# The Sterkfontein Caves Palaeontological and Archaeological Site

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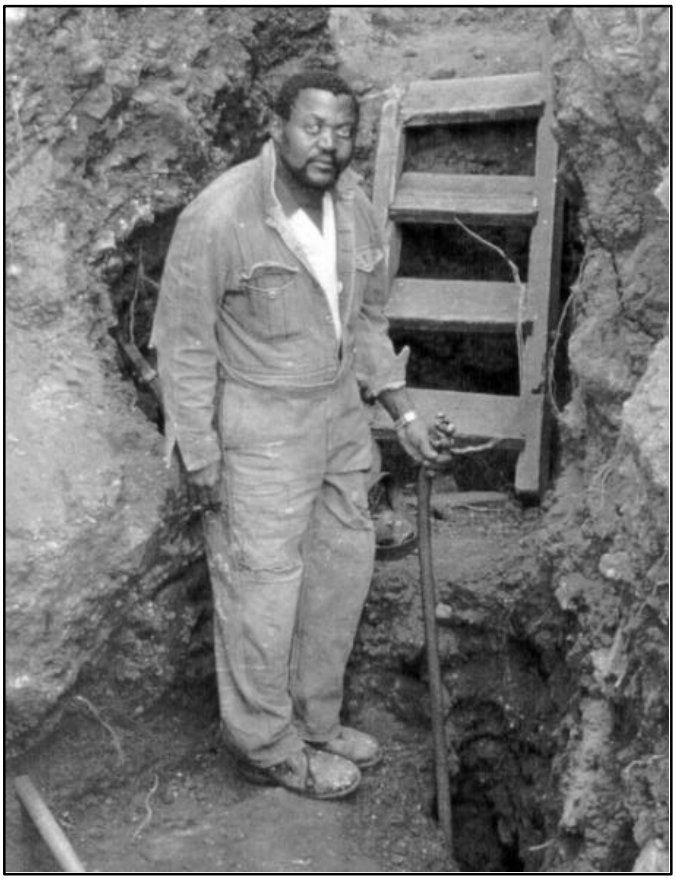
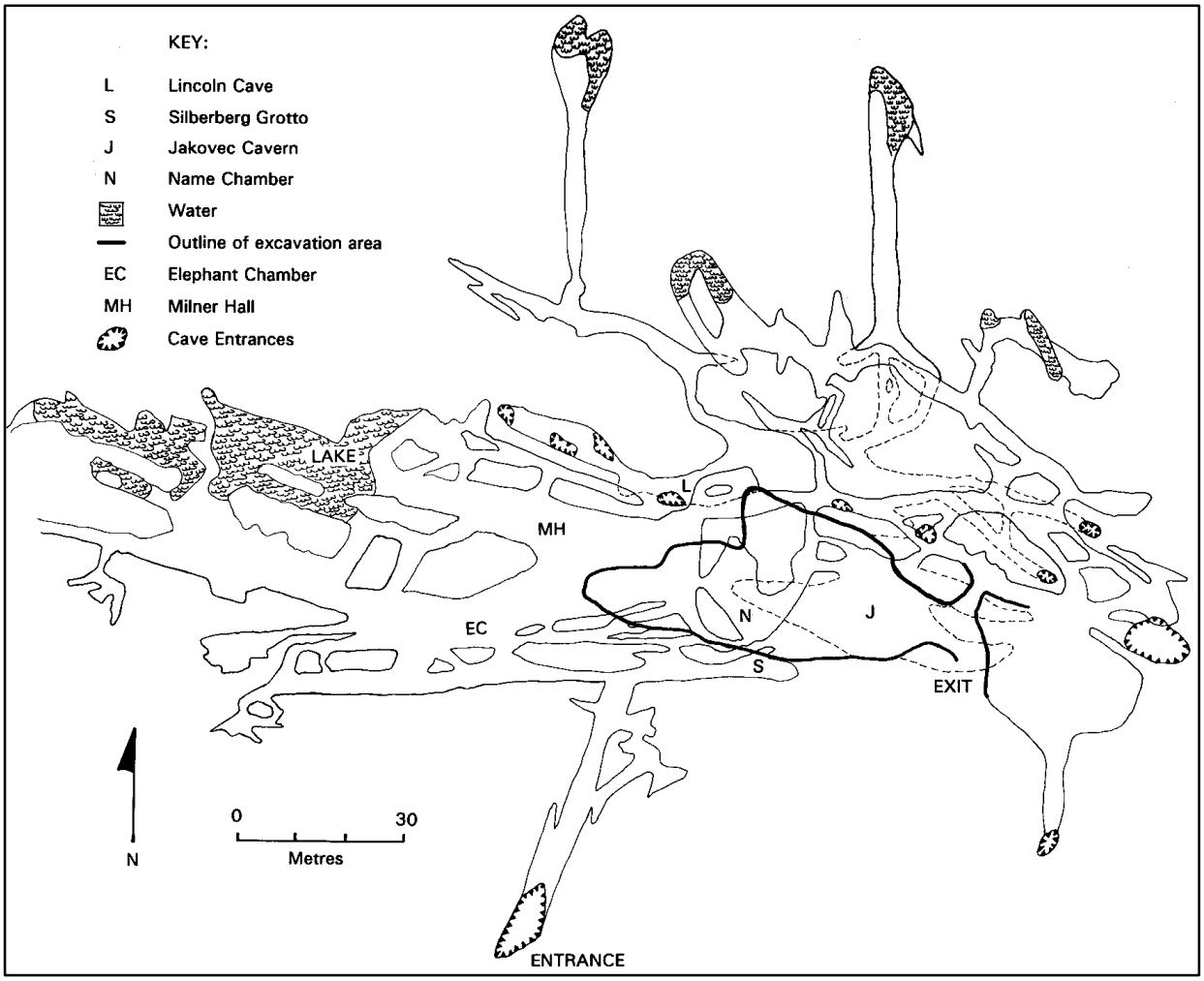


**This guidebook is dedicated to the memory of Simon Sekowe, foreman of the Sterkfontein excavation for many years, a gifted fieldworker, and an example to us all.**

**Cover : Skull and upper arm of the 3,3 million-year-old *Australopithecus* skeleton from the Silberberg Grotto (Member 2, Sterkfontein).**

## Introduction

Sterkfontein is one of the world's most productive and important palaeoanthropological sites.[1] It is the place where the very first adult ape-man was found by Dr Robert Broom in 1936. This ancient cave system has over the years revealed a sequence of deposits with fossils dating from about 3,5 to 1,5 million years ago, a period of time which spans the early development of the family of man–the *hominids*. In addition to almost 500 skull, jaw, teeth and skeletal fossils of these early hominids, there are many thousands of other animal fossils, over 300 fragments of fossil wood, and over 9 000 stone tools which include some of the earliest manifestations of human culture on earth. Some of the youngest deposits in the cave also contain fossils and tools from the period just prior to the emergence of modern humans, the period *ca.* 100 000 to 250 000 years ago.



