Paleoanthropological investigations of Middle Stone Age sites at Pinnacle Point, Mossel Bay (South Africa): Archaeology and hominid remains from the 2000 Field Season

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ABSTRACT

The Middle Stone Age (MSA) in South Africa has gained increasing attention due to the discovery of bone tools at Blombos Cave, the abundance of ochre suggesting artistic expression, the presence of a variety of lithic assemblages with advanced technological characteristics, and debates over the interpretation of the fauna. Linked to these findings are debates over the antiquity of modern human behavior, with some researchers arguing that the South African evidence suggests an early origin of modern behavior, while others suggesting a late origin. Resolution of these debates relies on two advances: improvements in our theoretical approach, and an improvement of the empirical record in Africa. We initiated fieldwork at Mossel Bay on the southern coast of the Cape to address the latter deficiency.

Our survey to date has covered a 2 km section of 8 km of coastal cliffs, penetrated 1 km inland, and resulted in the discovery of 28 archaeological sites, 21 of which are MSA, and 15 of those are caves or rock shelters. Test excavations were carried out at 3 of these caves, all at Pinnacle Point. Two (13A and 13B) yielded rich MSA horizons with outstanding preservation of fossil bone, and lithic assemblages. Two hominin fossils were found, and the incisor is metrically intermediate between Middle Pleistocene hominins and modern humans. The lithic assemblages are dominated by the early stages of artifact manufacture, and resemble typologically and technologically the regional variant of the MSA (the Mossel Bay Industry), but blades and points are significantly smaller than reported elsewhere. The fauna from both sites display a surprising rarity of small mammal, micromammals, and tortoise, unlike at most other MSA sites from the Cape. The shellfish remains indicate collection from nearby rocky outcrops and very occasionally also from sandy beaches. Collecting rounds targeted the mid- and lower reaches of the intertidal zone.

INTRODUCTION

The Mossel Bay Archaeology Project (MAP) is a long-term field study of the Middle Stone Age (MSA) in the Mossel Bay region. Our field research to date demonstrates that the Mossel Bay region has an unusually rich MSA record, and here we report on the first several years of survey and test excavation. Our primary research goals are to test several competing models concerning the behavioral modernity of MSA people in Africa and thus contribute to our knowledge of the origins of modern humans. In particular, we plan to focus on resolving several chronologic and chronometric questions about the South African MSA, raw material exploitation strategies, and faunal exploitation strategies. To that end we plan a longitudinal study that will involve two missions. The first ongoing effort involves survey (both archaeological and geological for raw material sources) and test excavations of discovered sites. The second will involve intensive excavations at those previously tested sites identified as having high potential for helping us resolve our research problems, which has just begun. As reported here, the lithic and faunal assemblages, though small, already expand the range of variation documented for the MSA in South Africa.

HISTORY OF RESEARCH

Archaeological research in the Mossel Bay region has not been intense, despite the early initiation of work by George Leith in 1888 (Leith, 1898) at Cape St. Blaize Cave (CSB), located in the town of Mossel Bay (Figure 1). Last excavated by Goodwin in 1932 (Goodwin & Malan, 1935), this site yielded a series of selected lithic collections central to the definition of the Mossel Bay Industry (Goodwin, 1930; Sampson, 1971). Goodwin argued for the presence of an inter-stratified Howiesons Poort occupation at CSB, but this was based on the presence of point-types thought at that time to be characteristic of the Howiesons Poort, while more recent definitions tend to rely on the presence of backed pieces (Volman, 1981; Thackeray, 1989). MSA research in the Mossel Bay region effectively stopped after these investigations.

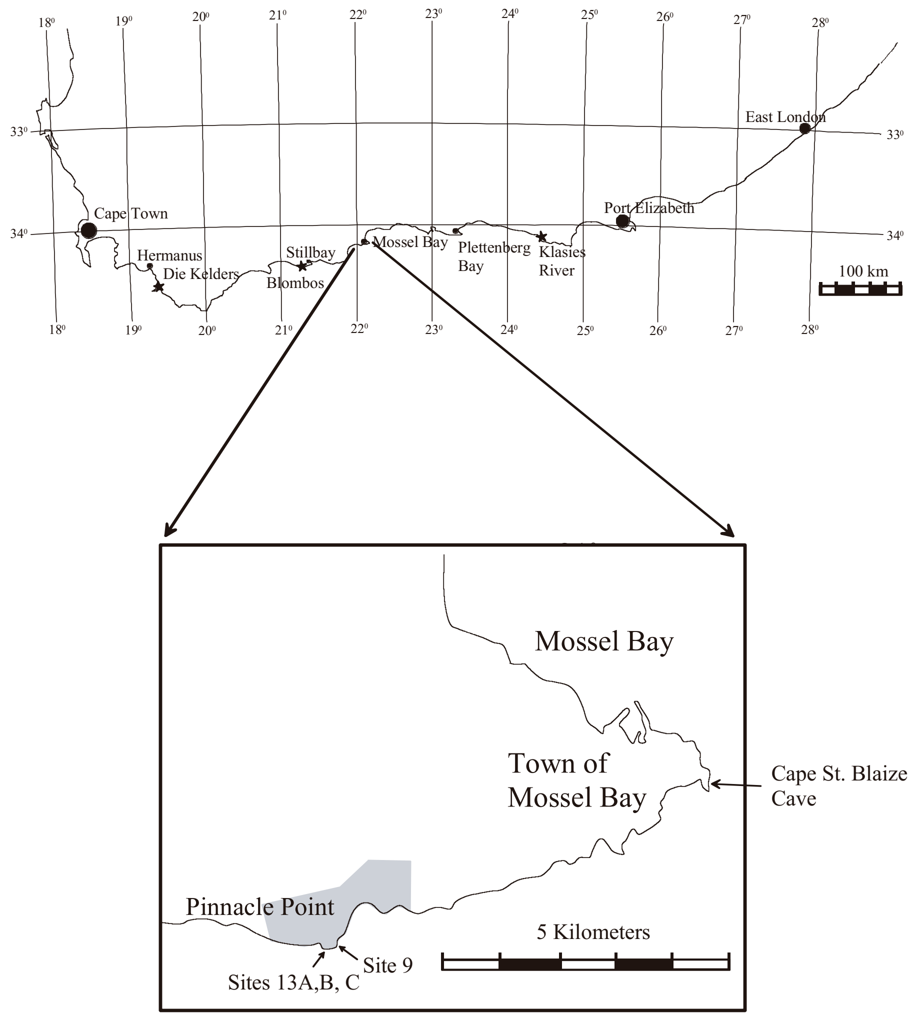


Figure 1. Map showing the Cape of South Africa (above), and a blow-up of the Mossel Bay peninsula, Pinnacle Point, and the surveyed area (grey shading).

In 1997 Kaplan and Nilssen conducted an environmental impact surface survey of the Pinnacle Point area (Figures 1 and 2), a section of coastal cliffs west of the town of Mossel Bay (Kaplan, 1997). Their work was in response to a hotel/casino/golf course development proposal for the area above the cliffs, which is now in the construction stage. They covered an area of approximately 2 km of the coast at Pinnacle Point and about 1 km inland and discovered 28 archaeological sites (21 MSA), 15 of which are caves/rockshelters. They named sites in numeric sequence of discovery, and sites deemed to be related in formation were given the same number with letters used to designate distinct caves or rockshelters. In March of 1999 Nilssen and Marean revisited Pinnacle Point and Mossel Bay to survey the area and investigate the potential of the sites. Four caves were selected for test excavation (Cave 9, 13A, 13B, and 13C). Since most of the caves/rockshelters in this area suggest high potential due to abundant scatters of MSA lithics, we chose these four based on

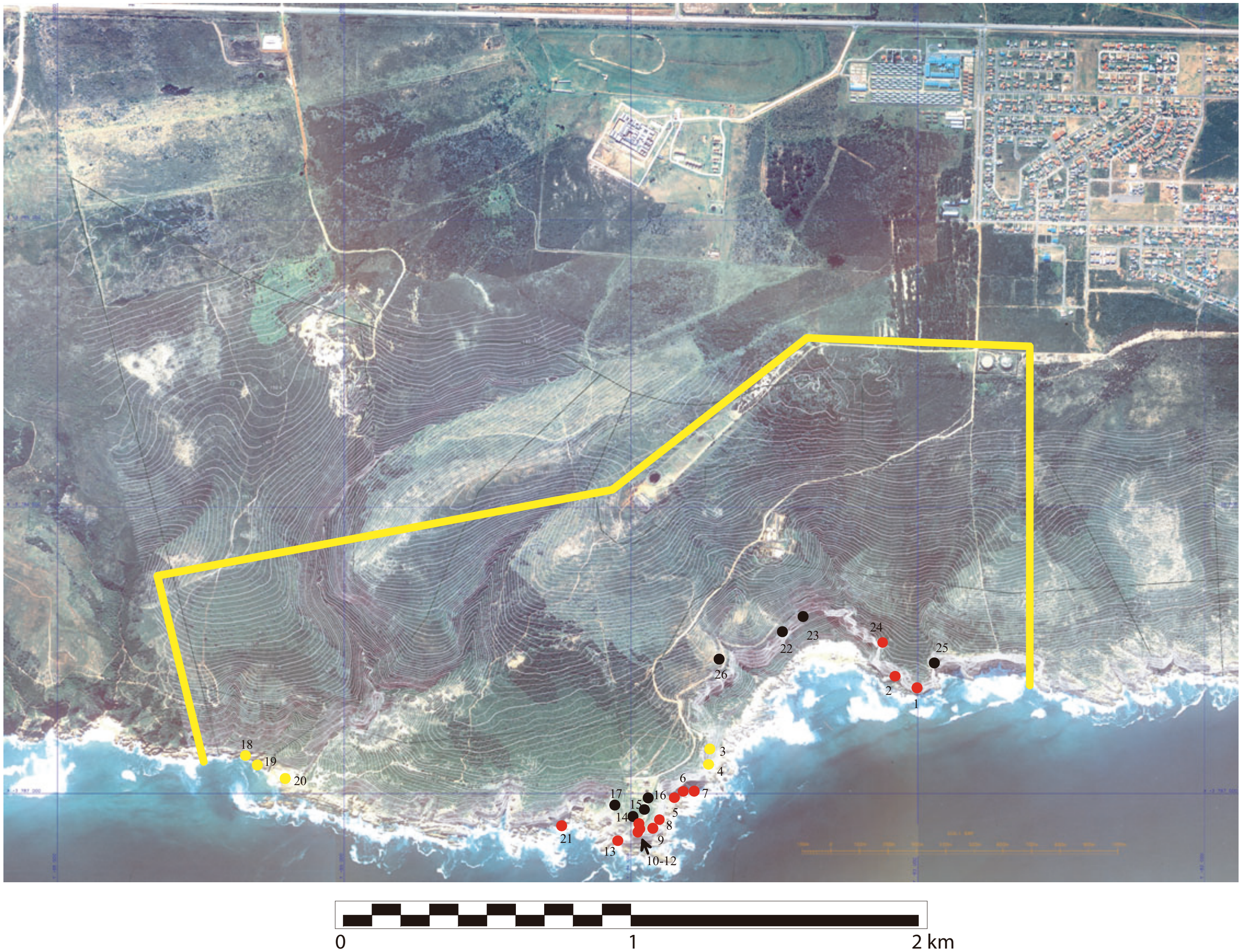


Figure 2. Aerial photograph of the survey area (enclosed yellow line), and the sites found to date: Red = cave/rockshelter, Black = open-air lithic scatter, and yellow = shell midden.

A)

B)

Figure 3. Pinnacle Point and the cliffs, showing A) Pinnacle Point from the north-east with the Site 13 Cave Complex indicated by the arrow, and B) the cliffs to the east of the site 13 complex and the stairs down the cliffs.

their proximity to one-another and the exceptionally high potential of 13B. Marean and Nilssen conducted another survey in March of 2000, established a coordinate system (grid), laid numerous permanent survey control points, and mapped Cave 13B.

In July of 2000 we conducted test excavations, preceded by several weeks of logistical work. The caves sit near the base of a nearly vertical cliff face roughly 60 m from base to top (Figures 3 and 4). Scaling the cliff is a hazardous climb, and probably explains the lack of discovery of these sites in the past. Bringing a team up and down the cliff daily would be impossible, so we built a 176 step wooden staircase from the top to bottom of the cliff. We installed piping from a municipality water line located above the cliff down to the excavations so that all materials could be wet-sieved with fresh water.

During the July fieldwork we decided to test only 3 caves, primarily because 13B required several test-pits to properly evaluate. We conducted 3 weeks of excavation with a field team of 15 and a lab team of 3, and followed by 2 months of curation and study at the South African Museum. In March of 2001 we revisited the sites with two teams for the purposes of luminescence dating. One team (Ann Wintle, Geof Duller, Helen Roberts, and Zenobia Jacobs) sampled sandy sediments from Caves 9 and 13A for the purpose of OSL dating, took background gamma measurements, and implanted dosimeters. A second team (Helene Valladas, Norbert Mercier, Chantal Tribolo) placed dosimeters into various locations of Cave 13B for TL dating of burnt lithics and took gamma measurements. In March of 2002 we continued with survey and mapping of the surrounding area. Since then, construction began on the development, and MAP maintains a team at Mossel Bay that monitors construction activity for archaeological remains. Significant quantities of Acheulean material have been found, and these are under study by Erin Lassiter, and will be reported elsewhere.

GEOLOGICAL BACKGROUND

The coastal cliffs in this area are exposures of the Skurweberg Formation of the Table Mountain Group. This is a coarse-grained, light-gray quartzitic sandstone, often covered with lichens, with beds of varying thickness and consolidation (see Figure 3). Small patchy exposures of the Robberg Formation of the Uitenhage Group outcrop above the Skurweberg Formation near the Mossel Bay point. The regional dip varies strongly from west to east between 10 to 75 degrees (South African Geological Series 3422AA 1993).

The vast majority of the caves we have examined occur in the nearly vertical coastal cliffs, and this is well illustrated in

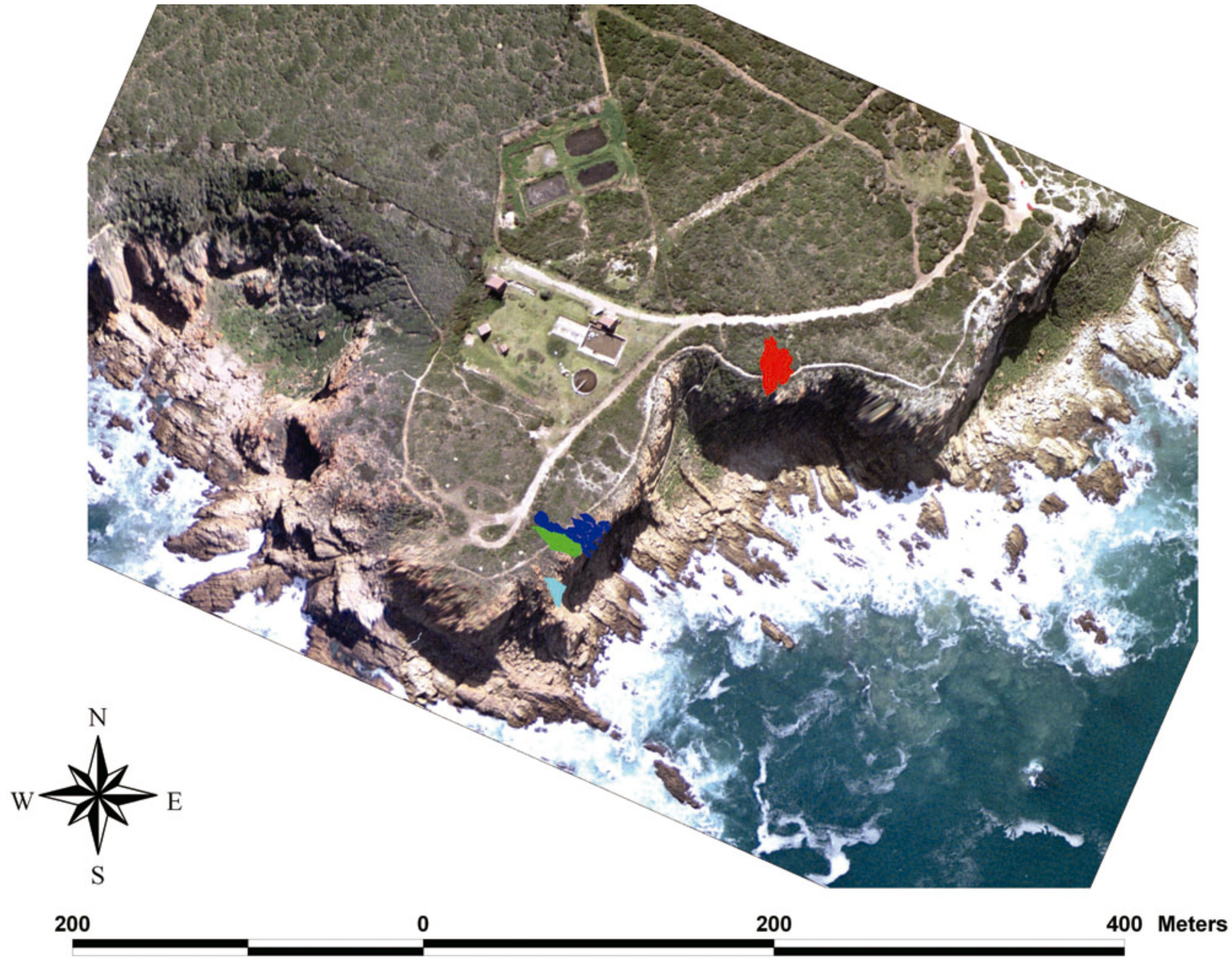


Figure 4. The location of several of the Pinnacle Point sites, plotted on an orthophoto that has been rectified to the MAP grid. The sites include site 9 (in red), 13A (in light blue), 13B (in green), and 13C (in dark blue) plotted on it. Orientation is magnetic north.

Figure 4, which is an orthophoto rectified to the MAP grid (see below), with maps of site 9 (in red), 13A (in light blue), 13B (in green), and 13C (in dark blue) plotted on it. We noticed a trend for caves and shelters to be present when the bedding plane was more horizontal (10-40 degrees) and less resistant layers of quartzite eroded out, likely by relatively higher sea levels, leaving more resistant layers intact above and below forming a cave or rock shelter (Figure 3). Many also occur in faults. Thus, caves and rock shelters occur in clusters that are predictable from the geologically mapped dip and faulting.

Calcretes and dunes cap the quartzite throughout the area (Figures 3A and 4). The calcretes are highly variable in thickness and form. Some are up to a meter thick or more, while others are thin flows of very hard calcite adhering directly to the quartzite. In several road cuts we observed calcretes and caliche horizons in the sands, and in several locations we observed MSA artifactual horizons in these cuts. Various calcite formations are present in the caves and rockshelters, particularly at joints and bedding planes. Small stalactites hang from the roofs of many of the caves, and flowstone formations are present in many and in some cases, cover archaeological deposits in the caves (see discussion of site 13B). In numerous locations there are fossilized and cemented dunes adhering to the quartzite, both inside and outside caves, and are testament to ancient dune activity that once abutted the cliffs. While the caves are mostly dry today, it is clear that water seeps through the joints and bedding planes of the quartzite. While quartzite is acidic and typically creates a sedimentary environment hostile to bone preservation, the water entering these caves has been buffered by the calcretes capping the quartzite, raising the ph of the sediments and resulting in outstanding bone preservation, as at Klasies River (Singer & Wymer, 1982: 2).

EXCAVATION PROCEDURES

We employ a three dimensional coordinate system (grid) that encompasses all our excavated sites, and will eventually envelope our entire research region (Figures 4 and 5). Our grid began in site 13B, and there is a MAP control point cemented into the cave that acted as our starting elevational datum. The x-y-z coordinates for that control point were originally and arbitrarily set at 100, 100, 0. Since then we have tied our grid into the South African national coordinate reference system. While South Africa's coordinate system was once based on a local framework (known as the Cape Datum), as of January 1, 1999, South Africa officially shifted to the World Geodetic System 1984 (WGS84) as their base, with the new system being called the Hartebeesthoek94 Datum. Our grid has been tied to this updated system through South Africa's network of passive trigonometric beacons (via total station shots to 16 MAP control points), and all our coordinates can be transformed to it using a two-dimensional conformal coordinate transformation (Wolf & Ghilani, 2002), and from there to latitude and longitude following the Gauss Conform Projection used by South Africa. Since the numbers used for planar coordinates in the South African system are large and unwieldy for day to day excavation tasks, we have elected to maintain our coordinate system (henceforth the MAP coordinate system) for use and publication of all planar coordinates, but have shifted our elevational measurements to conform to the South African system of true orthometric height above mean sea level, which is determined in Cape Town and verified by a variety of tide gauges distributed across the country. Recording and providing elevational data in sea level has obvious advantages, and the height of our starting elevational datum (originally set at 0, see above) in 13B is 20.988 m above mean sea level.

About 40 permanent control points have been shot-in throughout this area, typically as bolts in concrete in protected rock crevasses assessable to a prism, or holes drilled into the quartzite, both inside sites and on the landscape. These are numbered sequentially, digitally photographed, and available at the South African Museum and SAHRA. Any future researcher can access these, as well as the

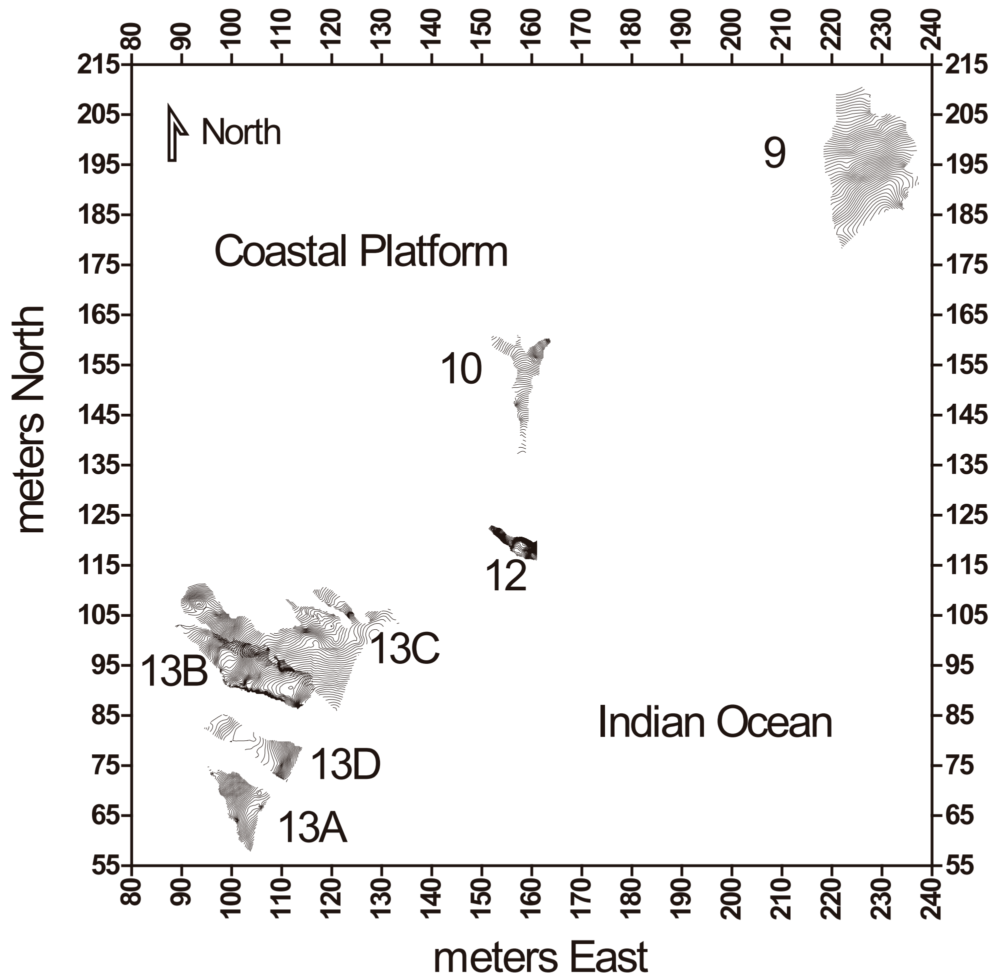


Figure 5. The position of the sites referred to in the text relative to the MAP grid. The site outlines are indicated by the limits of the drawn contour lines, and the scale is indicated by the axes labeled in meters. The approximate location of the cliffs and ocean are indicated. Orientation is magnetic north.

corresponding South African grid coordinates of 16 of these, and establish their precise position within our coordinate system (and the national coordinate system) using a standard surveyor's three-point resection (Wolf & Ghilani, 2002).

