton 'pendants' could have produced sound. The replicas all produced a sustained pulsed whirring sound when spun. The dual perforated 'spinning disk' replicas produced frequencies of 52 to 200 Hz while the singly perforated 'pendant' replicas had frequencies ranging from 55.55 to 250 Hz similar to the frequencies produced by other similar implements that functioned as bullroarers (Rusch, 2017). The replica of the single holed implement, MR 40, was the easiest to produce sound with, and its acoustic characteristics are similar to that of known bullroarers.

The use wear that resulted from the spinning was compared to that of the archaeological artefacts to investigate whether any of these may have functioned as aerophones. The original KRM spinning disk or 'wirra wirra' was not available for use-wear analysis, but, based on the experimental sound qualities, the hypothesis can be put forward that it was used as an aerophone as suggested by Singer and Wymer (1982: 128), and Louw (1960: 109) for the MR 5135 "woer-woer". The replica of the MR 5135 artefact did not produce sound, but it has been demonstrated here, that what would have been required to complete the Matjes River spinning disk and make it a sound-producing instrument is simply to remove material from the lower half of the implement, in a process of fine-tuning. The Klasies River replica produced a sustained whirring sound and when the hole position and symmetry of Matjes River replica were adapted to resemble the Klasies River artefact more closely, it produced a similar sound. The replica of the ethnographic spinning disk, KK058 also produced sustained sound, similar to that of the Klasies River replica. As all three artefacts are similar in concept and the sound quality, a likely hypothesis is that the Holocene archaeological dual holed artefacts might indeed have been sound producing implements, as originally suggested by Singer and Wymer (1982) and Louw (1960).

The recognition of use-wear development on archaeological artefacts can be complicated by a range of factors, including multi-functionality and repurposing of implements over time (Buc and Loponte, 2007; Falci et al., 2018), post-depositional alterations, such as animal or insect activity (Villa and d'Errico, 2001; Backwell et al., 2012), and curatorial handling (Griffitts, 2001; Buc and Loponte, 2007). Owing to their softness, bone tools are particularly susceptible to

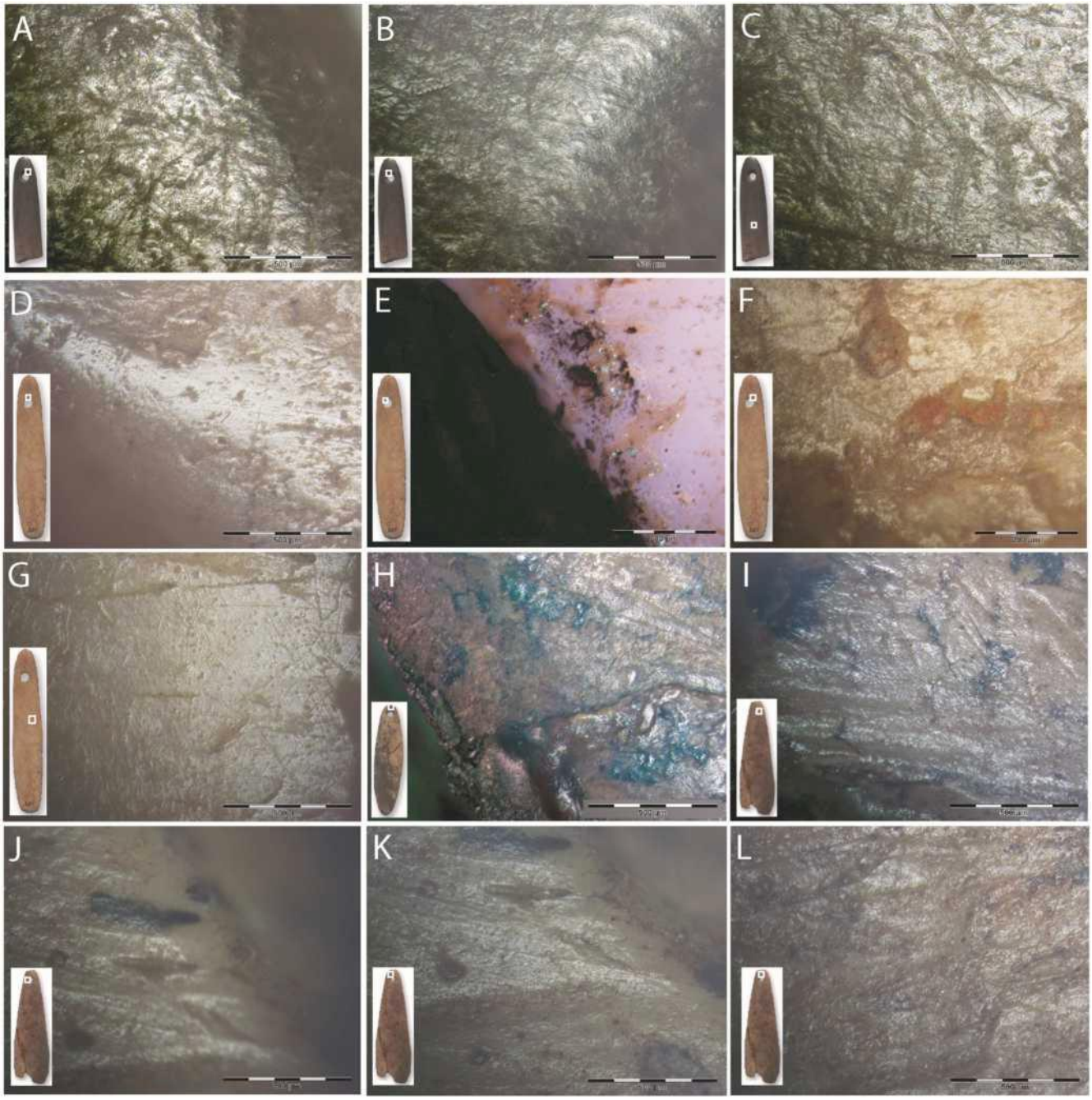


Fig. 16. Use-wear on archaeological 'pendants' from Matjes River. Pervasive rounding on the upper sector of the perforation of MR 37 (A-B); polish and striations consistent with prolonged fricative skin contact (C); pervasive rounding consistent with fricative contact against a soft pliable material on the upper sector of MR 205 (D); unidentified green florescent specks on the inner wall of the perforation of MR 205, image taken under ultraviolet light (E); ochre grains on outer rim of the perforation of MR 205 (F); Pervasive rounding and polishing consistent with contact against skin or leather (MR 205) (G); minimal rounding and polishing on upper sector of MR 39 (H); weakly developed indeterminate wear on lateral sectors of MR 40 (I-L). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

developing accidental wear (Legrand and Sidéra, 2007). Natural taphonomic alterations can be identified with reasonable confidence based on the numerous published studies devoted to recognizing these traces, as can curatorial alterations (Bradfield, 2016a). The archaeological artefacts included here have not been the subject of many previous studies that would have required their handling, and were mounted on display at the Bloemfontein National Museum for many years, thus limiting their exposure to incidental contact that could produce or mask micro-wear.

The use-wear that developed on our spinning disk replicas tended to concentrate along the left lateral edge of the perforations. The spinning disks that were spun using plant-based material strings developed minimal rounding whereas those strung using leather and rawhide developed more pronounced rounding and surface deformations. This difference in the degree of use-wear could have been as a result of different textures of the strings. Of the plant-based strings, hemp produced the most pronounced micro-wear. In no cases, however, was the use-wear sufficiently well developed to allow the contact material to be

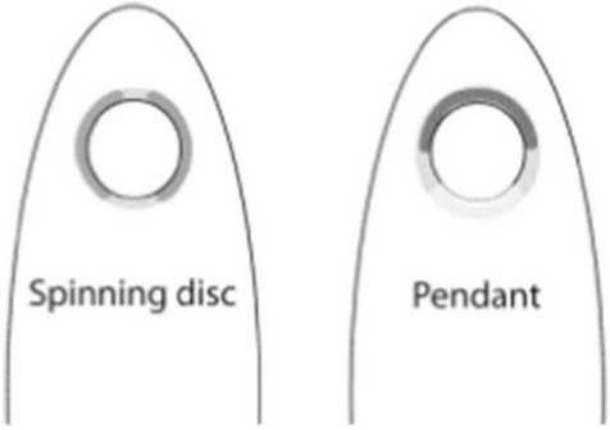


Fig. 17. Schematic diagram showing the location and relative intensity of use wear that develops on spinning disks and pendants. The darker lines indicate a higher degree of use-wear modification than the lighter lines.

Table 4
Frequency variation (Hz) of the replicated spinning disks.

ID	Plant fibre string frequency minimum Hz	Plant fibre string frequency maximum Hz
KK058 replica	57	200
KRM replica	52	142.85
MR 5135 replica	56	166.66

Table 5
Frequency variation (Hz) of the replicated 'pendants'.

ID	Leather string frequency maximum Hz	Plant fibre string frequency maximum Hz
MR37 replica	250	166.67
MR39 replica	142.86	125
MR205 replica	250	71.43
MR40 replica	76.92	55.55

identified under blind-test conditions. The concentration of use-wear in the left lateral sector is likely due to the specific shape of our replicas, which were modelled on the illustration of the Klasies River archaeological artefact. The use-wear on the Matjes River archaeological artefact was very poorly developed, which might be owing to the perforations not occurring in optimal position to facilitate spinning and sound generation.

Use-wear on the 'pendant' replicas that were mechanically spun for 15 h using different thread materials developed to a greater degree than on the hand-spun spinning disk replicas, although, in most cases, not well enough to identify the contact material. In general, the use-wear on the replicas developed most prominently along both the lateral sector rims. When we compared this pattern of use-wear to what is expected from pendants, beads and other perforated body ornaments we observed that, while the type of wear formation is similar the location is different (cf. Winnika, 2016; Falci et al., 2018). Due to the centrifugal force acting on the bone during spinning, it is unlikely to experience friction with the string in the same manner as a hanging pendant except during the brief periods of winding up and winding down when the wobble effect would likely result in the string contacting the lateral sectors of the perforation more than the upper sector. Fig. 17 presents a schematic of typical use-wear locations of spinning disks and pendants worn as body ornaments. In a sample of artefacts of unknown function, we can therefore expect use-wear concentrations in certain areas to indicate specific uses.

Significantly, most of the archaeological 'pendants', MR 37, MR205 and MR 39, developed use-wear along the upper sector rim, suggesting these artefacts were each suspended from a piece of string. Rim polish and rounding was widely distributed along the upper sector edge, probably due to movement on the string while suspended (see Falci et al., 2018). The micro-striations within the polish, numerous pits and the general appearance of surface deformation appear to be the result of contact with a leather thong (see Bradfield, 2015); although this cannot be unequivocally stated, as the polish was not sufficiently well developed. The single exception to this pattern was MR 40, where the use-wear placement was consistent with that seen on our replicas, i.e., along the lateral sector rims. It should be noted that this implement is more pear-shaped than the other pendants, which is a common characteristic of archaeologically known bullroarers (Morley, 2003). The complete length of this artefact would have been longer than the other pendants, falling within the range of European bullroarers (Morley, 2003; Bjerck, 2010), and the angle of the perforation is also wider. Therefore, based on the shape and the placement of the use-wear on MR 40, we suggest that this implement could have functioned as an aerophone (bullroarer) that was spun to produce sound.

In southern Africa ethnographically known bullroarers have been mostly played by young children (Frisbie, 1971; Nurse, 1972; Kirby, 2013: 99). Mans and Olivier (2005), in their fascinating account on musical practices from several Namibian groups, report on the use of bullroarers by the Uukwaluudhi from central north Namibia, the Kwanyama south of Oshakati and at Ongala, and the Ju|'hoansi from the Tsintsabis and Oshivelo areas. The Uukwaluudhi use it in 'calling rain' ceremonies and among the Ju|'hoansi and !Kung it is used in male initiation practices. Elderly Ju|'hoansi men play the bullroarer, which is a secret instrument, during initiation ceremonies, and burn it afterwards (England, 1995 cited in Mans and Olivier, 2005). For the Ju|'hoansi the sound of the bullroarer is associated with mythical creators; and among the !Kung, the sound of the *!xoe*, played by an elderly man at initiations ceremonies, indicates the presence of god. However, rituals by various Bushmen groups are very variable and the link of bullroarers to god and mythical beings may not always be relevant.

Another way in which bullroarers were used by the |Xam Bushmen was for manipulating bees so that "the bees may go to other people's places, that the people may eat honey" (Bleek and Lloyd, 1911: 354-355; Frisbie, 1971: 269; Hansen, 1996: 303; Rusch, 2017). Kirby (2013: 100) and Rusch (2017) highlight the similarity between the sound of a |Xam *!goin !goin* bullroarer and the sound produced by swarming bees, plus the evocative connection that particular sounds, like buzzing, have with enhanced states of association and altered consciousness. The idea that specific instruments can exercise control and influence animals through mimicry is conceptually widespread (Mans and Olivier, 2005), although there is regional variability. As the |Xam example demonstrates, they have an intimate relationship with bees. This is expressed in their cosmology, linking the creation of the antelope with honey, as well as in their practice of controlling bees with sound, which is likely to include extra-sensory mediations while under the influence of ASC or ESA.

It is perhaps significant that the spinning disk from Klasies River as well as the pendants, including the possible bullroarer from Matjes River, were associated with human remains. The Matjes River artefacts are noted as grave goods (Ludwig, 2005: 76). The spinning disks, pendants and the bullroarer from Matjes River are all from Layer C that has been described by Louw (1960) as rich in burials. More than 120 burials could have been excavated at the site (Ludwig, 2005: 73). However, there is lack of provenance detail as to which burial was associated with what material, which makes it difficult to further explain the association of the human remains and these grave goods (L'abbe et al., 2008: 66). The Klasies River spinning disk, as far as can be ascertained from Wymer's (1967/8) notebook, was associated with a fragment of a human mandible, "probably from the lower part, i.e. 6 or 7 surface" (Wymer's notebook). The association of the spinning disks,

the pendants and the bullroarer with human remains would suggest that these artefacts may not have been children's toys, but used by adults, perhaps in a more ceremonial setting, such as during trance/ healing dances or initiation ceremonies (see Mans and Olivier, 2005). The stroboscopic effect of spinning disks might be a consideration in this regard, especially seeing how the triboluminescent properties of certain substances, such as quartz crystals, were considered a manifestation of supernatural power (Lewis-Williams, 2002). In this manner, bullroarers may have provided auditory and optical stimulus during activities such as trance dances and mediatory practices conducted under the persuasions of animistic belief.

The spinning disk 'woer woers' that we tested have a sound analogous to respiration and in their oscillations produce a sound not unlike the regular pulsation of ocean waves, or breathing (Supplementary sound tracks, Files 1-5). The connection with breathing is drawn to attention in particular by the Klasies River artefact (Fig. 2), which appears to have been manufactured from rib bone (Singer and Wymer, 1982: 128). For this reason it may have been imbued with particular significance, beyond its utilitarian function (Pers. Comm. Dr. Chris Low 9-3-2018. See also Low, 2007). The attachment of symbolic associations to bone implements is not uncommon is other parts of the world (McGhee, 1977; Hagens, 2005; Willerslev, 2007).

The sounds recorded in the studio represent an objective measure (Figs. 6-11) but this only approximates what would have been a dynamic multisensory experience, enacted in context. For example, it is feasible that two or three instruments were played together, rather than one. In the sound studio with the software available it was possible to simulate a 'composition' by layering and manipulating sound tracks. The results are remarkable, but what is not included are the aural contributions that would be provided by topography and the spatial features of the archaeological site. Studies of the acoustic features at Upper Paleolithic archaeological sites have associated sound and the placement of rock art, for example (Waller, 1993). The role of acoustics in prehistory and the insights this may shed on human behaviour and use of space is only just beginning to be explored (see papers in Scarre and Lawson, 2006). Devereux suggests that the relationship between rock paintings and sound was motivated by the 'disorienting effects of low frequencies of at least some resonances' (Devereux, 2001). At Klasies River main site and Matjes River this is not the case. There are no rock paintings. Rather the acoustics and sound-making activities might better be explained by the ritual internment of the dead, in particular at the Matjes River site.

Acoustical considerations at Matjes River are particularly significant in light of the burial site and the sound-producing behaviour conducted there. In his review Ludwig notes: "The assemblage from Matjes River Rock Shelter includes a great variety of artefacts that are rare or unique, many of which may derive from grave contexts. As mentioned above, Matjes River has yielded the remains of 120 individuals, and the site was certainly a sacred one within the landscape of the area, a burial ground for thousands of years" (Ludwig, 2005: 73). Upon the evidence provided by the burial site and the associated musical instruments it seems reasonable to infer that the acoustics at the site did not go unnoticed but was integral to the activities that took place there.

