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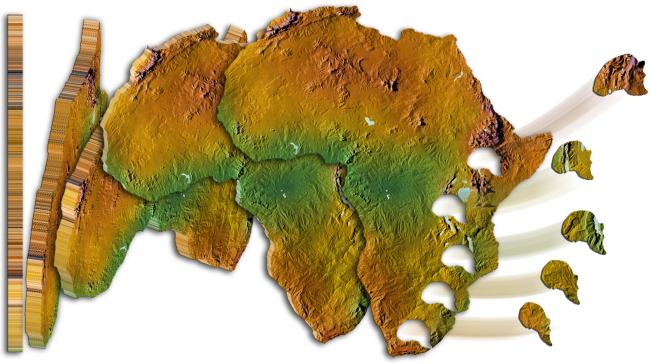

THE AFRICAN HUMAN FOSSIL RECORD

POSTER SESSION

SATURDAY, SEPTEMBER 27th, 8:30-10:30

SALLE DU SÉNÉCHAL

(*titles in alphabetical order per author*)

THE CAVE DEPOSITS OF SWARTKRANS AND KROMDRAAI, SOUTH AFRICA: TIME- RELATED CRANIODENTAL MORPHOSTRUCTURAL VARIATION IN CERCOPITHECOID TAXA AND THE EMERGENCE OF *HOMO*.

BEAUDET A.[1], BRUXELLES L.[2,3,4], MACCHIARELLI R.[5,6], DUMONCEL J.[1], THACKERAY J.F.[7], DE BEER F.[8], BRAGA J.[1,9]

[1] *Laboratory of Molecular Anthropology and Image Synthesis, UMR 5288 CNRS, Université de Toulouse, France*
[2] *Travaux et Recherches Archéologiques sur les Cultures, les Espaces et les Sociétés, UMR 5608 CNRS, Université de Toulouse, France*
[3] *Institut National de Recherches Archéologiques Préventives, Nîmes, France*
[4] *The School of Geography, Archaeology and Environmental Studies, University of the Witwatersrand, Johannesburg, South Africa*
[5] *Département de Préhistoire, UMR 7194 CNRS, Muséum national d'Histoire naturelle, Paris, France*
[6] *Département Géosciences, Université de Poitiers, France*
[7] *Institute for Human Evolution, University of the Witwatersrand, Johannesburg, South Africa*
[8] *South African Nuclear Energy Corporation, Pelindaba, South Africa*
[9] *Ditsong National Museum of Natural History, Pretoria, South Africa*

The Plio-Pleistocene cave deposits of Swartkrans were the first where the co-occurrence of early *Homo* and *Paranthropus* was recognized. Even if less abundant than the latter taxon, early *Homo* at Swartkrans is represented by some remarkable specimens, notably the partial cranium SK 847. Despite numerous dating attempts, the absolute and relative chronology of its sedimentary infill and questions about the homogeneity of Members 1 to 3 remain unresolved. Another key South African site, Kromdraai B, which yielded the type specimen of *Paranthropus* (TM 1517), also delivered remains which may belong to early *Homo*. Here again, the chronological setting of Members 1-3 is still controversial. Most biochronological analyses indicate an age of the deposits of 2-1.5 Ma, but other studies suggest an older age, closer to 3 Ma. Furthermore, at Kromdraai the chrono-

stratigraphic relationships between the KB "hominin site" and the KA "faunal site" are also not fully understood.

In order to reliably integrate the hominin fossil record from Swartkrans and Kromdraai into a pan-African evolutionary scenario, the chronological refinement of their deposits remains a primary, unavoidable task. However, because of the nature itself of the karst deposits and of their complex stratigraphy, rather than the direct application of chronometric methods, biostratigraphic comparisons and inter-sites bio-correlations are likely among the most reliable methods for temporal seriation of the South African paleocaves. In this context, given the density of their remains across most eastern and southern African paleontological sites, their wide geographic distribution and usual association with hominin remains, cercopithecoids are among the best candidates in the search for temporal biomarkers suitable for dating the South African fossiliferous caves.

We investigated selected craniodental remains from ten fossil papionin and colobine taxa from different stratigraphic units at Swartkrans and Kromdraai; in a comparative perspective, we also examined similar material from the sites of Sterkfontein and Makapansgat, as well as from extant representatives. The specimens were systematically detailed by X-ray microCT at a spatial resolution ranging from 20 to 120 µm at the South African Nuclear Energy Corporation (Necsa) and the Palaeosciences Centre of the University of the Witwatersrand, Johannesburg.

Four structures commonly used in paleoanthropological investigations for discriminating among extant hominids and fossil hominins, but not yet extensively reported for their evolutionary variation patterns and site-specific time-related trends in other fossil primate taxa, have been assessed in a comparative perspective: tooth endostructural organization, the bony labyrinth, the maxillary sinus, details of the endocranial morphoarchitecture. By using advanced techniques of 3D imaging and GM methods (semilandmarks and deformation-based models), these structures have been systematically characterized in both fossil assemblages and comparative modern specimens.

