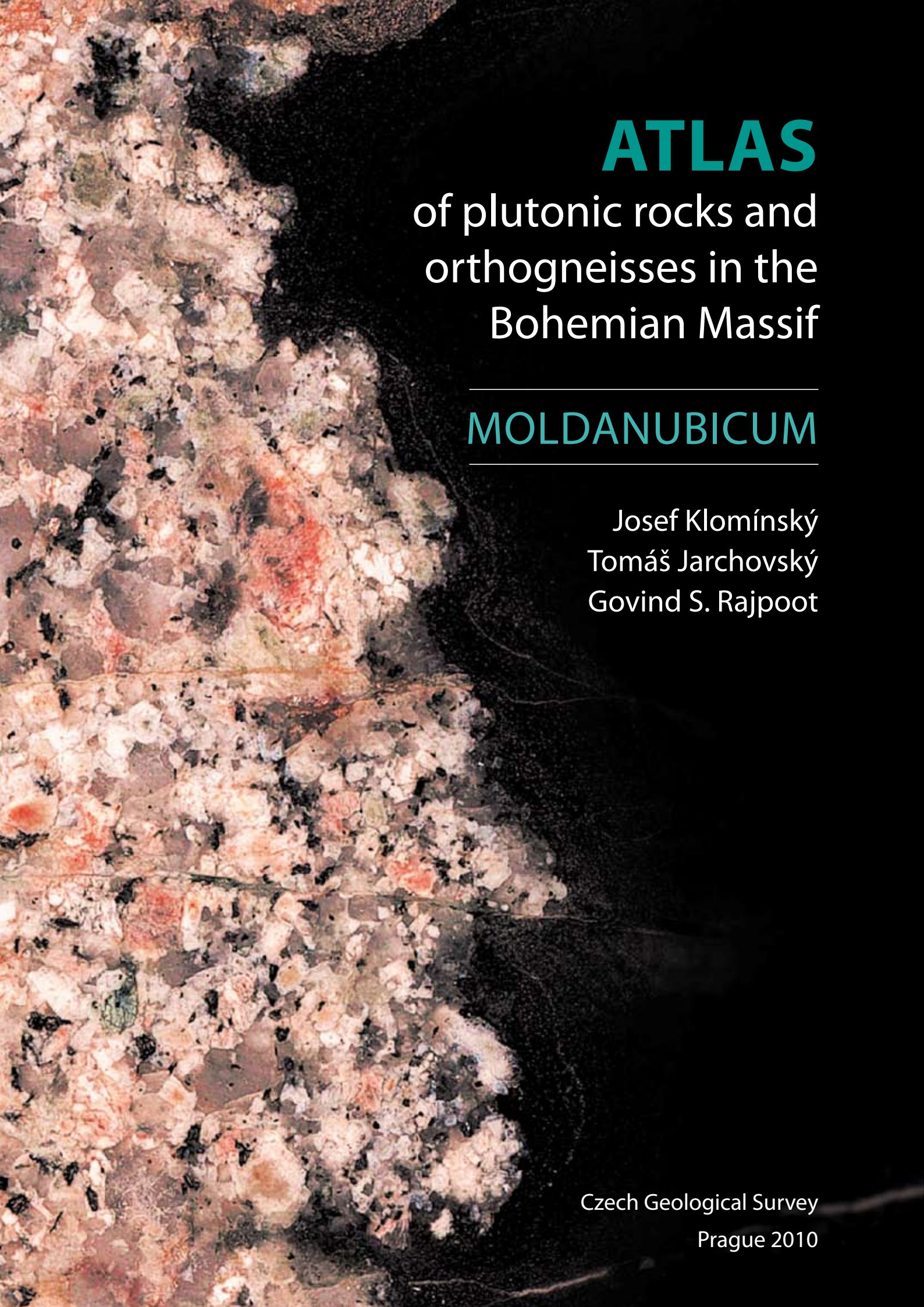

ATLAS

of plutonic rocks and orthogneisses in the Bohemian Massif

MOLDANUBICUM

Josef Klomínský
Tomáš Jarchovský
Govind S. Rajpoot

Czech Geological Survey
Prague 2010

CZECH GEOLOGICAL SURVEY

ATLAS
of plutonic rocks and orthogneisses in the Bohemian Massif

2. MOLDANUBICUM

Compiled by

Josef Klomínský
Tomáš Jarchovský
Govind S. Rajpoot

The **Moldanubicum** volume is a part of the **Atlas of plutonic rocks and orthogneisses in the Bohemian Massif** which consists of six chapters:

INTRODUCTION
1. BOHEMICUM
2. MOLDANUBICUM
3. SAXOTHURINGICUM
4. LUGICUM
5. BRUNOVISTULICUM AND MORAVOSILESICUM

In the Introduction volume are summarized general characteristics of the plutonic rocks and orthogneisses from a point of view of their composition, age, 3-D shape, zonation, metallogeny and spatial distribution.
The territorial sections 1–5 comprise structured geological parameters of the plutonic rocks and orthogneisses located within boundaries of the principal geological zones in the Bohemian Massif.
The compilation work was supported by the Radioactive Waste Repository Authority of the Czech Republic (RAWRA) and by the Czech Geological Survey.

Acknowledgements

We would like to thank the following colleagues who have helped in the compilation and correction of this review: A. Dudek, F. Fediuk, M. Chlupáčová, V. Janoušek J. Kotková, M. René, Z. Vejnar, P. Vlašímský, P. Schovánek and S. Vrána. We are grateful for technical assistance to P. Kopecký, M. Toužimský, J. Holeček, M. Fifernová, J. Kušková, J. Karenová, V. Čechová and L. Richtrová.
In spite of the negative view on our work and unrealistic comments we thank also to M. Štemprok and F. V. Holub for their criticism which helped us to improve the original manuscript.

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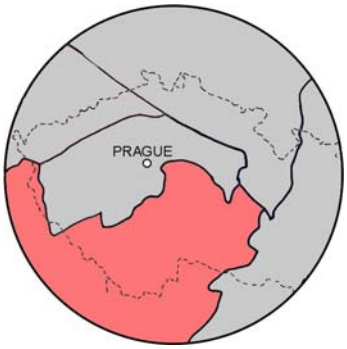
ISBN 978-80-7075-751-2

THE ATLAS OF PLUTONIC ROCKS AND ORTHOGNEISSES IN THE BOHEMIAN MASSIF



2. MOLDANUBICUM

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The locality map of the plutonic rocks and orthogneisses in the Bohemian Massif (folded)

FOREWORD

The Moldanubicum (Moldanubian Zone) is characterized by an abundance of the Late Variscan plutonic rocks of predominantly granitic composition (Holub et al. 1995). They are accompanied by a series of multiply deformed gneisses of granitic composition showing a broad span of geological ages.

Five principal groups have been recognized within the Moldanubian Zone:

2.1. Variscan intrusive rocks of the Late Palaeozoic age
The Moldanubian Composite Batholith

2.2. Ultrapotassic (high K-Mg) plutons (durbachites), some of them spatially related to the Central Bohemian Composite Batholith (see the Bohemicum)

2.3. Granitic intrusions of the Central Bohemian Composite Batholith (see the Bohemicum section)

2.4. Isolated mafic stocks in the Western Bohemia in the Moldanubicum

2.5. Pre-Variscan orthogneisses (metagranites) in the Moldanubicum

2.1.VARISCAN INTRUSIVE ROCKS OF THE LATE PALAEOZOIC AGE

MOLDANUBIAN (SOUTH BOHEMIAN) COMPOSITE BATHOLITH (MCB)

The Moldanubian Composite Batholith (MCB) with nearly 10,000 km^2 surface area and estimated volume of > 80,000 km^3 represents one of the largest batholiths in the Bohemian Massif. MCB consists of the western and eastern group of mostly allochthonous plutons. Only a few granitic massifs in the western group of plutons show autochthonous features (e.g. the Palite Massif and Paragranodiorite Massif). Estimates of the intrusion depths range from 18–20 km in the SW to 7–9 km in the E. The Batholith appears in the core of an anticline and at its western and eastern boundaries plunges below the crystalline schists. According to Klötzli et al. (1999) the evolution of the Moldanubian (South Bohemian) Composite Batholith begins with the partial melting of the Cadomian basement domain at 360 to 350 Ma and the formation of large masses of geochemically diverse granitoids (e.g. the Weinsberg Granite-Granodiorite) between 350 and 320 Ma. Subsequent intrusion of small amounts of I-type granites and a large volume of S-type granites follows (Mauthausen, Schrems, and Eisgarn type granites) between 330 and 310 Ma. U-Pb data indicate magmatic activity of the MCB over a period of 30 Ma. Each intrusion marks a relatively short-lived magmatic pulses within two main magmatic events. About 80 % of the MCB were formed at 331–323 Ma.

According to Koller (1994) the Moldanubian Composite Batholith can be divided mainly by textural reason into the following groups:

Group (Suite) **of older syn-orogenic granitoids (~350–335 Ma)**

A1) Minor gabbros and diorite, quartz monzonites,

A2) The coarse-grained Weinsberg-type granite, including the isolated Rastenberg Massif and two pyroxene-bearing Sarleisbach complex.

Group (Suite) **of younger, mainly post-orogenic granitoids (333–315 Ma)**

B1) Medium to fine-grained biotite granites including different varieties (Mauthausen- and Schrems Granite, Freistadt Granodiorite and others) forming dykes, sills, and stocks mainly within the Weinsberg Granite-Granodiorite,

B2) The two-mica or muscovite Eisgarn Granite s.l. including different subtypes (e.g. Mrákotín, Číměř and Zvůle (Landštejn) Granites),

B3) Small intrusions of slightly mineralised granites (Nebelstein, Hirschenschlag-Kozí hora, Homolka Granites and others),

B4) Pegmatites and aplite, late dykes.

According to Gerdes et al. (2003) in the MCB, four major magma types are defined based on age, trace elements, and radiogenic isotopes:

MagmaType 1 (335–325 Ma age) are represented by durbachites in the east (Rastenberg and Třebíč Massifs).

Finger et al. (2009) present the theory that the so-called "Palites" of the Bavarian Forest in the west belong to the Durbachite intrusions.

Magma Type 2 (315–330 Ma age) is mostly comprised by the Weinsberg Granite-Granodiorite.

Magma Type 3 is mainly comprised by the Eisgarn Granite.

Magma Type 4 (ca 300 Ma age) is represented by small bodies along major faults (e.g. the Pfahl granitoids).

According to Breiter et al. (1998) the interier of the eastern part of the MCB consists of the **Weinsberg Suite, Eisgarn s.l. Suite and Freistadt-Mauthausen Suite.** The Eisgarn s.l Suite comprises of the Číměř Granite Unit, Eisgarn Granite s.s. Unit and Homolka Granite Unit.

Regional position: Moldanubian Zone.

Rock types: Two main plutonic suites of the Moldanubian Composite Batholith are dominant (this review):

UPPER CARBONIFEROUS TO LOWER PERMIAN PLUTONIC SUITE

and

LOWER CARBONIFEROUS (VISÉAN) PLUTONIC SUITE

<u>Upper Carboniferous to Lower Permian Plutonic Suite</u>

1. **Eisgarn Granite s.l. -** (~ 5000 km^2) consists of large pluton and a series of isolated massifs and stocks of ± porphyritic muscovite-biotite granite (adamellite). The main phase of granite is represented by several rock types – facies representing interfaces of the differentiation, and/or separate intrusions (e.g. Mrákotín-Bílý Kámen, Číměř–Řásná, Lipnice, Kouty-Světlá, Altenberg, Lásenice-Deštná, Jiřín, Boršov, Kristallgranite II, Heibach, Mandelstein, Žofín (Reinpolz) and Eitzendorf Granites). In the western plutons of the Moldanubian Composite Batholith the Eisgarn Granite s.l., Falkenberg, Leuchtenberg, Steinwald, Rozvadov, Dreisesselberg, Steinberg, Theresienreut, Haidmühle, Heidel, Kötzting and Arnbruck Granites belong to the Eisgarn Granite Suite.
2. **Freistadt Granodiorite** (~ 400 km^2) – biotite-hornblende granodiorite and quartz diorite marginal, core and fine-grained facies. Karlstift Granite is a medium-grained variety of Freistadt Granodiorite intruded as a separate phase (result of mixing with the Mauthausen Granite). The Pavlov Granite shows geochemical and isotopic characteristics similar to the Freistadt intrusion. The Reinpolz Žofín) Granite forms small bodies within the Eisgarn Granite s.l. (Mandelstein Granite) and is similar to the Freistadt Granodiorite.
3. **Mauthausen Granite** (~ 375 km^2) – biotite granite. The Mauthausen Granite includes several bodies (Karlstein, Plöcking, Schrems Granites) with similar textural characteristics, which can have different intrusive histories. In the western plutons of the Moldanubian Composite Batholith the Viechtach, Patersdorf, Richnach, Metten and Lalling Granites and Hauzenberg Massif are members of the Mauthausen Group (Suite).
4. **Landštejn Granite** (~ 400 km^2) – equivalent of the Eisgarn Granite s.s. includes number of small circular stocks and bosses (3–10 km in diameter) of the coarse to medium-grained two-mica granite (e.g. the Zvůle, Čeřínek, Melechov, Bürgelwald, Flossenbürg, Eisgarn s.s., Plechý and Strážný Granites).
5. **Homolka Granite** (~ 6 km^2), includes small stocks within the Eisgarn, Číměř, and Landštejn Granites (e.g. the Stvořidla Granite, Šejby Dyke Granite, Homolka Granite, Křížový kámen Granite, Rubitzko Granite, Lagerberg Granite, Unterlembach Granite, Pyhrabruck-Nakolice Granite and Galthof Granites).
6. **Dyke Swarms –** Pelhřimov Granite porphyry (Pehřimov Dyke Swarm), Ševětín Microgranodiorite (Ševětín Dyke Swarm), Kaplice Porphyry (Kaplice Dyke Swarm), Štěpánovice Q-monzonite (Blanice Graben Dyke Swarm), Passau Forest Porphyry (Passau Dyke Swarm), Kvilda Dyke Granite (Kvilda Dyke Swarm), Sušice Quartz micro-monzodiorite (Sušice Dyke Swarm), Šejby Dyke Granite (Šejby Dyke Swarm), Josefsthal Granite (Litschau Dyke Swarm).

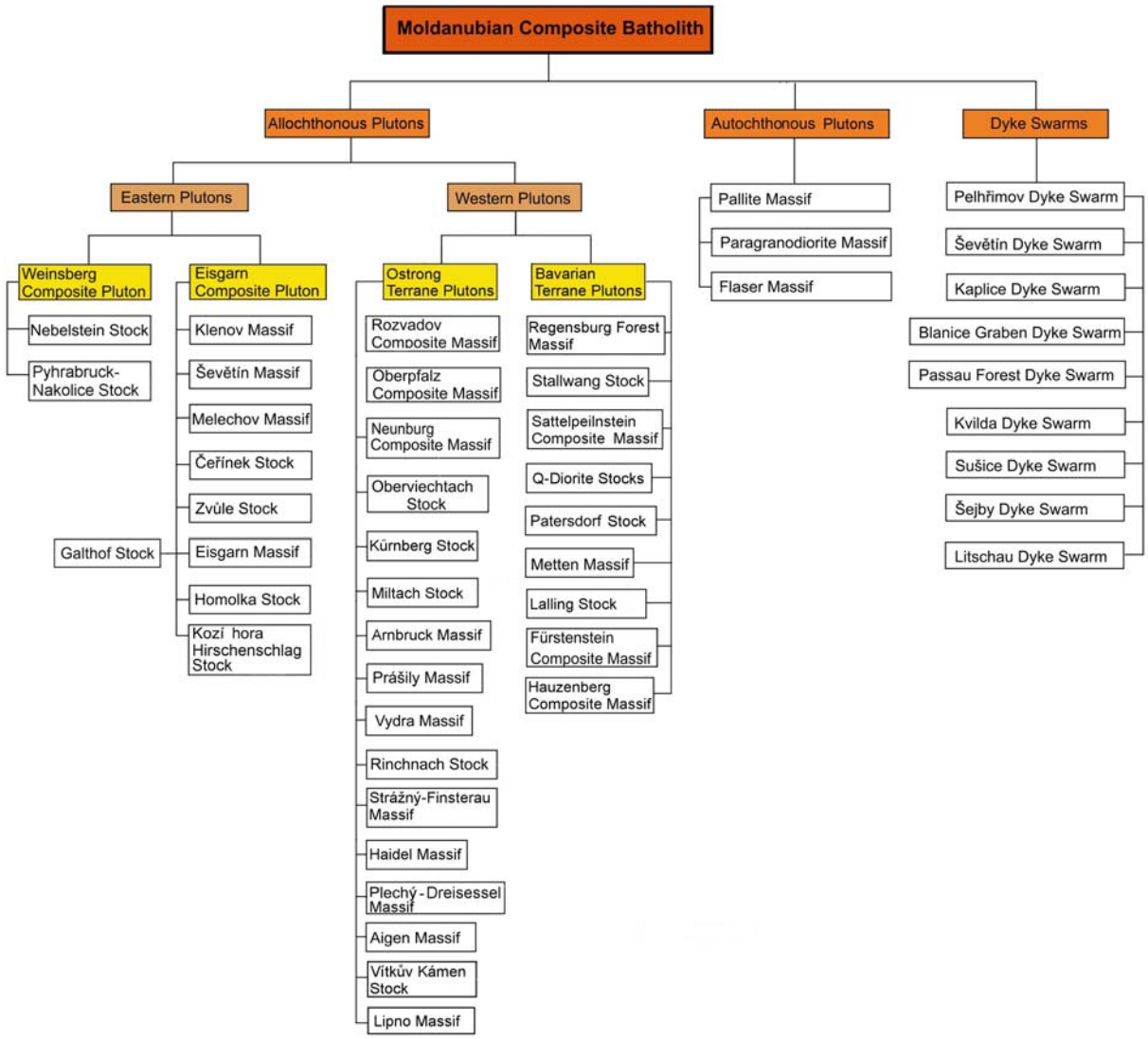

Fig. 2.1. *Moldanubian Composite Batholith hierarchical scheme according to plutons, massifs, stocks and dyke swarms.*

Lower Carboniferous (Viséan) Plutonic Suite

1. **Weinsberg Granite-Granodiorite-Granodiorite** – porphyritic biotite granodiorite including Kristallgranite I, Plöchwald Granite, Plessberg Granite, and Srní Granite.
2. **Diorite I – Gebharts Diorite** – several small older bodies (~ 1–4 km^2) of the quartz diorite – diorite – (Kleinzwettl) gabbro located within the Weinsberg Granite-Granodiorite and in the Kristallgranite I along the NE-SW discrete zone in the eastern and western part of MCB.
3. **Diorite II** – younger intrusions within the Weinsberg Composite Pluton.
4. **Palite** – granitoids (magmatic products possibly foliated and mylonitized) (5 × 45 km) in the western part of MCB.
5. **Paragranodiorite** – magmatic products (possibly foliated and mylonitized) (3.5 × 43 km) in the western part of MCB (Schlieren Granite).
6. **Flaser Granite –** biotite granite (possibly foliated and mylonitized) magmatic product (a set of oval bodies) in the western part of MCB.

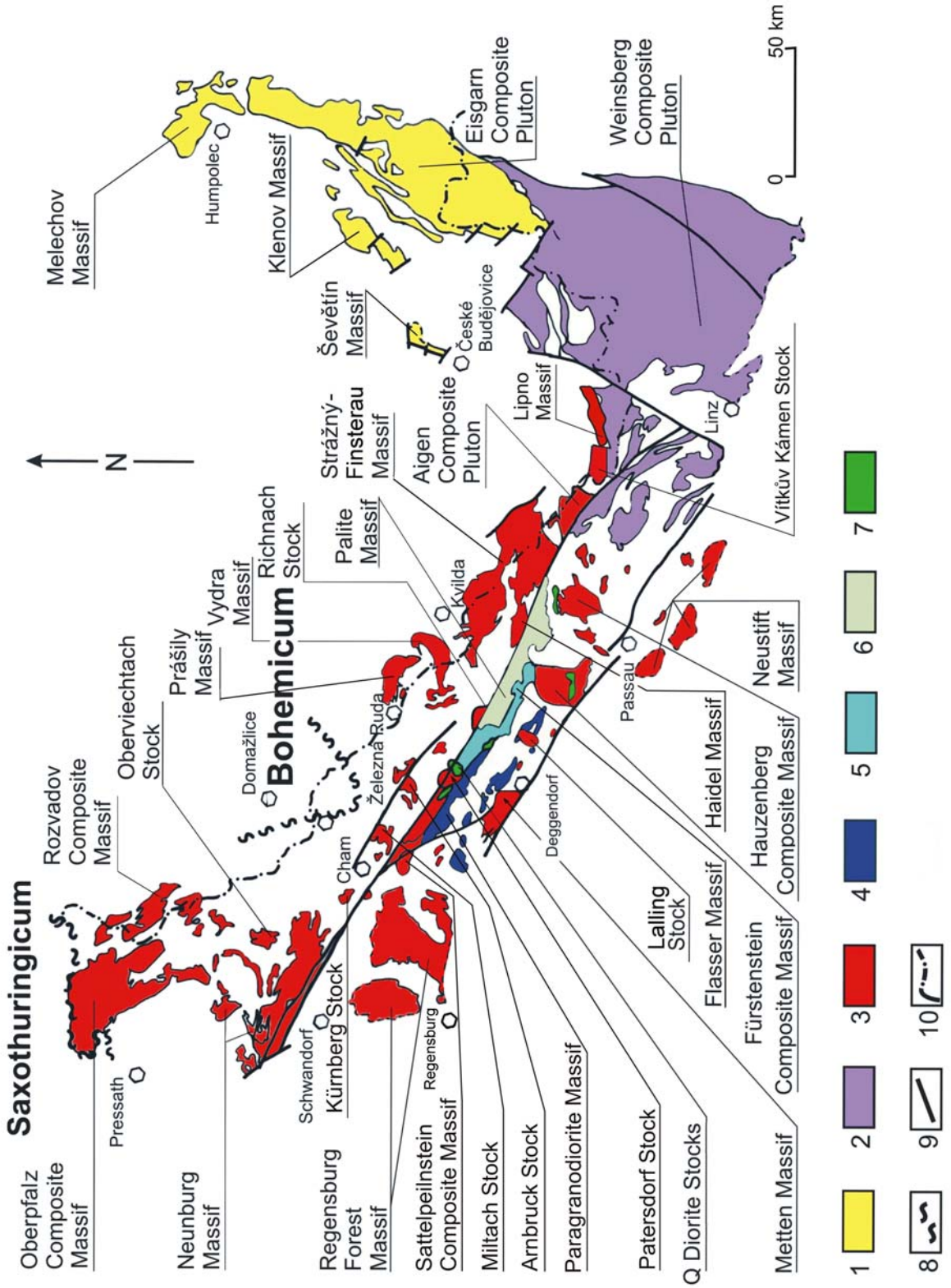

Fig. 2.2. *Moldanubian Composite Batholith geological sketch-map (adapted after Zitzmann et al. 1999, 1994, 1981). 1 – Eisgarn Composite Pluton, 2 – Weinsberg Composite Pluton, Western Plutons: 3 – allochthonous granitic massifs, 4–6 – autochthonous granitic massifs (4 – Paragranodiorite Massif, 5 – Flasser Massif, 6 – Palite Massif), 7 – allochthonous quartz diorite stocks, 8 – boundaries of principal tectonostratigraphic units, 9 – faults, 10 – state border.*

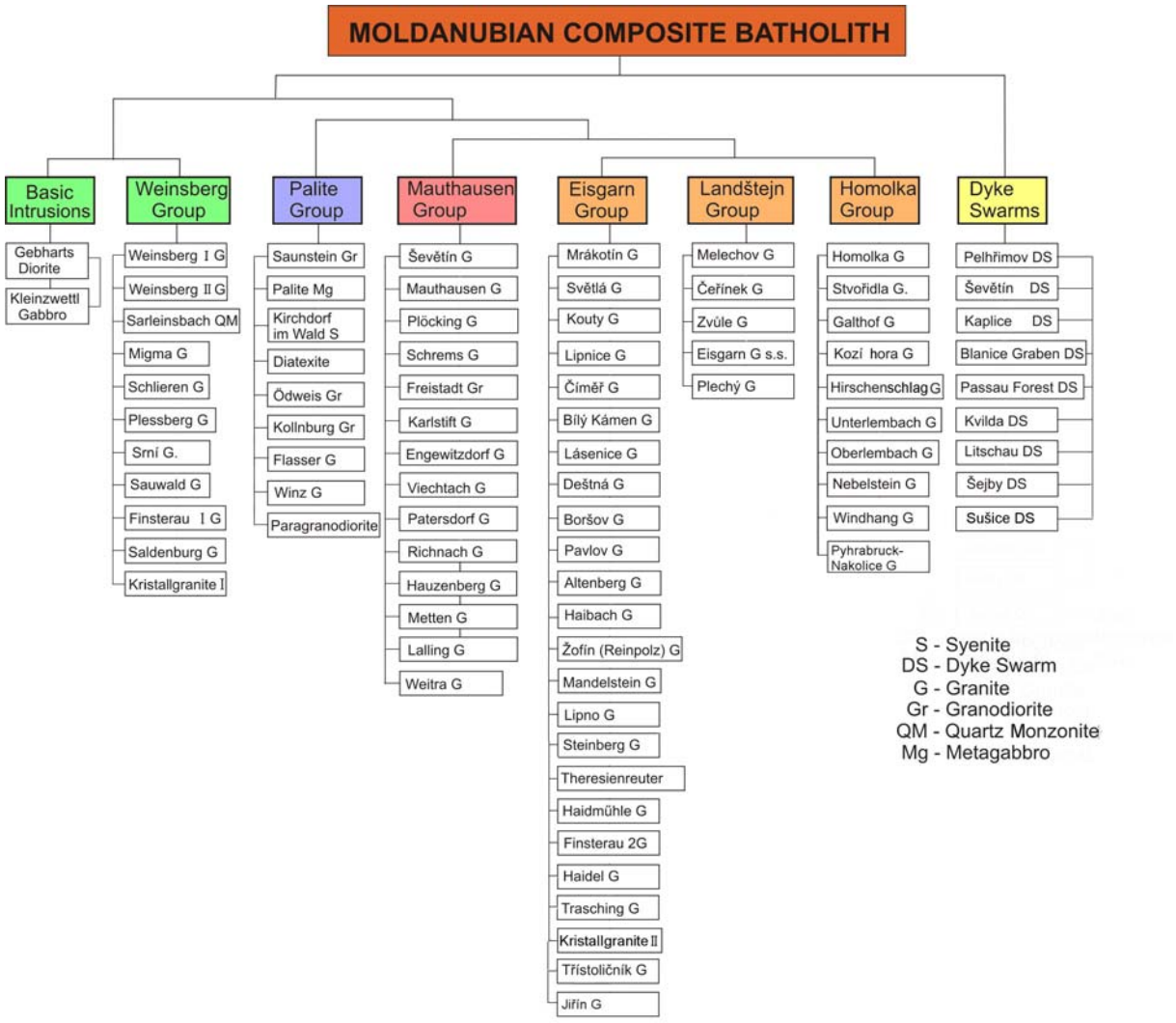

Fig. 2.3. *Moldanubian Composite Batholith hierarchical scheme according to rock groups and rock types.*

Size and shape (in erosion level): The Moldanubian Composite Batholith consists of two plutons and numerous granite massifs with high variation in size, composition, and shape. They are arranged into the horseshoe shape with opening toward the north. The total length of this semi-circular structure is over 400 km with average width of 50 km. The eastern wing of the Batholith (central part of Moldanubian Composite Batholith, e.g. Eisgarn Composite Pluton) is an almost compact set of outcrops in contrast to the western wing composed of archipelago of separate stocks and massifs of different size, shape, composition and age, some of which have features of the autonomous intrusions. Mauthausen Granite occurs mostly as discrete stocks and elongated bodies in and around the large Weinsberg Composite Pluton.

Volume of the Moldanubian Composite Batholith was estimated at about 80 000 km^3 from its average thickness of ca. 8 km.

Dyke Swarms represent late (Stephanian-Autunian) subvolcanic basic-intermediate to acid magmas spatially related to MCB and indicate the presence of the subsurface granite intrusion (e.g. the Pelhřimov circular structure). A cluster of more than 30 dykes of granite porphyries and rhyolites forms a distinct N-S trending zone about 20 km long and 5 km wide (between Lásenice and Litschau). The Ševětín and Sušice Dyke Swarms have mineralogical, chemical and isotopic indications of a possible impact melt origin.

Age and isotopic data: Granitic intrusions at 330–320 Ma occurred shortly after the thermal peak of the regional metamorphism (ca. 335 Ma) into hot high-grade country rocks. U-Pb

data indicate that the formation of the Moldanubian Composite Batholith lasted ca. 30 Ma (330–300 Ma). An inherited U-Pb zircon age spectrum shows peaks at around 500–530, 560–580, 650–670, 2000–2400 Ma.

BASIC INTRUSIONS
Gebharts Diorite 327.4 ± 0.8 Ma (U-Pb zircon).

WEINSBERG GROUP
Weinsberg Granite-Granodiorite 328 ± 6 Ma (U-Pb zircon), 323-328 Ma (Pb-Pb monazite), 357 ± 9–321 ± 12 Ma (U-Pb zircon), 349 ± 4 Ma (Rb-Sr, whole rock) 314.4 ± 2 Ma (Ar-Ar mica).), *Kristallgranite I,* 327 ± 35, 316-317 Ma (U-Th-Pb monazite) 315 ± 4, 313-325, Ma (U-Pb zircon), *Saunstein Granodiorite* 315 ± 3.3, 311 ± 4.9 (U-Pb titanite), 335-324 Ma (U-Pb zircon), *Sauwald Diatexite* 316 ± 1 Ma (U-Pb zircon), *Finsterau I Granite* 325.9 ± 1.9 Ma (Pb/Pb zircon),

PALITE GROUP
Palite rocks emplaced in the shear zone (the Pfahl zone) at 334 ± 3, 334 ± 1.1 Ma (Pb-Pb zircon), 327–342 Ma (U-Pb zircon), 474 ± 18 Ma (Rb-Sr whole rock), 310 ± 7 Ma (Rb-Sr biotite and apatite – cooling age), *Saunstein Granodiorite* 315 ± 3.3 and 311.0 ± 4.9 Ma (U-Pb titanite), 335–324 Ma (U-Pb zircon). Individual K-feldspar crystals from the Saunstein Granodiorite yield Permo-Carboniferous ages 15 to 30 Ma younger than the crystallisation are of the host rock.
Ödwies Granodiorite: 318-320 Ma (U-Pb zircon), 326 ± 2, 329 ± 6 Ma (U-Pb zircon), 331 ± 9 Ma (Rb-Sr whole rock), *Kollnberg Granodiorite* 320 Ma (U-Pb zircon). The coarse-grained Paragranodiorite facies intruded the fine-grained facies. The Patersdorf Granite intrudes the Paragranodiorite within a short time interval 325 ± 3 Ma and 326 ± 3 Ma (Pb-U zircon).

MAUTHAUSEN GROUP
Freistadt Granodiorite 302 ± 2 Ma (Pb-Pb monazite), 329 ± 7 Ma (Rb-Sr muscovite), *Mauthausen Granite:* 300 Ma (U-Pb monazite), 317.5 ± 1 Ma (U-Pb monazite), 365 ± 8 Ma (Rb-Sr whole rock), 324 ± 4 Ma (Rb-Sr muscovite), *Karlstift Granite* 376 ± 9 Ma (Rb-Sr whole rock), *Hauzenberg Granite II* 320 ± 3, 317 ± 2 Ma (U-Pb zircon, 318,320, 329 ± 7 Ma (U-Th-Pb monazite), *Patersdorf Granite* 322 ± 2, 323.4 ± 1.6 Ma (Pb-Pb zircon), *Richnach Granodiorite* 329.2 ± 2.1, 320.4 ± 6.5 Ma (Pb-Pb zircon), *Oberviechtach Granite* 320 Ma (U-Pb zircon),

EISGARN GROUP
Eisgarn Granite – Dreisessel (Třístoličník) Granite 311 ± 4 Ma (K-Ar muscovite), 337 ± 6 Ma (U-Th-Pb monazite), *Eisgarn Granite* 316 ± 7, 303 ± 6 Ma (Rb-Sr whole rock), 328 Ma (Ar-Ar muscovite), 327 ± 4 Ma (Pb-Pb monazite), *Eisgarn Granite (*from the type locality*)* 327–328 Ma (U-Pb zircon), *Kouty Granite* 313 ± 15 Ma (Th, U, Pb monazite), *Lipnice Granite* 313 ± 15, 315 ± 23, 308 ± 13 Ma (Th, U, Pb). *Číměř Granite* 330 ± 6.5 Ma (Rb-Sr whole rock), *Altenberg Granite* 310 Ma (U-Pb zircon, monazite), 316 ± 1 Ma (U-Pb monazite), *Kristallgranite II* 315 ± 4 Ma (U-Pb zircon), 325 ± 5 Ma, 306 ± 4 Ma (K-Ar biotite), *Žofín Granite 324* ± 14 Ma (Rb-Sr whole rock), 313–303 ± 2–3 Ma (Ar-Ar muscovite), *Mandelstein Granite* 314–307 ± 2 Ma (Ar-Ar muscovite), *Weitra Granite* 305 ± 2, 311 ± 3 Ma (Ar-Ar muscovite), *Steinwald Granite* 312 ± 0.4 Ma (Pb-Pb zircon), *Falkenberg Granite* 316 ± 9, 303, 320, 315.7 ± 0.6 Ma (Pb-Pb zircon), *Rozvadov Granite* 314 Ma (K-Ar biotite), *Leuchtenberg Granite* 333 ± 5 Ma, 342 ± 5 Ma (U-Pb zircon), 322.7 ± 0.7 Ma (Pb-Pb zircon), 321 ± 8 Ma (Rb-Sr whole rock), 325 (K-Ar micas),

LANDŠTEJN GROUP
Melechov Granite 318 ± 7, 317 ±17 Ma (Th, U, Pb monazite), *Landštejn (Zvůle) Granite:* 303 ± 3 Ma, 320 ± 2.7 Ma (Rb-Sr whole rock), *Flossenbürg and Bärnau Granites* 310.6 ± 0.3, 313 ± 2 Ma (Pb-Pb zircon), *Plechý Granite* 317.8 ± 9.3 Ma (U-Th-Pb monazite),

HOMOLKA GROUP
Nebelstein Granite 310 ± 1.9, 310.9 ± 2.0 Ma (Rb-Sr biotite), 307.8 ± 1.9, 306.1 ± 1.7 Ma (Rb-Sr muscovite), 312-308 Ma (Ar-Ar muscovite), *Pyhrabruck-Nakolice Granite* 314 ± 6 Ma (Rb-Sr whole rock), 314–312 Ma (Ar-Ar muscovite), *Lagerberg Granite* 313 ± 7 Ma (Rb-Sr whole rock*), Homolka Granite* 317 ± 2, 315 ± 3, Ma (Rb-Sr muscovite), 320 ± 4 Ma (Rb-Sr whole rock), *Gasthof Granite* 317 ± 8, 306 ± 7 Ma (Rb-Sr whole rock),
DYKE SWARMS
subvolcanic felsic dykes 295 ± 5 Ma (Rb-Sr whole rock), *Josefsthal Granite* 318±3 Ma

(Rb-Sr whole rock), *Kaplice Dyke Swarm* 301 ± 4 Ma, 270 ± 2 Ma (Ar-Ar hornblende), *Pelhřimov Dyke Swarm* 228 Ma (K-Ar whole rock). *, Ševětín Microgranodiorite* ca. 270 Ma (Ar-Ar hornblende),

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Trasching Granite 321 ± 3 Ma (U-Pb monazite), *Peuerbach and Schärding Granites* 316-319 Ma (U-Pb monazite), *Sulzberg Granite* 327 Ma (U-Pb monazite), *Friedenfels Granite* 311.5 ± 0.4 Ma (Pb-Pb zircon), *Mitterteich Granite* 309.4 ± 1.4 Ma (Pb-Pb zircon), *Liebenstein Granite* 314.4 Ma (Pb-Pb zircon), *Tittling Granite* 335 ± 25 Ma (Pb-Pb, zircon), *Eberhardsreuth Granite* 316–312 Ma (Pb-Pb zircon), 318–312 Ma (U-Pb zircon), *Saldenburg Granite* 318–312 Ma (Pb-Pb zircon), *Fürstenstein Diorite* 334–332 Ma (Pb-Pb zircon), 321 Ma (U-Pb titanite), *Neunburg Granite* 319 ± 2 Ma (U-Pb zircon), *Schärding Granite* 316–319 Ma (U-Th-Pb monazite),

The major phase of the Weinsberg Granite-Granodiorite is intruded by Freistadt Granodiorite, Mauthausen Granite, dykes of Kristallgranite II (Eisgarn Granite s.l.) and the Plessberg Granite. Dykes of the Schrems and Eisgarn Granite cut across the Gebharts Quartz diorite (existence of the older and younger diorites).

Xenoliths of the Eisgarn Granite and granite porphyry were found in the central part of the Homolka Stock.

Temporal (field) relations (from the older type to the younger type): Gebharts Diorite → Weinsberg Granite-Granodiorite (Kristallgranite I) → Freistadt Granodiorite → Karlstift Granite–Reinpolz Granite → Mauthausen Granite → Eisgarn Granites (Kristallgranite II)→ Landštejn Granites → Homolka Granite → Felsic Dyke Swarms.

Geological environment: Moldanubian Composite Batholith intruded a polymetamorphic terrain of the Moldanubian Zone consisting of three Units (two of which are in a tectonically inverted position) from the present bottom to top: the Ostrong, Drosendorf, and Gföhl Units. The Gföhl nappe contains the highest-grade rocks: various migmatites, mainly leucocratic migmatized gneisses with some felsic retrogressed granulites are also present. The Varied Group of the Drosendorf Unit is characterised by garnet-bearing ortho- and paragneisses, pelitic schists, marbles and amphibolites. The cordierite-sillimanite-K-feldspar-biotite gneisses of the Monotonous Group of the Ostrong Unit are probably in a parautochthonous position. Far to the northwest, the Steinwald Granite in the Oberpfalz Composite Massif (the Western Plutons of MCB) intruded the Saxothuringian Zone (Cambrian to Ordovician phyllites and micaschists and orthogneisses).

Contact aureole: the contacts are complex and cut discordantly the country rocks. Contact zone has a very complicated fabric and definite granite-gneiss boundary is not well-defined. A broad aureole of the periplutonic metamorphism (migmatitization and pearl gneisses) is in the exocontact.

Cordierite formed during low pressure metamorphism is a typical mineral of many of these rocks. In general, the granites in the northern part of the Moldanubian Composite Batholith are peraluminous, containing andalusite, often sillimanite and in places cordierite. These minerals are less abundant and/or lacking farther to the south. The temperature of the Moldanubian upper crust was lower than 200 ^{o}C by ca. 270 Ma (time of the granodiorite dyke intrusion), but sediments of the Lhotice basin of the Stephanian C age cover the Ševětín Massif.

Zoning: the Moldanubian Composite Batholith possesses a zonal structure. It is represented by two-mica and biotite granites along the norther margin (Eisgarn Granite) and mostly biotite granites and granodiorites (Weinsberg Granite-Granodiorite-Granodiorite) futher to the south.

Regional scale: Compositional gradients (zonation) in the multiple composite intrusion of two plutonic suites. This zonation indicates the gradual emplacement of the batholith from south to the north and also its rising to higher crustal level. The youngest members of MCB are subvolcanic high-level intrusions (e.g. Homolka Granite).

According to Siebel et al. (2008) there exists some kind of source-related chemical zonation within southwestern part of the Moldanubian Composite Batholith with low Ca-Sr-Y granites (S-type granites) being more abundant in the north, whereas high Ca-Sr-Y granites (I-type granites) dominate in the region between the Pfahl and Danube faults. The crustal block south of the Pfahl fault was uplifted for several kilometres relative to the northern block at

time when I-type granite production was most intensive (Finger and René 2009).

Local scale: Flossenbürg and *Bürgerwald Granites* show gradational zonation from SW to NE (trend of differentiation).

Zvůle and Čeřínek Granites – reverse zonation with the most evolved facies along the endocontact.

Eisgarn Granite s.s., Melechov and Stvořidla Granites show structural and compositional normal concentric zoning (ring intrusions).

Mineralization: greisenization and K-feldspatization of the Eisgarn granites is associated with sub-economic Mo, Sn-W-Nb-Ta mineralization, and U in shear zones. Stratabound mineralization and quartz veins with Ag-Pb-Zn + Au, F, W (scheelite) at the exocontact of the granite.

Heat production (μWm^{-3}): *Číměř Granite* 3.7, *Mrákotín Granite* 2.83, *Weinsberg Granite-Granodiorite* 3.5–5.0, *Mauthausen Granite* 2.5–6.5, *Schrems Granite* 5.41, *Eisgarn Granite* 7.07.

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I. Eastern plutons of the Moldanubian Composite Batholith

2.1.1. EISGARN COMPOSITE PLUTON

Regional position: northern part of the Moldanubian Composite Batholith in the Moldanubian Zone (a group of eastern plutons). The major part of the pluton is interconnected in shallow depth with the Melechov and Klenov Massifs. According to René (2000) the Eisgarn Composite Pluton mostly represented by the Eisgarn Granite s.l. consists of three magmatic episodes:

1. Lásenice-Deštná Granite subtype,
2. Číměř and Mrákotín Granite subtypes,
3. Eisgarn Granite s.s.

Rock types:

A. <u>*Eisgarn Granites (s.l.)*</u>

1. *Mrákotín Granite* – two-mica ± porphyritic granite (marginal facies of the Číměř Granite*) Kouty and Světlá Granite* are facies of the Mrákotín Granite.
2. *Číměř (Řásná) Granite* – porphyritic two-mica granite
3. *Lipnice Granite* – medium-grained two-mica granite
4. *Bílý Kámen Granite* – ± porphyritic fine-grained two-mica granite.
5. *Lásenice-Deštná Granite* – medium to fine-grained biotite (+ muscovite)
6. *Boršov Granite* – fine-grained muscovite-biotite granite
7. *Pavlov Granite* – fine-grained muscovite-biotite granite
8. *Jiřín Granite* – fine-grained two-mica granite

B. <u>*Landštejn Granites*</u>

1. *Zvůle (Landštejn) Granite* – coarse to medium-grained two-mica alkali-feldspar granite
2. *Čeřínek Granite* – ± porphyritic coarse-grained two-mica granite
3. *Melechov Granite* – coarse to medium-grained two-mica alkali-feldspar granite
4. *Eisgarn Granite (s.s.)* – porphyritic biotite-muscovite granite

C. <u>*Homolka Granites*</u>

1. *Homolka Granite* – medium-grained muscovite topaz-bearing alkali-feldspar granite
2. *Kozí hora–Hirschenschlag Granite*– biotite magnetite-bearing granite
3. *Galthof Granite* – porphyritic medium-grained muscovite alkali-feldspar granite
4. *Stvořidla Granite* – medium to fine-grained muscovite (± biotite) alkali-feldspar granite

D. <u>*Porphyry Dyke Swarms*</u>

PELHŘIMOV DYKE SWARM

1. *Felsite Rhyolite* – partly with fluidal fabric
2. *Pelhřimov Granite Porphyry* – felsic alkali-feldspar granite porphyry.

ŠEVĚTÍN DYKE SWARM

Ševětín Microgranodiorite – amphibole granodiorite and quartz monzonite.

KAPLICE DYKE SWARM

Kaplice Granodiorite Porphyry – biotite granodiorite porphyry, hornblende quartz diorite porphyry.

BLANICE GRABEN DYKE SWARM

Štěpánovice Quartz Micromonzodiorite – sub-ophitic pyroxene-biotite fine-grained or locally medium-grained quartz monzodiorite.

SUŠICE DYKE SWARM

Sušice Quartz monzonite – augite quartz micromonzonite.

LITSCHAU DYKE SWARM

Josefsthal Granite – fine-grained alkali-feldspar leucogranite.

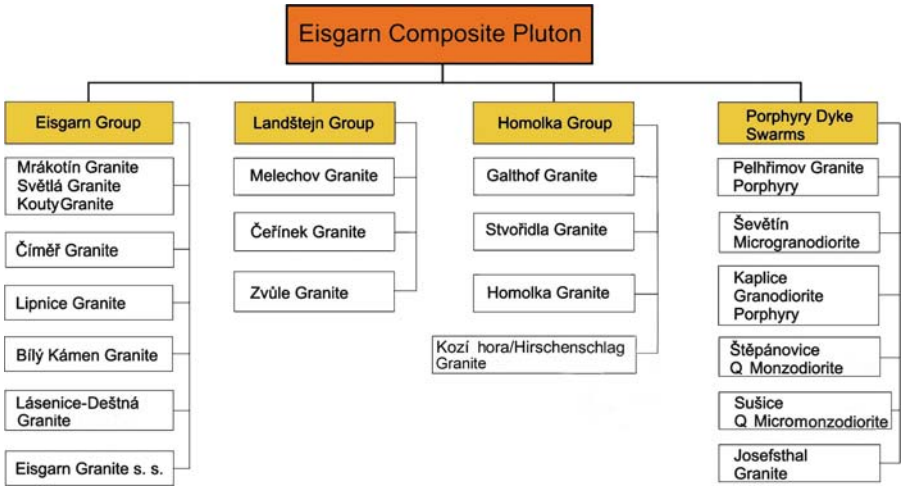

Fig. 2.4. *Eisgarn Composite Pluton hierarchic scheme according to rock groups and rock types.*

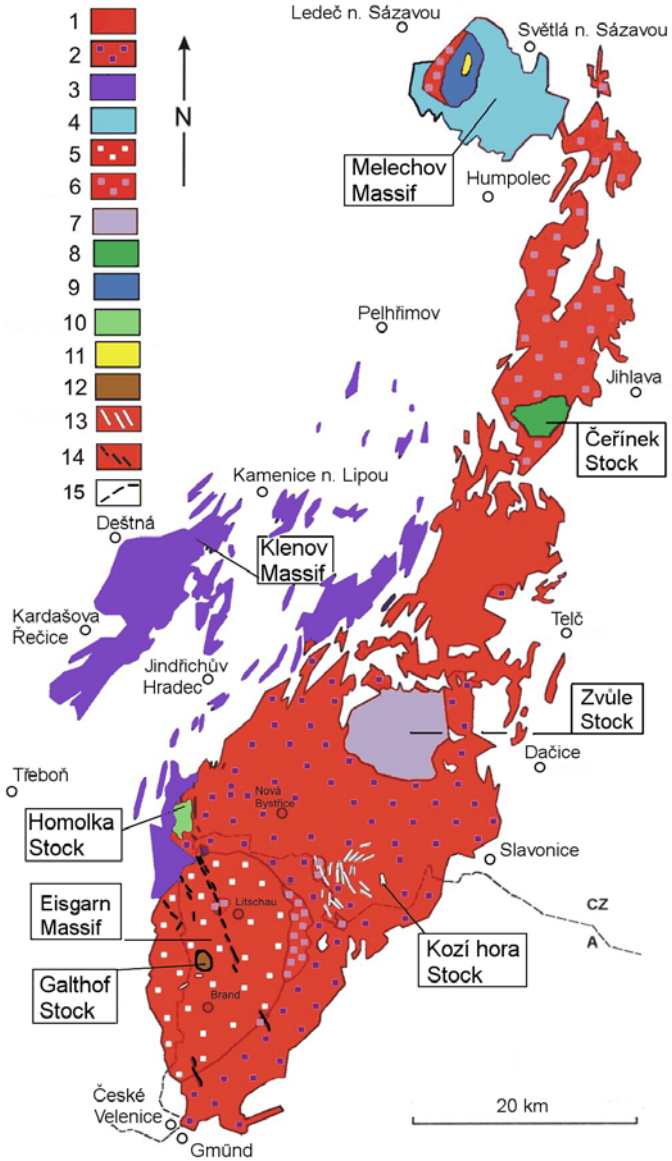

Fig. 2.5. *Eisgarn Composite Pluton geological sketch-map (adapted after Breiter et al. 1998).* <u>*Eisgarn Group:*</u> *1 – Mrákotín Granite, 2 – Číměř Granite, 3 – Lásenice-Deštná Granite, 4 – Lipnice Granite, 5 – Eisgarn Granite s.s., 6 – Eisgarn Granite s.l.,* <u>*Landštejn Group:*</u> *7 – Zvůle Granite, 8 – Čeřínek Granite,* <u>*Homolka Group:*</u> *9 – Melechov Granite, 10 – Homolka Granite, 11 – Stvořidla Granite, 12 – Galthof Granite, 13 – Kozí hora-Hirschenschlag Stock,* <u>*Porphyry Dyke Swarms:*</u> *14 – Litschau Dyke Swarm.*

Eisgarn Granite s.l. including Zvůle (Landštejn) Granite

Quarz-rich, potassic, strongly peraluminous, leucocratic, S-type, I & M-series, granite

n = 80	Med.	Min	Max	QU1	QU3
SiO_2	72.60	68.15	75.88	72.16	73.40
TiO_2	0.23	0.06	0.52	0.14	0.28
Al_2O_3	14.46	12.93	15.76	14.21	14.94
Fe_2O_3	0.38	0.04	1.44	0.25	0.52
FeO	0.97	0.12	2.33	0.74	1.29
MnO	0.04	0.01	0.70	0.03	0.27
MgO	0.29	0.01	1.23	0.05	0.41
CaO	0.93	0.40	2.43	0.76	1.10
Na_2O	3.10	2.12	4.60	2.85	3.32
K_2O	5.01	3.13	5.98	4.76	5.20
P_2O_5	0.26	0.04	0.65	0.20	0.30
Mg/(Mg + Fe)	0.26	0.01	0.54	0.05	0.34
K/(K + Na)	0.52	0.31	0.63	0.49	0.54
Nor.Or	30.67	18.73	36.27	29.08	31.75
Nor.Ab	28.90	19.89	42.07	26.76	30.76
Nor.An	2.81	0.47	11.23	1.70	3.96
Nor.Q	31.82	22.29	39.43	30.34	33.18
Na + K	205.86	170.44	248.32	200.96	209.42
*Si	186.20	133.01	224.52	180.10	193.79
K-(Na + Ca)	-9.18	-94.93	32.19	-20.46	1.36
Fe + Mg + Ti	27.50	9.34	69.27	21.94	37.85
Al-(Na + K + 2Ca)	47.24	1.56	92.34	32.32	55.00
(Na + K)/Ca	12.03	4.99	29.22	10.16	15.90
A/CNK	1.22	1.02	1.51	1.16	1.27

Trace elements (mean values in ppm): *Eisgarn Granite* – **Ba** 67, **Cs** 30, **Ga** 24, **Hf** 2, **Li** 154, **Nb** 16, **Pb** 22, **Rb** 368, **Sc** 3.3, **Sr** 40, **Th** 11, **U** 12, **Y** 18, **Zn** 84, **Zr** 54, **La** 14, **Ce** 31, **Sm** 1.6, **Eu** 0.29, **Yb** 1, **Lu** 0.1 (Breiter and Sokol 1997).

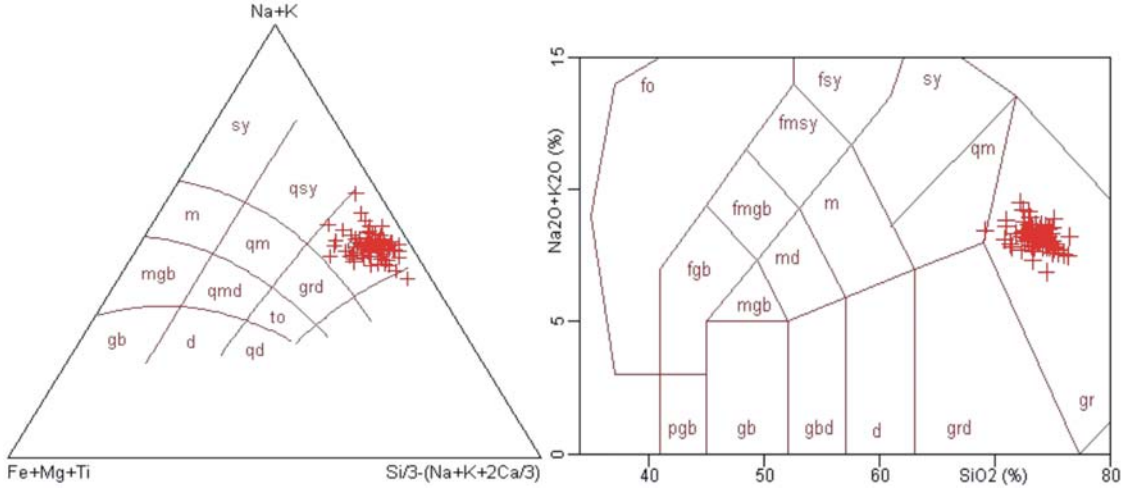

Fig. 2.6. *Eisgarn Granite (s.l). ABQ and TAS diagrams.*

Size and shape (in erosion level): The Eisgarn Composite Pluton is an elongated body with the area of ca 1600 km^2 (100 × 15 km).

A number of preserved islets and blocks of crystalline schists are found that together with the shape and position of the intrusion bring evidence that only the apical part of the Eisgarn Composite Pluton was laid bare. The average dips both of the contact and of the Moldanubian paragneisses fluctuates around 20°. It can be calculated that the real thickness of the roof of the pluton corresponds to a value

of about 2000 m (Dudek and Suk 1965). The Zvůle Granite – a circular stock (5 km in diameter) within the Číměř Granite. Melechov Granite – a circular stock (3 × 6 km) within the Kouty (Světlá) Granite, Čeřínek Granite – circular stock (3 km in diameter) within the Bílý Kámen Granite. The Eisgarn s.s. – elliptical massif (20 × 15 km) within the Mrákotín Granite. The Galthof Granite – irregular body (1.5 km^2) and two outcrops (< 0.1 km^2) intrude the Eisgarn Massif. Homolka Granite is elongated circular stock (6 km^2)in the Číměř Granite, Josefsthal Granite – a granite dyke in the Eiagarn Massif, Kozí hora-Hirschenschlag Granite – ring-shaped structure of small stocks, dykes and zones of metasomatism in the Číměř Granite, with occurrence of molybdenite-magnetite greisens.

Age and isotopic data:

EISGARN GROUP

Eisgarn granites 327 ± 4 Ma (Pb-Pb monazite), 316 ± 7, 303 ± 6 Ma (Rb-Sr whole rock) (0.7147), 328 Ma (Ar-Ar muscovite), *Číměř Granite* 330 ± 6.5 Ma (Rb-Sr whole rock), *Kouty Granite* 313 ± 15 Ma (Th, U, Pb monazite), *Lipnice Granite* 313 ± 15, 315 ± 23, 308 ± 13 Ma (Th, U, Pb).

LANDŠTEJN GROUP

Landštejn Granite 303 ± 3 Ma (Rb-Sr whole rock), *Zvůle Granite* 320 ± 2.7 Ma (Rb-Sr whole rock), *Melechov Granite* 318 ± 7, 317 ±17 Ma (Th, U, Pb monazite).

HOMOLKA GROUP

Galthof Granite 317 ± 8 and 306 ± 7 Ma (Rb-Sr whole rock), *Homolka Granite* 317 ± 2, 315 ± 3, Ma (Rb-Sr muscovite), 320 ± 4 Ma (Rb-Sr whole rock), 300 ± 41 Ma (Rb-Sr whole rock).

DYKE SWARMS

Subvolcanic felsic dykes: 295 ± 5 Ma (Rb-Sr whole rock*), Josefsthal Granite* 318 ± 3 Ma (Rb-Sr whole rock)

Temporal (field) relations: The Stvořidla Leucogranite intrudes the Melechov Granite at the Melechov Massif. The Lásenice Granite is older than all two-mica granites. The Eisgarn granites s.l. are intruded by Landštejn (Zvůle) Granite.

Xenoliths of Eisgarn Granite and granite porphyry were found in the central part of the Homolka Stock and in the Weinsberg Granite-Granodiorite (Besednice).

Geological environment: Large amount of roof pendants (paragneisses and migmatites) in the north indicate much shallower erosion level compared to the southern part of the CMB.

Contact aureole: due to the gentle dip of the contact surface the width of the exomorphic contact zone expressed in the order of kilometres is only an apparent one and in reality does not exceed several hundred meters. The contact metamorphism especially in the northern part is characterized by mass formation of cordierite.

Zoning: *Eisgarn Granite s.s.* shows distinct normal concentric zoning. *Zvůle and Čeřínek Granites* – ring-shaped reverse zoning with the most evolved facies along the endocontact. *Melechov* and *Stvořidla Granites* show distinct structural and compositional normal concentric zonation.

Mineralization: greisenization and K-feldspatization of the Eisgarn granites is incompanied by sub-economic Mo, Sn-W-Nb-Ta mineralization (e.g. Homolka Granite), and U in shear zones; stratabound mineralization and quartz veins with Ag-Pb-Zn + Au, F, W (scheelite) at the exocontact of the granite.

Heat production (μWm^{-3}): *Číměř Granite* 3.7, *Mrákotín Granite* 2.83, *Lásenice Granite* 2.01, *Eisgarn Granite s.s.* 4.31–7.07, *Homolka Granite* 1.52.

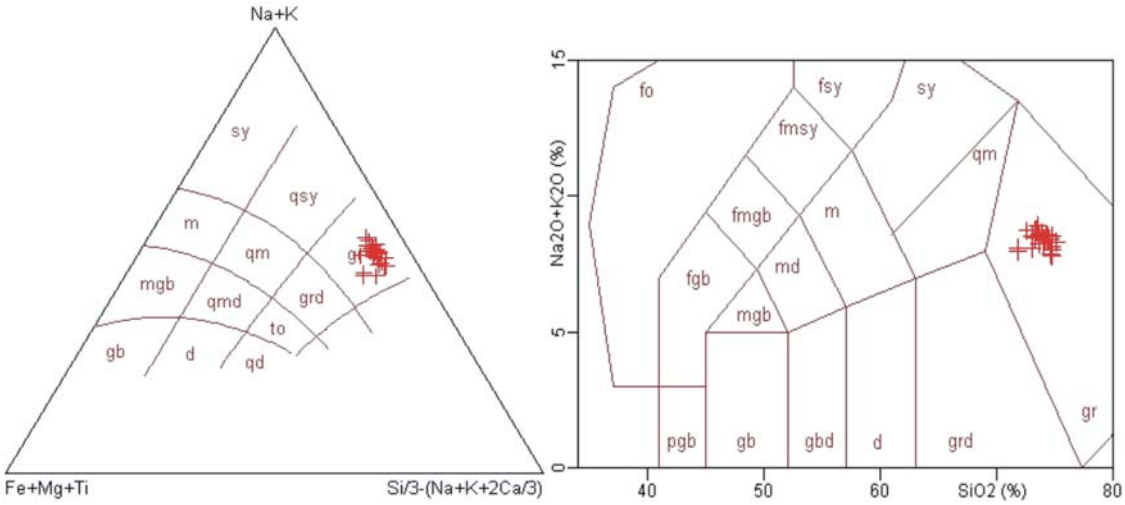

Fig. 2.7. *Mrákotín Granite ABQ and TAS diagrams.*

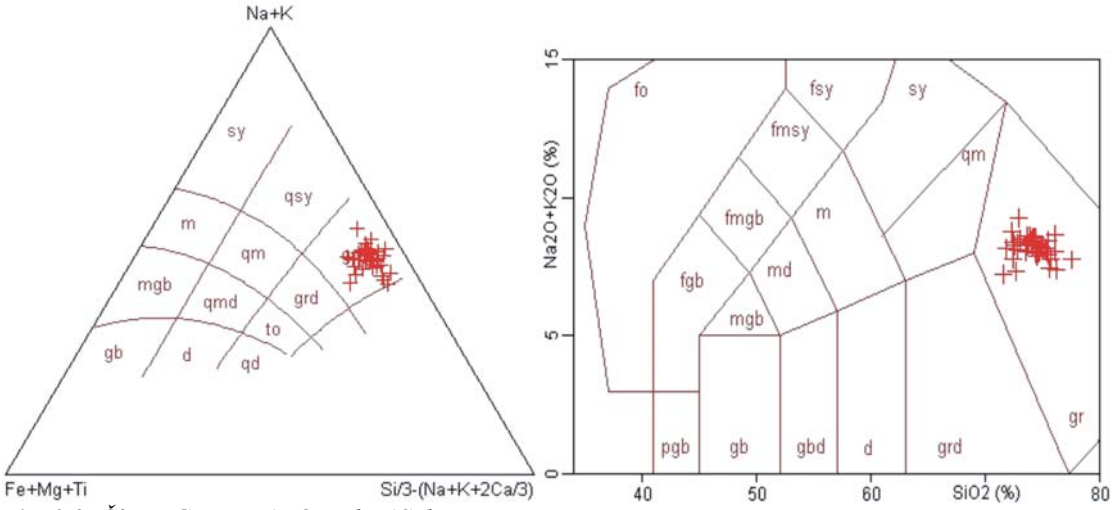

Fig. 2.8. *Čímě*ř *Granite ABQ and TAS diagrams.*

Mrákotín Granite

Quartz-rich, potassic, peraluminous, leucocratic, S-type, granite

n = 20	Median	Min	Max	QU1	QU3
SiO_2	72.90	72.07	73.99	72.50	73.61
TiO_2	0.21	0.15	0.37	0.17	0.23
Al_2O_3	14.38	13.96	14.75	14.16	14.48
Fe_2O_3	0.47	0.08	0.96	0.25	0.75
FeO	0.76	0.26	1.47	0.50	0.92
MnO	0.02	0.02	0.03	0.02	0.02
MgO	0.32	0.23	0.56	0.29	0.33
CaO	0.82	0.50	1.01	0.71	0.86
Na_2O	2.99	2.76	3.24	2.92	3.10
K_2O	5.29	4.81	5.65	5.17	5.48
P_2O_5	0.24	0.20	0.31	0.23	0.25
Li_2O	0.016	0.010	0.022	0.014	0.017
Mg/(Mg + Fe)	0.31	0.28	0.38	0.30	0.33
K/(K + Na)	0.53	0.51	0.56	0.53	0.54
Nor.Or	32.10	29.39	34.52	31.53	33.13
Nor.Ab	27.79	25.76	29.91	27.11	28.57
Nor.An	2.58	0.88	3.31	1.90	2.81
Nor.Q	31.73	29.38	34.98	31.20	32.51

Na + K	210.32	196.35	222.60	206.47	213.22
*Si	185.92	169.99	201.36	180.15	188.50
K-(Na + Ca)	0.48	-11.67	11.90	-1.68	6.08
Fe + Mg + Ti	27.24	22.23	41.26	25.65	28.34
Al-(Na + K + 2Ca)	42.68	32.43	56.74	37.75	50.76
(Na + K)/Ca	14.34	11.72	23.04	13.39	16.11
A/CNK	1.21	1.15	1.28	1.18	1.24

Číměř Granite

Quartz-rich, potassic, peraluminous, leucocratic, S-type, granite

n = 37	**Median**	**Min**	**Max**	**QU1**	**QU3**
SiO_2	73.26	70.98	78.90	72.58	73.89
TiO_2	0.24	0.10	0.40	0.18	0.29
Al_2O_3	14.36	12.08	15.41	14.10	14.59
Fe_2O_3	0.50	0.05	2.22	0.38	0.72
FeO	0.75	0.00	1.69	0.47	0.96
MnO	0.02	0.01	0.06	0.02	0.03
MgO	0.33	0.13	0.71	0.29	0.43
CaO	0.73	0.29	1.96	0.63	0.81
Na_2O	3.01	2.50	3.98	2.94	3.12
K_2O	5.08	3.31	6.07	4.75	5.22
P_2O_5	0.23	0.08	0.31	0.22	0.25
Li2O	0.015	0.006	0.034	0.013	0.018
Mg/(Mg + Fe)	0.32	0.20	0.41	0.30	0.34
K/(K + Na)	0.53	0.35	0.58	0.50	0.54
Nor.Or	30.95	20.17	36.63	29.35	32.02
Nor.Ab	28.00	23.40	36.86	27.27	28.82
Nor.An	2.13	-0.06	9.26	1.48	2.60
Nor.Q	33.30	27.70	38.66	31.56	34.54
Na + K	205.30	188.08	229.88	200.10	209.85
*Si	193.20	163.32	224.93	182.94	199.70
K-(Na + Ca)	-1.29	-93.10	18.87	-10.65	4.19
Fe + Mg + Ti	28.84	12.08	50.05	25.54	32.42
Al-(Na + K + 2Ca)	51.63	10.24	73.28	43.03	56.25
(Na + K)/Ca	16.05	5.69	41.34	13.90	18.39
A/CNK	1.24	1.05	1.35	1.21	1.29

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2.1.1.01. KLENOV MASSIF

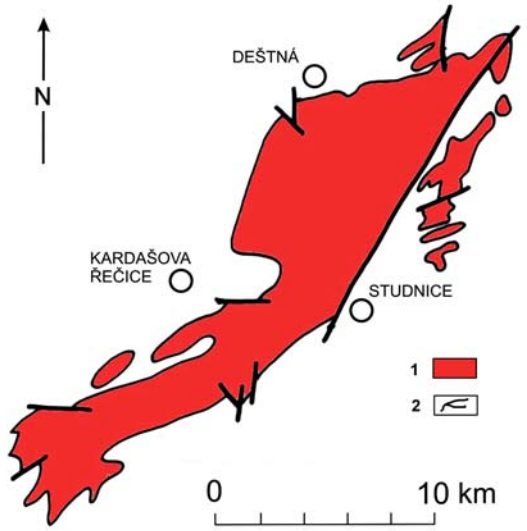

Fig. 2.9. *Klenov massif geological sketch-map (after Krešl et al. 1993). 1 – Lásenice-Deštná Granite, 2 – faults.*

Regional position: an independent massif or an integral part of the South Bohemian Batholith (Eisgarn Composite Pluton) within the Moldanubian Zone. Homogenous intrusion of the Eisgarn Granite s.l.

Rock types:

1. *Číměř Granite* – porphyritic two-mica granite (xenolites in the Lásenice-Deštná Granite).
2. *Lásenice-Deštná Granite* – ± porphyritic two-mica granite (the main rock type).
3. *Aplite Granite* – fine-grained two-mica granite forming minor bodies (not shown in map).

Size and shape (in erosion level): long oval shape – 140 km^2 (30 × 6 km).

Age and isotopic data: *Uranium mineralization (*cutting the Lásenice-Deštná Granite) 255 ± 3 Ma (U-Pb, pitchblende*), granodiorite porphyry* 263–222 Ma (Ar-Ar mica), xenoliths of the Číměř Granite in the Deštná Granite and Aplite Granite.

Geological environment: sillimanite-biotite paragneisess.

Contact aureole: periplutonic migmatitization of the Moldanubian paragneisses.

Zoning: unknown.

Mineralization: Okrouhlá Radouň uranium deposit in the endocontact of the massif.

Heat production (μWm^{-3}): *Číměř Granite* 3.7, 2.83, *Lásenice-Deštná Granite* 1.96, 2.01.

Lásenice-Deštná Granite

Quartz-normal, sodic/potassic, peraluminous, leucocratic, S-type, granite

n = 17	Median	Min	Max	QU1	QU3
SiO_2	73.89	72.64	75.22	73.18	74.55
TiO_2	0.11	0.07	0.35	0.10	0.15
Al_2O_3	14.52	13.75	14.90	14.22	14.62
Fe_2O_3	0.47	0.17	0.97	0.30	0.57
FeO	0.50	0.15	0.93	0.28	0.74
MnO	0.03	0.01	0.05	0.03	0.04
MgO	0.22	0.11	0.34	0.19	0.24
CaO	0.66	0.44	0.89	0.54	0.75
Na_2O	3.53	2.88	3.91	3.35	3.79
K_2O	4.79	4.24	5.82	4.35	4.90
P_2O_5	0.24	0.16	0.35	0.21	0.28
Li_2O	0.013	0.004	0.034	0.010	0.024
Mg/(Mg + Fe)	0.28	0.20	0.33	0.27	0.29
K/(K + Na)	0.47	0.42	0.57	0.45	0.49
Nor.Or	29.04	25.81	35.35	26.42	29.46
Nor.Ab	32.46	26.59	35.75	30.68	34.58
Nor.An	1.48	-0.06	3.47	1.20	2.12
Nor.Q	32.01	28.47	37.13	30.69	33.61
Na + K	213.60	197.69	230.21	210.13	216.51
*Si	185.05	169.48	213.83	179.92	194.53
K-(Na + Ca)	-24.67	-46.55	19.05	-35.07	-19.18
Fe + Mg + Ti	19.74	10.96	30.13	18.22	23.35
Al-(Na + K + 2Ca)	47.22	24.43	60.10	37.85	54.00
(Na + K)/Ca	17.85	13.29	25.74	16.36	21.98
A/CNK	1.23	1.12	1.31	1.17	1.27

Trace elements (mean values in ppm): *Lásenice-Deštná Granite* – **Ba** 256, **Cs** 12.1, **Ga** 15, **Hf** 1, **Li** 33, **Nb** 7, **Pb** 37, **Rb** 175, **Sc** 2.75, **Sr** 83, **Th** 6, **U** 5.7, **Y** 14.5, **Zn** 33, **Zr** 23, **La** 5.3, **Ce** 11, **Sm** 0.7, **Eu** 0.45, **Yb** 1, **Lu** 0.11 (Breiter and Sokol 1997).
Číměř Granite – **Ba** 317, **Cs** 13.7, **Ga** 22, **Hf** 3.4, **Li** 79, **Nb** 10, **Pb** 24, **Rb** 271, **Sc** 3.1, **Sr** 100, **Th** 17.4, **U** 7.7, **Y** 16, **Zn** 79, **Zr** 93, **La** 26, **Ce** 61, **Sm** 5.7, **Eu** 0.57, **Yb** 1, **Lu** 0.1 (Breiter and Sokol 1997).

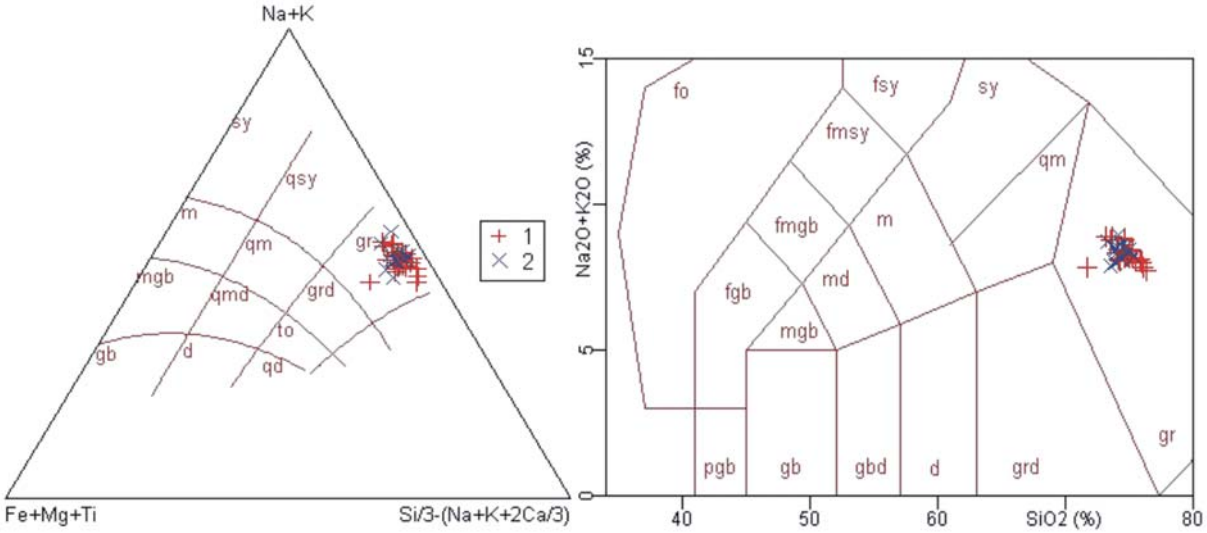

Fig. 2.10. *Lásenice–Deštná Granite ABQ and TAS diagrams 1 – Deštná Granite, 2 – Aplite Granite.*

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2.1.1.02. ŠEVĚTÍN MASSIF

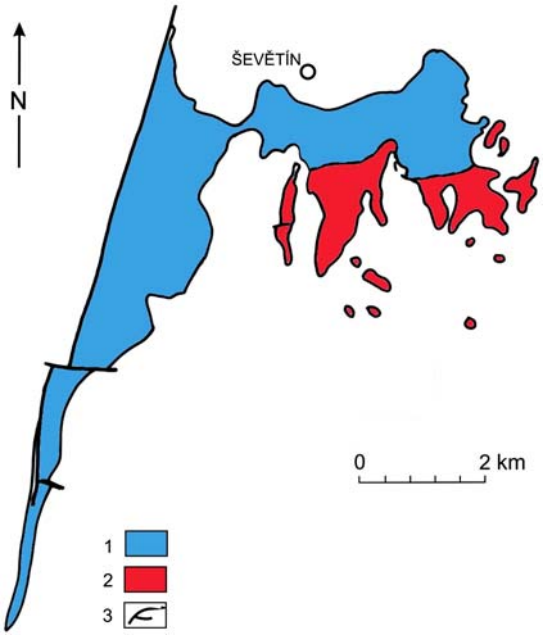

Fig. 2.11. *Ševětín Composite Massif geological sketch-map (adapted after Janoušek et al. 2002). 1 – Ševětín Granite, 2 – Deštná Granite (Eisgarn Granite s.l.), 3 – faults.*

Regional position: Moldanubian Zone. A member of the Eisgarn Composite Pluton.

Rock types:

1. *Deštná Granite* – two-mica granite with cordierite ± andalusite.
2. *Ševětín 1 Granite* (light facies) – fine to coarse-grained biotite–muscovite granodiorite to granite.
3. *Ševětín 2 Granite* (dark facies) – fine-grained biotite granite forming minor bodies.

Both varieties are comparable with the Mauthausen Granite.

Size and shape (in erosion level): L-shaped shallow intrusion with two perpendicular branches (12 km^2). The Deštná Granite (ca. 7 km^2) is largely covered by sediments of the Stephanian C. The Ševětín 1 Granite (light facies) occupies ca 4 km^2. The Ševětín 2 Granite (dark facies) is confined to the area of approximately 100 by 200 m.

Age and isotopic data: the dark variety of the Ševětín Granite forms blocks enclosed at the light-coloured Deštná Granite. The age of Ševětín Granites is comparable with Mauthausen Granite in Austria (~ 315 Ma). Ševětín Granite (two-mica granite) is intruded by a dyke of microgranodiorite cooling age of which has been dated at 274 Ma (Ar-Ar amphibole).

Geological environment: Moldanubian paragneisses and Upper Cretaceous cover (tectonically outlined).

Contact aureole: not described.

Zoning: not described.

Mineralization: unknown.

