MINERALOGY AND MATRIX COMPOSITION OF CI CLASTS IN THE CHONDRITIC BRECCIA KAIDUN; M.E. Zolensky[1], R.A. Barrett[2] and A.V. Ivanov[3], [1]Planetary Science Branch, NASA Johnson Space Center, Houston, TX 77058; [2]Lockheed ESCO, 2400 NASA Rd. 1, Houston, TX 77058; [3]Vernadsky Institute of Geochemistry and Analytical Chemistry, USSR Academy of Sciences, 117975, Moscow, USSR.

INTRODUCTION: The Kaidun meteorite is a remarkable breccia containing identified clasts of CI, CR, and two different enstatite chondrites. Although abundant work has been reported on bulk composition, bulk mineralogy, oxygen isotopes, noble gas composition, nuclear tracks and cosmogenic nuclides of various clasts of Kaidun [1-3], the detailed mineralogy of the matrix of the carbonaceous chondrite clasts remains unexplored. We report here preliminary results of examinations of the mineralogy, mineral chemistry and matrix bulk composition of CI clasts from Kaidun. These clasts show unique features not reported from other samples of the CI parent body (or bodies).

PROCEDURES: Three thin sections of Kaidun were examined by standard petrographic and microprobe techniques. Selected matrix grains were then ultramicrotomed and examined with a STEM.

PETROGRAPHY: Kaidun CI clasts consist dominantly of fine-grained brown matrix typical of CI1s, broken by abundant magnetite, sulfides, carbonates and widely dispersed small (generally <10 um) fragments of olivine and pyroxene. A few scattered small aggregates of anhydrous and hydrous minerals are encountered. Larger crystals and aggregates of olivine are found near the periphery of CI clasts, adjacent to CR and enstatite chondrite clasts. These have probably been injected into the CI clasts during aggregation on the parent body. The various CI clasts contain greatly varying amounts of sulfide, olivine and magnetite, which is also reflected in their bulk matrix compositions.

MATRIX BULK COMPOSITION: Figure 1 shows the average bulk compositions of three Kaidun CI clasts plotted on a diagram of S/Si vs. Fe/Si. The spread in compositions of these clasts is consistent with varying Fe-sulfide and serpentine contents. Figure 2a shows average matrix compositions (hollow squares) of three Kaidun CI clasts plotted on a reduced area Fe-Si-Mg atomic wt% ternary diagram. Shown for comparison are the fields we have delineated for average bulk matrix of 20 CM and 5 other CI chondrites. Collectively, the Kaidun CI clast matrix compositions display a great range in Fe content. In this respect their compositions are similar to those of CM chondrites, as noted earlier [1].

PHYLLOSILICATES: The dominant mineral in Kaidun CI clasts is serpentine, as shown by Figure 2b. Here Kaidun serpentine analyses are plotted with the bulk matrix compositions for comparison. These sets of data are nearly identical. Disparate serpentine analyses, with higher relative Si contents, are probably contaminated with saponite. It is interesting that these serpentine analyses are similar to those of the so called "intermediate" serpentine type noted for CM chondrites by Zolensky and co-workers [4]. Individual serpentine grains vary up to 25 um in diameter. In grains of serpentine, a 14A phyllosilicate is also found. In some cases 7A fringes of serpentine can be traced directly into this second phase. Characteristically, this phase has repetitive 4 and 10A fringes. This data and the (crude) compositions we have collected to date are most compatible with a chlorite, either chamosite or ferroan clinochlore.

The second most abundant phyllosilicate found here is saponite. It is generally present as scattered flakes and fibers generally not exceeding 30 nm wide. However, we have found a gargantuan clast of coarse-grained saponite measuring 0.5 by 0.8 mm! This clast appears to be a single crystal (or parallel growth of crystals) of saponite enclosing rounded olivine (Fo90-99) and magnetite crystals. The lineation of this saponite can be traced into parallel dislocations in the olivine crystals, all of which have corroded edges. The edges of this clast grade gradually into the surrounding matrix.

MAGNETITE: The magnetites in the Kaidun CI clasts have the traditional rounded, plaquete and framboid morphologies typical of CI1s. Many of these crystals have minor Ni.

SULFIDES: Pyrrhotite is the most abundant sulfide here, and is ubiquitously present. Most pyrrhotites contain minor Ni, and some actual pentlandite crystals are present. Sulfides range from anhedral grains to euhedral, large crystal plates. This is typical of CIs.

OLIVINE: Matrix olivine crystals vary from Fo59 to Fo100. Pyroxene was also reported in a previous study [1].

CA-MINERALS: Ca-carbonates are abundant in the matrix, and have few impurities. Whitlockite is also present.

DISCUSSION: Kaidun CI clasts share many similarities with other CIs, as outlined above. However, their bulk compositions also show similarities to CMs. In addition, the saponite clast discussed above appears to be

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uniquely coarse-grained. Another apparently unique feature of these clasts is the abundant chlorite in the matrix, associated with serpentine. Geochemical modeling reveals that chlorite is stable under conditions of aqueous alteration proposed for CM and CI chondrite parent bodies. It is interesting that it has not been found in abundance before this. The Kaidun meteorite contains a unique record of chemical and physical processes acting on the chondrite parent bodies. Further work should serve to bring these processes into clearer focus.