At Matjes River the sound generated by the ocean waves travels up a narrow valley and is amplified in certain wind conditions. The configuration of the valley fronting the shelter might contribute by channelling and compressing sound waves into the shelter. It might also be that the sound energy from the ocean is reflected by the encompassing rear wall of the shelter. Boundary elements, which could be the valley sides and structure of the rock shelter, in this case, are known to 'attenuate sounds external to the site and may change their frequency spectrum' (Cross and Watson, 2006: 109). The site faces east and the ocean sound is louder or softer depending on the wind strength and direction but the sound energy is most noticeable when the wind blows from the east. Further detailed study would inform on exactly what causes this noticeable acoustic phenomenon.

Matjes River is a burial place of significant proportions and potentially a liminal space where the living negotiated their relationship with death and dying. It is feasible that the mediating influence of sound provided one of the affordances that allowed processes of grieving and mourning to take place. We suggest that the spinning disks and the analogous sounds of breathing (and cessation) was an integral feature, if not at all these occasions then at some, but the unusual soundscape of the site would always be present. The ocean waves sounding in the shelter and the site's acoustics would surely have been significant for the people living in this coastal habitat, pursuing their foraging activities in the intertidal zone.

The biopsychological effects of music and sound making are correlated to biochemical causes, such as the release of the neuromodulator dopamine and the neurohormone oxytocin. These chemicals enhance social bonding and influence feelings of anticipation and reward satisfaction. Purposeful sound-making activity generates group cohesion, encourages entrainment and synchronization (Wurz, 2009) and this would certainly have provided an advantage in the confrontation with death. While not death defeating we argue here that the musical instruments and related behaviours will have provided assurances to the people who buried their dead at Matjes River.

Acoustic phenomena such as echoes, flutter-echoes, resonances, filter and partial sound occlusion (Cross and Watson, 2006) are likely to give rise to 'aural illusions'. As earlier noted one of the artefacts that we tested displayed the capacity to self-animate (Fig. 9). This feature fits comfortably into the category 'aural illusions'. Sounds evocative of buzzing, wind and surging water may have helped to mediate the mystery that surrounds death by inducing ASC or ESA and thus aided transition into the spirit realm where relations with spirits-of-the-dead could be negotiated. With respect to the 'disorienting' effect of low frequencies, mentioned above, we should note that of the four pendants examined it was the one with the lowest frequencies which had use-wear consistent with its use as an aerophone bullroarer (Fig. 11).

The whirring, pulsed sounds produced by the spinning disks and bullroarers may not be considered by all as 'music'. However, Blacking (1973: 10) mentions that "…different societies tend to have different ideas on what they regard as music…" and Nurse (1972) and Kirby (2013) describe the bullroarer as an integral part of 'Bushman' music. This study provides a small glimpse into the use of aerophones during the Wilton period in South Africa. It is very likely that these implements had a variety of functions and purposes, depending on the specific context in which they were used.

6. Conclusions

Here, we have demonstrated the sound-producing capabilities of dual and singly perforated bone disks and have illustrated the use-wear patterns that can differentiate sound production from other functions, possibly related to body adornments. In particular, the lateral placement of weakly-developed use-wear around a perforation in a spinning disk is contraposed to that of better developed wear confined to the upper sector of a perforation in a pendant. The use-wear findings of this study, although quantitatively limited, highlight the importance of thorough use-wear studies to ascertain the function of archaeological artefacts (see Bradfield, 2016b).

All the pendants and the KRM dual-perforated bone disk were able to produce sound. The replicas of the KRM implement and MR 40 most easily produced sound. This latter piece presented use-wear more consistent with being spun than with being worn as a pendant, suggesting that it may indeed have been used for sound production, rather than as a mere ornament. Dual perforated bone disks produced a greater sound frequency range than singly perforated disks, suggesting the latter implement would have greater flexibility and application to a musical setting. Another interesting dynamic regarding sound production is the role that the string material plays; with leather producing a higher pitched sound than plant fibre string.

Use-wear combined with an approach that includes morphological study and sound experimentation provides a powerful tool for analysis. As this experiment suggests, three lines of evidence improves resolution where previously a single line of evidence was considered adequate. We are confident that there exist many other tools in the archaeological record capable of producing sound. With these results in mind we look forward to the direction bone tool studies and archaeomusicology might take in the future.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jasrep.2019.02.021.

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CHAPTER 5: SUBMITTED PAPER # 3

Rust, R., Kumbani, J., Rusch, N., Wurz, S. Submitted in July 2020

Rock art Research

Flute playing in the rock art of the Klein Karoo and Cederberg; a link to ancient sound.

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Flute playing in the rock art of the Klein Karoo and Cederberg; a link to ancient sound.

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Key words: Rock art, flute playing, ancient sound

ABSTRACT

Even though music is inextricably part of the social fabric of all past and present societies, it has not received in depth attention in the archaeological literature from South Africa. This topic perhaps received most attention in rock art studies, where images are mainly discussed in relation to the trance dance and musical bow playing. Here we hone in on flute playing in rock art depictions from the Cape region. To contextualise our data on flute playing in the rock art imagery we inventorise archaeological flutes from the Palaeolithic record and discuss South African ethnographic instances of flute playing. We describe four rock art scenes, from the Attakwas and Ezeljagdzpoort sites in the Klein Karoo, and from Zimri shelter and the Procession shelter in the Cederberg with figures that are playing what is highly likely to be flutes.

Introduction

Musical aspects of rock art images in South Africa are frequently addressed through discussion of shamanism (Lewis-Williams 1981a; Lee 1987). There has also been some discussion on musical bows in rock art (Lee and Woodhouse 1970; Lewis-Williams 1981a; Lee 1987; Lewis-Williams 1990; Lewis-Williams and Challis 2010; 2011; Vogels 2012; Vogels and Lenssen-Erz 2017), but thus far flute playing has received little attention. Flutes are aerophones, wind instruments proper that confine the vibrating air in its body (von Hornbostel and Sachs 1961: 23). They are hollow tubes with or without holes in the shaft that produce a tone when the air is blown through an opening. Ethnographic and archaeological flutes are most frequently in bone, wood, reed and clay. A flute or pipe without perforations can only produce a single tone, but the more perforations the more tones the flute or pipe can produce by covering and uncovering the holes (Morley 2003). As a result of these various designs and modifications made in their shafts, flutes come in different categories for example, V notched flutes, flutes bundled together as panpipes (open or clossed), end blown flute (open or clossed), cross blown flutes and fipple flutes amongst other types (von Hornbostel and Sachs 1961; Atema 2014). Aerophones known as whistles are close cousins of flutes, although the the distinction between flutes and whistles is a grey area (Montagu 2001; Morley 2013; Kumbani 2020). A whistle is usually a shorter pipe, for example "a short, usually high-pitched flute ('edge aerophone')" with or without fingerholes (Montagu 2001: 1), made in material such as wood or bone (Morley 2013; Atema 2014). We cannot identify whether the implements that we discuss are whistles or flutes, but we use 'flutes' here without attributing any definitive classification to the depicted implements.

Here rock art depictions involving possible flute players are presented from two areas, the Klein Karoo, from the Attakwas Kloof and Ezeljagdzpoort sites, and from the Cederberg, from the Procession and Zimri's shelters (Fig. 1).

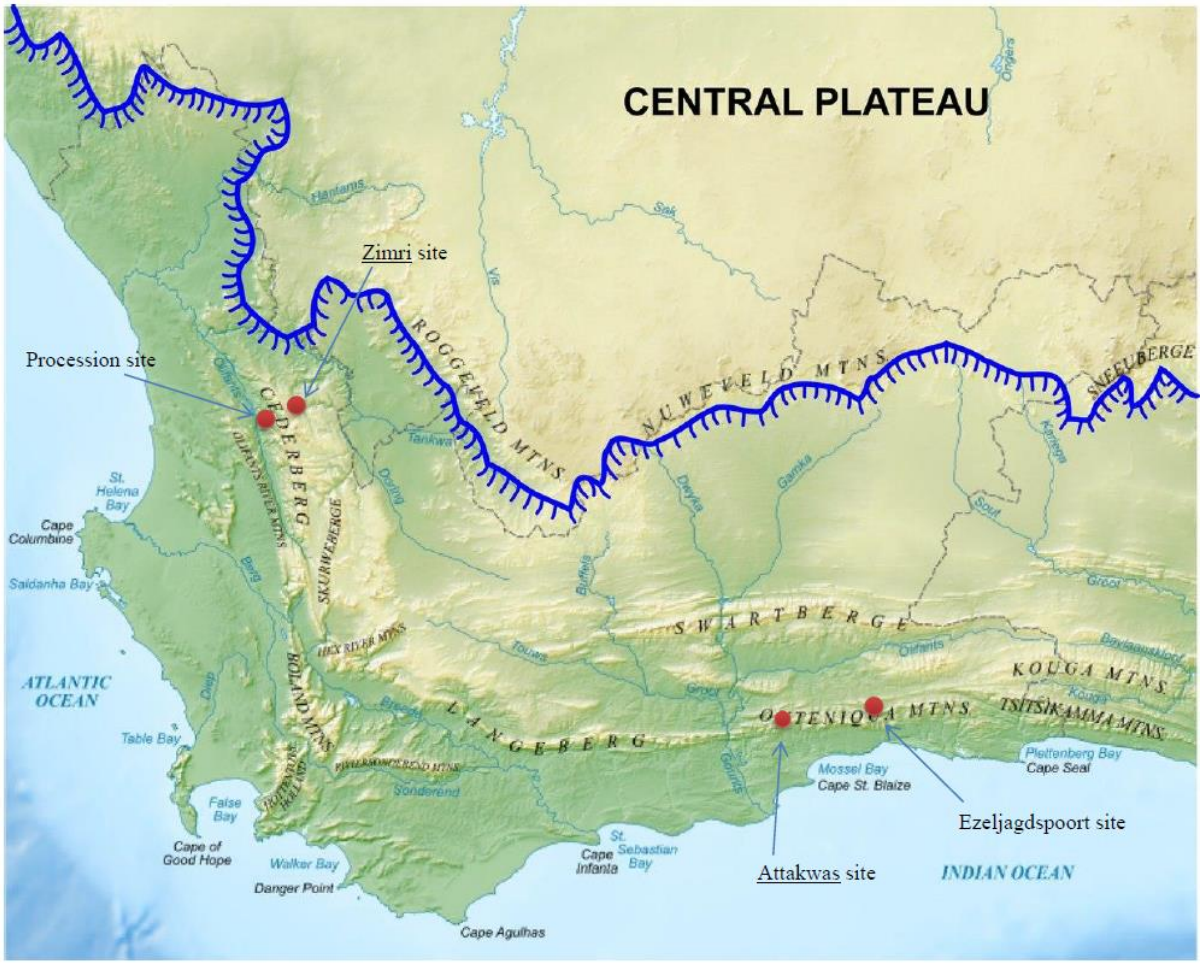


Figure 1. Map showing the rock art sites with flute players from the Cederberg and Outeniqua Mountains (base map from Wikipedia: Oggmus - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=32948923)

Geographically, the Klein Karoo is a 300 km long valley, 80-100 km wide, formed by the two parallel Cape Fold Mountain ranges, the Swartberg to the north, and the continuous Langeberg-Outeniqua range to the south. The Cederberg occurs inland and its mountains stretch about 50 km parallel to the west coast of the Western Cape. The sites in both areas are located in ravines and rock shelters in the mountainous areas, either on designated reserves managed by CapeNature or on private land (Rust 2008; Deacon et al. 2018). The painted images occurring in the Klein Karoo and Cederberg are regionally variable but there are discernible similarities. The parallels in depictions in the Klein Karoo and Cederberg rock art are apparent in the prominence of human figures, frequently in the context of processions and group scenes, as well as depictions of elephants and eland. Images of fat-tailed sheep provide indication of temporal shifts in the painting tradition of the region (Deacon 1998; Rust 2008;

Parkington 2013; Deacon et al. 2018; Swart 2020). Hand-prints, finger dots and geometric images juxtapose or superimpose older paintings and are part of more recent rock art renderings, although the tradition of hand painted images may be older (Rust 2008). Therianthropic figures occur, most usually as an amalgamation of human and animal elements. Noteable examples are a procession of elephant-headed human figures (Parkington 2013, Fig. 70a and b) and the unusual pictorial hybridization of dragonflies and humans (Mguni 2013). More subtle but no less ambiguous are ichthyoidal and avian featured figures (Hollmann 2005; Rust 2008; Rust and Van der Poll 2011). These images convey a sense of human-animal continuity and are indicative of an embodied experience of spiritual envelopment and transformation (Guenther 2020: 247-258). Depictions of hand-clapping women and lines of dancing women (Parkington 2013, Figs. 95a, b and 97; Rust 2019) represent occasions at which sound-making is likely to have occurred, as for example first menstruation ceremonies. Denticulations, crenulations and zig-zags interspersed between the women in a painting of this kind have been highlighted as an attempt to represent vibration and sound produced at these occasions (Rusch 2017: 209 and Fig. 10). These activities indicative of a ritual nature are illustrated on the rock face in groupings of human figures, walking, moving in a procession, sometimes individually depicted, some with elaborate headdresses and adornments on arms and legs, or grouped near power animals like the eland, the elephant and other animal species. They wear karosses, carry fly whisks, sticks that may be used during the dance ritual, rattles, bags, spears, bows and arrows. In many instances the human figures are grouped in convoluted dance postures, bend forward, their bodies thrown into antics to illustrate the energy of the dance ritual (Rust 2008). These group scenes are a feature of the rock paintings throughout southern Africa and identify healing dances and the ritual of altered states (Lewis-Williams and Dowson 1989) and initiation (Parkington 2013; Rust 2019). Sound and music-making is, and will have been, integral at many, if not all such group gatherings, as it still is practised today (Katz et al. 1997). Among the San Bushmen musical instruments were important in ritual activities, especially the dance (Bleek and Lloyd 1911). Music and sound were endowed with a power. For example, the playing of a musical instrument, a *goura*, averted the destructive forces of the rain (Bleek and Lloyd 1911: 321).

Here we explore the relationship between rock art and one particular type of musical instrument, the flute. Where ethnographic data shed light on flutes and flute playing, we discuss this information to identify music production in the paintings.

Ethnography of flute players in South Africa

The use of flutes in South Africa is well documented ethnographically. Reed flutes are the earliest musical instruments to be described by colonial travellers to South Africa (Kirby 2013: 193). When Vasco da Gama and his entourage landed at Cape St Blaize near Mossel Bay they were welcomed by flute players (Olivier 2006: 195). Kirby (2013: 194) mentions Peter van Meerhoff who in 1661 described a reed flute ensemble among the Nama Hottentots in Namaqualand, an arid region that covers a part of the Northern Cape Province of South Africa and extends into the neighbouring Namibia (Kirby 2013). There were between one and two hundred flute players each with a hollow reed in their hand and they danced in a circle whilst playing the flutes. In the centre there was the man holding a long stick and the reed flutes sounded like trumpets. Van Meerhoff suggested that the central figure was a master of ceremonies, an interpretation that needs rethinking.

Kirby (2013) documented the use of flutes among the various groups in South Africa during the 20th century. He observed the Korana Hottentots at Bloemhof at the Vaal River in the North West Province playing reed-flutes whilst dancing and mentions that: "The flutes were sounded in succession, beginning with the highest pitch, which was played by the leader. The men's dance steps involved a leaping movement. The women formed a larger circle outside that of the men, and moved in the opposite direction, clapping their hands (*inna // am*) and shaking their buttocks (*!harekhwedi*)" (Kirby 2013: 205). Among the Korana the reed-flute was the most important musical instrument in that it brought many performers and people together and it was part of their social life (Kirby 2013: 202). The Korana called their reed flute *a ≠adi* and the flutes were kept by the leader of the music group.

Reed flutes were also used by the Bushmen (Stow 1905: 109). The Bushmen women for example, engaged in music competitions when a group would visit their neighbours and they would play music and dance for few days. Only women participated in these ceremonies and no men were allowed to take part. They played flutes without holes during these competitions (Stow 1905: 115). Mans and Olivier (2005) recorded the recent use of flutes by Nama and Damara groups in Sesfontein, Namibia. Their flutes are also called by various names (Appendix Table 1) and they come in various lengths. The Nama and Damara use the term ≠ãb to refer to larger flutes and male figures and they have the term ≠ãgu which denotes female and smaller flutes. Some of the flutes are made using papaya tree leaf stem and reeds. These flutes were used in various social contexts. For example, during designation of a new chief, at

weddings, funeral anniversaries and for entertainment purposes (Mans and Olivier 2005: 58). Reed flutes are also still used by some cultural groups for example the Venda (Kumbani 2020). In Zimbabwe a flautist recorded at Lake McIlwane (now Lake Chivero), 40km west of the capital Harare, featured on the cover of The South African Archaeological Society, "Rock-Paintings in Africa" Vol. XII (47), Cape Town: Rustica Press. The image shows a maroon kilted flautist in an upright posture holding a pipe-like object with both hands and with the head slightly bending downwards. The description accompanying this particular cover image refers to the flute as a reed or buck pipe similar to the flutes which Meerhoff described in 1661 among the Nama (see Kirby 2013: 194). The existence of this flutist image perhaps indicates that there could be more such paintings in the southern African region that are yet to be "rediscovered" and analysed in detail.