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Ševětín 1 Granite

Quartz-normal, sodic, peraluminous, mesocratic, S-type, granite

n = 9	Median	Min	Max	QU1	QU3
SiO_2	72.18	70.65	73.09	71.90	72.29
TiO_2	0.23	0.13	0.29	0.22	0.26
Al_2O_3	14.64	13.96	15.12	14.19	14.89
Fe_2O_3	0.43	0.05	0.73	0.17	0.63
FeO	1.02	0.83	1.55	0.98	1.31
MnO	0.05	0.04	0.09	0.04	0.05
MgO	0.51	0.32	0.64	0.48	0.57
CaO	1.29	0.76	1.64	0.84	1.38
Na_2O	3.59	3.49	4.28	3.53	3.70
K_2O	4.59	4.10	4.75	4.50	4.60
P_2O_5	0.15	0.13	0.22	0.14	0.20
Li2O	0.014	0.006	0.055	0.010	0.018
Mg/(Mg + Fe)	0.37	0.30	0.40	0.35	0.40
K/(K + Na)	0.46	0.41	0.46	0.44	0.46
Nor.Or	28.02	25.15	28.94	27.65	28.16
Nor.Ab	33.33	32.61	39.64	32.81	34.03
Nor.An	5.19	2.81	7.37	3.32	6.24
Nor.Q	28.70	22.31	32.40	28.09	29.66
Na + K	213.30	205.00	238.97	209.86	215.77
*Si	172.15	133.49	190.50	168.67	176.38
K-(Na + Ca)	-41.39	-66.50	-28.93	-48.33	-38.77
Fe + Mg + Ti	35.65	27.28	42.07	33.61	41.41
Al-(Na + K + 2Ca)	34.67	-18.79	52.74	27.29	37.41
(Na + K)/Ca	9.27	8.17	15.49	8.47	13.69
A/CNK	1.16	0.95	1.25	1.12	1.17

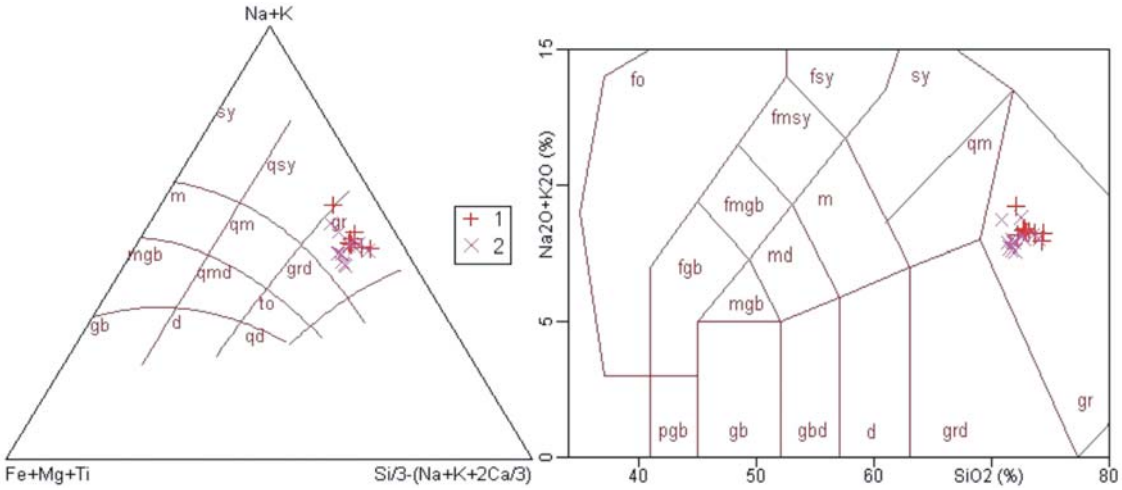

Fig. 2.12. *Ševětín Granite ABQ and TAS diagrams. 1 – Ševětín 1 Granite (light facies), 2 – Ševětín 2 Granite (dark facies).*

Ševětín 2 Granite

Quartz-normal, sodic/potassic, peraluminous, mesocratic, S-type, granite

n = 7	Median	Min	Max	QU1	QU3
SiO_2	70.90	69.81	71.60	70.48	70.91
TiO_2	0.33	0.25	0.37	0.28	0.34
Al_2O_3	14.96	14.84	15.21	14.84	15.10

Fe_2O_3	0.44	0.08	1.18	0.08	0.45
FeO	1.89	0.37	2.10	1.28	1.95
MnO	0.05	0.04	0.05	0.04	0.05
MgO	0.83	0.61	0.88	0.67	0.84
CaO	1.63	1.41	1.81	1.50	1.70
Na_2O	3.35	3.10	3.53	3.18	3.38
K_2O	4.40	4.22	4.52	4.33	4.45
P_2O_5	0.13	0.12	0.16	0.12	0.14
Li2O	0.010	0.000	0.018	0.000	0.015
Mg/(Mg + Fe)	0.40	0.38	0.45	0.39	0.41
K/(K + Na)	0.46	0.44	0.49	0.46	0.47
Nor.Or	27.38	25.99	27.83	26.72	27.49
Nor.Ab	31.56	29.10	33.05	29.83	31.61
Nor.An	7.33	6.48	8.60	6.71	7.88
Nor.Q	28.26	26.85	30.01	27.14	28.79
Na + K	202.49	194.52	208.59	194.55	203.44
*Si	170.80	165.64	184.02	167.17	171.52
K-(Na + Ca)	-43.40	-54.80	-32.30	-46.41	-43.08
Fe + Mg + Ti	55.03	39.69	57.56	41.98	56.34
Al-(Na + K + 2Ca)	31.70	27.36	51.69	27.53	34.00
(Na + K)/Ca	6.97	6.20	7.80	6.67	7.27
A/CNK	1.13	1.11	1.22	1.12	1.14

2.1.1.03. MELECHOV MASSIF

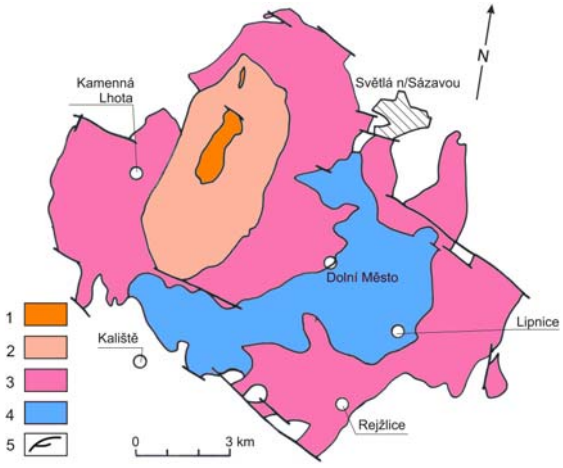

Fig. 2.13. *Melechov Massif geological sketch-map (adapted after Veselá 1991, Matějka, 1997). 1 –Stvořidla Granite, 2 – Melechov Granite, 3 – Světlá Granite and Kouty Granite, 4 – Lipnice Granite, 5 – faults.*

Regional position: The Varied Group of the Moldanubian Zone (Drosendorf Unit). Integral part of the Eisgarn Composite Pluton.

Rock types:

1. *Lipnice Granite* – fine-grained two-mica monzogranite.
2. *Světlá and Kouty Granite* – medium-grained biotite-muscovite alkali-feldspar granite (gradational contact with the Lipnice Granite).
3. *Melechov (Landštejn type) Granite* – medium-grained alkali-feldspar two-mica granite.
4. *Stvořidla (Homolka type) Granite* – fine-grained two-mica alkali-feldspar leucogranite.

Size and shape (in erosion level): – 120 km^2, oval shape (10 × 15 km) with numerous apophyses at the contact.

Age and isotopic data: *Melechov Granite* 318 ± 7, 317 ±17 Ma (Th, U, Pb monazite), *Kouty Granite* 313 ± 15 Ma (Th, U, Pb monazite), *Lipnice Granite* 313 ± 15, 14, 315 ± 23, 308 ± 13 Ma (Th, U, Pb monazite).

The Eisgarn group of granites (Mrákotín, Číměř, Kouty, Světlá granites) are intruded by the Melechov Granite and this granite is intruded by the Svořidla Granite.

Geological environment: High-grade metamorphic rocks (migmatites and sillimanite-cordierite paragneisses).

Contact aureole: Periplutonic migmatitization of the Moldanubian paragneisses.

Zoning: Structural and compositional normal concentric zoning with ring intrusion of the Melechov Granite with the Stvořidla Granite in the centre. Cryptic zoning is interpreted based on variation of trace-element patterns.

Mineralization: unknown.

Heat production (μWm^{-3}): *Lipnice Granite* 4.35.

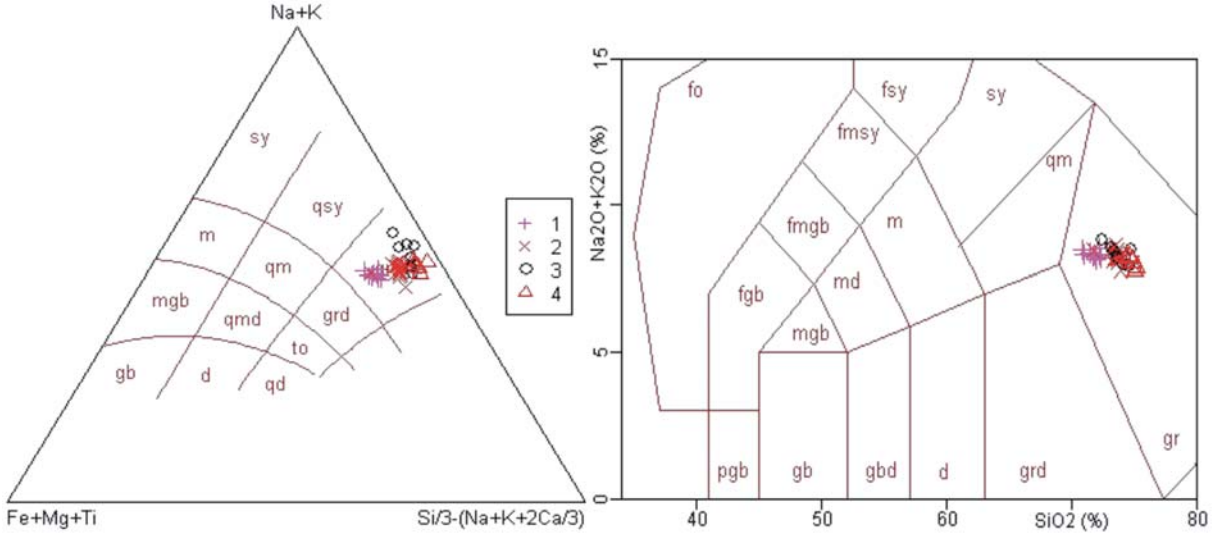

Fig. 2.14. *Melechov Massif ABQ and TAS diagrams. 1 – Lipnice Granite, 2 – Kouty and Světlá Granites, 3 – Melechov Granite, 4 – Stvořidla Granite.*

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Lipnice Granite

Quartz-rich, potassic, strongly peraluminous, leucocratic, S-type, granite

n = 13	Med.	Min	Max	QU1	QU3
SiO_2	70.61	68.91	72.49	69.88	70.85
TiO_2	0.48	0.25	0.61	0.47	0.51
Al_2O_3	14.62	14.40	15.05	14.58	14.67
Fe_2O_3	0.44	0.08	1.06	0.22	0.60
FeO	1.59	1.01	2.00	1.27	1.89
MnO	0.04	0.03	0.06	0.03	0.04
MgO	0.72	0.40	0.85	0.69	0.80
CaO	1.03	0.65	1.25	1.01	1.17
Na_2O	2.97	2.84	3.43	2.95	3.05
K_2O	5.09	4.77	5.33	5.05	5.24
P_2O_5	0.27	0.26	0.36	0.27	0.28
Li_2O	0.02	0.01	0.03	0.02	0.02
Mg/(Mg + Fe)	0.38	0.32	0.40	0.37	0.39
K/(K + Na)	0.53	0.48	0.55	0.53	0.54
Nor.Or	31.66	29.22	32.90	31.59	32.53
Nor.Ab	28.26	26.64	31.93	27.88	28.86
Nor.An	3.50	0.88	4.37	3.40	4.21
Nor.Q	29.44	27.02	31.42	28.37	29.87
Na + K	204.86	202.85	211.96	204.21	207.58
*Si	171.13	160.02	184.95	168.43	178.00
K-(Na + Ca)	-5.35	-21.00	3.16	-9.63	-4.43
Fe + Mg + Ti	52.76	32.12	60.39	50.06	56.60
Al-(Na + K + 2Ca)	44.77	36.95	52.11	39.20	48.22
(Na + K)/Ca	11.15	9.37	18.29	9.73	11.27
A/CNK	1.22	1.18	1.25	1.19	1.23

Trace elements (mean values in ppm): *Lipnice Granite* – **Co** 5, **Cr** 27, **Cu** 6, **Ga** 11, **Ni** 8, **Pb** 11, **Rb** 300, **Sn** 6, **Sr** 101, **V** 22, **Zn** 86, **Zr** 220

Kouty Granite

Quartz-rich, potassic, strongly peraluminous, leucocratic, S-type, granite

n = 20	Med.	Min	Max	QU1	QU3
SiO_2	72.54	71.09	73.63	72.08	72.79
TiO_2	0.25	0.11	0.58	0.23	0.30
Al_2O_3	14.56	14.15	15.03	14.41	14.68
Fe_2O_3	0.32	0.04	1.25	0.19	0.82
FeO	0.98	0.16	1.87	0.46	1.29
MnO	0.03	0.02	0.04	0.02	0.04
MgO	0.41	0.23	0.79	0.37	0.47
CaO	0.77	0.68	1.04	0.70	0.8
Li_2O	0.02	0.01	0.05	0.02	0.03
$7Na_2O$	3.16	2.91	3.54	3.09	3.27
K_2O	4.89	4.37	5.39	4.78	5.09
P_2O_5	0.28	0.26	0.39	0.27	0.33
Mg/(Mg + Fe)	0.34	0.29	0.39	0.32	0.36
K/(K + Na)	0.51	0.45	0.54	0.49	0.52
Nor.Or	30.10	26.58	32.95	29.29	31.02
Nor.Ab	29.57	27.14	32.69	28.71	30.46
Nor.An	1.84	1.01	3.03	1.58	2.29
Nor.Q	31.82	28.38	34.50	31.01	32.37

Na + K	207.01	194.97	214.85	205.03	211.69
*Si	186.25	170.34	199.70	181.48	187.82
K-(Na + Ca)	-11.07	-36.89	2.60	-16.94	-6.57
Fe + Mg + Ti	34.40	20.69	56.92	30.46	35.24
Al-(Na + K + 2Ca)	47.52	39.01	64.28	44.72	52.67
(Na + K)/Ca	14.99	11.41	17.66	12.89	16.39
A/CNK	1.24	1.20	1.34	1.22	1.26

Trace elements (mean values in ppm): *Kouty Granite* – **Ba** 628, **Cs** 7, **Ga** 26, Hf 5, **Li** 75, **Nb** 7, **Pb** 10, **Rb** 305, **Sc** 5, **Sr** 116, **Th** 46, **U** 6, **Y** 14, **Zn** 91, **Zr** 226, **La** 60, **Ce** 157, **Sm** 10.5, **Eu** 0.76, **Yb** 1.15, **Lu** 0.16 (Breiter and Sokol 1997).

Melechov Granite

Quartz-rich, sodic, peraluminous, leucocratic, S-type, granite

n = 8	**Med.**	**Min**	**Max**	**QU1**	**QU3**
SiO_2	72.36	70.78	73.60	71.87	72.80
TiO_2	0.10	0.08	0.14	0.09	0.13
Al_2O_3	14.96	14.44	15.86	14.71	15.47
Fe_2O_3	0.25	0.18	0.74	0.20	0.34
FeO	0.66	0.16	0.93	0.33	0.86
MnO	0.03	0.02	0.04	0.03	0.04
MgO	0.23	0.15	0.28	0.16	0.26
CaO	0.68	0.65	0.78	0.65	0.7
Li_2O	0.04	0.02	0.04	0.03	0.043
Na_2O	3.69	3.46	4.19	3.58	3.89
K_2O	4.30	4.19	4.50	4.20	4.40
P_2O_5	0.39	0.37	0.44	0.37	0.44
Mg/(Mg + Fe)	0.29	0.27	0.38	0.27	0.30
K/(K + Na)	0.43	0.40	0.45	0.41	0.44
Nor.Or	26.36	25.42	27.29	25.60	26.74
Nor.Ab	34.14	32.24	38.70	33.27	36.01
Nor.An	0.69	0.38	1.41	0.47	0.97
Nor.Q	31.29	27.23	33.89	29.34	32.92
Na + K	212.07	202.95	228.63	206.31	220.65
*Si	178.89	155.48	195.45	168.92	187.57
K-(Na + Ca)	-42.68	-54.63	-32.48	-53.64	-37.85
Fe + Mg + Ti	20.79	10.71	24.79	15.46	22.07
Al-(Na + K + 2Ca)	57.15	42.09	68.19	51.96	63.19
(Na + K)/Ca	16.96	14.83	18.98	16.07	17.81
A/CNK	1.30	1.21	1.35	1.26	1.31

Trace elements (mean values in ppm): *Melechov Granite* – **Co** 2, **Cr** 8, **Cu** 6, **Ga** 7, **Nb** 13, **Ni** 5, **Pb** 18, **Rb** 186, **Sn** 21, **Sr** 59, **V** 4, **Zn** 49, **Zr** 28.

Stvořidla Granite

Quartz-rich, sodic/potassic, peraluminous, leucocratic, S-type, granite

	5st25	**5st11**	**5st12**	**5st27**	**5st40**
SiO_2	73.74	73.32	73.79	73.78	73.24
TiO_2	0.06	0.08	0.10	0.06	0.10
Al_2O_3	14.43	14.59	14.50	14.54	14.99
Fe_2O_3	0.77	0.29	0.11	0.76	0.28
FeO	0.23	0.70	0.86	0.32	0.09
MnO	0.04	0.04	0.04	0.04	0.03
MgO	0.17	0.17	0.20	0.19	0.10

CaO	0.69	0.60	0.61	0.72	0.42
Na_2O	3.48	3.47	3.58	3.50	3.95
K_2O	4.46	4.58	4.09	4.70	3.75
P_2O_5	0.41	0.40	0.38	0.42	0.42
Li_2O	0.03	0.02	0.04	0.03	0.01
Mg/(Mg + Fe)	0.24	0.23	0.26	0.24	0.32
K/(K + Na)	0.46	0.46	0.43	0.47	0.38
Nor.Or	27.08	27.94	25.01	28.38	22.88
Nor.Ab	32.11	32.17	33.27	32.12	36.63
Nor.An	0.74	0.35	0.54	0.82	-0.71
Nor.Q	34.14	33.24	34.66	32.95	34.49
Na + K	206.99	209.22	202.37	212.74	207.09
*Si	193.90	190.41	199.75	188.02	194.24
K-(Na + Ca)	-29.91	-25.43	-39.56	-25.99	-55.33
Fe + Mg + Ti	17.82	18.60	19.57	19.44	8.50
Al-(Na + K + 2Ca)	51.77	55.90	60.63	47.12	72.31
(Na + K)/Ca	16.82	19.55	18.60	16.57	27.65
A/CNK	1.28	1.29	1.32	1.25	1.39

Trace elements (mean values in ppm): *Stvořidla Granite* – **Co** 1, **Cr** 7, **Cu** 3, **Ga** 5, **Nb** 15, **Ni** 4, **Pb** 16, **Rb** 279, **Sn** 41, **Sr** 41, **V** 2, **Zn** 48, **Zr** 36.

2.1.1.04 ČEŘÍNEK STOCK

Regional position: Moldanubian Zone. A member of the Eisgarn Composite Pluton. The stock is intruded into the Mrákotín Granite.

Rock types:

1. Čeřínek Granite (central facies) – porphyritic coarse-grained two-mica granite.

2. Čeřínek Granite (marginal facies) – ± porphyritic medium-grained biotite-muscovite granite.

Size and shape (in erosion level): 35 km^2 (8.5 × 5,5 km), E-W trending stock.

Age and isotopic data: no isotopic data.

Temporal (field) relations: Mrákotín Granite (Bílý Kámen Granite – regional facies) → Čeřínek Granite.

Geological environment: the Mrákotín (Bílý Kámen) Granite, paragneiss.

Contact aureole: not described.

Zoning: concentric reverse zonation with transitional porphyritic marginal facies.

Mineralization: not reported.

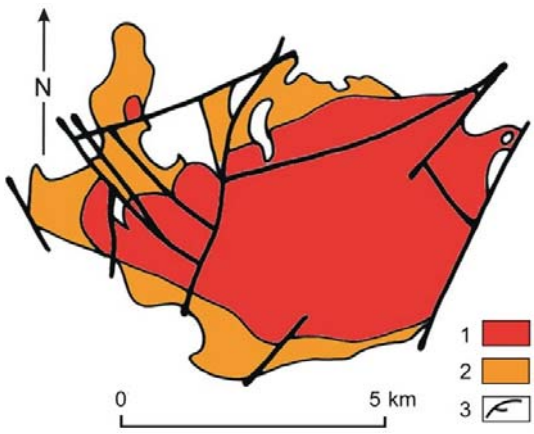

Fig. 2.15. *Čeřínek Stock geological sketch-map (adapted after the geological map 1 : 50,000, Veselá 1989 and 1992). 1 – Čeřínek Granite (central facies), 2 – Čeřínek Granite (marginal facies), 3 – faults.*

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Čeřínek Granite

Quartz-rich, sodic/potassic, peraluminous, leucocratic, S-type, granite

	Ce8068J	8067JAN	8066CEJ	8065ČEŘ	8064BOR	8163ČEŘ
SiO_2	73.28	74.15	72.37	73.12	74.38	73.22
TiO_2	0.20	0.11	0.22	0.15	0.15	0.21
Al_2O_3	14.31	14.43	14.33	14.48	13.83	14.43
Fe_2O_3	0.65	0.69	0.90	0.69	0.44	1.03
FeO	0.66	0.51	0.46	0.61	0.81	0.37
MnO	0.03	0.03	0.02	0.03	0.03	0.03
MgO	0.35	0.26	0.38	0.35	0.24	0.33
CaO	0.88	0.98	0.87	0.78	1.01	0.71
Na_2O	3.06	3.71	3.07	3.34	3.28	3.25
K_2O	5.59	4.27	5.43	4.76	4.75	4.69
P_2O_5	0.19	0.17	0.22	0.28	0.12	0.28
Li2O	0.01	0.01	0.01	0.03	0.01	0.03
Mg/(Mg + Fe)	0.33	0.29	0.34	0.33	0.26	0.31
K/(K + Na)	0.55	0.43	0.54	0.48	0.49	0.49
Nor.Or	33.85	25.72	33.17	28.98	28.85	28.57
Nor.Ab	28.16	33.97	28.51	30.90	30.28	30.09
Nor.An	3.20	3.80	2.94	2.10	4.37	1.74
Nor.Q	30.58	32.33	30.59	32.52	32.85	33.57
Na + K	217.43	210.38	214.36	208.85	206.70	204.46
*Si	178.65	189.34	176.79	187.54	193.94	193.31
K-(Na + Ca)	4.25	-46.53	0.71	-20.62	-23.00	-17.96
Fe + Mg + Ti	28.53	23.58	29.87	27.70	24.63	28.88
Al-(Na + K + 2Ca)	32.20	38.04	36.02	47.69	28.87	53.60
(Na + K)/Ca	13.86	12.04	13.82	15.02	11.48	16.15
A/CNK	1.15	1.17	1.17	1.23	1.13	1.27

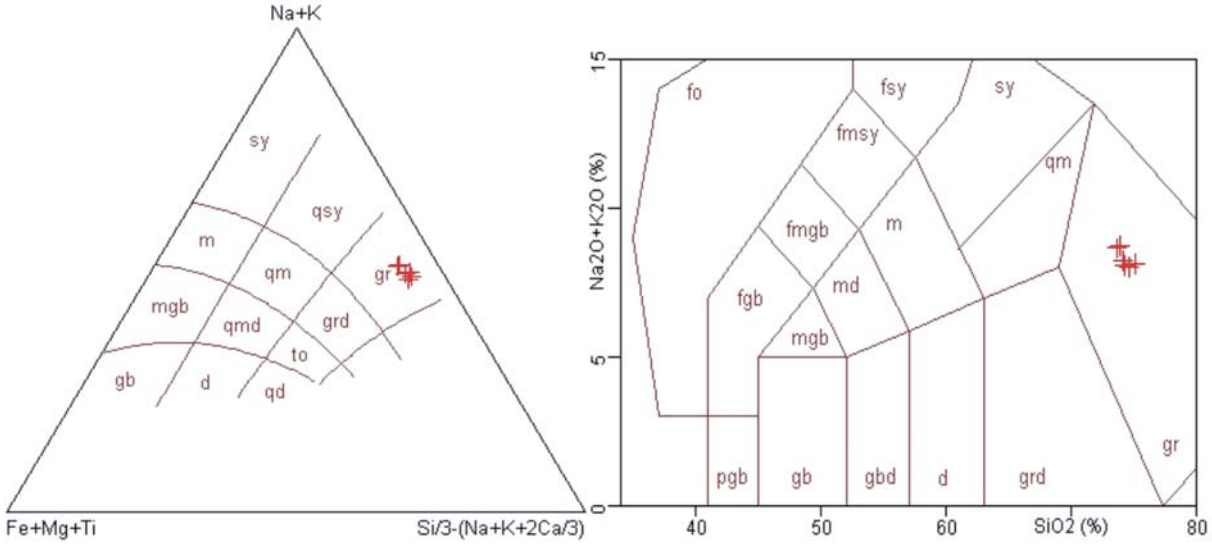

Fig. 2.16. *Čeřínek Granite ABQ and TAS diagrams.*

2.1.1.05. ZVŮLE (LANDŠTEIN) STOCK

Regional position: Moldanubian Zone. A member of the Eisgarn Composite Pluton. The Číměř Granite is intruded by the Zvůle Stock.

Rock types:

Zvůle Granite – medium- to coarse-grained slightly porphyritic two-mica granite.

Size and shape (in erosion level): circular shape in the diameter of ca. 5 km (20 km^2).

Age and isotopic data: 320.5 ± 2.7 Ma (Rb-Sr whole rock).

Temporal (field) relations: Eisgarn Granite s.l. → Zvůle (Landštejn) Granite → Homolka Granite → Felsic Dyke Swarm.

Geological environment: Číměř Granite, and paragneisses.

Contact aureole: not described.

Zoning: reverse zonation with the most evolved facies along the endocontact.

Mineralization: not reported.

Heat production (μWm^{-3}): *Zvůle Granite* 1.56.

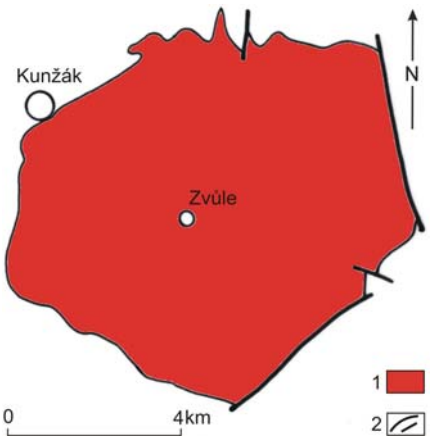

Fig. 2.17. *Zvůle Stock geological map (adapted after Breiter 1998). 1 – Zvůle Granite, 2 – faults.*

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Zvůle Granite

Quartz-rich, potassic, peraluminous, leucocratic, S-type, granite

	Zv8141M	8140HEŘ	8139VAL	8138ZVŮ
SiO_2	72.18	72.96	73.62	72.88
TiO_2	0.38	0.27	0.15	0.20

Al_2O_3	14.34	14.33	14.36	14.40
Fe_2O_3	0.70	0.85	0.91	0.76
FeO	1.17	0.48	0.21	0.57
MnO	0.03	0.01	0.02	0.03
MgO	0.60	0.37	0.31	0.36
CaO	0.83	0.74	0.74	0.87
Na_2O	2.67	2.70	3.20	3.22
K_2O	5.33	5.63	4.81	4.66
P_2O_5	0.28	0.21	0.27	0.28
Li2O	0.01	0.01	0.02	0.02
Mg/(Mg + Fe)	0.37	0.34	0.34	0.33
K/(K + Na)	0.57	0.58	0.50	0.49
Nor.Or	32.82	34.40	29.25	28.51
Nor.Ab	24.98	25.07	29.58	29.94
Nor.An	2.35	2.37	1.96	2.59
Nor.Q	32.75	32.72	33.67	33.28
Na + K	199.33	206.67	205.39	202.85
*Si	191.24	189.30	194.24	191.13
K-(Na + Ca)	12.21	19.21	-14.33	-20.48
Fe + Mg + Ti	44.71	29.90	23.90	28.90
Al-(Na + K + 2Ca)	52.68	48.35	50.22	48.91
(Na + K)/Ca	13.47	15.66	15.56	13.08
A/CNK	1.27	1.23	1.25	1.24

Trace elements (ppm): **Rb** 349, **Sr** 66, **Zr** 55, **Zn** 75, **Nb** 14, **Pb** 22, **Ga** 31, **V** 6, **Th** 8.7, **U** 6.

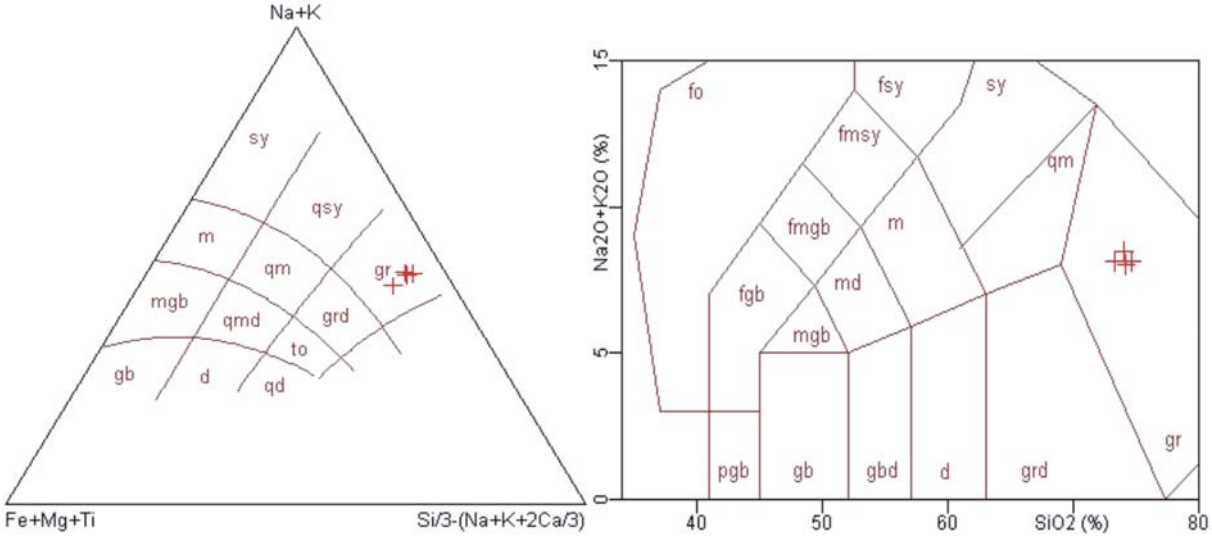

Fig. 2.18. *Zvůle Granite ABQ and TAS diagrams.*

2.1.1.06. EISGARN MASSIF

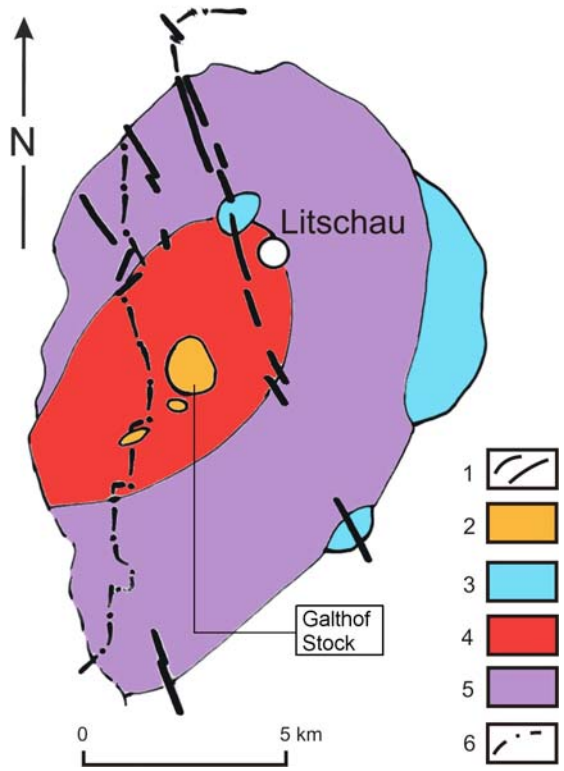

Fig. 2.19. *Eisgarn Massif geological sketch-map (after Breiter 1998). 1 – Litschau Dyke Swarm, 2 – Galthof Granite, 3 – Eisgarn Granite (fine-grained variety) 4 – Eisgarn Granite (central facies), 5 – Eisgarn Granite (marginal facies), 6 – state border.*

Regional position: an internal massif in the Eisgarn Composite Pluton (an integral part of the South Bohemian Batholith) within the Moldanubian Zone.

Rock types:

1. *Eisgarn Granite s.s.(marginal facies)* – locally porphyritic coarse-grained two-mica granite (petrographically resembles the Lanštejn type granite).
2. *Eisgarn Granite* s.s. (central facies) – non-porphyritic medium-grained two-mica granite (petrographically resembles the Číměř Granite).
3. *Eisgarn Granite s.s.* – fine-grained two-mica granite. Several oval or long shape (up to 9 × 3 km) bodies inside of the Eisgarn Massif and along its margin.
4. *Galthof Granite (Homolka – type Granite)* – fine-grained muscovite alkali-feldspar granite forming a small stock) 1.5 km^2 and larger irregular bodies in the centre of the Eisgarn Massif (see 2.1.1.7. Galthof Stock).
   Three textural varieties: a medium-grained porphyritic, a medium-grained equigranular, and fine-grained one.
5. *Josefthal Granite* – fine-grained granite (a member of the Litschau Dyke Swarm)

Size and shape (in erosion level): long oval (elliptical) shape 110 km^2 (16 × 10 km).

Age and isotopic data: *Galthof Granite* 317 ± 8 Ma and 306 ± 7 Ma (Rb-Sr whole rock), the Eisgarn Granite s.s. intrudes the Číměř Granite.

Geological environment: sillimanite-biotite paragneisess, the Číměř Granite and the Lásenice Granite.

Contact aureole: periplutonic migmatitization of the Moldanubian paragneisses.

Zoning: petrographically and chemically well zoned body with normal concentric zonation.

Mineralization: not reported.

Heat production (μWm^{-3}): 4.31–7.07.

Eisgarn Granite s.s.

Quartz-rich, sodic/potassic, peraluminous, leucocratic, S-type, granite

n = 8	Median	Min	Max	QU1	QU3
SiO_2	73.87	72.64	75.43	73.67	74.49
TiO_2	0.12	0.03	0.27	0.07	0.13
Al_2O_3	14.15	12.96	14.81	13.13	14.50
Fe_2O_3	0.25	0.12	0.42	0.12	0.32
FeO	0.53	0.24	1.34	0.36	0.70
MnO	0.01	0.01	0.05	0.01	0.03
MgO	0.12	0.01	0.44	0.02	0.13
CaO	0.42	0.14	0.83	0.38	0.45
Na_2O	3.35	2.79	4.33	2.98	3.46

K_2O	4.82	3.78	5.38	4.12	4.97
P_2O_5	0.27	0.22	0.82	0.25	0.33
Li_2O	0.020	0.005	0.045	0.011	0.024
Mg/(Mg + Fe)	0.20	0.04	0.32	0.04	0.25
K/(K + Na)	0.49	0.36	0.54	0.42	0.52
Nor.Or	29.23	22.83	32.82	25.10	30.48
Nor.Ab	30.74	26.07	39.75	27.78	32.08
Nor.An	0.24	-3.25	2.03	-0.78	0.41
Nor.Q	34.48	31.60	37.02	31.61	35.65
Na + K	207.20	192.37	225.88	199.74	210.87
*Si	196.87	182.02	211.85	183.25	209.02
K-(Na + Ca)	-13.18	-67.49	1.87	-39.20	0.00
Fe + Mg + Ti	15.01	5.47	36.72	13.37	16.85
Al-(Na + K + 2Ca)	49.30	18.41	80.01	37.84	60.11
(Na + K)/Ca	26.93	14.18	80.01	15.63	29.79
A/CNK	1.27	1.10	1.43	1.20	1.32

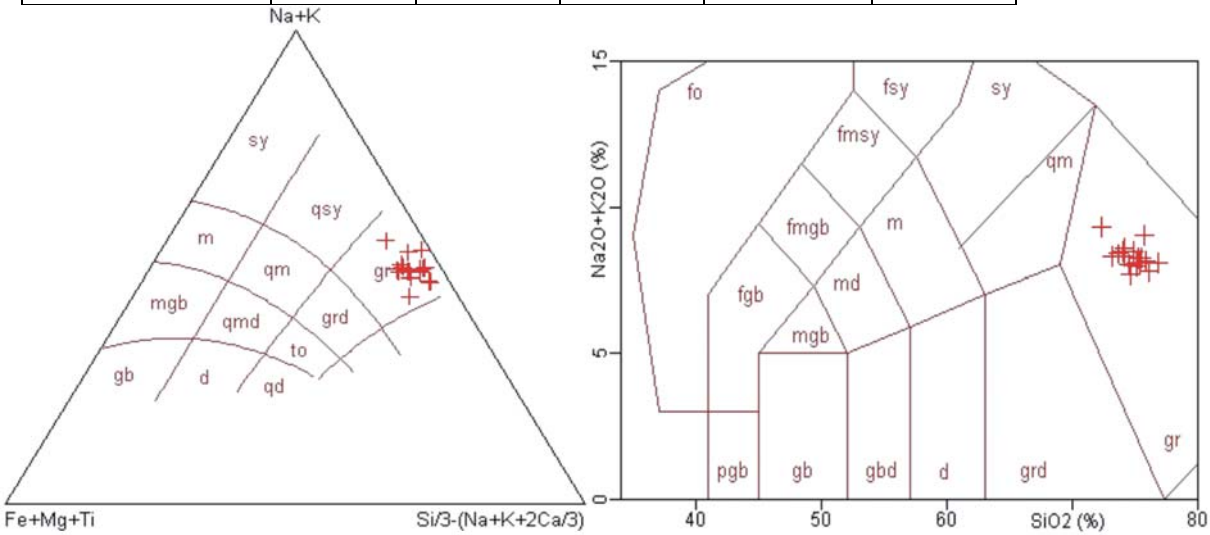

Fig. 2.20. *Eisgarn Granite s.s. ABQ and TAS diagrams.*

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2.1.1.07. GALTHOF STOCK

Geological position: Moldanubian Zone. A member of the Homolka Group in Eisgarn Massif (the Eisgarn Composite Pluton).

Rock types: *Galthof Granite* – medium-grained muscovite granite. Three textural varieries: a medium-grained porphyritic, a medium-grained equigranular, and a fine-grained ones.

The Galthof Granite subtype is the Hoher Berg Granite. The subtype Lunkowitzwald Granite can be distinguished from the main Galthof intrusion by geochemistry.

Porphyry dykes are associated to the Galthof Granite.

Size and shape (in erosion level): oval shape of the stock in diameter of 1.2 km (1.5 km^2), and two small outcrops (< 0.1 km^2).

Age and isotopic data: 319 ± 2.4 Ma (Rb-Sr whole rock), 306.4–313 Ma (Ar-Ar muscovite), The Hoher Berg Granite

317 ± 8 Ma (Rb-Sr whole rock). The Lunkowitzwald Granite 306 ± 7 Ma (Rb-Sr whole rock). The Galthof Granite is one of the youngest members of MCB (subvolcanic high-level intrusion).

Geological environment: Eisgarn Granite s.s.

Contact aureole: not reported.

Zoning: not reported.

Mineralization: not reported.

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Galthof Granite

Quartz-normal, sodic, peraluminous, leucocratic, S-type, granite

	Galt2631	**Galt2628**
SiO_2	71.96	74.72
TiO_2	0.07	0.07
Al_2O_3	15.62	14.62
Fe_2O_3	0.32	0.42
FeO	0.45	0.40
MnO	0.03	0.03
MgO	0.06	0.10
CaO	0.46	0.51
Na_2O	4.70	3.80
K_2O	3.99	4.09
P_2O_5	0.46	0.45
Mg/(Mg+Fe)	0.12	0.18
K/(K+Na)	0.36	0.41
Nor.Q	27.70	34.89
Nor.Or	24.02	24.60
Nor.Ab	43.01	34.73
Nor.An	-0.74	-0.44
Na+K	236.38	209.46
*Si	157.37	199.00
K-(Na+Ca)	-75.15	-44.88
Fe+Mg+Ti	12.64	14.19

Al-(Na+K+2Ca)	53.95	59.45
(Na+K)/Ca	28.82	23.03
A/CNK	1.27	1.32

Trace elements (mean values in ppm): *Galthof Granite* – **Nb** 31**, Rb** 654**, Sn 22, Sr <**7**, Zn** 70**, Zr** 19.

2.1.1.08. HOMOLKA STOCK

Regional position: Moldanubian Zone. A member of the Eisgarn Composite Pluton. The stock is intruded along the contact between the Lásenice and Číměř Granites. omolka Stock is of the youngest members of MCB (subvolcanic high-level intrusions).

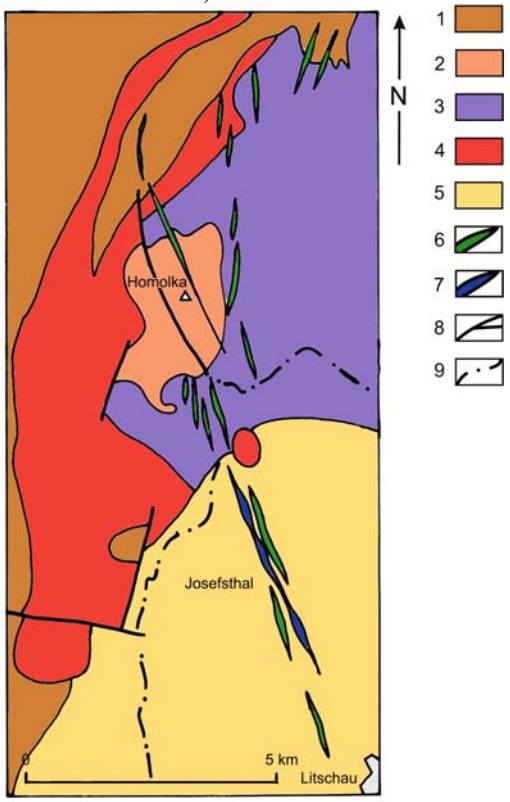

Fig. 2.21. *Homolka Stock and Litschau Dyke Swarm geological map (adapted after Breiter 1998.) 1 – gneiss, 2 – Homolka Granite, 3 – Číměř Granite, 4 – Lásenice Granite, 5 – Eisgarn Granite, 6 – Granite porphyry, 7 – Josefsthal Dyke Granite, 8 – fault, 9 – state border.*

Rock types:

1. *Homolka Granite* – equigranular medium-grained topaz-bearing leucocratic (muscovite) alkali-feldspar granite. A porphyritic variety is developed in the W part of the body.
2. *Marginal Pegmatite* (stockscheider) – megacrystic K-feldspar fine-grained granite in some parts at the S and W contacts of the stock.

Size and shape (in erosion level): 6 km^2 (3.5 × 2 km), NNE-SSW trending stock.

Age and isotopic data: *Homolka Granite* 317 ± 2, 315 ± 3, Ma (Rb-Sr muscovite), 320 ± 4 Ma (Rb-Sr whole rock).

Temporal (field) relations: Eisgarn granites → Landštejn granites → Homolka Granite → Felsic Dyke Swarm.

Geological environment: the Lásenice and Číměř Granites, granite porphyries.

Contact aureole: not described.

Zoning: xenoliths of Eisgarn type granite, and granite porphyries in the central part of the body.

Mineralization: greisenization and sub-economic dissemination of cassiterite, ferro-columbite, ferro-tantalite, and U-micas.

Heat production (μWm^{-3}): *Homolka Granite* 1.52.

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Homolka Granite

Quartz-normal, sodic, peraluminous, leucocratic, S-type, alkali-feldspar granite

	Ho2511	**Ho2444**	**Ho2457**	**Ho2458**
SiO_2	73.63	72.33	73.11	73.37
TiO_2	0.05	0.02	0.01	0.03
Al_2O_3	14.77	15.36	14.94	15.08
Fe_2O_3	0.07	0.80	0.62	0.41
FeO	0.67	n.d.	n.d.	n.d.
MnO	0.04	0.03	0.20	0.04
MgO	0.07	0.04	0.04	0.04
CaO	0.46	0.42	0.63	0.58
Na_2O	3.99	4.44	4.50	5.01
K_2O	3.83	3.72	3.69	3.64
P_2O_5	0.54	0.43	0.93	0.78
Mg/(Mg + Fe)	0.14	0.09	0.09	0.15
K/(K + Na)	0.39	0.36	0.35	0.32
Nor.Or	23.31	22.54	22.16	21.67
Nor.Ab	36.91	40.89	41.08	45.32
Nor.An	0.02	0.07	0.06	0.02
Nor.Q	34.05	30.91	32.06	29.13
Na + K	210.08	222.26	223.56	238.96
*Si	192.94	174.02	174.55	161.19

K-(Na + Ca)	-55.64	-71.78	-78.10	-94.73
Fe + Mg + Ti	12.57	11.27	8.89	6.51
Al-(Na + K + 2Ca)	63.57	64.40	47.36	36.50
(Na + K)/Ca	25.61	29.68	19.90	23.10
A/CNK	1.36	1.33	1.31	1.23

Trace elements (mean values in ppm): *Homolka Granite* – **Ba** 35, **Cs** 75, **Ga** 35, **Hf** 1.3, **Li** 500, **Nb** 51, **Pb** 6, **Rb** 1145, **Sr** 0.8, **Th** 0.8, **U** 4.2, **Y** 3, **Zn** 93, **Zr** 13, **La** 26, **Ce** 61, **Sm** 5.7, **Eu** 0.57, **Yb** 1, **Lu** 0.1 (Breiter and Sokol 1997).

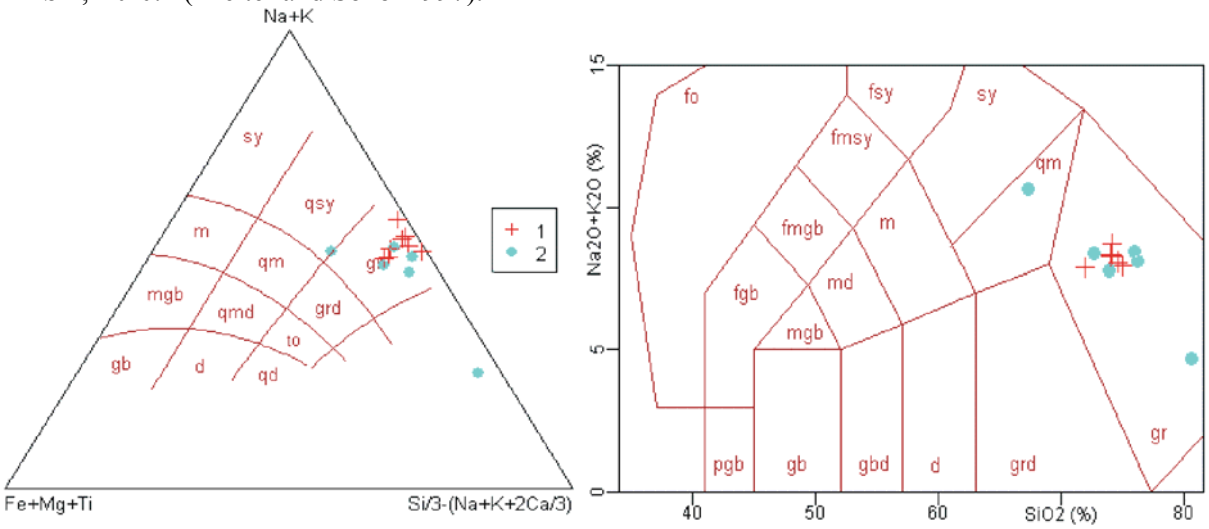

Fig. 2.22. *Homolka and Kozí hora/Hirschenschlag Granites ABQ and TAS diagrams. 1 – Homolka Granite, 2 – Kozí hora Granite.*

2.1.1.09. KOZÍ HORA/HIRSCHENSCHLAG STOCK

Geological position: Moldanubian Zone. A member of the Eisgarn Composite Pluton.

Rock types: *Kozí hora-Hirschenschlag Granite* – biotite magnetite-bearing leucogranite

Porphyry dykes are associated to the Late-Variscan Kozí hora/Hirschenschlag Granite.

Size and shape (in erosion level): ring-shaped structure of small stocks, porphyry dykes and zones of greisenisation and metasomatic potash-feldspatization in diameter of 5 km.

Age and isotopic data: 316 ± 1.6 Ma (Ar-Ar muscovite). One of the youngest members of MCB are subvolcanic high-level intrusions.

Geological environment: Číměř Granite.

Contact aureole: greisenization and K-feldspatization of the Číměř Granite.

Zoning: circular arrangement of porphyry dykes, dykes of feldspatites, greisens, and quartz veins around the granite outcrop.

Mineralization: quartz veins and greisens with pyrite, magnetite, molybdenite, fluorite, and beryl.

2.1.2. WEINSBERG COMPOSITE PLUTON

Regional position: southern part of the Moldanubian Composite Batholith (a group of eastern plutons).

Rock types:

A. Basic Intrusions

1. *Gebharts (Quartz) Diorite* – several small bodies (up to 20 km^2 but usually 1–4 km^2).
2. *Kleinzwettl Gabbro* – quartz diorite to diorite – located within the Weinsberg Granite-Granodiorite along the NE-SW discrete zone in the northeastern part of the pluton.

B. Weinsberg Group

Weinsberg Granite-Granodiorite – porphyritic (megacrystic) biotite granodiorite – facies (see Fig. 2.23. 2.24.):

Weinsberg 1 Granite – very coarse-grained biotite ± quartz-poor granite to quartz monzodiorite.

Weinsberg 2 Granite – very coarse-grained biotite ± garnet ± cordierite granite.

Srní Granite – porphyritic biotite granite

Sarleinsbach Quartz Monzonite (mafic variety of the Weinsberg Granite-Granodiorite) – porphyritic coarse-grained pyroxene-bearing biotite quartz monzonite.

"Schlieren Granite" – coarse-grained biotite ± hornblende granite-granodiorite (in situ melt)

Migma Granite – (completely melted granite from Peuerbach and Schärding Granites)

Sauwald Diatexite – medium-grained biotite ± cordierite granite to tonalite.

Orbicular Granite (a small body in the Weinsberg Granite-Granodiorite) – biotite-cordierite granodiorite (plagioclase, biotite, cordierite and quartz). The orbicules develop around nuclei of cordierite-biotite gneisses and sillimanite-biotite schists.

Autochthonous S-type granitoids:

Plöchwald Granite – coarse-grained two-mica granite

Plessberg Granite – fine-grained hornblende-bearing biotite granite.

C. Mauthausen Group

Freistadt Granodiorite (~ 400 km^2) – biotite ± hornblende granodiorite and quartz diorite.

"Marginal type – coarse-grained granodiorite,

"Central type" – medium-grained quartz diorite)

Fine-grained type – fine-grained variety of Freistadt Granodiorite intruded as a separate phase (mixing member with the Mauthausen Granite?) – medium-grained biotite granite with porphyritic marginal facies. The fine-grained granite is similar in age and composition to the Mauthausen Granite.

Weitra Granite – fine-grained biotite granite (main type, western subtype and Schützenberg type), magnetic and non-magnetic varieties.

Reinpolz Granite – fine-grained biotite granite that forms small bodies NW of Weitra.

Karlstift Granite – fine- to medium-grained biotite granite (fine-grained and porphyritic facies). Reaction product of the Freistadt and Weinsberg Granite-Granodiorites.

Engerwitzdorf Granite – porphytitic biotite granite (equivalent of the Karlstift Granite).

Plöcking Granite – fine-medium-grained biotite granite (isolated oval stock).

Mauthausen Granite (~ 375 km^2) – fine-medium-grained biotite granite. The name of the Mauthausen Granite is applied to several intrusive bodies with similar textural characteristics, which can have different intrusion histories (the Karlstein, Plöcking, Schrems Granites). Some of them are intruding the Weinsberg Granite-Granodiorite (e.g. the Schrems Granite is an isolated body (5 x 2 km in size) located at the northern Weinsberg Granite-Granodiorite margin.

D. Eisgarn Group (also a member of the Eisgarn Composite Pluton)

Eisgarn Granite s.l.:

Altenberg Granite – fine-grained biotite-muscovite) granite.
Haibach Granite – fine- to medium-grained two-mica granite.
Žofín Granite (Aussengranite) – equigranular ± porphyritic medium-grained muscovite-biotite granite (resembles the Mrákotín Granite).
Mandelstein Granite – coarse-grained two-mica granite (core and rim facies).

<u>*E. Homolka Group*</u> (also a member of the Eisgarn Composite Pluton)
Unterlembach Granite – leucocratic, medium-grained muscovite alkali-feldspar granite.
Pyhrabruck-Nakolice Granite – leucocratic, medium-grained muscovite topaz-bearing alkali-feldspar granite.
Windhang Granite.
Nebelstein Granite – muscovite – two-mica to biotite (at depth) alkali-feldspar granite.
Šejby Dyke-Granite – aplitic to pegmatitic muscovite alkali-feldspar granite
Lagerberg Granite – (marginal facies of the Pyhrabruck-Nakolice Granite) – non-porphyritic medium-grained two-mica alkali-feldspar granite.

Size and shape (in erosion level): ~ 3200 km^2, a triangular shape, the dominant Weinsberg Granite-Granodiorite is intruded by a set of massifs and stocks of younger granites (e.g. the Nebelstein Stock). The Weinsberg Granite-Granodiorite plunges towards the S beneath "perlgneiss".
Perldiatexite – elongated body several km wide and up to several tens km long in the Danube Valley (Mühlviertel Zone and Sauwald Zone).
Pyhrabruck-Nakolice Granite forms small stock (5 km^2) in the Mandelstein Granite. The Unterlembach Granite forms two systems of dykes (5–20 m) and three stocks cutting the Eisgarn Granite s.s. The Šejby Dyke Granite consists of several N-S trending dykes in the Weinsberg Granite-Granodiorite.

Age and isotopic data:
BASIC INTRUSIONS
Gebharts Diorite 327.4 ± 0.8 Ma (U-Pb zircon).
WEINSBERG GROUP
Weinsberg Granite-Granodiorite 328 ± 6 Ma (U-Pb zircon), 322 ± 4 Ma (SHRIMP U-Pb zircon), 323–328 Ma (Pb-Pb monazite), 357 ± 9–321 ± 12 Ma (U-Pb zircon), 349 ± 4 Ma (Rb-Sr, whole rock) 314.4 ± 2 Ma (Ar-Ar mica). *Sarleinsbach Quartz Monzonite* 355 ± 9 Ma, 345 ± 5 Ma (U-Pb zircon), 322 ± 4 Ma (SHRIMP zircon), 323 Ma (U-Pb zircon), *Sauwald Diatexite* 316 ± 1 Ma (U-Pb zircon).
MAUTHAUSEN GROUP
Freistadt Granodiorite 302 ± 2 Ma (Pb-Pb monazite), 329 ± 7 Ma (Rb-Sr muscovite). *Mauthausen Granite* 365 ± 8 Ma (Rb-Sr whole rock), 324 ± 4 Ma (Rb-Sr muscovite), 316 ± 1 Ma (U-Pb zircon). *Karlstift Granite* 376 ± 9 Ma (Rb-Sr whole rock).
EISGARN GROUP
Altenberg Granite 310 Ma (U-Pb zircon, monazite), 293.4 ± 1.5 Ma (Ar-Ar mica). *Sulzberg Granite* 326 Ma (U-Pb zircon), *Žofín Granite* 324 ± 14 Ma (Rb-Sr erochron, whole rock), *Mandelstein Granite* 314-–307 ± 2 Ma (Ar-Ar muscovite), *Weitra Granite* 305 ± 2, 311 ± 3 Ma (Ar-Ar muscovite), *Žofín Granite* 313–303 ± 2–3 Ma (Ar-Ar muscovite).
HOMOLKA GROUP
Pyhrabruck Granite 314 ± 6 Ma (Rb-Sr whole rock), *Lagerberg Granite* 313 ± 7 Ma (Rb-Sr whole rock), *microgranodiorite dyke* ca. 270 Ma (Ar-Ar hornblende), *Nakolice Granite* 296 ± 31 Ma (Rb-Sr whole rock), *Pyhrabruck-Nakolice* 314–312 Ma (Ar-Ar muscovite), *Šejby Granite* 301 ± 41 Ma (Rb-Sr whole rock). *Nebelstein Granite* 311.6 ± 1.4 Ma (Rb-Sr whole rock), 312–308 Ma (Ar-Ar muscovite),310 ± 1.9, 310.9 ± 2.0 Ma (Rb-Sr biotite), 307.8 ± 1.9, 306.1 ± 1.7 Ma (Rb-Sr muscovite).

<u>*Temporal (field) sequence:*</u> Gebharts Diorites → Weinsberg Granite-Granodiorite → Freistadt Granodiorite – Karlstift Granite ? Reinpolz Granite – Weitra Granite → Mauthausen Granite → Altenberg Granite → Žofín Granite → Mandelstein Granite → muscovite granites of Unterlembach, Oberlembach and Pyhrabruck-Nakolice bodies.
The Mandelstein Granite is intruded by the Pyhrabruck-Nakolice Granite. Roof pendants and giant xenoliths of fine-grained porphyritic biotite-muscovite granite within the Mandelstein Granite (probably the Žofín Granite).
Dykes of the Schrems and Eisgarn Granites intrude the Gebharts Diorite. The Schrems

Granite encloses Weinsberg Granite-Granodiorite xenoliths. The Plessberg Granite is younger than the Weinsberg and Plöchwald Granites.

Geological environment: Proterozoic gneisses.

Contact aureole: Periplutonic migmatization of the Moldanubian paragneisses (older than granites). Transition zone between the Weinsberg Granite-Granodiorite and paragneiss (pearl gneiss).

Zoning: the Weinsberg Granite-Granodiorite is chemically homogeneous intrusion. The Mandelstein body is chemically concentric zoned with the core enriched in Na, Rb, Li, F, P, and U. Structural zonation in the Karlstift Granite is indicated by the porphyritic facies at the pericontact and the equigranular facies in the inner part of the body. The Mandelstein Granite consists of the core facies and the rim facies (coarse-grained two-mica granites).

Mineralization: greisenization and K-feldspatization of the Eisgarn granites s.l. is associated with sub-economic Mo, U, Sn-W-Nb-Ta mineralization.

Heat production (μWm^{-3}): *Weinsberg Granite-Granodiorite* 3.5–5.0, *Freistadt Granodiorite* 2.69, *Mauthausen Granite* 4.03, 5.41, *Schrems Granite* 5.41, *Gebharts Diorite* 3.01.

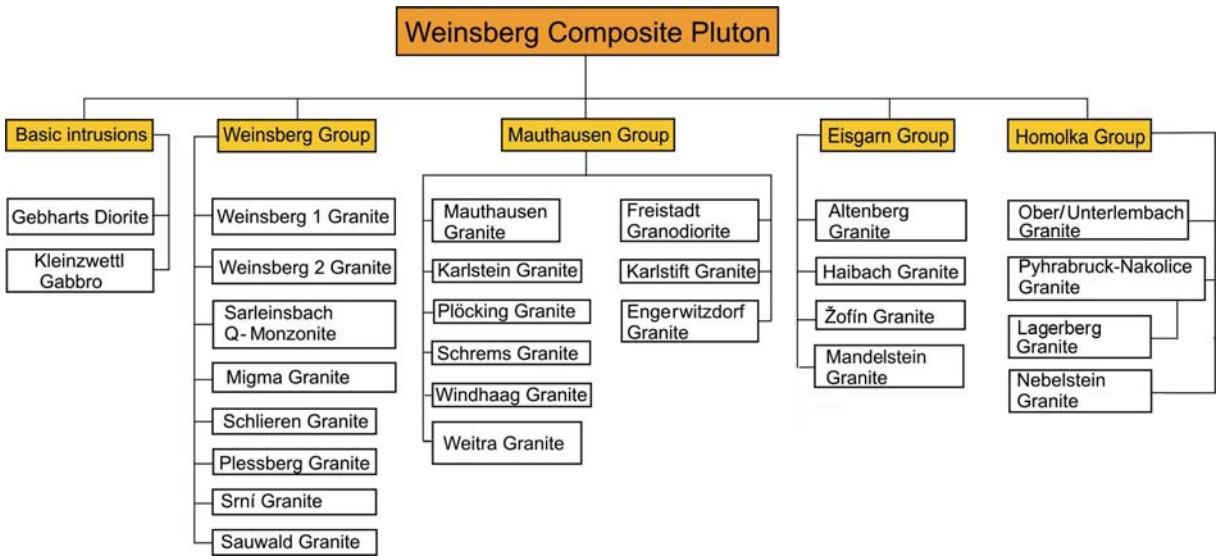

Fig. 2.23. *Weinsberg Composite Pluton hierarchic scheme according to rock groups and rock types.*

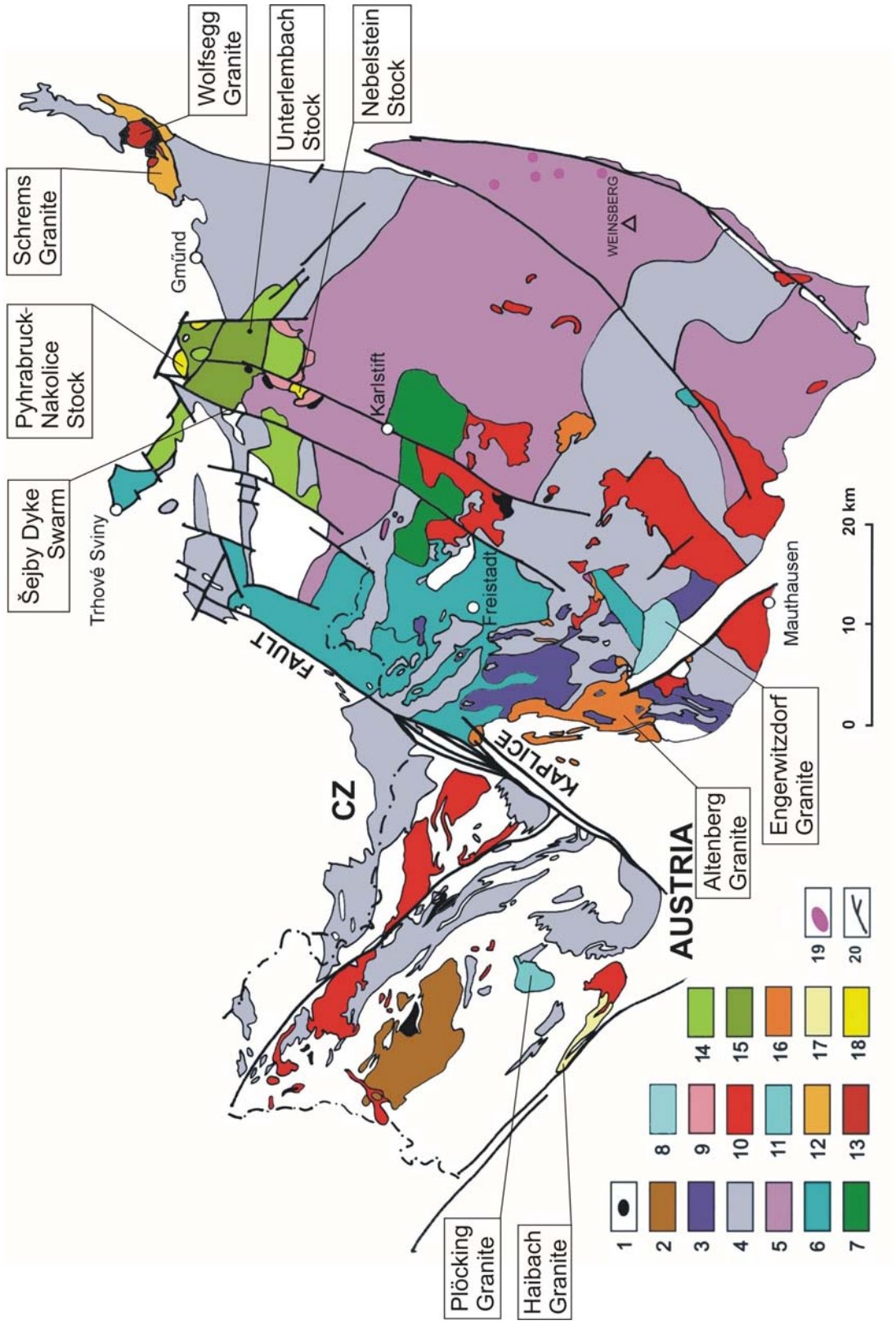

Fig. 2.24. *Weinsberg Composite Pluton geological-sketch-map (adapted after Vellmer and Wedepohl 1994, Gerdes et al. 1998, Breiter and Scharbert 2006). 1 – basic intrusions, 2 – Sarleinsbach Q-Monzonite, 3 – Schlieren Granite, 4 – Weinsberg 1 Granite-Granodiorite, 5 – Weinsberg 2 Granite, 6 – Freistadt Granodiorite,7 – Karlstift Granite, 8 – Engerwitzdorf Granite, 9 – Weitra Granite, 10 – Mauthausen Granite, 11 – Plöcking Granite, 12 – Schrems Granite, 13 – Wolfsegg Granite, 14 – Žofín Granite, 15 – Mandelstein Granite, 16 – Altenberg Granite, 17 – Haibach Granite, 18 – Pyhrabruck-Nakolice and Nebelstein Granites, 19 – Young granite stocks and aplite, 20 – faults.*

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Weinsberg Granite to Granodiorite

Large variation in composition. Quartz-poor to quartz normal, potassic, peraluminous, mesocratic, S-type, I-& M- series, granodiorite to quartz monzonite

n = 22	Med.	Min	Max	QU1	QU3
SiO_2	67.22	61.07	71.10	65.42	69.02
TiO_2	0.64	0.30	1.05	0.53	0.78
Al_2O_3	15.25	12.17	17.71	14.30	15.97
Fe_2O_3	0.82	0.18	3.28	0.45	1.12
FeO	2.65	2.02	4.88	2.45	3.33
MnO	0.04	0.00	0.12	0.02	0.05
MgO	0.94	0.47	2.17	0.87	1.12
CaO	2.05	1.16	3.11	1.56	2.36
Na_2O	3.09	2.82	4.00	2.95	3.28
K_2O	5.33	2.58	7.16	4.51	5.60
P_2O_5	0.26	0.15	0.69	0.19	0.32

Mg/(Mg + Fe)	0.32	0.14	0.43	0.28	0.36
K/(K + Na)	0.51	0.33	0.61	0.49	0.54
Nor.Or	32.85	16.31	44.16	28.29	35.01
Nor.Ab	29.74	26.65	37.13	27.76	31.33
Nor.An	8.52	4.73	15.02	6.40	10.15
Nor.Q	18.68	7.11	31.69	17.53	26.77
Na + K	212.88	166.11	249.80	196.37	228.12
*Si	120.59	66.17	186.78	112.80	154.25
K-(Na + Ca)	-27.43	-97.92	12.16	-39.06	-16.79
Fe + Mg + Ti	89.20	50.04	138.69	72.86	95.02
Al-(Na + K + 2Ca)	1.21	-23.27	55.23	-5.82	25.85
(Na + K)/Ca	5.94	3.56	10.27	4.69	7.08
A/CNK	1.02	0.94	1.25	1.00	1.11

Trace elements (mean values in ppm): *Weinsberg Granodiorite* – **Ba** 950, **Li** 30, **Nb** 8, **Pb** 35, **Rb** 170, **Sr** 160, **Zn** 6, **Zr** 200. (Breiter and Sokol 1997).

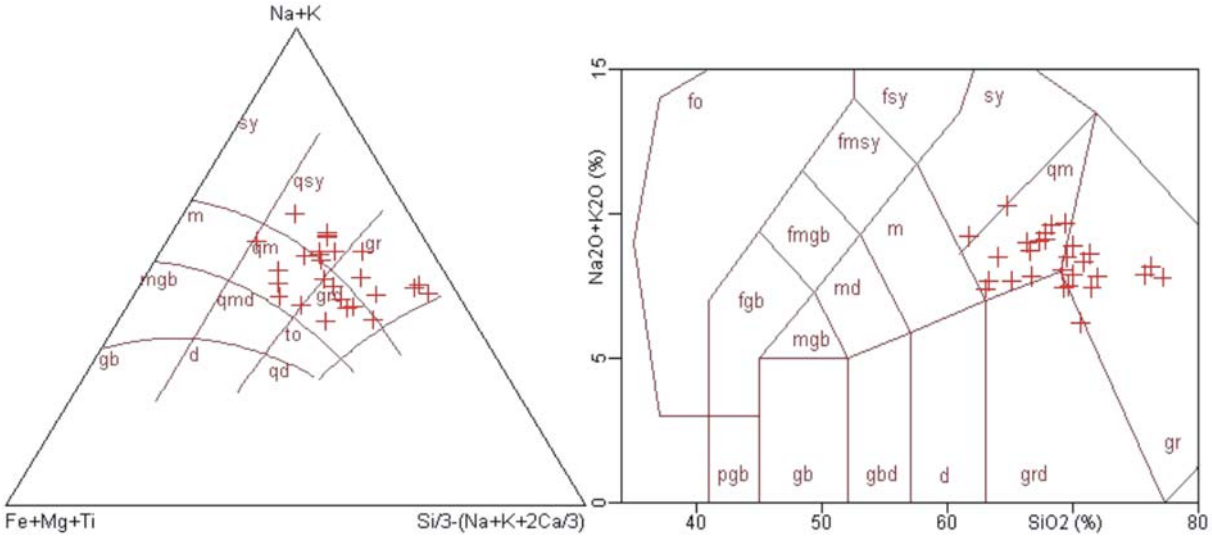

Fig. 2.25. *Weinsberg Granite to Granodiorite ABQ and TAS diagrams.*

Mauthausen Granite

Quartz-normal, sodic/potassic, moderately peraluminous, S-type, I-series, mesocratic, granite

	1161M	**1162M**	**1163M**	**1164M**	**1165M**	**1166M**
SiO_2	69.50	72.22	69.72	69.24	69.14	72.13
TiO_2	0.48	0.36	0.47	0.22	0.42	0.34
Al_2O_3	15.19	14.65	14.93	17.37	15.42	14.64
Fe_2O_3	0.30	0.32	0.23	0.26	0.65	0.30
FeO	2.28	1.81	2.58	2.51	2.05	1.35
MnO	0.04	0.04	0.04	n.d.	0.04	0.03
MgO	1.05	0.77	1.14	0.78	1.16	0.54
CaO	1.98	1.30	1.60	1.94	2.28	1.50
Na_2O	3.25	3.36	2.68	3.39	3.33	3.62
K_2O	4.98	4.45	5.35	4.05	4.28	4.56
P_2O_5	0.17	0.15	0.23	0.08	0.24	0.16
Mg/(Mg + Fe)	0.42	0.39	0.42	0.34	0.44	0.37
K/(K + Na)	0.50	0.47	0.57	0.44	0.46	0.45
Nor.Or	30.72	27.26	33.38	24.78	26.44	27.75
Nor.Ab	30.47	31.28	25.41	31.53	31.26	33.48

Nor.An	9.09	5.66	6.78	9.42	10.17	6.58
Nor.Q	23.93	29.76	26.83	25.99	25.44	27.92
Na + K	210.61	202.91	200.08	195.38	198.33	213.64
*Si	151.42	182.30	167.70	165.68	158.14	168.69
K-(Na + Ca)	-34.45	-37.12	-1.42	-58.00	-57.24	-46.74
Fe + Mg + Ti	67.58	52.83	72.99	60.32	70.74	40.22
Al-(Na + K + 2Ca)	17.07	38.42	36.06	76.54	23.17	20.37
(Na + K)/Ca	5.97	8.75	7.01	5.65	4.88	7.99
A/CNK	1.08	1.17	1.16	1.30	1.10	1.09

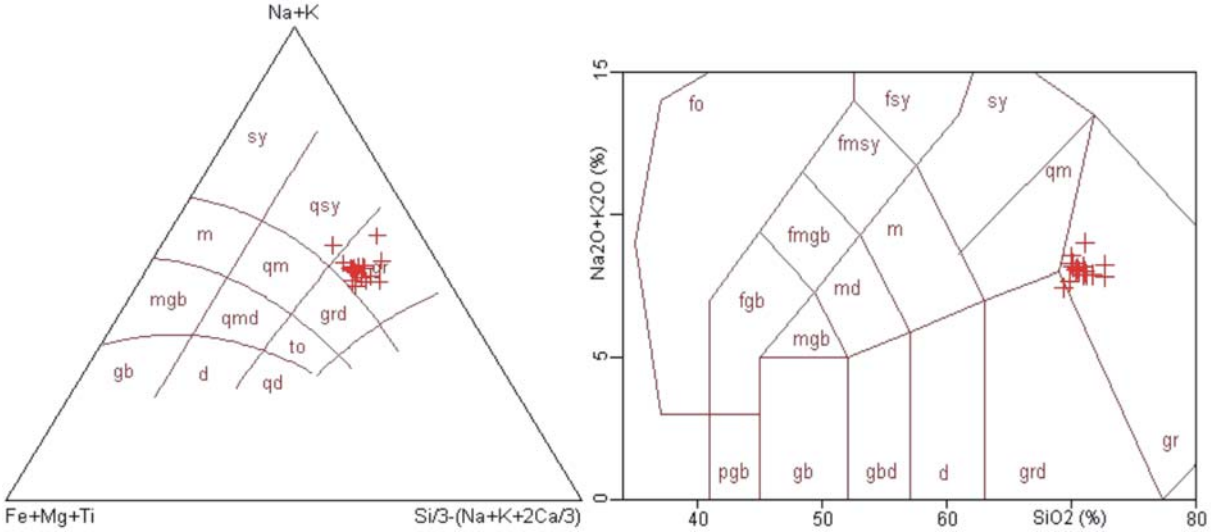

Fig. 2.26. *Mauthausen Granite ABQ and TAS diagrams.*

Freistadt Granodiorite

Quartz-normal, sodic, low peraluminous, mesocratic, S-type, I- and M-series, granodiorite

	1189F	**1190F**	**1191F**	**1192F**	**1193F**	**1194F**
SiO_2	66.44	70.78	70.95	68.15	71.38	71.38
TiO_2	0.54	0.31	0.22	0.52	0.34	0.36
Al_2O_3	16.39	14.93	14.71	15.76	15.23	15.23
Fe_2O_3	1.58	0.57	0.25	1.07	0.47	0.30
FeO	1.78	1.65	1.49	1.75	2.04	1.65
MnO	0.03	0.02	0.04	0.04	0.05	0.03
MgO	1.21	0.73	0.55	1.23	0.68	0.62
CaO	3.28	1.98	1.57	2.43	1.34	1.85
Na_2O	4.18	3.84	3.51	3.62	3.92	3.82
K_2O	2.80	3.73	4.84	4.68	3.47	3.42
P_2O_5	0.16	0.09	0.06	0.05	0.12	0.15
Mg/(Mg + Fe)	0.40	0.37	0.36	0.44	0.33	0.36
K/(K + Na)	0.31	0.39	0.48	0.46	0.37	0.37
Nor.Or	17.23	22.90	29.79	28.60	21.29	20.95
Nor.Ab	39.09	35.82	32.83	33.62	36.56	35.57
Nor.An	15.85	9.59	7.70	12.13	6.08	8.49
Nor.Q	22.22	27.08	26.03	20.68	29.28	29.38
Na + K	194.34	203.11	216.03	216.18	200.17	195.88
*Si	135.27	166.02	158.92	133.01	179.90	178.12
K-(Na + Ca)	-133.92	-80.03	-38.50	-60.78	-76.72	-83.64
Fe + Mg + Ti	81.37	52.12	40.29	74.81	55.43	46.63
Al-(Na + K + 2Ca)	10.55	19.47	16.85	6.65	51.12	37.22

(Na + K)/Ca	3.32	5.75	7.72	4.99	8.38	5.94
A/CNK	1.05	1.08	1.07	1.03	1.22	1.16

***Trace elements (mean values in ppm)*:** *Freistadt Granodiorite* – **Ba** 1366, **Cs** 4, **Ga** 20, **Hf** 5, **Li** 30, **Nb** 12, **Pb** 27, **Rb** 140, **Sc** 6.5, **Sr** 290, **Th** 20, **U** 3.4, **Y** 22, **Zn** 59, **Zr** 170, **La** 5.3, **Ce** 37, **Sm** 5.5, **Eu** 1.2, **Yb** 0.3, **Lu** 0.2 (Breiter and Sokol 1997).

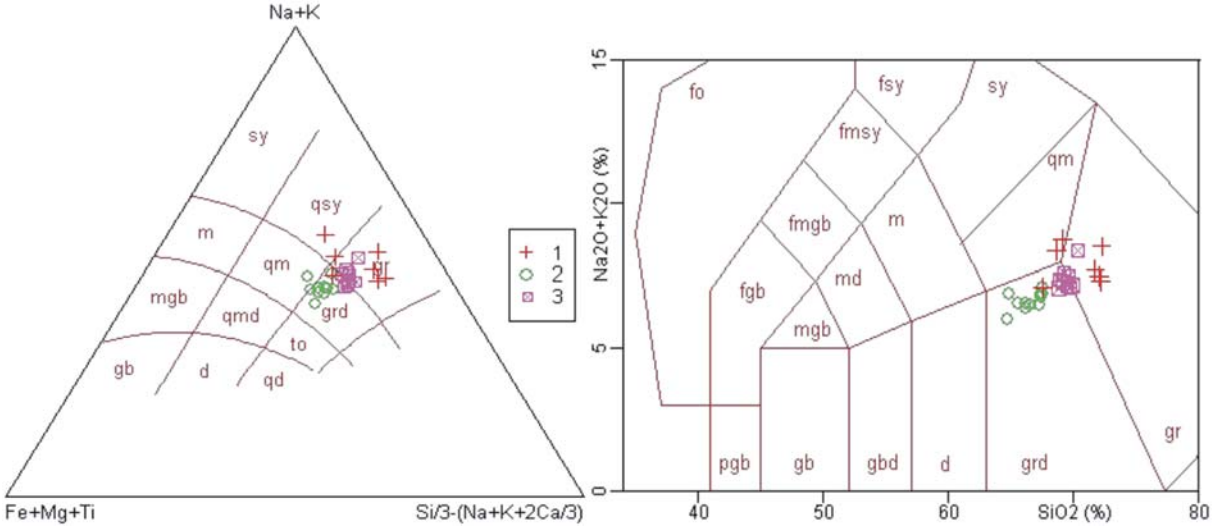

Fig. 2.27. *Freistadt Granodiorite ABQ and TAS diagrams. 1 – fine-grained type, 2 – Marginal type, 3 – Central type.*

Žofín and Mandelstein Granite

Quartz-rich, potassic, peraluminous, leucocratic, S-type, granite

	Z3131	**Z3349**	**Z3320**	**M3120**	**M3121**	**M3122**
	Žofín Granite			Mandelstein Granite		
SiO_2	71.21	72.56	72.76	73.20	72.65	72.60
TiO_2	0.29	0.34	0.28	0.12	0.26	0.32
Al_2O_3	14.91	14.06	14.21	14.89	14.16	14.45
Fe_2O_3	0.70	0.80	0.90	0.54	0.73	0.66
FeO	0.85	0.96	0.52	0.55	1.05	0.99
MnO	0.03	0.03	0.02	0.03	0.04	0.03
MgO	0.45	0.45	0.28	0.19	0.33	0.32
CaO	0.67	0.74	0.51	0.50	0.70	0.67
Na_2O	2.96	2.78	2.69	2.86	3.21	3.20
K_2O	5.45	5.53	5.58	5.42	4.74	5.00
P_2O_5	0.33	0.18	0.21	0.38	0.27	0.23
Mg/(Mg + Fe)	0.35	0.32	0.27	0.24	0.25	0.26
K/(K + Na)	0.55	0.57	0.58	0.55	0.49	0.51
Nor.Or	33.52	33.93	34.29	32.97	29.12	30.56
Nor.Ab	27.67	25.93	25.12	26.44	29.97	29.72
Nor.An	1.17	2.55	1.22	-0.04	1.77	1.87
Nor.Q	30.83	32.22	33.56	33.90	32.91	31.83
Na + K	211.23	207.12	205.28	207.37	204.23	209.42
*Si	175.86	186.63	192.31	192.78	190.50	185.38
K-(Na + Ca)	8.25	14.51	22.58	13.87	-15.43	-9.05
Fe + Mg + Ti	35.47	38.86	29.00	20.63	35.25	34.01
Al-(Na + K + 2Ca)	57.67	42.59	55.58	67.21	48.88	50.45
(Na + K)/Ca	17.68	15.70	22.57	23.26	16.36	17.53
A/CNK	1.29	1.20	1.28	1.35	1.25	1.24

Trace elements (mean values in ppm): *Žofín Granite* – **Sn** 9, **Zn** 73, **As** 5, **Nb** 16, **Cu** 4, **Rb** 326, **Zr** 129, **Pb** 22, **Sr** 64, **Th** 32, **U** 8, **Y** 13.
Mandelstein Granite – **Sn** 4, **Zn** 64, **Nb** 24, **Nb** 4, **Cu** 4, **Rb** 308, **Zr** 118, **Pb** 14, **Sr** 93 , **Th** 18, **U** 7.5 , **Y** 17.

