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Towards a stable numerical time scale for the early Paleogene

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The construction of an astronomical time scale for the early Paleogene is hampered by ambiguities in the number, correlation and tuning of 405-kyr eccentricity related cycles in deep marine records from ODP cores and land-based sections. The two most competing age models result in astronomical ages for the K/Pg boundary that differ by $\sim$750 kyr ($\sim$66.0 Ma of Vandenberghe et al. (2012) versus 65.25 Ma of Westerhold et al. (2012); these ages in turn are consistent with proposed ages for the Fish Canyon sanidine (FCs) that differ by $\sim$300 kyr (28.201 Ma of Kuiper et al. (2008) versus 27.89 Ma of Westerhold et al. (2012)); an even older age of 28.294 Ma is proposed based on a statistical optimization model (Renne et al., 2011). The astronomically calibrated FCs age of 28.201 $\pm$ 0.046 Ma of Kuiper et al. (2008), which is consistent with the astronomical age of $\sim$66.0 Ma for the K/Pg boundary, is currently adopted in the standard geological time scale (GTS2012). Here we combine new and published data in an attempt to solve the controversy and arrive at a stable nuemrical time scale for the early Paleogene.

Supporting their younger age model, Westerhold et al. (2012) argue that the tuning of Miocene sections in the Mediterranean, which underlie the older FCs age of Kuiper et al. (2008) and, hence, the coupled older early Paleogene age model of Vandenberghe et al. (2012), might be too old by three precession cycles. We thoroughly rechecked this tuning; distinctive cycle patterns related to eccentricity and precession-obliquity interference make a younger tuning that would be consistent with the younger astronomical age of 27.89 Ma for the FCs of Westerhold et al. (2012) challenging. Next we compared youngest U/Pb zircon and astronomical ages for a number of ash beds in the tuned Miocene section of Monte dei Corvi. These ages are indistinguishable, indicating that the two independent dating methods yield the same age when the same event is dated. This is consistent with results of single crystal U/Pb zircon dating of the Fish Canyon tuff itself (Wotzlaw et al., 2013), which produced a youngest U/Pb age of 28.196 $\pm$ 0.038 Ma that is indistinguishable from the astronomically calibrated age of 28.201 $\pm$ 0.046 Ma for the FCs. Finally, youngest U/Pb zircon ages for ash layers that are found directly above the K/Pg boundary in North America are close to 65.9 Ma and thus consistent with the older astronomical age model with an age of $\sim$66.0 Ma for the boundary. Summarizing, the new and published data summarized above unanimously favor the older option of the two alternative astronomical time scales for the early Paleogene.

References

Kuiper, K.F., A. Deino, F.J. Hilgen, W. Krijgsman, P.R. Renne, and J.R. Wijbrans, 2008. Synchronizing the Rock Clocks of Earth history. Science 320, 500-504.

Renne, P.R., G. Balco, K.R. Ludwig, R. Mundil, and K. Min, 2011. Response to the comment by W.H. Schwarz et al. on "Joint determination of 40K decay constants and 40Ar*/40K for the Fish Canyon sanidine standard, and improved accuracy for 40Ar/39Ar geochronology". Geochim. Cosmochim. Acta 75, 5097-5100.

Vandenberghe, N., F.J. Hilgen, and R.P. Speijer, 2012. The Paleogene Period. In: The Geological Time Scale 2012, Gradstein, F., et al., eds., Elsevier, pp. 855-921.

Westerhold, T., U. Röhl, and J. Laskar, 2012. Time scale controversy: Accurate orbital calibration of the early Paleogene. Geochem. Geophys. Geosyst., 13, Q06015, doi:10.1029/2012GC004096.

Wotzlaw, J.-F., U. Schaltegger, D.A. Frick, M.A. Dungan, A. Gerdes, and D. Günther, 2013. Tracking the evolution of large-volume silicic magma reservoirs from assembly to supereruption. Geology, doi:10.1130/G34366.1