with reversly zoned cores suggests different, more complex origin of their formation, and then mixing of two types of grains in one magma reservoir.

Chemical compositions of minerals from tonalite (increase in An content towards the mantles in plagioclase, increase in Al^{IV} and Ti in biotites) indicate crystallization event in differentiating magma prior to emplacement into granodiorite sequence.

Geochemical compositions of granodiorites and tonalites indicate mafic sources of derived magma (I-type granitoids in the sense of Chappell and White, 1974). Trace element signatures preclude the involvement of substantial amounts of garnet either in the residue during partial melting or as a part of the fractionating assemblage during an AFC process (DePaolo, 1981). Amphibole and plagioclase have to be considered as major fractionating phases during magma genesis (Altherr et al., 1999)

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Geochemistry and Geochronology of the Javornik Granodiorite and its Geodynamic Significance in the Eastern Variscan Belt

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The Złoty Stok – Skrzynka shear zone (ZSSsz) is situated in the West Sudetes, immediately north of the Orlica-Śnieżnik dome. ZSSsz is made up of late Proterozoic-early Paleozoic sedimentary and volcanic rocks which have undergone multiple deformation and medium- to low-grade matamorphism during Early and Late Paleozoic time. Numerous granitoids sills and dykes intruded the shear zone and commonly form sheeted-bodies parallel to the regional tectonic foliation in the host rocks.

Jawornickie granitoids are broadly calc-alkaline with relatively high alkali (Na_2O+K_2O) content, ranging from5.8 to 9.2 wt. %, and Na_2O/ K_2O ratios of 1.05 to 3.56 consistent with orogenic granitoid rocks (Maniar and Piccoli, 1989) and typical of I-type granitoid rocks (Chappell and White, 1974). They are generally weakly metaluminous to mildly peraluminous, (except for one sample wich is strongly peraluminous - A/CNK=1.5) with alumina saturation indices in the range from 0.92 to 1.1, and ASI is poorly correlated with SiO_2. The primitive-mantle trace element spider diagram for Jawornickie granitoids, shows an obviously negative anomaly, features considered typical of crustal-derived granite. Chondrite-normalized REE patterns are all moderately fracionated and have LREE enrichment $(La/Yb)_N$ ranging from 9.2 to 21.7 and negative Eu anomaly in the range from 0.55 to 1.27. REE concentrations decrease regularly as a function of increasin SiO_2 content, and the size of Eu anomaly decrease irregulary with increasing SiO_2.

Oxygen isotope data for Jawornickie granitoids include 6 quartz, 3 biotite, 2 muscovite and 1 amphibole analyses. Results are systematic and demonstrate that, in general, isotopic partitioning varies from high to low $\delta^{18}O$ in the sequence quartz> muscovite> amphibole> biotite.Quartz was mineral selected for comparison between different lithologic type because it resistance to post-crystallization exchange and alteration. Oxygen isotopic composition of quartz separates cluster between +9.3 and +11.4 ‰. $\delta^{18}O$ values for muscovite are between +9 to +10, for biotite are in the range from 3.3 to 6.1, and for amphibole has $\delta^{18}O$ of 6.6 ‰. The equilibrium fractionation of ^{18}O and ^{16}O between coexisting minerals is a function of temperature but is independent of pressure. Accordingly, obtained data would allow the estimation of temperatures of igneous crystallization or later subsolidus alteration. The temperature obtained with the Qz-Ms pair ranged from 727 to 776 °C, with the Qz-Bt pair tepmeratures ranged from 463 to 577. The single quartz-amphibole pair yields a nominal temperature of 719 °C.

The geochemical chracteristic and $\delta^{18}O$ values of quartz are consistent either with primitive metasedimentary source rocks or with meta-igneous source rocks, such as amphibolites.

The geochemistry of igneous rocks bear a close relationship to their tectonic settings of formation. Jawornickie granitoids samples plotted in the field of syn-collision granitoids on discrimination diagram by Batchelor et al. (1985) and cluster in the syn-collision/volcanic-arc fields on Pearce et al. (1984) diagrams. On the Rb-Hf-Ta digram (Harris et al., 1986) Jawornickie granitoids data fall between volcanic arc and late- to postcollisional granitoid fields, indicative of an evolved I-type magmatic system.