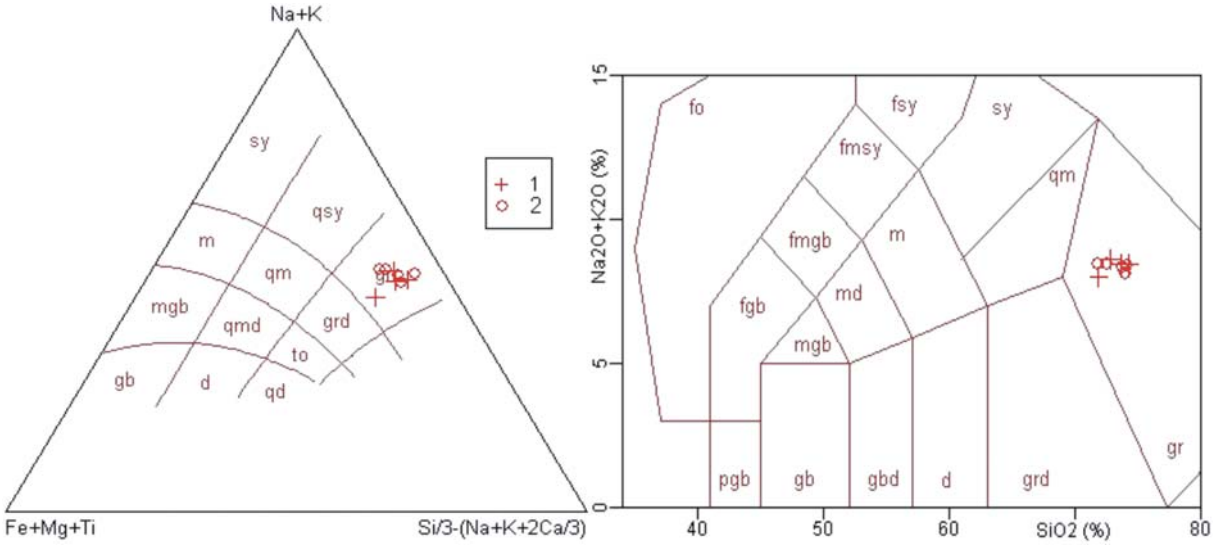

Fig. 2.28. *Žofín and Mandelstein Granites ABQ and TAS diagrams. 1 – Žofín Granite, 2 – Mandelstein Granite.*

Weitra Granite

Quartz-normal, potassic, peraluminous, mesocratic, S-type, granite

	Wm3225	**Wm3422**	**Wm3223**	**Wn2493**	**Wn3347**	**Wn3348**
	Magnetic facies			Nonmagnetic facies		
SiO_2	70.85	70.87	71.90	73.09	69.26	69.41
TiO_2	0.44	0.50	0.41	0.41	0.50	0.53
Al_2O_3	14.36	14.16	13.92	13.34	14.69	14.66
Fe_2O_3	0.65	1.26	0.91	0.60	1.02	0.97
FeO	1.50	1.63	1.08	1.65	1.65	1.71
MnO	0.05	0.05	0.04	0.04	0.05	0.05
MgO	0.69	0.80	0.67	0.73	0.82	0.86
CaO	1.50	2.06	1.30	1.58	2.03	1.88
Na_2O	2.94	2.91	2.98	2.84	3.38	3.39
K_2O	4.90	5.01	4.77	4.34	4.51	4.49
P_2O_5	0.16	0.20	0.15	0.19	0.19	0.20
Mg/(Mg + Fe)	0.37	0.34	0.38	0.37	0.36	0.37
K/(K + Na)	0.52	0.53	0.51	0.50	0.47	0.47
Nor.Or	30.38	30.68	29.45	26.87	27.89	27.78
Nor.Ab	27.70	27.08	27.96	26.72	31.77	31.88
Nor.An	6.68	9.21	5.70	6.90	9.23	8.40
Nor.Q	29.65	28.02	31.90	34.12	25.83	26.24
Na + K	198.91	200.28	197.44	183.79	204.83	204.73
*Si	176.32	168.40	185.99	202.91	155.28	158.00
K-(Na + Ca)	-17.58	-24.26	-18.07	-27.67	-49.51	-47.58
Fe + Mg + Ti	51.70	64.60	48.20	53.75	62.37	63.95
Al-(Na + K + 2Ca)	29.59	4.33	29.55	21.83	11.25	16.12
(Na + K)/Ca	7.44	5.45	8.52	6.52	5.66	6.11
A/CNK	1.13	1.03	1.14	1.11	1.06	1.08

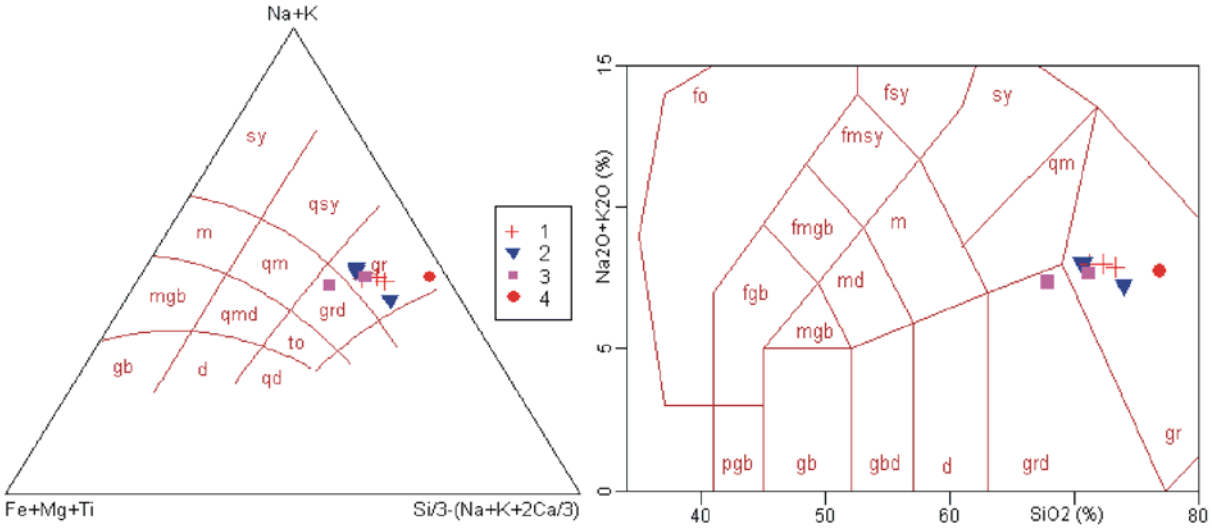

Fig. 2.29. *Weitra Granite ABQ and TAS diagrams. 1 – Weitra Granite – magnetic facies, 2 – Weitra Granite – non-magnetic facies , 3 –Karlstift Granite, 4 – Weitra Mu-granite.*

Karlstift Granite

Quartz-normal, sodic, peraluminous, I/S-type, granodiorite

	Kar3355	**Kar3395**
SiO_2	69.84	66.00
TiO_2	0.52	0.67
Al_2O_3	14.67	15.10
Fe_2O_3	0.64	1.50
FeO	1.78	2.15
MnO	0.05	0.08
MgO	0.80	1.30
CaO	2.21	2.93
Na_2O	3.25	3.31
K_2O	4.26	3.83
P_2O_5	0.18	0.36
Mg/(Mg + Fe)	0.37	0.39
K/(K + Na)	0.46	0.43
Nor.Or	26.40	24.12
Nor.Ab	30.61	31.69
Nor.An	10.24	12.97
Nor.Q	27.53	23.80
Na + K	195.33	188.13
*Si	165.86	143.19
K-(Na + Ca)	-53.83	-77.74
Fe + Mg + Ti	59.20	89.39
Al-(Na + K + 2Ca)	13.94	3.90
(Na + K)/Ca	4.96	3.60
A/CNK	1.07	1.04

2.1.2.01. NEBELSTEIN STOCK

Regional position: Moldanubian Zone. A member of the Homolka Group in the Weinsberg Composite Pluton. The stock is intruded along the contact between the Weinsberg Granite-Granodiorite, Mauthausen and Eisgarn Granites. One of the youngest members of MCB subvolcanic high-level intrusions (e.g. the Pyhrabruck-Nakolice Granite).

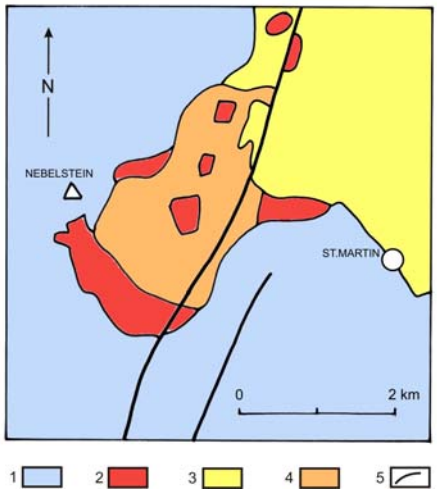

Fig. 2.30. *Nebelstein Stock geological map (after Göd and Koller 1989). 1 – Weinsberg Granite-Granodiorite, 2 – Mauthausen Granite, 3 – Eisgarn Granite s.l., 4 – Nebelstein Granite, 5 – faults.*

Rock types:

1. *Nebelstein Granite* – highly altered medium- to coarse-grained muscovite-± biotite alkali-feldspar granite. A porphyritic variety is developed in the W part of the body.
2. *Biotite Granite* – medium-grained granite in sub-surface parts of the stock.
3. *Greisen.*

Size and shape (in erosion level): 5 km^2 (3 × 2 km), NE-SW (N-S) trending stock.

Age and isotopic data: *Nebelstein Granite* 311.6 ± 1.4 Ma (Rb-Sr whole rock), 312–308 Ma (Ar-Ar muscovite).

Temporal (field) relations: Weinsberg Granite-Granodiorite → Eisgarn Granite → Mauthausen Granite → Nebelstein Granite → Greisen.

Geological environment: the Weinsberg, Mauthausen and Eisgarn Granites.

Contact aureole: not described.

Zoning: normal concentric zonation (Nebelstein Granite in the upper part of the stock and *Biotite Granite* in the lower part of the intrusion).

Mineralization: greisenization and sub-economic dissemination of molybdenite and chalcopyrite. Presence of magnetite, pyrite and pyrrhotite.

Heat production (μWm^{-3}): *Nebelstein Granite* 1.52.

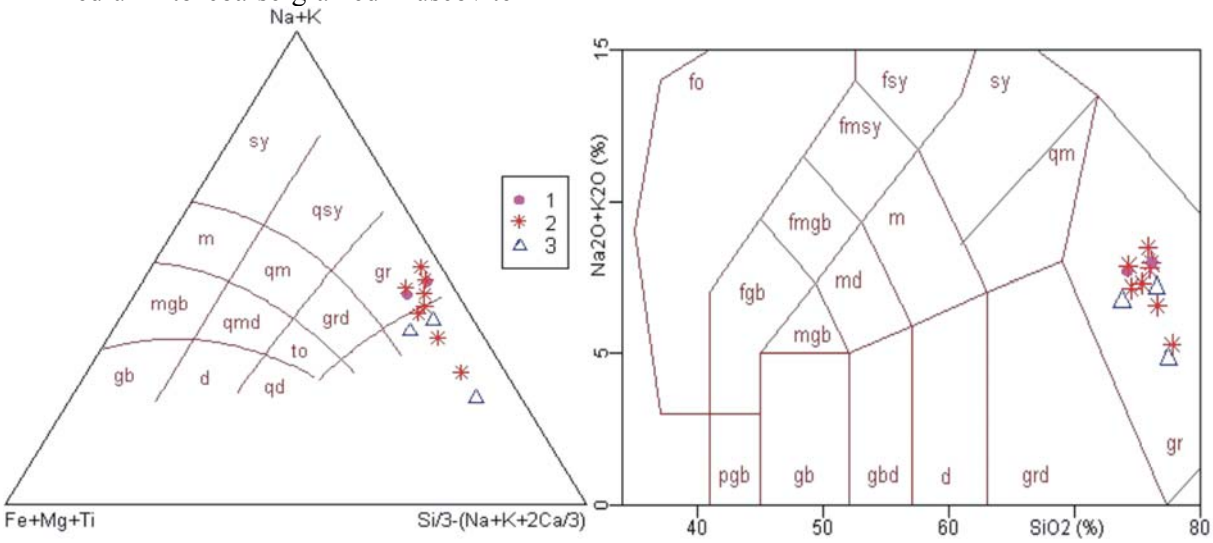

Fig. 2.31. *Nebelstein Granite ABQ and TAS diagrams.1 – Biotite Granite, 2 – Nebelstein Granite, 3 – greisen.*

Nebelstein Granite (biotite granite, two-mica granite, muscovite granite)

Quartz-rich, potassic, peraluminous, leucocratic, S-type, granite

	NebBio	Neb2Mic	NebMu	NebMusc
SiO_2	73.60	75.54	75.15	74.99
TiO_2	0.26	0.09	0.08	0.10
Al_2O_3	14.08	13.78	13.62	13.21
Fe_2O_3	1.83	0.96	1.71	2.52
MnO	0.04	0.03	0.01	0.02
MgO	0.44	0.14	0.09	0.12
CaO	1.08	0.59	0.46	0.42
Na_2O	2.75	3.15	2.82	1.91
K_2O	4.89	4.72	4.87	4.52
P_2O_5	0.17	0.10	0.11	0.15
Mg/(Mg + Fe)	0.32	0.22	0.09	0.09
K/(K + Na)	0.54	0.50	0.53	0.61
Nor.Or	29.84	28.56	29.64	28.11
Nor.Ab	25.50	28.97	26.09	18.06
Nor.An	4.38	2.32	1.60	1.15
Nor.Q	34.83	36.01	37.51	44.79
Na + K	192.57	201.87	194.40	157.60
*Si	202.91	210.20	217.05	253.43
K-(Na + Ca)	-4.17	-11.95	4.20	26.85
Fe + Mg + Ti	37.10	16.63	24.66	35.80
Al-(Na + K + 2Ca)	45.42	47.70	56.66	86.83
(Na + K)/Ca	10.00	19.19	23.70	21.04
A/CNK	1.22	1.23	1.28	1.53

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2.1.2.02. PYHRABRUCK-NAKOLICE STOCK

Regional position: Moldanubian Zone. A member of the Homolka Group in the Weinsberg Composite Pluton.

Rock types:

1. *Pyhrabruck-Nakolice Granite* – medium-grained muscovite leucocratic topaz-bearing alkali-feldspar granite.
2. *Lagerberg Granite* (marginal facies of the Pyhrabruck-Nakolice Granite) – non-porphyritic medium-grained two-mica alkali-feldspar granite

Size and shape (in erosion level): 4 km^2 (1.5 × 3.5 km) in size W-E trending oval body.

Age and isotopic data: *Nakolice-Pyhrabruck Granite* 316 ± 3 Ma (Rb-Sr whole rock), 313.7 ± 2.1 Ma (Ar-Ar muscovite). Lagerberg Granite 313 ± 7 Ma (Rb-Sr whole rock).

Geological environment: paragneiss and the Mandelstein (Eisgarn) Granite.

Contact aureole: not reported

Zoning: non-porphyritic medium-grained two-mica alkali-feldspar granite (Lagerberg Granite) along the southern contact of the muscovite granite (Pyhrabruck-Nakolice Granite).

Mineralization: accessory cassiterite and columbite.

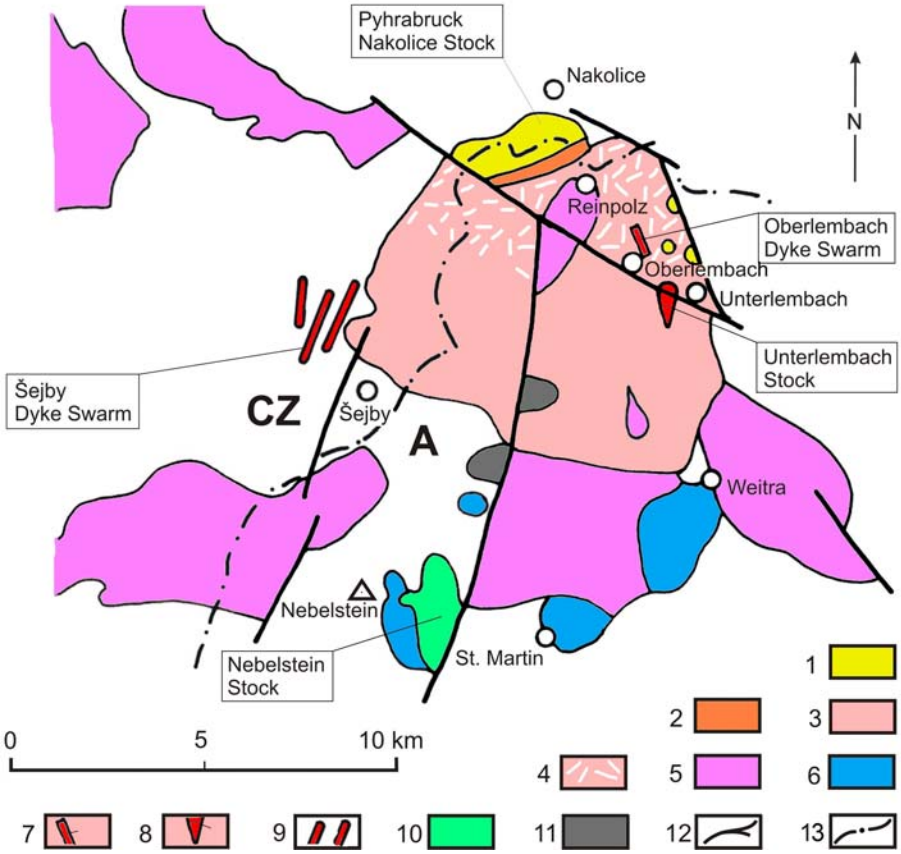

Fig. 2.32. *Pyhrabruck-Nakolice, Nebelstein and Unterlembach Stocks and Šejby and Oberlembach Dyke Swarms geological sketch-map (adapted after Breiter and Scharbert 2006). 1 – Pyhrabruck-Nakolice Granite, 2 – Lagerberg Granite, 3 – Mandelstein Granite (rim facies), 4 – Mandelstein Granite (core facies), 5 – Žofín (Reinpolz) Granite, 6 – Weitra Granite, 7 – Unterlembach Granite, 8 – Oberlembach Granite, 9 – Šejby Dyke Swarm, 10 – Nebelstein Stock, 11 – Basic intrusive rocks, 12 – faults, 13 – state border.*

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Pyhrabruck-Nakolice Granite

Quartz-rich, sodic, peraluminous, leucocratic, S-type, granite

	NAG-1	**NAG-2**	**MPZ-7**	**Nak2478**	**NAG-3**	**Py2477**
SiO2	72.22	73.32	72.16	74.55	73.37	74.33
TiO2	0.02	0.02	0.02	0.04	0.03	0.03
Al2O3	15.74	14.74	16.02	14.87	14.84	14.43
Fe2O3	0.55	0.47	0.40	0.97	0.56	0.77
FeO	0.51	0.53	0.57	n.d.	0.42	n.d.
MnO	0.02	0.02	0.02	0.02	0.02	0.03
MgO	0.07	0.07	0.11	0.04	0.08	0.04
CaO	0.35	0.31	0.50	0.30	0.34	0.43
Na2O	4.30	4.56	4.19	3.53	4.60	3.79
K2O	3.89	4.13	3.64	3.81	4.01	3.87
P2O5	0.43	0.42	0.46	0.33	0.37	0.45
Li2O	0.05	0.05	0.05	0.05	0.04	0.04
Mg/(Mg+Fe)	0.11	0.11	0.17	0.07	0.13	0.09
K/(K+Na)	0.37	0.37	0.36	0.42	0.36	0.40
Nor.Q	30.78	29.37	31.93	37.72	29.63	35.94
Nor.Or	23.52	24.84	22.06	23.11	24.08	23.48
Nor.Ab	39.52	41.68	38.60	32.54	41.98	34.96
Nor.An	-1.12	-1.25	-0.57	-0.71	-0.76	-0.86
Na+K	221.35	234.84	212.49	194.81	233.58	204.47
*Si	175.15	168.24	181.89	215.21	169.42	202.78
K-(Na+Ca)	-62.41	-64.99	-66.84	-38.37	-69.36	-47.80
Fe+Mg+Ti	15.98	15.26	15.93	13.65	15.23	11.02
Al-(Na+K+2Ca)	75.27	43.57	84.27	86.51	45.72	63.57
(Na+K)/Ca	35.47	42.48	23.83	36.42	38.53	26.67
A/CNK	1.38	1.23	1.43	1.48	1.23	1.35

Trace element (average content in ppm): *Nakolice Granite* – **Rb** 768, **Cs** 15.4, **Ba** 5.8, **Sr** 10.8, **Zr** 31.5, **Hf** 1.72, **Sn** 25, **Nb** 40, **Zn** 64, **Pb** 6.7, **Th** 2.5, **U** 5.56, **Y** 7.3.

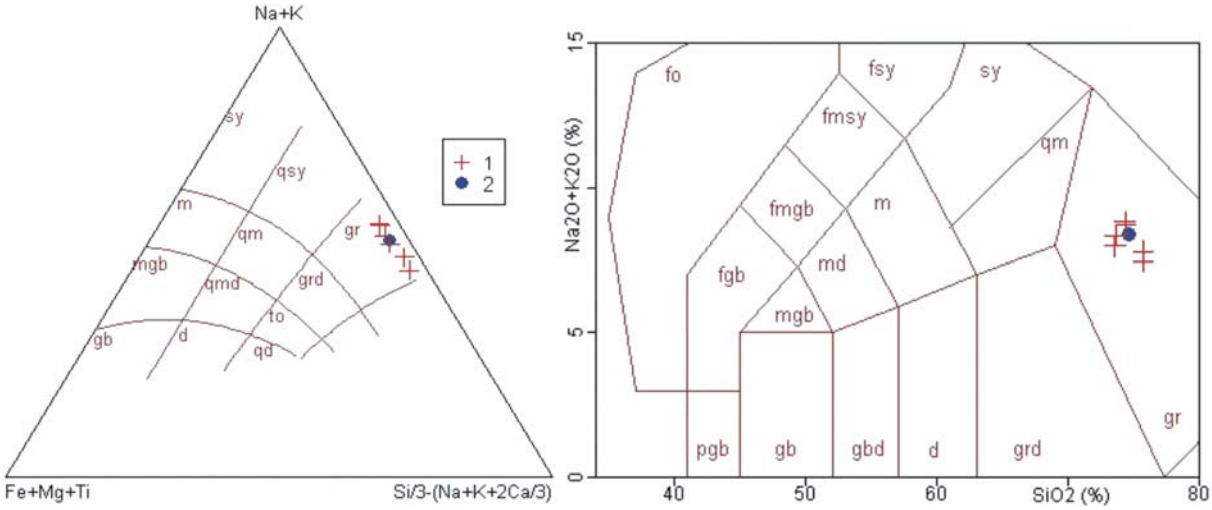

Fig. 2.33. *Pyhrabruck-Nakolice Stock ABQ and TAS diagrams. 1 – Pyhrabruck-Nakolice Granite, 2 – Lagerberg Granite.*

2.1.2.03. UNTERLEMBACH STOCK AND OBERLEMBACH GRANITE DYKES

Regional position: Moldanubian Zone. Members of the Homolka Group in the Weinsberg Composite Pluton.

Rock types:

Unterlembach Granite – slightly porphyritic medium-grained two-mica alkali-feldspar granite (up to 20 ppm U). Along the contact absence of biotite.

Oberlembach Granite – fine-grained alkali-feldspar muscovite granite. Two textural varieties have been distinguished: fine-grained and medium-grained ones. Fine-grained variety contains schlieren and xenoliths of the medium to coarse-grained one.

Size and shape (in erosion level): Oberlembach Granite – two systems of steeply inclined dykes cutting the Mandelstein (Eisgarn) Granite. Unterlembach Granite – three small outcrops max. 300 m in diameter.

Age and isotopic data: no data.

Geological environment: Mandelstein (Eisgarn) Granite.

Contact aureole: not reported.

Zoning: No reported.

Mineralization: sub-economic exogenous uranium.

Ober/Unterlembach Granite

Quartz rich, sodic/potassic, peraluminous, leucocratic, S-type granite

	O-Lembach	OL2487	OL2488	UL2482	UL2483	UL2289
SiO_2	72.30	76.01	75.63	75.31	76.35	75.97
TiO_2	0.27	0.06	0.07	0.03	0.04	0.05
Al_2O_3	14.50	13.78	14.23	14.10	13.87	13.86
Fe_2O_3	1.30	0.20	0.22	0.23	0.25	0.59
FeO	0.80	0.26	0.20	0.58	0.50	n.d.
MnO	0.02	0.02	0.01	0.02	0.02	0.02
MgO	0.37	0.08	0.10	0.05	0.04	0.06
CaO	0.87	0.42	0.41	0.30	0.31	0.28
Na_2O	3.20	3.58	3.99	3.72	3.23	3.41
K_2O	5.40	4.37	3.75	3.83	4.21	3.92
P_2O_5	0.26	0.16	0.13	0.33	0.27	0.25
Li_2O	0.01	0.01	0.01	0.04	0.01	n.d.
Mg/(Mg+Fe)	0.25	0.24	0.30	0.10	0.09	0.16
K/(K+Na)	0.53	0.45	0.38	0.40	0.46	0.43
Nor.Q	29.77	35.74	35.35	37.01	39.13	39.22
Nor.Or	32.72	26.37	22.60	23.28	25.51	23.83
Nor.Ab	29.47	32.83	36.55	34.36	29.75	31.51

Nor.An	2.67	1.05	1.20	-0.71	-0.25	-0.27
Na+K	217.92	208.31	208.38	201.36	193.62	193.27
*Si	172.85	208.38	206.33	212.88	226.27	224.87
K-(Na+Ca)	-4.12	-30.23	-56.45	-44.07	-20.37	-31.80
Fe+Mg+Ti	39.99	8.86	8.90	12.58	11.59	9.51
Al-(Na+K+2Ca)	35.80	47.32	56.45	64.83	67.70	68.93
(Na+K)/Ca	14.05	27.81	28.50	37.64	35.03	38.71
A/CNK	1.17	1.23	1.27	1.35	1.37	1.38

Trace elements (mean contents in ppm): *Oberlembach Granite* – **Rb** 311, **Cs** 12.5, **Ba** 48.7, **Sr** 23.8, **Zr** 21.4, **Hf** 1.07, **Sn** 10, **Nb** 23.5, **Zn** 21.5, **Pb** 18.8, **Th** 2.70, **U** 6.8, **Y** 12.

Unterlembach Granite – **Rb** 522, **Cs** 13, **Ba** 14.3, **Sr** 4.2, **Zr** 11.2, **Hf** 1.05, **Sn** 12, **Nb** 38.5, **Zn** 52.5, **Pb** 8.5, **Th** 1.94, **U** 20.4.

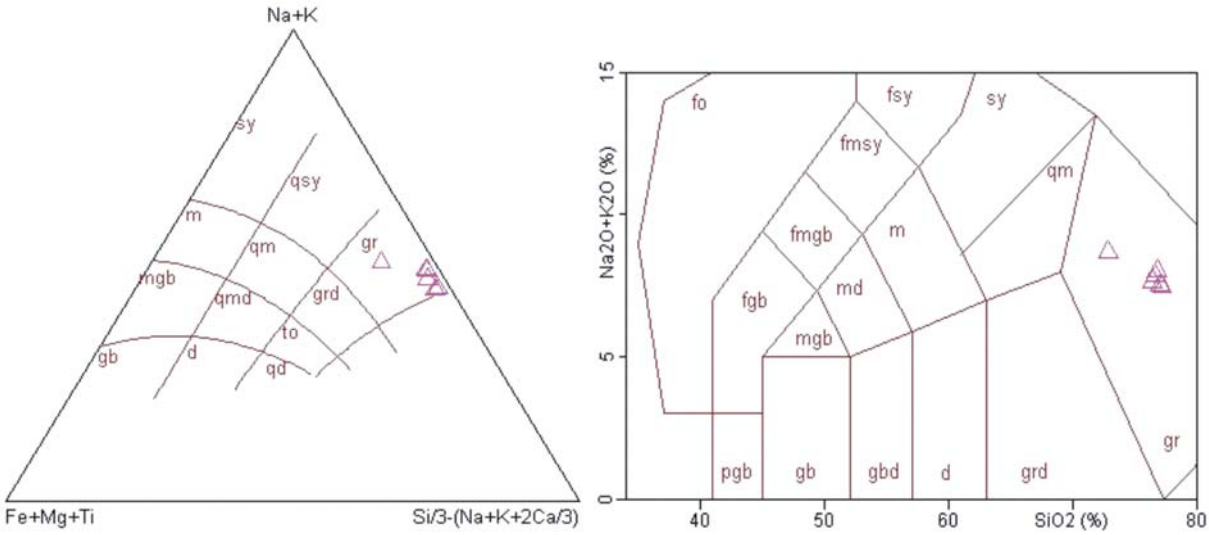

Fig. 2.34. *Oberlembach Stock und Unterlembach Granite Dykes ABQ and TAS diagrams.*

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II. Western plutons of the Moldanubian Composite Batholith

The western wing of the Moldanubian Composite Batholith in the Bavarian Forest consists of an archipelago of more or less independent massifs. Some of them are segmented and tectonized by the Bavarian "Pfahl" Zone. The southern part of the Bavarian Forest (Passau Forest) was uplifted along this deep seated tectonic zone relative to the northern part, so that exposed massifs are frequently surrounded by a broad aureole of anatexites (in situ generated granitoids, e.g. the Palite Massif). Their age and composition are similar to the eastern plutons. According to Siebel et al. (2008) in the western wing of the Moldanubian Composite Batholith granites in the Bavarian Terrane (high Ca-Sr-Y granites) and the Ostrong Terrane (low Ca-Sr-Y granites) define two distinct granite types, which formed at about the same time but from different source materials in two compositionally distinct Variscan basement units separated by the Pfahl Shear Zone.

According to Knop and Finger (2009) in the western plutons of the Moldanubian Composite Batholith Eisgarn Suite: the Dreisesselberg, Steiberg, Theresienreut and Haidmühle, Heidel, Kötzting and Arnbruck Granites belong to the Eisgarn s.l. Suite and the Viechtach, Patersdorf, Richnach, Metten and Lalling Granites and Hauzenberg Massif are members of the Mauthausen Suite.

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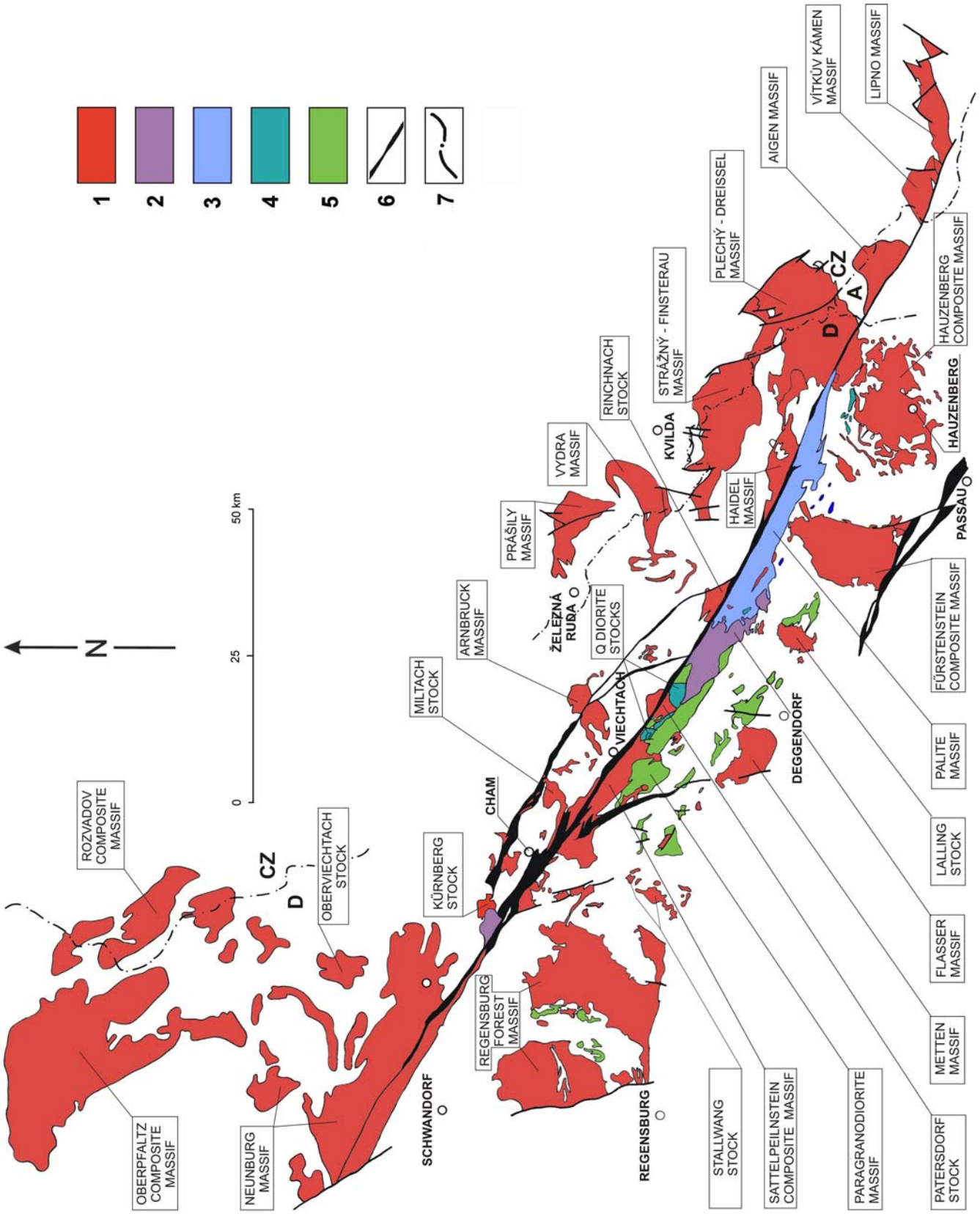

Fig. 2.35. *Western plutons of the Moldanubian Composite Batholith geological sketch-map (adapted after Teipel et al. 2008). 1 – Allochthonous Plutons, 2–4 – Autochthonous Plutons: (2 – Flasser Massif, 3 – Palite Massif, 4 – Paragranodiorite Massif), 5 – Q-diorite Stocks, 6 – Faults, 7 – state border.*

a. **Allochthonous plutons**

PLUTONS IN THE OSTRONG TERRANE

2.1.3. ROZVADOV (-WAIDHAUS) COMPOSITE MASSIF

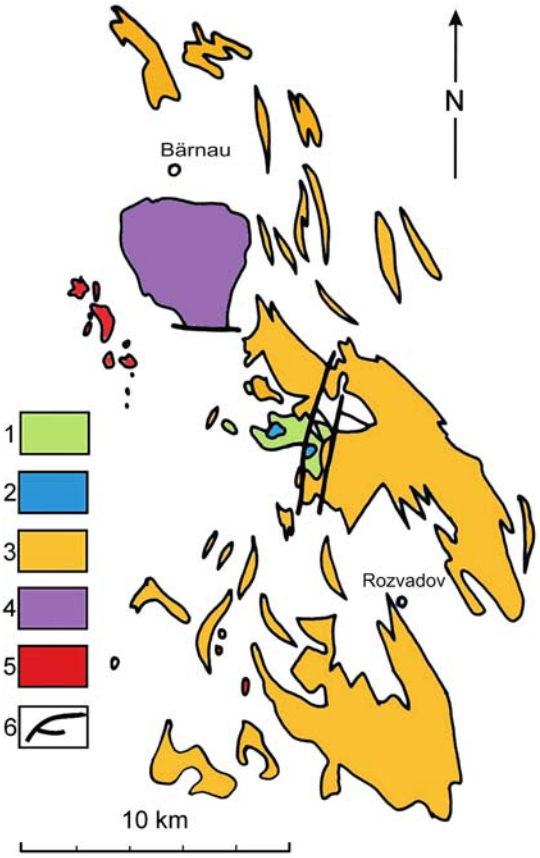

Fig. 2.36. *Rozvadov Composite Massif geological sketch-map (adapted after Breiter and Siebel 1995). 1 – Cordierite Granite, 2 – Redwitzite, 3 – Rozvadov Granite, 4 – Bärnau Granite, 5 – Křížový kámen(Kreuzstein) Granite, 6 – faults.*

Regional position: satellite massif of the MCB in Proterozoic H-T metamorphic rocks of the Moldanubian Zone. The massif is the most north-westerly situated manifestation of the Moldanubian-type (synchronous) magmatism.

Rock types:

1. *Cordierite Granite* – biotite-cordierite granite (Kolerova Huť)
2. *"Redwitzite" – cordierite rich tonalite* (~ 5 km^2).
3. *Rozvadov Granite* (50 km^2) – fine-medium-grained two-mica granite.
4. *Bärnau Granite* (15 km^2) – coarse-medium grained two-mica granite (similar to the Flossenbürg Granite and to the group of two-mica granites widespread throughout the Moldanubian Zone).
5. *Křížový kámen (Kreuzstein) Granite* (2 km^2) – fine- to medium-grained zinnwaldite (muscovite) alkali-feldspar granite with topaz and high P content (comparable with the stanniferous Li-mica granites of the Krušné hory Mts.-Erzgebirge Batholith).
6. *Waidhaus Granite* – muscovite-albite granite (not shown in the skech-map).

Shape and size: 100 km^2 (30 × 7 km), elongated, and protuberant in map section parallel to metamorphic schistosity, elliptical with several smaller satellite outcrops and stocks in the periphery (the Bärnau, Rozvadov and Waidhaus body). Circular body of the Bärnau Granite.

Age and isotopic data: *Cordierite Granite* 303 Ma (K-Ar muscovite), *Rozvadov Granite* 314 Ma (K-Ar biotite), *Bärnau Granite* 313 ± 4 Ma (Rb-Sr whole rock).

Temporal (field) relations:
Redwitzite → Cordierite Granite → Rozvadov Granite → Bärnau Granite → Křížový kámen Granite (dykes of the Rozvadov Granite are cut by the Bärnau Granite).

Contact aureole: semi-concordant and discordant endo-exocontacts of the massif and its rock types. Broad periplutonic contact aureole consisting of intense intercalation of gneisses and granite.

Geological environment: paragneisses of the Moldanubian Zone.

Zoning: weak compositional zoning indicative of several intrusive phases.

Circular and coherent Bärnau Granite is deeply rooted intrusion (according to gravity data), with porphyritic variety in the western contact. Parallel magnetic mineral orientation.

Mineralization: Křížový kámen Granite is enriched in Nb (up to 52 ppm) and Ta (up to 34 ppm) more than in Sn (22 ppm) and W (4 ppm).

Heat production (μWm^{-3}): *Rozvadov Granite* 1.54, *Křížový kámen Granite* 1.91.

Rozvadov Granite

Quartz-normal, potassic, peraluminous, leucocratic, S-type, granite

	495R	**496R**	**497R**	**2379R**
SiO_2	70.16	63.22	73.66	74.27
TiO_2	0.06	0.28	0.12	0.12
Al_2O_3	15.54	19.54	14.13	14.34
Fe_2O_3	0.08	0.84	0.57	0.49
FeO	1.50	2.41	0.57	0.48
MnO	0.06	0.04	0.03	0.02
MgO	0.41	1.45	0.23	0.19
CaO	0.58	1.42	0.82	0.59
Na_2O	2.56	3.08	3.47	2.86
K_2O	6.83	5.64	4.99	4.70
P_2O_5	0.19	0.20	0.20	0.18
Mg/(Mg + Fe)	0.31	0.45	0.27	0.26
K/(K + Na)	0.64	0.55	0.49	0.52
Nor.Or	42.24	35.10	30.23	28.76
Nor.Ab	24.06	29.13	31.95	26.60
Nor.An	1.70	6.03	2.82	1.80
Nor.Q	25.78	17.13	31.20	37.05
Na + K	227.63	219.14	217.92	192.08
*Si	154.71	114.71	180.98	212.94
K-(Na + Ca)	52.06	-4.96	-20.65	-3.02
Fe + Mg + Ti	32.82	83.57	22.29	19.04
Al-(Na + K + 2Ca)	56.86	113.94	30.31	68.48
(Na + K)/Ca	22.01	8.65	14.90	18.26
A/CNK	1.25	1.45	1.14	1.35

Trace elements (mean values in ppm): *Rozvadov Granite* – **Ba** 250, **Li** 45, **Nb** 7, **Pb** 33, **Rb** 233, **Sr** 181, **Th** 3, **U** 3.5, **Y** 10, **Zn** 52, **Zr** 94, **La** 33, **Ce** 68, **Sm** 6.1, **Eu** 0.57, **Yb** 0.71, **Lu** 0.31 (Breiter and Sokol 1997).
Bärnau Granite – **Ba** 250, **Li** 45, **Nb** 7, **Pb** 33, **Rb** 233, **Sr** 181, **Th** 3, **U** 3.5, **Y** 10, **Zn** 52, **Zr** 94, **La** 33, **Ce** 68, **Sm** 6.1, **Eu** 0.57, **Yb** 0.71, **Lu** 0.31 (Breiter and Sokol 1997).
Křížový kámen Granite – **Ba** 5, **Cs** 35, **Hf** 1.5, **Li** 600, **Nb** 37, **Pb** 5, **Rb** 1010, **Sr** 7, **Th** 2, **U** 5.5, **Y** 1.6, **Zn** 98, **Zr** 18, **La** 0.65, **Ce** 1.1, **Sm** 0.14, **Eu** 0.02, **Yb** 0.27, **Lu** 0.03 (Breiter and Sokol 1997).
Rb 989, **Cs** 51.5, **Sr** <7, **Ba** 5.1, **Zn** 112, **Sn** 35, **Pb** 4.8, **Zr** 20.9, **Hf** 1.6, **Nb** 36, **U** 9.7, **Th** 2.4 (Breiter 1998).

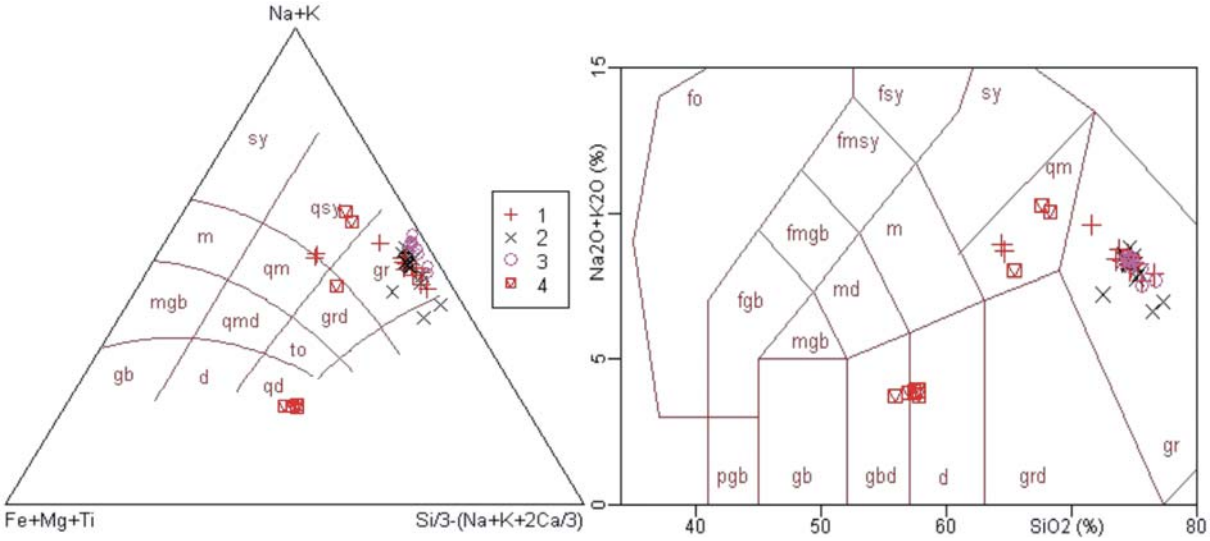

Fig. 2.37. *Rozvadov Massif ABQ and TAS diagrams. 1 – Rozvadov Granite, 2 – Bärnau Granite, 3 – Cordierite Granitoids (granite to tonalite), 4 – Křížový kámen (Kreuzstein) Granite.*

Bärnau Granite Quartz-rich, sodic, peraluminous, leucocratic, S-type, granite

Křížový kámen (Kreuzstein) Granite Quartz-rich, sodic, peraluminous, leucocratic, S-type, granite

	Bärnau Granite		Křížový kámen /Kreuzstein Granite		Redwitzite	
	twdtBär.	**2169Bärn**	**Kreuzst.**	**2375Kreuz.**	**Cord.Bi**	**2357Cord**
SiO_2	73.19	75.34	73.42	73.76	55.51	66.67
TiO_2	0.13	0.09	0.01	0.01	0.32	0.28
Al_2O_2	14.55	13.30	15.18	14.56	25.33	17.43
Fe_2O_2	1.17	0.47	0.66	0.26	6.02	0.69
FeO	n.d.	0.48	n.d.	0.43	n.d.	0.92
MnO	0.03	0.03	0.09	0.05	0.08	0.02
MgO	0.24	0.14	0.02	0.02	4.65	0.69
CaO	0.47	0.48	0.22	0.20	1.34	0.79
Na_2O	3.68	3.23	4.68	4.51	1.91	2.84
K_2O	4.40	3.56	3.56	3.39	1.83	6.95
P_2O_2	0.35	0.33	0.51	0.43	0.38	0.34
Mg/(Mg + Fe)	0.28	0.21	0.05	0.05	0.60	0.44
K/(K + Na)	0.44	0.42	0.33	0.33	0.39	0.62
Nor.Or	26.77	21.97	21.39	20.61	11.93	42.54
Nor.Ab	34.03	30.30	42.74	41.67	18.92	26.42
Nor.An	0.02	0.21	-2.31	-1.90	4.57	1.74
Nor.Q	32.98	41.07	31.58	33.38	29.30	20.61
Na + K	212.17	179.82	226.61	217.51	100.49	239.21
*Si	188.28	232.45	178.09	189.31	191.54	121.27
K-(Na + Ca)	-33.71	-37.20	-79.36	-77.12	-46.67	41.83
Fe + Mg + Ti	22.24	17.17	8.89	9.87	194.81	42.09
Al-(Na + K + 2Ca)	56.79	64.25	63.65	61.28	349.15	74.90
(Na + K)/Ca	25.32	21.01	57.76	60.99	4.21	16.98
A/CNK	1.29	1.38	1.34	1.33	3.57	1.32

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2.1.4. OBERPFALZ (TIRSCHENREUTH) COMPOSITE MASSIF (OCM)

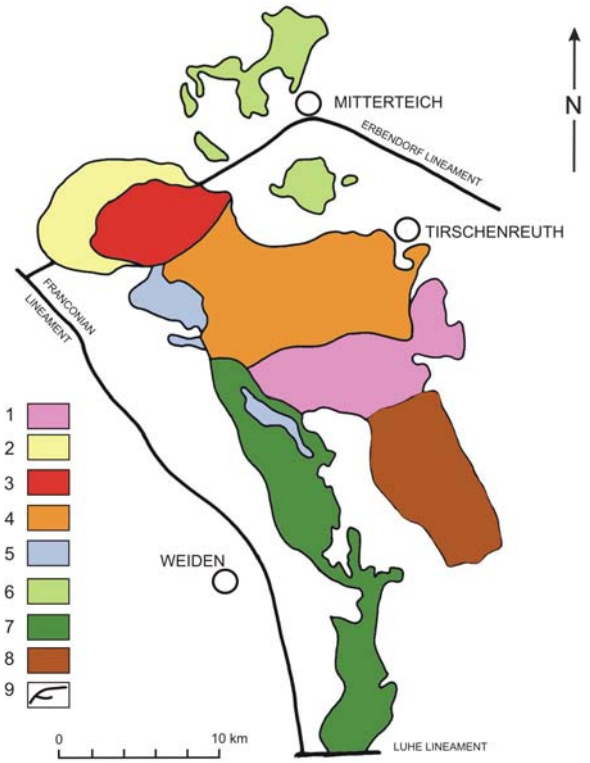

Fig. 2.38. *Oberpfalz Composite Massif geological sketch-map (adapted after Siebel et al. 2003). 1 – Liebenstein Granite, 2 – Steinwald Granite, 3 – Friedenfels Granite, 4 – Falkenberg Granite, 5 – Redwitzite, 6 – Mitterteich Granite, 7 – Leuchtenberg Granite, 8 – Flossenbürg Granite, 9 – faults.*

Regional position: OCM is located in the border zone between the Moldanubicum and Saxothuringicum. It incorporates the *Steinwald Granite and Falkenberg Granite. Falkenberg Granite* crosses the Erbendorf Line – the boundary between the Moldanubian and the Saxothuringian Zone.

Rock types:

A. YOUNGER GRANITES (316–300 Ma)

Blasenberg Granite – aplite granite – fine-grained granite (dyke-like granite within the Friedenfels Granite).

Steinwald 1 Granite – roof facies – porphyritic muscovite-biotite monzogranite.

Steinwald 2 Granite – medium-grained muscovite (biotite) monzogranite

Friedenfels Granite – medium-grained muscovite-biotite granite.

Liebenstein Granite – leucocratic facies of the Falkenberg Granite.

Flossenbürg Granite – medium-grained muscovite-biotite granite, a more acid fractionated portion of the Falkenberg Granite.

Bürgelwald Granite – coarse-grained two-mica granite represents the upper part of the Flossenbürg Granite.grained two-mica granite.

Falkenberg Granite – porphyritic coarse-

Mitterteich Granite – medium-grained muscovite-biotite granite

Zainhammer Granite – a small granite body in the Steinwald Granite.

Stock Granite – fine-grained, aplitic granites in the central part of the Falkenberg Granite.

B. OLDER GRANITES (342–321 Ma)

Leuchtenberg Granite – porphyritic medium-grained granite.

"Redwitzite" – heterogeneous cordierite-bearing melanocratic hornblende-biotite tonalite (Reuth-Erbendorf, Tirschenreuth-Mähring, Wurz-Ilsenbach Redwitzite).

Size and shape (in erosion level): 450 km^2 – several laccolithic intrusions with average thickness of 4–5 km (the *Steinwald-Friedenfels, Falkenberg, Leuchtenberg and Flossenbürg* intrusions). The *Flossenbürg Granite* (oval intrusion 62 km^2) represents a coherent intrusion dipping to the NE, *Falkenberg Granite* (146 km^2) – a sheet-like intrusion (thickness of < 4 km), *Steinwald Granite* – concentric reverse zoning, depth of the intrusion between 2 and 4 km, *Leuchtenberg Granite* (70 km^2) – an elongated, plate-like (tabular), and near vertically dipping intrusion. *Redwitzites* form four separate intrusive centres (the largest intrusive body covers the area of 7 × 4 km. The body of the *redwitzite* in the *Leuchtenberg Granite* is 8 km long and 1–1.5 km wide.

The *Flossenbürg Granite* is a NW-SE trending laccolith of more than 500 m thickness, having a rather steep contact at its SW margin, and gently dipping towards the NW underneath the *Falkenberg Granite.* The *Leuchtenberg Granite* most probably has the shape of a nearly vertical sheet with an approximate width of some 3 km. The shape of the *Falkenberg Granite* is approximately that of a horizontal plate which has solidified at a depth of approximately 9–12 km with an assumed original thickness of about 9 km, 3 km of which having now been removed by erosion. The *Falkenberg Granite* cooling rate to 400 and 350 °C lasted over approximately 6 and 15 Ma, respectively.

Age and isotopic data:

Phase I (342–321) – *Redwitzite* ~ 321.7 ± 1.3, 323.8 ± 1.2, 323.2 ± 1.3, 322.8 ± 1.3 Ma (Pb-Pb zircon), 322 ± 4.5 Ma (U-Pb titanite), 545 ± 16 Ma , 470 ± 33 Ma, 468 ± 9 Ma, 415 ± 20 Ma (Rb-Sr whole rock), 344 Ma (K-Ar amphibole), 350–325 Ma, 350 Ma (K-Ar biotite), 342–346 Ma (Ar-Ar amphibole),

Phase Ib (330–325 Ma) – *Leuchtenberg Granite* 333 ± 5 Ma, 342 ± 5 Ma (U-Pb zircon), 322.7 ± 0.7 Ma (Pb-Pb zircon), 321 ± 8 Ma (Rb-Sr whole rock), 325 (K-Ar micas), *Zainhammer Granite* 321.1 ± 0.6 Ma (Pb-Pb zircon),

Phase II (316 – 300 Ma) - *Flossenbürg and Bärnau Granites* 310.6 ± 0.3 Ma, 313 ± 2 Ma (Pb-Pb zircon), 311.9 ± 2,7 Ma, 313,2 ± 2,0 Ma (Rb-Sr whole - rock), *Falkenberg Granite* 316 ± 9 Ma ,315.7 ± 0.6 Ma (Pb-Pb zircon), 303 Ma (U-Pb zircon), 320 Ma (U-Pb zircon), (Pb-Pb zircon), 311 ± 4 Ma (Rb-Sr whole rock), 307 ± 22 Ma (Rb-Sr muscovite), 300 ± 1 Ma (Rb-Sr biotite), *Friedenfels Granite* 311.5 ± 0.4 Ma (Pb-Pb zircon), 301 ± 8 Ma (Rb-Sr whole rock), 314 ± 2.3 Ma, *Steinwald Granite* 312.2 ± 0.4 Ma (Pb-Pb zircon), 310 ± 5 Ma (Rb-Sr whole rock), *Mitterteich Granite* 309.4 ± 1.4 Ma (Pb-Pb zircon), *Liebenstein Granite* 314.4 ± (Pb-Pb zircon.

Temporal sequence: Redwitzite (325–321 Ma) → Falkenberg /Liebenstein Granite (316–314 Ma) → Mitterteich, Friedenfels Granite → Steinwald/ Flossenbürg Granite (312–309 Ma).

Intrusive sequence: 1. *Leuchtenberg Granite*, 2. *Falkenberg Granite*, 3. *Flossenbürg Granite*, 4. some fine-to medium grained granites.

Contact aureole: Surrounding gneisses and schists are altered into hornfelses at the *Leuchtenberg Granite* exocontact. Several new minerals as andalusite, sillimanite, cordierite, biotite and garnet. Contact metamorphic assemblages around the southern part of the *Leuchtenberg Granite* favour magma emplacement at a depth of approximately 10 km.

Geological environment:

Zoning: *Flossenbürg Granite* – subhorizontally stratified intrusion (asymmetric zoning), geochemical gradation from SW to NE, dipping to the NE, *Falkenberg Granite* – compositional asymmetric normal zoning.

Mineralization: greisenization and albitization is associated with the *Steinwald granites* (the tin-bearing and tungsten-bearing granites). U and base metal mineralization (post-granitic faulting and alteration). The roof between *Flossenbürg Granite and Bürgerwald Granite* show topaz mineralization

Heat production (μWm^{-3}): Steinwald Granite 4.1.

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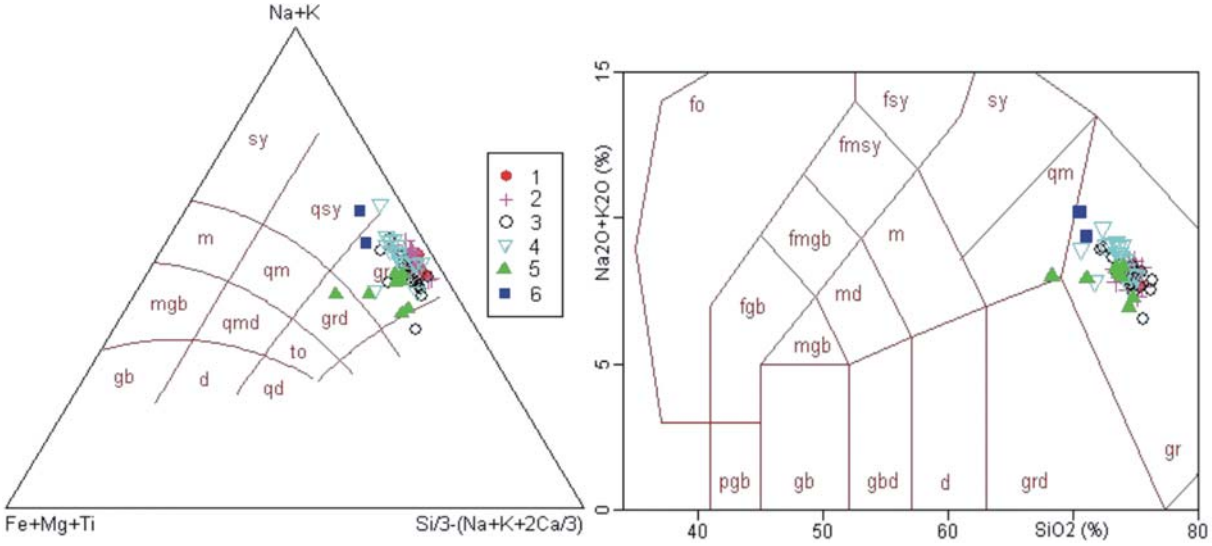

Fig. 2.39. *Oberpfalz Composite Massif ABQ and TAS diagrams. 1 – Blasenberg Granite, 2 – Steinwald Granite, 3 – Friedenfels Granite, 4 – Flossenbürg Granite, 5 – Mitterteich Granite, 6 – Liebenstein Granite.*

Steinwald Granite

Quartz-rich, sodic, peraluminous, leucocratic, S-type, granite

n = 19	Med.	Min	Max	QU1	QU3
SiO_2	74.20	73.10	75.70	73.80	74.60
TiO_2	0.09	0.02	0.18	0.04	0.12
Al_2O_3	14.70	13.40	15.40	14.00	15.00
Fe_2O_3	0.42	0.06	0.96	0.27	0.49
FeO	0.60	0.07	1.20	0.40	1.00
MnO	0.03	0.02	0.08	0.02	0.05
MgO	0.13	0.02	0.29	0.08	0.16
CaO	0.45	0.23	0.63	0.28	0.54
Na_2O	4.10	3.20	4.90	3.67	4.30
K_2O	4.03	3.52	4.78	3.82	4.31
P_2O_5	0.36	0.19	0.48	0.30	0.38
Mg/(Mg + Fe)	0.17	0.04	0.34	0.10	0.21
K/(K + Na)	0.39	0.32	0.48	0.37	0.44
Nor.Or	24.12	21.01	28.95	23.03	26.04
Nor.Ab	37.71	29.57	44.45	33.68	39.27
Nor.An	-0.09	-1.91	1.67	-1.20	0.72
Nor.Q	32.54	28.47	37.75	31.48	33.11
Na + K	217.36	193.71	232.86	212.39	223.09
*Si	189.87	169.20	218.88	179.86	194.85
K-(Na + Ca)	-55.30	-94.44	-20.73	-65.51	-36.74
Fe + Mg + Ti	20.51	11.44	27.32	13.10	24.16

Al-(Na + K + 2Ca)	52.36	35.63	87.09	46.90	56.15
(Na + K)/Ca	27.09	17.52	56.61	21.06	39.76
A/CNK	1.27	1.18	1.48	1.24	1.29

Trace elements (mean values in ppm): *Steinwald Granite* – **Ba** 5, **Be** 2.7, **Cr** 5**, Cs** 65, **Cu** 5, **Ga** 40, **F** 1840, **Li** 260, **Ni** 14, **Nb** 35, **Pb** 57, **Rb** 731, **Sn** 39, **Sr** 6, **Th** 2, **U** 10, **V** 6, **Y** 10, **Zn** 81, **Zr** 34, **W** 9.07, **Mo** 0.05–0.80, **As** 2–100, **Sb** 0.23–0.39, **Au** 0.6–6.8 ppb (Richter and Stettner 1987). *Steinwald Granite (roof facies)* – **Ba** 2, **Be** 4.2, **Cr** 3, **Cs** 158, **Cu** 3, **Ga** 51, **F** 3300, **Li** 530, **Ni** 1, **Nb** 52, **Pb** 15, **Rb** 1195, **Sn** 65, **Sr** 4, **Th** 2, **U** 17, **V** 3, **Y** 10, **Zn** 90, **Zr** 29, **W** 13.7, **La** 8, **Ce** 20, **Mo** 0.05–0.10, **As** 2–60, **Sb** 0.23–0.39, **Au** 1.1–16.3 ppb (Richter and Stettner 1987). *Friedenfels Granite* – **Ba** 88, **Be** 3.4, **Cr** 5, **Cs** 25, **Ga** 26, **F** 674, **Li** 137, **Nb** 21, **Pb** 26, **Rb** 406, **Sn** 22, **Sr** 31, **Th** 6, **U** 15, **V** 7, **Y** 13, **Zn** 58, **Zr** 66, **W** 5.14, **Mo** 0.05–0.85, **As** 2–4, **Sb** 0.2–0.28, **Au** 0.6–5.3 ppb (Richter and Stettner 1987).

Falkenberg Granite

Quartz-normal, potassic, peraluminous, S-type, I-series, granite

n = 15	**Med.**	**Min**	**Max**	**QU1**	**QU3**
SiO_2	71.40	65.50	76.20	70.00	74.50
TiO_2	0.48	0.05	0.66	0.10	0.50
Al_2O_3	14.40	13.90	16.90	14.30	14.90
Fe_2O_3	0.80	0.08	2.07	0.25	0.96
FeO	1.70	0.20	2.20	0.50	1.90
MnO	0.03	0.01	0.05	0.02	0.04
MgO	0.40	0.08	1.18	0.20	0.55
CaO	1.13	0.28	2.86	0.38	1.27
Na_2O	3.00	2.60	3.50	2.90	3.20
K_2O	5.50	4.44	6.32	5.22	5.69
P_2O_5	0.26	0.16	0.32	0.23	0.29
Mg/(Mg + Fe)	0.29	0.06	0.51	0.17	0.32
K/(K + Na)	0.53	0.45	0.60	0.51	0.56
Nor.Or	33.27	27.21	37.76	32.11	34.43
Nor.Ab	27.90	23.74	32.60	26.34	29.84
Nor.An	4.03	0.73	13.08	0.59	4.70
Nor.Q	27.67	20.13	35.98	25.71	32.75
Na + K	218.89	194.65	227.65	207.21	222.26
*Si	164.41	122.17	209.63	152.26	192.48
K-(Na + Ca)	-8.95	-69.67	40.28	-17.71	18.63
Fe + Mg + Ti	49.10	12.58	82.98	15.62	57.10
Al-(Na + K + 2Ca)	36.59	7.23	63.72	22.67	53.44
(Na + K)/Ca	11.30	4.06	43.84	9.23	24.24
A/CNK	1.19	1.05	1.32	1.11	1.25

Trace elements (mean values in ppm): *Falkenberg Granite* – **Li** 98, **Rb** 362, **Sr** 109, **Ba** 465, **Ti** 2140, **Zr** 160.

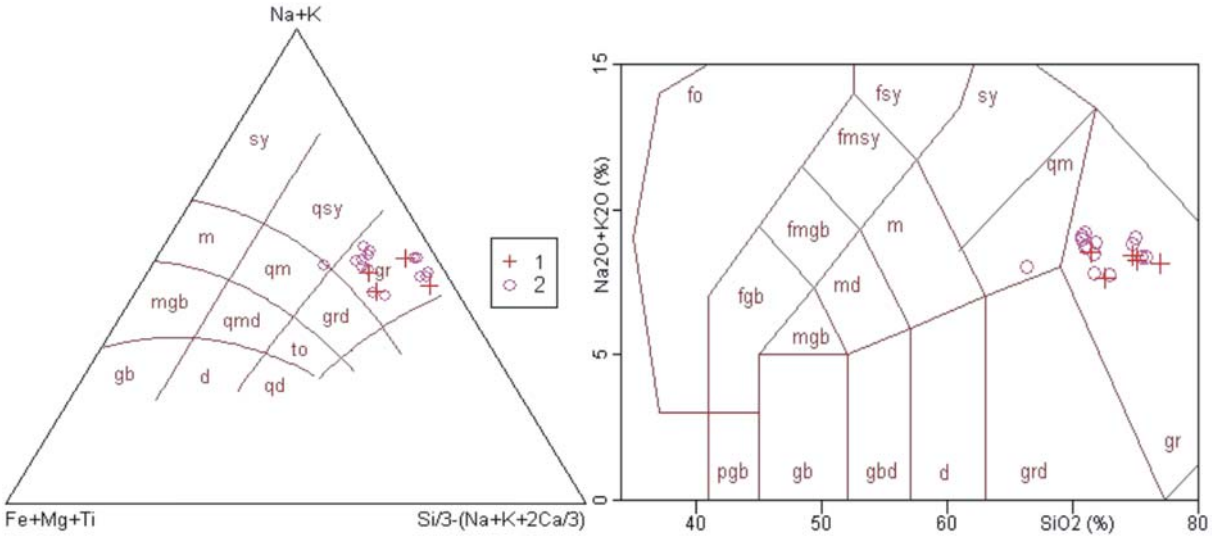

Fig. 2.40. *Oberpfalz Composite Massif ABQ and TAS diagrams. 1 – Leuchtenberg Granite, 2 – Falkenberg Granite.*

Flossenbürg Granite

Quartz-normal, sodic, peraluminous, leucocratic, S-type, I-series, granite

n = 8	**Med.**	**Min**	**Max**	**QU1**	**QU3**
SiO_2	72.70	70.80	74.00	72.40	73.60
TiO_2	0.17	0.04	0.39	0.09	0.17
Al_2O_3	14.80	14.20	16.00	14.60	14.80
Fe_2O_3	0.30	0.12	1.35	0.16	0.60
FeO	0.80	0.40	1.20	0.60	0.91
MnO	0.03	0.01	0.04	0.02	0.03
MgO	0.30	0.02	0.81	0.23	0.35
CaO	0.73	0.49	1.35	0.65	0.80
Na_2O	3.12	2.90	4.90	2.95	3.90
K_2O	4.79	4.09	5.76	4.62	4.96
P_2O_5	0.24	0.10	0.37	0.21	0.28
Mg/(Mg + Fe)	0.33	0.03	0.37	0.29	0.35
K/(K + Na)	0.45	0.39	0.57	0.41	0.51
Nor.Or	29.14	24.65	35.11	28.08	30.24
Nor.Ab	28.74	26.86	44.01	27.25	35.78
Nor.An	1.90	0.01	5.32	1.51	2.60
Nor.Q	30.38	23.00	35.81	27.46	31.79
Na + K	211.40	193.29	259.82	197.45	228.40
*Si	177.93	136.01	208.01	161.71	187.96
K-(Na + Ca)	-33.74	-65.16	14.45	-54.48	-10.12
Fe + Mg + Ti	26.59	15.03	58.61	16.16	27.22
Al-(Na + K + 2Ca)	42.30	22.90	71.32	36.91	47.68
(Na + K)/Ca	15.13	8.20	29.74	12.61	19.12
A/CNK	1.20	1.11	1.36	1.17	1.21

Trace elements (mean values in ppm): *Flossenbürg Granite* – **Li** 152, **Rb** 454, **Sr** 39, **Ba** 215, **Zr** 69.

Leuchtenberg Granite

Quartz-rich, sodic, low peraluminous, I/S-type, I-series, granite

	L292Leu	**308Leuc**	**271Leuc**
SiO_2	72.00	74.20	74.90
TiO_2	0.40	0.05	0.08
Al_2O_3	13.80	14.40	13.00
Fe_2O_3	1.00	0.32	0.28
FeO	1.60	1.00	0.48
MnO	0.05	0.09	0.02
MgO	0.87	0.17	0.26
CaO	1.70	0.44	0.38
Na_2O	3.30	4.06	2.59
K_2O	4.26	4.30	5.33
P_2O_5	0.18	0.15	0.01
Mg/(Mg + Fe)	0.38	0.18	0.38
K/(K + Na)	0.46	0.41	0.58
Nor.Or	26.17	25.98	33.04
Nor.Ab	30.81	37.28	24.40
Nor.An	7.54	1.22	1.91
Nor.Q	30.22	30.88	36.93
Na + K	196.94	222.31	196.75
*Si	182.29	184.10	214.27
K-(Na + Ca)	-46.35	-47.56	22.81
Fe + Mg + Ti	61.41	22.78	17.65
Al-(Na + K + 2Ca)	13.43	44.78	44.99
(Na + K)/Ca	6.50	28.33	29.04
A/CNK	1.07	1.20	1.21

Trace elements (mean values in ppm): *Leuchtenberg Granite* – **Li** 74, **Rb** 244**, Sr** 178, **Ba** 620, **Ti** 2270, **Zr** 191.

2.1.5. NEUNBURG COMPOSITE MASSIF

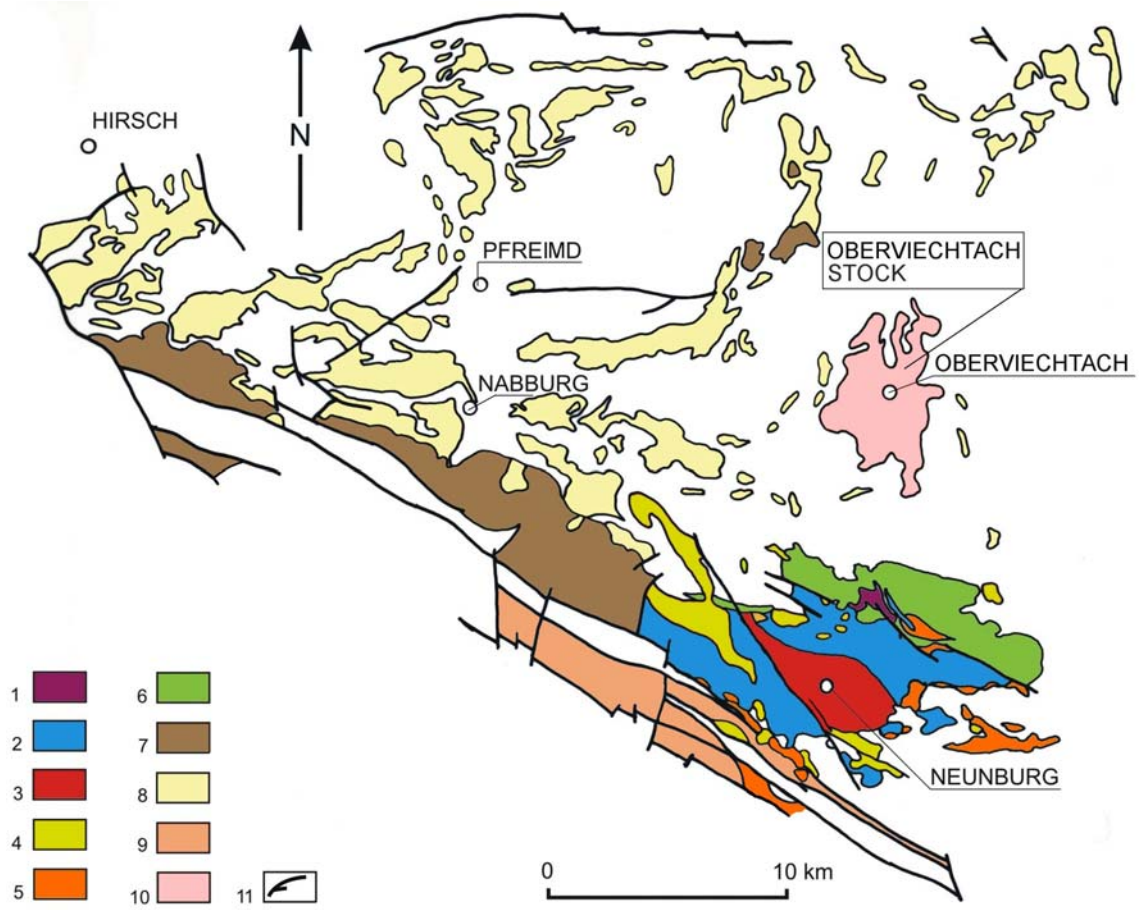

Fig. 2.41. *Neunburg Composite Massif and Oberviechtach Stock geological sketch-map (after Bauberger 1969, Wiegand 1995). 1 – Neunburg Granite (roof facies), 2 – Neunburg Granite (normal facies), 3 – Neunburg Granite (central facies), 4 – Neunburg Granite (marginal facies), 5 – Penting Granite, 6 – Thanstein Granite, 7 – Neunburg Granite undivided, 8 – Oberviechtach type Granite, 9 – Winz (Orthogneiss) Granite, 10 – Oberviechtach Stock, 11 – faults.*

Geological position: Ostrong Terrane of the Moldanubian Zone.

Rock types:

1. *Neunburg Granite* (70 km^2) – medium to coarse-grained muscovite-biotite granite (Central, Normal, Marginal and Roof Facies).
2. *Thanstein Granite* – fine to medium grained muscovite-biotite granite.
3. *Penting Granite* – porphyritic medium- to coarse-grained biotite granite.
4. *Oberviechtach Granite* – fine-grained muscovite-biotite granite (equivalent to the Mauthausen Granite).
5. *Winz Granite (Winz Orthogneiss)* – porphyroclastic coarse-grained chlorite metagranite.

Size and shape (in erosion level): 530 km^2, elongated intrusion, segmented and outlined by marginal faults of the Bohemian Massif.

Age and isotopic data: *Neunburg Granite*: 320, 319 ± 3.6 Ma (U-Pb zircon), 300 ± 6 and 318 ± 29 Ma (Rb-Sr whole rock), 324 ± 6 to 319 ± 6 Ma (K-Ar muscovite), 323 ± 5 to 320 ± 5 Ma (K-Ar biotite), 300 ± 6 Ma (K-Ar biotite), 310 ± 6 (Rb-Sr biotite), 315 ± 8 Ma (Rb-Sr muscovite),

Oberviechtach Granite 320 to 310 Ma (U-Pb zircon), 354 ± 35 (Rb-Sr whole rock), 320 ± 8 Ma (Rb-Sr biotite) and 318 ± 8 Ma (Rb-Sr muscovite).

Temporal relationship: *Thanstein Granite* (the oldest) → *Penting Granite* → *Neunburg Granite* (the latest).

S-type magmatism in the western wing of the Moldanubian Composite Batholith started 5–10 Ma earlier than in the Oberpfalz Massif.

Geological environment: metatectic cordierite-sillimanite K-feldspar gneiss, biotite-plagioclase gneiss and diatectic gneiss. Contact with the gneisses and diatexites.

Contact aureole: a broad anatectic and diatectic aureole.

Zoning: zoned fractional crystallization.

Mineralization: Ba-F veins, pegmatite.

Heat production (μWm^{-3}): *Thanstein Granite* 1.92, 8.55, *Penting Granite* 5.04, *Neunburg Granite* 3.29.

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Neunburg Composite Massif

Thanstein Granite Quartz-normal, potassic, peraluminous, mesocratic, S-type, granite
Penting Granite Quartz-normal, potassic, peraluminous, mesocratic, S-type, granite
Neunburg Granite Quartz-normal, potassic, peraluminous, mesocratic, S-type, granite

	Thanstein Granite	**Penting Granite**	**Neunburg Granite**			
			Zentral-	Normal-	Dach-	Randfazies
number of samples	35	38	10	45	9	21
SiO_2	74.71	71.63	71.07	72.45	74.19	73.09
TiO_2	0.47	0.37	0.26	0.30	0.22	0.26
Al_2O_3	14.94	14.90	15.63	15.00	14.63	14.75
Fe_2O_3	2.25	2.11	1.83	1.84	1.41	1.60
MnO	0.03	0.03	0.03	0.03	0.02	0.03
MgO	0.53	0.48	0.46	0.40	0.25	0.33
CaO	0.44	0.48	0.38	0.38	0.20	0.41
Na_2O	2.75	2.72	2.89	3.07	3.35	3.28
K_2O	5.89	5.86	6.36	5.68	5.43	5.22
P_2O_5	0.29	0.28	0.26	0.26	0.28	0.24
Mg/(Mg + Fe)	0.31	0.31	0.33	0.30	0.26	0.29
K/(K + Na)	0.58	0.59	0.59	0.55	0.52	0.51
Nor.Or	34.90	35.82	38.53	34.37	32.55	31.59
Nor.Ab	24.77	25.27	26.61	28.23	30.52	30.17
Nor.An	0.27	0.55	0.18	0.18	-0.87	0.46
Nor.Q	32.76	31.08	27.70	30.53	31.87	31.63
Na + K	213.80	212.19	228.30	219.67	223.39	216.68

*Si	195.45	179.49	161.47	177.75	185.82	183.94
K-(Na + Ca)	28.47	28.09	35.00	14.76	3.62	-2.32
Fe + Mg + Ti	47.23	42.98	37.60	36.74	26.63	31.49
Al-(Na + K + 2Ca)	63.90	63.29	65.09	61.35	56.77	58.36
(Na + K)/Ca	27.25	24.79	33.69	32.42	62.64	29.64
A/CNK	1.32	1.31	1.30	1.30	1.28	1.28

***Trace elements (ppm)**: Thanstein Granite* – **Be** 9, **Sc** 6, **V** 21, **Cr** 29, **Ni** 15, **Cu** 9, **Zn** 80, **Ga** 22, **Rb** 256, **Sr** 92, **Y** 45, **Zr** 153, **Nb** 12, **Sn** 7, **Cs** 11, **Ba** 320, **Th** 16, **U** 3 (Bauberger – Streit 1982).

Thanstein Granite – **Ba** 459, **Cr** 16, **Co** 70, **Ga** 25, **Nb** 10, **Pb** 32, **Rb** 389, **Sr** 80, **Th** 83, **U** 8, **V** 25, **Y** 17, **Zn** 90, **Zr** 213, **Mo** 5.5(Wiegand 1995).

