Journal of Human Evolution 55 (2008) 756–757

Contents lists available at ScienceDirect

Journal of Human Evolution

journal homepage: www.elsevier.com/locate/jhevol

News and Views

Suggested guidelines for invasive sampling of hominid remains

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ARTICLE INFO

Article history:
Received 19 March 2008
Accepted 30 April 2008

Introduction

The last few years have witnessed remarkable technical developments in paleoanthropology. On the one hand, accurate imaging techniques have limited the need to access actual specimens. On the other hand, direct dating, isotopic studies, and the study of ancient DNA, proteins, and microstructures have experienced great technical improvements but still require a degree of invasive sampling. The power of these invasive approaches for answering important questions in evolutionary anthropology brings forward the question of how to balance preservation of fossil hominid remains for the future against the application of current scientific analyses.

In order to address these issues, a workshop was hosted by the Max-Planck Institute for Evolutionary Anthropology in Leipzig on April 26–27, 2007 where the issues that emanate from the need for sampling of hominid remains versus the need for preservation of specimens for the future were discussed. At the end of the meeting, the participants produced a set of recommendations that might be useful to museums and other institutions as well as scientists that have to make decisions on requests for invasive sampling of hominid remains.

Recommendations for sampling hominid remains

1: The scientific question addressed should be important enough to justify invasive sampling of hominid remains and should not

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0047-2484/$ – see front matter
doi:10.1016/j.jhevol.2008.04.010

be answerable by any other means. For example, direct dating of hominid remains should be a measure of last resort, primarily used only when the archaeological context has been lost. When new excavations are done, and clear stratigraphical association exists between the hominid remains and the archaeological material, dating can always be done on associated remains.

2: If abundant and/or less-unique animal fossils are present at a site, the invasive techniques should be shown to be successfully applied to such remains before hominid fossils are sampled. Whenever possible, minimally destructive tests able to predict whether the planned analysis can be successful (e.g., amino-acid analyses) should be performed on the hominid specimen prior to the sampling.

3: The scientist suggesting invasive sampling must demonstrate a relevant publication record. The more unique a specimen is, the higher the standards should be. This applies in particular to type specimens. Envisioned protocol, equipment, long-term funding, and archival resources should all be considered in relation to the project suggested. A detailed application should be presented to the curators. If the institution curating the remains does not have adequate in-house expertise to judge the track record of the applicant and the research proposal, the application should be sent by the curators to external reviewers.

4: Negative as well as positive results should be reported back to curators and be published in papers and/or in on-line databases.

5: Redundant (duplicate) sampling should be done only when scientifically absolutely necessary. Whenever possible, sampling should be minimized by performing different types of analyses on the same sample. Regarding specimens that yielded negative results, requests for renewed sampling should be granted only when new technologies or new sampling procedures are available.

6: When sampling, anatomical importance and anthropogenic influences should be considered and destruction minimized. A single hominid fossil in a site is obviously immensely more valuable than a low-information piece—e.g., a shaft splinter—within a large series of hominid remains. Anatomically redundant elements and skeletal elements with low anatomical information should be sampled in priority. When possible, internal samples should be used, using pre-existing fragments and breaks.

7: Prior to sampling, the specimen should be documented by photography, high-resolution molding and/or microCT (if proven risk-free) whenever possible.

Recommendations for infrastructure developments

The participants also discussed developments of infrastructure that would be helpful to curators in their roles as "gatekeepers" to valuable hominid fossils. These suggestions included the following:

I: **A ranking system of the uniqueness of specimens.** Such a system could guide curators in their decisions and would range from samples that are absolutely unique and put on a "red list" to, for example, bone fragments whose species affiliation could be determined only via molecular analyses.

II: **An on-line database of hominid remains sampling**. Such a database could serve as a clearing-house and be associated with a web page where curators and scientists could report on sampling, negative results, and other curatorial issues, perhaps in a wiki-like self-correcting and comprehensive way.

III: **A standardized application form.** Such application forms already exist in some institutions (e.g., AMNH New York, Musée de l'Homme Paris, NHM London; see online supplemental information for a sampling of these). A common guideline for evaluation should include the definition of the research question, the description of the sampling and analysis methods, the expected results and significance, a stepwise procedure as applicable, and how the study will improve and/or maintain the collection.

IV: **A list of referees.** A list of potential experts for different kinds of analytical techniques could be established and made available for the curators as a help to evaluate proposals.

It is hoped that these guidelines as well as the development of infrastructure as outlined above may make it easier to strike the delicate balance between preservation of hominid remains for future generations and the use of such remains for gaining further insights into human evolution.

Appendix. Supplementary material

Supplementary material for this article may be found, in the online version, at doi: 10.1016/j.jhevol.2008.04.010