Biotite polytypes versus occurrence in granite body, Karkonosze, Poland

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Correlation between the polytypic compositions of biotites and their occurrence in the granite body was studied in the eastern part of the Karkonosze granite massif, SW Poland. Polytypic composition was expressed as the per cent ratio of $2M_1$ polytype in the mixture with the 1M (and 3T) polytypes, and was assessed based on powder diffraction patterns. The oblique texture method was used to enhance intensities of the diagnostic reflections: $\bar{1}14$ of $2M_1$ and $\bar{1}12$ of 1M.

The ratio of $2M_1$ decreases in the sequence: schlieren-free parts of granite, schlieren-rich parts, and schlieren themselves. Assuming that schlieren form as biotite segregations against rigid walls of country rocks during ascension of plastic magma, the magma chamber environment favours crystallization of $2M_1$, and the marginal parts of intrusion favour crystallization of 1M.

Biotite crystals occurring as inclusions in central parts of feldspar phenocrysts show a high ratio of $2M_1$ up to 43%. Biotites forming inclusions at the rims of feldspar phenocrysts have similar polytypic compositions as the main pool of biotites in the rock, and are about 25% $2M_1$. Assuming that the onset of crystallization of feldspar phenocrysts took place in the environment of the initial stage of magma crystallization, and that the tiny biotite crystals occurring in the central parts of feldspar phenocrysts preserved their original polytypic composition, this environment would promote the formation of the $2M_1$ polytype. This interpretation is in accordance with results of earlier studies (Wilamowski, 2002).

Biotites from mafic microgranular enclaves (MME) show $2M_1$ ratios of about only 6%, which is the lowest value recorded in the studied pool of samples. The polytypic composition of biotites from MME is either original, or established after incorporation of the enclaves. In the latter case recrystallization of biotites would occur under thermal influence of the granite magma. Indeed, the oval shapes of enclaves suggest their intensive thermal reworking. Also, the feldspar phenocrysts from granite magma often penetrate inside the MME proving the plastic state of the enclaves, which favours recrystallization processes.

Positive correlation of $2M_1$ with Ti content, and negative correlation with octahedral Al, are observed. Correlations between the polytypic compositions of biotites and the oxygen isotope compositions are expected. The oxygen isotope studies are in progress.

This study was supported by the research project of the Ministry of Science and Higher Education no 2 P04D 058 27.

Reference

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Revisiting the oldest rocks in China

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Background

It has been known for over fifteen years that the Anshan region of the North China Craton contains the oldest rocks in China, extending back to 3811 Ma (Liu *et al*., 1992). Although these rocks are some of the most ancient preserved examples of continental crust on Earth, they occupy only a small portion of the craton, cropping out over an area of <20 km^2. We re-examined the Anshan area to determine if (i) the extent of ancient zircons is more widespread than originally defined, (ii) components older than 3.8 Ga are present, and (iii) Hf isotopic data can provide evidence of crustal evolution back to 4 Ga or beyond.

Results

Our results establish that rocks ~3.8 Ga in age are present in three areas close to Anshan City: in the Baijiafen, Dongshan and Shengoushi complexes. A mylonitized trondhjemite in the Baijiafen quarry has a SHRIMP zircon $^{207}Pb/^{206}Pb$ age of 3800±5 Ma, identical to earlier results from the area. Importantly, biotite schist from this quarry records a $^{207}Pb/^{206}Pb$ age of 3723±17 Ma, and is cut by veins of trondhjemite dated at 3620±23 Ma, making this the oldest known supracrustal rock in the North China Craton. Trondhjemite collected adjacent to the site in the Dongshan complex that recorded an age of 3811±4 Ma, yielded younger zircons defining a crystallization age of 3680±19 Ma, indicating the complexity of magmatic relations in this area. A trondhjemite from the Shengoushi complex has a $^{207}Pb/^{206}Pb$ age of 3777±13 Ma, making this the third area in the district recording ages of ~3.8 Ga. The Hf data indicate that some zircons from all three complexes have depleted mantle model ages that extend back to 4.0 Ga. However, no rocks of this age have been identified and the data reveal that it is unlikely that considerably older components are present in the North China Craton.

Reference

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