

Preliminary results of excavations at Lincoln Cave, Sterkfontein, South Africa

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RECENT EXCAVATIONS OF UNDISTURBED deposits within the Lincoln Cave, Sterkfontein, have conclusively demonstrated that at least one of the deposits is mid- to late Pleistocene in age. The artefacts recovered from this excavation are in a datable context, sandwiched between two flowstone layers which could be dated using uranium series methods. The excavation furthermore yielded good indications that a portion of an older breccia has been eroded and that fauna and artefacts from this older, reworked breccia have been redeposited within the younger deposit. These findings suggest that the Lincoln Cave system may be connected to the Sterkfontein Cave system and that the location of the possible link lies in the vicinity of grid square L/63 in the main Sterkfontein excavation.

Introduction

The Sterkfontein hominid site is situated within the Sterkfontein Valley, 50 km northwest of Johannesburg. In 1997 excavations were undertaken in the Lincoln Cave, an area of the Sterkfontein site which had not then been examined in detail. Prior to excavation, we postulated that the Lincoln Cave would contain a Middle Stone Age (MSA) deposit, as this part had previously been considered to be mid- to late Pleistocene in age by A. Hughes and E. Vrba (R.J. Clarke, pers. comm.). This report presents the results of dating samples taken for analysis and a brief overview of the deposit and material recovered during the course of excavations.

Methods

A portion of the Lincoln Cave deposit to the south of the cave was uncalcified and could be removed with picks and shovels. From there the excavated material was wet-sieved. The calcified deposit at the northern side of the cave necessitated the use of hammers and chisels, however, which we found to be more effective and less destructive than a jackhammer. Small blocks of breccia were removed and the provenances recorded, after which bones and stones were released from the matrix.

Air-scribes and hand tools were used to remove the breccia from around the individual bones.

The fossils and artefacts analysed for this study were excavated from early 1997 to 1998. Material from subsequent excavations has been excluded here. These artefacts and fossils are presently housed at the University of the Witwatersrand.

Location of the Lincoln Cave

Lincoln Cave forms part of the Lincoln-Fault cave system, which lies adjacent to the Sterkfontein Cave system. Very little has been published on this cave, with the exception of a speleological survey by Boshoff and colleagues.¹ At that time, the Lincoln-Fault cave measured 1665 m in length, making it one of South Africa's longest caves. Despite the name, Boshoff and his colleagues could find no

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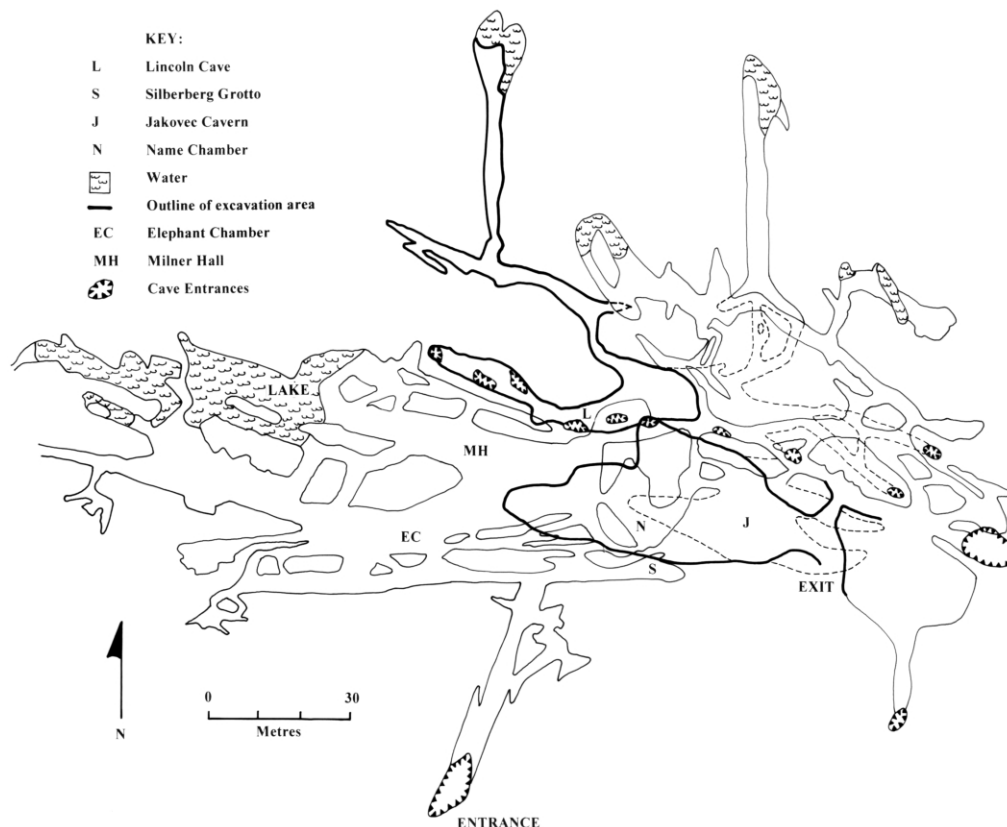