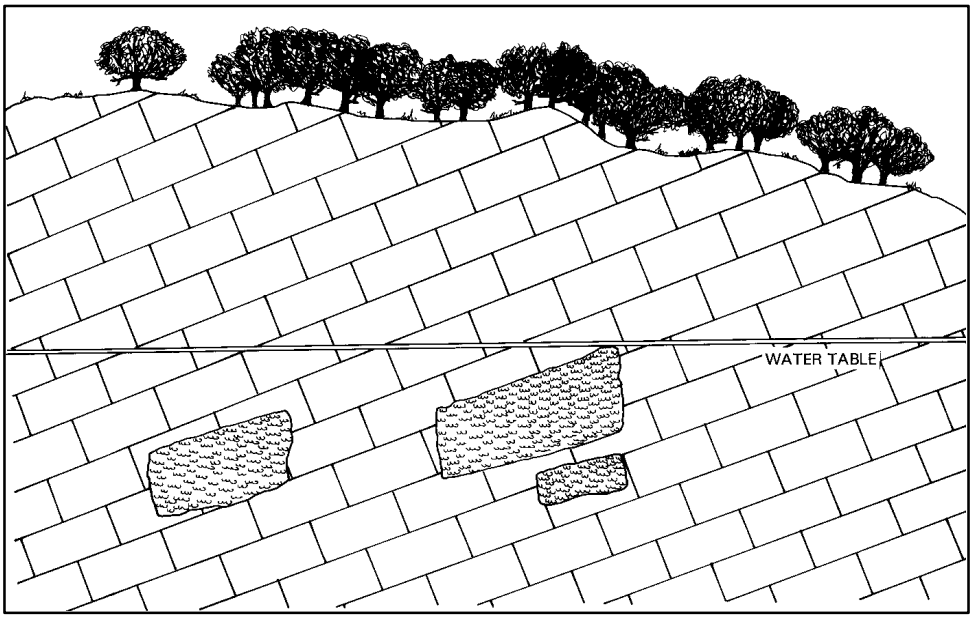

*The cave system at Sterkfontein, slightly simplified, after Wilkinson 1983.[6] Dashed lines indicate lower caves.*

As you descend the steps into the Sterkfontein Caves, you are going back over 2,5 billion years to a time when the South African interior was submerged under a *warm shallow sea*. Under these conditions, sediments formed which eventually hardened into the dolomitic limestone rock on which you stand today as you visit the caves. The chemical components of the water were rich in calcium carbonate, magnesium carbonate, and small amounts of manganese and iron. At times, changes in the water chemistry formed bands of silica as chert layers within the dolomite. *Ripple marks* were created in these sediments due to wave action against the shore, and they are now preserved in the rocks. One of the earliest forms of life on earth is also found in these rocks-cyanobacteria, a blue-green algae which grew in the warm, shallow water where it had sunlight for photosynthesis. As each algal layer was covered by sediment, a new layer formed in order to reach the sunlight. These layered structures are called *stromatolites* and are commonly preserved in the dolomite. Tiny egg-like concretions of calcium carbonate called *oolites* also formed around grains of sediment in the shallow water due to the presence of the algae and the alkaline nature of the sea.

Hundreds of millions of years were to pass whilst the dolomite lay beneath the seabed and became covered by other sediments that formed massive formations of quartzite and shale, which in some areas were affected by molten rocks erupting from deeper levels within the earth.

## Cave Formation

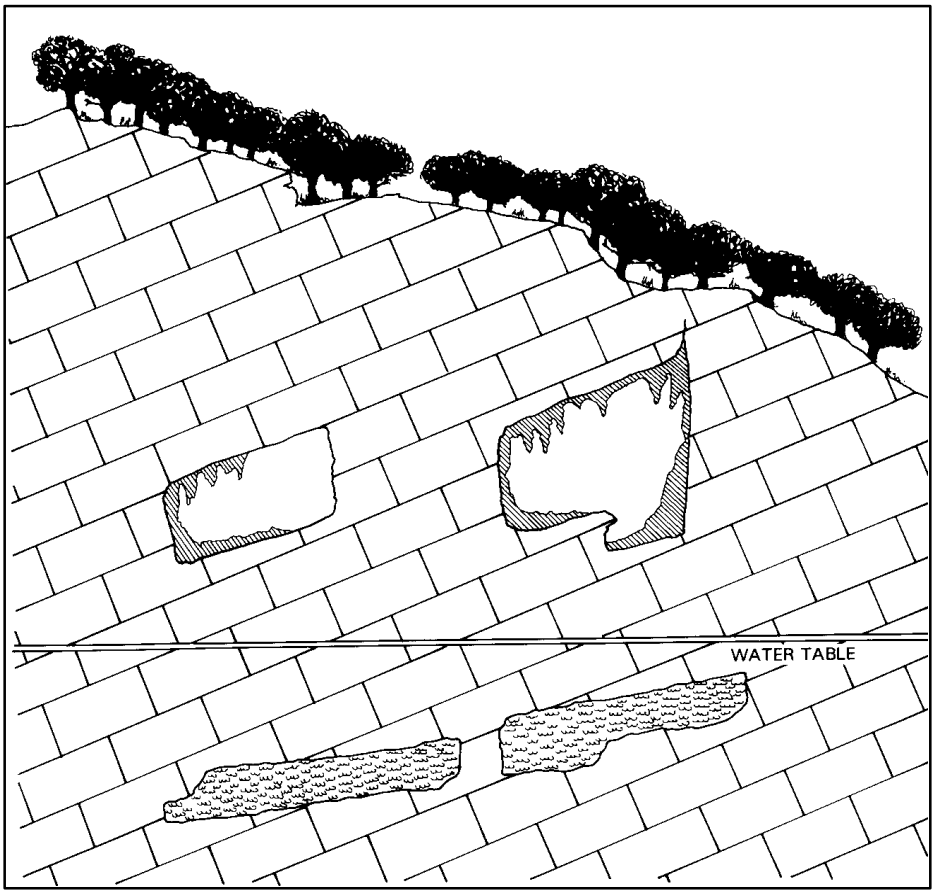
It was probably not until some time about 20 to 30 million years ago that the first caverns began to form in the dolomites at levels some 50 or 60 m below the surface. By this




time, the sea had retreated and earth movements had affected the area, causing the rocks to dip in a north westerly direction. In deep levels under the water table, *weakly acidic*

*ground water* began to dissolve out calcium carbonate from the dolomite along horizontal bedding planes and vertical joints which served as planes of weakness for this acid attack. Many large caverns formed in this manner under the water table. In the Elephant Chamber and the Milner Hall, you can see the stark effect of the dissolution of dolomite in the form of massive rock pinnacles hanging overhead. Today the water table is much lower and is marked by the underground lake within the Milner Hall. As other caves formed beneath the water table over time, an underground network of caves was produced which is only evidenced on the surface by occasional sinkholes and collapses or by the trees and bushes which surround shafts leading down to caverns.

