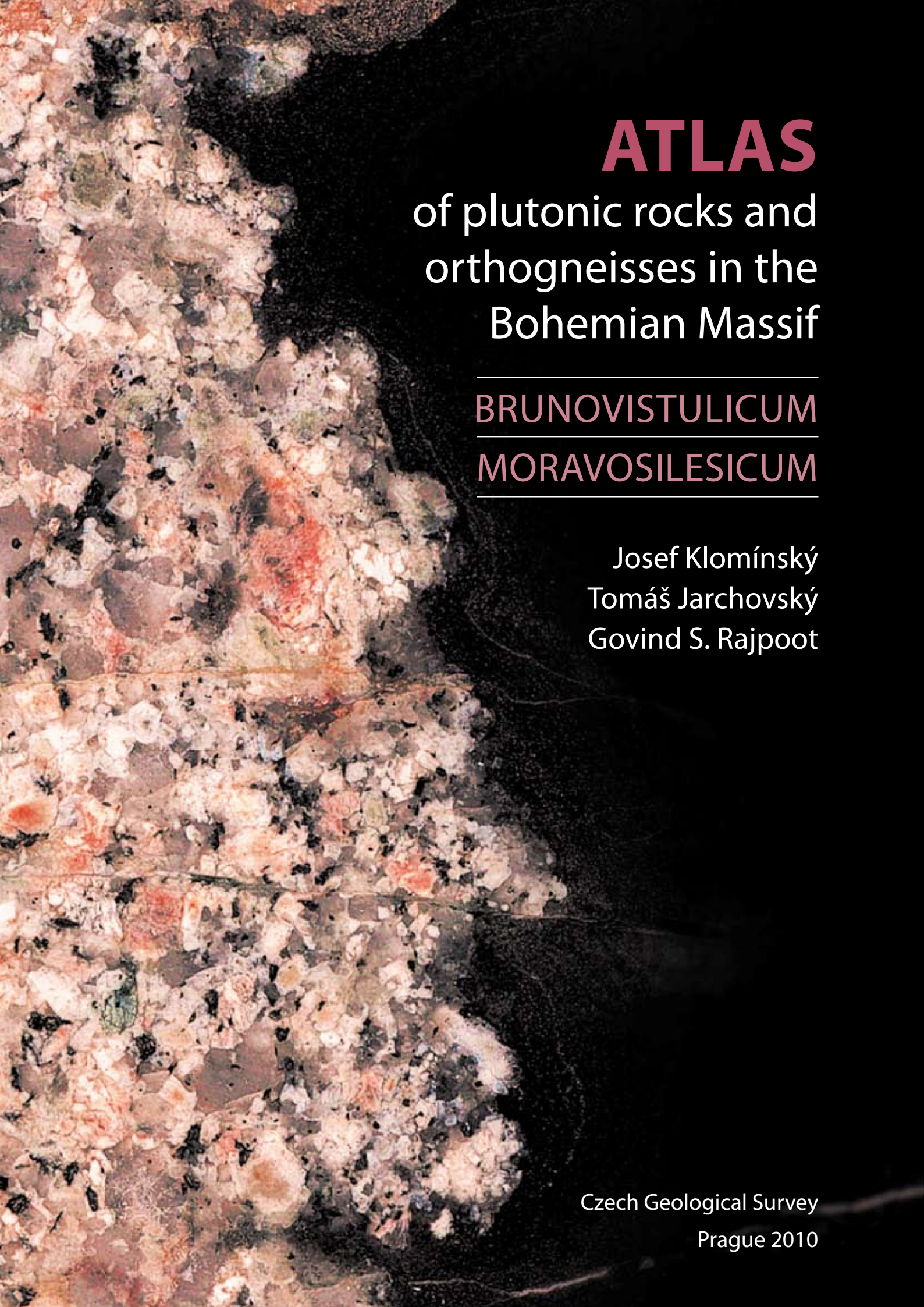


ATLAS

of plutonic rocks and orthogneisses in the Bohemian Massif

BRUNOVISTULICUM
MORAVOSILESICUM

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

5. BRUNOVISTULICUM & MORAVOSILESICUM

Compiled by

Josef Klomínský
Tomáš Jarchovský
Govind S. Rajpoot

The **Brunovistulicum & Moravosilesicum** 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

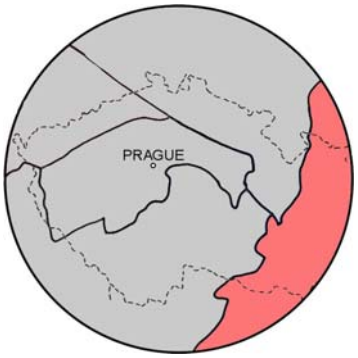
We would like to thank the following colleagues who have helped in the compilation and correction of this review: A. Dudek, F. Fediuk, M. Chlupáčová, V. Janoušek J. Kotková, M. René, Z. Vejnar, P. Vlašímský, P. Schovánek and S. Vrána. We are grateful for technical assistance to P. Kopecký, M. Toužimský, 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.

* Corresponding author Josef Klomínský, Czech Geological Survey, Klárov 131/3, Prague 1, Czech Republic.
Fax (+420) 257 531 376. E-mail address: josef.klominsky@geology.cz

© J. Klomínský, T. Jarchovský, G. S. Rajpoot, 2010

ISBN 978-80-7075-751-2

THE ATLAS OF PLUTONIC ROCKS AND ORTHOGNEISSES IN THE BOHEMIAN MASSIF



5. BRUNOVISTULICUM & MORAVOSILESICUM

Josef Klomínský [a]*, Tomáš Jarchovský [a], Govind S. Rajpoot [b]

[a] Czech Geological Survey, Klárov 131/3, Praha 1, [b] Náchodská 2030, Praha 9, Czech Republic

Contents

FOREWORD 3
5.1. BRNO COMPOSITE BATHOLITH 4
5.1.1. BRNO COMPOSITE PLUTON 9
5.1.2. SLAVKOV MASSIF 19
5.1.3. ŽDÁNICE MASSIF 20
5.1.4. LUBNÁ MASSIF 21
5.1.5. MIKULOV MASSIF 22
5.1.6. STUPAVA MASSIF 23
5.1.7. SVRATKA MASSIF 24
5.1.8. OLOMOUC (UPPER MORAVA BASIN) MASSIF 26
BASIC INTRUSIONS 27
5.1.9. VLKOŠ STOCK 27
5.1.10. RUSAVA MASSIF 27
5.1.11. JABLUNKOV MASSIF 28
5.2. THAYA (DYJE) DOME 28
5.2.1. THAYA COMPOSITE MASSIF 29
5.2.2. PLEISSING ORTHOGNEISS 31
5.2.3. BÍTEŠ ORTHOGNEISS 32
5.3. KEPRNÍK ORTHOGNEISS 34
5.4. DESNÁ ORTHOGNEISS 36
5.5. STRZELIN ORTHOGNEISS 39
VARISCAN INTRUSIONS 40
5.6. ŽULOVÁ-STRZELIN COMPOSITE MASSIF 40
5.7. ŠUMPERK MASSIF 46
5.8. RUDNÁ STOCK 48

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

FOREWORD

The Brunovistulicum and the Moravosilesian Zone (BMSZ) represent Precambrian lithosphere at the eastern termination of the Central European Variscides along the eastern margin of the Moldanubian Zone and the Lugicum. According to Dudek (1980) three principal structural blocks are distinguished into sub-units along major faults: the South Moravian Block, the Central Moravian Block and the North Moravian Block. The southern part of the Central Moravian Block and the predominant part of the Southern Moravian Block are formed predominantly by granitic plutonites.

The Brunovistulicum consists of the Slavkov Terrane (the island arc crust), the Brno-Břeclav Terrane (a late Proterozoic back arc basin) and the Thaya Terrane (older continental crust). The extraordinary abundance of plutonic basement rocks of Cadomian age represents one of the most specific lithological features of the BMSZ (Finger et al. 1995). Mainly amphibolite facies crystalline schists were formed by metamorphism of monotonous metasediments with minor amounts of volcano-sedimentary series containing metabasites. During Hercynian orogeny, western part of the Brunovistulicum was reworked and incorporated into the structure of the Hercynian fold belt. It is covered mainly by nappes of the outer Western Carpathian Foredeep (over 4,000 m thick at the Těšany borehole) as well as by overthrusted tectonic slices of the Hercynides. Formation and consolidation of the Brunovistulicum prior to Hercynian orogeny is documented by transgression of Cambrian and Middle to Upper Devonian sediments. Most of the Brunovistulian granitoids were formed during a major tectonothermal event at ca. 580–600 Ma. The large batholitic terrain in the south-western half of the Moravosilesian basement consists of two separate domains, the smaller Thaya (Dyje) Dome and the larger Brno Composite Batholith. Both these domains are today separated from each other by a major post-Variscan sinistral fault system. Although only to a minor part directly exposed at the surface, the plutonites are known from drillings and geophysical research to occupy at least one third of the entire basement. The size of the original coherent batholitic complex can be estimated at least at 10,000 km^2.

The BMSZ comprises of series of mostly Cadomian magmatic intrusions which are intruded and/or tectonically emplaced into all the above mentioned terranes. They are represented by the Brno Composite Pluton, Slavkov Massif, Ždánice Massif, Lubná Massif, Mikulov Massif, Nikolčice Massif, Svratka Massif, Thaya Composite Massif, Pleissing Orthogneiss, Bíteš Orthogneiss, Olomouc Massif, Vlkoš Stock, Rusava Massif, Jablunkov Massif, Keprník Orthogneiss, Strzelin Orthogneiss and the Desná Orthogneiss. These magmatites show a high compositional variation and a variable degree of deformation and much younger regional (Variscan) metamorphism. Only three rather small Variscan (Upper-Carboniferous) granitic massifs (the Žulová-Strzelin Composite Massif, Šumperk Massif and the Rudná Stock) are cropping out at the boundary between the Desná and Keprník Domes.

References

CHAB, J. – BREITER, K. – FATKA, O. – HLADIL, . – KALVODA, J. – ŠIMŮNEK, Z. – ŠTORCH, P. – VAŠÍČEK, Z. – ZAJÍC, J. – ZAPLETAL, J. (2008): Outline of the geology of the Bohemian Massif: The basement rocks and their Carboniferous and Permian cover. – Czech Geol. Survey Publishing House, Prague 296 p.

CHÁB, J. – STRÁNÍK, Z. – ELIÁŠ, M. Eds (2007): The geological map of the Czech Republic 1 : 500 000. – Czech Geol. Survey, Prague.

DUDEK, A. (1980): The Crystalline basement block of the Outer Carpathians in Moravia: Brunovistulicum. – Rozpr. Čs. Akad. Věd, Ř. mat. přír. Věd 90, 8, 3–83.

DUDEK, A. – MELKOVÁ, J. (1975): Radiometric age and isotopic data determination in the crystalline basement of the Carpathian Foredeep and of the Moravian Flysch. – Věst. Ústř. Úst. geol. 50, 257–264.

DUDEK, A. – ŠMEJKAL, V. (1968): Das Alter des Brunner Plutons. – Věst. Ústř. Úst. geol. 43, 45–51.

FINGER, F. – FRASL, G. – DUDEK, A. – JELÍNEK, E. – THÖNI, M. (1995): Igneous Activity (Cadomian Plutonism in the Moravo-Silesian Basement). In: Dallmeyer, R. D. – Franke, W. – Weber, K. Eds: Pre-Permian Geology of Central and Eastern Europe, 495–507. – Springer Verlag, Berlin.

FINGER, F. – HANŽL, P. – PIN, C. – VON QUADT, A. – STEYRER, H. P. (2000): The Brunovistulian: Avalonian Precambrian sequence at the eastern end of the Central European Variscides? – Geol. Soc. London, Spec. Publ. 179, 103–112.

FINGER, F. – SCHITTER, F. – RIEGLER, G. – KRENN, E. (1999): The history of the Brunovistulicum: total - Pb monazite ages from the metamorphic complex. – GeoLines 8, 21–23.
FRIEDL, G. – FINGER, F. – McNAUGHTON, N. J. – FLETCHER, I. R. (1998): New SHRIMP-zircon ages for orthogneisses from the south-eastern part of the Bohemian Massif (Lower Austria). Proceedings of the Intern. Conference Palaeozoic orogenesis and crustal evolution of the European lithosphere. – Acta Univ. Carol., Geol. 42, 251–251.
FRIEDL, G. – FINGER, F. – McNAUGHTON, N. J. – FLETCHER, I. R. (2002): The Precambrian history of the south-eastern Bohemian Massif. In: GEO 2002, Planet Earth, past, development, future. Program and abstracts. – Schr.-Reihe Dtsch. Geol. Gesell. 21, 124 pp.
HÖCK, V – LEICHMANN, J. (1994): Excursion C: Das Moravicum der Thayakuppel. – Mitt. Österr. mineral. Gesell. 139, 407–427.
JELÍNEK, E. – DUDEK, A. (1993): Geochemistry of subsurface Precambrian plutonic rocks from the Brunovistulian complex in the Bohemian Massif, Czechoslovakia. – Precambrian Res. 62, 103–125.
KALVODA, J. – BÁBEK, O. – FATKA, O. – LEICHMANN, J. – MELICHAR, R. – NEHYBA, S. – ŠPAČEK, P. (2008): Brunovistulian Terrane (Bohemiqn Massif, Central Europe) from late Proterozoic to late Paleozoic: an overview. – Int. J. Earth Sci. 97, 497–518.
KRÖNER, A. – ŠTÍPSKÁ, P. – SCHULMANN, K. – JAECKEL, P. (2000): Chronological constraints on the pre-Variscan evolution of the northeastern margin of the Bohemian Massif, Czech Republic. In: Franke, W. – Haak, V. – Oncken, O. – Tanner D. Eds: Orogenic Processes: Quantification and Modelling in the Variscan fold belt. – Geol. Soc. London, Spec. Publ. 179, 175–197.
LEICHMANN, J. – HÖCK, V. (2008): The Brno Batholith: an insight into the magmatic and metamorphic evolution of the Cadomian Brunovistulian Unit, eastern margin of the Bohemian Massif. – J. Geosci. 53, 281–305.
SCHULMANN, K. – KRÖNER, A. – HEGNER, E. – WENDT, I. – KONOPÁSEK, J. – LEXA, O. – ŠTÍPSKÁ, P. (2005): Chronological constraints on the pre-orogenic history, burial and exhumation of deep-seated rocks along the eastern margin of the Variscan orogen, Bohemian Massif, Czech Republic. – Amer. J. Sci. 305, 407–448.
SOUČEK, J. – JELÍNEK, E. – BOWES, D. R. (1992): Geochemistry of gneisses of the eastern margin of the Bohemian Massif. In: Kukal, Z. Ed.: Proceedings of the 1st International Conference on the Bohemian Massif, Prague, Czechoslovakia, Sept. 26-Oct. 3, 1988, 269–285. – Czech Geol. Survey, Prague.
ŠTELC, J. – WEISS, J. et al. (1986): Brněnský masív. – 255 pp. Univ. J. E. Purkyně, Brno.
SUK, M. – ĎURICA, D. – OBSTOVÁ, V. – STAŇKOVÁ, E. (1991): Deep boreholes in Bohemia and Moravia and their geological applications. – 174 pp. Nakladatelství Gabriel. Praha. (English abstract)
VAN BREEMEN, O. – AFTALION, M. – BOWES, D. R. – DUDEK, A. – MÍSAŘ, Z. – POVONDRA, P. – VRÁNA, S. (1982): Geochronological studies of the Bohemian Massif, Czechoslovakia, and their significance in the evolution of the Central Europe. – Trans. Roy. Soc. Edinburgh, Earth Sci. 73, 89–108.
ZACHOVALOVÁ, K. – LEICHMANN, J. – ŠVANCARA, J. (2002): Žulová Batholith: a post-orogenic, fractionated ilmenite-allanite I-type granite. – J. Czech Geol. Soc. 47, 35–44.
ŻELAŻNIEWICZ, A. – BUŁA, Z. – JACHOWICZ, M. (2002): Neoproterozoic granites in the Upper Silesia massif of Brunovistulicum, S. Poland: U-Pb SHRIMP evidence. – Schr.-reihe Dtsch. geol. Gesell. 21, 361–362.

5.1. BRNO COMPOSITE BATHOLITH

Regional position: the Brno Composite Batholith with its satellite massifs probably represents a Cadomian-consolidated margin of the Fennosarmatian platform.

The Brno Composite Batholith consists of several large outcrops (e.g. the Brno Composite Pluton) and much larger subsurface area under younger sedimentary cover, where much information is available from boreholes and from geophysics. This area comprises the Lubná Massif, Mikulov Massif, Slavkov Massif, Stupava Massif, Ždánice Massif, Olomouc Massif,Rusava Massif ,Mušov Diorite, Dražovice Massif, Vlkoš Stock and Strachonín Massif.

The suite of the Mikulov Granite-Granodiorite, Stupava Granodiorite and Slavkov Tonalite corresponds to the Blansko, Doubravice and Královo Pole Granodiorites (the Slavkov Tonalite), the Tetčice, Krumlovský les and Veverská Bítýška types can be correlated to the Mikulov Granite and the Stupava Granodiorite. The batholith to the northeast comprises separate

plutonic bodies of the Olomouc Massif, and the group of basic bodies (e.g. the Vlkoš Stock, Rusava Massif, Jablunkov Massif).

The Svratka Massif to the west is an equivalent of Western Granodiorites/Granites of the Brno Composite Pluton. Most of the Brunovistulian granitoids were formed during a major tectonothermal event at ca. 580–600 Ma. The exposed parts of the Brno Composite Batholith have been described by Štelcl and Weiss (1986) and Finger et al. (1989). Petrology and geochemistry of the covered portion has been studied by Jelínek and Dudek (1993) from the cores of bout 100 deep boreholes (Suk and Ďurica et al. 1991) drilled mainly by the Moravian Oil Concern, Hodonín.

According to Leichmann and Höck (2008) the Brno Batholith (the Brno Composite Pluton in this rewiew) consists of three genetically independent complexes: Western Granitoid Complex – WGC (part of the Thaya Terrane), Ophiolite Belt (Metabasite Zone or Central Basic Belt), and Eastern Granitoid Complex – EGC (part of the Slavkov Terrane). The EGC represents a relatively primitive Cadomian volcanic-arc enviroment. The OB is segment of an almost completely metamorphosed ophiolite sequence. The WGC comprises three main granite suites, with distinct S-type (the Tetčice Suite),
I-type (Rena Suite), and A-type (Hlína Suite) affinities. Equivalents of all three suits were recognized in the northern part of the Dyje Batholith (Leichmann and Höck 2008).

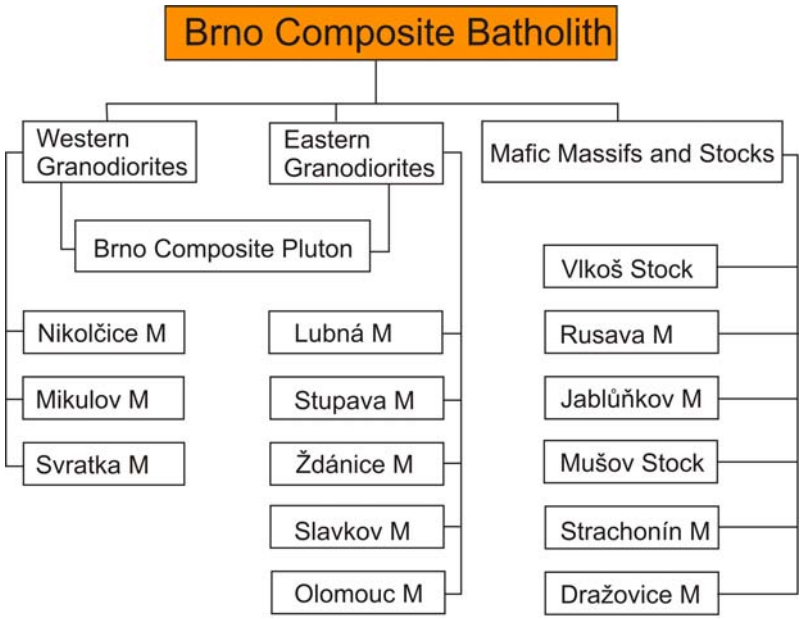


Fig. 5.1. *Brno Composite Batholith hierarchical scheme according to plutonic units – plutons, massifs (M) and stocks.*

Boreholes into the Brno Composite Batholith in the basement of the Outer Carpathian (Suk and Ďurica et al. 1991)

	Borehole	*Subsurface depth in meters*
Lubná Massif		
Granite	Lubná 1, 2	1352–1861
Granite	Lubná 3–29	
Stupava Massif		
Granodiorite	Roštín 1	1506
Granodiorite	Kožušice 1–8	870–1303
Granodiorite	Stupava 1	2431
Granodiorite	Osvětimany 1	2518
Nikolčice Massif		
Granite	Nikolčice 5	1364

Granodiorite	Nikolčice 2A	2225
Granodiorite	Nikolčice 4	1506
Mikulov Massif		
Granite	Březí 1	1701
Granite	Mikulov 1	2582
Granite	Dunajovice 1	1803
Granite	Staatz 3	3406
Granite	Hagenberg 1	3180
Granodiorite	Drnholec 9	393
Granodiorite	Hrušovany 1	742
Granodiorite	Těšany	4257
Slavkov Massif		
Tonalite	Slavkov 2	1320
Tonalite	Bučovice 1	1052
Tonalite	Marefy 1	1041
Tonalite	Nitkovice 2	1766
Ždánice Massif		
Tonalite	Žarošice 2	1620
Tonalite	Ždánice 1–6	
Mušov Massif		
Diorite	Mušov 1	1705
Diorite	Mušov 2	1910
Strachotín Massif		
Quartz diorite	Strachotín 2	3075
Granodiorite	Strachotín 1	2448
Dražovice Massif		
Diorite	Dražovice 2	1500
Vlkoš Stock		
Gabbro	Vlkoš 1	615
Jablunkov Massif		
Gabbro	Jablunkov 1	3200

Rock types: the plutonic rocks range from an ultramafic composition through gabbronorites, gabbros, diorites, quartz diorites, leucotonalites, leucogranodiorites and granites to leucogranites.

The Brno Composite Pluton

Western Granodiorites (Western Granodiorite Suite – WGS) – *Bobrava area*:

Veverská Bítýška Granodiorite – biotite-hornblende granodiorite,

Černá hora Granodiorite – leucocratic granodiorite,

Tetčice Granodiorite – biotite-hornblende granodiorite,

Krumlovský les Granodiorite – biotite granodiorite,

Vedrovice Granodiorite – biotite–hornblende leucogranodiorite,

Réna Granodiorite – porphyritic biotite leucogranodiorite,

Hlína Granite – biotite leucogranodiorite,

Kounice Granodiorite – biotite-hornblende granodiorite,

Leskoun Granodiorite – cataclastic granodiorite,

Střelice Granodiorite – porphyritic hornblende – biotite granodiorite.

Central Metabasite Zone (Ophiolite belt)

Metadiorite Belt (in the west of the Central Basic Zone – CBZ – a part of the WGS) – metagabbro metadiorite and the *Jundrov Granodiorite* – biotite granodiorite (tectonic raft in the metabasite zone),

Metabasalt Belt (in the east of the CBZ) – metabasalt and metarhyolite.

Eastern Granodiorites (Eastern Granodiorite Suite – EGS):

Doubravice Granodiorite – biotite granodiorite,

Blansko Granodiorite – biotite to hornblende-biotite granodiorite to quartz diorite,

Jundrov Granodiorite – chlorite trondhjemite,

Královo Pole Granodiorite – biotite granodiorite to granite.

Svratka Massif

Svratka Metagranite – biotite metagranite,

Svratka Metadiorite – amphibole-biotite metadiorite.

