

FIRST EVIDENCE OF JURASSIC IN THE FOLKMAR SUTURE ZONE OF THE MELIATICUM IN SLOVAKIA AND ITS TECTONIC IMPLICATIONS

H. Kozur* & R Mock**

* Dr. sc. HEINZ KOZUR, Rízsó u. 83, H-1029 Budapest, Hungary.

** Dr. RUDOLF MOCK, Department of Geology and Paleontology, Faculty of Natural Sciences, J.A. Comenius University, Mlynska dolina, 842 12 Bratislava, Slovakia.

Abstract

The Gemicum s.str. (Gelnica, Rakovec and Klatov Units) was a continental block within the Meliata Ocean. In its surrounding suture zones rocks of a Middle Jurassic accretionary complex (Meliaticum) are partly preserved that contain blocks of the Triassic oceanic sequence. The Middle Jurassic turbidites (dated by radiolarians) of the Folkmar Suture Zone (name introduced herein) N of the Gemicum s.str. were formerly mapped as Scythian Werfen beds with basic and ultrabasic rocks. The Paleozoic unit between the Folkmar Suture Zone and the Veporicum (Crmel, Dobsina and Ochtina nappes) is named as Crmelicum. It corresponds to the eastern part of the Northern Grauwackenzone) of the Eastern Alps.

Introduction and general geologic situation of the investigated area

The oceanic Meliaticum, adjacent slopes and shelves of the Western Carpathians have been generally rooted in the Roznava Line (GRECULA, 1973) south of the Gemicum (e.g. MAHEL', 1974, 1986). Its suture character was recognized by MAHEL' (1974) and in general accepted since this time. Because of the occurrence of large amounts of glaucophane schists in the Sugov Valley area, we name this suture as Roznava-Sugov Suture Zone. It strikes E-W, in its western part NE-SW. The Gemicum was regarded in this model as the Paleozoic basement of the Silica Nappe (MELLO & VOZAROVA, 1983).

Especially interesting for the understanding of this suture zone is the Btrka Nappe (LESKO & VARGA, 1980), well exposed in the Sugov Valley area. It consists of glaucophane schists (originally basaltic lavas) and slope limestones with many

shallow-water blocks. MELLO et al. (1983) placed this sequence into the Meliaticum and could prove a Carnian age for limestones above the glaucophane schists. The cooling ages of the metamorphosis are Late Jurassic, confirming a largely Middle Jurassic subduction of the Meliata Ocean that closed in the Early Oxfordian (KOZUR, 1991 a, b). The Meliaticum of the Roznava-Sugov Suture Zone consists of a Middle Jurassic accretionary complex with Bathonian to Early Oxfordian flysch (Bathonian to Callovian distal turbidites, olistostromes, Early Oxfordian coarsening upwards sequence). Middle Triassic dismembered ophiolites of the oceanic crust and a Middle Triassic to Liassic oceanic sedimentary sequence (Pelsonian and Illyrian red pelagic limestones, Ladinian-Cordevolian red ribbon radiolarites and red shales, partly intercalated with pillow lavas, Late Triassic variegated radiolarites and gray cherty limestones, gray pelagic Liassic limestones and shales) are blocks in this Middle Jurassic flysch or part of melanges. Blocks of the pre-rift sequence are also present (Early Anisian light-coloured, recrystallized massive shallow-water limestones, Scythian limestones, marls, shales); most of the former mapped Werfen Beds (Scythian) both of the Meliata type area and of other regions are, however, slightly metamorphosed Bathonian-Callovian distal turbidites (KOZUR et al., in press). Chaotic melanges are common.

