

archaeology of the senses, symbolic behaviour

**Key words:** Wonderwerk Cave, Earlier Stone Age, Later Stone Age, Fauresmith,

Wonderwerk Cave (Northern Cape Province, South Africa) is an example of a natural locality that, in the past as in the present, was imbued with meaning and symbolism. Today, local communities associate the cave with a snake spirit, while over the last 10,000 years, in the Later Stone Age, rock art adorning the cave walls, attests to its special status. In this article we present evidence showing that in the terminal Acheulean over 180,000 years ago (the Fauresmith), hominins introduced manports with special sensory properties into the back of the cave because of its special natural visual and acoustic qualities. The archaeological record of Wonderwerk Cave, then serves as a unique and extensive diachronic record of milestones in the development of symbolic behavior. It provides evidence that supports the argument that elements of symbolic behavior emerged long before the dispersal of modern humans out of Africa.

**Abstract**

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**CASE STUDY FROM WONDERWERK CAVE, SOUTH AFRICA**

**MILESTONES IN THE DEVELOPMENT OF SYMBOLIC BEHAVIOUR: A**

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Visits from tourists and school groups are a regular occurrence at the archaeological site of Wonderwerk Cave in the Northern Cape Province, South Africa. During a recent archaeological field season, a group from a nearby township that had come for a traditional barbecue (*braai*) visited the site and questioned the authors about our work. One person asked us why there was a sign outside saying that visits inside the cave were taken at the visitor's risk. We explained that the back of the cave was currently closed due to the danger of section collapse and that the sign was there for legal reasons. The group was not terribly convinced by our explanation and a man came forward and asked us whether there were snakes in the cave. We replied that we had seen bats and birds but no snakes. Given how intent he was on this issue, we asked him why he was so interested in snakes. He explained that a large snake lived inside this cave, as in other

## Introduction

**Julia Martin (2008: 177-178) "Wonderwerk"**

*"I've come to summon the spirits," he says again simply. "Its like a Bushman instrument, but I've added my own variation"... Sitting on the ground at the threshold of Wonderwerk Cave, this sound....*

*The fire is out. Yet here where people sit at the mouth of the cave, the repetition of this sound absorbs the rhythm of our hearts, fingers plucking the single string, one sound calling up the spirits, calling into the night."*

deep caves and water holes. One had to show the snake respect but, he assured us, it could not hurt *us* since we did not believe in it. Throughout the rest of the day, members of the group came with containers to collect drip water from the cave entrance to take home and explained to us that this water was imbued with the power of the great snake. The ethnographic-archaeological record of Southern Africa documents that Khoi-San communities associated water sources with the powerful spirit of a snake (Hoff 1997), beliefs that continue to be widespread among local communities throughout the country (Bernard 2003). Snakes occur in San cosmology as 'rain-animals' (Lewis-Williams and Pearce 2004)<sup>1</sup>.

The spirits in the opening quote and the great snake, both associated with Wonderwerk Cave, provide powerful examples of the way in which beliefs have shaped human perceptions and actions *vis a vis* a natural location. Research in landscape archaeology now recognizes that localities such as these were imbued with significance in the minds of past peoples and constituted "components of a mythological landscape" (Bradley 2000:13). Following this approach, attention is given to both the functional (calculated/rational) factors as well as sensory experiences (both physical and emotional) that motivated people to exploit these locations in the past (Sheets-Johnstone 1990, Kus 1992, Gosden 2001, Scarre 2006, ). As described by Tilley in his analysis of Neolithic and Bronze Age menhirs in Brittany "they did not signify or represent anything in conventional semiotic terms and so we cannot reduce their experience to the level of language. They took on their meanings in relation to the experiences and feelings of those people who lived with them in the landscape through particular modes of encounter

and engagement" (Tilley 2004:35). In an 'archaeology of the senses', caves have been singled out for their specific sensory properties which have shaped human actions affecting, for example, the choice of locations for parietal art or selection of a cave as a sacred site (Bruchez 2007, Clottes 2004, Halverson and Bahn 2003, 2004, Hayden 2003, Renzikoff 2006).

For archaeologists, identification of such culturally significant natural features is challenging and may rely upon one or several of the following: the presence of physical modifications, their association with iconographic, epigraphic or literary sources, the presence of depots of symbolic artifacts, or the use of raw material from a special natural locale in the creation of symbolic artifacts (Bradley 2000). To this we would add, localities that came to be imbued with meaning due to their special sensory characteristics. In all cases, there is a complex web of connections between the sensory experience of a place, the meaning of the place and the symbols that express and enhance both the sensory experience and meaning. The literature on the relationship between perception, meaning, and symbols is extensive and complex, but from structuralism to semiotics the symbol has played a paramount role in analytic frameworks (for critiques see Hodder 1986, Inghild 2000, Preucel 2006)

In this context, we track the changing perceptions, meaning and symbolism of Wonderwerk Cave. As described above, today it serves as a special locality with clear symbolic associations for local communities, while during the Later Stone Age, between 1,000-10,000 years ago, it served as a home base *cum* ritual site. In the terminal

Acheulean, over 187,000 years ago, we propose that the back of the cave served as a natural locality of significance for early hominins. At this time, Wonderwerk Cave appears to have been part of a world imbued with meaning but without formalized symbols. We suggest that sensitivity to the sensory properties of a landscape and to materials, formed an integral element in the emergence of symbolic behavior.

### **Wonderwerk Cave**

Wonderwerk Cave, in the arid Northern Cape Province of South Africa (22°50'45"S; 23°33'29"E), is among the most impressive prehistoric sites in Southern Africa (Malan and Wells 1943; Beaumont 1990, 2004; Beaumont and Vogel 2006; Chazan et al. 2008, in press) (Figure 1). For several reasons, Wonderwerk would have been a salient and attractive feature in the landscape for both Pleistocene and Holocene hominins. It is one of the few caves in the Kuruman Hills-Asbestos Mountains (Curnoe et al. 2006; Herries et al. 2007) and is located at a high point in the local topography. From the single entrance, 26m wide, there is an unimpeded view of the Ghaap Plateau below (Figure 1). Access to the cave is easy as it lies at the base of the hill. As illustrated in Figure 2, prominent physical features are the sheer scale of the cave (ca. 140m long, width ranging between 11-24m and roof height ranging from 3-5.5m), its flat but arched roof and elongated smooth, roughly perpendicular walls. The presence of three large stalagmites is also notable: a small stalagmite outside the present cave mouth, a >5m high stalagmite situated at the front of Excavation 1 ca. 13m from the cave entrance and a still buried stalagmite in a recess off Excavation 6 at the back of the cave (Beaumont and Vogel

2006, George Brook pers comm. 2008) (Figure 2). These, together with the microfossil and geomorphological records (Avery 1995; Butzer 1984a,b), attest to greater water activity in the Pleistocene, including heavier rainfall as well as a longer rainy season, but current water action in the cave is minimal (Beaumont and Vogel 2006). The proximity of the cave to two perennial water sources would have further enhanced its importance; a seep some 5km to the south of the cave (on the east flank of the Gakorosa Hill) while 15km south of the cave is Bushmans hole (Boesmansgat), a massive karstic sinkhole, that is the third deepest water-filled cave in the world; estimated water volume of 4.5 million cubic meters (Beaumont and Vogel 2006).