The MAP coordinate system is oriented to magnetic north and grid coordinates advance positively to the north (x axis) and east (y axis). A 1 m square is named by the planar coordinates of its south-west corner. We excavated within 50 cm quadrants within squares, and these are named by their bearing: NE, NW, SE, and SW. Excavations were conducted within these quadrants following natural stratigraphic units (layers, features, etc.), and thus square-quadrant-stratigraphic unit provenience designation is the minimum assigned to any find, while most finds also have a precise 3D coordinate as well. Sediment volumes were measured during excavation, and bulk samples of sediment were taken from every unique stratigraphic unit. All finds that were identifiable or had a maximum linear dimension of 1 cm or more were plotted (henceforth called plotted finds) in x-y-z coordinates by total station directly to a hand-held computer using Survey Pro software. We used a specimen number-based system: all excavators were given pre-printed adhesive specimen numbers. Finds were dropped individually into plastic bags, the specimen number adhered to the inside, and the specimen number was typed into the hand-held computer, thus linking it to the coordinates and stratigraphic unit. All spatial data is linked within ArcView GIS, which is also linked to external relational databases with detailed descriptions of all finds.

All recording was done to forms (supplemented by notebooks), and those were typed into form-based database systems. All features and stratigraphic units were drawn to graph paper, and their shape and topography were shot in directly by total station to hand-held computer. We used both digital and film photography. Drawings were digitized to computer, and ArcView GIS with the Image Analysis extension is used to integrate the coordinate and image data.

All non-plotted materials were gently wet-sieved with fresh water through a nested 10-3-1.5 mm sieve. These were dried, packed in plastic bags, and transported to the field laboratory where they were sorted into major analytical categories, and some preliminary analyses performed. All plotted finds were labeled with their specimen number in black India ink. All materials were then transported to the South African Museum for study and storage.

We have completed the analysis of all the plotted finds, and that sample of artifactual and ecofactual material is reported here. The following is a general description of the excavated sites, and a description and preliminary interpretation of the major depositional events. Each square is described as a section of sediments, and the sediments are classified into a series of facies that are defined by their having similar characteristics that suggest they were formed under similar conditions. Broadly speaking, both natural and behavioral processes have contributed to the facies, typically with one dominant over the other. When anthropogenic sedimentary processes are significant, the name includes "MSA" to signal that character. No LSA (Later Stone Age) material was found in these sites. All descriptions proceed from bottom to top.

SITE 9: SUMMARY OF THE EXCAVATIONS

Site 9 is a large cave (Figures 5 and 6) in a heavily metamorphosed layer of quartzite that appears erosion resistant and shows few signs of spalling or other activity. There is a large debris field of cliff collapse outside (Figure 7a) and inside (Figure 7b) the mouth of the cave that nearly seals the entrance. One enters the cave by partially crossing this boulder field, ascending a steep hill of cliff collapse, and then descending down the other side into the cave. This collapse must be geologically recent, because the boulders are sharp and unweathered (unlike the typical boulders in this area), and lichens have yet to invade the zone of cliff detachment. Surprisingly, this cliff collapse did not seem to cause any roof collapse in the cave, and

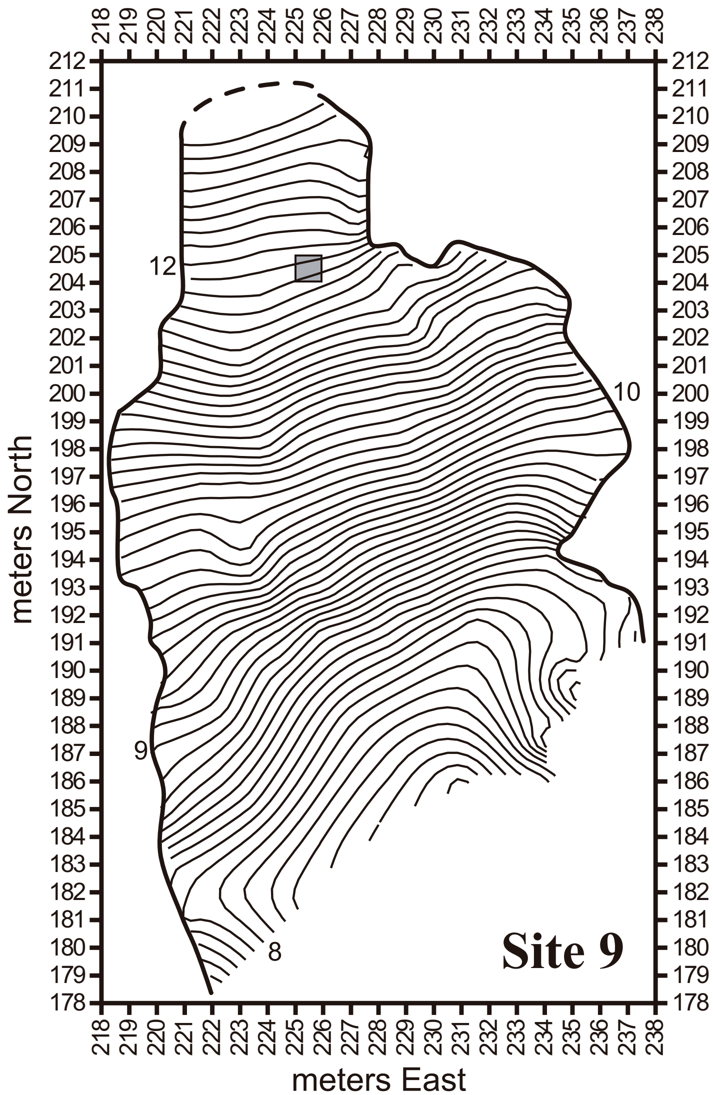


Figure 6. The outline and topography of Site 9, and the position of the test pit (the grey box). The contours are in meters asl, at 10 cm increments. The far northern part of the cave has a crawl space too low to the sediment to properly map, and thus the extent is estimated and indicated by a dotted line. There are several small caves within the walls and roof of Site 9 that are not mapped here. Orientation is magnetic north.

A)

B)

Figure 7. Site 9 from the outside and to the south-west (A) showing the large fresh blocks of stone from the recent cliff collapse, and (B) site 9 from the inside looking out showing the extent of the cliff collapse that fell into the cave.

the debris from the collapse failed to roll into the cave beyond the immediate area of the mouth. The cave is currently dry, and the few signs of flowstone are concentrated near the mouth. This cave appears to be very ancient, as suggested by the resistant rock into which it is cut.

Smaller caves are present to the west side of the mouth when looking in, and above the mouth as well. They have sandy sediments eroding out of their mouths and are difficult to access. We have recently explored one of these and found MSA sediments just several centimeters below dune sand.

The cave floor is covered by an undisturbed sand dune deposit (Figure 8). Despite the rarity of lithic material in and around this cave, we expected it to have a rich deposit of archaeological material, for several reasons. First, the cave presents a very agreeable living space: it is warm and protected from the elements. Second, the cave is likely to be very old, and thus could harbor even ESA material. We placed a 1 x 1 m excavation square near the back of the deposit (Figure 6). This appeared to be a likely location where we would miss potential cliff-collapse, but the obvious negative aspect of this placement was the potential for thick dune sands.

Square N204E225

Our excavations in this cave penetrated nearly 2 meters into the deposit (Figure 9) and failed to encounter any dense archaeological deposit, while a thin deposit of 7 flakes were encountered roughly 1 m below the surface. The profile is massive dune sand (Figure 9). The top 50 cm display included that we interpreted as

Figure 8. Site 9 from top of cliff collapse, showing the dune that comprises the surface of the cave, and our excavations near the back.

rock hyrax, as well as moderate stratification caused by these organic inclusions and perhaps some mild horizonation. Below this no stratification was obvious during excavation, but in section very subtle changes in the sands that may represent either temporary surfaces or could be postdeposional features caused by water action.

At 2 m, we deemed any further excavation to be hazardous, and thus terminated the excavation. However, we did probe the base of the square with a soil auger with a 10 centimeter diameter, saving all the materials from the auger for study. The auger did not encounter any obvious archaeological materials, but did strike rock at roughly 1 m below the base of our excavated square. We believe that this rock is likely to be roof fall, as the auger did not go through any zones of debris as one would expect if we were encountering a cave floor that had been exposed to erosion.

SITE 13A: SUMMARY OF THE EXCAVATIONS

This site presents a loose sandy dune against a 2-sided corner in the cliff wall (Figure 10), protected by an overhang in the cliff. The entire dune is within the drip zone of the overhang. The back of the dune against the cliff wall reveals a small

Figure 9. Site 9, square N204E225, south section.

A)

B)

Figure 10. Site 13A (A) from the south showing two locations of cemented dune with MSA lithics (red arrows) and (B) a close-up of the lower cemented dune with lithics.

cave or tunnel that currently is used as a latrine by fishermen and/or other visitors. The cliff wall and overlying ledge are quartzite, some of which is poorly metamorphosed and sometimes even friable. Adhering to the wall in two places is cemented dune sand that includes MSA lithics. There is a sample of this material adhering to the wall just near the top of the dune sands (Figure 10B), and there is another bit of cemented dune adhering to the wall several meters above the sediment surface (Figure 10A).

Just below the surface of the deposit is a narrow ledge of harder sandy matrix, partially stabilized with vegetation. On the ledge are numerous quartzite MSA lithics including points, blades, and cores. There is some patchy dark sediment eroding from the base of the dune near these artifacts that may represent eroding humic archaeological sediment. Below the ledge is a steep slope down to a beach boulder field, and the slope is covered in vegetation. The site overlooks the ocean and receives sun in the morning, but for most of the day the deposit was shaded, and reasonably well protected from wind.

We placed a 1 x 1 m excavation square near the center of the deposit (Figure 11).

Square N69E100

The entire section sampled by our excavations was composed of loosely-consolidated dune sands with human occupation being represented by thin lenses of finds, often with organic material interstratified. We recognized three facies in our excavations, each composed of several thin and horizontally discrete stratigraphic units, including hearths and other organic-rich layers (Figure 12).

At the base of our excavations was a dune sand of coarse undecalcified, light brown to white, poorly sorted sands (*White Sands MSA Facies*). Its thickness is unclear as it continued deeper, yet we terminated excavation because the loose sandy sections became unstable. Artifacts and fossil bone are abundant in lenses of finds that show little or no lithologic distinctions. A rotting roof block lies in this layer in the south-east part of the square, but this could be easily removed with fur-

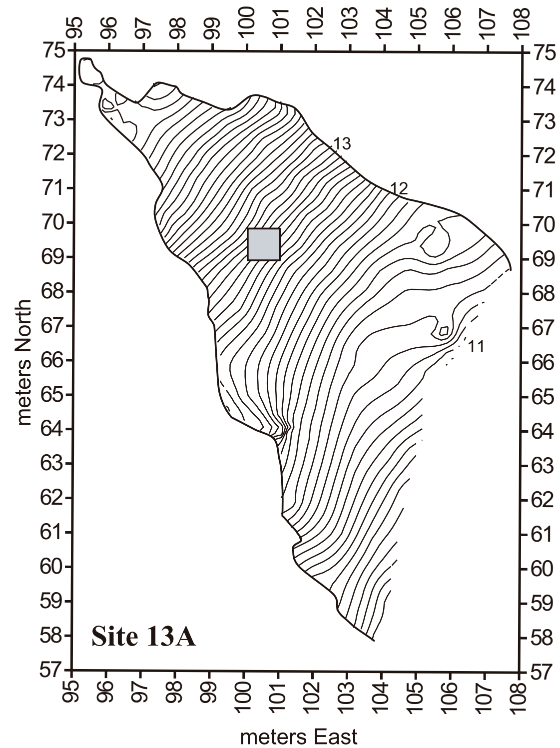


Figure 11. The outline and topography of Site 13A, and the position of the test pit (the grey box). The contours are in meters asl, at 10 cm increments. Orientation is magnetic north.

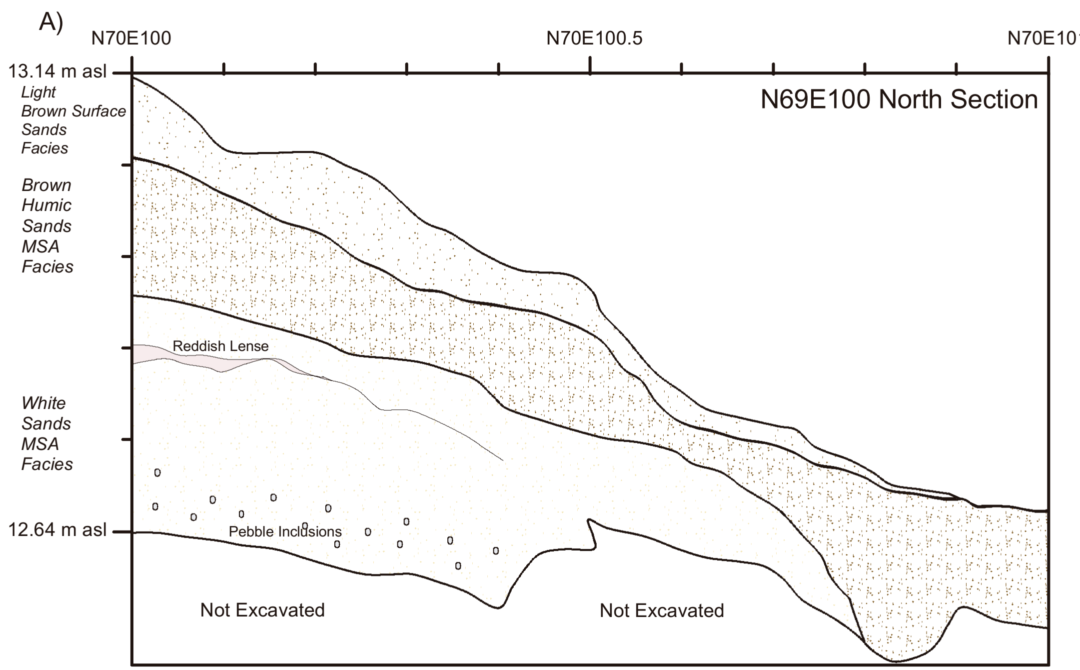


Figure 12. Site 13A N69E100 north section photo (A) and drawing (B).

ther excavation. These sands were dug as 2 separate stratigraphic units (J and K), recognizing a slight change in K to a sand with grayish nodules, very soft, within the sands and increased artifactual content.

The lower white sands grade into a series of inter-bedded brown-humic sand lenses and white-yellow non-humic sand lenses named the *Brown Humic Sands MSA Facies*. This facies ranges in thickness from approximately 10 to 15 cm. Excavators struggled to separate these during excavation and were reasonably successful. These seem to represent events of clean sand deposition (the white-yellow) along with the deposition of humic materials with sand (the brown sand). We also recognized very subtle lenses of burning, most of which are not visible in section, except for the reddish lense in Figure 12B.

The section is capped by a light brown surface sand of very loose and disturbed material called the *Light-brown Surface Sands Facies* that ranges in thickness from 3 to 15 cm. This unit is mostly sterile, and displayed clear signs of disturbance by foot traffic.

SITE 13B: SUMMARY OF THE EXCAVATIONS

Site 13B is a cave (Figure 13) with the circular mouth of the cave facing east and overlooking the ocean. From the back of the cave the mouth resembles a ship's porthole looking out to sea (Figure 13B). The roof of the cave is about 7 m high at the front and narrows as the sediments slope up toward the back. The entire cave has sufficient room to allow a person to walk or crawl except for the few meters at

B)

Figure 12. Site 13A N69E100 north section photo (A) and drawing (B).

the back. The dimensions of the cave are roughly 30 m long by 8 m wide, and it is oriented with its long axis in a roughly East/West direction (Figure 14). The floor of the cave at the mouth is 13 m above the high spring tide mark, and 15 m above mean seal level.

Several layers of quartzite of varying erosional resistance form the cave walls and ceiling. Much of the ceiling quartzite is friable, and seems to be regularly producing roof-spalling. The walls are more heavily consolidated and resistant to erosion. The friable nature of the roof makes this a very active cave, perhaps even reasonably young in age. Some of the cave roof and wall is covered by flow-stone, and small stalactites hang from several locations. On either side of the cave against the cave wall is a lightly consolidated MSA deposit (Figure 14, indicated as LC-MSA) that is capped by a flow-stone that emanates from several joints in the quartzite (Figure 15). This flowstone capped deposit was clearly cut by an erosional event, now leaving an exposed section. We initially recognized four distinct strata in the exposed section on the southern wall, but these are not as clear in the northern sections. Well-preserved and abundant fossil bone and MSA lithics are visible in this section.

The area within 13B is well protected from the elements. We noticed that the cave tended to be warmer inside than outside, and it is currently dry, though there is evidence that it was wetter at times during the past (see below). Winds rarely blew into the mouth, and during even the most intense of storms the inside of the cave was warm, dry, and sheltered from

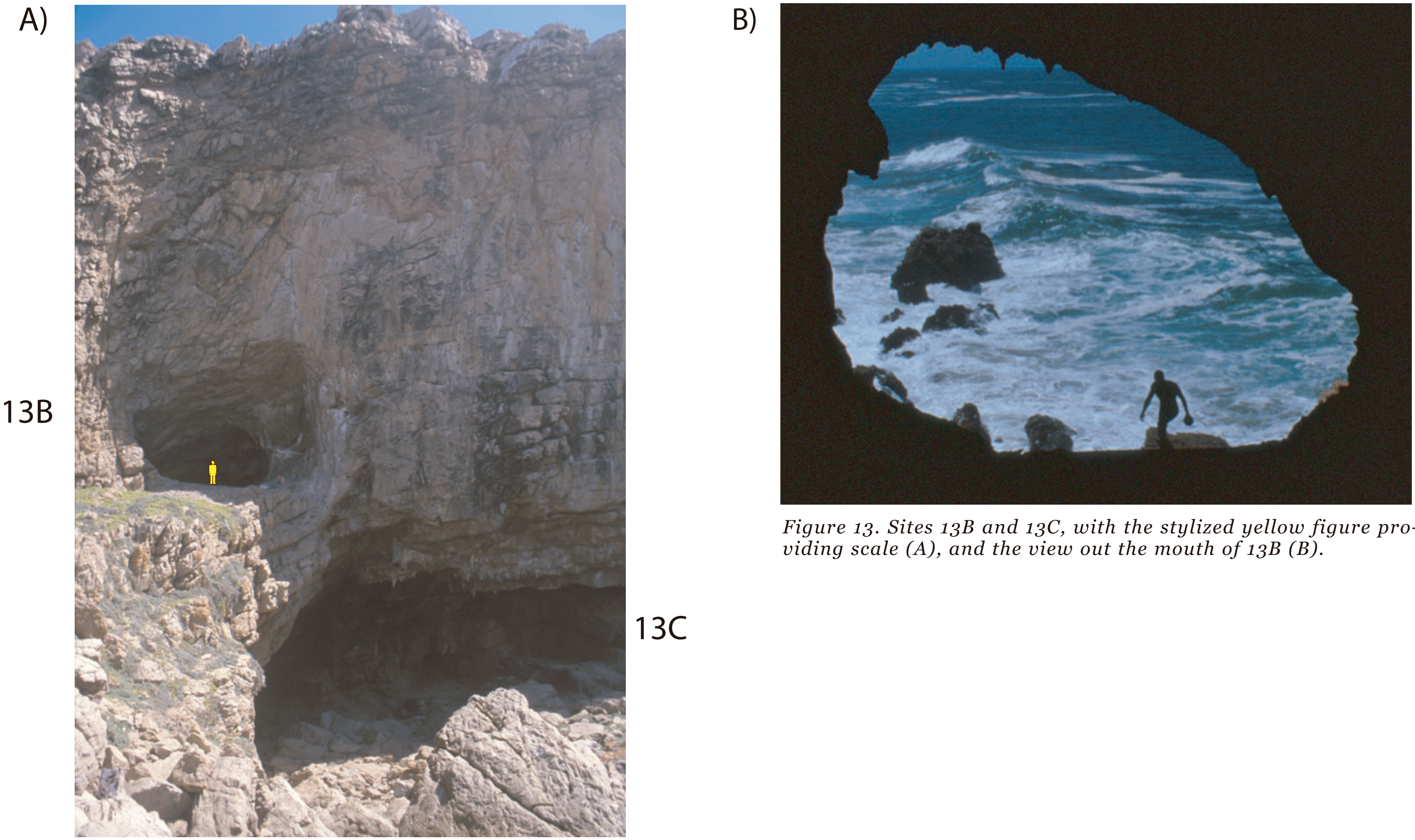


Figure 13. Sites 13B and 13C, with the stylized yellow figure providing scale (A), and the view out the mouth of 13B (B).

the wind. During the mornings the sun shines on the front 25% of the floor for several hours, and then disappears behind the cliffs. Overall, the cave provides a well-sheltered environment.

Our strategy for sampling this cave included testing three areas: front, back, and the side where the exposed section was located (Figure 14). Our excavations in the back at N97E97-N97E96 were placed to sample the area where we believed a thick midden was present, based on the exposure of MSA finds on the surface resulting from a disturbance, likely caused by fishermen using the cave as a camping spot. The initial square (N97E97) intersected this disturbance so as to evaluate the damage, and we extended it 50 cm to the west (N97E96, eastern quadrants) to get a better sample of the rich MSA layer. Our excavations in the front of the cave (N91E108) were placed in a fairly level area that looked suitable for domestic activities; currently fishermen that use the cave build their fires in this area. We decided to sample the LC-MSA by placing an approximately 50 x 50 cm square into the exposed section.

