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Grusification of granite (scheme based on the study of granites from Sudety Mts., SW Poland)

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Gruses that are developed on the Karkonosze granite (three outcrops) and the Izera granite (one outcrop) were investigated using optical microscope, scanning electron microscope equipped with EDS and electron microprobe, X-ray diffraction, IR spectrometry, chemical analysis (ICP-AES and ICP-MS), hydrogen and oxygen isotopic ratio determination and K-Ar dating. Three groups of samples were distinguished according to the degree of grusification (group I - compact granite; group II - friable granite; group III – granitic grus).

The results of the examination allowed to present the simplified scheme of the grusification:
1. Development of microcracks (caused by tectonic stress, mechanical upload or magma cooling processes) promote circulation of hydrothermal fluids in granites;
2. The presence of the microcracks in granite facilitate the circulation of low-temperature fluids (low-temperature hydrothermal or weathering fluids). Fluids cause hydration and expansion of primary biotite (vermiculitization), what leads to development of secondary cracks in a rock. Fluids can also induce advanced alteration of plagioclases into clay minerals (mainly smectite or vermiculite). Expansion of biotite during vermiculitization is the most important factor in grusification. Other processes of alteration also contribute to grusification.

Hydrothermal fluids in granite contribute the increase of alteration degree of primary minerals (e.g. sericitization and albitization of feldspar, chloritization or muscovitization of biotite, decomposition of monazite-(Ce) and formation of secondary REE phosphates). If primary biotite is subjected to muscovitization or chloritization, complete grusification of granite does not occur because of lack of vermiculitation.