Subsurface members of the Brno Composite Batholith

Slavkov Massif – hornblende-biotite leuco-granodiorite to tonalite,

Ždánice Massif – hornblende-biotite tonalite to quartz diorite,

Lubná Massif – biotite leucogranite (independent intrusion in the covered part of the Brno Composite Batholith,

Stupava Massif – leucogranodiorite to biotite granodiorite (an intrusion in the Brno Composite Pluton),

Olomouc Massif – two-mica leucogranite,

Mikulov Massif – muscovite-biotite granite grades into biotite granodiorite (western granodiorite),

Nikolčice Massif – biotite granodiorite (western granodiorite).

Basic Intrusions

Mušov Stock– diorite to quartz diorite,

Strachotín Massif – biotite diorite,

Dražovice Massif – biotite diorite,

Rusava Massif – gabbro and gabbrodiorite,

Jablunkov Massif – gabbro and gabbrodiorite,

Vlkoš Stock – gabbro and gabbrodiorite,

Ultramafics – (serpentinized dunites and enstatites in the Vlkoš Stock).

Age and isotopic data: The geological and relative relationship: ultramafics → diorites and quartz diorites → leucotonalites and leucogranodiorites → leucogranites, biotite granites, leucogranodiorites and granodiorites grade into each other.

Brno Composite Pluton – 555–585 Ma (U-Pb zircon), EGC 596.1 ± 2.1 Ma (Ar-Ar amphibole). *Dražovice Diorite* 1400 Ma (K-Ar amphibole), *Slavkov Tonalite* 547–576 Ma (K-Ar).

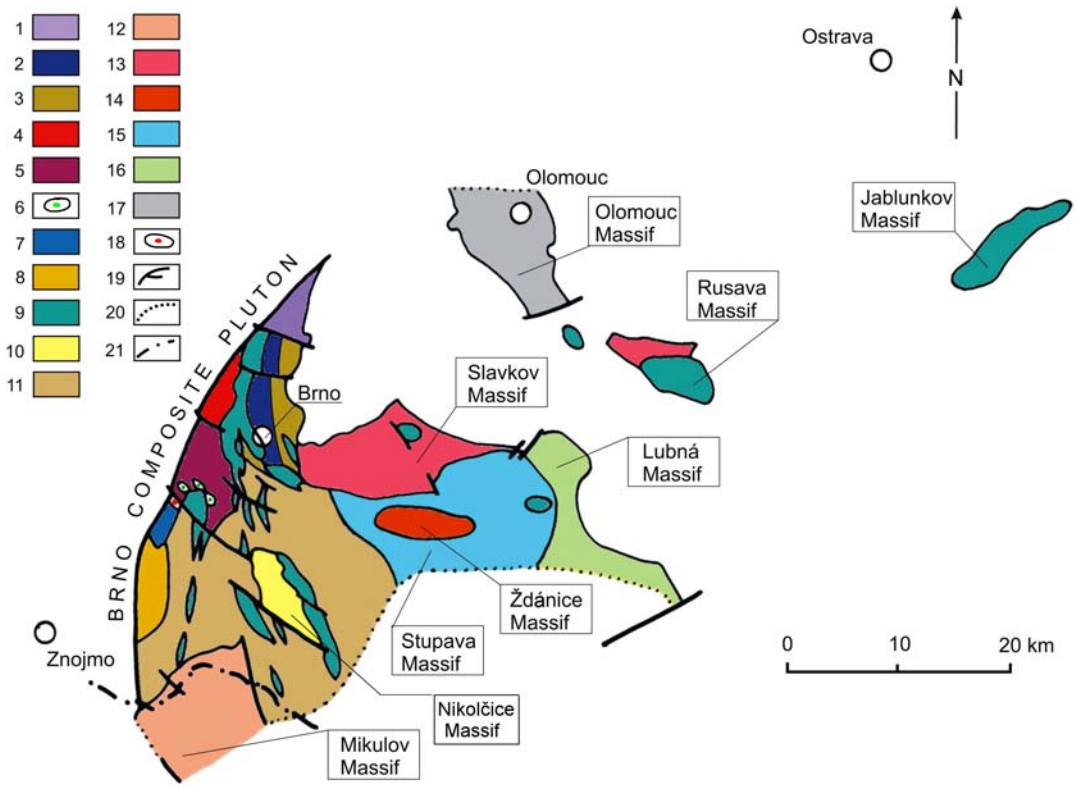


Fig. 5.2. *Brno Composite Batholith geological sketch-map (adapted after Dudek 1980, Skácelová and Weiss 1978, Dvořák et al. 1984, Mitrenga and Rejl 1993). 1 – Doubravice Granodiorite, 2 – Královo Pole Granodiorite, 3 – Blansko Granodiorite, 4 – Veverská Bítýška Granodiorite, 5 – Tetčice Granodiorite, 6 – Hlína Granodiorite, 7 – Krumlovský les Granodiorite, 8 – Leskoun and Vedrovice Granodiorite, 9 – Diorite, gabbro, gabbronorite, 10 – Nikolčice Granite, 11 – Biotite Granite, 12 – Mikulov Granite, 13 – Slavkov Tonalite, 14 – Ždánice Quartz diorite, 15 – Stupava (+ Jundrov) Leucogranodiorite, 16 – Lubná Leucogranite, 17 – two-mica leucogranite (Olomouc Massif), 18 – Réna Granodiorite, 19 – faults, 20 – boundaryof the BCB investigated by drillings, 21 – state border.*

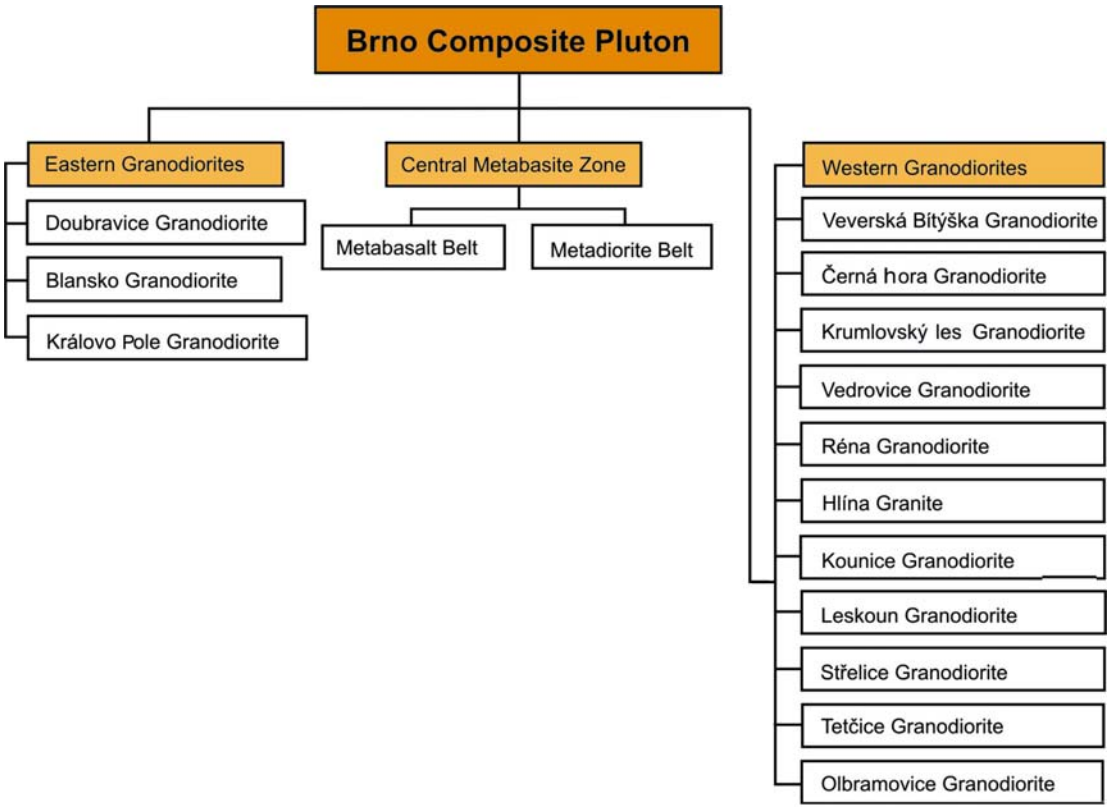


Fig. 5.3. *Brno Composite Pluton hierarchical scheme according to plutonic suites and rock types.*

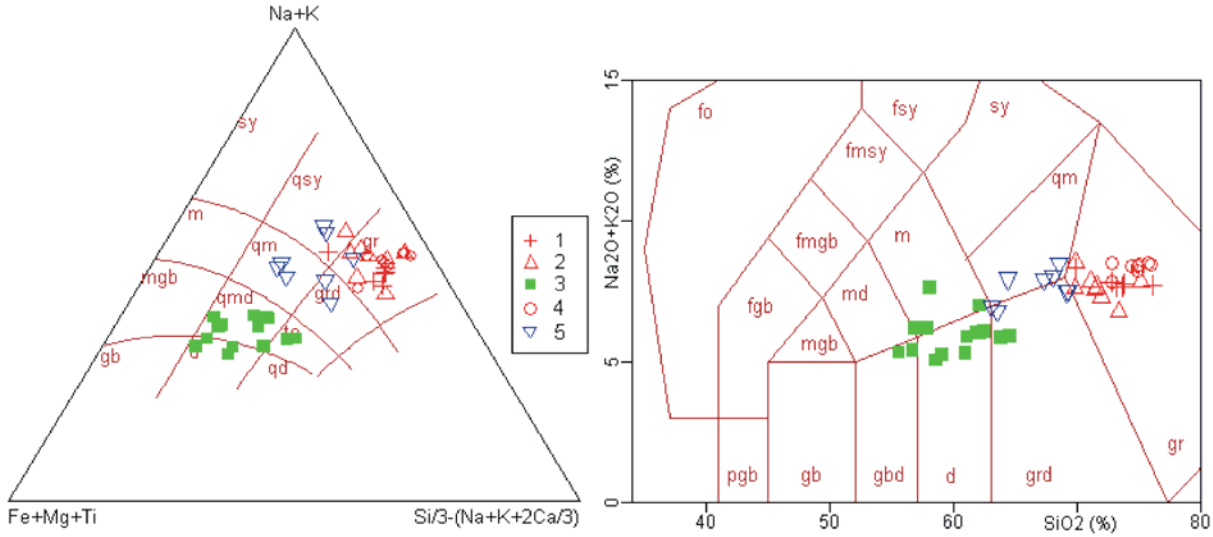


Fig. 5.4. *Brno Composite Batholith ABQ and TAS diagrams. 1 – biotite granites, 2 – leucogranites (Stupava Massif), 3 – quartz diorites (Ždánice Massif), 4 – leucogranite (Lubná Massif), 5 – leucotonalites (Slavkov Massif).*

5.1.1. BRNO COMPOSITE PLUTON (BCP)

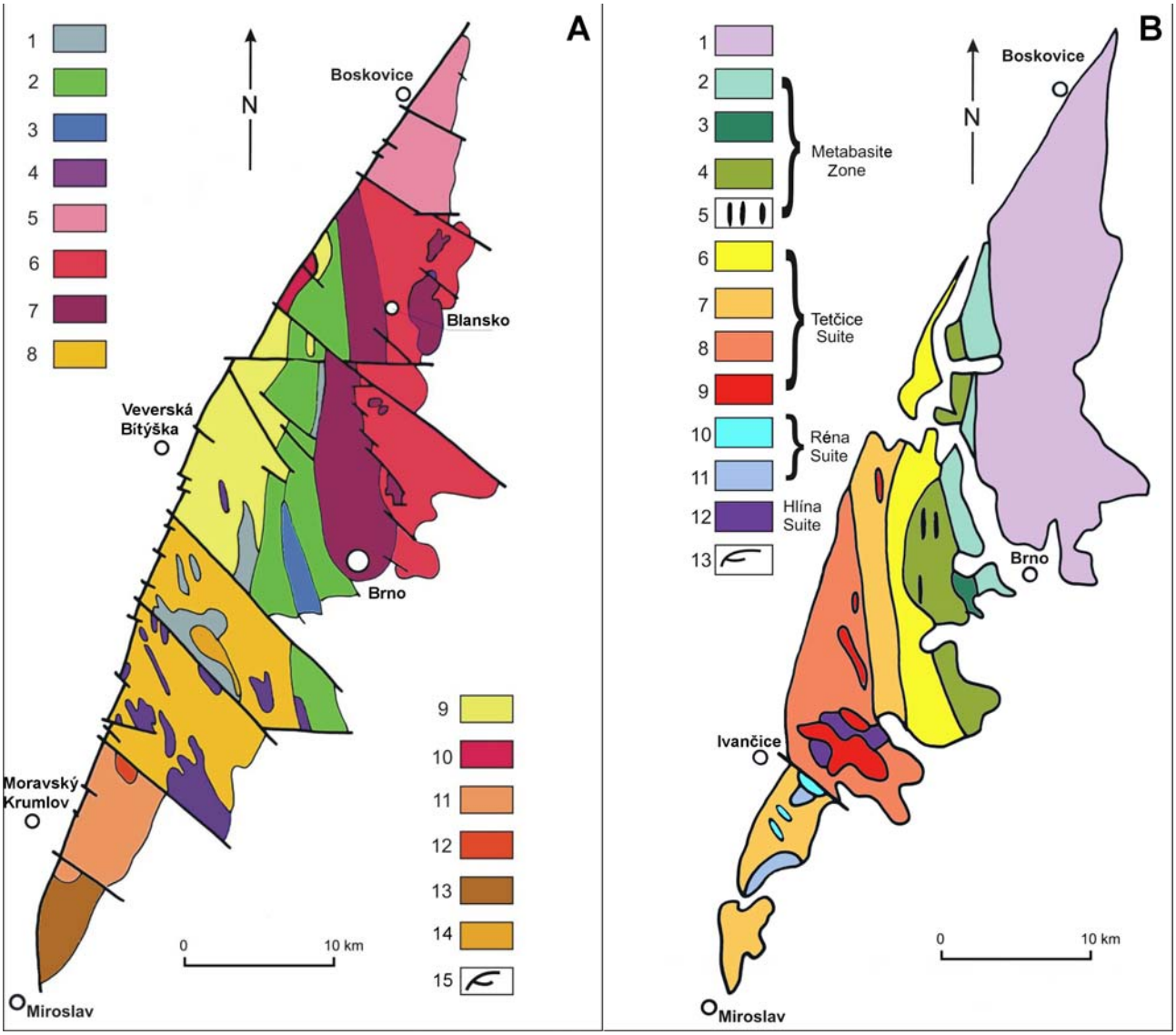


Fig. 5.5. *A. Brno Composite Pluton geological sketch-map (after Mitrenga and Rejl 1993). 1 – gneiss, migmatite, amphibolite, 2 – Central Basic Zone, 3 – Jundrov Granodiorite, 4 – diorite-gabbrodiorite-gabbro, 5 – Doubravice Granodiorite, 6 – Blansko Granodiorite, 7 – Královo Pole Granodiorite, 8 – Tetčice Granodiorite, 9 – Veverská Bítýška Granodiorite, 10 – Černá hora Granodiorite, 11 – Krumlovský les Granodiorite, 12 – Réna Granodiorite, 13 – Leskoun Granodiorite, 14 – Střelice Granodiorite, 15 – faults.*

B. Brno Composite Pluton geological sketch-map (after Leichmann and Höck 2008). 1 – ***Eastern Granitoid Complex*** *(quartz diorites, tonalites, granodiorites),* *Metabasite Zone* *2 – felsic volcanic rocks, 3 – trondhjemites, 4 – diorites and gabbros, 5 – ultramafic rocks.* ***Western Granitoid Complex:*** *Tetčice and Veverská Bítýška Suites* *6 – red granites, 7 – transition zone between red and grey granites, 9 – diorites,* *Réna Suite* *10 – amphibole-biotite granodiorites, 11 – biotite granites-granodiorites,* *Hlína Suite* *12 – garnet-bearing leucogranites, 13 – faults.*

The Brno Composite Pluton represents the major part of the Brno Composite Batholith. It consists of at least three units of different origin. All the units were tectonically juxtaposed, seemingly forming a single granitoid mass today.

BCP is composed of the Western and Eastern Granodiorite areas, which are separated by the Central Metabasite zone (bimodal volcanic association) with the Metabasite Belt in the eastern part and the Diorite Belt in the West. The Eastern Granodiorite area (EGA) is occupied by granodiorites and tonalites (I-type) of a volcanic arc (Slavkov Terrane). The Western Granodiorite area (WGA) consists of granites, granodiorites and tonalites of a more evolved magmatic arc with affinity to S granites (Thaya Terrane).

According to Leichmann and Höck (2008) the Brno Batholith (the Brno Composite Pluton in this rewiew) consists of three genetically independent complexes – Western Granitoid Complex – WGC (part of the Thaya Terrane), Ophiolite Belt – OB (Metabasite Zone or Central Basic Belt), and Eastern Granitoid Complex – EGC (part of the Slavkov Terrane). The EGC represents a relatively primitive Cadomian volcanic-arc enviroment. The OC is segment of an almost completely metamorphosed ophiolite sequence. The WGC comprises three main granite suites, with distinct S-type (the Tetčice Suite), I- type (Réna Suite), and A-type (Hlína Suite) affinities. Equivalents of all three suits were recognized in the northern part of the Dyje Batholith (Leichmann and Höck 2008).

Rock types:

Western Granodiorites (WGA) – Bobrava area:

Veverská Bítýška Granodiorite – biotite-hornblende granodiorite,

Černá hora Granodiorite – leucocratic granodiorite,

Tetčice Granodiorite – unhomogenous biotite granodiorite,

Krumlovský les Granodiorite – biotite granodiorite,

Vedrovice Granodiorite – biotite-hornblende leucogranodiorite,

Réna Granodiorite – porphyritic biotite leucogranodiorite,

Hlína Granite – biotite leucogranodiorite,

Kounice Granodiorite – biotite-hornblende granodiorite,

Mikulov Granite – muscovite-biotite granite,

Nikolčice Granite – biotite granodiorite,

Leskoun Granodiorite – cataclastic granodiorite,

Střelice Granodiorite – porphyritic hornblende-biotite granodiorite,

Jundrov Granodiorite – biotite granodiorite (tectonic raft in the metabasite zone).

Western Granitoid Complex (Leichmann and Höck 2008):

Tetčice Suite:

1. Red granites – coarse-grained granite.
2. Grey granodiorites – fine-grained biotite granodiorite.
3. Transition zone between red and grey granitoids.
4. Diorites – amphibole- or biotite-amphibole-bearing medium- to coarse-grained diorite (xenoliths in the Red and Grey granites).

Réna Suite:

1. Amphibole-biotite granodiorite.
2. Biotite granites-granodiorite.

Hlína Suite: 1. Garnet-bearing leucogranite.

Central Basic Zone (CBZ): (27 × 8 km) is divided in two sequences – plutonic (ultrabasic rocks, amphibole-bearing diorites, gabbros and trondhjemites) and volcanic (basalts and dolerite-rhyolites).

Metadiorite Belt (in the west of CBZ – a part of the WGC) – metagabbro, metadiorite and the and the *Jundrov Granodiorite* – biotite granodiorite and chlorite trondhjemite (tectonic raft in the metabasite zone).

Metabasalt Belt (in the east of CBZ) – metabasalt, metarhyolite.

Eastern Granodiorites (EGA) – *Svitava area:*

Doubravice Granodiorite – biotite granodiorite.

Blansko Granodiorite – biotite to hornblende-biotite granodiorite to quartz diorite.

Královo Pole Granodiorite – biotite granodiorite to granite.

Size and shape (in erosion level): at least 5,000 km^2 of total area (exposed and buried parts), triangular, 65 × 15 km, (exposed part – 650 km^2).

Age and isotopic data: The geological and relative relationship: ultramafics → diorites and quartz diorites → leucotonalites and leucogranodiorites → leucogranites, biotite granites, leucogranodiorites and granodiorites grade into each other.

Brno Composite Pluton – 555–585 Ma (U-Pb zircon), EGC 596.1 ± 2.1 Ma (Ar-Ar amphibole),

Veverská Bítýška Granodiorite 447 ± 12–407 ± 4 Ma (K-Ar),

Kounice Granodiorite 537 ± 12 Ma (K-Ar), 584 ± 5 Ma (Rb-Sr),

Blansko Granodiorite 590 Ma,

Mafics 600 ± 30 Ma, 1 065 ± 10 Ma, 1 270 ± 130 Ma, Dražovice Diorite 1 410 ± 140 Ma (K-Ar hornblende),

WGC – diorites 584 ± 5 Ma (U-Pb zircon), 586.9 ± 0.5 Ma (Ar-Ar amphibole),

Central Basic Belt – tholeiitic rhyolite 725 ± 15 Ma (Pb-Pb zircon), diorite 584 ± 5 Ma (U-Pb zircon),

Basalt dyke penetrating the western metabasite belt 434 ± 8 Ma, 434 ± 16 Ma (K/Ar whole-rock).

The leucogranites intruded into the other plutonic types (the youngest intrusions are the Réna and Střelice Granodiorites). Biotite granites, leucogranodiorites and granodiorites grade into each other a set of contiguous, coeval, and consanguineous clustered intrusions. Contacts range from barely chilled to completely interdigitating and gradational contacts representing coexisting liquids. Gabbronorites and gabbros form independent bodies.

Geological environment: Neoproterozoic biotite paragneisses with abundant layers of metavolcanics (metabasalts and metaandesites), migmatites and amphibolites and Cambrium and Upper Devonian-Lower Carboniferous cover rocks (limestone, conglomerate and slates).

Contact aureole: Contact rocks are often strongly sheared and mylonitized.

Zoning: East-west chemical asymmetry and compositional zoning from tonalite-granodiorite to biotite granodiorite/granite.

Mineralization: numerous occurrences of molybdenite, barite and fluorite, Cu sulphides.

***Heat Production (μWm^{-3})*:** Brno Composite Pluton 1.54, *Blansko Granodiorite* 0.77, *Veverská Bítýška Granodiorite* 1.39, *Krumlovský les Granodiorite* 1.62, *Réna Granodiorite* 1.98, Western Granodiorites 1.46, Eastern Granodiorites 0.79.

References

BREEMEN, O. VAN – AFTALION, M. – BOWES, D. R. – DUDEK, A. – MÍSAŘ, Z. – POVONDRA, P. – VRÁNA, S. (1982): Geochronological studies of the Bohemian Massif, Czechoslovakia, and their significance in the evolution of the Central Europe. – Trans. Roy. Soc. Edinburgh, Earth Sci. 73, 89–108.

BUKOWY, S. (1972): Budowa podloza karbonu Gornoslaskiego Zaglebia Weglowego. – Prace Inst. Geol. 61, 23–59.

DALLMEYER, D. R. – FRITZ, H. – NEUBAUER, F. – URBAN, M. (1994): $^{40}Ar/^{39}Ar$ mineral age controls on the tectonic evolution of the southeastern Bohemian Massif. In: Pre-alpine Crust in Austria, Excursion guide "Geology of the Moravian Zone", 14–22. – Krems.

DUDEK, A. (1980): The Crystalline basement block of the Outer Carpathians in Moravia: Bruno-Vistulicum. – Rozpr. Čs. Akad. Věd, Ř. mat. přír. Věd 90, 3–83.

DUDEK, A. – MELKOVÁ, J. (1975): Radiometric age and isotopic data and determination in the crystalline basement of the Carpathian Foredeep and of the Moravian Flysch. – Věst. Ústř. Úst. geol. 50, 257–264.

DUDEK, A. – ŠMEJKAL, V. (1968): Das Alter des Brunner Plutons. – Věst. Ústř. Úst. geol. 43, 45–51.

DVOŘÁK, J. – FRIÁKOVÁ, O. – MITRENGA, P. – REJL, L. (1984): The influence of the structure in the eastern part of the Brno Massif upon the development of overlying sedimentary formations. – Věst. Ústř. Úst. geol. 59, 21–28.