Fig. 1. South-north cross section of the Lincoln Cave. The deposit on the left is Lincoln Cave South and the deposit on the right is Lincoln Cave North.

sign of a fault or fracture inside the cave, nor did they consider it possible that there could be a link between the Lincoln-Fault and Sterkfontein cave systems owing to the chert barrier between them described as a 'formidable obstacle', permitting only water to pass through tiny cracks in the chert.¹

The Lincoln Cave deposits

Lincoln Cave contains a broad band of deposit in one area (Fig. 1), which has been obscured in the middle by the lime miners who constructed a rubble ramp to facilitate the removal of the breccia and lime from the cave during mining operations over 60 years ago. The ramp effectively divides the deposit into two smaller deposits, which we designated Lincoln Cave North and Lincoln Cave South, and has been temporarily left there by us to facilitate access to the excavation.² Much of the surrounding deposit was blasted and removed by the mining operations. The Lincoln Cave North breccia is uniformly hard, and it appears in places to extend across the cave to the southern wall, although this material was not excavated. Rather, the softer material above was excavated from the most southerly area and this material is referred to as the Lincoln Cave South sample.

The stratigraphic profile of the Lincoln Cave North deposit (Fig. 2) reveals that the fossiliferous breccia is sandwiched between two layers of flowstone and that this breccia varies in thickness. Uranium series dating can be applied to such flowstone to give chronological boundaries for the deposit. The procedure is briefly as follows: The radioactivity of the uranium and thorium isotopes is determined by alpha particle counting and the age of the flowstone is given by the activity ratio of ^{234}U and its daughter isotope, ^{230}Th . The presence of non-radiogenic ^{232}Th in the samples indicates that some ^{230}Th also would have been present when the layer was formed and a correction for this initial ^{230}Th needs to be made. Experience has shown that the initial $^{230}\text{Th}/^{232}\text{Th}$ ratio commonly is about unity.³ When this correction is made, the capping flowstone gives an age of $115\,300 \pm 7700$ years and the lower flowstone dates to $252\,600 \pm 35\,600$ years ago (Table 1). The North breccia

