



From AMOR to AMOR2 – Prototypes for automated orientation and imaging of planktonic foraminifera for morphometric analyses

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Planktonic foraminiferal species descriptions notoriously lack quantitative information about morphological variation of their shells. Understanding evolution and paleoenvironmental influences on shell morphology require a synoptic view of a species' variation over its global paleobiogeography. „Evolutionary prospection“ – our approach for mapping morphological boundaries of extant and extinct menardiform globorotalids (Neogene tropical planktonic foraminifera) through time (Knappertsbusch, 2016), calls for statistically robust morphometric measurements from thousands of specimens. For this purpose AMOR (Automated Measurement system for shell mORphology) has been developed some time ago. This device automatically orients and images specimens under a binocular microscope. It consists of a motorized tilting stage allowing pitch and roll movements coupled with an automated binocular microscope from Leica. The software of AMOR is encoded in LabView and includes functions for X- and Y tilting and translation, centering, automagnification, and autofocussing of specimens in keel view under the microscope. Before saving to disk, images are autorotated for vertical alignment on the monitor. Functions can be operated either in manual mode when handling single specimens, or work sequentially in automatic mode when processing series of specimens in a multicellular slide. After image collection shell parameters are extracted using separate digital image and morphometric software. While difficulties limited early versions of AMOR to more bilaterally symmetric Globorotalia menardii sensu stricto, modified algorithms allow now orientation of asymmetric menardiforms or forms with a circular periphery in aequatorial view (e.g., G. miocenica, G. multicamerata).

With growing experience we learnt, that automated microfossil orientation requires species specific algorithms in order to best position specimens into the desired standard keel-view. Adapted to program AMOR v. 3.28 scripting of functions using AutoIt scripting language was found to be an elegant solution to increase flexibility. It allows combining core-functions and enables us to create a „portfolio“ of adapted scripts for processing particular morphologies of a species without the need of re-programming sophisticated LabView code.

This newer concept and other reasons required re-building of the existing system, and so device AMOR2 was recently completed with improved hardware, modified features, and updated soft functions. The new device will now be applied in an ongoing research project about prospecting patterns of morphological evolution in menardiform globorotalids along Agulhas' trackway (see Knappertsbusch and Friesenhagen (2018) and the contribution of Friesenhagen during the present EGU conference).

Reference cited:

Knappertsbusch, M. (2016). Evolutionary prospection in the Neogene planktic foraminifer Globorotalia menardii and related forms from ODP Hole 925B (Ceara Rise, western tropical Atlantic): evidence for gradual evolution superimposed by long distance dispersal ? Swiss Journal of Palaeontology, 135, 205-248.

Knappertsbusch, M. and Friesenhagen, T. (2018). Prospecting patterns of morphological evolution in menardiform globorotalids along Agulhas' trackway: Review and research in progress. Abstract. FORAMS 2018 Symposium, 17-22 June 2018, Edinburgh, UK., Session IX, temporary abstracts, 331.

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