Indication of Geological Structures and Tectonics in Geophysical Fields

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The anomalous gravity field of the Earth depicts density changes of subsurface parts of the Earth crust in a relative sensible way. These density changes reflect a petrographical diversity of rock environment and geometry of geological bodies. It is possible to find out indications connected with tectonics in gravity images, along which often occur horizontal and vertical movements.

On examples from a contact zone of the Bohemian Massif and the West Carpathians we present the gravity data processing by means of modern software tools which enable to detect and depict even less expressive or hidden indications too. Outputs of this modern data processing are maps with an outstanding ability to indicate and visualise structure and tectonic patterns of a studied region. These enable quite an easy and relatively objective interpretation which can be executed not only by geophysicists but also by not very experienced other collaborators in geologic or related branches. Modern data processing contributes to specification of the knowledge of the geological structure and in many cases may bring new information for final geological solutions.

Examples of Defining Chronology of Metamorphism in Metabasic Rocks of the Kaczawa Mts. and East Karkonosze Mts.

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The relative age, in other words the order of crystallisation, of minerals and mineral parageneses may be studied in the rocks mainly through microstructures such as zoned grains, inclusions, replacements, alteration as well as relationships of veins. Zoned grains, most commonly of amphiboles have been observed in metabasites of both the Kaczawa Mts. Complex and the East Karkonosze Mts. Complex. Zones from the centre to the margin indicate the order of crystallisation while the composition of the zones, analysed with the electron microprobe, allows to estimate the corresponding metamorphic conditions. This gives a chance of defining stages and/or events in the metamorphic history of the complex.

In medium grained diabases of the Świerzawa Unit in the Kaczawa Mts Complex the following zones, from the centre to the margin, have been noted (Smulikowski 1990); 1) clinopyroxene (salite) - kaersutite - crossite - glaucophane - actinolite, 2) kaersutite - riebeckite - glaucophane - magnesioriebeckite - actinolite (Fig. 1); 3) light brown hornblende - bluish green actinolitic hornblende - actinolite - crossite. The coexisting plagioclase is always albite, usually with epidote inclusions. Clinopyroxene, kaersutite and possibly also light brown hornblende represent original minerals of the igneous protolith. Glaucophane and crossite correspond to the glaucophane schist facies conditions (high P/T metamorphism stage) while actinolite, actinolitic hornblende as well as riebeckite/magnesioriebeckite correspond to greenschist facies. Most probably mineral zones in these composite grains represent various stages of the same metamorphic event (monometamorphism), but not in every zoned grain all the stages have their mineral representation.

In the Rudawy Janowickie (East Karkonosze Mts. Complex) olive high-Ti magnesiohornblende is common in most of the amphibolites of the Leszczyniec Volcanic Formation. No relics of clinopyroxene nor kaersutite are present. Most probably this hornblende originated from primary mafic basaltic minerals, mainly augite, in an early event of regional metamorphism, under conditions of the higher T part of amphibolite facies. Possibly this may be attributed to the ocean floor metamorphism.

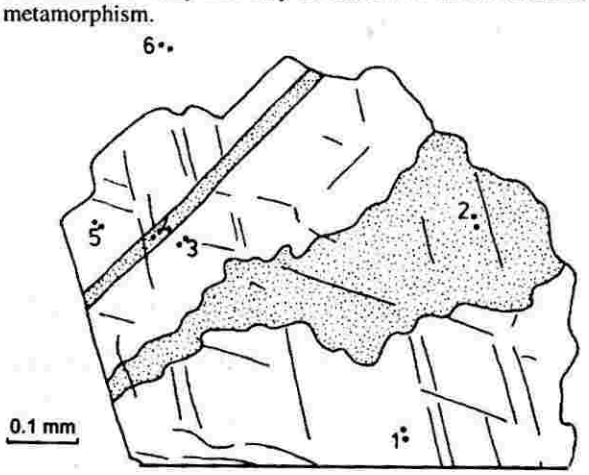

Fig. 1. Microscope image of the composite amphibole grain present in the metadolerite of Świerzawa Unit, N of Wojcieszów, Kaczawa Complex (after Smulikowski 1990). 1 - kaersutite; 2 - riebeckite; 3 - glaucophane; 4 - magnesioriebeckite; 5 - actinolite; 6 - chlorite. Dots represent analysed spots.

As a rule this olive hornblende is surrounded by the blue-green, low-Ti magnesiohornblende or ferrohornblende which