KOZUR & MOCK (1973 a, b) rooted the Silica, Stratena, Strazov and Choc Nappes not in the Roznava-Sugov Suture Zone, but in the Gemic Suture Zone (ANDRUSOV, 1968) north of the Gemicum s.l.; ANDRUSOV (1968) did also not exclude such a root Zone for the Choc Nappe s.l. (Hronicum). This suture zone is named herein as Folkmar Suture Zone, because the Gemic Suture Zone sensu ANDRUSOV (1968) is identical with the Margecany-Lubenvk Line that represents the thrust boundary of the Gemicum s.l. on the Veporicum and is not a suture zone. In

the model of KOZUR & MOCK, the Veporicum with its slightly metamorphic Permian-Mesozoic cover units (in the northern units with Late Triassic Carpathian Keuper, in the Southern Units with Late Triassic Main Dolomite) corresponds to the Unterostalpin of the Eastern Alps.

The following facts are in favour of this model: (1) Along the Folkmar Suture Zone, the largest bodies of Middle Triassic dismembered oceanic crust of the Meliaticum occur, e.g. the ultrabasites of the asbestos quarry in Dobsinā and the ultrabasites and pillow lavas in the vicinity of Jaklovce. Ladinian red ribbon radiolarites interfingering with pillow lavas and Anisian red pelagic limestones are also known from Jaklovce (KOZUR & MOCK, 1985). Immediately north of this suture zone no remnants of Meliaticum are known. (2) The Folkmar Suture Zone is characterized by chaotic melanges of Meliaticum in a deep-seated fault. (3) At the northern margin of the Meliaticum in the Roznava-Sugov Suture Zone, there is a slope development (Bŕrka Nappe) consisting originally of pillow lavas, shallow-water and slope limestones of Middle Triassic age overlain by Late Triassic limestones of the same character. This slope development is totally different from the northern slope and outer shelf of the Meliaticum with transitional facies to ribbon radiolarite facies and with pelagic Hallstatt Limestones, but without Middle Triassic pillow lavas. The Bŕrka Nappe development is very similar to the slightly metamorphic Triassic cover of the Gemicum s.str. that consists of Middle and Late Triassic shallow-water limestone with layers of basic tuffs in the Middle Triassic part. (4) The Folkmar Suture Zone separates the Gemicum s.str. (Gelnica, Rakovec and Klatov Units) from a different Paleozoic between the Folkmar Suture Zone and the Veporicum. This Paleozoic is characterized by fossiliferous Early and Middle Carboniferous with characteristic magnesite deposits in the Crmel Nappe (GRECULA, 1982) and Ochtina Nappe (KOZUR & MOCK, in press). In the third nappe (Dobsinā Nappe; KOZUR & MOCK in press) the marine fossiliferous Carboniferous ranges up to the Bashkirian (Westfal A, Late Morrovia) as shown by conodonts (KOZUR & MOCK, 1977). In this nappe also gneisses and micaschists are present. These three nappes are united to the Crmelicum (KOZUR & MOCK, in press). It corresponds to the Northern Grauwackenzone of the Eastern Alps. The Crmelicum is part of the basement of the Silica and Stratena Nappes.

New stratigraphic data by KOZUR et al. (in press) in the Meliaticum south of the Gemicum have shown that the Meliaticum consists there of a Bathonian to Early Oxfordian accretionary complex confirming the suture character of the

Roznava-Sugov Suture Zone. But along the Folkmar Suture Zone, the mapped Scythian sediments, in which blocks of Meliaticum Middle Triassic oceanic crust and some oceanic Triassic sediments occur, are also a Middle Jurassic accretionary complex consisting to a large part of Jurassic turbidites and a coarsening upwards sequence.