The pock-marked inner surface topography of Wonderwerk Cave comprises large slabs of roof spill and pits dug during the early 1940's from which organic-rich sediment was removed and erroneously sold as guano for fertilizer. Following the discovery of lithic artifacts and fossil bones by the 'guano diggers', archaeological investigations and excavations ensued (Malan and Cooke 1941; Malan and Wells 1943; Camp 1948; Butzer 1984a,b). The most extensive of these were undertaken by P.B. Beaumont (the McGregor Museum), from the 1970's through to late 1990's, who excavated seven areas inside the cave. The resulting sequence has yielded rich and varied lithic and organic remains from the Earlier Stone Age (ESA), Middle Stone Age (MSA) and Later Stone Age (LSA) (Thackeray et al. 1981; Thackeray 1984; Humphreys and Thackeray 1983; Beaumont 1982, 1990, 2004; Beaumont and Vogel 2006; Chazan et al. 2008, in press). The archaeological record indicates that the intensity and timing of occupation within the cave varied spatially. Moreover, as proposed here, different areas may have served

specific functions that relate to their particular sensory properties. The most striking

distinction is found between the front and back of the cave.

### The Front of the Cave

The presence of a large stalagmite outside the cave mouth suggests that the cave

overhang may have been located further forward<sup>11</sup>. The current entrance provides a

panoramic view of the surrounding area such that it is not surprising that the most intense  
ESA and LSA hominin occupation occurred in this part of the cave. Sound travels freely  
from outside the cave into this well lit space. These features, as well as the low and  
gently angled scree slope that connects the interior of the cave to the landscape outside,

recalls a rock shelter more than a deep cave environment. Malan and Wells (1943) noted  
that there is no real talus deposit since the LSA material found on the slope represents  
'spillage' material that originated inside the cave.

Excavation 1 is located ca. 14m from the present mouth of the cave (Figure 2). The

archaeological deposits here reach a depth of ca. 5m and have yielded cultural remains  
characteristic of the ESA and LSA. The latter occupation, ca. 2m deep (Layers 1 to 4d,  
and possibly also layer 5a-b), has been dated by radiocarbon to 1,210±50 - 10,000±70 BP  
(Beaumont and Vogel 2006). The intensity of this occupation and nature of the finds,

including some of the oldest dated African *art mobilier* (engraved dolomite and haematite  
slabs) dating to 10,200 BP, conforms to exploitation of the cave as a base camp

(Humphreys and Thackeray 1983; Thackeray et al. 1981; Thackeray 1984). In practical

terms, the cave entrance offered a vantage point for hunters, providing a panoramic view onto the Chhap plateau below, while the inner area offered a spacious, warm and dry habitation given that the cave temperature is constant (Beaumont and Vogel 2006).

It is likely that at least during a portion of the LSA, the site was imbued with ritual as well as aesthetic significance for indigenous hunter-gatherers or pastoralists (Ouzman 2001; Lewis-Williams 2002), as denoted by the polychrome rock paintings that cover the walls of the cave entrance. The images of animals and people as well as geometric forms are referential to experience of the ordinary world as well as to realms of the senses, imagination and beliefs (Ouzman 2001, Lewis-Williams 2002, Lewis-Williams and Pearce 2004). It is possible that the significance of this part of the cave with its rock art lies in ritual beliefs that continue today, associating water sources with the powerful spirit of a snake or rainfall (Hoff 1997; Bernard 2003, Lewis-Williams and Pearce 2004).

Perhaps the large stalagmite that dominates this part of the cave, dated by U-series to the last 35,000 years (George Brook pers comm. 2008) such that it may have been active during at least part of the LSA occupation, was associated with this belief. Given that the rock art is restricted to an area of up to 40m from the cave entrance and does not occur beyond this area, this offers a significant insight into the manner in which the LSA peoples viewed and related to the cave as a rock shelter rather than as a deep cave context. A further issue is that the quantity of natural light diminishes as one penetrates deeper into the cave, documented by the excavators Malan and Wells (1943: 259) who noted that at 75m from the entrance they worked in total darkness. The presence of LSA rock paintings in Wonderwerk further accentuates the special status of this site, since



engravings (petroglyphs) are the prevalent rock art form in the interior of South Africa (Thackeray et al. 1981; Morris 2002). It is likely that the rock paintings were produced during more than one period of the LSA as both naturalistic representations of animals and geometric finger painted figures are included (Parkington, Morris, and Rusch 2008). This demonstrates that even in the LSA the cave was a focus of extensive, long term ritual attention.

Below the LSA are some 3 meters of ESA deposits containing Acheulean artifacts dominated by handaxes (Layers 6-11) that is constrained by OSL and paleomagnetic ages between 0.78-1.96 Ma (Chazan et al. 2008; Chazan et al. in press). The basal deposit, Layer 12, yielded a small lithic assemblage characterized by small flakes and cores but without bifaces. It may represent an Oldowan industry as suggested by the combined magnetostigraphy and cosmogenic isotope burial date obtained for this layer of ca. 2 Ma (Chazan et al. 2008). Thus, the initial occupation of this area in Wonderwerk Cave may represent the oldest evidence of intentional hominid cave use worldwide, since other southern African caves of similar antiquity are thought to represent infills (Kuman and Clark 2000).

What is striking about the Acheulean deposits in Excavation 1 is the low density of artifacts. There are no clearly defined floors and artifact density ranges from one to three artifacts per square meter over a depth of 20-30cm. This represents a different form of cave exploitation to the modalities commonly found in Middle Stone Age (MSA) and LSA cave sites in South Africa such as Klasies River, Blombos, Sibudu, Rose Cottage,

Excavation 6 at the back of the cave, located ca. 140m within the hillsides, contrasts markedly with the entrance (Figure 2). It is the quietest area of the cave being sheltered from outside sound, which is muffled or extinguished by the time it reaches the back. No echo is produced here, but sound resonates. Most notably, this is a zone of darkness that is poorly illuminated by daylight that is reflected inwards from the entrance reaching to the back cave wall. As noted before, if the entrance overhang projected further forward, this would have further reduced the light penetrating to the back. The view towards the cave entrance is limited to a small circle of light which creates a silhouette of the entrance and stalagmite. Although at the back of the cave the roof is high and the cave still wide, the general ambience in this zone is one of stillness, darkness and enclosure.

