composition can be estimated sufficiently well to allow a fairly precise determination of the isotopic composition of Xe from spontaneous fission of $^{248}$Cm. The data also allow two other estimates of the spontaneous fission yields, the first from a small amount of xenon released at 500° C from the aluminum foil enclosing the sample, and the second from a reheating performed following a one-month accumulation of new fission products. After fairly large corrections for incomplete decay of precursors to $^{131}$Xe and $^{132}$Xe, these independent estimates of the spontaneous fission yields are in reasonable agreement with the estimates based on the initial outgassing of the sample, corrected as described for the induced-fission component. The best estimate of the composition of Xe from spontaneous fission of $^{248}$Cm is as follows:

$$^{134}Xe/^{136}Xe = 1.065 \pm 0.015$$
$$^{132}Xe/^{136}Xe = 0.81 \pm 0.03$$
$$^{131}Xe/^{136}Xe = 0.49 \pm 0.06$$

These results are totally inconsistent with any of the various estimates of the CCF composition, as shown in the accompanying figure, implying that if spontaneous fission of $^{248}$Cm contributed at all to the CCF component, the contribution was relatively minor.

## LITHIC FRAGMENTS IN SUPUHEE

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Examination of rough surfaces of the H6 chondrite Supuhee revealed a number of black lithic fragments. In polished thin section, a 0.6 mm fragment was found which contains abundant troilite plates and framboidal magnetite aggregates, like those in C1 and C2 chondrites, set in a fine-grained, opaque matrix. With the broad beam of the electron microprobe and a solid-state detector, bulk chemical analyses were obtained, giving a Si/Mg atomic ratio of 0.93 ± 0.02. This distinguishes the fragment from ordinary and enstatite chondrites having ratios of 1.05 and 1.27, respectively, and shows its similarity to carbonaceous chondrites which have a ratio of 0.95. Using a focused electron beam and solid-state detector, the troilite was found to contain $<0.7$ % Ni. No elements other than Fe were detected in the magnetite. Another phase is present with the following composition: CaO 28.8 to 34.0%, MgO 11.0 to 15.9%, MnO 6.3 to 7.9%, FeO 0.7 to 2.6%, sum 53.4 to 54.7%. The only reasonable anion which, when added in stoichiometric proportion, yields a sum of 100% is carbonate. On this basis, the observed phase has the formula $Ca_{.55}Mg_{.32}Mn_{.10}Fe_{.02}CO_3$, a composition unique among reported meteoritic carbonates. A single olivine grain, $Fa_{46}$, was also found. The presence of oxidized and volatile-rich phases in this clast supports the suggestion of Laul *et al.* (1973) that Supuhee contains a small admixture of late condensates.

Two other fine-grained black clasts containing metallic nickel-iron and troilite were analyzed. While both have bulk Si/Mg atomic ratios of ~ 1.03, similar to ordinary chondrites, one has a total Fe content of 16.3% and the other has a total S content of 6.4%. Their bulk chemical compositions are thus significantly different from each other and from all classes of ordinary chondrites. Supuhee is probably an impact-produced breccia in which fragments of infalling material are preserved.

Laul, J.C., Ganapathy, R., Anders, E., and Morgan, J.W., 1973. Chemical fractionations in meteorites-VI. Accretion temperatures of H-, LL-, and E-chondrites, from abundance of volatile trace elements. *Geochim. Cosmochim. Acta* **36**, 329-357.

## ISOTOPIC ANOMALIES OF NOBLE GAS IN METEORITES AND THEIR ORIGINS: SEPARATED MINERALS FROM ALLENDE

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Eleven mineral fractions from Allende C3 chondrite were analyzed for He, Ne, Ar, Kr, and Xe by mass spectrometry. As shown before (Lewis, Srinivasan and Anders, 1975) most of the heavy noble gases, of unexceptional isotopic composition, are contained in an ill-defined, $HNO_3$-soluble Cr-mineral ("Q"), comprising 0.04% of the meteorite. The remaining noble gases, of decidedly non-solar isotopic composition, are contained in chromite (0.2%) and amorphous carbon (0.2%). They have virtually identical concentrations and isotopic compositions in the two minerals: $^3He/^4He = 1.6 \times 10^{-4}$, $^{20}Ne/^{22}Ne = 8.7$, $^{36}Ar/^{38}Ar = 4.82$. Xenon is enriched up to two-fold in both heavy and light isotopes, while Kr is enriched only in heavy isotopes. Some difference is found in the patterns of light xenon isotope enrichment for chromite and carbon.

The available data suggest that chromite, carbon, and Q, and hence their associated gas components, are of local rather than extra-solar-system origin. The excess heavy Kr and Xe isotopes may have been produced by fission of a superheavy element, while the remaining isotopic anomalies may be due to mass fractionation during trapping. The virtual identity of the noble-gas components of chromite and carbon suggests that both minerals formed simultaneously, perhaps by a reaction such as $Fe + 2\,Cr + 4\,CO \rightarrow FeCr_2O_4 + 4C$.

Lewis, R.S., Srinivasan, B. and Anders, E., 1975. Host phase of a strange xenon component in Allende. *Science* **190**, 1251-1262.