Our investigations have been concentrated to an area between Kurtava skala NW of Jaklovce in the northwest and the area between Vel'ky Folkmar and Kosicka Bela in the southeast. In this area, a narrow syncline of predominantly Scythian rocks of the Stratena Nappe on Gemicum s.l. is shown in the newest geological map of this area (BAJANNK et al., 1984). This synclinal structure is shown SW of the Crmel Nappe and NE of nappes of the Gemicum s.str. On both flanks Permian and pre-Permian Paleozoic was mapped. Our investigations have shown that most of the "Scythian" rocks are in reality slightly metamorphosed turbidites with few thin intercalations of cherts. In thin sections these cherts contain radiolarians of post-Triassic age, but mostly no exact age determinations are possible by badly preserved radiolarians from thin sections; In some some cases a Jurassic age can be assumed. Because of the metamorphism, the radiolarians cannot be extracted by solving with HF. However, one sample yielded determinable radiolarians. This sample (Mar-VL, location map see fig. 1) has been derived from turbidites west of Jaklovce, mapped as Early-Middle Scythian (Griesbachian-Nammalian ?) by BAJANNK et al. (1984). It contains a Middle Jurassic radiolarian fauna with *Eucyrtidellum unumaense* (Yao), *Pseudocrucella* sp., *Sriatojaponocapsa plicarum* (YAO), *Tetradityma* sp. and *Praezhamoidellum* sp. The dominance of *S. plicarum* and the absence of all Callovian guide forms probably excludes Callovian age, but all the common Aalenian-Bajocian guide forms are missing as well. Therefore a Bathonian age is most probably.

Jurassic ages were also recognized in other places by studies of radiolarians in thin sections. Most of these radiolarites are few centimetres thin layers or olistoliths within turbidites and olistostromes, so far mapped as shallow-marine or coastal deposits of Early Triassic age (Werfen facies). South of Jaklovce such sequences are partly also mapped as continental Permian by BAJANNK et al. (1984). In a chaotic melange of the big old Jaklovce quarry, belemnites have been found in lbreccias, also indicating post-Triassic age.

Tectonic implications of the Jurassic age of the turbidites and olistostromes formerly mapped as Scythian in Werfen facies

(1) Large parts of the Scythian in Werfen facies mapped by BAJANNK et al. (1984) as a narrow NW-SE striking syncline in the Stratena Nappe near the northeastern margin of the Gemicum s.l. are in reality a Middle Jurassic flysch. Also small parts of the mapped continental Permian (e.g. south of Jaklovce) are Middle Jurassic turbidites or olistostromes.

(2) The investigated Jurassic rocks are not Triassic rocks of a shallow nappe on Gemicum Paleozoic as so far mapped, but are situated between two different Paleozoic units, the Gemicum s.str. in the SW and the Crmel Nappe in the NE. In large parts of the outcrops, the rocks consist of chaotic melanges that contain beside Jurassic turbidites also blocks of Middle Triassic dismembered ophiolites, Ladinian red ribbon cherts, Anisian red pelagic limestones, Late Triassic cherty limestones, all of the Triassic oceanic Meliata sequence. Moreover, Jurassic breccias and shales with numerous belemnites are also present. The rocks have the character of an accretionary wedge in suture position.

(3) The Crmel Nappe (GRECULA, 1982), so far regarded as Hercynian nappe, is an Alpidic nappe structure separated from the Gemicum s.str. by a suture zone (Folkmar Suture Zone) with Jurassic turbidites and blocks of Triassic rocks.

(4) The Crmel Nappe is part of the Crmelicum, a Paleozoic unit in nappe structure between the Folkmar Suture Zone and the Margecany-Lubenvk Line, which separated the Crmelicum from the Veporicum. The Crmelicum corresponds in its tectonic position and stratigraphic sequence to the Northern Grauwackenzone of the Eastern Alps (e.g. Veitsch Nappe).

