1 Introduction

Granites are one of the most common rocks in the continental crust. Although they consist predominantly of quartz and feldspar, with little or no mafic minerals, their formation and evolution have been long debated. The early Yanshanian granites, in South China occurred over a wide region of ~1000 km long and ~600 km wide, with a total exposed area exceeding 64000 km² (Sun et al., 2006; Zhou et al., 2006; Li et al., 2009). Some early Yanshanian granites are associated closely with economically significant rare-metal deposits (W, Sn, Nb, Ta) (Zhao et al., 2002; Hua et al., 2003; Tao et al., 2013). The genesis of these granites, particularly the relationship between crystal fractionation and ore formation in the evolution of granitic magmas, have been attracting great attention. We carried out in this study chronological, geochemical, and zircon Hf isotopic investigations on the early Yanshanian Xitian granite complex in the Hunan Province, South China.

2 Analysis Results and Discussion

2.1 Zircon U-Pb dating

In situ zircon U–Pb data have been determined for mafic microgranular enclaves (MME) and host granitoids from the Xitian granite complex in order to constrain the sources and petrogenesis of granites. The zircon U–Pb age of the enclaves (150.5±1.1 Ma) is identical to that of the host granites (151.3±1.8 Ma), establishing that the mafic and felsic magmas were coeval (Fig.1). Their synchronous zircon U-Pb age with the host granite excludes the possibility of restite from the melted metamorphic rocks at greater depth and xenolith from the country rocks at shallower depth.

2.2 Geochemistry

The early Yanshanian Xitian granites and their enclaves are compositionally characterized by high SiO₂ (72.2%-77.9%), K₂O (3.9%-5.6%), and low P₂O₅ (0.02%-0.2%). These samples also have A/CNK values of 1.0-1.1, and are enriched in Rb, Th, and U, and depleted in Ba, Nb, Ta, Sr, P, Ti, and Eu. These geochemical features suggest that the early Yanshanian Xitian granites and their enclaves are metaluminous to slightly peraluminous and are of highly fractionated I-type granite. Zircon saturation temperature analysis suggests that the temperature of the hybrid magma parental to the Xitian granitoids and their enclaves (735-834°C) is identical to the highly fractionated I-type Fogang
The high-precision U-Pb zircon age of Xitian early Yanshanian granites and their enclaves is ca. 150 Ma, similar to the ages of many other small stocks hosting the most widely distributed W and Sn mineralization.

Detail geochemical and zircon Hf isotopic investigations suggest that the Xitian early Yanshanian granites are fractionated I-type. The involvement of coeval mantle-derived materials in generation of the early Yanshanian granites in Xitian implies that they provide not only rock-forming materials but also heat sources.

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References


3 Conclusions

Fig.2. Histogram of $\varepsilon_{Hf}(t)$ and $T_{DM}$

granite in South China (728-840°C) involving mantle-derived material in its generation(Li et al.,2009). Zircon Hf isotopic data(Fig.2) together with zircon saturation temperature of bulk-rocks suggest that mantle-derived materials must have played an important role in the generation of the early Yanshanian Xitian pluton.