U–Pb isotope systematics of eucrites: A record of the thermal history

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Eucrites represent basaltic crust that underwent a complex thermal history involving magmatism, metamorphism and metasomatism, probably on Vesta. To set chronological constraints on these thermal events, we have conducted U–Pb dating for pyroxene as well as plagioclase of four eucrites: Agoult, an unbrecciated granulitic eucrite [1]; Camel Donga, a brecciated eucrite [2]; DAG 380, a weakly shocked eucrite; NWA 049, a metasomatized eucrite [3]. We are still in the process of analysis for plagioclase of Camel Donga, DAG 380 and NWA 049.

The model $^{207}Pb/^{206}Pb$ ages of the analyzed fractions range from 4532 to 4435 Ma, in general agreement with the results of previous eucrite U–Pb dating [4,5]. The oldest model ages were obtained from pyroxene fractions of Agoult and DAG 380 and plagioclase fractions of Agoult. The Agoult plagioclase fractions yielded a consistent isochron $^{207}Pb/^{206}Pb$ age of 4532.4 ± 0.9 Ma, while pyroxene fractions of all studied eucrites do not define precise isochrons. The isochron and model $^{207}Pb/^{206}Pb$ ages are distinctly younger than a $^{207}Pb/^{206}Pb$ age of 4554.5 ± 2.0 Ma for Agoult zircon which was interpreted as the timing of prolonged high-T metamorphism [6]. Considering that Agoult underwent an rapid heating event subsequent to high-T metamorphism [1], we intepret the placioclase and pyroxene ages as reflecting that rapid heating event. Notably, an identical $^{207}Pb/^{206}Pb$ age of 4531 ± 10 Ma was reported for Camel Donga zircon [7], whereas Camel Donga pyroxene and plagioclase yielded model $^{207}Pb/^{206}Pb$ ages of ca. 4510 Ma. This implies that the 4532 Ma heating event caused zircon U–Pb age resetting only in brecciated eucrites and that a thermal event at ca. 4511 Ma further led to Pb isotope disturbance in their pyroxene and plagioclase. The youngest model ages of ~4435 Ma were obtained from pyroxene fractions of NWA 049. Since this meteorite exhibits evidence of metasomatism [3], the ages would appoximate the timing of fluid-rock interactions on Vesta.

[1] Yamaguchi et al. (2009) *GCA* **73**, 7162. [2] Palme et al. (1988) *Meteoritics* **23**, 49. [3] Barrat et al. (2011) *GCA* **75**, 3839. [4] Manhes et al. (1984) *GCA* **48**, 2247. [5] Tera et al. (1997) *GCA* **61**, 1713. [6] Iizuka et al. (2015) *EPSL* **409**, 182. [7] Zhou et al. (2013) *GCA* **110**, 152.