(5) The Gemicum s.str. (Gelnica, Rakovec and Klotov Units) is a continental block within the oceanic Meliaticum. It has a shallow-water Triassic cover unit with Middle Triassic basic tuffs, similar to the Btrka Nappe (more shallow-water, fewer basic volcanics than in this slope facies of the southern branch of the Meliaticum). Both in the north (Folkmar Suture Zone) and in the south (Roznava-Sugov Suture Zone) the Gemicum s.str. is bordered by suture zones with Middle Jurassic turbidites, olistostromes and melanges that contain blocks of oceanic Triassic and partly also blocks of pre-rift rocks. In the westernmost part of the Gemicum north of Ratkova, the Gemicum s.str. between the two above suture zones is only about 1.5 km broad. NW of Ratkova (south of Ploski), the Gemicum disappeared and the Folkmar Suture Zone and the Roznava-

Sugov Suture Zone united into the Roznava-Folkmar Suture Zone south of the Ochtina Nappe of the Crmelicum. Also along this united suture zone a narrow stripe of oceanic Meliaticum is exposed. This situation continued far toward the SW. The westernmost surface outcrops of the Ochtina Nappe are NNW of Lucenec, about 45 km W of the western end of the Gemicum s.str. In the east, the "tripel point" of the E-W striking Roznava-Sugov Suture Zone and of the there NW-SE striking Folkmar Suture Zone is covered by younger sediments. It occurs a little SW of Kojice.

(6) In both suture zones the Meliaticum consists of Middle Jurassic accretionary complexes with blocks of oceanic Triassic and of chaotic melanges. Especially in the northern suture zone the melanges dominate. The closing of the Meliata ocean in the southern suture zone and in the united Roznava-Folkmar Suture Zone was during the Early Oxfordian. In the northern suture zone the exact time of the closing could not yet be dated, because the coarsening upwards sequence have not yet been dated. However, it cannot be younger than in the united Roznava-Folkmar Suture Zone. A somewhat earlier closing is possible, but according the radiolarian fauna of sample Mar-VL, the closing must be within the Middle Jurassic, if it was earlier than in the Roznava-Sugov Suture Zone.

(7) At the base of higher nappe units, parts of the Meliaticum accretionary complex is involved in salinar melanges with late Permian hypersaline rocks. In these salinar melanges mostly only the harder rocks are preserved as blocks (dismembered ophiolites, rarely Ladinian radiolarites as intercalations in pillow lavas). The rather soft Jurassic turbidites are only exceptionally preserved in salinar melanges.

(8) The nappes of the Silicicum and Hronicum were rooted in the Folkmar Suture Zone, outside the Gemicum in the joint Roznava-Folkmar Suture Zone. In both cases these nappes have been derived from the northern slope and shelf of the Meliaticum.

Acknowledgement

We thank the Deutsche Forschungsgemeinschaft for supporting the radiolarian investigations.