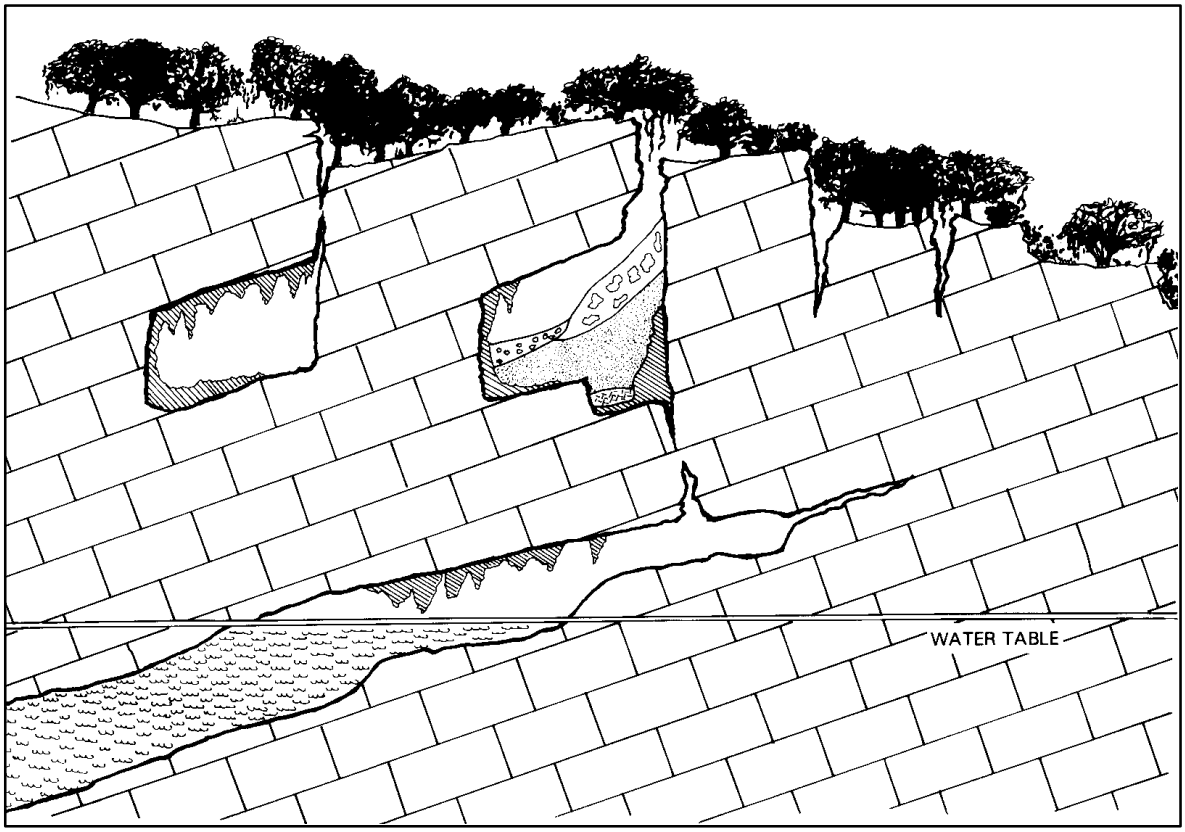
At some time after cave formation, the water table dropped in the area. The existing caverns became air-filled voids which then lay above water, but they were still sealed off from the ground surface. As slightly acidic groundwater slowly seeped through cracks in the dolomite, the calcium carbonate continued to be dissolved out of the rocks. When each drop of water reached the cave roof, some carbon dioxide was released and a chemical reversal took place. Microscopic residues of calcium carbonate were deposited with each drop of water and over thousands of years formed stalactites hanging from the roof and walls. In this way, many beautiful structures slowly formed: some look like icicles, others like curtains. In




some parts of the cave, beautiful crystalline growths cover the walls. Where the lime-charged water dripped down onto the cave floor, stalagmites could also grow upwards, sometimes joining with stalactites to form beautiful columns. Unfortunately, very few of these attractive

structures remain in the section of the cave open to the public. Many were mined by lime-quarry workers, and others were destroyed by souvenir hunters and vandals.

The underground caves would have first opened to the surface in the form of a relatively narrow slot at the top of a steep vertical shaft. Such a shaft can be seen above your head at the bottom of the entrance steps just before you enter the Elephant Chamber. These slots or *avens*

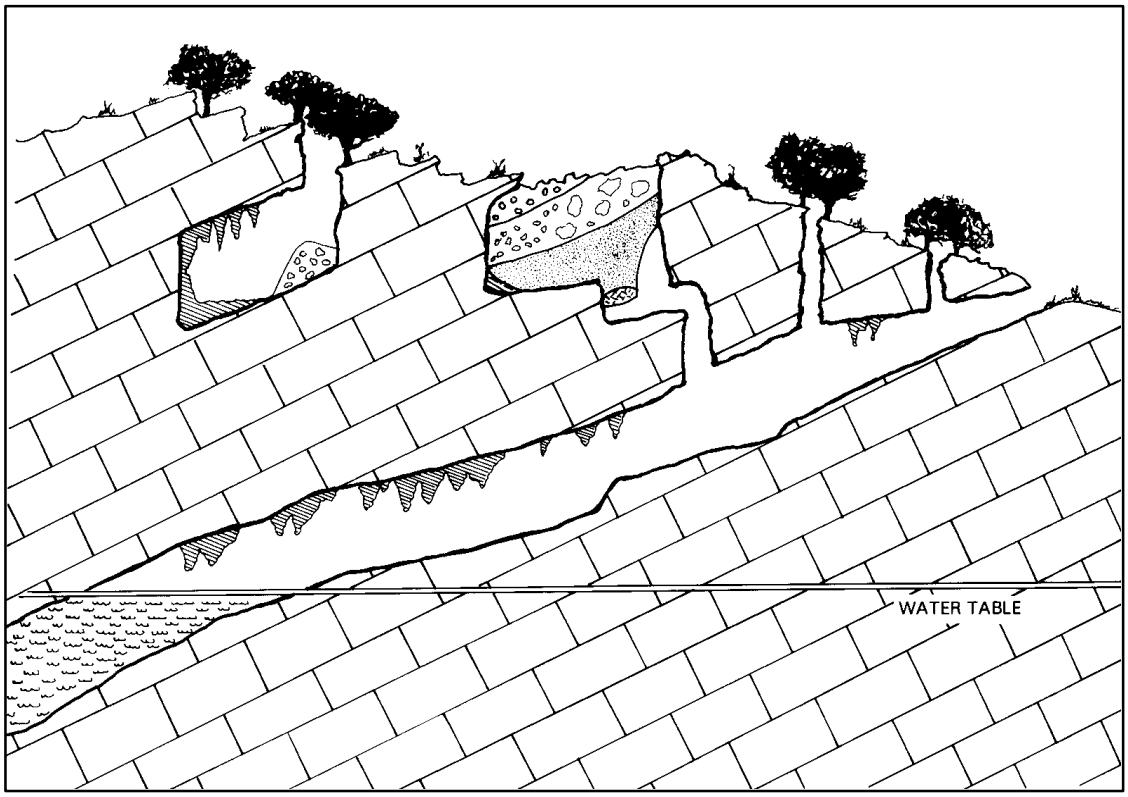



formed as a result of the continuing dissolution of the dolomite along vertical cracks or joints over time. As the land surface above the caves also continued to erode away, some joints eventually became open to the surface, thus ending the sealed, isolated state of the underground caves.