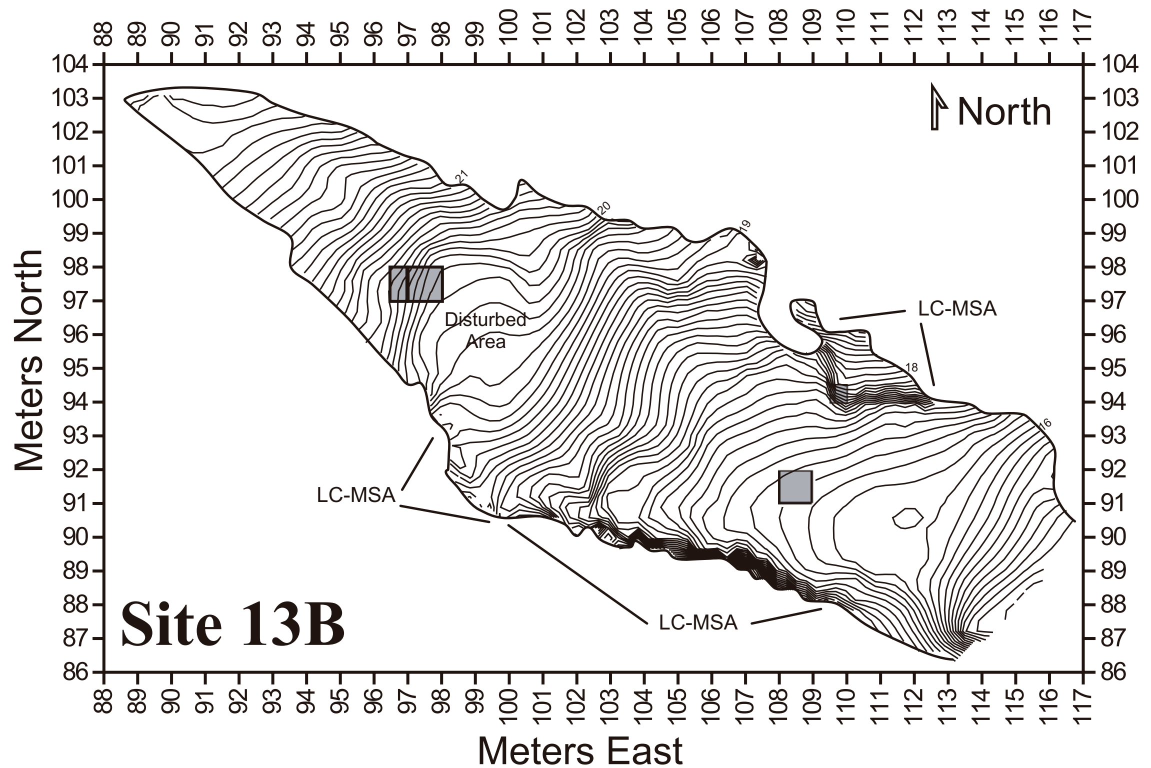


Figure 14. The outline and topography of Site 13B, and the position of the test pits (the grey boxes). The contours are in meters asl, at 10 cm increments. LC-MSA is the lightly consolidated MSA deposits. Orientation is magnetic north.

Square N97E97 - N97E96

Excavations in this area provided the longest section, but dense MSA remains were found only in the top layers (Figures 16 and 17). Water-worn boulders line the base of the excavated area, and we have labeled it the *Boulder Facies*. Spaces between the boulders are filled with very loose silty sediment, and in some cases there are empty holes between the boulders. There are also some empty spaces between the boulders and the base of the sections, perhaps indicating that the tops of the boulders are still an active point of erosion. The loose sediment between the boulders includes some roof-fall up to 20 x 20 cm that is not water-worn but exhibits a thin coating of clay, sometimes patchily adhering to the roof-fall. We found rolled fossil bone in this loose sediment, and some of it was bird. In antiquity, it is likely that there was a very active, high-energy stream running through the cave, as indicated by the large water-worn boulders, or else the worn boulders represent a very high sea stand.

The Boulder Facies is capped by sediments that continue approximately 1 m up the section and are named the *Laminated Facies*. This is a predominantly sterile zone of grayish-brown silty sediment with thin multiple laminae of sand (Figure 16 and 17). The few finds from these units were small, polished, pieces of fossil mammal bone, and there was very little roof fall in these units. The laminated sediment is clearly the result of water activity, and we currently are analyzing it to establish the precise process of deposition.

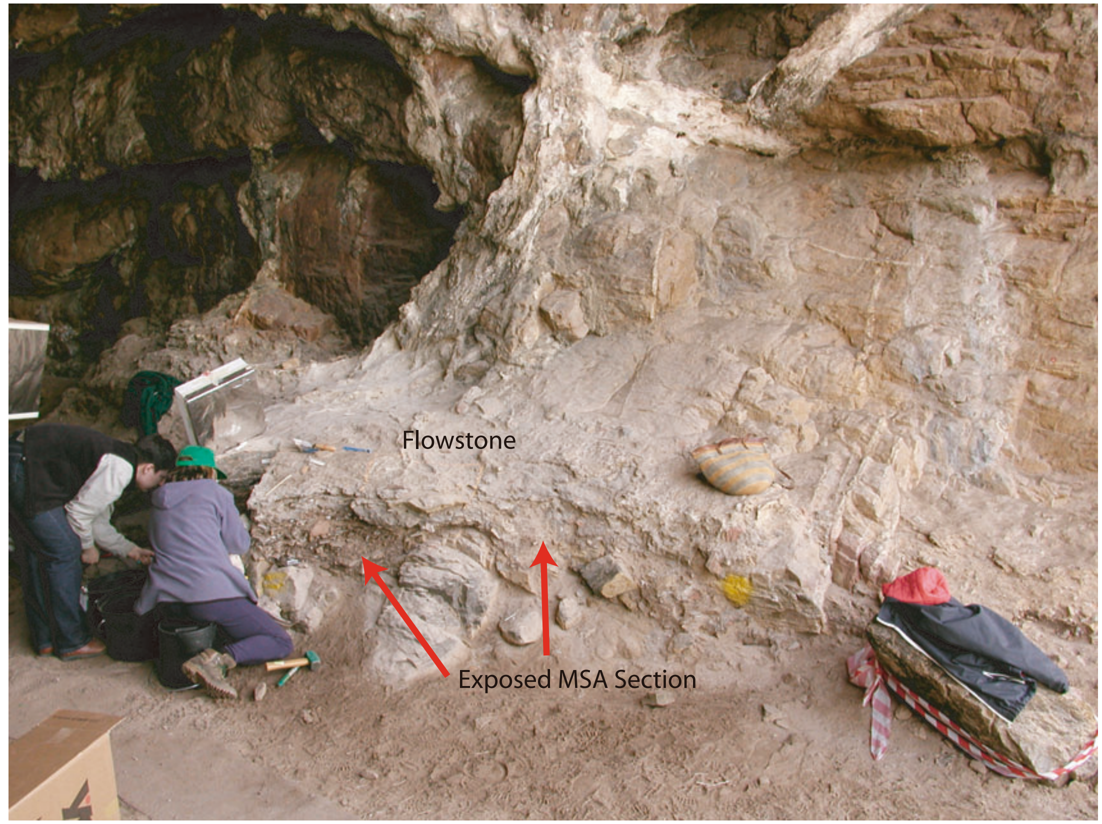


Figure 15. The flowstone on the north-east wall of site 13B capping the MSA deposit (LC-MSA), the MSA section eroded and exposed by natural erosional processes, and the location of our test excavation into that section.

The *Laminated Facies* is overlain by yellowish sediments with some stringers of brown organic material, the lower half of which displays randomly oriented roof spall. When first encountered, we interpreted this to be an erosion gulley cutting into the Laminated Facies, and named it the Erosion Gulley Facies. However, the

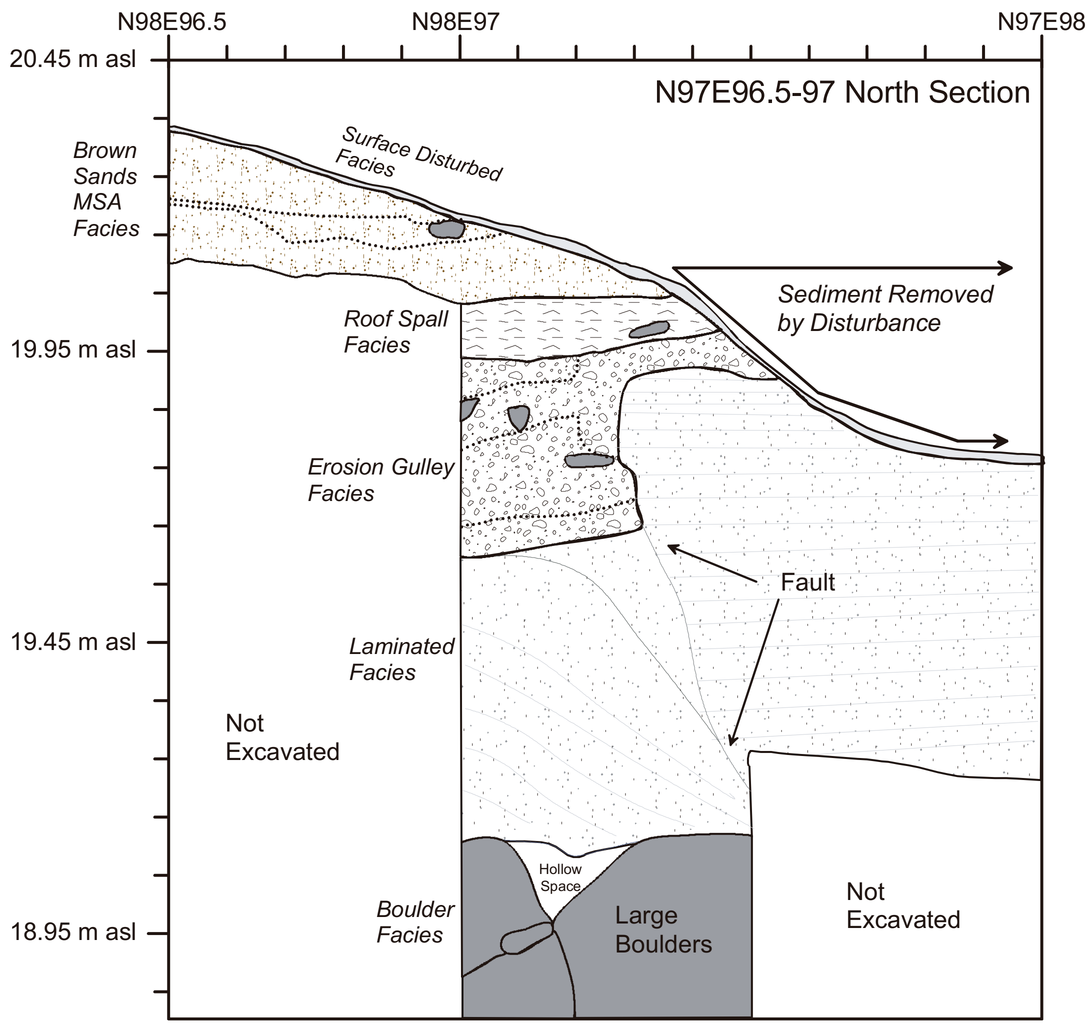


Figure 16. Section drawing for the northern section of N97E96.5 and N97E97, site 13B.

Laminated Facies displays a clear fault in the north section (Figure 16 and 17). This fault resulted in substantial (> 30 cm) downward vertical displacement of the western Laminated Facies sediments, as well as some sediments that overlie the Laminated Facies. Thus, the intrusive-appearance of the Erosion Gulley Facies may in fact be entirely due to the fault, with the layer above infilling the post-fault depression caused by the subsiding sediments. For now, we will retain the Erosion Gulley Facies since it has some features characteristic to water action, and in fact erosion may have followed the slope dip caused by the subsidence.

A yellowish layer of decomposing roof spall (the *Roof Spall Facies*) overlies the Erosion Gulley Facies, and postdates the fault as it is not cut by it. It averages about 10 cm thick. This layer is sandy quartzitic debris that resembles the surface sediment covering the back of the cave, but is finer grained. Only one burnt lens (WF) occurs within this facies.

Overlying this predominantly sedimentary set of facies is a more anthropogenic

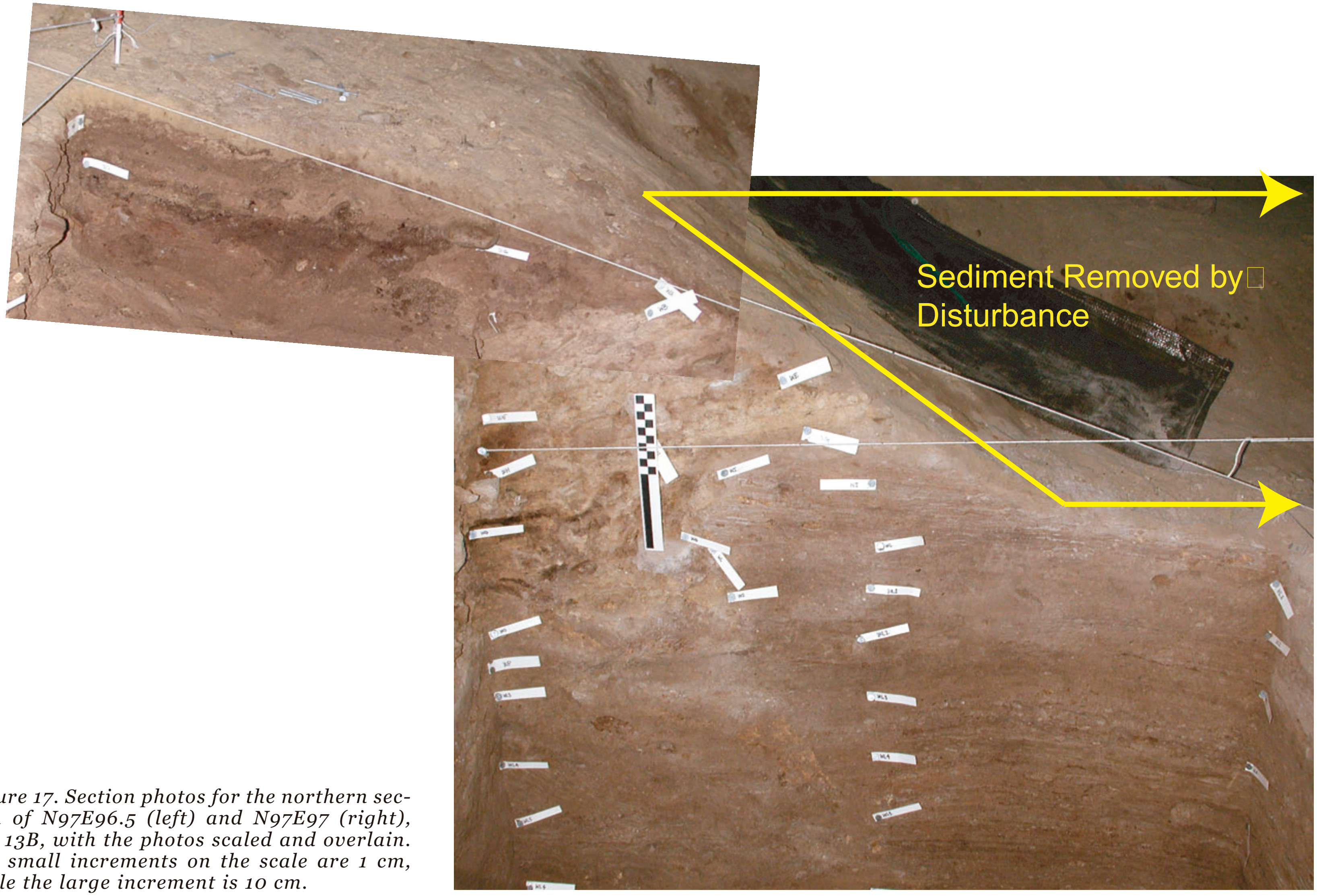


Figure 17. Section photos for the northern section of N97E96.5 (left) and N97E97 (right), site 13B, with the photos scaled and overlain. The small increments on the scale are 1 cm, while the large increment is 10 cm.

facies named the *Brown Sand MSA Facies* that ranges in thickness from 3 to 20 cm. This is an organic-rich, black to dark brown, sandy sediment rich in lithics and fauna. In N97E97 we encountered a thin and horizontally restricted layer of this facies (named WB) that projected just 30 cm into the square. The rest had been removed by the recent disturbance, which cut all the way into the top of the Laminated Facies (Figure 16 and 17). In the west section of N97E97 WB appeared thin and homogeneous. To sample WB better, we extended our excavation with two 50 cm quads to the west into N97E96. As we excavated west, WB thickened and increased in complexity (Figure 16 and 17). Several discrete lenses became visible, some of which appeared in the west section of the 2 newly excavated quads. While dark, they do not appear to be hearths, but may be organic-rich dumps of material. This facies appears to extend far into the back of the cave, as it is visible under a small block of roof fall to the west of our excavation.

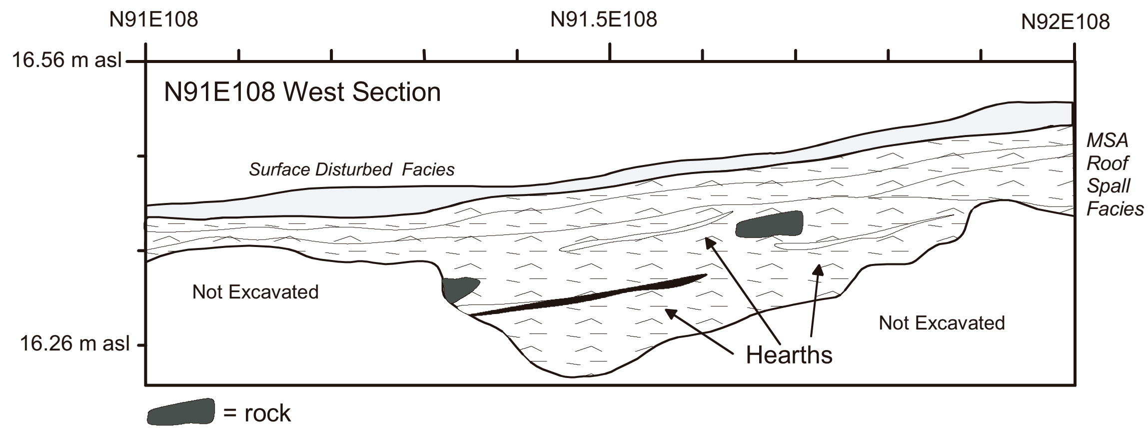


Figure 18. Section drawing for the western section of N91E108, site 13B.

Capping this rich MSA facies is a final layer of roof spall called the *Surface Disturbed Facies*. This material is coarse with sandy yellow roof detritus, and ranges from 2 to 4 cm thick.

Square N91E108

The base of this square is a clast-supported matrix of small (1 cm and smaller) roof spall with fresh edges, variably cemented and uncemented, called the *MSA Roof Spall Facies*. We do not know the thickness since we did not excavate to its full depth. Uncemented zones were excavated and appear as valleys in the floor of the square between the cemented zones. Stratified within this matrix are small, thin, well-preserved hearths with lithics and fauna laying in and beside the hearths (Figure 18 and 19). The hearths, as shown in close-up digital photography (Figure 19B), have discrete bands of ash, charcoal, and baked (reddish-brown) sediment. We expect these hearths to continue in all directions, as they are clearly visible in section.

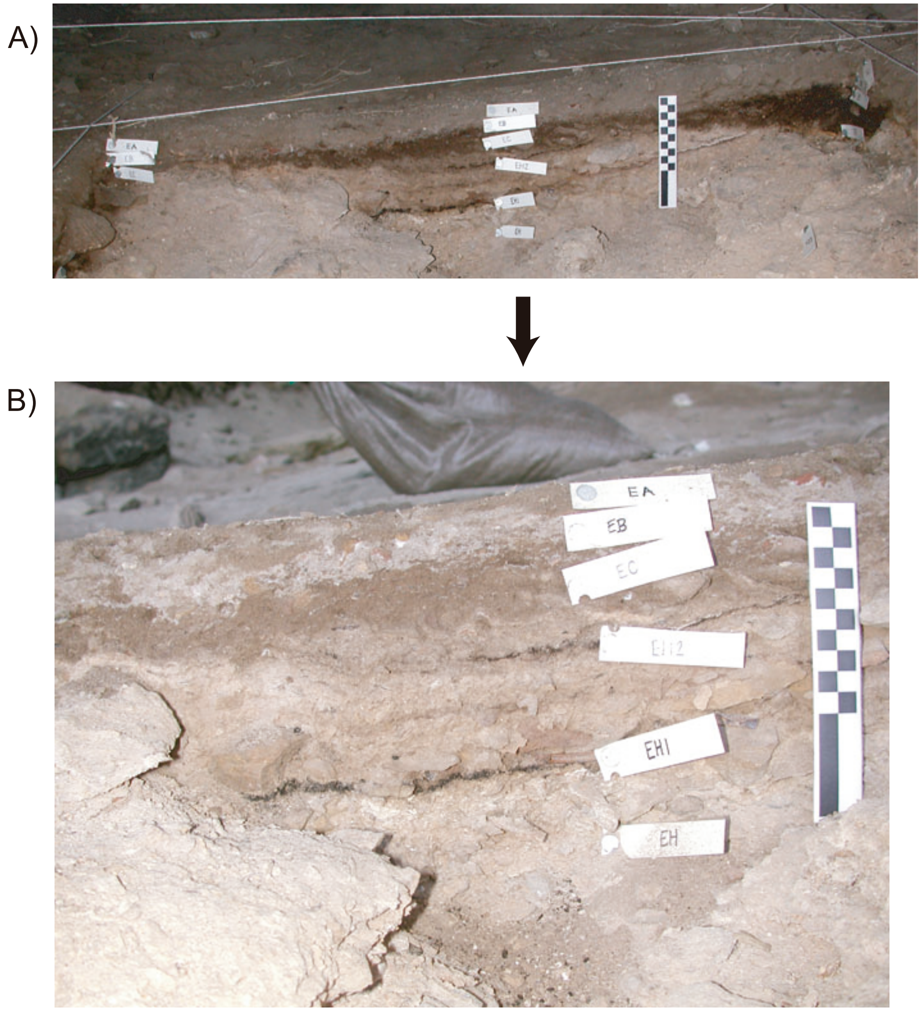


Figure 19. Site 13B N91E108 west section photo (A) and close-up photo of hearths (B). The small increments on the scale are 1 cm, while the large increment is 5 cm.

A very thin surface material of wind-blown dusty sediment and roof spall overlies the MSA Roof Spall Facies, includes signs of recent burning, and is called the *Surface Disturbed Facies*. It ranges from 2 to 5 cm thick.

Square N94E109

The excavation of N94E109 was complicated by the cement-like flowstone capping the archaeological horizons, and the semi-cemented nature of the deposit. We used an angle-grinder to cut through the flowstone, and lifted it off, and it separated reasonably cleanly from the underlying archaeological sediment. Slow careful excavation with metal tools allowed us to excavate the semi-cemented archaeological horizons sufficiently cleanly to allow stratigraphic excavation and 3-D plotting of the finds.

The main part of the section is grouped as a single facies, despite the fact that it has multiple lenses of material that were excavated as separate stratigraphic units (Figures 20 and 21). The *Lightly Consolidated MSA Facies* has multiple layers of burning and organic deposition clearly visible in photography, and ranges in thickness from 20 to 35 cm. Lenses of burnt material may represent hearths, and they are often associated with burnt fauna, lithics, and ochre (for example, NEJ at the base of the section, Figure 21). The entire section is partially cemented with calcium carbonate, and gypsum occurs as lenses, nodules, and pipes running into the section, the latter likely to be gypsum infillings of holes left by tree roots that once snaked through the section.