References

- ANDRUSOV, D. (1968): Grundriß der Tektonik der Nördlichen Karpaten.- 188 pp.; Bratislava.
- BAJANNK, S., IVANICKA, J., MELLO, J., PRISTAS, J., REICHWALDER, P., SNOPOKO, L., VOZAR, J., VOZAROVA, A. (1984): Geologická mapa Slovenského rudohoria; Bratislava.
- DUMITRICA, P. & MELLO, J. (1982): On the age of the Meliata group and the Silica Nappe radiolarites (localities Držkovce and Bohňovo, Slovak Karst, CSSR).- *Geol. práce, Spravy*, 77, 17-28; Bratislava.
- GRECULA, P. (1973): The homeland of the Gemeric and its metallogenesis.- *Mineralia slovacica*, 5, 221-245; Spišská Nova Ves.
- GRECULA, P. (1982): Gemicikum - segment riftogunneho bazínu Paleotetúdy.- *Mineralia slovacica*, Monografia, 2, 263 pp.; Bratislava.
- KOZUR, H. (1991 a): The geological evolution at the western end of the Cimmerian ocean in the Western Carpathians and Eastern Alps.- *Zbl. Geol. Paläont.*, Teil I, 1991(1), 99-121; Stuttgart.
- KOZUR, H. (1991 b): The evolution of the Meliata-Hallstatt ocean and its significance for the early evolution of the Eastern Alps and Western Carpathians.- *Palaeogeogr., Palaeoclimatol. Palaeoecol.*, 87(1-4), 109-135; Amsterdam.
- KOZUR, H. & MOCK, R. (1973 a): Die Bedeutung der Trias-Conodonten für die Stratigraphie und Tektonik der Westkarpaten.- *Geol. Paläont. Mitt. Innsbruck*, 3(2), 1-14; Innsbruck.
- KOZUR, H. & MOCK, R. (1973 b): Zum Alter und zur tektonischen Stellung der Meliata-Serie des Slowakischen Karstes.- *Geol. Zborn., Geol. Carpathica*, 24(2), 365-374; Bratislava.
- KOZUR, H. & MOCK, R. (1977): Erster Nachweis von Conodonten im Paläozoikum der Westkarpaten.- *Casopis min. geol.*, roc., 22(3), 299-305, 1 fig., 2 pls.; Praha.
- KOZUR, H. & MOCK, R. (1985): Erster Nachweis von Jura in der Meliata-Einheit der südlichen Westkarpaten.- *Geol. Paläont. Mitt. Innsbruck*, 13(10), 223-238; Innsbruck.
- KOZUR, H. & MOCK, R. (1987): Deckenstrukturen im südlichen Randbereich der Westkarpaten (vorläufige Mitteilung).- *Geol. Paläont. Mitt. Innsbruck*, 14(6), 131-155; Innsbruck.
- KOZUR, H. & MOCK, R. (1988): Deckenstrukturen im südlichen Randbereich der Westkarpaten und Grundzüge der alpidischen Entwicklung in den Karpaten.- *Acta Geol. Geogr. Univ. Comen.*, Geol., 44, 5-100; Bratislava.
- KOZUR, H., MOCK, R. & OZVOLDOVA, L. (in press): New biostratigraphic results in the Meliaticum of its type area around Meliata village (Slovakia) and their tectonic and paleogeographic significance.- *Geol. Paläont. Mitt. Innsbruck*, Sonderbd.
- KOZUR, H. & RITI, ZS. (1986): The first paleontological evidence of the Triassic ophiolites in Hungary.- *N. Jb. Geol. Paläont. Mh.*, 1986(5), 284-292; Stuttgart.
- MAHEL', M. (ed.) (1974): Tectonics of the Carpathian Balkan regions, 455 pp.; Bratislava.
- MAHEL', M. (ed.) (1986): Geologická stavba československých Karpat. *Paleoalpínske jednoty*, 1, 503 pp.; Bratislava.
- MELLO, J., MOCK, R., PLANDEROVA, E. & GAAL, L. (1983): Nové stratigrafické poznatky o meliatskej skupine.- *Geol. práce, Spravy*, 79, 55-81; Bratislava.
- MELLO, J. & VOZAROVA, A. (1983): Je Paleozoikum brusnovej antiklinály súčasťou silického prvkrova? *Geol. práce, Spravy*, 79, 263-266; Bratislava.
- LESKO, B. & VARGA, I. (1980): Alpine elements in West Carpathian structure and their significance.- *Mineralia slovacica*, 12(2), 97-130; Bratislava.

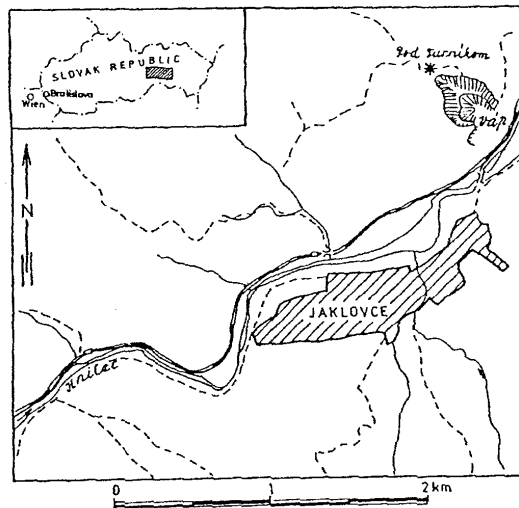


Figure 1: Location map
 * = Sampling point of sample Mar-VL within slightly metamorphic gray to greenish gray turbidites, mapped so far as Early Scythian