Against the back wall of the cave, in Excavation 6, Beaumont undertook a stepped excavation covering ca. 25 m<sup>2</sup>. The uppermost deposits comprise a relatively rich lithic

### *The Back of the Cave*

Die Kelders, Nelson Bay, Elands Bay to name but a few (Mitchell 2002; Deacon and Deacon 1999). Such low intensity exploitation of a cave, perhaps corresponds to the 'background noise' that a number of researchers have predicted was scattered across the Acheulean landscape (Panger et al. 2002: 242-243) suggesting that at this time, the front part of the cave was perceived as an extension or continuum of the landscape outside. This is corroborated by the absence of coeval early Acheulean deposits deeper inside the cave.

and faunal assemblage that Beaumont alternatively attributed to the terminal Acheulean, Fauresmith industry (Beaumont 1990) and more recently to the MSA (Beaumont and Vogel 2006). Preliminary analysis by one of us (MC) indicates that the assemblage is more consistent with the Fauresmith due to the co-occurrence of blades, prepared core flakes, and bifaces (Figure 3), an association that fits within the definition of this industry (Mitchell 2002: 62). There are some distinctive pieces in this assemblage, such as a large unifacially flaked blade (Figure 4:d), that do not have clear parallels in other Fauresmith assemblages while, the bifaces are of variable size and do not strictly conform to the small size expected under the strict definition of the Fauresmith. The archaeological deposit in Excavation 6 includes faunal and lithic remains in densities that are higher than those found in other periods and locations within the cave with the exception of the LSA in the front of the cave.

Interestingly, the Excavation 6 lithic assemblage does not include complete knapping sequences and it is likely that the flaked tools and bifaces were produced elsewhere and introduced here. The diversity of the lithic industry raises questions about site function suggesting that a range of activities took place. The nature of the association between lithics and fauna remains to be determined given that the taphonomic analysis of the fauna (by LKH) provides evidence for extensive carnivore, porcupine and raptor activity. In Excavation 6, there is no evidence for underlying earlier ESA deposits. The top height of the Fauresmith deposits relative to the cave roof, indicates that if present, the MSA or LSA deposits would not have been substantial. A single U/Th date on a fragment of

stalagmite recovered from the Fauresmith deposits in Excavation 6, gave a minimum age of  $187,000 \pm 8$  kyr (Beaumont and Vogel 2006), while three paleomagnetic samples from the different layers in Excavation 6, have yielded normal signals underlain by a reverse, the latter associated with a sterile layer (Hagai Ron unpublished data). This places the age range for hominin occupation at the back of the cave as between 0.187 to 0.780 kyr the latter being the top of the Matuyama Reverse Chron (Baksi and Hoffman 2000). Given the limited light penetrating to the back of the cave, an issue that is still being addressed in our research is the use of pyrotechnology. One potential hearth has been identified in the profile of Excavation 6, but heavily burnt lithics have as yet not been identified in this assemblage.

Although the evidence for early hominin activity at the back of Wonderwerk Cave is unequivocal, the question still remains as to whether it is related to a now-buried entrance in this part of the cave. Malan and Wells (1943: 258) categorically stated that the cave "comes to a dead end and no openings other than the front entrance were found". However, there is a small recess in the cave wall leading off from Excavation 6 (Figure 2), that is presently filled with sterile sediment such that the full extent of its size and depth is unknown, that may have opened out onto the surface of the hill in which the cave sits (Figure 3a). In order to examine this question, we intercalated a 3-D model of the cave generated from a geomatic survey of the cave with a standard topographic survey of the hillside (Ruther et al. in press). Figure 3b situates the cave within a topographic map of the hill. The contour for the elevation of the roof of the cave is indicated as a bold line. This contour line runs roughly perpendicular to the cave mouth and thus there is no

point at which the back of the cave is closer than 140 meters from the surface of the hill. Figure 5b shows a cut away view situating the cave within the hill. This figure clearly shows the depth of the back of the cave within the hill. There is virtually no soil accumulation on the slopes of the hill and in most places the ironstone and dolomite bedrock is exposed. Thus, there is no possibility of a massive overburden Pleistocene sediments that has led to a reconfiguration of the hillside. The results as shown in Figure 3, demonstrate that the back of Wonderwerk Cave is deeply buried in the hillside so that it is unlikely that the side recess provided access to the exterior. This establishes the occupation of Excavation 6 as an intentional exploitation by hominins of this deep cave context.

There is a large stalagmite, at present almost completely buried in sediments, inside the recess at the back of the cave. Although this stalagmite has still to be dated, the paleomagnetic ages for the sterile sediment filling the recess demonstrate that a large portion of the recess pre-dates the hominin occupation in Excavation 6 (Hagai Ron, unpublished data). Thus, both the stalagmite and recess would have been accessible for hominins only via a low crawl space (Figure 2). If the stalagmite was still forming during the time of occupation, the steady drip of water may have produced a notable aural effect in this side chamber that would have added to the overall sensory experience of this extraordinary environment. It is unlikely that there were perennial water pools at the back of the cave when Excavation 6 was occupied, making it improbable that the use of this zone was motivated by the presence of a water source. What then spurred terminal Acheulean hominins to penetrate ca. 100m into the dark cave interior? One possible

explanation is that due to the distance from the cave entrance, this location offered refuge and protection. People could hide here in the dark becoming, both literally and metaphorically, invisible. Practically, this would make it easier to ambush intruders unused to the dark. Yet for those inside, this context provided no view of those outside the cave or of the surrounding landscape, while once in back of the cave they would have been trapped without a means of escape. These factors make a functional interpretation of Excavation 6, as representing a straight-forward subsistence related occupation, extremely unlikely.

Instead, we propose that the special sensory characteristics at the back of the cave were the decisive features determining hominin use of this zone. Corroboration for this hypothesis is found in the material record. In his publications on Excavation 6, Beaumont mentions the presence of several intriguing and non-utilitarian manurports. These comprise introduced quartz crystals, small chalcedony pebbles and incised slabs of banded ironstone (Beaumont and Vogel 2006: 222). In processing collections we have to date, identified over twenty quartz crystals from Excavation 6. The crystals range from 1-5 cm in size, with at least one twinned crystal (Figure 5). The crystals are often damaged or incomplete however, there are no clear indications that they were knapped or modified in any way for use as tools. Damage to the largest crystals (Figure 5d) is probably the result of natural processes since there is no negative bulb. The most compelling argument against a functional explanation of the quartz crystals is the small size of most (6a-b) making them unsuitable for knapping. Quartz crystals occur in pockets within the dolomite formation outside the cave, but not within the cave. Neither

is there any apparent karstic process that could have led to their concentration in this part of the cave. Consequently, these natural crystals originate outside the cave and were intentionally introduced into the cave. Likewise, the multi-coloured chaledony pebbles also found in Excavation 6 are too small to have served as raw material for artifacts however, further research is needed to determine their source (Figure 6e).

