# Zircons from the Czarnów Schists, East Karkonosze Complex, Sudetes, SW Poland: Morphology and Geochemistry

*Ryszard KRYZA[1] and Mentor MURTEZI[2]*

[1] *Institute of Geological Sciences, University of Wrocław, Cybulskiego 30, 50-205 Wrocław, Poland*

[2] *Institute of Geological Sciences of the Polish Academy of Sciences, Podwale 75, 50-449 Wrocław, Poland*

The quartz-feldspathic rocks (the so-called "leptynites", Teisseyre 1973) and mica schists of the Czarnów unit in the East Karkonosze Complex, the West Sudetes, have problematic origin and age. They may represent felsic metavolcanics and metasediments of Neoproterozoic (?) age, and form, apparently, the country rocks of the Kowary orthogneiss (Aleksandrowski et al. 2000; Kryza and Mazur 1995), which intruded at ca 500 Ma (Oliver et al. 1993). To highlight the problematic origin of the Czarnów schists, zircons from a set of representative samples of these rocks were studied. The study comprised description of morphological features, Pupin's (1980) typological classification and electron microprobe analyses (83 spot analyses in 29 representative crystals and Zr/Hf profiles across 14 zircon grains). Zircon concentrates from 5 different rock samples were first studied with the typology method. Three samples come from the fine-grained quartz-feldspathic schists from the northern part of the area. Two samples come from coarser-grained and darker mica schists from the southern part of the Czarnów unit. Crystals for microprobe analyses ($SiO_2$, $ZrO_2$, $HfO_2$, $La_2O_3$, $Ce_2O_3$) were hand-picked from 4 selected rock samples (two from northern and two from southern part). The microprobe analyses were performed using the Cambridge M9 probe at the Department of Mineralogy and Petrology, Institute of Geological Sciences, Wrocław University. Analytical conditions: two WDS spectrometers, 15 kV, 50 nA, 15 s, ZAF, standards: Si, Zr and Hf – natural zircon (Hf peak position measured on $HfO_2$), La & Ce – synthetic phosphates. For a better distinction between significant, real variation in chemical composition of zircons and incidental analytical effects caused by cracks, uneven surface at crystal margins etc., some statistical procedures for the raw microprobe data were applied.

All the studied samples reveal zircon populations with very similar morphological features. However, considerable differences were ascertained in typology: samples from the quartz-feldspathic schists have types with dominating {100} prism and {101} pyramide (types S24, S23, S19 and S18), whereas in those from the mica schists forms {110} and {211} prevail (types S12, S7 and S2).

The observed typological diversity can imply different protoliths for these rocks. The morphology of zircons from the quartz-feldspathic schists is close to rhyolites or trachytes, whereas those from the mica schists have zircon populations typical of S-type granitoids.

This typological variation corresponds with differences observed in chemical characteristics of the zircons: the studied grains from the mica schists display higher Hf contents, usually with rims richer in Hf than cores. Differences in $HfO_2$ content, observed within zircon crystals can be due to changes in Hf concentration in magma during zircon crystallization (Caironi et al. 2000). The chemical variation corresponds with optical zonation abundant in some crystals – each zone has slightly different average Zr/Hf ratio.

The observed large proportion of idiomorphic crystals and general lack of "apparent extinction angle" in all samples suggest their igneous origin. The rocks from the N and S parts of the area have considerably different types of zircons which suggests different protoliths. The quartz-feldspathic schists of the northern area most probably represent acid volcanogenic rocks, while the mica schists in the southern part contain zircons typical of S-type granitoids or sedimentary material derived from such igneous protoliths.

## References

ALEKSANDROWSKI P., KRYZA R., MAZUR S., PIN C. and ZALASIEWICZ J.A., 2000. The Polish Sudetes: Caledonian or Variscan? *Transactions Royal. Soc. Edinburgh: Earth Sciences,* 90: 127-146.

CAIRONI V., COLOMBO A., TUNESI A. and GRITTI C., 2000. Chemical variations of zircon compared with morphological evolution during magmatic crystallization: an example from the Valle del Cervo Pluton (Western Alps). *Eur. J. Mineral.*, 12: 779-794.

KRYZA R. and MAZUR S., 1995. The Leszczyniec meta-igneous complex in the eastern part of the Karkonosze-Izera Block, Western Sudetes: trace element and Nd isotope study. *N. Jb. Miner. Abh.,* 170 (1): 59-74.

OLIVER G.J.H., CORFU F. and KROGH T.E., 1993. U-Pb ages from SW Poland: evidence for a Caledonian suture zone between Baltica and Gondwana. *J. Geol. Soc. London,* 150: 355-369.

PUPIN J. P., 1980. Zircon and Granite Petrology. *Contrib. Mineral. Petrol.*, 73: 207-220.

TEISSEYRE J., 1973. Metamorphic rocks of the Rudawy Janowickie and Lasocki Range. *Geologia Sudetica,* 8: 7-120.