Magmatic evolution and source of the Proterozic rapakivi granite complex in the North China Craton

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Typical rapakivi granites occur in Proterozoic on the North Hemispheres and are often associated with anorthosite, mangerite and charnockite, constituting anorthosite-mangerite-charnockite-granite (AMCG) suite. The origin and source of this suit are still unsolved problems, particularly on felsic rocks. A similar AMCG suite occurs in the North China Craton. The Shachang rapakivi granite and the Damiao anorthosite complexes are the significant felsic and mafic rocks of this suite. The Shachang complex consists of amphibole-biotite (Am-Bi) rapakivi granites, porphyritic Bi granites, coarse-grained Bi granites, medium- to fine-grained Bi granites and two-mica granites. Six zircon U–Pb ages are obtained for all these rocks including the ovoidal alkali feldspar megacrysts and matrix of the Am-Bi rapakivi granites, showing that the Am-Bi rapakivi granites and porphyritic Bi granites formed at ca. 1700 Ma and the other rocks from ca. 1691 to 1682 Ma. Crystallization pressure for the matrix of Am-Bi rapakivi granites is ca. 4 kbar and temperatures for the complex are mainly 780°C to 660°C.

The Shachang and the Damiao complexes have different geochemical evolutional trends, suggesting distinct sources for them. Zircon Lu-Hf and whole-rock Sm-Nd isotopic compositions of the Shachang complex are homogeneous with $\varepsilon_{Hf}(t)$ and $\varepsilon_{Nd}(t)$ values varying from −9.8 to −3.3 and −6.4 to −3.4, respectively, and they overlap significantly with the evolution of the Archeozoic metamorphic rocks of the Miyun Group in this region. In addition, compositions of the amphibole and biotite from the Shachang complex are of crust affinity. All above lines of evidence suggest crust source for this complex, rather than fractional crystallization from parental magma of the Damiao anorthosite derived from mantle with crustal assimilation. The composition evolution of the Shachang complex implies that the Am-Bi rapakivi granites crystallized during a decompressing process with potassium-rich while the other rocks at a low pressure with silicon-rich. This study is helpful for further understanding the evolution and source of Proterozoic rapakivi granites in AMCG suite.