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2006-03

Academy of Science of South Africa (ASSAf)

http://hdl.handle.net/10539/21451

Hall, G. et al. 2006. An Acheulean handaxe from Gladysvale Cave site, Gauteng, South Africa.South Afriacn Journal of Science 102(3/4), pp.103-105.

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An Acheulean handaxe from Gladysvale Cave Site, Gauteng, South Africa

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We describe a single handaxe from fossiliferous breccias at Gladysvale Cave, South Africa. The artefact is the only known tool so far discovered during the controlled excavations conducted at this site over the last decade, and was recovered from decalcified sediments near the stratigraphic interface of two breccia units, making it difficult to assign it with confidence to either. The morphology of the handaxe indicates a middle–late Acheulean industry, and preliminary electron spin resonance and palaeomagnetic dating suggest an age of greater than 780 000 years.

Introduction

Gladysvale Cave, one of the less well-known sites within the Cradle of Humankind World Heritage Site (COHWHS), is located some 13 km north-northeast of Sterkfontein, on the John Nash nature reserve (Fig. 1) in the dolomites and cherts of the Eccles Formation of the Malmani Subgroup of the Transvaal Supergroup. Detailed accounts of the history of excavations at Gladysvale may be found in refs 1 and 2. During the last decade, Gladysvale has become the focus of much new research.[2,3,4–9]

The cave consists of several underground chambers reaching to a depth of 65 m below surface,[10] as well as open-air deposits exposed by erosion and the subsequent collapse of dolomite roof blocks.[5] The underground cave consists of an upper chamber in which a number of fills of different age are preserved, and are known collectively as the Gladysvale Internal Deposits (GVID).[8,9] The outer de-roofed section is known as the Gladysvale External Deposit (GVED).[2,4,5] The co-occurrence of major speleothem markers and similar ages of these two deposits suggest that they are linked.[8] The deeper underground deposits have been only partially explored, and contain both calcified and decalcified breccias, which have been excavated by members of the University of Zurich. Three-dimensional Geographical Information System (GIS) images showing the associations between the different sections of the cave can be found in Schmid.[6]

The first hominin remains were recovered in 1992 from *ex situ* miners' dumps and led to renewed analysis and excavation of the site. Fossils attributed to *Australopithecus* and *Homo* remains have subsequently been recovered from the deposits.[12,13] The deposits have yielded a rich faunal assemblage, including Pliocene and Pleistocene mammal species, abundant microfauna and diverse avian fauna.[1,2,4,11–14]

As with all South African cave breccias, dating the deposit is a major issue. Initial faunal analyses of the outer deposits suggest an age range of from mid to late Pliocene[6] to early–mid Pleistocene age[1] for the site. Preliminary electron spin resonance (ESR) dating of bovid tooth enamel from the GVID and GVED suggests an age range of *c.* 200 kyr to *c.* 1.3 Myr ago.[6,15] Further and ongoing research using different techniques (palaeomagnetic dating and U-series) supports this age estimate.[4,9]

Stratigraphy of the outer deposits

Sedimentologically, two distinct units appear to be present in the outer deposits: the GVED and a partially exposed talus cone (Fig 2). The exposed section of the GVED is about 5 m thick and consists of domes of calcified breccia surrounded by pockets of decalcified material. Both areas are fossiliferous in nature and most likely represent a single deposit, which underwent a post-depositional phase of preferential decalcification, probably as a result of the de-roofing of this part of the cave and presence of tree roots growing down into the deposits. The calcified breccias of the GVED are clearly stratified, an unusual occurrence within South African cave deposits, and nine sedimentary units (A to I) can be identified, by clast and matrix composition, by the presence or absence of fossils and binding flowstones.[2,4]

To the northeast of the GVED, sedimentary strata are significantly different (Fig. 2). The clast sizes are considerable larger than those of the GVED and the overall morphology of this area of the deposit is more cone-like, as suggested by the radial pattern of dip directions of large chert-rich dolomite clasts. Sediments were most likely sourced through a separate, more southwestern entrance to the GVED, and are thus informally recognized as the South Western Cone (SWC). A speleothem (flowstone) layer, up to 40 cm thick, caps the SWC and, where present, forms the contact between the SWC and the GVED. Preservation of this layer is not ideal, however; prior to decalcification of the deposit, this layer most likely capped the entire cone. Flowstone layers such as this take considerable time to grow and only do so once specific thresholds, primarily climatic, have been crossed (see Richards and Dorale[17]). Thus, this flowstone layer

