TECTONIC SETTING OF THE TRIASSIC "HALLSTATT" (S.L.) FACIES IN NE HUNGARY

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Abstract: As opposed to the Lower Juvavicum of the Northern Limestone Alps, the original N–S deepening tendency has been preserved in the Aggtelek and Bódva Units of the Aggtelek–Rudabánya Mts., with well recognizable south-vergent imbricated and folded structures, although combined with north-vergent ones. Therefore this area has an outstanding importance in the renewed discussion about the position of the Alpine Hallstatt Triassic.

Geological setting

The Aggtelek and Rudabánya Mts. occur in the NE-most part of the Pelso Megaunit (Composite Terrane). Non-metamorphosed Middle–Upper Anisian to Upper Norian pelagic basinal and slope facies, corresponding partly to the "Euhallstatt" facies of the Eastern Alps, characterize the Bódva Unit and Szõlõsardó Subunit of the Rudabánya Mts. and the Derenk Subunit of the Aggtelek Mts. The Aggtelek Unit and Alsóhegy Subunit were in outer shelf setting till the early Late Carnian, with southward facing reefs in the Upper Anisian (between Aggtelek and Égerszög; Velledits et al., in the present volume) and in the Carnian (Alsóhegy, Kovács, 1977 in Kovács et al., 1989). Then their shelf margin domain broke down and pelagic Hallstatt limestones, locally interfingering with Pötschen limestones were deposited till the Late Norian. The Szõlõsardó Subunit, interfingering with the Bódva Unit, and the Derenk Subunit (representing the northernmost "Euhallstatt" facies in the North Pannonian – Inner West Carpathian orogenic collage; Haas and Kovács, 2001) in the southern front of the Alsóhegy Subunit were in slope setting also till the early Late Carnian, then normal sequences of Hallstatt and Pötschen limestones were deposited till the Late Norian, with only very scarce signs of sediment movements. (Note: units and subunits are understood herein in terms of "tectono-stratigraphic" units.)

Recent, detailed structural analysis of the Lower Triassic formations has been presented by Hips, 2001, and that of the metamorphosed units exposed in the NE part of the Rudabánya Mts. by Fodor and Koroknai, 2000.

Studied structural cross sections

Alsóhegy section (A–A')

The Middle to early Late Carnian reef complex (with reef facies on the S and lagoonal facies on the N) contacts the Derenk Subunit at its southern foreland (in the investigated Vecsem Spring section from the Middle Carnian to Middle Norian upward) along a mappable brecciated zone (with a characteristic red and pink calcite

vein network) of tens of metres width. The Hallstatt limestones dip with 22/58° below the reef limestone. Although the present contact of the two subunits is along a subvertical fault (dipping near the section 169/71°), mapping geolgists uniformly considered the reef complex having been thrust onto the Hallstatt limestone at its foreland (cf. Less et al., 1988).

Szúnyogtetõ anticline (*northern part of* B–B')

The core of this anticline is formed by Lower Triassic rocks, mainly marls. Middle and Upper Triassic pelagic carbonates, overlying the Steinalm Limesone, and finally uppermost Triassic to Jurassic marls and shales occur on its southward overturned limb, with steep to subverical dip. Its sequence was explored by the borehole Szalonna 5.

Dunnatetõ – Kalackó-tetõ section (*southern part of* B–B'): *thrusts over Jurassic formations*

In the northern part of Dunnatetõ, in the southern front of the Szúnyogtetõ anticline, the overturned limb of another recumbent fold occurs. It is much better exposed outside of the line of the section, in the NW part of Dunnatetõ and especially on Csipkés-hegy (section C–C'), where it becomes nearly horizontally lying. In most part of the section, imbrications can be seen (repetitions of the Gutenstein and Steinalm Formations; figured already by Balogh, 1953). This setting was explored by the borehole Szalonna 4, which reached Jurassic rocks of the Telekesoldal Group at depth 537,0m. These latters come to the surface at the southern end of the section. Outside of the section, along the SW foot of the hills at the margin of the Bódva basin, they crop out continously from Csipkéstetõ to village Szalonna. Some subvertical neotectonic tear faults, cutting the imbricated structure, can also be recognized along the section. On the S, already in front of the foothill, these structures are truncated by an Early Miocene strike-slip fault bounding the Darnó Zone from the SE.

Dunnatetõ–Csipkés-hegy section (C–C')

This complementary section extends from the borehole Szalonna 5 to Csipkés-hegy, e.g. until the W foot of that. The recumbent fold mentioned in the previous paragraph, after a tear fault becomes overturned already on the western edge of Dunnatetõ, as indicated by red chert beds of the Bódvalenke Limestone Fm. in the key section Dunnatetõ-NW. More to the W, on top of the Csipkés-hegy, it becomes completely overturned and practically horizontally lying, as indicated by the overturned sequence on the western slope of the hill and by the borehole Perkupa 74, drilled on top of the hill. At the foot of the hill olistostrome horizons of the Telekesoldal Group (although different in composition from that of the type exposure) are exposed. Shales–marls, attributable to the Jurassic, occur in the lower part of the sequence of the borehole Perkupa 74.

Conclusions

–South-vergent mesoscale thrusts and folds characterize the investigated cross section of the Aggtelek and Rudabánya Mts. Nevertheless, N-vergent movements can also be recognized (Less, 2000). Reconstruction of the complex deformational history and timing of the events needs further detailed studies.

–As opposed to the problem of the Lower and Upper Juvavicum of the Northern Limestone Alps (see the discussion Schweigl and Neubauer, 1997 versus Gawlick et al., 1999 and Mandl, 2000), the original southward deepening tendency has been preserved in the units of the Aggtelek and Rudabánya Mts. This tendency is even more pronounced, if the territory of the Slovak Karst is also taken into consideration, where Upper Triassic Hallstatt facies occurs on the S (in the western continuation of the Aggtelek Unit) and Dachstein reef facies on the N (Mello et al., 1997).
–This southward deepening tendency points to a southward (according to present coordinates) existing Triassic pelagic/oceanic domain. This is in apparent contradiction with results of recent structural and geophysical investigations carried out at the northern margin of the Slovak Karst area, which indicate northward transport directions (at least from the Late Cretaceous onward) and suggest an original northerly setting of ophiolites occuring atop the Gemeric units (Neubauer et al., 1996; Plašienka, 1997). However, a pre-Late Cretaceous (probably Jurassic) sinistral strike-slip faulting, which has been recently proposed for the Eastern Alps (Schuster and Frank, 1999) may give an eventual explanation for this apparent contradiction (Frank, pers. comm.).
–Ductile deformations observed on metabasalt intercalations of crystalline limestone blocks of the Borka Unit point to a northward transport (Faryad, 1997). These high-pressure metamorphosed blocks were metamorphosed in Late Jurassic (160-150 Ma) at about 40km depth (Mello et al., 1998) and are interpreted as constituents of an olistostrome or melange complex (Faryad, op. cit.). These deformations apparently contradict the stratigraphic and sedimentological criteria, which indicate southward polarity. However, the blocks can be interpreted, as having been rotated into the direction of the Late Cretaceous (90-80 Ma, according to Plašienka, op. cit.) nappe stacking. Reconciliation between N-ward tectonic transport in the Borka Unit and S-vergent folds, reverse faults and southward facies polarity needs further detailed structural studies.

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