Capping this anthropogenic facies is a mostly sterile facies of

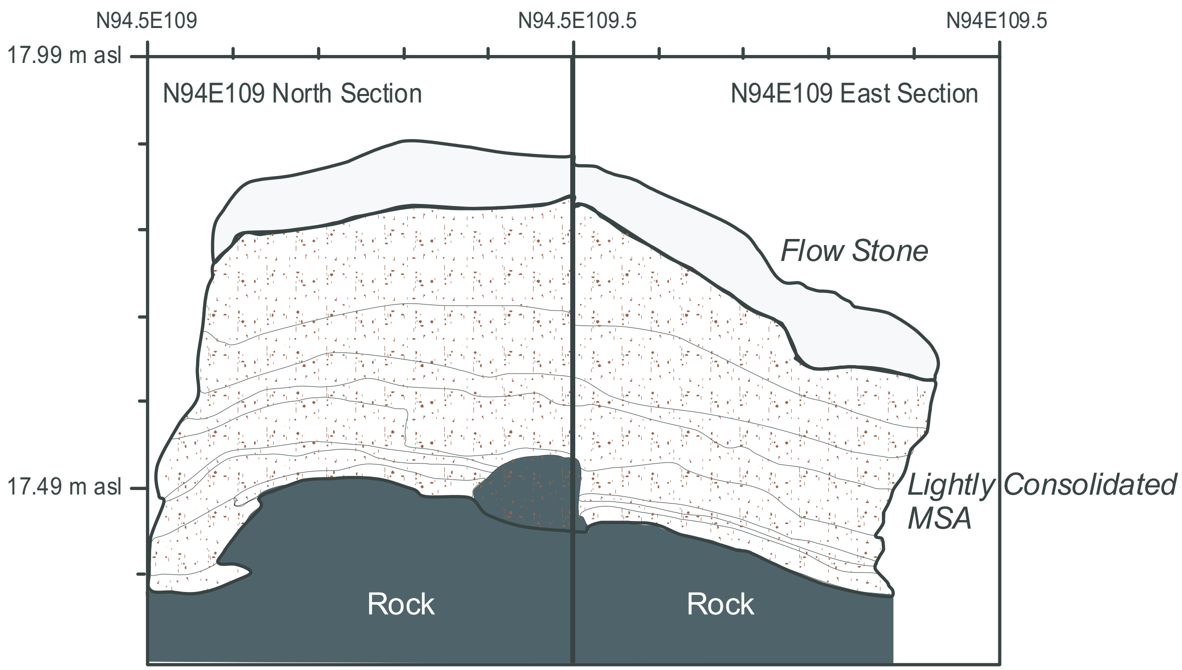


Figure 20. Site 13B N94E109 north (on left) and east (on right) section drawing.

very hard flowstone (5 to 10 cm) that has seeped down from fissures in the quartzite above named the *Flowstone Facies*. It does include a few lithics and fossil bone, but these are likely in secondary context. The flowstone appears to have multiple events of flowstone deposition. As noted above, there is also a flowstone on the south-west wall of the cave that caps an archaeological horizon. It is possible that these two flowstones once connected, capping an LC-MSA deposit that covered the entire cave floor, and was subsequently eroded out.

PRELIMINARY SEDIMENTARY HISTORY OF THE THREE SITES

There is a fairly clear sequence of sedimentary, erosional, and anthropogenic processes that are evident in all three caves that we believe can be cross-correlated to some degree. The lack of LSA remains suggests all anthropogenic activity is MSA. As will be clear below, we believe that the series of caves and shelters between 13A and 13C are all part of a complex that have shared depositional and formational histories, and henceforth we use the term “site 13 cave complex” to refer to them collectively. Below we summarize this sequence as we now understand it, and suggest some tentative chronometrically meaningful correlations to the OIS system. Many of our preliminary interpretations below are based on our current observations wedded to other recent stratigraphic and chronometric results from other coastal caves such as Die Kelders Cave 1 (Marean et al., 2000) and Blombos (Henshilwood et al., 2001; Henshilwood et al., 2002). Forthcoming radiometric dates for the sites will allow us to check our correlations and tie these sequences to the OIS and sea level sequence.

The site 13 cave complex, along with site 9, shows substantial evidence for dune formation, dune cementation, non-

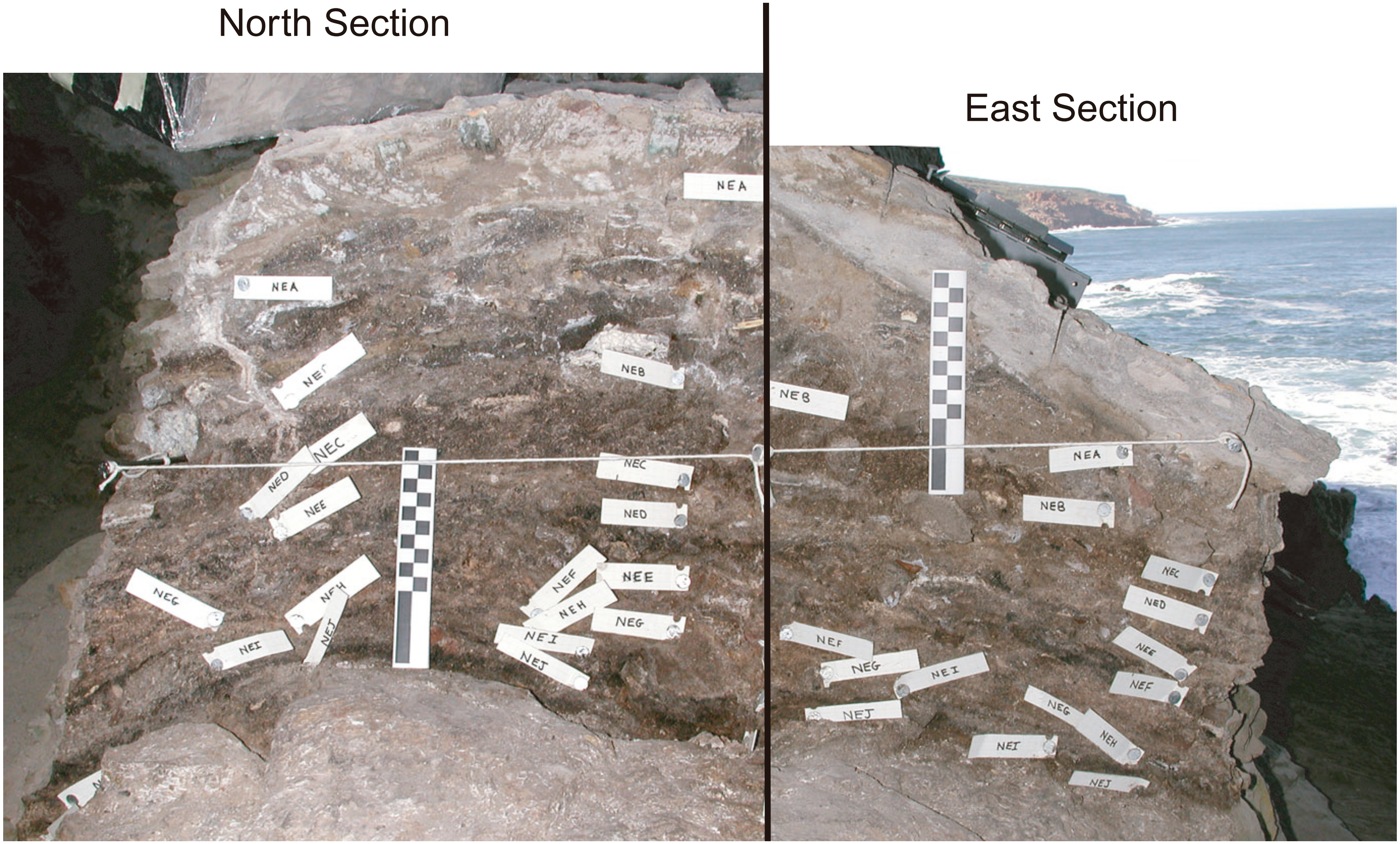


Figure 21. Site 13B N94E109 north (on left) and east (on right) section photos. The small increments on the scale are 1 cm, while the large increment is 5 cm.

dune sediment deposition (often dominated by roof exfoliation mixed with anthropogenic formation), flowstone formation (often capping dune and non-dune surfaces), cementation of MSA material to the cave walls and cliff face, and subsequent erosional episodes. Just east of 13A we have mapped a set of cemented dune deposits (with MSA lithics) clinging to the cliff face that also extend into a very shallow and high cave above 13A that lacks any deposit on its floor. Our analyses of the elevational data show that the flowstone and dune surfaces of the cemented material in 13B stands roughly at the same elevation as the highest cemented material in 13A and the cave above. It seems likely that these calcite formations represent a related event of discharge of carbonate charged water from the surrounding quartzite that in some cases cemented MSA deposit to abutting cave and cliff wall (13A and 13B) and in other areas formed a flowstone capping that same MSA deposit (13B at N94E109).

Thus, we think it likely that the site 13 cave complex once held a connected set of MSA deposits that wrapped around the cliff walls, penetrated into the various caves and shelters, and likely spilled far down the current slope toward the ocean. Remnants of this set of deposits is preserved as the LC-MSA Facies in 13B (N94E109), as well as in the small and generally isolated sets of MSA cemented deposits adhering to the cave and cliff walls in and around 13A and in 13B. We think it likely that this set of deposits dates prior to OIS5e. One explanation for their current eroded state is that rising sea levels of OIS5e cut and undermined this massive set of deposits. Wave action eroded away the exposed deposits on the slope, ripping out much of the sediments from the cave mouths, assisted possibly by stream action (the large cobble-layer named the Boulder Facies at the base of N97E97), arising from the generally greater rainfall (Deacon & Lancaster, 1988) during OIS5e times. The remnant MSA deposit owes its survival to being cemented to adjacent walls by calcite deposition near the walls.

Some of the lithics in the lag deposit of 13C may be the remnants of this eroded LC-MSA. In favor of this hypothesis is the fact that MSA artifacts are currently eroding out of the 13B cave mouth above the seaward end of the lag deposit in 13C. Against this hypothesis are several facts. First, some of the lag deposit occurs under 13B and to the north, and if these were from 13B then they must have been washed back (west) into 13C and north. However, many of these lithics are fresh and show no signs of water polishing. Second, there is a substantial deposit of material in the back of 13C, and MSA lithics are eroding out of this deposit, so this may also be a source of lithics for the lag deposit. And third, the erosional event must be very ancient, and this means that the lithics would have been on the surface of the beach for a very long time. While some lithics show water polishing, the majority have sharp, unrounded edges.

Following this erosional event (OIS5) was a period of deposition resulting from a combination of aeolian, possibly fluvial (ground water seepage) transport of silty sediments as evidenced by the laminated sediments in N97E97 in 13B, and anthropogenic processes. The laminated sediments in 13B may have been cut by erosional events of stream activity emanating from the back of the caves, though these sediments were clearly faulted. The lack of dune deposits in 13B suggests that dunes were vegetated and inactive during this time, and/or that 13B was sealed during the time that dunes were active on the coastal shelf. A period of fine-grained roof spalling terminated the formation of laminated facies, after which MSA people reoccupied the cave and anthropogenic sedimentation once again became a major contributor. The occupation in the back of 13B appears to include only one event of unknown duration, as indicated by the vertical distribution of lithics. Figure 22 plots the lithics from the most northerly 25 cms of the excavated area: this is done because the deposits slope strongly to the south-east, and plotting all would falsely represent their vertical distribution. As is clear, there appears to be a single horizon of lithics that begins at the top of the Brown Sands MSA Facies, then scatters downward, with substantial vertical displacement in the fault zone.

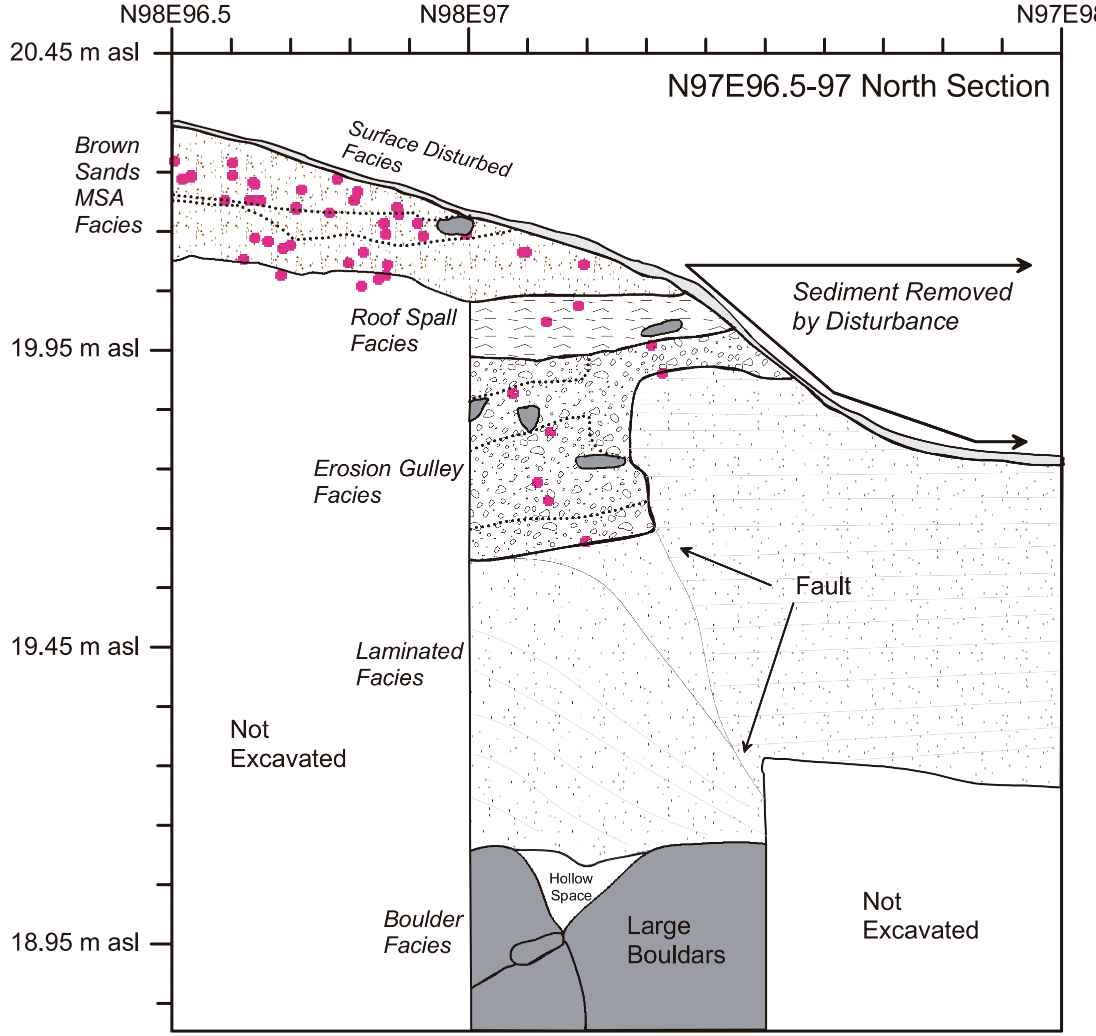


Figure 22. Site 13B northern section of N97E96.5 and N97E97, with lithics from the most northerly 25 cms in purple.

We believe the front of 13B was utilized for domestic tasks, as indicated by the hearths in N91E108. Artifact production and mammal-bone processing occurred in this area. The back of the cave seems to have been used as a midden, as represented by the Brown Sand MSA Facies. It is possible that this stage of sediment deposition is represented by the darker sediments eroding out below the dune in 13A, but not reached by our excavations, and we think it likely that the dune hides a much deeper, buried cave that extends farther into the cliff wall, and may be partially filled with sediment.

The dunes in 9 and 13A document a period of active dune formation. Both sites were occupied, 9 only sporadically and 13A more regularly. 13B was not occupied, nor did dunes blow into the site, suggesting that the cave may have been sealed. We believe it likely that this period of dune formation dates to OIS4 or 3, as it does at Die Kelders Cave 1 (Mareant al., 2000) and Blombos (Henshilwood et al., 2002). A dune blew into site 9, fairly rapidly, as suggested by the massive and homogenous nature of the profile. The protected nature of the cave retarded any wind erosion of the sands, which subsequently stabilized in the cave. The resistant and dry nature of site 9 minimized any further sedimentary processes, and there was little diagenetic modification of the profile. A shallow dune also blew up against 13A, which was more exposed and subject to erosion. Sedimentation and erosion was interspersed with occupation as indicated by the White Sands MSA Facies and the Brown Humic Sands MSA Facies. Both sites 9 and 13A were then abandoned for a substantial period of time, with further dune sand formation capping the deposit. There was no LSA occupation at any of the sites.

DESCRIPTION OF THE LITHIC ASSEMBLAGES

The following section provides a description of the MSA lithics found at 13A and 13B during the 2000 excavation season, as well as a sample taken from the lag deposit in 13C. Figures 23 though 26 illustrate complete specimens that were chosen for illustration for being representative of the major categories discussed below, and Appendix 1 lists the details of those specimens. The sample from 13C includes 2 randomly placed 50 cm x 50 cm squares, with 100% collection in those squares. An attempt is made here to provide both a typological and technological review of the samples from each stratigraphic aggregate, as described above, as well as to examine any broader differences that may exist between 13A and 13B. We also discuss the nature of the lithic assemblages relative to the definition of the "Mossel Bay Industry" (sensu Goodwin 1930). The small sample of 7 lithics from site 9 is not described.

Raw Materials

At 13A and 13B the predominant raw material is quartzite, generally fine-grained, that varies in color from light grey (Figure 23A-F), dark grey, light brown (Figure 23G,H), to red. Quartz, crystalline quartz (grouped with quartz for this analysis), and the local cave quartzite (a coarser material than the preferred fine-grained quartzite) are used to a lesser degree, while silcrete, crypto-crystalline silicates (includes chert and chalcedony), and hornfels are less commonly used (Figure 27). At many MSA sites including Klasies River (Singer & Wymer, 1982), Nelson Bay Cave (Volman, 1981), DKI (Thackeray, 2000), and Montagu Cave (Keller, 1973) there is a visible change in the frequency of fine-grained versus course grained raw material represented in the stratigraphic column. Often a shift towards fine-grained raw material use, and especially silcrete, has been equated with the Howiesons Poort Industry (Thackeray, 1992). There is no obvious change in raw material frequency percentages between stratigraphic aggregates at 13A and 13B. However, the Brown Humic Sands MSA Facies of Cave 13A does appear to have a slightly greater percentage of silcrete when compared with other aggregates, as well as a high diversity of raw materials (Table 1, Figure 27). An increased sample might produce a more striking pattern.

We initiated a lithic raw material survey in 2000 targeted toward developing an understanding of both primary and secondary raw material sources. Raw material and its transport has figured prominently in discussions of the MSA of South Africa (Ambrose & Lorenz 1990; McBrearty & Brooks, 2000), yet there are no systematic studies of raw material distributions. Despite this, silcrete is often classified as "exotic" (e.g. Ambrose & Lorenz 1990). We have initiated a survey to locate and sample possible source locations for major categories of utilized raw materials and we are testing several noninvasive methods to chemically fingerprint the sources. We have been seeking to find and charac-

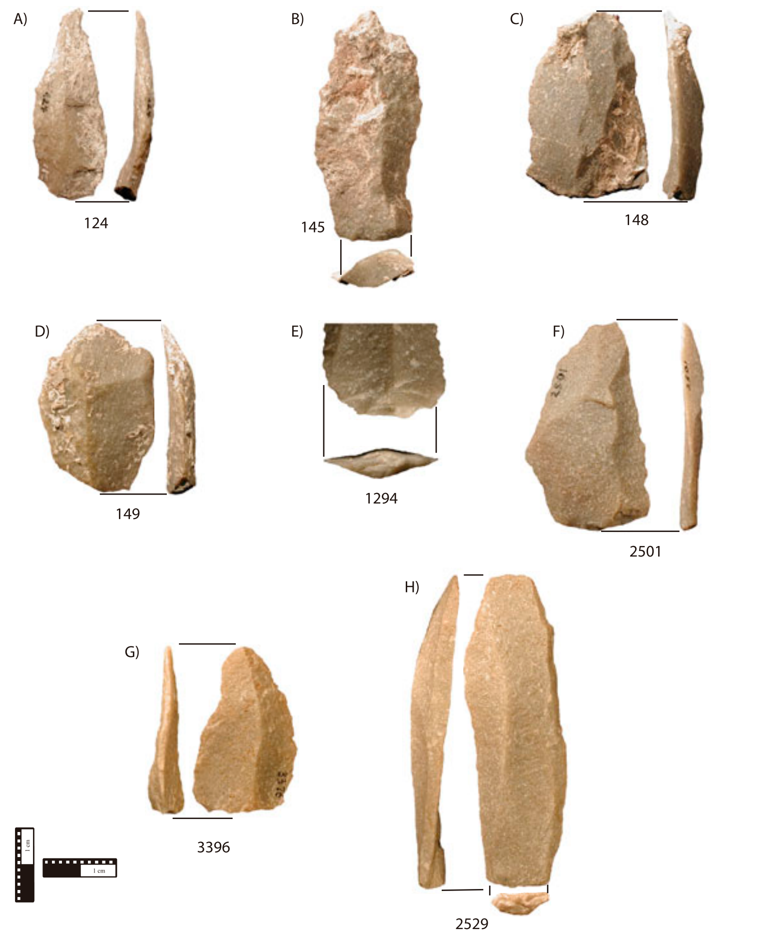


Figure 23. Photographs of lithics from sites 13A and 13B. All are dorsal view unless otherwise indicated: A) convergent blade, B) quadrilateral blade with view of butt, C) flake, D) flake, E) proximal fragment with view of butt, F) point, G) point, and H) quadrilateral blade. The number next to the lithic is its MAP specimen number. Additional information may be found in Appendix 1.

TABLE 1: THE COUNTS OF RAW MATERIAL TYPES IN THE SITE 13 CAVE COMPLEX LITHIC SAMPLES.

SITE NAME	STRATIGRAPHIC AGGREGATE	QUARTZITE	QUARTZ	TMS	SILCRETE	CCS	HORNFELS	OTHER	GRAND TOTAL
13A	Brown Humic Sands MSA Facies	93	2	2	10	1	4	2	114
	White Sands MSA Facies	28		4	1				33
13A Total		121	2	6	11	1	4	2	147
13B	Surface Disturbed Facies	5							5
	Brown Sand MSA Facies	54	14	8		2	1	2	81
	Roof Spall Facies	1							1
	Erosion Gulley Facies	3							3
	Laminated Facies	1		2					3
	MSA Roof Spall Facies	110	6	13	6			1	136
	Lightly Consolidated MSA Facies	134	23	5	4	2	1	1	170
	13B Disturbance Sample	76	2	9	4	1			92
13B Total		384	45	37	14	5	2	4	491
13C Total	Lag Deposit Sample	98	5	5	3	1	4	4	120
Grand Total		**603**	**52**	**48**	**28**	**7**	**10**	**10**	**758**

terize sources that are both primary (sources in their original formation location) and secondary (transported by natural processes).

Initial efforts to find secondary sources focused on the silcrete rich Grahamstown formation of the Bredasdorp geological group (South African Geological Series 3420 1993; 3422A 1993) at the confluence of the Gourits and Drour Rivers some 12-15 km NE of Pinnacle Point. This location was chosen as being an area that would naturally concentrate silcrete and quartzite cobbles of the Bredasdorp and Table Mountain Groups respectively. A survey of the Gourits River resulted in the collection of three silcrete cobbles of variable quality within a period of about onehour. The beach also contained quartzite and quartz cobbles as well as shale and mudstone. A survey of the Drour River (an ephemeral streambed that was dry at the time of our visit) discovered a much higher concentration of silcrete and it was possible to locate relatively high quality cobbles and pebbles within a few minutes of searching. The survey encompassed approximately 3-4 linear kilometers and turned up not only silcrete and quartzite cobbles and pebbles, but also some small golf ball-size chert and hornfels pebbles. In general, the higher quality fine-grained materials occurred in smaller nodules.

