

Constraint for crustal uplifting in the orogenic belt using single-grain mineral Rb-Sr isochron of magmatic rocks

DONGYANG HUO, NAIZHEN ZHANG, WEIYONG LI, JUN HE AND FUKUN CHEN

School of Earth and Space Sciences, University of Science and Technology of China

Rapid uplifting and cooling of the shallow crust is closely related to deep tectonic processes, such as detachment of subducted slab and extension of the lithosphere. In this study, we focus on the Triassic Jiazishan pluton in the Sulu orogenic belt, eastern China, to reveal crustal evolution in the orogen, by means of zircon U-Pb isotopic and single-grain mica Rb-Sr isochron dating. The Jiazishan syenite pluton is characterized by enrichment of light rare earth elements, large ion lithophile elements and depletion of high field strength elements. Rock samples have initial ϵ_{Nd} values ranging from -17.5 to -13.8 and initial $^{87}\text{Sr}/^{86}\text{Sr}$ values from 0.7064 to 0.7074. Magmas of this pluton is speculated to be derived from partial melting of an enriched mantle. Zircon U-Pb isotopic dating yields formation ages of ~ 213 Ma, while single-grain biotite Rb-Sr isochron give ages of ~ 205 Ma. Magma temperatures can be constrained at about 750°C via average zirconium saturation temperature. On the basis of the closure temperatures of biotite Rb-Sr isotopic system ($350\text{--}400^\circ\text{C}$), the cooling rate of the pluton in an early stage can be placed at approximately $50^\circ\text{C}/\text{Ma}$. The calculation results of Al-in-hornblende barometer suggest that the pluton experienced a cooling process with moderate variations in pressure or crustal depth and therefore, the uplifting of the pluton is estimated at ~ 1.35 km within 8 Myr (an uplift rate of 0.17 mm/yr). This rapid uplifting might be associated with the detachment of the subducted slab and the crustal extensional process in early Mesozoic. Moreover, the biotite rubidium-strontium isotopic system do not record chronological information related to the Late Mesozoic lithospheric thinning in the eastern North China, implying that by this time the tectonic units of the Sulu orogenic belt must have been exhumed to a shallow-crustal level.