Neunburg Granite – **Ba** 393, **Cr** 15, **Co** 69, **Ga** 20, **Nb** 13, **Pb** 34, **Rb** 307, **Sr** 79, **Th** 19, **U** 5.6, **V** 16, **Y** 16, **Zn** 56, **Zr** 107, **Mo** 4.3 (Wiegand 1995).

Penting Granite – **Ba** 541, **Cr** 17, **Co** 63, **Ga** 24, **Nb** 13, **Pb** 36, **Rb** 292, **Sr** 94, **Th** 41, **U** 6.2, **V** 20, **Y** 17, **Zn** 77, **Zr** 161, **Mo** 4.2 (Wiegand 1995).

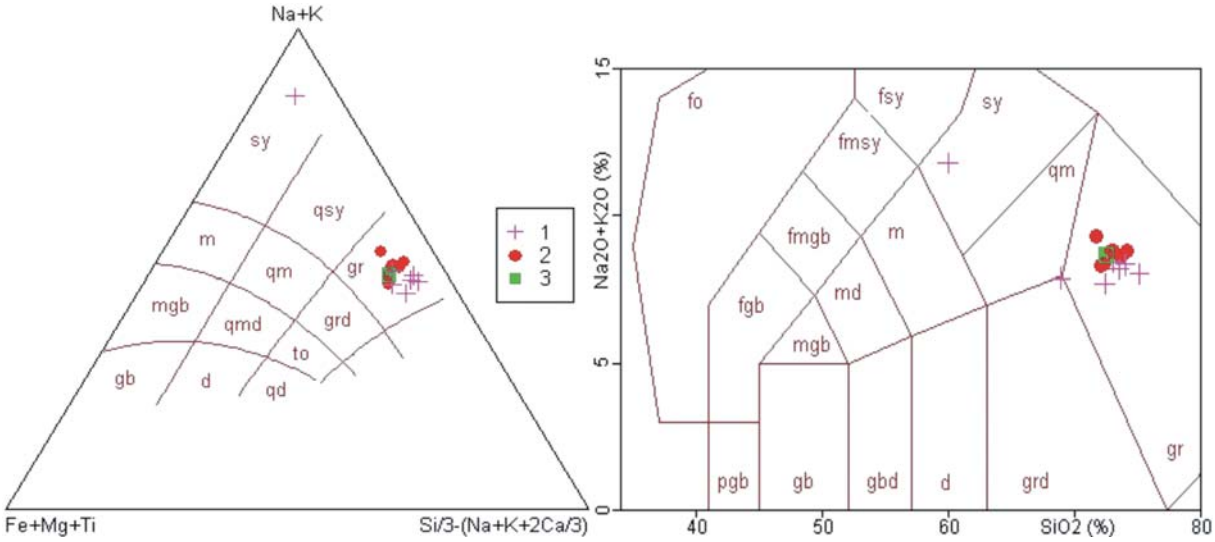

***Fig. 2.42.** Neunburg Composite Massif ABQ and TAS diagrams. 1 – Thanstein Granite, 2 – Neunburg Granite, 3 – Penting Granite.*

2.1.6. OBERVIECHTACH STOCK

Geological position: Ostrong Terrane of the Moldanubian Zone, a member of the Neunburg Composite Massif.

Rock types: 1. *Oberviechtach Granite* – fine-grained muscovite-biotite granite (equivalent to the Mauthausen Granite).

Size and shape (in erosion level): oval intrusion – 17 km^2 (6 × 4 km) at the eastern margin of archipelago of the irregular outcrops of the fine-grained two-mica granite over the area of 20 × 40 km.

Age and isotopic data: *Oberviechtach Granite* 320 to 310 Ma (U-Pb zircon), 354 ± 35 (Rb-Sr whole rock), 320 ± 8 Ma (Rb-Sr biotite).and 318 ± 8 Ma (Rb-Sr muscovite).

S-type magmatism in the western wing of the Moldanubian Composite Batholith started 5–10 Ma earlier than in the Oberpfalz Massif.

Geological environment: metatectic cordierite-sillimanite K-feldspar gneiss, biotite-plagioclase gneiss and diatectic gneiss. Sharp contact with the high-grade gneisses.

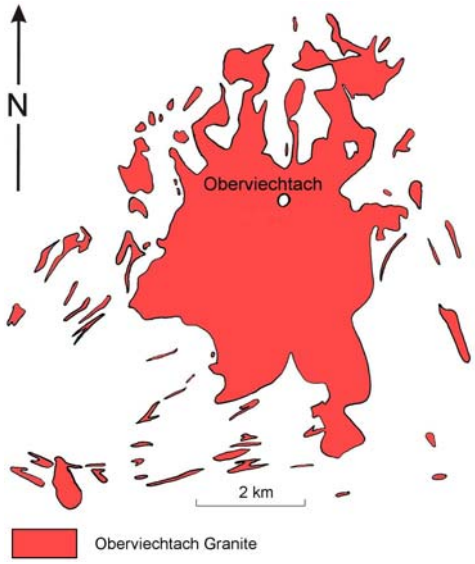

Fig. 2.43. *Oberviechtach Stock geological sketch-map (after Düsing and Brunnacker 1958).*

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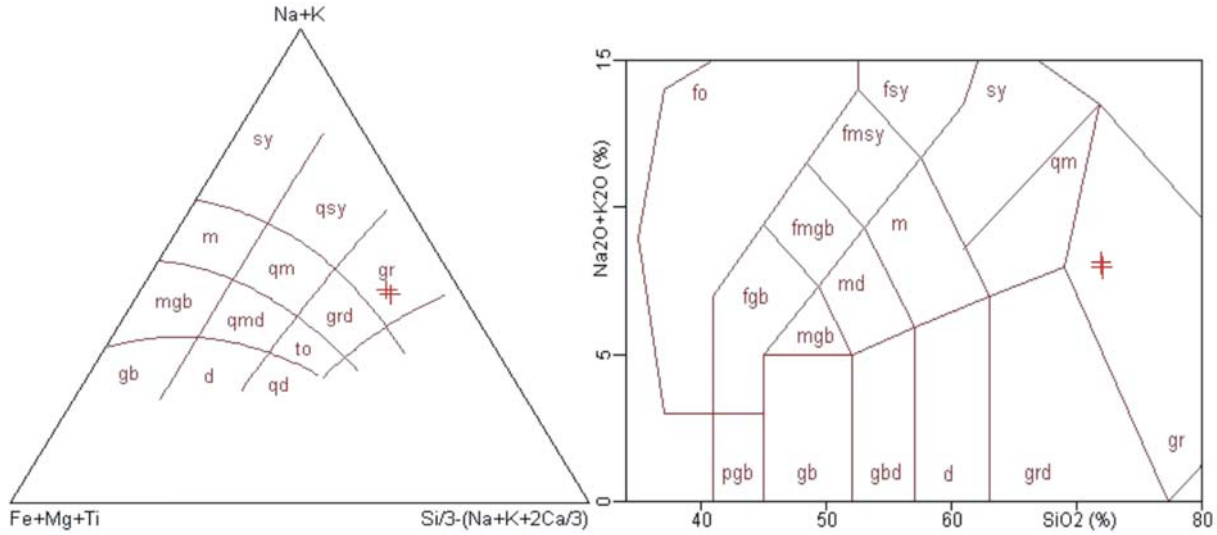

Fig. 2.44. *Oberviechtach Stock ABQ and TAS diagrams. Oberviechtach Granite.*

2.1.7. KÜRNBERG STOCK

Geological position: Ostrong Terrane of the Moldanubian Zone.

Rock types: *Kürnberg Granite* – fine- to medium-grained two-mica leucogranite.

Size and shape (in erosion level): elliptical shape (3 × 4 km).

Age and isotopic data: no isotopic data.

Geological environment: metatectic cordierite-sillimanite-K-feldspar gneiss, diatectic gneiss.

Contact aureole: not described.

Mineralization: not reported.

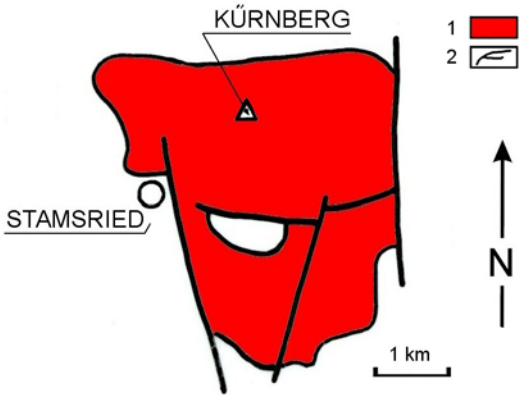

Fig. 2.45. *Kürnberg Stock geological sketch-map (adapted after Teipel et al. 2008). 1 – Kürnberg Granite, 2 – Faults.*

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2.1.8. MILTACH STOCK

Geological Position: Ostrong Terrane of the Moldanubian Zone.

Rock types: *Miltach Granite* – fine- to medium-grained two-mica leucogranite.

Size and shape (in erosion level): longated shape (~16 km^2)

Age and isotopic data: 321.8 ± 3.7 Ma (Pb/Pb zircon).

Geological environment: metatectic cordierite-sillimanite-K-feldspar gneiss, diatectic gneiss.

Contact aureole: not described.

Mineralization: not reported.

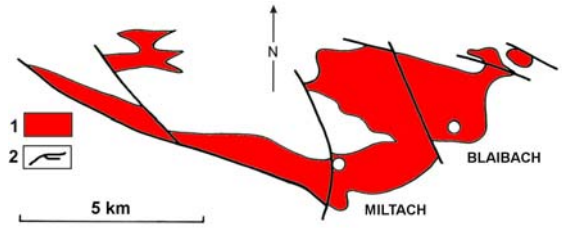

Fig. 2.46*. Miltach Stock geological sketch-map (adapted after Teipel et al. 2008). 1 – Miltach Granite, 2 – Faults.*

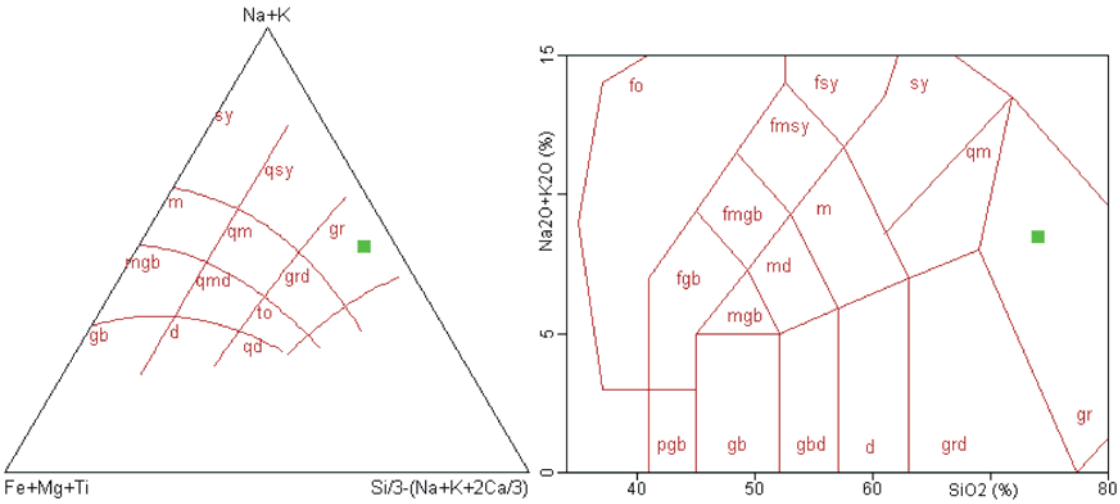

Fig.2.47. *Miltach granite ABQ and TAS diagrams.*

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2.1.9. ARNBRUCK MASSIF (AM)

Geological position: Ostrong Terrane of the Moldanubian Zone. AM is cut by the Runding Fault.

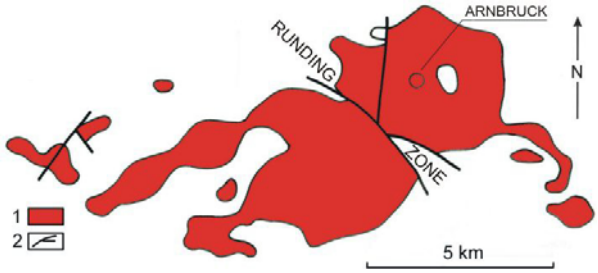

Fig. 2.48. *Arnbruck Stock geological sketch-map (adapted after Teipel et al. 2008). 1 – Arnbruck Granite, 2 – faults.*

Rock types: *Arnbruck Granite* – fine- to medium grained two-mica leucogranite. Equivalent to the Eisgarn Granite.

Size and shape (in erosion level): elliptical shape 35 km^2 (5 × 12 km).

Age and isotopic data: 325.3 ± 2.1 Ma (Pb/Pb zircon).

Geological environment: cordierite-sillimanite-K-feldspar gneiss and diatectite gneiss.

Contact aureole: not described.

Mineralization: not reported.

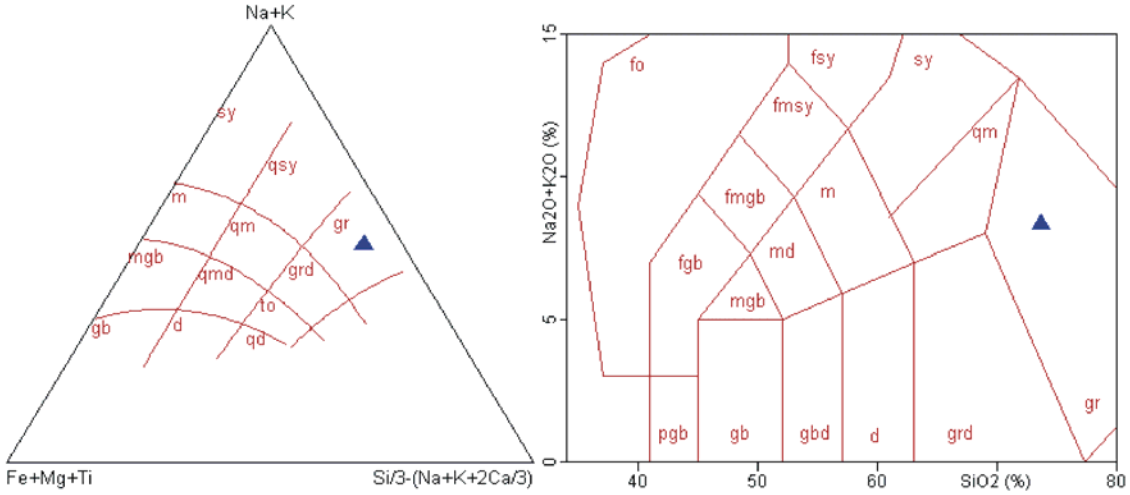

Fig. 2.49. *Arnbruck Granite ABQ and TAS diagrams*

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2.1.10. PRÁŠILY MASSIF

Geological position: Ostrong Terrane of the Moldanubian Zone.

Rock types:

1. *Kristallgranite I (Weinsberg Granite-Granodiorite)* – coarse-porphyritic biotite granite
2. *Kristallgranite II (Eisgarn Granite)* – medium- to coarse-grained muscovite granite
3. *Dyke Granite* – fine-grained muscovite granite at the northern contact
4. *Eisgarn Granite s.l.* – medium-grained muscovite-biotite granite along the northern and eastern margin).

Size and shape (in erosion level): oval shape 6 × 14 km.

Age and isotopic data: Late-Variscan**.** No isotopic data.

Geological environment: paragneisses and migmatites.

Contact aureole: narrow aureole, local presence of cordierite.

Zoning: zonation is indicated by Th distribution.

Mineralization: unknown.

Heat production (μWm^{-3}): *Kristallgranite I* 3.56, *Kristallgranite II* 3.61.

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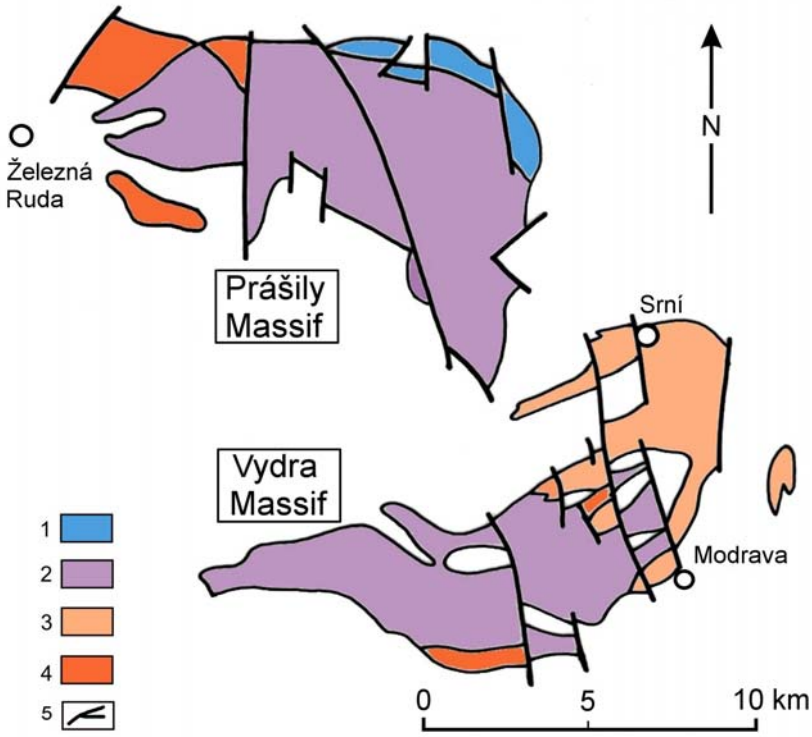

Fig. 2.50. *Prášily and Vydra Massifs geological sketch-map (adapted after Unger et al. 1999 and Žáček and Babůrek 2007). 1 – Dyke Granite, 2 – Kristallgranite I, 3 – Kristallgranite II, 4 – Eisgarn Granite s.l.*

2.1.11. VYDRA MASSIF

Geological position: Monotonous part (Ostrong Terrane) of the Moldanubian Zone.

Rock types:

The central part of the massif is formed by porphyritic granite (Kristallgranite I). Two-mica Kristallgranite II rims in the eastern margin of the Vydra Massif.

1. *Granodiorite to Quartz diorite* – coarse-grained non-porphyritic biotite granodiorite to quartz diorite (isometric body).
2. *Kristallgranite* I (Weinsberg type) – porphyritic coarse-grained biotite granite to granodiorite (in the southern part of the body).
3. *Srní Granite* (Kristallgranite I – Weinsberg type) – even-grained biotite granite to granodiorite
4. *Kristallgranite II* (Eisgarn Granite s.s.) – medium-grained muscovite-biotite, locally slightly cataclastic granite (along the northern and eastern margin).
5. unclassified leucogranite apophyses at the western exocontact.

Size and shape (in erosion level): an apical part of the larger granite body. Half-moon shape 20 × 7 km, elongated in the E-W direction (a half of the intrusion is hidden under about 100 m thick cover of the crystalline rocks).

Age and isotopic data: *Kristallgranite I:* 327 ± 35 Ma (U-Th monazite).

Geological environment: sillimanite – biotite ± cordierite migmatites, gneisses and orthogneisses.

Zoning: concentric zonation highlighted by the magnetic circular anomaly and Th distribution.

Contact aureole: extensive periplutonic migmatization.

Mineralization: not reported.

Heat production (μWm^{-3}): *Granodiorite to Q-diorite* 5.91, *Kristallgranite I* 3.56, *Kristallgranite II* 3.61, *leucogranite dykes* 2.03.

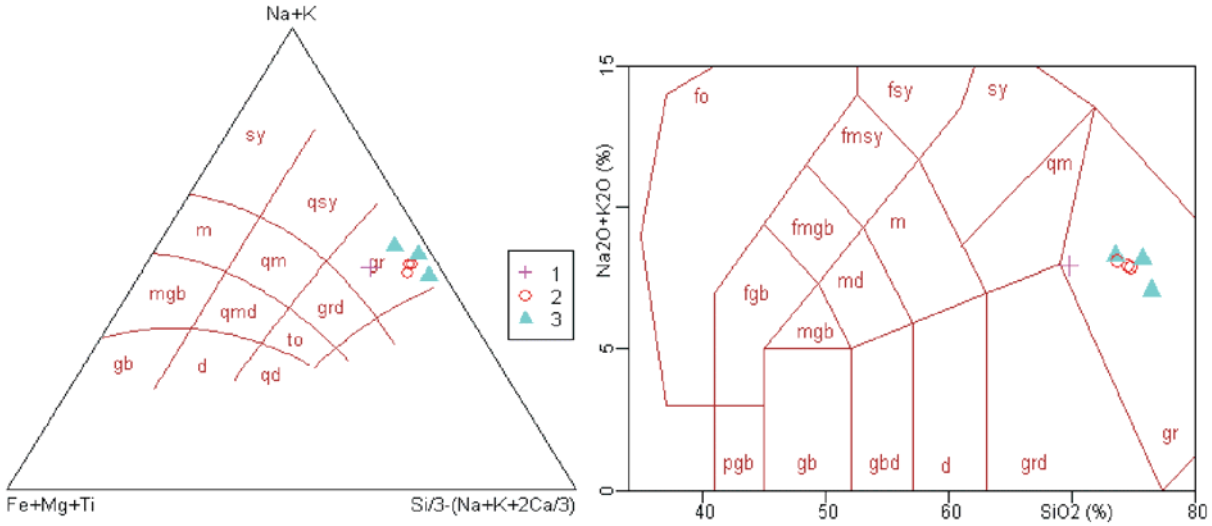

Fig. 2.51. *Vydra Massif ABQ and TAS diagrams. 1 – Kristallgranite I, 2 – Kristallgranite II, 3 – Kvilda Dyke Swarm.*

Vydra Granite

Quartz-normal, potassic, peraluminous, mesocratic, S-type granite

	51bi-granite
SiO_2	68.90
TiO_2	0.43
Al_2O_3	15.59
Fe_2O_3	0.75
FeO	2.39
MnO	0.82
MgO	0.06

CaO	1.81
Na_2O	2.75
K_2O	5.09
P_2O_5	0.24
Li_2O	0.01
Mg/(Mg+Fe)	0.03
K/(K+Na)	0.55
Nor.Q	27.29
Nor.Or	31.60
Nor.Ab	25.94
Nor.An	7.77
Na+K	196.81
*Si	163.91
K-(Na+Ca)	-12.94
Fe+Mg+Ti	49.63
Al-(Na+K+2Ca)	44.79
(Na+K)/Ca	6.10
A/CNK	1.20

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Vydra Granites

Quartz-rich, potassic, peraluminous, leucocratic, S-type granite

	biotite granite 5	two-mica granite 45	two-mica granite 46	two-mica granite 19
SiO_2	68.90	72.46	73.28	73.80
TiO_2	0.43	0.20	0.17	0.09
Al_2O_3	15.59	15.17	14.17	14.66
Fe_2O_3	0.75	0.50	0.84	0.51
FeO	2.39	0.79	0.92	0.71
MnO	0.82	0.38	0.29	0.22
MgO	0.06	0.03	0.03	0.06
CaO	1.81	0.60	0.66	0.70
Na_2O	2.75	3.01	2.95	3.53
K_2O	5.09	4.96	4.87	4.26
P_2O_5	0.24	0.31	0.09	0.17
Li_2O	0.01	0.02	0.02	0.03
Mg/(Mg + Fe)	0.03	0.03	0.03	0.07
K/(K + Na)	0.55	0.52	0.52	0.44
Nor.Or	31.60	30.34	29.89	25.88
Nor.Ab	25.94	27.98	27.52	32.60
Nor.An	7.77	0.98	2.81	2.43
Na + K	196.81	202.44	198.60	204.36
*Si	163.91	192.42	200.10	196.74
K-(Na + Ca)	-12.94	-2.52	-3.56	-35.94
Fe + Mg + Ti	49.63	20.47	26.24	18.92
Al-(Na + K + 2Ca)	44.79	74.06	56.13	58.57
(Na + K)/Ca	6.10	18.92	16.87	16.37
Nor.Q	27.29	33.44	34.35	33.66
A/CNK	1.20	1.37	1.26	1.28

5 – Kristallgranite I, 45, 46, 19 – Kristallgranite II.

Trace elements (mean values in ppm): *Kristallgranite I* – **V** 21, **Co** 7, **Cr** 17, **Ni** 12, **Cu** 10, **Zn** 63, **Rb** 183, **Sr** 237, **Y** 31, **Zr** 302, **Nb** 13, **Pb** 39, **U** 4 (Žáček – Sulovský 2005).
Kristallgranite II – **V** 10, **Cr** 5, **Ni** 9, **Cu** 6, **Zn** 60, **As** 4, **Rb** 280, **Sr** 70, **Y** 10, **Zr** 87, **Nb** 12, **Sn** 10, **Pb** 34, **U** 9 (Žáček – Sulovský 2005).
Leucogranite – **Cr** 4, **Ni** 4, **Co** 25, **Zn** 52, **As** 18, **Rb** 217, **Sr** 30, **Y** 6, **Zr** 17, **Nb** 10, Sn 34, **Pb** 33, **U** 4 (Žáček – Sulovský 2005).

2.1.12. RINCHNACH STOCK

Geological position: Ostrong Terrane of the Moldanubian Zone closely bounded to the northeast side of the Pfahl zone.

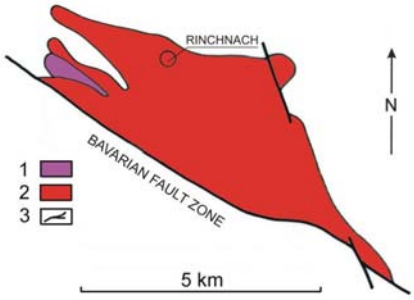

Fig. 2.52. *Rinchnach Stock geological sketch-map (adapted after Teipel et al. 2008). 1 – Kristallgranite I, 2 – Rinchnach Granodiorite-Granite, 3 – Bavarian Fault Zone.*

Rock types: *Rinchnach Granodiorite-Granite* – fine-grained biotite granodiorite to granite (equivalent to the Mauthausen Granite).

Size and shape (in erosion level): oval shape 6 × 2.5 km (12 km^2).

Age and isotopic data: *Rinchnach Granodiorite* 329.2 ± 2.1 Ma (Pb-Pb zircon), 320.4 ± 6.5 Ma (Pb-Pb zircon).

Geological environment: metatectic cordierite-sillimanite K-feldspar gneiss,

biotite-plagioclase gneiss, diatectic gneiss and pearl gneisses.

Contact aureole: not described.
Mineralization: not reported.

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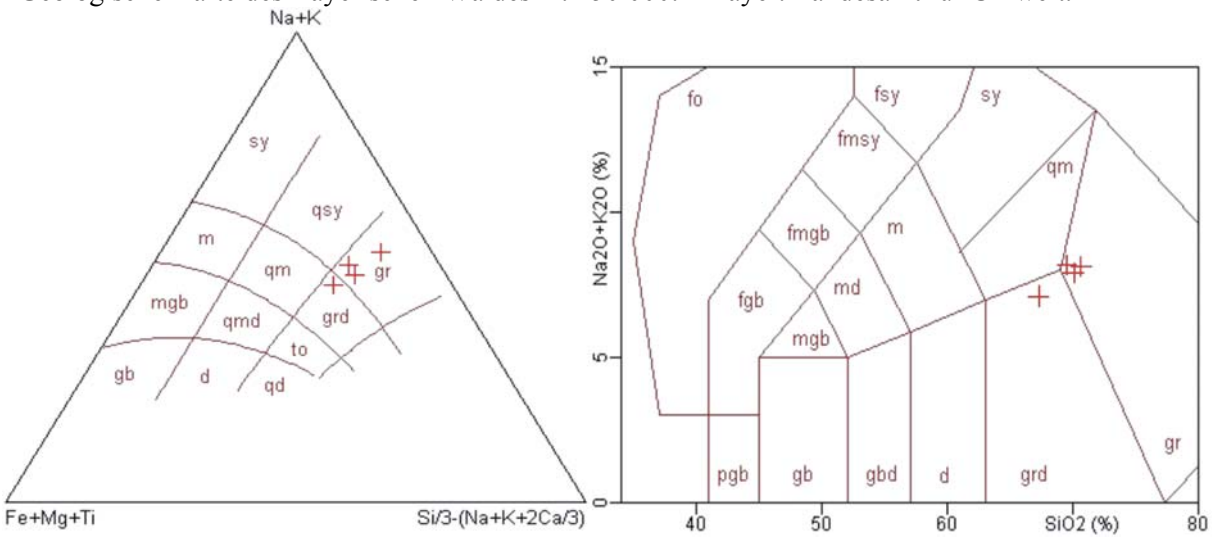

Fig. 2.53. *Rinchnach Stock ABQ and TAS diagrams. Rinchnach Granodiorite-Granite*

Rinchnach Granodiorite-Granite

Quartz-normal, sodic, very weakly peraluminous, mesocratic, I-type, granodiorite

	Ri1	**Ri2**	**Ri3**
	monzogranite		granodiorite
SiO_2	67.12	70.01	68.32
TiO_2	0.58	0.48	0.48
Al_2O_3	16.46	15.00	15.09
$Fe_2O_{3tot.}$	3.57	2.90	2.80
MnO	0.06	0.05	0.05
MgO	1.32	1.00	0.96
CaO	3.39	2.40	2.34
Na_2O	3.88	3.53	3.59
K_2O	3.20	4.37	4.45
P_2O_5	0.20	0.17	0.19
Mg/(Mg + Fe)	0.42	0.40	0.40
K/(K + Na)	0.35	0.45	0.45
Nor.Or	19.49	26.52	27.39
Nor.Ab	35.91	32.56	33.59
Nor.An	15.98	11.08	10.79
Nor.Q	22.57	25.31	23.65
Na + K	193.15	206.70	210.33
*Si	138.92	153.17	140.88
K-(Na + Ca)	-117.71	-63.92	-63.09

Fe + Mg + Ti	84.75	67.16	64.92
Al-(Na + K + 2Ca)	9.19	2.28	2.55
(Na + K)/Ca	3.20	4.83	5.04
A/CNK	1.04	1.02	1.02

Trace elements in ppm: *Rinchnach Granodiorite-Granite* – **Ba** 783, **Rb** 186, **Sr** 270, **Zr** 220, **Y** 35, **Ce** 77.

2.1.13. STRÁŽNÝ-FINSTERAU MASSIF

Geological position: Ostrong Terrane of the Moldanubian Zone.

Rock types:

1. *gabbro (minor bodies).*
2. *Finsterau I Granite (Weinsberg – Kristallgranite I type)* – coarse-grained porphyritic (megacrystic) biotite granite
3. *Finsterau II Granite (Kristallgranite II – Eisgarn type)* – weakly porphyritic muscovite granite.
4. *Lusen Granite* medium-grained two-mica granite cuts the Finsterau granites in several locations.
5.

Size and shape (in erosion level): 30 km × 10 km. Lusen Granite forms a separate intrusion in the northern margin of the Strážný-Finsterau Massif.

5. *Dyke Granite*

Age and isotopic data: *Weinsberg Granite-Granodiorite*: 349 ± 4 Ma (Rb-Sr whole rock), *Kristallgranite II:* 316 ± 7 Ma (Rb-Sr whole rock), *Finsterau I Granite* 325.9 ± 1.9 Ma (Pb/Pb zircon), *Finsterau II Granite (Kristall II Granite)* 324.1 ± 1.8 Ma (Pb/Pb zircon), *Lusen Granite* 324.9 ± 3.5 Ma (Pb/Pb zircon).

Geological environment: gneisses, migmatite.

Contact aureole: not described.

Mineralization: not reported.

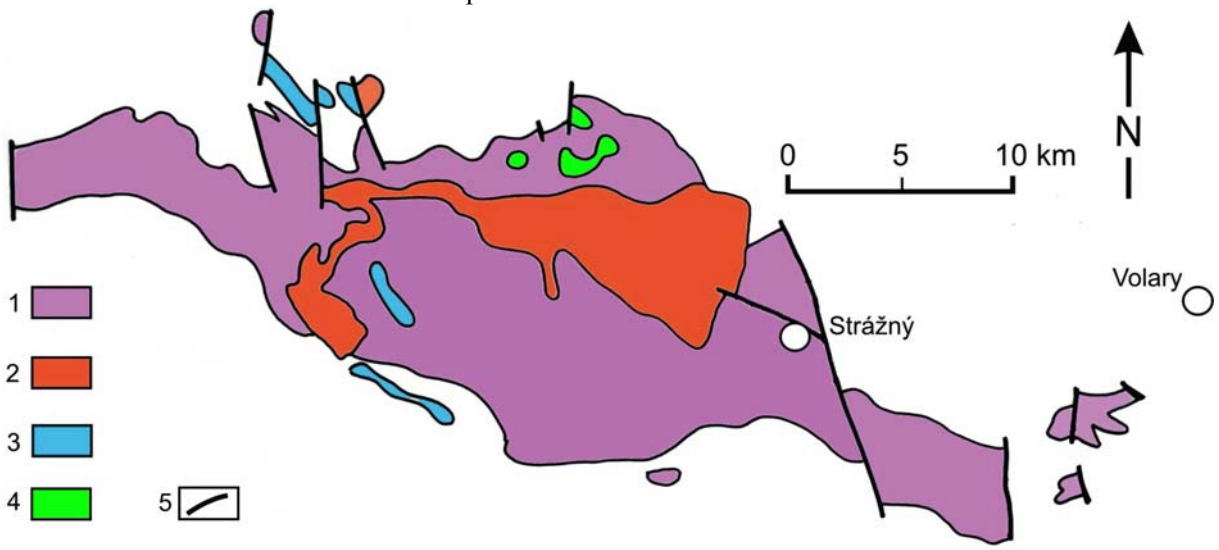

Fig. 2.54. *Strážný-Finsterau Massif geological sketch-map (adapted after Unger et al. 1999). 1 – Finsterau I Granite (Kristallgranite I), 2 – Finsterau II Granite (Kristallgranite II), 3 – Dyke Granite, 4 – Gabbro, 5 – faults.*

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2.1.14. HAIDEL MASSIF

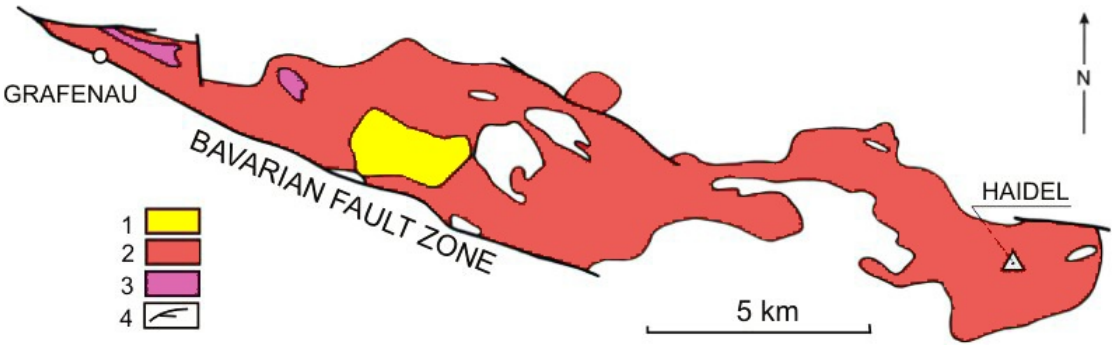

Fig. 2.55. *Haidel Massif geological sketch-map (adapted after Teipel et al. 2008). 1 – Haidel Granite, 2 – Dreisessel Granite, 3 – Kristallgranite I, 4 – Bavarian Fault Zone.*

Geological position: Ostrong Terrane of the Moldanubian Zone.

Rock types: *Haidel Granite* – medium grained biotite granite mostly with occasional K-feldspar phenocrysts (up to 8 cm in length) – equivalent to the Eisgarn Granite s.l.

Dreisessel Granite – medium-grained, strongly porphyritic muscovite-biotite granite (equivalent of the Eisgarn Granite s.l.).

Size and shape (in erosion level): long elliptical shape 25 × 3 km (55 km^2).

Age and isotopic data: 323.4 ± 2.6 Ma (Pb/Pb zircon).

Geological environment: cordierite-sillimanite-K-feldspar gneiss and granites of the Plechý (Dreisessel-Plöckenstein) Massif.

Contact aureole: not described.

Mineralization: not reported.

References

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2.1.15. PLECHÝ (DREISESSEL-PLÖCKENSTEIN) MASSIF

Geological position: Ostrong Terrane of the Moldanubian Zone. The Plechý and Haidmühle Granites were emplaced as a deeply rooted ~ NE-SW elongated intrusion. The Plechý massif extends to depth of at least ~ 8 km below the present-day erosion level.

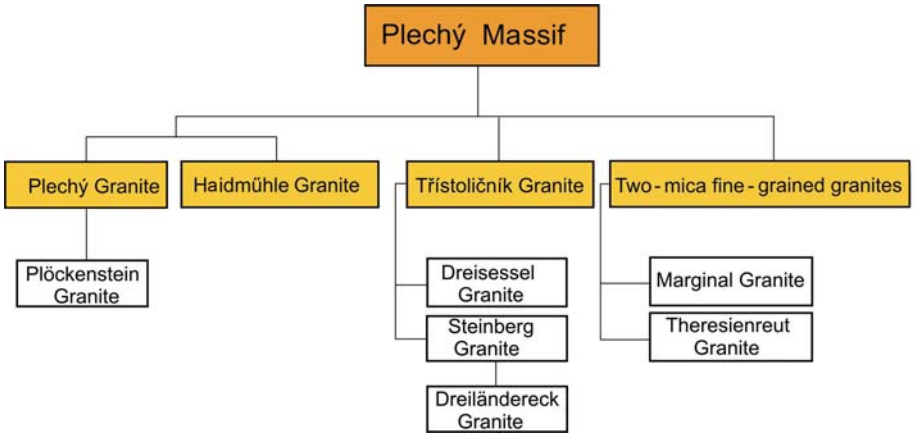

Fig. 2.56. *Plechý (Dreisessel-Plöckenstein) Massif hierarchic scheme according to rock types.*

Rock types:

1. *Kristallgranite II* (the Eisgarn s.s. type) – biotite-muscovite granite (equivalent of the Plechý Granite).
2. *Steinberg Granite* – porphyritic (strong alignment of K-feldspar phenocrysts) medium- to coarse-grained biotite-rich granite, equivalent ob the Eisgarn Granite s.l. (variety of the Třístoličník Granite).
3. *Theresienreut Granite* – medium grained two-mica granite (not shown in the map) – equivalent of the Eisgarn Granite s.l.
4. *Marginal Granite* – equigranular, fine to medium-grained biotite-muscovite, garnet-bearing granite.
5. *Plechý (Plöckenstein) Granite* – coarse-grained, weakly porphyritic biotite-muscovite granite (similar to the Eisgarn Granite s.s.).
6. *Haidmühle 1 Granite* – coarse-grained biotite granite (variety of the Plechý Granite) – equivalent of the Eisgarn Granite s.l.
7. *Haidmühle 2 Granite* – medium-grained biotite granite (equivalent of the Eisgarn Granite s.l.), numerous cordierite sillimanite metatectic enclaves.
8. *Třístoličník (Dreisessel) Granite* – medium-grained, strongly porphyritic muscovite-biotite granite (equivalent of the *Eisgarn Granite s.l.*). The granite comprises two granite varieties: the *Steinberg and Dreisessel Granite*. The later has been interpreted as the roof facies of the *Plechý Granite*.
9. *Dreiländerecke Granite* – two-mica granite with extremely high Th content (50–99 ppm). It is a variety of the *Třístoličník Granite (Steinberg Granite*).

Size and shape (in erosion level): 26 × 21 km, elliptic shape, elongated to the southwest and extended to the depth of 5.5 km and 8 km respectively (based on the geophysical model).

Age and isotopic data: Upper Palaeozoic according to geological indications and isotopic data (~ 328 to ~ 321 Ma). *Třístoličník (Dreisessel) Granite:* 337 ± 6.5 Ma (U-Th-Pb monazite), 322 ± 19 Ma (Rb-Sr whole rock), 318 ± 10 amd 316 ± 8 Ma (Rb-Sr muscovite), 327.1 ± 1.9 Ma (Pb/Pb zircon), *Plechý (Plöckenstein) Granite:* 347.8 ± 9.3 Ma (U-Th-Pb monazite), 324.8 ± 3.4 Ma (Pb/Pb zircon), *Haidmühle Granite:* 320.7 ± 1.6 Ma (Pb/Pb zircon), *Steinberg Granite*: 328 ± 2 Ma (Pb/Pb zircon).

Field relationship (from older to younger): Plechý Granite – Haidmühle Granite → Třístoličník (Dreisessel) Granite → Marginal Granite.

Geological environment: migmatized cordierite-sillimanite gneiss and retrogressed granulites. The southwestern margin of the massif is crosscut by the NW-SE Pfahl shear zone. To the north the massif is in intrusive contact with fine-grained, equigranular muscovite-biotite granite. To the northeast the

massif is juxtaposed against the older ~ 340 Ma melagranite to melasyenite of the Želnava (Knížecí Stolec) Massif.

Contact aureole: not described.

Zoning: sub-vertical magmatic fabric indicating concentring zonation. The Třístoločník Granite is characterized by steep margin-parallel magmatic foliation.

Mineralization: not reported.

Heat production (μWm^{-3}): *Plechý Granite* 3.31, *Třístoličník Granite* 4.90.

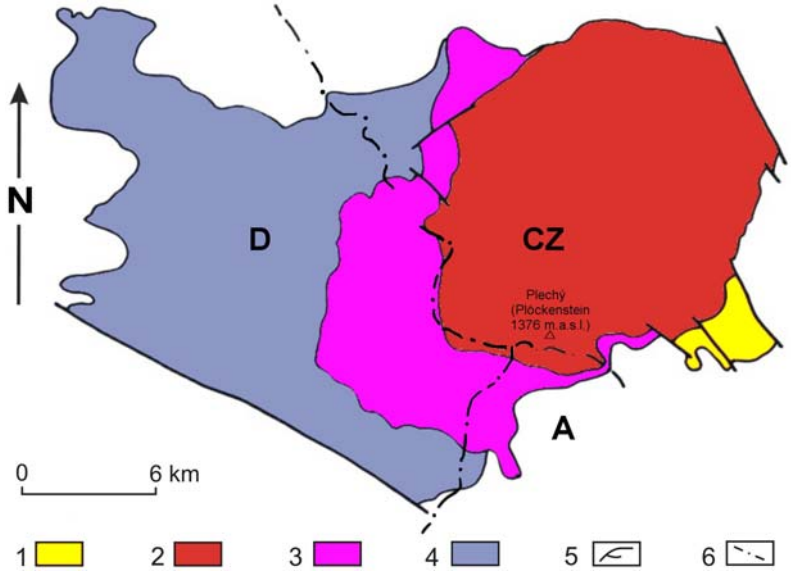

Fig. 2.57. *Plechý (Dreisessel-Plöckenstein) Massif geological sketch-map (adapted after Verner et al. 2008). 1 – Marginal Granite, 2 – Plechý Granite, 3 – Třístoličník Granite, 4 – Haidmühle Granite, 5 – faults, 6 – state border.*

Plechý Granite

Quartz-rich, potassic, peraluminous, mesocratic, S-type, I-series, granite

n = 30	Median	Min	Max	QU1	QU3
SiO_2	73.19	71.85	74.65	73.02	73.60
TiO_2	0.17	0.04	0.25	0.16	0.20
Al_2O_3	14.53	13.64	15.29	14.27	14.72
Fe_2O_3	0.53	0.13	0.96	0.44	0.60
FeO	0.72	0.09	1.10	0.57	0.84
MnO	0.03	0.01	0.05	0.02	0.03
MgO	0.27	0.03	0.41	0.24	0.31
CaO	0.57	0.25	0.76	0.53	0.63
Na_2O	3.19	2.68	3.99	3.11	3.40
K_2O	5.09	4.45	5.69	4.85	5.27
P_2O_5	0.31	0.24	0.38	0.28	0.32
Li_2O	0.026	0.000	0.044	0.021	0.033
Mg/(Mg + Fe)	0.28	0.09	0.33	0.24	0.30
K/(K + Na)	0.51	0.45	0.56	0.48	0.52
Nor.Or	31.04	27.02	34.52	29.38	31.96
Nor.Ab	29.57	25.04	36.54	28.70	31.57
Nor.An	0.79	-0.69	2.13	0.58	1.14
Nor.Q	31.85	27.72	37.80	31.10	33.35
Na + K	213.22	185.42	233.01	209.04	219.56
*Si	185.68	160.49	217.01	180.46	191.61
K-(Na + Ca)	-5.55	-34.67	17.61	-19.79	0.40
Fe + Mg + Ti	26.05	8.64	33.87	24.01	28.37
Al-(Na + K + 2Ca)	49.68	34.54	79.75	45.92	54.85

(Na + K)/Ca	20.97	15.46	49.25	18.57	22.54
A/CNK	1.25	1.18	1.43	1.22	1.28

Trace elements (mean values in ppm): *Plechý Granite* – **Ag** 7, **Cu** 4, **Cr** 16, **Nb** 15, **Ni** 9, **Pb** 25, **Rb** 340, **Sn** 11, **Sr** 57, **Th** 16, **U** 9, **Zr** 80 a 193 (Breiter 2007).

Třístoličník (Dreisessel) Granite

Quartz-rich, potassic, peraluminous, leucocratic, S-type, granite

n = 9	Median	Min	Max	QU1	QU3
SiO_2	72.57	71.40	74.30	71.77	73.22
TiO_2	0.26	0.17	0.49	0.22	0.35
Al_2O_3	14.10	13.73	14.38	14.00	14.30
Fe_2O_3	0.58	0.00	0.70	0.28	0.65
FeO	1.14	0.77	2.15	0.86	1.49
MnO	0.04	0.03	0.61	0.03	0.47
MgO	0.23	0.02	0.37	0.03	0.29
CaO	0.69	0.53	0.85	0.62	0.79
Na_2O	2.91	2.56	3.40	2.77	3.10
K_2O	5.32	4.88	5.68	5.19	5.53
P_2O_5	0.33	0.23	0.42	0.29	0.39
Li_2O	0.025	0.000	0.037	0.000	0.034
Mg/(Mg + Fe)	0.23	0.02	0.26	0.02	0.24
K/(K + Na)	0.53	0.49	0.58	0.52	0.57
Nor.Or	32.42	29.89	35.16	31.92	34.38
Nor.Ab	27.09	23.98	31.57	25.87	28.98
Nor.An	1.39	0.63	2.55	0.75	1.57
Nor.Q	31.15	30.37	36.25	30.70	31.63
Na + K	209.99	194.29	222.34	206.80	212.67
*Si	181.97	176.66	208.10	179.02	185.14
K-(Na + Ca)	1.30	-17.85	18.91	-3.21	16.70
Fe + Mg + Ti	30.79	18.11	38.38	28.51	36.93
Al-(Na + K + 2Ca)	41.74	33.87	58.13	37.18	46.23
(Na + K)/Ca	17.07	13.64	21.50	15.31	17.80
A/CNK	1.21	1.16	1.32	1.20	1.24

Trace elements (mean values in ppm): *Třístoličník Granite* – **Cr** 6.2, **Ni** 9.6, **Cu** 2.2, **Zn** 92, **As** 1.5, **Rb** 432, **Sr** 27, **Y** 8.6, **Zr** 113, **Nb** 17.4, **Sn** 9.8, **Pb** 18.4, **Th** 32.4, **U** 11 (Breiter 2007).

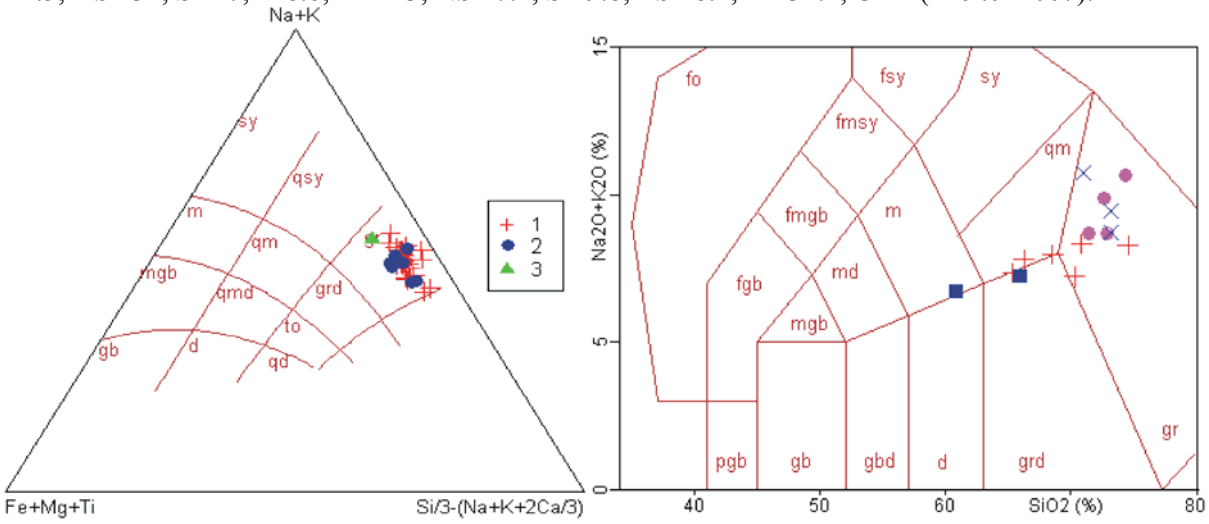

Fig. 2. 58. *Plechý (Dreisessel-Plöckenstein) Massif ABQ and TAS diagrams: 1 - Plechý (Plöckenstein) Granite, 2 –Třístoličník (Dreisessel) Granite 3 – .Haidmühle Granite, (K. Breiter personal communication).*

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2.1.16. AIGEN MASSIF

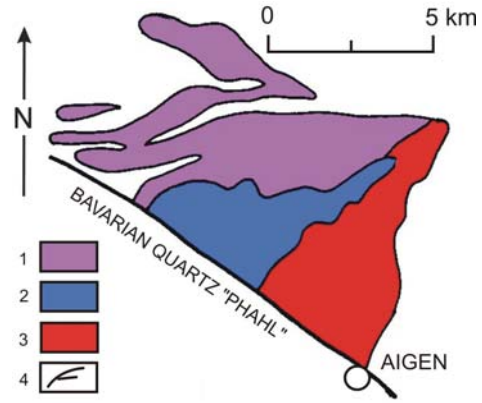

Fig. 2.59. *Aigen Massif sketch-map (adapted after Zitzmann 1999). 1 – Kristallgranite I (Weinsberg type), 2 – Kristallgranite II (Eisgarn Granite s.s.), 3 – Sulzberg Granite, 4 – fault.*

Geological position: Ostrong Terrane of the Moldanubian Zone, cut by the Bavarian Quartz "Pfahl"zone.

Rock types:

1. *Kristallgranite I* (Weinsberg type) – porphyritic, coarse-grained biotite granite.
2. *Sulzberg Granite* – fine-grained two-mica granite.
3. *Kristallgranite II* (Eisgarn Granite s.s.) – coarse-grained two-mica granite.

Size and shape (in erosion level): oval shape (8 × 7 km).

Age and isotopic data: Upper Palaeozoic according to geological indications. *Sulzberg Granite* 326 ± 1 Ma (U-Pb zircon).

Geological environment: gneisses and migmatites.

Contact aureole: not described.

Mineralization: not reported.

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2.1.17. VÍTKŮV KÁMEN STOCK

Geological position: Moldanubian Zone

Rock types: *Číměř Granite* – medium-grained porphyritic muscovite-biotite granite (alternatively porphyritic facies of the Eisgarn Granite – the Vítkův kámen facies).

Weinsberg Granite-Granodiorite – medium-grained porphyritic granite with abundant penetrations of the Číměř Granite.

Size and shape (in erosion level): elliptical stock outcrop (in west and east tectonic). Tabular shape of intrusion, ~ 22 km^2 (34 × 5 km) with moderate dipping to the south and contact with the country rocks (parallel to foliation of the country rocks).

Age and isotopic data: The Číměř Granite (Eisgarn Granite s.l.) is younger than the Weinsberg Granite-Granodiorite. No isotopic data.

Geological environment: the Weinsberg Granite-Granodiorite, sillimanite-biotite paragneiss, biotite hornfels, and muscovite-biotite cordierite-bearing paragneiss.

Contact aureole: in the paragneisses up to 200 m wide.

Mineralization: not reported.

References

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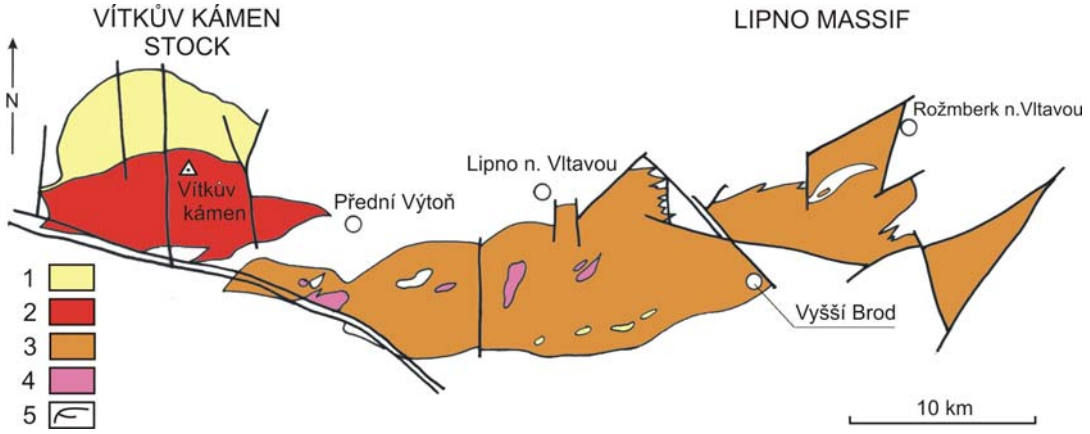

Fig. 2.60. *Vítkův kámen Stock and Lipno Massif geological sketch-map (after Slabý and Vrána 1991, 1993). 1 – Číměř Granite, 2 – Weinsberg Granite-Granodiorite, 3 – Lipno Granite, 4 – 5 – faults.*

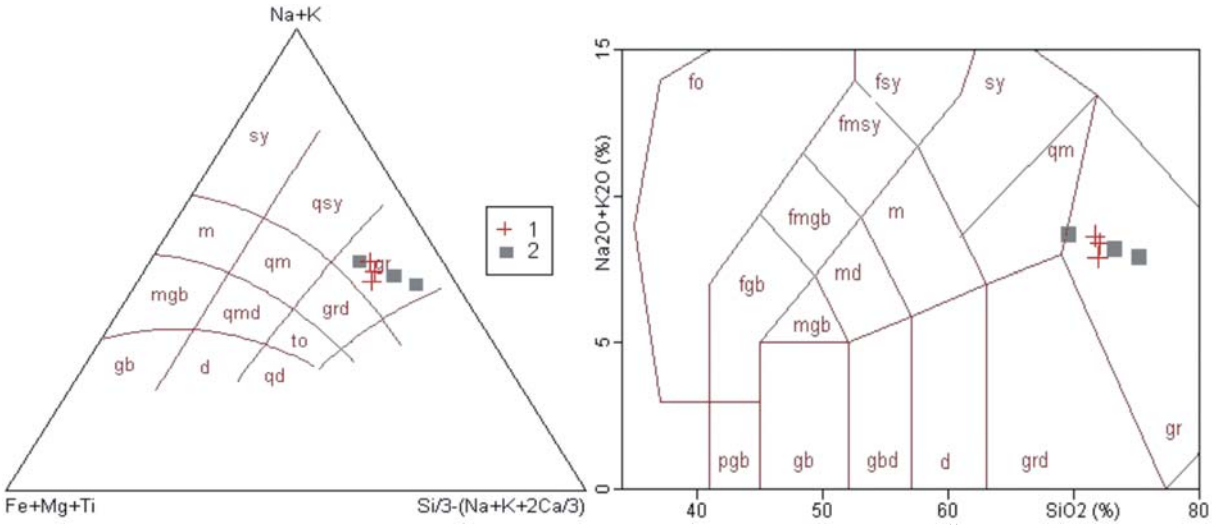

Fig.2. 61. *Vítkův kámen Stock ABQ and TAS diagrams. 1 – Weinsberg type granite, 2 – Číměř type Granite.*

Vítkův kámen Stock

Weinsberg Granite: Quartz normal, potassic, moderately peraluminous, mesocratic, S-type granite
Číměř Granite: Quartz rich, potassic, peraluminous, mesocratic, S-type granite

	2	3	5	6	7	8
	Weinsberg Granite			Číměř Granite		
SiO_2	71.52	71.21	71.59	68.77	71.38	74.78
TiO_2	0.53	0.46	0.46	0.44	0.28	0.22
Al_2O_3	14.11	14.54	14.26	16.29	14.56	13.92
Fe_2O_3	0.47	0.51	0.44	0.59	0.45	0.34
FeO	2.35	1.96	2.10	2.10	1.42	1.06
MnO	0.04	0.03	0.03	0.05	0.03	0.02
MgO	0.72	0.62	0.65	0.80	0.54	0.33
CaO	1.59	1.13	1.20	0.84	0.58	0.69
Na_2O	3.02	3.06	2.87	2.88	2.84	2.61
K_2O	4.85	5.52	5.44	5.74	5.15	5.26
P_2O_5	0.25	0.28	0.27	0.29	0.26	0.18
Li_2O	0.01	0.01	0.01	0.01	0.02	0.00
Mg/(Mg + Fe)	0.31	0.31	0.31	0.35	0.34	0.30
K/(K + Na)	0.51	0.54	0.55	0.57	0.54	0.57
Nor.Or	29.90	33.84	33.49	35.42	32.08	32.08
Nor.Ab	28.30	28.51	26.85	27.01	26.88	24.19
Nor.An	6.51	3.90	4.35	2.36	1.23	2.31
Nor.Q	29.19	27.49	28.98	25.77	32.24	35.76
Na + K	200.43	215.95	208.12	214.81	200.99	195.91
*Si	177.45	165.68	174.78	156.73	188.11	210.76
K-(Na + Ca)	-22.83	-1.69	1.49	13.96	7.36	15.15
Fe + Mg + Ti	63.12	54.83	56.65	62.00	42.32	29.97
Al-(Na + K + 2Ca)	19.95	29.29	29.12	75.13	64.25	52.85
(Na + K)/Ca	7.07	10.72	9.73	14.34	19.43	15.92
A/CNK	1.10	1.14	1.14	1.34	1.33	1.26

2.1.18. LIPNO MASSIF

Geological position: Moldanubian Zone.

Rock types: *Lipno Granite* – medium-to fine-grained muscovite-biotite granite, locally porphyritic facies (equivalent of the Mrákotín Granite).

Weinsberg Granite-Granodiorite – medium-grained porphyritic granite (enclaves in the Lipno Granite).

Size and shape (in erosion level): tabular shape in W-E direction, ~ 50 km^2 (12 × 3–4 km, intrusive contact parallel to foliation of the country rocks.

Age and isotopic data: *Lipno Granite* 349 Ma (K-Ar mica). The Lipno (Mrákotín) Granite is younger than the Weinsberg Granite-Granodiorite.

Geological environment: the Weinsberg Granite-Granodiorite, sillimanite-biotite paragneiss, biotite hornfels, and muscovite-biotite cordierite-bearing paragneiss.

Contact aureole: up to 200 m wide.

Mineralization: not reported.

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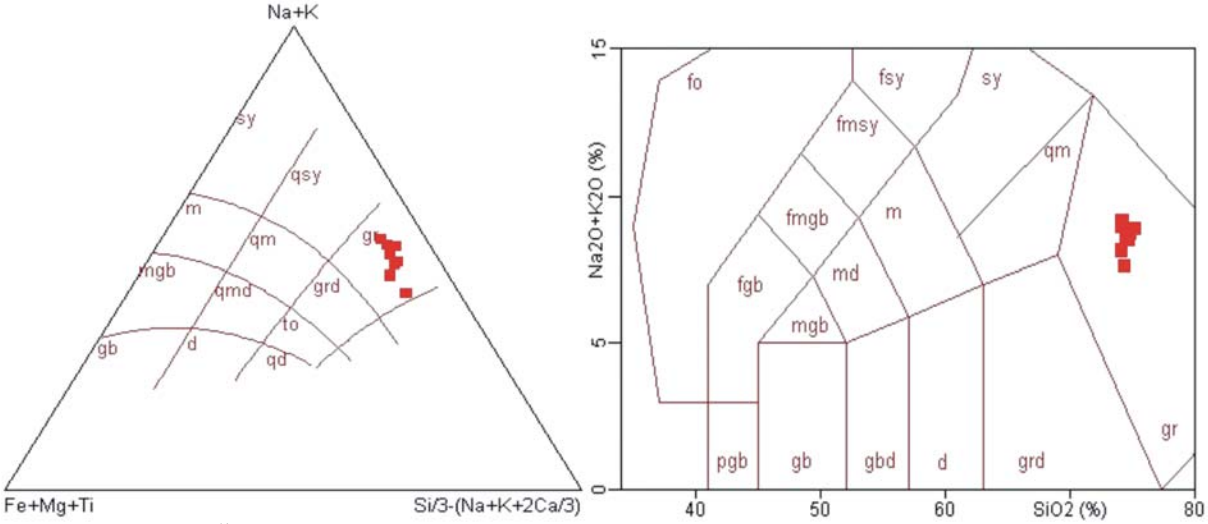

Fig. 2.62. *Lipno (Číměř) Granite ABQ and TAS diagrams.*

Lipno Granite

Quartz-rich, potassic, peraluminous, leuco-mesocratic, S-type granite

	mu-biGr	mu-biGr
SiO2	72.94	74.45
TiO_2	0.17	0.25
Al_2O_3	13.52	13.11
Fe_2O_3	0.51	0.25
FeO	1.88	1.05
MnO	0.04	0.11
MgO	0.39	0.21
CaO	0.69	0.48
Na_2O	3.03	3.62
K_2O	4.99	5.20
P_2O_5	0.24	0.30
Li_2O	n.d.	0.03
Mg/(Mg + Fe)	0.23	0.21
K/(K + Na)	0.52	0.49
Nor.Or	30.93	31.59
Nor.Ab	28.54	33.42
Nor.An	1.93	0.41
Nor.Q	32.61	30.78
Na + K	203.73	227.22
*Si	192.73	180.10
K-(Na + Ca)	-4.13	-14.97
Fe + Mg + Ti	44.38	26.10
Al-(Na + K + 2Ca)	37.17	13.11
(Na + K)/Ca	16.56	26.55
A/CNK	1.19	1.08

PLUTONS IN THE BAVARIAN TERRANE

2.1.19. REGENSBURG FOREST MASSIF

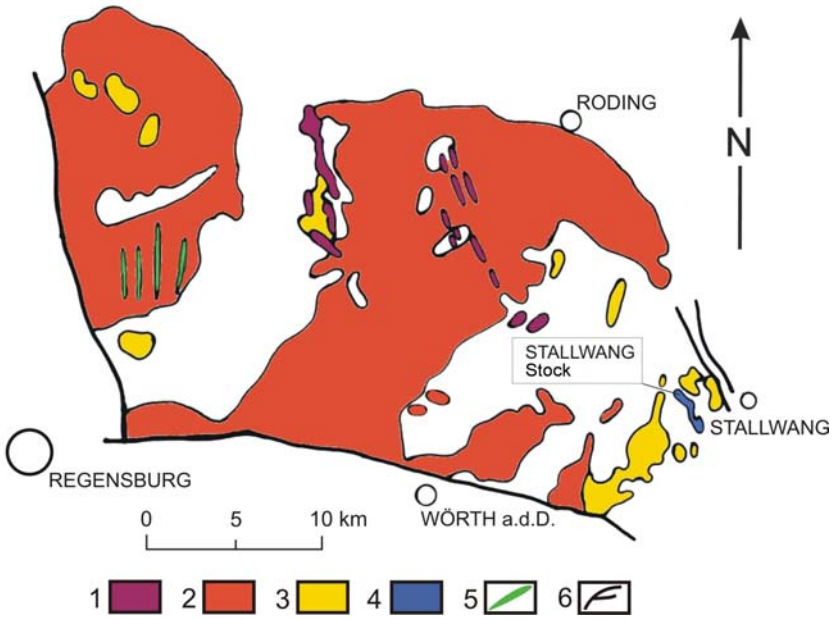

Fig. 2.63. *Regensburg Forest Massif and the Stallwang Stock geological sketch-map (adapted after Bauberger 1981 and Hann 2005). 1 – Diorite, 2 – Regensburg Forest Granite (Kristallgranite I), 3 – Trasching Granite (Kristallgranite II), 4 – Stallwang Stock, 5 – porphyry, 6 – faults.*

Regional position: Bavarian Terrane of the Moldanubian Zone.

Rock types:

1. *Diorite* – fine-grained quartz diorite to granodiorite.
2. *Regensburg Forest (Kristallgranite I)* – coarse-grained porphyritic biotite granite *to granodiorite (similar to Finsterau I Granite and Breitenberg Granodiorite).*
3. *Trasching (Kristallgranite II)* – porphyritic medium-grained granite.
4. *Lusengipfel Granite.*

Size and shape (in erosion level): 350 km^2, two rounded outcrop areas. The area between two parts of the massif is underlain by unexposed granite (37 × 20 km area). The massif extends westward below the Mesozoic cover. Trasching Granite 0.5 × 1.5 km stock within the Kristallgranite I.

Age and isotopic data: *Anatexite* 325 ± 6, 316 ± 6 Ma (K-Ar biotite), 314 ± 12 Ma (muscovite), 453 ± 10 Ma (Rb-Sr whole rock), *Kristallgranite I* – 315 ± 4 Ma (U-Pb zircon), 320 ± 6 Ma (K-Ar biotite), 314 ± 6 Ma (K-Ar muscovite), 313 – 325 Ma (U-Pb zircon), 316-317 Ma (U-Pb monazite), 326 ± 6 (Rb-Sr biotite), 349 ± 11 Ma (Rb-Sr whole rock), *Diorite* 320 ± 8 Ma (K-Ar biotite), 335 ± 12 Ma (Rb-Sr whole rock), *Kristallgranite II* 319 ± 12 Ma (Rb-Sr whole rock), 315 ± 8 Ma (Rb-Sr biotite), *Trasching Granite* 321 ±3 Ma (U-Pb monazite). Kristallgranite I is intruded by the Kristallgranite II, *Breitenberg Granodiorite* 308 ± 68 Ma (Rb-Sr whole rock).

Geological environment: anatexite–metatexite and homogenous diatexite (Lower Cambrian pelites).

Contact aureole: the gradual transition into the pre-granitic anatexite.

Zoning: not observed.

Mineralization: unknown.

Regensburg Forest Granite

Quartz-normal, potassic, peraluminous, mesocratic, granodiorite

n = 7	Median	Min	Max	QU1	QU3
SiO_2	67.50	64.60	69.90	65.80	69.20
TiO_2	0.68	0.47	0.91	0.49	0.73
Al_2O_3	14.80	14.10	16.30	14.50	15.00
Fe_2O_3	0.93	0.65	1.23	0.74	0.98
FeO	2.76	2.08	4.34	2.14	3.14
MnO	0.04	0.04	0.05	0.04	0.04
MgO	1.15	0.73	1.43	0.99	1.25
CaO	1.88	1.38	2.82	1.45	2.26
Na_2O	2.89	2.55	3.65	2.73	2.90
K_2O	5.20	4.37	6.34	4.38	5.22
P_2O_5	0.25	0.21	0.60	0.23	0.25
Mg/(Mg + Fe)	0.34	0.31	0.38	0.32	0.36
K/(K + Na)	0.53	0.50	0.57	0.51	0.55
Nor.Or	32.45	27.57	38.44	27.72	32.95
Nor.Ab	27.05	24.56	33.64	26.12	27.95
Nor.An	8.32	5.47	12.33	6.06	8.79
Nor.Q	23.91	14.93	29.70	21.15	24.16
Na + K	197.14	181.09	252.40	186.37	207.64
*Si	147.50	97.91	180.46	138.50	150.47
K-(Na + Ca)	-15.57	-51.08	6.79	-28.62	-15.27
Fe + Mg + Ti	90.90	64.62	120.93	69.23	95.54
Al-(Na + K + 2Ca)	23.69	3.51	29.23	7.01	27.89
(Na + K)/Ca	5.40	3.71	8.48	4.41	7.86
A/CNK	1.11	1.03	1.14	1.05	1.13

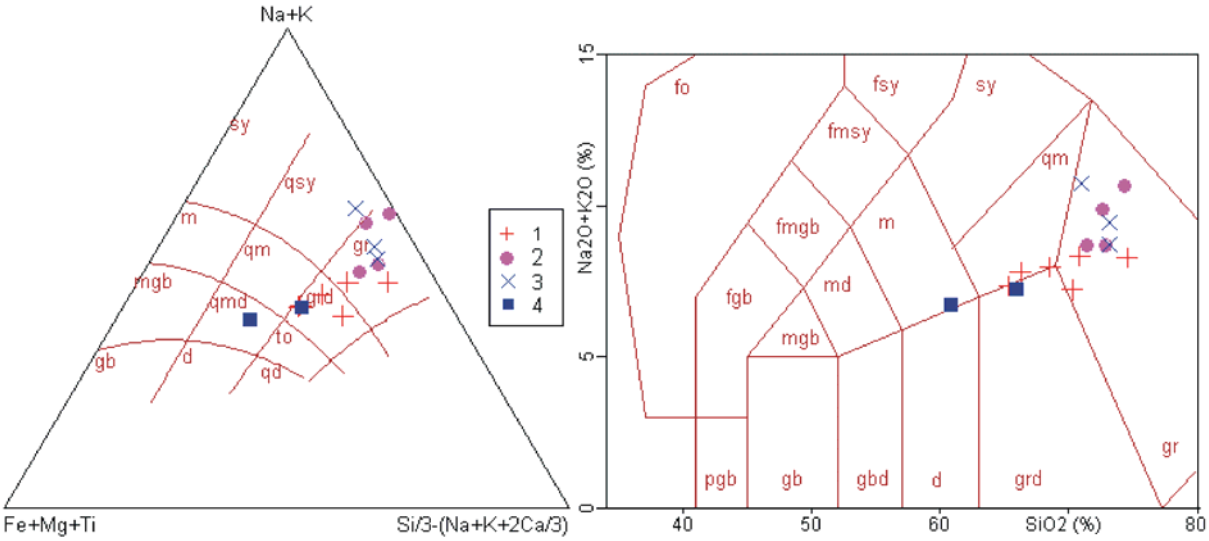

Fig. 2. 64. *Regensburg Forest Massif ABQ and TAS diagrams: 1-Regensburg Forest (Kristall 1) Granite, 2 - Kristall II Granite, 3 - Lusengipfel Granite, 4 – Breitenberg Granodiorite.*

Lusengipfel Granite: Quartz-normal, mostly potassic, low peraluminous, mesocratic, I/S type granite

Finsterau Granite: Quartz-normal, mostly potassic, low peraluminous, mesocratic, I/S type granite

Breitenberg Granodiorite*:* Quartz-normal, sodic-potassic, peraluminous, meso- to melanocratic, I-type, granodiorite

	gfm335	FKG333	FKG334	bg261	bg320
	Lusengipfel Granite	**Finsterau Granite (Kristallgranite I)**		**Breitenberg Granodiorite (Kristallgranite I)**	
SiO_2	71.00	67.00	71.60	60.10	65.40
TiO_2	0.21	0.56	0.23	1.11	0.78
Al_2O_3	14.90	16.30	15.10	17.30	15.90
Fe_2O_3	0.73	0.74	0.54	1.91	1.44
FeO	0.54	2.14	0.88	3.78	2.80
MnO	0.03	0.04	0.02	0.08	0.07
MgO	0.33	0.99	0.37	2.90	2.02
CaO	0.90	1.80	0.78	4.50	3.20
Na_2O	2.54	3.65	3.17	3.02	2.82
K_2O	8.20	6.34	6.16	3.58	4.36
P_2O_5	0.50	0.23	0.24	0.38	0.29
Mg/(Mg + Fe)	0.32	0.38	0.32	0.48	0.46
K/(K + Na)	0.68	0.53	0.56	0.44	0.50
Nor.Or	49.17	38.44	37.27	22.86	27.36
Nor.Ab	23.15	33.63	29.15	29.30	26.89
Nor.An	1.19	7.61	2.34	21.42	14.83
Nor.Q	22.42	14.92	26.25	14.29	21.63
Na + K	256.07	252.40	233.09	173.47	183.57
*Si	127.12	97.91	154.86	106.46	141.21
K-(Na + Ca)	76.09	-15.27	14.59	101.69	-55.49
Fe + Mg + Ti	27.49	70.65	31.08	162.43	116.93
Al-(Na + K + 2Ca)	4.44	3.51	35.63	5.78	14.54
(Na + K)/Ca	15.96	7.86	16.76	2.16	3.22
A/CNK	1.06	1.03	1.16	1.04	1.07

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2.1.20. STALLWANG STOCK

Geological position: monotonous series (Bavarian Terrane) of the Moldanubian Zone at the SE periphery of the Regensburg Forest Massif.

Rock types:

1. *Stallwang Granodiorite* – porphyritic biotite granodiorite.
2. *Stallwang Granite* – medium to fine-grained two-mica granite.
3. *Granite Porphyry.*

Size and shape (in erosion level): Stallwang Granodiorite forms several bodies elongated in a NW-SE direction. The largest body has a dimension of 2 km × 350 m. Two-mica granite forms several lenses and the largest body is 2 km wide and 3 km long. Granite Porphyry forms a local dyke swarm consisting of about ten dykes (width of up to 100 m and 600 m along strike).

Age and isotopic data: *Stallwang Granodiorite* 333 Ma (U-Pb zircon), 324 ± 2 Ma (Pb-Pb zircon), *Two-mica Granite* 323 ± 4 Ma (U-Th-Pb monazite), 285.6 ± 2.9 (Rb-Sr biotite), 328.8 ± 3.4 Ma (Rb-Sr whole rock), *Granite Porphyry* 323 ±2 Ma ((Pb-Pb zircon). Granite Porphyry dykes intersect diatexites and also cut the two-mica Granite.

Geological environment: contact with the gneisses and homogenous diatexites with K-feldspar megacrysts and/or with numerous metamorphic relics.

Contact aureole: a broad anatectic and diatectic aureole.

Zoning: not reported.

Mineralization: not reported.

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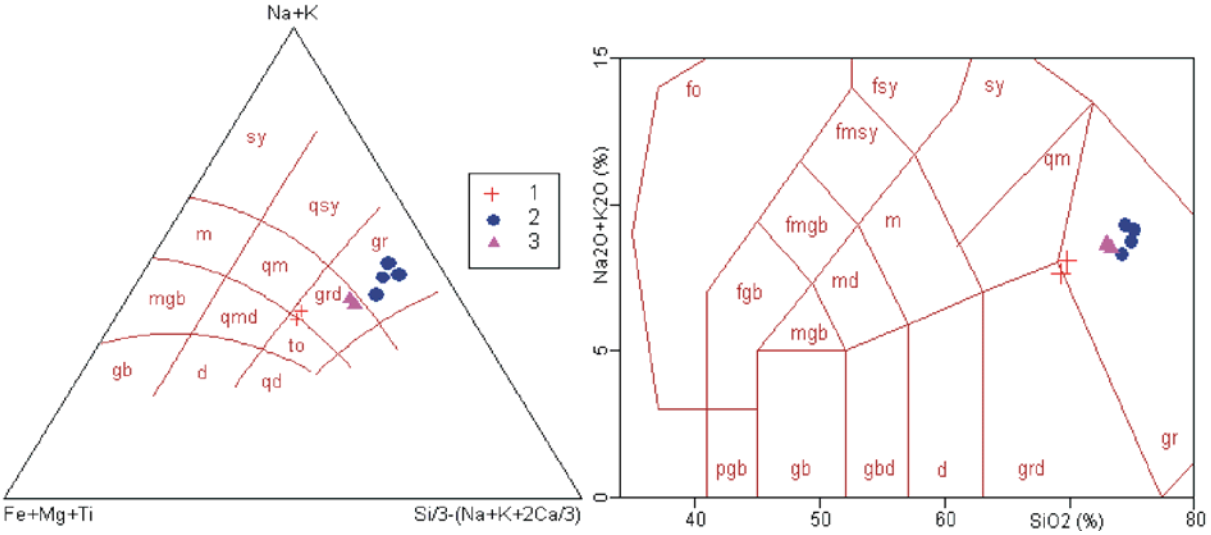

Fig. 2.65. *Stallwang Stock ABQ and TAS diagrams. 1 – Stallwang Granodiorite, 2 – Stallwang Granite, 3 – Granite Porphyry.*

Stallwang Granodiorite: Quartz-normal, sodic, peraluminous, mesocratic, I/S type, granodiorite

Stallwang Granite: Quartz-normal, potassic, peraluminous, leuco- to mesocratic, S type, granite

	GrdST19	ST198	TMST85	ST51	ST278b	ST278b
	Granodiorite		**Two-mica granite**			
SiO_2	64.90	65.39	71.46	71.65	71.93	73.38
TiO_2	1.21	1.10	0.21	0.40	0.21	0.22
Al_2O_3	15.32	14.99	14.16	14.55	14.34	13.98
Fe_2O_{3tot}	5.74	5.41	1.42	2.56	1.53	2.57
MnO	0.08	0.08	0.01	0.03	0.03	0.04
MgO	1.84	1.55	0.37	0.75	0.38	0.37
CaO	2.67	2.59	0.56	0.97	0.57	0.55
Na_2O	3.07	3.30	3.02	3.02	2.96	2.93
K_2O	4.10	4.25	5.36	5.01	6.02	5.98
P_2O_5	0.53	0.52	0.36	0.28	0.30	0.30
Mg/(Mg + Fe)	0.38	0.36	0.34	0.36	0.32	0.22
K/(K + Na)	0.47	0.46	0.54	0.52	0.57	0.57
Nor.Or	25.66	26.49	33.24	30.63	36.80	35.97
Nor.Ab	29.20	31.26	28.46	28.06	27.50	26.79
Nor.An	10.32	9.94	0.45	3.06	0.88	0.76
Nor.Q	23.94	23.01	31.74	31.17	29.46	30.72
Na + K	186.12	196.73	211.26	203.83	223.34	221.52
*Si	142.19	135.25	178.53	182.14	168.94	179.04
K-(Na + Ca)	-59.63	-62.44	6.37	-8.38	22.14	22.61
Fe + Mg + Ti	132.73	120.03	29.60	55.70	31.23	44.14
Al-(Na + K + 2Ca)	19.51	5.28	46.84	47.31	37.94	33.40
(Na + K)/Ca	3.91	4.26	21.16	11.78	21.97	22.59
A/CNK	1.12	1.06	1.25	1.23	1.19	1.17

Trace elements (mean values in ppm): *Stallwang Granodiorite* – Ba 1080, Rb 170, Sr 238, V 69, Y 58, Zn 99, Zr 453, Ce 136, Eu 1.2, La 77, Nb 37, Nd 73, Pb 30, Sm 11, Th 16, Yb 4.8 (Siebel et al. 2006).