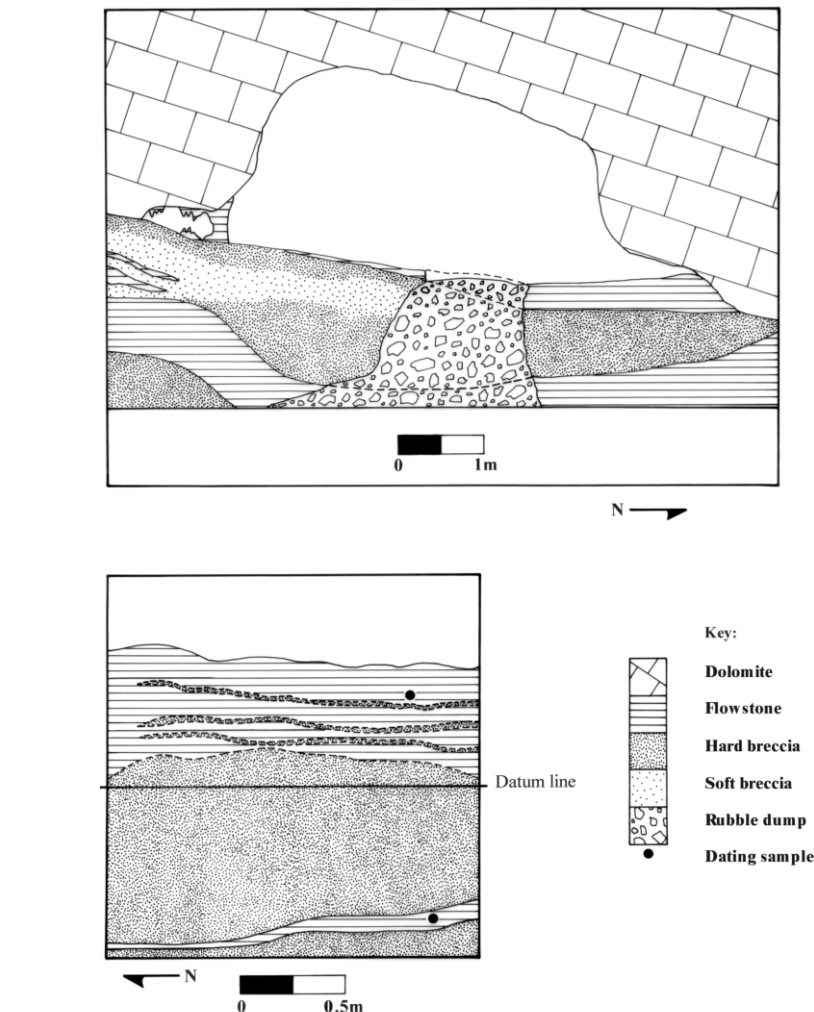


Fig. 2. North-south stratigraphic profile of the Lincoln Cave North deposit of the western side of the deposit. The triangle indicates the approximate location of the second dating sample, which was taken from the eastern side of the profile (after ref. 2).

cia in between is thus firmly placed within the earlier Middle Stone Age. The earliest date for an MSA assemblage in southern Africa is from Florisbad, c. 259 000 \pm 35 000 years,⁴ and the MSA persists until c. 22 000 years ago.⁵

Results

Faunal samples from the Lincoln Cave North and South samples were analysed separately and species identified are listed in Tables 2 and 3. Lincoln Cave North contains fauna typical of the mid-to late Pleistocene. All but one species (*Megalotragus* species) are extant. *Equus burchellii*, *Antidorcas* species and *Alcelaphinae* species identified from this deposit are associated with grassland environ-

ments.⁶ Although the artefact assemblage from Lincoln Cave North is small (five specimens), these artefacts appear typologically older than the MSA and may indicate possible mixing between older and younger deposits.

Analysis of the faunal material of the Lincoln Cave South sample (Table 3) likewise indicates possible mixing between older and younger deposits. Two extinct species of hominid, *Homo cf. ergaster* and *Paranthropus* species, have recently been recovered from this deposit.⁶ The artefact assemblage recovered from Lincoln Cave South (69 specimens) contains four artefacts diagnostic of the MSA. These are three quartz flakes with faceted platforms, and a diabase blade.⁷ However,

Table 1. Dating results for flowstone from Lincoln Cave North deposit.

Analysis no.	Sample position	(ppm)	Activity ratios			Age (kyr)*	
			U-234/U-238	Th-230/U-234	Th-230/Th-232	f = 0	f = 1
U-587	Capping	0.103 \pm 0.003	1.468 \pm 0.053	0.725 \pm 0.027	18.5 \pm 1.9	126.8 \pm 8.6	115.3 \pm 7.7
U-614	Base	0.109 \pm 0.002	1.358 \pm 0.028	0.977 \pm 0.04	111 \pm 35	260.6 \pm 37.9	252.6 \pm 35.6

*The ages given in the last column are those corrected for an initial $^{230}\text{Th}/^{232}\text{Th}$ activity ratio of unity, that is, f = 1.

Table 2. Macromammalian taxa recovered from Lincoln Cave North.

