Differential dissolution susceptibility of Paleocene-Eocene planktic foraminifera from North Pacific ODP sites

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We investigated shell characteristics and differential dissolution susceptibility for planktic foraminiferal species derived from upper Paleocene and lower Eocene deep-sea sequences, ODP Site 865 (Allison Guyot) and Sites 1209B, 1210B and 1212A (Shatsky Rise) in the North Pacific Ocean. The purposes of this study are: 1) assessing the effects of differential dissolution on upper Paleocene-lower Eocene planktic foraminiferal assemblages, at species level and within different biozones, in order to quantify dissolution susceptibility of genera and species; 2) investigating the differences in their shell characteristics; 3) revealing the connection between the shell parameters and the dissolution robustness of taxa and 4) identifying the key shell parameter(s) in the dissolution susceptibility of foraminiferal taxa.
Two independent experiments were carried out, one focusing on gradual qualitative deterioration of taxa by dissolution and the other by concentrating on the weight loss of taxa. To gain data on shell parameters such as wall thickness, porosity and pore size, we analyzed SEM images of taxa. The number of chambers in the last whorl of taxa and the size of specimens are determined using binocular microscopy.

Our results confirm previous experimental results on differential dissolution susceptibility among taxa at generic level (Nguyen et al. 2009, *Marine Micropaleontology*). Accordingly, the large muricate *Acarinina* and *Morozovella* are most resistant, followed by the cancellate *Subbotina* and the small muricate *Igorina*. At species level, the thick-walled *A. soldadoensis* and *A. subsphaerica*, the large *M. subbotinae* are the most resistant species. Most of the large *Morozovella* species such as *M. aequa*, *M. formosa-gracilis*, *M. velascoensis* and *M. pasionensis*, together with *A. nitida* show average dissolution resistance. Small muricate *Igorina* species, the cancellate *S. velascoensis* and the thin-walled *M. acuta* and *M. occlusa* are the most vulnerable species.

Among the test's structural parameters, wall thickness and size are the key parameters in dissolution resistance of a species. We propose a dissolution resistance formula, based on these two shell parameters. Application of this formula reveals a good agreement between the calculated and the measured dissolution resistance, indicating that the formula is applicable to the experimental dissolution process. The agreement between our experimental results and in-situ experimental results as well as natural quantitative/qualitative records suggests that our experiments well mimic natural dissolution processes. Consequently, these experimental results are meaningful for interpretations of foraminiferal dissolution in natural environments, especially in studies on early Paleogene climatic events that are often associated with dissolution phenomena.

References:

Nguyen, T.M.P., Petrizzo, M.-R. & Speijer, R.P. (2009): Experimental dissolution of a fossil foraminiferal assemblage (Paleocene-Eocene Thermal Maximum, Dababiya, Egypt): Implications for paleoenvironmental reconstructions. Marine Micropaleontology, 73, 241-258.