THE AR/AR CHRONOLOGY AND HALOGEN CONTENT OF THE NOVATO BRECCIATED L6 CHONDRITE

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Introduction: The moderately shocked (S4) brecciated L6 chondrite Novato, CA, fell on Oct. 17th 2012 [1]. The fall was initially observed by the CAMS (Cameras for Allsky Meteor Surveillance) camera network. Subsequently six fragments of totaling ~300 g were discovered [1]. Hence, Novato is among the limited number of events, where a meteorite fall, its trajectory and classification can be linked [1]. This is important to determine the pre-atmospheric orbit, identify possible parent body asteroids and assess the ejection history and, more generally, dynamic evolution of the asteroid belt and its asteroid families [e.g., 2]. To this aim, the transfer time in space is important as the parent body chronology timing potential impacts and metamorphism [1, 3-4]. Here we report our study of the Ar/Ar systematics in Novato mineral separates and Novato's halogen inventory.

Experimental: Very small (0.01-0.05 mg) pyroxene and feldspar separates each from both the dark and light lithologies of fragment N01 were neutron-irradiated in July 2013 and analyzed with Manchester's new Argus VI mass spectrometer by laser step-heating extraction.

Results and discussion: All samples analyzed give evidence for multiple impact events within the last 1 Ga. Both feldspar samples (dark and light lithology) give ages of ~800-900 Ma, which might date the time of parent body break-up, consistent with a comparable age (880 Ma) of the L5 chondrite Cat Mountain [5]. Systematic differences between the dark, troilite-rich and light lithologies could not be found, in agreement with the trapped noble gas record [1,3]. There is no Ar/Ar evidence for an event around 470 Ma, as suggested by the U-He system of Novato [1,4], and found for a large number of shocked L chondrites [6]. Pyroxenes from the dark and light lithologies gave ages of ~670 Ma and ~370 Ma, respectively. Novato may not originate from the L chondrite parent body that broke-up at 470 Ma and was linked to the Gefion asteroidal family [7]. The halogen content of 4-11 ppm, 6.0 ppb, and 0.3-1.8 ppb for Cl, Br and I, respectively, is at the low end of the already low concentrations observed for type 6 ordinary chondrites [e.g., 8 and references therein]. Those low halogen abundances are generally the natural result of the thermal metamorphism experienced on the L chondrite parent body. The fact that Novato is an observed fall and fragment N01 was recovered immediately before any rain fall within five days [1] also means that there was no potential for significant halogen loss/gain through terrestrial weathering.

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