

Do We Have a Remnant of the Hanseatic Terrane and/or Rheno-Hercynian Ocean in the Western Carpathians? – A Case Study from the Devonian of the Považský Inovec Mts.

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Geodynamic evolution understanding in orogenic belts like the Alps, Carpathians or Himalayas that contain multistage metamorphic and magmatic episodes is often problematic. The polyorogenic history of such orogenic belts, marked by incorporation of pre-Mesozoic polycrystalline basement blocks into young Alpine structures, resulted in formation of complicate rocks puzzle often characterised by juxtaposition of various terranes and/or blocks due to multistage tectonic evolution by large-scale nappe and strike-slip tectonics. However, unravelling orogenic episodes in the modern polyorogenic belts is practically impossible without precise stratification and dating, as lithological and structural relations within various fragments are frequently ambiguous. The European Hercynian (Variscan) and Alpine mountain chains are typical collisional orogens, and are built up of pre-Hercynian basement blocks that, in most cases, originated at the north Gondwana margin. Such pre-Hercynian elements were part of a pre-Ordovician continental ribbon – the Hun superterrane in the former eastern prolongation of Avalonia, and their present-day distribution resulted from juxtaposition through Hercynian and/or Alpine tectonic evolution (Stampfli and Borel 2002, von Raumer et al. 2003). The Devonian was a period of relative silence in the Earth history between vanishing Caledonian movement in the Lower Devonian and beginning of Hercynian (Variscan) orogenesis in the Upper Devonian. Thick terrigenous accumulations of so-called Old red sandstone, huge marine carbonatic and flysch sediments, as well as extensive products of submarine basic and/or bimodal volcanism represent the rocks record of this period. Sedimentary record has in European realm general feature of changing facies from terrigenous clastic material at the north (Old red continent evolution) through a mixture of psammitic-pelitic depositions and/or neritic-pelagic interchange (Rheno-Hercynian evolution) to calcareous sedimentation with pelitic intercalation (Bohemian – Barrandian's evolution) at the southern margin.

Devonian in the Western Carpathians (WC) has not large area extension in general. There are known only the Gelnica and Rakovec Groups in the Gemic unit that consist of metagreywackes, phyllites, lydites, carbonates and basic volcanics, the Harmonia Group in the Malé Karpaty Mts. (Tatric unit) with similar metamorphosed rocks (phyllites, greywackes, limestones and basic volcanics), and the Predná hola sedimentary-volcanogenic complex (Veporic Unit). Devonian limestones were sporadically described from deep boreholes at the southern Slovakia. Recently in the frame of construction new geological map of the Považský Inovec Mts., there was documented an unusual volcano-sedimentary complex for the Tatric unit of the WC. This complex was displayed in the official General map of Slovakian territory as amphibolites (Kamenický 1956, Kamenický in Buday et al. 1962). However, our field

