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TESCHENITE CLAN ROCKS AND THEIR POSSIBLE ANALOGUES
IN THE WESTERN CARPATHIANS

Abstract: In the Western Carpathians, alkaline rocks of various types, predominantly of Cretaceous age, occur in some Mesozoic tectonic units (Silesicum, Tatricum, Krížna and Choč Nappes). In the Outer Western Carpathians (teschenite-picrite association), the volcanites are more differentiated (from picrites to syenites), while mostly only basanite-type rocks (rarely picrites) or their volcanoclastics are found in the Central Western Carpathians. In the Inner Western Carpathians, rocks of this type (alkaline basanites) do not occur in the Mesozoic. Here they are Upper Triassic volcanites of the Jaklovce development of the Meliata Group.

Keywords: teschenite, alkali basalts, petrology, Mesozoic, Western Carpathians

INTRODUCTION

Volcanic activity belongs to the basic geological processes that affect the development of geological units. The analysis of the type, stratigraphic classification as well as of material filling of its products helps to reconstruct the development of each geological unit in time and space, in this case Western Carpathians. Mesozoic volcanic activity in different tectonic units of the Western Carpathians was paid little attention in the past. Only recently, several modern papers have been published, which has enabled to present a preliminary synthesis on the volcanic activity in the Mesozoic of the basic geological units in the Western Carpathians.

TESCHENITE-PICRITE PROVINCE

From the point of view of the Western Carpathians, the Moravian-Silesian Beskydes and the Beskydes Upland on both sides, the Czech Republic and Poland, are an area of numerous occurrences of alkaline intrusive, sub-volcanic and less frequently also extrusive bodies. In geological literature the whole province has been named as „sub-Beskydes petrographic province“ (Smulikowski 1929), „teschenite association“ Šmíd (1962), „teschenite province“ (Mahmood 1973), „teschenite-picrite formation“ (Hovorka 1976), and/or „province of Cretaceous alkaline lamprophyres at the edge of the Bohemian Massif“ (Dostal, Owen 1998). Volcanic activity was happening in the

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Lower Cretaceous of the Silesian nappe which has been proved by the latest results of $^{40}\text{Ar}/^{39}\text{Ar}$ dating (Lucińska-Anczkiewicz et al. 2002) and K/Ar dating (Grabowski et al. 2003)

The most significant findings are:

- The discussed Cretaceous teschenite-picrite province is a area of teschenite rock type (Hohenegger 1861 in Spišiak, Hovorka 1997), later named as picrite type (Tschermak 1866 in Spišiak, Hovorka 1997). The first systematic and so far unsurpassed microscopic-petrographic characteristics of the rocks of the given province were published by the classics of the Czech (Pacák 1926) and Polish (Smulikowski 1929, 1930 in Spišiak, Hovorka 1997) petrography.
- In recent years (Dostal, Owen 1998, Lucińska-Anczkiewicz et al. 2002) the whole association of plutonic, dyke, subvolcanic as well as extrusive rocks has been labelled as „alkaline lamprophyres“. Our arguments against this name are based on the fact that alkaline lamprophyres cover dyke/vein rocks and the association under discussion contains a majority of hypabyssal rocks (teschenites), then also lava flows (with pillow texture) and extrusives (tuffs). For this reason we do not recommend to use the term „alkaline lamprophyres“ for the whole group of either plutonic/sub-volcanic or extrusive rocks.
- Although the current occurrences of the discussed plutonic-volcanic formation are in tectonic (nappe) position, their ESE linear displacement is still evident. In compliance with the earlier formulated concepts (Hovorka, Spišiak 1988, Narębski 1990) we suppose that their penetration to the bottom of the water basin is a result of short-term (embryonal) rifting of the crust of the basin bottom.
- From geochemical point of view the volcanites of the teschenite-picrite province correspond to within-plate alkali basalts (Spišiak, Hovorka 1997, Dostal, Owen 1998). The normalized curve has a steep falling course towards low contents of HREE without any visible Eu-anomaly. Such a course of the normalized curve is typical of ocean island basalts (OIB), continental alkaline volcanic suites of Central and Western Europe, but also of the Mesozoic volcanic rocks from other parts of Europe (North Pyrenean rift zone, Northern Calcareous Alps).

