

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

**Anonymous Referee #2**

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The contribution by Hoffmann and co-workers reports on a number of noninvasive analytical approaches and imaging techniques for the characterization and functional understanding of the cephalopod inner morphostructural organization, and also provides evidence of specific applications of such methods to both extant and fossil representatives. However, as it stands, the paper does not satisfactorily develop any of its declared goals, notably that of "diversity and disparity", which is conversely a potentially formidable issue in paleobiology. The introductory section widely fluctuates between a number of (paleo)biological and technological issues, finally not allowing the emergence of any clear scientific problematic, nor providing any valuable hypothesis to be tested. Sometimes in the text, the impression to a reader is that, as today a number of performing analytical techniques and technological facilities are rather easily available (even at moderate prices), why do not try to apply some among them to the so rich

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and varied record of fossil ammonoids after having run some tests on Nautilus? In other words, besides any introductory story, in principle this section should end with some unambiguous statements concerning the specific research goal(s) of this work, otherwise the paper sounds as an essentially technical report - even if reporting a few original results - mostly suitable for commercial use. With this respect, I honestly found the methodological "review" of very poor scientific value and interest (I cannot rate it higher than a Master level), more appropriate for a web forum open for technical comments to users, rather than having any real impact on a professional reader of a qualified scientific journal. I wonder about the interest of most trivial, even naive information provided among the "guidelines" (the most astonishing being that a surface scanner does not provide access to internal feature!). I understand my comments sound here as extremely critical - a behaviour which is/seems always "easy" when commenting on the work developed by other colleagues - but I also admit to have already faced the experience of elaborating a comparable account for a professional volume on the application of high-resolution noninvasive investigative techniques (including  $\mu$ CT and SR $\mu$ CT) in primate-human paleontology, thus having encountered similar difficulties in finding a reasonable and satisfying compromise between "techniques" and "scientific research". After having carefully considered the contribution by Hoffmann and co-workers, my plain conclusion is that they did not find such equilibrium, and that the text is also quite boring, after all. However, even accepting the highly disputable principle of a section preliminarily illustrating to a completely incompetent reader the pro and contra (but with respect to what scientific questions[s]) of different analytical methods (but, in this case, the review should attain much, much higher standards), I am anyhow surprised about the paucity of citations of papers dealing with the application of (SR) $\mu$ CT to the fossil record (among the numerous, I note those of Sutton, 2008, in Proc. R. Soc. B 275; El Albani et al., 2010, in Nature 466, notably for its SI documents), while the list of references even includes a short contribution to a meeting. A very serious limit of this work consists in the fact that, besides a few minor comments, it does not integrate any quantitative GM and/or FEA application, but is essentially limited to

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qualitative imaging, which is not enough. Marginally, I note that it happened to me to organize an international meeting on similar "analytical techniques" already in nineties, where some  $\mu$ CT-based results obtained in the quantitative analysis of a fossil primate specimen were firstly discussed; nearly 20 years later, in a professional paper I would expect a bite more than an introductory course to undergraduate students. As a whole, I simply suggest: (i) to recalibrate the introduction and to present a concrete problem(s) to be tested/question(s) to be answered (many interesting have been evoked by Hoffmann and co-workers, but none has been satisfactorily considered); (ii) to merge a significantly abridged version of the present "operating instructions" with the results, still maintaining a structure into distinct paragraphs according to the applied methods having provided original results specifically elaborated and discussed in the paper (i.e., SS, CT, microCT, nanoCT). Anyhow, this section should be more quantitative (linear, surface, volumetric data comparatively describing variation in inner structural organisation should be provided, elaborated, and critically commented), not almost invariably descriptive; (iii) to avoid the sections on SR $\mu$ CT and MRI techniques, as they have not used in any original analysis reported in this paper. In sum, in my modest view, as it stands this paper is useless for professional paleobiologists.

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