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**REPORT TO THE**

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# *Swartkrans Cave, South Africa*


**FILED BY PROJECT DIRECTOR:**

**Travis Rayne Pickering, Ph.D.***

**Associate Professor**

*University of Wisconsin-Madison*

*Department of Anthropology*

*Madison, Wisconsin, 53706, USA*

**and**

*Institute for Human Evolution*

*University of the Witwatersrand*

*Johannesburg, South Africa*

**PROJECT COLLABORATORS:**

**C.K. Brain, Ph.D.**

**(Permit Holder and Project Co-ordinator)**

**Morris Sutton, MSc**

**Ron J. Clarke, Ph.D.**

**Kathleen Kuman, Ph.D.**

**Jason Heaton, Ph.D.**

**Robyn Pickering, MSc**

* Contact details: Prof. T.R. Pickering, University of Wisconsin-Madison, Department of Anthropology, 1180 Observatory Drive, 5240 Social Science Building, Madison, Wisconsin, 53706, USA; Phone: (608) 262-5818; E-mail: tpickering@wisc.edu

*Introduction*

We initiated a new research program at Swartkrans Cave (South Africa), the Swartkrans Paleoanthropological Research Project (SPRP), in June 2005, which continues with support from the National Science Foundation (USA), the LSB Leakey Foundation (USA) and the Palaeontology Scientific Trust (South Africa). In this, our second annual report to SAHRA, I summarize our progress during the 2005, 2006, 2007 and 2008 field seasons.

Much of the summary reiterates general information about our continuing project, but many new items of interest are précised in the subsection titled *Member 4*, an area of the site on which we focused our greatest attention in 2009. This year, we also initiated new excavations underground to the northwest of the base of the Member 4 talus cone, clearing 8 $m^2$ of miners' rubble to an average depth of ~2 m, in anticipation of exploratory scientific excavations we will undertake later this year and in 2009 into the true cave deposit covering this area. Our clearing exercise yielded Pleistocene faunal remains in the highly disturbed miners' rubble, which are recorded and being curated using the techniques described below for other materials from the rest of Swartkrans.

Finally, in 2009, Robyn Pickering obtained the first ever tightly constrained chronometric age estimates for Swartkrans. The estimates are based Uranium-Series applications to speleothems from the Member 4 area, as well as from older portions of the site. Analyses of the latter materials are still in-progress, but the Member 4 dates are completed and provide a maximum age estimate for the Middle Stone Age lithic assemblage recovered from the stratum above the dated calcite flowstone. We summarize these chronometric results below in the *Member 4* subsection, and have incorporated them into publication number 2, also listed below.

### *Mapping: generation of geospatial data*

A theodolite (EDM) was used to re-establish a square meter grid system over Swartkrans (C.K. Brain's original overhead metal grid has experienced some significant shifting over the years). During excavation in the Lower Bank and Member 4 (see details below) X, Y, and Z coordinates for each quadrant are being recorded. For decalcified and lightly calcified deposits, coordinates are being recorded for each 5 cm level. Before controlled our removal of calcified, *in situ* Hanging Remnant sediments, in January 2006, we used the EDM to record coordinates of sections of deposit.

All this recorded EDM information is currently being entered into a Geographic Information System (GIS) computer program to better study the spatial interrelationships between the cave infills and accumulating agents. This will also allow for the creation of a three-dimensional view of the deposits and the location of artifacts and fossils within them. Additionally, the data will contribute to a better understanding of the relationship between the different members (infills) within the cave system.

### *Excavation and analysis: recovery and study of paleontological and archaeological data*

*Hanging Remnant, Member 1*

From the inception of the SPRP, the Hanging Remnant of Swartkrans was, for several reasons, identified as an area of great scientific interest and potential. First, this portion of the site was worked in the earliest days of excavation there by Robert Broom and John Robinson and the sample they recovered is heavily biased in favor of readily identifiable fossils, such as those from the skull and articular ends of limb bones. While the large hominid sample from this deposit is informative biologically, it thus needs a more detailed taphonomic and paleoecological context. There is still a considerable volume of Hanging Remnant remaining at Swartkrans, one that can yield a suitable taphonomic sample to augment and contextualize the previously recovered sample.

In addition, the Hanging Remnant sample recovered by Broom and Robinson is set-apart from the assemblages of other depositional units at Swartkrans in its complete absence of stone tools and butchered

animal bones. This is an interesting contrast and one that will be investigated systematically with the additional recovery of more materials.