Outside the written literature there are ethnographic examples of instruments. Those pertinent to this study are archived in the Kirby Collection of Musical Instruments, curated by the School of Music at the University of Cape Town. Numerous forms of flute aerophone are included. This collection is instructive since it provides a useful reference that *inter alia* suggests how flutes can or might have been played. As previously noted, there are end- and side-blown examples. Some are perforated and can produce many notes while pipes produce a single note. The variety of flute instrument types and modes in which they can be played is worth reiterating since study of the instruments informs what an investigator might "see" when examining the painted images. For example, pipes are played singly i.e. one person one note. Kirby (1965) recorded this mode of pipe playing (Plate 49 A and B) but pipes can be bound together and in combination they form a single instrument that is played by an individual. Archaeologically an instrument like this remains indeterminate because pipes, or bone tubes are invariably excavated individually, whereas they could have provided one element (note) in a multi-tube instrument. Kirby Plate 48 illustrates examples of combined-pipe instruments collected from various ethnic groups in the southern Africa region. One of the painted examples from the Cederberg region, described later in this article, draws on such observations, made possible by the repository of archived ethnographic instruments. From this we could identify what is plausibly a musical instrument depicted in the painting.

Ethnography provides evidence of yet another way of playing a flute (Kirby 1965, Plates 47A and 48B). A note created by blowing across or into a single tube (usually a reed) can be modulated by using a tuning-stick. Restricting or enlarging the air-space in the tube alters the note produced (slurs the note). This is achieved by inserting and withdrawing the tuning-stick that varies the volume of air in the tube while being played. In other cases, the tuning device

might not be a stick. For example, the word |*'ãb* is a word that was spoken in Kora, a KhoeSan language of the early Cape but now extinct. What |*'ãb* refers to is "a plug used to tune reed flute". The Kora and KhoeSan click-languages provide informative insight into how flute aerophones were constructed and played (Appendix Table 1).

Archaeological flutes

Flutes constitute the earliest undisputed musical instruments in the archaeological record (Morley 2003, 2013; Conard et al. 2009; Atema 2014). Archaeological implements, referred to as flutes, with and without finger holes occur in the Upper Paleolithic of Europe. These archaeological flutes are in bone, ivory (Atema 2014; Cornard et al. 2009; Morley 2013) and sometimes clay (Pomberger et al. 2018). In later periods rare wooden flutes also occur for example, two flutes made in Elder wood (Benito 2018). One, pipe is 42 cm long, is from Charavines in France, associated with the Neolithic period, dating to around ca. 2 600 BCE. The other is a Bronze Age wooden pipe from Hagnau-Burg in Germany dated to ca. 1 050 BCE (Benito 2018: 26). Appendix Table 2 lists examples of some of the known archaeological flutes. The list is not exhaustive but is meant to provide a general background of flutes from the archaeological record.

The oldest bone flute could be from a Neanderthal site of Divje Babe in western Slovenia (Turk et al. 1997; Atema 2004; Turk et al. 2018). This flute is widely known as the "Neanderthal flute" and has received a lot of publicity and academic attention due to its potential importance as the oldest musical instrument (Morley 2006; Atema 2014). The flute is made from a femur of a cave bear and is believed to be dated around 60 000 years BP (Turk et al. 2018). It has two finger holes and possibly a third finger hole which may be an incidental fracture (Atema 2004). The question is whether Neanderthals had developed the technical musical capabilities of making flutes or not? Scholars are divided on whether the holes in this implement are anthropic or are a result of carnivore activity (d'Errico et al. 1998; 2003). The scholars who advocate that the Divje Babe bone implement is a flute argue that the position of the holes, the spacing and the acoustic reconstructions indicate some form of human agency (Morley 2006).

Some tubular artefacts from the archaeological record, mostly in bone, have been referred to as whistles and in most cases have blow holes (Megaw 1960; Payne 1991; Atema, 2014). For example, Megaw (1960) describes an archaeological whistle from Pekárna cave in Moravia, Czech Republic. This piece has a blow hole and is open on both ends (Megaw 1960). Similar artefacts are also described by Payne (1991) from Marsh Pass, Basketmarker caves in Arizona, United States of America. In southern Africa, bone pipes that may have

been used as flutes were recovered from Later Stone Age, Early Iron Age and from historic contexts (Kumbani 2020). Later Stone Age sites that yielded bone tubes occur in the southern Cape and in the western Cape peninsular area of South Africa (Inskeep 1987). Some of the Later Stone Age archaeological sites that have yielded bone tubes include Matjes River, Nelson Bay Cave, Boomplaas, Die Kelders, Bonterberg Shelter (Kumbani 2020). Most of these tubes are in bird bone (Ludwig 2005:46). Decorations occur on some of the pipes and none have holes.

Reconstructions or actualistic studies have played a major role in music archaeological research (Lawson 2010). Amidst the debate on whether bone tubes with holes were flutes or not, the Divje Babje piece was replicated by a Slovenian team led by Drago Kunej and Mira Omerzel-Terlep. The team found out that the replica of the Divje Babe flute produced a clear sound. It was observed that the use of the three holes allowed the flute to produce three to six notes (pentatonic scale) (Atema 2004: 21). Besides the reconstruction of the Divje Babe flute, there are also a number of other bone flutes that have been reconstructed. For example, Atema (2004) replicated the Veyreau flute with a wing bone of a Griffon vulture (Appendix Table 2) and it produced clear sound. Another example includes the acoustic reconstruction of the Roque St Christophe or Pas du Miroir flute that was done in the painted cave of Faunte de Gaume in France. The reconstruction was successful, and the recording was used for an exhibition that was named "Dark Caves, Bright Visisons" for the American Museum of Natural History in 1992 (Atema 2004). There are not any reconstructions as yet that have been conducted on the bone tubes from southern Africa.

The flute players of the Klein Karoo

Two archaeological sites in the Klein Karoo/ Langeberg rock art may show flute players in painted imagery on the rock face. One of the sites is in the Attakwas Mountains, Klein Karoo. The content of the painted images on the rock face at the site shows highly animated postures of human figures, and the presentation of objects that can be construed as musical instruments, rattles and a flute. These paintings are on a large boulder, prominent in the landscape (Rust 2008). Parts of a frieze of human figures (average size 75 mm in height), positioned in a row, are five figures grouped together. These figures show antic postures, one figure has his legs up in the air. They are depicted with tail flaps/coverings over the buttocks; they hold rattles and one figure appears to be playing a flute. The right hand of the flute player shows curved fingers as if holding, the flute in position. The left arm of the flute player is held upward holding a rattle. There are lines present that could be interpreted as the flow of energy of a dance ritual. A

scan of a section of the tracing shows the flute player, central to the frieze, and other figures in antic postures (Fig. 2)



Figure 2. A scan of a section of the tracing (cut off on the left side) of the panel showing the flute player (third figure from the left), and other figures showing antic postures in the procession (Tracing by Rust, housed at Stilbaai Museum achives, Western Cape).

The other site is situated on the Brak Rivier south of the Kammanasie mountain near Oudtshoorn in the Klein Karoo. Known as Ezeljagdspoort site it has had ambiguous interest for more than 170 years (Alexander 1837: 316), partly because the figures resembled mythical beings or figures "obviously connected with local mythology" (Rudner and Rudner 1970: 106). In 1835 these paintings were first copied by Maj. C.C. Mitchell for Sir James Alexander on a visit to the site. Set in his colonial view of the time that rock paintings were simple renderings of domesticated life, Alexander had little explanation for the figures at the Ezeljagdspoort site (Alexander 1837: 317).

The central frieze of Ezeljagdspoort figures undoubtedly represent therianthropic figures in form, and have been interpreted to represent "swift-people" (Rudner and Rudner 1970; Lewis-Williams 1990; Lewis-Williams et al. 1993; Hollmann 2005a, 2005b; Lewis-Williams and Challis 2011), although recent research have interpreted these figures as having fish tails (Rust 2020). The upper part of these figures are human with round heads, well-defined

shoulders, and human arms and hands with finger-like extremities (Fig. 3). Behavioural activities such as the bending or veering of arms and holding of objects that are stick-like, are evident in the depictions of these therianthropes. The central figure of this frieze has an upright posture with arms held upward and joined in holding a ‘short stick’ which we have interpreted as a possible one tone reed flute. Fingers of both hands are depicted, with the fingers of the right extended while some curve around the instrument as if holding it in position. Whether fish or bird transformations apply to this figure, the nature of the depiction suggests transfiguration that project the ritual dance in interpretation with possible musical accompaniment of a flute instrument held in hand. The figure is also shown in a forward bending position from tail upward confirming a dance posture (Lewis-Williams and Challis 2011). Ritual behaviour and spiritual significance associated with the healing/ trance dance are constantly present in depictions on the rock face and we underline what other researchers have inferred, that although there are regional and procedural differences in religious practices throughout time, the dance remains the fundamental religious rite among San groups and also among the southern Bushmen, the /Xam (Bleek and Lloyd 1911; Bleek 1935; Barnard 1992; Lewis-Williams and Challis 2011). The other figures in the group of therianthropes surrounding this figure suggest the ritual behaviour of the images as they are intertwined by a long-curved line with a human head, arms and hands with extended fingers.



Figure 3. A recent tracing at the Ezeljagdspoort site showing the frieze of painted images (Rust 2019)

The Cederberg flute players

In the Cederberg region of southern Africa there are two sites in which there are painted human figures holding what appear to be musical instruments, which we suggest most likely represent flutes. The Zimri shelter was "discovered" by Jan Zimri in the 1970s while conducting a survey in the Cederberg Wilderness Area. The survey was managed by archaeologist Janette Deacon then working for the South African Heritage Resources Agency (SAHRA) and Swart (2020) most recently analysed the complex imagery of this shelter. The human figure with instrument in hand is one element of a large painted frieze (Fig. 4). Clearly the painted figure is male as indicated by his penis and the hunting accoutrements that he is carrying. One hand holds what is likely a two-pipe flute, or possibly a whistle although this is less likely given the length of the tubes. Four reed flute sets were collected by Kirby from the "Red-Dunes Bushmen" living on the Western edge of the Kalahari in the vicinity of Haruchas (Kirby 2013: 154). The instruments are archived in the Kirby Collection of Musical Instruments at the University of Cape Town. These flutes deserve mention because they most closely approximate what is represented in the Zimri painting. What could be illustrated in

the painting is a two-tube reed flute, similar to the ethnographic examples, which are open, end-blown flutes without fingerholes. They are made from river reeds, with the longest cut to a length of 180mm. In the ethnographic models the reeds are combined (tied together) in sets of 4 and 6 tubes/reeds. The other hand of the figure is raised to the forehead in a gesture which remains opaque, although not unknown because the posture is recorded elsewhere (Rusch and Parkington 2010: 60). The entire painted surface portrays what can best be described as palimpsest that includes a multiplicity of painting events, layed down over an extended period of time. The human figure with instrument is spatially associated on the rock surface with a fat-tailed sheep and two equid-like animals that are painted as if walking one behind the other towards the flute player. This might provide a relative indication of age of within the last 2000 years, although we return to this question later.



Figure 4. A male human figure holding a two-tube/reed flute, painted alongside a fat-tailed sheep rendered in the fine-line method. Zimri shelter, Cederberg, Southern Africa. This image has not been subjected to digital enhancement. Photograph © Neil Rusch

The second site is Procession shelter, one of several painted sites along the Jan Dissels River, near Clanwilliam in the Cederberg (Fig. 5). The shelter derives its name from a procession of painted figures, mostly men, wearing a kaross. Parkington (2013: 91-97; 2002: 37-47) argues that cloaked (kaross clad) human figures are "depictions of initiated men, hunters who have killed their first eland..." (2013: 96). To the left at the entrance of Procession shelter there is a monochrome painting of a reclining human figure. With both hands raised this human figure holds to his mouth what we suggest is a flute. This may be an example of "self-declaritive" expression (England 1968), rather than an outgoing performance for others. This is suggested by the fact that the figure with flute is painted on the outside wall of the rock shelter, on its own, apart from the main procession and other images.

Solomon (2007: 155) makes the observation that rock paintings generate and create meanings rather than contain meaning. In this case two areas of meaning and instrument playing praxis are deserving of comment. This is made possible by a supporting framework of known San cultural practices and cosmology. Care and precision were required to paint the extrusions of fine red lines "raining down" from the horizontal painted line above the figure, and from the back of the human figure's head and neck. Moreover, exactitude was required to paint the two thin parallel horizontal ochre lines that are attached to the shoulders and neck of the reclining figure. Two possible interpretations can be given to these lines, neither of which is mutually exclusive. On the one hand they might be read as "power lines", "ropes to god" or lines of potency (Lewis-Williams 1981b; Lewis-Williams et al. 2000; Keeney 2003). On the other hand the lines attatched to the player may be "thinking strings" (Bleek and Lloyd 1911: 87-89), and in particular the ones connected to the neck (Bleek 1956: 564). In whichever way these lines and threads are understood they do however lend metaphorical, even supernatural, significance to the activity depicted, which in this case happens to be flute playing.



Figure 5. Human figure painted in a supine position with both hands holding a flute. Procession shelter, Cederberg, Southern Africa. The red/magenta elements in this image are enhanced, using Decorellation Stretch software. Photograph © Neil Rusch.

Discussion

The images with possible flute players add to the music archaeological record of South Africa. These images are interpreted as flute players due to the postures and positioning of hands typical of whistle/flute players. The interpretation of the San rock art in South Africa is mainly centered on the ritual aspect of the medicine man and and the 'power' animals like eland, elephant and the rain animal (Lewis-Williams and Challis 2011). Against this background, the musical depictions in the art which encompass dancing scenes and musical instrument players are not perceived as musical scenes per se but they are considered as part of the ritual processions that are depicted in the art. Music and dance accompany the spiritual ritual. The Attakwas rock art site of a flute player (cf. Fig 2) surrounded by other figures is a vivid presentation of articulated dance postures adopted by the participants in the ritual. The spiritual energy that is communicated between the dancers that facilitate healing or bring

rain is shown by the lines that surround these figures (Lewis-Williams and Dowson 1989), as are present in the other examples cited.

The playing of the flute may have also played a role in rain making, given the documented reference to sound and rain-making in the ethnographic record. In 1875, Lucy Lloyd, sister-in-law to Wilhelm Bleek the German philologist at the Cape, deceased three years at the time, showed /Han≠kasso, the /Xam San informant, a copy of the Ezeljagdspoort paintings (cf. Fig. 3), and in explanation /Han≠kasso refers to the long humanoid line as *!khwa: !ʌhai:n;* which dwells in the water and is worm-like (Bleek and Lloyd Collection 1878: L.VIII.1.6074-6077). Lloyd translated *!khwa: !ʌhai:n;* according to the *Bushman Dictionary* (Bleek 1956: 369) as the rain's navel or caterpillar. /Han≠kasso did not offer a full interpretation of the paintings but does refer to 'sorcery' in explanation and he emphasised that the Ezeljagdspoort paintings represent /Khwa's people, the rain's people. He stated that the figures were human yet mystical. He described the figures in the Ezeljagdspoort painting as the rain's sorcerers as they were able to influence the weather. The figures also hold dancing sticks (Lewis-Williams 2002). /Han≠kassõ discusses two opposing themes: the power of the water people making rain and thwarting adverse weather conditions by addressing the rain, and on the other hand, inciting such destructive forces. The rain makers addressed the rain formally to impede it from sending thunderstorms that may harm people (Hollmann 2004: 191). /Han≠kassõ implies that the long humanoid line *!khwa: !ʌhai:n;* depicted in the Ezeljagdspoort paintings may indicate such division or opposing forces and that the people in the paintings may be entreating the rain's navel in the animated ritual actions depicted, to be beneficial and not harm them. The trance dance and possible associations with rain-making and the "rains' things" as implied by /Han≠kasso's explanations of the Ezeljagdspoort paintings are linked with pan-San traditions (Lewis-Williams and Challis 2011).

