

Interactive comment on “Orbitally tuned time scale and astronomical forcing in the middle Eocene to early Oligocene” by T. Westerhold et al.

Anonymous Referee #2

Received and published: 22 January 2014

The interval discussed in this paper is middle Eocene to early Oligocene with new astrochronological ages given for polarity chrons C12n to C20n of the geomagnetic polarity timescale (GPTS). IODP Sites U1333 and U1334, ODP Sites 1218, 1052, 1172 and 1260 are the sites discussed.

The usefulness of the astrochronologies (based on XRF and stable isotope data) is related to the quality magnetic polarity stratigraphies because the resulting ages are intended to update the GPTS.

Apart from a sentence in the caption of Fig. 2, it is not stated that the magnetic stratigraphies for Sites 1218 and U1334 are “mapped in” from Site U1333. Table S16 in the Pangaea database has a heading that also states that the magnetic stratigraphies for Sites U1334 and 1218 are “mapped in” from Site U1333. This obviously means

C3191

that the magnetic stratigraphies for Sites U1333, U1334 and 1218 are not independent. The Site U1333 polarity zone boundaries are “mapped into” Sites U1334 and 1218 using the same XRF and other core-scanning data that is used to derive the astrochronologies. The filtered output from the XRF data, that are used to derive the astrochronologies, are certain to correlate from site to site if the site-to-site correlations are based on the magnetostratigraphies (and XRF data), and the XRF data are used to “map in” the magnetostratigraphies from Site U1333 to Sites 1218 and U1334.

Turning to Site U1333: The magnetic stratigraphy at Site U1333 for C12n to C20n is presented in the Supplemental Information and in the Pangaea database. Two figures: a demagnetization diagram (Fig. S12) and a plot of VGP latitudes and declinations versus age (Fig. S13) represent the documentation of what appears to be a high-quality and useful magnetic stratigraphy. In the future, particularly if these astrochronologic ages for the GPTS are adopted, those interested in timescales will want to see more details on the Site U1333 magnetic stratigraphies. Although the data are archived in Pangaea, more complete documentation should be included in this paper, or published elsewhere, before publication of the astrochronologies considered here. Statements in the Supplemental Information of this paper such as: “As shown by Pälike et al. (2010) [Shipboard Data], Site U1333 sediments are accurate recorders of the paleomagnetic field...” are misleading because it is not possible to determine this from shipboard data.

Site 1052: The polarity stratigraphy at Site 1052 is referenced to Pälike et al. (2001). It is based on poor quality shipboard paleomagnetic data (ODP Leg 171B) (Shipboard Scientific Party, 1998) with support from shorebased work of Ogg and Bardot (2001). The magnetic stratigraphy at this site above C17r is very poor, and the black/white bars indicating polarity zones in Fig. 6 are misleading. At the very least, an assessment of the quality of the magnetostratigraphic record should be given, with complete referencing.

Site 1172: The polarity stratigraphy is referenced to Rohl et al. (2004) although it is ac-

C3192

tually documented in Fuller and Touchard (2004) and Touchard and Fuller (2004). Hole 1172D magnetic stratigraphy in the C17r to C18r interval is given in Fig. 7, although I do not see this interval documented in the Fuller/Touchard papers. The shipboard data magnetic stratigraphies in the relevant interval (Fig. F19, in Shipboard Scientific Party, 2001) indicates very poorly defined magnetic stratigraphy.

Site 1260: In Fig. 7, the C18r-C20r interval is indicated as black/white bars. The polarity stratigraphy is referenced to Westerhold and Rohl (2013), although it comes from the Shipboard Scientific Party (2004) and from Suganuma and Ogg (2006). The polarity designation in Suganuma and Ogg (2006) is based on a "polarity rating" from rotary cores where the viscous magnetic overprint is used to determine declination (and hence polarity) in these low paleolatitude (low inclination) data. The shipboard magnetostratigraphic data seem to be difficult to interpret in this interval.

Without a full discussion of the magnetic stratigraphies, and the uncertainties associated with them, the astrochronological recalibrations of the GPTS cannot be evaluated. The stable isotope data, used in the astrochronologies, are available in the Pangaea database although these data are also not documented and referenced to Wilson et al. (unpublished).

In summary, another updated calibration of the GPTS is not useful unless the data that are used are fully documented. This is not the case for the magnetostratigraphic or stable isotope data. As the magnetostratigraphies for Sites U1333, U1334 and 1218 are not independent, but "mapped in" from Site U1333 using the XRF data used to derive the astrochronologies, agreement in astrochronological ages of polarity reversals among the three sites is guaranteed.

Interactive comment on Clim. Past Discuss., 9, 6635, 2013.