Stallwang Granite – Ba 318, Rb 290, Sr 68, V 14, Y 12, Zn 14, Zr 127, Ce 48, Eu 0.3, La 26, Nb 16, Nd 24, Pb 27, Sm 5.2, Th 13, Yb 1.1 (Siebel et al. 2006).

Granite Porphyry – Ba 797, Rb 251, Sr 149, V 41, Y 43, Zn 62, Zr 381, Ce 146, Eu 0.9, La 68, Nb 27, Nd 66, Pb 37, Sm 10, Th 36, Yb 3.5 (Siebel et al. 2006).

2.1.21. SATTELPEILNSTEIN COMPOSITE MASSIF

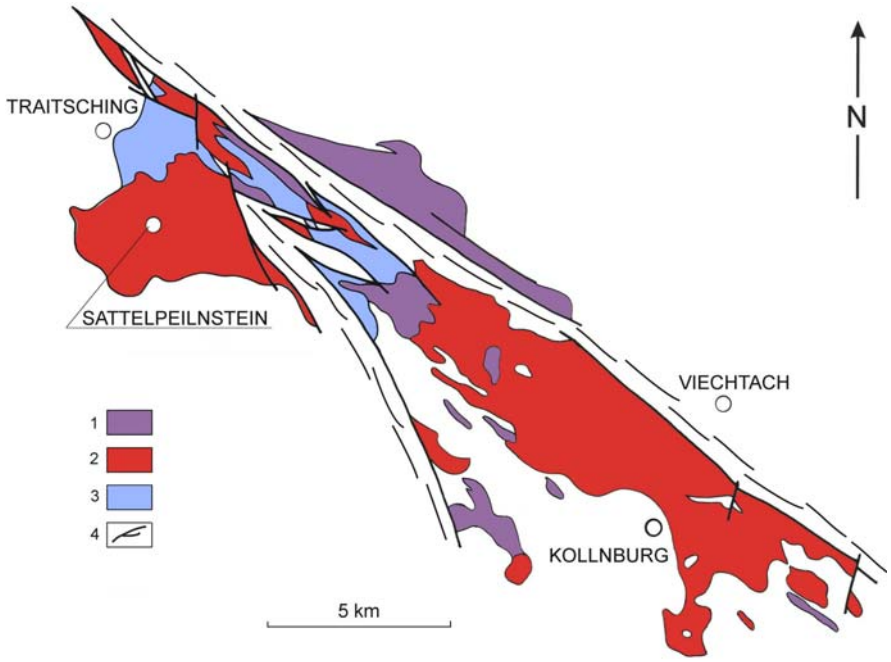

Fig. 2.66. *Sattelpeilnstein Composite massif geological sketch-map (adapted after Teipel et al. 2008). 1 – Sattelpeilnstein Granite, 2 – Kristallgranite 1, 3 – Traitsching Granodiorite, 4 – Bavarian Tectonic Zone.*

Geological position: Bavarian Terrane of the Moldanubian Zone.

Rock types:

Sattelpeilnstein Granite – fine- to medium-grained biotite granite.

Kristallgranite I (Weinsberg Granite-Granodiorite type).

Traitsching Granodiorite – medium- to coarse-grained granodiorite to tonalite.

Size and shape (in erosion level): strongly elongated intrusions along the Bavarian Pfahl. Size of 66 km^2 (25 × 4 km)

Age and isotopic data: 322.3 ± 3.4 Ma (Pb/Pb zircon).

Geological environment: homogenous diatexite, diatexite-gneiss and diatectic gneiss.

Contact aureole: not described.

Mineralization: not reported.

References

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2.1.22. QUARTZ DIORITE STOCKS

Geological position: western part of the MCB. In the Drosendorf Monotonous Series (Moldanubian Zone), along the Bavarian Quartz "Pfahl".

Size and shape (in erosion level): several stocks up to 2 km in diameter and dykes 2–20 meters thick, up to 200 m in length, concordant with gneiss.

Age and isotopic data: *Quartz diorite* – 314 ± 6 Ma (age of the deformation event).

Geological environment: the Bavarian Pfahl Zone separates anatectic pearl gneisses and sillimanite gneisses on its southwestern side from migmatitic cordierite-sillimanite gneisses to the northeast.

Contact aureole: not described

Mineralization: not reported.

References

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2.1.23. PATERSDORF STOCK

Geological position: On the boundary between the Ostrong and Bavarian Terrane of the Moldanubian Zone (Patersdorf Stock is segmented by the Bavarian Pfahl zone).

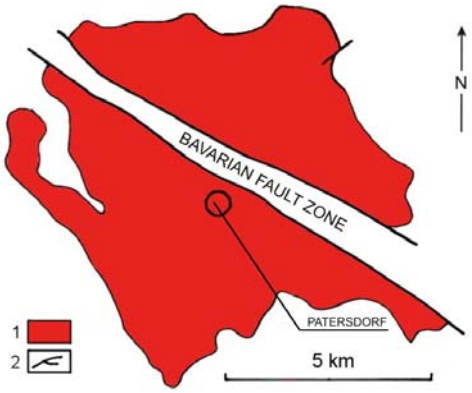

Fig. 2.67. *Patersdorf Stock geological sketch-map (adapted after Teipel et al. 2008). 1 – Patersdorf Granite and Granodiorite, 2 – Bavarian Tectonic Zone.*

Rock types:

1. Patersdorf Granite – fine-grained biotite granite (equivalent of the Mauthausen Granite).

2. Patersdorf Granodiorite – two dark facies of biotite granodiorite, a fine- to medium-grained variety and a coarse-grained porphyritic variety.

Size and shape (in erosion level): semicircular multiple intrusion in diameter of about 7 km (30 km^2). The granodiorites are part of a larger body that can be traced for several km towards northwest.

Age and isotopic data: 322 ± 2 Ma (Pb-Pb zircon), 323.4 ± 1.6 Ma (Pb-Pb zircon), 308 ± 5 Ma (Rb-Sr K-feldspar). Large quartz dyke 247 ± 21 Ma (Rb-Sr). 308 ± 5 Ma. (Rb-Sr K-feldspar). The Patersdorf Granodiorite predates the Patersdorf Granite.

Geological environment: Pearl gneisses and the Paragranodiorite Massif.

Contact aureole: not described.

Mineralization: not reported.

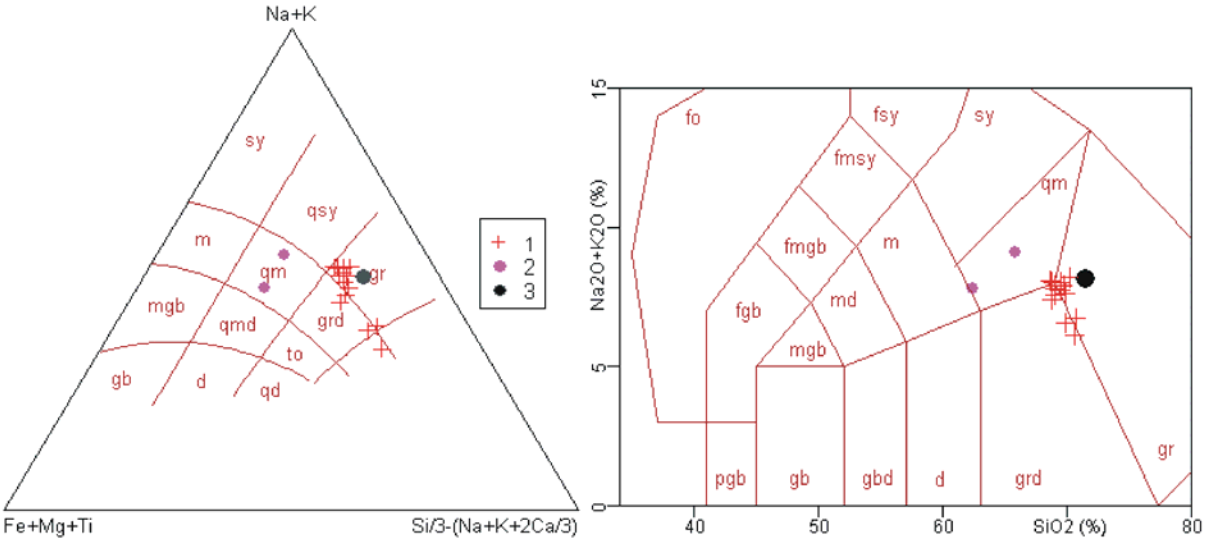

Fig. 2. 68. *Patersdorf Stock ABQ and TAS diagrams. 1 -Patersdorf Granite, 2 – Patersdorf Granodiorite, 3 – Sattelpeilnstein Granite.*

Patersdorf Granite Quartz-normal, sodic/potassic, moderately peraluminous, mesocratic, I-type, I-series, granodiorite

Sattelpeilstein Granite Quartz-normal, potassic, peraluminous, mesocratic, S-type granite

n = 13	Median	Min	Max	QU1	QU3	Sattelpeilstein Granite
SiO_2	68.78	67.52	70.52	68.50	69.72	70.74
TiO_2	0.51	0.42	0.54	0.47	0.52	0.44
Al_2O_3	15.41	14.94	15.98	15.13	15.56	14.80
Fe_2O_3	2.70	0.58	3.12	0.76	3.04	2.63
FeO	0.00	0.00	2.68	0.00	2.53	0.04
MnO	0.05	0.00	0.10	0.05	0.08	0.70
MgO	1.08	0.88	1.17	1.02	1.10	1.00
CaO	2.50	2.18	2.90	2.38	2.69	3.09
Na_2O	3.55	1.50	3.79	2.77	3.67	5.48
K_2O	4.39	4.03	4.70	4.29	4.60	0.30
P_2O_5	0.19	0.16	0.25	0.18	0.23	0.34
Mg/(Mg + Fe)	0.40	0.35	0.42	0.37	0.41	0.54
K/(K + Na)	0.45	0.41	0.67	0.43	0.52	28.18
Nor.Or	26.97	24.59	29.11	26.18	28.64	33.43
Nor.Ab	32.85	14.31	35.43	26.11	34.17	28.65
Nor.An	11.78	9.85	13.38	11.05	12.47	3.08
Nor.Q	24.95	22.35	35.47	23.61	25.33	216.07
Na + K	206.03	146.29	214.71	186.84	207.87	164.50
*Si	149.31	134.04	213.96	144.13	158.72	-1.19
K-(Na + Ca)	-63.79	-82.73	6.50	-73.88	-38.33	55.83
Fe + Mg + Ti	72.27	62.30	85.90	68.53	76.82	38.91
Al-(Na + K + 2Ca)	6.66	-2.53	74.51	3.49	18.88	12.12
(Na + K)/Ca	4.41	3.23	5.52	3.92	4.66	1.19
A/CNK	1.04	1.01	1.35	1.03	1.09	

Trace elements (ppm): *Patersdorf Granite* – **Ba** 940, **Ce** 92, **Co** 5, **Cr** 30, **Nd** 35, **Ni** 90, **Pb** 25, **Rb** 170, **Sm** 6, **Sr** 310, **Y** 41, **Zn** 15, **Zr** 273.

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2.1.24. METTEN MASSIF

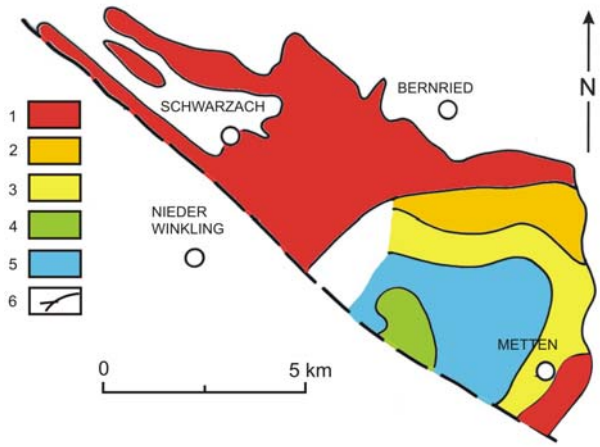

Fig. 2.69. *Metten Massif geological sketch-map (after Schreyer 1967). 1 – Luhhof Granite, 2 – Edenstetten Granite, 3 – Metten Granite, 4 – Central 1 Granite, 5 – Central 2 Granite, 6 – faults.*

Geological position: Bavarian Terrane of the Moldanubian Zone.

Rock types:

1. *Luhhof Granite* (dark facies) – granoblastic fine-grained biotite-muscovite granite.
2. *Edenstetten Granite* (light facies).
3. *Metten Granite* medium-grained two-mica granite (equivalent of the Mauthausen Granite).

Central 1 Granite – medium-grained biotite granite.

Central 2 Granite – coarse-grained biotite granite.

Age and isotopic data: *Luhof Granite* 321.6 ± 3.8 Ma (Pb/Pb zircon), *Metten Granite* : 310 ± 5 Ma (K-Ar muscovite), 321.0 ± 3.8 Ma (Pb/Pb zircon) 324.2 ± 5.0 Ma (Pb/Pb zircon).

Size and shape (in erosion level): oval shape cut-off by the fault (16 × 6 km).

Geological environment: pearl gneisses and the Paragranodiorite Massif.

Contact aureole: not described.

Zoning: asymmetric compositional zoning of the internal structure.

Mineralization: unknown.

References

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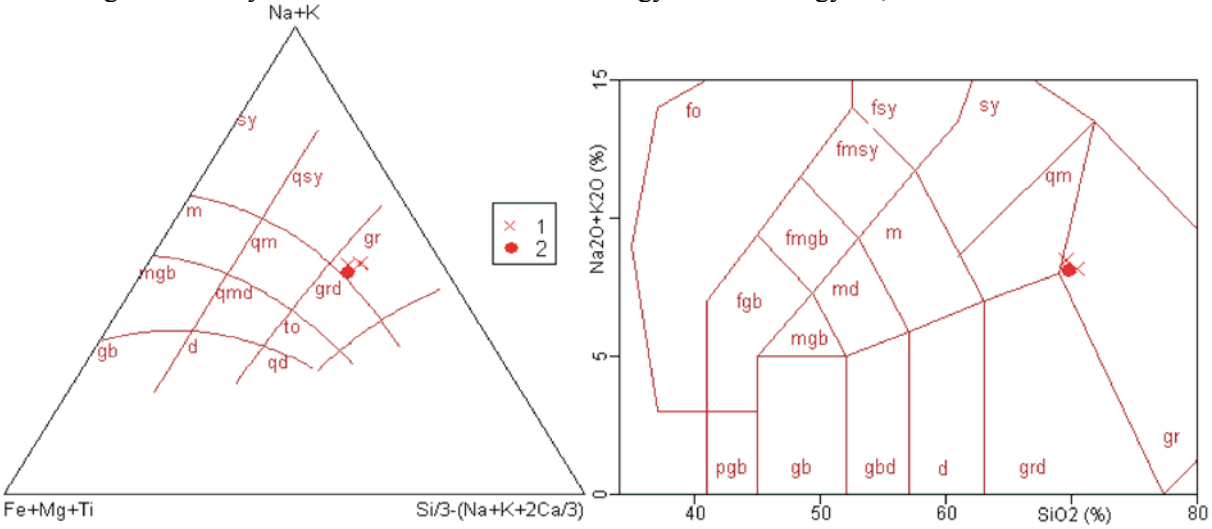

Fig. 2.70. *Metten Massif and Lallig Stock ABQ and TAS diagrams:1 – Metten Granite, 2 – Lalling Granite.*

2.1.25. LALLING STOCK

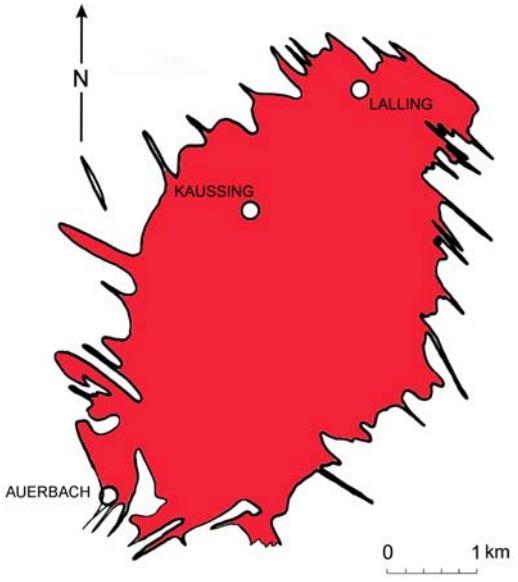

Fig. 2.71. *Lalling Stock geological sketch-map (after Dürr and List 1969).*

Geological position: Bavarian Terrane of the Moldanubian Zone. A member of the Mauthausen Group of the MCB.

Rock types: *Kaussing (Lalling) Granite* – fine- to medium-grained biotite granite (equivalent of the Mauthausen Granite) associated with small volumes of dioritic or tonalitic intrusions.

Size and shape (in erosion level): elliptical shape (3 × 6 km) with characteristic dyke-like contact with the country rocks (parallel to foliation of the country rocks).

Age and isotopic data: 321.6 ± 5.6 Ma (Pb/Pb zircon), younger than Flaser Granite.

Geological environment: diatexites and gneisses, pearl gneisses and Paragranodiorite Massif.

Contact aureole: not described.

Mineralization: not reported.

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2.1.26. FÜRSTENSTEIN COMPOSITE MASSIF (FCM)

Regional position: Bavarian Terrane of the Moldanubian Zone. The largest intrusive body of the Passau Forest area penetrating the Moldanubian series of migmatitic paragneisses. The massif comprises multiple intrusions of three distinct late-Variscan magmatic events (at 334–331, 322–321, and 318–312 Ma).

Rock types:

1. *Fürstenstein Diorite* – quartz diorite and granodiorite (redwitzite?) – several varieties in the southern part of the massif – smaller bodies and blocks enclosed in surrounding granites.
2. *Tittling Granite* – medium-grained biotite granite to granodiorite.
3. *Eberhardsreuth Granite* – medium-grained biotite granite, a small body in the northern part of the massif, rather similar to the previous type, with exception of presence of red-brown biotite and monazite.
4. *Saldenburg Granite* (105 km^2) – porphyritic coarse-grained biotite granite (Kristallgranite I) comparable to the Weinsberg Granite-Granodiorite).
5. *Hybrid Granite* – rather heterogeneous rock, biotite partly altered to secondary muscovite.

Size and shape (in erosion level): semicircular, 17 × 10 km (150 km^2), more than half of the whole surface occupies the Saldenburg Granite (105 km^2).

Age and isotopic data: *Fürstenstein Massif* (10 samples, 316 ±14 Ma (Rb-Sr whole rock) *Tittling Granite* 324–321 Ma (Pb-Pb zircon), 335 ± 25 Ma (Pb-Pb zircon), 330 Ma (Rb-Sr biotite), corresponding to an early phase of Variscan orogeny. *Saldenburg Granite* (intrudes the Tittling Granite) and *Eberhardsreuth Granite* 316–312 Ma (Pb-Pb zircon), 318–312 Ma (U-Pb zircon). *Saldenburg Granite* 318–312 Ma (Pb-Pb zircon), 312 ± 5 Ma (K-Ar muscovite), 305 ± 18 Ma (Rb-Sr whole rock), *Fürstenstein Diorite* 334–332 Ma (Pb-Pb zircon), 321 Ma (U-Pb titanite), 300 ± 5 Ma (K-Ar biotite), *Temporal (field) sequence:* Fürstenstein Diorite → Tittling Granite → Eberhardsreuth Granite → Saldenburg Granite.

Geological environment: biotite plagioclase gneiss ("Pearl gneiss") at the western contact, migmatitic diatexites at the eastern contact.

Contact aureole: contact interactions between gneiss and granitoids are generally insignificant. On the other hand granites cause feldspatization with sharp contact and hybridization of diorites.

Zoning: Saldenburg Granite is slightly enriched in quartz and secondary muscovite along its margin.

Mineralization: not reported.

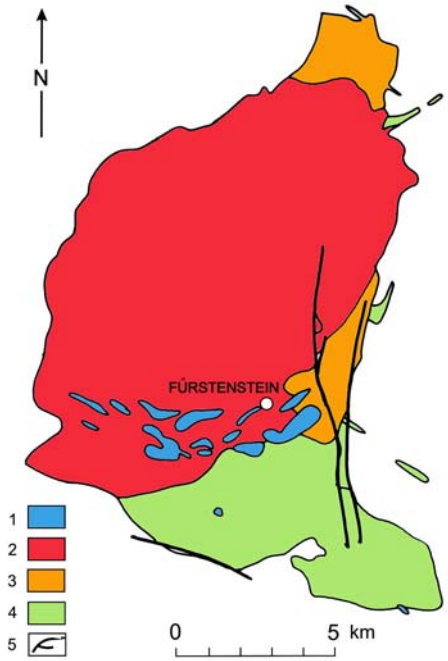

Fig. 2.72. *Fürstenstein Composite Massif geological sketch-map (adapted after Troll 1964). 1 – Fürstenstein Diorite, 2 – Saldenburg Granite, 3 –Two-mica Granite, 4 – Tittling and Eberhardsreuth Granites, 5 – faults.*

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Fürstenstein Diorite

Quartz-normal, sodic, peraluminous, mesocratic, S-type diorite

	1361F	**1362F**	**1363F**	**1364F**	**1365**	**1366F**
SiO_2	65.21	65.31	63.96	60.23	62.71	63.76
TiO_2	1.02	0.75	0.45	0.94	0.64	0.79
Al_2O_3	15.40	16.48	18.85	18.02	17.62	15.28
Fe_2O_3	1.46	0.96	1.36	1.77	1.50	1.77
FeO	3.53	3.16	3.20	4.04	3.59	4.08
MnO	0.04	0.08	0.06	0.09	0.08	0.10
MgO	1.62	1.42	0.08	2.43	1.63	2.36
CaO	3.09	3.48	3.43	5.24	4.48	3.51
Na_2O	3.29	3.55	3.82	3.26	3.73	2.99
K_2O	3.98	3.23	3.48	2.59	2.44	4.21
P_2O_5	0.29	0.32	0.46	0.33	0.38	0.22
Mg/(Mg + Fe)	0.37	0.38	0.03	0.43	0.37	0.42
K/(K + Na)	0.44	0.37	0.37	0.34	0.30	0.48
Nor.Or	24.99	20.20	21.28	16.45	15.31	26.83
Nor.Ab	31.40	33.75	35.50	31.47	35.58	28.96
Nor.An	14.26	16.05	14.47	25.61	20.95	17.22
Nor.Q	20.63	21.43	19.54	15.30	18.40	17.59
Na + K	190.67	183.14	197.16	160.19	172.17	185.87
*Si	134.37	137.82	116.90	111.66	122.47	126.13
K-(Na + Ca)	-76.76	-108.03	-110.54	-143.65	-148.45	-69.69
Fe + Mg + Ti	120.43	100.67	69.23	150.51	117.25	147.45
Al-(Na + K + 2Ca)	1.55	16.38	50.69	6.80	14.07	-10.99
(Na + K)/Ca	3.46	2.95	3.22	1.71	2.16	2.97
A/CNK	1.03	1.08	1.20	1.04	1.07	0.98

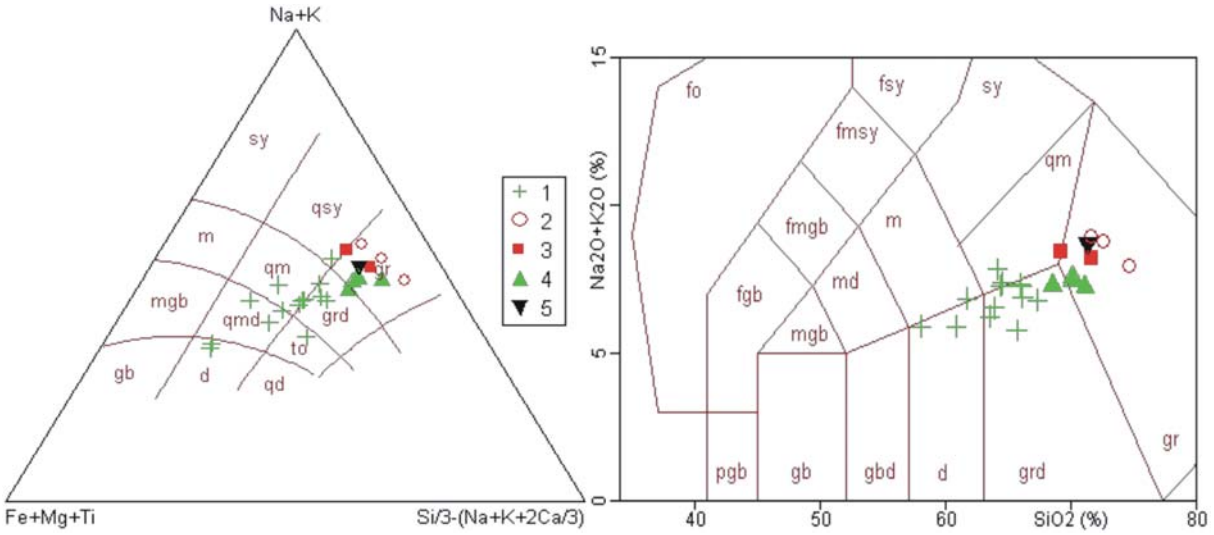

Fig. 2.73. *Fürstenstein Composite Massif ABQ and TAS diagrams. 1 – Fürstenstein Diorite, 2 – Saldenburg Granite, 3 – Eberhardsreuth Granite, 4 – Tittling Granite, 5 – Hybrid Granite.*

Tittling Granite: Quartz-normal, sodic, peraluminous, mesocratic, S-type, granite

Eberhardsreuth Granite: Quartz-normal, sodic, peraluminous, mesocratic, I-type, granite

Saldenburg Granite: Quartz-normal to -rich, sodic, peraluminous, leucocratic, S-type, granite

	Tittling		Eberhardsr.	Saldenburg		
	grTittl	grTittl	grEberh	1359Sal	1360Sal	GW17Sal
SiO_2	68.42	70.63	69.17	71.91	74.53	70.64
TiO_2	0.52	0.25	0.46	0.38	0.22	0.41
Al_2O_3	16.30	15.64	16.01	14.43	14.08	14.57
Fe_2O_3	1.10	0.72	0.49	0.48	0.79	0.57
FeO	2.13	1.82	2.31	1.88	1.32	1.88
MnO	0.07	0.05	0.06	0.05	0.03	n.d.
MgO	1.20	0.44	0.68	0.10	0.11	0.52
CaO	2.32	2.36	2.26	1.04	0.77	1.46
Na_2O	3.40	3.59	4.02	3.17	3.29	3.79
K_2O	3.91	3.62	4.38	5.52	4.64	5.21
P_2O_5	0.51	0.15	0.11	0.19	0.08	0.20
Mg/(Mg + Fe)	0.40	0.24	0.30	0.07	0.09	0.28
K/(K + Na)	0.43	0.40	0.42	0.53	0.48	0.47
Nor.Or	23.94	22.09	26.56	33.69	28.04	31.70
Nor.Ab	31.64	33.30	37.04	29.40	30.22	35.05
Nor.An	8.44	11.08	10.76	4.04	3.37	6.10
Nor.Q	26.24	28.23	20.94	28.09	33.52	23.15
Na + K	192.73	192.71	222.72	219.50	204.68	232.92
*Si	159.26	171.08	134.15	167.08	199.64	141.62
K-(Na + Ca)	-68.07	-81.07	-77.03	-3.64	-21.38	-37.72
Fe + Mg + Ti	79.73	48.42	60.94	39.44	33.77	51.36
Al-(Na + K + 2Ca)	44.62	30.26	11.08	26.79	44.36	1.13
(Na + K)/Ca	4.66	4.58	5.53	11.84	14.91	8.95
A/CNK	1.21	1.12	1.04	1.12	1.20	1.02

2.1.27. HAUZENBERG COMPOSITE MASSIF

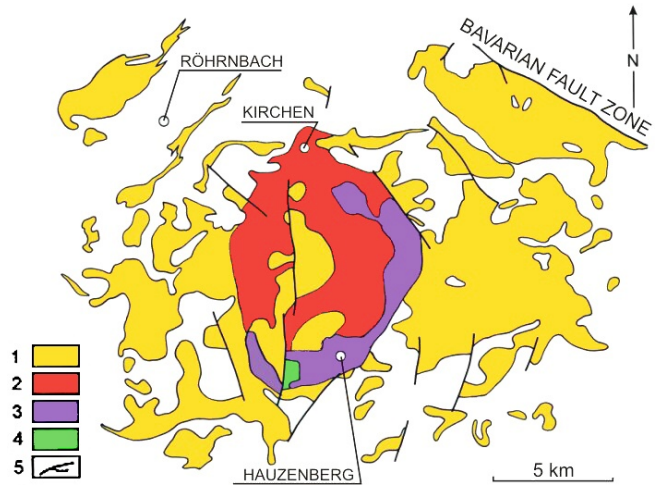

Fig. 2.74. *Hauzenberg Composite Massif geological sketch-map (adapted after Teipel et al. 2008). 1 – Hauzenberg Granite II, 2 – Hauzenberg Granodiorite, 3 – Hauzenberg Granite I, 4 – Mica Quartz Diorite, 5 – faults.*

Regional position: Bavarian Terrane of the Moldanubian Zone. Located in Passau Forest, the largest granitoid body beside the Fürstenstein Composite Massif.

Rock types:

1. *Hauzenberg Granite I* – fine- and medium-grained biotite granite (18 % of the body surface) forms the roof of the massif. Contacts towards the Hauzenberg Granite II are often sub-horizontal.
2. *Hauzenberg Granite II* – medium- to coarse-grained two-mica granite (over 50 % of the surface area), main volume of the massif. Sporadic K-feldspar phenocrysts up to 5 cm in length. *Halfgreisen' Granite* (a subtype developed from Hauzenberg Granite II) – phenocrystic fine-grained biotite – muscovite granite.
   Hausenberg Granite is an equivalent of the Mauthausen Granite.
3. *Hauzenberg Granodiorite* – medium-grained biotite granite to granodiorite forms an envelope on the east and south of the main oval body.
4. *Mica Quartz Diorite* – fine-grained biotite-hornblende quartz diorite forms irregular, elongated lenses (about 1 km long, dipping moderately to the N) in gneiss anatexites near the northern exocontact.

Size and shape (in erosion level): Oval main body (80 km^2) and several apophyses up to one km thick. An estimation of the emplacement depth is 16 ± 2 km.

Age and isotopic data:

Hauzenberg Granite I 300 ± 6 Ma, 290 ± 7 Ma (K-Ar biotite), 289 ± 5, Ma (K-Ar muscovite), 284 ± 3 and 313 ±3 Ma for muscovite and 293 ± 3 Ma (K-Ar biotite), 310 ± 3 and 308 ± 8 Ma (Rb-Sr biotite), 334 ± 13 Ma (Rb-Sr whole rock), *Hauzenberg Granite II* 312 ± 6 Ma (Rb-Sr biotite isochron), 320 ± 3 Ma (U-Pb zircon), 318, 320 and 329 ± 7 Ma (U-Pb monazite), *Hauzenberg Granodiorite* (younger intrusion) 284 ± 4, 294 ± 5 Ma (K-Ar biotite), 302 ± 13 Ma (Rb-Sr biotite), 317 ± 2, 318.6 ± 4.1 Ma (Pb-Pb zircon).

Geological environment: biotite-plagioclase gneiss, migmatitic diatexites. Anatectic gneisses with intercalations of migmatitic amphibolites, calc-silicate rocks and granulites (Variegated group) of the Moldanubian Unit.

Contact aureole: not studied (lack of outcrops).

Zoning: *Hauzenberg Granite II* in the centre is surrounded by medium-grained granodiorite along the margin. *Hauzenberg Granite I* forms irregular bodies cut by the *Hauzenberg Granite II*.

Mineralization: younger mineralization in the Hauzenberg Granodiorite and their pegmatites differs from those in the Hauzenberg Granite I and II by presence of quartz-pyrite-molybdenite and apatite-beryl mineral assemblages in vein cavities.

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Hauzenberg I and II Granites

Quartz-normal, potassic, peraluminous, leucocratic, S-type, granite

	Hauzenberg Granite I		**Hauzenberg Granite II**			
	258grha	242grha	241grha	259grha	260grha	262grha
SiO_2	73.70	74.50	73.10	73.80	72.30	71.80
TiO_2	0.23	0.21	0.18	0.20	0.27	0.35
Al_2O_3	14.30	13.90	15.10	14.40	14.10	14.20
Fe_2O_3	0.26	0.34	0.05	0.38	0.44	0.46
FeO	0.97	0.94	1.14	1.00	1.26	1.71
MnO	0.01	0.02	0.02	0.03	0.02	0.03
MgO	0.35	0.32	0.37	0.36	0.52	0.75
CaO	0.79	0.68	0.84	0.85	0.86	1.69
Na_2O	3.40	3.33	3.59	3.45	2.68	3.12
K_2O	5.47	5.40	5.40	5.20	5.60	4.71
P_2O_5	0.18	0.15	0.21	0.15	0.24	0.13
Mg/(Mg + Fe)	0.34	0.31	0.35	0.32	0.36	0.38
K/(K + Na)	0.51	0.52	0.50	0.50	0.58	0.50
Nor.Or	32.98	32.56	32.44	31.33	34.58	29.00
Nor.Ab	31.16	30.51	32.78	31.59	25.15	29.20
Nor.An	2.79	2.43	2.83	3.29	2.81	7.85
Nor.Q	29.06	30.66	27.30	29.59	31.60	29.19
Na + K	225.86	222.11	230.50	221.74	205.38	200.69
*Si	173.62	183.11	165.06	177.58	185.50	177.56
K-(Na + Ca)	-7.66	-4.93	-16.17	-16.08	17.08	-30.81
Fe + Mg + Ti	28.33	27.92	27.94	30.13	39.35	52.57

Al-Na + K + 2Ca)	26.79	26.60	36.07	30.73	40.84	17.90
(Na + K)/Ca	16.03	18.32	15.39	14.63	13.39	6.66
A/CNK	1.12	1.12	1.16	1.14	1.20	1.08

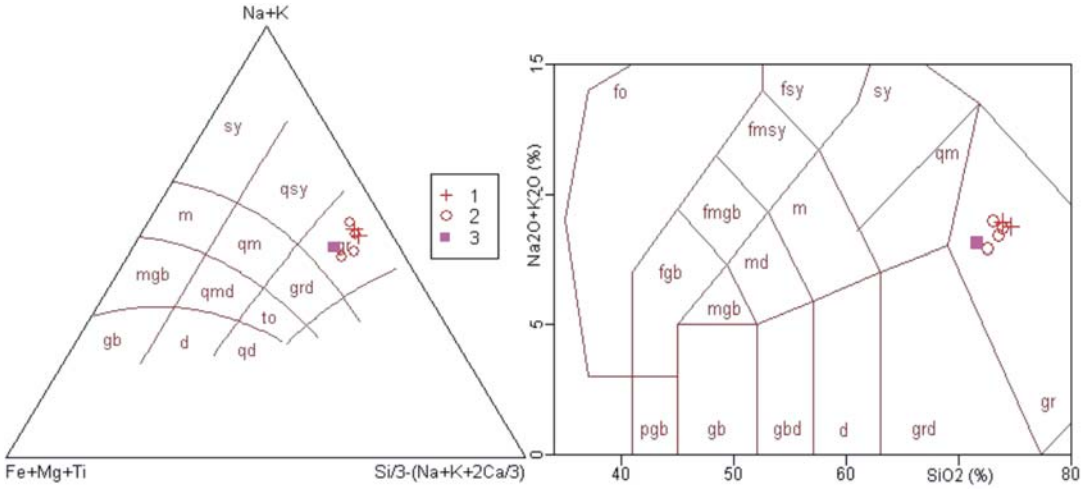

Fig. 2.75. *Hauzenberg Massif ABQ and TAS diagrams. 1 – Hauzenberg Granite I, 2 – Hauzenberg Granite II, 3 – Hauzenberg Granodiorite*

2.1.28. NEUSTIFT MASSIF

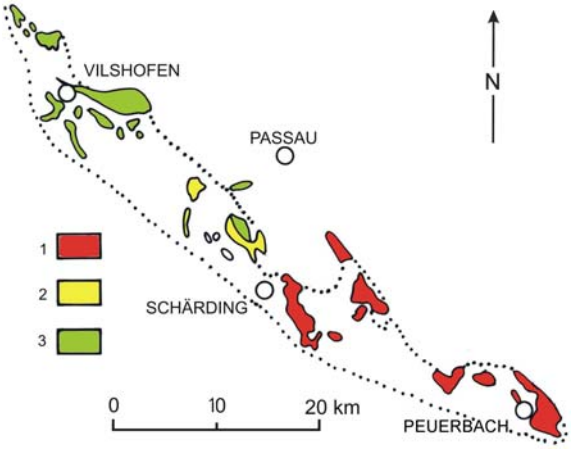

Fig. 2.76. *Neustift Massif geological sketch-map (after Troll 1964). 1 – Schärding Granite-Granodiorite, 2 – Platte-Gurlarn Granodiorite, 3 – Neustift Granite.*

Geological position: Moldanubian Zone (Bavarian Terrane).

Rock types:

1. *Platte-Gurlarn Granodiorite* – medium- to coarse-grained biotite-cordierite granodiorite.
2. *Neustift Granite* – fine- to medium-grained biotite-muscovite granite.
3. *Schärding Granite-Granodiorite* – fine- to medium-grained biotite granite with cordierite and muscovite.
4. *Peuerbach Granite* (coarse-grained variety of the Schärding Granite) – foliated coarse-grained biotite granite to granodiorite (without cordierite and muscovite).
5. *"Saure" Dyke Granite* – fine-grained cordierite granite (not shown in the map).

Size and shape (in erosion level): a set of large outcrops arranged in NW-SE direction over the area of 70 km × 10 km (100 km^2) SW of Danube river.

Age and isotopic data: *Peuerbach and Schärding Granites:* 316–319 Ma (U-Pb monazite). *Platte-Gurlarn Granite:* 311 ± 2 Ma (Pb-U monazite). Schärding and Neustift Granites are younger than the Platte-Gurlarn Granite.

Geological environment: transitional contacts to the homogeneous granodioritic cordierite pearl gneiss or nebulitic cordierite-bearing migmatite.

Zoning: not reported.
Mineralization: unknown.

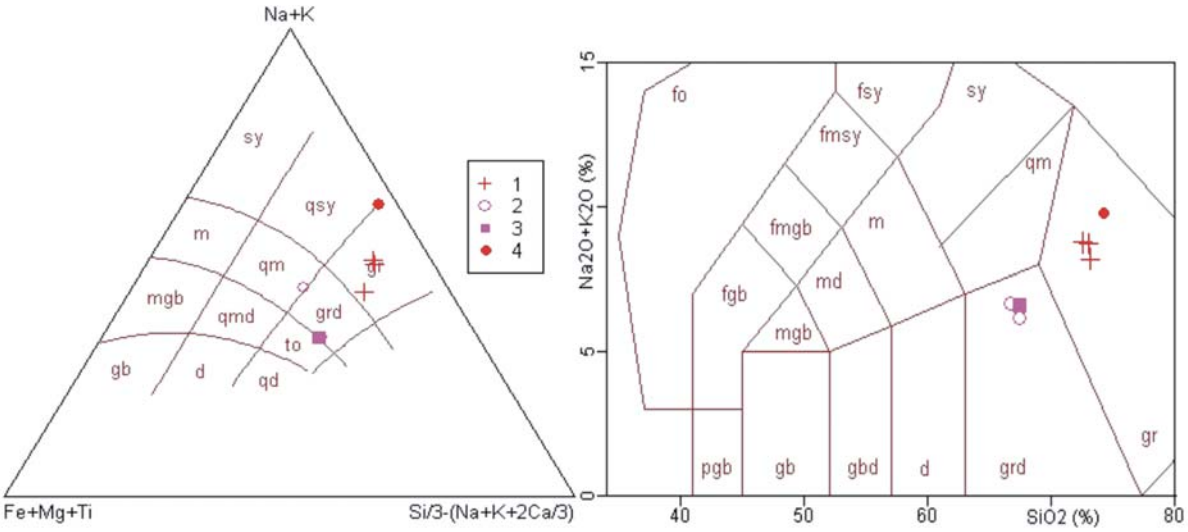

Fig. 2.77. *Neustift Massif ABQ and TAS diagrams. 1 – Platte-Gurlarn Granodiorite, 2 – Neustift Granite, 3 – Schärding Granite-Granodiorite, 4 – dyke granite.*

Neustift Granite Quartz-normal to -rich, potassic, peraluminous, mesocratic, S-type, granite

Plate-Gurlarn Granodiorite Quartz-normal to rich, sodic, peraluminous, mesocratic, S-type, granodiorite

Schärding Granite-Granodiorite Quartz-normal to -rich, sodic, peraluminous, mesocratic, S-type, granodiorite

	1grNeustift	**2grNeustift**	**3Plate/Gurlarn**	**4Plate/Gurlarn**	**5grSchärding**
	granite		granodiorite		
SiO_2	72.80	72.00	65.58	66.19	67.02
TiO_2	0.35	0.25	0.80	0.34	0.86
Al_2O_3	12.82	14.87	15.63	16.98	15.72
Fe_2O_3	2.49	0.38	0.70	1.35	0.59
FeO	1.34	1.31	4.54	3.55	5.04
MnO	0.02	0.07	0.08	0.08	0.10
MgO	0.65	0.73	1.87	1.84	1.96
CaO	0.66	0.76	1.86	2.02	1.40
Na_2O	2.79	3.18	3.02	5.90	2.55
K_2O	5.36	5.51	2.99	0.70	3.97
P_2O_5	0.25	0.19	0.17	0.34	0.10
Mg/(Mg + Fe)	0.24	0.43	0.39	0.40	0.38
K/(K + Na)	0.56	0.53	0.39	0.07	0.51
Nor.Or	32.90	33.61	19.50	4.33	25.53
Nor.Ab	26.02	29.48	29.89	55.51	24.96
Nor.An	1.69	2.60	8.94	8.17	6.85
Nor.Q	33.09	28.13	27.90	20.20	28.18
Na + K	203.84	219.61	160.83	205.22	166.58
*Si	192.20	170.80	180.91	138.04	188.56
K-(Na + Ca)	12.00	0.82	-66.95	-211.46	-23.16
Fe + Mg + Ti	70.37	44.25	128.53	116.17	136.93
Al-(Na + K + 2Ca)	24.38	45.30	79.79	56.20	91.96

(Na + K)/Ca	17.32	16.20	4.85	5.71	6.65
A/CNK	1.14	1.20	1.37	1.24	1.44

***Trace elements (ppm)*:** *Platte-Gurlarn Granodiorite* – **Ba** 542 and 967, **Co** 16, **Cr** 36, **Cu** 32, **Ga** 21, **Ni** 52, **Pb** 34, **Rb** 123 and 217, **Sc** 17, **Sr** 291, **V** 112, **Y** 39, **Zn** 63, **Zr** 197 and 302,

Neustift Granite – **Ba** 696, **Cu** 19, **Ga** 20, **Ni** 15, **Rb** 388, **Sr** 162, **V** 4, **Y** 56, **Zn** 121, **Zr** 168,

Schärding Granite-Granodiorite – **Ba** 1012, **Co** 12, **Cr** 170, **Cu** 52, **Ga** 24, **Ni** 50, **Rb** 158, **Sr** 216, **V** 78, **Y** 78, **Zn** 68, **Zr** 250.

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b. **Autochthonous plutons**

Diatexite migmatites form a major rock formation in the Regensburg Forest part of the Moldanubicum, in the Monotonous series (Siebel et al. 2006). These rocks were derived from metasedimentary precursors of mainly greywacke composition. Within the diatexites numerous discrete, kilometre-scale bodies of granitoids (granodiorites, biotite granites, two-mica granites) and oblong bodies of augengneisses, dominantly of granodioritic composition, often characterized by large potash feldspars, occur on both sides of the tectonic line of the "Pfahl " zone in the western part of the Moldanubicum. The main mafic mineral north of this line is biotite. Gneisses in the south also contain pyroxene of diopside composition, cummingtonite, and green hornblende. Although several processes (magmatic, metamorphic and metasomatic) seem to have contributed to the formation of these rocks, they are generally considered by most authors to be dominantly of magmatic origin (e.g. Siebel et al. 2005). U-Pb and Pb-Pb geochronologic data (zircon, monazite) show that all these granitoids were formed at 322–325 Ma, i. e. when peak metamorphic conditions prevailed which lead to the formation of the diatexites (Siebel et al. 2006). The Pfahl zone played a major role in localizing multiple granitoid intrusions. The intrusion of palites (327–342 Ma) is followed by sheared granitic dykes (326–331 Ma) and emplacement of granodiorites and undeformed granites (321–329 Ma). The composition of the diatexites overlaps with the field of the biotite granite and two-mica granites. Textural observations show that the homogenous diatexites represent highly granitized rocks that did not segregate from the source. This observation might suggest that these granitoids can be interpreted as an intrusive equivalent of the diatexites. Textural and isotopic comparison supports a genetic granite-diatexite link (Siebel et al. 2006). Finger et al. (2007) present the theory that the so-called "Palites" of the Bavarian Forest belong to the Durbachite intrusions.

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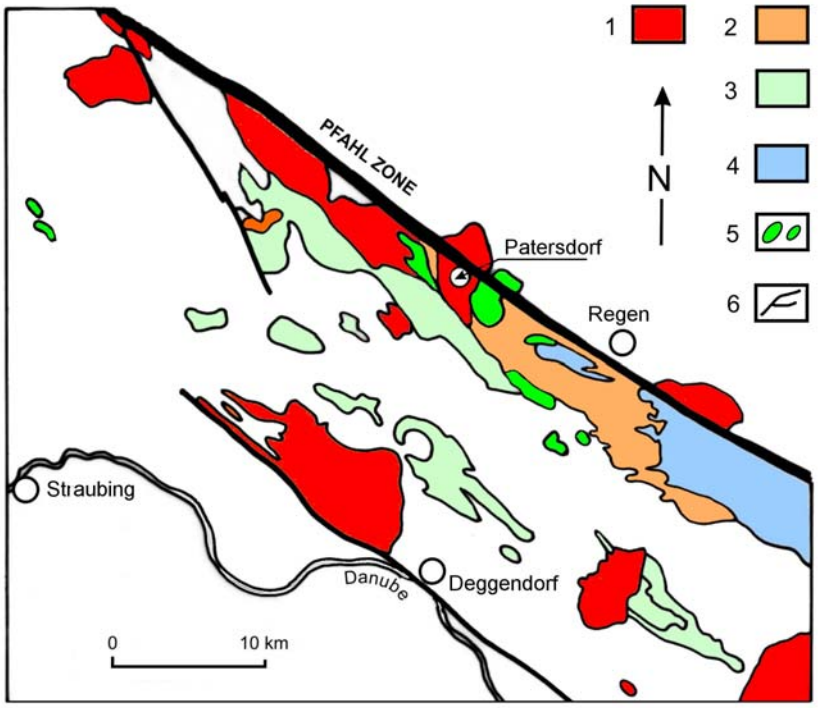

Fig. 2.78. *Autochthonous granitoid massifs of the Moldanubian Composite Batholith sketch-map. 1 – Allochthonous (intrusive) granitoids (Upper Carboniferous), Autochthonous granitoids: 2 – Flaser Massif, 3 – Paragranodiorite Massif, 4 – Palite Massif, 5 – Quartz diorite Stocks, 6 – faults.*

2.1.29. PALITE MASSIF

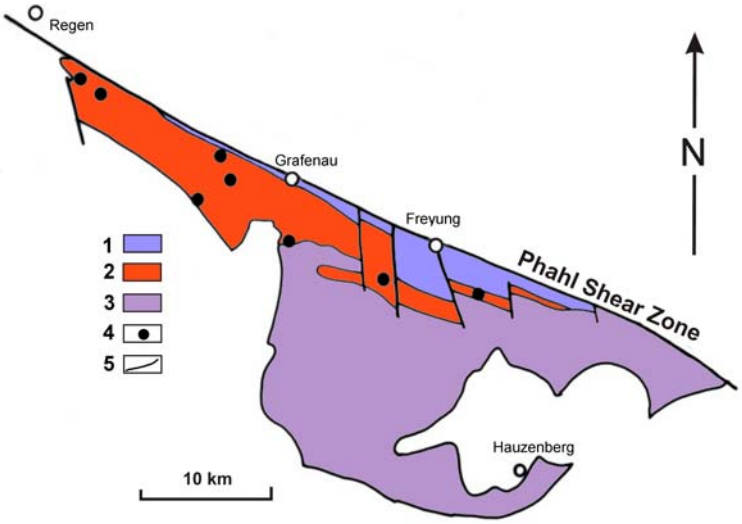

Fig. 2.79. *Palite Massif geological sketch-map (after Steiner 1972). 1 – "Footwall Stockwork" – hypersthene gneiss, 2 – "Hangingwall Stockwork" – metagranodiorite to "augengneiss", 3 – Diatexites, 4 – locality of rock dykes, 5 – major faults.*

Geological position: Monotonous Group (Bavarian Terrane of the Moldanubian Zone), along the Bavarian Quartz "Pfahl". These granitoids are supposed to be a product of anatexis of Variscan age. Finger et al. (2007) present the theory that the so-called „Palites" of the Bavarian Forest belong to the Durbachite intrusions.

The intrusion is divided into two parts – "hangingwall stockwork" consisting of Palite – Saunstein Granodiorite (amphibole-bearing gneiss) and "footwall stockwork" comprised by Palite II – (hypersthene gneiss), porphyritic granite and Core Gneiss.

Rock types:

1. *Palite Metagabbro* – feldspatic hornblende-diopside gabbro (small lens-like bodies in Palite I and II).
2. *Palite I – Saunstein Granodiorite* ± porphyritic (megacrystic) ± cataclastic and blastomylonitic coarse-grained biotite-hornblende granodiorite to "augengneiss".
3. *Kirchdorf im Wald Syenite* – porphyritic (megacrystic) coarse-grained biotite syenite (the rock type belongs to the same rock unit as the Saunstein Granodiorite).
4. *Palite II Gneiss* – hypersthene gneiss.
5. *Diatexite* – medium-grained hornblende – bearing quartzdiorite, quartzmonzonite to granodiorite.
6. *Rock dykes* (3–15 m wide) – intermediate to felsic composition (monzogranite).

Size and shape (in erosion level): 5–7 km wide and 45 km long intrusion along the southwestern part of the Pfahl zone. A zone of amphibole-bearing diatexites measures 15 by 30 km (a series of former dacites, andesites and basalts from an island arc. These volcanics belong to the same magmatic event which produced the precursors of the palites immediately to the north).

Age and isotopic data: Palite rocks emplaced in the shear zone (the Pfahl zone) at 334 ± 3, 334 ± 1.1 Ma (Pb-Pb zircon), 327–342 Ma (U-Pb zircon), 474 ± 18 Ma (Rb-Sr whole rock), 310 ± 7 Ma (Rb-Sr biotite and apatite – cooling age), *Saunstein Granodiorite* 315 ± 3.3 and 311.0 ± 4.9 Ma (U-Pb titanite), 335–324 Ma (U-Pb zircon). Individual K-feldspar crystals from the Saunstein Granodiorite yield Permo-Carboniferous ages 15 to 30 Ma younger than the crystallisation are of the host rock. *Rock dykes* 322 ± 5 to 331 ± 9 Ma (U-Pb zircon).

Geological environment: The Pfahl zone separates anatectic Pearl gneisses and sillimanite gneisses on its southwestern side from migmatitic cordierite-sillimanite gneisses to the northeast.

Contact aureole: not described.

Mineralization: not reported.

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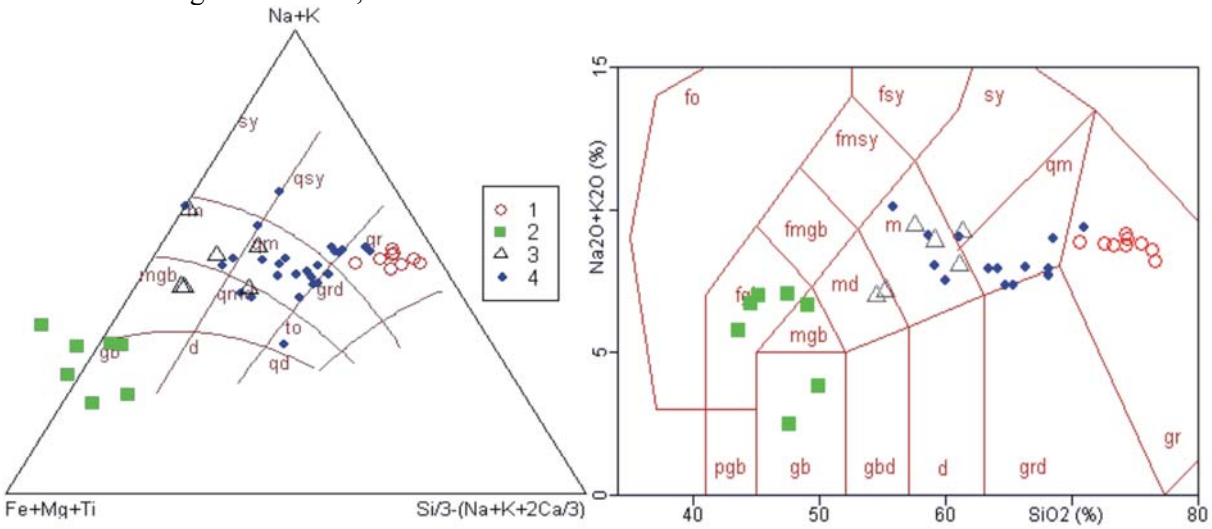

Fig. 2.80. *Palite Massif ABQ and TAS diagrams. 1 –Palite Metagabbro, 2 – Palite I – augen gneiss and amphibole gneiss, 3 – Palite II - hypersthene gneiss, 4 – granitic dykes.*

Palite Metagabbro

Quartz-poor, sodic/potassic, metaluminous, melanocratic, I-type, gabbro

n = 7	Median	Min	Max	QU1	QU3
SiO_2	46.84	42.98	49.60	43.50	47.26
TiO_2	1.98	1.20	4.71	1.68	2.38
Al_2O_3	17.03	14.05	18.63	16.15	17.59
Fe_2O_3	1.75	0.48	3.60	1.55	1.76
FeO	7.40	6.89	7.79	7.10	7.50
MnO	0.15	0.07	0.20	0.14	0.16
MgO	8.27	5.68	10.74	7.50	8.87
CaO	9.46	5.89	14.36	6.38	9.55
Na_2O	2.60	1.40	4.65	1.84	2.85
K_2O	3.67	0.60	4.32	1.20	4.00
P_2O_5	0.68	0.27	2.29	0.30	0.95
Mg/(Mg + Fe)	0.62	0.55	0.69	0.56	0.62
K/(K + Na)	0.46	0.18	0.67	0.23	0.47
Nor.Or	23.26	3.76	26.65	7.92	24.38
Nor.Ab	26.09	13.13	41.64	17.53	27.14

Nor.An	27.24	21.31	72.95	25.52	33.25
Nor.Q	0.00	0.00	0.00	0.00	0.00
Na + K	163.70	72.12	199.10	109.38	169.89
*Si	10.36	-66.20	52.26	-18.31	19.36
K-(Na + Ca)	-127.81	-302.70	-114.65	-275.05	-126.71
Fe + Mg + Ti	365.12	281.21	413.01	337.99	371.73
Al-(Na + K + 2Ca)	-132.82	-271.27	-25.26	-218.40	-128.66
(Na + K)/Ca	1.14	0.28	1.71	0.64	1.14
A/CNK	0.79	0.51	0.97	0.64	0.81

Palite I –Saunstein Granodiorite

Quartz-normal, sodic/potassic, mostly peraluminous, mesocratic, I/S type, granodiorite

	Aug	**Aug2**	**Aug3**	**Aug**	**Aug5**
SiO_2	65.50	64.50	63.12	54.90	64.00
TiO_2	0.65	0.76	0.78	1.24	0.93
Al_2O_3	16.50	17.32	17.32	18.98	17.11
Fe_2O_3	0.24	0.49	0.74	1.60	0.18
FeO	3.25	3.20	3.10	3.90	4.60
MnO	0.05	0.05	0.04	0.08	0.05
MgO	1.31	1.51	1.94	2.71	0.93
CaO	3.36	3.36	3.37	4.13	3.40
Na_2O	3.16	3.12	3.00	4.00	3.09
K_2O	4.73	4.15	4.77	5.93	4.15
P_2O_5	0.07	0.28	0.22	0.75	0.37
Mg/(Mg + Fe)	0.40	0.42	0.48	0.47	0.26
K/(K + Na)	0.50	0.47	0.51	0.49	0.47
Nor.Or	29.57	26.00	30.05	36.04	26.20
Nor.Ab	30.02	29.71	28.72	36.94	29.65
Nor.An	17.15	15.72	16.28	15.99	15.42
Nor.Q	17.52	19.50	15.96	0.00	19.20
Na + K	202.40	188.80	198.09	254.99	187.83
*Si	121.04	129.09	112.03	0.49	126.81
K-(Na + Ca)	-61.46	-72.48	-55.62	-76.82	-72.23
Fe + Mg + Ti	88.92	97.69	110.35	157.14	101.04
Al-(Na + K + 2Ca)	1.79	31.50	21.85	-29.55	26.92
(Na + K)/Ca	3.38	3.15	3.30	3.46	3.10
A/CNK	1.01	1.13	1.09	0.97	1.12

Palite I – Saunstein Granodiorite - **Ba** 1927, **Cr** 102, **Ga** 23, **Ni** 36, **Nb** 19, **Pb** 32, **Rb** 216, **Sr** 757, **Th** 5, **U** 1, **V** 114, **Y** 39, **Zn** 81, **Zr** 412, **Cl** 452**, Sc** 25, **Co** 13, **La** 73, **Ce** 162, **Nd** 77, (Finger et al. 2007).

Palite Massif – dykes

Quartz-normal, mostly potassic, peraluminous, mesocratic, I/S type, granodiorite

	K-gr1	**Kgr2**	**Kgr3**	**Kgr4**	**Kgr5**	**Kgr6**
SiO_2	66.06	67.90	67.36	67.48	60.40	59.06
TiO_2	0.70	0.66	0.57	0.26	0.81	1.21
Al_2O_3	16.23	15.76	16.06	16.28	18.64	18.64
Fe_2O_3	0.11	n.d.	n.d.	0.01	0.53	0.47
FeO	2.99	2.71	2.76	2.20	4.78	6.00
MnO	0.02	0.01	0.01	0.01	0.10	0.11
MgO	0.86	0.66	0.60	0.42	2.57	1.21

CaO	2.17	2.03	2.24	2.30	3.86	3.22
Na_2O	3.00	3.00	3.09	3.08	3.94	3.17
K_2O	5.93	5.79	5.79	6.17	2.76	4.77
P_2O_5	0.30	0.22	0.26	0.16	0.39	0.36
Mg/(Mg + Fe)	0.33	0.30	0.28	0.25	0.46	0.25
K/(K + Na)	0.57	0.56	0.55	0.57	0.32	0.50
Nor.Or	36.96	35.84	35.80	38.01	17.63	30.61
Nor.Ab	28.42	28.22	29.04	28.84	38.26	30.92
Nor.An	9.27	9.03	9.84	10.80	17.93	14.78
Nor.Q	18.45	21.16	19.76	18.55	12.67	10.73
Na + K	222.72	219.74	222.65	230.39	185.74	203.57
*Si	117.97	132.82	124.42	116.63	103.46	85.80
K-(Na + Ca)	-9.60	-10.07	-16.72	-9.40	-137.37	-58.44
Fe + Mg + Ti	73.13	62.39	60.47	44.44	147.12	134.63
Al-(Na + K + 2Ca)	18.62	17.35	12.85	7.28	42.64	47.64
(Na + K)/Ca	5.76	6.07	5.57	5.62	2.70	3.55
A/CNK	1.09	1.08	1.06	1.03	1.16	1.18

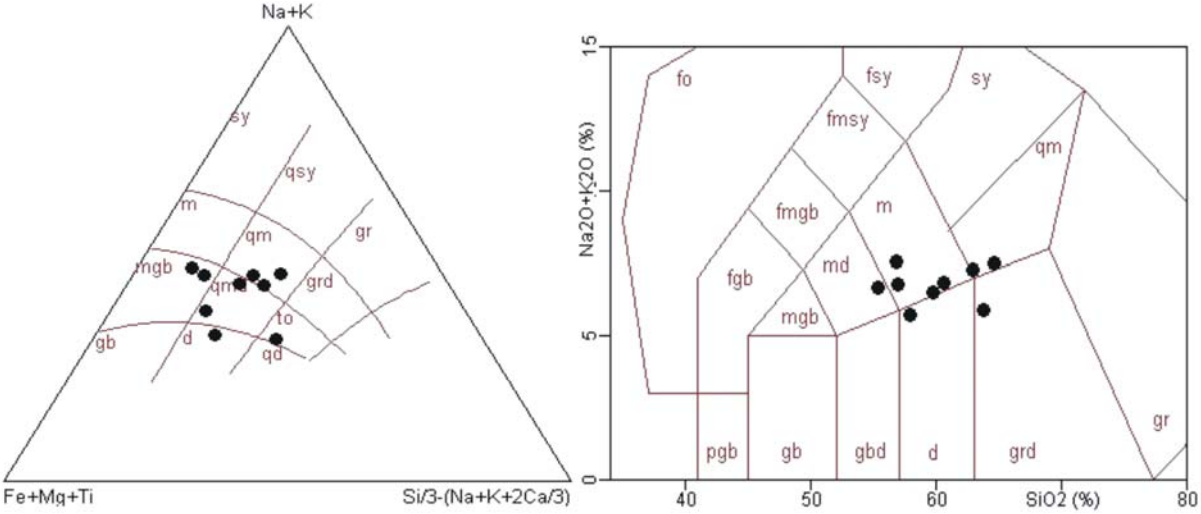

Fig. 2.81. *Palite Massif ABQ and TAS diagrams. 1 – diatexites.*

Diatexites

n = 9	Median	Min	Max	QU1	QU3
SiO_2	59.52	55.24	64.68	56.74	62.82
TiO_2	0.86	0.47	1.61	0.79	1.00
Al_2O_3	16.90	15.71	20.77	16.62	18.26
Fe_2O_3	7.02	4.76	9.73	5.19	7.59
FeO	0.00	0.00	0.00	0.00	0.00
MnO	0.09	0.06	0.24	0.08	0.13
MgO	3.01	2.42	4.05	2.92	3.51
CaO	4.78	2.74	5.55	3.77	4.87
Na_2O	3.65	2.98	5.21	3.61	4.00
K_2O	2.88	1.47	3.91	2.30	3.60
P_2O_5	0.24	0.05	0.62	0.23	0.30
Mg/(Mg + Fe)	0.49	0.44	0.52	0.45	0.51
K/(K + Na)	0.37	0.16	0.44	0.28	0.40
Nor.Or	18.30	9.07	24.48	14.27	22.85

Nor.Ab	34.73	28.77	48.86	34.25	38.23
Nor.An	21.97	14.19	27.18	17.63	23.77
Nor.Q	12.22	2.75	24.85	10.64	15.75
Na + K	187.04	157.31	202.95	174.54	199.34
*Si	86.97	41.15	162.34	77.87	108.96
K-(Na + Ca)	-121.61	-235.88	-83.87	-157.06	-106.90
Fe + Mg + Ti	182.06	125.57	234.93	148.00	185.53
Al-(Na + K + 2Ca)	-2.81	-20.59	53.48	-7.99	0.66
(Na + K)/Ca	2.18	1.93	3.28	2.01	2.90
A/CNK	0.99	0.94	1.21	0.98	1.00

2.1.30. PARAGRANODIORITE MASSIF

Geological position: Monotonous Group (Bavarian Terrane of the Moldanubian Zone), along the Bavarian Quartz "Pfahl". These granitoids are supposed to be magmatic products of in situ anatexis of metapelites during the Variscan high-grade metamorphism.

Rock types:

1. *Paragranodiorite s.s.* ("Granodiorite") – medium- to fine-grained biotite granodiorite
2. *Ödwies Granodiorite* – medium-grained biotite granodiorite
3. *Kollnburg Granodiorite* – medium-grained biotite granodiorite

Size and shape (in erosion level): up to 3.5 km wide and 43 km long belt of oval bodies in the southwestern part of the Pfahl zone.

Age and isotopic data: *Ödwies Granodiorite:* 318–320 Ma (U-Pb zircon), 326 ± 2, 329 ± 6 Ma (U-Pb zircon), 331 ± 9 Ma (Rb-Sr whole rock), *Kollnberg Granodiorite* 320 Ma (U-Pb zircon). The coarse-grained Paragranodiorite facies intruded the fine-grained facies. The Patersdorf Granite intrudes the Paragranodiorite within a short time interval 325 ± 3 Ma and 326 ± 3 Ma (Pb-U zircon) is best estimate for the time of emplacement and crystallization of Paragranodiorite.

Geological environment: the Pfahl zone separates anatectic pearl gneisses and sillimanite gneisses on its southwestern side from migmatitic cordierite-sillimanite gneisses to the northeast.

Contact aureole: transitions to the Pearl gneisses and the Palite are described.

Mineralization: not reported.

Paragranodiorite

Quartz- normal, potassic, very strongly peraluminous, mesocratic, S-type, granite

4-paragranodiorite	(locality Bernhardsberg)
SiO_2	65.82
TiO_2	0.94
Al_2O_3	15.71
Fe_2O_{3tot}	5.87
FeO	n.d.
MnO	0.08
MgO	1.86
CaO	2.18
Na_2O	2.39
K_2O	4.10
P_2O_5	0.64
Mg/(Mg + Fe)	0.38
K/(K + Na)	0.53
Nor.Or	25.73
Nor.Ab	22.79
Nor.An	7.01
Nor.Q	30.11

Na + K	164.18
*Si	175.06
K-(Na + Ca)	-28.95
Fe + Mg + Ti	131.48
Al-(Na + K + 2Ca)	66.59
(Na + K)/Ca	4.22
A/CNK	1.36

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2.1.31. FLASER MASSIF

Geological position: Monotonous Group (Moldanubian Zone), along the Bavarian Quartz "Pfahl". These granitoids are supposed to be a product of in situ anatexis of Variscan age.

1. *Flaser Granite* – medium-grained ± foliated biotite granite.
2. *Winz Granite* – diaphtoretic mylonitized porphyroblastic biotite granite (Danube valley).

Size and shape (in erosion level): up to 3.5 km wide and 43 km long belt of oval bodies in the southwestern part of the Pfahl zone.

Age and isotopic data: the Flaser Granite is younger than the Palite (xenoliths of Palite within the Flaser Granite). *Flaser Granite* – 316 ± 6 Ma (Rb-Sr whole rock).

Geological environment: the Pfahl zone separates anatectic pearl gneisses and sillimanite gneisses on its southwestern side from migmatitic cordierite-sillimanite gneisses to the northeast.

Contact aureole: Flaser Granite passes into the Pearl gneiss.

Mineralization: not reported.

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III. Dyke Swarms

The most of the dyke swarms in the periphery or within the Moldanubian Composite Batholith are reported as its subvolcanic satellite suite mostly of Permian age. They composition vary in a large range from leucogranite to diorite. The Pelhřimov Dyke Swarm within the Pelhřimov circular structure is interpreted as an explosive volcanotectonic structure indicating of a subsurface intrusive body. According to Vrána (1993 and 2004) the Ševětín and Sušice dyke Swarms have mineralogical, chemical and isotopic indications of a possible impact melt origin.

Main dyke swarms of the Moldanubian Composite Batholith are:

1. Pelhřimov Dyke Swarm
2. Ševětín Dyke Swarm
3. Kaplice Dyke Swarm
4. Blanice Graben Dyke Swarm
5. Passau Forest Dyke Swarm
6. Kvilda Dyke Swarn
7. Sušice Dyke Swarm
8. Šejby Dyke Swarm
9. Litschau Dyke Swarm

2.1.32.1. PELHŘIMOV DYKE SWARM

Geological position: the Moldanubian Zone.

Rock types: *Pelhřimov Granite Porphyry* – felsic alkali-feldspar granite porphyry (corresponds to composition of tin-bearing granite).

Size and shape (in erosion level): the Pelhřimov circular structure (of 9.6 km in diameter) is interpreted as explosive volcanotectonic structure associated with a dyke swarm of granite porphyry indicating of a subsurface intrusive body.

Age and isotopic data: probably Upper Permian in age, 228 Ma (K-Ar whole rock).

Geological environment: migmatized gneiss and biotite-sillimanite gneiss.

Contact aureole: albitization, chloritization and muscovitization.

Mineralization: fluorite sub-economic mineralization.

Pelhřimov Granite Porphyry

Quartz rich, sodic, peraluminous, leucocratic, S-type, granite

	Pelhřim1
SiO_2	73.72
TiO_2	0.04
Al_2O_3	15.15
Fe_2O_3	0.31
FeO	0.55
MnO	0.04
MgO	0.14
CaO	0.45
Na_2O	3.82
K_2O	4.21
P_2O_5	0.36
Li_2O	0.03
Mg/(Mg + Fe)	0.22
K/(K + Na)	0.42
Nor.Or	25.44
Nor.Ab	35.08
Nor.An	-0.14
Nor.Q	33.05

Na + K	212.66
*Si	190.98
K-(Na + Ca)	-41.91
Fe + Mg + Ti	15.52
Al-(Na + K + 2Ca)	68.81
(Na + K)/Ca	26.50
A/CNK	1.35

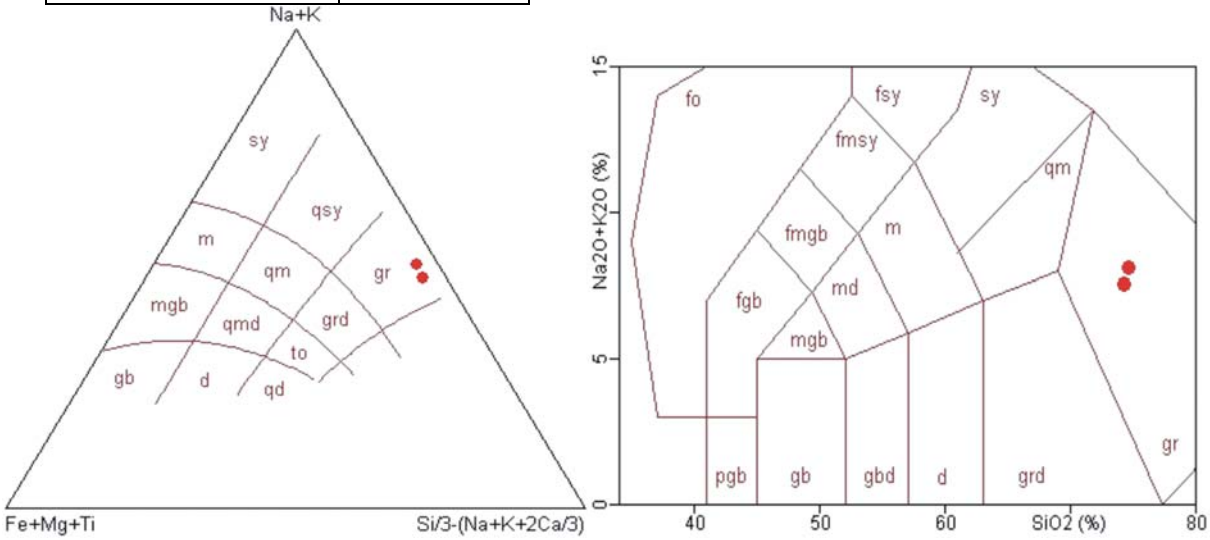

Fig. 2.82. *Pelhřimov Granite Porphyry ABQ and TAS diagrams.*

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2.1.32.2. ŠEVĚTÍN DYKE SWARM (ŠDS)

Geological position: Moldanubian Zone (Varied Group). ŠDS is located within the perimeter of the Ševětín impact structure (Varied Group).

Rock types: *Ševětín Microgranodiorite* – amphibole granodiorite to quartz monzonite.

Size and shape (in erosion level): almost vertical dykes, one to ten meters thick and up to 70 meters long.

Age and isotopic data: Autunian age**,** 270 ± 2 Ma (Ar/Ar hornblende). One dyke cuts across the late-Variscan Ševětín Granite.

Geological environment: migmatitic sillimanite-biotite (cordierite) gneiss. ŠDS in association with rare monomict breccia dykes.

Contact aureole: chilled margin up to 30 cm wide.

Zoning: dykes show a centroradial trend.

Mineralization: not reported.

Heat production (μWm^{-3}): *Ševětín Microgranodiorite* 2.48.

Ševětín Microgranodiorite

Quartz-normal, sodic, weakly peraluminous, melanocratic diorite

n = 9	Median	Min	Max	QU1	QU3
SiO_2	57.41	54.89	60.46	57.13	58.14
TiO_2	0.81	0.73	1.05	0.75	0.85

Al_2O_3	15.68	15.38	16.28	15.62	16.03
Fe_2O_3	0.97	0.72	1.34	0.85	1.09
FeO	4.53	4.09	5.56	4.30	5.07
MnO	0.10	0.08	0.12	0.09	0.11
MgO	4.84	3.90	6.20	4.74	5.35
CaO	3.76	3.55	5.69	3.62	5.01
Na_2O	2.96	2.68	3.45	2.75	3.28
K_2O	2.99	2.27	3.30	2.50	3.16
P_2O_5	0.23	0.21	0.34	0.23	0.32
Mg/(Mg + Fe)	0.62	0.57	0.63	0.60	0.62
K/(K + Na)	0.38	0.31	0.43	0.37	0.40
Nor.Or	19.94	15.46	22.72	17.20	21.38
Nor.Ab	30.28	28.02	36.59	28.47	34.11
Nor.An	19.35	18.07	30.96	18.74	27.26
Nor.Q	10.80	5.94	16.27	9.95	12.51
Na + K	161.65	136.94	175.91	143.54	166.10
*Si	109.68	96.79	129.77	105.14	117.82
K-(Na + Ca)	-106.18	-142.01	-92.98	-126.81	-100.68
Fe + Mg + Ti	204.62	176.44	258.20	200.34	224.16
Al-(Na + K + 2Ca)	4.34	-29.38	14.79	-3.44	13.89
(Na + K)/Ca	2.46	1.35	2.78	1.56	2.52
A/CNK	1.03	0.93	1.08	1.00	1.07

Trace elements (mean values in ppm): *Ševětín Microgranodiorite* – **Li** 102, **Be** 3, **Sc** 18, **V** 72, **Cr** 170, **Co** 18, **Ni** 59, **Cu** 9, **Zn** 70, **Ga** 17, **As** 7, **Rb** 110, **Sr** 387, **Y** 22, **Zr** 189, **Nb** 17, **Sn** 5, **Cs** 6.8, **Ba** 890, **Th** 10.7, **U** 3.2, (Vrána et al. 1993).

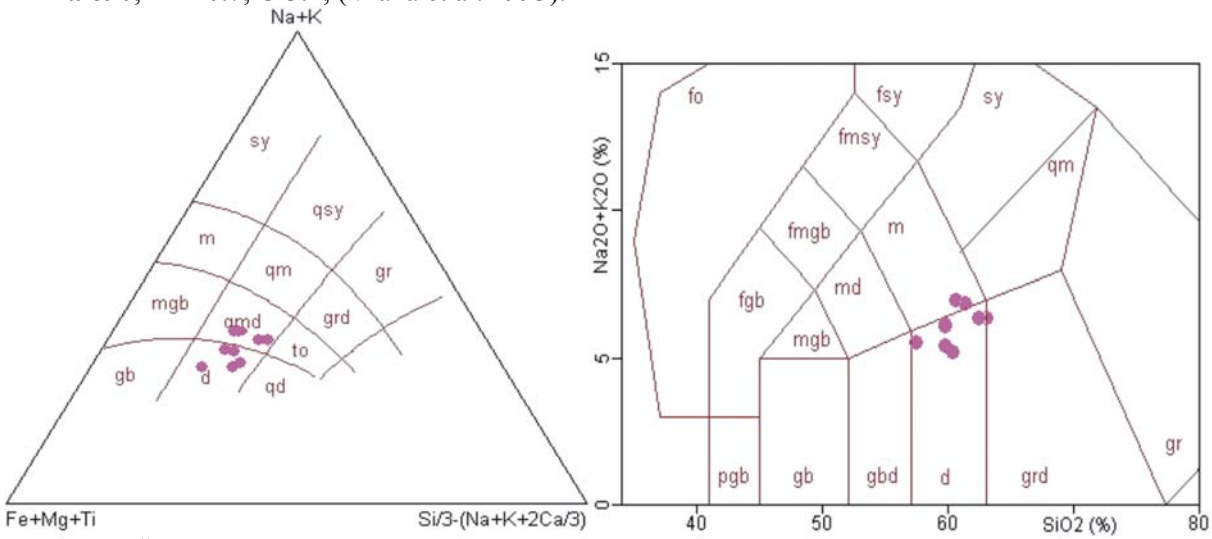

Fig. 2.83. *Ševětín Microgranodiorite ABQ and TAS diagrams.*

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2.1.32.3. KAPLICE DYKE SWARM (KDS)

Geological position: KDS is associated with the Kaplice fault zone in the Moldanubian Zone.

The dyke swarm strongly indicates the presence of the Freistadt Granodiorite at a subsurface level, covered by metamorphic rocks and older Variscan granitoids (Weinsberg and Eisgarn Granite).

