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NEW I-XE AGES OF CAMPO DEL CIELO SILICATES

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Introduction: Silicate inclusions in IAB irons have been reported to be rich in "atmosphere-like" trapped heavy noble gases and radiogenic ^{129*}Xe [1–5], ureilite-like Xe was observed in El Taco Campo del Cielo silicates at higher than 1000 °C extractions [6]. And since the I-Xe system seems to be preserved in these inclusions [7–9], silicates in IABs can provide diverse ages, reflective of different closure times, and the potential for cooling rate information.

Results: Silicates from one studied Campo del Cielo polished section (Museum of Natural History, Vienna) consisted of chrome diopside and oligoclase, mostly in complex intergrowths, in some cases surrounded by graphite rims. Separated diopside and oligoclase represented two different inclusions on the polished section and were free of graphite contamination. Contrary to the earlier observations, trapped Xe in these silicates is isotopically consistent with Ordinary Chondrites component. Concentrations of ^{132}Xe (after correction for small fission contributions) are 1.0×10^{-10} ccSTP/g and 1.4×10^{-10} ccSTP/g, four times less then in previously studied silicates [6, 7]. Diopside contained 5.8×10^{-9} ccSTP/g of ^{129*}Xe, the highest concentration observed so far in IAB silicates, oligoclase one order of magnitude less - 5.0×10^{-10} ccSTP/g. Corresponding I-Xe ages are 4556.4 ± 0.3 Ma and 4558.0 ± 0.6 Ma. I-Xe age of oligoclase is in agreement with previously reported 4559.1 ± 0.7 Ma [7]. I-Xe age of chrome diopside is 1.6 Ma younger, but consistent with I-Xe ages for silicates from other IAB meteorites [8, 9]. Although these silicate inclusions were embedded in metal only 9 mm apart, they show 1.6 Ma age difference. And while the I-Xe system in oligoclase closed earlier, correlated radiogenic Xe in this sample was released at lower temperatures than in diopside. We suggest that these silicates were formed in different locations and depths within the IAB parent body, thus their difference in closure time, and were later brought together by mixing and reassembly of the debris after an impact [10]. This catastrophic event and resulting heterogeneous heating at the cm scale [11] did not reset the I-Xe system in studied silicates, but could be responsible for the significant loss of radiogenic Xe in less refractory oligoclase.

Supported by NASA grant #NNG06GE84G and FWF (Austria). We thank Harald Stehlik for help in acquiring this sample.

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LOOKING FOR THE CARRIER PHASE OF ^{54}CR IN THE CARBONACEOUS CHONDRITE ORGUEIL

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Introduction: ^{54}Cr anomalies are widely distributed in inner solar system materials [1–6]. These variations have been attributed to nucleosynthetic effects. Astronomical models predict that ^{54}Cr, along with other neutron-rich nuclides, such as ^{50}Ti, are produced in a neutron-rich environment at or near nuclear statistical equilibrium in both Type Ia and Type II supernovae [7, 8]. Further constraints on the nucleosynthetic source of ^{54}Cr largely rely on the identification of the carrier phase. Isolating and identifying the carrier phase of ^{54}Cr anomalies is an outstanding problem in cosmochemistry. We have recently started to search for the carrier phase by in-situ NanoSIMS analyses of a residue separated from the C1 chondrite Orgueil.

Methods: The original CsF/HCl Orgueil residue was ashed in an O-plasma to remove C. The remaining minerals were dispersed as a liquid suspension onto a gold substrate. A quick SEM examination of the mount shows that the mineral assemblage includes mostly sub-micron chromite and Cr-rich spinel, and a small amount of SiC. Isotope measurements were made on a Cameca NanoSIMS 50L in multi-collection mode at the Carnegie Institution. A 0.5–0.7 µm, O^- primary ion beam of ~13 pA intensity was rastered over 25×25 µm^2 areas. For each area, 16 sequential 256×256 pixel images were obtained. Positive secondary ions of ^{50}Cr+^{50}Ti, ^{52}Cr, ^{53}Cr, ^{54}Cr+^{54}Fe, ^{28}Si and ^{56}Fe were detected simultaneously on six electron multipliers. ^{28}Si was detected in order to aid in the identification of the mineralogy. ^{56}Fe was used to correct interference from ^{54}Fe on ^{54}Cr. We could not make any correction for the interference from ^{50}Ti on ^{50}Cr. The spatial resolution of these isotopic images was largely limited by the primary beam size.

Results: We obtained about 30 isotope images, covering tens of thousands of grains. For each image, we defined regions of interest with high ^{52}Cr count rate to avoid background areas. Most of the regions have ^{54}Cr/^{52}Cr (corrected for ^{54}Fe interference) within two standard deviations from the mean values obtained within individual images. However, we detected several areas with positive ^{54}Cr/^{52}Cr anomalies of 100‰ to 300‰, deviating from the mean by 2 to 4 standard deviations. For one of these anomalous regions, a smaller area (5×5 µm^2) around this region was reimaged and we confirmed the anomaly. Comparing these isotope ratio images with SEM images, the anomalous areas typically contain one or a few grains of chromite and Cr-rich spinel of <200 nm. Because the typical grain size is smaller than the beam size, the actual ^{54}Cr enrichments are probably much higher. In these areas, we did not detect resolvable anomalies in ^{53}Cr/^{52}Cr.

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