Primary context silcrete and fine-grained quartzite deposits are located within 10km of Pinnacle Point. A silcrete outcrop of the Grahamstown Formation located on a ridgetop above the R327 road near Hartebeeskuildam, some 9-10 km from Pinnacle Point was visited. Silcrete here is of moderate to good quality, and several samples were collected. One such sample is virtually identical in terms of matrix and cortex appearance, color, and texture to a small piece of silcrete debitage found in 13B. High quality quartzite similar to the buttery and dark grey quartzites found in the Pinnacle Point samples are located 7 km to the east at Mossel Bay, outcropping at the Mossel Bay point near Cape St. Blaize Cave, and extending beneath the surface of the Indian Ocean. In several locations below the cliffs there are a variety of secondary quartzite sources in the form of beach cobbles. Along the cliff tops there are raised beaches with quartzite cobbles along with several scatters of MSA lithic debris that may suggest these were a source for raw material. While the caves of the site 13 cave complex are in quartzite, this coarser material fractures erratically and does not seem to have been a preferred raw material. We do not know of any other potential sources for the other raw materials.

An examination of cortical debitage can give some indication of the primary or secondary depositional nature of the raw material source location. Three types of cortex were noted and recorded: cobble cortex, outcrop cortex, and rind cortex. Cobble cortex is smooth, very round, sometimes dimpled, and is often of uniform shade and color. Outcrop cortex is generally more rough, irregular, and varied in shade and color. Rind cortex is the chalky matrix that often surrounds silcrete nodules, and is found on silcrete from both primary and secondary contexts. Most of the complete quartzite cortical flakes at Pinnacle Point have cobble cortex (Table 2, Figure 24A, 28). Silcrete cortical flakes are of both cobble and rind type. The majority of the CCS, hornfels, and other raw materials have cobble type cortex. This suggests that while some of the raw materials are coming from a primary context, most, including many of the more fine-grained raw materials, are coming from a secondary high-energy context. Source locations for such cobbles would include a storm beach at a river mouth, an active riverbed or streambed, a raised beach, or a geologically uplifted riverbed deposit.

This limited survey and analysis demonstrates that the major categories of raw material used during the MSA for flake production can still be found within

10-15 km of the Pinnacle Point, in both primary and secondary contexts, but that secondary contexts were preferred. There could be submerged raw material sources in the vicinity of the caves that would have been available to MSA hominins. Future surveys will focus on the nearby Gourits, Grootbrak, and Kleinbrak river mouths, and surrounding river terrace deposits as well as outcrops of the Bredasdorp and Table Mountain Groups.

Technology and Typology

The total sample of plotted lithics from the 2000 Pinnacle Point excavations consists of slightly more than 600 pieces. While there is much more material in the sieved and unplotted sample, it is small (generally < 1 cm) and fragmented. The largest excavated samples from 13A come from the Brown Humic Sands Facies, and at 13B from the Brown Sand MSA Facies, MSA Roof Spall Facies, and Lightly Consolidated MSA Facies (Table 1). The vast majority (95%) of the lithic artifacts in all aggregates are unretouched pieces: flakes, blades, points, flake and blade fragments,

TABLE 2: THE FREQUENCY OF CORTEX TYPES FOR COMPLETE PIECES IN SITE 13 CAVE COMPLEX LITHIC SAMPLES.

SITE NAME	STRATIGRAPHIC AGGREGATE	COBBLE	OUTCROP	RIND	NO CORTEX	GRAND TOTAL
13A	Brown Humic Sands MSA Facies	18	3	0	32	53
	White Sands MSA Facies	2	1	0	10	13
	13A TOTAL	20	4	0	42	66
13B	Surface Disturbed Facies	10	1	0	29	40
	Brown Sand MSA Facies	20	1	0	41	62
	Roof Spall Facies	0	0	0	2	2
	MSA Roof Spall Facies	0	0	1	0	1
	Lightly Consolidated MSA Facies	18	2	0	25	45
	13B TOTAL	48	4	1	97	150
13C	Lag Deposit Sample	13	2	1	19	35
ALL	**GRAND TOTAL**	**81**	**10**	**2**	**158**	**251**

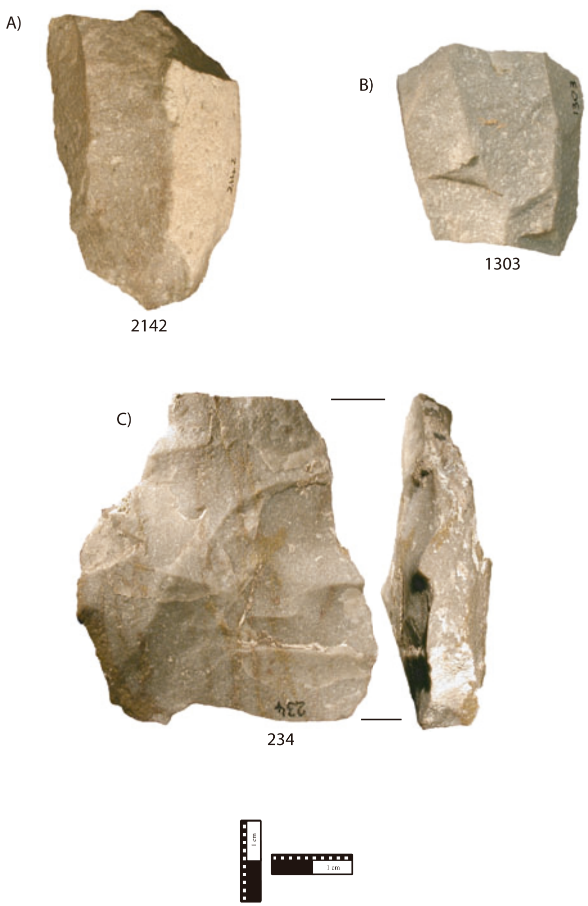


Figure 24. Photographs of lithics from sites 13A and 13B. All are dorsal view unless otherwise indicated: A) cortical flake, B) multiple platform core on flake, and C) disc core with side view. The number next to the lithic is its MAP specimen number. Additional information may be found in Appendix 1.

and chunks/block shatter. Retouched pieces (.76%), cores (2.5%) and hammerstones (1.4%) are far less frequent. Complete pieces (flakes, points, blades, and indeterminate pieces with only minor damage) account for 33% of the unretouched sample. Our analysis will focus on the unretouched complete pieces due to the small size of the retouched sample.

All stratigraphic aggregates show a similar pattern where flakes dominate, followed by blades and then points (Table 3, Figure 29). Cortex is common (37%) on the complete piece sample. Primary pieces (67-100% cortex coverage) are present in all complete piece samples greater than 10 pieces, suggesting that primary reduction occurred to some extent in all of the major stratigraphic aggregates. All aggregates with reasonable samples show a similar pattern: the representation of non-cortical pieces dominates, with a steady decrease in frequency as the cortex covers more area (Table 4, Figure 30). We also coded all lithics with a slightly modified version of Geneste's (1988) techno-typology for Middle Paleolithic stone tool assemblages. The vast majority of both whole and fragmented pieces fall into Stages 1 (21%) and 2 (54%) of the techno-typology system, suggesting a dominance of the early stages of manufacture, a result consistent with the cortical flake frequencies noted above.

We coded platform type following Thackeray and Kelly (1988:24) with the addition of the simple facetted category to describe flake platforms with one to two faceting scars. Plain platform (Figure 23B, 25E) pieces dominate the sample as might be expected, with a smaller number of flakes and blades with facetted (Figure 23E, 23H, 25A, 25C, 26A), dihedral, simple facetted, crushed, and cortical platforms (Table 5). The dorsal scar pattern on complete flakes and blades demonstrates that most of the complete debitage is produced with parallel (36.4%) and convergent (24.4%) flaking with a small percentage produced using radial flaking (4.2%) and other methods.

Cores are rare but are more numerous than retouched pieces. There are a total of 20 cores, of which 16 are complete. The majority of all cores are produced on quartzite and quartz. Core classification follows Volman (1981). Disc cores (Figure 24C, 26D) make up nearly half of the core sample (9), followed by single platform (4, Figure 26E), and multiple platform cores (2, Figure 24B is one on a flake). Other core types represented include conical, convergent, core-on-flake, and minimal cores. Over half of the cores have some percentage of cortex on their total surface. The direction and orientation of negative flake scars on the core surface give some idea of flake production technique. Radial flaking is the predominant core preparation method followed by unidirectional parallel flaking and multiple direction flaking. This is interesting in light of the fact that most of the complete flakes show parallel and convergent flake preparation. It appears that in their final stage of reduction, a large number of cores are flaked radially before they are discarded.

Only 5 retouched pieces were found in the excavations, all at site 13B. Four of the five are notched pieces, and the fifth is a denticulate. One fragment of a Still Bay point was found on the surface of 13C. There are nine hammerstones, all of which are found in Cave 13B. Battered pebbles are included in this category. The

TABLE 3: THE COUNTS OF MAJOR SHAPE TYPES FROM THE COMPLETE PIECES IN THE SITE 13 CAVE COMPLEX LITHIC SAMPLES.

	STRATIGRAPHIC AGGREGATE	FLAKE	POINT	BLADE	INDETERMINATE	GRAND TOTAL
13A	Brown Humic Sands MSA Facies	33	5	14	1	53
	White Sands MSA Facies	8	1	3	1	13
	13A TOTAL	41	6	17	2	66
13B	Surface Disturbed Facies	2	0	0	0	2
	Brown Sand MSA Facies	27	5	7	1	40
	Roof Spall Facies	0	0	0	1	1
	MSA Roof Spall Facies	27	1	13	4	45
	Lightly Consolidated MSA Facies	51	3	5	3	62
13B	**13B TOTAL**	107	9	25	9	150
13C	Lag Deposit Sample	15	1	11	8	35
ALL	**GRAND TOTAL**	**163**	**16**	**53**	**19**	**251**

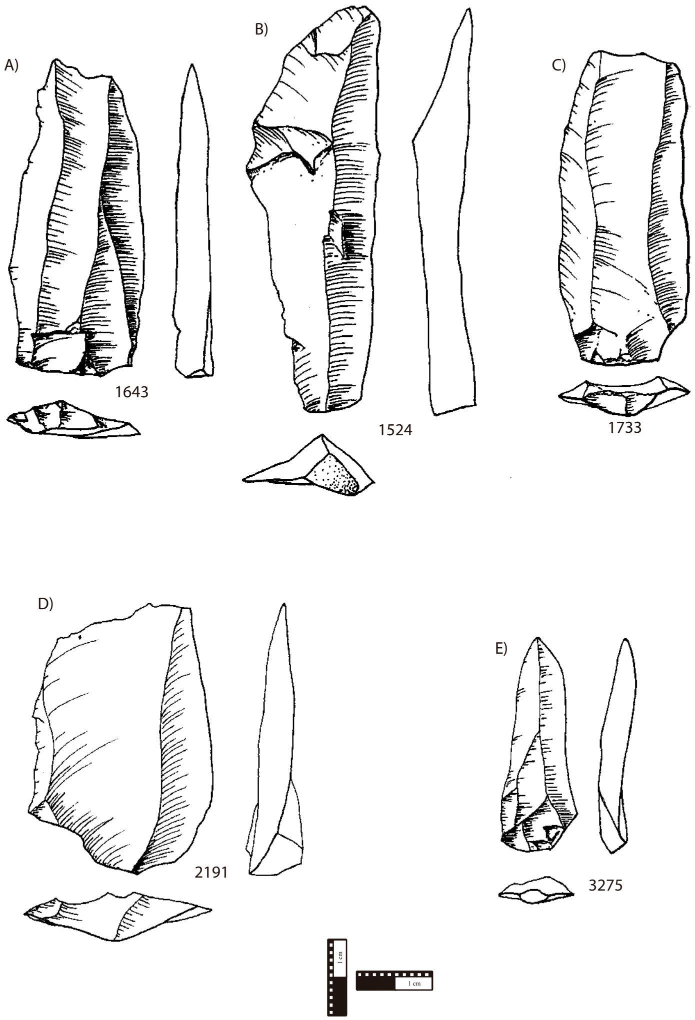


Figure 25. Drawings of lithics from sites 13A and 13B. All are dorsal view unless otherwise indicated: A) blade with facetted butt, B) blade with cortical butt C) flake with facetted butt, D) flake with facetted butt, and E) blade. The number next to the lithic is its MAP specimen number. Additional information may be found in Appendix 1.

hammerstones are all either quartzite cobbles or pebbles.

During excavation we thought we noticed a difference in the size of artifacts between 13A and 13B. While this is true (Table 6), there are no statistical differences in the size of flakes, blades, and points between the two sites (Figure 31). However, there is a difference in the proportions between length and width of points between the two sites. At 13A, length and width increase in concert, while at 13B as points get longer they also become less wide. The samples, however, are small and this pattern remains unconfirmed.

Discussion of Lithics

The lithic assemblages from the sites 13A and 13B are composed predominantly of fragmented pieces, followed by whole pieces (flakes, blades, and points), and a small sample of cores and retouched pieces. The abundance of cortical pieces represented in all technological categories, as well as an almost complete lack of finished retouched products suggest that the lithics are representative of early and middle phases of lithic tool production. Raw materials are diverse but are dominated by high quality quartzites.

While research near Mossel Bay has not been intense, early research in this area was fundamental to the definition of the MSA in South Africa and the development of nomenclature still in use today. Leith's excavations at Cape St. Blaize in 1888 resulted in a described sample of quartzite blades and points with few stratigraphic details (Leith, 1898). This same sample was used to define the Mossel Bay Culture (van Hoepen, 1926). The

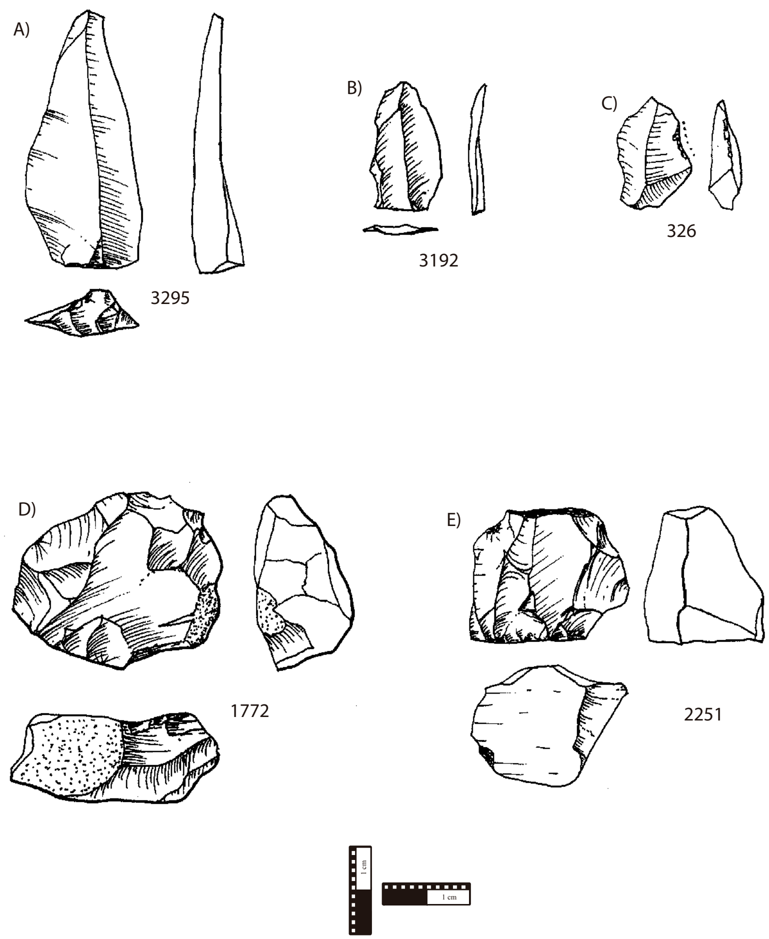


Figure 26. Drawings of lithics from sites 13A and 13B. All are dorsal view unless otherwise indicated: A) point with facetted butt, B) flake C) flake fragment with retouch, D) disc core, and E) single platform core. The number next to the lithic is its MAP specimen number. Additional information may be found in Appendix 1.

Cape St. Blaize sample was then supplemented with visits to the cave and surface collections at Gouritz River and Knysna Heads that resulted in the recognition of the Mossel Bay Variation (Goodwin & Van Riet Lowe, 1929) later termed an Industry (Goodwin, 1930).

Cape St. Blaize was re-excavated by Goodwin and the lithics and stratigraphy received its first comprehensive description (Goodwin & Malan, 1935), but the analysis focused on a subjectively defined sub-sample and the illustrations were of special pieces that are hardly characteristic of the total sample (Marean, pers. obs.). Keller's analysis of Goodwin's sample provided a quantitative analysis (Keller, 1968), but Goodwin's layers were collapsed into one aggregate and the analysis focused only on retouched pieces, which comprise a tiny percentage of the assemblage. Sampson (1974) maintained the use of the Mossel Bay Industry in concert with accepted terminological protocols, but noted its poor documentation. The Mossel Bay Industry was later subsumed into the MSA2 (Volman, 1984) though recently the old formal name has been used to describe materials at Klasies River (Wurz 2002). Wurz (Wurz, 2002; Wurz et al., 2003) suggests continuing the use of the term Mossel Bay, though she prefers "sub-stage" over "Industry". Wurz considers the Klasies River lithics from the SAS member to belong to the Mossel Bay substage (= MSAII of Singer and Wymer and MSA2b of Volman), largely on the basis of metric criteria as a reflection of technology.

Through this long history the description and definition of the industry has fluctuated as the nature of the samples, and the

TABLE 4: THE FREQUENCY OF CORTEX COVERAGE TYPES FOR COMPLETE PIECES IN SITE 13 CAVE COMPLEX LITHIC SAMPLES.

SITE NAME	STRATIGRAPHIC AGGREGATE	0	1-33%	34-66%	67-99%	100%	INDETERMINATE	GRAND TOTAL
13A	Brown Humic Sands MSA Facies	30	12	7	2	0	2	53
	White Sands MSA Facies	9	2	1	1	0	0	13
	13A Total	39	14	8	3	0	2	66
13B	Surface Disturbed Facies	2	0	0	0	0	0	2
	Brown Sand MSA Facies	30	6	4	0	0	0	40
	Roof Spall Facies	0	1	0	0	0	0	1
	MSA Roof Spall Facies	25	10	7	2	1	0	45
	Lightly Consolidated MSA Facies	40	13	6	1	2	0	62
	13B Total	97	30	17	3	3	0	150
13C	Lag Deposit Sample	22	8	5	0	0	0	35
ALL	**GRAND TOTAL**	**158**	**52**	**30**	**6**	**3**	**2**	**251**

preferences of the researchers to sample, have changed. We have examined the Cape St. Blaize collection from Goodwin's excavations and note that the lithics in the collection are large, probably a reflection of the rather coarse screening methods Goodwin used. It seems questionable to define an industry on a skewed sample that has yet to be completely analyzed and published. The use of the term "Mossel Bay Industry" assumes the presence of a regional pattern, and it is by no means clear that this exists, and so it is critical to more precisely define the characteristics and variability of the MSA lithics from the Mossel Bay area. While the site 13 cave complex collections are small, they do provide one of the few unbiased collections of MSA lithics from the Mossel Bay area.

The original definitions of the Mossel Bay were grounded in typology: "All the implements are of one general shape; they may be described thus: Longitudinally trimmed flakes, trimmed by the removal of two or at most three convergent flakes" (Goodwin & Van Riet Lowe 1929:136). He continues, "The flakes generally form points with a general shape much [like] that of an acute-angled isosceles triangle.

TABLE 5: THE FREQUENCY OF PLATFORM TYPES FOR COMPLETE PIECES IN 13 CAVE COMPLEX LITHIC SAMPLES.

SITE NAME	STRATIGRAPHIC AGGREGATE	PLAIN	DIHEDRAL	FACETTED	SHATTERED	SIMPLE FACETTED	NO PLATFORM	CORTICAL	CRUSHED	INDETERMINATE
13A	Brown Humic Sands MSA Facies	22	3	12	0	3	0	4	4	5
	White Sands MSA Facies	2	3	1	1	1	0	1	2	2
	13A TOTAL	24	6	13	1	4	0	5	6	7
13B	Surface Disturbed Facies	0	0	0	0	0	0	0	0	2
	Brown Sand MSA Facies	14	3	7	1	5	0	1	4	5
	MSA Roof Spall Facies	7	0	3	0	2	0	2	0	31
	Roof Spall Facies	0	0	0	0	0	0	0	0	1
	Lightly Consolidated MSA Facies	26	9	6	0	9	3	2	7	0
	13B TOTAL	47	12	16	1	16	3	5	11	39
13C	Lag Deposit Sample	16	3	4	1	2	1	3	3	0
ALL	**GRAND TOTAL**	**87**	**21**	**33**	**3**	**22**	**4**	**13**	**20**	**48**

A number of parallel-sided rectangular flakes...point to this form being also a desired type. Secondary trimming seems uncommon, but is present in some specimens. Some few oak-leaf types appear. In all instances the butt of the implement or flake is facetted [sic] and gently rounded" (Goodwin 1929:136). The latter comment about butt-faceting is inconsistent with

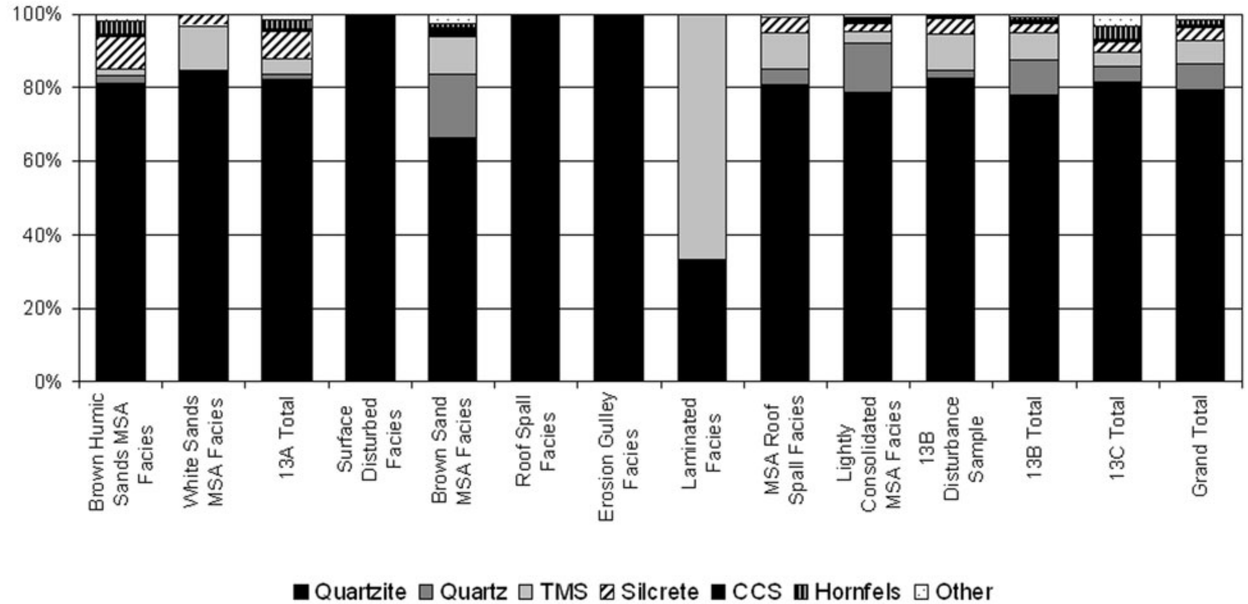


Figure 27. The percentage of raw materials of all lithics by site and stratigraphic aggregate from the site 13 cave complex. CCS = crypto-crystalline silicates, while TMS (Table Mountain Sandstone) refers to the local coarse-grained quartzite.

our results at Pinnacle Point (Figure 23B, 25E, Table 5), and during our examination of the Cape St. Blaize assemblage from Goodwin's excavations we discovered plain platforms (as did Keller, 1968). From a typological perspective, our samples are similar to those from Cape St. Blaize as described by both Goodwin (Goodwin & Malan, 1935) and Keller (Keller, 1968) if one keeps in mind that those original samples are likely somewhat biased.