Some of the paintings provide an opportunity to comment on contact between hunter-gatherer and herders. The figure described from Zimri shelter is associated with a depiction of a fat-tailed sheep. At Ezeljagdspoort site a figure of a sheep is present to the right of the frieze (cf. Fig. 3). Domesticated fat-tailed sheep were introduced into southern Africa around 2000 years ago (Deacon et al. 2018). Rock art researchers agree that at the time of the introduction of pastoralism, the fine-line tradition of painting was compounded by finger painting and these images juxtaposed or superimposed some of the older rock art on the rock face (Deacon et al. 2018; Manhire et al. 1986; Yates et al. 1994). Finger dots over or near older paintings may have encoded a rhythmic motion on the rock face, absorbing so to speak the potency

essentially suggested by the fine-line paintings (Rust 2008). Temporal and social change is thus reflected in Figure 3. If the image of the flute player and fat-tailed sheep are contemporaneous, which seems likely, then this particular image lends credence to the observation that "pastoralism was not initially as extensive and/or pervasive in the interior mountains as it was on the coastal foreland. This allowed hunter-gatherers living in the mountains to paint fat-tailed sheep images before cultural change affected the praxis of painting" (Jerardino 1999: 65; Yates et al. 1994: 54, 57). What these observations suggest is that the images in Figure 3 were painted early in the pastoralism phase when the fine-line tradition had not yet been disrupted, perhaps as early as 2000 years ago. This approximate dating is important since it reflects the aural continuity of flute playing across the region, as indicated by recent ethnography (Kirby 2013) and by the painting.

Kirby argues that the type of reed-flute instrument most likely held by the individual in Figure 3 was borrowed from the Hottentots by among others, the Bushmen. This is contra George Stow who believed the influence of diffusion went the other way (Kirby 2013: 153-154). Be this as it may, the disagreement aligns with what is depicted in the painting, namely a transitional phase in the history of the region i.e. a time when pastoralists were moving into the territory and when the fine-line tradition of rock painting, that hunter-gatherers had been practicing until that time, was on the cusp of disappearing. The human figure with flute is thus best described as a "crude fine-line" painting (Swart 2020: 271, Appendix panel 24-25). This categorization captures the betwixt and between rendition of changing realities in the region, which the fine-line fat-tailed sheep and the crude fine-line flute player painting reinforces.

The flute player from Procession shelter is in reclining position with a flute raised to his mouth. The supine position is unusual, considered from within a Western predisposition of how a flute is or should be played. Ethnography tells us otherwise. With respect to the practice of musical bow playing, for example, the supine position is not unusual. The *gora*, another San instrument, could and was played in the same way. The practice of playing the musical bow in a reclining position was photographically recorded in the 19th century (Kirby 1965, Plate 53b) as well as in recent times in the Kalahari (Le Roux and White 2004: 122-123). The Procession shelter painting captures and records the same practice, as it appears to have been adopted for playing the flute. This image provides a rare, if not unique, example of this instrument playing practice.

Kirby was intrigued by the supine method of playing another instrument, the musical bow: "It is of great musical interest. […] the fact that the end of the instrument is in the player's

mouth is very significant. He may be doing either of two things. He may be simply enjoying the sounds yielded by the string as communicated to him partly through the ears, but more definitely through the bones of his head …" (Kirby 2013: 195). It may well be that the flute player, as depicted in the Procession shelter painting, is represented as inducing or undergoing a similar experience. In other words the player experiences playing the flute as a transmitted aural experience. Simultaneously the instrument's vibrations are being received by the player as direct body experience. The physical characteristics of the Procession shelter give added reason to suggest this. Upon entering the shelter one is forced onto ones knees and once inside the enveloping rock cavity one must remain in a prone or sitting position. The floor in the shelter/cavity is solid rock, and is highly polished suggesting many visitations. It is conceivable that vibration reception was augmented by lying on the floor and playing a flute in the rock chamber and that the fine horizontal and vertical lines, above and below the painted flute player, represent this experience in a proprioceptively enriching space. Increasing attention is being given to painted sites and their association with acoustics, and acoustic enhancement. Locations in the landscape and the physical architecture of shelters and caves are studied in order to detect unusual acoustic phenomena such as resonances, echoes and reverberations (Díaz-Andreu and Mattioli 2016; 2019), which might have attracted painters to make paintings at such sites in the first place. With this as a concept hypothesis one of us (NR assisted by sound engineer and composer Simon Kohler) conducted a preliminary experiment at Procession shelter. In contra-distinction to the hypothesis our result proved negative. Sound played within the rock chamber produced no resonances, echoes or reverberations. Sound played within the chamber had no measurable amplification outside the rock shelter, which is what, in particular, had been expected. Procession shelter is an acoustically neutral space according to this preliminary investigation: "this is the kind of neutral space we hope to achieve for specific recording purposes" (Pers. Comm. Simon Kohler 15-05-2019). The "negative" result opens the enquiry: what if Procession shelter was chosen, and painted, because of its exceptionally neutral acoustic quality rather than for any psycho-acoustic effects induced by resonances, echos and reverberation? This could well be the case, and appears possible given the self-delectative manner of instrument playing observed in the Kalahari five decades ago (England 1968). From other information available, it seems that "Bushman self-delectative songs are generally intimate, personal, and even contemplative in their expression" (Hansen 1996: 299). This mode of musical expression that is self-reflective finds support in Kirby's observations that go further in suggesting a kinesthetically sensitive feedback that is operative in this manner of playing an instrument.

(Kirby 2013: 195). For somatic and kinesthetic attentativeness in storytelling, see Rusch, 2016: 883-885). Our study suggests that the painting of the flute player at Procession shelter is a rare document of an occasion like this.

Conclusion

The incidence of flute players in the rock art of South Africa indicate the occurrence of sound production or music making using flutes during possible rituals and dance activities. Four rock art scenes, from the Attakwas and Ezeljagdzpoort sites in the Klein Karoo, and from Zimri shelter and the Procession shelter in the Cederberg with figures that are playing what is highly likely to be flutes have been described. The Attakwas image contains animated dancing figures that include a flute and rattle player. The Ezeljagdpoort image highlight for the first time the possible role of flute playing and sound in rain making rituals. Here the mythical figures are linked to a central flute player in a dancing posture. A two-pipe flute, very similar to reed flute sets documented by Kirby, held by a male figure is painted at Zimri shelter. The flute player occurs next to a fat-tailed sheep and two equid-like animals that are painted as if walking one behind the other towards the flute player. We also documented the rare if not unique reclining position of the flute player from Procession shelter. In contrast to the other sites this flute player appears on the outside wall of the rock shelter apart from the main procession and other images within the shelter. We suggest that these musical depictions bear witness to ritual, metaphorical 'meaning making' that was part of the act of painting images on to the rock face.

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Appendix

Table 1*.KhoeSan nomenclature from the southern Africa region descriptive of aerophones, namely flutes and reed musical instruments*

Reference source		Kora: a lost KhoiSan language of the early Cape and the Gariep	Du Plessis, M. 2018. University of South Africa (UNISA) Press, Pretoria
	Word	**Translation**	**Interpretation**
1	dī|hau|hau	gather, collect	gather (as reeds), collect, pg. 279 [Mgd]
2	gamas		name of one of the reed-flutes in the 6- or 7-piece consort (bass, 'few feet long') [Ebt]
3	kaiǂ'ās	big flute	'big flute' in the 4-piece reed-flute consort, pg. 283 [Kby]
4	xãe	blow	blow (as playing flute or gora) pg. 290 [Mgd]
5	ǂ'ādi	flutes	consort of individual monotone reed-flutes, pg. 331 Flute names (individual) for **4-flute consort**: (1) ǂōǂōs, (2) !namis, (3) kaiǂ'ās (tonic note (1) according to some consultants, (4) tuxana Flute names (individual) for **6- or 7-flute consort**: (1) ǁoǁos (~ǂōǂōs), (2) ǁgoatoab (largest roars), (3) gamas (bass, few feet long), (4) ǁhũis (higher pith, together with gamas makes up the kai ǂ'ākua), (5) !aros, (6a) kx'āǁms (according to some consultants), (6b) |ũbis or !'ulīs (according to other consultants), pg. 331.
6	ǂ'ās|aīb	reed-dance	[Mhf]

7	|'mb	plug	plug used to tune reed flute, pg. 205 [Ebt]
8	|'umma	breath	breath (Nama |ommi); 'ums, soul, breath (Nama |oms), pg. 295 [Mhf]
9	|hãb	reed	spelling, see also ǂ'āb pg. 295 [Ebt28, Mgd]
10	ǁgoatoab		name of one of the reed-flutes in the 6- or 7-flute consort (largest, 'roars'), pg. 301 [Ebt]
11	ǁ'ōb	breathe	pg. 303 [Mhf]
12	ǁhũis		name of one of the reed-flutes in the 6- or 7-piece consort (higher pitch, together with gamas known as kai ǂ'ākua) pg. 304 [Ebt]
13	!aros		name of one of the reed-flutes in the 6- or 7-piece consort (ringing clear note) pg. 308 [Ebt]
14	!'ulīs		name of one of the reed-flutes in the 6- or 7-piece consort, pg. 313 [Ebt]
15	!namis		name of one of the reed-flutes in the 4-piece consort, pg.316 [Kby]
16	ǂ'āb	reed	reed (for flute), arrow, pg. 319 [Mhf]
17	ǂ'oab	wind	pg. 320 [Mhf]
18	xãe	blow	blow, as when playing a wind instrument pg. 326
Reference source		A Bushman Dictionary, (selected terms from the ǂKhomani San)	Bleek, D. 1956. American Oriental Society: New Haven, Connecticut.
19	|khosike	wind instrument, part of	part of ǁnasi |khosike, a wind instrument, the ocarina, made of a hollow cucumber, pg. 313 [Kby]
20	|khosi	bone pipe	pg. 340 [Dk]
Reference source		Khoekhoegowab Glossary, Language of the Damara, Haiǁom and Nama	Haacke, W.H.G.1999. Gamsberg Macmillan Publishers: Windhoek, Namibia
21	flīs	mouth-organ	pg. 10
22	xawupu.s xapupu	woer-woer whirlygig	free aerophone, pg. 48
23	xâi	play, blow	play (wind instrument), blow (horn), pg. 29
24	|omǂui	breathe out	exhale, pg. 54
25	|omǂgā	breathe in	Inhale, inspire air, pg. 54
26	|om.s	soul	pg. 54

27	|gau|gau	harmonise, tune	tune musical instrument, pg. 59.
28	ǁnâ.s	trumpet, bugle	brass wind instrument, pg. 90
29	ǂâ.b	reed, bamboo, arrow	pg. 110
30	ǂnani.b ǂnuni.b	whistle, flute, recorder	pg. 123
31	ǂnani ǂnuni	play flute, blow (on) instrument	pg. 123. Play (!gapu) musical bow; play (|khō) wind instrument; play (|khō) string instrument, pg. 221
Reference source		The Living Musics and Dance of Namibia (Nama and Damara)	Mans, M. and Olivier, E. 2005. Scientific report for the project - The Living Musics and Dance of Namibia: Exploration, Publication and Education. Volume 1. Instruments, Windhoek
32	·āb	(denotes male and larger) flute	Nama and Damara: generic term ·āb pg. 57
33	·ās	(denotes female and smaller) flute	pg. 57
34	·āgu	flutes (pl.)	pg. 57
35	!koam	set of flutes	set of flutes which follow !aias (leader) pg. 57
36	!nanidi	six (set of six)	six reed flutes played by a single man in hocket with the other player pg. 57
37	xâi-ams	mouth (of flute)	"to blow - mouth / song" p. 58
38	·nani	to play (flute)	Nama and Damara transitive verb
39	xâi, ≠ādidixâis		"the sound of flutes blowing" p. 58
40	soas ta ≠nûo	to play in hicket	"space - you - appear / seat" p. 58
41	/nûgu ≠noagu /haogo	compete to argue together, assemble	Nama and Damara, competition between flutes. pg. 58
42	haka ≠ädi		"four - flutes" pg. 58

Notes:

The words above exist in dictionaries and glossaries, as referenced in the table, but the originating sources are also provided by in-text square bracketing […], where possible.

1) [Dk] - Doke, C.M. 1936. An outline of ǂKhomani Bushman phonetics. *Bantu Studies* 10(4).
2) [Ebt] - J.A. 1936. *The Korana*. Maskew Miller, Cape Town.
3) [Kby] - Kirby, P.R. 1936. The musical practices of the |Auni and ǂKhomani Bushmen. *Bantu Studies*, 10(4).
4) [Mgd] - Maingard, L.F. 1937. The ǂKhomani dialect of Bushman: its morphology and other characteristics, in *Bushmen of the Southern Kalahari*. Johannesburg.

5) [Mhf] - Meinhof, C. 1930. *Wörterverzeichnis* in *Koranadialekt des Hottentottischen*. Reimer, Berlin.

Table 2. Flutes from the archaeological record

	Site	Country	Date/ Time period	Description	Material	Reference
1	Divje Babe	Slovenia	Middle Paleolithic 58.6 ±_ 34 Ka	Left femur of a juvenile cave bear with two complete holes. 113.6 mm length, 23.5 mm and 17.0 mm width at its narrowest point. 9.7 mm and 9.0 mm maximum diameters of holes, 35 mm distance between holes. A number of experiments were done to replicate this implement	Bear bone	J. Atema 2004, 2014; I.Morley 2006; M.Turk et al. 2018:5
2	Hohle Fels	Germany	Aurignacian c. 38-28 Kya	Flute 1: recovered in 12 pieces, length of 218 mm and a diameter of about 8mm. The flute has five finger holes and has two V shaped notches on one end. Distal end is broken.	Radius of a griffon vulture (Gyps fulvus).	N. J. Conard et al. 2009; I. Morley 2003, 2013.
3	Hohle Fels	Germany	Basal Aurignacian c. 38-28 Kya	Flute 2: Length 11.7 mm, width 4.2 mm, thicknes 1.7 mm. It has one finger hole.	Mammoth Ivory	N.J.Conard et al. 2009
4	Hohle Fels	Germany	Aurignacian. lowest unit of archaeological horizon Vb. Initial Upper Paleolithic occupation c. 40kya > 35 Kya	Flute 3: Length 21.1mm, width 7.6 mm, thickness 2.5mm, The flute has 9 small notches and incised lines	Mammoth Ivory	N.J.Conard et al. 2009; I. Morley 2013; M.Turk et al. 2018

5.	Vogelherd	Germany	Aurignacian c.38-28 Kya	Vogelherd flute 1: Length 17.5 mm, width 5,8 mm, thickness 1,8 mm. One partly preserved finger hole.	Bird bone	N.J.Conard et al. 2009; I. Morley 2013
6	Vogelherd	Germany	Aurignacian c.38-28 Kya	Vogelherd flute 2	Mammoth Ivory	N.J.Conard et al. 2009; I.Morley 2013
7	Roque St Christophe/ Pas du Miroir	France	Aurignacian I period 25- 35 Kya.	4 finger holes and 2 on the other side. Replictaed and the sound was recorded by Atema (2004) for an exhibition called Dark Caves, Bright Visisons"for the American Museum of Natural History in 1992	Ulna of a bear	J.Atema 2004, 2014
8	Geißenklösterle	Germany	Upper Aurignacian 43, 150 - 39, 370 cal BP	Flute 1: Recovered in 23 pieces. 120 mm long. It has 3 finger holes.	Bird bone- swan radius	I.Morley 2013; N.J.Conard et al. 2009
9	Geißenklösterle	Germany	Upper Aurignacian 43, 150 - 39, 370 cal BP	Flute 2: Recovered in 7 pieces. Notches along the edges of the two halfs	Mammoth Ivory	I.Morley 2013; N.J.Conard et al. 2009
10	Geißenklösterle	Germany	Upper Aurignacian 43, 150 - 39, 370 cal BP	Flute 3: It is 187 mm long. Recovered in 31 fragments.	Mamoth Ivory	N.J.Conard et al. 2009
11	Isturitz	France	Aurignacian period	Flute 1: Oldest flute from Isturitz. Length 14 mm, diameter 15-20. 3 holes and the third hole is broken. Has 9 short parallel incisons between the second and the third	Right ulna of a bird (Most probably a vulture)	G.Lawson & F.d'Errico 2002

				hole.		
12	Isturitz	France	Gravettian period c. 28-22 Kya	Flute 2: Recovered in 2 pieces. Reconstructed by Buisson 1990	Left ulna of a vulture	D.Buisson 1990 cited in I.Morley 2013
13	Isturitz	France	Gravettian period c. 28 - 22 Kya	Flute 3: Length 212 mm, diameter 11-14 mm. 4 holes. One side is smoothly finished. Reconstruction done by Lawson and d'Errico 2002	-	G.Lawson & F.d'Errico 2002
14	Isturitz	France	Gravettian period c. 28 - 22 Kya	Flute 4: Length 56.5 mm, diameter 13.6 mm-15 mm. 2 holes on anterior.	Left ulna of probably a vulture	D.Buisson 1990 cited in I.Morley 2013
15	Isturitz	France	Gravettian period c. 28 - 22 Kya	Flute 5: Length 67 mm, diameter 15-18 mm. 1 hole on the posterior and one on the anterior.	Right ulna of probably a vulture	D.Buisson 1990 cited in I.Morley 2013.
16	Isturitz	France	Gravettian period c. 28 - 22 Kya	Flute 6: Length 91 mm, diameter 7 mm. 2 holes on the posterior.	Ulna of a small bird	D.Buisson 1990 cited in I. Morley 2013
17	Isturiz	France	Gravettian period c. 28 - 22 Kya	Flute 7 Reconstructed by Buisson, 1990.	Right probably of a vulture	D. Buisson 1990 cited in I. Morley 2013
18	Sesklo	Greece	6th millennium cal BC	Length 64 mm. It is a whistle. It has a blow hole. Described as a whistle and it was reconstructed by Pomberger et al., 2018.	Bird bone	B.M. Pomberger et al. 2018
19	Brunn 2	Austria	5670 - 5350 cal BC	4 flutes with lengths of about 140mm. Flute 1: best-preserved, cylindrical shape, It has 2	Clay	B.M. Pomberger et al. 2018: 457.