Finally, the Hanging Remnant produced in 1949 the first ever fossils of very early *Homo* (*c.* 1.8 million years old) in the world. These fossils, now assigned to *Homo ergaster*, are however fragmentary and rare at Swartkrans. They are also rare in East Africa as well, and thus it would be of great scientific significance should our renewed work in the Hanging Remnant produce more of them for detailed study by paleoanthropologists.

Converging on these scientific considerations was a mandate we received from the South African Heritage Resources Agency (SAHRA) that, in the interest of public safety, the geologically unstable face of the Hanging Remnant of Swartkrans Member 1 should be removed. Thus, we are most grateful to Mr. John Cruise of John Cruise Mining (Johannesburg) for generously donating his time, expertise and labor in removing a large section of the Hanging Remnant during January 2006. Cruise's operation was overseen in the field by Mr. Dusty van Rooyen and involved controlled blasting of the heavily calcified sediments (explosives were kindly donated by African Explosives). Several tons of breccia were removed in enormous blocks during this operation, which were then reduced with jackhammers and other hand-held tools. During 2006, these smaller, now-manageable blocks were sorted and prioritized and entered into the acetic acid preparation process that we have established in the Sterkfontein workshed, across the road from Swartkrans Hill. The Hanging Remnant breccia is fossiliferous and crushed hominid tooth fragments were identified in one of the reduced blocks during July 2006. These are added to right upper canine tooth of *Paranthropus robustus* recovered from a breccia block of the Hanging Remnant by our team in 2005. We anticipate the recovery of additional hominid fossils, along with abundant non-hominid faunal remains, as our work on the Hanging Remnant breccia continues.

The Hanging Remnant sub-project is the longest term one within the larger SPRP because preparation of fossils out of the heavily calcified breccia will require several years. Morris Sutton is overseeing this work, with the assistance of Andrew Pashawana. Concurrently, we are also investigating decalcified deposits, in the anticipation that our analyses and interpretations of these materials will be more

rapidly forthcoming and that our expedient publication of these results will support the longer-term work on the Hanging Remnant.

*Lower Bank, Member 1*

One of those decalcified deposits is the Member 1 Lower Bank, which provides a suitable comparative sample for the Hanging Remnant materials, as they both purportedly derive from the same geological member of the Swartkrans Formation. In contrast to the Hanging Remnant, though, previous work in the Lower Bank established an *archaeological* component to the unit, represented by stone and bone tools, as well as butchered animal bones. The precise nature of the Lower Bank lithic assemblage has not yet been firmly established given the small size of the original recovered sample (n= 298). Our new excavation, conducted in the Lower Bank since 2005, has increased the stone tool sample significantly (already larger than the original number listed above) and is continuing even as Dr. Kathy Kuman and Mr. Sutton begin analysis of the materials already recovered. In addition, at least three new bone tools have been identified by our team. New zooarchaeological recoveries include several bone flakes presumably created by hominid hammerstone percussion during marrow extraction from ungulate limb bones. A large amount of other fauna has also been recovered in the new Lower Bank excavations, among it several hominid specimens, listed in Table 1 below.

*Member 4*

Sutton's Ph.D. excavation of Swartkrans Member 4 continues. While the uppermost layers of the surface excavation have yielded a good sample of Middle Stone Age (MSA) lithic artifacts similar to those collected originally by C.K. Brain, artifacts are less abundant deeper. To test the hypothesis that the archaeological material simply represents a secondary surficial deposit, in 2006 we began excavation underground, at the base of the talus cone upon which the surface assemblage has formed. Our results are presented in publication number 2 below and summarized here:

(1) The uppermost layer is the MSA tool-bearing deposit, 110 – 120 cm in depth and composed of dark brown, organic-rich and loose non-calcified sediment, mixed with small clasts of broken dolomite.

(2) The MSA stratum overlies a now-fragmented speleothem, dated by U-Th disequilibrium to *c.* 110 ka., which sets the maximum age for the MSA and serves as a capstone for two underlying strata that necessarily must be older than *c.* 110 ka.

(3) Immediately beneath the dated speleothem is a large talus cone deposit >10 m in depth. This talus cone deposit, a light brown, decalcified and slightly organic matrix with small to medium size (10 – 25 cm) clasts of dolomite, contains an abundance of fossilized bone, but no stone artifacts deeper than its outer layer. The presence of *Paranthropus robustus* fossils in the talus cone deposits corroborates the inference based on superposition that it is of greater (early Pleistocene) age than the overlying speleothem and MSA units.