The metrics tell a different story. Goodwin (Goodwin & Malan, 1935:131) provided metric data for points only, while Keller provided metric data on a variety of classes but only retouched pieces, and he did not sub-divide the sequence by layer. Goodwin's point measurements range in mean length from 83 mm in the lower (C4) layer to 65 mm in the upper (C1) layer: there is a steady decrease in point length over time (Figure 31). The Klasies River points (Wurz et al., 2003, Table 3:

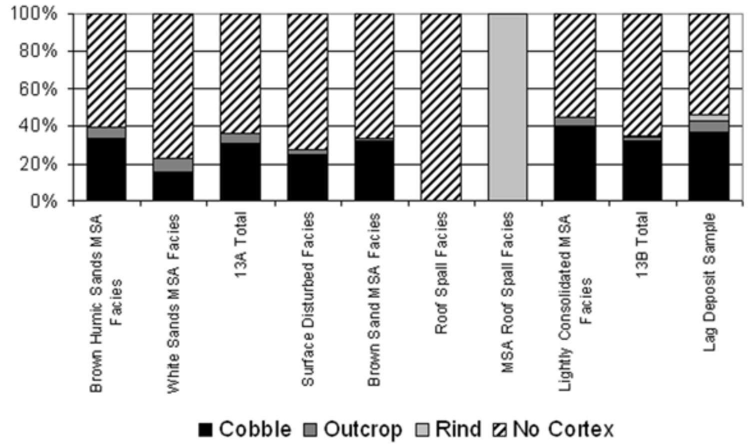


Figure 28. The percentage of cortex coverage categories for complete pieces by site and stratigraphic aggregate from the site 13 cave complex.

1118) fall comfortably within the range of the upper layers at Cape St. Blaize (Figure 31), while those from the site 13 cave complex are significantly smaller than both. Similarly, the blades from the site 13 cave complex are significantly smaller than those at Klasies River (compare our Table 6 with Wurz et al. 2003: Table 1: 1110). From these metric data, and tentatively, there are several possible alternative conclusions: 1) the site 13 cave complex material is not the same as the classic Mossel Bay Industry, 2) the Mossel Bay Industry shows a time vectored diminution, as first recognized by Goodwin at Cape St. Blaize and reaffirmed by Wurz's recent results from Klasies River, and the site 13 cave complex material is at the end of this diminution, or 3) the Cape St. Blaize material is biased toward larger pieces and does not adequately represent the range of variation in the Mossel Bay region. An unbiased sample from a dated new excavation at Cape St. Blaize would provide a starting point to answer this question.

ANALYSIS OF THE MOLLUSK REMAINS

The following section provides a description of the shellfish remains from sites 9, 13A, and 13B. Observations include species identification, MNI counts and percentage frequency of MNI and weight (grams). For the purpose of this analysis, observations were obtained from quantified marine shells plotted during excavations and recovered from the 10 mm sieve. Marine shell was also retained in the 3 mm and 1.5 mm sieves. The analysis of this finer material might provide a more complete picture of the shellfish

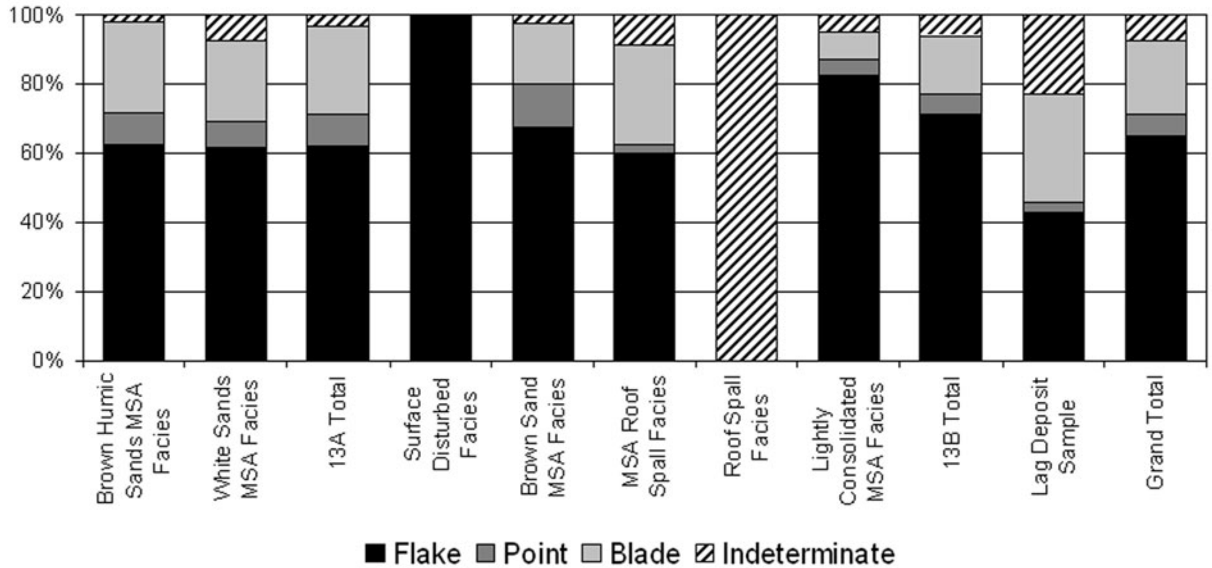


Figure 29. The percentage of major shape categories of complete pieces by site and stratigraphic aggregate from the site 13 cave complex.

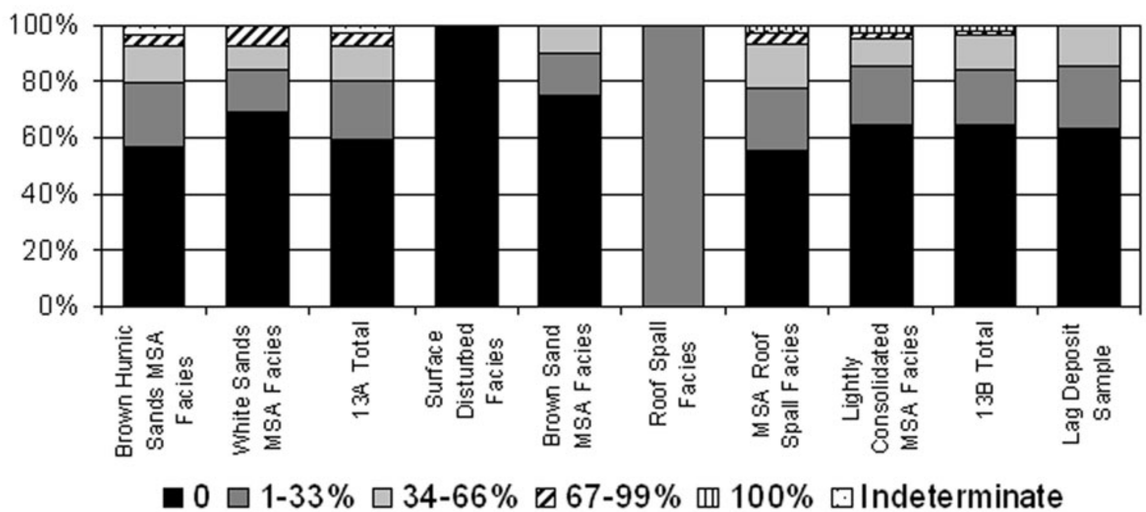


Figure 30. The percentage of cortex coverage classes for complete pieces by site and stratigraphic aggregate from the site 13 cave complex.

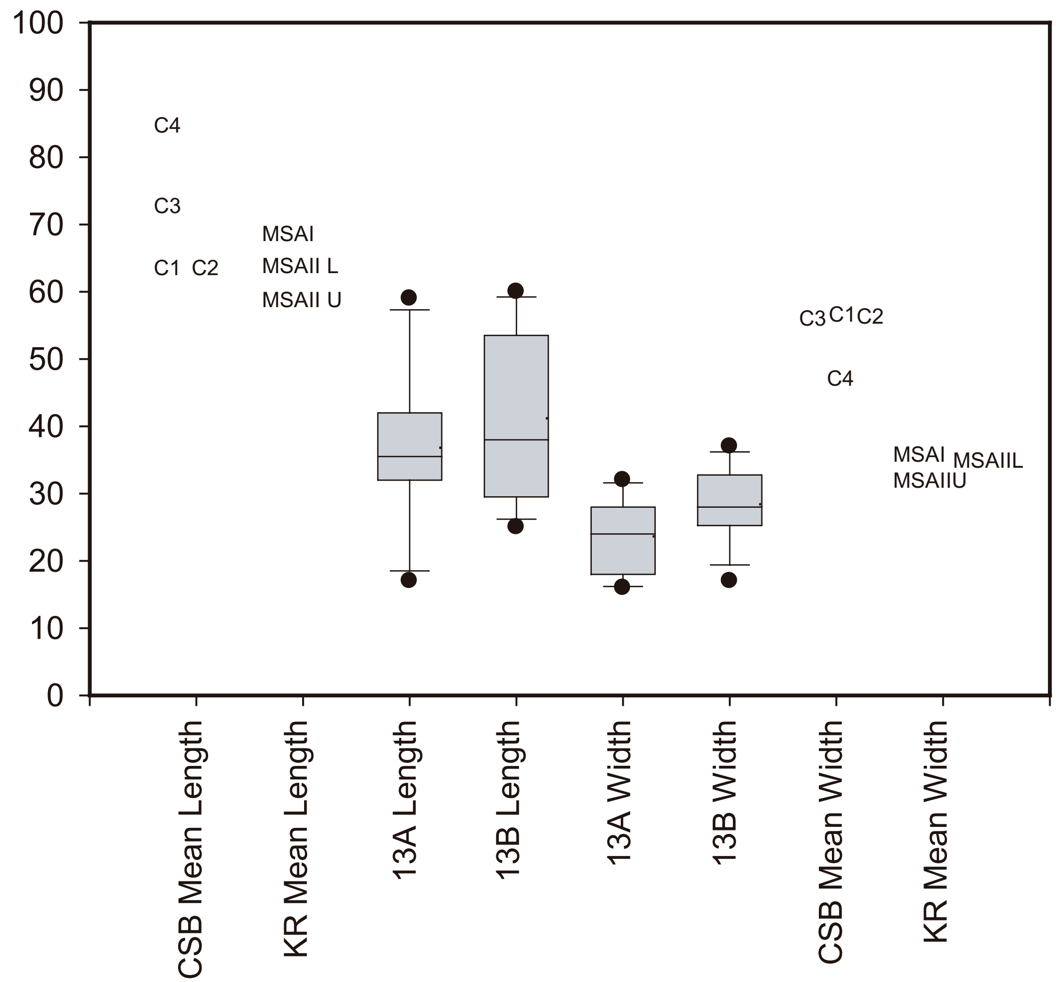


Figure 31. The median (solid bar), 25th/75th percentile (box), 10th/90th percentile (whisker), and maximum outlier (dot) of point lengths and widths from 13A and 13B. Also included are the mean point lengths and widths from Cape St. Blaize cave (CSB) and Klasies River (KR) from Goodwin and Mason (1935) and Wurz et al. (2003), respectively. These are plotted for each layer (CSB) or analytical aggregate (KR), with CC1-4 from CSB and MSAI-IIU for KR.

assemblages, particularly once the sample size of marine shells is increased with further excavations. So far, the amount of marine shell recovered from all sites combined does not exceed 0.6 kg, which is a very small sample. The few observations described and discussed in this report are strictly preliminary.

Methodological and taphonomic considerations

Analysis was undertaken on all shell material, including that of terrestrial origin and macro sediments, such as water-worn shells. Quantification (counting and weighing) was only undertaken on shell remains that resulted from collections made by people in the past. Although quantified, fresh-looking shells (e.g. the presence of periostrum on marine shells) were excluded from the final tables as these were likely deposited during visits to the caves by local 20th Century fishermen. Such remains are present on the cave floor today, and occur in the surface layers. Although present in fair quantities and recorded in spreadsheet files, water-worn shells were also excluded from the final tables as they were deemed to not be the direct result of shellfish consumption by people in the past. Based on earlier work with LSA shell-bearing deposits along the South African West Coast (Jerardino, 1997), it is clear that the presence of water-worn shells in archaeological sites do not reflect the deliberate transport of these to camp sites. Instead, their presence in archaeological sites is likely the result of water-worn shells clinging to the byssus (threads of attachment) of rocky shore mussels (e.g. black, brown and ribbed mussels) which were collected by people and subsequently taken back to sites for processing and consumption.

During the washing and labeling of the shell material it became apparent that land snail shells were less frequently broken than those of marine origin. If people collected land snails while also collecting marine shellfish during the same visits, then both land snail and marine shells would have been discarded and affected in the same way by post-depositional factors. For this reason, it was expected that land snail and marine shells should show a similar degree of breakage. Upon initial visual inspection, this expectation was not confirmed. After quantifying the number of broken land snail and marine shells for each site, it became clear that marine shells are markedly more fragmented than land snails (Table 7). Although the overall Minimum Number of Individuals (MNI) for each site is very small, the percentage of unbroken land snail shells is markedly higher (between 77% and 50%) than that for marine shells (between 20% and 0%). Unless some significant differences in shell density and toughness exist between land snail and marine shells, this difference (if representative of the larger portion of shells at these sites) could reflect different depositional histories.

The sequence of taphonomic events regarding the presence and preservation of land snail and marine shells was likely as follows. After shellfish were brought back to site and their flesh consumed, shells were discarded and subsequently fragmented as a result of food processing (heating, opening of bivalves and scooping of limpet contents) and trampling. After the site was abandoned, land snails moved into the site as part of their usual foraging rounds and some subsequently died there. Other agents responsible for the introduction of land snails to the site seems unlikely, as one of their usual predators (field mice) are always capable of breaking up their shells (Jerardino, personal observation, Namaqualand 1989-1996). Moreover, during field surveys, whole and empty snail shells are not rare among bushes (on bare surfaces and on those of open sites) and away from mice nests. This clearly shows that land snails can die with their shells undamaged after moving across the landscape during their short life spans. Consequently, land snails do not appear to have been collected by people in the past.

For the above reasons, land snails are not included in the final results of the shellfish analysis at this stage. Nevertheless, as additional shell samples become available with further excavations, this conclusion should be revised before pro-

TABLE 6: SUMMARY STATISTICS FOR THE COMPLETE FLAKES, BLADES, AND POINTS IN SITE 13 CAVE COMPLEX LITHIC SAMPLES.

	13A			13B		
	FLAKES					
	Length	*Thickness*	*Width*	*Length*	*Thickness*	*Width*
Mean	39.6	7.9	28.1	40.1	7.4	25.5
Std	17.4	4.0	9.5	18.0	3.5	11.6
95% Confidence Limit	6.0	1.4	3.3	3.5	0.7	2.2
Sample Size	41	41	41	107	107	107
Minimum	13	2	7	11	2	8
Maximum	89	18	53	91	20	75
	BLADES					
	Length	*Thickness*	*Width*	*Length*	*Thickness*	*Width*
Mean	35.3	6.9	24.7	39.1	9.2	29.2
Std	21.2	4.9	9.0	16.6	6.7	10.7
95% Confidence Limit	11.3	2.6	4.8	6.8	2.8	4.4
Sample Size	17	17	17	25	25	25
Minimum	9	3	12.96	15	3	16
Maximum	84	17	41	86	38	59
	POINTS					
	Length	*Thickness*	*Width*	*Length*	*Thickness*	*Width*
Mean	36.8	7.5	23.7	41.2	8.6	28.4
Std	13.7	3.8	6.1	13.1	3.5	6.2
95% Confidence Limit	14.4	4.0	6.4	10.1	2.7	4.7
Sample Size	6	6	6	9	9	9
Minimum	17	3	16	25	6	17
Maximum	59	14	32	60	15	37

TABLE 7. PERCENTAGE FREQUENCY OF WHOLE (UNBROKEN) LAND SNAIL AND MARINE SHELLS FOR EACH SITE ASSEMBLAGE. TOTAL N IS TOTAL MNI AND NOT TOTAL NUMBER OF COUNTABLE SHELLS (BIVALVES AND LIMPETS DIFFER IN THE EQUIVALENCE OF THESE TWO NUMBERS).

SITE	TYPE OF SHELL	FREQ. (%)	TOTAL N
9	land snail	62.3	61
	marine shell	20.0	10
13A	land snail	76.9	13
	marine shell	8.9	55
13B	land snail	50.0	2
	marine shell	0.0	25

ceeding with the analysis of shell remains. Also, the preliminary interpretation of the presence of land snails should also be tested with experiments designed to compare possible differences in the strength and toughness of both land snail and marine shells.

Site 9

An extremely small amount of relatively well preserved shells (total MNI = 12; total weight = 27.4 g) were recovered from site 9. This small amount of shell is further dwarfed by the considerable amount of excavated deposit (2 cubic meters, Table 8). The low density of marine shells along with the presence of few cultural remains appears to indicate very few and brief visits to the cave by people. Only three shellfish species are represented in the Site 9 sample (Table 8), namely one species of limpet (*Patella oculus*), the brown mussel (*Perna perna*), and the black mussel (*Choromytilus meridionalis*). At least two brown mussels and all four black mussels recovered from PP9 are sub-adults. It is highly unlikely that people would have collected sub-adult individuals while ignoring larger adult-sized mollusks. In shell middens of clearly human origin along the South African west coast (Jerardino, 1997), sub-adults are always outnumbered by adult individuals by at least one, and frequently two orders of magnitude. Consequently, it is likely that agents other than humans incorporated much of the marine shell into the site 9 deposits. Only the presence of one limpet can be attributed directly as a result of foraging rounds by people along the nearby shore. The remaining brown mussels are too fragmented for their identification as either adults or sub-adults. In sum, shellfish collection by humans using site 9 was almost non-existent.

Site 13A

Compared to site 9, a much larger number of marine shells were recovered from 13A (Tables 9 and 10). A total of twelve species are present in this assemblage, although not all of these species are present throughout the stratigraphic sequence and at this stage of fieldwork. Sub-adult brown and black mussels are present, although in very small numbers, throughout the stratigraphic sequence. Limpet species collected from 13A include *P. barbara*, *P. oculus*, *P. granularis* and possibly *P. tabularis*. In a few instances, weight of shell was estimated, as varying quantities of sand was found cemented to a number of shell fragments. A total of 1.5 grams of shell was not possible to identify, and thus named "unidentified". Marine shells from 13A appear reasonably well preserved, although somewhat brittle and/or chalky at times when handled during analysis (particularly *P. perna*).

P. perna and *Turbo* sarmaticus dominate the 13A shell assemblage at this stage of field work. According to the list of species (Tables 9 and 10), the large majority of shellfish was collected from the mid- and lower intertidal rocky shores. Among these species, *T. sarmaticus*, Haliotis *spp*, chitons and *Cymatium cutaceum* are found in the lower reaches of the intertidal and below. Large adult brown and black mussels (*P. perna* and *C. meridionalis*) are also found in the low intertidal and subtidal shores (Kilburn & Ripey 1982, Jerardino personal observation). However, size observations for black and brown mussel shells are not available due to extensive breakage of shell remains.

The sample size of marine shells so far recovered from 13A is very small, and thus little can be said at this stage. For instance, the Brown Humic Sands facies appears to have a relatively larger number of shells and higher richness of species when compared to the older and younger stratigraphic components. Nevertheless, this higher species richness in Brown Humic Sands could just be the result of larger quantities of deposit recovered during excavations, and thus an artifact of a larger sample size.

TABLE 8. MNI COUNT AND WEIGHT (G) OF MARINE SHELL REMAINS AT SITE 9 THROUGHOUT ITS STRATIGRAPHIC SEQUENCE ORDERED TOP (LEFT) TO BOTTOM (RIGHT).

	STRATUNITS ND-NE		STRATUNITS NH-NH1		STRATUNITS NI-NI7	
SPECIES	MNI	w	MNI	w	MNI	w
Patella oculus	1	5.3	0	0	0	0
Perna perna	0	0	3	8.5	4	7.4
Choromytilus meridionalis	0	0	0	0	4	6.2

Site 13B

Despite excavation efforts in three areas of this cave, a very small amount of marine shell was recovered (nearly 97 grams overall) (Table 11). This mass is three times less than that excavated from only one square in 13A. An additional amount of marine shell (about 180

TABLE 9. MNI COUNT AND PERCENTAGE FREQUENCY (%MNI) OF MARINE SHELL REMAINS AT SITE 13A THROUGHOUT ITS STRATIGRAPHIC SEQUENCE. LBSS: LIGHT-BROWN SURFACE SANDS FACIES; BHS: BROWN HUMIC SANDS MSA FACIES; WS: WHITE SANDS MSA FACIES.

	LBSS		BHS		WS	
SPECIES	MNI	%	MNI	%	MNI	%
Perna perna	0	0	31	81.6	13	68.4
Choromytilus meridionalis	0	0	1	2.6	0	0
Turbo sarmaticus	1	33.3	3	7.9	0	0
Haliotis spp	0	0	1	2.6	0	0
Patella *spp*	1	33.3	1	2.6	4	21.1
Crepidula sp.	0	0	1	2.6	1	5.3
Chiton	1	33.3	0	0.0	0	0
Turritellidae	0	0	0	0	1	5.3
TOTAL MNI	**3**	**100**	**38**	**100**	**19**	**100**

grams), however, was obtained from the disturbed material swept from the surface of the cave and believed to result from the disturbance by fishermen (Table 12). Shell preservation appears to vary from one area of excavation to the next. In N91E108, a small amount of burnt shell was found and only in a few instances the shell weight was estimated because of clumps of sand cemented to other shell fragments. In N94E109, burnt and chalky shell is noticeable, and clumps of sand were removed from shell fragments whenever possible before weighing, although this was not always possible. In N97E97 and N97E96, shell was relatively well preserved and in only one instance the shell weight was estimated because of sand cemented to shell fragments.

Overall, *P. perna* and *T. sarmaticus* appear in 13B with highest frequency, with Patella *spp*. (*P. argenvillei and P. longicosta*) and the sandy-bottom white mussel *Donax serra* in moderate quantities (Table 11). The analysis of the marine shell from the disturbance shows the same species comprising the large majority of the assemblage, with Patella *spp*. dominating above the other species (Table 12). Very little can be inferred, at this stage, from the available observations due to the small amounts of shell material. According to the list of species (Tables 11 and 12), the large majority of shellfish taken back to 13B was collected from the mid- and lower intertidal rocky shores, with some visits to sandy beaches where *D. serra* was collected.

Haliotis *spp*, chitons and Crepidula *spp* are not present in 13B (but present in 13A), and their absence could just be the result of the very small quantities of shell recovered from this site at this stage. *D. serra* and barnacle, however, are present in 13B, and are absent from 13A. Either this observation reflects contrasting behavioral and environmental data between 13A and 13B, or it might be an anomaly resulting from the small sample size.

Discussion of Shellfish Remains

MSA inhabitants of sites 13A and 13B collected marine shellfish from nearby rocky reefs and very occasionally also from sandy beaches. Their collecting rounds targeted the mid- and lower reaches of the intertidal from where brown mussels (*P. perna*), arikreukel snails (*T. sarmaticus*), limpets (Patella *spp*), chitons (Polyplacophora) and black mussels (*C. meridionalis*) were collected during low spring tides. Other species were also gathered (e.g., ear shells or Haliotis *spp*, white mussel [*D. serra*] and corrugated white mussel [*Venerupis corrugate*]), but in much smaller quantities.

