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Biogeosciences
Discussions

Interactive comment on "Chemical composition of modern and fossil Hippopotamid teeth and implications for paleoenvironmental reconstructions and enamel formation – Part 2: Alkaline earth elements as tracers of watershed hydrochemistry and provenance" *by* G. Brügmann et al.

Anonymous Referee #1

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General comments

This paper follows a companion paper investigating the chemical composition of extant and fossil hippopotamid dental remains, already published by Biogeosciences earlier this year. The present contribution, well within the scope of Biogeosciences, aims at investigating the variations of alkaline earth elements preserved in fossil hippopotamids

in view of using them as markers of environmental changes. It concludes that two elements preserved in fossil hippo enamel, Ba and Sr, are reliable, interesting sources of data for documenting environmental conditions and trends, given the moderate effect of diagenetic processes and the lack of physiological control of their internal concentrations. To a lesser extant, Mg could be also somewhat useful in some conditions. The work presents also other interesting results and further tracks of investigations: some enlightening of the process of amelogenesis and the environmental evolution that occurred during the late Neogene in the western Branch of the Eastern Africa Rift System. The analyses are properly documented. The effects of diagenesis are investigated and discussed. The discussion is thorough. The results of the study have in my opinion significant implications for a diverse array of methods and indicate that the method could be suitable to obtain novel data on environmental evolution in various African basins with important Cenozoic fossil records. To this extent, the paper appeared quite convincing to me. However, with regard to the biology of the group used in this study, the Hippopotamidae, the authors somewhat overlooked some details that may potentially alter their results (see below), and tended to make statements without citing the available literature. In addition, there should be room to present a bit more of the sampling procedures and to further investigate intra-individual variations.

Specific comments

Regarding dispersal abilities of extant hippos, the authors listed only two papers of 2011 by Chansa et al. There is a much more developed literature on hippopotamids, including by Kingdon {, 1979 #54} and Eltringham {, 1993 #979; , 1999 #505}. In addition, this is related to only one extant species. The authors generalize this limited dispersal ability to all hippopotamids. How this can be ascertained?

"Hippopotamid teeth are very robust environmental archives" Some explanations are required. What do you intend exactly?

"Hippopotamid teeth [. . .] represent the most common mammalian fossils in African

terrestrial sediments." Some references on fossil hippopotamids must be added to back up this statement, which I would in any case certainly moderate: "represent one of the most common mammalian fossils in African terrestrial sediments". First, this figure considerably varies from a site to another (e.g., at Laetoli, there are no fossil hippos at all). Second, at family level, bovid remains are in general much more abundant than hippopotamid ones.

"In order to avoid these effects, we only analyzed molar teeth." In the case of H. amphibius, weaning is generally completed in calves aged between 6 and 12 months (Elthringham, 1999). Deciduous premolars and first molars start to erupt roughly at the same time, meaning that their enamel is in part formed while suckling is still occurring {Laws, 1968 #16}. In the supplement, identifications of sampled teeth indicate several molar fragments as well as premolars. First, it means that the above statement is incorrect, as premolars are also found in the sample – this should be corrected throughout the paper. Second, the provided level of identification does not warrant that molars are all M2s or M3s or that the premolars are permanent teeth. Therefore, the authors cannot ascertain that preweaning effects are fully avoided in their sample. They will need to refine their identifications or to consider potential inclusion of preweaning material in their sample.

Although the sample has been described in previous publication, it would be much easier for the readers to quickly summarize the fossil sample features in one sentence, indicating essentially specimen numbers distributed by site and general stratigraphic levels.

Sample procedure is in my opinion too quickly described. In particular, it would be good to provide further information on the profile locations. Were some samples done at different positions in a given tooth along the crown, relative to cervix/apex? In other ways, could it be expected that some variations in Sr and Ba concentrations have been recorded through the life time of a given individual, along the crown of molars or, even better, in the enamel of evergrowing canine?

Technical comments

The word "hippopotamid" do not need capital first letter, as it is not a formal term of the taxonomy (unlike "Hippopotamidae").

p. 3652, l. 15 & p. 3668, l. 28: correct spelling is "Hippopotamus amphibius".

p. 3652, l. 24: precise which chapter(s) of Bobe et al. 2007 describes the litho- and biostratigraphy of the sampled lake basins.

Interactive comment on Biogeosciences Discuss., 9, 3645, 2012.