Presolar Silicate Grains in Isheyevo and NWA 801 Chondrites

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Presolar silicate grains found in primitive meteorites are believed to have condensed in stellar outflows as well as in novae and supernovae (SNe) ejecta. Multi-isotopic investigations combined with elemental and structural information of individual grains can potentially provide insights into stellar evolution and nucleosynthesis, grain condensation and processing and galactic chemical evolution.

Here, we report on a search for presolar silicates in fine grained lithic clasts in the Isheyevo (CB/CH) chondrite as well as interchondrule matrix (ICM) regions and fine grained chondrule rims (FGRs) in the NWA 801 (CR2) chondrite. The NanoSIMS ion probe was used to produce secondary ion images of ^{16}O, ^{17}O, ^{18}O, ^{28}Si, ^{29}Si, ^{30}Si and $^{24}Mg^{16}O$ for searching O-anomalous grains in Isheyevo clasts (243200 μm^2) and in NWA 801 (69200 μm^2). A total of 23 presolar silicate grains were found with varying abundances of ~10 parts per million (ppm) for Isheyevo clasts, ~40 ppm for FGRs and ~7 ppm in ICM for NWA 801, which probably points towards different aqueous alteration pathways for chondritic fine grained materials [1]. A large majority of grains (16) are ^{17}O enriched (group-I) and condensed in low mass RGB/AGB stars with near solar metallicity, and one group-II grain with ^{18}O depletion probably condensed via cool bottom processing (CBP) in an AGB star (e.g.[2]). One grain with ~13 times solar $^{17}O/^{16}O$ ratio likely has a nova origin and five ^{18}O-rich group-IV grains, with one extremely ^{18}O enriched (~34 times solar) grain likely originated in SNe type-II ejecta (e.g.[3]). Preliminery TEM investigations of one group-IV grain shows that it is a crystalline forsterite, probably of SN origin. This interpretation is also supported by Mg-rich silicate dust observations in a SN remnant [4]. Spectroscopic observations suggest a striking difference of proportions of crystalline grains in interstellar medium (ISM) and in meteorites and interstellar dust particles, which suggests crystalline dust amorphization in the ISM followed by thermal annealing in solar nebula (e.g.[5]). The Mg-rich crystalline silicate that we found could have formed in a nearby SN and subsequently injected in the protosolar nebula before being irradiated by high energy ions in the ISM.

[1] Leitner et al. (2016) *EPSL* **434**, 117-128. [2] Nittler et al. (1997) *ApJ.* **483**, 475-495. [3] Nguyen and Messenger (2014) *ApJ.* **784**, 149 (15pp). [4] Rho et al. (2008) *ApJ.* **673**, 271-282. [5] Nguyen et al. (2016) *ApJ.* **818**, 51 (17pp).