Slovak Geol. Mag., 6, 2-3(2000), 273–274

Early Palaeozoic deep-sea turbidites of the Southern Gemeric Unit (Western Carpathians; Slovak Republic)

ANNA VOZÁROVÁ[1] & JÁN IVANIČKA[2]

[1]Department of Mineralogy and Petrology, Comenius University Bratislava, Mlynská dol. pav. G, 842 15 Bratislava, Slovak Republic
[2]Geol. Survey of Slovak Republic, Mlynská dol. 1, 817 04 Bratislava, Slovak Republic

Abstract: The Early Paleozoic flysch complex of the Southern Gemeric Unit (the Gelnica Group) were described in terms of seven lithofacies, vhich they labeled A through G. They represent various part of turbidite slope/rise complex interfingering with hemipelagic facies in its disthal part, that graded into deep seafloor. A wedge or thick lens of siliciclastic sediments associated with redeposited acid to intermediate pyroclastics and brecciated volcanites were accumulated in fore-deep basin, along active continental margin.

Key words: Inner Western Carpathians, Southern Gemericum, deep-sea turbidites, facies analysis

Introduction

The essential part of surficial occurrences of Early Palaeozoic complexes in the Alpine Southern Gemeric Unit is formed by volcanic-sedimentary formations, which underwent regional metamorphism under pressure-temperature conditions of the lower part of greenschist facies. The complex of these formations, designed under the name Gelnica Group was defined firstly and delimited regionally in the geological map of the Slovenské rudohorie Mts., 1:50 000 - eastern part (Bajaník et al. 1984). The Gelnica Group is a megasequence of flysch sediments that associates with the rhyolite-dacite volcanoclastic rocks (Snopko, 1967; Snopko & Ivanička, 1978). Acid to intermediate volcanism was highly explosive, which resulted in the redeposition of a vast amount of volcanoclastic material into the original sedimentary basin through a system of gravity currents. Within the Gelnica Group, the marginal and distal flysch facies were distinguished. In the distal zones, thin layers of dark lydites developed besides the fine grained siliciclastic sediments. On the basis of lithofacial analysis, three formations were defined within the Gelnica Group from the bottom upwards: the Vlachovo Formation, the Bystrý potok Formation and the Drnava Formation.

The palynological analysis has proved an Early Palaeozoic age of the Gelnica Group (Snopková 1964; Čorná 1972; Čorná & Kamenický 1976; Snopková & Snopko 1979; Ivanička et al. 1989), the problem, however, has remained its relatively wide stratigraphical age, ranging from the Late Cambrian-Ordovician to Early Devonian. The new biostratigraphical data, based mainly on foraminifers of the family *Psammosphaeridae* and *Saccamminidae*, proved the Ordovician – Early Silurian age of the Vlachovo Formation and the Bystrý potok Formation sedimentary sequences (Vozárová et al. 1998).

Regional metamorphism of the Gelnica Group rock assemblages did not exceed low pressure conditions of the lower part of the greenschist facies (Sassi & Vozárová 1987; Faryad 1991; Vozárová 1993; Molák & Buchardt 1995). The age of this metamorphism has not been radiometrically determined so far, but on the basis of geologic data (the occurrence of rock fragments from the Gelnica Group in Permian conglomerates of the Gočaltovo Group) it is pre-Permian and the most probably Variscan.

Diagnostic features of flysch sequence

A lithofacial analysis of the Early Paleozoic flysch complex of the Southern Gemeric Unit was based on the model defined by Mutti & Ricci-Lucchi (1972). In spite of the low-grade metamorphism of sediments the majority of diagnostic sedimentary features of this complex are remained, as a consequence of low-pressure type of regional metamorphism. Based on the mentioned sedimentary model the Early Paleozoic turbidites were described in terms of seven lithofacies.

Facies A: The gravity transported deposits: debris flow full of a chaotic assemblage of brecciated blocks, derived from sliding or mass flow and sandy/pyroclastic turbidites. Dominant are massive, thick and poorly-sorted coarse-grained metasandstones and metapyroclastics. In addition to gravity-displaced deposits, this continental slope assemblage all laterally prograde to thinner turbidites, represented by relative fine-grained metasandstones and metasiltstones and rare metapelites.

Facies B: Thick to massive medium- to coarse-grained metasandstones, locally with parallel to undulating laminae. The most diagnostic structure is erosional bases. Facies B is closely associated with facies A and intergrades with it. Both facies A and B appear to be pro-

duced by rapidly moving turbidity currents that fill the feeder channels along the slope and the upper fan.

Facies C: It consists of classic turbidites. This facies is mostly medium- to fine-grained metasandstones with well developed Bouma sequence (Bouma intervals A-B, seldom A-B-C). The metasandstone beds are generally planar and laterally continuous. The beds are typically 30-70 cm thick and may be separated by thin metapelites partings. These sequence were deposited by the classical turbidity current mechanism and is the dominant facies on the middle and outer fan.

Facies D: It consists of couplets of parallel-bedded, laterally continuous fine-grained metasandstones and metasiltstones and thicker metapelites. The most diagnostic feature is the planar nature of the beds, which are typically 3-20 cm thick and show more lateral continuity than facies C. Facies D appears to represent the lower velocity portion of the Bouma cycle (Bouma intervals B-E). It is results from low-energy turbidity currents that left their coarse material behind. This facies is interpreted as deposits of lower fan.

Facies E: Thinner, irregular and discontinuous beds of metasandstones and metasiltstones, which alternated with metapelites. The most diagnostic feature of thid sequence is higher sandstone-to-shale ratios and metasandstones with basal graded and structurless interval with sharp upper contacts.

