

## Distributional patterns and shifts of early Middle Miocene Gastropod Faunas in the Central Paratethys

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Early Badenian gastropod assemblages of the Central Paratethys are best documented by the Austrian faunas of Styria and Lower Austria and by the Hungarian fauna of Varpalota. The Austrian faunas are known to science for more than 150 years and were usually termed as the „Grund Fauna“. Due to an inadequate definition of the now historical stage „Helvetian“, the separation of the advanced „Grund Fauna“ from the slightly older Early Miocene Karpatian one remained doubtful throughout most of the 20<sup>th</sup> century. However, during the last years the Middle Miocene status of the fauna was accepted by most workers based on the increased biostratigraphic data. Recently the dating was confirmed by magnetostratigraphy, mammals and planktonic foraminifera. These data document a gap between the Karpatian gastropod fauna of the Korneuburg Basin and the Badenian section Grund of approximately 1.5 ma.

Both faunas may be considered as typical migrational faunas, since both faunas coincide with a marked transgressive event from the Mediterranean area into the Central Paratethys.

One of the main differences between the late Early Miocene Karpatian gastropod faunas of the Western Paratethys and those of early Middle Miocene Badenian faunas is a sudden increase in diversity. About 150 gastropod species of the Karpatian are opposed by more than 300 species of the Early Badenian. This „bloom“ can be observed within most gastropod families but is most conspicuous within the cypraeids, turrids, cancellariids, nassariids, or muricids. However, the modern character of the fauna is not only based on the evolution of new Paratethyan taxa (e.g. within nassariids) but is probably only a result of immigration from the adjacent Mediterranean. Nonetheless, the Karpatian fauna was also characterised by a high number of immigrations, resulting in more than 70% of „Mediterranean“ species within the Central Paratethyan Korneuburg Basin (Austria).

Despite the documented open seaways and the fair possibilities for migration, several Early Miocene Mediterranean species did not enter the Central Paratethys before the Badenian. Among these species *Rimella* (*Dientomochilus*) *decussata* (DEFR.), „*Pseudonina*“ *reyti* COSSM. & PEYR., *Fasciolaria* (*Pleuroploca*) *tarbelliana* (GRAT.), or *Morum* (*Oniscidia*) *cythara* (BROCCHI) are typical. Mediterranean origin is also likely for taxa such as *Malea* (*Cadium*) *denticulata* (DESH.) and *Pereiraea gervaisi* (VÉZIAN). Obviously, the ecological conditions

allowing the northward migration of these species were established not before the Early Badenian. Similarly, the strombid *Tibia dentata* (GRAT.) is unknown from the Karpatian of the Paratethys but forms extraordinary large populations in the Mediterranean at that time (Mut Basin in Turkey, Qom Basin in Central Iran). Nevertheless, the same species starts to form equivalent populations within the Styrian Basin in the Early Badenian, witnessing a distinct extension of its optimum-zone into the southern Central Paratethys. Comparable northward restrictions in their Middle Miocene distribution area can be documented for the stromboids *Pereiraea gervaisi* (VÉZIAN) and *Strombus schroeckingeri* (HOERN.) which both are restricted to the southern basins of the Central Paratethys.

Within the Paratethys the Early Badenian gastropod fauna is also highly indicative in respect to biostratigraphy. Several species, such as *Trigonostoma crenatum* (HÖRN.), *Rimella* (*Dientomochilus*) *decussata* (DEFR.), *Pereiraea gervaisi* (VÉZIAN), *Strombus* (*Euprotomus*?) *schroeckingeri* HÖRNES, *Malea* (*Cadium*) *denticulata* (DESH.), and *Cassidaria cingulifera* HOERN. & AUING. seem to be restricted to this rather short time slice. Furthermore, the surprising bloom of many Early Miocene (Karpatian, Burdigalian) relics characterises the fauna. Thus, the Central Paratethys acted as Early Badenian sanctuary for several Early Miocene species, which are otherwise highly characteristic for the Karpatian assemblages of the Paratethys. These „old fashioned“ survivors such as *Tympanotonos papaveraceus* (BAST.), *Turritella gradata* MENKE, *Protoma cathedralis* BAST., *Euthriofusus burdigalensis* (DEFR.), *Ocenebra* (*Ocinebrina*) *crassilabiata* (HILBER), and *Perrona louisae* (HÖRN. & AUING.) have a last but strong acme in the „Grund Fauna“ but fade abruptly without reaching the Middle Badenian. Some of these relics are not „Kümmerforms“ indicating a near extinction but display rather a peak concerning numbers of individuals as well as size. But even within persistent species such as *Volema* (*Melongena*) *cornuta* (AGASSIZ), *Genota ramosa elisae* HÖRN. & AUING., *Tibia dentata* GRAT., *Gyrineum* (*Aspa*) *marginatum* (MARTINI), *Mitra scrobiculata* (BROCC.), *Tudicula rusticula* (BAST.) and the *Nassarius dujardini-edlaueri-schoenni* group a similar „bloom“ can be observed in the Early Badenian.

Generally, the thermophilic character of these assemblages – indicated among others by a maximum diversity of strombids throughout the history of the Paratethys – agrees well with an Early Langhian climatic optimum.