FINGER, F. – FRASL, G. – DUDEK, A. – JELÍNEK, E. – THÖNI, M. (1995): Cadomian plutonism in the Moravo-Silesian basement. In: Dallmeyer, R. D. – Franke, W. – Weber, K. P. Eds: Tectonostratigraphic Evolution of the Central and Eastern European Orogens, 495–507. – Springer Verlag, Berlin.

FINGER, F. – FRASL, G. – HÖCK, V. – STEYRER, H. P. (1989): The granitoids of the Moravian Zone of Northeast Austria: products of a Cadomian Active Continental Margin? – Precambrian Res. 45, 234–245.

FINGER, F. – HANŽL, P. – PIN, C. – VON QUADT, A. – STEYRER, H. P. (2000): The Brunovistulian: Avalonian Precambrian sequence at the eastern end of the Central European Variscides? – Geol. Soc. London, Spec. Publ. 179, 103–112.

FINGER, F. – PIN, CH. (1997): Arc-type crustal zoning in the Brunovistulicum, eastern Czech Republic: A trace of the Late-Proterozoic Euro-Gondwana margin. MAEGS 10, Session 4. – J. Czech Geol. Soc. 42, 53.

FINGER, F. – SCHITTER, F. – RIEGLER, G. – KRENN, E. (1999): The history of the Brunovistulian: total-Pb monazite ages from the metamorphic complex. – GeoLines 8, 21–23.

FINGER, F. – TICHOMIROWA, C. – PIN, C. – HANŽL, P. (2000): Relics of an early-Panafrican metabasite-metarhyolite formation in the Brno Massif, Moravia, Czech Republic. – Int. J. Earth Sci. 89, 328–335.

FRIEDL, G. – FINGER, F. – McNAUGHTON, N. J. – FLETCHER, I. R. (1998): New SHRIMP-zircon ages for orthogneisses from the south-eastern part of the Bohemian Massif (Lower Austria). Proceedings of the Intern. Conference Palaeozoic orogenesis and crustal evolution of the European lithosphere. – Acta Univ. Carol., Geol. 42, 251–251.

FRITZ, H. – DALLMEYER, R. D. – NEUBAUER, F. (1996): Thick-skinned versus thin-skinned thrusting: Rheology controlled thrust propagation in the Variscan collisional belt (the southeastern Bohemian Massif, Czech Republic – Austria). – Tectonics 15, 1389–1413.

GREGEROVÁ, M. (1982): The ultramafic rocks of the Brno Massif. – Folia Fac. Sci. Nat. Univ. Purkyn. 21, 3–34. (In Russian)

HANŽL, P. (1994): The correlation between Nectava gneisses and granodiorites of the northern part of the Brno Massif. – Bull. Czech Geol. Surv. 69, 73–80.

HANŽL, P. (1997): Structural profile through the Brno Massif. – Explor. Geophys. Remote Sens. Environment. 4, 1, 29–38.

HANŽL, P. et al. (1999): Geological map of Brno City and its surroundings, 1 : 50,000. – Czech Geol. Survey, Prague.

HANŽL. P. – MELICHAR, R. (1997): The Brno Massif: Variscan reactivation of a Cadomian active continental margin. – J. Czech Geol. Soc. 42, 56.

HANŽL, P. – MELICHAR, R. (1997): The Brno Massif: a section through the active continental margin or a composed terrane? – Krystalinikum 23, 33–58.

HANŽL, P. – MELICHAR, R.(1998): The Brno Massif: A section through an active continental margin. – Geolines 6, 19.

HANŽL, P. – PŘICHYSTAL, A. – MELICHAR, R. (1995): The Brno Massif: Volcanites of the northern part of the metabasite zone. – Acta Univ. Palack. Olomuc., Fac. Rér. Nat. Geol. 34, 75–82.

HROUDA, F. (1999): Petrophysical properties of the Brno Massif and their tectonic implication. – Geolines 8, 30.

JANOUŠEK, V. – HANŽL, P. (2000): Nd isotopic composition of metabasalts from the metabazite Zone, Brno Massif – geochronological and genetic implications. In: Abstracts of the Conference Moravskoslezské paleozoikum, February 3, 2000, 8. – Brno. (In Czech)

JELÍNEK, E. – DUDEK, A. (1993): Geochemistry of subsurface Precambrian plutonic rocks from the Brunovistulian complex in the Bohemian Massif, Czechoslovakia. – Precambrian Res. 62, 103–125.

KALVODA, J. – BÁBEK, O. – FATKA, O. – LEICHMANN, J. – MELICHAR, R. – NEHYBA, S. – ŠPAČEK, P. (2008): Brunovistulian Terrane (Bohemian Massif, Central Europe) from late Proterozoic to late Paleozoic: an overview. – Int. J. Earth Sci. 97, 497–518.

LEICHMANN, J. (1994): Trondhjemites of the Brno Massif. – Geol. Výzk. Mor. Slez. v Roce 1993, 82–85. (In Czech)

LEICHMANN, J. – HÖCK, V. (2008): The Brno Batholith: an insight into the magmatic and metamorphic evolution of the Cadomian Brunovistulian Unit, eastern margin of the Bohemian Massif. – J. Geosci. 53, 281–305.

LEICHMANN, J. – NOVÁK, M. – SULOVSKÝ, P. (1999): Peraluminous whole-rock chemistry versus peralkaline mineralogy of highly fractionated, garnet-bearing granites from the Brno Batholith. – Ber. Dtsch. mineral. Gesell. 1, 144.

MELICHAR, R. – ROUPEC, P. (1994): Nové poznatky o geologii brněnského masívu jižně od Černé Hory. – Geol. Výzk. Mor. Slez. v Roce 1993, 90–91.

MITRENGA, P. – WEISS, J. – REJL, L. (1976): New results about the geological structure of the southern part of the Brno Massif. – Výzk. Práce Ústř. Úst. geol. 13, 33–39. (In Czech)

MITRENGA, P. – REJL, L. (1993): Brněnský masiv (The Brno massif). In: Přichystal, A. – Obstová, V. – Suk, M. Eds: Geologie Moravy a Slezska, 9–13. – Mor. zem. muz. – Sekce geol. věd Přírodověd. fak. Masaryk univ. Brno.

PŘICHYSTAL, A. (1999): K-Ar age determination of a basaltic dike from Želešice (Brno Massif). – Geol. výzk. Mor. Slez. v Roce 1998, 120.

SEDLÁKOVÁ, I. – LEICHMANN, J. (2009): Thoriem bohaté granity západní části brněnského masivu. – Geol. Výzk. Mor. Slez., 118–120.

SKÁCELOVÁ, D. – WEISS, J. (1978): A model of the development of the Brno Massif based on geophysical data. – Čas. Mineral. Geol. 23, 409–415. (In Czech)
ŠTELCL, J. (1963): Brněnský masív v geologické literatuře od roku 1801. – Folia Fac. Sci. Nat. Univ. Purk. Brun., Geol. 4, 5, 43–81.
ŠTELC, J. – WEISS, J. et al. (1986): Brněnský masív. – 255 pp. Univ. J. E. Purkyně, Brno.

Eastern Granodiorites

Mostly quartz-normal, sodic, peraluminous/metaluminous, mesocratic, I-type granodiorite

	Doubravice Granodiorite	**Blansko(dark) Granodiorite**	**Blansko(light) Monzogranite**	**Královo Pole Granodiorite**	**Tetčice Granodiorite**
SiO_2	68.29	65.36	72.15	67.32	70.67
TiO_2	0.41	0.54	0.34	0.51	0.32
Al_2O_3	15.92	15.41	11.49	14.85	14.39
Fe_2O_3	1.51	2.18	1.90	1.65	1.43
FeO	0.87	1.78	1.40	0.97	1.09
MnO	0.06	0.06	0.08	0.09	0.06
MgO	1.00	2.19	2.08	1.05	0.86
CaO	1.40	3.34	1.89	3.25	2.00
Na_2O	4.53	4.65	4.41	4.99	3.69
K_2O	3.30	2.23	1.90	2.53	3.30
P_2O_5	0.02	0.22	n.d.	0.11	0.09
Mg/(Mg+Fe)	0.44	0.51	0.54	0.42	0.39
K/(K+Na)	0.32	0.24	0.22	0.25	0.37
Nor.Or	20.32	13.92	11.98	15.58	20.41
Nor.Ab	42.40	44.11	42.27	46.70	34.68
Nor.An	7.10	15.98	10.01	16.05	9.77
Nor.Q	24.02	19.55	31.71	19.69	30.31
Na+K	216.25	197.40	182.65	214.74	189.14
*Si	145.97	125.50	195.15	120.10	179.15
K-(Na+Ca)	-101.08	-162.26	-135.67	-165.26	-84.67
Fe+Mg+Ti	60.98	113.21	99.17	66.62	58.44
Al-(Na+K+2Ca)	46.46	-13.90	-24.42	-39.03	22.12
(Na+K)/Ca	8.66	3.31	5.42	3.71	5.30
A/CNK	1.18	0.97	0.90	0.89	1.09

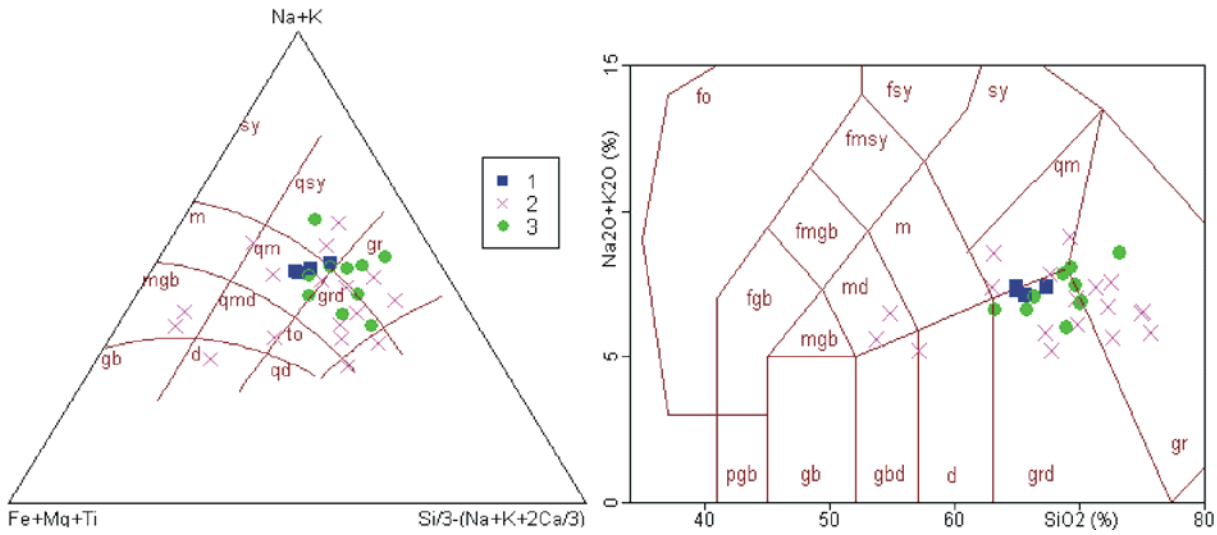


Fig. 5.6. *Brno Composite Pluton ABQ and TAS diagrams – Eastern Granodiorites. 1 – Doubravice Granodiorite, 2 – Blansko Granodiorite, 3 – Královo Pole Granodiorite.*

Western Granodiorites

Mostly quartz-normal, sodic, mostly peraluminous, leuco- to mesocratic, S-type granodiorite to granite

	Kounice (dark) Granodiorite	**Kounice (light) Monzogranite**	**Vever. Bítýška Granodiorite**	**Krumlovský les Granodiorite**	**Vedrovice Granodiorite**	**Olbramovice Granodiorite**
SiO_2	64.65	72.97	71.81	70.06	70.11	73.50
TiO_2	0.45	0.20	0.40	0.30	0.22	0.25
Al_2O_3	16.82	13.92	13.95	15.06	15.39	13.46
Fe_2O_3	1.24	0.73	0.67	1.47	0.98	0.47
FeO	3.06	1.16	0.93	1.13	1.57	1.36
MnO	0.08	0.05	0.05	0.07	0.07	0.07
MgO	1.44	0.62	0.54	0.93	0.90	0.33
CaO	2.90	1.25	2.34	1.48	2.60	2.65
Na_2O	4.49	3.09	4.23	3.26	3.67	3.45
K_2O	2.61	4.70	4.07	4.38	3.38	3.36
P_2O_5	0.30	0.08	0.04	0.11	0.08	0.11
Mg/(Mg+Fe)	0.38	0.37	0.38	0.40	0.39	0.24
K/(K+Na)	0.28	0.50	0.39	0.47	0.38	0.39
Nor.Or	16.32	28.85	24.59	27.03	20.73	20.57
Nor.Ab	42.68	28.83	38.85	30.57	34.21	32.10
Nor.An	13.14	5.90	11.61	6.91	12.84	12.87
Nor.Q	18.84	31.80	24.30	29.11	27.21	32.52
Na+K	200.31	199.50	222.92	198.20	190.19	182.67
*Si	123.88	190.46	147.65	172.89	167.85	193.59
K-(Na+Ca)	-141.19	-22.21	-91.81	-38.59	-93.03	-87.24
Fe+Mg+Ti	99.52	43.19	39.76	60.99	59.23	36.15
Al-(Na+K+2Ca)	26.58	29.27	-32.42	44.77	19.31	-12.85
(Na+K)/Ca	3.87	8.95	5.34	7.51	4.10	3.87
A/CNK	1.11	1.13	0.90	1.19	1.07	0.96

Trace elements(mean values in ppm): *Veverská Bítýška Granodiorite* – **Co** 9.5, **Cr** 81, **Cu** 9, **Mo** 8, **Ni** 80, **Nb** 15, **Rb** 130, **V** 37, **Y** 21, **Zn** 43, **Zr** 113, **La** 31.33, **Ce** 76.09, **Pr** 8.72, **Nd** 27.13, **Sm** 4.14, **Eu** 0.94, **Gd** 3.52, **Tb** 1.0, **Dy** 3.26, **Ho** 0.50, **Er** 1.95, **Tm** 0.37, **Yb** 2.12, **Lu** 0.21.

Krumlovský les Granodiorite – **Co** 24.5, **Cr** 71.5, **Cu** 26, **Ni** 5, **Nb** 33.5 **Pb** 15, Rb 37.5, **V** 205, **Y** 32.5, **Zn** 94.5, **Zr** 33.5, **La** 31.6, **Ce** 81.3, **Pr** 12.04, **Nd** 46.5, **Sm** 7.45, **Eu** 2.49, **Gd** 7.42, **Tb** 1.25, **Dy** 6.25, **Ho** 1.24, **Er** 3.71, **Tm** 0.37, Yb 3.29, **Lu** 0.47.
Tetčice Granodiorite – **Co** 26, **Cr** 160, **Cu** 38, **Ni** 42, **Nb** 51, **Pb** 20, **Rb** 68, **V** 173, **Y** 27.8, **Zn** 79, **Zr** 75, **La** 41.7, **Ce** 89.4, **Pr** 10.3, **Nd** 43.1, **Sm** 6.87, **Eu** 2.26, **Gd** 6.81, **Tb** 1.0, **Dy** 5.33, **Ho** 1.08, **Er** 3.14, **Tm** 0.35, **Yb** 2.88, **Lu** 0.42.
Blansko Granodiorite – **Co** 25, **Cr** 329, **Cu** 42, **Mo** 11, **Ni** 181, **Nb** 7, **Pb** 10, **Rb** 29, **V** 100, **Y** 15, **Zn** 100, **Zr** 136, **La** 22.14, **Ce** 58.52, **Pr** 9.46, **Nd** 28.19, **Sm** 5.12, **Eu** 1.47, **Gd** 4.42, **Tb** 1.0, **Dy** 3.03, **Ho** 0.59, **Er** 1.35, **Tm** 0.30, **Yb** 1.53, **Lu** 0.20.
Královo Pole Granodiorite – **Co** 13, **Cr** 321, **Cu** 9, **Mo** 14, **Ni** 181, **Nb** 8, **Pb** 12.6, **Rb** 45, **V** 52, **Zn** 70, **Zr** 117, **La** 20.41, **Ce** 52.46, **Pr** 5.62, **Nd** 19.90, **Sm** 53.47, **Eu** 0.97, **Gd** 2.50, **Tb** 1.0, **Dy** 1,95, **Ho** 0.43, **Er** 1.23, **Tm** 0.34, **Yb** 0.98, **Lu** 0.16.

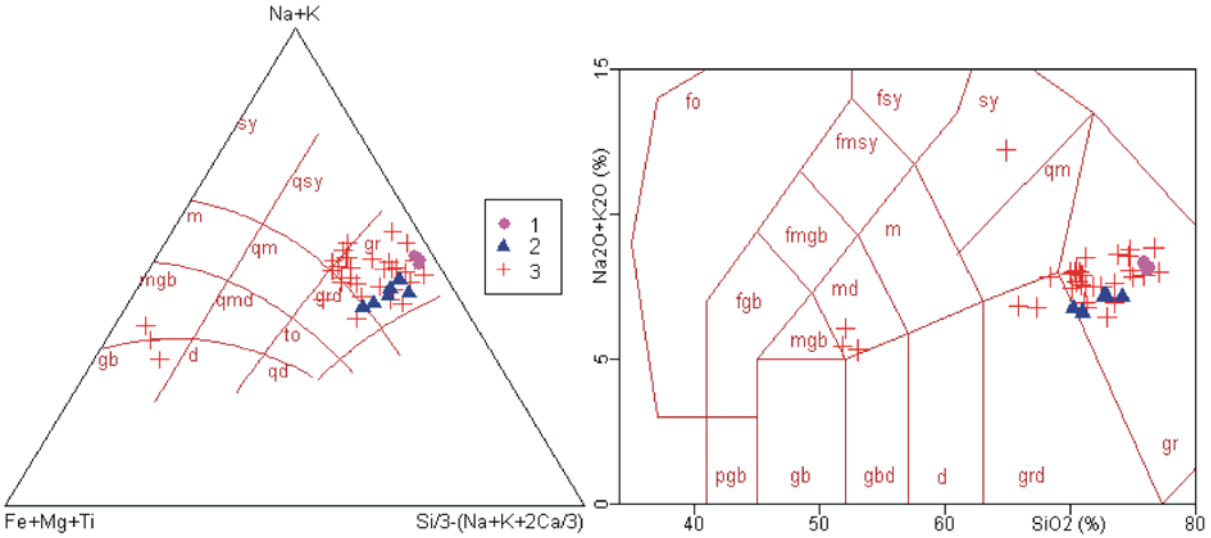


Fig. 5.7. *Brno Composite Pluton ABQ and TAS diagrams – Western Granodiorites (Western Granitoid Complex) ABQ and TAS diagrams. 1 – Hlína Suite, 2 – Réna Suite, 3 – Tetčice Suite.*

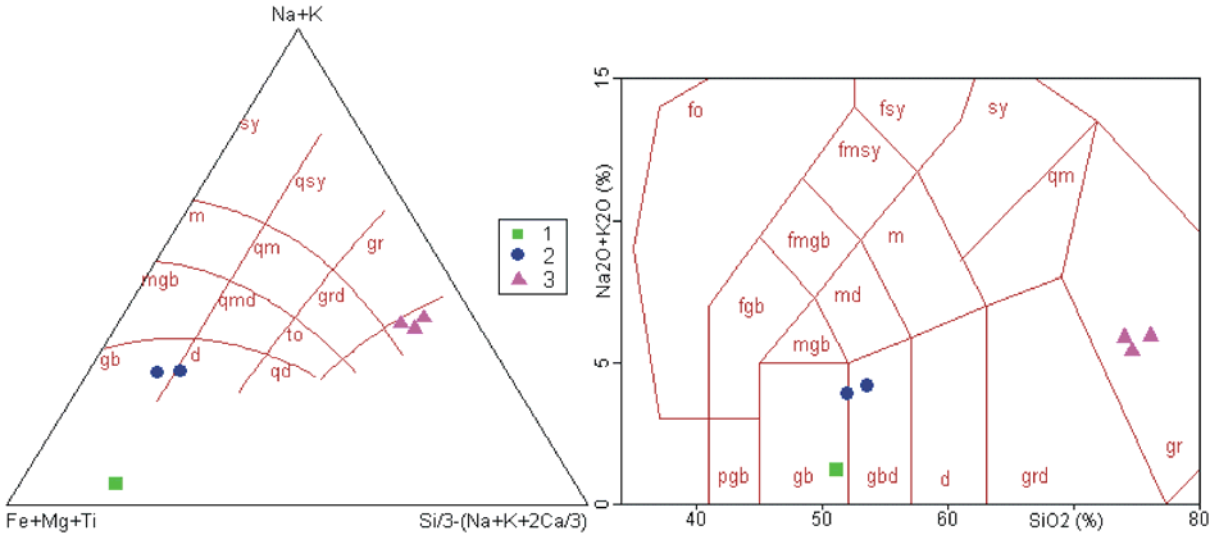


Fig.5.8. *Brno Composite Pluton – Metadiorite Belt of the CentralBasic Zone (Ophiolite Belt) ABQ and TAS diagrams. 1 – gabbro, 2 – diorite, 3 – trondhjemite (Jundrov Granodiorite).*

Tetčice Suite

Tetčice Granodiorite – Quartz-normal, sodic, peraluminous,, mesocratic, S-type granodiorite
Tetčice Red Granite – Quartz-rich, sodic-potassic, peraluminous, leucocratic, S-type, granite

		grdJ-5	**grdJ-6**	**redGrJ-**	**redGrJ-**	**redGrJ-**
	Tetčice Granodiorite			**Tetčice Red Granite**		
SiO_2	72.19	73.43	72.33	74.04	73.46	74.21
TiO_2	0.21	0.13	0.27	0.15	0.11	0.21
Al_2O_3	14.96	15.11	15.64	13.92	13.74	13.74
Fe_2O_3	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
FeO_{tot}	1.81	1.24	2.09	1.25	1.41	1.57
MnO	0.04	n.d.	n.d.	n.d.	n.d.	n.d.
MgO	0.67	0.53	0.40	0.36	0.23	0.51
CaO	1.41	1.84	1.56	1.24	1.35	0.62
Na_2O	4.34	4.23	4.66	3.13	3.25	3.39
K_2O	2.55	3.37	2.82	4.61	4.68	5.13
P_2O_5	0.05	n.d.	0.02	n.d.	0.07	0.07
Mg/(Mg+Fe)	0.39	0.43	0.25	0.34	0.23	0.37
K/(K+Na)	0.28	0.34	0.28	0.49	0.49	0.50
Nor.Or	15.73	20.29	17.05	28.28	28.81	31.29
Nor.Ab	40.70	38.71	42.82	29.19	30.41	31.42
Nor.An	6.96	9.31	7.79	6.39	6.50	2.70
Nor.Q	30.88	28.56	27.49	32.76	31.38	30.42
Na+K	194.19	208.05	210.25	198.88	204.24	218.32
*Si	189.54	177.45	172.48	197.13	187.25	186.02
K-(Na+Ca)	-111.05	-97.76	-118.32	-25.23	-29.58	-11.53
Fe+Mg+Ti	44.46	32.05	42.41	28.22	26.72	37.15
Al-(Na+K+2Ca)	49.30	23.05	41.25	30.25	17.43	29.40
(Na+K)/Ca	7.72	6.34	7.56	8.99	8.48	19.75
A/CNK	1.21	1.08	1.16	1.12	1.08	1.13

Trace elements (in ppm): *Tetčice Granodiorite* – **Nb** 9, **Zr** 147, **Y** 16, **Sr** 384, **Rb** 87, **Pb** 16, **Ga** 16, **Zn** 38, **Cu** 7, **Ni** 8, **Co** 7, **Ba** 1284, **Sc** 2, **Cr** 4, **V** 8.
Tetčice Red Granite – **Nb** 14 , **Zr** 155, **Y** 16, **Sr** 270, **Rb** 123, **Pb** 15, **Ga** 15, **Zn** 19, **Cu** 12, **Ni** 8, **Co** 5, **Ba** 779, **Sc** 1, **Cr** 2, **V** 5.