Although present in the caves, terrestrial mollusks (land snails) were apparently not collected by MSA people. These mollusks are likely to have entered the caves (perhaps attracted by the garbage left behind) after the abandonment of these sites on several occasions during sediment deposition. The relative frequency of land snail shells differ from site to site, as does the density of marine shells.

TABLE 10. SHELL WEIGHT (G) AND PERCENTAGE WEIGHT OF MARINE SHELL REMAINS AT SITE 13A THROUGHOUT ITS STRATIGRAPHIC SEQUENCE. LBSS: LIGHT-BROWN SURFACE SANDS FACIES; BHS: BROWN HUMIC SANDS MSA FACIES; WS: WHITE SANDS MSA FACIES.

	LBSS		BHS		WS	
SPECIES	w	%	w	%	w	%
Perna perna	3.5	19.6	164.7	73.6	48.4	53.7
Choromytilus meridionalis	0	0	3.7	1.6	1.6	1.7
Venerupis corrugata	0	0	0.1	<0.1	0	0
Turbo sarmaticus	10.2	57.0	37.8	16.9	0	0
Haliotis spp	0	0	0.7	0.3	0	0
Burnupena *sp.*	0	0	1.2	0.5	0	0
Cymatium cutaceum	0	0	0.4	0.2	0	0
Patella *spp*	0.4	2.2	3.5	1.6	39.1	43.4
Helcion sp.	0	0	0.2	0.1	0	0
Crepidula sp.	0	0	0.4	0.2	0.3	0.3
Chiton	3.8	21.2	9.5	4.2	0	0
Turritellidae	0	0	0	0	0.8	0.9
Unidentified	0	0	1.5	0.7	0	0
TOTAL WEIGHT (G)	**17.9**	**100**	**223.7**	**100**	**90.2**	**100**

TABLE 11. MNI COUNT AND WEIGHT (G) OF MARINE SHELL REMAINS AT SITE 13B IN SQUARES N91E108, N94E109, AND N97E97-N97E96. SDF: SURFACE DISTURBED FACIES; MRS: MSA ROOF SPALL FACIES; LC-MSA: LIGHTLY CONSOLIDATED MSA FACIES; AND WA AND WB ARE THE MAJOR STRATIGRAPHIC UNITS COMPRISING THE BROWN SANDS MSA FACIES.

	N91E108				N94E109		N97E97-N97E96			
	SDF		MRS		LC-MSA		WA		WB	
Species	MNI	w	MNI	w	MNI	w	MNI	w	MNI	w
Perna perna	1	1.0	1	10.2	2	7.6	0	0	1	2.8
Choromytilus meridionalis	0	0	0	0	1	2.9	0	0	0	0
Donax serra	2	9.3	2	21.8	0	0	0	0	0	0.3
Veneridae	0	0	0	0	0	0	0	0	0	0.3
Bivalve	0	0	0	0	0	0.3	0	0	0	0
Turbo sarmaticus	0	4.3	0	1.5	1	1.3	0	0	1	6.7
Patella spp	0	0	0	2.3	0	0	1	19.0	0	0
Nucella squamosa	0	0	0	0	1	4.3	0	0	0	0
Barnacle	0	0	0	0	0	0	0	0	0	0.7
Unidentified	0	1.8	0	0	0	0	0	0	0	0
TOTAL (MNI/WEIGHT)	**3**	**16.4**	**3**	**35.8**	**5**	**16.4**	**1**	**19.0**	**2**	**10.8**

ANALYSIS OF REPTILE, BIRD, AND MAMMAL REMAINS

As stated above, one of our long-term research goals is to test several competing models of human behavioral modernity in the MSA. Faunal exploitation has become a critical point of debate in this issue (Marean & Assefa, 1999). South African faunal assemblages have been used to develop “the less effective hunter” model championed by Klein and colleagues (e.g.Klein, 1995; 2000), though the MSA component of the empirical record underlying that model is somewhat thin. For that reason, a goal of this project is to improve our understanding of MSA faunal exploitation through the production and study of well-excavated and well-pre-

TABLE 12. MNI COUNT AND WEIGHT (G) OF MARINE SHELL REMAINS AT SITE 13B FROM THE DISTURBED DEPOSITS.

SPECIES	MNI	%MNI	W	%W
Perna perna	2	14.3	8.9	4.9
Donax serra	1	7.1	7.4	4.2
Turbo sarmaticus	3	21.4	10.2	5.7
Patella *spp*	7	50.0	142.4	79.4
Burnupena sp.	1	7.1	10.1	5.6
Helcion sp.	0	0	0.1	0.1
Unidentified	0	0	<0.1	<0.1
TOTAL (MNI/WEIGHT)	**14**		**179**	

served faunal samples. At this stage, the small size of the faunal assemblages from our excavations restricts us from making any confident conclusions, but our descriptions here show that enlarged samples hold great promise, and the current small samples already extend the range of variation seen in MSA faunal assemblages.

Bone preservation is excellent in all 3 caves that were tested due to calcium carbonate enriched water seeping through the walls and roof of the caves. Only a few South African sites dating to the MSA preserve animal bones and the sites of Klasies River and Die Kelders Cave 1 have yielded the largest samples thus far reported. Faunal remains are dense relative to excavated sediment at 13A and 13B. Thus far we have examined and analyzed all plotted and identifiable bone from the three tested caves and the following account pertains to those finds.

Methodology

Excavated materials were washed on site with fresh water and where necessary, specimens were washed again in the laboratory at the South African Museum in Cape Town. Bones coated in adhering matrix were carefully cleaned by soaking for several days in luke-warm water and brushing off adhering matrix with soft nylon-bristled brushes. In cases where adhering matrix was very tough and difficult to remove, bone surfaces were cleaned piecemeal with a mechanical tool commonly used by palaeontologists to prepare fossils. Special care was taken not to damage cortical surfaces. Specimens were identified to taxon and/or species and skeletal element where possible. Each specimen was examined macro- and microscopically (using a 10-40X zoom binocular microscope) for fracture features, weathering, burning and bone surface modification such as marks produced by animal gnawing as well as percussion and cut marks produced by humans. Information from detailed examination was computer coded using a system developed by Marean (Marean et al., 2001). Here we present a general overview of the nature of faunal remains in the tested sites. Minimum Numbers of Individuals (MNIs) are not given as the samples are very small and thus such values are of no real significance.

Site 9

A mere 9 bone specimens were plotted and they derive from; unidentified micromammal, Cape gray mongoose, chacma baboon, unidentified bovid and unidentified carnivore (see Table 13). It is interesting that no tortoise remains were recovered since tortoise remains are found in high frequencies in most South African archaeological deposits. None of these fragments retain any characteristics indicative of humans having been the primary accumulating agents. Interestingly, the majority of identified fragments are from carnivores.

Site 13A

The archaeological deposit in this site consists of two depositional horizons as described above. Unlike the deposit in Cave 9, that in Site 13A consists of material remains deposited predominantly by humans. For Site 13A as a whole, 350 plotted, identifiable bone specimens are presented in Table 13. Fragments from only two species were identifiable, namely angulate tortoise and grysbok/steenbok. The assemblage is dominated by unidentified mammal, followed by unidentified bovid and tortoise bone. Carnivore and unidentified micromammal bone is rare. Damage caused by animal gnawing is rare while humanly induced damage occurs more commonly, indicating that the faunal remains in this site were mostly collected and deposited by humans. Interestingly, fish, snake and bird bone are entirely absent.

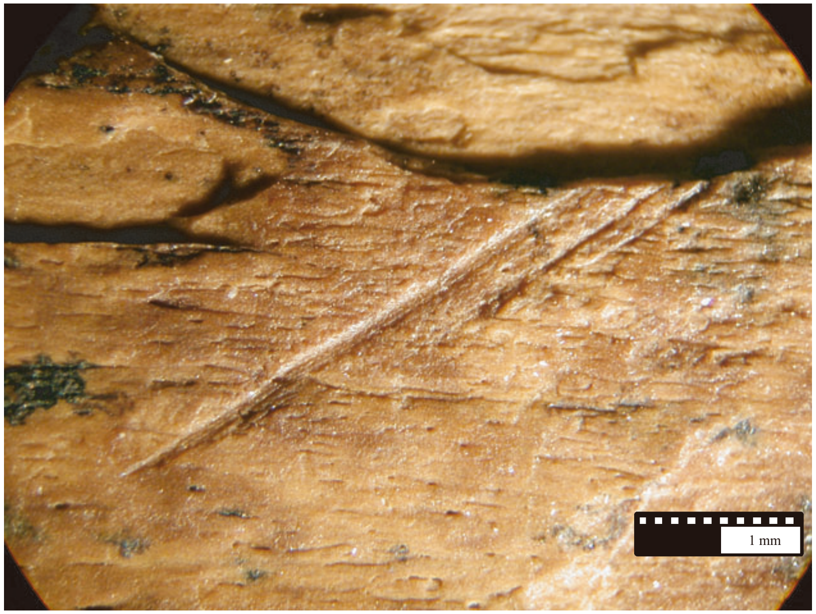
Site 13B

Four of the seven identified Facies in Site 13B consist of deposits with high densities of archaeological material and those are the focus of our presentation here. Overall, faunal preservation in 13B is excellent and bone fragments are present in high frequencies. Some fragments have a thin matrix adhering to the surface (Figure 32C). This is easily removed mechanically. A total of 1479 plotted, identified fragments are presented in Table 13 for Site 13B.

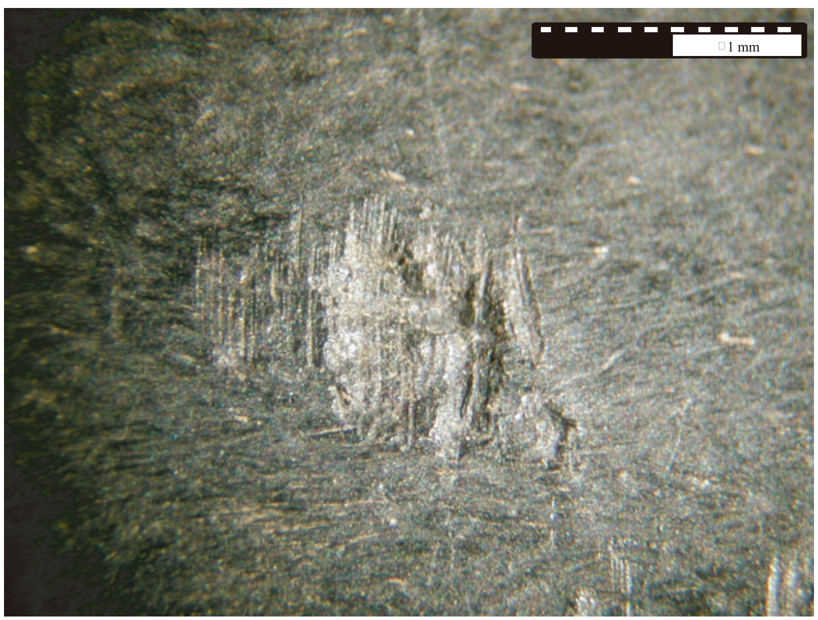
A total of 262 plotted, identified bone fragments were unearthed from the Lightly Consolidated Facies representing 4 identifiable species: angulate tortoise, grysbok/steenbok, mountain reedbuck and eland. Of the bovids, eland are represented by the most specimens. No bird, fish, snake or carnivore remains were found in this Facies. The vast majority of bones are from larger mammals with micromammals and small mammals only represented by 10 specimens.

The sample from the Brown Sand MSA Facies includes 417 plotted and identified specimens that include angulate tortoise, jackass penguin, Cape gray mongoose, hyrax, springbok, Cape fur seal, black wildebeest, vaal rhebuck and eland. Again, of the bovids, eland are represented by the largest number of fragments. Micromammals and small mammals are only represented by 9 specimens and carnivore, fish and snake bones are entirely absent.

A)



B)



C)

Figure 32. Photographs of A) a stone tool cutmark, B) a hammer-stone percussion mark, and C) matrix adhering to the surface of a fragment from site 13B. All photographs taken with a 10-40X zoom binocular microscope, and the scale is 2 mm long.

TABLE 13. THE NUMBER OF IDENTIFIABLE SPECIMENS (NISP) PER STRATIGRAPHIC AGGREGATE FOR THE THREE EXCAVATED SITES.

	WHITE SANDS MSA FACIES	BROWN HUMIC SANDS MSA FACIES	SITE 13 A TOTAL	LIGHTLY CONSOLIDATED MSA FACIES	PONDING FACIES	EROSION GULLEY FACIES	ROOF SPALL FACIES	BROWN SAND MSA FACIES	MSA ROOF SPALL FACIES	SURFACE DISTURBED FACIES	SITE 13B TOTAL	SITE 9
REPTILE												
Chersina angulata (angulate tortoise)	5	27	32	11	2	0	0	34	32	5	84	0
BIRD												
Spheniscus demersus (jackass penguin)	0	0	0	0	0	0	0	1	0	0	1	0
Unidentified Bird	0	0	0	0	0	0	0	1	1	0	2	0
MICROMAMMAL												
Chrysochloridae (mole)	0	0	0	0	0	0	0	0	1	0	1	0
Unidentified Micromammal	1	1	2	8	2	1	3	7	7	2	30	1
SMALL MAMMAL												
Lepus sp. indet.	0	0	0	0	0	0	0	0	1	0	1	0
Herpestes pulverulentus (cape grey mongoose)	0	0	0	0	0	0	0	1	0	0	1	1
Procavia capensis (hyrax)	0	0	0	0	0	0	0	1	1	0	2	0
Unidentified Small Mammal	0	0	0	2	0	0	0	0	0	0	2	0

TABLE 13. THE NUMBER OF IDENTIFIABLE SPECIMENS (NISP) PER STRATIGRAPHIC AGGREGATE FOR THE THREE EXCAVATED SITES. (CONTINUED)

	WHITE SANDS MSA FACIES	BROWN HUMIC SANDS MSA FACIES	SITE 13 A TOTAL	LIGHTLY CONSOLIDATED MSA FACIES	PONDING FACIES	EROSION GULLEY FACIES	ROOF SPALL FACIES	BROWN SAND MSA FACIES	MSA ROOF SPALL FACIES	SURFACE DISTURBED FACIES	SITE 13B TOTAL	SITE 9
LARGE MAMMAL												
Antidorcas marsupialis (springbok)	0	0	0	0	0	0	0	1	1	0	2	0
Artocephalus pusillus (Cape fur seal)	0	0	0	0	0	0	0	1	0	0	1	0
Connochaetes gnou (black wildebeest)	0	0	0	0	0	0	0	1	0	1	2	0
Papio ursinus (chacma baboon)	0	0	0	0	0	0	0	0	0	0	0	1
Pelorovis antiquus (giant buffalo)	0	0	0	0	0	0	0	0	1	0	1	0
Pelea capreolus (vaal rhebuck)	0	0	0	0	0	0	0	2	1	0	3	0
Raphicerus campestris (steenbok)	0	0	0	0	0	0	0	0	2	0	2	0
Raphicerus sp. indet. (steenbok/grysbok)	0	1	1	2	0	0	0	0	6	0	8	0
Redunca fulvorufula (mountain reedbuck)	0	0	0	4	0	0	0	0	1	0	5	0
Taurotragus oryx (eland)	0	0	0	5	1	0	0	6	2	5	19	0
Unidentified Bovid	11	28	39	30	2	1	0	65	111	9	218	1
Unidentified Carnivore	1	1	2	0	0	0	0	0	1	1	2	5
Unidentified Primate	0	0	0	0	0	0	1	0	0	0	1	0
Unidentified Mammal	101	173	274	200	15	7	32	296	502	39	1091	0

The sample from the MSA Roof Spall Facies includes 671 plotted, identified specimens representing the following species; angulate tortoise, unidentified mole, unidentified hare, hyrax, springbok, extinct giant buffalo, vaal rhebuck, steenbok, grysbok/steenbok, mountain reedbuck, eland and unidentified carnivore (Table 13). Raphicerus sp. is represented by the most identifiable specimens among the bovids. This Facies includes the widest variety of bovid species when compared to all facies in this site and the combined specimens from the other tested sites. Only one bird bone is present in this Facies while fish and snake are entirely absent.

The Surface Disturbed Facies has a total of 62 plotted, identified bone fragments representing the following identified species; angulate tortoise, black wildebeest, eland and unidentified carnivore. Eland are represented by the largest number of fragments. Bird, fish, snake and small mammals are not represented by plotted or identified specimens.

DISCUSSION OF REPTILE, BIRD, AND MAMMAL REMAINS

While the faunal assemblages from sites 13A and 13B are small, they do provide high expectations for enlarged samples, and show several interesting patterns. Most of the fauna from these sites appear to have been collected by hominids as evidenced by the frequent occurrence of cutmarks (Figure 32A), hammerstone percussion marks (Figure 32B), and burning. Hammerstone percussion marked fragments are far more numerous than carnivore tooth marked specimens (Figure 33), and the latter frequencies are far below what are typical of carnivore fragmented assemblages (see Marean et al. 2000, Table 3). The very low frequency of carnivore tooth marks suggests a minimal involvement of carnivores as either primary accumulators of faunal material or secondary ravagers of hominid discarded bone.

Though the samples are small and thus the pattern is not conclusive, the representation of fauna from both 13A and 13B is rather unique relative to other MSA assemblages in South Africa. Unlike most other MSA cave deposits, remains from small mammals are not well represented. Figure 34 groups the remains into tortoise, micromammal (mouse-sized species), small mammal (hare size species), and large mammal (from small bovid and larger). Most South African MSA assemblages have substantial quantities of tortoise. At Die Kelders Cave 1 tortoise is either the first or second most abundant taxon in all MSA layers, being several orders of magnitude more abundant than any large mammal taxon (Klein & Cruz-Uribe, 2000). Tortoise appears to be the most abundant taxon in the Blombos Cave MSA layers (Henshilwood et al., 2001). While tortoise is abundant at 13A and 13B, its numbers do not approach those present at most MSA sites in South Africa.

Similarly, small mammals are either the first or second most abundant taxon at both Die Kelders Cave 1 and Blombos, but are rare to absent at 13A and 13B. Continuing this pattern is a rarity of micromammals, which tend to be very abundant in cave assemblages throughout South Africa. Large mammals are, almost uniquely, the dominant faunal component at 13A and 13B.

Raptors, owls, and small carnivores are typical accumulators of micromammal, small mammal, and tortoise remains, while hyenas and other large carnivores regularly accumulate the remains of large mammals in caves. The rarity of micromammals, small mammals, and tortoise suggests that there was little owl or raptor involvement in the accumulation of the fauna at 13A and 13B. The lack of carnivore tooth marks, and the abundance of percussion and cut marks, suggests that people were the primary accumulators of the large mammals. If supported by larger samples, the assemblages from 13A and 13B may provide a faunal collection with a very "clean" taphonomic signature dominated by human accumulation, unlike most other South African MSA sites.

The sample size is too small to say anything definitive about the species representation, but the presence of several species suggests an environment different from today. The combined presence of wildebeest, springbok, and eland is a clear indication of open grassy conditions. *Pelorovis antiquus* is typically associated with dry open conditions, and its presence may suggest an arid grassland ecosystem.

DESCRIPTION OF HOMININ SPECIMENS

Two hominin fossil fragments were found during the 2000 season: a cranial fragment and an incisor. Both were found in deposits derived from the disturbance (see discussion above). The cranial fragment was found in the middle of the fishermen disturbance, likely very close to its original *in situ* position. The incisor was found down-slope of the disturbed area in the sediment that had been dug away from the disturbed area. Their scientific value is slightly reduced by this secondary context. However, there are several facts that provide strong confidence that these remains are MSA, and further that they derive from the Brown Sand MSA Facies. First, there is no LSA deposit in the cave. Second, their condition is mineralized and strongly resembles in color the fossilized material from the Brown Sand MSA Facies. Third, in the disturbed area there is only one fossiliferous horizon, and thus only one potential source – the Brown Sand MSA Facies.

Specimen 4500 – Parietal Fragment

This is a well-mineralized left parietal fragment measuring ca. 65 mm by ca. 55 mm. Approximately 45 mm of the specimen's sagittal suture (*sutura sagittalis*) is preserved (Figure 35). The maximum thickness along the sagittal border is 6.5 mm and the minimum thickness is 5.6 mm. The serrations are open and there is no evidence of fusion with the opposite side. Although weathered, the surface of the inner table preserves substantial morphological detail. The groove for the sagittal sulcus is weakly developed in this specimen. A pronounced depression of the arachnoid granulations (pacchionian bodies) occurs parallel to the sagittal bor-

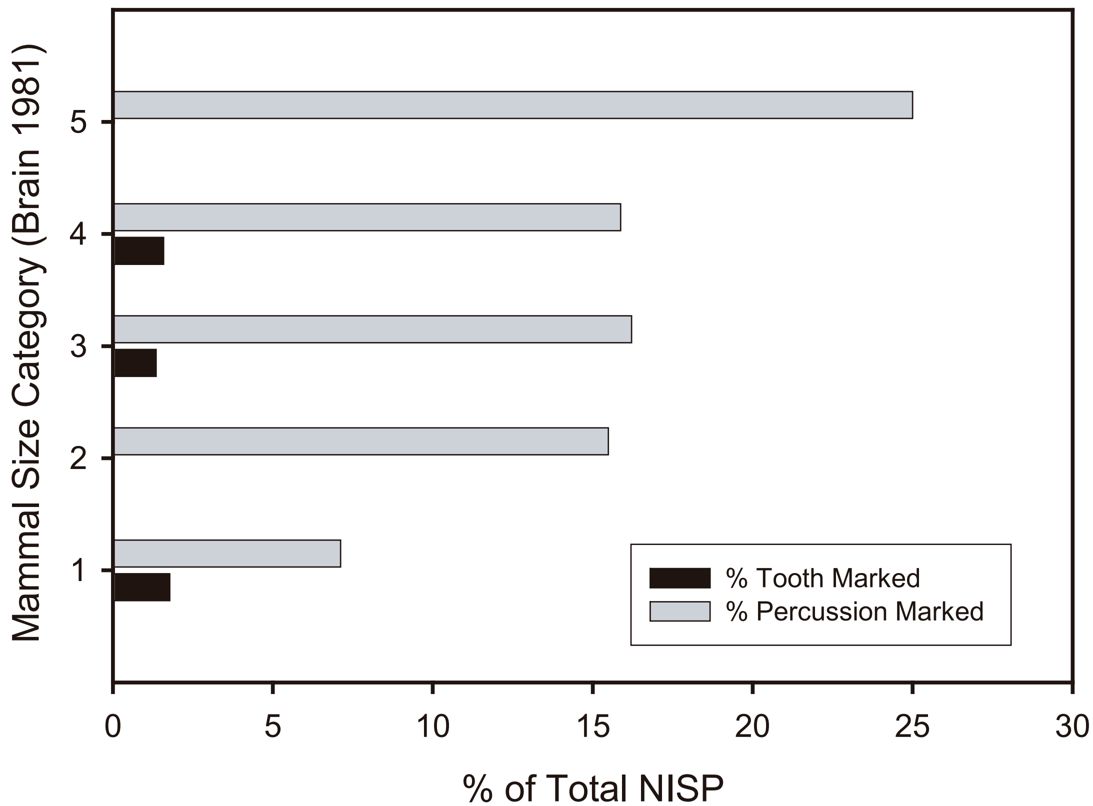


Figure 33. The percentage of total NISP by Mammal Body Size Category (Brain 1981) of tooth marked and percussion marked fragments at sites 13A and 13B.

der. Faint arterial impressions (*impressiones arteriosae*), representing impressions left by branches of the anterior ramus of the middle meningeal artery, radiate towards the sagittal border. Foramina for emissary veins are visible across both the internal and external surfaces. The surface of the external table has a mottled roughness to it, a sign of extensive weathering, and there are calcite crystals on this surface. Staining, possibly manganese, is present on both the internal and external surfaces.