Another intriguing aspect of the Excavation 6 lithic assemblage is the high frequency of banded ironstone slabs. This is a raw material that is readily available in the area immediately surrounding the cave (e.g. on top of the hillside), but not inside the cave. Some of these slabs had been modified for use as simple cores or as core scrapers, while others were abandoned without modification. Six of the slabs show incisions. Beaumont published one slab with a series of parallel incised lines (Beaumont and Vogel 2006: Fig 6). Examination of two other slabs under an Environmental SEM shows a network of incised lines that is inconsistent with natural processes and points to intentional modification by hominins (Figure 6). None of the incisions on the slabs exhibit the clear patterning found on rounded rock fragments from the MSA at Blombos Cave (Henshilwood et al. 2002). However the ironstone slabs from Wonderwerk, together with the chaledony pebbles and quartz crystals, are consistent with the emerging body of evidence for the early exploitation of minerals such as ochre for non-utilitarian purposes, from sites including Blombos Cave, Klein Kliphuis and Pinnacle Point (South Africa), Twin Rivers (Zambia), Sai Island (Sudan) and Qafzeh Cave (Israel) (d'Errico et al. 2003, Mackay and Welz 2008, Marean et al. 2007, Barham 2002, Van Peer et al. 2004, Hovers et al. 2003).

The occupation of the dark zone at the cave back, as attested to in Excavation 6, is surprising given the absence of another back entrance, the distance from the cave mouth and the availability of better illuminated, warm and dry locations towards the cave mouth. The depth and richness of the deposit implies recurring visits to this locality. In the absence of a convincing economic or functional motive, the most parsimonious explanation for the occupation at the back of the cave lies in the special sensory properties of this locality, nestling deep in the hillside - darkness, silence, a sense of enclosure and perhaps even the resonance of occasional dripping water. In contrast to the cave front with its rock art, at the back there is no evidence for intentional modification of the environment in order to augment its special sensory properties or have them acquire referential significance. The natural environment and the apparently non-utilitarian objects found here, have as a common denominator their notable sensory properties; the quartz crystals embody properties relating to refraction of light but also to touch due to their geometric shape, while the chalcedony pebbles are multi-colored but also rounded and smooth. Some of the banded ironstone slabs are modified, but lack clearly defined symbols or images that are recognizable and intelligible to us. It is possible that the observed incisions served to 'open up' the surface of the rock and to alter perception of the rocks' surface rather than to create notation or representation as expected in the earliest artistic depictions (Lewis-Williams and Dowson 1988). Thus, the



manuports introduced into Excavation 6 added to, or perhaps were a manifestation of, the

overall sensory experience of this location. As such we interpret the occupation of the

back of Wonderwerk Cave as representing a set of intentional and repeated activities

relating to sensory perception (sound, light, touch), that were distinctive and meaningful

for the hominins who occupied/used this area of the cave.

Acknowledgement of the role played by sensory perceptions in determining and

motivating past human behavior has given rise to an 'archaeology of the senses'. Thus,

there is a growing body of archaeological publications that refer to the visual and non-

visual sensory properties of sites and material culture (for example: Waller 1993, Jahn

and Devereaux 1996, MacGregor 1999, Watson and Keating 1999, Gosden 2001,

Ouzman 2001, Mills 2005, Bruchez 2007). Few of these studies though relate to the

sensory world of early hominins. An exception is the study of the site of Sima de los

Huesos at Atapuerca, Spain (>350 kyr) where 27 people (MNI count) were deposited in a

deep crevice along with a single quartzite handaxe (Carbonell et al. 2003). The authors

suggest that both the handaxe and the intentional deposition of bodies might be evidence

of symbolic behavior, perhaps relating to the darkness prevailing in this locality and the

unusual surface texture and color of the quartzite handaxe. At both Sima de los Huesos

and Wonderwerk Cave, the sensory properties attached to a particular natural locale and

to objects, appear to have shaped hominin behavior in the choice of context as well as the

nature of activities undertaken there.

Excavation 6 at Wonderwerk Cave raises the likelihood that over 180,000 years ago

hominins valued places with particular sensory properties - absence of sound and light. The question remains open as to whether the evidence from Excavation 6 fits within

definitions of modern human behaviour as that "is mediated by socially constructed

patterns of symbolic thinking, actions and communications that allow for material and information exchange between and across generations and contemporaneous

communities" (Henshilwood and Marean 2003: 635). We propose that the activities

observed at the back of Wonderwerk Cave are clearly related to symbolic behavior,

supporting the view advanced by some researchers (McBrearty and Brooks 2000;

D'Errico et al. 2003), that the emergence of modern human behavior began to develop before the dispersal of anatomically modern humans out of Africa. (McBrearty and

Brooks 2000; D'Errico et al. 2003).

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## References

- Avery, D.M. 1995. Southern savannas and Pleistocene hominid adaptations: the micromammalian perspective. In *Palaeoclimate and Evolution with Emphasis on Human Origins* (eds E.S. Vrba, S.H. Denton, T.C. Partidge, and L.M. Burckle). New Haven: Yale University Press, pp. 459-478.
- Baksi A. and Hoffman K.A. 2000. On the age and morphology of the Reunion event. *Geophysical Research Letters*, 27: 2997-3000.
- Barham, L.S. 2002. Systematic pigment use in the Middle Pleistocene of south central Africa. *Current Anthropology*, 31:181-190.
- Beaumont, P. 1982. Aspects of the Northern Cape Pleistocene project. In *Palaeoecology of Africa and the Surrounding Islands* (eds J.A. Coetzee and E.M. van Zinderen Bakker). Rotterdam: Balkema, pp. 41-44.
- Beaumont, P. 1990. Wonderwerk Cave. In *Guide to Archaeological Sites in the Northern Cape* (eds P. Beaumont and D. Morris). Kimberley: McGregor Museum, pp. 101-134.
- Beaumont, P. 2004. Wonderwerk Cave. In *Archaeology in the Northern Cape: Some Key Sites* (eds D. Morris and P. Beaumont). Kimberley: McGregor Museum, pp. 31-36.

- Beaumont, P. and Vogel, J. C. 2006. On a timescale for the past million years of human history in central South Africa. *South African Journal of Science*, 102:217-228.
- Bernard, P. S. 2003. Ecological implications of water spirit beliefs in southern Africa: the need to protect knowledge, nature, and resource rights. *USDA Forest Service Proceedings RMRS-P-27:148-154*.
- Bradley, R. 2000. *An Archaeology of Natural Places*. London: Routledge.
- Bruchez, M. S. 2007. Artifacts that speak for themselves: sounds underfoot in Mesamerica. *Journal of Anthropological Archaeology*, 26:47-64.
- Butzer, K. W. 1984a. Later Quaternary environments in South Africa. In *Late Cenozoic Palaeoclimates of the Southern Hemisphere* (ed J. C. Vogel). Rotterdam: Belkema, pp. 235-264.
- Butzer, K. W. 1984b. Archaeogeology and Quaternary environments in South Africa. In *Southern African Prehistory and Palaeoenvironments* (ed R. G. Klein). Rotterdam: Belkema, pp. 1-64.
- Camp, C. L. 1948. University of California African Expedition--Southern Section. *Science*, 108:550-552.

