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Proterozoic, Paleozoic and Mesozoic rapakivi granites in China central orogenic system and their implications

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Rapakivi granites, characterized by rapakivi texture, A-type feature and an anorogenic setting, often occur in the northern hemisphere in Proterozoic. However, more and more Phanerozoic rapakivi granite suites have been identified and some even occur in orogenic belts. Significantly, three stages, Proterozoic, Palaeozoic and Mesozoic rapakivi granites have been identified in the China central orogenic system (CCOS), a major orogen in Asia. It is unusual for one orogenic system with three stages of rapakivi granites.

The Proterozoic rapakivi granites occur in the western segment of the CCOS with SHRIMP zircon U–Pb dating of 1778 ± 17 and 1778 ± 12 Ma. They exhibit typical rapakivi texture and typical A-type granite features. Whole-rock $\epsilon_{Nd}(t)$ values of the granites range from -6.09 to -5.74 , and their zircon $\epsilon_{Hf}(t)$ values are from -8.3 to -5.2 , indicating they were derived from old continental crust. Their ages, rapakivi texture and geochemical features are very close to the typical Proterozoic rapakivi granites within the North China Craton (NCC) suggesting they both have similar sources and implying part of the basement of the western CCOS similar to that of the NCC. This provides new data to solve the dispute on the basement origin in the western segment of the CCOS and it is the first case of Proterozoic rapakivi granites, probably derived from the southern margin of the NCC, involved in a Palaeozoic orogen. They and the rapakivi granites in the NCC are all belong to the group of Proterozoic rapakivi granites of the northern hemisphere.

The Palaeozoic rapakivi granites, typical A-type granite, also occur in western segment of the CCOS. SHRIMP zircon U–Pb age for the granites is 433 ± 5 Ma. Their whole-rock $\epsilon_{Nd}(t)$ values are from -9.2 to -8.7 and zircon $\epsilon_{Hf}(t)$ values from -5.8 to -0.2 . These data suggest that the granites were derived from old continental crust. The A-type granite affinities and absence of deformation, particularly in the context of the (ultra)-high pressure metamorphism and evolution of Palaeozoic granites in this orogen, suggest a post-collisional setting for these rapakivi granites. These rocks are an example of Palaeozoic rapakivi granites emplaced in a post-collisional setting.

The Mesozoic rapakivi (rapakivi-textured) granites are located in the eastern segment of the CCOS. Zircon U–Pb dating for the granites yields 209 ± 2 Ma to 212 ± 2 Ma. The granites are I-A type with rapakivi texture. The whole-rock $\epsilon_{Nd}(t)$ and zircon $\epsilon_{Hf}(t)$ values for the granites vary from -2.3 to -4.4 and $+0.7$ to -7.6 , respectively. These granites were derived from old continental crust with contribution of juvenile component. The possible bimodal magmatism suggested by the coeval granites and lamprophyre dykes, combined with the structural pattern, geochemical features and regional tectonics, indicate a post-collision setting for these rapakivi-textured granites.