REFERENCES: [1] Ivanov et al. (1986) Meteoritika 45, 3-19; [2] Ivanov et al. (1987) Meteoritika 46, 40-44; [3] Ivanov (1989) Geochemistry International 26, 84-91; [4] Zolensky et al. (1991) LPSC XXII, this volume; [5] Zolensky et al. (1989) Icarus 78, 411-425.

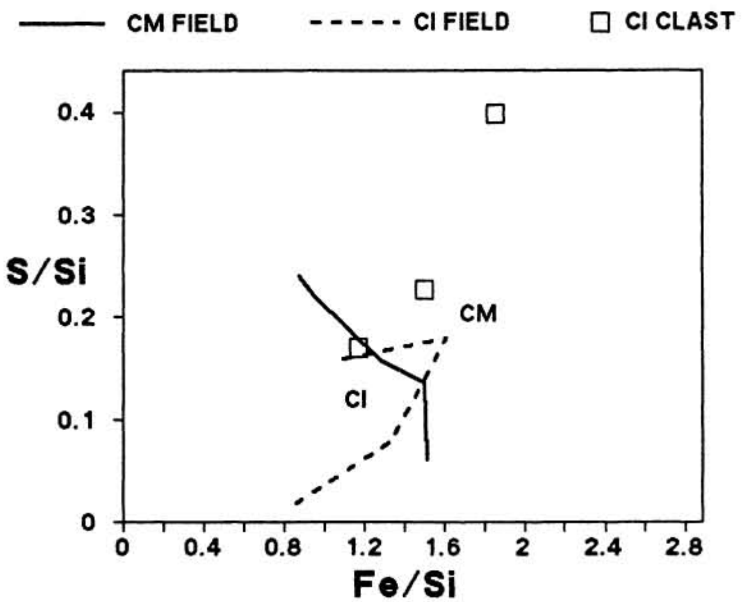

FIGURE 1

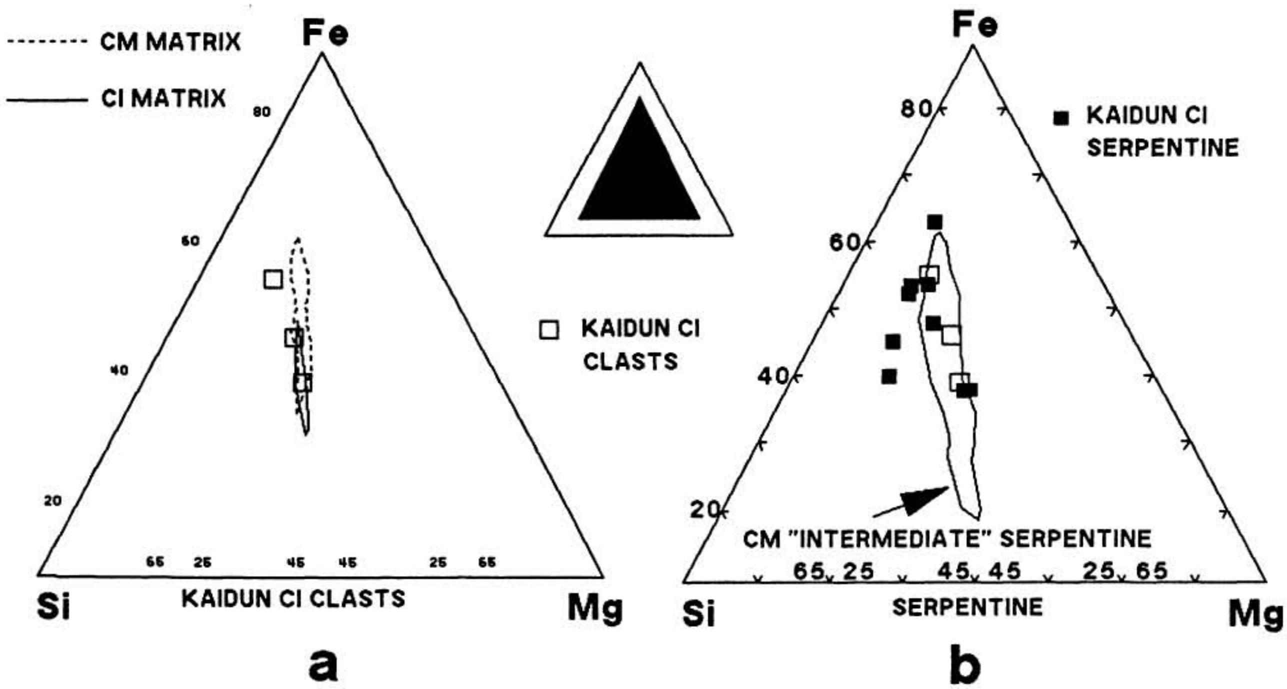

FIGURE 2