Carbonell, E., Mosquera, M., Ollé, A., Rodríguez, X.P., Sala, R., Verges, J.M., Arsuaga, J.L., and Berúdez de Castro, J.M. 2003. Did the earliest mortuary practices take place more than 350,000 years ago at Atapuerca? *L'Anthropologie*, 107:1-14.

Chazan, M., Ron, H., Matmon, A., Porat, N., Goldberg, P., Yates, R., Avery, D.M.,

Sumner, A., and Horwitz, L.K. 2008. First radiometric dates for the Earlier Stone Age sequence in Wonderwerk Cave, South Africa. *Journal of Human Evolution*, 55:1-11.

Chazan, M., Avery, D.M., Goldberg, P., Matmon, A., Porat, N., Ron, H., Ruther, H.,

Sumner, A., Yates, R., and Horwitz L.K. In Press. The Earlier Stone Age Sequence in the Northern Cape Province, South Africa: New Research at Wonderwerk Cave. In *Les*

*Cultures a Bifaces* (ed H. de Lumley).

Clothes, J. 2004. Hallucinations in caves. *Cambridge Archaeological Journal*, 14(1): 81.

Curnoe, D., Herries, A.I.R., Brink, J., Hopley, P., Van Reyneveld, K., Henderson, Z., and

Morris D. 2006. Discovery of Middle Pleistocene fossil and stone tool-bearing deposits at Groot Kloof, Ghaap Escarpment, Northern Cape Province. *South African Journal of*

*Science*, 102: 180-184.

d'Errico, F., Henshilwood, C., Lawson, G., Vanhaeren, M., Tillier, A.-M., Sorressi, M., Bresson, F., Maureille, B., Nowell, A., Lakarra, J., Backwell, L., and Julien, M. 2003. Archaeological evidence for the emergence of language, symbolism, and music- an

- alternative multidisciplinary perspective. *Journal of World Prehistory*, 17:1-70.
- Deacon, H.J., and Deacon, J. 1999 *Human Beginnings in South Africa*. Cape Town: David Philip.
- Gosden C. 2001. Making sense: archaeology and aesthetics. *World Archaeology*, 32 (2): 163-167.
- Hayden, B. 2003. *Shamans, Sorcerers, and Saints: The Prehistory of Religion*. Smithsonian Institution Press: Washington, DC.
- Helvenston, P.A. and Bahn, P.G. 2003. Testing the 'three stages of trance' model. *Cambridge Archaeological Journal*, 13(2): 213-224.
- Helvenston, P.A. and Bahn, P.G. 2004. Walking the trance fixed. *Cambridge Archaeological Journal*, 14(1): 90-98.
- Henshilwood, C., d'Errico, F., Yates, R., Jacobs, Z., Tribolo, C., Duller, G., Mercier, N., Sealy, J.C., Valladas, H., Watts, I. and Wintle, A.G. 2002. Emergence of modern human behavior: Middle Stone Age engravings from South Africa. *Science*, 295: 1278-1280.
- Henshilwood, C. and Marean, C. 2003. The origin of modern human behavior: Critique of the models and their test implications. *Current Anthropology*, 44(5): 627-651.

Heries, A., Curnoe, D., Brink, J., Henderson, Z., Morris, D., Van Reyneveld, K., and Hodge, E. 2007. Landscape evolution, paleoclimate and Later Stone Age occupation of the Ghaap Plateau escarpment, Northern Cape Province, South Africa. *Antiquity*, 81:313.

Hodder, I. 1986. *Reading the Past*. Cambridge: Cambridge University Press.

Hoff, A. 1997. The water snake of the Khoekhoen and/Xam. *South African Archaeological Bulletin*, 52:21-37.

Hovers, E., Ilani, S., Bar-Yosef, O., and Vandermeersch, B. 2003. An early case of color symbolism: ochre use by modern humans in Qafzeh Cave. *Current Anthropology*, 46:3-27.

Humphreys, A.J.B., and Thackeray, A.I. 1983. *Ghaap and Gariep: Later Stone Age Studies in the Northern Cape*. Cape Town: South African Archaeological Society.

Ingold, T. 2000. *The Perception of the Environment: Essays in Livelihood, Dwelling, and Skill*. London: Routledge.

Jahn, R.G., and Devereaux, P. 1996. Preliminary investigations and cognitive considerations of the acoustical resonances of selected archaeological sites. *Antiquity*, 70:665-666.



- Kuman, K., and Clark, R.J. 2000. Stratigraphy, artefact industries, and hominid associations for Sterkfontein, Member 5. *Journal of Human Evolution*, 38:827-847.
- Kus, S. 1992. Toward an archaeology of body and soul. In *Representations in Archaeology* (ed J.S. Gardin and C.S. Peebles). Bloomington: Indiana University Press, pp. 168-177.
- Lewis-Williams, J.D. 2002. *The Mind in the Cave: Consciousness and the Origins of Art*. London: Thames and Hudson.
- Lewis-Williams, J.D., and Dowson, T.A. 1988. The signs of all times: Entoptic phenomena in Upper Paleolithic art. *Current Anthropology*, 29:201-245.
- Lewis-Williams, J.D., and Pearce D.G. 2004. Southern African San rock painting as social intervention: A study of rain-control images. *African Archaeological Review*, 21 (4): 199-228.
- MacGregor, G. 1999. Making sense of the past in the present: a sensory analysis of carved stone balls. *World Archaeology*, 31:258-271.
- Mackay, A., and Welz, A. 2008. Engraved ochre from a Middle Stone Age context at Klein Kliphuis in the Western Cape of South Africa. *Journal of Archaeological Science*,

Malan, B.D., and Cooke, H.B.S. 1941. A preliminary account of the Wonderwerk Cave, Kuruman district. *South African Journal of Science*, 37:300-312.

Malan, B.D. and Wells, L.H. 1943. A further report on the Wonderwerk Cave, Kuruman. *South African Journal of Science*, 40:258-270.

Marean, C.W., Bar-Matthews, M., Bernatchez, J., Fischer, E., Goldberg, P., Herries, A.I.R., Jacobs, Z., Jerardino, A., Karkanas, P., Minichillo, T., Nilsson, P.J., Thompson, E., Watts, I., Williams, H.M. 2007. Early human use of marine resources and pigment in South Africa during the Middle Pleistocene. *Nature*, 449: 905-908.

