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The Role of Culture in Early Expansions of Humans

Excavation at Sibudu 2011

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THE ROLE OF CULTURE IN EARLY EXPANSIONS OF HUMANS

Editorial

For a second time the ROCEEH Newsletter focuses on South Africa – but this time with a methodological perspective on material culture and its implication for cognition. We also introduce field work at Sibudu, provide new insights into the ROAD database and report on ROCEEH conference activities.

Still Bay and Howiesons Poort – tool diversity in the MSA of Southern Africa

Lithics are the most frequent category of find from Southern African MSA sites. Other find categories such as organic tools (including bone points, notched bones or fragments of ostrich eggshells used as flasks) are much rarer from MSA contexts. Personal ornaments represented by perforated mollusks and small beads manufactured from ostrich eggshells are limited to a very few MSA sites, as is the occurrence of intentionally decorated objects. In contrast, the use of pigments in the Southern African MSA is much more common.

Two technocomplexes within the MSA deserve special consideration: the Still Bay (SB) dates between roughly 77 and 70 ka and is characterized by bifacial points of lanceolate shape, the so-called Still Bay Points, while the Howiesons Poort (HP) dates between roughly 66 and 59 ka and is a blade-based industry characterized by geometric backed tools called segments, crescents or lunates. Due to the presence of special tool types such those mentioned, but also due to changes in technology and in the choice of raw materials, both technocomplexes clearly differ from each other and from other MSA assemblages. As is indicated by the dates for these technocomplexes, HP regularly overlies SB stratigraphically.

Still Bay point from Blombos Cave, South Africa. Photo: Wikimedia Commons, V. Mourre.

Howiesons Poort segments from Geelbek and Anyskop, South Africa. Photo: S. J. Walker.

Excavation at Sibudu 2011. Photo: M. Malina.

In African Stone Age archaeology there is lively discourse about why people developed two technocomplexes during the course of the MSA with such distinct tool-kits that include several innovative traits, and why both disappeared after such relatively short time spans. Still the reasons are far from clear. Changes in climate and environment do not seem to be adequate reasons, since these do not coincide with the rise and fall of the SB or HP.

The ROCEEH project is testing whether the lithics themselves provide any clues. One approach taken by ROCEEH is to determine the respective degree of tool diversity. This approach was used by Jürgen Richter in 1990 to demonstrate the degree of specialization of late Magdalenian assemblages as a function of tool type groups. He started with two basic assumptions: 1) the internal structure of a site changes regularly during the length of stay; and 2) the typological complexity of an assemblage increases with the length of stay. To calculate the degree of tool-diversity, Richter used the Simpson index for diversity, which, for instance, serves in plant economy science to determine the natural diversity of plant communities. Although this method was greatly expanded upon by Thorsten Uthmeier and Utz Böhner in the analyses of Middle and Upper Paleolithic assemblages from southern Germany, this approach does not seem to have had a significant impact on international Paleolithic research.

To simplify the arithmetic procedure, the tool types first have to be arranged in tool groups. The diversity index indicates how balanced the distribution of the tool groups is within a given entity, such as an assemblage. The higher the index, the more diverse is the assemblage. This means that an index near zero indicates a low degree of diversity and a high degree of specialization: only one or few tool groups dominate the assemblage, pointing to short visits at the site. An index near one indicates a high degree of diversity and a low degree of specialization: the spectrum of tool groups is broad, several tool groups appear in similar significant proportions, pointing to longer stays at the site. The more diverse the assemblage is, the larger the number of different activities practiced at the site. Of course, the index values per se only offer a relative order. Conclusions are only possible when comparing several assemblages.

In the case of the Southern African MSA we created 14 tool groups: e.g., bifacial points, bifacial tools, points (excluding bifacial points), backed segments/crescents, denticulates/notched tools, scrapers, informal tools, etc. To calculate the full diversity index, the exact numbers of all tool types from an assemblage must be known. Since this is not the case for the majority of published assemblages entered into ROAD, we generated a 'minimum index'. The minimum index indicates how many tool groups are present in each assemblage. Adding the values of all assemblages from a given phase of the MSA, for instance SB or HP, and dividing the total by the number of assemblages from that phase results in a minimum index for the chosen technocomplex. Once these indices have been calculated for all phases of the MSA, these phases can be compared with each other based on their chronological order.