Tetčice Suite

Tetčice Diorite – Quartz-normal, sodic, metaluminous to peraluminous, I-type, diorite
Tetčice Tonalite – Quartz-normal, sodic, peraluminous, I-type, tonalite

	diJ-1c	**diJ-14b**	**toJ-15**
	Diorite		**Tonalite**
SiO_2	51.67	51.42	64.55
TiO_2	1.46	1.39	0.32
Al_2O_3	18.16	18.75	18.33
Fe_2O_3	n.d.	n.d.	n.d.
FeO_{tot}	8.80	9.04	2.80
MnO	0.13	0.15	0.09
MgO	4.62	4.56	0.95
CaO	7.79	8.08	4.25
Na_2O	3.71	3.65	4.51
K_2O	2.32	1.74	2.18
P_2O_5	0.64	0.44	0.10

Mg/(Mg+Fe)	0.48	0.47	0.37
K/(K+Na)	0.29	0.24	0.24
Nor.Or	14.61	11.11	13.52
Nor.Ab	35.52	35.41	42.52
Nor.An	36.71	40.18	21.45
Nor.Q	0.00	0.00	17.07
Na+K	168.98	154.73	191.82
*Si	25.07	34.48	115.76
K-(Na+Ca)	-209.37	-224.92	-175.04
Fe+Mg+Ti	255.47	256.45	66.57
Al-(Na+K+2Ca)	-90.18	-74.68	16.57
(Na+K)/Ca	1.22	1.07	2.53
A/CNK	0.83	0.85	1.05

Trace elements (in ppm): *Tetčice Diorite* – **Nb** 22, **Zr** 196, **Y** 33, **Sr** 808, **Rb** 64, **Pb** 18, **Ga** 22, **Zn** 95, **Cu** 20, **Ni** 20, **Co** 22, **Ba** 1006, **Sc** 26, **Cr** 116, **V** 174.
Tetčice Tonalite – **Nb** 10, **Zr** 227, **Y** 10, **Sr** 684, **Rb** 57, **Pb** 16, **Ga** 20, **Zn** 42, **Cu** 13, **Ni** 9, **Co** 6, **Ba** 767, **Sc** 3, **Cr** 2, **V** 23.

Réna Suite

Réna Granodiorite – Quartz normal, sodic, moderately peraluminous, mesocratic, S-type granite-granodiorite

	RenaJ-8	**grdJ-9**	**grdJ-10**	**grdJ-22**	**gr-grdJ**	**gr-grdJ**
	Réna Granodiorite				**Réna Granite-Granodiorite**	
SiO_2	71.97	73.35	69.43	70.14	71.86	71.86
TiO_2	0.26	0.16	0.37	0.35	0.27	0.21
Al_2O_3	14.59	14.38	15.11	15.38	14.67	15.17
Fe_2O_3	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
FeO_{tot}	2.05	1.46	2.83	2.54	2.04	1.55
MnO	0.01	0.07	0.43	0.09	0.10	0.04
MgO	0.74	0.46	1.25	0.97	0.54	0.38
CaO	2.22	1.95	2.73	2.69	2.05	2.29
Na_2O	3.25	3.24	3.29	3.64	3.64	3.87
K_2O	3.83	3.82	3.36	2.88	3.46	3.15
P_2O_5	0.05	n.d.	0.09	0.11	0.09	0.03
Mg/(Mg+Fe)	0.39	0.35	0.41	0.40	0.31	0.30
K/(K+Na)	0.44	0.44	0.40	0.34	0.38	0.35
Nor.Or	23.68	23.47	21.12	17.92	21.36	19.31
Nor.Ab	30.53	30.26	31.43	34.42	34.15	36.05
Nor.An	11.18	10.06	13.78	13.29	10.01	11.58
Nor.Q	30.20	32.62	27.12	28.39	29.92	29.53
Na+K	186.20	185.66	177.51	178.61	190.922	191.76
*Si	186.69	198.09	175.22	178.53	183.37	179.68
K-(Na+Ca)	-63.14	-58.22	-83.51	-104.28	-80.55	-98.84
Fe+Mg+Ti	50.17	33.75	75.06	63.83	45.19	33.65
Al-(Na+K+2Ca)	21.15	27.19	21.86	27.48	24.05	24.47
(Na+K)/Ca	4.70	5.34	3.65	3.72	5.22	4.70
A/CNK	1.08	1.11	1.09	1.11	1.10	1.09

Trace elements (in ppm): *Rena Granodiorite* – **Nb** 11, **Zr** 106, **Y** 18, **Sr** 262, **Rb 130**, **Pb** 19, **Ga** 17, **Zn** 45, **Cu** 7, **Ni** 9, **Co** 5, **Ba** 476, **Sc** 3.5, **Cr** 5.5, **V** 16.

Hlína Suite

Hlína Granite – Quartz-rich, sodic, peraluminous, leucocratic, I/S-type granite

	HlínaJ-	**J-21c**	**J-Re**	**J-1v**
SiO_2	75.79	75.86	74.92	75.46
TiO_2	0.03	0.04	0.04	0.04
Al_2O_3	13.64	13.60	13.48	13.27
Fe_2O_3	n.d.	n.d.	n.d.	n.d.
FeO_{tot}	0.90	0.71	0.79	0.84
MnO	0.10	0.09	0.04	0.90
MgO	0.03	0.03	0.03	0.02
CaO	0.96	1.02	1.16	0.61
Na_2O	3.85	3.85	3.93	4.18
K_2O	4.21	4.29	4.15	4.11
P_2O_5	0.02	0.01	0.01	0.01
Mg/(Mg+Fe)	0.05	0.06	0.06	0.02
K/(K+Na)	0.42	0.42	0.41	0.39
Nor.Or	25.38	25.81	25.20	24.92
Nor.Ab	35.27	35.21	36.27	38.52
Nor.An	4.73	5.09	5.85	3.04
Nor.Q	32.53	32.27	31.42	31.06
Na+K	213.63	215.32	214.93	222.15
*Si	195.43	193.41	186.92	189.23
K-(Na+Ca)	-51.97	-51.34	-59.39	-58.50
Fe+Mg+Ti	13.65	11.13	12.25	12.70
Al-(Na+K+2Ca)	20.00	15.37	8.42	16.69
(Na+K)/Ca	12.48	11.84	10.39	20.42
A/CNK	1.08	1.06	1.03	1.07

Trace elements (in ppm): *Hlína Granite* – **Nb** 34, **Zr** 75, **Y** 35, **Sr** 22, **Rb** 174, **Pb** 9, **Ga** 21, **Zn** 10, **Cu** 3, **Ni** 0.5, **Co** 0.5, **Ba** 18, **Sc** 2, **Cr** 0.5, **V** 3.

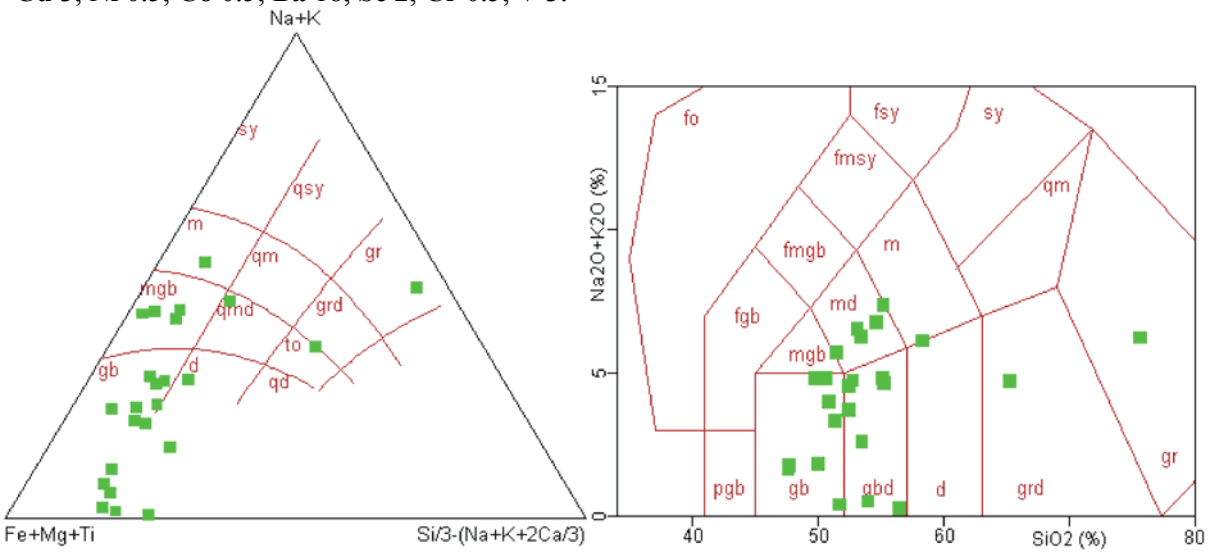


Fig. 5.9. *Brno Composite Pluton – Metadiorite Belt of the Central Metabasic Zone ABQ and TAS diagrams. Gabbros and diorites.*

Metadiorite Belt of the Central Metabasic Zone

Quartz-deficient, sodic, mostly metaluminous, melanocratic, diorite and gabbro

n = 7	Median	Min	Max	QU1	QU3
SiO_2	47.10	43.78	52.91	46.24	50.90
TiO_2	0.76	0.21	1.25	0.36	0.84
Al_2O_3	18.17	14.02	21.84	15.38	20.18
Fe_2O_3	2.10	0.91	8.52	1.43	2.13
FeO	6.44	0.00	7.86	5.34	6.70
MnO	0.14	0.00	0.47	0.00	0.19
MgO	6.76	3.31	11.14	4.00	7.48
CaO	9.43	6.24	13.37	6.94	9.96
Na_2O	3.16	1.65	4.70	2.74	3.92
K_2O	1.10	0.90	1.80	1.09	1.37
P_2O_5	0.26	0.00	0.67	0.00	0.28
Mg/(Mg+Fe)	0.62	0.45	0.72	0.45	0.63
K/(K+Na)	0.19	0.14	0.39	0.15	0.20
Nor.Or	7.12	6.01	11.18	6.10	8.75
Nor.Ab	29.65	17.09	44.36	26.61	33.34
Nor.An	48.43	31.55	61.72	34.18	52.92
Nor.Q	0.00	0.00	0.47	0.00	0.00
Na+K	125.33	86.79	189.88	113.34	149.64
*Si	31.93	-41.39	56.94	-11.51	51.69
K-(Na+Ca)	-237.20	-317.03	-201.76	-280.96	-230.11
Fe+Mg+Ti	296.89	193.74	395.58	234.90	301.86
Al-(Na+K+2Ca)	-124.25	-205.86	41.22	-202.82	-80.57
(Na+K)/Ca	0.70	0.48	1.53	0.53	0.84
A/CNK	0.72	0.60	1.11	0.62	0.85

5.1.1. SLAVKOV MASSIF

Regional position: sub-surface member of the Brno Composite Batholith in its northern margin.

Rock types: *Slavkov Tonalite* – medium-grained biotite- hornblende leucogranodiorite to tonalite. Relations to Blansko Granodiorite.

Size and shape: ~ 100 km^2, E-W trending elliptic intrusion. The massif has been encountered in a great number of boreholes at depth up to 1041 to 1766 m.

Age and isotopic data: *Slavkov Tonalite* 565, 560, 547–576 Ma (K/Ar).

Geological environment: the Stupava Leucogranodiorite.

Zoning: unknown.

Mineralization: unknown.

References

DUDEK, A. (1980): The Crystalline basement block of the Outer Carpathians in Moravia: Bruno-Vistulicum. – Rozpr. Čs. Akad. Věd, Ř. mat. přír. Věd 90, 8, 3–83.

Slavkov Tonalite

Quartz-normal, sodic, metaluminous to peraluminous, I-type, I-series, tonalite to quartz diorite

	Slav73	Slav108	Slav110	Slav10
SiO_2	62.46	61.47	66.67	67.54
TiO_2	0.65	0.80	0.40	0.61
Al_2O_3	17.53	17.38	16.43	15.08
Fe_2O_3	2.10	2.23	1.35	1.74
FeO	2.18	2.14	1.30	2.15
MnO	0.07	0.08	0.06	0.05

MgO	1.90	1.83	1.01	1.90
CaO	4.46	4.51	1.61	0.87
Na_2O	4.56	4.84	6.10	3.76
K_2O	2.14	1.96	2.16	3.60
P_2O_5	0.20	0.20	0.17	0.20
Mg/Mg+Fe	0.45	0.44	0.41	0.47
K/(K+Na)	0.24	0.21	0.19	0.39
Nor.Or	13.26	12.21	13.18	22.69
Nor.Ab	42.95	45.83	56.56	36.01
Nor.An	21.83	22.21	7.09	3.20
Nor.Q	15.47	13.67	17.65	26.71
Na+K	192.59	197.80	242.71	197.77
*Si	100.91	89.61	108.03	166.59
K-(Na+Ca)	-181.24	-194.99	-179.69	-60.41
Fe+Mg+Ti	111.96	113.17	65.09	106.53
Al-(Na+K+2Ca)	-7.40	-17.34	22.53	67.34
(Na+K)/Ca	2.42	2.46	8.45	12.75
A/CNK	0.99	0.96	1.09	1.32

Trace elements (mean values in ppm): *Slavkov Tonalite* – **Rb** 26, **Sr** 1030, **Ba** 984, **Nb** 11, **Ga** 20, **Y** 15, **Zr** 159, **V** 46, **Co** 4.5, **Cr** 80, **Ni** 6, **Cu** 4, **Pb** 10, **Zn** 56, **As** 6, **Sc** 5, **Hf** 4, **Ta** 0.52, **Cs** 0.5, **Th** 2.6, **U** 1.7.

5.1.2. ŽDÁNICE MASSIF

Regional position: sub-surface member of the Brno Composite Batholith.

Rock types: *Ždánice Tonalite* – mafic medium-grained biotite- hornblende quartz diorite to tonalite.

Size and shape: 90 km^2 (18 × 6 km), E-W trending elliptic intrusion. The massif has been encountered in a number of boreholes at depth up to 1620 m.

Age and isotopic data: *Ždánice Tonalite* 600 ± 30 Ma(K/Ar hornblende).

Geological environment: Stupava Leucogranodiorite.

Zoning: unknown.

Mineralization: unknown.

References

DUDEK, A. (1980): The Crystalline basement block of the Outer Carpathians in Moravia: Bruno-Vistulicum. – Rozpr. Čs. Akad. Věd, Ř. mat. přír. Věd, 90, 8, 3–83.

Ždánice Tonalite

Quartz-normal, sodic, metaluminous, meso- to melanocratic, I-type, I-series, tonalite to quartz gabbro

n = 12	Median	Min	Max	QU1
SiO_2	58.92	54.69	63.08	55.44
TiO_2	1.26	0.30	1.76	0.70
Al_2O_3	16.08	15.09	18.41	15.80
Fe_2O_3	2.96	1.51	6.80	2.78
FeO	3.16	2.30	5.10	2.62
MnO	0.13	0.00	0.33	0.08
MgO	2.96	2.16	4.38	2.30
CaO	4.51	1.80	6.23	3.47
Na_2O	3.66	3.07	4.24	3.24
K_2O	2.36	1.47	3.10	1.54
P_2O_5	0.24	0.12	0.45	0.24
Mg/(Mg+Fe)	0.44	0.38	0.53	0.42
K/(K+Na)	0.30	0.20	0.37	0.21
Nor.Or	15.26	9.67	20.65	9.93
Nor.Ab	35.95	29.90	42.92	31.59
Nor.An	22.75	7.54	32.02	17.82
Nor.Q	15.43	8.08	24.09	9.61
Na+K	157.19	147.01	202.64	152.42
*Si	107.69	76.93	151.88	84.58
K-(Na+Ca)	-152.76	-198.36	-103.10	-179.70
Fe+Mg+Ti	174.88	143.87	237.04	148.62
Al-(Na+K+2Ca)	-16.16	-46.42	68.97	-35.57
(Na+K)/Ca	1.87	1.37	6.31	1.56
A/CNK	0.97	0.89	1.30	0.92

Trace elements (mean values in ppm): *Ždánice Tonalite* – **Rb** 44, **Sr** 497, **Ba** 745, **Nb** 10, **Ga** 17, **Y** 2, **Zr** 142, **V** 102, **Co** 18, **Cr** 52, **Ni** 15, **Cu** 84, **Pb** 16, **Zn** 95, **As** 9, **Sc** 15, **Hf** 4, **Ta** 0.5, **Cs** 1.1, **Th** 2.7, **U** 1.2.

5.1.3. LUBNÁ MASSIF

Regional position: sub-surface member of the Brno Composite Batholith.

Rock types: *Lubná Granite* – medium to coarse-grained massive leucogranite.

Size and shape: actual size and shape is unknown. The massif has been encountered in a great number of boreholes at depth up to 1861 m. The granite mass of small thickness had been thrust northward over metamorphics of the northern part of the Central Moravian Block.

Age and isotopic data: Cadomian. No isotopic data.

Geological environment: muscovite-biotite paragneiss (migmatized), and the Stupava Leucogranodiorite.

Zoning: unknown.

Mineralization: unknown.

References

DUDEK, A. (1980): The Crystalline basement block of the Outer Carpathians in Moravia: Bruno-Vistulicum. – Rozpr. Čs. Akad. Věd, Ř. mat. přír. Věd 90, 8, 3–83.

Lubná Granite

Quartz-normal, sodic, weakly peraluminous, I-type, I-series, monzogranite

	Lubná 17	**Lubná 18**
SiO_2	71.23	72.01
TiO_2	0.81	0.40
Al_2O_3	12.92	13.67
Fe_2O_3	1.10	1.32
FeO	1.82	1.13
MnO	0.13	0.10
MgO	1.00	0.50
CaO	1.10	0.99
Na_2O	3.86	4.36
K_2O	3.81	4.05
P_2O_5	0.14	0.43
Mg/(Mg+Fe)	0.38	0.27
K/(K+Na)	0.39	0.38
Nor.Or	23.69	24.57
Nor.Ab	36.48	40.20
Nor.An	4.77	2.13
Nor.Q	29.38	28.06
Na+K	205.46	226.69
*Si	176.64	161.04
K-(Na+Ca)	-63.28	-72.36
Fe+Mg+Ti	74.09	49.69
Al-(Na+K+2Ca)	9.04	6.46
(Na+K)/Ca	10.47	12.84
A/CNK	1.05	1.06

Trace elements (mean values in ppm): *Lubná Granite* – **Rb** 100, **Sr** 170, **Ba** 930, **Nb** 16, **Ga** 16, **Y** 20, **Zr** 155, **V** 21, **Co** 4, **Cr** 30, **Ni** 16, **Cu** 124, **Pb** 29, **Zn** 20, **As** 18, **Sc** 3, **Hf** 4.8, **Ta** 1.2, **Cs** 3, **Th** 18, **U** 3.4.

5.1.4. MIKULOV MASSIF

Regional position: surface and sub-surface member of the Brno Composite Batholith in its southern part.

Rock types: *1. Mikulov Granite* – muscovite–biotite granite grades into biotite-granodiorite

2. Mikulov Granodiorite – biotite-granodiorite (grades into granite).

Size and shape (in erosion level): the massif has been encountered in a number of boreholes at depth up to of 2,582 m.

The massif has a rectangular shape and size 9 × 12 km (the southern margin is not outlined).

Age and isotopic data: Cadomian. No isotopic data.

Geological environment: sub-surface equivalents of the Tetčice, Krumlovský Les and Leskoun Granodiorites, diorite-gabbrodiorite–gabbro intrusions.

Zoning: unknown.

Mineralization: unknown.

References

DUDEK, A. (1980): The Crystalline basement block of the Outer Carpathians in Moravia: Brunovistulicum. – Rozpr. Čs. Akad. Věd, Ř. mat. přír. Věd 90, 8, 3–83.

Mikulov Granite

Quartz-normal, sodic, mostly peraluminous, I-type, I-series, granite

n = 7	Median	Min	Max	QU1	QU3
SiO_2	71.83	67.53	74.16	71.42	72.09
TiO_2	0.51	0.19	0.65	0.36	0.54
Al_2O_3	13.94	11.37	15.00	13.67	14.68
Fe_2O_3	0.95	0.37	1.55	0.61	1.21
FeO	1.26	0.42	1.96	0.53	1.60
MnO	0.06	0.02	0.10	0.03	0.06
MgO	0.76	0.43	1.14	0.48	0.80
CaO	1.20	0.63	1.89	0.88	1.23
Na_2O	4.16	3.40	5.38	3.89	4.40
K_2O	3.34	2.68	4.42	3.11	3.46
P_2O_5	0.05	0.00	0.30	0.00	0.14
Mg/(Mg+Fe)	0.38	0.27	0.60	0.28	0.39
K/(K+Na)	0.35	0.25	0.45	0.31	0.36
Nor.Or	20.46	16.69	27.10	18.99	21.43
Nor.Ab	38.73	31.76	50.92	36.25	41.43
Nor.An	4.39	2.29	6.40	3.85	5.85
Nor.Q	30.45	20.30	32.29	27.17	30.76
Na+K	208.23	201.02	230.51	203.83	210.92
*Si	178.21	129.86	187.72	168.66	178.73
K-(Na+Ca)	-87.40	-138.11	-29.65	-109.44	-78.84
Fe+Mg+Ti	48.71	39.97	77.01	42.35	51.01
Al-(Na+K+2Ca)	21.26	-52.35	67.16	15.15	26.05
(Na+K)/Ca	10.29	6.18	17.89	8.52	10.77
A/CNK	1.10	0.81	1.32	1.07	1.11

Trace elements (mean values in ppm): *Mikulov Granite* – **Rb** 67, Sr 300, **Ba** 900, **Nb** 14, **Ga** 16, **Y** 13, **Zr** 107, **V** 15, Co 2, **Cr** 45, **Ni** 5, **Cu** 67, **Pb** 23, **Zn** 41, **As** 5, **Sc** 2.4, **Hf** 3, **Ta** 0.6, **Cs** 1.6, **Th** 3.7, **U** 1.1.

5.1.5. STUPAVA MASSIF

Regional position: a sub-surface member of the Brno Composite Batholith

Rock types: *Stupava Granodiorite* – medium-grained biotite leucogranodiorite to leucotonalite.

Size and shape (in erosion level): the massif has been encountered in a great number of boreholes at depth up to 2,518 m. The oval shape oriented in E-W direction and rough estimation of the size of the intrusion is 20 × 15 km.

Age and isotopic data: Cadomian. No isotopic data.

Geological environment: the Slavkov Tonalite, and the Ždánice Tonalite.

Zoning: unknown.

Mineralization: unknown.

References

DUDEK, A. (1980): The Crystalline basement block of the Outer Carpathians in Moravia: Bruno-Vistulicum. – Rozpr. Čs. Akad. Věd, Ř. mat. přír. Věd 90, 8, 3–83.

