the original solid state texture and development of large volumes of nebulitic migmatites in the Gföhl unit.

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Geochemical Variability of the Kłodzko – Złoty Stok Massif: Possible Role of Multiple Mafic End-Members of Hybrid Granitoids

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The Klodzko - Zloty Stok massif (KZS) is one of the Variscan plutonic bodies located within the Lugian Zone at NE margin of the Bohemian Massif in southern Poland. Though the rocks were described petrographically in a great detail (namely by Wierzcholowski 1976) and many silicate analyses were published, the trace element contents and geochemical characteristics are still poorly known.

The plutonic rocks from the KZS are dominantly intermediate and only marginally acidic. The whole compositional range of major plutonic rocks (excluding enclaves) is from about 54 to 68 wt.% with rare leucogranites up to 75%.

Lorenc (1991) stressed the metaluminous chemistry of the major rock types, their hybrid nature and abundance of dark inclusions that he interpreted as typical mafic magmatic enclaves (MME). According to him the role of mafic magma in petrogenesis of granitoids forming the KZS was principal.

Geochemical study of a new set of samples displays highly variable composition of major rock types as well as of MME. These data enabled us to differentiate at least 3 compositional groups (Table 1) that differ in petrochemical parameters.

Mafic varieties of rocks from the KZS display typical features of mantle-derived magmas or hybrid magmas dominated in composition by the mantle end-members (high mg-values, high contents of MgO, Cr, Ni). However, composition of the mafic members vary and they cannot represent single magma batch.

The most potassic plutonic rock yet analysed are monzonites from the endocontact of the KZS at Żelazno. These and some other dark and K-rich rock varieties from KZS are similar in chemical composition to “vaugneritic” and “syenitic” intrusions in the Niemcza Zone, namely at Kożmice and Piława Górna (cf. Puziewicz 1987, 1988). Their chemical composition cannot be due to contamination of a common basaltic magma with crustal rocks or melts as these rocks have not only high K and Rb but also the highest MgO, Cr and Ni and the *mg*-values.

Composition of the prevailing relatively dark and K-rich granitoids resemble that of shoshonitic rocks (SHO). Some granitoids from surroundings of Laskówka and Laski correspond to the high-K calc-alkaline series (HKCA) with different composition of MME.

Compared to durbachitic rocks from the Moldanubian Zone of the Bohemian Massif, even the most potassic rocks from the KZS and the Niemcza Zone display significantly lower contents of K_2O, P_2O_5, Rb, Cs, Th and U. However, their geochemical signature, namely in the “spider diagrams”, seems to be similar. We consider existence of some similarities in history of their mantle sources.

Group	Rocks	SiO_2	K_2O	K_2O/Na_2O	*mg*
UK	monzonite to melagranodiorite	54–58	3.4–4.7	1.3–2.2	72–65.3
SHO	melagranodiorite to granodiorite	58.7–62.5	3.4–4.2	1.1–1.3	55.7–53.1
HKCA	biotite granodiorite to monzogranite	64–68	3.1–3.5	1.0–1.1	46.4–43.1

mg = MgO/(MgO + FeOtot.) (from molar values)

Tab. 1. Comparison of selected petrochemical parameters for major compositional groups of plutonic rocks from the Klodzko – Zloty Stok massif and similar rocks from the Niemcza Zone.

Rocks of the KZS display high LILE/HFSE elemental ratios and also the high Th/Ta ratios are typical for igneous rocks derived from sources geochemically modified in the supra-subduction environment at destructive plate margins. However, as the mantle may retain the "subduction signature" after cessation of subduction, derivation of the K-rich mantle magmas may not be contemporaneous with active subduction in the area.

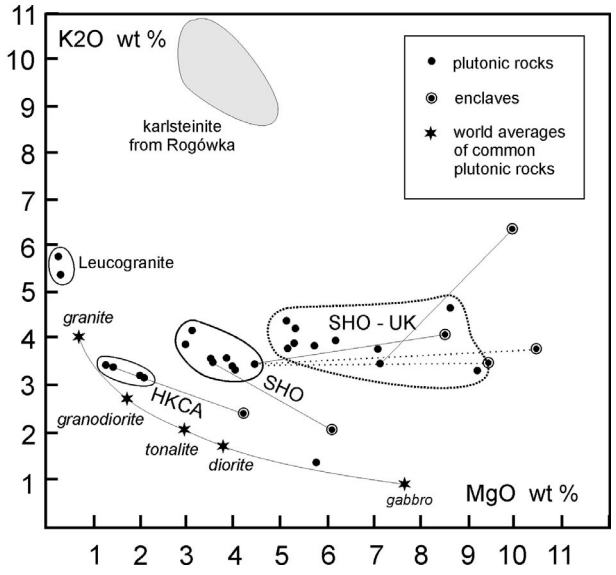

Fig. 1. The K_2O versus MgO plot for rocks of the Klodzko – Zloty Stok massif and the Niemcza Zone. Averages of common plutonic rocks are from Le Maitre (1976).

The compositional diversity and significant differences in incompatible elemental ratios between members of individual compositional groups from the KZS cannot be ascribed to increasing degree of enrichment superimposed on a common mantle lithology, or to decreasing melting degrees. Geochemical characteristics and variability of K-rich magmas can be due to distinctive sources within the heterogeneous subcontinental lithospheric mantle with complex history.

An extreme composition has to be considered for source of the peralkaline dyke rock of karlsteinite composition intruding the SHO plutonites at Rogówka.

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Generalized Angelier-Mechler's / Arthaud's Method

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During last 20 years, numerical methods of paleostress reconstructions were very well developed, but progress in graphical methods was nearly stopped, however modern computers enable good graphical presentation of data. Merit of graphical methods is illustrative relation between data and results. Two basic graphical methods include right dihedra method (Angelier and Mechler 1977) and M-plane method (Arthaud 1969). These two methods are the two marginal cases of general inverse method based on one-fault inverse analysis.

Using fault coordinate system, where *l*-axis is striae lineation, *n*-axis is normal to fault plane and *m*-axis complete right-

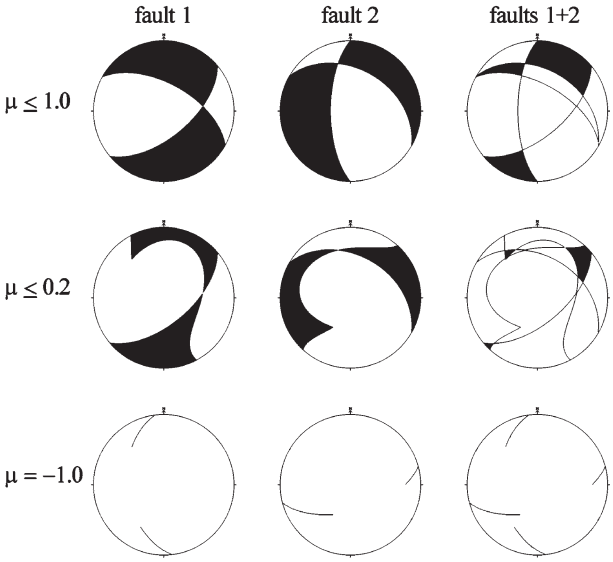

Fig. 1. Equal-area plots for different methods of σ_1-determination based on one-fault inversion: Angelier-Mechler's method ($\mu \leq 1$), descripted method (variable μ, e.g. $\mu \leq 0.2$), Arthaud's method ($\mu = -1$, no solution in this case).