REE, Ba, Sr, Rb, and K characteristics of chondrules from the Tieschitz (H3) chondrite.

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Elemental abundances of REE, Ba, Sr, Rb, K, Ca and Mg in the individual chondrules from the Tieschitz (H3.6) chondrite were determined by the improved mass spectrometric isotope dilution technique (MSID) (1) to examine chemical characteristics of chondrule-formation processes and the chondrule-precursors. Chondrule-rim and -core samples, and the matrix materials were also analyzed for the elements. The analytical precisions are estimated to be better than 3% for the most cases.

In Fig. 1, most of the chondrules analyzed in this work have the flat-REE patterns with minor (20 - 30%) negative Eu anomaly, which confirm the earlier results by the INAA (2). It is pointed out that there are not systematic abundance variations of REE among the different textural types of chondrules nor noticeable irregularities of Ce and Yb. These results are different from those of chondrules from the Allende (CV3) chondrite (1). Generally, Ca and REE are positively correlated, but although Sr abundances are most variable any clear correlation of Sr with REE are not found among Tieschitz chondrules, indicating presence of REE-free refractory precursor materials enriched in Sr.

The moderately-volatile elements, Rb and K, are depleted in the chondrule-cores but relatively enriched in the rims (Fig. 2). Thus, it seems likely that the alkaline element abundances in the bulk chondrule are mainly controlled by the rim. It is worth noting that all the chondrule-materials (bulk, core and rim) analyzed so far, as well as the matrix, have the similar Rb/K ratio close to the CI Rb/K value. Similar results were obtained for the Allende chondrules (1).

The heating experiments for lunar basalts (3), chondritic meteorites (4) and the synthetic materials (5) indicate that large elemental fractionations among the alkaline elements occur during the melting-vaporization processes of these materials. Therefore, as is the case of the Allende chondrules, we suggest that significant fractionations and/or loss of Rb and K did not occur during the chondrule formation melting processes, and thus the low Rb and K abundances and the uniform Rb/K distributions found for chondrules were established basically before the melting.

The matrix materials have lower trace element abundance with the positive Eu anomaly (Fig. 3). The Ca and Mg concentrations in this samples are 0.551% and 4.49%, respectively, suggesting that the matrix materials contained significant amount of non-silicate materials. The trace element pattern of the rim are quite similar to that of the matrix and particulaly the agreement of non-silicate-free (Mg-normalized) trace element abundances in the matrix with those in the rim are noteworthy, though it can not be ruled out that the matrix materials are contaminated with the rim materials significantly and the pattern of the matrix represents that of the rim. Hence, it is possible that the chondrule-rim was formed from the matrix materials by sintering. In addition, in view of the complementary abundance patterns for the cores and the rims (and thus the matrix) (Fig. 3), it is considered that the core and rim (matrix) are genetically related.

From the above results, it is strongly suggested that the main features of trace elements observed for the Tieschitz chondrules were established before

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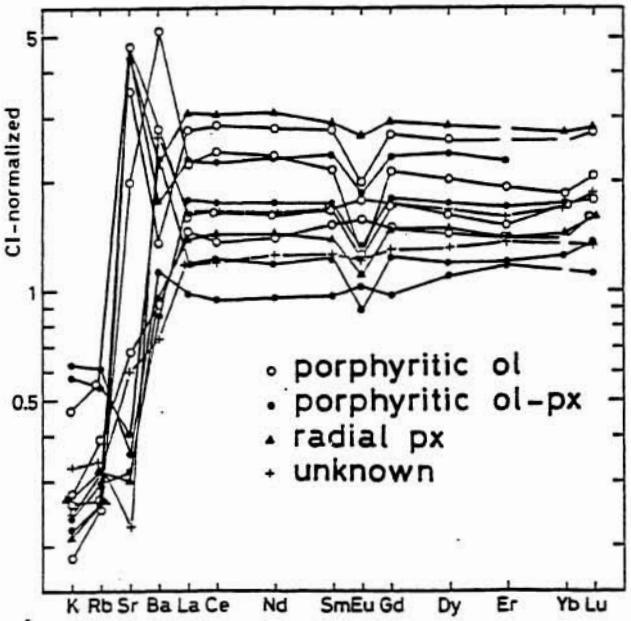

Fig. 1. Trace element abundance patterns for chondrules from the Tieschitz (H3) chondrite.

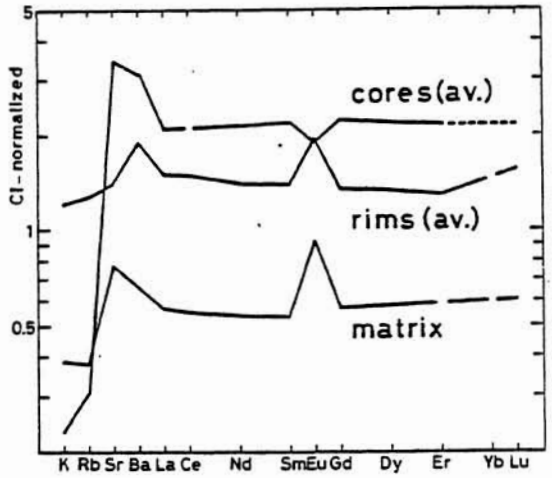

Fig. 3. Trace element abundance patterns for the matrix and averages of cores and rims of 3 chondrules from the Tieschitz.

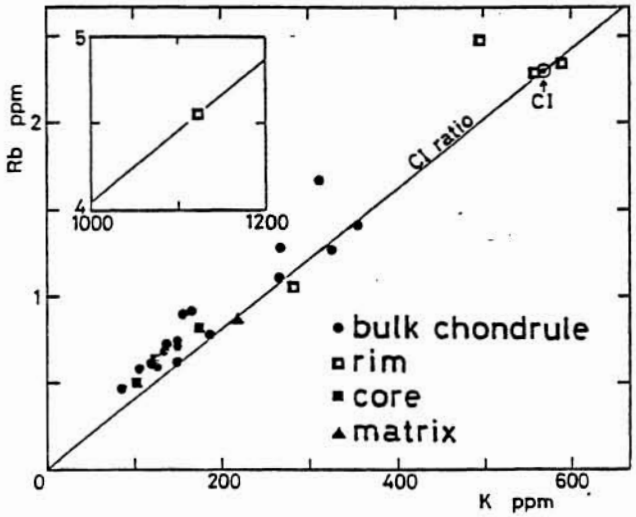

Fig. 2. The K vs. Rb plot for the bulk, rim and core samples of chondrules, and the matrix from the Tieschitz.

the chondrule formation melting: during formation processes of chondrule-precursors and/or accreation of precursor materials.

References:
(1) K. Misawa & N .Nakamura (1986), LPS XVII 551, (2) J. L. Gooding et al. (1980), Eaeth Planet. Sci. Lett. 50, 171, (3) E. K. Jr. Gibson & N. J. Hubbard (1972), LPSC 3rd, 2003, (4) J. L. Gooding & D. M. Muenow (1976), Geochim. Cosmochim. Acta, 40, 675; Meteoritics 12, 401, (5) M. E. Kreutzberger et al. (1986) Geochim. Cosmochim. Acta 50, 91.