Abstract

The Leszczyniec Metaigneous Complex, hereinafter referred to as the Leszczyniec Unit, is the highest tectonic element in the stack of nappes of the Karkonosze-Izera Massif, which is exposed in the eastern cover of the Karkonosze Granite in the Western Sudetes. The nappes include metamorphosed sedimentary and igneous rocks belonging to the Saxo-Thuringian suture zone. They were derived from the accretionary prism or subduction channel formed during the Devonian-early Carboniferous subduction of the Saxo-Thuringian Ocean and the continental margin of the Saxo-Thuringian terrane under the active margin of the Teplá-Barrandian terrane.

The protolith of the Leszczyniec Unit was dated to an age interval of c. 20 Ma, ranging from 510 to 490 Ma. Six zircon concentrates from various varieties of the Paczyn gneisses and metarhyolite were determined using the LA-ICP-MS (Laser Ablation Inductively Coupled Plasma Mass Spectrometry) method. Although the protolith age of the Leszczyniec Unit does not differ from previously published dates, a complete set of geochronological data was obtained for the first time as part of this study. While the age of the Leszczyniec Unit was not surprising, an innovative result is the finding of an almost complete lack of an inherited component in the population of zircons from the rocks examined. Among 255 analyses, only a dozen or so cases acquired ages in the range of 550-520 Ma. The obtained data prove that the protolith of the Leszczyniec Unit was formed as a result of the melting of igneous rocks of an age slightly older (550-520 Ma) than the age of the Leszczyniec Unit itself.

Thirty-nine samples were analysed for the content of major, trace and Rare Earth Elements, and 12 samples for the isotope ratios $^{87}Sr/^{86}Sr$, $^{143}Nd/^{144}Nd$, and $^{176}Hf/^{177}Hf$. This extensive data set provides evidence in favour of the hypothesis of the supra-subduction origin of the protolith rocks for the Leszczyniec Unit. Rare Earth Elements show depletion in HFSE (High Field Strength Elements) and limited fractionation even in more felsite rock samples, which indicates the emplacement of the protolith within a magmatic arc established on oceanic crust. Its activity lasted about 20 million years in the late Cambrian. The arc existed above a subduction zone that consumed 550-520 Ma crust. This suggests subduction of the oceanic crust of the marginal (back-arc) basin developed off the coast of Gondwana. The conducted research allowed to negatively verify two previously postulated hypotheses. The Leszczyniec Unit is not a relic of the lower Palaeozoic oceanic crust in the West Sudetes. Moreover, it is not a product of syn-rift magmatism within the lower continental crust.

The age of metamorphism of the Leszczyniec Unit was determined on two samples of the felsic Paczyn gneisses. The method of *in situ* Rb/Sr dating of single white mica grains using laser ablation was applied. Both samples gave an age of approximately 350 Ma (early Carboniferous), which was interpreted as the age of deformation. The deformation was accompanied by metamorphism of the epidote-amphibolite facies and then of the greenschist facies. The peak metamorphic conditions were determined by thermodynamic modelling to be 8.8–9.9 kbar and 485–530 °C. It was assumed that during the Devonian-early Carboniferous subduction of the Saxo-Thuringian Ocean, the protolith of the Leszczyniec Unit belonged to the upper plate, i.e. to the active margin of the Teplá-Barrandian terrane and was pulled into the subduction zone as a result of tectonic erosion. Consequently, the tectonic suture separating the Saxo-Thuringian and Teplá-Barrandian domains in the eastern cover of the Karkonosze Granite is structurally located below the Leszczyniec Unit.

Compared to the data collected for late Cambrian (meta-) igneous rocks in the Bohemian Massif, the present study proves that late Cambrian magmatism, widespread in the terranes originating from the northern margin of Gondwana, cannot be unquestionably interpreted as the effect of continental rifting without taking into account the tectonic position of the considered units. As shown in the dissertation, Cambrian igneous complexes, currently belonging to the Variscan allochthon, could have been emplaced in a magmatic arc setting associated with the subduction of the crust of marginal basins developed at the northern margin of Gondwana.