Our case study has shown that the average minimum index for the SB assemblages amounts to ca. 1.9 tool groups, while for the HP assemblages the value is ca. 3.3 tool groups. This means that on average there are more tool

groups in HP assemblages than in SB assemblages. One of our next steps will be to calculate the full index for all those assemblages where possible. Moreover, we started to calculate diversity indices for the other phases of the MSA. Given the higher number of different tool groups in HP assemblages, ROCEEH wants to test if the appearance of HP might be connected with an increasing flexibility of the hunter-gatherer groups responsible for this technocomplex. In analogy, the end of the HP might be connected with decreasing flexibility. Indeed, the minimum diversity index for post-HP assemblages shows a lower value than for HP assemblages; nonetheless, it is still somewhat higher than the value for SB assemblages.

Of course, the diversity index only represents one piece of the puzzle in the analysis of lithic assemblages. An index of raw material diversity indicating how many different lithic raw material varieties appear in an assemblage must also be considered. Moreover, the results for tool diversity should be combined with the results of faunal analyses, since Richter demonstrated that special tool types may correlate with the frequency of special hunted animal species. In combination with other parameters such as site topography or the presence of features, reconstructions of land-use patterns will be possible. The ROCEEH team is in the process of completing a study of the Southern African MSA which will test those different aspects. Later on the method will be applied to other parts of Africa as well. Michael Bolus

The 2011 Excavation in late MSA deposits at Sibudu Rockshelter, KwaZulu-Natal

Acting on an invitation from Lyn Wadley of the University of the Witswatersrand, a team of eight archaeologists from the University of Tübingen and ROCEEH conducted field work at Sibudu in February and March 2011. Preliminary analysis of the materials recovered from Sibudu ended on March 24 when we deposited the finds at the Natal Museum in Pietermaritzburg. During this period the team from Wits under Wadley's direction excavated pre-Still Bay deposits in the deep sounding in the northern part of the excavation.

The Tübingen team focused on six square meters in the western part of the excavation area where sediments representing the late MSA are preserved. The excavation produced 3089 single finds. In all the team excavated 357 buckets from quarter meters of the excavation units. These buckets form the basis of analysis for finds that were not measured individually. The fauna from layers BSp and SPCA is dominated by large mammalian species, and the specimens are often heavily burnt and fragmented. A detailed analysis of the faunal remains will be undertaken in the future. The same applies for the rich botanical remains from the excavation.

Unifacial point from Sibudu. Photo: S. Rudolf.

By far the largest class of material recovered is chipped stone. This category includes 2137 single finds and 33,700 pieces of chipped stone from the coarse screen. The most common raw materials are dolerite and hornfels, with far lower amounts of quartzite, jasper, quartz and sandstone. An initial examination of the assemblage including 25 cores and 353 tools provides a preliminary assessment of the lithics from layers BSp and SPCA. Most of the cores document the production of relatively thin products, but one unidirectional core documents the production of thick triangular products like those often seen among the debitage; the other main class of cores is single platform cores. The assemblage of tools includes many unifacial points, convergent scrapers, steeply retouched blades and flake fragments, pieces with retouched projections similar to perçoirs, and many other forms including isolated burins. The wealth of retouched finds can be used to characterize the assemblages from layers BSp and SPCA. The abundance of unifacial points in both layers BSp and SPCA is particularly remarkable.

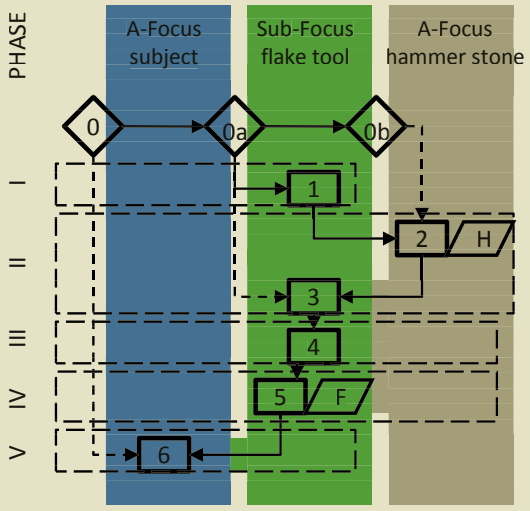
Among the inorganic finds the team recovered 86 pieces of ochre. Debate continues on the uses of ochre powder, but using observations from Sibudu, Wadley demonstrated that ochre powder was often used to produce adhesives. The team also defined and excavated 26 features that are comprised nearly completely of anthropogenic combustion features in various states of preservation. We collected dozens of samples for micromorphological study to help us better characterize these deposits in the future.