## Breccia

As you ascend the steps from the Milner Hall, you will see on your left a different kind of rock to the usual grey dolomite–a brownish orange rock containing blocks of dolomite and chert. This rock we call *breccia*. It is an ancient cave infill of earth, rock, and frequently bone that over many thousands of years was washed into the cave from the surface to form a sloped deposit called a *talus* which was slowly cemented by dripping lime. Some of this breccia has collapsed from older, higher caverns above, and some of it has been decalcified and returned to its original soft, earthy state. It is from these ancient cave infills that we excavate fossil bones *(fauna)*, plant remains *(flora)*, and stone tools *(artefacts)* that tell us about life around the caves from 3,5 to 1,5 million years ago. Study of the different species of

animals and hominids in the cave deposits and their development through time allows us to construct a picture of both human and animal *evolution* (change over many generations). When these observations are put into the context of changes that we find in vegetation, climate and culture through time, they build pictures of the past, like a series of time capsules excavated from the cave. Today the cave roof and the top portion of the breccia infills have



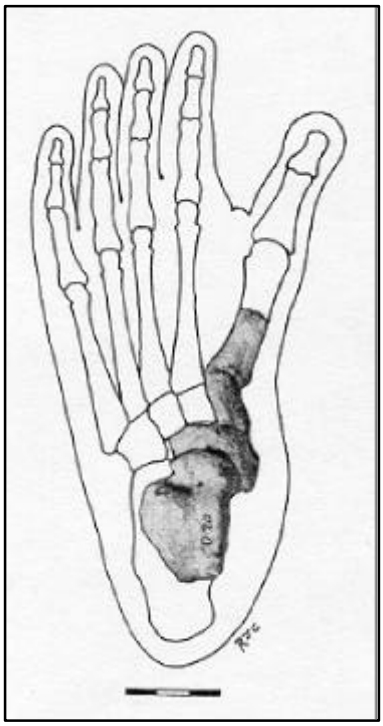

eroded away in the main area of cave deposits. You can see these exposed breccias in the excavated area as you follow the path to your right after exiting the cave tour.

## The Early Cave Infills

When the caves first opened to the surface, the opening would have been a relatively narrow and dangerous slot obscured by thick vegetation, leading to a long drop down a shaft into the cave. The earliest cave infills so far excavated date to about 3,5 to 3,0 million years ago and are preserved in geological Members 1, 2 and 3 in what is called the Silberberg Grotto, which is behind the locked gate to your left halfway down the entrance steps.[2] Fossils excavated from that cave consist largely of monkeys and carnivores, some of which are found as partial skeletons. Such finds indicate that animals probably fell into a narrow shaft and were either killed by the fall or were trapped and could not climb out.

In 1994 and 1997, 12 foot and lower leg bones of a single individual of *Australopithecus* were identified by Clarke in boxes of animal bones that had been excavated in 1980 from the Silberberg Grotto. Catalogued as StW 573, these bones are from both sides of the body and suggested to Clarke that the rest of the skeleton must still be embedded in the breccia of the

underground cave. He gave a cast of the distal right tibia to his assistants, Stephen Motsumi and Nkwane Molefe, and asked them to search the Member 2 breccia for a section of bone to which it would fit. On 3 July 1997, they found it, and subsequent excavation has uncovered the lower legs, left humerus and radius, and a complete skull (Clarke 1998[2]). Palaeomagnetic dating of several travertine layers above and below the skeleton by Tim Partridge of Wits University and John Shaw and Dave Heslop of Liverpool University has yielded a date of 3,3 million years (Partridge *et al.* 1999[2]). This date makes the skeleton the oldest in South Africa and older than the 3,2 m.yrs. old Lucy skeleton of *Australopithecus afarensis* which has no skull or feet. The skull, still embedded in matrix, already appears different from *Australopithecus africanus* and has some resemblances to *Australopithecus afarensis* but there are differences in the humerus and radius. The foot was capable of upright walking, but it was also adapted to life in trees as many of the footbones are chimpanzee-like, indicating flexibility and an ability to use the big toe for grasping. The trail of 3,6 million-year-old footprints of

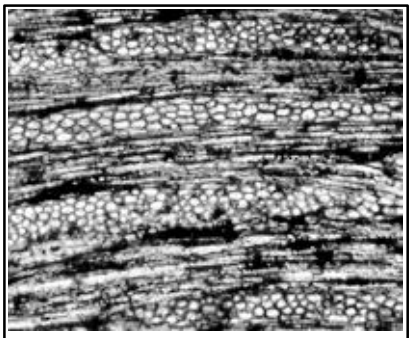


*Reconstruction of the StW 573 foot*

*Australopithecus afarensis* at Laetoli in Tanzania were clearly made by a similar ape-like foot. In general, *Australopithecus* fossils show traits in the base of the skull, the hip bones, the back-bones, the upper and lower legs and the feet which confirm that *Australopithecus* was upright but had some ape-like traits.

By 2,8 million years ago, there was at least one opening to the caves which had become larger and was surrounded by tropical forest trees from which lianas grew down into the cave entrance. This has been revealed by fossilised wood fragments from the Member 4 breccia identified by Dr Marion Bamford of the Bernard Price Institute for Palaeontology.[3] By analysing thin sections of the wood under a microscope, Dr Bamford has been able to dentify two species of tropical Western and Central African vegetation no longer growing in southern Africa, as well as a third species which is today restricted to the moister, more tropical province of Kwa-Zulu Natal. The fauna from this period also contains a large species of leaf-

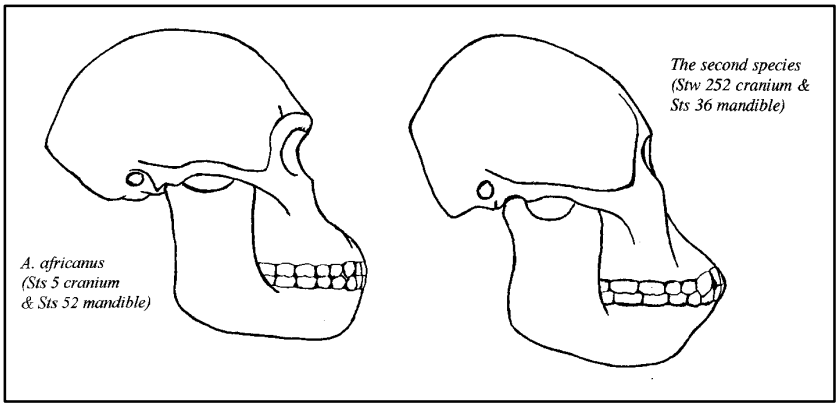
eating colobus monkey which required big trees for its survival. This large species of monkey is extinct, and no species of colobus occurs in Southern Africa today. Other fauna, such as many of the antelope species, suggest open grassland nearby, as do the rodent species. Rats, mice and other microfauna such as shrews, lizards and small birds are abundant in some of the cave deposits because they were the prey of owls, which often roost in cave entrances. Owls regurgitate the indigestible fur and bones of their prey, and deposits close to such roosts are particularly rich in microfauna.



