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Interactive comment on “Towards adaptable, interactive and quantitative paleogeographic maps” by N. Wright et al.

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Review of Wright et al. by C.R. Scotese

General Comments: This paper is publishable, but needs to be refocused and cleaned up. It seems like the author began writing one paper - "How to create new and better paleogeographic maps", and ended up with a different paper "Testing paleogeographic maps with on-line data, and a few other interesting ideas". In this regard the title should be changed, and the introduction rewritten to reflect the actual content of the paper.

Recommendations: Publish with major revisions. Adaptable, interactive, and quantitative paleogeographic maps already exist. So the title should be changed to something like, "Ground-truthing Australian paleogeographic maps using fossil information from

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the Paleobiology Database" . The section on Greater India should be dropped. All uses of the terms "paleobiology" and "paleobiogeography" should be changed to a more appropriate descriptor. (see below for suggestions). The Emsian example is in error and should be fixed or removed (see comments below). The citation for Langford, 2001 should be double-checked.

Some Other Quibbles: The authors use several terms seemingly interchangeably, when in fact they mean very different things. These terms are: paleobiology & paleobiogeography. The terms paleobiology and paleobiogeography should be deleted from the text. They mean something very different from what the authors are describing. Paleobiology has evolutionary and organismic connotations. Paleobiogeography specifically refers to comparisons of faunas between geographically separated areas - with special attention to the similarity and vicariance (cosmopolitan versus endemic). The terms the authors should be using are biofacies, marine fossils, terrestrial fossils, or simply paleoenvironments based on fossils. There is also some confusion regarding the term "paleogeography". Paleogeography is not synonymous with "plate reconstruction" or "paleoreconstruction". Paleogeography specifically refers to the reconstruction of paleoenvironments (deep sea, deep shelf, shallow sea, and the host of non-marine environments). The Australian Paleogeographic Atlas is indeed an excellent set of detailed "paleogeographic" maps. As Amadeus Grabau (the father of paleogeography) said in the final paragraph of his monumental book, Principles of Stratigraphy (1924), "When the science of Stratigraphy has developed so that its basis is no longer purely of chiefly palaeontological, and when the sciences of Lithogenesis, of Orogenesis and of Glyptogenesis (geomorphology), as well as of Biogenesis, are given their due share in the comprehensive investigation of the history of our earth, then we may hope that Palaeogeography, the youthful daughter science of Stratigraphy, will have attained unto that stature which will make it the crowning attraction to the student of earth history."

Which is to say that before you can make an accurate paleogeographic map, you must first reconstruct the tectonic environment, correctly date the rocks, map the lithofacies,

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and then interpret the sedimentary environment to make the best, educated guess as to the paleoenvironment or paleogeography. GPLATES may or may not be a good vehicle to do this. I am not yet convinced (it has no real database capabilities). Fossils are indeed an important indicator of sedimentary environments - but there are many other indicators. The authors should be congratulated for recognizing that the information in the Paleobiology database can be used to test and improve existing paleogeographic maps, but should also recognize that the PBDB cannot be used to make a paleogeographic map from scratch. To their credit the authors, in the final section, do recognize the limitations of the Paleobiology database. Also, as far as I am aware all maps are "static". Databases, which can be sources of information for paleogeographic maps are not static - but neither are they maps. As far as I know there are no "dynamic maps". I.e. which constantly change and are updated with the inflow of new data. It is unlikely that there will be any "dynamic paleogeographic maps" any time soon, because a paleogeographic map is a highly interpreted creation. It is based incomplete data, is strongly dependent on time dependent contingencies, and like all maps is simply a visual hypothesis that needs be tested with additional data. I agree that the best paleogeographic maps are made, maintained and updated using a technology that combines mapping software and databases. However, this is not GPLATES but rather a GIS (Geographic Information System). This is what I use. I find it odd that the authors do not even mention GIS technology, which is the obvious solution to the problem of "static maps". And yes, there is GIS software that also reconstructs plates using the same data and algorithms as GPLATES. Some Other Problems A key citation (the source of the paleogeographic maps) is probably incorrect. I spoke with Rob Langford and he believes the citation refers only to his Cenozoic Atlas. The proper citation should probably be "Totterdell, J, 2002. XXXXXXXXXX"- which is how the on-line database is credited. The authors need to sort this out. Also the plate model, which is provided in the Supplement, is credited as Golonka, 2007. The model that is used is clearly the PALEOMAP Project plate model circa 1995. This is the plate model that Golonka and his colleagues at MOBIL used. In the text Golonka does cites the source

of the plate model as Scotese (2004), but like all plate models, the credit tends to get lost (especially when all the comment fields are deleted!!).