Although the team from Tübingen has just started research at Sibudu, already the work has produced useful results that will help us understand adaptations during the later stages of the Middle Stone Age. One goal of this research is to characterize the artifact assemblages and other materials recovered from the site to document the cultural variability in this period. Following the work of Zenobia Jacobs, layers BSp and SPCA both date to about 58,000 years ago and may document parts of the same cultural systems or result from the activities of closely related groups of people. In the future we hope to give these people a stronger identity by studying the sequence from Sibudu. Since the site represents the best record for this period preserved in Southern Africa, one could consider using the site as a type locality for characterizing the social-cultural record of the later parts of the MSA. Future work will address this issue more systematically. Nicholas J. Conard

Approaches to paleocognition in the MSA of Southern Africa

With regard to the evolution of cognition Southern Africa has become one of the most interesting find regions in the last decade. While the question of art and symbolic representation dominates the discussion about cultural and cognitive modernity in Europe, mainly technological developments raise questions about the underlying cognitive competence in the southern part of Africa. With Marlize Lombard and Lyn Wadley as partners, Miriam Haidle from ROCEEH has analyzed the relevance of several outstanding examples. In 2009, Wadley discussed the cognitive implications of production and use of compound adhesives made from resin, ochre, and probably fat in the MSA. We use cognigrams and effective chains as tools to examine a process of analog complexity in the production of birch tar used by Neandertals up to 200,000 years ago. Based on a rigorous examination of stone artifacts and their context, Lombard and Phillipson (2010) deduced the use of bow and arrow as a component of Howiesons Poort industries. Systematic coding of the behavioral components reveals that at least 26 sub-processes were involved in the production and use of bow and arrow. It turns out to be a very complex behavior with cognitive components that go beyond a composite tool. Finally, snares and traps are postulated for the Howiesons Poort and probably also Still Bay assemblages of Sibudu. These artifacts can be seen as indicators of complex cognition and enhanced working memory (Wadley 2010). We expect to examine the cognitive background for the use of snares during the second half of 2011. The analytical tools for a comparative analysis of cognition in tool behavior were developed by Haidle and are described below.