(4) The lowest sedimentary unit, a reddish, moderately organic matrix that contains bone and has only occasional small to very small casts of dolomite, is termed the LB East Extension. The LB East Extension is largely decalcified, but has areas of remaining calcification. The matrix of the LB East Extension is consistent with that of the LB of Member 1 from Brain's original excavation area on the cave's surface, and we infer that the former is an eastward extension of the latter.

We combine our new observations with Brain's previous interpretation of the formation of the Swartkrans Cave deposits in the following, revised reconstruction, which focuses on the deposits of Swartkrans northeast:

(1) Sometime probably in excess of 1.7 Myr. ago, joints in the roof of an underground cavern that was to become Swartkrans Cave opened between the ground surface and the cavern. This shaft began to admit surface-derived sediment, which formed a talus cone below the shaft and extended toward the northwest corner of the cave; this deposit is now referred to as the LB of Member 1. We now infer that the infilling also continued laterally toward the east for ~50 m until it reached the east wall of the cave. The passage through which this eastward extension of the LB traveled was very narrow due to the extreme thickness of the cave's roof near its north wall; this leveled the LB East Extension

deposit, as reflected in fabric orientation (NNE) on that portion of the cave. Eventually, but still in the early Pleistocene (*c.* 1.8 – 1.0 Myr. old), based on faunal dates for the contiguous surface LB of Member 1, the eastern part of the cave became choked with LB East Extension sediments.

(2) Later in the early Pleistocene, the continued dissolution of dolomite by groundwater resulted in a partial collapse of a section of cave roof in the Member 4 area. The resulting aven allowed the infilling of the Member 4 talus cone deposit, as evidenced by the large roof spall in the contact zone of the LB East Extension and the overlying talus cone deposit and by the presence of surface-weathered dolomite rubble in the lower portions of the talus cone deposit. Fabric orientation reflects the steep northward advance of the talus formation. The talus cone eventually filled the opening, once again choking off the area from further infill.

(3) A speleothem was deposited over the talus cone deposit in the late Pleistocene, *c.* 110 ka.

(4) A MSA deposit covered the top of the talus cone in the Member 4 area, with some material filtering down the north surface of the cone. The density of stone tools and complete absence of bone preservation indicate deposition of MSA materials after the dissolution and collapse of the cave roof. Preliminary analysis of the MSA stone artifacts reflects the majority of the assemblage is in fresh condition with only minimal edge damage, suggesting little colluvial movement of the artifacts.

*Member 3*

The Member 4 discovery prompted us to consider the potential of other underground deposits at Swartkrans. Thus, in August 2006, we began the newest sub-project of SPRP, excavating in the base of the Member 3 gully. SPRP project coordinator and Swartkrans permit holder, C.K. Brain, suggested that additional, uninvestigated deposits might underlie Member 3, as his previous excavations in Member 3 revealed a void beneath it. Currently, we are excavating in the base of Member 3 with the plan to create an opening to the underlying deposits, all the while recovering Member 3 fossils, including hominids (Table 1), and archaeological remains from sediments that have slumped into the base of gully in the nearly twenty since

Brain's excavations ceased at Swartkrans. This sub-project promises to yield a good deal to our understanding of site geomorphology and exciting new discoveries.

**Table 1.** *Annotated list of hominid fossils recovered by the Swartkrans Paleoanthropological Research Project, 2005 - 2007*