## Books.

Martin, J. 2008. *A Millimetre of Dust. Visiting Ancestral Sites*. Cape Town: Kwela

McBrearty, S., and Brooks, A.S. 2000. The revolution that wasn't: a new interpretation of the origin of modern human behavior. *Journal of Human Evolution*, 39:453-563.

Mills, S. 2005. Sensing the place: sounds and landscape. In *(un)Settling the Neolithic* (eds D. Bailey, A. Whittle, and V. Cummings). Oxford: Oxbow, pp. 79-89.

Mitchell, P. 2002. *The Archaeology of Southern Africa*. Cambridge: Cambridge

Morris, D. 2002. *Driekopseiland and 'the rain's magic power': history and landscape in a new interpretation of a Northern Cape rock engraving site*. Masters, University of the Western Cape, Cape Town.

Ouzman, S. 2001. Seeing is deceiving: rock art and the non-visual. *World Archaeology*, 33:237-256.

Panger, M.A., Brooks, A.S., Richmond, B.G., and Wood, B. 2002. Older than the Oldowan? Rethinking the emergence of hominin tool use. *Evolutionary Anthropology*, 11:235-245.

Parkington, J., Morris, D., Rusc, N. 2008. *Karoo Rock Engravings*. Cape Town: Krakadouw Trust.

Preucel, R.W. 2006. *Archaeological Semiotics*. Oxford: Blackwell.

Reznikoff, I. 2006. The evidence of the use of sound resonance from Paleolithic to Medieval times. In *Archaeoaoustics* (eds C. Scarre and G. Lawson ). Cambridge: McDonald Institute, pp. 77-84.

Ruther, H., Chazan, M., Schroeder R., Neeser R., Held C., Walker S.J., Matmon A. and Horwitz, L.K. in press. Laser scanning for conservation and research of African cultural heritage sites: The case study of Wonderwerk Cave, South Africa. *Journal of Archaeological Science*.

Scarre, C. 2006. Sound, place and space: Towards an archaeology of acoustics. In *Archaeoaoustics* (eds C. Scarre and G. Lawson ). Cambridge: McDonald Institute, pp. 1-11.

Sheets-Johnstone M. 1990. *The Roots of Thinking*. Philadelphia: Temple University Press.

Thackeray, J. F. 1984. *Man, Animals, and Extinctions: The Analysis of Holocene Faunal Remains from Wonderwerk Cave, South Africa*. Ph.D, Yale University, New Haven, CT.

Thackeray, A.I., Thackeray, J.F., Beaumont, P. and Vogel, J.C. 1981. Dated rock engravings from Wonderwerk Cave, South Africa. *Science*, 214:64-67.

Tilley C. 1994. *A Phenomenology of Landscape*. Oxford: Berg.

Van Peer, P., Rots, V., and Vroombans, J.-M. 2004. A story of colourful diggers and grinders: The Sangoan and Lupernban at site 8-B-11, Sai Island, Northern Sudan. *Before Farming*, 3:article 1.

Waller, S.J. 1993. Sound reflection as an explanation for the content and context of rock

art. *Rock Art Research*, 10:91-101.

Watson, A., and Keating, D. 1999. Architecture and sound: an acoustic analysis of megalithic monuments in prehistoric Britain. *Antiquity*, 73:325-336.

## Captions

Figure 1: Aerial photograph with topographic overlay showing the geographic setting of Wonderwerk Cave and the location of other locations mentioned in the text.

Figure 2: Plan view of Wonderwerk Cave generated from a 3-D scan. Photographs show (a) stalagmite adjacent to cave entrance (b) flat, arched roof in the central portion of the cave. Numbers 1 and 6 refer to Excavation Areas discussed in text. (Fig courtesy of H. Ruther).

Figure 3: a. Topographic map of the hill with showing the position of the cave. In all directions the back of the cave is well over 100 meters from the surface of the hill The dark line indicates the contour line at the elevation of the top of the cave. b. Cut away view of the hill showing the position of the cave.

Figure 4: Fauresmith lithic artifacts from Wonderwerk Cave Excavation 6: a. Unretouched point (square AA150); b. Blade (square ?148); c. Core (square DD149); d. Unifacially retouched blade (square CC148); e. Biface (square AA150). Drawing by A. Sumner.

Figure 5: Quartz crystals and chalcedony pebbles from Wonderwerk Excavation 6. (a-b) Small quartz crystal, b is a twinned crystal. (c-d) large quartz crystals, c is damaged

however the crystal facets are clearly visible on d. Note scars possibly produced by flaking on the bottom of crystal d. (e) Chalcedony pebbles.

Figure 6: Banded ironstone slab with incised lines from Wonderwerk Excavation 6. The surface is soft and could be classified as ochre. (a) Photograph of the slab (courtesy of Royal Ontario Museum). (b) Photograph with major lines. Location of SEM photos indicated by letter (c-e). c-d. ESEM photographs showing details of lines.

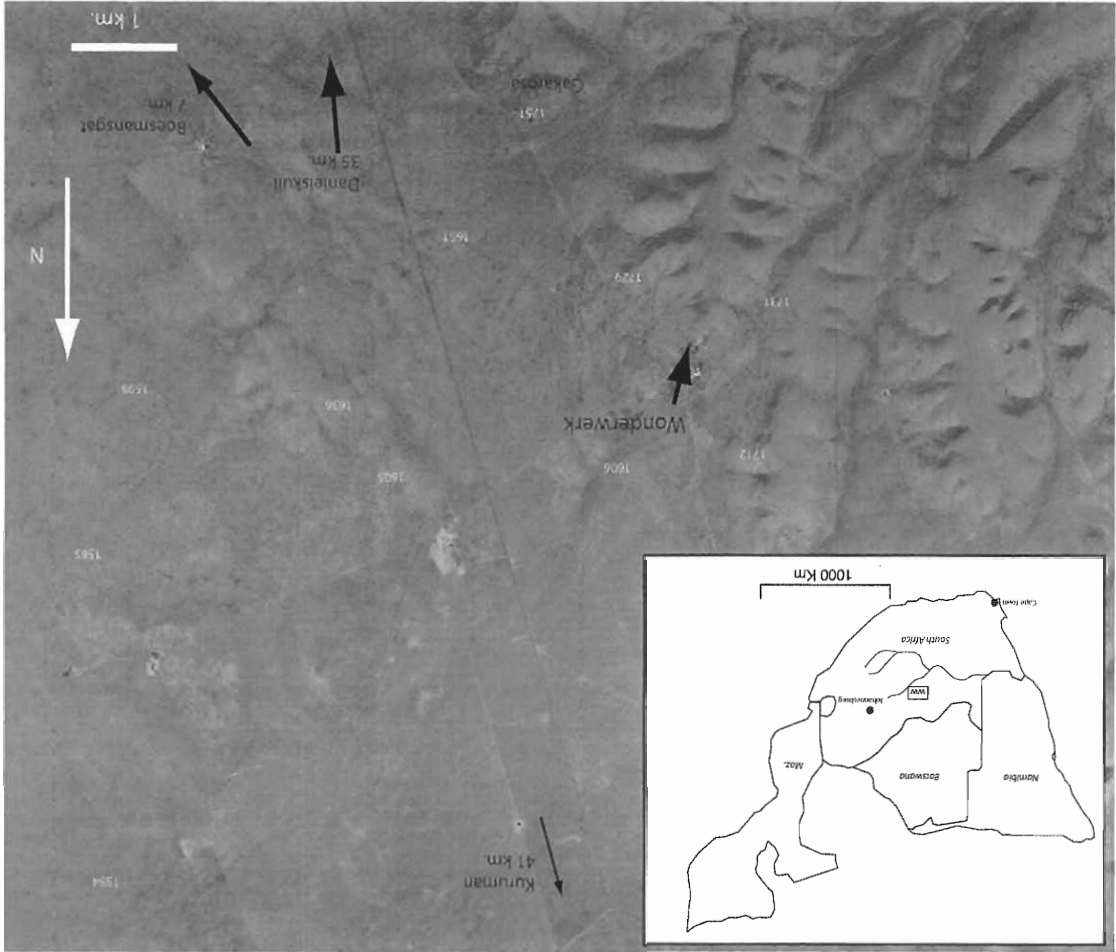
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#### ENDNOTES

