

ition, on the assumption of a particular value for $\delta^{15}\text{N}$ in the trapped N_2 . Since these mixing lines pass through the Viking martian atmosphere composition, we assume that this $\delta^{15}\text{N}$ is $+620 \pm 160\%$ (Nier and McElroy, 1977). Comparison of the resulting abundance patterns with Viking data constitutes a test of this assumption that the trapped gases in EETA 79001 are martian.

Relative elemental abundances. Nitrogen and the principal noble gas isotopes are trapped in the 79001 glass in relative proportions that agree within error with Viking results. The first report of carbon abundance in the trapped component (Carr *et al.*, 1985) claims a very good agreement between the amount present in the glass, relative to N and Ar, and the Viking CO_2/N_2 and CO_2/Ar mixing ratios. But the stated C content, 4.6 ppm, corresponds to values of these mixing ratios that are more than triple the Viking values. This ambiguity needs to be resolved. **Absolute elemental abundances.** The 79001 abundance data illustrate the remarkable fact, first pointed out by Ott and Bequemann (1985), that absolute number densities (particles/volume) of gases trapped in the glass and gases in the present-day lower martian atmosphere are very nearly the same. We agree with their conclusion that this must represent an important boundary condition on the trapping mechanism. **Isotopic ratios.** Of those isotope ratios in the glasses that were also measured by Viking, only trapped $^{36}\text{Ar}/^{38}\text{Ar}$ is in apparent disagreement. The extraordinarily low average value of 4.0 ± 0.2 in three glass samples (Wiens *et al.*, 1985) falls at the low end of the range 4-7 originally estimated for the martian atmosphere (Biemann *et al.*, 1977), but is at variance by $\sim 2\sigma$ with the latest report (Owen *et al.*, 1977) that "... $^{36}\text{Ar}/^{38}\text{Ar}$ appears to exhibit the terrestrial value (5.3) within the errors of measurement ($\pm 10\%$)." The quality of the spacecraft data are such that it is unclear whether the discrepancy is significant. **Comparison with Earth.** Elemental abundance ratios of the noble gases in 79001 and in the Earth's atmosphere are qualitatively similar. The diagnostic $^{84}\text{Kr}/^{132}\text{Xe}$ ratio of ~ 20 -25 (Bogard *et al.*, 1984; Becker and Pepin, 1984) clearly distinguishes these gases from trapped chondritic gases. Ne, Kr, and nonradiogenic Xe isotopic compositions appear to be Earth-like, with small offsets due to fractionation in Kr and perhaps Xe, except for the heavy Xe isotopes where excesses suggest a different component structure (Becker and Pepin, 1984; Swindle *et al.*, 1984). The significantly lower $^{36}\text{Ar}/^{38}\text{Ar}$ may point to alteration by a Mars-specific process, but attempts to address this in terms of an identifiable mechanism (e.g. spallation of planetary surface materials) have so far failed (Wiens *et al.*, 1985).

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CHAINPUR (LL-3): FRACTIONATED SIDEROPHILE ELEMENTS IN CHONDRULES, FRAGMENTS, AND CHONDRITE MATRIX
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We have analyzed by INAA 19 chondrules, 21 lithic fragments, and six grain-size fractions of the Chainpur (LL3) chondrite for a variety of lithophile, chalcophile, and

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siderophile elements. Here we report on our results of the siderophile element study which was complemented by EMP analyses of the metal phases present in each individual object.

Metal is generally depleted in Chainpur chondrules as compared to chondritic abundances similar to what has been observed in other chondrites (e.g. Howard, 1802; Dodd, 1978). In taking the abundance factor $0.6 \times \text{CI}$ for Ni as a threshold for high or low metal contents, all grain-size fractions of Chainpur $> 3.4 \mu\text{m}$, 12 fragments out of 21 (57%) and four chondrules out of 19 (21%) are "metal-rich," "Metal-poor" are the grain-size fraction $< 3.4 \mu\text{m}$ ($\text{Ni} = 0.31 \times \text{CI}$), a good portion of the lithic fragments and most of the chondrules. The latter tend to reach the lowest depletion factors down to $0.03 \times \text{CI}$.

The siderophile elements are fractionated in all constituents investigated. The most severe fractionations observed in Chainpur constituents are the Fe/Ni and Ir/Ni fractionation. Fe/Ni: Most fragments and chondrules have $\text{Fe}/\text{Ni} > \text{CI}$. Only a few very metal rich chondrules and fragments and the grain-size fraction $> 200 \mu\text{m}$ have $\text{Fe}/\text{Ni} < \text{CI}$. This fractionation can clearly be attributed to partitioning of Fe between metal and silicates under fairly oxidizing conditions. Ir/Ni: This ratio is $< \text{CI}$ for all 21 lithic fragments, 14 chondrules, and all grain-size fractions $> 10 \mu\text{m}$. Ir/Ni $> \text{CI}$ have five chondrules and the grain-size fractions $< 10 \mu\text{m}$. The strong Ir/Ni fractionations displayed by most Chainpur constituents in our opinion strongly suggest vapor fractionation. Ir-rich metal in chondrules from Chainpur has previously been described and identified as a "primitive refractory component" (Grossman and Wasson, 1982). Our study confirms the presence of such a component which could account for the strong positive Ir anomalies in two chondrules and the $< 3.4 \mu\text{m}$ grain-size fraction. Apparently, this refractory component was not properly sampled during the chondrule-forming process and mainly remained finely dispersed and still is present as very fine grains. Whether these fine refractory grains formed via fractional condensation or evaporation cannot be decided. A second type of Ir-rich metal is present in three refractory chondrules. The correlation of Ir with refractory lithophile elements (Kurat *et al.*, 1984) strongly suggests formation via fractional evaporation during chondrule formation. All lithic fragments and the majority of chondrules have $\text{Ir}/\text{Ni} < \text{CI}$ and appear to contain a metal component which condensed from a gas which has previously been fractionated by partial removal of refractory siderophile elements.

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CAN TRACKS IN METEORITES BE USED TO STUDY ULTRAHEAVY COSMIC RAYS?
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The idea of using tracks in meteorites to study the chemical composition of the heaviest Galactic Cosmic Rays, has been around since their discovery (Fleischer *et al.*, 1967). However, the inconclusive results obtained by this method, together with the development of very large man-made Cosmic Ray detectors with good charge resolution, have made meteorites less and less attractive for this purpose. Thanks to satellite experiments, we now have a rather good knowledge of the Cosmic Ray composition up to Pb ($Z = 82$), but the actinide abundance appears to be extremely small (e.g. Binns *et al.*, 1982) and will probably be very difficult to measure with any man-made detector. Yet, a knowledge of the Cosmic Ray abundance of this group of elements would be extremely important, in view of the very specific character of the process by which they are synthesized (r-process), and of the astrophysical sites where this can take place. A comparison with the actinide abundance in