				conical holes inside and three holes in the upper part. Flute 2 has 3 holes. Flute 3 has 2 holes and a ledge. Flute 4 has a conical hole. Only flute 2 was reconstructed.		
20	Brunn 3	Austria	5300 - 5250 cal BC	2 flutes. Flute 1: recovered in 2 pices, has a conical shape and 3 holes and wider at the upper part. Flute 2: Only a narrower part without holes was found. Both flutes were reconstructed. The first flute produces a melodius sound.	Clay	B.M. Pomberger et al. 2018
21	Gellénháza	Hungary	-	It has 3 holes and a narrower lower part. Simillar to the Brunn implements.	Clay	H.K. Simon 1996 cited in B.M. Pomberger et al. 2018. 457
22	Ovcharovo-gorata	Bulgaria	5750 - 5500 cal BC	Occurred at the same time with the oldest part of Brunn 2	Clay	R. Krauss 2014 cited in Pomberger et al. 2018:457
23	Hotnitsa	Bulgaria	-	Younger than the Ovcharovo- gorota flute and could be contemporaneous with the Brunn 3 site	Clay	B.M. Pomberger et al. 2018
24	Anzabegovo	Macedonia	6000 - 5800 cal BC	It has a half of a finger hole (46 mm)	Bone	B.M. Pomberger et al. 2018
25	Olby Lynge	Denmark	Mesolithic Ertebolle 7500 - 6300 BP	5cm long, oval cross-section 0.4 x 0.7cm abd could be blown as blockless duct flute"	Bird bone	C.S. Lund 1985
26	Les	France,	30 Ky BP	4/5 holes on the front and	Ulna of a	J. Atema

	Roches/Castel Merle	Dordogne		2 at the back	mammalian bone	2014
27	La Roque	France, Dordogne	30 Ky BP?	No archaeological context. It was found during road construction in 19th century. It is estimated to date around 32ky BP. It is 12.5cm long and 2cm in diameter	Made of a mammalian bone	J. Atema 2004, 2014
28	Veyreau	France	4 Ky BP	It is 17.5cm long. It has 5 round finger holes inline with a large square hole near one end. It has dots decoration. The flute was recovered from a burial context.	It is made of a wing bone (ulna) of a Griffon vulture. This was replicated by Atema 2004 and produced sound.	J. Atema 2014
29	Skara	Sweden	ca 1050 - 1530 AD	16 block duct flutes. 5 are almost complete, 2 are not finished and the rest are damaged. Their length ranges from 13 - 19cm long. 2- 4 finger holes. One has a wooden block.	2 are pig bones and the rest are sheep/goat shin bone.	J. Atema 2014
30	Jiǎhú	China	8 - 9 Ky BP	The six flutes are 18 - 25cm long. They are polished and have 5-8 finger holes each. Two of the flutes were recovered from a burial context of an adult man.	Made from wing bones (ulnas) of red crowned crane	J. Atema 2014
31	Matjes River	South Africa	Later Stone Age, 9580 ± 85 BP and 5400 ± 250 BP	36 bone tubes were recovered from Layer B and C. 2 decorated flutes came from Layer B. They have no finger holes. 6 of the flutes are only cut on one end and the other end	Mostly made of bird bone expect a few of a Bov II phalange and a tibia of a bovid size I	J.T. Louw 1960; B. Ludwig 2005; R. Protsch & J.J. Oberho

				is closed.		lzer 1975: 40
32	Nelson Bay Cave	South Africa	Final Later Stone Age, 3350 ± 60 BP	8 flutes. Some have decorations.	Made of bird bone	R.R.Inskeep 1987:166; M. Lombard et al. 2012
33	Die Kelders	South Africa	Ceramic Later Stone Age 1960 ± 85 BP	5 Flutes that were made using ring and snap method. One bone has a series of notches.	Made of bird bones and mammal bones	F.R.Schweitzer 1979: 127
34	Boomplaas	South Africa	Final Later Stone Age, 1510 ± 75 BP and 1700 ± 55 BP	No decorations	Animal bones but not specified	J.Deacon et al. 1978
35	Oudepost 1	South Africa	Historical period (1669 - 1732)	10 bone tubes. Only 2 are intact and the rest and in bad condition.	Made of Flamingo bones	C.Schrire & J.Deacon 1989: 105.

CHAPTER 6: MUSICAL BOWS IN SOUTH AFRICAN ROCK ART

6.1. INTRODUCTION

The musical bow is speculated to have been discovered as a result of hunting, after releasing the arrow and a musical tone from the vibrating string was heard (Balfour 1899 *cited in* Kirby 2013: 259; Stow 1905; Dargie 2001). Some consider it the first musical instrument of the Bushman (Stow 1905; Montagu 2017). A musical bow is an instrument that is made of a wooden stave and has a string attached to both ends of the stave (Dargie 2001). The musical bow belongs to the chordophone family which comprises of musical instruments that produce sound through the vibration of strings (von Hornbostel & Sachs 1961). South African depictions of musical bows are found in the Maloti Drakensberg Mountains, in the KwaZulu Natal region and in the Eastern Cape Province. Their use as musical instruments has a long history and has been documented ethnographically and they are still used even today for musical purposes.

6.2. MUSICAL BOWS: A CONTEMPORARY AND ETHNOGRAPHIC PERSPECTIVE

On face value musical bows seem to be a simple invention but playing them produces complex results (Dargie 2001; Stacey 2016). Musical bows are found in various geographical regions. For example, the *mbulumbumba* from Angola found its way to south America in Brazil and it is known as *berimbau* in that part of the world whereas the *uta* or *ota* from Kenya ended up in India (Stacey 2016: 13). Musical bows are known from countries such as South Africa, Mozambique and Zimbabwe (Stacey 2016: 18). In South Africa for example, Dave Dargie did extensive research on the Xhosa musical bows and their songs (Stacey 2016: 18). Impey (1983) investigated the *umakhweyana* which is a Zulu resonated bow (Stacey 2016).
Ethnographically, southern Africa has been home to a variety of musical bows some of which are now scarce and gradually disappearing (Kirby [1934] 2013; Dargie 2001; Stacey 2016). The most common musical bow in South Africa is the Xhosa mouth bow called *umrhubhe* and *uhadi* from the Eastern Cape that is now found even in Cape Town (Dargie 2001, Stacey 2016). The Xhosa also have a musical bow called *umqangala*, a mouth bow that is played by percussion (Dargie 2001). A resonated bow from KwaZulu Natal is known as *umakhweyana* and the *ughubu* is the Zulu version of the *uhadi*. Important songs accompany the *ughubu* and among them are royal songs called *amahubo* (Dargie 2001). In Swaziland they have the

makhweyane and in Mozambique they have *xitende* whereas the *lesiba* is found in Lesotho (Stacey 2016).

Among hunter gatherer societies bows are used in different contexts which include hunting, fighting and as musical instruments (Vogels & Lenssen-Erz 2017). Kirby ([1934] 2013: 261) mentions that in 1880 the late Dr Bleek had a few !Kung Bushman brought to his house at Mowbray in the Cape so that he would investigate their language. One of the !Kung Bushman who is described as a youth could play his bow for musical purposes and he also used the same bow for hunting since he had also brought his arrows with him. His bow did not have a resonator. In Section 6.2.1 different types of musical bows are described.

6.2.1. Different types of musical bows

a) Bows with separate resonators

Bows with separate resonators were used in southern Africa (Camp & Nettle 1955; Dargie 2001). In this case, the bow sits on top of the resonator and the resonator is not permanently fixed onto the bow (Figure 1). The mouth can also be used as a resonator. The purpose of the resonator is to amplify the sound of the musical bow and it also makes the overtones audible (Dargie 2001; Stacey 2016). The other purpose of the resonator is to help the player to isolate overtones of his or her own choice so as to create a melodic line from them, ie. to generate different pitches from one basic pitch generated by the single string (Lüdemann personal communication August 2020). This type of bow was used among the Tswana, Hottentots (Khoekhoe), Berg-Dama (Damara), Bushman of Angola, Tsonga and the Ba-ila (Camp & Nettle 1955). The Tswana and the Khoekhoe used a big U-shaped bow with a sinew. A hollow wooden resonator was used by the Damara whereas the Ba-ila used two deeply curved bows resting on a pot that was used as a resonator. Besides the pot, the Ba-ila also used the mouth as a resonator (Camp & Nettle 1955) (See Figure 3).



FIGURE 1. A /XAM BUSHMAN PLAYING A MUSICAL BOW WITH A SEPARATE RESONATOR (PICTURE COURTESY OF SAM CHALLIS).

b) Bows with attached resonators

This type of musical bow has a resonator such as a gourd that is permanently fixed (Figure 2; Figure 7) on the bow stave (Kirby 1934; Camp & Nettle 1955; Dargie 2001). Sometimes a tin resonator was used in place of the gourd. Bows with permanent attached resonators have been recorded among the Tswana, Tsonga, Sotho, Swazi, Zulu, and the Xhosa (Kirby [1934] 2013; Camp & Nettle 1955). Wood or cane was used for the stave while the strings were made of twisted hair, sinew, leather, or wire and a thin stick or reed was used as a beater (Camp & Nettle 1955). Resonated bows were also sometimes braced in the middle using wire, sinew or fibre. A loop was put on the middle of the string and it played a double function (Figure 8) of tying the string on to the bow stave as well as fastening the resonator (Camp & Nettle 1955). This type of a braced resonated bow was found among the Venda, Tshopi, Tsonga, Sotho, Swazi, Zulu, Ba-ila, Lamba, Balubedu and the Bakwebo (Camp & Nettle 1955). Both the Ovimbundu and the Chopi used the mouth as another extension of the resonator and the Chopi would also add rattles of tin and calabash on the bow stave.



FIGURE 2. A SWAZI MAN PLAYING A BOW WITH A RESONATOR (GOURD TO AMPLIFY THE SOUND) (PICTURE ADAPTED FROM THE KIRBY 2013: 266).

c) Bows using the human mouth as resonator

In some cases, the mouth was used as a resonator (Figure 3) in the absence of gourd resonators (Camp & Nettle 1955). The mouth technically enhances the pitches of the bow. This method was commonly used by the Bushman and the end of the bow was put in the mouth while the arrow was used for playing the string. The Khoekhoe also used this technique, but unlike the Bushmen their bow stave was made from hard wood and was strictly meant for musical purposes only and was not used for hunting purposes (Camp & Nettle 1955). A hollow curved reed bow stave was used by various groups that include the Venda, Tswana, Sotho, Pedi, Swazi, Zulu, Pondo, Xhosa, Basuto and the Shangaan-Tsonga. The Zulu call this hollow curved reed bow *umgangala* and it is played by women. Among the Zulu, Xhosa and the Swazi they have a dual system of the hollow reed and a rod. A braced bow of this type and with a wire as a string was found among the Damara, Herero, Masarwa Bushmen, Karanga and Shangaan (Camp & Nettle 1955). Another braced bow type has three staves. This stave has one central portion and has two pieces fixed on either side and was found among the Ndebele, Sotho, Pedi, Zulu, Chopi, Basuto, Bakwebo and the Balebedu (Camp & Nettle 1955). There is another short bow made of solid wood, thinned on both ends and it has notches. It is played by rubbing or

scrapping the notches with a stick and it was recorded among the Ovimbundu, Tchokwe, Qung Bushmen, Zulu, Shangaan-Tsonga and the Karanga (Camp & Nettle 1955) and it was also used among the Venda (Kirby 2013: 312).



FIGURE 3. ʒU¯'|'ASI (!KUNG SAN) MUSICIAN PLAYING THE MOUTHBOW ÐG!AO (PICTURE ADAPTED FROM VOGELS 2012: 188 ORIGINAL PICTURE IS FROM ENGLAND 1995, PHOTO 1).

d) The *gora*

A *gora* is a bow with a string that is attached to a broad thin, flexible tongue shaped quill (Figures 4 & 5) and this is fixed to the end of the bow (Stow 1905). The *gora* was played by both the Bushman and the Khoekhoe (Kirby 1931). It is a combination of a wind and string instrument (Camp & Nettle 1955). The quill functions as a mouthpiece in this instance (Figures 4 & 5). According to Kirby ([1934] 2013: 233), the *gora* has for many years attracted the attention of the travellers and the instrument is peculiar to South Africa. This is made of a slender bow of wood and is tapered in the same way as the Khoekhoen or Bushman bow was tapered. A thin string of twisted sinew was prepared and one end of it was run through a tiny hole made in the slit and flattened barrel end of the quill of a feather which would have been cut into a roughly spatulate shape and the sinew was secured in that position (Kirby[1934] 2013: 233). The string is either tightened or loosened at will by the person playing the instrument. By breathing in and out with force (Figure 5), the quill and through it the string is set in vibration (Stow 1905; Camp & Nettle 1955; Kirby [1934] 2013). The *gora* was common among the Bushman and it was also adopted by the Tswana, Sotho, Zulu, Xhoasa, Swazi and the Venda (Camp & Nettle 1955).



FIGURE 4. THE GORA WITH A QUILL AT THE END OF THE STRING (PICTURE ADAPTED FROM THE KIRBY DIGITAL COLLECTION MANAGED BY UCT LIBRARIES HTTPS://DIGITALCOLLECTIONS.LIB.UCT.AC.ZA/ISLANDORA/OBJECT/ISLANDORA%3A20153/DATASTREAM/OBJ/VIEW)

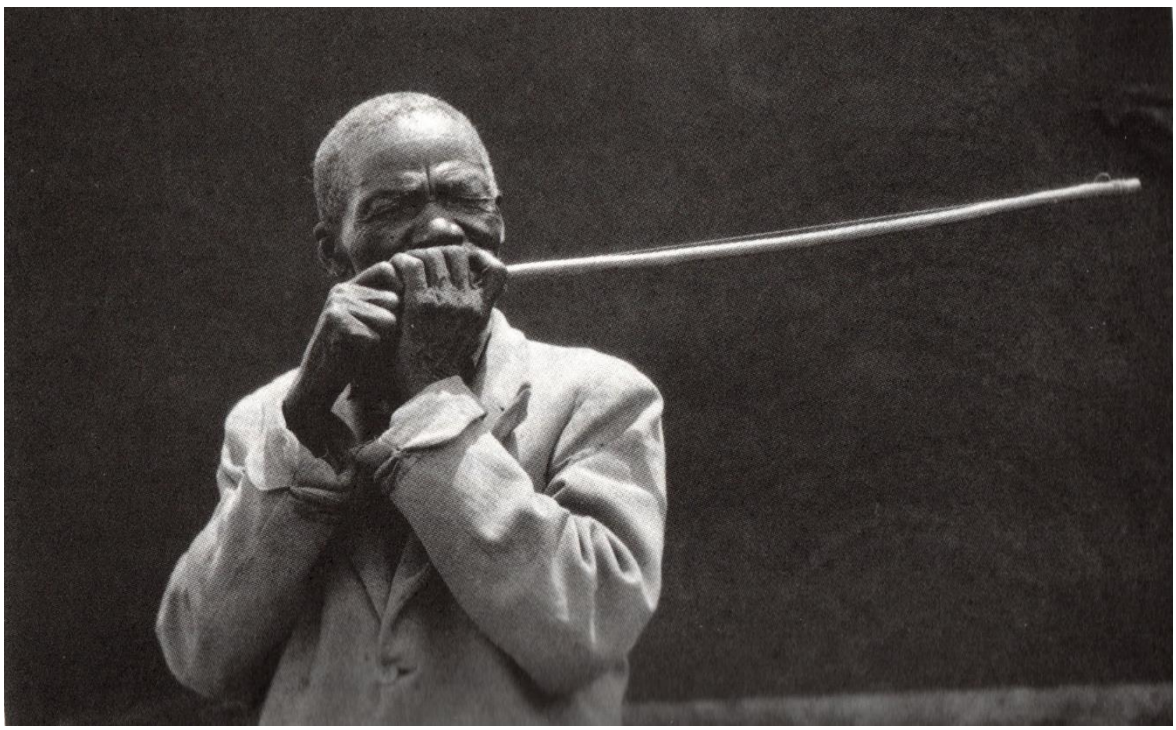


FIGURE 5. A KORANA HOTTENTOT MAN PLAYING THE GORA. PICTURE ADAPTED FROM KIRBY (2013: 239)

e) The Ground-bow

Another type of musical bow is called a ground-bow (Kruger 1989). This type of chordophone was recorded in countries including the Ivory Coast, Cameroon, Northern Zaire, Uganda, Central African Republic (Rycroft 1980: 57 cited in Kruger 1989: 391). In southern Africa it was used in Zimbabwe, Botswana and in the northern part of South Africa, amongst the Venda. The ground-bow was previously reported by Blacking in 1959 amongst the Venda but Kirby seems not to have come across this type of instrument since he does not mention it in his seminal book, "*Musical instruments of the indigenous people of South Africa*" (Kruger 1989). Making the ground-bow involves using a supple branch of a tree or a young growing sapling less than two meters that is pruned. A string is then tied onto this branch stretching downwards to the resonator that is fixed in the ground (Figure 6). In the absence of a growing sapling, a loose branch supported with stones is used to make a ground-bow (Kruger 1989: 392). Various materials like twisted sinew, plant fiber and in some cases a wire were used to make the string (*lurale*). Some would wound the wire with hair obtained from an oxtail. At a later stage thin, strong ropes were used. A small pit was dug, and it functioned as a resonator and the size of the hole would determine the sound (Kruger 1989: 393). A big stone was placed in the hole and then the string was tied on to the stone and the string would pass through a hole on a piece of a corrugated iron that was used to cover the hole. In some few cases a winnowing basket (*luselo*) would be used as a resonator while put upside down to cover the hole and fastened on the ground by small pegs. The calabash (*demba*) was also preferred and was placed in the hole and soil would be used to secure it around its circumference (Kruger 1989). The string would then go through a small perforation on the gourd and then was tied on to a small stick that would be put inside the gourd and positioned horizontally to fasten the string. With time the gourd resonators were overtaken with large metal tins around the 1920s and 1930s (Kruger 1989).