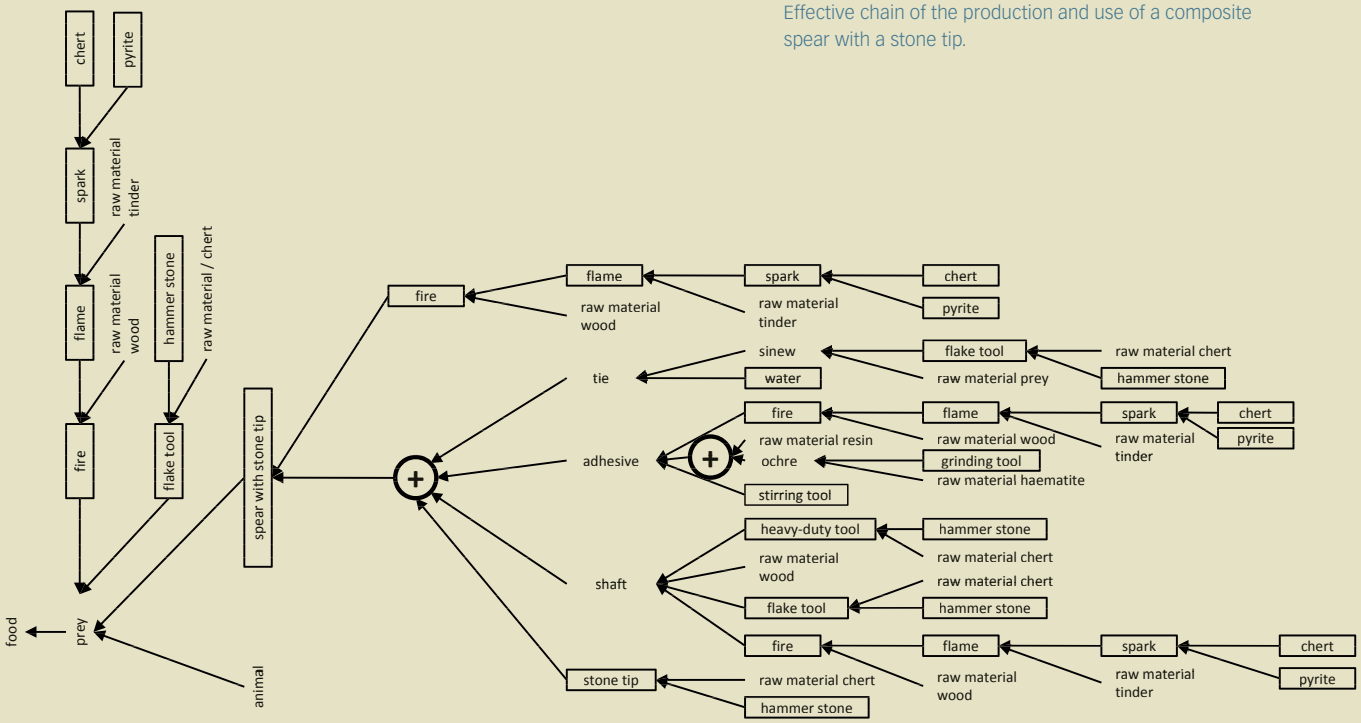
Cognigrams provide the possibility to analyze and contrast different forms of tool behavior – be it from hominins or other animals. As a basis for comparison, equivalent and self-contained study units need to be identified. Every unit comprises a behavioral process initiated by an internal or external stimulus (need, problem) and terminated by the positive or negative satisfaction of the need (the solution to the problem). The complete study units are coded in cognigrams, which represent an enhancement on the basis of the concept of *chaîne opératoire*.



0. Perception of need: cutting
0a. Perception of sub-problem 1: cutting tool needed
0b: Perception of sub-problem 2: hammerstone needed
Phase I: search for raw material
1. Search for suitable raw material for flake tool
Phase II: search for hammerstone
2. Search for suitable hammerstone for flake tool production
Phase III: core preparation
3. Preparing core with hammerstone
Phase IV: flake production
4. Detaching flake with hammerstone
Phase V: retouch
5. Retouching flake with hammerstone
Phase VI: satisfaction of need
6. Possessing the possibility to cut

Cognigram of the production of a basic flake tool as module of a complex behavior.

In cognigrams, the various single-action steps that are pooled in larger phases of action are assigned to different attention foci. These include all separate, discrete elements of attention that take part in the sequence and include the acting subject, objects to be treated, locations, and actively operated tools. They may be active agents or passive elements. The different attention foci are initiated by the probable perceptions of needs and problems that start the actions. Additionally, effects of one focus on another are also represented. Cognigrams are tools to examine various cognitive and behavioral aspects, such as goal-oriented decision making, sequencing of actions, or flexibility in application of problem-solution concepts. Coding the



Effective chain of the production and use of a composite spear with a stone tip.

factors of tool behavior in cognigrams systematically yields valuable insights for cognitive studies in archaeology and ethology and in innovation research.

Effective chains are a simplified extract of cognigrams. In this sort of diagram only the foci and their effects on each other are represented. Effective chains become a valuable tool in the comparison of complex and multifactorial behavior, especially if this behavioral process is modularized in several sub-processes. As a result the thought-and-action process of a tool must not be seen as a whole, but can be dissected into small units of the production of unspecific basic tools, the production of unspecific semi-finished products, and process units related to the production and use of the specific tool. While the cognigrams of the small units are given separately, effective chains provide an overview of all elements included in a process of tool behavior, as well as their relations. Both, cognigrams and effective chains, give an ideal scheme of past behavior. They are mainly based on a summary of evidence gathered by archaeological remains, experiments and ethnographic analogies. This evidence is completed by realistic assumptions about phases of raw material procurement, transport of different elements, and repeated interruptions of the process by other urgent needs. Minor variability in the sequence of actions is included. If not specifically noted, cognigrams represent the preferably simplest way of coding a thought-and-action-process.