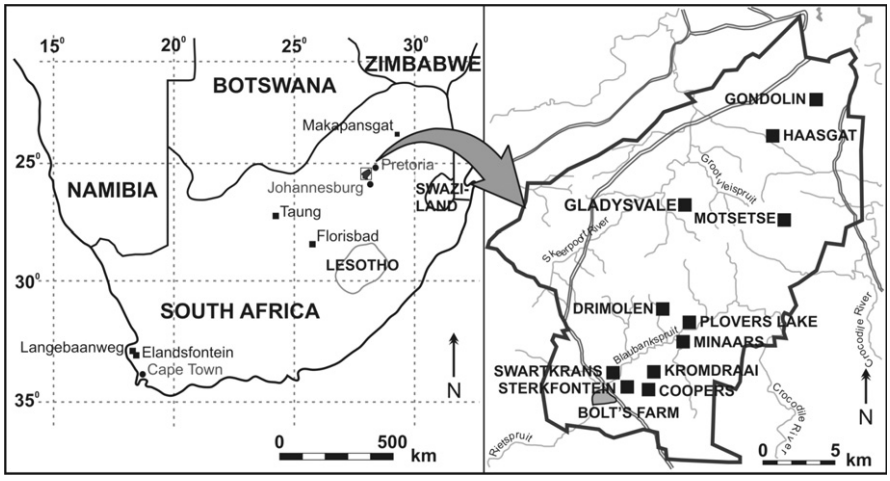

Fig. 1. The location of Gladysvale Cave in relation to other Plio-Pleistocene sites in South Africa and in the Cradle of Humankind World Heritage Site.

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can be interpreted as representing a time during which few or no sediments entered the cave[2,8,9,17] and suggests that the SWC and GVED were deposited at different times, potentially several thousand years apart. The apparent superposition of the GVED on the SWC suggests that the latter is the older of the two units.

ESR dating on bovid tooth enamel from the GVED indicates an age range of 578–830 kyr for the strata.[4] The GVED strata all have a normal palaeomagnetic signal, suggesting they were deposited during the Brunhes Normal period between 0–780 kyr ago.[18] The flowstone layer separating the SWC and the GVED has a reversed signal, suggesting an age of >780 kyr ago for the SWC.

The handaxe

The handaxe (GV15605) was found lying horizontally, with the ventral side up in decalcified and non-stratified sediments, ~5 cm from calcified breccia and ~10 cm below the flowstone marking the boundary between the GVED and the SWC (Fig. 2). The position of the handaxe below the boundary flowstone (Fig. 2B) suggests that the SWC strata host the tool, as shown in the stratigraphic column in Fig. 2. However, as the artefact was found in decalcified sediments, where the amount of mixing, erosion and sediment settling cannot easily be determined and was in close proximity to both geological units, it cannot be assigned with confidence to either. Thus only a tentative Early to Middle Pleistocene age can be given.

The handaxe is made from a fine-grained quartzite. The tool is almost 17 cm in length and 7 cm wide. It has clearly been bifacially worked, made on an elongated large flake, with an overall lanceolate shape. The use of quartzite allows the striking of large flakes, an option for the production of blanks to be used in the manufacture of bifaces[19–21] and satisfies the need for more robust flake edges.[22] A feature of the later Acheulean is the production of extensively flaked and symmetrical hand axes. Rough or poorly shaped handaxes do occur in the later Acheulean, but there have been no extensively flaked examples recovered from early Acheulean contexts.[19] The striking platform on the butt of the Gladysvale implement has been obliterated by the removal of a number of flakes. The dorsal surface has indications of numerous flake scars, more so than the ventral surface. There is evidence for the removal of at least 12 flakes on the dorsal surface, whereas it appears that there are only six removals on the ventral surface. The ventral flaked areas are also in general smaller than those on the dorsal surface. The dorsal side is least four times larger than the ventral section and has a more pronounced profile (Fig. 3). This may indicate that the piece was not fully reduced or reworked when it was incorporated into the deposits. The edges are only slightly rounded or smoothed and all evidence of flaking is readily visible (Fig. 4). All the raised areas on the handaxe have slight signs of smoothing and polish due to internment in the deposit, and virtually its entire surface has a shiny coating of manganese. The combination of these features, as well as minimal abrasion and weathering, suggests that the artefact is in a relatively fresh condition.