*Enlarged thin section of fossil liana: Dichapetalum mombuttense*
Photograph: M. Bamford

As a whole, the fauna and flora from two of the earliest cave infills (Members 2 and 4 of the Sterkfontein Formation) indicate that between 3,3 and 2,6 million years ago the Sterkfontein valley was a mix of riverine forest-fringe and open woodland. Tropical to subtropical forest fringe is also reconstructed at many other early hominid sites from 4 to 2 million years ago in Africa - the period which was most crucial in the development of our ancient hominid ancestors and related species on the African Continent. Hominids adapted successfully to a mosaic of closed and open habitats because their tendency to walk upright allowed them to use resources beyond the forest, while the ability of some species to continue climbing in trees provided them with safety from carnivores and with potential food and sleeping sites.

Although the Member 2 fauna suggests the cave was a death trap over 3 million years ago, by 2,8 to 2,6 million years ago the entrance had enlarged and various carnivores were living around the cave and actively hunting a variety of monkeys and antelope, along with *Australopithecus*.[4] Some of these carnivores are now extinct, such as sabre-toothed cats, long-legged hunting hyaenas, and a very large variety of lion. Others species such as hyaena, leopard, caracal and jackal are like their modern counterparts. It was in large part because of these carnivores that the remains of hominids became concentrated at sites like Sterkfontein. As they were dropped into the cave from kills stored in trees or washed into the cave with rains, the bones became preserved within the breccias. Although some scientists believe that all the hominids from this early deposit represent *Australopithecus africanus*, Clarke[5] has suggested that a second species of *Australopithecus* is present which has some similarities to *Paranthropus*, another genus of hominid which appeared about 2,7 million years ago.



Until recently, *Australopithecus* had only been found in the Member 2 and 4 breccias (3,3 and 2,8 to 2,6 million years old, respectively). However, in 1995 Clarke began investigating a lower cave known as the Jacovec Cavern[6], where the team soon discovered a partial cranium of *Australopithecus*, as well as remains of at least two other individuals. Several other fossils of an extinct monkey, *Parapapio broomi*, and the hunting hyaena, *Chasmoporthetes*, along with the absence of stone tools, suggest an age generally equivalent to the *Australopithecus* deposit in the main excavation, if not earlier. The exciting new discoveries in the Jacovec Cavern and Member 2 show the continuing importance and great potential of the lesser known deposits at Sterkfontein.

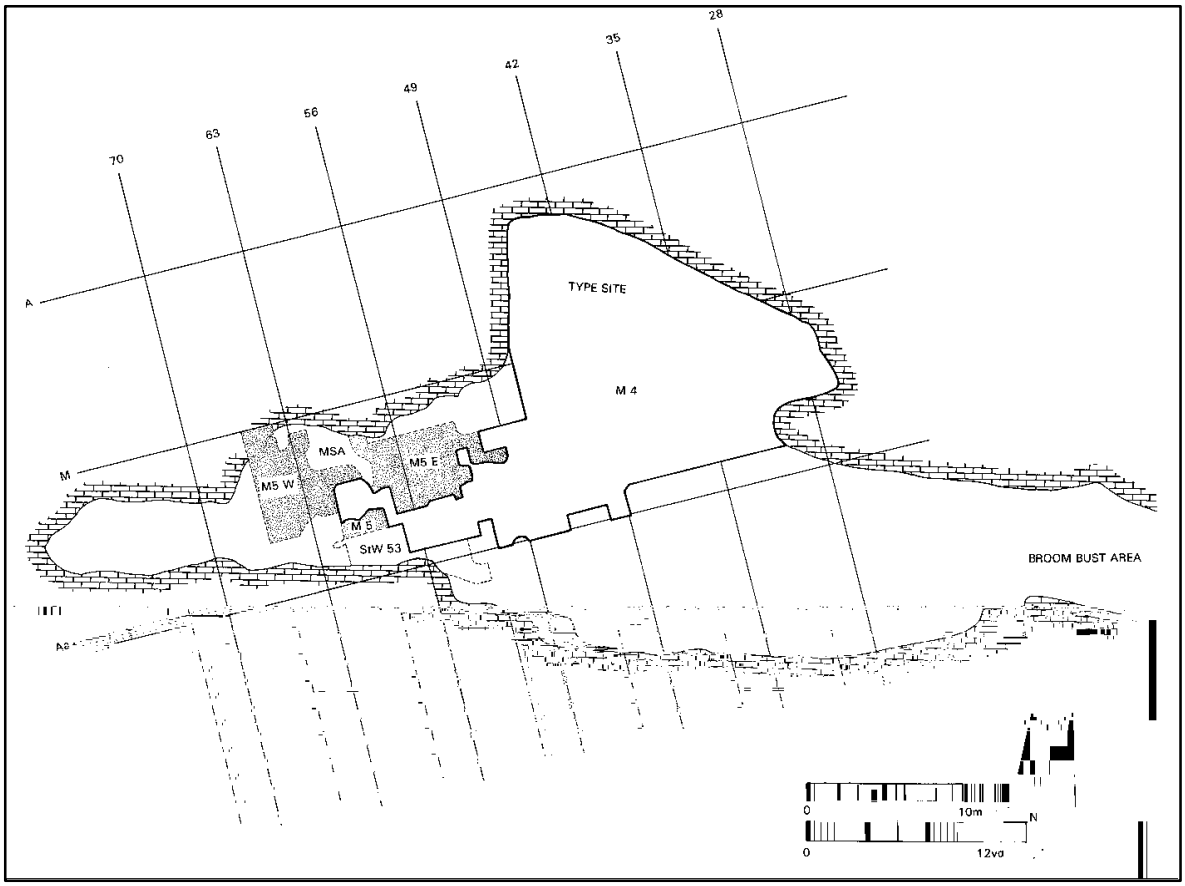
## The Later Cave Infills

By 2,5 million years ago, the African climate had become drier and grasslands more extensive. The main body of australopithecine breccia had been formed and the cave roof may have collapsed and blocked off the entry of any younger breccias to this eastern side of the cave system. Some deposits at the southern end of the site appear to preserve a late phase of breccia which relates to this drier climate, and for the first time, fossils of the extinct gelada baboon, *Theropithecus oswaldi*, appear in these deposits. This species of *Theropithecus* indicates that the more closed forested habitat was becoming patchier as drier grassland habitat became more extensive.

A hominid cranium, StW 53, was found in 1976 associated with *Theropithecus oswaldi*. Originally it was also thought to be associated with primitive stone tools and was placed in the species *Homo habilis.* Recent excavations have, however, shown that although it lay very close to the tool-bearing breccia, StW 53 actually came from a separate deposit that does not contain stone tools, although we estimate it may be between 2 to 2,6 million years old and is thus within the time range for tool manufacture. Clarke (in Kuman and Clarke in press[7]*)* has argued that the anatomy of StW 53 is primitive and is more consistent with *Australopithecus* than with early *Homo,* and like *Australopithecus* in Member 4, it is unlikely to have been a tool-maker. In fact stone tool cutmarks on StW 53 have been seen as evidence that this hominid was the victim of butchery (Pickering *et al* 1999[7]).