Stupava Granodiorite

Quartz-normal, sodic, low peraluminous, I-type, I-series, granodiorite to granite

	St104	St106	St168	St201
SiO_2	68.36	74.08	70.48	72.01
TiO_2	0.26	0.05	0.81	0.38
Al_2O_3	15.90	14.49	14.35	14.55
Fe_2O_3	0.92	n.d.	1.83	1.28
FeO	1.62	0.89*	1.13	1.03
MnO	0.07	0.04	0.16	0.06
MgO	0.78	0.23	0.79	0.72
CaO	2.44	0.98	1.29	1.44
Na_2O	5.04	5.02	4.51	4.40
K_2O	2.41	2.71	3.03	2.28
P_2O_5	0.12	0.05	0.14	n.d.
Mg/(Mg+Fe)	0.36	0.31	0.32	0.36
K/(K+Na)	0.24	0.26	0.31	0.25
Nor.Or	14.77	16.38	18.52	13.98
Nor.Ab	46.93	46.11	41.90	41.01
Nor.An	11.73	4.64	5.67	7.42
Nor.Q	21.99	29.82	27.89	32.24
Na+K	213.81	219.53	209.87	190.0
*Si	136.43	179.80	165.80	191.8
K-(Na+Ca)	-154.98	-121.93	-104.20	-119.25
Fe+Mg+Ti	56.70	18.73	68.42	53.01
Al-(Na+K+2Ca)	11.41	30.07	25.93	43.98
(Na+K)/Ca	4.91	12.56	9.12	7.41
A/CNK	1.05	1.12	1.11	1.18

* = tot FeO

Trace elements (mean values in ppm): *Stupava Granodiorite* – **Rb** 50, **Sr** 600, **Ba** 935, **Nb** 10, **Ga** 17, **Y** 11, **Zr** 126, **V** 22, **Co** 2.5, **Cr** 90, **Ni** 3, **Cu** 6, **Pb** 14, **Zn** 34, **As** 6, **Sc** 3, **Hf** 2.8, **Ta** 0.5, **Cs** 1, **Th** 2.1, **U** 1.8.

5.1.6. SVRATKA MASSIF

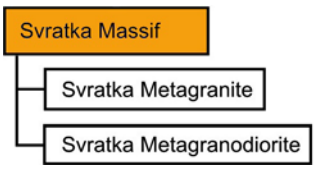


Fig. 5.10. *Svratka M assif hierarchical scheme according to rock types.*

Regional position: the core of the Svratka Dome in the Moravicum (western part of the Brunovistulicum) is a paraautochthonous equivalent of Western Granodiorites/Granites of the Brno Composite Pluton.

Rock types: *Svratka Metagranit*e – biotite metagranite,

Svratka Metagranodiorite – amphibole-biotite metagranodiorite to metadiorite, sheet-like bodies in the Svratka Granite.

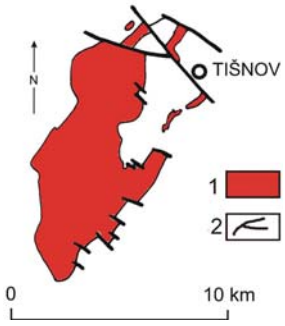


Fig. 5.11. *Svratka Massif geological sketch-map. 1 – Svratka Metagranite and Metagranodiorite, 2 – faults.*

Age and isotopic data: Cadomian. No isotopic data.

Size and shape (in erosion level): Svratka Massif ~ 40 km^2, cupola (domal shape). Bíteš Orthogneiss constitutes the upper part of the Svratka Dome.

Geological environment: Bílý Potok Group – phyllites, marbles, mica schists and greenschists.

Contact aureole: contact is mostly tectonized.

References

HÖCK, V – LEICHMANN, J. (1994): Excursion C: Das Moravicum der Thayakuppel. – Mitt. Österr. mineral. Gesell. 139, 407–427.

JAROŠ, J. (1992): The nappe structure in the Svratka Dome. In: Kukal, Z. Ed.: Proceedings of the 1st International Conference on the Bohemian Massif, Prague, Czechoslovalia, Sept. 26-Oct. 3, 1988, 137–140. – Czech Geol. Survey, Prague.

SOUČEK, J. (1992): Petrology of the Bíteš orthogneiss of the Svratka Dome. In: Styles of superposed Variscan nappe tectonics. (Case study of the external Moldanubian Zone). 7th Svratka Geological workshop, Kutná Hora, Abstracts, 56–57. – Geol. úst. Čs. akad. věd, Praha.

SOUČEK, J. – JELÍNEK, E. – BOWES, D. R. (1992): Geochemistry of gneisses of the eastern margin of the Bohemian Massif. In: Kukal, Z. Ed.: Proceedings of the 1st International Conference on the Bohemian Massif, Prague, Czechoslovakia, Sept. 26-Oct. 3, 1988, 269–285. – Czech Geol. Survey, Prague.

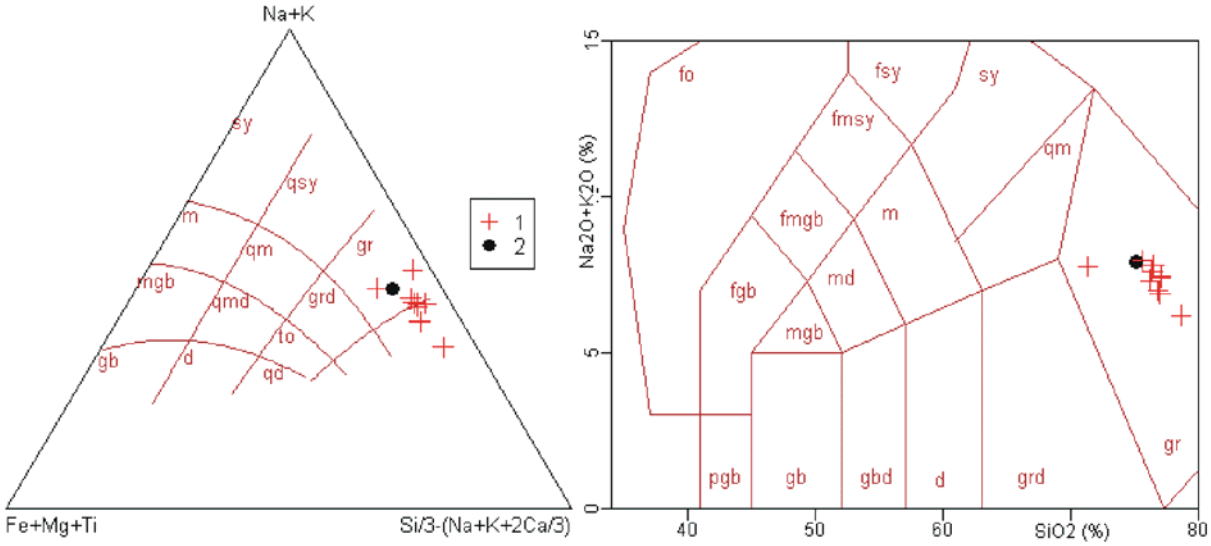


Fig. 5. 12*. Svratka Massif ABQ and TAS diagrams. 1 – Svratka Metagranite, 2 – Bíteš Orthogneiss*

Svratka Metagranite

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

n = 9	Median	Min	Max	QU1	QU3
SiO_2	75.54	74.31	77.49	75.18	75.87
TiO_2	0.12	0.08	0.18	0.10	0.14
Al_2O_3	12.79	12.07	13.48	12.74	13.01
Fe_2O_3	0.24	0.08	0.39	0.20	0.30
FeO	1.21	0.38	1.47	1.14	1.32
MnO	0.02	0.01	0.03	0.01	0.02
MgO	0.26	0.01	0.45	0.17	0.28
CaO	0.70	0.55	1.43	0.56	0.85
Na_2O	2.60	1.90	3.32	2.44	2.68
K_2O	4.51	4.20	5.04	4.32	4.89
P_2O_5	0.28	0.24	0.35	0.27	0.29
Mg/(Mg+Fe)	0.24	0.01	0.36	0.23	0.26
K/(K+Na)	0.55	0.47	0.59	0.52	0.56
Nor.Or	28.12	26.18	30.99	26.57	30.23

Nor.Ab	24.46	18.00	30.75	22.92	25.05
Nor.An	1.65	0.90	5.28	1.12	2.61
Nor.Q	39.11	33.63	47.71	38.40	40.88
Na+K	182.56	150.49	202.89	172.85	188.53
*Si	226.41	192.36	271.21	222.70	238.23
K-(Na+Ca)	7.12	-36.88	15.56	-6.99	9.94
Fe+Mg+Ti	27.11	13.16	32.56	25.94	28.96
Al-(Na+K+2Ca)	41.68	10.83	61.93	38.88	48.29
(Na+K)/Ca	12.23	7.96	19.73	11.82	18.80
A/CNK	1.24	1.07	1.42	1.22	1.27

5.1.7. OLOMOUC (UPPER MORAVA BASIN) MASSIF

Regional position: isolated intrusion in paragneisses of the Precambrian Brunovistulian Unit (Slavkov Terrane). A subsurface member of the Brno Composite Batholith.

Rock types: *Olomouc Granite* – two-mica granite to granodiorite.

Size and shape (in erosion level): the size and shape is mostly unknown (more than 300 km^2).

Age and isotopic data: Krčman pegmatite 540, 470 Ma (K/Ar).

Geological environment: Neoproterozoic biotite paragneisses (retrograde sheared) with abundant layers of metavolcanics (Metabasalts and meta-andesites).

Contact aureole: two regional metamorphic phases overlapped by the younger phase of contact metamorphism.

Zoning: unknown.

Mineralization: pegmatite dykes.

References

HLOBILOVÁ, J. (1963): Příspěvek k petrografii krystalinika v Hornomoravském úvalu I. – Acta Univ, Palack. Olomouc. 10, Geogr.-Geol. 1964, 4, 119–176.

KOPEČNÝ, V. (1975): The dynamometamorphism of granitoids in the Baba Hill near Olomouc. – Čas. Slez. Muz., Sér. A 24, 49–53. (In Czech)

Olomouc Granite

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

	1667Hor	**1668Hor**	**1669Hor**	**1670Hor**
SiO_2	74.46	73.96	76.16	75.65
TiO_2	0.11	n.d.	n.d.	n.d.
Al_2O_3	12.94	12.73	15.24	13.51
Fe_2O_3	0.32	1.57	0.77	0.33
FeO	0.51	1.73	n.d.	0.69
MnO	0.01	n.d.	n.d.	n.d.
MgO	0.31	0.46	0.27	0.38
CaO	0.68	1.89	0.60	0.38
Na_2O	2.37	3.51	1.63	2.49
K_2O	6.28	4.38	4.11	6.12
P_2O_5	0.51	0.11	n.d.	n.d.
Mg/(Mg+Fe)	0.41	0.21	0.41	0.41
K/(K+Na)	0.64	0.45	0.62	0.62
Nor.Or	38.51	26.54	25.26	37.00
Nor.Ab	22.09	32.33	15.23	22.88
Nor.An	0.01	8.87	3.10	4.11
Nor.Q	34.55	29.93	47.47	33.16

Na+K	209.82	206.26	139.86	210.29
*Si	195.19	181.58	275.52	199.77
K-(Na+Ca)	44.73	-53.97	23.97	35.15
Fe+Mg+Ti	20.18	55.18	16.35	23.17
Al-(Na+K+2Ca)	20.04	-23.68	138.02	26.13
(Na+K)/Ca	17.30	6.12	13.07	14.56
A/CNK	1.14	0.92	1.85	1.11

BASIC INTRUSIONS

5.1.8. VLKOŠ STOCK

Regional position: isolated intrusion in paragneisses of the Precambrian Brunovistulian Unit (Slavkov Terrane).

Size and shape: subsurface outcrop of the oval (1 × 2 km) body at depth of over 600 m under sedimentary cover.

Rock types: *Vlkoš Gabbro* – pyroxene gabbro.

Age and isotopic data: Cadomian. No isotopic data.

Geological environment: Neoproterozoic biotite paragneisses (retrograde sheared) with abundant layers of metavolcanics (metabasalts and meta-andesites).

Contact aureole: two regional metamorphic phases with younger phase of contact metamorphism.

Zoning: unknown.

Mineralization: unknown.

5.1.9. RUSAVA MASSIF

Regional position: isolated intrusion in paragneisses of the Precambrian Brunovistulian (Slavkov Terrane).

Rock types: *Rusava Gabbrodiorite* – hypersthene gabbronorite

Size and shape): subsurface outcrop of the elongated, about 40 km^2 body at the depth of over 2,000 m.

Age and isotopic data: Cadomian. No isotopic data.

Geological environment: Neoproterozoic biotite paragneisses (retrograde sheared) with abundant layers of metavolcanics (metabasalts and metaandesites).

Contact aureole: two regional metamorphic phases with younger phase of contact metamorphism.

Zoning: unknown.

Mineralization: unknown.

5.1.10. JABLUNKOV MASSIF

Regional position: isolated intrusion in paragneisses of the Precambrian Brunovistulian Unit (Slavkov Terrane).

Rock types: *Jablunkov Gabbronorite.*

Size and shape): subsurface outcrop of the elongated, ~30 km^2 body at the depth of over 3000 m.

Age and isotopic data: 550 Ma (U/Pb monazite).

Geological environment:: Neoproterozoic biotite paragneisses (retrograde sheared) with abundant layers of metavolcanics (metabasalts and metaandesites).

Contact aureole: two regional metamorphic phases with younger phase of contact metamorphism.

Zoning: unknown.

Mineralization: unknown.

5.2. THAYA (DYJE) DOME (TD)

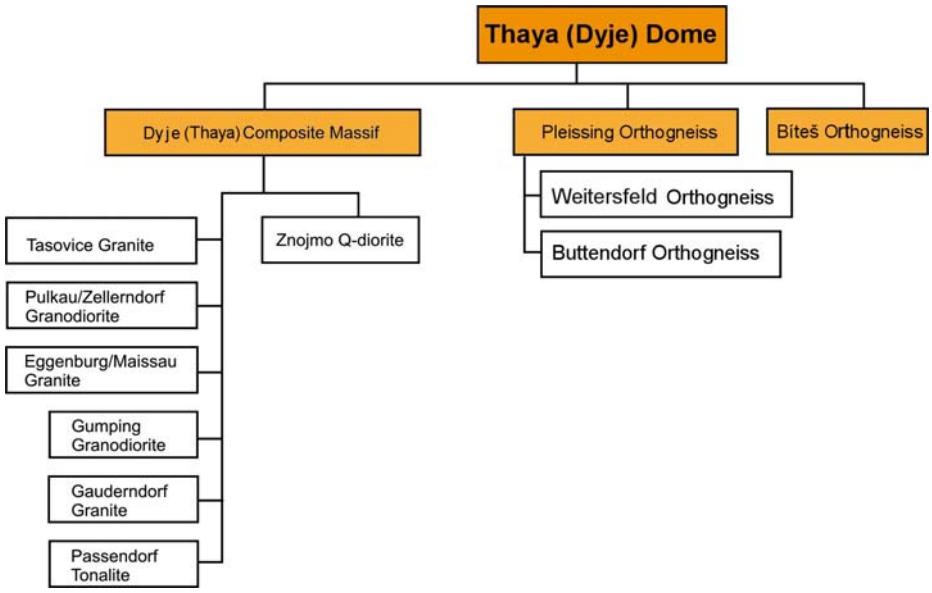


Fig. 5. 14. *Thaya Dome hierarchical scheme according to rock groups and rock types*

Regional position: In the Thaya Dome, three N-S- elongated and generally west to northwest-dipping tectonic units are usually distinguished, each consisting of a granitoid core and a schist mantle. These units are from the east to the west as follows: the autochthonous Thaya Composite Massif, the autochthonous (paraautochthonous?) Pleissing Nappe and the allochthonous Bíteš Gneiss Nappe.

Equivalents of the Brno Composite Pluton (Western Granitoid Complex) with distinct S-type (the Tetčice Suite), I-type (Réna Suite), and A-type (Hlína Suite) affinities were recognized in the northern part of the Dyje Batholith (Leichmann and Höck 2008).

5.2.1. DYJE (THAYA) COMPOSITE MASSIF (DCM)

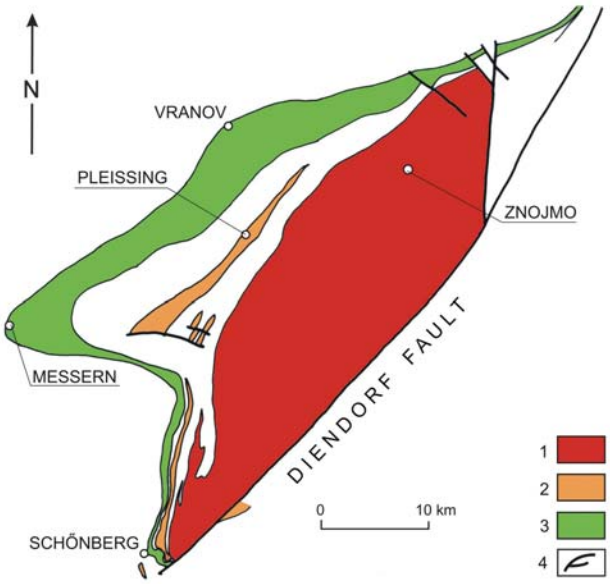


Fig. 5.15. *Thaya Dome geological-sketch map. 1 – Dyje (Thaya) Composite Massif, 2 – Pleissing Orthogneiss, 3 – Bíteš Orthogneiss, 4 – faults.*

Regional position: a part of the Precambrian lithosphere at the eastern termination of the Central European Variscides (Brunovistulian Unit). DCM belongs to the Thaya Terrane (older continental crust) as a lowermost sub-unit of the Thaya Dome.

According to Leichmann and Höck (2008) the Brno Batholith (the Brno Composite Pluton in this rewiew) consists of three genetically independent complexes: Western Granitoid Complex – WGC (part of the Thaya Terrane), Ophiolite Belt – OB (Metabasite Zone or Central Basic Belt), and Eastern Granitoid Complex – EGC (part of the Slavkov Terrane). The EGC represents a relatively primitive Cadomian volcanic-arc enviroment. The OB is segment of an almost completely metamorphosed ophiolite sequence. The WGC comprises equivalents of the Brno Composite Pluton (Western Granitoid Complex) with distinct S-type (the Tetčice Suite), I-type (Réna Suite), and A-type (Hlína Suite) affinities were recognized in the northern part of the Dyje Batholith (Leichmann and Höck 2008).

Rock types: predominant high K, I-types granites and granodiorites).

1. *Znojmo Quartz diorite* – biotite-amphibole quartz diorite (several small bodies),
2. *Tasovice Granite* – foliated fine-grained pink biotite granodiorite,
3. *Pulkau/Zellerndorf Granodiorite to Granite (Hauptgranite)* – biotite granite to granodiorite,
4. *Eggenburg/ Maissau Granite* – light grey to pink biotite granite ± amphibole and tourmaline,
5. *Gumping Granodiorite* – porphyritic biotite granodiorite (quartz monzodiorite),
6. *Gauderndorf Granite* – fine-grained biotite granite/granodiorite,
7. *Passendorf Tonalite* – fine- to medium-grained biotite tonalite.

Size and shape (in erosion level): elliptical, ~ 520 km^2 .

Age and isotopic data: *Znojmo Q-diorite* 630 ± 50 Ma (K/Ar hornblende), *Tasovice Granite* 550 ± 6 Ma (Rb/Sr), 580 Ma, *Eggenburg Granite* 583± 11 Ma (U-Pb zircon), *Gumping Granodiorite* 595 ± 1 Ma (Pb-Pb zircon).

Contact aureole: two regional metamorphic phases with younger phase of contact metamorphism. Thaya Granodiorites are sheared with decreasing grade from west to east.

Geological environment: granitoids of the Biteš Gneiss Nappe, Lukov Unit (phyllites, mica schists, marble, calc-silicate rock).

Zoning: compositional and structural zoning from NW to SE (decreasing acidity and mylonitization).

Mineralization: unknown.

Heat production (μWm^{-3}): 1.8–2.3.

References

BATÍK, P. (1999): Moravikum dyjské klenby – kadomské předpolí variského orogénu. – Věst. Čes. geol. Úst. 74, 363–370.

FRASL, G. – FINGER, F. (1988): The "Cetic Massif" below the Eastern Alps characterized by its granitoids. – Schweiz. Mineral. Petrogr. Mitt. 68, 433–439.

FINGER, F. – FRASL, G. (1989): The granitoids of the Moravian zone of northeast Austria: Product of Cadomian active continental margin? – Precambrian Res. 45, 235–245.

FINGER, F. – FRASL, G. – DUDEK, A. – JELÍNEK, E. – THÖNI, M. (1995): Cadomian plutonism in the Moravo-Silesian basement. In: Dallmeyer, R. D. – Franke, W. – Weber, K. P. Eds: Tectonostratigraphic Evolution of the Central and Eastern European Orogens, 495–507. – Springer Verlag, Berlin.

FINGER, F. – FRASL, G. – HÖCK, V. – STEYRER, H. P. (1989): The Granitoids of the Moravian Zone of Northeast Austria: products of a Cadomian active continental margin? – Precambrian Res. 45, 234–245.

FINGER, F. – HANŽL, P. – PIN, C. – VON QUADT, A. – STEYRER, H. P. (2000): The Brunovistulian: Avalonian Precambrian sequence at the eastern end of the Central European Variscides? – Geol. Soc. London, Spec. Publ. 179, 103–112.

FINGER, F. – RIEGLER, G. (1999): Der Thayabatholith und der kristalline Untergrund des Weinviertels. – Arbeitstagung Geol. Bundesanst. Wien 1999, 23–31.

HÖCK, V. – LEICHMANN, J. (1994): Excursion C: Das Moravicum der Thayakuppel. – Mitt. Österr. mineral. Gesell. 139, 407–427.

LEICHMANN, J. – HÖCK, V. (2008): The Brno Batholith: an insight into the magmatic and metamorphic evolution of the Cadomian Brunovistulian Unit, eastern margin of the Bohemian Massif. – J. Geosci. 53, 281–305.

SCHARBERT, S. (1977): Neue Ergebnisse radiometrischer Altersdatierungen an Gesteinen des Waldviertels. – Arbeitstagung Geol. Bundesanst. Wien 1977, 11–15.

SCHARBERT, S. – BATÍK, P. (1980): The age and isotopic data of the Thaya (Dyje) Pluton. – Verh. Geol. Bundesanst. (Wien) 3, 325–331.

WIESENEDER, J. – FREILINGER, – G. KITTLER, G. – TSAMBOURAKIS, G. (1976): Der kristalline Untergrund der Nordalpen in Österreich. – Geol. Rdsch. 65, 512–526.