Rock types: *Kaplice Porphyry* – 1. Biotite granodiorite porphyry

2. Hornblende quartz diorite porphyry.

Size and shape (in erosion level): two linear clusters of dykes up to 15 m wide near Kaplice (35 km long) and Trhové Sviny (20 km long).

Age and isotopic data: 305 ± 5 Ma, 301 ± 4 Ma, 270 ± 2 Ma (Ar-Ar hornblende).

Geological environment: gneisses and migmatites, granulites (Kaplice Unit, Monotonous Group), Weinsberg and Eisgarn granites.

Contact aureole: not described.

Mineralization: not reported.

References

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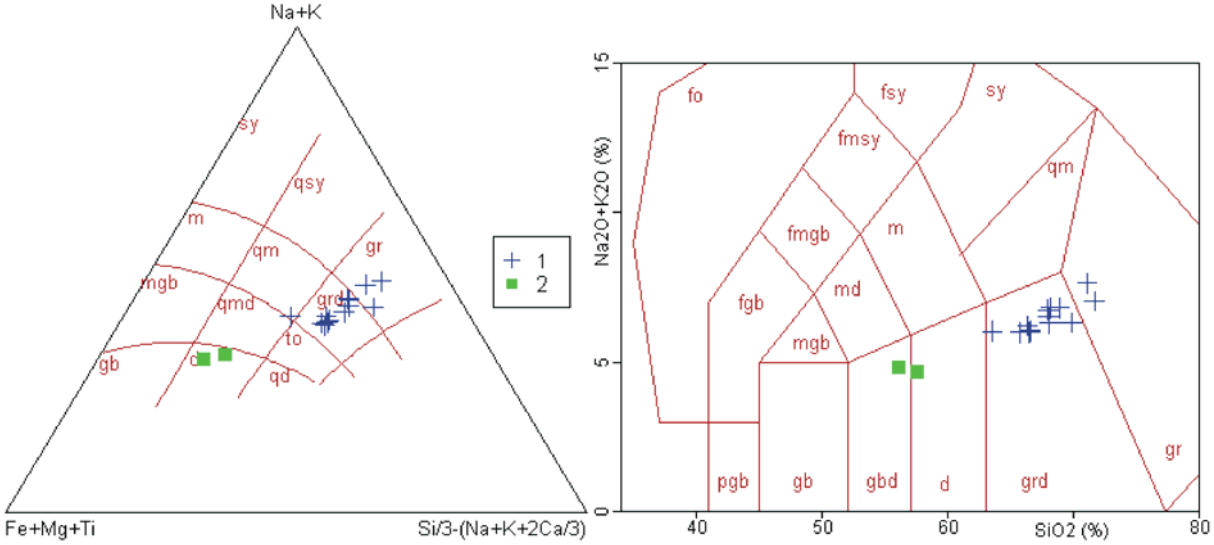

Fig. 2.84. *Kaplice Dyke Swarm ABQ and TAS diagram: 1 – Kaplice Granodiorite Porphyry, 2 – Kaplice Quartz Diorite Porphyry.*

Kaplice Granodiorite Porphyry

Quartz-normal, sodic, peraluminous, mesocratic,S-type granodiorite

n=14	Median	Min	Max	QU1	QU3
SiO_2	65.98	62.24	70.40	63.92	66.54
TiO_2	0.49	0.29	0.62	0.42	0.53
Al_2O_3	16.31	15.29	17.25	16.16	16.48
Fe_2O_3	0.98	0.31	1.59	0.73	1.09
FeO	2.43	1.27	2.94	2.20	2.52
MnO	0.07	0.04	0.42	0.05	0.07
MgO	1.56	0.75	2.52	1.18	1.87
CaO	3.22	1.26	4.89	2.53	3.46
Na_2O	3.62	3.46	4.69	3.54	3.82
K_2O	2.33	2.02	3.38	2.23	2.80
P_2O_5	0.17	0.10	0.19	0.15	0.17
Mg/(Mg+Fe)	0.46	0.34	0.52	0.41	0.47
K/(K+Na)	0.30	0.24	0.35	0.27	0.33
Nor.Q	23.96	16.92	28.21	22.74	25.20

Nor.Or	14.68	12.87	20.95	13.85	17.78
Nor.Ab	35.00	33.77	43.55	34.22	36.75
Nor.An	15.76	5.31	24.65	11.88	17.81
Na+K	172.74	161.55	202.78	165.51	179.77
*Si	150.55	119.52	175.75	148.06	157.33
K-(Na+Ca)	-128.63	-166.09	-81.72	-137.38	-110.64
Fe+Mg+Ti	87.77	48.34	127.97	78.03	101.55
Al-(Na+K+2Ca)	33.12	-3.29	55.37	22.65	48.41
(Na+K)/Ca	2.93	1.92	9.03	2.42	3.56
A/CNK	1.13	1.00	1.23	1.09	1.18

Kaplice Quartz diorite Porphyry

quartz-normal, sodic, metaluminous, melanocratic, I-type quartz diorite

	KC4	**KC10**
SiO_2	55.91	54.46
TiO_2	0.87	0.89
Al_2O_3	18.01	18.29
Fe_2O_3	1.83	2.16
FeO	4.40	3.61
MnO	0.09	0.09
MgO	3.77	5.06
CaO	7.40	7.46
Na_2O	3.33	3.26
K2O	1.19	1.37
$P2O_5$	0.20	0.26
Mg/(Mg+Fe)	0.52	0.61
K/(K+Na)	0.19	0.22
Nor.Q	8.97	6.09
Nor.Or	7.86	9.09
Nor.Ab	33.42	32.89
Nor.An	39.56	39.66
Na+K	132.72	134.29
*Si	89.48	79.16
K-(Na+Ca)	-214.15	-209.14
Fe+Mg+Ti	188.65	214.04
Al-(Na+K+2Ca)	-42.96	-41.16
(Na+K)/Ca	1.01	1.01
A/CNK	0.90	0.91

2.1.32.4. BLANICE GRABEN DYKE SWARM

Geological position: associated with the late Variscan Blanice Graben in the Moldanubian Zone.

Rock types: *Štěpánovice Quartz monzodiorite* – sub-ophitic pyroxene-biotite fine-grained or locally medium-grained quartz monzodiorite.

Size and shape (in erosion level): several dykes up to 3 km long and 20–50 m wide. Shallow (subvolcanic) intrusion.

Age and isotopic data: likely Stephanian-Viséan age. No isotopic data.

Geological environment: mafic granulites and silimanite-cordierite-biotite migmatite.

Contact aureole: abundant xenoliths of hydrothermal quartz, and scarce igneous enclaves.

Zoning: not reported.

Mineralization: not reported.

Štěpánovice Quartz monzodiorite

Quartz-normal, sodic, metaluminous, melanocratic, I-type, gabbrodiorite

n = 8	Median	Min	Max	QU1	QU3
SiO_2	51.50	50.54	52.60	51.06	51.77
TiO_2	1.49	1.46	1.59	1.48	1.57
Al_2O_3	15.78	15.64	16.04	15.69	15.93
Fe_2O_3	0.98	0.67	1.03	0.75	1.03
FeO	7.46	6.85	7.78	6.92	7.66
MnO	0.14	0.12	0.15	0.13	0.14
MgO	6.46	5.71	7.61	6.19	6.80
CaO	6.83	6.37	7.35	6.81	6.96
Na_2O	2.55	2.39	2.78	2.42	2.62
K_2O	2.39	2.28	2.85	2.35	2.52
P_2O_5	0.39	0.34	0.49	0.36	0.44
Li_2O	0.005	0.004	0.009	0.004	0.006
Mg/(Mg + Fe)	0.58	0.56	0.61	0.57	0.59
K/(K + Na)	0.38	0.35	0.44	0.36	0.41
Nor.Or	16.92	15.96	20.10	16.13	17.94
Nor.Ab	27.26	25.86	29.05	25.94	27.72
Nor.An	37.04	34.96	39.48	36.86	37.90
Nor.Q	0.00	0.00	1.44	0.00	0.00
Na + K	136.51	130.63	139.61	132.06	138.34
*Si	66.71	55.81	78.23	59.70	72.28
K-(Na + Ca)	-154.68	-166.60	-140.09	-162.96	-146.20
Fe + Mg + Ti	296.70	268.99	323.90	283.35	306.58
Al-(Na + K + 2Ca)	-71.62	-84.34	-51.92	-83.29	-69.21
(Na + K)/Ca	1.10	1.05	1.17	1.06	1.13
A/CNK	0.83	0.80	0.88	0.81	0.84

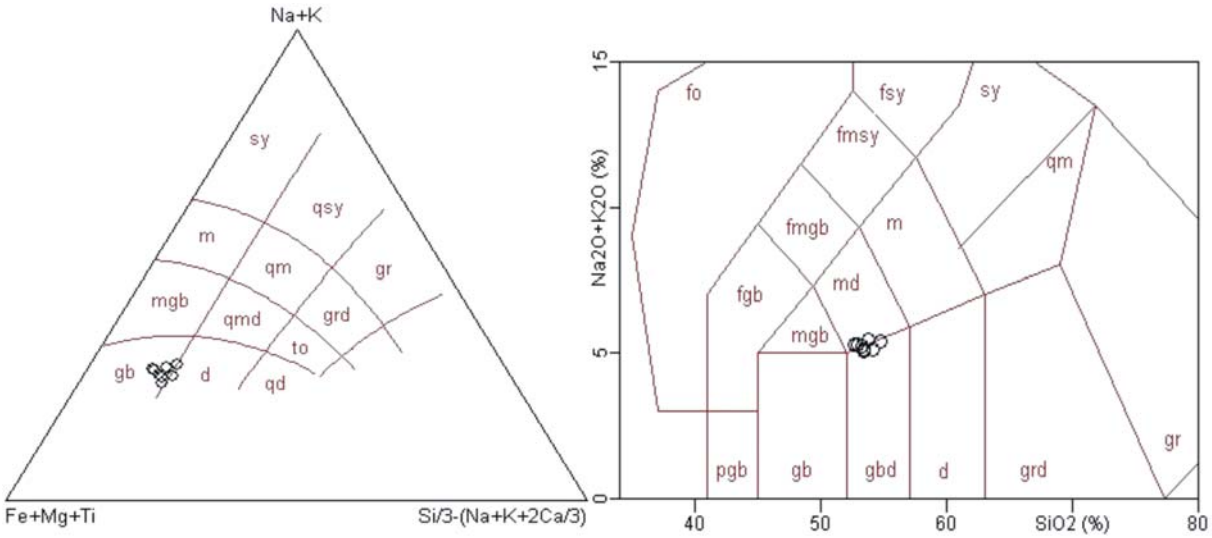

Fig. 2.85. *Blanice Graben Dyke Swarm ABQ and TAS diagrams. Stěpánovice Quartz monzodiorite.*

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2.1.32.5. PASSAU FOREST DYKE SWARM

***Geological position*:** Late Variscan calc-alkaline dykes are associated to the Late-Variscan granitoid massifs and anatectic gneisses between the Bavarian Quartz "Pfahl" and the Donau River; the dykes are not affected by deformation along the Phahl Shear Zone.

Rock types:

Bavarian Forest Dykes – basaltic trachyandesite-dacite series and rhyolites.

Passau Forest Porphyry – biotite granodiorites, amphibole granodiorite and diorite porphyry – most common types with phenocrysts of biotite, plagioclase, quartz and ± amphibole. Rare granodiorite porphyry contains K-feldspar in the matrix.

Size and shape (in erosion level): undefined number of steep dykes is arranged into a zone more than 10 km long and about 5 km wide between Waldkirchen and Linz. Their width varies from dm up to maximum 30 meters, and up to 2 km length (vertical dip and strike between 120° and 140°).

Age and isotopic data: cooling age 297 ± 7 Ma (Rb-Sr biotite). Dykes penetrate the Hauzenberg Granite with sharp contacts. Dacite 302 ± 7 Ma (Rb-Sr apatite-biotite), Time of intrusion of the dykes ca. 300 Ma.

Geological environment: gneisses and the Hauzenberg Granite.

Contact aureole: not defined.

Mineralization: not known.

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Passau Forest Porphyry

Quartz-normal, sodic, moderately peraluminous, mesocratic, quartz diorite to diorite porphyry

n = 6	Median	Min	Max	QU1	QU3
SiO_2	65.59	62.51	66.96	64.78	66.64
TiO_2	0.68	0.39	1.85	0.44	0.88
Al_2O_3	16.64	14.81	17.45	16.55	17.02
Fe_2O_3	1.33	0.67	1.68	1.32	1.53
FeO	2.35	1.84	2.97	1.98	2.36
MnO	0.06	0.01	0.64	0.03	0.06
MgO	1.47	1.32	3.12	1.33	2.04
CaO	3.49	3.19	5.04	3.36	3.55
Na_2O	3.76	3.12	4.03	3.49	3.88
K_2O	2.06	1.83	3.13	2.03	2.92
P_2O_5	0.28	0.00	1.15	0.06	0.51
Mg/(Mg + Fe)	0.44	0.40	0.56	0.42	0.49
K/(K + Na)	0.28	0.26	0.35	0.28	0.32
Nor.Or	12.97	11.51	19.10	12.78	17.90
Nor.Ab	34.88	29.81	37.54	33.88	36.59
Nor.An	16.02	9.35	23.40	12.93	18.08
Nor.Q	23.42	19.47	26.87	20.47	23.52
Na + K	168.94	139.54	192.04	155.72	187.79
*Si	143.10	130.35	171.47	131.15	143.75
K-(Na + Ca)	-134.40	-159.39	-114.79	-144.77	-130.28

Fe + Mg + Ti	90.92	82.50	163.00	86.78	110.51
Al-(Na + K + 2Ca)	23.62	-44.63	57.99	17.39	23.65
(Na + K)/Ca	2.67	1.73	3.33	1.92	3.09
A/CNK	1.12	0.90	1.20	1.10	1.14

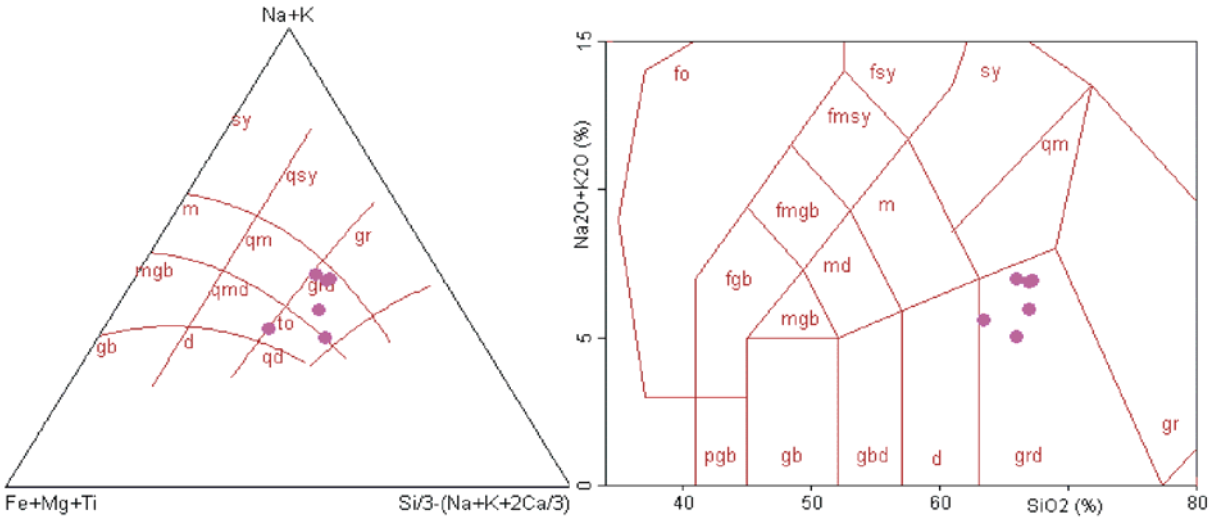

Fig. 2.86. *Passau Forest Dyke Swarm ABQ and TAS diagrams. Passau Forest Porphyry.*

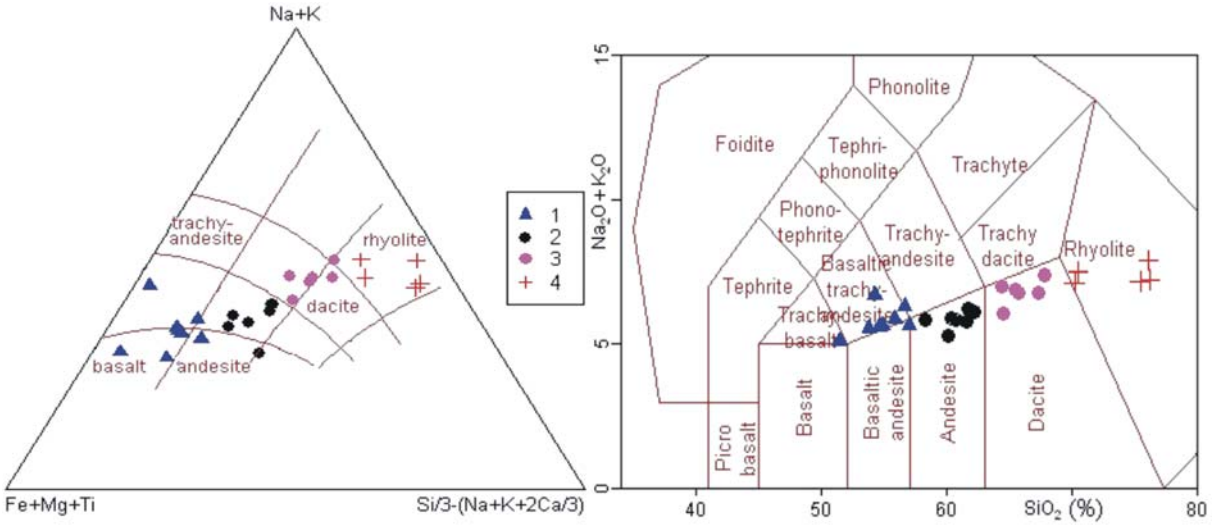

Fig. 2.87. *Bavarian Forest Dykes ABQ and TAS diagrams. -1 - basaltic trachyandesite,2 - andesite, 3 - dacite,4 - rhyolite.*

2.1.32.6. KVILDA DYKE SWARM

Geological position: Monotonous Group of the Moldanubian Zone.

Rock types:

Kvilda Dyke Granite – ± porphyritic medium-grained muscovite ± biotite tourmaline-bearing alkali-feldspar leucogranite.

Size and shape (in erosion level): NW-SE trending zone 1–3 km wide and more than 10 km long with abundant leucogranite dykes (more than 50). The width of individual dykes is less than 10 m, mostly ~ 40 cm to several metres. According to the geophysical indications the dyke swarm is rimming subsurface extension of the Vydra Massif.

Age and isotopic data: 326 ± 6.9 Ma (U-Th monazite).

Geological environment: sillimanite – biotite ± cordierite migmatites, gneisses and orthogneisses.

Contact aureole: not described.

Mineralization: not reported.

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Kvilda Dyke Granite

Quartz-rich, sodic, peraluminous, leucocratic, S-type, granite

	leukoG3	**leukoG2**	**leukoG6**
SiO_2	72.37	74.86	75.24
TiO_2	0.14	0.05	0.02
Al_2O_3	15.15	14.29	14.59
Fe_2O_3	0.41	0.32	0.51
FeO	1.05	0.30	0.28
MnO	0.35	0.10	0.08
MgO	0.05	0.03	0.04
CaO	0.53	0.53	0.36
Na_2O	4.31	3.78	4.47
K_2O	3.85	4.30	2.49
P_2O_5	0.27	0.24	0.37
Li_2O	0.03	0.01	0.00
Mg/(Mg + Fe)	0.04	0.06	0.07
K/(K + Na)	0.37	0.43	0.27
Nor.Or	23.39	25.94	15.05
Nor.Ab	39.80	34.65	41.05
Nor.An	0.86	1.07	0.68
Na + K	220.83	213.28	197.11
*Si	174.37	195.73	216.02
K-(Na + Ca)	-66.79	-40.13	-97.80
Fe + Mg + Ti	22.66	9.43	11.41
Al-(Na + K + 2Ca)	57.79	48.45	76.56
(Na + K)/Ca	23.37	22.57	30.71
Nor.Q	29.74	33.81	37.84
A/CNK	1.27	1.24	1.42

Trace elements (ppm)*: *Kvilda Leucogranite – **Cr** 4, **Ni** 4, **Co** 25, **Zn** 52, **As** 18, **Rb** 217, **Sr** 30, **Y** 6, **Zr** 17, **Nb** 10, **Sn** 34, **Pb** 33, **U** 4 (Žáček – Sulovský 2005).

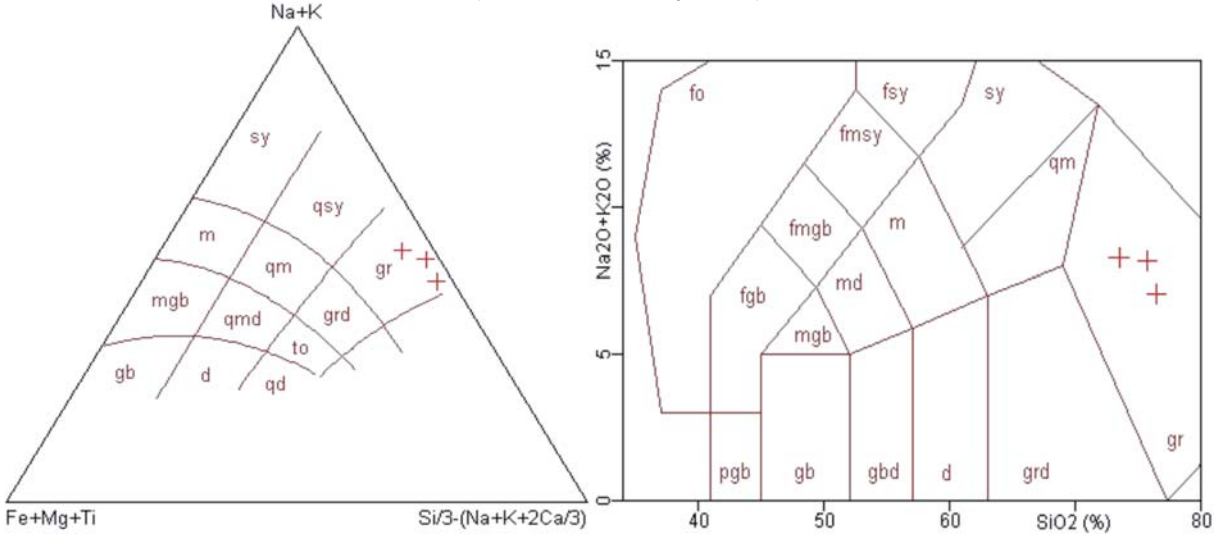

Fig. 2.88. *Kvilda Dyke Swarm ABQ and TAS diagrams.*

2.1.32.7. SUŠICE DYKE SWARM

Geological position: the Moldanubian Zone.

Rock types: *Sušice Quartz monzonite* – augite quartz micro-monzodiorite (similar to the Ševětín dykes).

Size and shape (in erosion level): NW-SE trending dykes of several meters wide coincide with the Sušice circular structure about 18 km in diameter. Nearly circular cauldron-like subsidence is triggered by the evacuation of a magma chamber.

Age and isotopic data: The Sušice dykes are related to the Permian volcanic activity in the Moldanubian zone. No isotopic data.

Geological environment: migmatite, orthogneiss and sillimanite-biotite gneiss.

Contact aureole: not reported.

Mineralization: not reported.

References

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Sušice Quartz micro-monzonite

Quartz-normal, sodic, metaluminous, melanocratic, I-type, monzodiorite

	SN15	SN16	SN18	SN24	SN28
SiO_2	54.74	55.09	56.44	55.95	58.08
TiO_2	1.55	1.59	1.27	1.28	1.25
Al_2O_3	15.55	15.66	16.57	16.49	16.55
Fe_2O_3	1.81	1.81	1.22	1.37	1.44
FeO	6.29	6.37	4.99	4.99	5.21
MnO	0.13	0.14	0.10	0.10	0.10
MgO	4.13	4.06	3.99	3.89	4.29
CaO	6.20	6.11	6.66	5.93	6.44
Na_2O	2.58	2.76	2.54	3.07	2.88
K_2O	3.14	3.18	2.52	2.83	2.63
P_2O_5	0.25	0.25	0.25	0.26	0.27
Li_2O	0.01	0.01	0.00	0.00	0.01
Mg/(Mg + Fe)	0.48	0.47	0.53	0.52	0.54
K/(K + Na)	0.44	0.43	0.39	0.38	0.38
Nor.Or	21.46	21.54	16.96	19.00	17.26
Nor.Ab	26.80	28.41	25.98	31.32	28.73
Nor.An	33.68	32.87	35.77	31.49	33.52
Nor.Q	5.85	5.17	10.20	7.07	9.13
Na + K	149.92	156.58	135.47	159.15	148.78
*Si	80.06	76.41	98.47	80.75	96.88
K-(Na + Ca)	-127.14	-130.50	-147.22	-144.72	-151.93
Fe + Mg + Ti	232.17	232.05	199.69	199.21	212.70
Al-(Na + K + 2Ca)	-65.67	-66.96	-47.59	-46.81	-53.45
(Na + K)/Ca	1.36	1.44	1.14	1.51	1.30
A/CNK	0.84	0.83	0.89	0.89	0.87

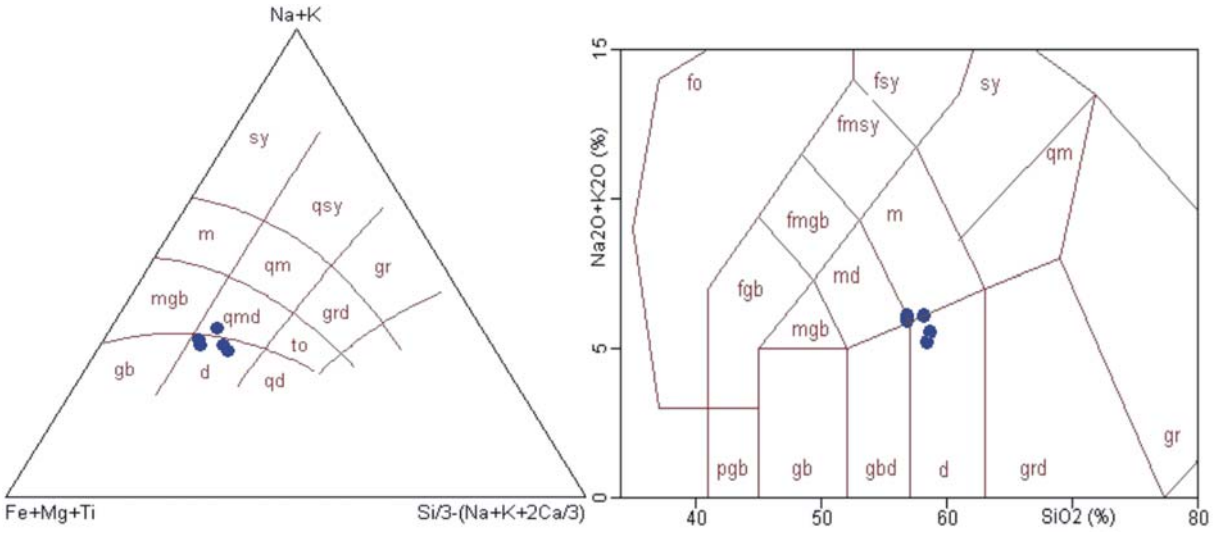

Fig. 2.89. *Sušice Dyke Swarm ABQ and TAS diagrams. Sušice Quartz micro-monzodiorite.*

2.1.32.8. ŠEJBY DYKE SWARM

Geological position: Moldanubian Zone. A member of the Homolka Group in the Weinsberg Composite Pluton. Several dykes cutting theWeinsberg Granite-Granodiorite.

Rock types:

Šejby Dyke-granite – aplitic to pegmatitic muscovite alkali-feldspar granite.

Size and shape (in erosion level): N-S and NE-SW trending dykes of several meters wide.

Age and isotopic data: One of the youngest members of MCB are subvolcanic high-level intrusions. *Šejby Dyke Granite* 308 ± 2 Ma.

Geological environment: paragneisses, and the Weinsberg Granite-Granodiorite.

Contact aureole: not reported.

Mineralization: greisenization and sub-economic dissemination of cassiterite, ferro-columbite, ferro-tantalite.

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Šejby Dyke Granite

Quartz normal, sodic, peraluminous, leucocratic, S-type granite

	SEG-5	**SEG-3**	**SEG-4**	**S2476**	**S2494**	**S2613**
SiO_2	72.98	73.24	71.12	73.38	73.89	73.42
TiO_2	0.01	0.03	0.03	0.03	0.02	0.04
Al_2O_3	15.09	14.70	15.89	14.31	15.05	15.52
Fe_2O_3	0.44	0.46	0.36	0.41	0.21	n.d.
FeO	0.05	0.40	0.31	n.d.	0.54	0.85
MnO	0.06	0.02	0.04	0.04	0.04	0.03
MgO	0.07	0.11	0.09	0.01	0.06	0.05
CaO	0.78	0.38	0.65	0.54	0.50	0.40
Na_2O	5.55	4.68	5.33	5.54	3.55	6.17
K_2O	3.00	3.97	4.15	2.39	3.89	1.99
P_2O_5	0.80	0.48	0.73	0.65	0.51	0.40
Mg/(Mg+Fe)	0.20	0.19	0.19	0.04	0.12	0.09
K/(K+Na)	0.26	0.36	0.34	0.22	0.42	0.18

Nor.Q	27.70	29.42	23.11	30.97	36.52	27.48
Nor.Or	17.84	23.87	24.68	14.44	23.69	11.86
Nor.Ab	50.15	42.76	48.17	50.88	32.86	55.87
Nor.An	-1.41	-1.30	-1.60	-1.64	-0.91	-0.66
Na+K	242.79	235.31	260.11	229.52	197.15	241.36
*Si	152.81	166.49	126.72	171.16	206.83	161.21
K-(Na+Ca)	-129.31	-73.51	-95.47	-137.66	-40.88	-163.98
Fe+Mg+Ti	8.07	14.44	11.44	5.76	11.89	13.58
Al-(Na+K+2Ca)	25.72	39.81	28.75	32.24	80.57	49.16
(Na+K)/Ca	17.46	34.73	22.44	23.84	22.11	33.84
A/CNK	1.18	1.21	1.17	1.20	1.45	1.24

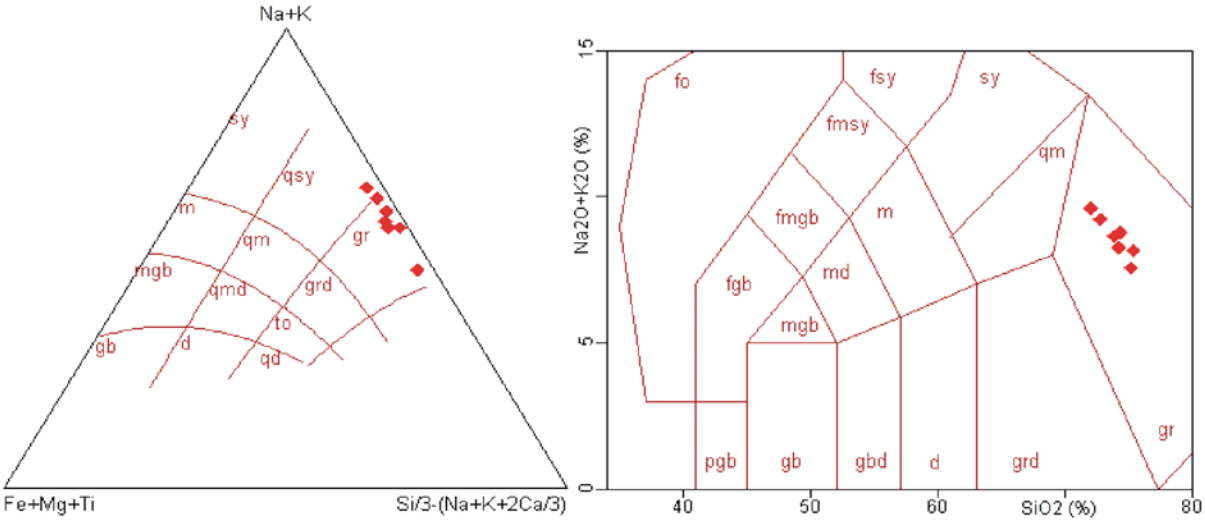

Fig. 2.90. *Šejby Dyke Granite ABQ and TAS diagrams.*

2.1.32.9. LITSCHAU DYKE SWARM (LDS)

Geological position: Moldanubian Zone. A member of the Eisgarn Composite Pluton. Several dykes and small stocks cutting the Eisgarn s.s. Granite, Lásenice Granite, Číměř Granite and paragneisses. One of the youngest members of MCB are subvolcanic high-level intrusions.

Rock types:

1. *Litschau Rhyolite* – felsitic dyke rhyolites, partly with fluidal fabric.
2. Granite porphyry.
3. *Josefsthal Dyke Granite* – fine-grained leucocratic muscovite granite.

Size and shape (in erosion level): a swarm of more than 30 dykes of rhyolites, granite porphyries and dyke granites forms a N-S trending zone, about 30 km long and 5 km wide, between Lásenice and Schrems. This zone is part of longer, but not continuous "zone of volcano-tectonic activity" extending to the north of Pelhřimov, the Homolka and Galthof Stocks. Individual dykes are 2–20 m thick and up to 1.5 km long.

Age and isotopic data: One of the youngest members of MCB are subvolcanic high-level intrusions. LDS is older than the Homolka Stock. *Josefsthal Dyke Granite* 314 ± 3.5 Ma (Rb-Sr).

Geological environment: the Číměř Granite, Eisgarn Granite, Lásenice Granite and gneisses.

Contact aureole: subvertical sharp contacts, without, or with only very weak alteration of the country rocks.

Zoning: the structure of some thicker dykes is zoned, the fluidal rhyolite at the contact passes gradually into granite porphyry in the centre (e.g. the Josefsthal Dyke).

Mineralization: traces of wolframite and cassiterite mineralization.

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High-potassic plutonites in the Moldanubicum

High-potassic (high K-Mg) plutonites (*Durbachites)* within the Moldanubian Zone are represented by the *Melagranite Group* comprising porphyritic amphibole-biotite melagranite, and the *Melasyenite Group* consisting of two-pyroxene melasyenite, quartz biotite-hornblende monzonite and melagranite. This rock group is highly typical for some parts of the hercynian orogenic belt of central to western Europe and ie associated with exhumed lower-crustal metamorphic rocks of the former orogenic root (Holub 2005). Durbachite suite of 342–332 Ma old rocks follows a curved line from Corsica – Massif Central – Vosges – Schwarzwald, to the Bohemian Massif. Typical durbachite in the Bohemian Massif is usually referred to as the Čertovo břemeno type. According to Bernard and Dudek (1967), Klomínský and Dudek (1978), Janoušek and Holub (2007) and Finger et al. (2007) two groups of durbachite massifs intruded into the Moldanubian Zone and granitoids of the Central Bohemian Pluton (Blatná a Červená granodiorites). Western group consists of the Milevsko, Tábor, Mehelník, Netolice, Želnava (Knížecí stolec) Massifs and numerous small bodies in the vicinity of Písek, Vodňany and Prachatice. These intrusive bodies are concentrated within a zone of NNE-SSW direction, which is about 130 km long and up to 25 km wide. The eastern group comprises the Rastenberg, Hengstberg Sheet, Jihlava and Třebíč Massifs with small satellite bodies in the vicinity of Nové Město na Moravě (Radoňovice and Nové Město stocks). Most of these plutons are formed by porphyritic amphibole-biotite melagranite and granodiorite. Only the Tábor and Jihlava Massifs consist of non-porphyritic two-pyroxene melasyenite, which represents independent intrusion. In the Bohemian Massif, also the Złoty Stok Massif and the Meissen Composite Massif in the Lugicum resemble the durbachites from the Moldanubian Zone. According to Finger et al. (2007) the so-called „Palites“ of the Bavarian Forest belong also to the Durbachite intrusions.

The durbachite suite has been produced by the progressive hybridization of ultrapotassic mantle magma and a felsic crustal melt (e.g. Holub et al. 1997). According to Finger et al. (2007) apart from their similar ages (335–338 Ma) the durbachite plutons are defined by a special geochemical signature, unique among the Variscan granitoids of the Bohemian Massif. This includes a strong (to extreme) enrichment of the LIL elements K, Th, U, Rb, Cs, Ba (often > 2000 ppm), Sr (often > 1000 ppm) in combination with relatively high content of MgO (mostly > 3 wt. %, Fe_2O_3 total / MgO mostly > 2), Cr (often > 100 ppm) and Ni (often > 10 ppm). The least folic types of the durbachite plutons (durbachites sensu stricto according to Janoušek and Holub 2007) have extremely K_2O-rich (ultrapotassic-syenitic) composition and intermediate Si_2O contents, while others are comparably less (but still strongly) K_2O enriched and shoshonitic-granodioritic (e. g., Rastenberg pluton). The causal link between HP-HT metamorphism and ultrapotassic magmatism in the collisional orogens on the example of the Moldanubian Zone has been described by Janoušek and Holub (2007).

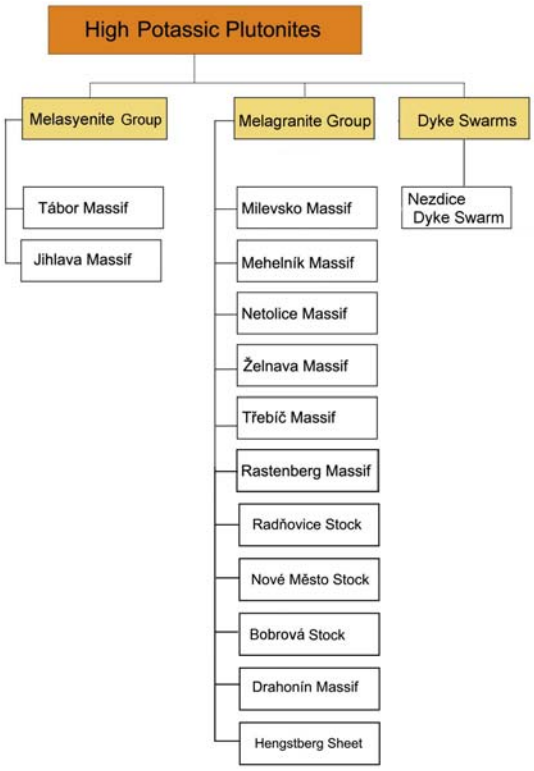

Fig. 2.91. *Ultrapotassic plutonites hierarchic scheme according to rock groups and rock types.*

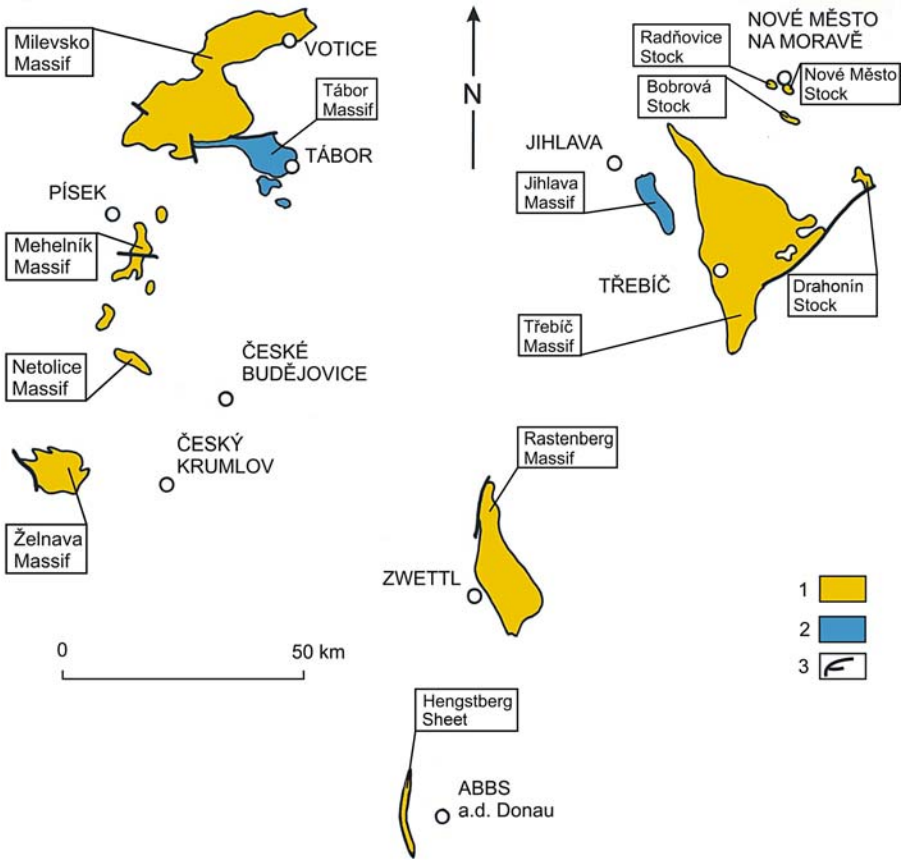

Fig. 2.92. *Ultrapotassic plutonites geological sketch-map (adapted after Fiala et al. 1983). 1 – porphyritic hornblende-biotite melagranite and granodiorite (Melagranite group), 2 – two-pyroxene melasyenite and melagranite (Melasyenite group), 3 – faults.*

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2.2.1. MILEVSKO MASSIF

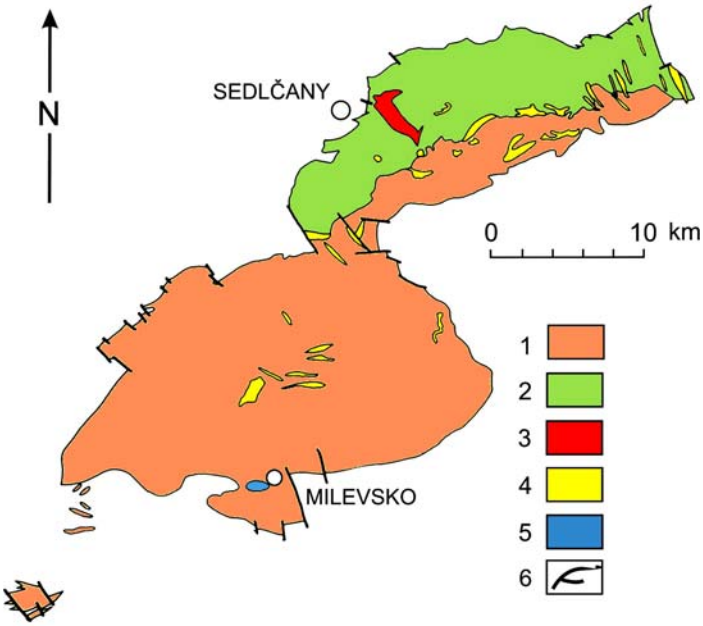

Fig. 2.93. *Milevsko Massif geological sketch-map (adapted after Fusán et al. 1967). 1 – Čertovo břemeno Melagranite, 2 – Sedlčany Granodiorite, 3 – Kosova Hora Granodiorite, 4 – Leucogranite, 5 – Milevsko Dyke Swarm, 6 – faults.*

Regional position: a member of the Durbachite Suite in the Moldanubian Zone (Drosendorf Unit) on the southern periphery of the Central Bohemian Pluton.

Rock types:

1. *Čertovo břemeno Melagranite* (220 km^2) – porphyritic biotite-amphibole melagranite (durbachite), granodiorite, quartz melagranite to mela-monzogranite and syenodiorite with dark- normal (syenitic) and light- leucocratic (granodioritic) facies.
2. *Sedlčany Granodiorite* (120 km^2) – porphyritic amphibole-biotite granite represents the most acidic variety of the Čertovo břemeno Melagranite.
3. *Kosova Hora Granodiorite* (5 km^2) – porphyritic biotite ± cordierite-muscovite granodiorite-monzogranite (a member of the Maršovice Suite of the Central Bohemian Pluton).
4. *Leucogranite* – leucocratic microgranite dykes and sills – Milevsko Dyke Swarm (LG – Leucogranite group of the Central Bohemian Pluton).

Size and shape (in erosion level): 340 km^2, subhorizontal, relatively thin tabular body with maximum thickness of about 2–3 km.

Age and isotopic data: 343–346 Ma (Pb-Pb zircon) 336 Ma (Ar-Ar biotite). Čertovo břemeno Melagranite is younger (according to the field evidence) than the Blatná and Červená Granodiorites. Tábor Syenite is younger than the Čertovo břemeno Melagranite.

Cooling age of the Čertovo břemeno Melagranite less than 300 °C is 336 Ma (Ar-Ar biotite).

Geological environment: granitoids of the Central Bohemian Pluton, Tábor Massif, Varied Group of the Moldanubian Zone.

Zoning: subhorizontal stratification – dark facies in hanging-wall of the light facies.

Mineralization: small U-mineralization occurrences in shear zones (e.g. Velká uranium deposit near Milevsko).

Heat production (μWm^{-3}): *Čertovo břemeno Melagranite* 5.6, *Sedlčany Granodiorite* 5.79.

Fig. 2.94. *Milevsko Massif hierarchic scheme according to rock groups and rock type.s*

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Čertovo břemeno Melagranite

Large variation in composition. Quartz deficient, potassic, metaluminous, melanocratic, I-type, I & M series, granodiorite to monzonite

n = 47	Med.	Min	Max	QU1	QU3
SiO_2	61.75	55.49	68.67	58.67	64.11
TiO_2	0.77	0.28	1.51	0.64	0.86
Al_2O_3	13.80	12.66	17.17	13.26	14.06
Fe_2O_3	1.04	0.00	3.30	0.87	1.30
FeO	3.68	0.49	6.51	3.00	4.28
MnO	0.08	0.05	0.54	0.07	0.10
MgO	4.34	2.43	7.76	3.89	5.91
CaO	2.97	1.26	4.73	2.68	3.48
Na_2O	2.32	1.60	4.45	2.14	2.60
K_2O	6.29	3.12	7.80	5.97	6.58
P_2O_5	0.66	0.09	5.57	0.51	0.80
Mg/(Mg + Fe)	0.64	0.49	0.82	0.61	0.66
K/(K + Na)	0.63	0.32	0.75	0.60	0.66
Nor.Or	41.07	20.66	52.16	38.74	43.90
Nor.Ab	23.19	16.52	44.78	21.67	25.83

Nor.An	11.38	-23.82	21.18	8.83	13.30
Nor.Q	10.20	0.00	25.43	5.71	14.96
Na + K	209.84	172.54	251.79	202.36	218.71
*Si	97.43	44.99	148.70	76.37	108.93
K-(Na + Ca)	2.42	-134.42	44.12	-9.32	13.57
Fe + Mg + Ti	175.74	115.16	290.16	154.41	232.27
Al-(Na + K + 2Ca)	-44.01	-118.10	15.30	-68.33	-28.49
(Na + K)/Ca	4.07	2.09	9.67	3.22	4.57
A/CNK	0.90	0.70	1.63	0.84	0.95

***Trace elements (ppm)*:** *Čertovo břemeno Melagranite* – **Ba** 1491, **Cs** 23.5, **Ga** 21, **Hf** 8.4, **Li** 35, **Nb** 25, **Pb** 49, **Rb** 314, **Sc** 13.1, **Sr** 376, **Th** 30.3, **U** 11.3, **Y** 17, **Zn** 70, **Zr** 320, **La** 41, **Ce** 91, **Sm** 10.7, **Eu** 1.85, **Yb** 1.37, **Lu** 0.27 (Breiter and Sokol 1997).

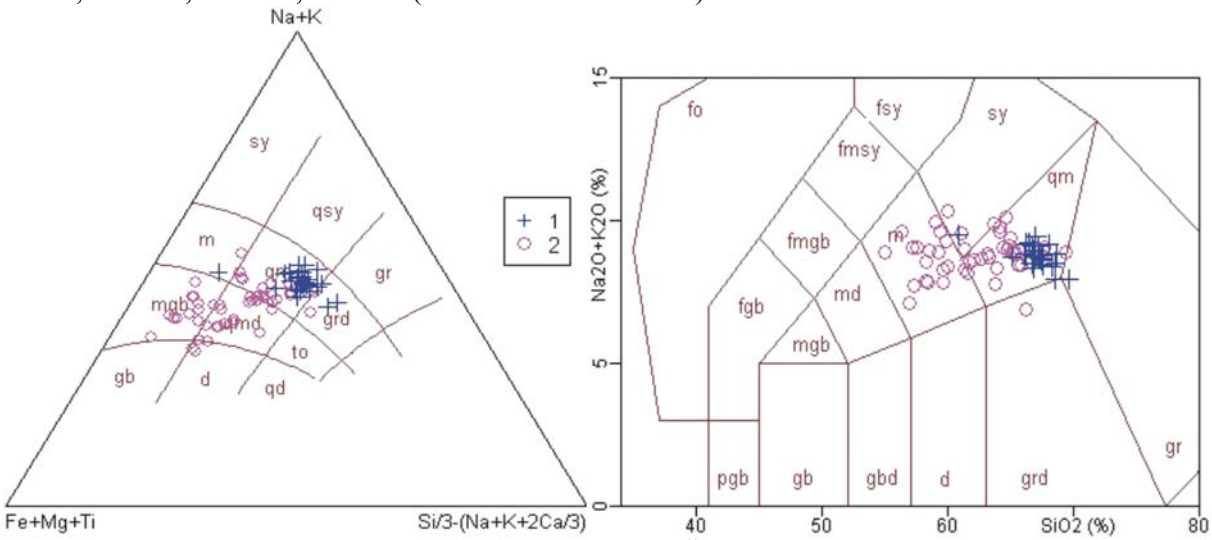

Fig. 2.95. *Milevsko Massif ABQ and TAS diagrams. 1 – Čertovo břemeno Melagranite, 2 – Sedlčany Granodiorite.*

Sedlčany Granodiorite

Quartz-normal, potassic, metaluminous, mesocratic, I-S-type, quartz monzonite to granodiorite

n = 13	**Med.**	**Min**	**Max**	**QU1**	**QU3**
SiO_2	66.54	63.80	67.94	65.76	66.83
TiO_2	0.48	0.05	0.83	0.45	0.53
Al_2O_3	14.57	13.25	15.20	14.35	14.69
Fe_2O_3	0.89	0.69	1.60	0.80	1.23
FeO	2.60	2.12	3.25	2.25	2.69
MnO	0.07	0.04	0.14	0.06	0.07
MgO	2.55	1.60	2.93	2.35	2.67
CaO	2.42	1.94	2.97	2.31	2.77
Na_2O	2.88	2.50	3.18	2.80	2.97
K_2O	5.76	5.38	6.25	5.50	5.87
P_2O_5	0.35	0.27	0.51	0.31	0.42
Mg/(Mg + Fe)	0.55	0.47	0.59	0.53	0.59
K/(K + Na)	0.57	0.53	0.62	0.55	0.58
Nor.Or	36.09	33.92	39.47	34.74	37.12
Nor.Ab	27.37	24.00	30.23	26.35	28.70
Nor.An	10.27	8.05	13.51	9.72	11.61
Nor.Q	18.00	14.32	21.05	17.20	18.50
Na + K	214.99	207.05	226.33	210.50	216.71

*Si	124.90	108.37	139.70	115.68	128.29
K-(Na + Ca)	-17.10	-29.42	14.76	-22.44	-12.98
Fe + Mg + Ti	121.25	94.09	141.40	103.88	126.42
Al-(Na + K + 2Ca)	-19.15	-63.18	11.15	-29.44	-7.96
(Na + K)/Ca	4.94	3.99	6.08	4.41	5.24
A/CNK	0.96	0.83	1.07	0.93	1.01

Trace elements (mean values in ppm)*: Sedlčany Granodiorite* – **B** 17, **Ba** 1460, **Be** 7, **Co** 5, **Cr** 80, **Cs** 50, **Cu** 8, **Ga** 19, **Li** 50, **Ni** 22, **Pb** 50, **Rb** 370, **Sn** 5, **Sr** 230, **V** 49, **Zn** 62, **Zr** 190 (Vejnar 1974).

2.2.2. TÁBOR MASSIF (TM)

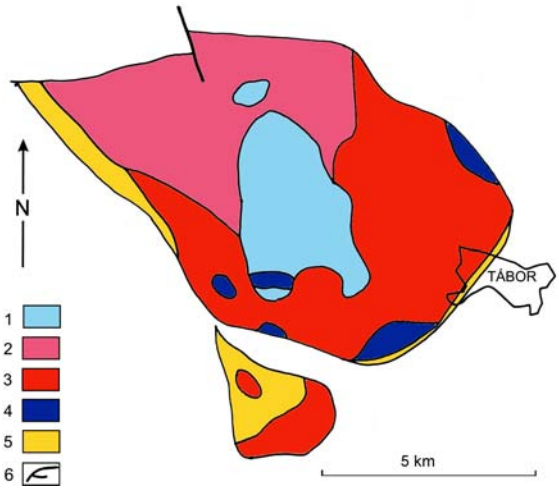

Fig. 2.96. *Tábor Massif geological sketch-map (adapted after Jakeš 1968). 1 – Dražice Quartz Syenite, 2 – Třemešná Melagranite, 3 – Klokoty Melagranite, 4 – Náchod-Košín Granite, 5 –Marginal Granite, 6 – faults.*

Regional position: a member of the Durbachite Suite in the Moldanubian Zone (Drosendorf Unit) on the southeastern periphery of the Central Bohemian Composite Batholith.

Rock types: *Tábor Syenite (*subtypes)*:*

1. *Dražice Quartz Syenite* – fine-grained biotite- two pyroxene melasyenite.
2. *Náchod-Košín Granite* – fine-grained pyroxene-biotite melagranite.
3. *Klokoty Melagranite* – fine-grained hornblende-pyroxene-biotite melagranite
4. *Třemešná Melagranite* – medium-grained hornblende-pyroxene-biotite melasyenite to melagranite.
5. *Marginal Granite* (a facies of the Třemešná Melagranite) – rich in biotite with plan-parallel structure.

Size and shape: 60 km^2, oval ethmolith and two satellite bodies: Malšice body – 10 km^2 and Maršov body – 3 km^2.

Age and isotopic data: 343 Ma (K-Ar), 336.6 ± 1.0 Ma (U-Pb zircon), 336.3 ± 0.8 Ma (U-Pb rutile). Dražice Syenite is younger than the Čertovo břemeno Melagranite.

Contact aureole: intrusive, steeply discordant contact against high-grade metamorphic rocks and tectonic contact with the Milevsko Massif.

Geological environment: migmatites and paragneisses of the Varied and Monotonous Groups of the Moldanubian Zone, Čertovo břemeno Melagranite and Dehetník Granodiorite.

Zoning: concentric reverse zonation (pyroxene > biotite in the centre and biotite > pyroxene at the margin).

Mineralization: unknown.

Heat production (μWm^{-3}): *Dražice Quartz Syenite* 1,59, *Klokoty Granite* 3.07.

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Tábor Syenite

Quartz-deficient, potassic, metaluminous, melanocratic, syenite, monzonite to monzogabbro

n = 43	Med.	Min	Max	QU1	QU3
SiO_2	58.38	53.00	61.35	56.86	59.14
TiO_2	0.87	0.58	1.60	0.82	0.99
Al_2O_3	13.29	11.50	16.79	12.79	13.75
Fe_2O_3	1.17	0.00	2.75	0.72	1.85
FeO	4.68	3.74	7.46	4.49	5.16
MnO	0.10	0.03	0.21	0.05	0.14
MgO	6.12	3.65	9.46	5.37	7.22
CaO	4.24	2.73	6.07	3.90	4.60
Na_2O	2.44	1.56	3.57	2.06	2.89
K_2O	6.32	3.86	7.43	5.95	6.60
P_2O_5	0.67	0.00	1.84	0.25	0.93
Mg/(Mg + Fe)	0.66	0.49	0.70	0.60	0.68
K/(K + Na)	0.62	0.47	0.72	0.58	0.67
Nor.Or	43.02	25.53	48.22	39.36	44.62
Nor.Ab	24.38	16.52	37.45	21.46	29.05
Nor.An	13.66	1.56	29.89	9.84	16.75
Nor.Q	1.66	0.00	10.89	0.00	4.22
Na + K	207.46	175.22	251.81	198.09	225.90
*Si	56.99	23.78	96.13	41.81	71.58
K-(Na + Ca)	-23.99	-107.24	28.84	-43.97	-2.68
Fe + Mg + Ti	242.25	192.60	364.31	223.34	273.34
Al-(Na + K + 2Ca)	-108.78	-178.25	-24.88	-119.26	-84.27
(Na + K)/Ca	2.87	1.82	4.19	2.34	3.16
A/CNK	0.74	0.58	0.97	0.69	0.81

Trace elements (mean values in ppm): *Tábor Syenite* – **B** 6, **Ba** 6400, **Be** 5, **Co** 8, **Cr** 280, **Cs** 40, **Cu** 8, **Ga** 11, **Li** 62, **Ni** 130, **Pb** 47, **Rb** 350, **Sn** 1, **Sr** 430, **V** 120, **Zn** 80, **Zr** 290 (Vejnar 1974).

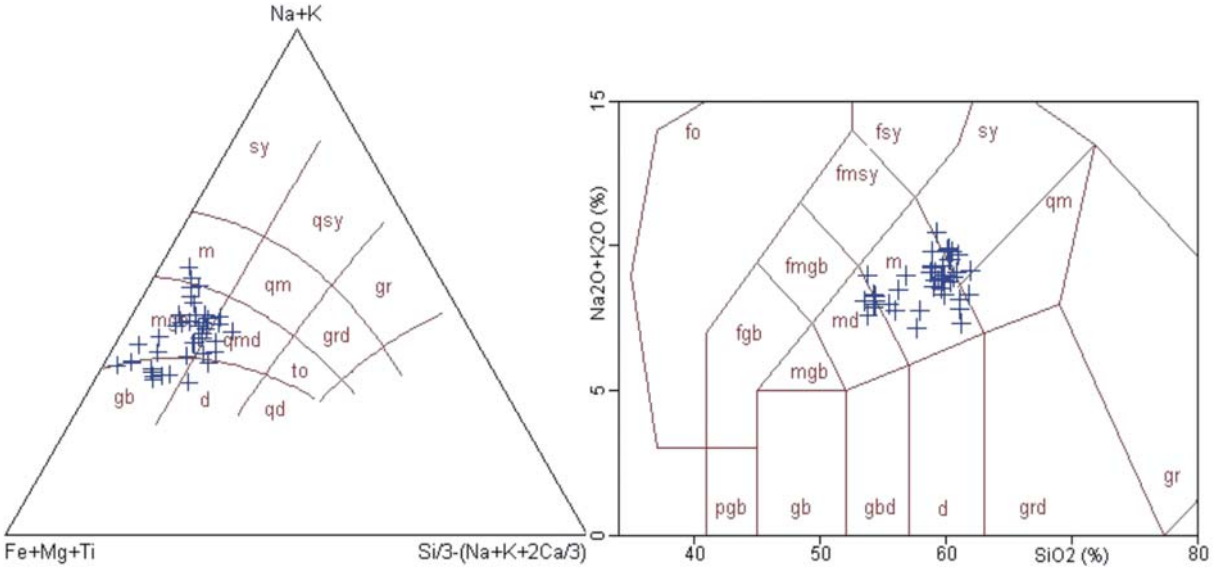

Fig. 2.97. *Tábor Massif ABQ and TAS diagrams. 1 – Tábor Syenite.*

2.2.3. MEHELNÍK MASSIF (MM)

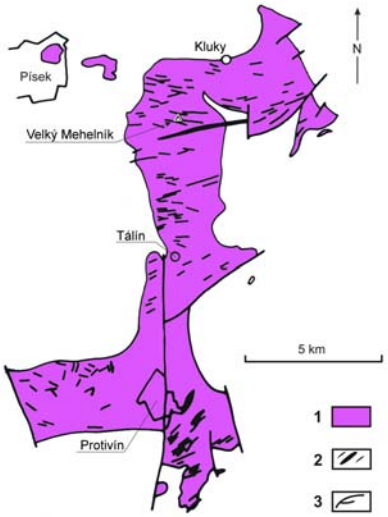

Fig. 2.98. *Mehelník Massif geological sketch-map (adapted after the geological map 1 : 50,000 CGS 1991). 1 – Mehelník Melagranite, 2 – leucogranite dykes, 3 – faults.*

Regional position: MM belongs to intrusive suite of Variscan ultrapotassic magmatic rocks (referred as the Durbachite Suite). DM intruded western segment of the Gföhl Unit in the Moldanubian Zone.

Rock types: *Mehelník Melagranite* – porphyritic amphibole-biotite melagranite to melasyenite.

Size and shape (in erosion level): ~ 70 km²; sheet-like tectonically segmented intrusive body with steep and partly discordant contacts in relation to the regional metamorphic fabric.

Age and isotopic data: Variscan age is expected. No isotopic data. Similar in age to the *Čertovo břemeno Melagranite* – 343–346 Ma (Pb-Pb zircon) 336 Ma (Ar-Ar biotite).

Contact aureole: not defined.

Geological environment: felsic granulites and high-grade migmatitic paragneisses of the Gföhl Unit.

Zoning: not defined.

Mineralization: unknown.

Heat production: no data.

References

FINGER, F. – GERDES, A. – JANOUŠEK, V. – RENÉ, M. – RIEGLER, G. (2007): Resolving the Variscan evolution of the Moldanubian sector of the Bohemian Massif: the significance of the Bavarian and Moravo-Moldanubian tectonometamorphic phases. – J. Geosci. 52, 9–28.

HEJTMAN, B. (1949): The syenitic rocks of the vicinity of Vodňany and Protivín. – Věst. St. geol. Úst. Čs. Republ. 24, 232–248. (In Czech)

2.2.4. NETOLICE MASSIF (NM)

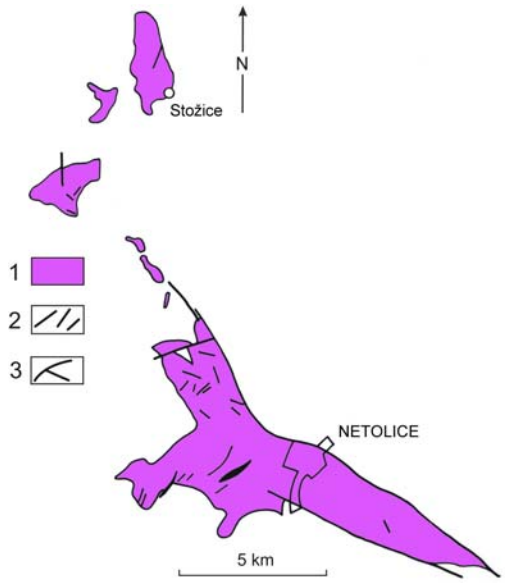

Fig. 2.99. *Netolice Massif geological sketch-map (adapted after Geological map 1 : 50,000 CGS 1998). 1 – Netolice Melagranite, 2 – leucogranite dykes, 3 – faults.*

Regional position: NM belongs to intrusive suite of Variscan ultrapotassic magmatic rocks (referred as the Durbachite Suite). NM intruded western segment of the Gföhl Unit in the Moldanubian Zone.

Rock types: *Netolice Melagranite* – porphyritic amphibole-biotite melagranite to melasyenite.

Size and shape (in erosion level): ~ 30 km²; several outcrops of the sheet-like intrusive body with steep (tectonically outlined) and partly discordant contacts in relation to the regional metamorphic fabric.

Age and isotopic data: Variscan age is expected. No isotopic data. Similar in age to the *Čertovo břemeno Melagranite* – 343–346 Ma (Pb-Pb zircon) 336 Ma (Ar-Ar biotite).

Contact aureole: not defined.

Geological environment: felsic granulites and high-grade migmatitic paragneisses of the Gföhl Unit.

Zoning: not defined.

Mineralization: unknown.

Heat production: no data.

References

FINGER, F. – GERDES, A. – JANOUŠEK, V. – RENÉ, M. – RIEGLER, G. (2007): Resolving the Variscan evolution of the Moldanubian sector of the Bohemian Massif: the significance of the Bavarian and Moravo-Moldanubian tectonometamorphic phases. – J. Geosci. 52, 9–28.

HEJTMAN, B. (1949): The syenitic rocks of the vicinity of Vodňany and Protivín. – Věst. St. geol. Úst. Čs. Republ. 24, 232–248. (In Czech)

2.2.5. TŘEBÍČ MASSIF (TM)

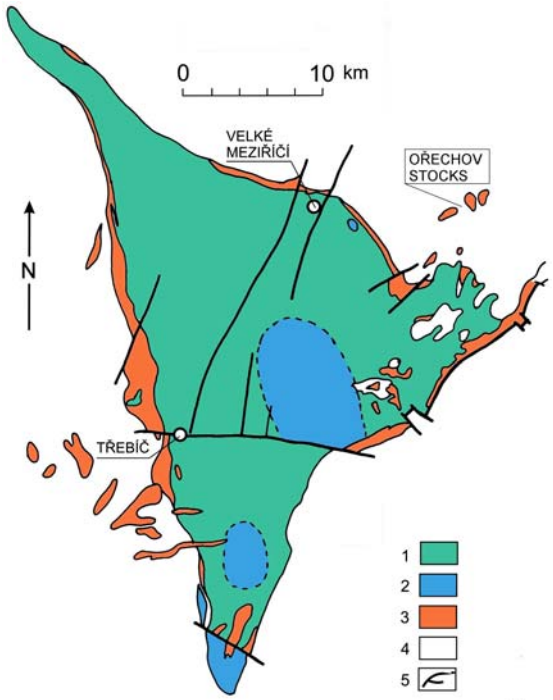

Fig. 2.100. *Třebíč Massif geological sketch-map (adapted after Bubeníček 1968). 1 – Třebíč 1 Melagranite, 2 – Třebíč 2 Melagranite, 3 – Leucogranite (Rand Aplite), 4 – Tourmaline Granite, 5 – faults.*

Regional position: a member of the Melagranite Suite in the Moldanubian Zone (Drosendorf Unit). TM was intruded at the boundary between the Gföhl Unit and the Drosendorf Unit.

Rock types:

1. *Třebíč 1 Melagranite* – porphyritic hornblende – biotite melagranite (fine-grained marginal facies).
2. *Třebíč 2 Melagranite* – biotite melagranite.
3. *Amphibole syenite* – a small stock.
4. *Tourmaline Granite.*
5. *Leucogranite* – two-mica leucogranite.
6. *Aplite and pegmatite dyke swarm* (small bodies), and marginal (rand) aplite.
7. *Alkali-feldspar Syenite* of nordmarkite type (a stock at the exocontact of the Třebíč Massif – not shown in the map).

Size and shape (in erosion level): 600 km^2, triangular sheet-like shape ethmolith, segmented by faults. Several windows of underlying metamorphic rocks of Drosendorf (Varied) and Gföhl Units within the Třebíč Massif. Very expressive planar flow structure of potassium-feldspars, marginal aplite – almost continuous aplite some tens meters to one km in width. Several small satellite bodies of similar plutonic rocks crop out North of the TM (the Ořechov Stocks).

Age and isotopic data: porphyritic hornblende-biotite melagranite 340 ± 8 Ma (U-Pb zircon), 338 and 332 Ma (U-Pb zircon), *pegmatite* 336 Ma (U-Pb monazite).

Contact aureole: not well defined.

Geological environment: high-grade migmatitic paragneisses of the Moldanubian (Drosendorf Unit).

Zoning: concentric normal (subhorizontal stratification) zonation (acidity of rocks is decreasinig from the centre to the margin).

Mineralization: spatially related rare-element pegmatites, Pb-Zn-Ag-Cu, F, W, U, Th.

Heat production (μWm^{-3}): *Třebíč Melagranite* 5.8–3.2.

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Třebíč Melagranite (durbachite)

Quartz-deficient, potassic, metaluminous, melanocratic, quartz monzonite, diorite to granodiorite (shoshonitic affinities)

n = 19	Median	Min	Max	QU1	QU3
SiO_2	59.40	53.64	69.96	57.35	64.09
TiO_2	0.92	0.00	1.41	0.65	1.04
Al_2O_3	13.98	12.20	16.70	12.81	15.51
Fe_2O_3	1.10	0.10	2.96	0.90	1.23

FeO	4.32	1.31	5.36	2.30	4.55
MnO	0.08	0.02	0.18	0.06	0.09
MgO	5.94	0.68	7.55	2.03	6.13
CaO	3.41	1.69	5.19	2.70	3.73
Na_2O	2.32	1.56	3.97	2.06	2.90
K_2O	6.20	4.55	7.42	5.46	6.81
P_2O_5	0.59	0.24	1.07	0.40	0.76
Mg/(Mg + Fe)	0.65	0.36	0.71	0.55	0.66
K/(K + Na)	0.64	0.44	0.75	0.54	0.66
Nor.Or	42.06	28.11	50.30	33.81	44.25
Nor.Ab	22.79	15.95	36.51	21.56	29.10
Nor.An	13.29	1.95	22.82	9.70	14.59
Nor.Q	7.07	0.00	23.46	1.63	11.51
Na + K	210.33	167.05	244.76	198.16	225.02
*Si	80.41	37.64	143.63	52.83	90.99
K-(Na + Ca)	-6.71	-79.24	49.71	-47.59	2.70
Fe + Mg + Ti	235.90	53.66	301.24	100.16	246.50
Al-(Na + K + 2Ca)	-58.44	%-149.71	31.41	-88.42	-17.69
(Na + K)/Ca	3.57	2.00	7.65	2.96	4.23
A/CNK	0.84	0.64	1.15	0.79	0.96

Trace elements (mean values in ppm): *Třebíč Melagranite* – **B** 350, **Be** 120, **Co** 86, **Cu** 396, **Pb** 730, **U** 60, Zr 2120 (Bubeníček 1987), **Ba** 1310–2000, **Co** 22-30, **Cr** 198–349, **Nb** 37–71, **Ni** 63–97, **Sr** 348–461, **V** 59–96, **Zr** 359–476, **Th** 13–17, **U** 6.3 (Zachovalová 1999),**Th** 36, **U** 10.7 (Sulovský 2000).
Rand Aplite – **B** 699, **Be** 75, **Cu** 98, **Pb** 256, **U** 29, **Zr** 457 (Bubeníček 1987).
Aplite – **B** 4166, **Be** 225, **Cu** 226, **Pb** 677, **U** 31, **Zr** 797 (Bubeníček 1987), **Th** 12.8, **U** 5.2 (Sulovský 2000), **U** 14, **Th** 42 (Zachovalová et al. 1999).

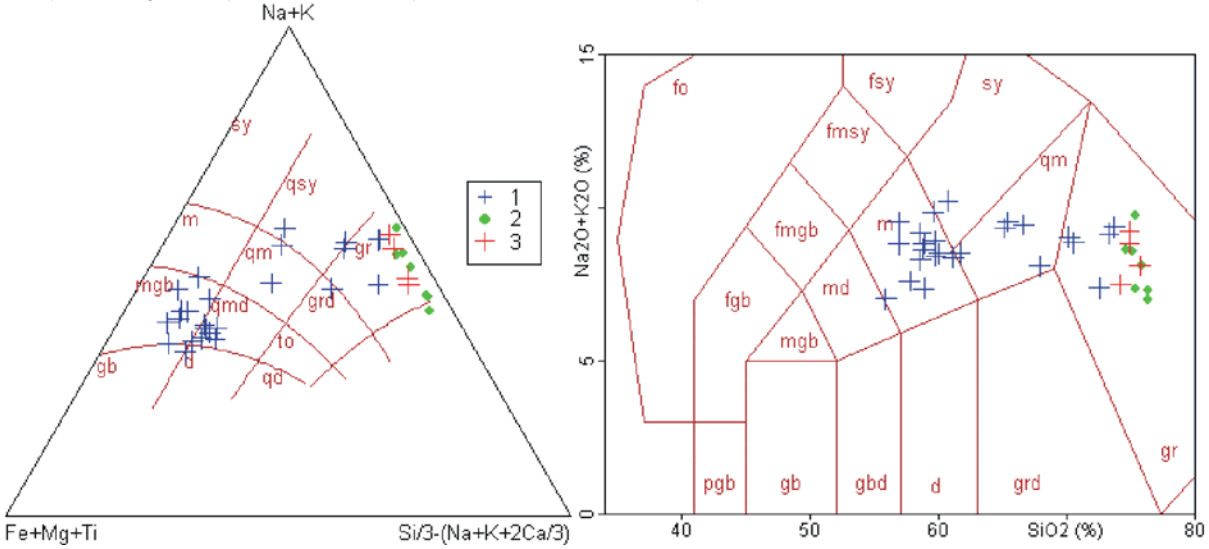

Fig. 2. 101. *Třebíč Massif ABQ and TAS diagrams. 1 – Třebíč Melagranite, 2 – Třebíč muscovite aplite, 3 – Ořechov Granite.*

2.2.5.01. OŘECHOV STOCKS

Regional position: within biotite orthogneisses of the Strážec Unit of the Moldanubian Zone (eastern part) (Drosendorf Unit). Ořechov Stocks are equivalwnts of the leucogranite from the Třebíč Massif.

Rock types: *Ořechov Granite* – two-mica tourmaline-bearing leucogranite (similar to the tourmaline granite and two-mica leucogranite from the Třebíč Massif).

Size and shape (in erosion level): eight small granite stocks up to 1.5 km in diameter,

circular and/or oval shape, located along the NE-SW fault in the NE extension of the Třebíč Massif.

Age and isotopic data: Variscan age is expected. No isotopic data.

Contact aureole: not defined.

Geological environment: high-grade migmatitic paragneisses of the Moldanubian (Drosendorf Unit).

Zoning: not defined.

Mineralization: uranium spatially related to the Rožná-Olší uranium deposit.

Heat production (μWm^{-3}): Ořechov Granite 2.83.

Ořechov Granite

Quartz rich, sodic, peraluminous, leucocratic, S-type granite

	1321ORE	**re906**	**re907**	**re908**
SiO_2	73.36	73.73	74.65	73.81
TiO_2	0.15	0.08	0.09	0.08
Al_2O_3	15.56	14.09	14.01	14.25
Fe_2O_3	0.40	0.26	0.14	0.15
FeO	0.72	0.39	0.60	0.55
MnO	0.01	0.02	0.02	0.02
MgO	0.16	0.16	0.32	0.25
CaO	0.98	0.54	0.69	0.65
Na_2O	3.60	4.23	3.36	3.98
K_2O	3.82	4.86	4.65	4.75
P_2O_5	0.14	0.12	0.11	0.10
Mg/(Mg + Fe)	0.21	0.31	0.43	0.39
K/(K + Na)	0.41	0.43	0.48	0.44
Nor.Or	23.11	29.29	28.31	28.73
Nor.Ab	33.11	38.74	31.10	36.58
Nor.An	4.03	1.93	2.78	2.63
Nor.Q	33.69	27.67	33.67	29.05
Na + K	197.28	239.69	207.16	229.29
*Si	198.06	162.93	198.78	172.47
K-(Na + Ca)	-52.54	-42.94	-22.00	-39.17
Fe + Mg + Ti	20.89	13.66	19.18	16.74
Al-(Na + K + 2Ca)	73.34	17.75	43.36	27.37
(Na + K)/Ca	11.29	24.89	16.84	19.78
A/CNK	1.33	1.08	1.20	1.12

Trace elements (mean values in ppm): **Ba** 490, **Sr** 123, **Rb** 267, **Zr** 54, **U** 6.5, **Th** 11, **La** 16.6, **Ce** 32.8, **Pr** 3.62, Nd 12.8, **Sm** 2.83, **Eu** 0.505, **Gd** 2.14, **Tb** 0.38, Dy 1.99, **Ho** 0.36, **Er** 1.01, **Tm** 0.156, **Yb** 0.93, **Lu** 0.123.

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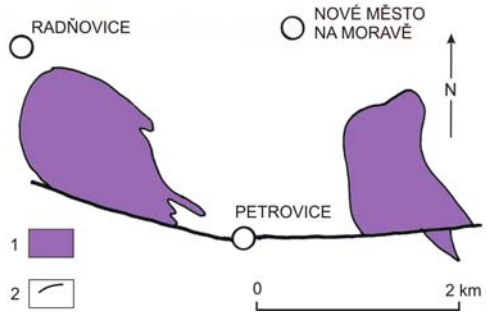

Fig. 2.102. *Radňovice and Nové Město Stocks geological sketch-map (adapted after Dosbaba and Sulovský 2006). 1 – Radňovice and Nové Město Melagranite, 2 – faults.*

2.2.6. RADŇOVICE STOCK

Regional position: Moldanubian Zone (Gföhl Unit).

Rock types: *Radňovice Melagranite* – strongly deformed porphyritic biotite-hornblende melagranite to quartz monzonite.

Size and shape (in erosion level): NW-SE trending oval shape intrusion in the diameter of 1 km (over 1 km^2). Intrusive contact plane dipping 30° to NW.

Age and isotopic data: Variscan age is expected. No isotopic data.

Contact aureole: not defined.

Geological environment: migmatitic gneisses and migmatites.

Zoning: not defined.

Mineralization: uranium related to the tectonic contact.

Heat production: No data.

