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Biogeosciences Discussions

Interactive comment on "Three-dimensional Magnetic Resonance Imaging of fossils across taxa" *by* D. Mietchen et al.

Anonymous Referee #1

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Review of Mietchen et al. “Three-dimensional magnetic resonance imaging of fossils across taxa”, Biogeosciences

This manuscript presents MRI analysis of three fossils, – a belemite guard, a crinoid columnal, a dolphine periotic bone, and a conifer cone. The authors show that in all four cases MRI provides high-contrast signal allowing non-invasive morphological characterization. The authors also carried out a careful analysis in order to determine the origin of the MR signal, and conclude that intracrystalline water or hydroxyl groups, rather than organic residues or free water, are the source of the MR signal. I am not an expert in MRI analysis, but their analysis appears to be thorough and the conclusion seems to be reasonable. At a broader level, the significance of this study lies in the potential of MRI techniques for non-invasive morphological characterization of other

fossils. To this end, the authors give a useful discussion on the advantages and limits of MRI in paleontological study.

The paper is well written and well organized. The only suggestion that I have is to add one paragraph describing how MRI works, perhaps in section 4 “Magnetic Resonance Imaging and Spectroscopy”. This may seem redundant to MRI veterans. However, as the audience of this paper includes paleontologists who may not be familiar with MRI techniques, a paragraph on MRI-101 would be very useful.

Page 2967, line 3, mis-spelling in “microcrystalline”

Page 2970, l ine 17, “elemental mapping of silicified wood from Neoproterozoic up to Miocene sites (Boyce et al., 2001)”. I do not think there are Neoproterozoic silicified wood. The Neoproterozoic specimens analyzed by Boyce et al. are cyanobacterial filaments from the Draken Formation.

Page 2976, line 3, Fig. 2D, F, in capitals

Page 2976, line 15-19, I am not sure why iron source for glauconite and pyrite formation necessarily came from hemoglobin degradation. It would be nice to show whether there is enough iron in hemoglobin to generate any significant amount of iron minerals. Why sedimentary iron source is excluded?

I also found that the title of some references (e.g., Brocks et al., 1999) are capitalized, which is inconsistent with other references in the bibliography.

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