Pulsed lithospheric extension? A case study of the Suzhou A-type granite in eastern China

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Because petrologic experiments of decompression partial melting can satisfactorily reproduce the fingerprint compositions, the occurrence of A-type granites is thus one kind of surface responses to lithospheric extension. It is intriguing how extensional magmatism took place and whether A-type granites are derived from anatexis of lower continental crust when lithosphere was thinned. In order to constrain these issues, a combined study of zircon U-Pb age and O isotope, whole-rock Nd-Sr and feldspar Pb isotopes was carried out for the Suzhou A-type granite in eastern China. The results provide insight into the relationship between the generation mechanism of A-type granites and the lithospheric extensional collapse.

Three stages of magmatism were recognized for the Suzhou pluton in terms of field, petrographic and trace element studies. On the basis of CL imaging and $\delta^{18}O$ analysis, two samples of euhedral zircon from different generations of granite were screened for U-Pb dating by SHRIMP technique. Concordant ages of 136±4 and 126±2 Ma were obtained, respectively, for the early and main stages of granite. These ages are not statistically overlapped with each other within analytical errors, clearly indicating two episodes of A-type granitic magmatism and thus two pulses of lithospheric extension. No inherited core was observed and high-T oxygen isotope fractionations are well preserved for the dated zircons, thus these ages represent timining of magma crystallization.

Available O-Nd-Sr-Pb isotopic data demonstrate that the Suzhou pluton is mainly derived from the preexisting old lower continental crust. In contrast to the internally heated settings for thickened orogens, an external energy source is implicitly required to trigger A-type magmatism in thinning settings. Geodynamically, excess heat could be supplied through either abnormal mantle convection accompanying slab rollback in the course of plate subduction, or mantle upwelling during plume activitiy. In either case, a time interval of about 5 to 10 Ma for the pulsed lithospheric extension was evidenced by the Suzhou A-type granite during late Mesozoic in eastern China. And the present study points to a coeval relationship between the lithospheric extension and the anatexis of lower continental crust.