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PETROGRAPHY AND GEOCHEMISTRY OF THE JAWORNICKIE GRANITOIDS, WEST SUDETES

GEOLOGICAL SETTING

The Jawornickie granitoids form a string of elongate subconcordant plutons, occurring within the multiply deformed rocks of the Złoty Stok – Skrzynka shear zone (ZSSsz). These sheeted-bodies are interpreted as sills injected parallel to the regional tectonic foliation in the host rocks, although more complex relationships occur, such as pluton margins cross-cutting the external foliation and dykes evolving into sills. The ZSSsz is an 10 km long (minimum length) near vertical shear zone, in northern part terminated by Sudetic Boundary Fault and by H. Cloos (1922) was linked with the Niemcza shear zone, located about 20 km farther to the north. The ZSSsz is of great interest because it may possibly provide important clues to understanding character of the boundary between Lugicum and Moravo-Silesicum. Despite its potential importance, only limited work has been carried out on the ZSSsz. The details of evolution of the ZSSsz, such as amount of deformation episodes, spatial development of structures, duration of events are poorly understood. The Jawornickie granitoids intruded a sequence of polimetamorphic metavolcanic and metapelitic rocks which dominant fabric has been developed under conditions typical of high-temperature amphibolite facies – T=650-700 ^{0}C and P=2.0-2,5 kb (Kozłowska-Koch, 1973; Smulikowski, 1979). The deformation and metamorphic of the ZSSsz makes the field determination of relationships between matamorphic and granitoid rocks difficult, because strain has commonly been concenrated along original boundaries. A distinctive strain aureole is not well developed; a foliation in the country rocks attributable to the emplacement of granites is lacking.

PETROGRAPHY

The mineralogical composition of the granitoid rocks is rather simple; variations exits in mineral abundances and rock fabric. The Jawornickie granitoids may be divided into five groups based on petrography and mineralogy:
type I - most typical, biotite is the only mafic silicate; Bt is relatively iron-rich with Fe/(Fe+Mg) ranging from 0.4 to 0.43, , and show little variation in tetrahedral aluminum; the compositional range of K-feldspar is Or_{87-95}; the composition of

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plagioclase is predominantly oligoclase (An12-25), rarely albite, type II – amphibole-bearing; biotite occurs as a primary mineral phase and as a reaction product associated with the margins of many amphibole grains; amphibole ranges from tremolite to pargasite, and is relatively iron-rich with Fe/(Fe+Mg) ratios ranging from 0.41 to 0.6, Ti – 0.18-0.28 (for O=22). Amphibole compositions at the margin have higher Si, Ti, Mg, and Al_{TOT}, and the compositions are progressively enriched in Ca, Na, Fe and K toward the center; the compositional range of K-feldspar is Or_{83-94}; the composition of plagiclase is oligoclase to albite (An_{2-26}),

type III- with primary muscovite; Or_{96-99}, An_{27-1}; Bt – Fe/(Fe+Mg) - 0.4-0.43, Ti – 0.21-0.23; Msc – Na/(Na+K) – 0.10-0.13, Si – 7,18-7,39 (for O=22)

type IV- leucogranite: Or_{93-96}, An_{3-17}; Msc – Na/(Na+K) – 0.08-0.1, Si – 7,22-7,36 (for O=22)

type V- pegmatite, Or_{78-93}, An_{3-9}; Msc – Na/(Na+K) – 0.03-0.06, Si – 7,17-7,42 (for O=22), Grt.

All these varieties have been variably deformed and metamorphosed; in places, igneous textures are preserved almost undeformed but elsewhere granites have been deformed to augen gneisses and mylonites. Biotites and hornblendes, accompanied by less obvious shape preferred orientation of feldspars and quartz ribbons usually form a weak foliation plan in the rocks. Only in some samples a strong biotite foliation is developed. Microstructures in the Jawornickie granitoids point to a magmatic to submagmatic development of the fabric with minor solid-state overprint.

GEOCHEMISTRY

Jawornickie granitoids show a limited, but significant variation of major element chemical composition, with SiO_2 ranging from 65 to 75 wt % (average 69,34 wt %, n=25). They are subalkalic, peraluminous and calc-alkaline (average A/CNK =1,6, (average $NaO+K_2O$)=7,77, average ($Fe_2O_3^T$/($Fe_2O_3^T$+MgO)= 0,59). Jawornickie granitoids show 'normal' variation trends of decreasing Al_2O_3, MgO, $Fe_2O_3^T$, CaO, MnO, TiO_2 and P_2O_5 with increasing SiO_2. Na_2O increasing with increasing SiO_2 whereas K_2O show substantial scatter, with no apparent trend. Available data allow jawornickie granitoids to characterized as follows: Rb < 160 ppm, Th <28 ppm, Pb< 70 ppm, U< 9 ppm, Nb< 14 ppm and substantial scatter in Ba concentrations. Increases in SiO_2 are accompanied by marked decreases in V, Zr, Sr and Th. Correlation between increase in SiO_2 and decrease in concentration of REE is especially well visibly for La and Ce, and crude for other REE.

T-P CONDITION OF GRANITE FORMATION

Some of the Jawornickie granitoids contain the critical mineral assemblage hornblende+biotite+plagioclase+alkalifeldspar+quartz+titanite+titanomagnetite+apatite that is required for application of the Al-in-hornblende barometer (Schmid, 1992). For our pressure estimates, we used rim compositions of hornblende grains in contact with quartz and alkalifeldspar. Cation calculations were based on 23 oxygens and cations number of 13 excluding Ca, Na and K. Pressure obtained yield ~ 5,5 kbar and suggest that the level of emplacement of the Jawornickie granitoids was in the range of 18-23 km. Temperature estimates determined using Blundy and Holland (1994) thermometer. For the pressure range obtained using Al-in-hornblende geobarometer, the average of the estimated temperatures is ~ 680 ^{0}C.

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