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1.8 Ga Mafic Dykes in North China Craton

Mingguo Zhai, Peng Peng and Tiesheng Li

Key Laboratory of Mineral Resources, Institute of Geology & Geophysics, Chinese Academy of Sciences, Beijing, 100029, China

1.8-1.7 Ga mafic swarms are well developed in the North China Craton (NCC). The dykes commonly trend NNW-SSE and NW-SE. Their lengths are up to 60 km, and the widths vary from 0.5 m to 60 m. The dykes in the western NCC (Shanxi-NW Hebei-Inner-Mongolia) have undergone subgreenschist to greenschist facies metamorphism and occur in rocks metamorphosed to amphibolite grade. Whilst the dykes in the eastern NCC (eastern Hebei and southern Jilin) commonly have suffered upper amphibolite to granulite facies metamorphism, their host rocks have been metamorphosed to granulite facies conditions. The dykes commonly consist of metamorphosed cooling margins containing hornblendes and plagioclase in dykes metamorphosed to high-grade conditions, and fine-grained mineral texture in dykes of low-grade metamorphism. The high-grade dykes can be subdivided into two kinds; one type is composed of two pyroxenes and plagioclase with blastodiabasic texture and the other type is composed of garnet, plagioclase and clinopyroxene with blastodiabasic and blastogabbroic texture. Mineral assemblages and metamorphic mineral reactions show that the high-grade dykes have undergone autometamorphism during their enplacement. Estimated metamorphic P and T conditions using geothermobarometries are 5.8-6.8 kbar and 700-810° C, respectively.

Two samples of the high-grade dykes yielded Sm-Nd metamorphic mineral isochron ages of 1759 ± 27.9 Ma and 1729 ± 55.1 Ma. Microscopic study of several samples from low-grade dykes with fine-grained diabase texture demonstrates that olivine grains are surrounded by coronas of ferrosilite + edenite + plagioclase + apatite, indicating that these dykes had a higher temperature metamorphic stage. Their $t_{DM(Nd)}$ values range from 2100 Ma to 1800 Ma. Li et al. (2000) reported a zircon age of 1769 ± 2.5 Ma for low-grade dyke in Shanxi Province. Therefore, the high-grade and low-grade dykes formed at the same time period. Geochemically, all mafic dykes are of tholeiite series with high Fe and low Mg contents. Their contents of large ion lithosphile elements (LILE), e.g. Ba and Rb, and light rare earth elements (LREE) are higher than those of MORB, exhibiting REE patterns of medium LREE-enrichment. Their $\varepsilon_{Nd}(t)$ values indicate a change of mantle composition, evolving from relative depletion (~+1) at 2100-1950 Ma to enrichment (-4 ~-11) at 1900-1700 Ma. Considering the anorogenic magmatic rock association of anorthosite and rapakivi with 1840-1650 Ma in Hebei Province and Yanshan-Xiong'er rifting of 1850-1650 Ma in the NCC, Zhai et al. (2000) suggested a ~1.8 Ga upwelling mantle plume model, which was possibly related to a breakup event of a possible Pre-Rodinian supercontinent.

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