
INTRODUCTION. Recent works show that variations of the isotopic composition of noble gases in separated meteoric minerals may reflect the initial isotopic heterogeneity in 2 the solar system (e.g. 1). The investigation of isotopic variations in various meteoric minerals is one of 3 the most effective methods for study of such isotopic heterogeneity.

In the present work we will describe experimental results of Xe isotopic composition measurements in mineral fractions, separated from the chondrite Tzariov by selective dissolution. The Tzariov chondrite was found in the territory of USSR in 1979 and related to the L-group of petrologic type 5, 6 and has effects of shock pressures at ~800 kbar causing complex brecciated structure (2).

EXPERIMENTAL METHODS. The silicate and metallic phases of the Tzariov chondrite were investigated. General procedures used in our laboratory for calibration of the mass-spectrometer MW-1201 and for extraction, analysis and data reduction have been described earlier (2). In some measurements the steepse heating method was used. The selective dissolution procedures were similar to those described by Shima M. and Honda M. (3) and Anders et al. (1). However, the method of Shima M. and Honda M. was improved by Lavrukhina et al. (4).

RESULTS AND DISCUSSION. The Xe content in different mineral phases can be estimated on the basis of obtained data of the Xe concentrations in chondrite sample etched with different reagents. Some results are summarized in Table 1. The main amount of Xe (~80%) is contained in olivine, pyroxene and plagioclase. About 16% Xe seems concentrated on the surface of the grains with high local concentration (~10^9 Xe/cm^2). And has been released in remarkable degree even during chemical treatment with water and EDTA. About 3% Xe is located in the acid-insoluble residue (chromite basis of obtained data of the Xe concentrations in chondrite sample etched with different reagents). This value is compatible with the Xe contents in the acid-insoluble residue from other equilibrated chondrites of H and LL-groups (5, 6). The Xe isotopic composition of samples treated with water and EDTA is compatible with the average Xe isotopic composition of the silicate phase. However, treatment of samples with more active reagents (CuCl_2 + HNO_3, 1M HCl, 3M HCl, 10M HF + 3M HCl, HNO_3) leads to changes in the Xe isotopic composition (Fig. 1). All Xe isotopic ratios, with the exception of the Xe-129/Xe-130 and Xe-128/Xe-130, are generally varied up to maximum in the fraction enriched in chromite. The Xe-129/Xe-130 ratio in the residue of the meteorite is decreased to 6.9. To study the Xe components in the mineral phases and the gas fractions released at different temperatures we plotted the measured Xe-130/Xe-132 ratios as a function of the Xe-136/Xe-132 ratios. It is seen that the Xe isotopic ratios in the mineral phases, with the exception of the Fe, Ni-phase and the fraction enriched in chromite, lie within the limits of experimental error on a straight line connecting the Xe isotopic compositions of the atmosphere-Xe and AVCC-Xe. The most data obtained with the thermal steepse studies of the mineral fractions plot outside the field of triangle. Probably, the Xe in the Tzariov chondrite is composed mainly of mixture from AVCC-Xe and atmospheric type Xe. However, they are accompanied by the third component which is enriched by Xe heavy isotopes (Fig. 2) and released only in heating experiments on the mineral fractions. The analysis has showed that the excess of the Xe heavy isotopes is generally due to mass-fractionation process and a small admixture of Xe produced with fission of Pu-234. The released gas portion at 1400-1600°C from the mineral fraction enriched in chromite has caused a great interest. In Fig. 3 deviations on the Xe isotopic composition relative to atmospheric Xe are shown. One can see that there is Xe component in which practically the heavy isotope excess equal. In Fig. 4 the isotopic composition of this component normalized to Xe-136 and the yield of Xe isotopes produced with Pu-234 and Cm-248 fissions are given. It is clear that the observed Xe isotopic ratios may be explained only by Cm-248 fission. Taking into account Cm-248 half-life time (~0.35 m.y.), we suggest that some mineral constituent of acid-insoluble fraction from the Tzariov chondrite was condensed not later than ~1 m.y. after the cessation of nucleo-synthesis.

INVESTIGATION OF Xe ISOTOPIC COMPOSITION

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Fig. 1. The variation in the Xe isotopic ratios of mineral fractions from the Tzariov chondrite. 1 — the silicate phase; 2 — the silicate phase without sulphates and chlorides; 3 — the fraction No. 2 without phosphates; 4 — the fraction No. 3 without metallic residue; 5 — the pyroxene-plagioclase fraction; 6 — the chromite phase with admixture of polymer; 7 — the chromite phase; 8 — the Fe, Ni-phase.

Fig. 2. The variation in the Xe-130/Xe-132 and Xe-136/Xe-132 ratios. 9 — AVCC-Xe; 10 — Atmospheric Xe; 11 — Solar Xe, 6.8 etc. — Temperature: 100. Other symbols as in Fig. 1.

Fig. 3. The Xe isotopic composition in the acid-insoluble residue from the Tzariov L 5, 6 and Krymka L 3 chondrites (1 and 3 respectively) normalized to atmospheric Xe. 2 — AVCC-Xe $6 = \left(\frac{Xe^{-1}}{Xe^{-130}}\right)_{\text{met}} / \left(\frac{Xe^{-1}}{Xe^{-130}}\right)_{\text{atm}} - 1.00$.

Fig. 4. Comparison of the Xe isotopic composition in acid-insoluble residue from the Tzariov chondrite (inside dashed line) with that of Xe produced with Pu-244 and Cm-244 fission (7).

Diameter of circles corresponds to the experimental error.