Ber. Inst. Erdwiss. K.-F.-Univ. Graz	ISSN 1608-8166	Band 9	Graz 2004

NASSARIIDAE AND RISSOIDAE GASTROPOD ASSEMBLAGES − A MIRROR OF ENVIRONMENTAL DYNAMICS IN THE PARATETHYS SEA

Mathias HARZHAUSER[1] & Thorsten KOWALKE[2]

[1] Natural History Museum Vienna, Geological-Paleontological Department, Burgring 7, A-1014, Austria
e-mail: mathias.harzhauser@nhm-wien.ac.at
[2] Department of Environmental and Geosciences, Palaeontology, LMU Munich, Richard-Wagner-Straße 10, D-80333 Munich, Germany, e-mail: t.kowalke@lrz.uni-muenchen.de

Nassariidae (Neogastropoda, Buccinoidea) and Rissoidae (Caenogastropda, Littorinimorpha) are typical molluscs in the marine and marine-brackish Miocene deposits of the Eurasian Paratethys Sea. They are among the few gastropod taxa that managed to pass the water chemistry crisis at the Badenian/Sarmatian boundary.
Within the Central Paratethys the three nassariid subfamilies are recorded by a rather constant number of taxa throughout the Early Miocene. The Nassariinae always range about 8-10 species whereas the Cylleninae and Dorsaninae are distinctly less manifold, comprising only 1-3 species each. This picture changes dramatically during the Early Badenian (Langhian) when the Nassariinae rise to 45 species within the Central Paratethys. Correspondingly the Cylleninae experience the acme during the Early Badenian being documented by at least eight species. For both groups the Late Badenian brings about some slowdown of radiation. This development is mirrored in the faunas of the Eastern Paratethys. There, the lower Middle Miocene Tarkhanian and Chokrakian stages reflect a maximum of nassariid diversity which collapses during the Karaganian crises. Afterwards, the Konkian stage which corresponds to the Upper Badenian of the Central Paratethys could not regain the loss.

Within the Rissoidae the early Badenian faunas indicate a marked increase in diversity. 28 species of Alvaniinae are described from the Badenian of the Central Paratethys. The maximum diversity was achieved during the Early Badenian as represented by the extraordinary rich faunas of Korytnica (Poland), Kostej, and Lapugy (Romania). At that time the diversity of the Alvaniinae seems to have been considerably lower in the Eastern Paratethys, where only 2 species were described from the Tarkhanian to Konkian of southern Russia. None of the manifold Badenian Alvaniinae passes the Badenian/Sarmatian boundary in the Central Paratethys and also the Eastern Paratethys seems to lack this taxon during the Sarmatian. Whilst, the environments of the Lake Pannon in the former Central Paratethys excluded any resettlement by Alvaniinae during the Late Miocene, at least two species managed to enter the Eastern Paratethys in the contemporaneous Maeotian. Correspondingly, the Rissoidae display their acme in the Central Paratethys during the Badenian. Whereas *Turboella* became extinct in the Paratethys at the Badenian/Sarmatian boundary, *Rissoa* contributes to the Sarmatian faunas as the sole representatives of the Rissoinae. In the Eastern Paratethys the genus holds on even to the Late Miocene and is mentioned from the Maeotian.

The Early Sarmatian acme of the Dorsaninae - mainly contributed by *Duplicata* – is rather homogeneous in both biogeographic areas. 12 species appear in the Central Paratethys and nine are documented from the Eastern Paratethys. Finally, with the establishment of Lake Pannon in the Central Paratethys the faunas drift apart. In the Eastern Paratethys *Akburunella* seized its change and attains a unique diversity during the Bessarabian.
The trigger of these developments and successions is difficult to reveal. However, a closer look to the early ontogeny shows that the majority of all investigated Nassariinae (93%) display indirect development with a shorter planktotrophic larval stage of few weeks. This is in strong contrast to 0% indirect development in the investigated Sarmatian Dorsaninae.

Indeed it is possible to state some pre-adaptation for direct development within the Eggenburgian to Badenian Dorsaninae. Although the pre-Sarmatian *Duplicata haueri* still experienced indirect development, it is already characterised by a more yolk-rich embryogenesis compared to that of the Nassariinae. With the dawn of the Sarmatian, representatives of the genus switch towards direct development, as documented by *Duplicata duplicata*. No lecithotrophic larval development is documented. Finally, the preference to yolk-rich embryogenesis culminates in the Bessarabian with the genus Akburunella which was most probably even supported by nurse-egg nutrition. Obviously, the tendency to renounce planktotrophy and to focus on a yolk rich embryogenesis turned out as competitive advantage in the Sarmatian fauna. In reverse, this development might hint to some kind of plankton-crises during the Early Sarmatian, which hampered the success of indirect developing nassariids.

The Badenian bloom in diversity is related with the Langhian climatic optimum, being best reflected by the occurrence of the tropical thermophilic genus *Cyllenina* and by the northward migration of thermophilic taxa from the Mediterranean area into the Paratethys. Consequently, the subsequent decline in nassariid diversity during the Late Badenian/Konkian might simply reflect the climatic deterioration. In contrast, the distribution of the fossil species of Rissoinae and Alvaniinae do not indicate any climatically driven north/south trend within the Badenian of the Central Paratethys. As in Recent time, climate has not been a major limiting factor in the distribution ofthese gastropods. Thus the abrupt extinction of all Alvaniinae and most Rissoinae at the beginning of the Sarmatian was most probably triggered solely by changes in the water-chemistry and not by shifts in the climate. This drastic change in composition of the faunas was followed by the take-over of the Mohrensterniinae in all shallow marine habitats formerly predominated by Rissoinae and Alvaniinae. The impoverishment of the faunas and the euryhaline character of the accompanying faunal elements indicates an extreme character of the *Mohrensternia* habitat. This endemic genus flourished also during the Karaganian and Maeotian in the Eastern Paratethys. Thus we interpret the genus to have favoured reduced marine conditions but not hypersaline ones. This agrees also well with the fact that *Mohrensternia* became nearly extinct in the Central Paratethys at the beginning of the *Ervilia* Zone, when oolithic sediments, the growth of foraminifera bioherms and the considerable increase of shell thickness in the mollusc fauna point to a shift towards marine to hypersaline waters oversaturated in $CaCO_3$.