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Age and composition of metamorphosed basic and felsic rocks in Miaowan (Yangtze): Meso-Neoproterozoic continent-arc collision in South China

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Apart from ultra-mafic rocks, metamorphosed mafic rocks (amphibilites with/without garnet), felsic rocks (banded migmatite) were also found in Miaowan Ophiolite Suite (MOS) in the Yangtze Craton.
Amphibolites without garnet include the massive and gneissic structures. Both are granoblastic texture. The former (named as massive amphibolites) are mainly composed of hornblende (50-55 %), plagioclase (40-45%) with minor zircons and quartz. They exhibit LREE-enriched REE patterns (La/Ybcn = 2.35-3.07) and display negative Nb (1.61-2.89 ppm) and Zr anomalies (28.8-37.6 ppm), suggesting they are ortho-amphibolites derived from ocean island basalts. The later (named as gneissic amphibolites) are mainly made up of amphibole (∼30%), plagioclase (∼30%) and quartz (∼40%). They are characterized by plat pattern with obvious positive abnormal in Eu (Eu/Eu = 1.32), Ba (62.0 ppm) and Sr (567 ppm), slight negative abnormal in Nb (1.52 ppm), Th (0.23 ppm) and Zr (25.6 ppm), similar to metamorphosed sediments in literature.
Garnet-amphibolites have porphyroblast texture and helicitic texture and are made up with garnet (∼5%), hornblende (∼70%), plagioclase (∼15%) and quartz (∼10%),with minor sphene and zircons. They do not show Eu anomalies (Eu/Eu =1.0) while displaying slight positive in U (0.33 ppm), Sr (269 ppm) and Sm (4.01 ppm), and significant negative abnormal in Th (0.58 ppm).
Banded migmatite are composed of black stripes dominated by hornblende and light-colored stripes dominated by quartz and calcite. They present significant positive abnormal in Ba (564-1122 ppm), slight positive abnormal in U (0.50-0.73 ppm), Nd (16.3-21.6 ppm), Sm (4.22-5.24 ppm) and negative abnormal in Th (1.87-3.18 ppm), Nb (7.64-9.62 ppm), Sr (219-266 ppm). REE distribution patterns of banded migmatite and garnet-amphibolites are enveloped by REE patterns of Miaowan basalts and Kongling TTG rocks, suggests they derived from both basalts and felsic rocks.
Zircons from amphibolites without garnet provided the formation age as 1003 Ma and latest metamorphic event as 970 Ma, while ages ranging 1139-1030 Ma interpreted as the xenocryst. Banded migmatite and garnet-amphibolite have different source, classified as Archean relic from local Kongling Complex, Paleoproterozoic relic from Shenongjia Arc and Meso-Neoproterozoic syn-tectonic sediments.
The garnet-amphibolite experienced epidote amphibolite facies prograde metamorphism (M1) recorded by garnet inclusions with P-T condition of 0.2-0.5 GPa and 480-520 [U+2103]; The peak metamorphism (M2) recorded by hornblende and plagioclase in the matrix with P-T condition of 0.96 GPa and 662 [U+2103]; The retrograde metamorphism (M3), recorded by the “white eyelet” and the retrograded matrix with P-T condition of 0.78 GPa and 648 [U+2103]. It recorded clockwise P-T path involving nearly isothermal decompression (ITD) after peak metamorphism, which is matched with the re-homogenized major elements character shown from garnet EDS mapping.
Based on our new data, we give a better understanding of the cratonic evolution during Meso-Neoproterozoic: the continent-arc collisional event between Yangtze craton and Shennongjia Arc began at ∼970 Ma.
Key words: Yangtze Craton; Kongling Complex; Meso-Neoproterozoic; Miaowan ophiolite suite; Metamorphosed basic and felsic rocks