Miriam Noël Haidle

ROAD: What's in?

Until now, the content of the **R**OCEEH **O**ut of **A**frica **D**atabase (ROAD) was accessible only to the ROCEEH team. To generate more publicity about its content, Zara Kanaeva developed a new query for ROAD. This simple interface can be accessed without registration through ROCEEH's website (www.roceeh.net). It allows data already included in ROAD to be queried for different assemblage types, localities and their age range, while presenting the results in GoogleMaps or GoogleEarth. This function was placed online at the end of 2010.

ROCEEH Workshops

"Hominin Environment, Ecology and Dispersal"
Johannesburg, 9–10 November 2010.

The ROCEEH research center sponsored a two-day workshop about hominid environment, ecology and dispersal at the University of the Witwatersrand hosted by the Bernard Price Institute (BPI) and the Institute of Human Evolution (IHE). The complete program including abstracts is available on www.roceeh.net. More than thirty scientists and graduate students from Johannesburg, Pretoria and Germany heard twelve lectures on varied topics from the disciplines of geography, habitat and climate reconstruction, biology, paleoanthropology and archaeology. The talks spanned from Pliocene to Holocene and focused on the links between

Southern and Eastern Africa, as well as the Middle Stone Age. A highlight of the workshop was a talk by Lee Burger about the new Australopithicus sediba finds from Malapa and the viewing of these remarkable fossil remains. The friendly atmosphere of the workshop provided ample time for discourse about these themes. The workshop strengthened the ties of a working group that studies African vegetation. The workshop was followed by fieldtrips to Makapansgat and Cave of Hearths led by Friedemann Schrenk, to Sterkfontein and Kroomdrai led by Francis Thackeray, and to Cooper's Cave led by Christine Steininger. The field trips highlighted the importance of these sites to paleoanthropological and paleontological research in the northern part of South Africa.

Field trip to Makapansgat limeworks.

Who's who?

This issue: Patrick Schmidt

Patrick Schmidt excavating in Tabon Cave, Philippines.

In 2008, Patrick Schmidt finished a European Erasmus Mundus Master Sc. in archaeology, Quaternary geology and mineralogical archaeometry with a focus on archaeological raw materials from Palawan Island (Philippines) in the Musée national d'histoire naturelle in Paris, the Università degli studi di Ferrara (Italy) and the University of the Philippines Diliman (Philippines). He is currently conducting doctoral research on the mineralogy of chemically and biochemically precipitated silica rocks (flint, chert, jasper, etc.) with a particular interest in their crystallographic/mineralogical evolution in reaction to thermal stress (intentional heat treatment and accidental burning). Patrick joined the ROCEEH team in 2009 and is responsible for data mining and input of the geological and paleoanthropological record into ROAD. He is also conducting research on the mineralogical composition of the soils at Makuyuni

Forthcoming

- Session: "Spatial prediction of archaeological sites and paleoenvironments" by Michael Märker. Computer Applications and Quantitative Methods in Archaeology (CAA).
  Meeting **(12–16 April 2011)** in Beijing (China).
  (http://www.caa2011.org/#home|default)

- The Nature of Culture.
  ROCEEH-Symposium **(15–18 June 2011)**
  in Tübingen.
  (http://www.roceeh.net/roceeh/index.php?id=63&L=5)

- Session: "Linked effects of climate change, orbital forcing, tectonics and biotic interaction: Which model is required to explain faunal evolution and its paleobiogeographical and paleoenvironmental implications during the Quaternary?" by Christine Hertler, Maria Rita Palombo, Ralf-Dietrich Kahlke, Thomas Kaiser, Frédéric Lacombat.
  XVIII International Union for Quaternary Research (INQUA) Congress **(21–27 July 2011)** in Bern, Switzerland (http://www.inqua2011.ch/).

- Conference: 3rd East African Association for Palaeoanthropology and Palaeontology (EAAPP) Conference **(8–12 August, 2011)** in Addis Ababa, Ethiopia. Co-organized by ROCEEH and Heidelberg Academy of Sciences and Humanities. (http://www.eaapp.or.ke/events.htm)

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