Radňovice and Nové Město Stocks

Radňovice Melagranite: Quartz-normal, potassic, metaluminous, melanocratic, I-type, melagranite

Nové Město Melagranite: Quartz-normal, potassic, metaluminous, melanocratic, I-type, melagranite

Hengstberg Melagranite: Quartz-normal, sodic/potassic, metaluminous, mesocratic, I-type, melagranite

	2Radnov	10Radno	4NoveMe	9NoveMe	44HengstB
SiO_2	65.24	64.60	65.36	65.38	59.92
TiO_2	0.87	0.86	0.76	0.76	0.82
Al_2O_3	12.94	12.98	13.05	13.06	16.29
Fe_2O_3	0.17	0.40	0.56	0.50	5.17
FeO	3.48	3.58	3.16	3.01	n.d.
MnO	0.07	0.07	0.06	0.06	0.08
MgO	4.48	4.82	4.44	3.87	3.00
CaO	3.08	3.03	2.86	3.34	3.96
Na_2O	2.37	2.25	2.43	2.29	3.18
K_2O	5.20	5.79	5.39	5.14	4.77
P_2O_5	0.79	0.64	0.66	0.70	0.43
Mg/(Mg + Fe)	0.68	0.68	0.68	0.66	0.53
K/(K + Na)	0.59	0.63	0.59	0.60	0.50
Nor.Or	34.12	38.00	35.17	33.57	30.42
Nor.Ab	23.64	22.44	24.10	22.73	30.82
Nor.An	11.19	12.01	10.87	13.22	18.15
Nor.Q	18.80	15.68	18.23	20.11	11.43
Na + K	186.89	195.54	192.86	183.03	203.90
*Si	138.44	126.82	135.75	139.98	81.45
K-(Na + Ca)	-20.99	-3.70	-14.97	-24.32	-71.95
Fe + Mg + Ti	172.65	185.23	170.71	153.73	149.49

Al-(Na + K + 2Ca)	-42.62	-48.70	-38.58	-45.68	-25.22
(Na + K)/Ca	3.40	3.62	3.78	3.07	2.89
A/CNK	0.91	0.88	0.92	0.90	0.95

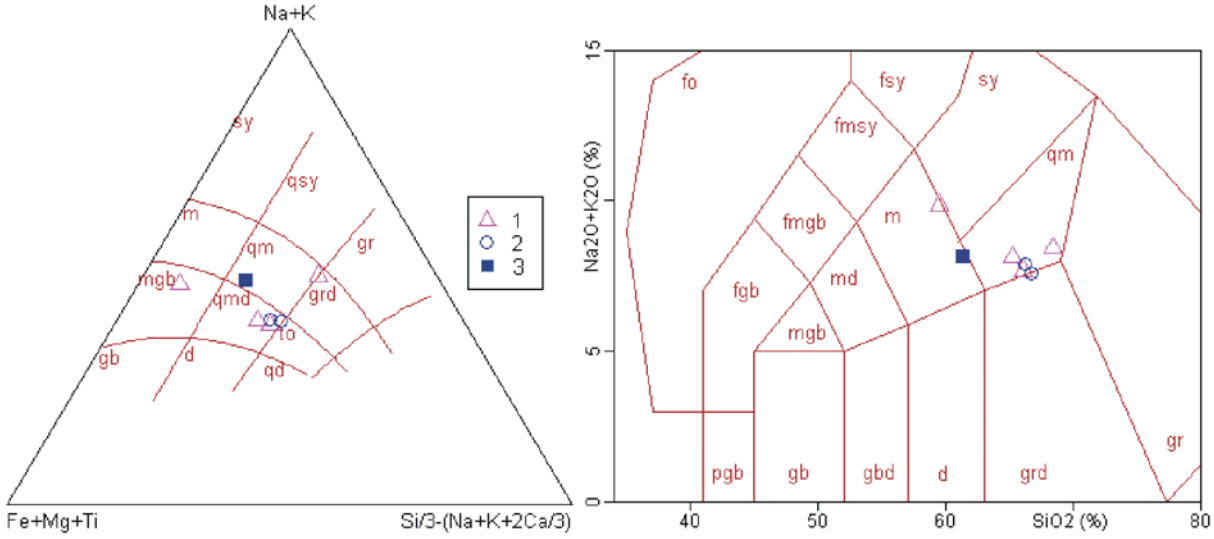

Fig. 2.103. *Radňovice and Nové Město Stocks ABQ and TAS diagrams. 1 – Radňovice Melagranite, 2 – Nové Město Melagranite, 3 – Hengstberg Melagranite.*

Trace elements (mean values in ppm): *Radňovice and Nové Město Stocks* – **Ba** 1288, **Co** 16.9, **Cr** 376, **Ni** 62, **Rb** 392, **Sr** 328, **U** 25, **Nb** 25, **Y** 23, **Zr** 339, **Cs** 43, **Th** 49, **Ta** 2.2, **Hf** 10.3, **Tl** 2.3

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2.2.7. NOVÉ MĚSTO STOCK

Regional position: Moldanubian Zone (Gföhl Unit).

Rock types: *Nové Město Melagranite* – strongly deformed porphyritic biotite-hornblende melagranite to quartz monzonite.

Size and shape (in erosion level): N-S trending oval shape intrusion in the diameter of 1 km (over 1 km^2).

Age and isotopic data: Variscan age is expected. No isotopic data.

Contact aureole: not defined.

Geological environment: migmatitic gneisses and migmatites.

Zoning: not defined.

Mineralization: uranium spatially related the tectonic contact.

Heat production (μWm^{-3}): no data.

References

DOSBABA, M. – SULOVSKÝ, P. (2006): Geologická posice, petrologie a geochemie hornin durbachitové série v okolí Nového Města na Moravě. – Acta Mus. Morav., Sci. Geol. 91, 177–190.

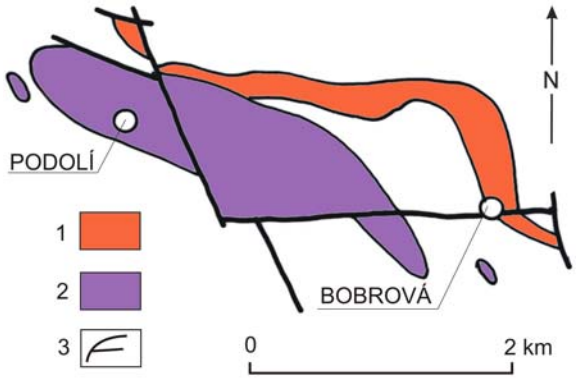

Fig. 2.104. *Bobrová Stock geological sketch-map. 1 – Bobrová Granite, 2 – Bobrová Melagranite, 3 – faults.*

2.2.8. BOBROVÁ STOCK (BS)

Regional position: MS belongs to intrusive suite of Variscan ultrapotassic magmatic rocks (referred as durbachite). Moldanubian Zone (Gföhl Unit).

Rock types:

Bobrová Granite – medium grained muscovite-biotite granite

Bobrová Melagranite – strongly deformed porphyritic biotite-hornblende melagranite to quartz monzonite.

Size and shape (in erosion level): NW-E trending long oval shape intrusion 2 × 0.6 km (over 1 km^2).

Age and isotopic data: Variscan age is expected. No isotopic data.

Contact aureole: not defined.

Geological environment: biotite and biotite-sillimanite paragneisses with cordierite.

Zoning: not defined.

Mineralization: unknown.

Heat production (μWm^{-3}): no data.

2.2.9. DRAHONÍN MASSIF (DM)

Regional position: DM belongs to intrusive suite of Variscan ultrapotassic magmatic rocks (referred as durbachite). DM intruded NE flank of the Moldanubian Zone (Gföhl Unit).

Rock types: *Drahonín Melagranite* – porphyritic amphibole-biotite melagranite to melasyenite.

Size and shape (in erosion level): ~ 80 km², sheet-like intrusive body with steep and partly discordant contacts in relation to the regional metamorphic fabric.

Age and isotopic data: 339 ± 2Ma (U-Pb zircon); 323.5 ± 1.1Ma (Pb-Pb zircon).

Contact aureole: not defined.

Geological environment: felsic granulites and high-grade migmatitic paragneisses of the Gföhl Unit.

Zoning: not defined.

Mineralization: unknown.

Heat production: no data.

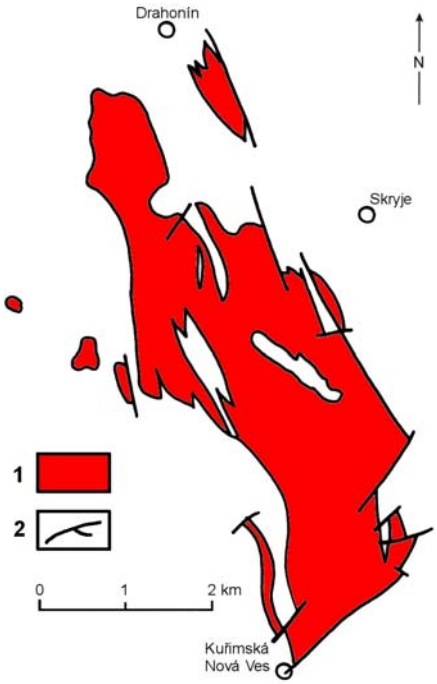

Fig. 2.105. *Drahonín Massif geological sketch-map. 1 – Drahonín Melagranite, 2 – faults.*

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VERNER, K. – BURIÁNEK, D. – SOEJONO, I. – VONDROVIC, L. – ZAVŘELOVÁ, A. – MELICHAR, R. (2007): The record of the structural evolution of NE part of the Moldanubian Zone, Svratka and Polička Crystalline Complex. In: Breiter, K. Ed.: Sbor. abstraktů sjezdu Čes. geol. společ., Volary 2007, 115–116. – Czech Geol. Soc. Prague. (In Czech).

2.2.10. JIHLAVA MASSIF (JM)

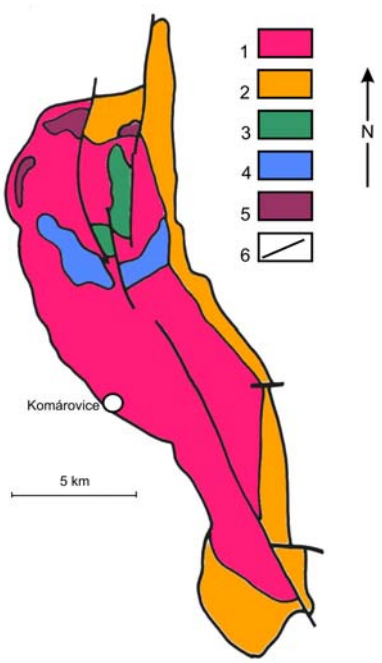

Fig. 2.106. *Jihlava Massif geological sketch-map (adapted after Verner et al. 2006). 1 – Jihlava Melasyenite, 2 – Jihlava Melagranite, 3 – coarse-grained quartz syenite, 4 – porphyritic quartz syenite, 5 – migmatite (relict of the country rock), 6 – faults.*

Regional position: a member of the high-K plutonites (Metasyenite Suite) in the Moldanubian Zone.

Rock types:

1. *Jihlava Syenite* (in the centre) – medium-grained biotite – pyroxene quartz melasyenite to melagranite, quartz monzonite – biotite-pyroxene-hornblende quartz monzonite (light and dark variety) to ± porphyritic pyroxene monzonite (amount of quartz is highly variable).
2. *Jihlava Melagranite* (at margins) – medium grained amphibole-biotite quartz syenite to melagranite.
3. Porphyritic quartz syenite.
4. Coarse-grained quartz syenite.
5. Gabbro to monzodiorite (enclaves) – e.g. 2 km long body in the northern part of the massif.

Shape and size: 46 km^2 (15 × 3 km), elliptical moderately elongated, sigmoidal shape with steep (70°) and sharp contacts, mostly parallel to the foliation pattern of the host-rock foliations. Steep S- to SE-dipping magmatic foliation is defined by orientation of feldspars and biotite. Deeper level of the massif crops out in its southern parts.

Age and isotopic data: 330 (K-Ar biotite), 325 and 337 Ma (Rb-Sr whole rock), 335.2 ± 0.54 Ma (U-Pb zircon).

Geological environment: high-grade migmatitic cordierite-bearing paragneisses of the Monotonous Group of the Drosendorf Unit.

Contact aureole: contact aureole is rather narrow. Zone of migmatization in the western exocontact is more intense than in the eastern side of the massif.

The western contact is sheeted, i.e. consists of multiple monzonitic and more leucocratic sheets up to several meters thick alternating with host-rock rafts or stopped blocks. In contrast the eastern margin, there is no evidence for either sheeting or sharp discordant contact.

Zoning: JM is divided into the western and eastern part by a zone of enclaves of the country rocks. Inverse asymmetric concentric zonation (decreasing colour index from southwest to northeast). More mafic ± porphyritic pyroxene monzonite in the core and pyroxene-hornblende quartz monzonite in the eastern endocontact of the massif.

Mineralization: pegmatites at the eastern endocontact.

Heat production (μWm^{-3}): *Jihlava Melasyenite* 4.01.

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Jihlava Syenite

Quartz-deficient, sodic/potassic, metaluminous, melanocratic, monzonite to monzogabbro

	1156J	**1157J**	**1158J**	**1159J**	**1160J**
SiO_2	58.56	58.97	58.25	59.82	57.00
TiO_2	0.90	0.33	0.77	0.81	0.05
Al_2O_3	14.25	14.07	12.78	13.17	14.33
Fe_2O_3	1.73	2.65	1.43	3.39	0.74
FeO	4.37	5.31	5.70	2.98	5.25
MnO	0.08	0.67	n.d.	n.d.	0.11
MgO	5.08	5.43	5.72	5.80	5.81
CaO	3.79	4.58	4.56	3.90	4.72
Na_2O	2.69	3.81	4.32	2.22	2.45
K_2O	5.75	4.46	5.52	5.39	5.76
P_2O_5	0.78	0.12	0.42	0.77	0.88
Mg/(Mg + Fe)	0.60	0.54	0.59	0.63	0.63
K/(K + Na)	0.58	0.44	0.46	0.62	0.61
Nor.Or	38.22	28.47	38.57	35.78	39.61
Nor.Ab	27.18	36.97	44.02	22.40	25.60
Nor.An	15.37	17.64	0.00	16.04	20.50
Nor.Q	5.25	1.38	0.00	11.93	0.29
Na + K	208.89	217.64	256.61	186.08	201.36
*Si	70.93	55.06	12.34	99.43	58.75
K-(Na + Ca)	-32.30	-109.92	-103.52	-26.74	-40.93
Fe + Mg + Ti	219.85	246.01	248.87	238.03	227.17
Al-(Na + K + 2Ca)	-64.22	-104.68	-168.26	-66.54	-88.28
(Na + K)/Ca	3.09	2.66	3.16	2.68	2.39
A/CNK	0.86	0.73	0.61	0.84	0.81

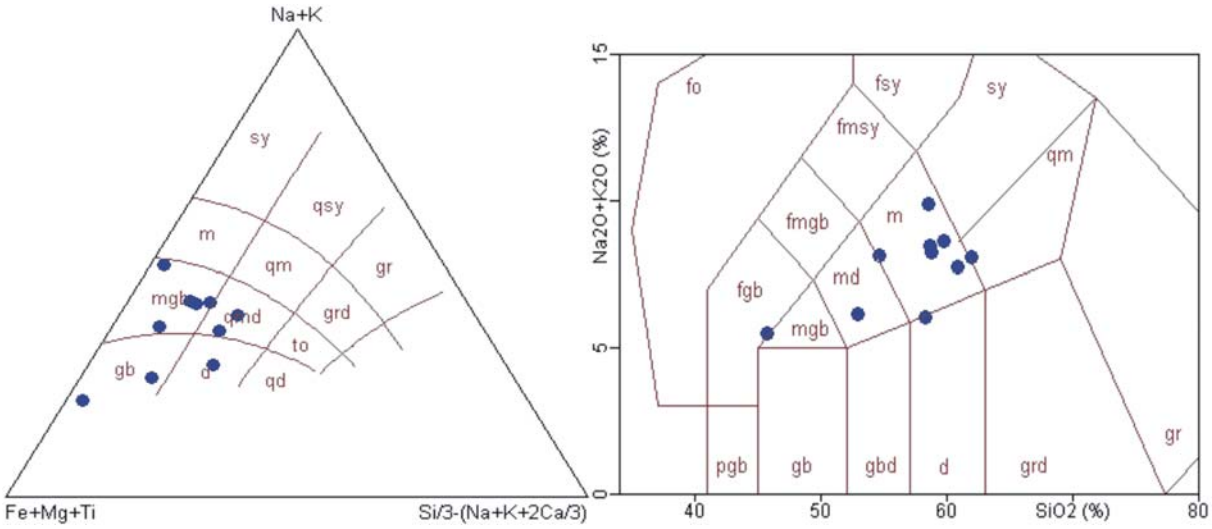

Fig. 2.107. *Jihlava Massif ABQ and TAS diagrams. 1 – Jihlava Melasyenite.*

2.2.11. RASTENBERG MASSIF (RM)

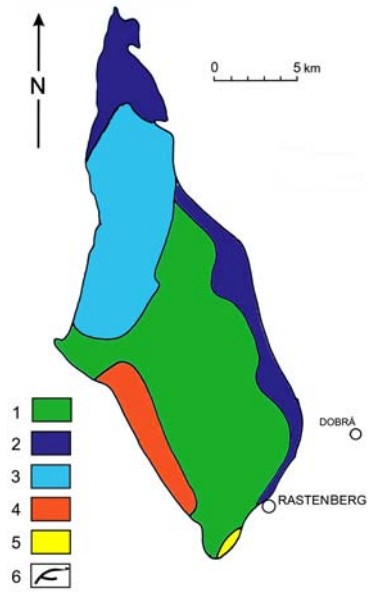

Fig. 2.108. *Rastenberg Massif geological-sketch-map (adapted after Gerdes et al. 2000). 1 – Rastenberg Melagranite (main type), 2 – Rastenberg Melagranite (marginal type), 3 – Kleehof Granodiorite, 4 – Eschenbach Quartz Monzonite, 5 – Loschberg Quartz Monzodiorite, 6 – faults.*

Regional position: a member of the Durbachite (high-K) Suite, located at the eastern border of the Moldanubian Composite Batholith. RM was intruded at the boundary between the Gföhl Unit and the Drosendorf Unit.

Rock types:

1. *Rastenberg Melagranite* (main type) – porphyritic hornblende-biotite melagranite (quartz monzonite) with very common mafic enclaves
2. *Rastenberg Melagranite* (marginal type) – medium-grained melagranite.
3. *Eschenbach Quartz Monzonite* – porphyritic hornblende-biotite quartz monzonite – with very common mafic enclaves.
4. *Kleehof Granodiorite* – porphyritic biotite granodiorite (the most quartz-rich variety).
5. *Loschberg Quartz Monzonite* – pyroxene-hornblende quartz monzodiorite (isolated bodies > 500 m in diameter).

Size and shape (in erosion level): 400 km^2 (33 ×12 km), pear-like (oval) shape.

Age and isotopic data: 338 ± 2 Ma (U-Pb zircon – emplacement age), 328 ± 10 Ma (U-Pb zircon), 353 ± 9 Ma (U-Pb zircon), 323 ± 1 Ma (U-Pb monazite). The Loschberg Quartz monzonite is the youngest member of the Rastenberg massif.

Contact aureole: partly discordant contacts, the growth of K-feldspars to a distance of 30 m from the contact.

Geological environment: high-grade metamorphic gneisses (Drosendorf Unit) of the Moldanubian Zone.

Zoning: asymmetric compositional and textural zonation (e.g. the Rastenberg Melagranite and its marginal facies). The Rastenberg Melagranite (main facies) and the Eschenbach Quartz Monzonite show a continuous compositional range.

Mineralization: unknown.

Heat production (μWm^{-3}): *Rastenberg Melagranite* 6.08.

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Rastenberg Melagranite

Large variation in composition. Quartz-deficient, potassic, metaluminous, melanocratic, I-type, I-series, monzonite

	1151	**1152**	**1153**	**1154**	**1155**
SiO_2	60.04	60.98	55.65	63.79	54.54
TiO_2	1.02	0.99	1.38	0.74	1.36
Al_2O_3	14.64	15.18	13.59	13.86	13.09
Fe_2O_3	0.96	0.48	0.69	0.62	0.78
FeO	4.09	3.83	5.40	3.13	6.45
MnO	0.97	0.07	0.10	0.07	0.13
MgO	4.58	3.93	6.60	3.73	9.04
CaO	3.39	3.55	3.61	2.92	4.50
Na_2O	2.14	3.20	1.65	2.40	2.32
K_2O	7.52	5.55	7.94	6.32	4.82
P_2O_5	0.65	0.64	0.81	0.44	1.15
Mg/(Mg + Fe)	0.58	0.62	0.66	0.64	0.69
K/(K + Na)	0.70	0.53	0.76	0.63	0.58
Nor.Or	49.02	35.92	51.71	41.06	33.86
Nor.Ab	21.20	31.48	16.33	23.70	24.77
Nor.An	13.83	14.67	13.82	12.74	17.53
Nor.Q	3.53	7.25	0.00	13.43	0.00
Na + K	228.72	221.10	221.83	211.64	177.21
*Si	64.07	75.00	43.99	107.55	71.88
K-(Na + Ca)	30.16	-48.73	50.97	4.67	-52.77
Fe + Mg + Ti	195.40	169.27	264.89	153.18	340.93
Al-(Na + K + 2Ca)	-62.13	-49.61	-83.70	-43.59	-80.63
(Na + K)/Ca	3.78	3.49	3.45	4.06	2.21
A/CNK	0.86	0.90	0.80	0.89	0.83

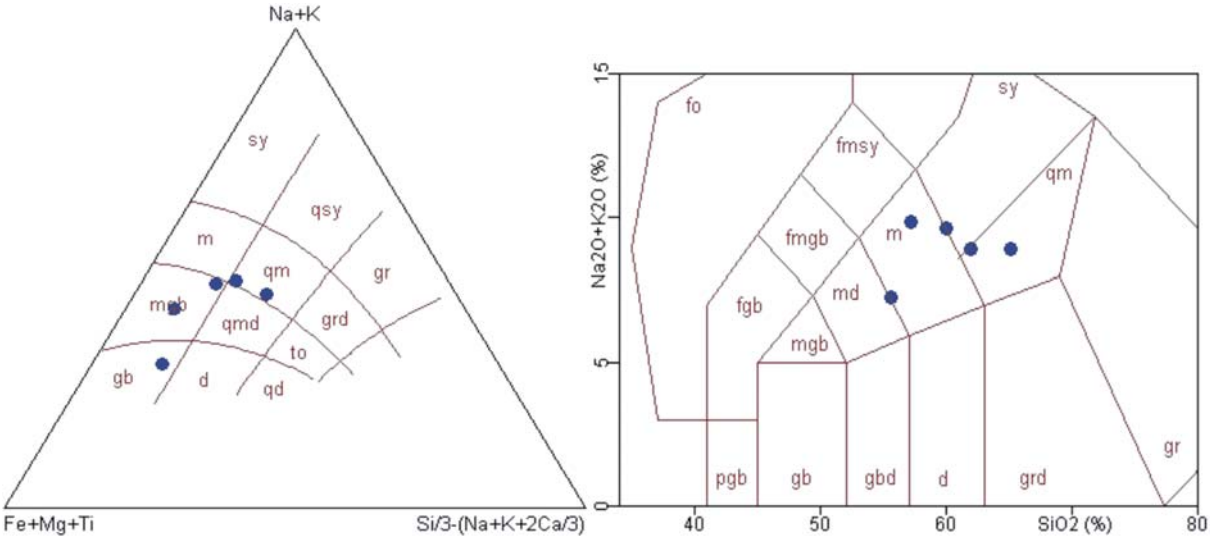

Fig. 2.109. *Rastenberg Massif ABQ and TAS diagrams. 1– Rastenberg Melagranite.*

2.2.12. HENGSTBERG DYKE (SHEET)

Regional position: Moldanubian Zone (Gföhl Unit).

Rock types: *Hengstberg Melagranite* – strongly deformed porphyritic biotite-hornblende melagranite of the Rastenberg type.

Size and shape (in erosion level): about 3 km^2, N-S trending sheet-like intrusion 100–500 m thick can be followed over a distance of 11 km.

Age and isotopic data: Variscan age is expected. No isotopic data.

Contact aureole: intrusive contact to granulites and to the overlying migmatites.

Geological environment: granulite, granulite gneiss and migmatite.

Zoning: not defined.

Mineralization: unknown.

Heat production (μWm^{-3}): no data.

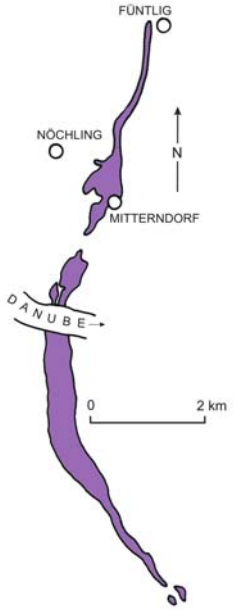

Fig. 2.110. *Hengstberg Sheet geological sketch-map (adapted after Fuchs 2005). Hengstberg Melagranite.*

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2.2.13. ŽELNAVA (KNÍŽECÍ STOLEC) MASSIF (ŽM)

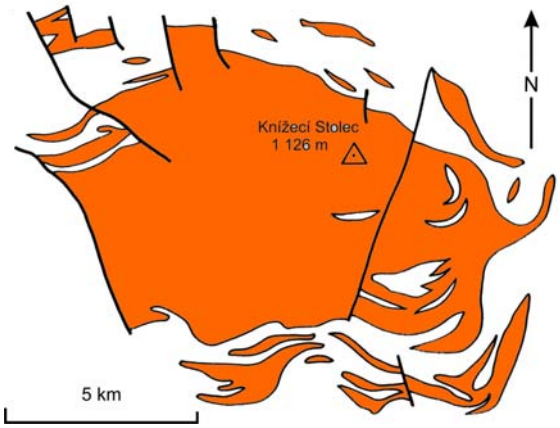

Fig. 2.111. *Želnava Massif geological sketch-map (after Verner and Pertoldová 2004). 1 – Želnava Quartz syenite (Rastenberg Melagranite).*

Geological position: Moldanubian Zone at the Bavarian Quartz "Pfahl", in the southwestern part of the Moldanubian Composite Batholith. The Želnava Massif is a member of the durbachite suite of the Moldanubicum. ŽM is surrounded by retrogressed granulitic gneisses of the Křišťanov Granulite Massif.

Rock types: *Želnava Quartz syenite* – porphyritic amphibole-biotite melaquartz syenite to melaquartz monzonite (durbachite) with microgranular mafic enclaves, fine-grained granodiorite to quartz syenite, dykes of the fine-grained leucocratic granite. Želnava Quartz syenite is the product of mingling of potassium-enriched mantle and crust melts.

Size and shape (in erosion level): about 55 km^2 in the area 10 × 5.5 km, ethmolith of approximately oval shape, numerous apophyses and enclosed blocks of the host rocks.

Magmatic fabric in the massif is relatively strong. It is defined by the alignment of large tabular K-feldspar phenocrysts (2 to 4 cm in length) and biotite aggregates. Older, steeply to moderately NW- dipping magmatic foliation corresponds to the regional metamorphic foliation in the granulite gneisses. Younger, subhorizontal to moderately SE to NW foliation dipping bears subhorizontal magmatic lineation plunging from the W to the N. The above described magmatic structures grade into narrow zones of high-temperature subsolidus deformation along massif margins that are associated predominantly with dextral kinematics.

Age and isotopic data: 340.9 ± 8.4 Ma (U-Th-Pb monazite and uraninite). Relative age of the emplacement of the Želnava Massif (in magmatic stage) matches retrograde metamorphism in the granulite gneisses.

Geological environment: granulite gneisses of the Křišťanov Granulite Massif to the E and N, fine-grained leucocratic granites in the variable degree of deformation.

Contact aureole: narrow (max. 0.5 m), intrusive contact. The presence of numerous durbachite cone-sheets inward-dipping around the massif. These sheets are predominantly discordant to the steep foliation in the host granulite.

Zoning: several textural and compositional rock varieties may represent several magma pulses of the deep-seated ring complex.

Mineralization: unknown.

Želnava Quartz syenite

Quartz normal/poor, potassic, metaluminous, melanocratic, I-type monzonite to monzogabbro

	durb388	**durb414**	**durb389**
SiO_2	47.58	48.60	56.35
TiO_2	1.14	1.47	1.30
Al_2O_3	11.51	13.30	13.06
Fe_2O_3	1.40	n.d.	1.31
FeO	7.18	7.96	4.79
MnO	0.17	0.14	0.10
MgO	13.70	9.44	7.11
CaO	6.73	6.14	4.10
Na_2O	1.05	1.23	1.76
K_2O	4.70	7.43	6.37

P_2O_5	0.81	1.12	0.89
Li_2O	0.03	0.01	0.02
Mg/(Mg + Fe)	0.74	0.67	0.68
K/(K + Na)	0.75	0.80	0.70
Nor.Or	30.52	46.03	44.22
Nor.Ab	10.36	11.58	18.57
Nor.An	28.24	18.60	16.99
Nor.Q	0.00	0.00	2.47
Na + K	133.67	197.45	192.04
*Si	50.28	-0.82	71.83
K-(Na + Ca)	-54.10	8.58	5.34
Fe + Mg + Ti	471.73	363.49	275.82
Al-(Na + K + 2Ca)	-147.66	-155.24	-81.80
(Na + K)/Ca	1.11	1.80	2.63
A/CNK	0.64	0.67	0.81

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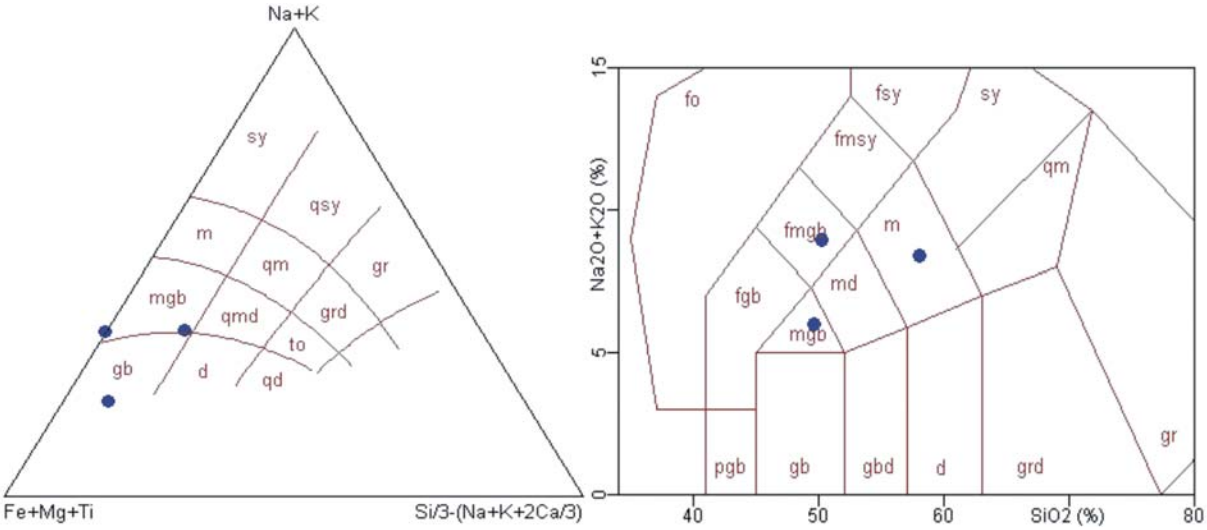

Fig. 2.112. *Želnava Massif ABQ and TAS diagrams. 1 – Želnava Melaquartz syenite (melamonzonite).*

2.2.14. NEZDICE DYKE SWARM (NDS)

Geological position: the Moldanubian Zone. The melasyenite porphyry dykes occupy a large zone of an approximately triangular shape and a length of about 115 km (NE-SW) at a width of ca. 50 km.

NDS corresponds in terms of its texture, structure and chemical composition to melasyenites – durbachites, typical of many parts of the high-potassic plutonites in the Moldanubicum. NDS consists of two clusters of dykes of a "durbachitic" appearance, northern one in the vicinity of Kašperské Hory and Nezdice and southern one, between Svojše and Stachy.

Rock types: *Melasyenite porphyry* – K-feldspar phenocrysts in fine- to medium-grained matrix of potassium feldspar, oligoclase, Mg-biotite (phlogopite), actinolite and minor quartz.

Size and shape (in erosion level): The dyke swarms strike generally E-W of ENE-WSW. The width of the dykes varies from 1–2 m to 10–20 m; the length some of them exceeds 1–2 km.

Age and isotopic data: no data.

Geological enviroment: NDS cut metamorphic rocks, mainly migmatites, gneisses and the pre-Variscan orthogneisses.

Contact aureole: not reported.

Mineralization: not reported.

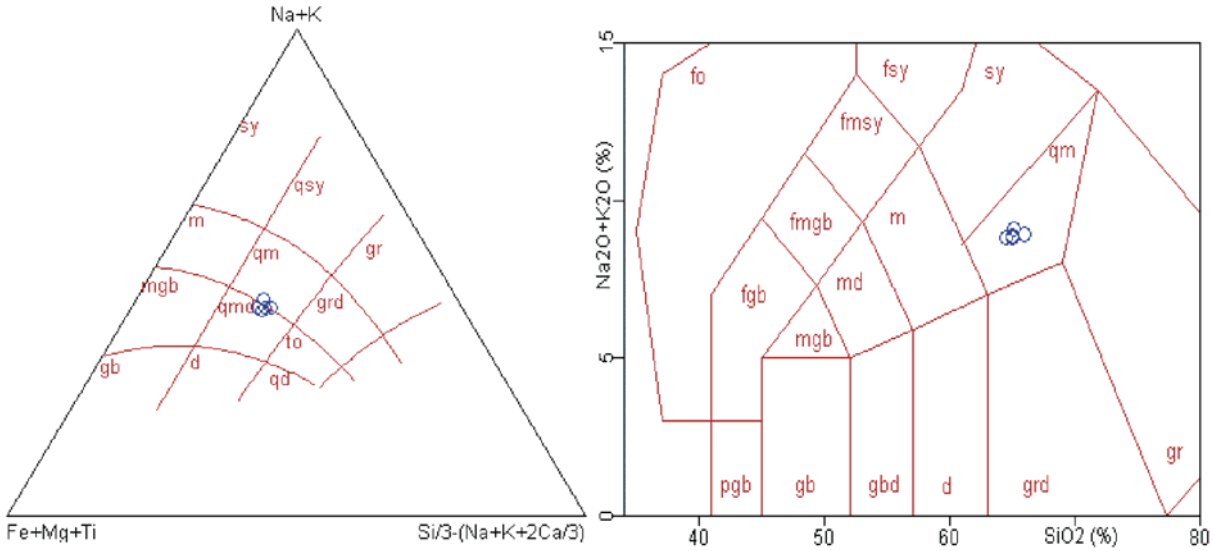

Fig. 2.113. *Nezdice Melasyenite porphyry ABQ and TAS diagrams.*

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Nezdice Melasyenite porphyry

Quartz normal, highly potassic, metaluminous, melanocratic, I type granite

	Kvilda100	ČkyněSZ110	KašpH11	KašpHAv4	BavorovAv3
SiO_2	64.13	63.33	64.62	63.64	64.39
TiO_2	0.75	0.71	0.84	0.72	0.75
Al_2O_3	13.38	13.10	13.47	13.24	13.46
Fe_2O_3	1.40	0.95	4.21	1.15	4.13
FeO	2.75	0.00	2.91	0.00	2.84
MnO	0.07	0.07	0.08	0.07	0.08
MgO	4.23	4.08	4.46	4.15	4.28
CaO	2.52	2.12	2.82	2.46	2.65
Na_2O	2.43	2.34	2.61	2.39	2.47
K_2O	6.31	6.21	6.38	6.23	6.32
P_2O_5	0.61	0.55	0.65	0.56	0.62
Li_2O	0.01	0.00	0.01	0.00	0.01
Mg/(Mg + Fe)	0.66	0.65	0.67	0.65	0.66
K/(K + Na)	0.63	0.61	0.64	0.62	0.64
Nor.Q	14.88	13.45	16.35	14.53	16.17
Nor.Or	40.61	40.46	41.33	40.53	40.70
Nor.Ab	23.99	23.17	25.49	23.30	24.50
Nor.An	9.57	7.18	11.40	9.00	9.58
Na+K	211.56	209.49	218.41	210.69	212.59
*Si	114.33	107.13	120.46	107.41	114.41
K-(Na + Ca)	11.08	3.58	14.60	5.03	14.34
Fe + Mg + Ti	167.10	162.96	173.81	163.61	172.49
Al-(Na + K + 2Ca)	-42.57	-48.28	-29.91	-46.94	-34.47
(Na + K)/Ca	4.78	4.19	5.60	4.50	4.86
A/CNK	0.91	0.88	0.94	0.89	0.93

Trace elements (in ppm): *Kvilda Melagranite porphyry* – **V** 59,**Co** 15, **Cr** 237, **Ni** 78, **Cu** 21, **Zn** 68, **As** 9, **Rb** 353, **Sr** 312, **Y** 19, **Zr** 346, **Nb** 26, **Sn** 14, **Pb** 44, **Th**38, **U** 18.

Members of the Central Bohemian Composite Batholith in the Moldanubicum

2.3.1. ŘÍČANY MASSIF (ŘM)

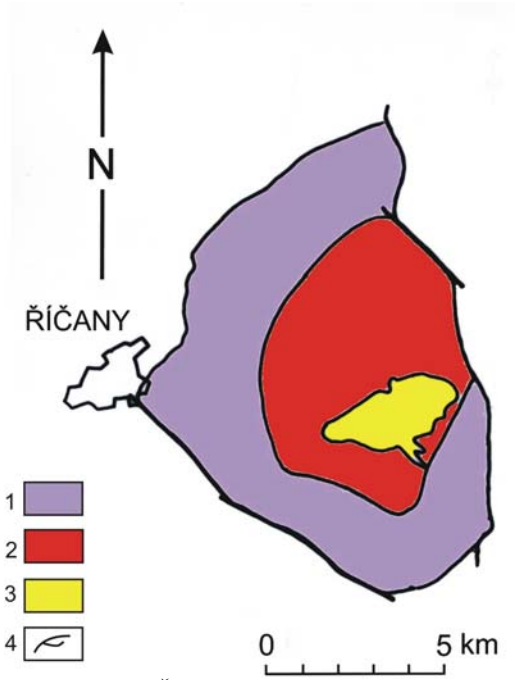

Fig. 2.114. *Říčany Massif geological sketch-map (adapted after Janoušek et al. 1997). 1 – Říčany Granite (outer zone), 2 – Říčany Granite (central zone), 3 – Jevany Granite, 4 – faults.*

Regional position: a member of the Central Bohemian Composite Batholith.

Rock types:

1. *Říčany Granite* (70 km^2) – porphyritic biotite (± muscovite) granite (outer zone) and equigranular biotite granite (central zone).
2. *Jevany Granite* (3 km^2) – muscovite-biotite leucogranite with tourmaline.
3. *Žernovka Granite* – biotite rich enclaves.
4. *Marginal Aplite* (along the southern contact and containing Sn mineralization).
5. *Kšely Granite* (probably deformed equivalent of the Říčany Granite).

Shape and size: oval shape – 72 km^2 (10 × 13 km). The outcrop of the hypotetic hidden Říčany-Kutná Hora Batholith (48 × 24 km).

Age and isotopic data: 330 (K-Ar), 335 Ma (Rb-Sr), 336 ± 3.5 Ma (Ar-Ar biotite).

Contact aureole: contact metamorphosed Palaeozoic sediments (the Tehov "Islet").

Geological environment: Sázava Tonalite, Tehov metasediments, Permian Cover.

Zoning: Compositional concentric zonation (tectonically outlined in the E, increase of acidity towards the centre (Jevany Granite), cryptic zoning is interpreted based on variation of trace-element patterns. The outer part consists of the porphyritic facies of the Říčany Granite, whereas the central part is made up by non-porphyritic facies. The eastern part of the intrusion is cut-off by subvertical fault. The origin of the reverse zoning is explained by high-level emplacement as a single batch of magma from deeper level vertically graded magma chamber.

Mineralization: Sn (cassiterite).

Heat production (μWm^{-3}): *Říčany Granite* 3.4, 4.6, *Jevany Granite* 5.69.

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Říčany Granite

Large variation in composition. Quartz-poor, sodic, peraluminous (weakly), mesocratic, S-type, I- & M-series, granite

n = 17	Med.	Min	Max	QU1	QU3
SiO_2	69.66	67.38	71.63	68.82	70.54
TiO_2	0.35	0.22	0.44	0.31	0.40
Al_2O_3	15.25	14.25	16.18	14.71	15.62
Fe_2O_3	0.63	0.08	2.08	0.31	1.14
FeO	1.47	0.60	2.22	1.14	1.58
MnO	0.04	0.01	0.08	0.03	0.07
MgO	1.19	0.46	2.38	1.08	1.30
CaO	1.41	0.99	1.83	1.28	1.61
Na_2O	3.48	3.20	3.94	3.33	3.60
K_2O	5.43	4.72	6.35	5.06	5.67
P_2O_5	0.39	0.14	0.51	0.21	0.44
Mg/(Mg + Fe)	0.53	0.35	0.65	0.43	0.57
K/(K + Na)	0.50	0.46	0.55	0.49	0.52
Nor.Or	32.90	28.79	38.86	30.95	34.65
Nor.Ab	32.36	30.03	36.39	30.82	33.48
Nor.An	5.12	3.21	7.63	3.89	5.91
Nor.Q	23.75	16.36	28.60	20.67	24.92
Na + K	228.49	204.77	255.69	221.69	235.91
*Si	142.81	109.90	175.07	128.87	150.20
K-(Na + Ca)	-24.12	-38.61	-2.62	-27.80	-19.94
Fe + Mg + Ti	58.94	31.67	104.42	56.40	68.82
Al-(Na + K + 2Ca)	16.19	-13.97	53.04	2.86	40.09
(Na + K)/Ca	9.36	7.00	14.20	8.18	9.83
A/CNK	1.10	0.98	1.25	1.02	1.19

Trace elements (mean values in ppm): *Říčany Granite* – **B** 30, **Ba** 1020, **Be** 12, **Co** 5, **Cr** 30, **Cs** 26, **Cu** 4, **Ga** 20, **F** 1500, **Hf** 5.5, **Li** 84, **Ni** 10, **Pb** 40, **Rb** 250, **Sn** 17–30, **Sr** 250, **Th** 27, **U** 8, **V** 48, **Zn** 25, **Zr** 160 (Vejnar 1974).
W 1.2, **La** 24.3, **Ce** 61, **Sm** 4.3, **Eu** 0.92, **Tb** 0.35, **Yb** 0.3, **Lu** 0.07 (Palivcová et al. 1992).

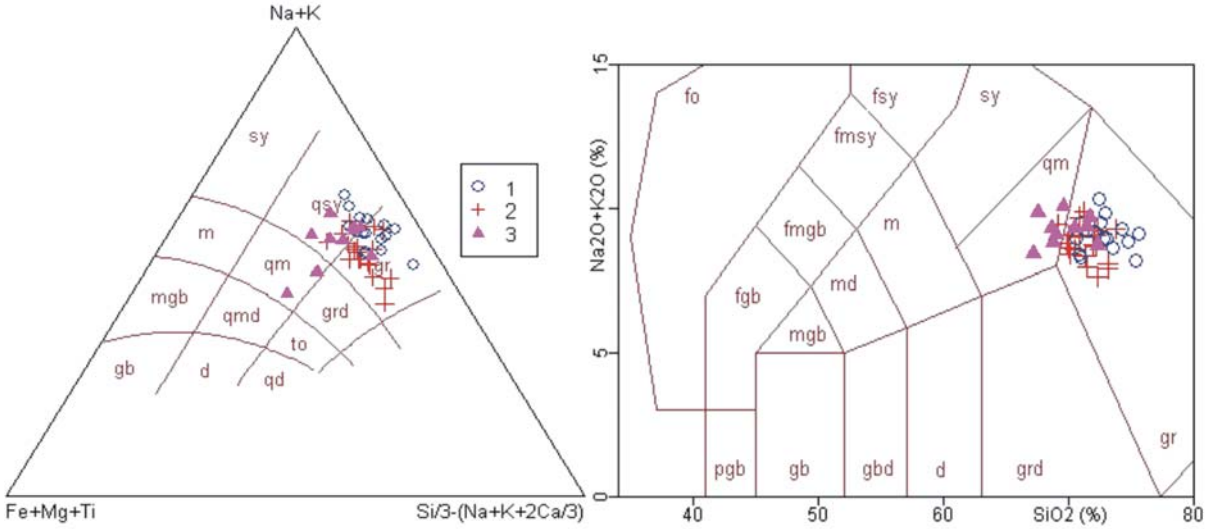

Fig. 2.115. *Říčany Massif ABQ and TAS diagrams. 1 – Jevany Granite, 2 – Říčany Granite, 3 – Žernovka Granite.*

Jevany Granite

Quartz-rich, sodic, peraluminous (very weakly), leucocratic, S-type, I- and M-series, granite

n = 15	Median	Min	Max	QU1	QU3
SiO_2	72.04	70.05	75.15	70.52	73.59
TiO_2	0.20	0.13	0.30	0.15	0.24
Al_2O_3	14.17	12.96	15.98	13.67	14.46
Fe_2O_3	0.36	0.08	1.46	0.21	0.61
FeO	0.92	0.39	1.52	0.60	1.09
MnO	0.03	0.02	0.05	0.02	0.03
MgO	0.61	0.30	0.95	0.39	0.70
CaO	1.12	0.72	1.93	0.84	1.15
Na_2O	4.22	3.45	5.50	3.74	4.46
K_2O	4.67	4.07	5.70	4.35	4.70
P_2O_5	0.08	0.05	0.24	0.06	0.13
Mg/(Mg + Fe)	0.45	0.32	0.56	0.37	0.49
K/(K + Na)	0.43	0.33	0.50	0.39	0.45
Nor.Or	28.16	24.59	34.59	26.17	28.56
Nor.Ab	38.61	31.61	50.78	34.41	41.01
Nor.An	5.19	0.00	8.87	2.43	5.45
Nor.Q	25.26	20.14	33.43	20.56	26.7
Na + K	240.71	210.48	273.62	217.93	241.78
*Si	151.92	113.07	196.60	128.53	161.60
K-(Na + Ca)	-61.23	-103.29	-25.01	-74.19	-45.20
Fe + Mg + Ti	37.67	18.35	50.60	24.05	42.99
Al-(Na + K + 2Ca)	-1.04	-34.77	42.11	-24.72	11.06
(Na + K)/Ca	12.11	6.95	18.49	7.43	13.037
A/CNK	1.00	0.89	1.20	0.92	1.05

Trace elements (mean values in ppm): *Jevany Granite* – **B** 19, **Ba** 1200, **Be** 5, **Co** 3, **Cs** 9.1, **F** 700, **Hf** 4.4, **Li** 94, **Pb** 68, **Rb** 170, **Sc** 2.4, **Sn** 3.6, **Sr** 540, **Th** 32.1, **U** 11.7, **V** 48, **Zn** 25, **Zr** 160,**W** 1.1, **La** 17.5, **Ce** 50, **Sm** 4.1, **Eu** 0.55, **Tb** 0.25, **Yb** 0.8, **Lu** 0.03 (Palivcová et al. 1992).

Žernovka Granite (enclaves)

Quartz-normal, potassic, peraluminous, mesocratic, I-type, granite to granodiorite

	6zernov	7zer	8zer	9zer	10zer	11zer
SiO_2	68.62	68.35	67.38	66.85	68.82	69.07
TiO_2	0.40	0.40	0.27	0.47	0.22	0.37
Al_2O_3	15.83	15.49	15.62	14.14	14.59	15.19
Fe_2O_3	0.36	0.64	1.29	1.42	1.30	0.63
FeO	1.58	1.91	2.22	2.15	1.89	0.99
MnO	0.07	0.07	0.08	0.12	0.08	0.03
MgO	1.21	1.27	1.43	3.83	2.38	1.30
CaO	1.83	1.70	1.41	1.80	1.75	1.48
Na_2O	3.35	3.58	3.48	3.37	3.20	3.91
K_2O	5.67	5.67	6.35	4.99	5.60	6.10
P_2O_5	0.51	0.51	0.23	0.38	0.21	0.21
Li_2O	0.21	0.21	n.d.	n.d.	n.d.	n.d.
Mg/(Mg + Fe)	0.52	0.47	0.42	0.66	0.57	0.59
K/(K + Na)	0.53	0.51	0.55	0.49	0.54	0.51
Nor.Or	34.63	34.65	38.86	31.52	34.60	36.92
Nor.Ab	31.10	33.25	32.37	32.35	30.05	35.97

Nor.An	5.91	5.25	5.68	6.87	7.63	6.10
Nor.Q	21.27	19.76	16.41	18.47	20.42	17.20
Na + K	228.49	235.91	247.12	214.70	222.16	255.69
*Si	130.44	123.07	109.92	134.77	138.83	109.90
K-(Na + Ca)	-20.35	-25.45	-2.62	-34.90	-15.57	-23.05
Fe + Mg + Ti	61.55	71.14	85.94	148.65	104.42	58.57
Al-(Na + K + 2Ca)	17.11	7.65	9.33	-1.21	1.94	-10.17
(Na + K)/Ca	7.00	7.78	9.83	6.69	7.12	9.69
A/CNK	1.10	1.07	1.05	1.03	1.02	0.98

2.3.2. BENEŠOV MASSIF (BM)

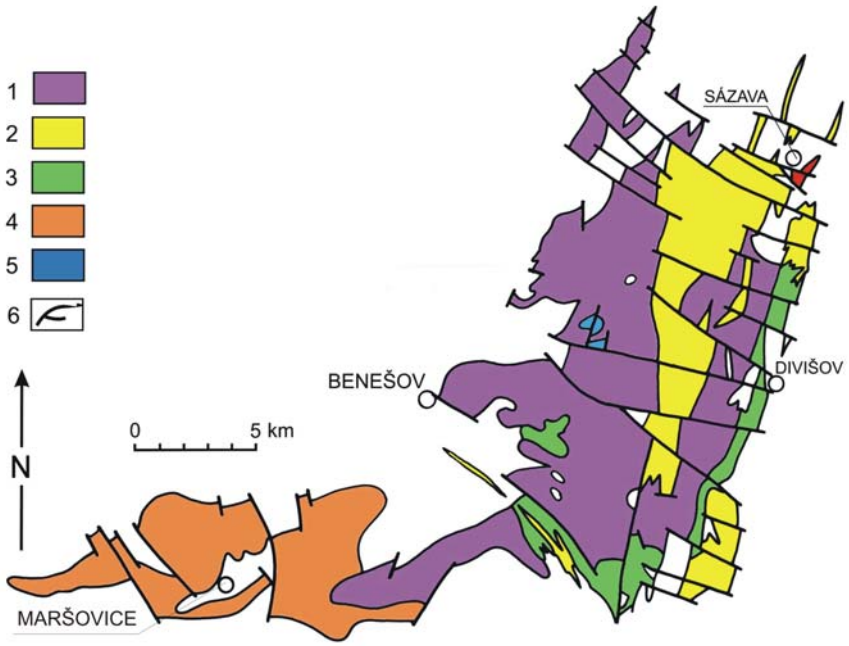

Fig. 2.116. *Benešov Massif geological sketch-map (adapted after Fusán et al. 1967). 1 – Benešov Granodiorite, 2 – Benešov Granite, 3 – Benešov Hybrid Granodiorite, 4 – Maršovice Granodiorite, 5 – Sázava Tonalite, 6 – faults.*

Regional position: a member of the Metagranitoids of the Central Bohemian Composite Batholith.

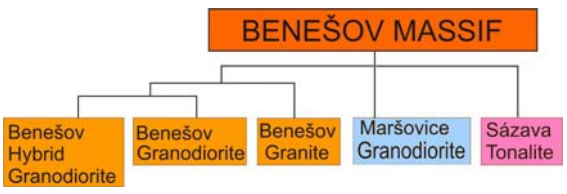

Fig. 2.117. *Benešov Massif hierarchic scheme according to rock groups and rock types (Colours represent the mutual relations).*

Rock types:

1. *Benešov Hybrid Granodiorite* – cataclastic medium-grained hornblende-biotite melanocratic granodiorite to syenodiorite.
2. *Benešov Granodiorite* – cataclastic ± porphyritic medium-grained biotite ± amphibole melanocratic granodiorite.
3. *Benešov Granite* – cataclastic fine-grained muscovite-biotite granodiorite to granite.
4. *Maršovice Granodiorite* – contaminated (hybrid) fine-grained muscovite-biotite granite to granodiorite with cordierite (the facies of the Benešov Granodiorite).
5. *Sázava Tonalite* – a small stock within the Benešov Granodiorite.

Size and shape (in erosion level): Benešov granitoids – 200 km^2, crescent-like shape in the map section (37 × 10 km). Maršovice Granodiorite – 40 km^2.

Age and isotopic data: the Sázava Tonalite intrudes the Benešov Granodiorite. The Benešov Granodiorite is older than the Benešov Granite. No isotopic data.

Geological environment: The Popovice Complex, the Sázava Tonalite, Moldanubian bi-mu and bi paragneisses and Neo-Proterozoic phyllites.

Contact aureole: not described.

Zoning: normal compositional zoning (the Benešov Granite in the centre of the Benešov Granodiorite and a narrow rim of the Benešov Hybrid Granodiorite along the BM margin).

Mineralization: no data.

Heat production (μWm^{-3}): *Benešov Granodiorite* 3.5.

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Benešov Hybrid Granodiorite

Quartz-deficient, sodic, metaluminous, mesocratic, I-type, monzonite to granodiorite

n = 9	Med.	Min	Max	QU1	QU3
SiO_2	62.45	59.74	65.64	62.08	64.43
TiO_2	0.55	0.45	0.82	0.51	0.61
Al_2O_3	15.05	13.61	15.82	14.88	15.67
Fe_2O_3	1.04	0.85	1.81	1.04	1.18
FeO	3.85	3.59	4.50	3.70	3.98
MnO	0.08	0.05	0.14	0.06	0.09
MgO	2.88	1.63	5.89	2.69	3.72
CaO	4.12	2.25	4.67	3.38	4.38
Na_2O	3.21	2.54	4.30	2.82	3.22
K_2O	4.08	1.74	5.44	3.70	5.06
P_2O_5	0.26	0.10	0.61	0.17	0.48
Mg/(Mg + Fe)	0.49	0.35	0.69	0.48	0.57
K/(K + Na)	0.46	0.21	0.56	0.41	0.55
Nor.Or	26.13	11.08	35.50	23.73	33.72
Nor.Ab	31.09	25.52	41.62	28.09	31.25
Nor.An	20.22	8.95	23.26	14.44	22.18
Nor.Q	14.92	5.84	20.21	12.34	18.02
Na + K	190.21	175.70	206.50	186.22	195.85
*Si	112.21	83.50	138.66	100.73	130.66
K-(Na + Ca)	-96.26	-178.85	-17.84	-100.23	-35.77
Fe + Mg + Ti	143.25	114.22	216.13	142.09	170.97
Al-(Na + K + 2Ca)	-28.69	-84.79	29.09	-49.04	-19.10
(Na + K)/Ca	2.51	2.28	4.76	2.28	3.43
A/CNK	0.93	0.79	1.16	0.88	0.95

Trace elements (mean values in ppm): *Benešov Hybrid Granodiorite* – **B** 36, **Ba** 3500, **Be** 10, **Co** 10, **Cr** 200, **Cs** 40, **Cu** 4, **Ga** 24, **Li** 70, **Ni** 35, **Pb** 47, **Rb** 240, **Sn** 2, **Sr** 370, **V** 145, **Zn** 86, **Zr** 170. (Vejnar 1974).

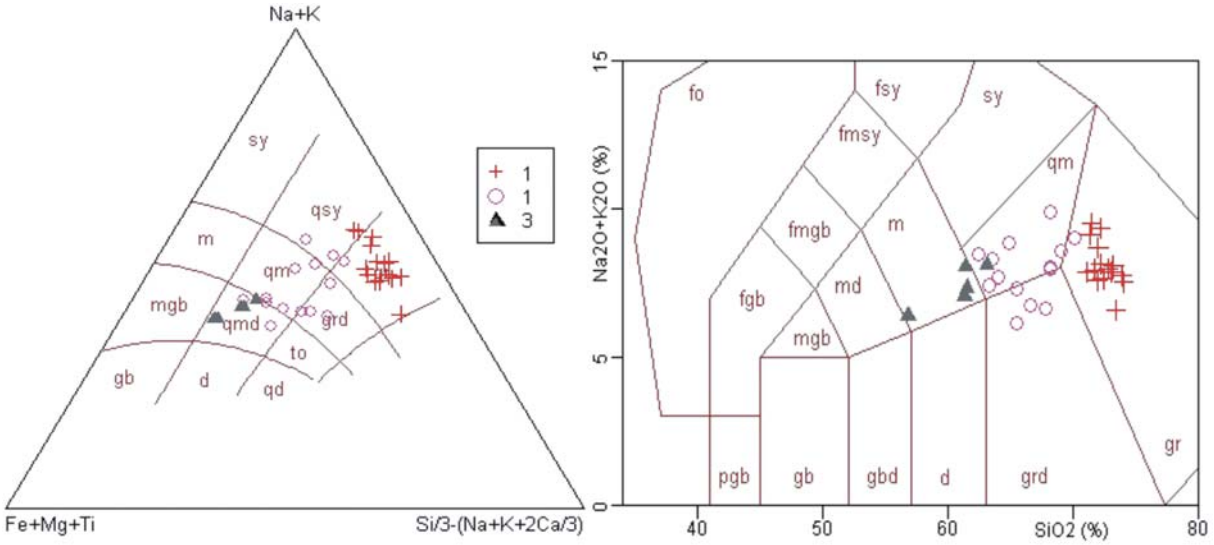

Fig. 2.118. *Benešov Massif ABQ and TAS diagrams. 1 – Benešov Granite, 2 – Benešov Granodiorite, 3 – Benešov Hybrid Granodiorite.*

Benešov Granodiorite

Quartz-normal, potassic, metaluminous, mesocratic, quartz monzonite

n = 9	Med.	Min	Max	QU1	QU3
SiO_2	66.90	64.48	68.76	65.22	67.39
TiO_2	0.50	0.25	0.70	0.43	0.58
Al_2O_3	15.18	13.90	17.35	14.06	15.59
Fe_2O_3	0.85	0.11	0.93	0.66	0.88
FeO	2.33	1.72	4.50	2.02	2.87
MnO	0.08	0.04	0.14	0.06	0.08
MgO	1.47	1.10	2.46	1.47	1.63
CaO	2.47	1.42	4.32	1.86	3.08
Na_2O	3.50	2.94	4.30	3.16	3.86
K_2O	4.80	1.74	6.29	3.82	5.86
P_2O_5	0.20	0.13	0.30	0.18	0.26
Mg/(Mg + Fe)	0.45	0.35	0.59	0.44	0.49
K/(K + Na)	0.51	0.21	0.57	0.39	0.54
Nor.Or	30.25	11.08	38.93	24.41	36.54
Nor.Ab	32.93	27.86	41.62	29.81	37.49
Nor.An	10.85	6.16	22.18	7.87	15.28
Nor.Q	18.28	14.75	23.31	15.88	21.40
Na + K	219.29	175.11	46.49	198.72	223.05
*Si	128.43	105.26	155.09	110.56	139.14
K-(Na + Ca)	-44.82	-178.85	-6.69	-99.24	-12.56
Fe + Mg + Ti	88.72	68.29	120.03	84.76	105.16
Al-(Na + K + 2Ca)	-0.48	-60.73	33.33	36.72	14.09
(Na + K)/Ca	4.98	2.28	8.79	3.21	7.43
A/CNK	1.01	0.83	1.13	0.90	1.07

Trace elements (mean values in ppm): *Benešov Granodiorite* – **B** 17, **Ba** 1460, **Be** 7, **Co** 5, **Cr** 80, **Cs** 50, **Cu** 8, **Ga** 19, **Li** 50, **Ni** 22, **Pb** 50, **Rb** 370, **Sn** 5, **Sr** 230, **V** 49, **Zn** 62, **Zr** 190 (Vejnar 1974).

Benešov Granite (acid granitoids)

Quartz-normal, sodic, low peraluminous, leucocratic, I-type, granite

n = 15	Median	Min	Max	QU1	QU3
SiO_2	71.27	69.70	73.47	70.88	71.62
TiO_2	0.22	0.00	0.26	0.16	0.24
Al_2O_3	14.66	13.91	15.26	14.36	14.84
Fe_2O_3	0.45	0.31	1.59	0.39	0.66
FeO	1.33	0.55	2.24	1.02	1.52
MnO	0.04	0.03	0.08	0.03	0.05
MgO	0.55	0.25	0.88	0.40	0.75
CaO	1.66	1.21	2.23	1.49	1.88
Na_2O	3.90	3.17	4.55	3.74	4.02
K_2O	3.86	3.37	5.70	3.75	4.02
P_2O_5	0.10	0.03	0.15	0.08	0.12
Mg/(Mg + Fe)	0.34	0.17	0.51	0.25	0.42
K/(K + Na)	0.40	0.38	0.52	0.39	0.41
Nor.Or	24.11	20.65	34.65	22.92	24.62
Nor.Ab	35.97	29.53	41.85	34.86	37.24
Nor.An	7.99	5.25	10.78	6.86	8.97
Nor.Q	27.14	20.68	35.14	24.41	28.46
Na + K	211.21	173.85	243.80	201.51	212.72
*Si	165.61	130.85	205.81	147.61	174.14
K-(Na + Ca)	-71.50	-87.55	-15.64	-82.06	-66.37
Fe + Mg + Ti	41.80	31.85	56.51	37.33	49.03
Al-(Na + K + 2Ca)	15.24	-21.24	37.02	7.67	20.10
(Na + K)/Ca	7.19	4.87	11.30	6.01	7.84
A/CNK	1.06	0.94	1.15	1.04	1.08

2.3.3. MILEVSKO DYKE SWARM

Regional position: a member of Central Bohemian Composite Batholith

Rock types:

1. Felsic alkali-feldspar granite porphyry, two-mica leucogranite and granite with cordierite and tourmaline.
2. Leucocratic cataclastic muscovite-biotite granites and granodiorites in the Benešov Massif and the Milevsko Massif.

Size and shape (in erosion level): 40 km^2 (surface area in the diameter of 8 km), dykes and sills.

Age: the Milevsko Dyke Swarm (dykes and sills) is younger than the Benešov and Milevsko Massifs. No isotopic data.

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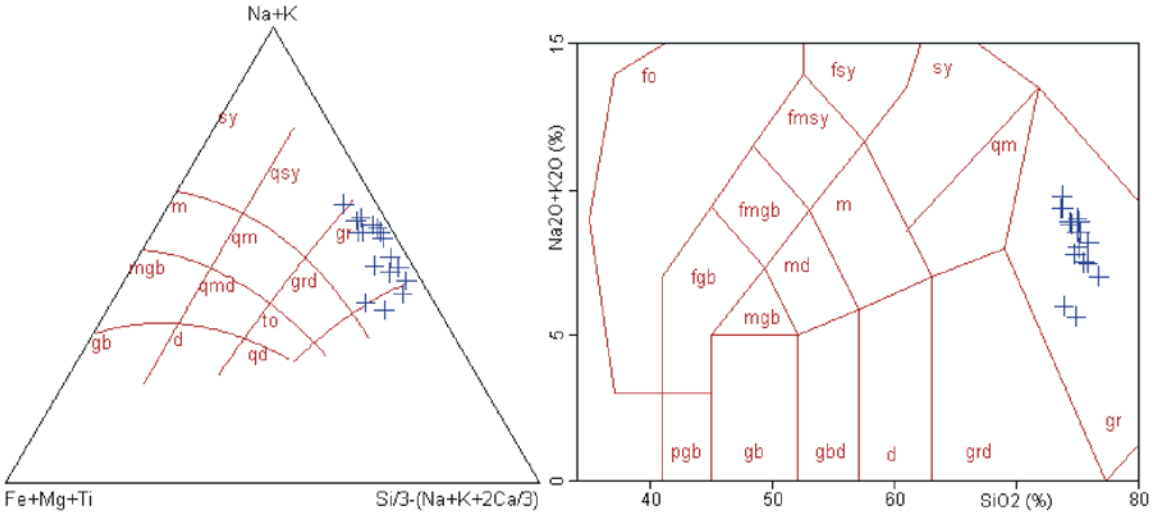

Fig. 2.119. *Milevsko Dyke Swarm ABQ and TAS diagrams.*

Milevsko Dyke Leucogranite

Quartz-rich, sodic-potassic, peraluminous (weakly), leucocratic, S-type, M-series, granite

N = 27	Median	Min	Max	QU1	QU3
SiO_2	73.76	71.26	77.52	72.83	74.08
TiO_2	0.15	0.00	0.29	0.10	0.21
Al_2O_3	13.97	11.03	15.76	13.00	14.24
Fe_2O_3	0.62	0.22	1.73	0.46	0.86
FeO	0.66	0.21	1.64	0.45	0.89
MnO	0.03	0.01	0.09	0.02	0.05
MgO	0.36	0.05	1.01	0.20	0.43
CaO	0.91	0.54	3.27	0.65	1.08
Na_2O	3.41	2.25	4.68	3.15	3.65
K_2O	4.83	3.24	6.68	4.40	5.40
P_2O_5	0.12	0.02	0.50	0.05	0.17
Mg/(Mg + Fe)	0.29	0.05	0.54	0.21	0.32
K/(K + Na)	0.47	0.39	0.65	0.44	0.55
Nor.Or	29.62	19.59	39.26	26.65	33.15
Nor.Ab	31.36	21.01	42.13	28.94	34.02
Nor.An	3.33	0.09	16.27	2.65	4.21
Nor.Q	31.18	23.39	38.84	26.51	32.15
Na + K	219.10	171.41	258.24	200.93	234.12
*Si	181.85	138.19	226.62	159.13	190.30
K-(Na + Ca)	-29.48	-92.13	52.23	-39.99	6.69
Fe + Mg + Ti	30.26	17.26	53.09	23.55	37.36
Al-(Na + K + 2Ca)	13.24	-28.23	66.20	4.05	25.52
(Na + K)/Ca	13.06	2.94	24.38	11.04	17.82
A/CNK	1.06	0.89	1.33	1.03	1.11

Isolated mafic stocks in the Western Bohemia

2.4.1. DRAHOTÍN STOCK

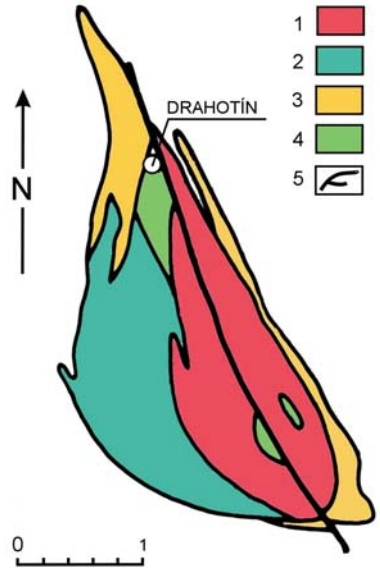

Fig. 2.120. *Drahotín Stock geological sketch-map (adapted after Vejnar 1980). 1 – olivine-free gabbronorite, 2 – biotite norite, 3 – Drahotín Quartz diorite, 4 – phlogopite-olivine gabbronorite + wehrlite, 5 – faults.*

Regional position: isolated body in the West Bohemian Shear Zone, confined to the Bohemian quartz lode.

Rock types:

1. *Drahotín Basal zone* – phlogopite-olivine gabbronorite + wehrlite
2. *Drahotín Main zone* – olivine-free gabbronorite
3. *Drahotín Upper zone* – biotite norite
4. *Drahotín Quartz diorite* – biotite-hornblende quartz diorite.

Size and shape (in erosion level): 5 km^2 (4.5 × 1.6 km, elliptical in shape

Age and isotopic data: 332 Ma (U-Pb zircon).

Geological environment: thermally recrystallized Moldanubian gneisses with scarce amphibolite interlayers.

Contact aureole: pyroxene-hornblende hornfelses, serpentinite.

Zoning: compositional zoning, related to a single period of crystal accumulation, marked layering (layered intrusion of tholeiitic magma). Layering dips 40–60° to NE or SE in the central area and up to 80° at the western margin. Asymmetrical pattern of zonation indicated by gradual succession of the olivine gabbro norite in the centre into intermediate zone of gabbronorite and marginal zone (Upper zone) of biotite norite.

Mineralization: not reported.

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1 – Drahotín Basal zone – phlogopite-olivine gabbronorite + wehrlite

	wehrlite 2a	ol gabbro-norite 2	ol gabbro-norite 3
SiO_2	45.71	46.18	47.98

TiO_2	0.75	0.95	0.76
Al_2O_3	6.88	9.25	7.52
Fe_2O_3	0.93	0.62	1.00
FeO	8.94	8.39	10.54
MnO	0.17	0.16	0.18
MgO	20.14	21.86	20.03
CaO	15.71	10.52	10.66
Na_2O	0.39	1.08	0.68
K_2O	0.24	0.85	0.56
P_2O_5	0.16	0.13	0.08
Mg/(Mg + Fe)	0.78	0.81	0.75
K/(K + Na)	0.29	0.34	0.35
Nor.Or	1.91	5.67	4.21
Nor.Ab	4.68	10.91	7.80
Nor.An	44.24	40.38	40.35
Nor.Q	0.00	0.00	0.00
Na + K	17.51	52.87	33.88
*Si	49.33	78.26	105.55
K-(Na + Ca)	-287.44	-204.31	-200.25
Fe + Mg + Ti	645.26	678.95	665.88
Al-(Na + K + 2Ca)	-442.58	-246.48	-266.49
(Na + K)/Ca	0.06	0.28	0.18
A/CNK	0.24	0.43	0.36

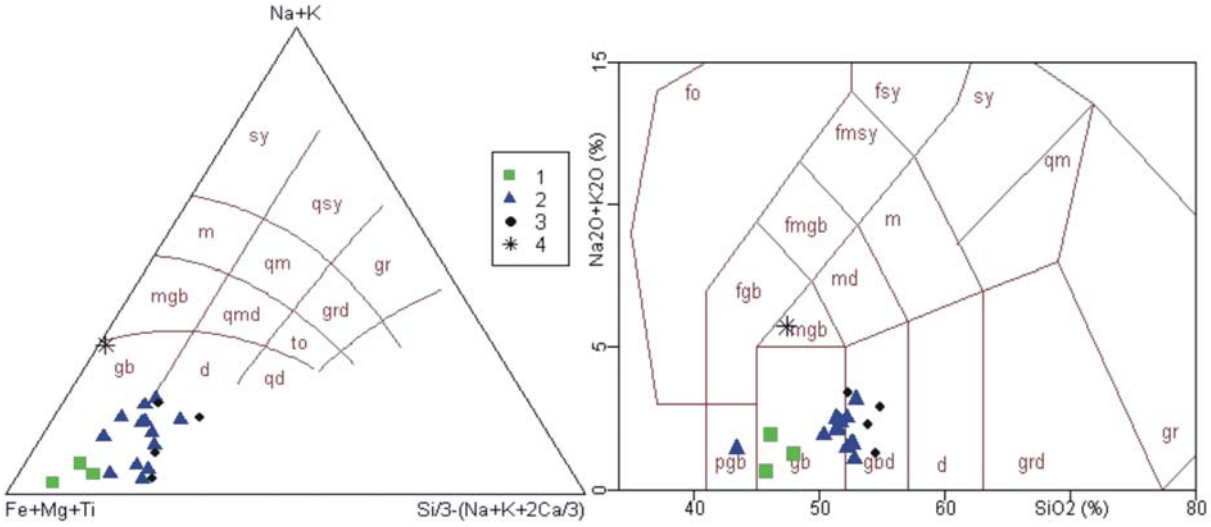

Fig. 2.121. *Drahotín Stock ABQ and TAS diagrams. 1 – olivine gabbronorite and wehrlite, 2 – gabbronorite, 3 –biotite-norite, 4 – biotite-hornblende quartz diorite.*

2 – Drahotín Main zone – olivine-free gabbronorite

n = 13	**Med.**	**Min**	**Max**	**QU1**	**QU3**
SiO_2	51.70	43.38	52.96	51.31	52.52
TiO_2	0.45	0.15	0.50	0.33	0.46
Al_2O_3	18.33	5.98	20.57	11.71	18.88
Fe_2O_3	0.44	0.00	10.19	0.25	0.89
FeO	6.87	4.57	18.04	5.79	10.16
MnO	0.13	0.09	0.27	0.12	0.21
MgO	9.47	5.98	21.48	7.45	16.03
CaO	10.90	3.59	17.03	8.01	12.07
Na_2O	1.59	0.74	2.29	1.11	1.87

K_2O	0.49	0.35	0.88	0.40	0.52
P_2O_5	0.07	0.04	0.14	0.05	0.11
Mg/(Mg + Fe)	0.73	0.50	0.76	0.62	0.75
K/(K + Na)	0.19	0.12	0.24	0.15	0.20
Nor.Or	3.26	2.45	5.82	3.11	3.74
Nor.Ab	16.64	10.02	23.05	13.23	19.06
Nor.An	60.11	24.36	80.88	48.56	63.37
Nor.Q	0.00	0.00	3.41	0.00	0.00
Na + K	63.57	31.14	92.52	46.63	73.55
*Si	89.88	41.08	213.87	71.66	146.22
K-(Na + Ca)	-237.08	-328.52	-88.26	-264.99	-175.06
Fe + Mg + Ti	323.86	250.84	783.09	297.07	555.28
Al-(Na + K + 2Ca)	-108.29	-421.92	10.05	-145.08	-41.83
(Na + K)/Ca	0.37	0.15	0.65	0.31	0.45
A/CNK	0.75	0.36	1.03	0.68	0.81

3 - Drahotín Upper zone – biotite norite

	bi norite 18	**bi norite 19**	**bi norite 20**	**bi norite 21**
SiO_2	54.54	54.88	53.92	52.26
TiO_2	0.55	0.28	0.72	1.07
Al_2O_3	4.84	18.85	11.27	17.65
Fe_2O_3	0.61	1.00	1.05	0.91
FeO	13.73	6.69	9.25	7.01
MnO	0.22	0.14	0.20	0.15
MgO	21.44	7.61	14.36	8.00
CaO	2.44	7.58	6.75	9.15
Na_2O	0.70	2.11	1.30	2.32
K_2O	0.58	0.77	0.99	1.09
P_2O_5	0.35	0.08	0.20	0.38
Mg/(Mg + Fe)	0.72	0.64	0.71	0.64
K/(K + Na)	0.36	0.19	0.34	0.24
Nor.Or	5.58	5.37	7.85	7.53
Nor.Ab	10.11	22.29	15.58	24.30
Nor.An	15.85	43.52	43.09	50.09
Nor.Q	1.56	7.76	0.37	0.00
Na + K	34.89	84.63	62.90	97.92
*Si	238.72	129.72	155.97	83.23
K-(Na + Ca)	-53.57	-186.94	-141.14	-214.80
Fe + Mg + Ti	737.73	298.03	507.25	320.99
Al-(Na + K + 2Ca)	-26.88	15.23	-82.44	-77.71
(Na + K)/Ca	0.80	0.63	0.52	0.60
A/CNK	0.83	1.05	0.74	0.83

2.4.2. MUTĚNÍN STOCK

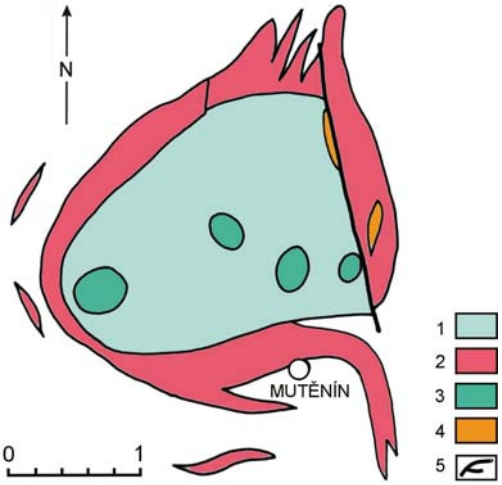

Fig. 2.122. *Mutěnín Stock geological sketch-map (adapted after Tonika 1978). 1 – Mutěnín Diorite, 2 – Mutěnín Quartz diorite, 3 – Mutěnín Ferrodiorite, 4 – Mutěnín Granite, 5 – faults.*

Regional position: isolated body within Moldanubian gneisses of the Bohemian Forest.

Rock types:

1. *Mutěnín Diorite* – biotite – hornblende diorite to monzogabbro.
2. *Mutěnín Quartz diorite* – hornblende – biotite quartz diorite.
3. *Mutěnín Syenite* – hornblende-biotite ferro-syenite.
4. *Mutěnín Ferrodiorite* – fayalitic ferro-diorite.
5. *Mutěnín Granite* – leucocratic granite.

Size and shape (in erosion level): 7 km^2 (2.5 × 3 km) approximately circular shape.

Age and isotopic data: 358 Ma (**K**-Ar biotite), 325 ± 6 Ma, 327 ± 7 Ma (K-Ar amphibole), gabbro 342 ± 2 Ma (U-Pb zircon).

Geological environment: thermally recrystallized Moldanubian paragneisses.

Contact aureole: pyroxene-hornblende hornfelses. The Mutěnín Stock intruded into the Moldanubicum at a depth of 23 ± 4 km as derived by using Al-in hornblende barometry.

Zoning: concentric compositional reverse zoning, ferrodiorite in the centre, biotite - hornblende diorite in the intermediate zone and quartz-diorite in the outer zone. Ring-like pattern of the intrusion.

Mineralization: not reported.