Technically, the sides and the top of the resonator were not supposed to be thick because this would interfere with the sound vibrations and produce poor sound vibrations (Kruger 1989). The string needed to be on full stretch and have a high-tension to produce a good tone. A stick was used to pluck the string and usually the player would be in a squatting position. The player targets the middle section and the lower part of the string (Kruger 1989). The fingers and a thumb can also be used to play the ground-bow and this method is used when one wants to obtain loud tones (Kruger 1989). The Venda called their ground-bow a *kalinga* or *galinga* and this instrument was used to accompany choral dance songs. However, Kruger (1989) noted with concern that there were only few Venda elderly people who remembered this instrument,

and this means that the instrument was already faced with extinction at the point that he did his research on the ground-bow.

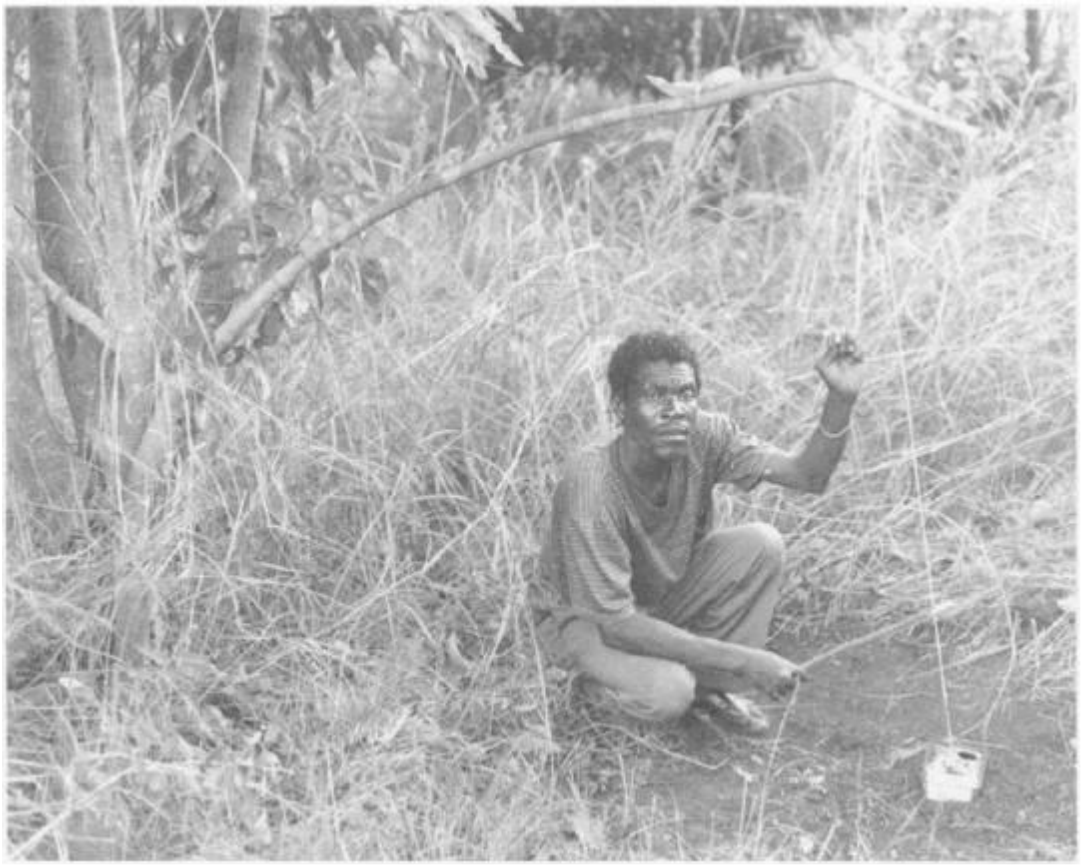


FIGURE 6. MR MULIMISI NETSHIFHEFHE PLAYING A GROUND-BOW (KALINGA). PICTURE ADAPTED FROM KRUGER (1989: 393).

6.2.2. Producing sound with a musical bow

Musical bows may be played by percussion whereby one strikes the string with a stick, by plucking or by friction through rubbing the string or the notches (Figure 7) on the bow stick (Dargie 2001). As a result, the bow string vibrates, half, quarter or a third. The full vibration of the bow string produces fundamental tone, and the partial vibrations can only produce overtones (Dargie 2001). If the player wants to produce more than one fundamental tone with the bow, he/she must touch the bow string to shorten its vibrating length. In this case, there will be constant tonality shift from for example F major to G major. All Xhosa musical bows use the whole tone tonality shift whereas the Zulu *ugubhu* musical bows uses semitone shift (Dargie 2001). A musical bow can produce more than one tone simultaneously, but it depends on how it is played and modified especially on the string (Dargie 2001; Camp & Nettle 1955).



FIGURE 7.SAN MUSICIAN WITH A SCRAPE BOW NXOXORO. PICTURE ADAPTED FROM VOGELS (2012: 192) (ORIGINAL PICTURE IS FROM KIRBY 1965, PL. 67 A).

Bracing of the musical bows is also another way of increasing the tones on a musical bow (Figure 8). As described above (Section 6.2.1, b & c) a loop is put on the bow stick and the string (Figure 8) as a way of dividing the bow string into two sections (Camp & Nettle 1955; Dargie 2001; Kirby [1934] 2013; Stacey 2016).The positions where players brace the bows may differ for example, some brace their bows right in the middle and others prefer to brace them close to the end of the musical bow. As a result of the bow being braced the two sections will produce different tones. In South Africa, Kirby ([1934] 2013: 276) recorded the use of braced bows among various cultural groups that include Tsonga, Venda, Swazi, Zulu and the Pedi (Figure 8).

The musical bow is played by both males and females. Among some cultural groups it is played by men only, for example among the Venda and the Pedi. Among the Venda it is played by the young boys, who sometimes sing along, or they may be quiet and among the Pedi it is played by the old men and the youths. Women are also not left out, for example, the *makweyane* (Figure 8 number 3) is played by the girls among the Swazi and they will be singing along while they are playing the instrument (Kirby [1934] 2013). Among the Zulu the instrument is played by both genders (Kirby ([1934] 2013). The musical bow is even used as a

musical instrument to accompany church songs (Dargie 2001: 11). For example, a Swati nun Mother Adelia Dlamini played a huge Swati *makweyane*. Dargie (2001) also recorded Zulu songs in 1981-1982 that were done with the *ugubhu*. These songs were done by Princes Phumuzile and group songs that were performed with *ugubhu* were also recorded.

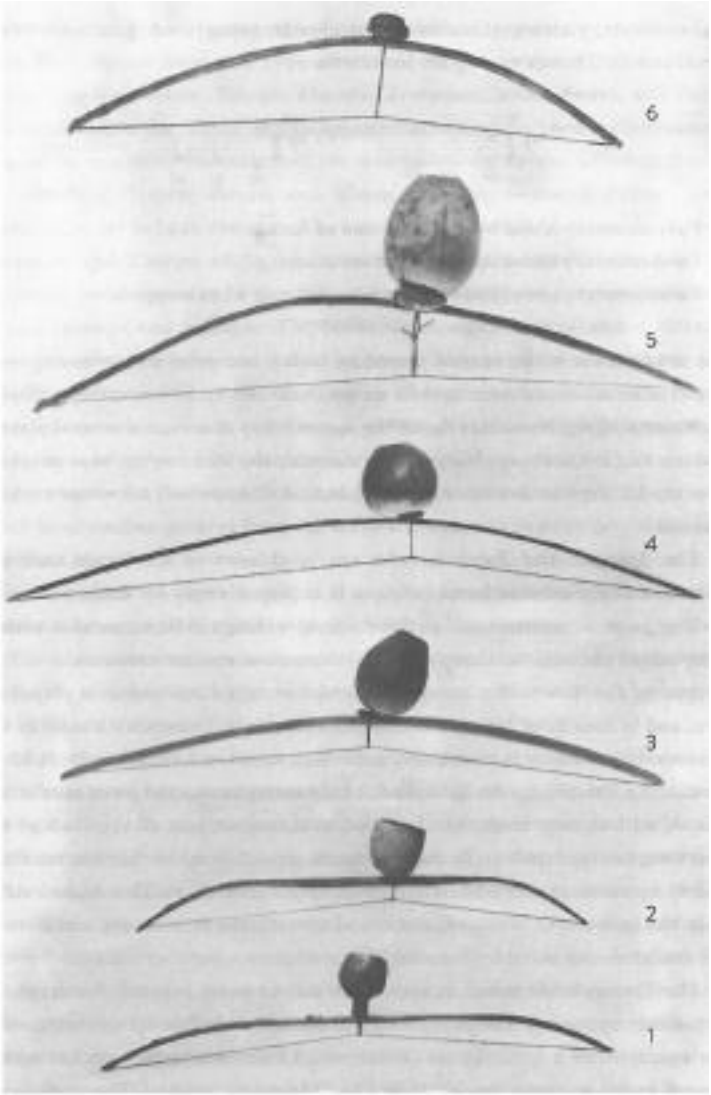


FIGURE 8. ETHNOGRAPHIC BRACED MUSICAL BOWS: 1- TSONGA (NHOKA); 2-VENDA (DENDE); 3- SWAZI (MAKWEYANA); 4- ZULU (UMAKHWEYANA); 5 & 6- PEDI (SEKGAPA). NOTE THAT ALL BOWS ARE BRACED (PICTURE ADAPTED FROM KIRBY 2013: 276).

The musical bow is still used today but, in most cases, wire is used instead of the sinew that was commonly used as documented in the ethnographic record. But some are afraid that the musical bow might disappear soon (Stacey 2016). In a bid to preserve the musical bow as a musical instrument there are various stakeholders working together in promoting the use of musical bow as an instrument that should be intergrated in the modern musical circles (Stacey

2016). For example, the University of KwaZulu Natal held an inaugural International Bow Music Conference early 2016 which brought together various scholars and artists from different parts of the world to present papers as well as engaging in live perfomances using the musical bow (Stacey 2016). In South Africa there are some individuals who play the musical bow with disticntion for example Madosini and Dizu Plaatjies (Stacey 2016).

6.3. MUSICAL BOW DEPICTIONS FROM SOUTH AFRICA

In the following section bows depicted from two regions in South Africa, the Maloti Drakensberg and the Eastern Cape are discussed. Apart from a general description the type of bow and playing mode are commented on. Table 1 has all the published musical bows from the southern African region but only depictions from South Africa will be discussed.

TABLE 1. PUBLISHED DEPICTIONS OF MUSICAL BOWS IN SOUTHERN AFRICA. UPDATED TABLE FROM VOGELS & LENSSEN-ERZ (2017: 10).

Site, area	Country	Citation
Maack Shelter, Daureb	Namibia	Breuil 1955: 11
Numas 62, Daureb	Namibia	Rudner & Rudner 1970: Fig. 69b
Sesaub B Daureb	Namibia	Rudner & Rudner 1970: Fig. 69a; Scherz 1986: Fig. 82
Hungorob 114, Daureb	Namibia	Pager 1989: 433; Lenssen-Erz 2001: Fig. 62
Soutrivier, Kaokofeld	Namibia	Rudner & Rudner 1970: Fig. 75a
Omaruru district, Erongo	Namibia	Scherz 1986: Fig. 221
Natal, Drakensberg-Mountains	Republic of South Africa	Lewis-Williams 1990: 30, 1981: 1
Natal Drakensburg Mountains	Republic of South Africa	Lewis-Williams & Challis 2010; 2011
Natal, Drakensberg-Mountains	Republic of South Africa	Lewis-Williams 1981:8
Wide Valley, Maclear	Republic of South Africa	Lee & Woodhouse 1970: Fig. 170; Ego 2015: Fig. 24–25
North-eastern Cape	Republic of South Africa	Dowson 1998: Fig. 5.7b; Lewis-Williams & Dowson 1989, Ego 2015: Fig. 23
North-eastern Cape.	Republic of South Africa	Lee 1987: Fig. 1

6.3.1. Maloti Drakensberg musical bows

A summary of the musical bow players depicted in the Maloti Drakensberg massif is provided by Lewis-Williams (1981: 8-9). Here three sites with musical bow players' depictions are discussed.

a) Rock painting from Injasuti in the Estcourt District (Figure 9)

There is a tracing of this whole panel available on the SARADA website (http://www.sarada.co.za/#/library/music/images/RARI-RSA-FER1-1R.).

The painting (Figure 9) contains four bow players. Three of them are playing bows with resonators whereas one of them is playing a bow without a resonator. The bows are resting on the shoulders of the players and they are using a stick to tap the string. This playing technique resembles the one shown in Figure 1. Lewis-Williams (1981: 8) comments that all the musical bow players are in a sitting position. It is evident, more specifically, that the figures are in a kneeling position.

On the panel there are some individuals holding sticks, and these are probably dancing sticks used in a trance dance. Lewis-Williams (1981; 1990) argue that musical bow players are associated with shamanism. He further considers that the musical bow is an instrument that is meant for solo performance (Lewis-Williams 1981: 8). However, the presence of resonators on the musical bows must be taken into consideration since their purpose is to amplify the sound.



FIGURE 9. FOUR MUSICAL BOW PLAYERS FROM THE INJASUTI REGION. PICTURE ADAPTED FROM LEWIS-WILLIAMS (1981: 8).

b) Six bow players from the Maloti Drakensberg (Figure 10)

Figure 10 shows further musical bow players from the Maloti Drakensberg. This painting has six musical bow players (Lewis-Williams & Challis 2010) but only 5 musical bows players are shown in Figure 10. The musical bow players are in a sitting position and they are playing resonated bows like Figure 9 above. Their instruments are resting on their shoulders and they are playing the bows using sticks. Previously, this painting was copied by George Stow in the 1870s (Lewis-Williams & Challis 2010, 2011). However, Stow did not manage to copy the panel as it is and his interpretation of a lion hunt by a group of people with shields was amiss since they are non-existent on this painting (Lewis-Williams & Challis 2010, 2011). The site was later traced (Figure 10) and reinterpreted. What was earlier referred to as shields have been interpreted as honeycombs and the bees and honey are understood to carry potency. On the top middle section there is a tusked serpent (encircled in red, Figure 10) emerging from the rock crack which perhaps was summoned by sound of the musical bows who were also relying on the potency of honey (Lewis-Williams & Challis 2010: 10).

