U-series dating report

Institute of Geology CAS

Samples quantity: 2

Material: calcite powder

Method description:

Chemical procedure of uranium and thorium separation

After thermal decomposition of organic matter a ^{233}U-^{236}U-^{229}Th spike is added to samples before any further chemical treatment. Sample is dissolved in nitric acid. Uranium and thorium is separated from carbonate matrix using chromatographic method with TRU-resin Chemical procedure has been done in U-series Laboratory of Institute of Geological Sciences, Polish Academy of Sciences (Warsaw, Poland). Internal standard sample and blank sample were prepared simultaneously any series of studied samples.

Measurement

Isotopic composition of U and Th measurement has been performed in Institute of Geology of the CAS, v. v. i. (Prague, Czech Republic). Measurements were performed with a double-focusing sector-field ICP mass analyzer (Element 2, Thermo Finngan MAT). The instrument was operated at a low mass resolution ($m/\Delta m \geq 300$). Measurement results were corrected for counting background and chemical blank.

Results:

Lab. no.	Sample	U cont. [ppm]	$^{234}U/^{238}U$ AR	$^{230}Th/^{234}U$ AR	$^{230}Th/^{232}Th$ AR	Age [ka]	*Corrected age [ka]	**Initial $^{234}U/^{238}U$ AR
1518	US 001	0.0277±0.0001	1.2743±0.0053	0.2581±0.0053	1.823±0.037	32.38±0.76	**19±1**	1.289±0.068
1519	S008 (a)	0.0458±0.0002	1.2334±0.0049	0.2308±0.0050	1.696±0.037	28.54±0.71	**15±1**	1.243±0.083

Calculations use the decay constant of Jaffey et al., 1971 (^{238}U), Cheng et al., 2013 (^{234}U and ^{230}Th) and Holden, 1990 (^{232}Th). Ages do not include uncertainties associated with decay constants.
AR – activity ratio;
* Corrected ages using typical silicate activity ratio $^{230}Th/^{232}Th = 0.83 \pm 0.42$ derived from the $^{232}Th/^{238}U$ activity ratio = 1.21 ± 0.6, $^{230}Th/^{238}U$ activity ratio = 1.0 ± 0.1, and $^{234}U/^{238}U$ activity ratio = 1.0 ± 0.1 (e.g., Cruz et al., 2005).
** Calculated based on $^{234}U/^{238}U$ AR corrected for detrital contamination and corrected age.

Cheng H, Edwards RL, Shen C-C, Polyak VJ, Asmerom Y, Woodhead J, Hellstrom J, Wang Y, Kong X, Sp C, Wang X, Alexander EC. 2013. Improvements in 230Th dating, 230Th and 234U half-live values, and U-Th isotopic measurements by multi-collector inductively coupled plasma mass spectrometry. Earth and Planetary Science Letters 371-372: 82-91.

Cruz Jr., F., W., Burns, S.J., Karmann, I., Sharp, W.D., Vulle, M., Cardaso, A.O., Ferrari, J.A., Dias, P.L.S., Vlana Jr., O., 2005. Insolation-driven changes in atmospheric circulation over the past 116,000 years in subtropical Brazil. Nature 434, 63–65.

Holden, N.E., 1990. Total half-lives for selected nuclides. Pure and Applied Chemistry, 62: 941-958.

Jaffey, A.H., Flynn, K.F., Glendenin, L.E., Bentley, W.C., Essling, A.M., 1971. Precision measurement of half-lives and specific activities of U-235 and U-238. Physical Review C 4: 1889-1905.