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INTERESTING GRANITOIDS IN THE BORDER AREA OF THE CZECH REPUBLIC, AUSTRIA AND BAVARIA

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Introduction

In framework of new geological mapping of the territory of the Šumava National Park (Bohemian Forest) on a scale of 1: 25 000, granitoid rocks in the Three-State-Point area (Dreiländerecke) between the Vltava (Moldau) valley to the NE and the Mühl-fault zone to the SW were studied. Our results in area extent and petrological characteristics of the studied granitoids differ significantly from older published Austrian and Czech geological maps (Thiele and Fuchs 1965, Miksa and Opletal 1995). We found several new varieties of granitoids which may be interesting for a better understanding of the geological evolution of the Mühlviertel: mafic biotite diorite, a plagioclase-rich variety of Weinsberg granite, two types of K-Mg-rich melagranitoids (durbachites) and a strongly radioactive Th-rich variety of two-mica granite of the Eisgarn family. Discovery of the highly radioactive Dreisessel granite is also important from the viewpoint of human health.

Geological and petrological description

Equigranular fine-grained mafic biotite granodiorite probably represents the oldest Variscan magmatic rock in the studied area. Diorite forms a small lenticular body in Austrian territory about 1km SE of the summit of the Plöckenstein (Fig. 1).

Porphyritic coarse-grained biotite granite of the Weinsberg type is the most widespread granitic rock in the whole Moldanubicum. In the studied area, we found an unusual basic variety of Weinsberg granite, which, in addition to some Kfs phenocrysts, also contains ubiquitous phenocrysts of oligoclase-andesine composition, locally up to 7x2cm in size.

Mafic K-Mg-rich granitoids termed durbachites (or the Rastenberg type in Austria) are another typical rock type of the Moldanubicum. One large and several small bodies of typical durbachite (SiO_2 around 60-65%) appear in the Czech territory to the north of the Vltava valley. Newly, several smaller bodies of extreme basic and mafic varieties of durbachite were found on both the Czech and Austrian sides of the border: pyroxene-biotite melasyenite (<50% SiO_2) and amphibole-biotite melasyenite (50-55% SiO_2). Both varieties contain phenocrysts of Kfs (3x1 cm up to 7x2 cm) in a matrix of oligoclase, Mg-rich biotite and diopside or actinolite.

Coarse-grained, locally porphyritic two-mica Plöckenstein (Plechý) granite forms an elliptical stock 13x10 km in size elongated in the SW-NE direction. In its geological position , petrographic character (Kfs-phenocrysts, plagioclase An_{2-10}, biotite, muscovite) and chemistry, this granite is very similar to the Eisgarn granite s.s. from its typical area N of Gmünd. According to the gravity measurement (Blížkovský and Novotný 1982), the Plökenstein body forms one of the most intensive negative gravity anomalies in the whole Moldanubicum, which seems to demonstrate very deep roots for this granite.

Heavy (or Dense) porphyritic medium- to coarse-grained two-mica granite of the Dreisessel (Třístoličník) type differs from the Plöckenstein type in a substantially higher content of Kfs-phenocrysts and especially in an extreme content of monazite and zircon inherited in biotite flakes. Monazite contains high amount of thorium (15-23% of the brabantite component) and thus this granite represents one of the most radioactive rocks within the whole Bohemian Massif. The Dreisessel granite is geologically younger than the Plöckenstein granite intruding its SW part like a ring dyke.

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Geochemistry

Granites of the Weinsberg type are characterised by 63-68% SiO_2 , 3-6% FeO_{tot}, 0.9-1.8% MgO, 2.0-3.2% CaO, 2.8-3.3% Na_2O and 3.9-5.4% K_2O. Si is negatively correlated with Fe, Mg, and Ca, and positively correlated with K. The contents of the trace element are relatively stable throughout the whole SiO_2 range (Rb 180-230 ppm, Sr 200-130, Zr 400-220ppm).

Rocks of the durbachite group in the studied area range from 47 to 61% SiO_2, 5.5 to 8.5% FeO_{tot}, 4.0-13.7% MgO, 2.3-6.7% CaO, 1.0-2.0% Na_2O and 4.7-7.7% K_2O. The high content of some in basic compatible rocks (Cr 200-700 ppm, Ni 70-260 ppm)and also of incompatible trace elements (Rb 300-450 ppm, Sr 280-500 ppm, Zr 250-600 ppm) are characteristic.

Granites of the Plöckenstein- and Dreisessel-types are internally much more homogeneous than the previous rock types. The Plöckenstein granite is peraluminous with 70-74% SiO_2, 0.8-1.6% FeO_{tot}, 0.1-0.3% MgO, 0.5-0.6% CaO, 3-4% Na_2O and 4.8-5.2% K_2O, 300-400 ppm Rb, 40-80 ppm Zr and 10-20 ppm Th. The Dreisessel granite is relatively depleted in SiO_2 (70.5-71.5%) and Na_2O (2.5-2.8%), and enriched in FeO_{tot} (1.8-2.2%), MgO (0.4-0.6%), CaO (0.8-1.0%), and K_2O (4.8-6.2%). The enrichment in Zr (170-220 ppm) and especially in Th (50-70 ppm) is remarkable.