Primates	
<i>Papio cf. cynocephalus</i>	Chacma baboon
Carnivora	
<i>Canis mesomelas</i>	Black-backed jackal
<i>Vulpes chama</i>	Cape fox
Hyaenidae indet.	Unidentified hyaena
Artiodactyla	
<i>Antidorcas</i> sp.	Springbok
<i>Pelea capreolus</i>	Grey rhebok
<i>Tragelaphus cf. scriptus</i>	Bushbuck
<i>Cf. Megalotragus</i> sp.	Extinct giant hartebeest
<i>Damaliscus dorcas</i>	Blesbok
<i>Phacochoerus aethiopicus</i>	Warthog
<i>Hippopotamus amphibius</i>	Hippopotamus
Perissodactyla	
<i>Equus burchellii</i>	Plains zebra
Rodentia	
<i>Hystrix africaeaustralis</i>	Porcupine

certain artefacts recovered from this deposit, including a quartzite bifacial chopper core, are more similar to Early Acheulean artefacts recovered from the Member 5 West deposit in the main Sterkfontein excavation.⁸⁻¹⁰ This combination of characteristic ESA and MSA tool forms suggests mixing between older and younger deposits.

Discussion

The recovery of typologically older artefacts and hominids in association with diagnostic MSA artefacts from the South deposit indicate the erosion of older deposits and subsequent redeposition of this material within the Lincoln Cave context. During the course of the excavation, it became apparent that the deposit extended across the cave into breccia at the southern wall of the cave. We continued the excavation into the southern breccia deposit and found that we had excavated to within approximately seven metres of the main site, while the breccia deposit continues in a southerly direction. No sign has yet been found of the chert barrier between them described by Boshoff and colleagues,¹ thus the infill appears to be continuous, possibly linking Lincoln Cave with the main Sterkfontein excavation in grid square L/63.

The age of the deposit in the area of L/63 is not known because its contents are not definitive for a relative age and it lacks datable materials, although Clarke is currently expanding the excavation of this area to obtain further information. A single

Table 3. Macromammalian taxa recovered from Lincoln Cave South.

Primates	
<i>Homo cf. ergaster</i>	Extinct hominid
<i>Paranthropus</i> sp.	Extinct hominid
<i>Papio cf. cynocephalus</i>	Chacma baboon
Carnivora	
<i>Canis mesomelas</i>	Black-backed jackal
<i>Vulpes chama</i>	Cape fox
<i>Otocyon megalotis</i>	Bat-eared fox
<i>Suricata cf. suricata</i>	Suricate (meerkat)
Artiodactyla	
<i>Hippotragus</i> sp.	Large hippotragine
<i>Raphicerus campestris</i>	Steenbok
<i>Antidorcas</i> sp.	Springbok
<i>Pelea capreolus</i>	Grey rhebok
Cephalophinae indet.	Indeterminate duiker
<i>Cf. Megalotragus</i> sp.	Extinct giant hartebeest
<i>Damaliscus dorcas</i>	Blesbok
<i>Phacochoerus aethiopicus</i>	Warthog
Perissodactyla	
<i>Equus burchellii</i>	Plains zebra
Hyracoidea	
<i>Procavia capensis</i>	Hyrax
Rodentia	
<i>Hystrix africaeaustralis</i>	Porcupine
<i>Pedetes capensis</i>	Springhare
Lagomorpha	
<i>Lepus cf. capensis</i>	Hare

tooth assumed to represent early *Homo sapiens* has been recorded.⁶ The L/63 area is almost certainly of a similar age to the Lincoln Cave deposits and is thus assumed to date from the mid- to late Pleistocene.⁷ Stratigraphic information suggests that the L/63 intrusive infill is younger than the contiguous Member 5 West deposit, which has been dated to 1.7–1.4 million years on the basis of the age of the Early Acheulean stone tool industry and the associated hominids and fauna identified from this deposit, including specimens of *Homo ergaster*.^{6,10,11}

Conclusions

The Early Acheulean artefacts identified from both Lincoln Cave North and South assemblages, and the *Homo cf. ergaster* identified only from the South sample, appear to have been eroded out of the older Member 5 West breccia and deposited into the Lincoln Cave by means of a connection in the L/63 area, which became choked with deposit during the formation of the younger deposit. The isolated *Paranthropus* incisor recovered from the South sample most likely eroded out of the Member 5 East Oldowan deposit, where three teeth from *Paranthropus* have been recorded.^{11,12}

Differences between the uniformly

hard breccia from the North deposit and the softer, unconsolidated South deposit suggest that different depositional phases of the same deposit were excavated. Further investigation of the faunal and artefactual material contained within these deposits would seem to confirm this. The Lincoln Cave North deposit is most likely the earliest phase of deposition, with the Lincoln Cave South deposit representing a slightly later phase, whereas the L/63 deposit is the youngest in the depositional series.

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