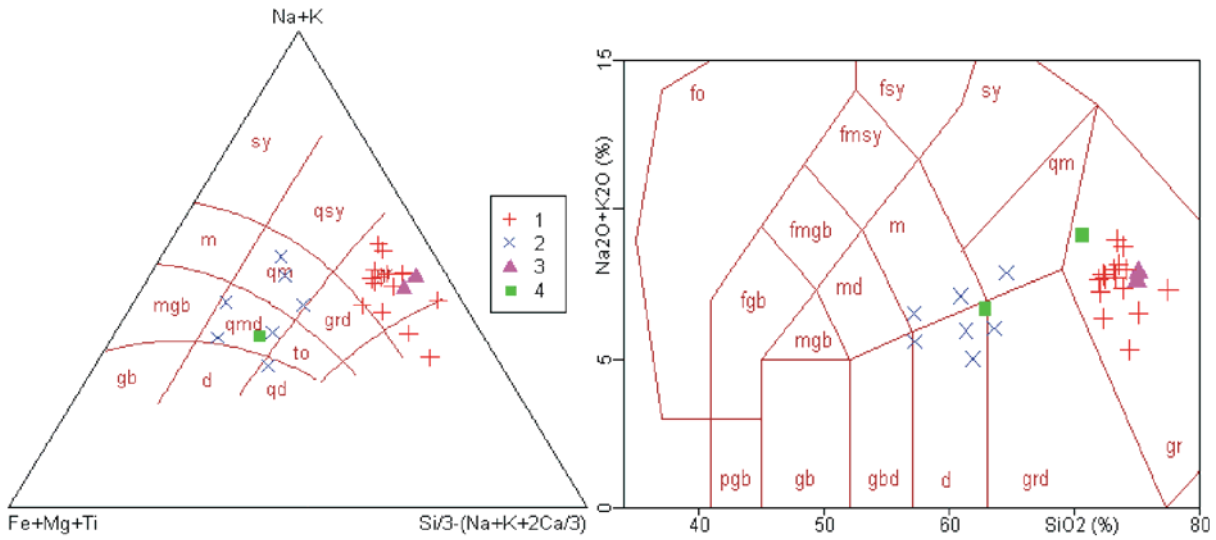


Fig. 5.16. *Thaya (Dyje) Dome ABQ and TAS diagrams. 1 – Dyje (Thaya) Granodiorite, 2 – Dyje (Thaya) Diorite, 3 – Bíteš Orthogneiss, 4 – Pleissing Orthogneiss.*

Dyje (Thaya) Granodiorite to Granite

Quartz-normal, sodic, moderately peraluminous, leucocratic, S-type, granodiorite

n = 9	Median	Min	Max	QU1	QU3
SiO_2	72.30	71.37	73.50	71.50	73.03
TiO_2	0.24	0.16	0.64	0.22	0.35
Al_2O_3	14.78	13.52	15.51	14.29	14.92
Fe_2O_3	0.54	0.10	0.98	0.52	0.59
FeO	1.46	0.92	2.05	1.12	1.59
MnO	0.05	0.02	0.07	0.04	0.06
MgO	0.97	0.37	2.14	0.75	1.14
CaO	1.25	0.22	2.27	0.95	1.86
Na_2O	4.00	2.92	4.37	3.77	4.29
K_2O	3.52	1.98	4.10	3.01	3.89
P_2O_5	0.05	0.03	0.18	0.04	0.05
Mg/(Mg+Fe)	0.51	0.33	0.65	0.35	0.54
K/(K+Na)	0.39	0.23	0.44	0.31	0.40
Nor.Or	21.86	12.21	24.99	18.24	23.98
Nor.Ab	37.31	27.79	40.30	35.69	39.87
Nor.An	6.02	0.87	11.23	4.62	8.74
Nor.Q	29.56	27.00	40.20	28.52	30.70
Na+K	203.40	168.33	215.16	201.53	211.24
*Si	179.35	168.10	234.22	178.14	190.65
K-(Na+Ca)	-63.42	-129.56	-27.62	-98.11	-58.71
Fe+Mg+Ti	58.14	29.91	84.19	45.65	58.90
Al-(Na+K+2Ca)	35.07	22.10	82.20	26.82	44.81
(Na+K)/Ca	9.14	4.98	51.85	6.08	12.50
A/CNK	1.15	1.08	1.48	1.11	1.20

5.2.2. PLEISSING ORTHOGNEISS (PO)

Regional position: part of the Precambrian lithosphere at the eastern termination of the Central European Variscides (Brunovistulicum). PO (nappe sheet) belongs to the higher tectonic sub-unit of the Thaya Dome (Thaya Terrane – older continental crust).

Rock types:

Two strongly deformed granitoid sheets:

1. *Weitersfeld Orthogneiss* – leucocratic granitic orthogneiss (upper sheet),
2. *Buttendorf Orthogneiss* – amphibole-biotite granodioritic and tonalitic gneiss.

Size and shape (in erosion level): allochthonous (paraautochthonous?) sheet-like bodies (20 km^2).

Age and isotopic data: Cadomian. No isotopic data.

Geological environment: the Lukov mica schists.

Zoning: unknown.

Mineralization: unknown.

References

FINGER, F. – FRASL, G. – HÖCK, V. – STEYRER, H. P. (1989): The Granitoids of the Moravian Zone of Northeast Austria: products of a Cadomian active continental margin? – Precambrian Res. 45, 234–245.

5.2.3. BÍTEŠ ORTHOGNEISS (BO)

Regional position: part of the Precambrian lithosphere at the eastern termination of the Central European Variscides (Brunovistulicum). BO (nappe sheet) belongs to the higher tectonic sub-unit of the Thaya Dome (Thaya Terrane – older continental crust). Bíteš Orthogneiss constitutes the upper part of the Svratka Dome.

Rock types: *Bíteš Orthogneiss* – severely sheared porphyroclastic leucocratic fine-grained muscovite- biotite granites and granodiorites to tonalite. The Bíteš Gneiss resemble the Pulkau/Zellerndorf Granodiorite/Granite (Hauptgranite) as well as the Weitersfeld Orthogneiss of the Pleissing Nappe.

Bíteš Orthogneiss – severely sheared porphyroclastic leucocratic muscovite- biotite granites and granodiorites to tonalite (see also 5.2.3. Bíteš Orthogneiss).

Size and shape (in erosion level): elongated intrusion of relatively small thickness (5 km), stretching ca. 120 km. and 240 km^2 (the Thaya Dome). Biteš Orthogneiss forms the oval sheet-like body in the Svratka Dome – 750 km^2 (42 × 15 km).

Age and isotopic data: 796 ± 11 Ma (Rb-Sr whole-rock), ~ 800 Ma, 570 ± 44 Ma (Rb-Sr whole-rock), 480 ± 50 Ma (Rb-Sr whole-rock), 480 Ma (Sm-Nd), 630 Ma (Pb-Pb zircon), 586 ± 7 Ma (SHRIMP U-Pb zircon),

Geological environment: Neoproterozoic biotite paragneisses (retrograde sheared) with abundant strata of metavolcanics (metabasalts and metaandesites).

Contact aureole: two regional metamorphic phases with younger phase of contact metamorphism, regional metamorphism is dated at 346 ± 7 Ma.

Zoning: unknown.

Mineralization: local tin-tourmaline mineralization at the western contact.

References

BATÍK, P. (1984): Geologická stavba moravika mezi bítešskou rulou a dyjským masívem. – Věst. Ústř. Úst. geol. 59, 322–330.

FINGER, F. – FRASL, G. – HÖCK, V. – STEYRER, H.P. (1989): The Granitoids of the Moravian Zone of Northeast Austria: products of a Cadomian active continental margin? – Precambrian Res. 45, 234–245.

FRIEDL, G. – FINGER, F. – McNAUGHTON, N. J. – FLETCHER, I. R. (1998): New SHRIMP-zircon ages for orthogneisses from the south-eastern part of the Bohemian Massif (Lower Austria). Proceedings of the Intern. Conference Palaeozoic orogenesis and crustal evolution of the European lithosphere. – Acta Univ. Carol., Geol. 42, 251–251.

LIEW, T. C. – HOFMANN, A. W. (1988): Precambrian crustal components, plutonic associations, plate environment of the Hercynian Fold Belt of central Europe: Indications from a Nd and Sr isotopic study. – Contr. Mineral. Petrology 98, 129–138.

MORAUF, W. – JÄGER, E. (1982): Rb-Sr whole-rock ages for the Bites Gneiss, Moravicum, Austria. – Schweiz. Mineral. Petrogr. Mitt. 62, 327–334.

NĚMEC, D. (1979): Zinnbringende Orthogneisse im Süden der Antiklinale von Svratka (nordwestlich Brno) und ihre Erzmineralisierung. – Z. geol. Wiss. 7, 1437–1447.

PRECLIK, H. (1934): Zur Kenntniss der chemischen Zusammensetzung der moravischen Erstarrungsgesteine. – Mineral. petrogr. Mitt. 45, 269–332.

SOUČEK, J. (1992): Petrology of the Bíteš orthogneiss of the Svratka Dome. In: Styles of superposed Variscan nappe tectonics. (Case study of the external Moldanubian Zone). 7th Svratka Geological workshop, Kutná Hora, Abstracts, 56–57. – Geol. úst. Čs. akad. věd, Praha.

SOUČEK, J. – JELÍNEK, E. – BOWES, D. R. (1992): Geochemistry of gneisses of the eastern margin of the Bohemian Massif. In: Kukal, Z. Ed.: Proceedings of the 1st International Conference on the Bohemian Massif, Prague, Czechoslovakia, Sept. 26-Oct. 3, 1988, 269–285. – Czech Geol. Survey, Prague.

Bíteš Orthogneiss

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

	1822Bit	**1823Bit**	**Hardegg**
SiO_2	74.31	76.36	73.82
TiO_2	0.16	0.04	0.13
Al_2O_3	12.70	13.02	14.62
Fe_2O_3	0.83	0.13	1.05
FeO	1.22	0.31	0.54
MnO	0.04	n.d.	n.d.
MgO	0.35	0.43	0.12
CaO	1.33	0.93	2.18
Na_2O	2.99	3.09	3.85
K_2O	4.83	4.12	3.20
P_2O_5	0.18	0.10	n.d.
Mg/(Mg+Fe)	0.24	0.64	0.13
K/(K+Na)	0.52	0.47	0.35
Nor.Or	29.62	25.21	19.24
Nor.Ab	27.87	28.73	35.17
Nor.An	5.62	4.10	11.01
Nor.Q	33.60	38.45	32.35
Na+K	199.04	187.19	192.18
*Si	197.41	225.38	191.44
K-(Na+Ca)	-17.65	-28.82	-95.17
Fe+Mg+Ti	38.08	17.12	25.28
Al-(Na+K+2Ca)	2.93	35.33	17.18
(Na+K)/Ca	8.39	11.29	4.94
A/CNK	1.03	1.17	1.06

5.3. KEPRNÍK ORTHOGNEISS

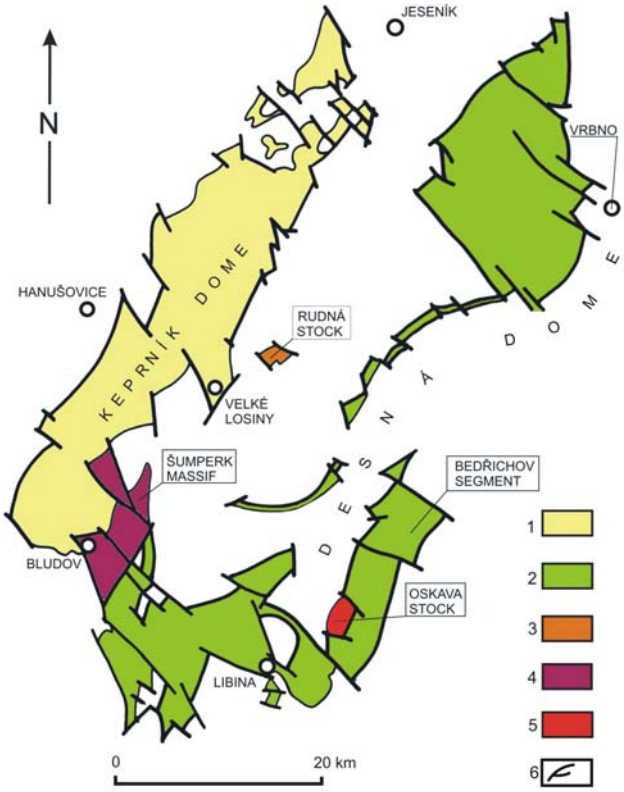


Fig. 5.17. Keprník-Desná Dome geological sketch-map (adapted after Cháb et al. 2008). 1 – Keprník Orthogneiss, 2 – Desná Orthogneiss, 3 – Rudná Stock, 4 – Šumperk Massif, 5 – Oskava Stock, 6 – faults.

Regional position: the core of the Keprník Dome (nappe-sheet) within the Moravo-Silesicum.

Rock types: *Keprník Orthogneiss*

1. cataclastic fine-grained two-mica orthogneiss,
2. cataclastic medium-grained two-mica orthogneiss,
3. cataclastic fine-grained leucocratic orthogneiss,
4. banded medium-grained biotite orthogneiss,
5. coarse-grained biotite orthogneiss,
6. fine-grained cataclastic biotite granodiorite,
7. muscovite metapegmatite – up to several tens of meters thick and about 1 km long bodies.

Size and shape (in erosion level): elongated domal tectonically deformed and outlined intrusion (50 × 10 km).

Age and isotopic data: 546 + 6/-8 Ma (U/Pb zircon), 583 Ma (U/Pb zircon), 300–310 Ma (Ar/Ar mica).

Geological environment: Pre-Devonian country rocks are represented by two-mica gneisses, mica schists with calc-silicate gneisses and marbles.

Contact aureole: not observed.

Mineralization: unknown.

References

BREEMEN, O. VAN – AFTALION, M. – BOWES, D. R. – DUDEK, A. – MÍSAŘ, Z. – POVONDRA, P. VRÁNA, S. (1982): Geochronological studies of the Bohemian Massif, Czechoslovakia, and their significance in the evolution of the Central Europe. – Trans. Roy. Soc. Edinburgh Earth Sci. 73, 89–108.

HEGNER, E. – KRÖNER, A. (2000): Review of Nd isotopic data and xenocrystic and detrital zircon ages from the Pre-Variscan basement in the eastern Bohemian Massif: speculations on palinspastic reconstructions. – Geol. Soc. London, Spec. Publ. 179, 113–129.

KRÖNER, A. – ŠTÍPSKÁ, P. – SCHULMANN, K. – JAECKEL, P. (2000): Chronological constraints on the pre-Variscan evolution of the northeastern margin of the Bohemian Massif, Czech Republic. In: Franke, W. – Haak, V. – Oncken, O. – Tanner D. Eds: Orogenic Processes: Quantification and Modelling in the Variscan fold belt. – Geol. Soc. London, Spec. Publ. 179, 175–197.

MALUSKI, H. – RAJLICH, P. – SOUČEK, J. (1995): Pre-Variscan, Variscan and Early Alpine thermo-tectonic history of the north-eastern Bohemian Massif: An Ar/Ar study. – Geol. Rdsch. 84, 345–358.

ŠITAVANC, D. – SOUČEK, J. (1988): Geochemie hornin keprnické klenby. – Čas. Mineral. Geol. 33, 149–170.

ŽÁČEK, V. Ed. (2000): Vysvětlivky k základní geologické mapě České republiky 1 : 25 000, 14-421 Velké Losiny, pp. 75. – MS Czech Geol. Survey, Prague.

Keprník Orthogneiss

Quartz-rich, sodic, moderately peraluminous, mesocratic, S-type, I-series granite

	17two-mica	1biotite	12orth	16ortho	17ortho	18ortho
SiO_2	69.77	69.15	71.18	71.22	72.88	72.18
TiO_2	0.27	0.33	0.20	0.27	0.13	0.17
Al_2O_3	15.91	16.09	14.90	15.35	14.45	14.87
Fe_2O_3	0.48	0.45	0.50	0.94	0.50	0.47
FeO	1.49	1.88	1.20	1.17	1.04	1.37
MnO	0.05	0.04	0.06	0.04	0.05	0.07
MgO	0.91	1.18	0.93	0.60	0.58	0.51
CaO	2.38	2.31	1.22	1.92	1.38	1.75
Li_2O	0.01	n.d	n.d.	n.d.	n.d.	0.01
Na_2O	4.51	4.22	3.50	4.19	3.19	3.58
K_2O	2.46	3.55	4.31	3.19	3.86	3.94
P_2O_5	0.10	0.07	0.06	0.11	0.04	0.06
Mg/(Mg+Fe)	0.45	0.47	0.49	0.34	0.40	0.33
K/(K+Na)	0.26	0.36	0.45	0.33	0.44	0.42
Nor.Or	15.09	21.69	26.62	19.35	23.83	24.07
Nor.Ab	42.04	39.19	32.86	38.64	29.93	33.24
Nor.An	11.59	11.38	5.94	9.05	6.87	8.59
Nor.Q	26.00	22.34	28.83	28.04	34.09	29.72
Na+K	197.77	211.55	204.45	202.94	184.90	199.18
*Si	161.01	144.62	175.93	169.35	203.02	180.46
K-(Na+Ca)	-135.74	-101.99	-43.19	-101.72	-45.59	-63.08
Fe+Mg+Ti	52.75	65.23	48.49	46.28	36.81	39.71
Al-(Na+K+2Ca)	29.79	22.04	44.64	30.03	49.65	30.42
(Na+K)/Ca	4.66	5.14	9.40	5.93	7.51	6.38
A/CNK	1.11	1.08	1.19	1.12	1.22	1.12

Trace elements (mean values in ppm): *Keprník Orthogneiss* – **B** 12, **Co** 19, **Cr** 33, **Cu** 48, **Rb** 48, **Sr** 400, **Y** 23, **Zn** 63, **Zr** 210.

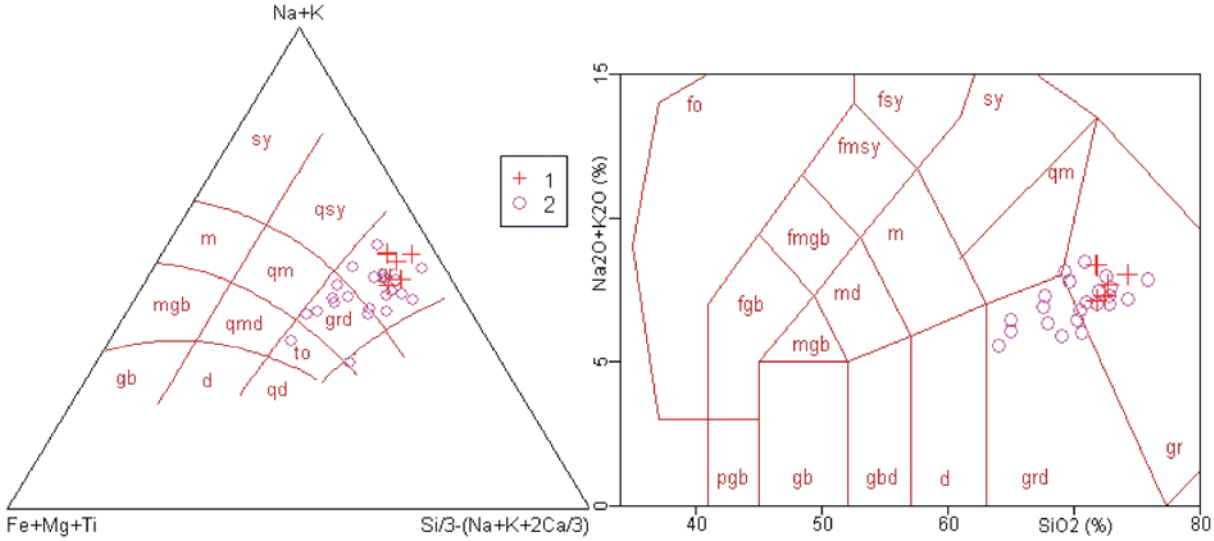


Fig. 5.18. *Keprník Orthogneiss and Desná Orthogneiss ABQ and TAS diagrams. 1 – Desná Orthogneiss (Metagranite), 2 – Keprník Orthogneiss.*

5.4. DESNÁ ORTHOGNEISS

Regional position: paraautochthonous Pre-Cambrian basement within the Moravo-Silesicum consists of two separate domal structures connected by fragmented remnants of the Desná Dome.

According to Hanžl et al. (2007) the Desná Unit consists of the Tonalite suite, Granite suite (Cadomian) and the Leucogranite suite (Polanka Leucogranite and Rudná (Early Carboniferous).

Rock types: porphyroclastic metagranitoids to orthogneisses of the granitic – granodioritic to tonalitic composition.

1. *Libina Metagranite* – mylonitic medium-coarse-grained two-mica metagranite,
2. *Polanka (Oskava) Metagranite* – foliated coarse-grained two-mica leucogranite,
3. *Orlík Orthogneiss* – mylonitic fine- to medium-grained two-mica metagranodiorite to metatonalite
   – mylonitic medium- to coarse-grained leucocratic two- mica metagranite
   – biotite to hornblende-biotite orthogneiss.

Size and shape (in erosion level): elongated, tectonically deformed and outlined domal intrusion (a groups of boudins from several metres to kilometres in size), separated by a group of cross-faults into a series of segments.

Oskava Stock is oval (small lens-like bodies) in shape of 1.5 km^2 (1.5 × 1 km), outlined by faults within the Bedřichov segment.

Age and isotopic data: Cadomian. 300–310 Ma (Ar/Ar micas), mylonites on the eastern rim 340–440 Ma (Ar/Ar micas), 273 Ma (Ar/Ar amphibole), 324 to 520 Ma (Ar/Ar muscovite), 323 ± 3 Ma (Ar/Ar biotite). 684.5 ± 0.9 Ma (Pb-Pb zircon) – crystallization of the protolith, 517 ± 12 Ma (U-Pb zircon), 598.4 ± 0.9 Ma. Polanka Leucogranite 330 Ma (Rb-Sr whole rock).

Geological environment: the Vrbno Group-Devonian graphite phyllite, quartzite, metaconglomerates, bimodal volcanics.

Contact aureole: unknown.

Mineralization: unknown.

Desná Metagranite to Metagranodiorite

Quartz-rich, sodic, peraluminous, mesocratic, S-type, granite to granodiorite

	GV4b	**GV6c**	**166**	**GV6d**	**GV25**
SiO_2	67.73	68.96	70.04	73.76	71.74
TiO_2	0.44	0.42	0.60	0.12	0.36
Al_2O_3	14.69	15.28	13.55	13.82	13.73
Fe_2O_3	0.88	1.28	0.49	0.93	0.94
FeO	2.38	1.61	3.60	0.73	1.48
MnO	0.08	0.08	0.08	0.06	0.07
MgO	1.37	0.97	1.55	0.38	0.79
CaO	2.30	2.36	1.99	1.06	1.71
Na_2O	5.17	3.79	3.83	3.85	4.33
K_2O	1.46	2.55	1.91	3.70	2.01
P_2O_5	0.12	0.12	0.08	0.03	0.07
Mg/(Mg+Fe)	0.43	0.38	0.40	0.29	0.37
K/(K+Na)	0.16	0.31	0.25	0.39	0.23
Nor.Or	9.20	15.90	12.24	22.57	12.52
Nor.Ab	49.54	35.92	37.30	35.69	40.99
Nor.An	11.33	11.52	10.14	5.23	8.46
Nor.Q	23.77	29.69	31.81	32.94	32.76
Na+K	197.83	176.44	164.15	202.80	182.40
*Si	150.58	178.08	200.76	193.81	195.27
K-(Na+Ca)	-176.85	-110.24	-118.52	-64.58	-127.54
Fe+Mg+Ti	83.68	67.79	102.25	32.75	56.50
Al-(Na+K+2Ca)	8.62	39.46	30.98	30.79	26.24

(Na+K)/Ca	4.82	4.19	4.63	10.73	5.98
A/CNK	1.04	1.16	1.14	1.13	1.11

Desná Metagranite

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

	LeuGV6e	**GV49**	**GV51**	**GV62**	**214**	**GV129**
SiO_2	73.78	76.66	77.81	77.10	75.53	75.69
TiO_2	0.05	0.14	0.07	0.11	0.17	0.15
Al_2O_3	13.99	12.46	12.06	12.55	12.78	12.65
Fe_2O_3	0.14	0.53	0.59	0.12	0.83	1.06
FeO	0.42	0.40	0.25	0.25	0.51	0.53
MnO	0.07	0.03	0.02	0.02	0.02	0.03
MgO	0.19	0.12	0.07	0.04	0.09	0.06
CaO	0.58	0.07	0.06	0.06	0.36	0.70
Na_2O	3.79	3.25	3.61	3.95	3.51	3.81
K_2O	5.67	5.54	5.11	4.79	5.06	5.12
P_2O_5	0.04	n.d.	0.02	0.02	0.01	0.01
Mg/(Mg+Fe)	0.35	0.19	0.13	0.16	0.11	0.07
K/(K+Na)	0.50	0.53	0.48	0.44	0.49	0.47
Nor.Or	34.20	33.48	30.67	28.80	30.65	30.67
Nor.Ab	34.74	29.85	32.93	36.10	32.31	34.68
Nor.An	2.67	0.36	0.17	0.17	1.76	3.45
Nor.Q	26.76	34.32	34.89	33.53	33.11	30.40
Na+K	242.69	222.50	224.99	229.17	220.70	231.66
*Si	159.73	201.96	205.97	197.85	194.04	179.93
K-(Na+Ca)	-12.26	11.50	-9.07	-26.83	-12.25	-26.72
Fe+Mg+Ti	12.94	16.94	13.49	7.36	21.87	24.03
Al-(Na+K+2Ca)	11.36	19.69	9.70	15.15	17.43	-8.20
(Na+K)/Ca	23.47	178.25	210.29	214.19	34.38	18.56
A/CNK	1.05	1.09	1.04	1.07	1.07	0.97