TATRIC – FATRIC UNITS

In Central Western Carpathians, Cretaceous alkaline rocks are occurring mostly in the Fatric unit (Křížna nappe). They are less frequent in the Tatric – cover series. Their petrographic as well as geochemical characteristics are very similar to each other. Products of volcanic activity in the Cretaceous of the Křížna tectonic unit have been reported from the Malé Karpaty Mts., Považský Inovec Mts., Strážovské vrchy upland, Malá and Veľká Fatra Mts. and Nízke Tatry Mts. The last summary data about the volcanism of the Tatric and Fatric unit and its products were published in Hovorka, Spišiak (1988).

The well-known occurrences of volcanic products are characteristic for several common features:

- Usually small amounts (several hundreds of m³) of lava flows were intensively mixed with the underlying lime mud and this process had a strong effect on the primary chemical composition of volcanic rocks. A part of xenoliths remained non-assimilated in the basic melt, in the form of xenoliths of different size, locally with traces of thermal re-crystallization and metasomatic substitution. (Veľká Fatra).
- The products of the volcanic activity are low-differentiated rocks of basalt/basanite type, rarely picrites, volcanoclastic rocks are represented substantially (hyaloclastites etc.)
- The majority of Mesozoic alkaline rocks (with the exception of picrites) are characterised by the presence of a fine-grained devitrified matrix (up to 40 %). Olivines, pyroxenes and to a lesser degree amphiboles (kaersutites) form phenocrysts and locally they accumulate into glomerophyres. A characteristic feature of the clinopyroxenes is sector and oscillation zoning. There are also Ti-biotites, apatites, chlorites and carbonates present in accessory amounts there.
- On the whole, Cretaceous volcanic rocks of Central Western Carpathians are characterised by low SiO₂ contents (cca 39 wt. %), enhanced contents of TiO₂ and P₂O₅ (3.2, and/or 0.8 wt. %) and elevated contents of Cr (280 ppm) and Ni (190 PPM), elevated contents of incompatible elements such as Ba (650 ppm), Sr (700 ppm) and L REE as well as those of Nb (78ppm), V (245 ppm) and Zr (305 ppm). A generally negative correlation Al₂O₃/CaO vs. Mg* (MgO/[MgO+FeO]) suggests that the rocks underwent clinopyroxene dominated fractionation. Although Cretaceous volcanic rocks penetrate through continental crust complexes, no significant crustal contamination can be observed. This is proved by a low Th/La ratio which is close to the ratios in primitive mantle (Sun, McDonough 1989).

Besides alkaline volcanic rocks in Central Western Carpathian there are also small occurrences of picritic rocks (Křížna and Choč? nappes). Petrographically, they are coarse-grained rocks composed of olivine, two types of Cpx, phlogopite, kaersutite, Fe-Al-Cr-spinel, accessory: apatite, serpentine minerals, chlorite, carbonate, etc. Geochemically, these picrites are similar to Cretaceous alkaline volcanics of Central Western Carpathian.

THE MELIATA UNIT BASALTS

The Meliata unit of Inner Western Carpathian represents a sedimentary-magmatic sequence of ophiolite type (Kozur, Mock 1985). It was developing from the Middle Triassic as a result of a collapse of the shelf (?) basin bottom. The unit is typical for tectonically dismembered incomplete ophiolite complex. Tholeiitic basalts bodies are also its integral members.

The present state of the knowledge is as follows:

- Spatially separated outliers of lava flows of tholeiitic basalts occur in basically two separate bands: a) in the belt of the Meliata zone (i.e. in the classical Meliata unit), b) in the Jaklovce – Košická Belá zone (the so-called Jaklovce evolution of the Meliaticum). Such location of occurrences is caused by tectonics and morphology of the terrain.
- A part of the Meliaticum underwent a high-pressure Jurassic-Triassic metamorphic re-crystallisation in pT conditions of the subduction zone during which typical blueschists originated (Faryad 1997 in Faryad et al. in press).
- Neither of the belts contains a complete ophiolite complex. Cumulate gabbros are known only from the boreholes in the Perkupa valley in Hungary but also in the form of pebbles together with the other members of the complete ophiolite complex in the Upper Cretaceous conglomerates in the vicinity of the Dobšiná Ice Cave (Hovorka et al. 1990 in Spišiak, Hovorka 1998).
- Tholeiitic character of the Upper Triassic-Jurassic basic volcanics of the Meliata unit results from bulk rock chemistry as well as from the composition of clinopyroxenes (Faryad et al. in press).

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