RADIOGENIC AND NUCLEOSYNTHETIC NEON-22 FROM INDIVUAL PRESOLAR ORGUEIL GRAPHITES.

P. R. Heck[1,2], M. Jadhav[3], M. M. M. Meier[4], S. Amari[3], E. Zinner[3], H. Baur[4] and R. Wieler[4]. [1]Robert A. Pritzker Center for Meteoritics and Polar Studies, Dept. of Geology, Field Museum. E-mail: prheck@fieldmuseum.org. [2]Chicago Center for Cosmochemistry, University of Chicago. [3]Laboratory for Space Sciences and the Physics Dept., Washington University, St. Louis. [4]Dept. of Earth Sciences, ETH Zurich, Switzerland.

Introduction: We report the detection of ^{22}Ne in individual presolar low-density graphite grains from the meteorite Orgueil (CI1) and discuss different stellar sources for the Ne.

Samples & Methods: We selected 15 graphite grains from Orgueil low-density separate OR1d (1.75–1.92 g/cm^3; [1,2]). The grains had previously been measured for C, N, O, Al-Mg, Si, K, Ca, and Ti isotopes with the NanoSIMS in St. Louis [1,2]. Large grains were selected (diam.: 3–12 µm). We used an IR laser gas extraction line coupled to an ultra-high sensitivity mass spectrometer equipped with a compressor ion source at ETH Zurich [3] to analyze isotopes of He and Ne (see refs. [4,5]).

Results: 4 out of 15 grains (27%) contained presolar ^{22}Ne above our detection limit (3.2×10^{-15} cm^3 STP), defined by the 2σ standard deviation of blanks [4]. This is lower than the 43% fraction of ^{22}Ne-rich grains in lower-density Murchison KE3 graphite (1.65–1.72 g/cm^3) [6] and similar to the Murchison KFB1 (2.10–2.15 g/cm^3) fraction of 22% [5]. Gas amounts ($[5.3–6.7]\times10^{-15}$ cm^3 STP ^{22}Ne) in OR1d are similar to those in KFB1 [5]. Concentrations ($[0.6–11]\times10^{-5}$ cm^3/g ^{22}Ne) decrease with increasing grain sizes. Significant amounts of material were consumed in the NanoSIMS as documented by SEM. This resulted in some loss of trapped noble gases.

Discussion: *Grain OR1d4m-13:* excesses of ^{12}C, ^{15}N, ^{18}O and ^{28}Si [1,2] indicate contributions from the He/C and Si/S zones of a type II supernova (SN) [7]. We interpret the ^{22}Ne as radiogenic (Ne-R) from the decay of ^{22}Na ($\tau_{1/2}$=2.6 a) that condensed with the graphite [5,8]. The ^{28}Si has to come from the Si/S or O/Si zone and would have included radioactive ^{44}Ti ($\tau_{1/2}$=60 a) that is produced in the same zones [7]. The absence of radiogenic ^{44}Ca could be due to absent TiC subgrains in this grain. It is unrealistic to explain the detected Ne as non-radiogenic: Although the upper limit of the ^{20}Ne/^{22}Ne ratio is consistent with the He/C zone ratio [7], low gas-to-grain velocities in this zone make ion implantation unlikely [5,8]. *Grain OR1d4m-18* has a ^{29}Si deficit and ^{30}Si excess, similar to Z type presolar SiC. Such grains most likely originated in low-mass, low-metallicity AGB stars [9]. The stellar source and the non-detection of ^{20}Ne imply that the ^{22}Ne of this grain is most likely implanted Ne-G from the He-shell. *Grain OR1d4m-19* is characterized by a low ^{12}C/^{13}C ratio and excess of radiogenic ^{44}Ca, diagnostic for a SN, thus requiring ^{22}Ne = Ne-R. *Grain OR1d4m-2* has a ^{12}C/^{13}C ratio (18) too low for an AGB star origin and too high for low ^{12}C/^{13}C sources other than SN. A SN source is therefore our preferred explanation.

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