Two granite varieties were dated – hbl+bt granite and bt+ms granite. Four mineral aliquots and associated flux monitors were analyzed by the $^{40}Ar/^{39}Ar$ step heating method. All samples show age spectra with well-behaved plateau. Results of isochrone regression in all cases are concordant with plateau age values. From a hbl+bt granite an amphibole revealed a vell defined age plateau at 351.1±3.7 Ma. A coexisting biotite yielded an oveall plateau age of 349.6±3.8 Ma. Muscovite from bt+ms granite showed a plateau age of 344.6±3.8 Ma whereasthe biotite concentrate of coexisting biotite yielded a corncordant plateau age of 343.1±3.8 Ma. Similar single zircon ages –348 Ma- were obtained by Kröner (unpublished data). These coincidental zircon and amphibole, biotite and muscovite ages imply fast cooling, and could be interpreted as cooling during tectonic exhumation and thrusting after the high pressure and high temperature events.

The work is supported by a research grant no. 6 P04D 011 20 from the State Committee for Scientific Research in Poland

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Some Remarks on the Geophysical Research of the Lithosphere

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The complicated structure of the Western Carpathian lithosphere with specific physical properties is a result of a complex geodynamic development of the orogen. On the surface, the structural pattern is documented by geology, but in the depth can be identified only by means of geophysics. Geophysical methods belong to one of the most important tools for the investigation of the structure and for the reconstruction of geodynamic development of the lithosphere in this region. The research of the Western Carpathian lithosphere consists of the application of the deep range geophysical methods, such as methods of seismic refraction a reflection profiling, seismology, gravimetry, magnetometry, magnetotelurics and geothermics. In our study of the structure and thickness of the lithosphere we used a modern method of integrated lithosphere modeling (Zeyen et al. 2002). 2D numerical models are based on a combined interpretation of heat flow, gravity data and topographic elevation. They have modeled lithosphere thickening underneath the central and eastern parts of the Western Carpathians. The lithosphere increases in thickness to a maximum of 140-150 km. The apparent lithosphere thickening was interpreted as a remnant of a subducted slab(s) of the European plate. Remnants of deep subduction below the Pannonian Basin have been detected earlier (Wortel and Spakman 2000). In addition to the slab detachment can be explained by the continuation of convergent movements between the overriding ALCAPA block and the European platform for a short time period after the slab break-off (Zeyen et al. 2002).

The western part of the Western Carpathians does not show lithosphere thickening (Zeyen et al. 2002). We suggest that the tectonic evolution of continental collision along the Carpathian orogen has changed in time and space. The differences in lithosphere thickness in these both parts of the Western Carpathians could be explained by the different geodynamic evolution during the Oligocene and Miocene. It is assumed that a compressional process during Miocene brought the northern (northeastern) segment of the Western Carpathians into frontal collision with the European platform, whereas the western segment suffered transpressional deformation due to oblique collision with the Bohemian massif (Csontos et al. 1992, Kováč et al. 1993).

Based on our results we constructed a new map of the lithosphere thickness in the ALCAPA region. The central and eastern parts of the Western Carpathians are bordered in the north by a thicker and stronger lithosphere of the European platform (100–150 km), which is underthrust (about of 50 km) beneath the margin of the overriding Carpathian orogen. Modification of the lithosphere depth was done only in the region, in which the profiles I, II, III, IV and V are located. Moreover, in this region we concentrated especially on the Western Carpathian area.

The hinterland of the Western Carpathians is characterized by a thin lithosphere. Typical for the back arc basin. Based on seismic and magnetoteluric measurements, the thinnest lithosphere (40 km) is located beneath the Békés Basin in Hungary (Posgay et al. 1995). The lithosphere under the other subbasins of the Pannonian Basin system reaches thickness of about 60 km (Horváth 1993). The integrated modeling of Zeyen et al. (2002) indicates a little bit larger lithosphere thickness (about 80 km) in this region. The extreme lithosphere thinning was probably caused by stretching of the overriding plate and associated asthenospheric mantle updoming (Bielik 1988).

The knowledge on structure of the crust in the Western Carpathians comes mainly from refraction measurements of the deep seismic sounding (e.g. Beránek et al. 1972; Mayerová et al. 1994) and reflection seismic measurements with the prolonged