and petrological study proved that the dominant part of this complex consists of dark grey fine-grained laminar to weakly banded pelitic-psammitic metamorphosed rocks – metagreywackes and phyllites. There were identified locally sills of submarine basic volcanics – amphibolites and/or its pyroclastic analogues, layers of black schists respectively graphitic metaquartzites and lydites, as well as calc-silicate hornfels – erlans and whole complex was called as Hlavinka volcano-sedimentary metamorphic complex (Kohút et al. 2005). The most common rocks of this complex – metagreywackes and phyllites are composed by quartz, plagioclase, K-feldspar, biotite and organic matter (graphite), in accessory content are present garnet, zircon and monazite. Metamorphic overprint of original volcano-sedimentary sequence reach to upper part of greenschist facies respectively lower part of amphibolite facies with $T=500$ to $550\text{ }^{\circ}\text{C}$ and $P=300\text{--}350\text{ MPa}$ (Kohút and Siman 2005). Due to apparent dominance of amphibolites there was omitted stratigraphic determination indicated Devonian age of palynomorphs, tracheids and phyto detritus (Čorná and Kamenický 1976) separated from black schists, and this part of the Tatric crystalline was regarded as “deep Lower Paleozoic basement” till present. However, crucial for the Devonian classification was recent discovery of hematite metaquartzites – a typical analogue of the Lahn-Dill volcano-sedimentary iron ores (Kohút and Havrila 2006) within the Hlavinka Group. Geochemistry confirmed greywacke protolith character of prominent metamorphic rocks (metagreywackes and phyllites) from the Hlavinka Group, whereas these rocks were sedimented at continental slope in the back-arc basin. These greywacke were derivate from an acid and/or intermediate magmatic rocks source that originated in an active continental arc. Rather unusual MORB geochemical character of metabasic rocks – amphibolites was shown as standard for Rheno-Hercynian evolution of the Devonian (Floyd 1995). Relative lack of modern stratigraphic data from Hlavinka Group partially supply dating of uraninite and monazite with the electron microprobe (CAMECA SX-100) in an attempt to broadly constrain formation ages of greywackes and hematite metaquartzites. The uraninite origin (390–380 Ma) was the most probably synchronous to formation of submarine-exhalation iron ores, whereas monazite data (350–330 Ma) from identical samples indicate rather final Meso-Hercynian metamorphic overprint of volcano-sedimentary pile (Kohút et al. in preparation).

The Carpathians form part of an extensive, equatorial, orogenic belt extending from Morocco in the Atlas Mountains, through the Alps, Dinarides, Pontides, Zagros, Hindukush to the Himalayas and to China. The Western Carpathians are the northernmost, E–W trending branch of this Alpine belt, linked to the Eastern Alps in the west and to the Eastern Carpathians in the east. Nowadays verification of Devonian in the Považský Inovec Mts., call for some geo-

dynamic questions and/or analogy not only within Alpine – Carpathians realm, but in the frame of whole Central European basement areas. Sedimentological or litho-facial evolution of Hlavinka Group – dominance of clastic terrigenous psammitic-pelitic material (grey-wackes and schist), small contribution of organic matter (black schists) with minimal limestone intercalations and typical basic volcanism causing Lahn-Dill iron ores (hematite metaquartzites) clearly affined with Rheno-Hercynian evolution of the European Variscan mobile zone. One can observe an analogous evolution today from the Lizard complex in Cornwall, through the Ardennes, the Rhenish Massif, the Harz Mts., northern part of Bohemian Massif (BM) to the easternmost part of BM – Moravo-Silesian zone (Jeseník Mts., and Drahaný Upland). The Devonian rock sequences in the frame of the Alps are well preserved in the Austro-Alpine realm, mainly in the Grauwacken Zone and Graz Paleozoic. Both occurrences form a part of the Ordovician – Carboniferous extensive volcano-sedimentary complexes with dominative calcareous and pelitic sedimentation during Devonian period, showing thus an affinity to Bohemian – Barrandian's evolution, although some faunal indications display strong Rheno-Hercynian similarity (Schönlaub 1995). Since Kossmat (1927) it is known that an elemental part of the Devonian basin remnants form Rhenohercynian zone of the European Variscides. The Rheno-Hercynian ocean was opened as a Devonian oceanic domain within the southern Laurussia margin, due to Gondwana-directed slab pull, and was situated between the southern margin of Laurussia (Avalonia) and Hanseatic terrane (Stampfli and Borel 2002, von Raumer et al. 2003). Due to Middle Devonian collision become weak Hanseatic block part of Hunic superterrane which collided during main Meso-Hercynian period (Visean) with Laurussia caused widespread granitization in whole Central European realm. It is evident now that Rheno-Hercynian ocean must have a continuation from the Moravo-Silesian zone to the Austro-Alpine domain and through the Western Carpathians join the Dobrogea suture in Romania and/or Moesia (Stampfli, personal communication). It is generally accepted that Hercynian basement of the Western Carpathians formed part of Hunic superterrane, however our study proved that before the docking of the Hunic terrane against Laurussia, part of the Carpathians pre-Hercynian basement recorded history of Rheno-Hercynian ocean and/or Hanseatic terrane, showing that affinity to Avalonia origin.

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