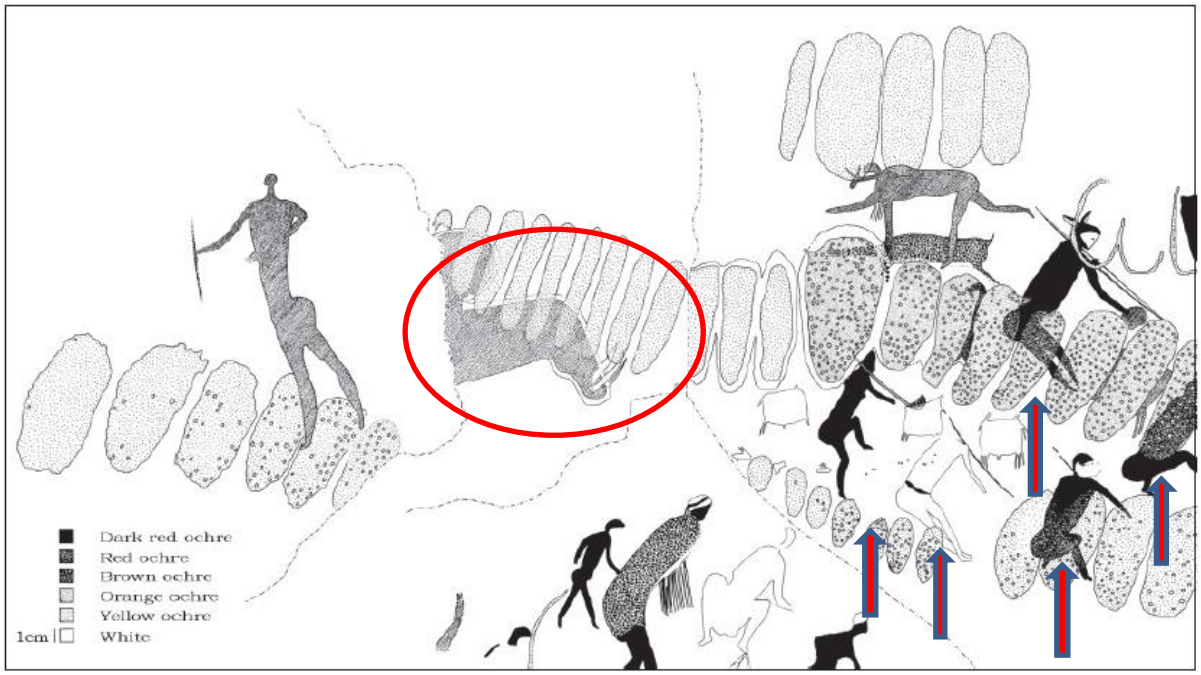


FIGURE 10. MUSICAL BOW PLAYERS ASSOCIATED WITH HONEYCOMBS AND A RAIN SERPENT (ENCIRCLED IN RED) FROM THE MALOTI DRAKENSBERG (PICTURE ADAPTED FROM LEWIS-WILLIAMS & CHALLIS 2010: 3). ONLY FIVE BOW PLAYERS ARE APPEARING ON THIS PICTURE AND ARE SHOWN BY THE RED ARROWS

c) The single bow player from the Injasuti region (Figure 11)

In Figure 11 one musical bow player playing a resonated bow is depicted in the Injasuti region in the Drakensberg Mountains (Lewis-Williams 1990: 30). The bow is resting on his shoulder and perhaps the individual was using the chin to control the string in order to produce various tones. The same technique has been noted from a /Xam Bushman who was using his chin to control the string (Figure 1). The player is holding a stick indicating that he was using the tapping method. This is a therianthropic figure with an antelope head



FIGURE 11. A NATAL DRAKENSBERG MUSICAL BOW PLAYER. PICTURE ADAPTED FROM LEWIS WILLIAMS (1990: 30).

6.3.2. Musical bow depictions in the Eastern Cape Region

Here three sites with musical bow players' depictions from the Eastern Cape Province are discussed.

a) Maclear RSA WID2 (SARADA), Figures 12 & 13

This painting occurs in the Wide Valley in Maclear. This painting was recorded some decades ago by Lee & Woodhouse (1970). This musical bow player is in a sitting position and is tapping the string of a resonated musical bow (Figures 12 & 13). The bow is resting on the shoulder of the player and unlike the suspended bows from the Maloti Drakensberg, this bow is resting on the ground. There is also a human figure seated next to the musical bow player who is clapping hands. On the same panel there are dancing figures, and some have dancing sticks. This same panel was described as a great dance (Blundell 2004: 138). There is also a rain animal with some dots (encircled in red, Figure 13) on the extreme top left and it could have been summoned by the sound of the musical bow (Lewis-Williams & Pearce 2004) The depiction has been interpreted as showing rain shamans performing a rain ritual. Some of the figures have antelope heads which represent rain shamans performing a rain ritual (Sam Challis personal communication October 2019).



FIGURE 12. MUSICAL BOW PLAYER AT WIDE VALLEY, MACLEAR IN THE EASTERN CAPE (PICTURE ADAPTED FROM HTTP://WWW.SARADA.CO.ZA/#/LIBRARY/MUSIC/IMAGES/RARI-LEE-RSA-WID2-10).



FIGURE 13. FULL PANEL OF THE MACLEAR MUSICAL BOW PLAYER. TAKE NOTE OF THE RAIN ANIMAL ENCIRCLED IN RED (PICTURE COURTESY OF SAM CHALLIS).

b) Maclear RARI-RSA-WID1-56 (Figure 14)

Figure 14 shows another bow player in a sitting position from site RSA WID1, in Maclear, Eastern Cape region. The bow has a resonator and is resting on the shoulder of the player. A stick is used for tapping the string. The end of the bow that is facing upwards has a small faint cross (encircled in red, Figure 14) which perhaps could be a tuning peg which can be used to adjust the string for different tone output when playing the instrument. Such technique has been noted on some ethnographic musical bows by (Kirby [1934 2013; Dargie 2001). The bow player is accompanied by two clapping individuals. In this case however, the people have antelope heads which directly indicates a ritual activity associated with the rain shamans (Lewis-Williams 1981; Lewis-Williams & Challis 2011).



FIGURE 14. A PAINTING FROM WIDE VALLEY FROM MACLEAR REGION OF THE EASTERN CAPE. NOTE THE SMALL CROSS ENCIRCLED IN RED WHICH PERHAPS IS A TUNING PEG ON THE BOW. (PICTURE ADAPTED FROM HTTP://WWW.SARADA.CO.ZA/#/LIBRARY/MUSIC/IMAGES/RARI-RSA-WID1-56).

c) North Eastern Cape (Figure 15)

As earlier mentioned, not all musical bows in the rock art of South Africa have resonators. There is another such example from the North Eastern Cape (Lee 1987). The musical bow is also resting on the shoulder of the player and a tapping stick is used to play the bow. The human figures also have antelope heads, and this signifies another depiction of the rain shamans (Lewis-Williams 1981). The web like structure or net (Figure 15) has been described as energy lines linked with shamanism (Lewis-Williams & Dowson 1989: 74 – 75). Lee (1987)

concurs with Lewis-Williams (1981) that the musical bows are associated with shamanism but further suggests that perhaps the musicians are also shamans.

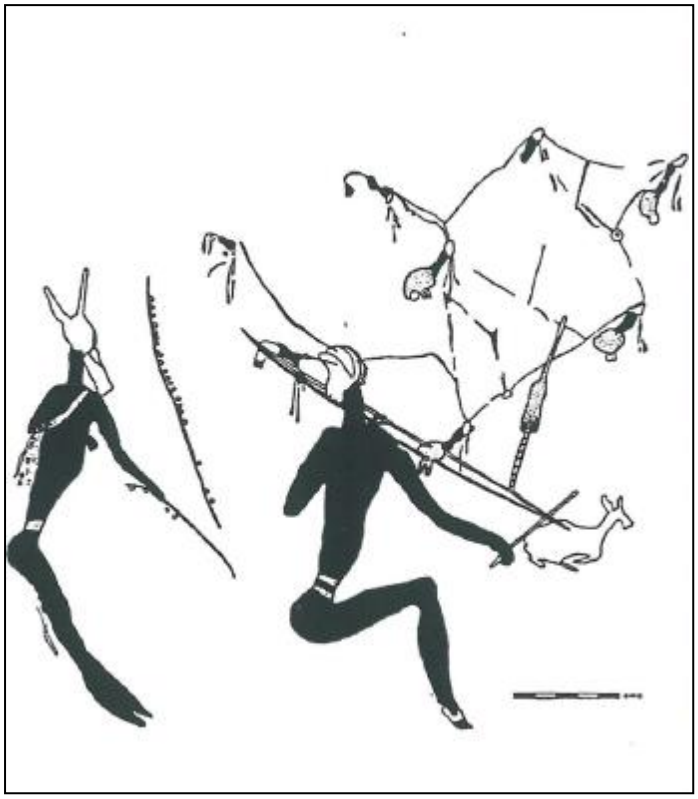


FIGURE 15. THE MUSICAL BOW PLAYER FROM THE NORTH EAST OF THE EASTERN CAPE PROVINCE (PICTURE ADAPTED FROM LEE 1987)

6.4. CONCLUSION

Two regions in South Africa the Maloti Drakensberg and the Eastern Cape Province have musical bow depictions. The depictions discussed above have some aspects in common – all of them are played by a stick. Most of the bows are resting on the shoulders of the player. The other recurring feature is that the musical bow players are therianthropic figures with antelope heads. This is interpreted as signifying shamans. It has been postulated that the musical bow players from Drakensberg massif represents rain shamans who used the musical bow to ask for rain like how the /Xam and Han≠kasso had a rain maker who would ask for rain by playing the musical bow (Lewis-Williams & Challis 2011: 151). In some cases, (Figures 10 & 13) rain animals are also depicted (Sam Challis personal communication October 2019). These paintings have been associated with rain shamans and the importance of sound production or musical sound in rituals can be fully realised in this regard by the presence of resonated musical bows. What might be learnt from the musical bow depictions from South Africa is that there could have been a close relationship between the shamans' rain making ritual and the

musical sound produced by musical bows. Although Lewis-Williams (1990: 30) put forward that musical bows were played by shamans, it is not inconceivable that these instruments could also have played an entertainment role (Kumbani 2020).

Even though no musical bows have been recovered from any archaeological excavation, their presence in the rock art can be used to infer their existence as musical instruments in the past. Ethnography also provides a rich history of the use of the musical bow. The important aspect is that the musical bow culture is still practiced despite some holding the view that the instrument is threatened with extinction. This discussion confirms that rock art can be used as a source of music archaeology (c.f. Vogels & Lenssen-Erz 2017).

CHAPTER 7: DISCUSSION AND CONCLUSION

7.1. INTRODUCTION

This Chapter discusses the wider context of this research in relation to the aims. The research findings on the evidence of sound producing and music-related artefacts are also summarised, and the methods that were employed and future avenues of research are further commented on.

7.2. ARCHAEOLOGICAL MUSICAL INSTRUMENTS AND SOUND PRODUCTION IN SOUTHERN AFRICA

The first aim of this thesis was to catalogue southern African archaeological musical instruments and sound producing implements. Identifying musical instruments from the archaeological record is a complicated task (e.g. Hickmann 2002; d'Errico & Lawson 2006; Scarre & Lawson 2006). As a result, there are some archaeological implements that might have been used for sound production and as musical instruments which could have been misinterpreted or overlooked. The other challenge is the poor preservation of music related materials which easily decompose in the archaeological record. As part of the research undertaken for this thesis, sound producing or music-related musical instruments from southern Africa have been catalogued from the LSA, Historical period, Early Iron Age (EIA)/Early Farming Communities and the Later Iron Age (LIA)/Later Farming Communities (Kumbani 2020). The artefacts were sourced through actualistic research, social media (Facebook), literature review and consultation of some of databases like the Kirby musical instruments online database (http://www.sacm.uct.ac.za/sacm/kirbycollection). The sound producing implements include spinning disks, a bullroarer, thumb piano or lamellophone keys, whistles, a trumpet, musical gongs/iron gongs/bells, bone tubes that could have been used as flutes as well as rock gongs. Selected musical depictions in South African rock art have also been investigated as sources of music archaeology. The SARADA website and "The African Rock Art Digital Archive" (http://www.sarada.co.za/#/library//images/) were consulted in this regard. This broad approach resulted in an extended list, but this information is not exhaustive of all music-related artefacts or sound producing implements from the region.

Music archaeology is still in its infancy in Africa (Blench 2013, 2014; Emerit 2013). In other areas such as Egypt research on past musical behaviours of the Egyptian civilisationhas been fairly well covered using a multidisciplinary approach (Emerit 2013). Various sources that encompass iconography, textual material, and archaeological evidence have been useful in this

regard. This evidence spans from the Predynastic period (3100 BCE) to the time of the Roman Empire domination (Fourth century CE) (Emerit 2013: 1). Iconographic evidence of musical depictions has been recovered from private tombs and temples and textual sources include hieroglyphs hieratic, Demotic as well as Greek inscriptions (Emerit 2013). These textual sources are rich, and they provide the names of musical instruments as well as explaining the playing techniques (Emerit 2013). On the flip side of the coin, many musical instruments from the Egyptian archaeological record lack provenance and were bought from the art markets under unclear circumstances and now they are exhibited in museums (Anderson 1976). In southern Africa there are fewer sources of music archaeology. There are no textual sources left by the people of the past except for musical depictions in the rock art and the music-related or sound producing artefacts, some of which have been discussed in this thesis, are scarce.

Another attempt at reconstructing music of the African past through archaeological means includes that of Blench (2013, 2014) who inventorises music related artefacts from north Africa and west Africa. Of the most interesting archaeological evidence of music related artefacts discussed by Blench are, for example, a very old possible bone flute from Haua Fteah in Libya. This implement was recovered from a context dated between 65,000-73,000 BP (Douka *et al.* 2013). He also discusses a surface find of an ocarina from a Chalcolithic site in Mauritania dated to around 2500 BP (Blench 2013: 36) and mentions musical instruments like drums and hand rattles that are on the Nok terracotta plaques from central Nigeria and he discusses musical instrument depictions in north African rock art. Blench (2014) further discusses the cultural exchange of music practices and musical instruments via the Indian Ocean through trade and slavery.

The inventory compiled by Blench (2013) has relatively few examples of music-related artefacts which include three aerophones namely two flutes and an ocarina. This shows how rare music-related artefacts from the archaeological record are. The two Iron Age Nok terracotta plaques from Nigeria also documented by Blench provide evidence for membranophones in form of drums and one plaque with idiophones in the form of paired gourd rattles. Rattles hardly preserve in the archaeological record but in this case, they are represented indirectly on the terracotta plaques. Blench (2013) also mentions evidence of musical bells found on the Benin bronze plaques from Nigeria and a Sao bronze figurine from Chad showing a transverse horn player. In southern Africa there is no evidence of any plaques that have evidence of music performance or musical instruments and no ocarinas have been

found yet. However, there are some similarities with the Blench's inventory. Rattles are reported from rock art at the Attakwas Kloof site in the Klein Karoo (Rust *et al*. submitted) and possible flutes from sites in the southern Cape (Kumbani 2020). The possible flute from Haua Fteah in Libya however has a finger hole whereas the bone pipes from southern Africa which could have been used as flutes, lack finger holes. No archaeological evidence of spinning disks and bullroarers has been reported from north and West Africa. This short discussion shows that the list of sound producing implements from the archaeological past in Africa needs to be expanded.

Not all the artefacts described in current inventories were necessarily used in 'musical' activities. Music is organised sound that is usually accompanied by intentional body movement or dance (Cross & Morley 2010). After listening to the sounds of the bullroarer (MR 40) replica (https://cdn.theconversation.com/audio/1700/mp3-mr40-bull-roarer.mp3) and the KRM spinning disk replica (https://cdn.theconversation.com/audio/1701/mp3-krm-woerwoer.mp3) the most probable conclusion will be that the sound does not encompass 'music' in comparison to various music genres people listen to nowadays. However, it should be considered that people perceive music differently and hence Atema (2014: 26) has suggested that, "Music is in the ear of the beholder". Perhaps in the past this whirring sound made a difference during a musical procession. The thumb piano keys from the LIA contexts from Zimbabwe and Zambia resemble the thumb piano keys of modern instruments. They are flattened on one end to allow the musician's fingers to play the keys (Kubik & Cooke 2001). *Mbira*, a type of lamellaphone, has a long history and it is suggested that an earlier version was made of a raffia palm in Gabon and in southern Cameroon before the advent of the metal keys (Kubik & Cooke 2001). The instrument is still commonly used in southern Africa and it is present in other regions around the world. The *mbira* or lamellophone is a musical instrument or not and hence the thumb piano keys hint that they were the musical instruments that were used by the LIA or Later Farming Communities in southern Africa.

Another archaeological instrument with a more certain musical connotation is the trumpet from Sofala (Kumbani 2020). Like other trumpets it has an opening for blowing air into the instrument, a common feature on most known trumpets from Africa (see von Hornbostel & Sachs 1961: 28). Most trumpets in Africa are side blown and have a mouthpiece just like the Sofala trumpet. Ethnographically, some ivory trumpets are known from other regions. In

Ghana it occurs among the Asante people (Kaminski 2007) and it is also known from the east African coast (Fagan & Kirkman 1967) though none is known in southern Africa. The Sofala ivory trumpet could have been used as musical instrument or a signaling instrument.