At Olduvai Gorge, Tanzania, and East Lake Turkana, Kenya, hominids with larger brains than *Australopithecus* have been found in association with Oldowan artefacts. These hominids are classed as *Homo habilis.* So far, no such large-brained hominids have been found with our Oldowan artefacts at Sterkfontein, although it is assumed that *Homo habilis* could well have been the maker of these tools. Some other small-brained hominids from East and South Africa which have been classed as *Homo habilis* are considered by some scientists to represent a species of *Australopithecus* that was contemporary with early *Homo*. This late *Australopithecus* species is represented in East Africa by a partial skeleton and upper jaw from lower Bed I of Olduvai Gorge, Tanzania. Olduvai Hominid 62, which has strong similarities to hominid StW 53 from Sterkfontein, has long arms relative to its legs, which indicates an arboreal adaptation. Furthermore, studies of the internal ear anatomy of StW 53 by Dr F Spoor have indicated that it was not habitually bipedal and was perhaps even less bipedal than *Australopithecus africanus*. As StW 53 comes from a deposit which reflects a drier climate than Member 4 and which lacks stone tools, it could be intermediate in time between Member 4 and the tool-bearing Member 5. As mentioned earlier, this would place it between 2,6 to 2,0 million years old, with the younger end of this age range close to the date for Olduvai Hominid 62. However, the StW 53 Infill may also prove to be a remnant of an even older breccia, and this possibility will have to be considered as well.

About 2,0 to 1,7 million years ago, artefacts were preserved in Member 5 in a breccia termed the Oldowan Infill. This breccia contains over 3 000 artefacts of the earliest tool industry named after Olduvai Gorge in Tanzania. The Oldowan Industry is traced back to just over 2,5 million years in Ethiopia and it occurs at a handful of other East African sites at a period from this date to 1,7 million years ago. The Sterkfontein Oldowan tools, dated by the associated fauna to between 2 to 1,7 million years old, are thus the earliest direct evidence for hominid culture




*A plan view of the most important breccias in the main excavation at Sterkfontein. Member 4 (M4, within the dashed line) has yielded hundreds of remains of Australopithecus. The Type Site was the locus of the original lime-quarrying activity and Dr Broom's discovery of the first adult Australopithecus in 1936 and Mrs Ples in 1947. The StW 53 Infill is named after the partial cranium discovered there in 1976 but has no stone tools. Oldowan artefacts were first excavated from Member 5 East (M5 E) in 1992 to 1994. Early Acheulean artefacts derive from both Member 5 East at higher levels than the Oldowan and from Member 5 West (M5 W), where they are in a better (undisturbed) context than in the eastern breccia. A much younger Middle Stone Age (MSA) Infill has been deposited in an eroded portion of the older breccias and divides Member 5 into its eastern and western sides*.

in Southern Africa.[8] They indicate that very early stone tool culture was widespread across Africa, and someday we may expect to find even earlier deposits with artefacts in Southern Africa. One early deposit which needs to be tested for artefacts is found at Sterkfontein in the Name Chamber. This breccia underlies the Oldowan Infill and appears to be a collapsed portion of some of the oldest breccias in the Member 5 area (Clarke[7]).

Although the local cave environment was moist in Member 5 times because of its proximity to the river, the fauna includes many more open-country species, such as horse, ostrich and springhare. It is in such habitats that fossils of *Paranthropus robustus*, a flat-faced ape-man

with a more specialised diet adapted to hard or gritty foods are found. This species was not found at Sterkfontein until 1992 when the deepening excavation reached the Oldowan deposit and yielded three teeth of *Paranthropus robustus*.

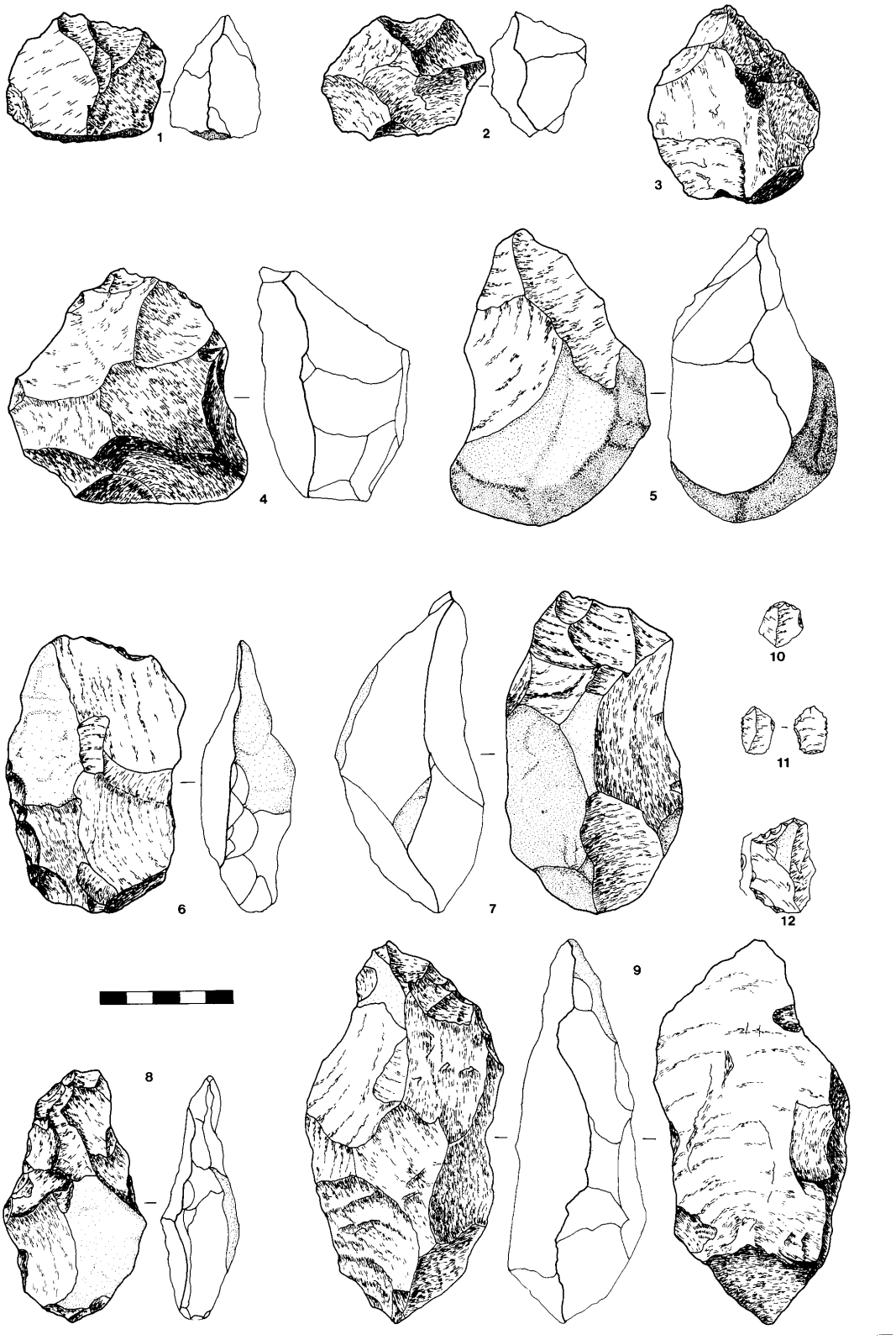
The Sterkfontein tools are very similar to the Oldowan artefacts which we know well from East Africa - intelligently made but simple tools which were made casually and used expediently for the purpose at hand. They consist mainly of flakes chipped or occasionally smashed from cobbles and pebble-sized rocks, a small number of cobble or pebble cores from which the flakes were struck, and the occasional core-based tool. The flakes would have been wanted for their sharp cutting or scraping edges. Although not much planning went into the shaping of these artefacts, forethought was needed to select the raw materials and bring them up to the site from the gravels, which lay within a few hundred metres of the site. The hominids did not favour the most common type of stone in the gravels, the quartzites. Instead they preferred using quartz, which is easy to chip and makes extremely sharp flakes, although quartzite and chert stones were also used to a lesser extent.

