I-Xe DATING: COMPARISON OF I-Xe AND Pb-Pb AGES OF RICHARDTON CHONDRULES AND SEPARATED MINERAL PHASES. O. V. Pravdivtseva1, Y. Amelin2, C. M. Hohenberg3, A. P. Meshik1, Laboratory for Space Sciences and Physics Department, Washington University, CB1105, One Brookings Drive, Saint Louis, MO 63130 (olga@wuphys.wustl.edu), 2Geochronology Laboratory, Royal Ontario Museum, 100 Queen’s Park, Toronto, Ontario, Canada.

Introduction: I-Xe data for 5 different mineral phases separated from the Richardton chondrite have been reported in our previous work [1]. Cr-spinel and pyroxene yield I-Xe ages (4.565 ± 0.003 Ga and 4.567 ± 0.002 Ga respectively) that are close to the age of the Shallowater reference meteorite (= 4.566 ± 0.002 Ga [2]), corresponding to isotopic closures associated with or shortly after primary mineralization. Feldspar indicates Xe closure at 4.555 ± 0.003 Ga, about 10 Ma later, probably due to subsequent metamorphism. Troilite displays a strongly disturbed I-Xe system with apparent (“best fit”) isochron age of 4.559 ± 0.005 Ma. While the Pb-Pb age for Richardton phosphate was determined to be 4.5534 ± 0.0006 Ga [3], the I-Xe system in apatite was completely disturbed.

Results: There is a general correlation between petrological type and textural integration in meteorites [4]. In spite of Richardton’s equilibrated petrologic type (H5), it shows a surprisingly low degree of chondrule-matrix integration [5]. The metamorphism, which affected the Rb-Sr distribution in Richardton [5], had comparatively little effect on the textures and major element chemistry of the chondrules (but may be responsible for the uniform Fe/Mg ratio of the pyroxene and olivine in Richardton chondrules). If so, I-Xe studies of Richardton chondrules can provide insight into the earliest stages of metamorphism on the Richardton parent body.

Comparison of I-Xe and Pb-Pb ages of individual Richardton chondrules and separated mineral phases also allows us to test the absolute I-Xe age normalization. Absolute I-Xe ages are determined using the 4.566 Ga age for the Shallowater, which, in turn, is derived from Acapulco phosphate, the only mineral separate to date for which both I-Xe and Pb-Pb ages have been accurately measured [2, 6]. Data for Richardton pyroxene separates yield Pb-Pb age of 5.563 ± 1 [7] and absolute I-Xe age of 4.567 ± 3 Ga. Both I-Xe and Pb-Pb chronometers show the same ~ 10 Ma difference between closing time of the more refractory fractions (Cr-spinels and pyroxene) and the secondary phases (phosphate, feldspar and troilite).

Although these Pb-Pb and absolute I-Xe ages are in agreement to within the errors, Acapulco phosphate, with its relatively large (2 Ma) uncertainty in Pb-Pb age does not provide the most precise normalization for absolute I-Xe ages. As more I-Xe and Pb-Pb data are obtained on the same objects, the absolute I-Xe age normalization can be progressively refined. More precision for absolute I-Xe ages is important for better delineation of the fine structure of alteration and post-formational evolution in general.

Four fragments from different Richardton chondrules (Fig.2), weighting 5.873 mg (RichCh-1), 7.052 mg (RichCh-2), 4.366mg (RichCh-3) and 7.613 mg (RichCh-6), were irradiated for I-Xe study in the MURR, along with other samples in a package designated SLC-15. Other fragments from these same chondrules were used for Pb-Pb studies. The 207Pb/206Pb ages for RichCh-2, RichCh-3 and RichCh-6, shown on Fig.1, will be directly compared with the I-Xe ages obtained for each of these chondrules.
Although pyroxene is most likely the main (or only) iodine host in chondrules, a phase-by-phase laser extraction analysis on a chondrule fragment will establish the dominant iodine carrier. Step-wise extractions for the I-Xe dating of individual chondrules are now underway.


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