| Member * | Catalog number | Date of recovery | Element | Taxon |
|---|---|---|---|---|
| 1 (HR, dump) | SWT/HR-1 | January 2006 | R. upper canine | *Paranthropus* |
| 1 (HR) | SWT/HR-2 | January 2006 | Crushed tooth fragments | *Paranthropus* |
| 1 (LB) | SWT/LB-1 | 30/8/2005 | R. upper central incisor | *Paranthropus* |
| 1 (LB) | SWT/LB-2 | 30/8/2005 | R. proximal femur | cf. *Paranthropus* |
| 1 (LB) | SWT/LB-3 | 13/9/2005 | R. upper first molar | *Paranthropus* |
| 1 (LB) | SWT/LB-4 | 25/4/2006 | Postcanine tooth (2 pieces) | cf. *Homo* |
| 1 (LB) | SWT/LB-5 | 8/5/2006 | R. upper first molar | *Homo* |
| 1 (LB) | SWT/LB-6 | 5/7/2006 | Upper molar | *Paranthropus* |
| 1 (LB) | SWT/LB-7 | 21/7/2006 | Manual intermediate phalanx | Hominidae |
| 1 (LB) | SWT/LB-8 | 27/7/2006 | Upper canine | *Paranthropus* |
| 1 (LB) | SWT/LB-9 | 29/8/2006 | Upper premolar | *Paranthropus* |
| 1 (LB) | SWT/LB-10 | 16/2/2007 | Upper first molar | *Paranthropus* |
| 1 (LB) | SWT/LB-11 | 22/2/2007 | L. upper molar | cf. *Paranthropus* |
| 1 (LB) | SWT/LB-12 | 27/2/2007 | R. upper third premolar | *Paranthropus* |
| 1 (LB) | SWT/LB-13 | 14/3/2007 | L. upper central incisor | *Paranthropus* |
| 1 (LB) | SWT/LB-14 | 2/5/2007 | L. upper premolar | *Paranthropus* |
| 1 (LB) | SWT/LB-15 | 17/5/2007 | R. upper central deciduous incisor | *Paranthropus* |
| 1 (LB) | SWT/LB-16 | 18/6/2007 | L. upper lateral incisor | *Paranthropus* |
| 1 (LB) | SWT/LB-17 | 16/8/2007 | Lower lateral incisor | *Paranthropus* |
| 3 | SWT/3-1 | 2/8/2006 | Manual proximal phalanx | Hominidae |
| 3 | SWT/3-2 | 8/8/2006 | L. upper lateral incisor | *Paranthropus* |
| 3 | SWT/3-3 | 5/8/2006 | R. lower second molar | *Paranthropus* |
| 4 | SWT/4-1 | 5/4/2005 | Pedal proximal phalanx | Hominidae |
| 4 | SWT/4-2 | 8/7/2006 | Molar | *Paranthropus* |
| 4 | SWT/4-3 | 9/11/2006 | R. upper first molar | *Paranthropus* |
| 4 | SWT/4-4 | 9/11/2006 | Molar | *Paranthropus* |
| 4 | SWT/4-5 | 15/11/2006 | R. upper central incisor | *Paranthropus* |

* HR = Hanging Remnant; LB = Lower Bank.

**Publications based on recent PAST funded work at Swartkrans**


1. Pickering, T.R., Sutton, M., Pickering, R., Brain, C.K., Heaton, J.L., Clarke, R.J. & Kuman, K. in prep. U-Pb isotopic age of a large sample of early hominids from Swartkrans Cave, South Africa.
2. Sutton, M., Pickering, T.R., Brain. C.K., Clarke, R.J., Heaton, J.L., Pickering, R. & Kuman, K. in prep. Newly discovered artifact- and fossil-bearing deposits, chronometric ages and early Pleistocene hominids at Swartkrans Cave, South Africa.
3. Pickering, T.R., Egeland, C.P., Domínguez-Rodrigo, Brain, C.K. & Schnell, A. (2008). Testing the "Shift in the Balance of Power" hypothesis at Swartkrans, South Africa: Hominid cave use and subsistence behavior in the Early Pleistocene. *Journal of Anthropological Archaeology* **27,** 30-45
4. Pickering, T.R. (in press). "*African Genesis* revisited: Reflections on Raymond Dart and the "Predatory Transition from Ape(-Man) to Man,"' In (S. Reynolds & C. Menter, Eds.) *Title pending*; volume based on the *African Genesis* conference celebrating 80th birthday of Phillip Tobias. Johannesburg: Wits Press.
5. Pickering, T.R., Domínguez-Rodrigo, M., Egeland, C.P., & Brain, C.K. (2007). "Carcass foraging by early hominids at Swartkrans Cave (South Africa): A new investigation of the zooarchaeology and taphonomy of Member 3," In (T.R. Pickering, K. Schick, & N. Toth, Eds.) *Breathing Life into Fossils: Taphonomic Studies in Honor of C.K. (Bob) Brain*. Pp. 233-253. Bloomington (IN): Stone Age Institute Press.
6. Domínguez-Rodrigo, M., Egeland, C.P. & Pickering, T.R. (2007). "Models of passive scavenging by early hominids: Problems arising from equifinality in carnivore tooth mark frequencies and extended concept of archaeological palimpsests," In (T.R. Pickering, K. Schick & N. Toth, Eds.) *Breathing Life into Fossils: Taphonomic Studies in Honor of C.K. (Bob) Brain*. Pp. 255-267. Bloomington (IN): Stone Age Institute Press.
7. Pickering, T.R. (2006) Subsistence behaviour of South Africa Pleistocene hominids. *South African Journal of Science* **102,** 205-210.