The progress of the CHIME monazite dating on JXA-8530F FE-EPMA equipped with R = 100 mm spectrometers

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The CHIME (Chemical Th-U-total Pb isochron method, Suzuki and Adachi, 1991) dating has been performed on JEOL JXA-8530F FE-EPMA introduced in Tono Geoscience Center of Japan Atomic Energy Agency. The age spectrum of detrital monazite grains is a useful measure for the provenance analyses of clastic sediments. The CHIME is best suited for dating of detrital monazite where grains are not chronologically uniform and many analyses are required to characterize a population. Analyses of Pb on conventional R = 140 or 160 mm spectrometers have disadvantage in count rate. The R = 100 mm spectrometer is desirable for quantitative determination of trace Pb, giving an intrinsic response 3 to 5 times higher than that of the R = 140 mm spectrometer. JXA-8530F equipped with three R = 100 and two R = 140 mm spectrometers significantly shortens an analyzing time. Spectral interferences peculiar to R = 100 mm spectrometers are found to be collected through the method of Amli and Griffin (1978) on the monazite analyses (Th, U, Pb, Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Er, P, Si, Ca, S, K, Na, Al and Mg). This interference correction and the pulse height discrimination (PHA) improve the spectral resolution of R = 100 mm spectrometer, which is comparable to that of conventional R = 140 mm spectrometer.

The CHIME monazite age for the Cooma granodiorite was determined to check the reliability of the data provided by this advanced procedure. The Cooma granodiorite is a 3 km ×6 km pluton at the core of an N-S trending Cooma metamorphic complex in the Lachlan Fold Belt, New Sowth Wales, southeastern Australia (Vernon et al., 2001). The procedure carried out 434 ±26 Ma for monazite from Cooma granodiorite, which was previously dated by SHRIMP as 432.8 Ma (Williams, 2001). The CHIME dating is applicable to monazite as young as ca. 60 Ma (Suzuki and Adachi, 1998). The Kojaku granite is exposed in the Tsuruga Peninsula and the northern side of the Lake Biwa, central Japan. The CHIME monazite age of the Kojaku granite is 68 ±8 Ma that accords well with the LA-ICP-MS U-Pb zircon age of 68.5 Ma (Sueoka et al., 2016, in press). Both of CHIME monazite age and U-Pb zircon age represent the formation age of rock body, because their closure temperatures are sufficiently high to record the formation of rock body, suggesting agreements of these ages guarantee accuracy of the monazite dating system. The age values in this study correspond to the values of the previous researches within the error range, thus the improved CHIME monazite dating using the JXA-8530F FE-EPMA has been established.

In our presentation we also show the CHIME age of the Steenkampskraal monazite, which was dated by SHRIMP as 1033 Ma (Knoper et al., 2000; Hokada and Motoyoshi, 2006). In addition, a quick heavy mineral identification method, which has been established as well, is introduced. In this method heavy minerals are identified based on their elemental compositions quantitatively analyzed by the FE-EPMA in contrast to the general conventional method depending on microscopic observations. The method is developed to enable the identification of several-hundred grains of heavy minerals in short time as possible, and by using this method the monazite grains for CHIME dating can be found quickly.

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Keywords: CHIME dating, EPMA, monazite