Facies F: It is represented by thick intervals of deformed chaotic deposits derived from sliding and mass flow.

Facies G: Thick massive metapelites, rarely with obscure continuous parallel bedding. These sediments are associated with horizon of thin-bedded lydites and scarce small lenses of alodapic limestones (with preserved parallel or ripple lamination).

Interpretation and conclusion

The thick Early Paleozoic flysch sequence was deposited in deep-marine basin. A wedge or thick lens of siliciclastic sediments associated with a huge mass of redeposited acid to intermediate pyroclastics and brecciated volcanites, which were accumulated along the active continental margin [referred to a chemical composition of volcanites – Vozárová & Ivanička (1996)], as well as according to detrital mode of metasandstones and typology of detrital zircons – Vozárová 1993). The spectacular association of facies represent various parts of the marine slope/rise complex graded to deep-sea plain. The slope and upper fan are composed of thick sequences of Facies G hemipelagic metapelites that have been cut by slumps (facies F) and thick channels filled with facies A and B metasandstones, metaconglomerates and metapyroclastics. The middle fan is characterised by smaller disthal fan channels filled with facies A and B, which are carved into planar laminated turbidites of facies C, D and E. In the lower fan, the fan channels become very thin or have disappeared, so the sequence composed mostly of facies C and D turbidites. Deep-sea plain associtions is dominated by thin, fine-grained facies D turbidites alternating with facies G hemipelagites.

Bouma sequences display a series of sedimentary structures reflecting decreasing flow velocities, from graded beds to higher flow velocity plane beds to lower flow velocity ripples and to finely laminated metasiltstones and metapelites. Slump deposits and mass flow debris are also characteristic of this system, as are preserved certain types of sole marks. Pelagic organism, particularly benthic foraminifers, are diagnostic, but they are very scarce.

References

Bajaník, Š., Ivanička, J., Mello, J., Pristaš, J., Reichwalder, P., Vozár, J. & Vozárová, A. 1984: Geological map of the Slovenské rudohorie Mts. 1:50 000. D. Štúr Inst. Geol., Bratislava.

Čorná, O. 1972: On the find of organic remains in the Betliar Member (Spišsko-gemerské rudohorie Mts.) Slovakia, Early Paleozoic. Geol. Zborn. Geol. carpath., 23, 2, Bratislava, 379-382 (in Russ.).

Čorná, O. & Kamenický, L. 1976: Ein Beitrag zur Stratigraphie des Kristallinikums der West Karpaten auf Grund der Palinologie. Geol. Zborn. Geol. carpath., 27, 1, Bratislava, 117-132.

Faryad, Sh. W. 1991: Metamorphism of the Early Paleozoic sedimentary rocks in Gemericum. Miner. slovaca, 23, 4, Bratislava, 315-324 (in Slovak).

Ivanička, J., Snopko, L., Snopková, P. & Vozárová, A. 1989: Gelnica Group - Lower Unit of Spišsko-gemerské rudohorie Mts. (Early Paleozoic, West Carpathians). Geol. Zborn. Geol. carpath., 40, 4, Bratislava, 483-501.

Molák, B. & Buchardt, B. 1996: Stable isotope composition of carbon in selected carbonaceous units of Slovakia with reference to Úrkút (Hungary) and Copperbelt (Zambia) examples. Slovak Geol. Mag., 1, Bratislava, 27-43.

Mutti, E. & Ricci-Lucchi, F. 1972: Turbidites of the Northern Apennines: Introduction to Facies Analysis. Trans. 1978 by T. H. Nilsen. International Geology Review 20 (2), 135-166.

Sassi, F. P. & Vozárová, A. 1987: The pressure character of the Hercynian metamorphism in the Gemericum (West Carpathians, Czechoslovakia). Rend. Soc. Ital. Min. Petr.,42, 73-81.

Snopko, L. 1967: Lithostratigraphy of the Gelnica Serie. Záp. Karp., 7, Bratislava, 103-152 (in Slovak).

Snopko, L. & Ivanička, J. 1978: Consideration on the paleogeography in the Early Paleozoic of the Spišsko-gemerské rudohorie Mts. In: Paleogeogr. Evol. Western Carpathians, J. Vozár (Ed.), D. Štúr Inst. Geol., Bratislava, 269-280 (in Slovak).

Snopková, P. 1964: Report on palynological research of Early Paleozoic samples of the Spišsko-gemerské rudohorie Mts. Správy o geol. výsk. v roku 1963 - Slovensko, D. Štúr Inst. Geol., Bratislava, 63-64 (in Slovak).

Snopková, P. & Snopko, L. 1979: Biostratigraphy of the Gelnica Serie of the Spišsko-gemerské rudohorie Mts. on the basis of palynological study. Záp. Karp., Ser. Geol., 5, D. Štúr Inst. Geol., Bratislava, 57-102 (in Slovak).

Vozárová, A. 1993: Variscan metamorphism and crustal evolution in the Gemericum. Záp. Karp., Ser. Min., Petr., Metal., Geoch., 16, Bratislava, 55-117 (in Slovak).

Vozárová, A. & Ivanička, J. 1996: Geodynamic position of acid volcanism of the Gelnica Group (Early Paleozoic, Southern Gemericum; Inner Western Carpathians). Slovak Geol. Mag., 3-4, D. Štúr. Publ., Bratislava, 245-250.

Vozárová, A., Soták, J. & Ivanička, J. 1998: A new microfauna from the Early Paleozoic formations of the Gemericum (foraminifera): constrains for another fossils or subfossils. In: Geodynamic Development of the Western Carpathians, M. Rakús (Ed.). D. Štúr Publ., Bratislava, 63-74.