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Solid Earth Discussions

Interactive comment on "Precise age for the Permian-Triassic boundary in South China from high precision U-Pb geochronology and Bayesian age-depth modelling" *by* Björn Baresel et al.

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This work contributes quality geochronology to the late-Permian record and utilizes a statistical approach likely to be used as the standard method for future studies involving accurate projection of time and uncertainty between dated horizons. The study is well done, thorough, and clearly presented in text and figures. I have a few comments:

Comment 1: Line 356 (and the first conclusion bullet): I think this section (and the paper) would benefit from inclusion of a date on Meishan bed 25 or 28, which bracket the P-T boundary in this section and were dated in Burgess et al (2014). Although the current work does utilize the ET2535 tracer, inter-laboratory bias might still be at a level above the internal precision quoted for many weighted mean dates, which

may effect the agreement that now exists between the two studies. You assert that age agreement between the three different sections indicates interlab agreement at the 0.05% level, but I'd like to see that agreement tested directly – doing so would corroborate the synchronicity of the south China sections, and would eliminate any circularity in arguing that current agreement indicates no bias.

Comment 2: Astrochronologic timescales also exist for the late Permian and early Triassic intervals in South China, some recently published with precision on par with the dates published here. Is it possible to integrate these datasets into the modeling approach used here? If so, would inclusion increase the precision to which section positions can be dated? If not, I'd be interested to see a short addition to the paper discussing the relationship of the timescale developed here with the astrochron timescale.

Comment 3: At Meishan, the boundary date is well defined because of bracketing dates (on beds 25 and 28) very close to the paleontologically-defined PTB. You show no dates above the boundary at Dongpan, and at Penglaitan your bracketing dates are at least 30cm from the boundary, with one coming from a zircon-bearing sediment, not from a volcanic ash. Although sediment accumulation rate is high at these sections relative to Meishan, a bracketing date close to the boundary would be helpful – I think this is another reason to date a bed from Meishan (specifically Bed 28).

Comment 4: This might be a result of my naïve understanding of the statistical method applied here, but are changes in lithology factored into the up/down-section projection of time? Can they be? I'd be interested to see how sediment accumulation rate changes in portions of the section that are entirely carbonate, or entirely clastic material, for example. Is any geochronlogically bracketed interval characterized by a single lithology? It would be interesting to test whether the model is improved by accounting for lithology change.

Comment 5: This study is in large part a test application of the Bchron technique to "deep" time. There is clear age accord between the modeled PTB boundary dates

generated in the Dongpan and Penglaitan sections, and likely coincidence of these with the Meishan section, which suggests utility of the Bchron method for the Permian and Triassic. As mentioned in the study, the carbon record from these sections does not allow for further correlation, and the astrochronogic timescale for the late Permian is not as well developed as that for the early Triassic. Thus, I wonder if the very early Triassic record, for which exists an accurate geochronologic and astrochronologic timescale and better chemostratigraphic correlation possibilities, might be a more robust interval on which to apply this model in the future.

Line-specific comments:

Line 30: “has” to “have”

Line 37: I’d not say that “plume-induced” is universally accepted. Some prefer a model in which subduction of sediments is responsible for huge amounts of flux melting – not many, but some.

Line 39: I don’t think “deeply” is the correct word.

Line 54: You might mention the reason that most geochronology isn’t precise enough to resolve biologic events – namely that these biologic events (i.e., extinction) occur on decamillennial timescales, and that most weighted-mean dates are characterized by uncertainty far in excess of this threshold.

Line 63: I suggest stating that by “expanded” you mean higher sediment accumulation rate over the same duration, which results in a thicker, more expanded section.

Line 68: Do you detect them or model them?

Line 181: You use a Th/U (magma) of 3.00 $\pm$ 0.50 (1σ). I’d appreciate a bit more explanation about why this value was chosen, and the sensitivity of dates to this parameter. E.g., what if 2 or 4 are used – I realize that the 2σ uncertainty covers this range, but interpretation based on the dates may be different and warrants a brief discussion. Burgess et al (2014) use a value of 3, which enables comparison between

datasets – is this why you use 3?

Line 220: No need for “strongly”

Line 305,6: Awkward sentence start

Line 332: ‘immediately” is not the correct word. I would prefer to see the stratigraphic depth of bed 25 below the boundary.

Line 342: the sentence starting with “that” is awkwardly phrased.

Figure 1: Please put location of the Meishan section on figure.

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