Desná Metatonalite

Quartz-normal, sodic, peraluminous to metaluminous, melanocratic, I/S type, tonalite to diorite

	GV130	**GV131**	**155B**	**GV32**	**2A**	**41A**
SiO_2	61.13	60.68	59.68	59.83	57.03	63.72
TiO_2	0.77	0.81	0.91	0.96	0.82	0.77
Al_2O_3	16.59	16.82	17.28	17.10	18.12	15.31
Fe_2O_3	2.34	2.30	1.67	2.14	1.73	2.30
FeO	3.74	4.01	4.62	4.88	4.80	3.71
MnO	0.12	0.13	0.11	0.12	0.15	0.14
MgO	2.81	2.93	3.22	3.53	3.16	3.14
CaO	5.62	5.72	3.81	3.79	6.95	2.67
Na_2O	3.77	3.71	3.91	3.80	4.29	3.53
K_2O	1.99	1.84	1.84	2.04	1.29	1.94
P_2O_5	0.15	0.16	0.18	0.17	0.18	0.18
Mg/(Mg+Fe)	0.46	0.46	0.48	0.48	0.46	0.49
K/(K+Na)	0.26	0.25	0.24	0.26	0.17	0.27
Nor.Or	12.63	11.72	12.04	13.27	8.30	12.64
Nor.Ab	36.36	35.91	38.88	37.57	41.94	34.96
Nor.An	28.89	29.46	19.62	19.47	36.25	13.30

Nor.Q	13.94	13.88	15.18	14.65	5.22	24.62
Na+K	163.91	158.79	165.24	165.94	165.83	155.10
*Si	108.42	109.85	120.56	120.93	67.94	166.66
K-(Na+Ca)	-179.62	-182.65	-155.05	-146.89	-234.98	-120.33
Fe+Mg+Ti	160.77	167.51	176.56	194.39	177.20	168.04
Al-(Na+K+2Ca)	-38.55	-32.48	38.22	34.70	-57.85	50.33
Na+K)/Ca	1.64	1.56	2.43	2.46	1.34	3.26
A/CNK	0.90	0.92	1.14	1.13	0.87	1.22

Desná Orthogneiss

Quartz-rich, sodic, peraluminous, mesocratic, S-type, M-series, granite

n = 13	**Median**	**Min**	**Max**	**QU1**	**QU3**
SiO_2	75.94	59.21	80.19	69.84	76.88
TiO_2	0.11	0.07	0.68	0.08	0.28
Al_2O_3	13.56	11.81	17.62	12.48	14.39
Fe_2O_3	0.64	0.38	2.03	0.56	0.78
FeO	0.42	0.10	3.45	0.29	1.97
MnO	0.04	0.03	0.09	0.03	0.06
MgO	0.30	0.09	3.60	0.17	1.46
CaO	0.71	0.19	4.63	0.31	2.10
Na_2O	3.68	3.24	4.60	3.52	3.94
K_2O	2.92	1.86	5.32	2.24	4.32
P_2O_5	0.05	0.01	0.78	0.02	0.15
Mg/(Mg+Fe)	0.40	0.15	0.60	0.29	0.47
K/(K+Na)	0.33	0.23	0.49	0.27	0.46
Nor.Or	17.79	11.44	31.84	13.56	26.35
Nor.Ab	34.88	30.29	42.70	32.78	36.48
Nor.An	3.27	-0.64	23.29	1.21	10.08
Nor.Q	33.99	12.21	51.01	29.77	37.48
Na+K	189.14	144.05	233.00	177.83	202.83
*Si	201.49	104.89	296.79	184.07	220.77
K-(Na+Ca)	-77.80	-154.40	-6.25	-112.83	-20.51
Fe+Mg+Ti	19.21	15.01	153.53	15.68	80.13
Al-(Na+K+2Ca)	36.66	-13.61	75.75	12.98	47.90
(Na+K)/Ca	14.94	2.02	63.99	5.03	42.15
A/CNK	1.18	0.95	1.49	1.06	1.22

Trace elements (mean values in ppm): *Desná Orthogneiss* – **B** 12, **Co** 19, **Cr** 33, **Cu** 48, **Rb** 48, **Sr** 400, **Y** 23, **Zn** 63, **Zr** 210.

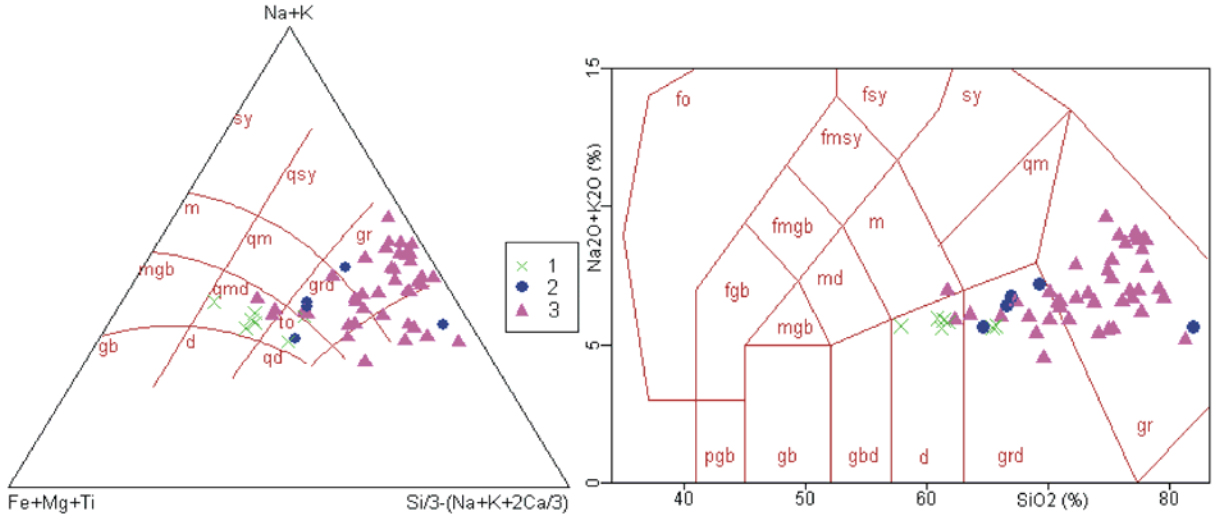


Fig. 5.19. *Desná Orthogneiss ABQ and TAS diagrams. 1 – Desná Metatonalite, 2 – Desná Metagranodiorite, 3 – Desná Metagranite and Leucogranite.*

References

CHÁB, J. – FIŠERA, M. – FEDIUKOVÁ, E. et al. (1984): Problémy tektonického a metamorfního vývoje východní části Hrubého Jeseníku. – Sbor. geol. Věd, Geol. 39, 27–72.

FIŠERA, M. – PATOČKA, F. (1989): Geochemistry of Variscan blastomylonites of the Vidly pod Pradědem locality, the Hrubý Jeseník Mts.: palaeotectonic implications. – Věst. Ústř. Úst. geol. 64, 301–312.

HANŽL, P. – JANOUŠEK, V. – ŽÁČEK, V. – WILIMSKÝ, D. – AICHLER, J. – ERBAN, V. – PUDILOVÁ, M. – CHLUPÁČOVÁ, M. – BURIÁNKOVÁ, K. – MIXA, P. – PECINA, V. (2007): Magmatic history of granite-derived mylonites from the southern Desná Unit (Silesicum, Czech Republic). – Mineral. Petrology 89, 45–75.

KOPEČNÝ, V. (1981): Petrografická charakteristika bedřichovské kry (Jeseníky). – Acta Univ. Palack. Olomouc, Fac. rer. nat. geogr. geol. 20, 19–34.

KRÖNER, A. – ŠTÍPSKÁ, P. – SCHULMANN, K. – JAECKEL, P. (2000): Chronological constraints on the pre-Variscan evolution of the northeastern margin of the Bohemian Massif, Czech Republic. In: Franke, W. – Haak, V. – Oncken, O. – Tanner D. Eds: Orogenic Processes: Quantification and Modelling in the Variscan fold belt. – Geol. Soc. London, Spec. Publ. 179, 175–197.

KUŽVART, M. (1966): K otázce stáří žuly od Horní Libiny u Uničova. – Čas. Mineral. Geol. 11, 15–19.

MALUSKI, H. – RAJLICH, P. – SOUČEK, J. (1995): Pre-variscan, Variscan and Early Alpine thermo-tectonic history of the north-eastern Bohemian Massif: An Ar/Ar study. – Geol. Rdsch. 84, 345–358.

ŽÁČEK, V. Ed. (2000): Vysvětlivky k základní geologické mapě České republiky 1 : 25 000, 14-421 Velké Losiny, pp. 75. – MS Czech Geol. Survey, Prague.

STRZELIN ORTHOGNEISS

Regional position: part of the "Strzelin massif" in the Moravo-Silesian Domain in Poland.

Rock types:

Strzelin Orthogneiss – fine to medium-grained, porphyritic biotite-muscovite granitogneiss,

Gosciecice Orthogneiss,

Nowolesie Orthogneiss,

Stachóv Orthogneiss (dark and light facies).

Size and shape (in erosion level): not characterized.

Age and isotopic data: 600 ± 8 Ma, 568 ± 6 Ma (U-Pb zircon).

Geological environment: Žulová-Strzelin Composite Massif.

Zoning: unknown.

Mineralization: unknown.

References

OBERC-DZIEDZIC, T. – KLIMAS, K. – KRYZA, R. – FANNING, M. (2001): SHRIMP zircon geochronology of the Neoproterozoic Strzelin Gneiss: Evidence for the Moravo-Silesian Zone affinity of the Strelin Massif, Fore-Sudetic Block, SW Poland. – Geolines 13, 96–97.

VARISCAN INTRUSIONS

5.5. ŽULOVÁ-STRZELIN COMPOSITE MASSIF

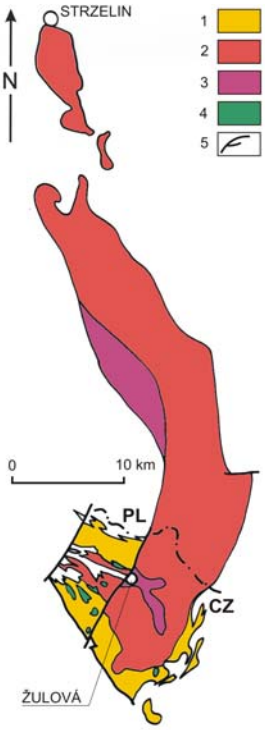


Fig. 5.20. *Žulová-Strzelin Composite Massif geological sketch-map. 1 – Žulová Granite, 2 – Marginal Granite, 3 – Starost Granodiorite, 4 – Hybrid Granodiorite/diorite, 5 – faults.*

Regional position: isolated (Žulová) intrusion in the Silesicum and a group of small stocks and dykes (the Strzelin Intrusion). The tonalite and quartz diorite dykes are several metres to several tens of metres thick. The size, shape and internal structure of the intrusions were defined on the basis of the interpretation of the borehole material.

Rock types:

1. *Hybrid Granodiorite* – hornblende-biotite diorite – quartz diorite, tonalite (older enclaves),
2. *Marginal Granite,*
3. *Žulová (Steinberg) Granite* – biotite granite,
4. *Starost (Sorge) Granodiorite* – hornblende–biotite granodiorite to tonalite,
5. *Alkali-feldspar Granite,*
6. *Bialy Kościol Granite* – coarse-grained muscovite-biotite granite,
7. *Gebczyce Granite* – fine-grained muscovite-biotite granite,
8. *Gromnik Granite* – fine-grained muscovite-biotite granite (subhorizontal dyke)
9. *Gęsiniec Tonalite* – medium-grained tonalite,
   – fine-grained quartz diorite,
   – fine-grained granodiorite
10. *Tonalite and quartz diorite dykes* – medium-grained diorite (B), fine-grained diorite (C), microdiorite (D).

Size and shape: Žulová massif 150 km^2, elliptical, part of the granodiorite intrusion, continuing in Poland as Strzelin massif (partly covered by Quaternary sediments and older country rocks). Žulová-Strzelin Composite Massif 60 × 7 km. According to gravity model the maximum thickness of 6 km of the Žulová intrusion is expected 5 km SE of Žulová town. Older hybrid granitoids form large enclaves. The Strzelin granite intrusion consists of small isolated bodies, mostly stocks, flat veins and sills up to tens of metres thick. Granite contacts are sharp and discordant.

Gęsiniec Intrusion forms a stock cut by a dyke of leucocratic two-mica granite with distinct contact metamorphic effects.

Age and isotopic data: *Žulová (Steinberg) Granite* 335 ± 7.5 Ma (K-Ar biotite), 260 Ma (K/Ar muscovite), 310 Ma (Ar/Ar), 292 ± 3 Ma (Ar/Ar amphibole), 290 ± 3 Ma (Ar/Ar biotite), *Starost Granodiorite* 341 ± 20 Ma, 349 ± 10 Ma (K/Ar), *Gebczyce and Kościol Granites* 330 ± 6 Ma (Rb-Sr whole-rock), pegmatite 304 Ma (U-Pb monazite). Strzelin intrusion: tonalite 291 ± 5.5 Ma (Pb-evaporation zircon), 301 ± 7 Ma (Pb-evaporation zircon), country rocks 279.4 ± 1.8 to

284.6 ± Ma (Ar-Ar muscovite), biotite granite and two-mica granite 347 ± 12, 330 ± 6 Ma respectively (Rb-Sr whole rock).

Geological environment: Upper Proterozoic to Silurian and Devonian (Staré Město, Vrbno, Branná, and Velké Vrbno groups of mica schist and gneisses with lenses of limestone, conglomerates, and quartzites.

Contact aureole: Sharp contact, sub-parallel to schistosity of the country rock. In SW is delimited by the Sudetic fault. Numerous roof pendants and scarce relicts of MP/MT-HT metamorphism. Outer refoliation belt in exocontact is penetrated by numerous dykes and stocks of inhomogeneous muscovite pegmatite and biotite granodiorite. A periplutonic migmatitization along the eastern exocontact. The Strzelin granite intrusion has produced little contact metamorphic effects (hornfelses).

Zoning: Vertical compositional zoning – relicts of the hornblende-biotite granodiorite at the roof of the Žulová-Strzelin Composite Massif. Frequent xenoliths of country rocks and granitized tonalites and diorites (the Great Tonalite Dyke) in SW endocontact of the Žulová-Strzelin Composite Massif.

Mineralization: Mineralogical occurrences of molybdenite and scheelite, cassiterite and fluorite.

Heat production (μWm^{-3}): *Starost Granodiorite* 2.04, *Žulová Granite* 2.91.

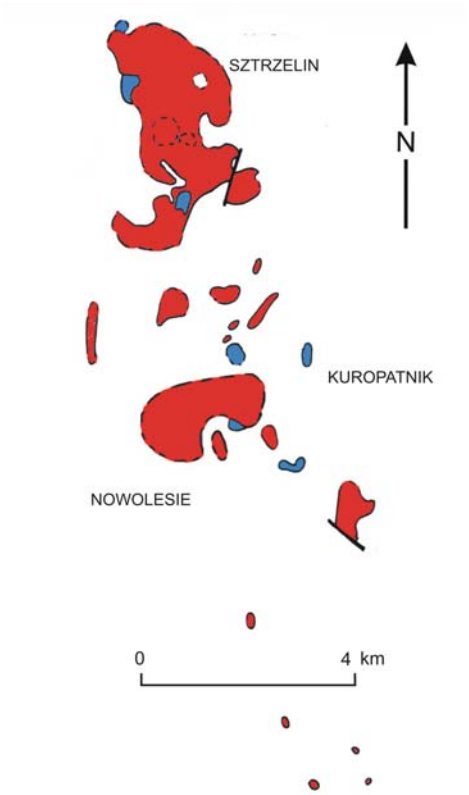


Fig. 5.21. *Strzelin (Intrusion) Massif geological sketch-map (adapted after Oberc-Dziedzic 2007). Blue colour– tonalite and quartz diorite, red colour – granite.*

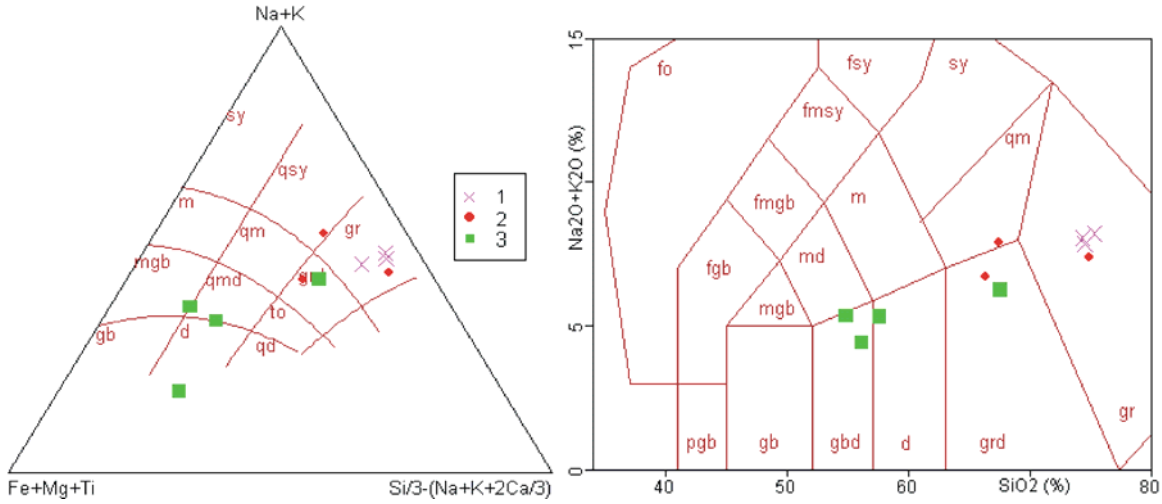


Fig. 5. 22. *Strzelin Massif (Gęsiniec Stock) ABQ and TAS sketch diagrams: 1 – Strzelin Granite, 2 – Strzelin Granodiorite, 3 – Gęsiniec Tonalite.*

Strzelin Massif

Strzelin Granite – quartz-rich, sodic/potassic, low peraluminous, leucocratic, I-type granite
Strzelin Granodiorite – quartz-rich/normal, sodic, low peraluminous, leuco/mesocratic, I-type granodiorite

	1granite	2granite	3granite	5granodiorite	6granodiorite
	StrzelinGranite			**StrzelinGranodiorite**	
SiO_2	74.36	73.93	74.72	66.15	67.51
TiO_2	0.27	n.d.	0.17	0.66	n.d.
Al_2O_3	12.88	13.93	13.25	16.62	17.54
Fe_2O_3	0.68	0.32	0.10	0.56	2.44
FeO	1.01	1.15	1.42	3.53	n.d.
MnO	0.04	0.03	0.20	0.05	n.d.
MgO	1.08	0.20	0.22	1.54	1.19
CaO	1.38	1.68	0.93	3.80	3.52
Na_2O	3.89	3.14	3.06	3.74	3.90
K_2O	3.95	4.86	5.09	2.95	3.99
P_2O_5	0.28	0.25	0.05	0.10	n.d.
Mg/(Mg+Fe)	0.54	0.20	0.19	0.40	0.49
K/(K+Na)	0.40	0.50	0.52	0.34	0.40
Nor.Q	30.87	31.43	32.70	20.14	19.01
Nor.Or	23.99	29.52	31.16	18.34	23.91
Nor.Ab	35.91	28.98	28.47	35.35	35.51
Nor.An	5.14	6.87	4.44	19.15	17.71
Na+K	209.40	204.52	206.82	183.32	210.57
*Si	186.73	185.66	196.66	138.49	122.12
K-(Na+Ca)	-66.27	-28.09	-7.26	-125.81	-103.90
Fe+Mg+Ti	52.77	24.99	28.62	102.66	60.10
Al-(Na+K+2Ca)	-5.68	9.12	20.22	7.54	8.34
(Na+K)/Ca	8.51	6.83	12.47	2.71	3.35
A/CNK	1.00	1.06	1.09	1.03	1.02

Gęsinec Tonalite

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

n=7	Median	Min	Max	QU1	QU3
SiO_2	55.04	54.27	66.97	54.27	56.64
TiO_2	1.50	0.58	1.83	0.88	1.50
Al_2O_3	17.88	12.52	19.68	12.52	17.88
Fe_2O_3	1.53	0.10	10.83	0.87	1.53
FeO	5.85	0.00	6.30	0.00	5.85
MnO	0.13	0.05	0.20	0.10	0.13
MgO	3.30	1.29	8.37	3.00	3.30
CaO	6.40	3.75	7.37	4.85	6.40
Na_2O	3.20	1.73	4.34	1.73	3.62
K_2O	2.02	1.66	2.59	1.66	2.02
P_2O_5	0.37	0.15	0.45	0.33	0.37
Mg/(Mg+Fe)	0.47	0.39	0.60	0.41	0.47
K/(K+Na)	0.29	0.22	0.50	0.23	0.29
Nor.Q	9.16	3.98	22.10	3.98	14.88
Nor.Or	13.25	10.74	18.25	10.74	13.25
Nor.Ab	31.90	18.52	40.99	18.52	35.59
Nor.An	32.84	18.53	37.37	25.16	32.84
Na+K	146.15	110.82	179.33	110.82	152.06
*Si	91.99	61.40	147.63	61.40	136.88
K-(Na+Ca)	-174.50	-212.99	-87.32	-212.99	-167.64
Fe+Mg+Ti	197.18	88.16	362.16	192.37	197.18
Al-(Na+K+2Ca)	-28.43	-37.92	14.29	-37.92	-23.28
(Na+K)/Ca	1.28	1.16	2.68	1.16	1.28
A/CNK	0.95	0.90	1.06	0.90	0.96

References

BEYER, J. (2003): Petrography and succession of granitoids from the southern part of the Strzelin Crystalline Massif (SW Poland) – preliminary data. – Geolines 16, 15–16.

CHÁB, J. – ŽÁČEK, V. (1994): Geology of the Žulová pluton mantle (Bohemian Massif, Central Europe). – Věst. Čes. geol. Úst. 69, 1–12.

HROUDA, F. – AICHLER, J. – CHLUPÁČOVÁ, M. – CHADIMA, CH. (2001): The magnetic fabric in the Žulová Pluton and its tectonic implications. – Geolines, 13, 62–63.

JEDLIČKA, J. (1997): Žulovský masiv ve Slezsku – přehled dosavadních znalostí. – Zpr. geol. Výzk. v Roce 1996, 121–123.

KRYSTEK, I. – HARAZIM, S. (1956): Petrografie a tektonika Žulovského plutonu. – Přírodověd. Sbor. ostrav. Kraje 3, 29–37.

LORENC, M. W. (1994): Role of basic magmas in the granitoid evolution (a comparative study of some Hercynian massifs). – Geologica sudet. 28, 3–121.

LORENC, M. W. – OLSZYNSKI, W. – WISZNIEWSKA, J. (1998): Distribution of phosphorus in granites and pegmatites of the Sudetes Mts. and rapakivi granites from Mazury Complex (NE Poland). – Acta Univ. Carol., Geol. 42, 69–72.

LOSOS, Z. – HLADÍKOVÁ, J. (1988): Izotopické složení grafitů a karbonátů z pláště žulovského masívu a jeho využití pro výpočet teplot metamorfózy. – Scr. Univ. Purkyn. brun., Geol. 18, 261–272.

MACHOWIAK, K. – ARMSTRONG, R. – KRYZA R. – MUSZYŃSKI, A. – (2008): Late-orogenic magmatism in the Central European Variscides: SHRIMP U-Pb zircon age constraints from the Żeleżniak Intrusion, Kaczawa Mountains, West Sudetes. – Geologica sudet. 40, 1–18.