Scientists debate which hominid made the Oldowan tools, the earliest of which date to just over 2,5 million years. Some scientists believe that *Paranthropus,* who is found at 2,7 million years and often in association with artefacts, would have been capable of flaking stone tools. Other scientists believe that flaked stone tools are most likely to be a human *(i.e., Homo)* invention. They argue that, although the earliest *Homo* dates to only 2,3 million years, only a few have been found and it is possible that older *Homo* fossils may yet be discovered. All scientists recognise, however, that cultural behaviour is not unique to humans. For example, some chimpanzee populations make use of natural stones, twigs, leaves, sticks and branches and can be said to have a more elaborate form of material culture than other animal species, and indeed one which varies across chimpanzee populations.

The Oldowan Infill at Sterkfontein has a fairly restricted distribution in the site, which suggests that it entered the cave through a narrow shaft from the surface. The fauna also suggests that many animals fell down this death-trap-like shaft into the cave (Pickering 1999[4]). Not even at this late stage within the caves' history did hominids ever live within the cave. Rather they used the shade of trees and perhaps also the shelter of dolomite outcrops above the cave entrance. Their occupations were brief, but debris accumulated over a long period of time and eventually washed or fell into the cave deposit.

By about 1,5 million years, the entrance to the western side of the cave must have enlarged considerably because from this period we find artefact-bearing breccias more widely distributed. The tools in these deposits belong to the Early Acheulean Industry [8,9] which is known for its handaxes and cleavers, some of which were made on large flakes (10 cm or longer) which took good strength and planning to detach. By this time, tool-bearing (archaeological) sites in Africa were becoming larger and more numerous and hominids were using a greater variety of habitats. Hominids had by then come to depend on using stone tools as a regular part of their strategy for survival, and their presence on the landscape was becoming more evident.

Although the Acheulean hominids were still not dwelling in caves and would not do so for another million years, they were better able to avoid predators and ensure their survival. As a




*Sterkfontein Artefacts: Numbers 1 to 5 and 10 to 12 are Oldowan, and Numbers 6 to 9 are Early Acheulean. 1 to 4 = cores. 5 = a proto-biface which may have been a tool. 6 and 7 = cleavers. 8 and 9 = handaxes. 10 to 12 = flakes.*

result, we only have 15 fragmentary hominid fossils in these breccias at Sterkfontein, but at least one of these suggests that *Homo ergaster* was responsible for this new tool culture (Kuman and Clarke in press [7]). There are even more complete fossils of *Homo ergaster* at the neighbouring site of Swartkrans ca. 1,7 to 1,5 million years old, as well as other examples of this hominid in the East African sites. The three neighbouring sites of Sterkfontein, Swartkrans and Kromdraai attest to the continued development of early human technology in southern Africa through to *ca*. 1 million years.

The youngest deposits at Sterkfontein are found in the Lincoln Cave, a separate cave immediately north of the main excavation of Members 4 and 5. Until 1997, the Lincoln Cave had not been excavated, although its fossils and deposits represented in lime workers' dumps had been thought to belong to the Middle Stone Age. Systematic excavation of a western breccia within the Lincoln Cave[10] has now demonstrated that this deposit formed sometime between 115 000 and 253 000 years ago. Middle Stone Age artefacts, fauna and a few hominid fragments are present. Unfortunately some older material, eroded from adjacent Early Acheulean deposits, are also incorporated in this younger infill, making the deposit less valuable for research. However, the work has shown that the Lincoln Cave shares at least one connection with the main Sterkfontein Caves system. At least one Middle Stone Age infill is also present in a northern area of the main excavation, but it has not produced hominids.

## Dr Broom's Discoveries

At the top of the exit steps from the cave tour, you will see the statue of Dr Robert Broom. It was Broom who made the first discovery of an adult ape-man skull. This was at Sterkfontein on 17 August 1936 when he was 70 years old and was working as palaeontologist at the Transvaal Museum. At that time, the caves were being quarried for lime by miners using dynamite to blast out the lime-rich deposits. The quarry men burned the lime in kilns near the site but left aside dumps of breccia that had no commercial value. It was in these dumps that fossils were found. Broom named his first find *Australopithecus transvaalensis*, putting it into the same genus as *Australopithecus africanus*, the name given by Professor Raymond Dart to the infant ape-man skull found at Taung in 1924.

In 1937, Broom found a fragment of infant mandible that he considered so different to the Taung child that he changed the genus name of the Sterkfontein ape-man to *Plesianthropus*. It is now recognised that the Sterkfontein hominids do indeed belong to *Australopithecus*. Broom, assisted from 1946 onwards by the young John Robinson, discovered many ape-men and other animal fossils at Sterkfontein. In 1947, they uncovered a well preserved skull of what Broom thought was a female *Plesianthropus*. The newspapers named it Mrs Ples, and it is the most complete skull of *Australopithecus africanus* yet found.

In 1938, Broom recognised another genus of ape-man at Kromdraai, a kilometre east of Sterkfontein. It had a flat face, large grinding teeth, and a rugged skull to accommodate a heavily built jaw. Broom named it *Paranthropus robustus*. In 1948, he and John Robinson began work at Swartkrans, 1km west of Sterkfontein, and recovered many *Paranthropus* fossils, as well as fossils of a 1,7 million-year-old species of our own genus *Homo* in 1949. These fossils are now known as *Homo ergaster*, and a mandible found by Robinson in 1949 was the first discovery of such an ancient ancestor in the direct lineage of modern man. Robert Broom died in 1951 and in the last 15 years of his life had discovered in the Sterkfontein Valley three major forms of early hominid relating to the ancestry of man.

