Magmatic and Tectonometamorphic Evolution of the Zawidów Granodiorite, Lusatian Granodiorite Complex, Sw Poland.

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The Zawidów (East Lusatian) granodiorite is situated at the northern edge of the Bohemian Massif in SW Poland and forms the easternmost part of the Lusatian Granodiorite Complex. The Lusatian granodiorites are peraluminous, calc-alkaline S-type granitoids with a geochronogically constrained Vendian to lowermost Cambrian emplacement age (Kröner et al. 1994, Tichomirowa et al. 1997). The Lusatian block is only marginally affected by Variscan magmatism, metamorphism and deformation. Towards its eastern margin granitic rocks show evidence of increasing deformation. Undeformed Zawidów granodiorite is homogeneous in mineralogical composition and shows only minor internal geochemical variation. It is medium-grained, composed of quartz (32%), sodic plagioclase (44%; 8-12% An), K-feldspar (15%) and biotite (8%). Accessory phases include ilmenite, apatite and zircon.

Lusatian granitoids intruded into deformed Cadomian greywackes and the latter are interpreted as a source rocks for granitic melts. The original temperature of granitic melts is reflected by the amount of dissolved Zr and REE. Eighteen whole-rock analyses of the Zawidów granodiorite and granodioritic gneisses show Zr contents ranging from 193 to 285 and S REE from 95 to 167. According to the calibration provided by Harrison and Watson (1983) and Montel (1993) the majority of the data suggest a melt temperature of the order of 800 - 850 °C. It is concluded that biotite-bearing sedimentary rocks, metapelites and/or metagreywackes, are of major importance in dehydration partial melting events producing granitic magmas with S-type chemical characteristics. According to Vielzeuf and Montel (1994) the multivariant field of the complex reaction

$$bt + pl + qtz = opx + kfs + melt + grt/crd/spl$$

limited by the opx-in and bt-out curves within temperature range 810 - 860 °C is located at low pressure (2 kbar).

Deformation of the Zawidów granodiorite has produced shear zones that show a broad range of microstructural developments, varying from non-foliated to strongly banded and foliated. The significance of those occasionally identifiable, small ductile shear zones is not fully recognized here. They were considered a part of the boundary between the Lusatian block and Izera-Karkonosze block (Ebert 1943). Several metre-scale shear zones are well exposed in small outcrops. Zawidów granodiorites experienced a polyphase, poorly resolved tectonometamorphic history. Microfabrics and textures indicate that the oldest documented geological event (D_1) is the result of shortening and SW-directed thrusting. The most common metamorphic paragenesis associated with D_1 in Zawidów granodiorite is:

$$Qtz + Ab + Bt + Msc \pm Ep, Ttn.$$

From the combined application of the plagioclase-muscovite geothermometer and the phengite geobarometer to this assemblage, metamorphic conditions were estimated to be 440-460 °C and 7-8,5 kbar.

D_2 took place during the retrograde metamorphic evolution. The effects of deformation upon the various minerals are typical of low grade mylonitization near the brittle-ductile transition. Although diagnostic mineral assemblages are absent, it is likely that D_2 was accompanied by low greenschist facies metamorphism. Temperatures calculated using the chlorite thermometer are within the range 231-238 °C. In general, the dominant microstructures are consistent with mainly dextral strike-slip.

D_3 is a phase of usually steeply dipping brittle faults of predominantly E-W and N-S strikes. They indicate mostly horizontal extension.

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