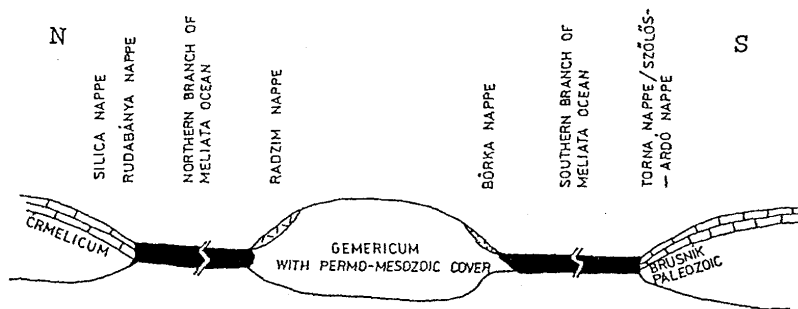


Figure 2: Schematic N-S section through the Meliata ocean with the intraoceanic continental block of the Gemicum s.str.

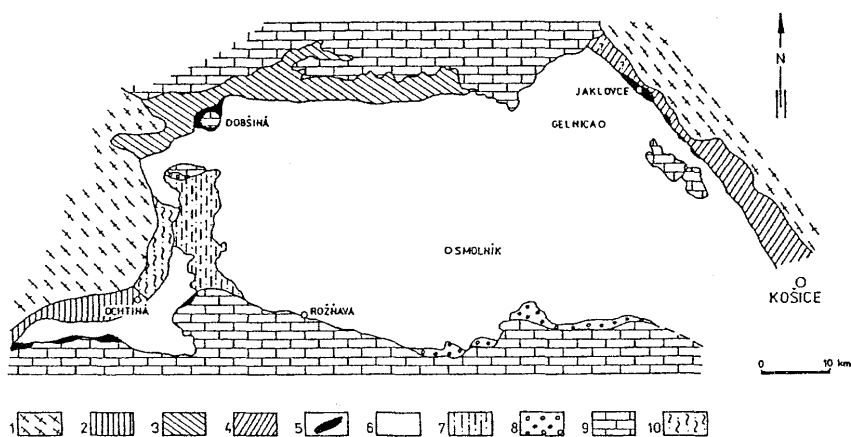


Figure 3: Simplified sketch of tectonic units around the margin of the Gemicum s.str. (from KOZUR & MOCK, in press).

1 = Veporicum (Central Western Carpathians). 2-4: Črnelicum; 2 = Ochtiná Nappe; 3 = Dobšiná Nappe (the discordant continental Permian of the northern and eastern part belongs either to this nappe, as shown in the figure, or to the Stratená Nappe); 4 = Črnel Nappe (the discordant continental Permian in the northwestern part belongs either to this nappe, as shown in the figure or to the Stratená Nappe). 5 = Oceanic development of the Meliaticum with dismembered ophiolites and sediments of the Middle-Upper Triassic oceanic sequences within Middle Jurassic turbidites, olistostromes and melanges. 6 = Gemicum s.str. (Gelnica, Rakovec and Klátov Units). 7 = Triassic Cover Unit of the Gemicum (shallow-water limestones with basic tuffs and tuffites in the Middle Triassic part), partly slope facies at the Gemeride slope of the Meliata Ocean (slope limestone with shallow-water limestone olistoliths and pillow lavas). 8: Bôrka Nappe and Radzim Nappe: Slope facies at the Gemeride slope of the Meliata Ocean (pillow lavas, metamorphosed to glaucophane schists, slope limestones and shallow-water limestone olistoliths). 9: Higher nappe units from the slope (except of Gemeride slope) and outer shelf of the Meliata ocean (Silica Nappe, Stratená Nappe, Torna Nappe etc.). 10: Units of unknown ages and tectonic positions.