

Interactive comment on “Non-invasive imaging methods applied to neo- and paleontological cephalopod research” by R. Hoffmann et al.

Anonymous Referee #3

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General Comments

The papers written by Hofmann et al. is summing up the different non invasive imaging methods available for research on cephalopods and how these approaches can be used to answer some aspects of the paleobiology of fossil cephalopods. The paper is mainly based on externally shelled cephalopods and focuses, in my opinion, on reconstructing appropriately the volume of the shell with different types of data acquisition. Although themes like functional morphology and diversity and disparity are mentioned these questions are not developed and most of the paper seems to be dedicated on the appropriate reconstruction of the volume of the shell of Nautilus or Spirula. Technical limits as well as sources of possible errors are pointed out. The method section is quite detailed and will certainly interest scientist that are thinking to acquire these machines

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for their lab and for scientists that wish to start this type of research and lack technical background. The brands and technical details make it a bit long and difficult to read. I think the use of a table that summarize the pro and cons and technical details (min-max size of the sample, resolution, preparation of the sample ect..) would make this part more pleasant to read and help the reader. I would also add in the table the types of scientific problematic these methods are more suitable to be used for. The second part of the manuscript explores briefly several themes in order to show the panel of applications of these methods in cephalopod research. The authors probably wanted to show many aspects, but, as a consequence, it seems a bit too superficial, without clear questions and answer from the data available in the article. Maybe only one goal should be thoughtfully explored, like for example the buoyancy of in external shelled cephalopods –Nautilus and at least one species of ammonite. The authors maybe could compare the results obtained with CT to what is obtained with other approaches (invasive or theoretical) on the same sample. The comparisons and results should be clearer (maybe another summarizing table) and the impact of the sources of error for the CT techniques could have been more explored. For example PVE is mentioned, but how much is the PVE creating an error for a shell reconstruction? It highly depends on the resolution of the scan, so what is the poorest resolution acceptable before introducing too much error with the segmentation for a reconstruction of the shell? For the fossil material the authors could have explored different types of preservation, the paper mostly uses hollow ammonites, but this preservation is not so common and the presence of crystals in them is not very surprising. For example the authors could have chosen one species of ammonite with different types of preservation and compare the results obtained with the different data acquisition methods. Overall this paper will be useful for researchers interested in applying non-invasive techniques on shell material (fossil or recent) in order to calculate the volume of the shell and chambers and is the response to an increasing interest towards this technology from the cephalopod community. Having an accurate non invasive method will indeed help to answer many aspects of fossil cephalopod paleobiology. Maybe this could be pointed out in

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the introduction and in the conclusion, and then focus the article on one main goal.

Specific Comments

Some references are missing. More specifically on cephalopods, CT scan and SR-CT scan were used lately for reconstructing internal parts of ammonoids and it was also used on living cephalopods.

Klug C, Riegraf W, Lehmann J (2012) Soft-part preservation in heteromorph ammonites from the Cenomanian-Turonian boundary event (OAE 2) in north-west Germany. *Palaeontology* 55: 1307-1331

Kruta I, Landman NH, Rouget I, Cecca F, Tafforeau P (2013) The radula of the Late Cretaceous scaphitid ammonite *Rhaeboceras halli* (Meek and Hayden, 1856). *Palaeontology* 56: 9-14

Kruta I., Mapes R., Pradel A., Tafforeau P., Landman N. H. (2014) New insights into the buccal apparatus of the Goniatitina; paleobiological and phylogenetic implication. *Lethaia* 47 (1), 38-48.

Tanabe K, Misaki A, Landman NH, Kato T (2013) The jaw apparatuses of Cretaceous Phylloceratina (Ammonoidea). *Lethaia* 46: 399-408

Westermann, B., Ruth, P., Litzlebauer, H.D. et al. (2002) The digestive tract of *Nautilus pompilius* (Cephalopoda, Tetrabranchiata): an X-ray analytical and computational tomography study on the living animal. *J. Exp. Biol.* 205, 1617–1624.

Figures: - Please indicate the type of data acquisition the image is referring to - Figure 6 is misleading. I suppose this is not the same specimen from Hoffmann and Zachow 2011 that was analyzed (different specimen number, resolution and diameter of the shell) but then you should quote the paper or modify the image. -Figure 4. Please indicate in the legend what are the different SD and SBD. I could not find in the paper referenced.

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