^{207}Pb-^{208}Pb decoupling of alkali feldspar from a late Mesozoic A-type granite in eastern China: Implications for magma dynamics

C.-S. WEI, Y.-F. ZHENG AND Z.-F. ZHAO

School of Earth and Space Sciences, University of Science and Technology of China, Hefei 230026, China (wchs@ustc.edu.cn)

During our ongoing isotopic study of late Mesozoic A-type granites in eastern China, an unexpected ^{207}Pb excess is found for alkali feldspar but not for zircon separated from Laoshan A-type granite. A concordant age of 120.2±1.7 Ma is in situ dated by SHRIMP II technique, but TIMS analysis yields a decoupling between ^{207}Pb/^{204}Pb and ^{208}Pb/^{204}Pb ratios for alkali feldspar. The distribution pattern of these two Pb isotopic ratios fails to be concurrently accounted for either with single-, two-stage Pb evolution or plumbotectonic model.

Given the petrogenetic connection with the lower crustal source for the generation of Laoshan A-type granite, an evident ^{207}Pb excess (Δ207 = 18 to 24%) was accordingly calculated if the lower crust of plumbotectonic model was taken as the reference. In order to reasonably account for the observed ^{207}Pb excess, an initial disequilibrium of excessive ^{231}Pa is envisaged as a favorite interpretation. Since A-type granitic magma is exclusively water undersaturated, the fossil ^{231}Pa excess is attributed to the low degree dynamic melting of old lower crust dehydrated under conditions of granulite facies.

As D_{Pa} value of zircon/melt is at least three orders of magnitude greater than that of alkali feldspar/melt pair (empirical estimations are from 204 to 312 vs. 0.13, respectively), Pa should thermodynamically prefer zircon rather than alkali feldspar under the similar physicochemical conditions. A reversal sequence of magma crystallization is thus proposed to reconcile the apparent paradox of fossil ^{231}Pa excess. Taking into account the limited half-life of ^{231}Pa ($t_{1/2}$ = 32760 yrs), only if zircon did not start to crystallize until 160 ka (≈ 5×$t_{1/2}$ of ^{231}Pa) later, then the signal of initial disequilibrium of fossil ^{231}Pa excess should be substantially diluted or totally decay away. Thus, the occurrence of fossil ^{231}Pa excess from alkali feldspar rather than zircon compellingly constrains that lifetime of Laoshan A-type granitic magmatism is at least not shorter than 160 ka.

A-type granites: >25 years later

JOSEPH B. WHALEN

Geolgocial Survey of Canada, 601 Booth Street, Ottawa, ON K1A 0E8. Canada (jwhalen@NRCan.gc.ca)

Since being defined in 1979 by Loiselle and Wones, A-type (alkaline, anhydrous, anorogenic ect.) granites have proven controversial. In this period, major progress has been made in their geochemical and isotopic characterization and, based on experimental studies, in constraining their magmatic P-T and fO_2 conditions. For example, commonly juvenile Nd-O isotopic signatures support a direct, or relatively rapid indirect link to mantle sources. However, in spite of this progress, it remains true that A- is also for 'ambiguous', likely because these magmas can be generated in various tectonic settings, from diverse protoliths through a number of processes, such that no universally applicable model is possible. Controversial aspects include: (1) use of elemental discrimination diagrams for their identification; (2) their tectonic significance (is 'A' for anorogenic?) and temporal relationship to 'post-collisional' magmatism; (3) petrogenetic models (protolith- versus process-based models and crustal- versus mantle-derivation): (4) importance of tectonic models involving delamination (e.g., slab breakoff) and (5) massive sulphide-related A-type rhyolitic volcanism. A particularly promising subject meriting further research is temporal differences between Archean, 1.8-1 Ga and <1 Ga A-type suites and implications for Earth evolution.

References

Loiselle, M.C. and Wones, D.R., (1979), Geol Soc Am Abst Prog **11**: 468