The Klasies River human skeletal collection indicates that modern parietal bone morphology was present in South African MSA populations (Singer & Wymer, 1982). Thus as a guide, a sample of parietal bones from a South African archaeological population was used to facilitate accurate positioning of the fragment in the skull. The presence of the sagittal suture made positioning relatively easy. The parietal bones in the comparative archaeological sample display distinctive changes in bone thickness, curvature and internal morphology along the sagittal border. Typically, relatively thin bone with minimal curvature, combine with depressions of the arachnoid granulations near the frontal angle, while thicker, relatively curved bone, combine with a pronounced groove for the sagittal sulcus approximately half way between the frontal and occipital angles. Specimen 4500 is a relatively thin fragment with minimal curvature. This, in addition to

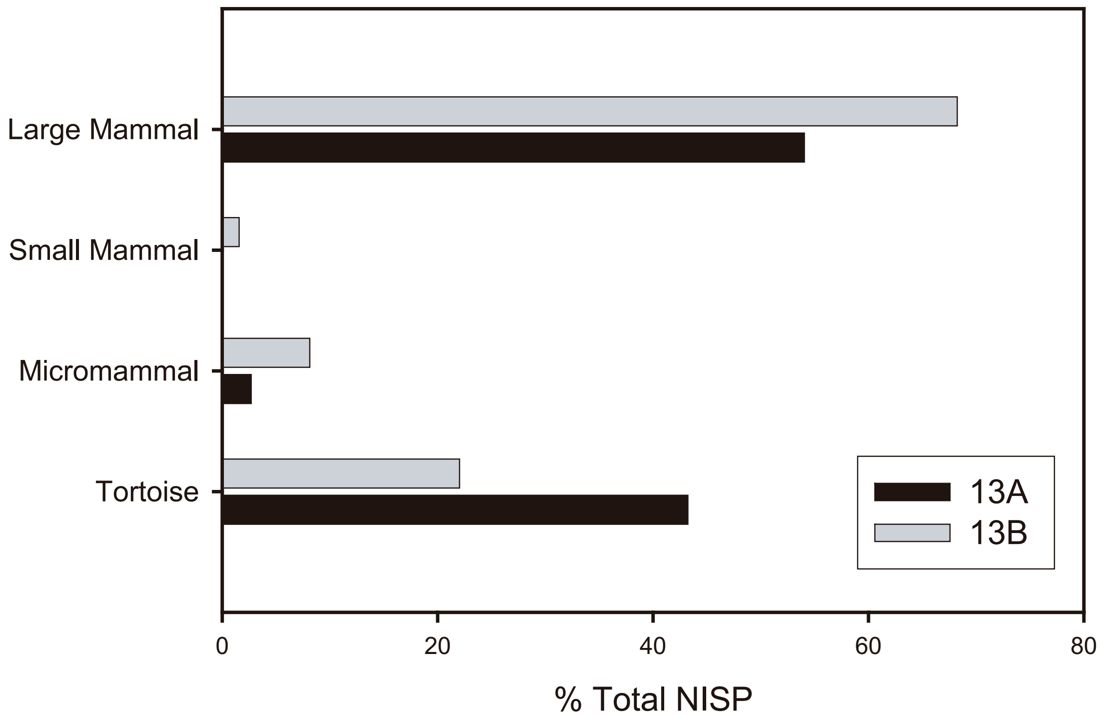


Figure 34. The percentage of total NISP of tortoise and mammal taxa grouped as tortoise, micromammal (mouse-sized species), small mammal (hare-size species), and large mammal (from small bovid and larger) at sites 13A and 13B.

the weak development of the groove for the sagittal sulcus and the presence of a depression of the arachnoid granulations on the inner surface, suggest that this fragment probably originated close to the frontal angle on the parietal bone from which it derives. The internal morphology of the fragment, i.e. the depression of the arachnoid granulations and the groove for the sagittal sulcus, makes anatomical sense only when positioned on the left parietal. On this side, the arachnoid granulations are closer to the anterior angle and the sagittal sulcus closer the the occipital angle. We therefore suggest that this is a fragment of a left parietal (see Figure 35).

The lack of fusion along the sagittal border suggests derivation from either a juvenile or young adult. The thickness of this specimen, however, favors derivation from a young adult rather than a juvenile. The pronounced depression of the arachnoid granulations adds weight to this view, as these depressions are rarely visible in juveniles, are more pronounced in adults and are most pronounced in old individuals (Gray et al. 1977).

Specimen 4501 - Central Incisor

This is a well-preserved, permanent right central mandibular incisor (Figure 36). The specimen is complete, except for a slightly damaged root apex. Estimated mesio-distal (MD) crown diameter is 5.9 mm and the bucco-lingual (BL) diameter is 6.2 mm. Estimated crown height is 7.5 mm and root length is ca.12.7 mm. Well-defined distal and mesial interproximal

Figure 35. The hominid parietal fragment (4500) showing external (A) and internal (B) surfaces, and its approximate location on a human skull (C). The scale is 2 cm long, and C) is not to scale.

wear facets (IWF) are placed slightly lingual to the midline of the tooth. Wear is comparable to wear stage 5 in the Murphy System [as modified by Smith (1984)], and is characterised by a broad strip of dentine exposed along the incisal edge. The crown outline, as seen in the lingual view, is marginally asymmetrical, with wear tapering slightly towards the disto-incisal edge. Consistent with the identification of this tooth as a central incisor, the distal crown edges do not flare distally to the degree that they would in lateral mandibular incisors (White and Folkens 2000). Discernible mesial and distal marginal ridges merge at a slight cervical enamel prominence, creating a significant degree of shoveling.

Microscopic scratches cover the entire surface of the crown. Vertically orientated scratches are especially evident close to the incisal edge, on the labial face. Enamel polishing is present over the entire surface of the crown. Remnants of dental calculus are evident on the cervical third of all four faces, but are especially pronounced on the mesial and distal faces. The tooth possesses a fully developed root, which tapers to a closed root apex. It is relatively long and MD compressed.

Specimen 4501 is a relatively large tooth when compared in absolute terms with modern African populations (Table 14, Figure 37). However, it falls at the lower end of the range of size variation displayed by a comparative sample of fossil specimens from the African Early, Middle and Late Pleistocene. Although worn, an estimate of Specimen 4501's crown height, suggests that it may have had the shortest crown height amongst the fossil specimens in the comparative sample. It compares more favorably in this dimension to modern African specimens. The estimated MD diameter of Specimen 4501 falls at the upper limits of the range of a comparative archaeological and modern African sample. Compared to the MD diameters of the sample of fossil specimens, it possesses the fourth most MD compressed crown after the Middle Pleistocene specimens of Atapuerca-SH (population mean of 5.5 mm), Mauer (5.5 mm) and Ternifine (Tighennif) (5.7 mm).

The BL diameter also falls at the upper limits of the range of a modern African sample, but is smaller than the mean values of an African archaeological sample. When compared to the BL diameters of the fossil human sample, it possesses the third most BL compressed crown after Dmanisi (5.9 mm) and Sangiran Bs 9706 (5.8 mm). In terms of overall crown shape (as expressed by a CSI of 105.1, Table 14), Specimen 4501 displays a level of relative BL expansion that falls between levels displayed by Plio-Pleistocene/Lower Pleistocene (e. g. Dmanisi, Sangiran 11and Sangiran Bs 9706) and Middle Pleistocene specimens (e.g. HDP1-3, Ternifine, Rabat, Mauer and Atapuerca-SH), and most closely resembles levels displayed by contemporary southern African populations. Bermúdez de Castro et al. (1999) identify relative BL expansion of mandibular incisors as one of the evolutionary trends of hominid evolution from the Lower through the Middle Pleistocene. The high levels of relative BL expansion in mandibular incisors that were attained by Middle Pleistocene populations were not retained by contemporary southern African populations such as the San, who generally display quite reduced levels. The dimensions of Specimen 4501 suggests that reductions in relative BL diameter may have occurred relatively early on in this region. In root length, this incisor also compares more favorably with modern African homologues than with fossil specimens.

Discussion of Hominid Remains

Specimen 4500 is a left parietal fragment of probably a young adult. There is insufficient morphology preserved to confidently assess the "modernness" of this specimen. Specimen 4501 is one of only a handful of measurable permanent central incisors from the South African MSA. Although mandibular central incisors were recovered in similar contexts at Klasies River and Die Kelders Cave 1, the teeth from these sites are either unerupted, or are too worn to provide useful metrical data on crown dimensions. Specimen 4501 is thus a valuable addition to a very small sample.

DISCUSSION AND CONCLUSIONS

Pinnacle Point near Mossel Bay has not been archaeologically investigated previous to our study, and our investigations to date have demonstrated that this stretch of coastline may have one of the richest records of MSA archaeological remains in South Africa. Caves, rockshelters, and open air MSA sites are abundant and archaeological sediments are well preserved. Calcretes and caliches are abundant in and around the surface sites, flowstones and dripstones are abundant in the caves and some seal MSA deposits,

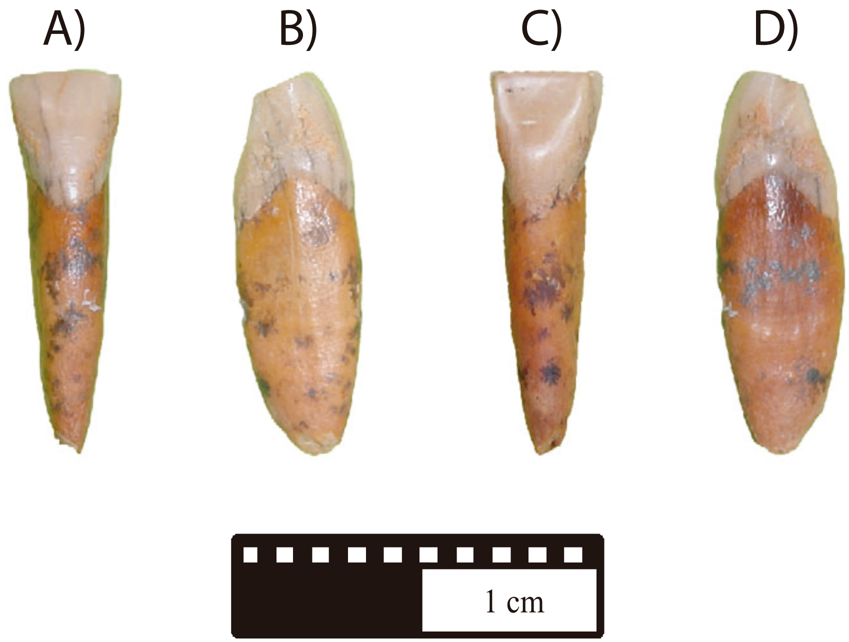


Figure 36. The hominid incisor (4501) showing A) buccal, B) distal, C) lingual, and D) mesial views. The scale is 2 cm long.

leading to the possibility of uranium-series dating. Some of the caves are well above the OIS5e high sea stand (Hendey & Volman, 1986; Van Andel, 1989; Richards et al., 1994; Van Andel & Tzedakis, 1996)) and thus may preserve OIS6 MSA material, a time poorly sampled in Africa but clearly critical to the MSA and the debate over the origins of modern people. Our excavations were productive at sites 13A and 13B, but less so at site 9 because a large dune sealed the deposit and we were unable to reach archaeological deposits.

The MSA lithic assemblages do not vary significantly between the sites and facies, but the samples are still fairly small when the assemblages are split into sub-assemblages. They display a diversity of raw materials that include local quartzites, non-local quartzites, silcretes of various types, and even non-local hornfels. While we have not yet developed a full understanding of the range and placement of sources, we have found that most of these raw materials are procurable fairly locally, and that silcrete may not be as “exotic” as is regularly claimed. The lithic assemblages include a high frequency of cortical pieces, suggesting primary core reduction on site. Uniformly, the samples represent the early stages of artifact manufacture, and “finished tools” as represented by retouched pieces are rare, as is typical for the MSA in southern Africa. The Mossel Bay region is famous in Stone Age studies because it lent its name to one of the first formally recognized stone tool industries in South Africa – The Mossel Bay Industry. The key characteristics of the Mossel Bay Industry are artifacts made on quartzites, and long pointed and parallel-sided flakes. Our excavations revealed

TABLE 14. MESIO-DISTAL (ESTIMATED) AND BUCCO-LINGUAL DIAMETERS (IN MM), CROWN SHAPE INDEX (CSI) AND ROOT LENGTH OF SPECIMEN 4501 AND CENTRAL MANDIBULAR INCISORS FROM SELECTED MODERN, ARCHAEOLOGICAL AND FOSSIL HUMANS FROM AFRICA.

	MESIO-DISTAL			BUCCO-LINGUAL						
SPECIMEN (S)	N	MM	S.D.	N	MM	S.D.	CROWN HEIGHT	ROOT LENGTH	CSI	REFERENCES
Mossel Bay 4501		5.9			6.2		ca. 7.5	ca. 12.7	105.1	This report
Atapuerca-SH	5	5.5	0.08	5	6.5	0.43			118.2	Bermudez de Castro (1986, 1988, 1993)
Border Cave 5					6.6					Stynder et al.(2001)
Dmanisi		6.2			5.9				95.2	Gabunia & Vekua (1995)
HDP1-3		6.4			7.2		ca. 8.1	15.1	112.5	Stynder et al.(2001)
KNM-ER-820		6.1			6.3				103.3	Wood (1991)
KNM-WT-15000		6.6			6.8		10.1	19.9	103	Brown & Walker (1993)
Mauer		5.5			7.1				129.1	Bermudez de Castro (1986)
Nubia, "Mesolithic", F	12	5.48	0.34	14	6.31	0.39			115.1	Calcagno (1989)
Nubia, "Mesolithic", M	8	5.8	0.35	11	6.43	0.39			110.9	Calcagno (1989)
OH16		6.5			7		10.6		107.7	Tobias (1991)
OH7		6.8			6.6		9.2		97.1	Tobias (1991)
Rabat		6			7				116.7	Bermúdez de Castro (1986)
S.A. Blacks		5.9			6		7.8	12.4	101.7	Shaw (1931)
S.A. Blacks, Female	61	5.3	0.35		5.71	0.42			107.7	Jacobson (1982)
S.A. Blacks, Male	181	5.33	0.42		5.83	0.39			109.4	Jacobson (1982)
S.A.Blacks, Male	56	5.43	0.45		6.2	0.32			114.2	Kieser et al. (1987)
San		5			5.2		6.8	12	104	Drennan (1929)
San, Female	5	5.4	0.84		5.6	0.61			103.7	van Reenen (1982)
San, Male	6	5.4	0.47		5.3	0.27			98.1	van Reenen (1982)
Sangiran 11		7.4			6.5				87.8	Wood (1991)
Sangiran Bs 9706		6			5.8		9.9		96.7	Baba et al. (2000)
Ternifine (Tighennif)		5.7			6.6		9		115.8	Bermúdez de Castro (1986)

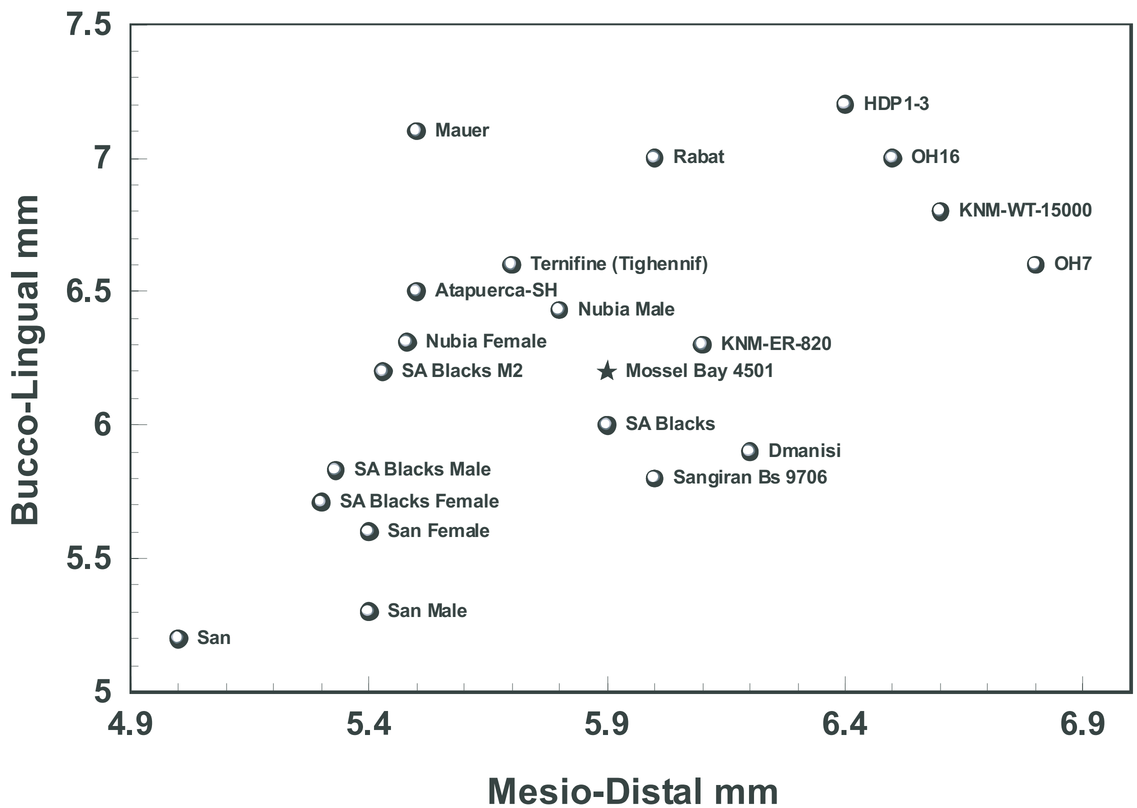


Figure 37. Scatterplot of the mesio-distal and bucco-lingual diameters in mm of the Mossel Bay 4501 hominid central incisor relative to central mandibular incisors from selected modern, archaeological and fossil humans from Africa.

material that is technologically and typologically similar, but also has some interesting differences in that the complete blades and points are significantly smaller than those from Cape St. Blaize (the Mossel Bay type sample) and Klasies River (the best described sample).

MSA inhabitants of caves at Pinnacle Point collected marine shellfish primarily from nearby rocky shores and very occasionally also from sandy beaches. Their collecting rounds targeted the mid- and lower reaches of the intertidal zone from where brown mussels, arikreukel snails, limpets, chitons and black mussels were collected most probably during low spring tides. Other species were also gathered (e.g., ear shells, white mussel and corrugated white mussel, but in much smaller quantities). Comparison of shell densities and species frequencies from MSA sites with those from nearby Holocene LSA sites might also help us estimate the distance between MSA shell bearing sites and their contemporary shoreline.

Fossil bone is well preserved in the deposits, and this is expected as the geology of the area features a laterally extensive, nearly continuous, calcrete (derived from ancient calcareous and now decalcified dunes) that caps the acidic quartzite. High frequencies of cut marks and hammerstone percussion marks on long bone fragments and the near absence of carnivore tooth marks on bone surfaces, strongly indicates that humans were responsible for accumulating and depositing the bulk of the faunal remains at 13A and 13B. Interestingly, there are no snake bones in either 13A or 13B. This is unusual and may have significant implications for interpreting the presence of snakes and other fauna in other MSA sites. Because both sites present a strong human taphonomic signature, the faunal assemblage may be a good indicator of the species range that hominids were and were not exploiting. Tortoises, small mammals, and microfauna are rare at both sites relative to other MSA sites in South Africa.

The hominin remains include two fragments: a parietal and central incisor. While the parietal is too fragmentary to interpret, the incisor falls comfortably between Middle Pleistocene hominins and modern humans in metric attributes. Given the rarity with which human fossil material is found in MSA sites in South Africa, this sample from such a small excavation perhaps provides optimism for further discoveries.

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APPENDIX 1: PROVENIENCE AND DESCRIPTIVE DATA FOR THE ILLUSTRATED LITHICS.

MAP	FIGURE	SITE	SQUARE	QUAD	STRATUNIT	FACIES	DESCRIPTION	PORTION	RAW MATERIAL
124	23	13B	N94E109	SE	NEE	Lightly Consolidated MSA Facies	Convergent Blade	Whole Flake	Quartzite
145	23	13B	N94E109	SE	NEE	Lightly Consolidated MSA Facies	Quadrilateral Blade	Whole Flake	Quartzite
148	23	13B	N94E109	SE	NEE	Lightly Consolidated MSA Facies	Flake	Whole Flake	Quartzite
149	23	13B	N94E109	SE	NEE	Lightly Consolidated MSA Facies	Flake	Whole Flake	Quartzite
234	24	13B	N94E109	SE	NEG	Lightly Consolidated MSA Facies	Radial Disc Core	Complete	Quartzite
326	26	13B	N94E109	SE	NEN	Lightly Consolidated MSA Facies	Flake Fragment with Retouch	Distal Fragment	Quartz
1294	23	13B	N91E108	SW	EC	MSA Roof Spall Facies	Indeterminate Fragment	Proximal	Quartzite
1303	24	13B	N91E108	SW	EC	MSA Roof Spall Facies	Multiple Platform Core on Flake	Whole Flake	Quartzite
1524	25	13B	N91E108	SW	EH	MSA Roof Spall Facies	Simple Blade	Whole Flake	Quartzite
1643	25	13B	N91E108	NE	EH3	MSA Roof Spall Facies	Facetted Blade	Whole Flake	Quartzite
1733	25	13B	None	None	Surface	13B Disturbance	Facetted Blade	Whole Flake	Quartzite
1772	26	13B	None	None	Surface	13B Disturbance	Disc Core	Complete	Silcrete

APPENDIX 1: PROVENIENCE AND DESCRIPTIVE DATA FOR THE ILLUSTRATED LITHICS. (CONTINUED)

MAP	FIGURE	SITE	SQUARE	QUAD	STRATUNIT	FACIES	DESCRIPTION	PORTION	RAW MATERIAL
2142	24	13B	N97E96	NE	WB	Brown Sand MSA Facies	Flake	Whole Flake	Cave TMS
2191	25	13B	N97E96	SE	WB	Brown Sand MSA Facies	Facetted Flake	Whole Flake	Quartzite
2251	26	13B	N97E96	SE	WB	Brown Sand MSA Facies	Single Platform Core	Complete	Quartzite
2501	23	13B	N97E96	NE	WB	Brown Sand MSA Facies	Point	Whole Flake	Quartzite
2529	23	13B	N97E96	NE	WB	Brown Sand MSA Facies	Quadrilateral Blade	Whole Flake	Quartzite
3192	26	13A	N69E100	NW	F	Brown Humic Sands MSA Facies	Whole Flake	Whole Flake	Silcrete
3275	25	13A	N69E100	NE	B	Brown Humic Sands MSA Facies	Simple Blade	Whole Flake	Quartzite
3295	26	13A	N69E100	NE	B	Brown Humic Sands MSA Facies	Facetted Point	Whole Flake	Quartzite
3396	23	13A	N69E100	NE	H	Brown Humic Sands MSA Facies	Point	Whole Flake	Quartzite