



FORAMS 2006

Evolution of western Tethyan involute *Heterostegina* from late Bartonian to the end-Priabonian

György Less¹; Ercan Özcan²; Cesare A. Papazzoni³ & Rudolf Stockar⁴

¹University of Miskolc, Department of Geology and Mineral Resources, H-3515, Miskolc-Egyetemváros, Hungary - foldlgy@uni-miskolc.hu

²Department of Geology, Faculty of Mines, Istanbul Technical University, Ayazađa/Istanbul 34469, Turkey

³Dipartimento del Museo di Paleobiologia e dell'Orto Botanico,

Università di Modena e Reggio Emilia, Via Università 4, I-41100 Modena, Italy

⁴Museo cantonale di storia naturale, Viale Carlo Cattaneo 4, CH-6900 Lugano, Switzerland

Eocene involute *Heterostegina* having originated from the *Operculina bericensis-roselli-gomezi* group are widespread in the upper Bartonian and Priabonian beds of the Western Tethys. They have been morphometrically investigated and the important features of the equatorial section of their A-forms were statistically evaluated from thirty-four localities (including five topotypical ones). These localities represent the whole late Bartonian to latest Priabonian interval, mark different ecological conditions and extend from Spain to Armenia. Populations are ranked into three species, *H. armenica*, *H. reticulata* and *H. gracilis* based on the presence/absence of granulation, on the arrangement, shape and density of secondary chamberlets and on the relative size of the proloculus. These species form evolutionary lineages within which (especially within *H. reticulata*) a very rapid evolution could be observed with the reduction of the number of operculinid chambers, the increase of the number of secondary chamberlets (counted at chamber 14) and in the increase of the size of the proloculus, although the last turned out also to be ecologically controlled.

This evolution is proven by the stratigraphical succession of populations in the Mossano section (Italy) and also by superpositions from other localities. The evolutionary changes are also accompanied by the change of co-occurring fossils starting with the disappearance of large-sized *Nummulites*, then followed by the appearance of genus *Spiroclypeus* and then by the disappearance of survivor middle Eocene orthophragmines. Based on the reduction of operculinid chambers as the most reliable parameter, two chronosubspecies of *Heterostegina armenica* (one of them is newly erected) and seven ones of *H. reticulata* (with three new subspecies) are defined biometrically. This allows us to subdivide the shallow benthic zone (SBZ) 18 very cautiously into three

while SBZ 19 into two subzones. *Heterostegina gracilis* (the only species with granulation) characterizes the SBZ 20 zone. The middle/upper Eocene (=Bartonian/Priabonian) boundary is suggested to be placed onto the base of the “Priabona marls” in the Mossano section corresponding to the SBZ 18/19 limit, to the first appearance of genus *Spiroclypeus*, to that of *Nummulites fabianii* and *Heterostegina reticulata mossanensis*. It falls into the upper part of both the P 15 planktic foraminiferal and NP 18 calcareous nannoplankton zones.

The extremely rapid evolution of *H. reticulata* accompanied with relatively large geographic distribution and wide ecological niche allows calibrating larger foraminiferal events around the proposed Bartonian/Priabonian boundary. As a working hypothesis, the extinction of large-sized *Nummulites* seems to be heterochronous in the late Bartonian in having migrated eastward. Relying on data from Italy, Hungary and Turkey, the first appearance of *Spiroclypeus* (with the same evolutionary degree) is proven to be synchronous in the very base of the Priabonian. Mediterranean Eocene involute *Heterostegina* became extinct very probably with no descendants at the very end of the Eocene.

This research was realized in the frame of I.G.C.P. project 393 having financed also some of Less's travels. The final phase of the work was sponsored for Less by the National Scientific Fund of Hungary (OTKA, Grants n° T 037619, 042799 and 060645), for Özcan by TÜBİTAK (project n° YDABAG-101Y060), for Papazzoni by MIUR Cofin 2002–2005 (resp. prof. A. Russo, Modena) and for Stockar by the Cantonal Museum of Natural History (Lugano).