Rb-Sr and U-Pb Dating of the Daguzhai and Luobuli Granitic Massifs in South China

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Abstract

Rb-Sr and U-Pb isotopic studies of the two contrasting granite types of the Daguzhai and Luobuli massifs in South China provide new constraints on the interpretation of isotopic age data for plutonic igneous rocks. A Rb-Sr internal isochron age of 146±7 Ma for the Luobuli adamellite is interpreted to represent the age of magma crystallization, whereas the whole-rock Rb-Sr isochron yields an older apparent age of 161±10 Ma which is regarded as resulting from contamination processes affecting the petrogenesis of this adamellite. In the Daguzhai granite the marked scatter of whole-rock Rb-Sr data in isochron diagram is ascribed to the open system behavior of Rb during postmagmatic autometasomatism. Uniformity of initial $\frac{^{87}Sr}{^{86}Sr}$ ratio in this granite is indicated in a plot of $\frac{^{87}Sr}{^{86}Sr}$ versus $\frac{^{86}Sr}{^{86}Sr}$. The autometasomatism has also affected zircon U-Pb system, resulting in a spread of data along the concordia curve between 165 and 125 Ma. This spread is regarded as indicating the duration of the autometasomatism.

Introduction

The advent of radiometric geochronology enables researchers to date a geological body such as plutons with sufficient accuracy. Rb-Sr, U-Pb and K-Ar methods have been routine dating tools for this purpose. In the case of the dating of plutonic events, disturbance of radiometric ages by thermal events subsequent to emplacement is often reported and uncertainties in the determination of the radiometric ages are yielded accordingly. Usually, three major uncertainties can be taken into account (e.g., Gale, 1982):

1. The time of closure of the relevant radiometric clock relative to the time of emplacement of a plutonic rock, which involves the closure temperatures of the minerals involved and, for example, the cooling rate of a pluton after emplacement.

2. The accuracy of the determination of the apparent radiometric age, which depends on the selection of fresh and appropriately representative rock samples, on attention to detail in achieving high-purity separates for any mineral separations which may be performed, on careful analyses of controlled accuracy and on proper statistical combination of the individual errors in assessing the overall error of the quoted radiometric age.

3. The question of possible partial or complete resetting of the radiometric system due to heating events subsequent to emplacement of the pluton.

The third uncertainty can easily cause the "geological error" defined by Brooks et al. (1972). In the case of autometasomatism, radioactive parent-daughter sys-
tern can be disturbed regularly or irregularly (e.g., Persson et al., 1987; Gerstenberger, 1989). Additionally, the validity of a radiometric age may be complicated by plutonic processes such as protracted fractionation (McCarthy and Cawthorn, 1980) or contamination (Hall, 1987; Zheng, 1989).

Problems arising from complicated petrogenetic histories have been encountered in dating the Daguzhai and Luobuli granitic massifs in South China. These two massifs have been investigated to possess the contrasting features like those in the case of S-type and I-type granitoids. Their petrography, geochemistry and isotopic geology have been described in comprehensive publication by Zhang (1984), Zheng et al. (1986) and Shen et al. (1988). Here we present the results of Rb-Sr and U-Pb dating and attempt to put some constraints on the implications for granitic dating.

**Geological Setting**

The Daguzhai and Luobuli massifs are located in the Taoshan composite granitic batholith. The batholith occurs within a 1100 km² area in Jiangxi Province, China (Fig. 1). It is intrusive into Sinian-Cambrian metasedimentary rock systems but partly covered by Cretaceous-Tertiary red beds (Fig. 2). Tectonically the batholith is situated at the northwestern margin of the Paleo-South China —— Southeast Asian Plate (or the northwestern part of the South China accretionary fold belt after Zhang et al., 1984).

Two distinct petrogenetic series can be distinguished in the Taoshan granitic batholith. According to Zheng (1987) Series I (S-type) contains major complexes which can be assigned to three petrographic associations: a gneissic granite, a