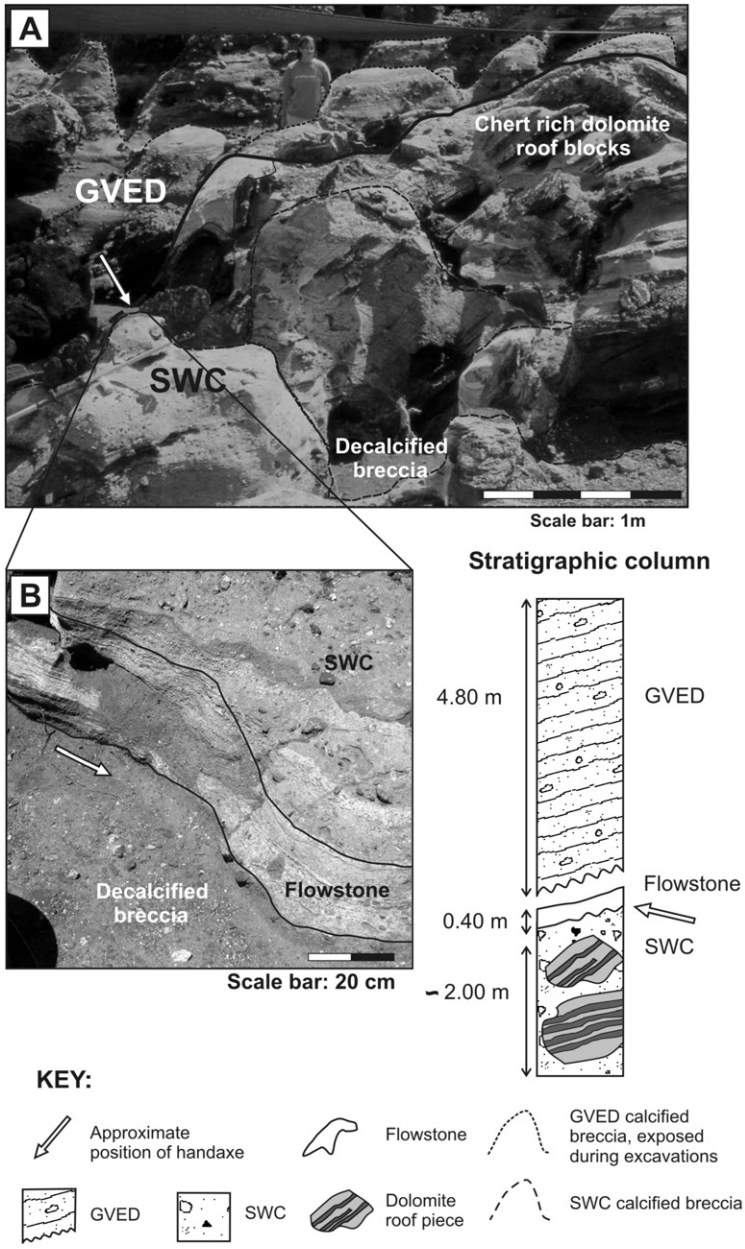

Fig. 2. Annotated photographs (**A**, general view of the external deposits at Gladysvale; **B**, close-up of the location of handaxe) and stratigraphic column of the Gladysvale External Deposit (GVED) and the South Western Cone (SWC), showing approximate position of the source of the handaxe.

Discussion and conclusions

The handaxe can be assigned to the Acheulean industrial style and is most likely an example of a mid to later Acheulean assemblage. It is, however, necessary to expand the archaeological assemblage before any further interpretation may be made. A possible reason for the notable absence of substantial numbers of stone artefacts at Gladysvale is the distance of the site from potential sources of stone, although it has been noted that there are quartzite boulders in the vicinity. Most known Acheulean sites occur in close proximity to sources of the necessary raw materials.[23] We intend to investigate the sources and suitability of potential raw materials in the area.