Specific Comments:

Ok now some specific comments. 9605 8 - biogeographic should be fossil 15 - "biogeographic indicators for paleobiology" should be "paleoenvironmental indicators from fossil evidence" 15-20 "our paleogeographic reconstructions" - where are these paleogeographic reconstructions? No new paleogeographic reconstructions are presented in this paper. I only see the Australian paleogeographic maps plotted on GPLATES reconstructions.

9606 8 - Not quite right. Relative plate motions cannot be determined by "commonalities in APW paths". You can only determine fixed relative positions. In any event it is to a solution to the longitude problem. 24 - I would get rid of this last sentence. It has nothing to do with the preceding paragraph. 9607 9 - many of these "collections" were from the same geographic locality. How many different geographic localities are represented? Maybe 20,000 - 30,000 at most. 15- Change "and biogeography" to "and fossil localities" 19- change biogeography to "fossil collections" 21- again, change biogeography to "paleoenvironments suggest by fossil data" 27 - not biogeography, fix it. 9806 4 - biofacies, not biogeography 3 Results

The chronological review is desultory, incomplete and mostly irrelevant. You are just restating what the Australian paleogeographic maps show. Why is this relevant? There is very little data for Australia from the PBDB. The limited fossil data agrees (>905) with the Australian maps. 9808 16 - was, not is. Please do a global search for "paleobiology" and "biogeography" and change them. Most of the time "fossil" would be a good substitute. 9610 8 - What is the Petroleum Wells Database? This needs a citation. It seems to come out of nowhere. OK, the authors finally find an apparent discrepancy between the fossil data and the paleogeography (Emsian). But I think they have made a mistake The map shown is Devonian (4), which according to the Australian Paleo-

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geographic Atlas represents a very short interval (less than 1 million years) at the end of the Emsian (398). The latest Emsian map (probably a regression) does indeed lack a marine seaway. The actual Emsian map (Devonian 3; 407 - 398 Ma) does show the seaway and is nearly identical to their map "C". Another words, fossil localities are in excellent agreement with the actual Emsian map. So what gives? I don't think the Emsian can be used as an example of a "mismatch". Peter Cook et al. got it right! Also, the date shown on the figure (395 Ma) is Eifelian, not Emsian.

9611 & 9612

More misuse of the terms biogeographic and paleobiology.

Summary comment: The entire result section confirms that the sparse data for Australia agrees well with the Australian Paleogeographic maps. With the exception of the Emsian data, which are plotted on the wrong map. The Australian paleogeographic maps have passed the test. Why not say this? Give the authors credit for doing a great job.

4 Discussion

1-5. This first sentence doesn't make any sense. The maps, in the first place, were made using a very precise quantitative approach. All that has changed is the technology from CAD to web-based data mining. I disagree with the last sentence. The PBDB was not designed to capture the sorts of information needed to make paleogeographic maps., and thus is a useful but inadequate data resource.

4.2 Devonian revisited Again. I believe the authors are in error. They used the wrong Emsian map.

4.3 Cretaceous I agree with the author's conclusions that the mid-Cretaceous (100 Ma) transgression was wider than portrayed in the Atlas.

4.4 Greater India This section seems like it belongs in another paper. It has nothing to do with the Paleobiology database/Australian atlas. Yes, I agree that paleogeography

can be used to test plate models. It is interesting but not relevant to this paper.

4.5 Data coverage etc. 20 - Again, there is a misconception about how high quality paleogeographic maps are made. GIS is the best solution because it includes all the positive attributes the authors tout: dynamic, easily updated, and easily changed. The authors need to mention this option.

9618 Phanerozoic misspelled.

Conclusions 1 - Yes, I agree. Any new data can be used to improve and refine paleogeographic maps. The changes that were suggested, in this case, were relatively minor. The Australian paleogeographic maps still would get an A+ in my book. But in principle I agree. Maps need to be continually tested with new data. GPLATES is a very useful tool that can be used to produce, update and revise plate tectonic reconstructions, but paleogeographic maps are much more complicated and need software that is also a fully functioning SQL database.

C.R. Scotese 08/24/12

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