Pb isotopic variability in leached and non-leached magnetic fractions of plagioclase from the Laramie anorthosite complex, Wyoming

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The trace element (HR-ICP-MS) and Pb isotopic compositions (MC-ICP-MS) of leached and non-leached feldspar fractions and whole rocks from four different rocks (anorthosite, leucogabbro, troctolite, monzosyenite) from the 1.43 Ga Laramie anorthosite complex (Wyoming) were determined. Significant trace element differences occur between different magnetic plagioclase fractions from the leucogabbro and troctolite. The more magnetic fractions have lower concentrations of trace elements, higher abundances of inclusions and Fe-Ti oxide lamellae, and represent the cores of plagioclase crystals. The least magnetic fractions, which contain higher concentrations of trace elements, lack inclusions and Fe-Ti oxide lamellae, are from the rims. The non-leached plagioclase fractions have Pb isotopic ratios ($^{206}Pb/^{204}Pb$ = 16.840-18.177, 17.090-17.768, and 16.971-17.291) that span a greater range of values than the Pb isotopic values of their corresponding whole rocks ($^{206}Pb/^{204}Pb$ = 17.255-17.666). The isotopic variation amongst the non-leached fractions is a result of higher U concentrations in the rims of the crystals producing higher radiogenic Pb contents through closed system radioactive decay during the 1.43 billion years since crystallization. In contrast, Pb isotopic ratios of leached plagioclase fractions from individual samples ($^{206}Pb/^{204}Pb$ = 16.665-16.713, 16.831-16.864, and 16.794-16.824) are almost within error and significantly different from the widely varying Pb isotopic ratios of the non-leached fractions. These results have important implications for studies where the Pb isotopic compositions of plagioclase are determined *in situ* by laser ablation MC-ICP-MS or SIMS. They also underscore the importance of leaching plagioclase before using the Pb isotopic composition of plagioclase as a proxy for the Pb isotopic composition of the magma from which the plagioclase crystallized.

Zircon Hf isotope evidence for the existence of Early Archean crust in the Yangtze craton of China

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The presence or absence of Early Archean crust in different continents provides an important basis for a comparison of their growth histories. Zircons Hf isotopes are a powerful tool for this purpose because the zircon Lu-Hf isotope system is much more resistant to hydrothermal alteration or metamorphism than other isotope systems such as Rb-Sr, U-Pb and Sm-Nd. Since the finding of ca. 3.8 Ga detrital zircon in the North China craton by means of SHRIMP U-Pb dating (Liu et al., 1992), it has been intriguing whether the Yangtze craton, one of the two major blocks constituting the basement of China continent, also contain the crustal reflict of Early Archean. It is generally accepted that the basement of the Yangtze craton mainly formed in the Paleoproterozoic, only with minor Archean rocks of ≤3.3 Ga (Chen and Jahn, 1998; Qiu et al., 2000). A combined study of zircon U-Pb dating and Hf isotope analyses for the Kongling migmatite from this craton reveals the existence of >3.5Ga rocks. An age of 2916±31 Ma is directly acquired by SHRIMP U-Pb dating. Calculated $\varepsilon_{Hf}(t)$ values show a bimodal distribution of −7.1±0.6 and −3.5±0.6, corresponding to a bimodal distribution of two-stage Hf model ages at 3.75±0.04 Ga and 3.52±0.03 Ga, respectively. These imply that their source materials can be divided into two groups, which were episodically extracted from the depleted mantle at about 3.5 Ga and 3.7 Ga, respectively, and remelted at about 2.9 Ga. This provides the first evidence for the existence of Early Archean (>3.5Ga) rocks in the Yangtze craton. Thus the early evolution history of the Yangtze craton may resemble the North China craton that has the crustal reflict as old as 3.8 Ga. These Early Archean rocks resided in the crust of the Yangtze craton for at least several hundreds of million of years before remelting, probably leaving some clues to be traced and verified.

References

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