<sup>1</sup> The python plays a central role in the San creation myth with humans descended from this snake. In the Tsodillo Hills, Botswana, the arid streambeds around the hills are said to have been created by the python as it circled the hills searching for water. In a small cave in this area, S. Coulson recently discovered a rock which was shaped like a python and covered with hundreds of indentations. "You could see the mouth and eyes of the snake. It looked like a real python. The play of sunlight over the indentations gave them the appearance of snake skin. At night, the firelight gave one the feeling that the snake was actually moving".

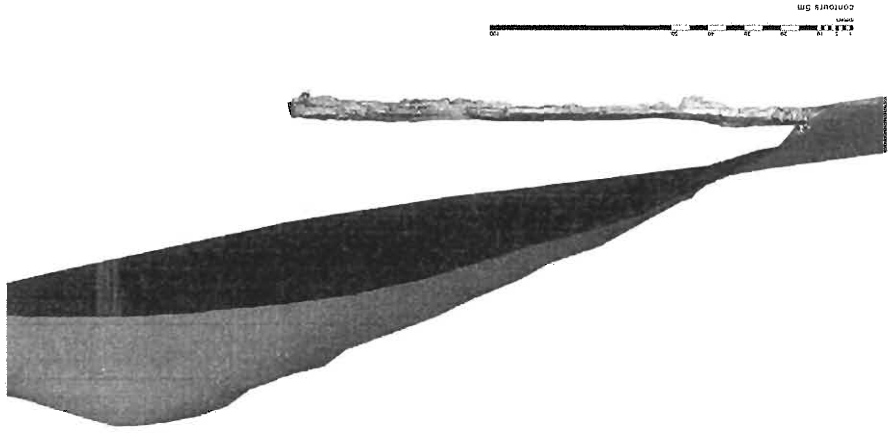
Sheila Coulson cited in: World's Oldest Ritual Discovered - Worshipped The Python 70,000 Years Ago. *ScienceDaily* (Nov. 30, 2006)

<sup>2</sup> Unfortunately U-series dating of this speleothem failed due to its poor state of preservation (George Brook, pers comm. 2009).

