NOBLE GAS (HE, NE, AR) ANALYSIS OF A VERY ORDINARY METEORITE THAT FELL ON OCTOBER 17TH, 2012 NEAR NOVATO, CA, USA.

M. M. M. Meier[1], P. Jenniskens[2], H. Busemann[3], R. Wieler[4]. [1]Lund Univ., Dept. Geology, SE-22362 Lund, Sweden. E-mail: matthias.meier@geol.lu.se. [2]SETI Institute, Carl Sagan Center, Mountain View, CA, USA. [3]SEAES Univ. Manchester, UK. [4]ETH Zurich, Dept. Earth Sci., Switzerland.

Introduction: On October 17th, 2012, at 19:44 PDT, a bright fireball was observed in the San Francisco Bay area and triangulated in the NASA CAMS video meteor network [1]. The calculated trajectory led Lisa Webber of Novato, CA, to recover the first meteorite (N1), which she made available for scientific study. Five others have since been found. Preliminary analysis indicates the meteorite is a highly shocked L6 showing a characteristic dark-light texture [2], typical for fragmental and regolith breccias [3].

Methods: We have analyzed two meteorite fragments (N1-7; 22.8 mg, N1-14; 47.8 mg) for He, Ne and Ar. Fragment N1-7 consists exclusively of the light lithology, while N1-14 contains about ~70% dark lithology. The two samples were weighted, wrapped in aluminum foil, and exposed to ultra-high vacuum for several days before analysis n a custom-built noble gas mass spectrometer. Extraction was done in a furnace, by heating the samples in a single temperature step to ~1800 °C. The gases were analyzed according to a protocol established in [4]. Blank corrections were never larger than 0.6% for He, 6% for Ne and 13% for Ar.

Results & Discussion: Both fragments yielded similar concentrations in all noble gas isotopes (within a few %), with the exception of 15% more ^{4}He in N1-14, and 18% more ^{40}Ar in N1-7. No solar wind gases were found, the Ne in the samples is cosmogenic (^{22}Ne/^{21}Ne = 1.09; ^{22}Ne = 2.7 × 10^{-8} cm^{3}STP/g). He (^{3}He/^{4}He = 0.062 – 0.075; ^{3}He = 9.5 × 10^{-8} cm^{3}STP/g) shows a contribution from radiogenic ^{4}He, and Ar (^{40}Ar/^{36}Ar = 424; ^{36}Ar/^{38}Ar = 3.0; ^{36}Ar = 1.7 × 10^{-8} cm^{3}STP/g) shows a contribution of both radiogenic and trapped Ar. According to [5], a ^{22}Ne/^{21}Ne of 1.09 corresponds to a pre-atmospheric radius of at least 30 cm and a shielding of ~20 cm, which is slightly larger than the size calculated from bolide observations [2]. We derived production rates of the cosmic-ray-produced ^{3}He, ^{21}Ne and ^{38}Ar from [5], and calculate cosmic-ray exposure (CRE) ages of 4.9, 6.4 and 5.9 Ma, respectively. This CRE age corresponds to a well-known peak at ~5-6 Ma in the CRE age histogram of shocked, de-gassed L chondrites [6]. The slightly lower ^{3}He CRE age, and the position of the samples below the "Bern-line" in a ^{3}He/^{21}Ne vs. ^{22}Ne/^{21}Ne diagram [7] suggest a He-loss of ~20-25%. Using L chondritic concentrations for K, U, Th [8], a U,Th-He age of 250-370 Ma, and a K-Ar age of 1300-1500 Ma was derived. Taking a He-loss of 20-25% into account, the U,Th-He age (350-490 Ma) is compatible with the time of the break-up of the L chondrite parent body, 470 Ma ago (e.g., [9]).

References: [1] see also: Busemann H. et al., 2013 (this conference) [2] Jenniskens P. et al., 2013, *MAPS*, in prep. [3] Rubin A. et al., 1983. *Meteoritics* 18:179–196. [4] Wieler R. et al., 1989, *GCA* 53:1449-1459. [5] Leya I. & Masarik J., 2009, *MAPS* 44:1061-1086. [6] Marti K. & Graf T., 1992. *Annual Reviews of Earth & Planetary Science* 20:221-243. [7] Eberhardt P. et al., 1966. *Zeitschrift für Naturforschung A* 21:414–426. [8] Wasson J. & Kallemeyn G., 1988. *Philosophical Transactions of the Royal Society of London* 325:535-544. [9] Korochantseva E. V. et al., 2007. *MAPS* 42:113-130.