Noble gas characteristics of the E chondrite St. Mark's

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Introduction

In order to completely characterise the noble gas inventory of E chondrites, we present results of the ongoing on line etching of the EH5 chondrite St. Mark's. Following the analysis of an HF/HCl-resistant residue etched with HNO_3 (Busemann et al., 2002), we now etch a *bulk* sample of this meteorite with conc. HF. This is the first on line etch experiment of a bulk meteorite sample to analyse composition and carrier of its primordial noble gas.

Radiogenic noble gases

The first nine etch steps contain variable proportions of the expected gas amounts (75% ^{40}Ar, 15% $^{36}Ar/^{84}Kr$, 5% ^{4}He) based on the bulk concentrations (Patzer et al., 2001), indicating that we selectively etch the minerals and partially resolve radiogenic, cosmogenic and trapped gas. The radiogenic ^{40}Ar and ^{129}Xe in the first five steps are perfectly correlated, suggesting one carrier mineral. The Ne isotopic data of these steps form a mixing line between trapped Ne and cosmogenic Ne with $^{22}Ne/^{21}Ne \sim 1.34$. This large ratio compared to ~1.1 shown in the later steps and bulk analyses is probably the result of Na in the mineral preferentially destroyed in the first steps. A potential carrier for $^{40}Ar_{rad}$ and $^{129}Xe_{rad}$ is thus djerfisherite $(K,Na)_6(Fe,Ni,Cu)_{25}S_{26}Cl$ that has been reported to be present as individual grains (20-40 μm) in St. Mark's silicates (e.g. Fuchs, 1966).

Subsolar noble gases

Subsolar gases are less fractionated relative to solar than Q gas. They are characteristic of E chondrites and reside in enstatite (Crabb and Anders, 1982). Significant amounts have been released from phase Q (Busemann et al., 2002) which enabled us to determine the He-Ar isotopic composition. The subsolar Kr and Xe isotopic composition is subject of this experiment in progress. Kr and Xe in the first etch steps are mainly terrestrial, but the elemental composition in the following steps shows trapped gases similar to those released from the residue. This indicates that subsolar gas might be a well-defined component incorporated into phase Q *and* enstatite, e.g. emitted from the early active sun.

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I-Xe analyses of Chainpur chondrules

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Introduction

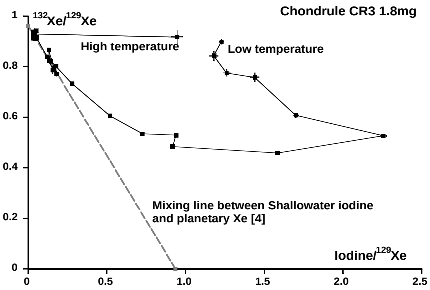
Chondrules from the unequilibrated ordinary chondrite Chainpur (LL3.4) have previously been found to have ^{129}I-^{129}Xe ages ranging over 50 Ma, the spread in ages being attributed to shock disturbance, and an evolution of $^{129}Xe/^{132}Xe$ with time [1]. Here we present the results from recent Xe analyses of 10 irradiated Chainpur chondrules.

Results

Chondrules were handpicked and showed no signs of mineralogical alteration. Major element (by EPMA) and trace element (by LA-ICPMS) bulk abundances were determined: REE abundances vary between 0.1-5 x CI with flat patterns from La to Lu but negative Eu anomalies.

The chondrules were irradiated and analysed for Xe isotopes by laser step heating [2]. On 3-isotope plots the data typically evolve towards progressively older points with increasing release temperature. After a suitable fission correction, half of the chondrules analysed are consistent with the age of the Shallowater standard (4564.6 Ma [3]) in their high temperature releases , two are younger (~10 and ~30 Ma after Shallowater) and the rest do not conform to well-defined isochrons. We do not observe any compelling evidence for a trapped component other than planetary [4] or for an evolving trapped component (in contrast to [5] and [1]).

The high-temperature releases define what is probably a formation age for chondrules with well-defined isochrons; the remaining chondrules appear to have disturbed I-Xe systematics. This disturbance may have been as a result of shock.



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