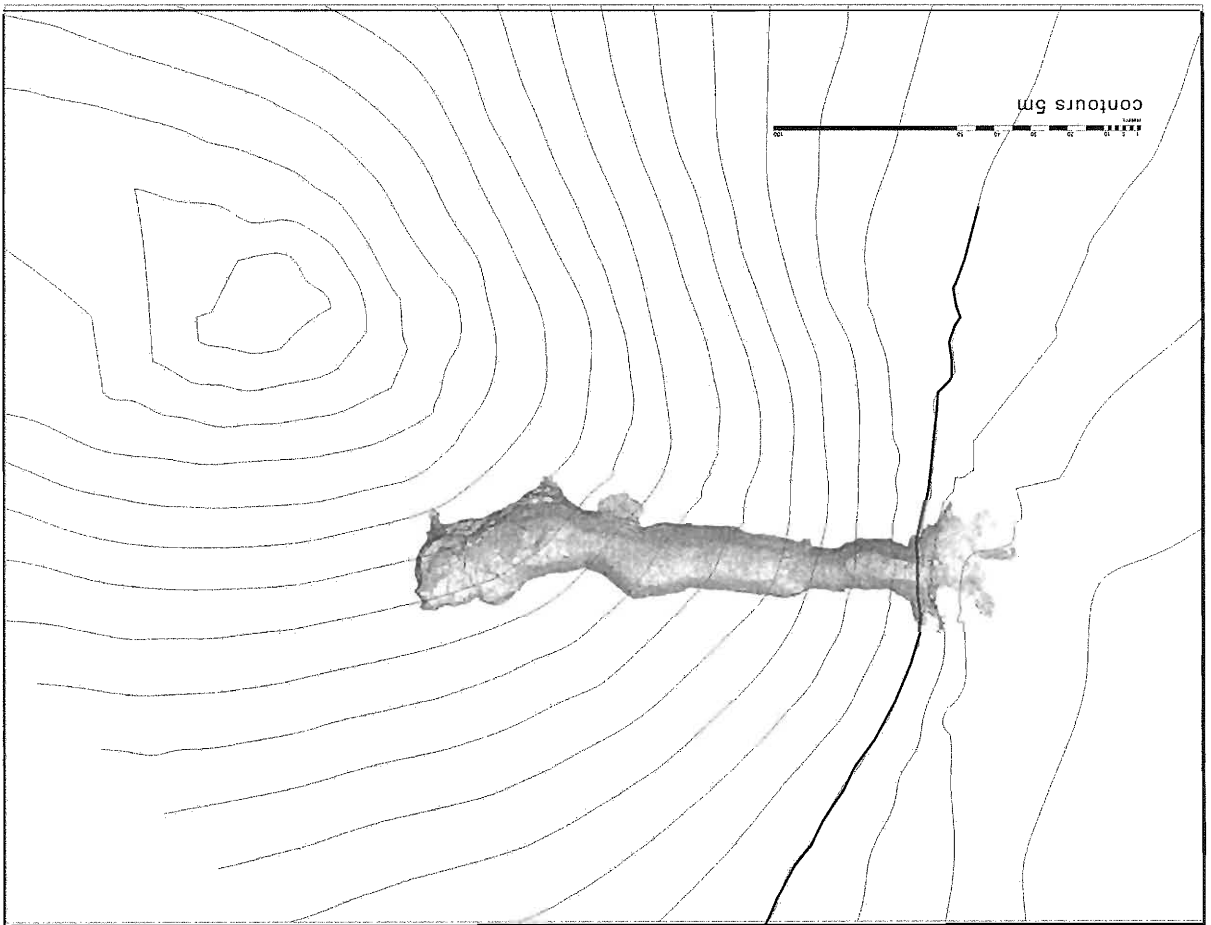


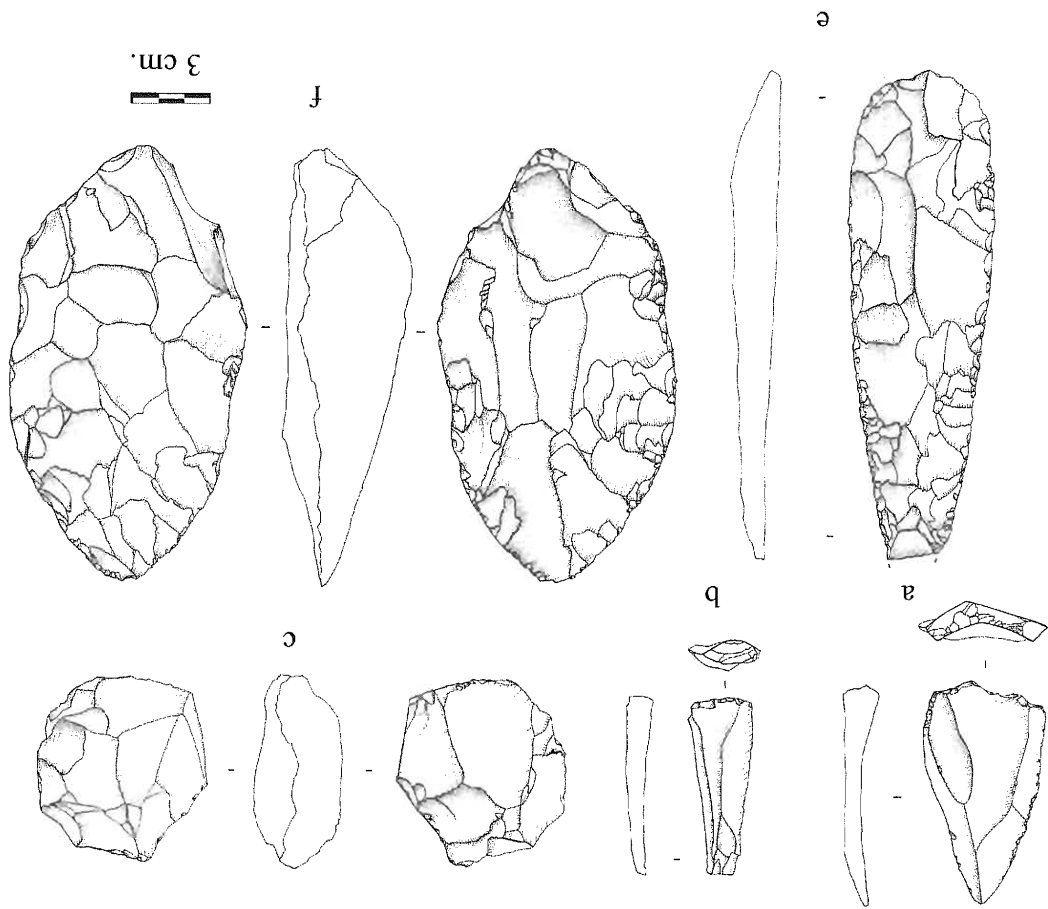


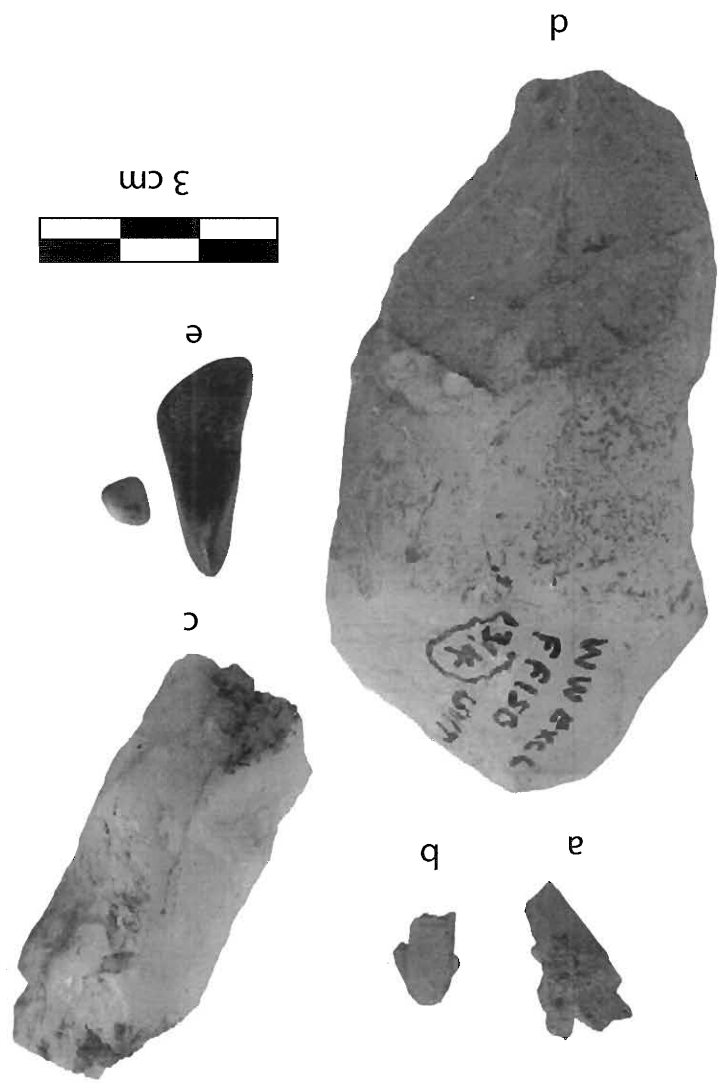
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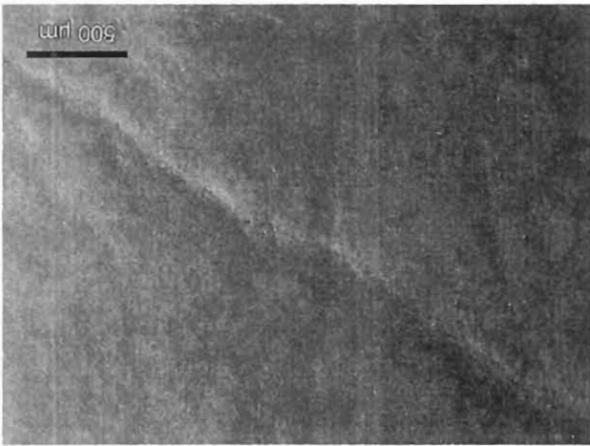
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