Volcano-sedimentary sequences in the Carpathian orogenic system (Ukrainian/Romanian transborder zone) versus volcanogenic deposits in Alpine (Italy) and Caledonian orogens (Poland): similarities and differences

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The geological record of the Alpine belt preserves the whole Permian-Mesozoic history of the Tethys Ocean and constitutes the base for palaeogeographic-geodynamic reconstruction of this ocean. Pre-orogenic period of the Jurassic-Cretaceous deposits in the Carpathians (Ukrainian-Romanian transborder zone) and Permian-Mesozoic deposits in the Dolomite Mts. document perfectly a long oceanic history of the northern and central part of the Western Tethys.

The Ukrainian Carpathians form a connecting link between the West and East Carpathians, but the structure of this connection is disputable. Accumulation of the ancient accretionary prism, which turned into the Flysch Carpathian nappes – was caused by the subduction of the Carpathian Flysch Basin basement beneath both the ALCAPA and Tisza-Dacia terranes. Outer Carpathian Flysch is divided into inner and outer flysch nappes. Inner Flysch Nappes of the Outer Eastern Carpathians (Fore-Marmarosh flysch prism) was formed in the front of Tisza-Dacia terrane during the Cretaceous-Paleogene times. The Kamyanyi (Kaminnyi) Potik, Rakhiv and Burkut suture units (Transcarpathian Ukraine) were developed in the frontal part of the Marmarosh basement nappes (Crystalline Massif) of the Central East Carpathians and correspond to the Outer Dacides-Severinides. Volcano-sedimentary complex of the Kamyanyi Potik Unit (Chyvchynian Mountains) is represented by: basalts and volcanic breccias, debris-flows and volcano-sedimentary breccias (with olistoliths of the limestones and basalts) within volcanic/tuffitic matrix and coral limestones with basalt fragments and pyroclastic intercalations, and thin-bedded micritic limestones with cherts interbedded by coarse/fine-grained calcareous pyroclastic turbidites (flysch). These associations were formed in the Early Cretaceous (Berriasian) times generating several different parts of the Outer Dacides-Severinides Carpathian basin. These facies have continual transition from very proximal type of debris

flows through flysch-type facies of coarse- and fine-grained pyroclastic turbidites up to flow of massive basaltic pillow lavas on the other side in our reconstruction. The present stage of investigations provide arguments that the volcanogenic formation of the Chyvchynian Mts was formed on the presumable oceanic crust and can be attributed to the Fore-Marmarosh suture zone.

On the other hand, the Triassic units in the Dolomite Mts, are tripartite, from Werfen-type clastic-carbonate Early Triassic units, through Mid-Triassic carbonate platforms with volcanogenic-carbonate deposits up to Late Triassic prograding and aggrading carbonate platforms. The Late Anisian–Ladinian Magmatic Cycle in this region, which had produced large amounts of volcano-sedimentary sequences, is a very well documented geodynamic event in the history of the Dolomites and, moreover, of the Alps. Our preliminary recognition of these deposits/units in several places in the Dolomites (syn-volcanic subaqueous deposits – pillow lavas, pyroclastic density current deposits, lahar deposits – and post-volcanic subaqueous deposits – volcanoclastic mass flow deposits) indicates absolutely unique chance to reconstruct these spectacular volcanogenic event(s) and especially in their geodynamic and geotectonic regimes, which are the base to wider palaeogeographical reconstruction of this part of the Western Tethys. Our comparative studies between Carpathians and Dolomites indicate very similar, almost identical, volcanogenic-sedimentary sequences. Such comparative studies, the most probably of syn-rift in origin sequences, analyzed in different, independent both in space and time selected parts of the Western Tethys, could help to understand similar geodynamic/geotectonic regimes in separated parts of the Tethys Ocean.

Finally, we can compare these Mesozoic Alpine volcanogenic units, both from sedimentological and geodynamical point of view, with some Caledonian examples from southern Poland (Sudety Mts and Holy Cross Mts). In the Sudety Mts whole Early and Middle Cambrian history of the so-called Stronie basin (Stronie Formation) indicate more similarities than differences, although all rocks of this formation were strongly metamorphosed [they are represented now by: amphibolites with marbles (as olistoliths?), mica schists/metapelites, mafic metavolcanogenic rocks, metabasaltic pillow lavas etc.]. On the other hand, the Late Silurian (Ludlovian) pyroclastic and greywacke flysch-type deposits in the Holy Cross Mts (so-called the Prągowiec, Niewachlów and Wydryszów beds) indicate strong volcanic activity in this part of the Iapetus Ocean as well, during syn-orogenic episode of this ocean history.

In conclusion, we would like to suggest, that such type of volcanogenic and sedimentary consortium usually occur together in several oceans independently in space and time, both in such old as Palaeozoic and younger as Mesozoic ones, but geotectonic/geodynamic regimes have probably been very similar.