Recommendation

High natural radioactivity of the Dreisessel granite in the neighbourhood of the Pendelin settlement at Schwarzenberg may have a negative influence on the health of the local population. We recommend that detailed geological mapping of this area be carried out, accompanied by measurement of the radioactivity (gamma-spectrometry).

References

BLÍŽKOVSKÝ M. and NOVOTNÝ A. (1982): Gravity map of the Bohemian Massif. MS Geofyzika n.p. Brno.

MIKSA V. and OPLETAL M. (1995): Geological map of the Czech Republic on a scale 1:50 000, sheet 32-14 Nová Pec. Czech Geological Survey. Praha.

OTT W.-D. (1992): Geologische Karte von Bayern 1:25000, Erläuterungen zum Blatt Nr. 7248/49 Jandelsbrunn, 72 s., München.

THIELE O. and FUCHS G. (1965): Übersichtskarte des Krislallins im westlichen Mühlviertel und im Sauvald, Oberösterreich. Geologische Bundesanstalt. Wien.

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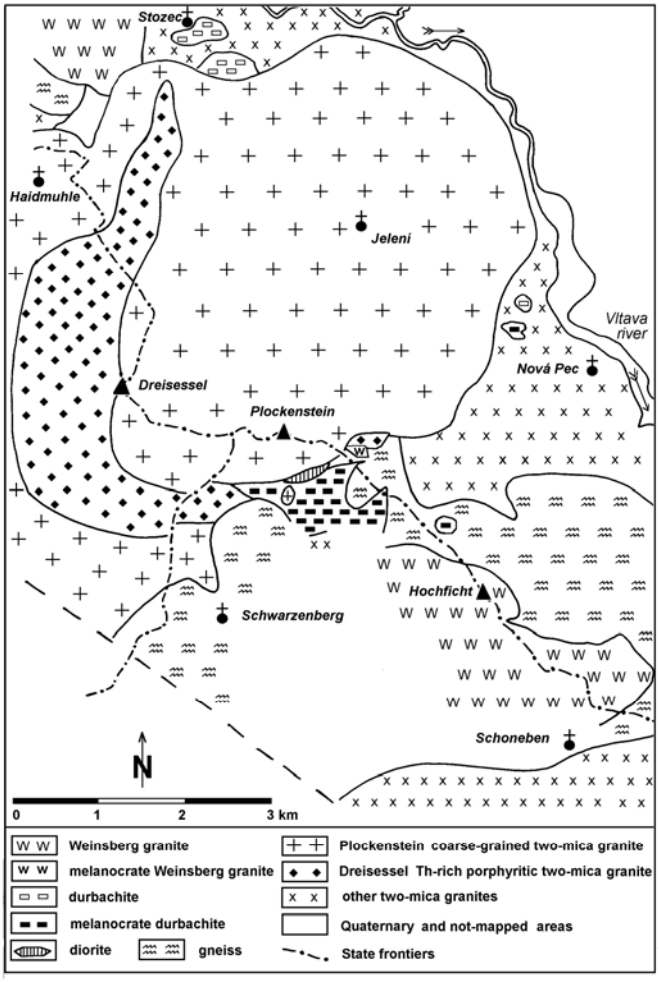

Fig 1. Simplified geological map of the Three-State-Point area between the Vltava (Moldau) valley to the NE and the Mühl-fault zone to the SW. (German area according to Ott 1992, slightly modified).

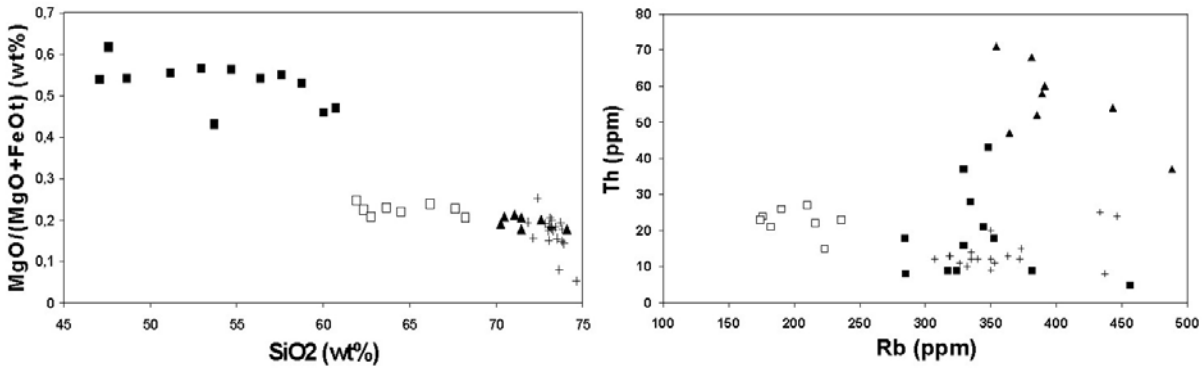

Fig 2. Chemical diagrams SiO_2 vers. MgO/(MgO+FeOt) and Rb vers. Th of the studied granitoids. The high MgO/(MgO+FeOt)-ratio is significant for rocks of the durbachite type. The Dreisessel granite is characterised by extreme enrichment in Th. Explanation: full squares- durbachite, empty squares- Weinsberg granite, crosses – Plöckenstein granite, triangles- Dreisessel granite.