## Dating

The South African early hominid cave sites are currently dated mainly by the species of fauna found within the various deposits. We rely on our understanding of when some species appear and others become extinct. Some species undergo subtle but significant changes in anatomy or dentition. Our fauna is then compared to fauna in the East African sites, which are dated by absolute methods. Volcanic activity in the East African sites has resulted in layers of ash and lavas which can be dated by the ratio of certain elements which decay at known rates after deposition. Because the South African sites are so distant from East Africa, differences in the fauna can be expected. For this reason, dates for our sites are always considered to be relative dates or reasonable estimates, rather than absolute ages. The newly announced date of 3,3 million years for the new skeleton from Member 2, however, is based on Palaeomagnetism. This method of dating relies on past changes in the earth's magnetic field caused by reversals in currents in the earth's molten core. The present north position was marked on stalagmitic flowstone samples before they were chiselled from the rock layers. Magnetic particles within these samples were then checked to see if they showed normal or reversed polarity. A stratigraphic sequence of these samples was then correlated with the well-dated global palaeomagnetic sequence and the best fit was determined within the known faunal age of the deposits.

## How Do We Name Fossils?

When fossils are excavated, they are given a catalogue number. After being studied, they are classified into a zoological *genus* and *species.* For example, modern humans are classified into the genus *Homo* and the species *sapiens*, and the modern leopard is classified as *Panthera pardus*. Fossil relatives of humans are classified into several different species, including *Homo erectus* and *Homo habilis,* but more ape-like human relatives are classified into different genera such as *Australopithecus* and *Paranthropus*. Fossil forms of big cat are placed into many different genera and species, such as *Dinofelis barlowi* and *Megantereon cultridens*. These Latin names are based on a particular identifying character of the fossil or the geographic area in which it was found, or they are intended to honour a particular individual. Thus *Dino* means "terrible," *felis* means "cat," and *barlowi* is in honour of George Barlow, the quarry manager at Sterkfontein at the time of Broom's first visit.

Sometimes hominid fossils have been given "nicknames." For example, Broom named his 1936 ape-man find from Sterkfontein (catalogue number TM 1511) *Australopithecus transvaalensis,* meaning Southern Ape of the Transvaal. One year later he found a fossil child's jaw (TM 1516) that he said was so different from the Taung child, *Australopithecus africanus*, that he must place the Sterkfontein fossils into a new genus. Thus he gave the name *Plesianthropus,* meaning Near Man. When in 1947 Broom and Robinson blasted out a fine cranium of an ape-man, Broom said it was a female *Plesianthropus,* so the newspapers gave it the nickname Mrs Ples.

## Excavation and Fossil Cleaning

At the end of 1966, Professor PV Tobias, palaeoanthropologist who was Head of the Department of Anatomy at the University of the Witwatersrand, initiated a programme of excavation of the Sterkfontein site that has now been continuous for over 33 years. For the

first 25 of these years, the excavations were directed at the site by Mr Alun Hughes, who was succeeded in 1991 by Dr Ronald Clarke.

The first ten years of the Wits University excavation were spent clearing the site of lime miners' breccia dumps, which were carefully mapped and processed for fossils. A datum point and grid were established, and each grid square was given a letter designation along the north-south line and a number designation along the east-west line. Each grid square is 7,5cm x 7,5cm large and 2,5cm deep, providing a fairly specific reference point for each fossil or artefact removed from the site. Excavation is done with jackhammers and compressor, crowbars and sledge hammers for hard breccia, and picks, shovels and sieves for decalcified, softer breccia. Even the tiniest microfauna can be retrieved in this way.

Fossils in blocks of hard breccia are taken to a work station or to the laboratory where they can be removed by slow and careful cleaning. Most of the breccia is chipped away with small pointed chisels and light-weight hammers, but fine cleaning or the cleaning of very important fossils is done under a microscope with dental picks and airscribes driven with air pressure. Microfauna can be released from hard breccia by soaking the blocks in baths of dilute acetic acid, carefully watched and frequently washed over a period of days or weeks.

## Personalities Instrumental in Discoveries and Excavation at Sterkfontein

*Guglielmo Martinaglia*, in 1896, blasted into the caves for lime, thus opening the way for future scientific exploration at Sterkfontein.

*Trevor Jones*, a student of Raymond Dart, obtained fossil monkeys from Sterkfontein in 1935 and thus made the first scientific study of fossils from the site, which he published in 1936.

*GWH Scheepers* and *Harding Le Riche*, students of Raymond Dart, collected fossil monkeys from Sterkfontein in 1936 and took Broom there on his first visit on August 9th, 1936.

*George W Barlow*, in 1936, was the lime quarry manager who gave Broom the first ape-man fossil blasted out of Sterkfontein breccia.

*Robert Broom*, medical practitioner and palaeontologist specialising in Karoo reptiles for most of his life, was appointed as palaeontologist at the Transvaal Museum in 1934 at the age of 68 and began to look for ape-man fossils in caves near Pretoria. He was rewarded on 17 August 1936 when Barlow handed him the braincast of the first adult *Australopithecus* fossil from Sterkfontein.

*John Robinson*, appointed as Broom's assistant at the Transvaal Museum in 1936, went on to make many discoveries at Sterkfontein and Swartkrans and was the first to interpret accurately the stratigraphy of Sterkfontein.

*CK Brain* and *ABA Brink* in 1956 made the first discovery of stone tools at Sterkfontein. These were Early Acheulean artefacts, the earliest tools found in Southern Africa for many years to come.

*Revil Mason*, archaeologist at University of the Witwatersrand, conducted a test excavation with Brain at Sterkfontein in 1956 after the first artefacts were discovered. He later went on to analyse the Early Acheulean industry excavated by Robinson in 1957-58.

*Phillip V Tobias*, anatomist and palaeoanthropologist, initiated the current programme of excavation at Sterkfontein in 1966, whilst he was Head of the Dept of Anatomy at the University of the Witwatersrand. The full-time excavation of Sterkfontein has run without interruptions from 1966 to the present, producing the richest repository of early hominid fossils in the world.

*Alun Hughes*, who had excavated and made discoveries of *Australopithecus* at Makapansgat in 1948, directly supervised the excavations at Sterkfontein from 1966 until 1991 and was responsible for the discovery of hundreds of *Australopithecus* fossils.

*Tim Partridge*, geologist, has made detailed studies of the Sterkfontein stratigraphy and identified six geological divisions of the Sterkfontein Formation which he described as Members 1 through 6. He was also involved in studying the geology at a number of other such ape-man sites.

*Ian Watt*, professor of surveying at the University of the Witwatersrand, has surveyed the Sterkfontein caves and laid out the excavation grid necessary for recording the positions of all finds during excavation.

*Ronald Clarke*, palaeoanthropologist at Goethe University and the University of the Witwatersrand, has supervised excavations at Sterkfontein since 1991, revised the stratigraphy, and discovered the skull and skeleton of the earliest South African hominid.

*Kathleen Kuman*, archaeologist at the University of the Witwatersrand, has assisted with excavations since 1991 and made detailed studies of the artefacts, including the earliest stone tools in Southern Africa belonging to the Oldowan industry.

*Stephen Motsumi* and *Nkwane Molefe* are two long-serving members of the Sterkfontein excavation team. At the request of RJ Clarke, they looked for and discovered the tibia shaft contact in Member 2 that led to the uncovering of the first-ever complete skull and associated skeleton of *Australopithecus*.

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