Other implements that are ethnographically and archaeologically similar are music gongs or iron gongs/ bells (see Vansina 1968). The gongs are conish like in shape and are made of metal and a metal beater was used to strike the gong to produce sound. These idiophones were interpreted as having been associated with royal people and kings. It seems that they could have been used as signaling instruments and could have been used even in musical processions. Their occurrence in southern Africa could have been through trade because they are originally known to be from West Africa and Central Africa**.**

Music archaeological research in Africa is still patchy whereas in other parts of the world for example Eurasia it is more developed. Much music archaeological work has focused on the European Upper Palaeolithic that has yielded a wealth of music-related artefacts such as bullroarers, flutes with and without finger holes and notched bones that could have been used as rasps (e.g. Morley 2003, 2013; Conard *et al*. 2009). In Scandinavia bullroarers and flutes have also been recovered (e.g. Lund 1981, 1985).

7.3. MUSIC, SOUND AND THE SOUTHERN CAPE HOLOCENE ARCHAEOLOGICAL RECORD

The Holocene sound producing implements were identified from the southern Cape archaeological record are aerophones, including double perforated spinning disks and a bullroarer. The double perforated bone implements from KRM and MR were previously interpreted as a "*wirra wirra*" and a "(*woer-woer)*/ bullroarer" respectively and the four single perforated implements from MR were interpreted as "pendants". The pendants' function was inferred from its form, but this can be sometimes misleading (Bradfield 2016). To test the hypothesis that these artefacts may have been sound producing implements they were replicated and were spun as aerophones.

The KRM "*wirra wirra*" replicas and the MR "pendant" replicas produced a whirring sound. The KRM double perforated implement was broken during excavation but it was later glued together (Singer & Wymer 1982). Unfortunately, the piece could not be located at Iziko Museums and hence no use-wear analysis was conducted on the archaeological piece. The MR double perforated implement was described by Louw (1960: 109) as the "most perfect bone

tool". However, the MR replica could not spin, and it was realised that it was asymmetrical. Two possible explanations are that perhaps it was still work in progress or the holes were wrongly placed, and it was discarded. Spinning disks are thought to have been used as toys but it is possible that the powerful whirring sound was used during rituals in the past and it could also have been used for musical purposes (see for example van Beek 1989). No other similar instruments have been reported from the archaeological record in southern Africa and Africa as a whole.

Microscopic use-wear analysis of the MR "pendant" replicas indicated that the use-wear was concentrated on the lateral sides of the perforations after spinning. Only one of the 'pendants' from Matjes River, MR 40 had use-wear that was concentrated on the lateral sides, matching the results observed on the replicas. It was thus inferred that MR 40 could have been a bullroarer. Morphologically, the MR 40 bullroarer is pear-shaped, and it resembles known bullroarers from other parts of the world. These include examples from the European Upper Palaeolithic (cf. Morley 2003: 36). Examples of similar shaped bullroarers include the Magdalenian bullroarer with red ochre and with some incisions from La Roche, Lalinde, Dordogne, one from Upper Solutrean levels at Lespugue, Haute-Garonne, another one from Laugerie Basse, Les-Eyzies-De-Tayac, Dordogne and another from Badegoule, Bersac, Dordogne in France (Morley 2003). The MR 40 bullroarer sound frequency varies from 250 to 55.55 Hz and this is within the same range as other known bullroarers (e.g. Fletcher *et al*. 2002; Rusch 2017). Ethnographically, bullroarers are known to have been used for various purposes which include scaring away bees from their hives so that people could gather honey (Bleek & Lloyd 1911; 2001), musical purposes (Nurse 1972) and as toys (Kirby [1934] 2013). It is reasonable to hypothesise that the MR 40 bullroarer was used as a sound-producing implement. It could have featured in any number of contexts, including musical processions or ritual activities. It might also have been used as a toy, but this is most unlikely when considering that MR 40 was associated with human burials. There is thus a possibility that MR 40 played a role in funerary practice of the people in the past.

The three other pendants investigated from Matjes River are from a similar context as the bullroarer. The placement of their use-wear was at the top of the perforations, like use-wear associated with pendants. Use-wear concentrated at the top of the perforation has also been noted on ethnographic pendants made of peccary canines on the Bará necklace from South America (Falci *et al*. 2018: 782).

The microscopic analysis also laid bare another aspect which could have been missed on two of the single perforated implements from MR site - they had ochre stains. The MR 40 bullroarer had ochre stains on the outer rim of the perforation, and it is most likely that the strings that were used on these implements were smeared with ochre though the reason for that cannot be clearly ascertained. Perhaps it was for aesthetic purposes, softening the string or the ochre could have served a symbolic purpose. There are also other single holed implements from MR site coming from Layer C and D that are thought to have been used as pendants or used in preparation of thongs (Louw 1960). These implements need to be investigated further for sound production in the past using similar approaches as this research.

The bone pipes described from MR may, as Louw and Kirby suggested, and discussed here, could have been flutes (see Table 2, Chapter 3). These bone pipes or tubes do not have finger holes and no actualistic studies have been carried out yet to test their sound producing qualities, but it is hypothesised that they were whistles or flutes. Six of the tubes (see Table 2, Chapter 3) from Matjes River including a phalange, have one opening on one side whereas the other side is naturally closed. This matches the description of whistles by Kirby (2013), and the clay whistles from K2 and Mapungubwe. Given the thin line between the flutes and the whistles, it may be considered that the bone tubes from MR consist of two types of aerophones namely flutes and whistles, but this proposition needs further probing through experimental work or comparative work with other known whistles. Some of the bone tubes or pipes from MR and NBC sites are neatly decorated with a chevron pattern as well as cross hatching. However, the purpose of these decorations is not clear and perhaps they were associated with symbolism.

There are other bone tubes from MR, not analysed in this research. Louw (1960) describes three bone tubes from Layer D. All in all, Louw (1960) recorded a total of forty-three bone tubes, four from Layer B, thirty-six from Layer C and three from Layer D. As mentioned above, Louw (1960) concurred with Kirby that the bone tubes from MR could have been used as flutes and considers that the Wilton people were responsible for the introduction of music and art. He further mentions that, "… it is suggested that the prehistoric man made instruments to produce musical sounds, and that the people responsible for the introduction of the Wilton culture into South Africa were also responsible for the introduction of the art of music" (Louw 1960: 109).

Both the sites of MR and NBC have yielded bone/ivory palettes (Ludwig 2005: 41). The bone palettes are flat and roundish to rectangular shape. Two examples from MR come from Layer C which yielded the artefacts analysed in this thesis, and the palette from NBC was recovered from Unit 104. The bone/ivory palettes from MR and NBC could have been used in sound production in the past as bone clappers. Bone clappers are flat bones that are held in both hands and instead of clapping directly using hands the bone clappers are used instead. Such evidence has been reported by Kirby (2013) who recorded the use of bone ribs as bone clappers that were used during musical performances by some cultural groups here in South Africa for example the Zulu, who call their bone clappers *marapo.*

It is interesting that some of the sound producing implements discussed in this thesis are associated with burials. The double holed artefact from KRM cave 1 is loosely associated with a human partial left mandible (SAM-AP6102, KRM 614) (Kumbani *et al*. 2019) and is dated to around 4800 BP (Singer & Wymer 1982; Nami *et al*. 2016). It is thus not clearly linked to a burial, but at the nearby Klasies River Mouth Cave 5 (KRM 5) a few broadly contemporaneous burials are found. About 6 burials were unearthed at KRM 5 and these are broadly dated to the LSA radiocarbon dated to around 4230 ± 60 (Hall & Binneman 1987). A burial of a young female estimated to have been between 16 and 18 years of age by the time of her death had a lining of plant material at the base of her burial hollow. The plant lining was then covered with red ochre whereas her skeleton was covered with a mixture of sand and red ochre. The skeleton was also adorned with ostrich eggshell beads that were stained with red ochre that were found around the neck, chest and pelvis (Hall & Binneman 1987: 142). The three infant burials were the most adorned with grave goods. For example, one of the infant burials at KRM 5 had a charcoal and ochre stained split cobble that was directly put on top of the skeleton. Ostrich eggshell beads were found around the left femur and the pelvis. On the neck of this infant were *Turbo sarmaticus* 'buttons' and two *Fissurella aperta* shells. The skeleton also had strings of *Bullia digitalis, Tricolia* spp. and *Nassarius kraussianus* beads and its skull was lightly stained with ochre. The other two infant burials at KRM 5 were also associated with burial goods that include beads and ochre (Hall & Binneman 1987). However, one of the burials at KRM 5 had no burial goods and this was a burial of a young man. It would be interesting to further study the perforated artefacts, for example the double holed *Turbo sarmaticus* 'buttons' for possible use wear associated with sound production.

The MR spinning disk template and MR 40 bullroarer at Matjes River come from Layer C, dating to ca. 9 – 5 ka (Protsch & Oberholzer 1975: 40) that has yielded burials. Grave goods from Layer C at MR include bone points, stone beads, bone and ivory palettes and a painted stone (Ludwig 2005: 39-42, 75). However, the way the material from MR site has originally been recorded has been criticised. The remains were mixed up after excavation and it is thus difficult to order the remains according to their layers and their contexts (L'abbe' *et al*. 2008). For example, out of the 172 boxes that mark all the remains, only 76 contain a single individual although it is estimated that about 40- 120 individuals were recovered from the site (Sealy 2006). Because of such poor documentation and recording it is thus difficult to tell which material was directly associated with these burials, but it is highly likely that some of the bone tubes, bullroarer and the spinning disk were associated with the human remains. The bone tubes described from NBC (Kumbani 2020) came from Unit 64, not associated with burials.

7.4. MUSICAL INSTRUMENT DEPICTIONS IN ROCK ART

The third and fourth research aims focused on documenting music and sound related rock art depictions of flute and musical bow playing. Evidence of flute playing in the rock art from the Klein Karoo and the Cederberg has been presented (Rust et al. submitted). Three of the depictions show players holding the flutes with both hands while in the Zimri painting a figure is holding a possible double flute with one hand. The four depictions have further been interpreted as flute players due to the similarity of the postures and the positioning of hands to flute playing. These depictions of possible flute players add new information to the music archaeological record of South Africa. Recently, bullroarer depictions have been reported from Doring River in the Cederberg, Western Cape of South Africa (Rusch & Wurz 2020).

In two of the cases the flute players are associated with other images portraying dancing figures. For example, the Attakwas painting in the Klein Karoo has five highly animated figures grouped together. One of the figures has his legs up in the air and some occur in a bending posture (Rust et al. submitted). One figure is holding a rattle and flute-like objects and lines occur that may be interpreted as signifying trance (Rust 2008). At the Ezeljagdspoort site the painting contains therianthropic figures thought to resemble mythical beings or "swift people"(Rudner & Rudner 1970, Lewis-Williams 1990; Lewis-Williams *et al*. 1993; Hollmann 2005a, 2005b; Lewis-Williams & Challis 2011) or, as recently suggested, figures with fish tails (Rust 2020). The Ezeljagdspoort site painting contains therianthropes associated with the flute player that are intertwined by a long-curved line suggesting ritual behaviour (Rust 2020).

A figure holding a possible double flute is depicted at Zimri shelter (Rust et al. submitted). Bundled open, end-blown flutes without finger holes are known from the ethnographic record for example among the Red-Dunes Bushman who made reed flutes that were bundled in sets of four or six tubes (Kirby 2013). This depiction complements the ethnographic information by showing that the bundled flutes may also have been used during the Holocene period. There is also a possibility that the bone tubes from the archaeological record described here could also have been bundled together as flutes.

At Procession shelter a figure in reclining position has a flute raised to his mouth. The painting is isolated, and it is on the outside wall of the rock shelter. The shelter derives its name from a procession of painted figures, mostly men, wearing a kaross suggested to be initiated men or hunters who have killed their first eland inside the shelter (Parkington 2013: 91-97). The association between the flute player and the procession may relate to ritual, but the contemporaneity of the images has not been determined. The reclining position of flute playing is rare and seems not to be known from the rock art or the ethnographic records. The flute depictions complement the ethnographic record on the use of the flutes and provide archaeological evidence of the use of flutes during the Holocene period. Flute playing may also have played an important role in rain making, given the documented reference to sound and rainmaking in the ethnographic record (Rusch 2016).

The case studies on the depictions of bow players in the Maloti Drakensberg massif, in KwaZulu-Natal and in the Maclear area in the Eastern Cape in South Africa are further examples of the richness of rock art as a source for music archaeology. Both regions show musical bows with resonators and those without resonators. Bow players from KwaZulu-Natal in the Maloti Drakensberg are kneeling whereas those from the Eastern Cape, Maclear are sitting down. Vogels & Lenssen-Erz (2017: 19) documented twelve depictions of bow players from the Daureb or Brandberg in Namibia. The images from the Daureb region have sitting and standing players and the bows have no resonators. Some depictions show braced bows, a phenomenon not yet recorded from South Africa. There is also a difference in the stance of the musical bow players. The musical bow players from South Africa rest their bows on their shoulders whereas those from Namibia hold it at shoulder level. Vogels & Lenssen-Erz (2017: 21) observed that communal playing of musical bows is depicted mostly in South Africa whereas in Namibia there is only one scene with bow playing in group context. Solo playing of the musical bow seems to only occur at the Maloti Drakensberg site.

Musical bow players have been associated with shamanism and rainmaking (e.g. Lewis-Williams 1981; Lee 1987; Lewis-Williams & Pearce 2004; Lewis-Williams & Challis 2010; 2011). Having musical instruments featuring in the rock art shows the importance of sound in group activities as well as the importance of dancing and clapping during possible rituals. Sound can be produced in various ways that may include singing, foot stamping, clapping, chanting and playing of musical instruments. Sound production could have been part and parcel of a ritual procession, but the possibility that musical performance was involved cannot be excluded.

Rock art provides a rich resource for music archaeology as a random selection of sites from over the world shows, for example from the Sahara (Blench 2013). Some of the instruments that feature in the Saharan rock art include lutes and trumpets, for instance, at the site of Tassili in Algeria (Viallet 1995 *cited in* Blench 2013). These lutes resemble the ethnographic lutes used in Niger. Other known musical depictions in the rock art occur in India and they show various scenes that include dancing, singing and playing musical instruments (Neumayer 1992-93). Some of these paintings appear on the Pachmarhi hills of central India and they have a variety of musical instruments some which look like flutes and type of a chordophone instrument with several strings and these paintings have been made available online on the Bradshaw Foundation website (https://www.bradshawfoundation.com/news/cave_art_paintings.php?id=Musical-depictions-in-Indian-rock-art) (Dubey-Pathak 2016).

In Europe musical instrument depictions in the rock art have been recorded in eastern Spain which is bordered by the Mediterranean coast of the Iberian Peninsula to the south (García Benito 2014; Díaz-Andreu & Mattioli 2019). A variety of instruments are depicted, and these include aerophones such as horns, ocarinas and bullroarers, idiophones and singing and dancing human figures (García Benito 2014). Muriecho L Shelter in Spain for example, has depictions of humans that seem to be singing and dancing and some flute like instruments are depicted as well (García Benito 2014). Bullroarers and buzz-bones have been recorded from sites such as La Vacada and Val del Charco del Agua Amarga in Spain (García Benito 2014: 330– 331). Bahn (2015) has revisited an earlier assertion that was made by Bégouën & Breuil (1958) who suggested that the engraving of an individual dressed like a bison at Les Trois Frères in Ariège, France show a musical bow player. However, Bahn (2015) disputes this assertion and he suggests that this interpretation was based on whim and he further argues that

this engraving is not even close to the other known musical bow player depictions that are found in South Africa and Namibia. The same engraving has also been interpreted by others as showing a nose flute (e.g. Rault 2000).

These musical depictions found in the rock art are an extremely useful source of music archaeology. It is interesting that no bullroarer depictions have yet been found from the southern African region. Furthermore, neither musical bow nor rattles have been recovered from the archaeological record of South Africa but their existence in the rock art is a clear testimony that such musical implements were used during the LSA.

7.5. CONCLUSION

The research question investigated here was whether there is any archaeological evidence for musical expression and sound production in southern Africa. This thesis discussed clear evidence for archaeological musical expression and sound production from this region during the last 10 000 years, contributing new information to a vastly understudied field in southern Africa. It has been demonstrated that a multidisciplinary approach has considerable potential to identify music-related and sound producing archaeological artefacts from the LSA, EIA, LIA as well as historical contexts. The music-related or sound producing artefacts that are discussed in this thesis fall into three broad categories namely aerophones, idiophones and chordophones. Actualistic research was invaluable to identify sound production in the past. Actualistic studies strengthened the hypothesis that the KRM and MR double perforated implements could have been spinning disks and the MR 40 ‘pendant’ a bullroarer, underscoring that this type of research is vital in music archaeological research. This work has also shown that hollow bone tubes or pipes that have been recovered from the LSA and from historic contexts, previously interpreted as beads or sucking tubes, may potentially be aerophones.

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