MALUSKI, H. – RAJLICH, P. – SOUČEK, J. (1995): Pre-Variscan, Variscan and Early Alpine thermo-tectonic history of the north-eastern Bohemian Massif: Ar^{40}/Ar^{39} study. – Geol. Rdsch. 84, 345–358.

MORAWSKI, T. (1973): Granity masywu Strzelin-Žulova. – Kwart. geol. 17, 924–924.

NOVÁK, M. – KIMBROUGH, D. L. – TAYLOR, M. C. – ČERNÝ, P. – ERCIT, S. T. (1998): Radiometric U/Pb data of monazite from granitic pegmatite at Velká Kraš, Žulová granite pluton, Silesia, Czech Republic. – Geol. carpath. 42, 309–310.
OBERC-DZIEDZIC, T. (1991a): Pozycja geologiczna granitoidów strzeliňskich. – Acta Univ. wratislav. 1375, Prace geol. mineral. 29, 295–324.
OBERC-DZIEDZIC, T. (1991b): The geology of the Strzelin granitoids (Fore-Sudetic Block, SW Poland). – Miner. Soc. Poland 14, 22–31.
OBERC-DZIEDZIC, T. (1999):The geology of Strzelin granitoids (Fore-Sudetic Block, SW Poland). – Mineral. Soc. Poland. Spec. Pap. 14, 22–23.
OBERC-DZIEDZIC, T. (2002): Polycycle structure of the tonalite-diorite dykes in the Strzelin Massif: A result of magmatic differentiation or separated magmatic pulses? – Mineral. Soc. Poland Spec. Pap. 20, 159–161.
OBERC-DZIEDZIC, T. (2007): Internal structure of the granite and tonalite intrusions in the Strzelin massif, Fore-Sudetic block, SW Poland. In: Kozlowski, A. – Wiszniewska, J. Eds: Granitoids in Poland. – Arch. mineral. 1, 217– 229.
OBERC-DZIEDZIC, T. – PIN, C. – DUTHOU, J. K. – COUTERIE, J. P. (1996): Age and origin of the Strzelin granitoids (Fore-Sudetic Block, Poland): $^{87}Rb/^{86}Sr$ data. – Neu. Jb. Mineral., Abh. 17, 187–198.
OLSZYNSKI, W. (1992): Post-magmatic ore mineralization in the Strzelin Granitoids (Lower Silesia). – Acta geol. pol. 22, 109–126.
PECINA, V. et al. (2005): Explanatory text to the geological map 1 : 25,000 sheet 14-221 Žulová, Czech Geol. Survey, Prague. (In Czech)
PIETRANIK, A. – KOEPKE, J. – PUZIEWICZ, J. (2006): Crystallization and resorption in plutonic plagioclase: implications on the evolution of granodiorite magma (Gęsiniec granodiorite, Strzelin crystalline massif, SW Poland). – Lithos 86, 260–280.
SOUČEK, J. (1987): Minerální asociace hornin pláště žulovského plutonu. – Práce Odb. přír. Věd Vlastivěd. Úst. (Olomouc) 36, 78–83.
SZCZEPAŃSKI, J. (2002): The $^{40}Ar/^{39}Ar$ cooling ages of white micas from the Jegłowa Beds (Strzelin massif, Fore-Sudetic block, SW Poland). – Geologica sudet. 34, 1–7.
TURNIAK, K. – TICHOMIROWA, M. – BOMBACH, K. (2006): Pb-evaporation zircon ages of post-tectonic granitoids from the Strzelin Massif (SW Poland). – Mineral. pol. Spec. Pap. 29, 212–215.
WISZNIEWSKA, J. – KRZEMIŃSKA, E. – MAZUR, S. – GAWĘDA, A. – KOZŁOWSKI, A. (2007): Foreword – brief outline of geology of Poland. In: Kozlowski, A. – Wiszniewska, J. Eds: Granitoids in Poland. – Arch. Mineral. Monogr. 1, 5–7.
ZACHOVALOVÁ, K. – LEICHMANN, J. – ŠVANCARA, J. (2002): Žulová Batholith: a post-orogenic, fractionated ilmenite-allanite I-type granite. – J. Czech Geol. Soc. 47, 35–44.

Žulová Granite

Quartz-rich, sodic-potassic, peraluminous (moderately), calc-alkaline, sub-mesocratic, S-type, I-series, granite

n=13	Median	Min	Max	QU1	QU3
SiO_2	73.93	71.48	75.23	72.53	74.28
TiO_2	0.22	0.00	0.37	0.18	0.26
Al_2O_3	13.77	12.71	14.85	13.25	14.20
Fe_2O_3	0.68	0.10	2.13	0.35	1.02
FeO	1.01	0.63	2.12	0.97	1.31
MnO	0.04	0.02	0.20	0.04	0.05
MgO	0.26	0.13	1.08	0.24	0.45
CaO	1.13	0.10	2.04	0.67	1.41
Na_2O	3.63	3.06	3.89	3.30	3.81
K_2O	4.22	3.48	5.09	4.03	4.87
P_2O_5	0.05	0.00	1.35	0.01	0.12
Mg/(Mg+Fe)	0.22	0.13	0.54	0.19	0.30
K/(K+Na)	0.43	0.38	0.52	0.41	0.49

Nor.Q	31.43	28.78	34.68	30.84	33.15
Nor.Or	25.84	21.34	31.16	24.48	29.61
Nor.Ab	33.93	28.47	35.96	30.47	35.51
Nor.An	4.44	-1.96	10.44	0.51	6.41
Na+K	206.82	192.06	223.42	204.52	210.98
*Si	186.73	163.75	203.51	179.02	198.14
K-(Na+Ca)	-41.21	-85.44	-7.26	-54.35	-25.82
Fe+Mg+Ti	35.93	22.00	60.88	28.69	51.12
Al-(Na+K+2Ca)	13.52	-5.93	81.32	4.64	30.75
(Na+K)/Ca	10.54	5.41	118.32	7.75	18.70
A/CNK	1.06	1.00	1.39	1.03	1.14

Trace elements (mean values in ppm): *Žulová Granite* – **Ba** 93, **Ce** 22, **Cr** 17, **La** 14, **Nb** 20, **Pb** 22, **Rb** 305, **Sr** 24, **Ta** 5, **Th** 12,**U** 8, **Y** 23, **Zn** 30, **Zr** 55 (Lorenc et al. 1998).

Starost Granodiorite

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

n=7	Median	Min	Max	QU1	QU3
SiO_2	70.54	67.06	74.56	68.75	71.07
TiO_2	0.04	0.00	0.20	0.00	0.18
Al_2O_3	15.30	13.86	16.25	13.88	15.61
Fe_2O_3	1.10	0.00	1.75	0.64	1.56
FeO	0.58	0.00	2.39	0.00	1.93
MnO	0.07	0.00	0.26	0.00	0.20
MgO	0.60	0.28	1.06	0.42	0.65
CaO	2.17	1.26	4.47	1.36	2.66
Na_2O	3.58	3.20	4.50	3.30	3.69
K_2O	3.87	3.06	5.29	3.25	3.98
P_2O_5	0.26	0.00	0.41	0.00	0.35
Mg/(Mg+Fe)	0.34	0.14	0.43	0.27	0.38
K/(K+Na)	0.40	0.33	0.52	0.36	0.41
Nor.Q	28.04	19.08	33.97	23.42	29.83
Nor.Or	23.15	18.80	31.98	19.97	23.32
Nor.Ab	33.44	29.40	41.78	30.75	33.80
Nor.An	10.36	3.96	18.87	4.14	12.05
Na+K	202.25	179.85	216.34	184.53	212.94
*Si	171.63	105.96	197.42	141.06	173.73
K-(Na+Ca)	-88.60	-123.64	-15.19	-110.11	-59.37
Fe+Mg+Ti	40.55	29.70	66.96	36.81	45.19
Al-(Na+K+2Ca)	20.35	-90.55	52.06	8.49	26.00
(Na+K)/Ca	4.65	2.67	8.96	3.86	6.01
A/CNK	1.10	0.76	1.24	1.03	1.11

Trace elements (mean values in ppm): *Tonalite* – **Ba** 555, **Cr** 33, **Cu** 46, **La** 14 ,**Nb** 12, **Ni** 16, **Rb** 54**, Sr** 430, **Zn** 54, **Zr** 55.
Diorite – **Ba** 592, **Cr** 50, **Cu** 36, **La** 14, **Nb** 12, **Ni** 20, **Pb** 14, **Rb** 44, **Sr** 275, **Zn** 55, **Zr** 205 (Lorenc et al. 1998).

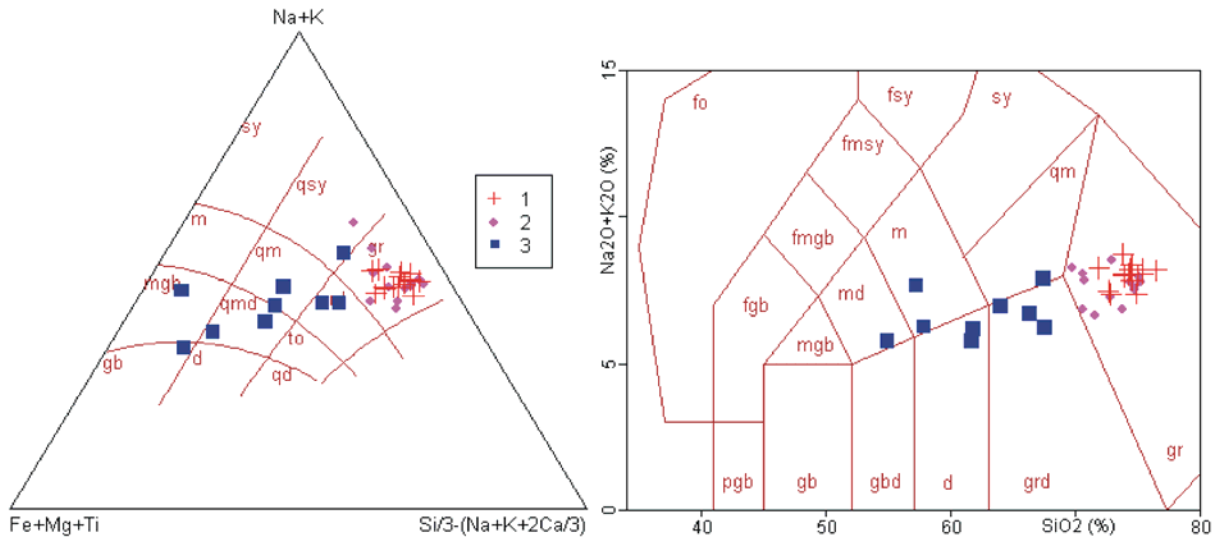


Fig. 5. 23. *Žulová-Strzelin Composite Massif ABQ and TAS diagrams: 1 – Žulová Granite, 2 – Starost Granodiorite, 3– Hybrid Granodiorite.*

5.6. ŠUMPERK MASSIF

Regional position: within the Moravo-Silesicum, at the boundary between the Desná and Keprník Domes, similar to the Rudná Stock (see Fig. 5.18).

Rock types: *Šumperk Granodiorite* – deformed leucocratic medium-grained biotite granite to granodiorite.

Size and shape (in erosion level): two large bodies and several satellite outcrops represent a tectonically segmented intrusion by the Temenice and Bludov faults. Sheet-like in shape.

Age and isotopic data: Carboniferous? No isotopic data.

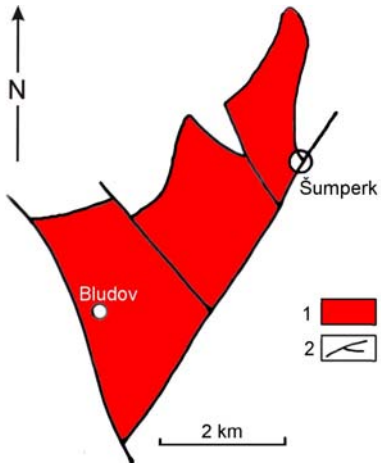


Fig. 5.24. *Šumperk Massif geological sketch-map (adapted after Cháb et al. 2007). 1 –Šumperk Granodiorite, 2 – faults.*

Contact aureole: sharp contact with marbles of Devonian age, tectonic contacts with the Keprník and Desná Orthogneiss.

Geological environment: the Keprník and Desná orthogneisses the Branná Group.

Contact aureole: narrow contact zone, distinctive selective thermal effects on Devonian marbles (tactite = "bludovite").

Zoning: not reported.

Mineralization: pegmatite and quartz-specularite veins at the exocontact.

References

CHÁB, J. – STRÁNÍK, Z. – ELIÁŠ, M. Eds (2007): The geological map of the Czech Republic 1 : 500 000. – Czech Geol. Survey, Prague.

CHLUPÁČOVÁ, M. – PECINA, V. – HROUDA, F. (1999): Magmatic anisotropy of the Šumperk granodiorite and its tectonics. – Geolines 8, 14.

MÍSAŘ, Z. (1959): Geologicko-petrografická studie šumperského granodioritového tělesa. – Sbor. Ústř. Úst. geol. Odd. geol. 25, 335–376.

Talla D., Losos Z., Sulovský P., Čopjaková R. (2005): Studium optických anomálií v granátech z Ca-skarnů brněnského, šumperského a žulovského masivu. Geol.výzk. Mor. Slez. v r. 2004, Masarykova Univerzita: ÚGV, ČGS, ISSN 1212-6209, 2005, XII/2005, 1, s. 98-102

Šumperk Granite

Quartz-normal, sodic, leucocratic, metaluminous granite

	grd1	jih2	sev3	lom4	grd25
SiO_2	71.18	69.43	72.07	69.08	70.90
TiO_2	0.06	0.12	0.04	0.07	0.26
Al_2O_3	16.02	16.01	16.05	16.87	14.61
Fe_2O_3	0.67	1.64	0.39	1.11	2.05
FeO	0.39	1.21	0.43	0.96	n.d.
MnO	0.04	0.02	0.01	0.03	0.04
MgO	0.06	0.60	0.35	0.59	0.49
CaO	3.53	2.93	2.68	3.02	2.37
Na_2O	4.03	4.33	4.26	4.25	3.83
K_2O	3.05	3.57	4.05	2.84	3.79
P_2O_5	0.12	0.06	n.d.	0.08	0.18
Mg/(Mg+Fe)	0.09	0.28	0.44	0.35	0.32
K/(K+Na)	0.33	0.35	0.38	0.31	0.39
Nor.Or	18.28	21.41	23.96	17.17	23.09
Nor.Ab	36.71	39.47	38.30	39.06	35.46
Nor.An	16.97	14.36	13.32	14.80	10.90
Nor.Q	27.02	22.17	23.50	25.00	27.53
Na+K	194.80	215.53	223.46	197.45	204.06
*Si	158.12	134.82	144.51	149.89	161.10
K-(Na+Ca)	-128.23	-116.18	-99.27	-130.70	-85.38
Fe+Mg+Ti	16.07	53.79	20.06	42.79	41.10
Al-(Na+K+2Ca)	-6.10	-5.62	-3.85	26.14	-1.68
(Na+K)/Ca	3.09	4.13	4.68	3.67	4.83
A/CNK	0.99	0.99	0.99	1.09	1.01

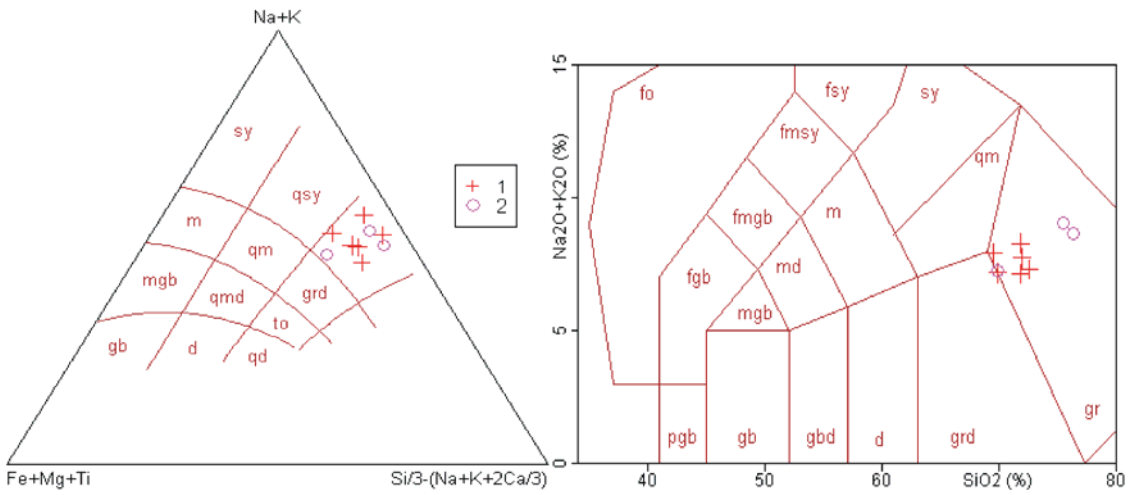


Fig. 5. 25. *Šumperk Massif and Rudná Stock ABQ and TAS diagrams. 1 – Šumperk Granite, 2 – Rudná Granite.*

5.7. RUDNÁ STOCK

Regional position: within the Moravo-Silesicum, at the boundary between the Desná and Keprník Domes, similar to the Šumperk Massif.

Rock types: *Rudná Granite* – foliated fine-grained leucocratic biotite to two-mica granite-granodiorite up to orthogneiss with magnetite and pyrite.

Size and shape (in erosion level): tectonically segmented intrusion oval in shape.

Age and isotopic data: Rudná Granite 330 Ma (Rb-Sr whole rock).

Geological environment: amphibolites and paragneisses.

Contact aureole: migmatite aureole of several metres in thickness.

Zoning: unknown.

Mineralization: rare-element pegmatites.

References

HANŽL, P. – JANOUŠEK, V. – ŽÁČEK, V. – WILIMSKÝ, D. – AICHLER, J. – ERBAN, V. – PUDILOVÁ, M. – CHLUPÁČOVÁ, M. – BURIÁNKOVÁ, K. – MIXA, P. – PECINA, V. (2007): Magmatic history of granite-derived mylonites from the southern Desná Unit (Silesicum, Czech Republic). – Mineral. Petrology 89, 45–75.

ŽÁČEK, V. Ed. (2000): Vysvětlivky k základní geologické mapě České republiky 1 : 25 000, 14-421 Velké Losiny, pp. 75. – MS Czech Geol. Survey, Prague.

Rudná Granite

Quartz-normal, sodic, weakly peraluminous, leucocratic, I-& S-type granite

	7 biotite alkali-feldspar granite	**1881RUD alkali-feldspar granite**	**6 biotite granodiorite**
SiO_2	75.53	75.59	69.23
TiO_2	0.17	0.13	0.45
Al_2O_3	12.78	13.00	15.71
Fe_2O_3	0.83	1.02	0.93
FeO	0.51	0.43	2.17
MnO	0.02	0.02	0.03
MgO	0.09	0.25	0.97
CaO	0.36	0.54	2.42
Na_2O	3.51	4.08	4.95
K_2O	5.06	4.96	2.21
P_2O_5	0.01	0.04	0.04
Mg/(Mg+Fe)	0.11	0.25	0.36
K/(K+Na)	0.49	0.44	0.23
Nor.Or	30.65	29.60	13.48
Nor.Ab	32.31	37.01	45.89
Nor.An	1.75	2.44	12.12
Nor.Q	33.12	29.43	23.25
Na+K	220.70	236.97	206.66
*Si	194.04	175.97	148.65
K-(Na+Ca)	-12.25	-35.98	-155.96
Fe+Mg+Ti	21.90	26.60	71.55
Al-(Na+K+2Ca)	17.43	-0.94	15.55
(Na+K)/Ca	34.38	24.61	4.79
A/CNK	1.07	1.00	1.06

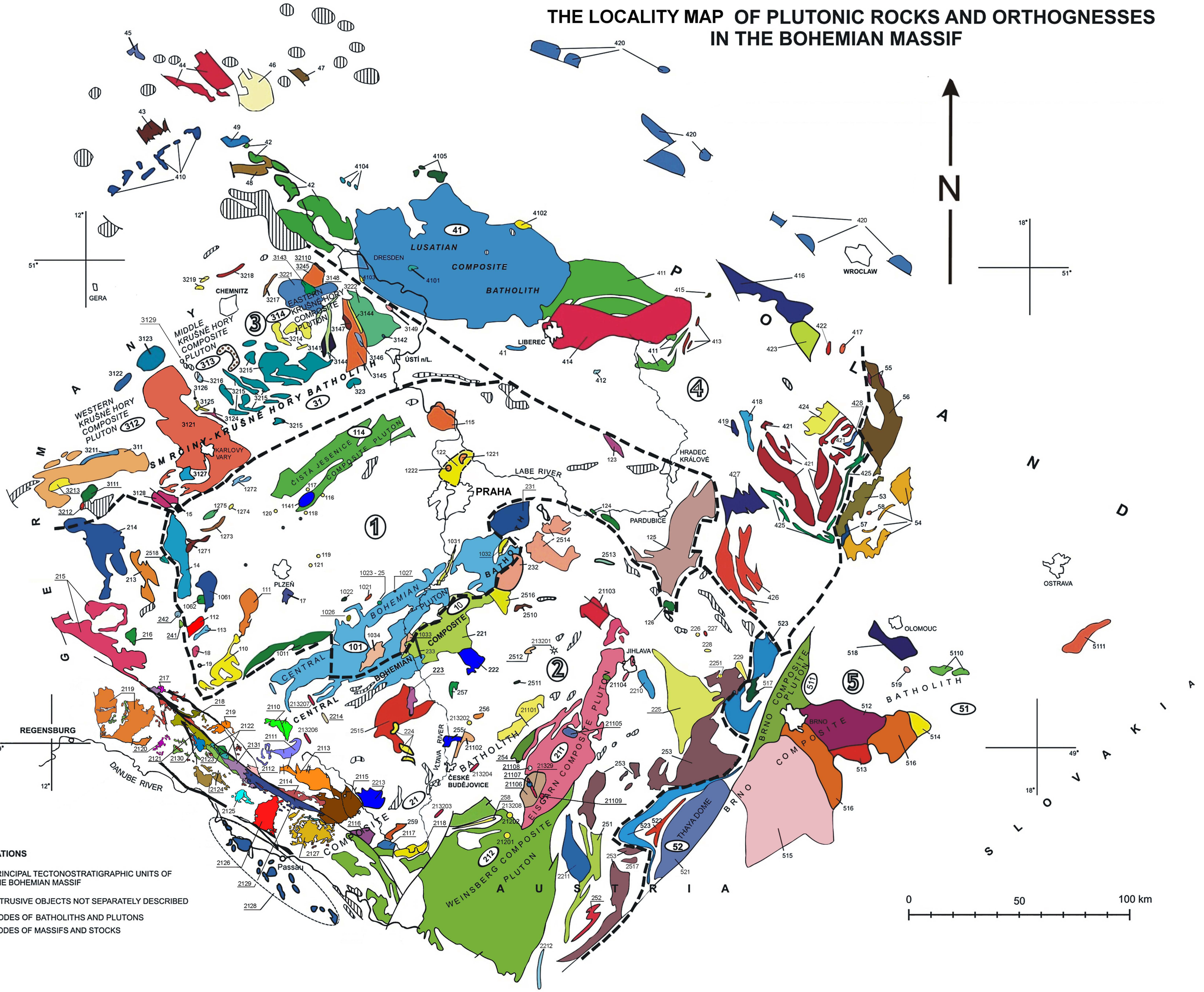
Atlas of plutonic rocks and orthogneisses in the Bohemian Massif

5. Brunovistulicum and Moravosilesicum

J. Klomínský, T. Jarchovský, G. S. Rajpoot

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



Správa úložišť radioaktivních odpadů
Dlážděná 6, 110 00 Praha 1
Tel.: 221 421 511
E-mail: info@rawra.cz
www.surao.cz