Microgranular enclaves in the Late Mesozoic Tonglu granitoid pluton, SE China: Implications for magma mixing and assimilation

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Mafic microgranular enclaves (MMEs) are ubiquitous in granitoids. Although the origin of MMEs have been a matter of debate, exact studies of them can well constrain the detailed processes of magma formation and evoluiton.

MMEs and their host granitoids from Tonglu, SE China formed coevally at ~130 Ma. Similar trace element and Sr-Nd compositions imply that geochemical equilibration between MMEs (I_{Sr} = 0.7083; $\varepsilon_{Nd}(t)$ = -4.7) and granitoids (I_{Sr} = 0.7085; $\varepsilon_{Nd}(t)$ = -5.4) may have been obtained. However, the mineral-scale variations of isotope and element compositions of plagioclase record magma mixing and assimilation.

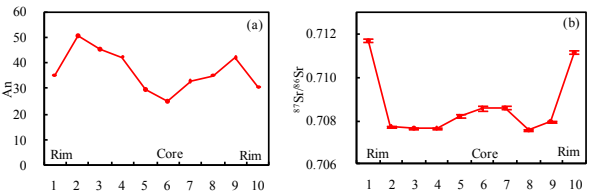

Fig.1 Variations of An values and Sr isotopic compositions of one plagioclase

Plagioclase is featured by reverse zonation in An value. The albitic cores suggest an origin from felsic magmas. Increasing An from the core to the mantle implies mixing with mafic magmas (Fig.1a). In situ Sr analyses of reversely zoned plagioclase show that albitic cores have more radiogenic Sr isotopic ratios (up to 0.7086) than the An-rich mantle (low to 0.7075), and the An-poor rims have the highest $^{87}Sr/^{86}Sr$ ratio (0.7117) (Fig.1b). These variations indicate that plagioclase crystallization initiate in a relative high radiogenic Sr felsic magma, which was mixed subsequently with a low radiogenic Sr mafic magma, and finally assimilated by ancient crustal material with high $^{87}Sr/^{86}Sr$ ratio. The occurrence of felsic microgranular enclaves with evolved Sr - Nd isotopic compositons (I_{Sr} = 0.7129; $\varepsilon_{Nd}(t)$ = -10.2) agrees well with assimilation of ancient continent crustal material.

In conclusion, it was acknowledged that the in-situ analytical techniques provide effective ways to reveal the detailed magmatic processes.