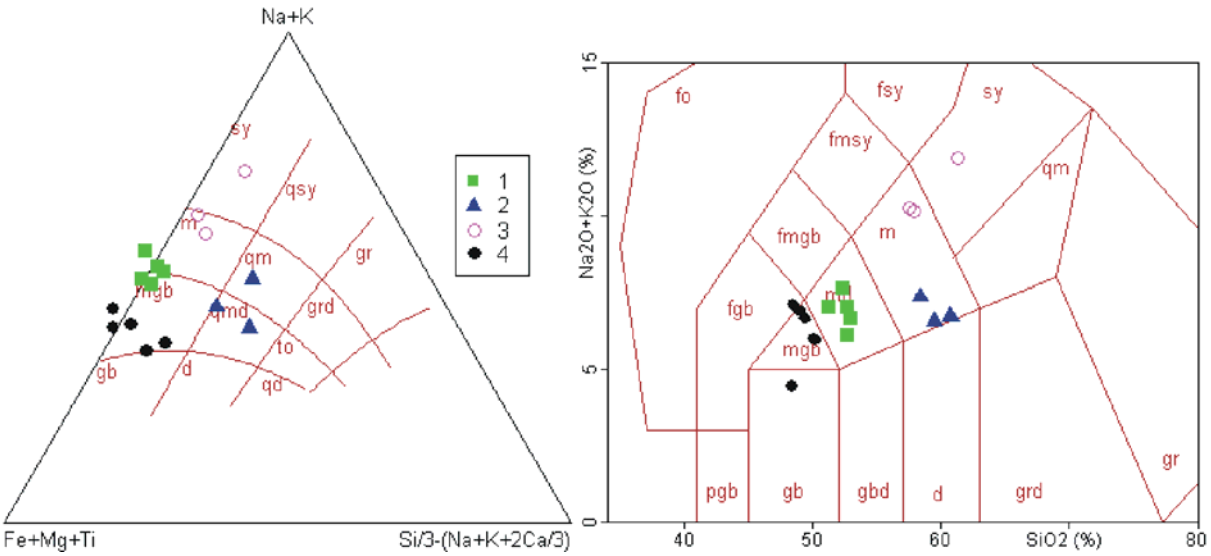

Fig. 2.123. *Mutěnín Stock ABQ and TAS diagrams. 1 – Mutěnín Diorite, 2–- Mutěnín Quartz Diorite, 3 – Mutěnín Syenite, 4 – Mutěnín Ferrodiorite.*

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1-2 Mutěnín Diorite

	mut.-10	**mut.-11**	**mut.-12**
SiO_2	50.25	59.45	58.39
TiO_2	0.94	2.00	1.27
Al_2O_3	18.39	18.93	17.35
Fe_2O_3	2.11	0.94	1.63
FeO	12.97	2.19	5.82
MnO	0.30	0.14	0.13
MgO	2.63	1.90	2.56
CaO	5.77	6.82	5.06
Na_2O	4.13	3.70	3.58
K_2O	1.81	2.85	3.76
P_2O_5	0.68	1.08	0.45
Mg/(Mg + Fe)	0.24	0.52	0.38
K/(K + Na)	0.22	0.34	0.41
Nor.Or	11.87	17.33	23.97
Nor.Ab	41.09	34.24	34.66
Nor.An	26.74	27.51	23.86
Nor.Q	0.00	12.09	6.35
Na + K	171.95	179.81	195.49
*Si	38.21	68.92	68.32
K-(Na + Ca)	-197.85	-180.56	-125.81
Fe + Mg + Ti	284.10	114.63	180.99
Al-(Na + K + 2Ca)	-16.65	-51.36	-35.17
(Na + K)/Ca	1.67	1.48	2.17
A/CNK	1.00	0.93	0.93

3 – Mutěnín Ferrodiorite

n = 9	**Med.**	**Min**	**Max**	**QU1**	**QU3**
SiO_2	51.29	48.25	53.02	49.06	52.71
TiO_2	2.31	1.33	3.00	1.85	2.58
Al_2O_3	20.05	18.27	26.41	19.54	21.33
Fe_2O_3	2.36	1.27	5.21	1.70	3.16
FeO	3.06	0.01	10.77	0.35	8.89
MnO	0.18	0.00	0.22	0.14	0.22
MgO	3.91	2.45	5.03	3.60	4.02
CaO	7.79	6.36	9.66	7.48	8.22
Na_2O	3.92	3.51	4.16	3.79	4.09

K_2O	2.89	0.69	3.83	2.47	3.17
P_2O_5	1.02	0.07	1.43	0.86	1.26
Mg/(Mg + Fe)	0.57	0.32	0.78	0.38	0.64
K/(K + Na)	0.32	0.11	0.40	0.28	0.35
Nor.Or	17.53	4.24	23.12	15.08	19.49
Nor.Ab	36.27	32.29	38.61	35.52	37.73
Nor.An	32.89	27.03	40.34	31.10	35.33
Nor.Q	0.00	0.00	3.34	0.00	0.00
Na + K	188.19	136.82	202.86	184.39	193.45
*Si	4.33	-11.61	38.26	-1.41	9.64
K-(Na + Ca)	-199.36	-257.38	-175.67	-228.68	-188.94
Fe + Mg + Ti	198.56	156.90	281.40	175.86	264.10
Al-(Na + K + 2Ca)	-69.72	%-102.66	104.06	-92.47	-61.49
(Na + K)/Ca	1.38	0.98	1.66	1.27	1.39
A/CNK	0.89	0.83	1.25	0.87	0.92

4 – Mutěnín Syenite

	mut-13	**mut-14**	**mut-15**
SiO_2	60.78	57.57	61.30
TiO_2	1.34	0.59	0.41
Al_2O_3	17.07	17.68	18.94
Fe_2O_3	0.71	2.33	1.29
FeO	6.44	6.52	3.69
MnO	0.11	0.17	0.09
MgO	2.18	0.65	0.72
CaO	4.04	4.11	1.56
Na_2O	3.57	3.80	3.87
K_2O	3.15	6.42	8.00
P_2O_5	0.61	0.14	0.13
Mg/(Mg + Fe)	0.35	0.12	0.21
K/(K + Na)	0.37	0.53	0.58
Nor.Or	20.19	39.08	48.49
Nor.Ab	34.75	35.16	35.63
Nor.An	17.35	20.03	7.07
Nor.Q	13.67	0.00	1.69
Na + K	181.99	259.04	294.58
*Si	107.21	11.50	26.87
K-(Na + Ca)	-120.22	-59.62	17.16
Fe + Mg + Ti	169.50	143.49	90.46
Al-(Na + K + 2Ca)	9.33	-58.35	21.59
(Na + K)/Ca	2.53	3.53	10.56
A/CNK	1.08	0.86	1.07

Pre-Variscan orthogneisses of the Moldanubian Zone

Moldanubian orthogneisses show a large compositional variation and chronological lag. Small granitic bodies located along shear zone boundary reveal transition from deformed granites with S-C fabric, through S-C orthogneiss and banded orthogneiss to ultramylonite.

The oldest preserved granitoids found so far in the Bohemian Massif are quartz-dioritic, tonalitic and granitic orthogneisses in the Moldanubian Zone. Dating points to intrusion ages of 2,060 ± 12 Ma to 2,104 ± Ma for these rocks (the Světlík Gneiss). The Dobra Gneiss, exhibits an emplacement age of 1,377 ± 10 Ma and the protolith of the Gföhl Gneiss has been dated at 480 Ma.

Lower Ordovician metagranites (~ 485–475 Ma) was recognized by Teipel et al. (2004) in the NW part of the Moldanubian Zone (the Bayerischer Wald).

According to Breiter et al. (2005) two principal types of lower Palaeozoic orthogneisses can be distinguished in the northeastern part of the Moldanubicum:

Biotite orthogneisses are distributed in the other part of the area (e.g. the Pacov, Želiv, Kácov, Vlastějovice, Římovice Orthogneisses), whereas leucocratic two-mica and muscovite-tourmaline orthogneisses (e.g. Choustník, Mladá Vožice, Blaník, Keblov, Přibyslavice, Leština Orthogneisses) form a SW-NE trending belt penetrating the entire area.

The composition of their protolith fluctuates from highly fractionated alkali-feldspar granite to quartz diorite.

Moldanubian orthogneissess differ in their shapes and sizes and often crop out in the vicinity of the major tectono-stratigrafic boundaries. They are named according to their localities: e.g. Popovice Gneiss, Uhelná Příbram Gneiss, Bílec Gneiss, Kollmitz Gneiss, Dobra Gneiss, Weiterndorf Gneiss (metagranite), Streiwiesen Gneiss (metagranite), Čavyně Orthogneiss.

Moldanubian orthogneisses typology (according to Suk 1969):

1. *Biotite-hornblende orthogneisses* (Světlík type).
2. *Migmatitic orthogneisses* – migmatites of the orthogneiss habit. They are represented by the Gföhl, Nové Hrady, Podolsko, and Popovice Gneisses.
3. *Biotite ± amphibole orthogneisses* with garnet and sillimanite represented by the Bechyně, Stráž, and the Pacov Orthogneisses.
4. *Muscovite-biotite orthogneisses and granite-gneisses (Blaník type)* represented by the Blaník, Choustník, Přibyslavice, Vlastějovice, Hluboká, and Radonice Orthogneisses.
5. *Dyke-like granites with orthogneissic fabric* are described from the eastern exocontact of the Central Bohemian Pluton and apophyses of the Moldanubian Composite Batholith.

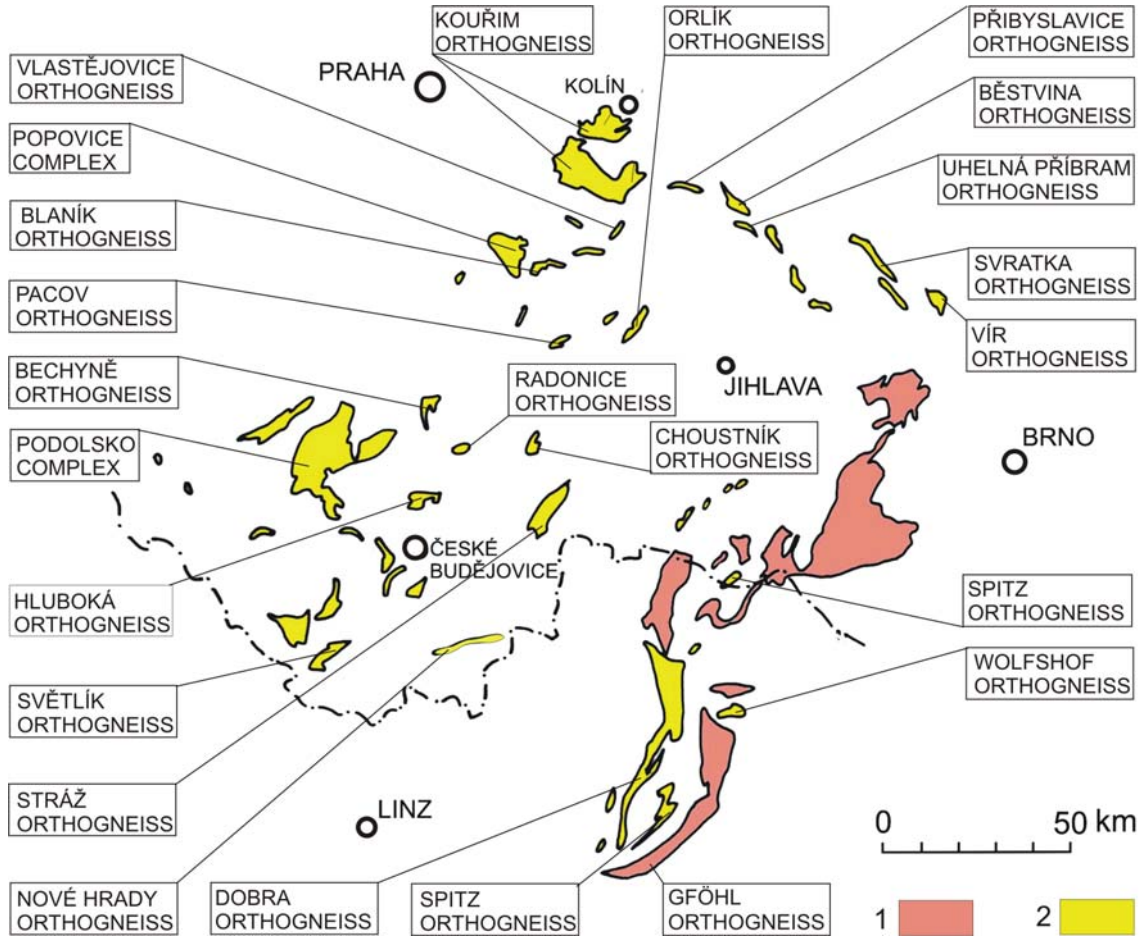

Fig. 2.124. *Metamorphosed granitoids (orthogneisses) in the Moldanubian Zone (adapted after Suk 1969). 1 – Gföhl Orthogneiss, 2 – biotite-hornblende and muscovite-biotite orthogneisses.*

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2.5.1. DOBRA ORTHOGNEISS

Regional position: the base of the Varied or Drosendorf Unit of the Moldanubian Zone.

Rock types:

1. *Braunegg Orthogneiss* – homogenous fine- to coarse-grained leucocratic biotite granitic orthogneiss.
2. *Dobra Orthogneiss* – homogenous fine- to coarse-grained melanocratic biotite granodiorite-tonalite orthogneiss (I-type).

Size and shape (in erosion level): 350 km^2 (60 × 6 km), a series of concordant and semi-concordant sills, the Braunegg Gneiss forms discordant stocks within the melanocratic Dobra Gneiss.

Age and isotopic data: *Dobra Gneiss:* 1,377 ± 10 Ma (U-Pb zircon), 480 Ma (Sm-Nd). The Dobra Gneiss originated from a granitic protolith with an age of ca. 1.38 Ga, which experienced high-grade metamorphism/anatexis at ca 600 Ma.

Geological environment: located at the tectonic boundary between the Drosendorf and Ostrong Unit.

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2.5.2. SPITZ ORTHOGNEISS

Regional position: Proterozoic basement within the Moldanubian nappe complex.

Rock types: *Spitz Orthogneiss* – leucocratic, fine- to medium-grained ± amphibole-biotite granodiorite to quartz diorite orthogneiss.

Size and shape (in erosion level): 120 km^2 – two long concordant strongly deformed sills.

Age and isotopic data: 620 Ma (Pb-Pb zircon), 614 ± 10 Ma (U-Pb zircon), 651 ± 16 Ma (U-Pb zircon), 620 Ma (SHRIMP U-Pb zircon).

Geological environment: structurally conformable or semi-conformable in sillimanite-biotite paragneisses of the Monotonous Group.

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2.5.3. GFÖHL ORTHOGNEISS

Regional position: a part of the Gföhl Unit forms several concordant strongly deformed sheets in the southeastern part of the Moldanubian Zone. Similar types of orthogneisses are reported from the Podolsko Complex, Popovice Complex, Rokytná migmatitic complex, and Jindřichův Hradec area.

They originated from different source rocks and by different ways: a) by migmatitization of paragneisses, connected with import of granitic components, b) by migmatic mobilization of

rocks – granulites, orthogneisses and feldspar-rich sediments (mostly tuffites), and/or texturally modified by local mylonitization during the consolidation of late tectonic (Variscan) granitoids. Some of the Gföhl Gneisses have a distinct tectonostratigraphic position.

Rock types: *Gföhl Orthogneiss* – several varieties of polyphase, migmatitic to anatectic (hybrid), mostly leucocratic S-type granite-gneiss showing stromatitic layering.

Central Gneiss – hybrid medium-grained biotite orthogneiss.

Size and shape (in erosion level): 1,500 km^2, a set of the concordant and semi-concordant sheets located along the eastern margin of the Moldanubicum over the distance of 180 km.

Age and isotopic data: 480 Ma (Pb-Pb zircon), 340 Ma (Sm-Nd), 482 ± 6 Ma (SHRIMP U-Pb zircon), 480–600 Ma (Pb-Pb zircon).

Geological environment: structurally conformable or semi-conformable sheets in tectonic contacts with granulites and sillimanite-biotite paragneisses. of the Monotonous and Varied Groups.

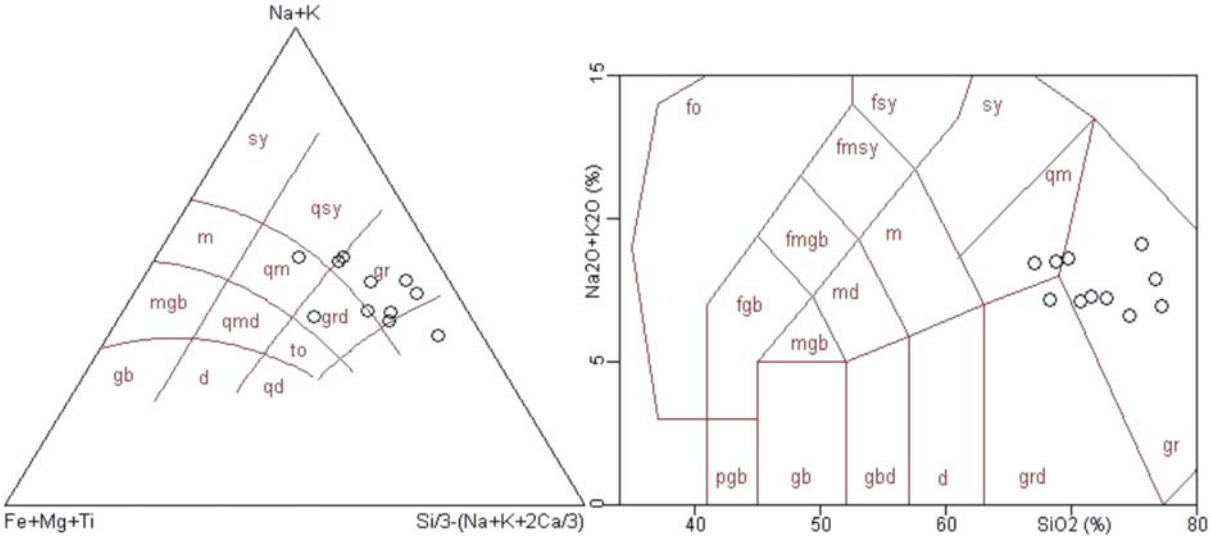

Fig. 2.125. *Gföhl Orthogneiss ABQ and TAS diagrams.*

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2.5.4. STRÁŽ ORTHOGNEISS

Regional position: discontinuous belt of isolated bodies in the Monotonous Group of the Moldanubian Zone.

Rock types: *Stráž Orthogneiss* – medium-grained biotite to amphibole-biotite orthogneiss (similar to the Mirotice Orthogneiss).

Size and shape (in erosion level): 85 km^2 (17 × 5 km), elongated body.

Age and isotopic data: 552 ± 11 Ma (Pb-Pb zircon).

Geological environment: structurally conformable or semi-conformable in sillimanite-biotite paragneisses of the Monotonous Group.

Contact aureole: intensive migmatitization of paragneisses at the exocontact (max. several tens of meters).

Zoning: compositional and textural zonation – fine-grained tonalitic orthogneiss in the marginal zone and porphyroclastic coarse-grained orthogneiss to metagranodiorite in the centre.

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2.5.5. HLUBOKÁ ORTHOGNEISS

Regional position: Monotonous Group of the Moldanubian Zone.

Rock types:

1. *Hluboká Orthogneiss* – tourmaline-bearing muscovite-biotite alkali-feldspar orthogneiss (granite) – similar to the Blaník Orthogneiss and Přibyslavice Granite.
2. Dykes of muscovite-tourmaline granite.

Size and shape (in erosion level): 15 km^2 (7 × 2 km) in outcrop size, two sheet-like bodies.

Age and isotopic data: 508 ± 7 Ma (Pb-Pb zircon).

Geological environment: structurally conformable or semi-conformable in sillimanite-biotite paragneisses of the Monotonous Group.

Contact aureole: partly discordant contact, metamorphosed and deformed along with the country paragneisses.

Mineralization: with Rb contents ranging from 300 to 500 ppm, Sr from 10 to 40, and Sn from 10–40 ppm the rock is comparable with tin-bearing granites.

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Hluboká Orthogneiss

Quartz-rich, sodic, peraluminous, leucocratic granite

	1HL	**2HL**	**3HL**	**4HL**	**5HL**	**6HL**
SiO_2	74.23	74.05	72.93	71.98	76.40	75.33
TiO_2	0.07	0.15	0.23	0.16	0.09	0.08
Al_2O_3	14.18	13.94	14.21	15.04	12.40	14.33
Fe_2O_3	0.15	0.35	0.55	0.16	0.05	0.68
FeO	1.03	0.58	0.97	1.33	1.75	0.02
MnO	0.02	0.34	0.44	0.02	0.03	0.04
MgO	0.06	0.12	0.32	0.27	0.10	0.10
CaO	0.29	0.43	0.51	0.51	0.31	0.37
Na_2O	3.96	3.81	3.49	3.73	2.85	4.23
K_2O	3.83	4.41	4.48	4.97	4.85	3.87
P_2O_5	0.54	0.48	0.42	0.48	0.23	0.33
Li_2O	0.04	0.03	0.02	0.02	0.01	0.02
Mg/(Mg + Fe)	0.08	0.15	0.23	0.24	0.09	0.21
K/(K + Na)	0.39	0.43	0.46	0.47	0.53	0.38
Nor.Or	23.36	26.79	27.46	30.29	29.90	23.14
Nor.Ab	36.71	35.18	32.52	34.55	26.70	38.44
Nor.An	-2.19	-1.06	-0.25	-0.65	0.02	-0.34
Nor.Q	35.00	33.09	32.97	28.84	38.37	33.67
Na + K	209.11	216.58	207.74	225.89	194.94	218.67
*Si	199.26	189.12	190.80	167.38	225.22	194.85
K-(Na + Ca)	-51.64	-36.98	-26.59	-23.93	5.48	-60.93
Fe + Mg + Ti	18.59	17.32	31.22	29.23	28.61	12.28
Al-(Na + K + 2Ca)	59.02	41.84	53.12	51.28	37.51	49.55
(Na + K)/Ca	40.44	28.25	22.84	24.84	35.27	33.14
A/CNK	1.35	1.24	1.29	1.27	1.21	1.25

Stráž Orthogneiss

Quartz-normal, sodic, peraluminous,
mesocratic granodiorite

	Stráž X
SiO_2	66.65
TiO_2	0.51
Al_2O_3	16.05
Fe_2O_3	n.d.
FeO	4.25
MnO	0.06
MgO	1.70
CaO	3.41
Na_2O	3.36
K_2O	2.64
P_2O_5	0.05
Mg/(Mg + Fe)	0.41
K/(K + Na)	0.34
Nor.Or	16.85
Nor.Ab	32.60
Nor.An	17.95

Na + K	164.48
*Si	164.74
K-(Na + Ca)	-113.18
Fe + Mg + Ti	107.76
Al-(Na + K + 2Ca)	29.09
(Na + K)/Ca	2.70
Nor.Q	24.09
A/CNK	1.10

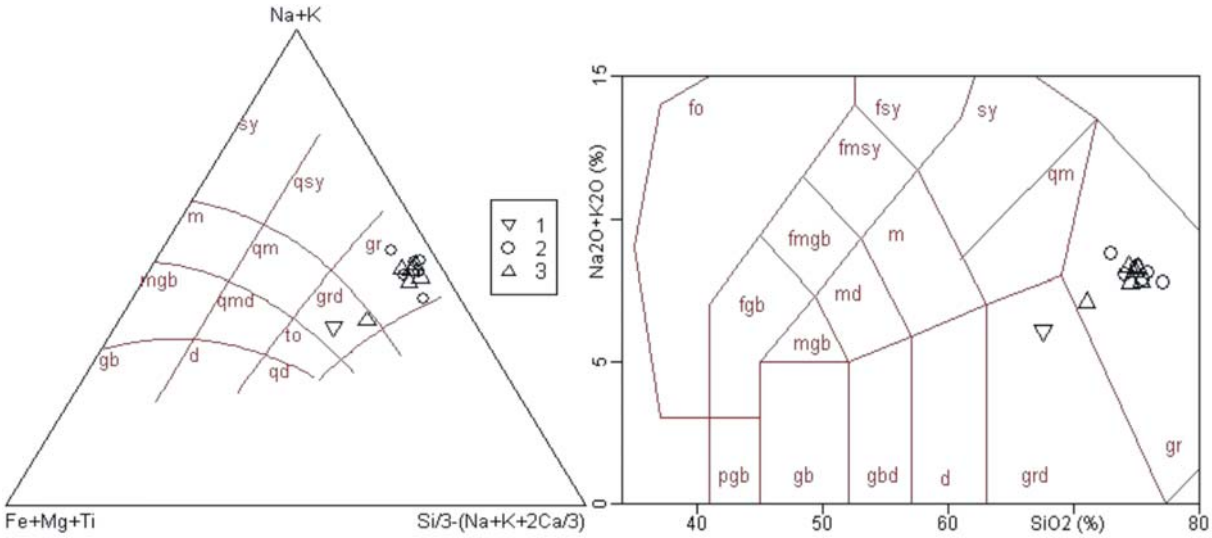

Fig. 2.126. *Moldanubian orthogneisses ABQ and TAS diagrams. 1 – Stráž Orthogneiss, 2 – Hluboká Orthogneiss, 3 – Radonice Orthogneiss.*

2.5.6. RADONICE ORTHOGNEISS

Regional position: Monotonous Group of the Moldanubian Zone.

Rock types: *Radonice Orthogneiss* – tourmaline-bearing muscovite-biotite alkali-feldspar orthogneiss (granite).

Size and shape (in erosion level): 7–8 km^2, oval shape.

Geological environment: structurally conformable or semi-conformable in sillimanite-biotite paragneisses of the Monotonous Group.

Contact aureole: contact orthogneiss is enriched by biotite and sillimanite at the endocontact (in width of several tens of meters).

Radonice Orthogneiss

Quartz-rich, sodic, peraluminous, mesocratic granite

	1RadA
SiO_2	74.11
TiO_2	0.10
Al_2O_3	14.38
Fe_2O_3	1.31
FeO	0.29
MnO	0.03
MgO	0.33
CaO	0.74
Na_2O	3.54
K_2O	4.19
P_2O_5	0.40
Mg/(Mg+Fe)	0.28

K/(K+Na)	0.44
Nor.Or	25.30
Nor.Ab	32.48
Nor.An	1.06
Nor.Q	34.59
Na+K	203.20
*Si	199.15
K-(Na+Ca)	-38.47
Fe+Mg+Ti	29.89
Al-(Na+K+2Ca)	52.80
(Na+K)/Ca	15.40
A/CNK	1.28

2.5.7. BECHYNĚ ORTHOGNEISS

Regional position: Monotonous Group of the Moldanubian Zone

Rock types: *Bechyně Orthogneiss –*

1. relict two-mica alkali-feldspar leucogranite (mobilisate),
2. muscovite-biotite orthogneiss (diatexite),
3. biotite orthogneiss (metatexite).

Size and shape (in erosion level): 20 km^2 (10 × 2 km), elongated slab – with thickness of about 1 km. Dipping under shallow angle toward the west.

Age and isotopic data: 550 Ma (Rb-Sr whole rock), 383–641 Ma (U-Pb zircon), 331 ± 5 Ma (Rb-Sr muscovite).

Geological environment: structurally conformable or semi-conformable in sillimanite-biotite paragneisses of the Monotonous Group.

Contact aureole: sharp western contact, and transitional eastern contact. Sharp intrusive contact of the leucogranite and orthogneiss (diatexite).

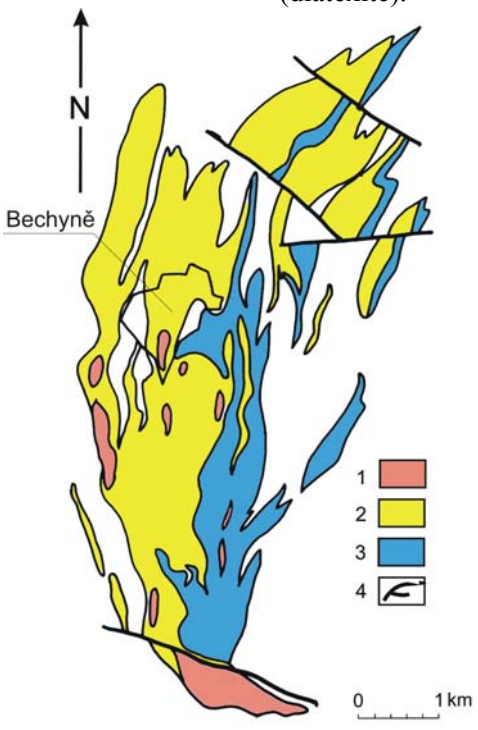

Fig. 2.127. *Bechyně Orthogneiss geological sketch - map (adapted after Fediuk 1976). 1 – alkali-feldspar granite (mobilisate), 2 – muscovite-biotite orthogneiss (diatexite), 3 – biotite orthogneiss (metatexite), 4 – faults.*

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FEDIUK, F. (1976): The Bechyně "orthogneiss": An anatectic type of Moldanubian orthogneissoids. – Acta Univ. Carol., Geol. 3, 187–207.

Bechyně Orthogneiss

Quartz-normal, sodic, peraluminous, leucocratic granite

n = 9	Med.	Min	Max	QU1	QU3
SiO_2	72.40	69.92	74.65	71.74	73.61
TiO_2	0.16	0.09	0.38	0.15	0.18
Al_2O_3	14.56	13.32	15.69	13.71	14.86
Fe_2O_3	0.27	0.21	0.72	0.23	0.46
FeO	1.36	0.58	2.16	1.12	1.44
MnO	0.04	0.02	0.07	0.03	0.05
MgO	0.35	0.21	1.20	0.33	0.48
CaO	1.37	0.65	1.82	0.86	1.57
Na_2O	n.d.	0.00	0.01	0.00	0.01
K_2O	3.73	3.11	4.33	3.39	3.83
P_2O_5	4.08	3.64	4.82	3.99	4.22
SiO_2	0.15	0.07	0.35	0.11	0.25
Mg/(Mg + Fe)	0.28	0.24	0.43	0.28	0.35
K/(K + Na)	0.43	0.38	0.45	0.41	0.44
Nor.Or	25.24	22.58	29.18	24.23	25.97
Nor.Ab	34.67	29.32	39.95	31.85	35.34
Nor.An	6.35	0.95	7.82	3.36	7.26
Nor.Q	30.15	24.16	37.60	29.00	32.05
Na + K	208.31	177.64	226.14	196.02	218.37
*Si	180.62	148.49	215.44	175.51	193.41
K-(Na + Ca)	-54.13	-81.31	-36.14	-64.55	-42.12
Fe + Mg + Ti	32.52	19.11	73.64	32.00	37.75
Al-(Na + K + 2Ca)	35.69	-12.26	65.57	6.99	63.71
(Na + K)/Ca	8.13	5.47	16.41	8.08	14.66
A/CNK	1.14	0.97	1.35	1.04	1.30

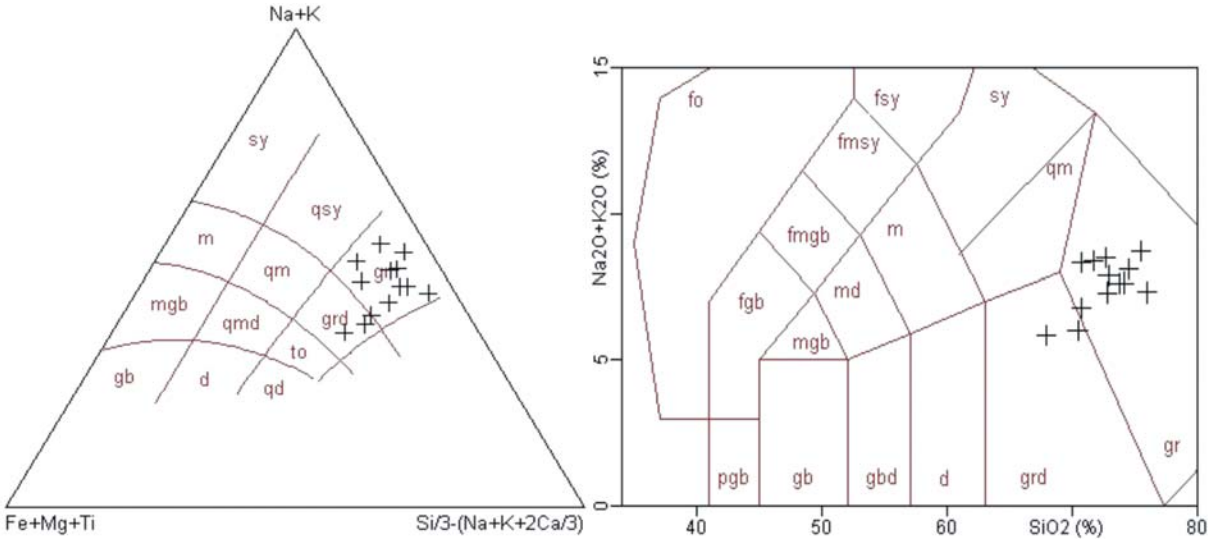

Fig. 2.128. *Bechyně Orthogneiss ABQ and TAS diagrams.*

2.5.8. NOVÉ HRADY ORTHOGNEISS

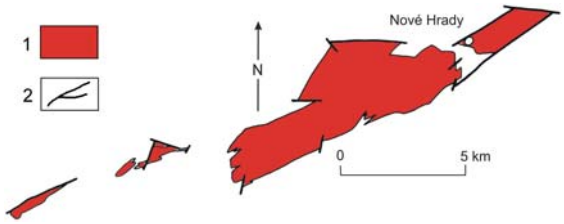

Fig. 2.129. *Nové Hrady Orthogneiss geological sketch-map (adapted after the geological map 1 : 50,000). 1 – biotite metagranite, 2 – faults.*

Regional position: the Drosendorf Unit of the Moldanubian Zone

Rock types: 1. *Nové Hrady Orthogneiss* – ± porphyroblastic fine-grained biotite orthogneiss with muscovite (originally biotite granite to quartz diorite).

2. *Nové Hrady Metagranite* – porphyroblastic medium-grained muscovite-biotite relict metagranite.

Size and shape (in erosion level): 30 km^2 (22 × 1 km), a thin and elongated tectonized slab.

Age and isotopic data: 459 ± 10 Ma (Rb-Sr whole rock).

Geological environment: structurally conformable or semi-conformable in sillimanite-biotite paragneisses of the Drosendorf Unit.

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Nové Hrady Orthogneiss

Quartz-rich, sodic, peraluminous, mesocratic granite to granodiorite

	1911N	2NHA	4NHA	10NH
SiO_2	70.58	72.61	72.11	65.44
TiO_2	0.33	0.19	0.18	0.58
Al_2O_3	14.32	15.26	15.29	16.68
Fe_2O_3	0.83	0.66	0.52	0.43
FeO	2.48	1.28	1.51	3.79
MnO	0.03	0.04	0.03	0.08
MgO	0.69	0.47	0.48	1.59
CaO	2.33	1.72	1.67	3.80
Na_2O	3.62	3.52	3.48	3.52
K_2O	3.32	4.09	4.20	2.20
P_2O_5	0.13	0.11	0.15	0.15
Li_2O	n.d.	0.01	0.01	0.01
Mg/(Mg + Fe)	0.27	0.30	0.30	0.40
K/(K + Na)	0.38	0.43	0.44	0.29
Nor.Or	20.61	24.70	25.51	13.99
Nor.Ab	34.15	32.31	32.12	34.02
Nor.An	11.24	7.98	7.50	19.23
Nor.Q	28.83	30.01	29.49	23.74
Na + K	187.31	200.43	201.47	160.30
*Si	176.56	181.95	178.72	157.57
K-(Na + Ca)	-87.87	-57.42	-52.90	%-134.64
Fe + Mg + Ti	66.19	40.14	41.71	104.89

Al-(Na + K + 2Ca)	10.81	37.90	39.23	31.74
(Na + K)/Ca	4.51	6.53	6.77	2.37
A/CNK	1.05	1.16	1.17	1.12

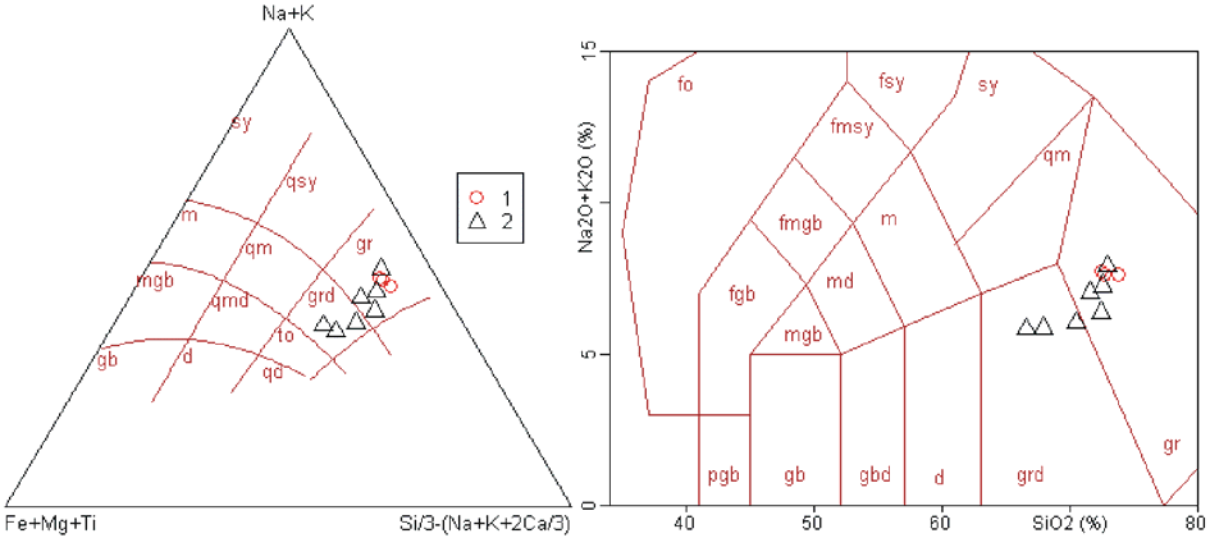

***Fig. 2.130**. Nové Hrady Orthogneiss ABQ and TAS diagrams. 1 –two-mica metagranites, 2 – biotite orthogneiss.*

2.5.9. SVĚTLÍK ORTHOGNEISS

Regional position: The Drosendorf Unit of the Moldanubian Zone.

Rock types: *Světlík Orthogneiss:*

1. medium-grained biotite to hornblende-biotite orthogneiss to metagranite,
2. fine-grained amphibole-biotite quartz dioritic orthogneiss (metadacite),
3. foliated garnet-tourmaline alkali-feldspar granite to pegmatite.

Size and shape (in erosion level): 20 km^2 (10 × 2 km), lens-shaped body.

Age and isotopic data: 2,110 ± 58 Ma, 2,104 ± 1 Ma (U-Pb zircon).

Geological environment: located at the tectonic boundary between the Drosendorf and Ostrong Unit. Structurally conformable or semi-conformable in sillimanite-biotite paragneisses of the Varied Group.

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Světlík Orthogneiss

Quartz-normal, sodic, peraluminous, leucocratic granite

	1svA	**2sv**	**3svB**	**4svB**	**5svA**	**6svC**
SiO_2	76.02	74.48	74.15	74.11	73.91	73.69
TiO_2	0.16	0.02	0.03	0.05	0.09	0.00
Al_2O_3	12.96	14.09	14.29	14.15	14.91	14.85
Fe_2O_3	0.32	0.02	0.14	0.26	0.04	0.00
FeO	0.49	0.57	0.32	0.24	0.39	0.48

MnO	0.03	0.33	0.14	0.03	0.02	0.08
MgO	0.22	0.05	0.06	0.10	0.15	0.04
CaO	1.09	0.23	0.32	0.39	1.08	1.12
Li_2O	n.d.	n.d.	n.d.	n.d.	n.d.	0.01
Na_2O	3.22	4.71	4.59	4.40	4.79	4.80
K_2O	4.36	4.26	4.40	4.79	3.69	4.10
P_2O_5	0.04	0.25	0.59	0.33	0.13	0.01
Mg/(Mg + Fe)	0.33	0.09	0.15	0.26	0.37	0.11
K/(K + Na)	0.47	0.37	0.39	0.42	0.34	0.36
Nor.Or	26.51	25.59	26.34	28.69	22.01	24.45
Nor.Ab	29.75	43.00	41.75	40.05	43.42	43.50
Nor.An	5.29	-0.52	-2.33	-0.24	4.54	5.54
Nor.Q	36.09	28.43	29.28	28.30	27.58	25.41
Na + K	196.48	242.44	241.54	243.69	232.92	241.95
*Si	212.30	168.03	166.03	162.82	164.28	153.56
K-(Na + Ca)	-30.77	-65.64	-60.40	-47.24	-95.48	-87.81
Fe + Mg + Ti	18.30	9.68	8.08	9.71	10.78	7.80
Al-(Na + K + 2Ca)	19.15	26.06	27.67	20.28	21.37	9.73
(Na + K)/Ca	10.11	59.11	42.33	35.04	12.09	12.11
A/CNK	1.08	1.13	1.17	1.11	1.09	1.03

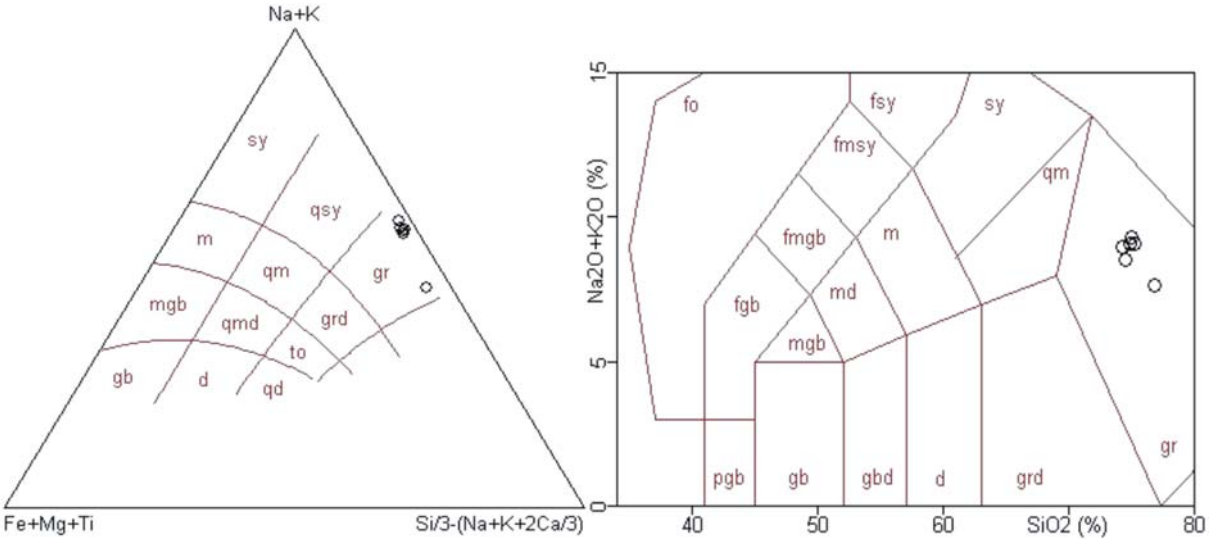

Fig. 2.131. *Moldanubian orthogneisses ABQ and TAS diagrams. 1 – Světlík Orthogneiss.*

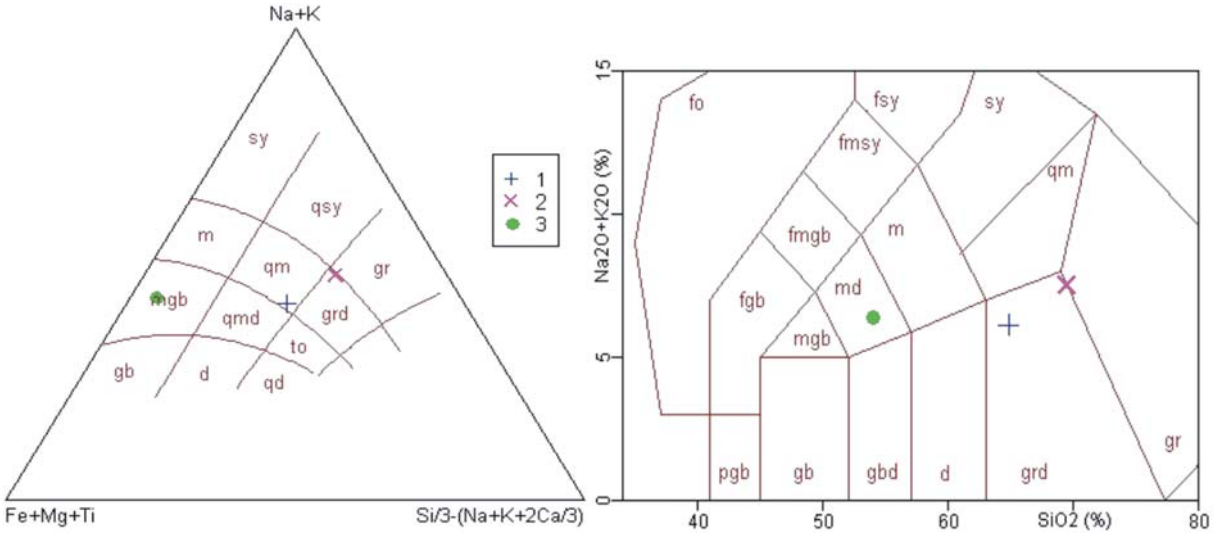

Fig. 2.132. *Moldanubian orthogneisses ABQ and TAS diagrams – Světlík Foliated Gneisses: 1 – Světlík Metatonalite, 2 – metagranodiorite, 3 – metaquartz diorite.*

Světlík Foliated Orthogneiss

	AA-2	AA-17	AA-20
	metatonalite	**metagranodiorite**	**quartz metadiorite**
SiO_2	64.83	69.09	53.10
TiO_2	0.62	0.37	1.07
Al_2O_3	15.91	14.62	17.37
Fe_2O_3	1.79	1.33	8.33
FeO	2.89	1.61	n.d.
MnO	0.11	0.06	0.13
MgO	2.51	1.53	4.61
CaO	5.00	3.06	7.08
Na_2O	4.50	4.20	4.98
K_2O	1.63	3.27	1.28
P_2O_5	0.23	0.19	0.46
Mg/(Mg + Fe)	0.49	0.49	0.52
K/(K + Na)	0.19	0.34	0.14
Nor.Or	10.10	20.03	8.10
Nor.Ab	42.39	39.09	47.87
Nor.An	24.44	14.44	34.36
Nor.Q	16.76	22.30	0.00
Na + K	179.82	204.96	187.88
*Si	120.40	141.96	22.54
K-(Na + Ca)	-199.76	-120.67	-259.78
Fe + Mg + Ti	132.72	81.68	232.16
Al-(Na + K + 2Ca)	-45.70	-26.99	-99.27
(Na + K)/Ca	2.02	3.76	1.49
A/CNK	0.88	0.93	0.79

2.5.10. BLANÍK ORTHOGNEISS

Regional position: The Drosendorf Unit of the Moldanubian Zone.

Rock types: *Blaník Orthogneiss* – leucocratic tourmaline-bearing two-mica alkali feldspar orthogneiss passing into metagranite.

Size and shape (in erosion level): 8 km^2, a slab 20 km long and about 100 to 1,000 m thick.

Age and isotopic data: 470 Ma (Rb-Sr whole rock).

Geological environment: structurally conformable or semi-conformable in sillimanite-biotite paragneisses of the Drosendorf Unit.

Contact aureole: tourmalinization at the endo-contact.

Mineralization: weak greisenization with Sn indices, pegmatite, uranium micas.

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Blaník Orthogneiss

Quartz-poor, sodic, peraluminous, leucocratic granite

	1 805BLA	**1806BLA**
SiO_2	72.23	72.60
TiO_2	n.d.	0.22
Al_2O_3	15.87	14.13
Fe_2O_3	0.68	0.41
FeO	0.87	0.96
MnO	0.06	0.11
MgO	0.75	0.88
CaO	1.14	0.72
Na_2O	3.98	4.38
K_2O	4.22	5.06
P_2O_5	0.18	n.d.
Mg/(Mg + Fe)	0.46	0.52
K/(K + Na)	0.41	0.43
Nor.Or	25.35	30.51
Nor.Ab	36.33	40.14
Nor.An	4.54	3.65
Nor.Q	27.64	23.00
Na + K	218.03	248.78
*Si	169.13	145.43
K-(Na + Ca)	-59.16	-46.74
Fe + Mg + Ti	39.24	43.10

Al-(Na + K + 2Ca)	52.96	3.03
(Na + K)/Ca	10.73	19.38
A/CNK	1.22	1.01

2.5.11. CHOUSTNÍK ORTHOGNEISS

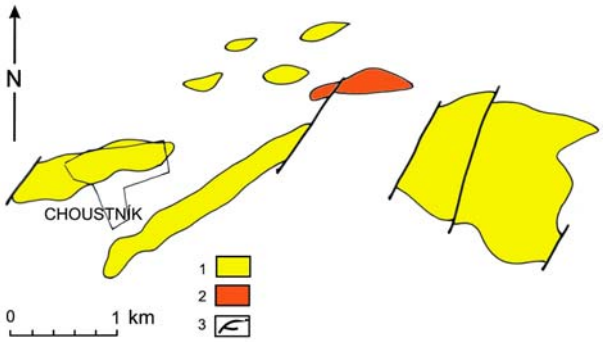

Fig. 2.133. *Choustník Orthogneiss geological sketch-map (adapted after Zikmund 1983). 1 – porphyroblastic two-mica orthogneiss, 2 –Relict metagranite, 3 – faults.*

Regional position: The Blaník type of orthogneiss within the Monotonous Group of the Moldanubian Zone.

Rock types:

1. *Choustník Orthogneiss* – porphyroblastic muscovite-biotite orthogneiss with tourmaline (Blaník type).
2. *Relict Metagranite* – coarse-grained biotite-muscovite (leucocratic to normal) alkali-feldspar metagranite.

Size and shape (in erosion level): 18 km^2 (6 × 3 km), several concordant lens-shaped, tectonized bodies and sills with sharp contact (up to 90 m thick).The Choustnik orthogneiss body has an approximately plate flat "undulated shape and dips gently to NW-N with an approximate angle of 15^o in concert with its interpretation as a klippe of the tectonically dismembered original batholith emplaced during thrust tectonics. The original thickness should be at least several kilometers.

Age and isotopic data: 459 ± 10 Ma (Rb-Sr whole rock).

Geological environment: structurally conformable or semi-conformable in sillimanite-biotite paragneisses of the Monotonous Group.

Choustník Orthogneiss

Quartz-rich, sodic-potassic, peraluminous, leucocratic granite

n = 8	Med.	Min	Max	QU1	QU3
SiO_2	74.03	73.01	78.17	73.53	75.38
TiO_2	0.23	0.09	0.34	0.13	0.28
Al_2O_3	12.88	11.22	13.64	11.25	13.60
Fe_2O_3	0.24	0.09	0.48	0.12	0.46
FeO	1.33	1.15	1.65	1.19	1.44
MnO	0.03	0.03	0.04	0.03	0.04
MgO	0.38	0.18	0.59	0.24	0.53
CaO	0.56	0.36	0.68	0.40	0.63
Na_2O	2.70	2.42	3.26	2.44	3.24
K_2O	4.38	3.85	5.32	3.99	4.58
P_2O_5	0.26	0.15	0.33	0.17	0.29
Li_2O	0.01	0.00	0.02	0.01	0.01
Mg/(Mg + Fe)	0.30	0.20	0.36	0.22	0.33
K/(K + Na)	0.49	0.45	0.56	0.48	0.54
Nor.Or	27.33	24.09	33.05	24.61	28.37
Nor.Ab	25.49	22.88	30.70	23.14	30.16
Nor.An	1.07	0.01	2.02	0.64	1.30
Nor.Q	35.91	33.77	44.78	33.94	43.29
Na + K	189.92	165.32	203.28	168.75	200.08
*Si	209.80	197.95	259.80	199.95	246.21
K-(Na + Ca)	-12.24	-31.72	15.31	-20.08	4.90
Fe + Mg + Ti	34.59	23.29	45.69	27.73	42.64

Al-(Na + K + 2Ca)	46.60	26.24	61.55	34.34	47.81
(Na + K)/Ca	17.02	16.56	31.67	16.70	22.01
A/CNK	1.25	1.14	1.39	1.21	1.26

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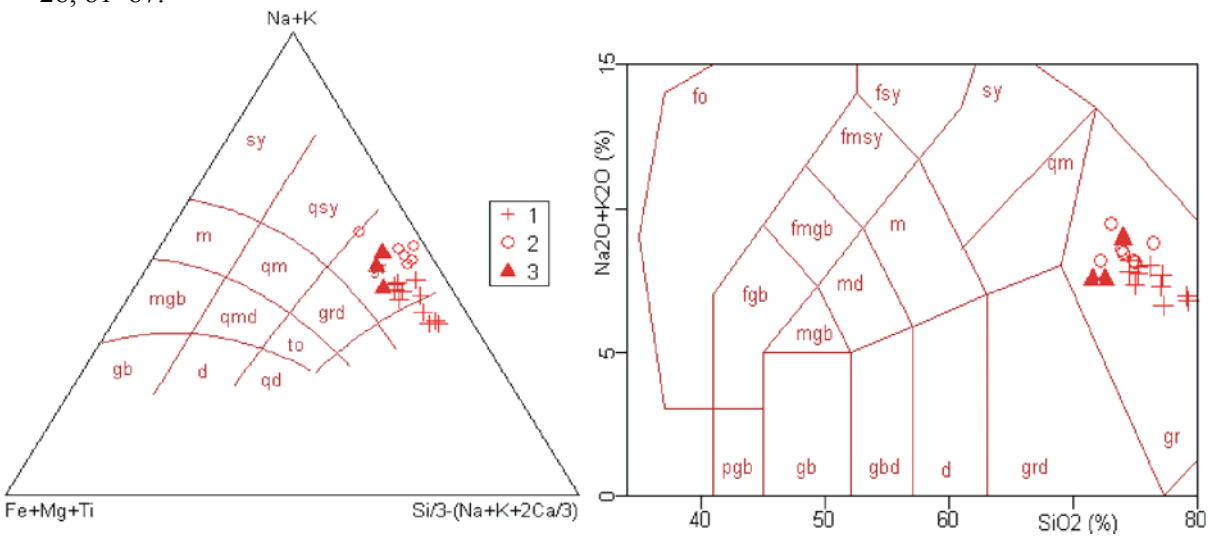

Fig. 2.134. *Moldanubian orthogneisses ABQ and TAS diagrams. 1 – Choustník Orthogneiss, 2 – Blaník Orthogneiss, 3 – Pacov Orthogneiss.*

2.5.12. PACOV ORTHOGNEISS

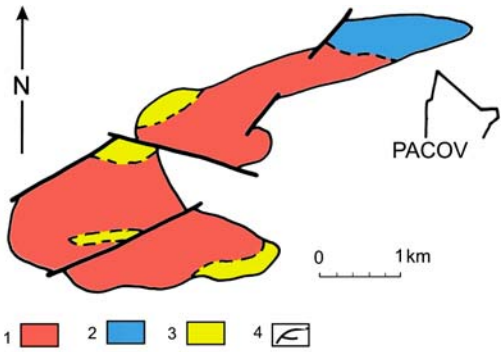

Fig. 2.135. *Pacov Orthogneiss geological sketch-map. 1 – muscovite-biotite orthogneiss, 2 – biotite orthogneiss with sillimanite, 3 – porphyroblastic orthogneiss, 4 – faults.*

Regional position: at the boundary between the Monotonous and Varied Groups of the Moldanubian Zone.

Rock types: *Pacov Orthogneiss –*

1. muscovite-biotite orthogneiss,
2. biotite orthogneiss with sillimanite,
3. porphyroblastic orthogneiss.

Size and shape (in erosion level): (7 × 3 km) folded and tectonically segmented lenses-like body with antiform structure.

Age and isotopic data: Cadomian?

Geological environment: structurally conformable or semi-conformable (transitional) in sillimanite-biotite paragneisses of the Monotonous Group.

Zoning: concentric metamorphic antiform structure

Mineralization: spatially associated with metamorphosed greisens.

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Pacov Orthogneiss

Quartz-normal, sodic, peraluminous, mesocratic granite

	1807PAC	**1808PAC**	**1810PAC**
SiO_2	71.33	73.50	71.45
TiO_2	0.26	0.26	0.14
Al_2O_3	16.01	13.37	14.75
Fe_2O_3	0.57	0.85	0.46
FeO	1.50	1.05	2.13
MnO	0.01	n.d.	0.07
MgO	0.54	0.25	0.55
CaO	1.76	0.90	1.32
Na_2O	4.30	3.39	3.20
K_2O	3.20	5.50	4.23
P_2O_5	0.21	0.20	0.22
Mg/(Mg + Fe)	0.32	0.20	0.27
K/(K + Na)	0.33	0.52	0.47
Nor.Or	19.30	33.30	26.25
Nor.Ab	39.42	31.19	30.18
Nor.An	7.50	3.22	5.36
Nor.Q	27.65	29.08	31.19
Na + K	206.70	226.17	193.08
*Si	168.10	170.89	187.62
K-(Na + Ca)	-102.20	-8.66	-36.99
Fe + Mg + Ti	44.69	34.73	50.83
Al-(Na + K + 2Ca)	44.93	4.29	49.51
(Na + K)/Ca	6.59	14.09	8.20
A/CNK	1.19	1.03	1.23

2.5.13. PŘIBYSLAVICE ORTHOGNEISS

Regional position: the orthogneiss-granite-pegmatite complex at the Drosendorf Unit of the Moldanubian Zone.

Rock types:

1. *Přibyslavice Orthogneiss* (metagranite) – tourmaline-muscovite and two-mica-tourmaline orthogneiss.
2. *Přibyslavice Granite* – muscovite-tourmaline alkali-feldspar granite.
3. *Pegmatite* – aplite-pegmatite dyke.

Size and shape (in erosion level): E-W elongated outcrop (~ 3 km^2), tectonically divided into three segments by two NNE-SSW trending faults.

Age and isotopic data: pre-Variscan (?) intrusion of the leucocratic muscovite-tourmaline granite later metamorphosed into the metagranite and orthogneiss. This rock is intruded by a stock of the muscovite granite (~ 50 m in diameter) and cut by highly evolved Li-bearing pegmatite. No isotopic data.

Geological environment: structurally conformable or semi-conformable in sillimanite-biotite and two-mica paragneisses of the Monotonous Group.

Contact aureole: A sharp zone (a few meters thick) showing gradual decrease of dark minerals (particularly biotite) and an increase

of felsic minerals (feldspathization and migmatitization) closer to the granite body.

Zoning: The percentage of tourmaline decreases and the intensity of deformation expressed by development of the foliation increases towards the contacts with the country rock.

Mineralization: cassiterite mineralization.

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Přibyslavice Orthogneiss (Metagranite)

Quartz-rich, sodic, (strongly) peraluminous leucocratic, S-type, granite

n = 14	**Med.**	**Min**	**Max**	**QU1**	**QU3**
SiO_2	72.80	67.05	75.27	71.95	73.20
TiO_2	0.03	0.02	0.26	0.02	0.04
Al_2O_3	14.85	13.55	16.03	14.70	15.13
Fe_2O_3	0.21	0.00	1.69	0.01	0.32
FeO	0.66	0.37	1.29	0.51	0.75
MnO	0.04	0.02	0.23	0.03	0.06
MgO	0.01	0.00	0.06	0.00	0.03
CaO	0.32	0.23	2.26	0.26	0.50
Na_2O	4.14	2.75	4.51	3.80	4.21
K_2O	4.00	2.81	4.40	3.91	4.05
P_2O_5	0.50	0.04	1.23	0.47	0.76
Mg/(Mg + Fe)	0.02	0.00	0.09	0.00	0.05
K/(K + Na)	0.39	0.31	0.48	0.38	0.41
Nor.Or	24.41	17.53	26.70	23.60	24.76
Nor.Ab	38.20	26.36	41.76	35.74	38.87
Nor.An	-1.68	-4.38	3.31	-2.26	-1.48
Nor.Q	32.43	27.84	38.81	30.81	34.88
Na + K	216.52	171.76	233.84	199.49	221.85
*Si	182.16	157.97	217.01	171.29	193.73
K-(Na + Ca)	-57.05	-86.59	-32.31	-64.10	-52.40
Fe + Mg + Ti	13.35	6.24	43.14	9.34	14.21
Al-(Na + K + 2Ca)	57.21	38.02	98.23	49.67	70.25
(Na + K)/Ca	36.07	4.26	54.23	22.37	40.98
A/CNK	1.35	1.26	1.58	1.28	1.38

Muscovite Granite – **Au** 0.05, **B** 94, **Ba** 10, **Co** 1.0, **Cs** 23, **Cu** 22, **Hf** 1.9, **Li** 175, **Rb** 589, **Ni** 9.5, **Sc** 14, **Sr** 317, **Ta** 10, **Th** 1.0, **U** 20, **Zn** 51, **Zr** 18, **La** 2.1, **Ce** 4.2, **Sm** 1.2, **Eu** 0.1**, Tb** 1.0, **Yb** 1, **Lu** 0.2 (Povondra et al. 1987).

Tourmaline-muscovite Metagranite – **Au** 0.07, **B** 1257, **Ba** 10, **Co** 1.0, **Cs** 19, **Cu** 6**, Hf** 1.2, **Li** 257, **Rb** 469, **Ni** 12, **Sc** 15, **Sr** 38, **Ta** 2.4, **Th** 1.0, **U** 17.8, **Zn** 50, **Zr** 47, **La** 1.9, **Ce** 5.7, **Sm** 1.0, **Eu** 0.1, **Tb** 1.0, **Yb** 1, **Lu** 0.2 (Povondra et al. 1987).

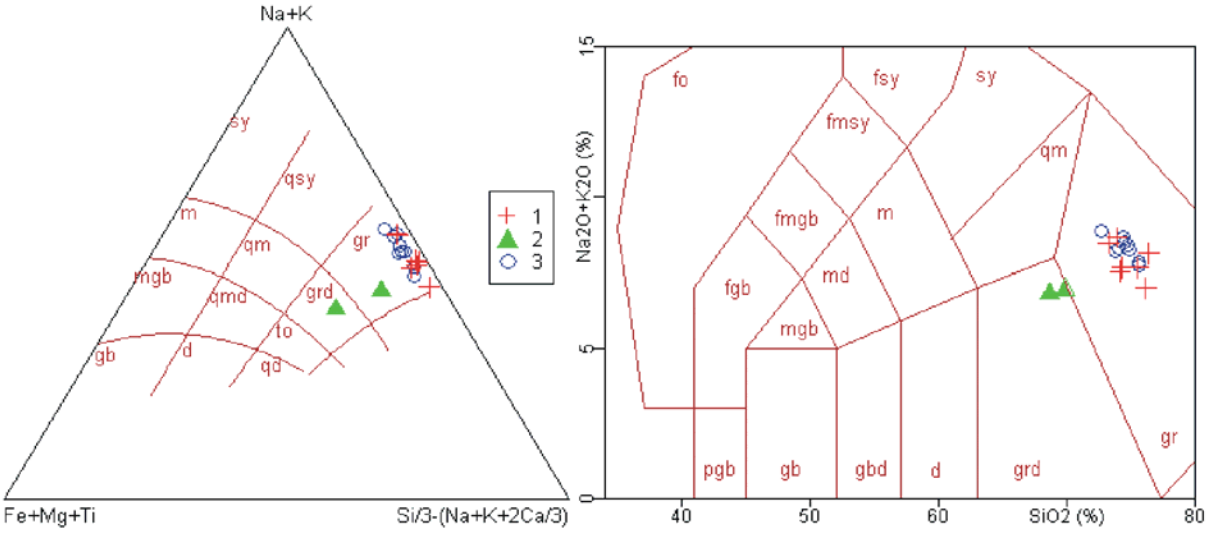

Fig. 2.136. *Přibyslavice Orthogneiss ABQ and TAS diagrams. 1 – muscovite-tourmaline metagranite, 2 – tourmaline muscovite orthogneiss, 3 – two-mica-tourmaline orthogneiss.*

2.5.14. KOUŘIM ORTHOGNEISS

Regional position: within the Kutná Hora Crystalline Complex.

Rock types: *Kouřim (Kaňk) Orthogneiss* – hybrid two-mica porphyroblastic orthogneiss (metamorphosed granites to volcanics).

Size and shape (in erosion level): a series of parallel sheets (tabular tectonized bodies) of total thickness of 1 to 1.5 km – 400 km^2 (25 × 15 km).

Age and isotopic data: Cadomian? No isotopic data.

Geological environment: Varied group of the Moldanubian Zone – numerous folded sills of hybrid orthogneisses in two-mica schists and gneisses.

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2.5.15. PODOLSKO ORTHOGNEISS (COMPLEX)

Regional position: the Drosendorf Unit of the Moldanubian Zone. Lithological and structural melange of granitized sediments and metamorphosed igneous rocks (the Podolsko Complex) near the contact of the Central Bohemian Pluton (CBCP), similar to the Gföhl Gneiss – migmatite of the orthogneiss habit.

Rock types:

1. *Semice Orthogneiss* – leucocratic ± migmatitic biotite and two-mica granitic orthogneiss.
2. *Podolsko Orthogneiss* – hornblende-biotite orthogneiss (metagraite).
3. *Garnetite* – pyrope, orthopyroxene and quartz – very high-pressure relic assemblage.
4. *Písek Granite* – leucocratic micrometagranite dyke swarm – vertical dykes with gneissic texture.

Size and shape (in erosion level): 600 km^2.

Age and isotopic data: *garnetite* 360 ± 10 Ma (U-Pb zircon), 355 ± 78 Ma (U-Pb zircon).

Geological environment: structurally conformable or semi-conformable in sillimanite-biotite paragneisses of the Drosendorf Unit.

Heat production (μWm^{-3}): *Podolsko Metagranite* 3.8.

References

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Podolsko Orthogneiss

Quartz-rich, sodic, peraluminous (moderately), leucocratic, S-type, M-series, granite

n = 12	Med.	Min	Max	QU1	QU3
SiO_2	73.23	70.13	77.03	71.68	75.73
TiO_2	0.13	0.00	0.32	0.01	0.21
Al_2O_3	13.50	11.85	15.87	12.45	14.40
Fe_2O_3	0.41	0.13	1.47	0.30	0.64
FeO	0.87	0.45	1.82	0.75	1.22
MnO	0.04	0.01	0.50	0.01	0.06
MgO	0.35	0.06	1.13	0.20	0.66
CaO	0.66	0.28	2.94	0.56	1.14
Li_2O	n.d.	n.d.	0.01	0.00	0.00
Na_2O	3.15	1.70	4.00	2.86	3.91
K_2O	4.25	2.98	7.23	4.19	5.00
P_2O_5	0.11	0.01	0.38	0.08	0.19
Mg/(Mg + Fe)	0.33	0.07	0.52	0.27	0.39
K/(K + Na)	0.48	0.33	0.74	0.41	0.54
Nor.Or	26.08	18.21	44.81	25.11	30.58
Nor.Ab	29.14	16.01	37.16	26.59	35.79
Nor.An	2.10	0.68	13.11	1.37	4.50
Nor.Q	32.08	23.98	42.14	26.51	36.08
Na + K	198.45	176.45	250.95	192.35	215.14
*Si	193.41	143.38	242.24	161.77	212.66
K-(Na + Ca)	-23.21	-118.23	93.30	-59.16	2.53
Fe + Mg + Ti	30.44	20.01	67.58	20.80	39.24
Al-(Na + K + 2Ca)	22.87	-7.80	52.96	14.37	34.07
(Na + K)/Ca	15.87	3.67	50.26	7.56	17.67
A/CNK	1.12	0.98	1.24	1.06	1.15

2.5.16. POPOVICE METAGRANITE (COMPLEX)

Regional position: lithological and structural mélange of in-situ granitized sediments and metamorphosed igneous rocks (the Popovice hybrid Complex) at the contact of the Moldanubian Zone and the Central Bohemian Pluton (CBCP).

Rock types: *Popovice Metagranite –*

1. hybrid fine-grained aplitic metagranite (migmatite of the orthogneiss habit),
2. hybrid biotite metagranite (similar to the Gföhl Gneiss).

Size and shape (in erosion level): 100 km^2 (7 × 14 km), semi-circular structure. Resistant hybrid metagranites at the periphery of the Popovice depression.

Age and isotopic data: older than the Central Bohemian Pluton. This Pluton is expected at the basement of the Popovice Gneiss. No isotopic data.

References

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Popovice Metagranite

Quartz-rich, sodic, peraluminous, leucocratic S-type granite

	1915P	**1916P**	**1917P**	**1918P**
SiO_2	77.03	75.27	73.23	72.17
TiO_2	0.20	0.13	n.d.	0.21
Al_2O_3	11.85	13.50	15.87	14.13
Fe_2O_3	0.13	0.41	0.68	0.64
FeO	0.84	0.47	0.87	0.81
MnO	0.01	0.01	0.06	0.02
MgO	0.20	0.27	0.75	0.33
CaO	0.57	0.76	1.14	0.86
Na_2O	3.01	3.91	3.98	3.15
K_2O	4.23	4.19	4.22	6.16
P_2O_5	0.23	0.38	0.18	0.05
Mg/(Mg + Fe)	0.27	0.36	0.46	0.29
K/(K + Na)	0.48	0.41	0.41	0.56
Nor.Or	26.07	25.23	25.11	37.49
Nor.Ab	28.19	35.79	35.99	29.14
Nor.An	1.37	1.29	4.50	4.06
Nor.Q	40.54	33.56	28.32	26.51
Na + K	186.94	215.14	218.03	232.44
*Si	233.63	193.41	174.68	157.72
K-(Na + Ca)	-17.48	-50.76	-59.16	13.81
Fe + Mg + Ti	20.80	20.01	39.24	30.12
Al-(Na + K + 2Ca)	25.44	22.87	52.96	14.37
(Na + K)/Ca	18.39	15.87	10.73	15.16
A/CNK	1.15	1.14	1.22	1.06

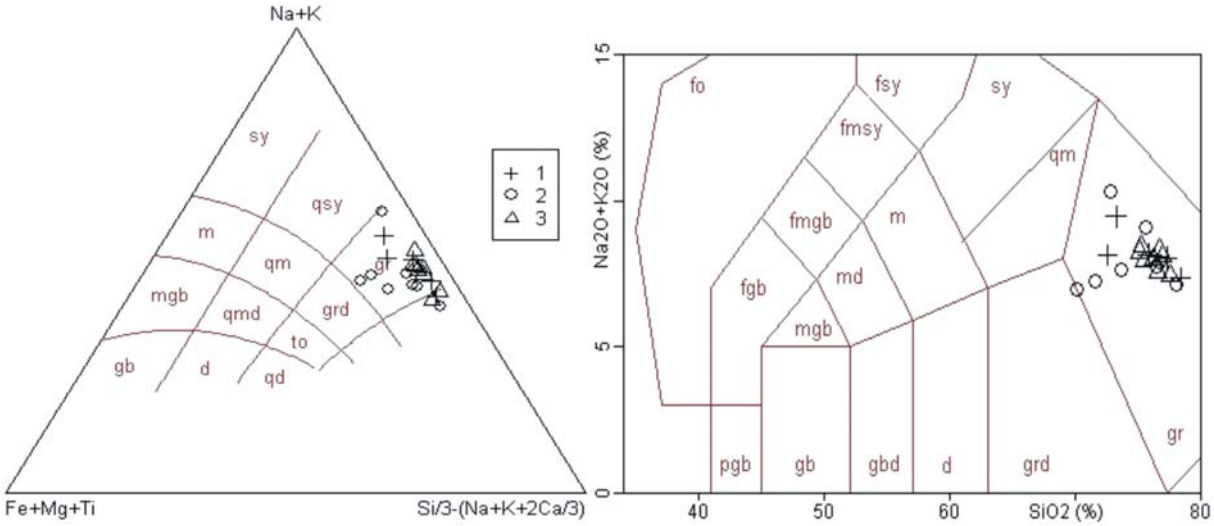

Fig. 2.137. *Moldanubian orthogneisses ABQ and TAS diagrams. 1 – Popovice Metagranite, 2 – Podolsko Orthogneiss, 3 – Votice Orthogneiss.*

2.5.17. WOLFSHOF ORTHOGNEISS

Regional position: Moldanubian Zone.

Rock types: *Wolfshof Orthogneiss* – homogenous fine- to medium-grained alkali feldspar syenitic (K-rich) orthogneiss.

Size and shape (in erosion level): 30 km^2 (9 × 3 km), oval shape of the strongly deformed concordant sills near the Gföhl Gneiss.

Age and isotopic data: 338 ± 6 Ma (U-Pb zircon)

Geological environment: structurally conformable or semi-conformable in sillimanite-biotite paragneisses of the Monotonous Group.

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2.5.18. TACHOV ORTHOGNEISS

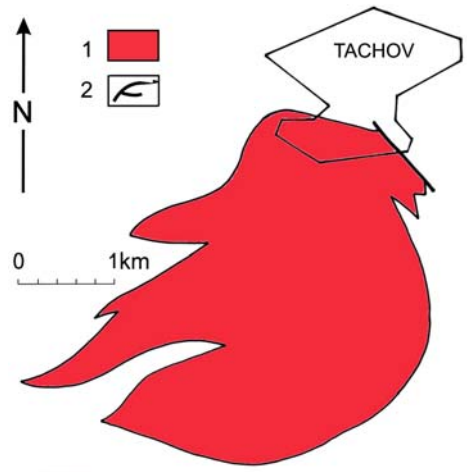

Fig. 2.138. *Tachov Orthogneiss geological-sketch-map. 1 – Tachov Orthogneiss, 2 – fault.*

Regional position: Moldanubian Zone.

Rock types:

1. *Tachov Orthogneiss* – medium-grained foliated two-mica orthogneiss.
2. *Sillgranite* – sheet-like granite

Size and shape (in erosion level): 7.5 km^2 (4.5 × 3 km) oval shape, smaller bodies of the Tachov Gneiss are cropping out in the western exocontact of the Bor Composite Massif.

Age and isotopic data: 449 ± 4 Ma (U-Pb zircon), 523 ± 15 Ma (Rb-Sr whole rock).

Geological environment: cordierite-biotite and sillimanite – biotite migmatized paragneiss.

References

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Tachov Orthogneiss

Quartz-rich, sodic, peraluminous, leucocratic granite

	Tach1	**Tach2**	**Tach3**
SiO_2	75.80	75.00	76.20
TiO_2	0.14	0.13	0.14
Al_2O_3	13.97	13.70	14.40
Fe_2O_{3tot}	1.35	1.27	1.42
FeO	n.d.	n.d.	n.d.
MnO	0.03	0.02	0.03
MgO	0.27	0.25	0.28
CaO	0.53	0.50	0.58
Na_2O	3.47	3.43	3.51
K_2O	3.99	3.65	4.54
P_2O_5	0.32	0.28	0.34
Mg/(Mg + Fe)	0.28	0.28	0.28
K/(K + Na)	0.43	0.41	0.46
Nor.Or	24.07	22.39	26.93
Nor.Ab	31.81	31.97	31.64
Nor.An	2.69	2.58	2.89
Nor.Q	36.70	38.11	34.17
Na + K	196.69	188.18	209.66
*Si	217.53	221.96	206.19
K-(Na + Ca)	-36.71	-42.10	-27.21
Fe + Mg + Ti	25.37	23.74	26.49
Al-(Na + K + 2Ca)	58.75	63.02	52.44
(Na + K)/Ca	20.81	21.11	20.27
A/CNK	1.27	1.30	1.23

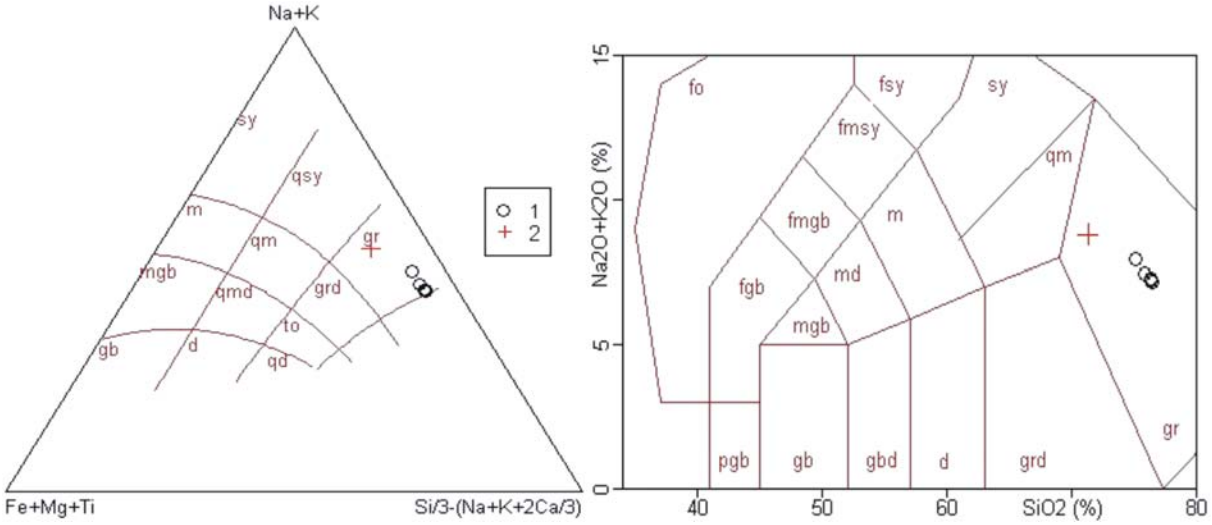

Fig. 2.139. *Tachov Orthogneiss ABQ and TAS diagrams. 1 – Tachov Orthogneiss, 2 – Sillgranite.*

Atlas of plutonic rocks and orthogneisses in the Bohemian Massif

2. Moldanubicum

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Published by the Czech Geological Survey
Prague 2010
First edition
Printed in the Czech Republic
03/9 446-412-10
ISBN 978-80-7075-751-2

THE LOCALITY MAP OF PLUTONIC ROCKS AND ORTHOGNESSES IN THE BOHEMIAN MASSIF

N

LUSATIAN COMPOSITE BATHOLITH

EASTERN KRUŠNÉ HORY COMPOSITE PLUTON

MIDDLE KRUŠNÉ HORY COMPOSITE PLUTON

WESTERN KRUŠNÉ HORY COMPOSITE PLUTON

KRUŠNÉ HORY BATHOLITH

SMRČINY

ČISTÁ JESENICE COMPOSITE PLUTON

BOHEMIAN COMPOSITE PLUTON

CENTRAL BOHEMIAN BATHOLITH

EISGRN COMPOSITE PLUTON

WEINSBERG COMPOSITE PLUTON

THAYA DOME

BRNO COMPOSITE PLUTON

BRNO COMPOSITE

OLDŘICHOV BATHOLITH

DRESDEN

CHEMNITZ

GERA

LIBEREC

ÚSTÍ n/L.

WROCLAW

HRADEC KRÁLOVÉ

PARDUBICE

PRAHA

LABE RIVER

KARLOVY VARY

PLZEŇ

ČESKÉ BUDĚJOVICE

JIHLAVA

OSTRAVA

OLOMOUC

REGENSBURG

DANUBE RIVER

Passau

VLTAVA RIVER

POLAND

CZECH REPUBLIC

SLOVAKIA

AUSTRIA

GERMANY

EXPLANATIONS

1 PRINCIPAL TECTONOSTRATIGRAPHIC UNITS OF THE BOHEMIAN MASSIF

INTRUSIVE OBJECTS NOT SEPARATELY DESCRIBED

213 CODES OF BATHOLITHS AND PLUTONS

445 CODES OF MASSIFS AND STOCKS

0 50 100 km

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