The preliminary results of this ongoing study project indicate that, by using different states of these evolving features as chronological markers, the site of Kromdraai could be temporally closer to Makapansgat, thus older than previously thought, and that the deposits of Swartkrans, confirmed to be younger than 2 Ma, are homogeneous, at least within Member 1.

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IDENTIFICATION OF *HOMO*-LIKE FEATURES IN VIRTUALLY RENDERED SOUTH AFRICAN AUSTRALOPITHS ENDOCASTS.

BEAUDET A.[1], DUMONCEL J.[1,2], THACKERAY J.F.[3], DURRLEMAN S.[4], SUBSOL G.[5], JESSEL J.-P.[2], BRAGA J.[1,6]

[1] *Laboratory of Molecular Anthropology and Image Synthesis, UMR 5288 CNRS, Université de Toulouse, France*
[2] *Institut de Recherche en Informatique de Toulouse, UMR 5505, Université de Toulouse, France*
[3] *Institute for Human Evolution, University of the Witwatersrand, Johannesburg, South Africa*
[4] *Aramis Team, INRIA, Sorbonne Universités, Université Pierre et Marie Curie Paris 06, Inserm, CNRS, Institut du Cerveau et de la Moelle Épinière, Paris, France*
[5] *Laboratoire d'Informatique de Robotique et de Microélectronique de Montpellier, UMR 5506 CNRS, Université de Montpellier II, France*
[6] *Ditsong National Museum of Natural History, Pretoria, South Africa*

Besides size increase, cortical reorganization is one of the most critical processes having affected human brain evolution. In the hominin fossil record, a virtual "early *Homo* endocast" is expected to display a characteristic neuroanatomical pattern including, among other features, a distinct Broca's area, the absence or only faint presence of a lunate sulcus positioned posteriorly, a unique orbitofrontal morphology, a relatively complex configuration of the middle meningeal network (Tobias, 1987; Holloway et al., 2004). Tracking the early appearance and full establishment of these derived features in the hominin fossil record should contribute the assessment and understanding of the inter-species evolutionary relationships within the human lineage and potentially allow the identification of the paleodeme from which early *Homo* emerged.

However, together with an expected degree of intra-species variation having occurred during hominin radiation, the confounding effects of non phylogenetic-based resemblances (homoplasy), and the unpredictable as much as unavoidable impact of taphonomy on the fossilisation process, such research is complicated by the nature itself of the investigated structures. For example, the original description of the *Australopithecus sediba* (spec. MH1) highlights a developmental degree of the frontal lobe closer to the human condition in association with a rather australopith-like cranial capacity and convolutional pattern, thus suggesting a mosaic evolutionary pattern of the neuroanatomical diagnostic features (Carlson et al., 2011). However, a recent publication contests the identification of *Homo*-like features in *A. sediba* and rather suggests a common australopith endocranial organization (Falk, 2014).

Paleoneurology has recently enlarged its traditional investigative toolkit by integrating descriptive morphology with advanced methods of high-resolution 3D imaging and computing suitable for the subtle characterization of the fossil morphoarchitecture (Bruner, 2014). In this perspective, we engaged in the computer-assisted revision of the endocranial structural organization of South African nonhuman hominin endocasts, with special attention to the quantitative assessment of the sulcal variation pattern and architectural asymmetries.

The fossil specimens investigated so far represent three relatively well-preserved *A. africanus* endocasts: the Taung child and the specimens Sts 5 and Sts 60 from Sterkfontein Member 4. Based on virtual reconstructions obtained from high-resolution tomography (Taung, Sts 5) and surface scanning (Sts 60), we combined a method of landmark-free registration (Durrleman et al., 2012; Dumoncel et al., 2014) and a method of 3D endocranial shape asymmetries to investigate topographic differences in morphostructural organization and, more specifically, in lobe conformation, and quantitatively characterize intra- and inter-specific variability. Cerebral petalias and petalial patterns were also assessed. Finally, a semi-automatic methodology was developed to automatically detect, extract and compare the sulcal topographic organizations.

Here we compare the evidence extracted from the three South African fossil endocasts to the figures from a representative sample of extant humans, bonobos and chimpanzees, and also discuss the value, limits and perspectives of our experimental analytical protocol.

Acknowledgements - Research supported by the Center of Research and Higher Education (PRES) of Toulouse, the Midi-Pyrénées Region, the French Ministry of Foreign Affairs and the National Center for Scientific Research (CNRS). We thank Stephany Potze, curator of the Palaeontology Section of the Ditsong National Museum of Natural History (Pretoria) and Little Company of Mary (Pretoria) for collection access and data acquisition.

NEW EXCAVATIONS REVEAL FIRST DISCOVERIES OF THE EARLIEST HOMININS FROM KROMDRAAI B.

BRAGA J.[1,2], THACKERAY J.F.[3], BRUXELLES L.[4,5,6], DURANTHON F.[7], COUZENS R.[5], DE BEER