EVIDENCE FOR EXTINCT ^{248}CM IN METEORITES? B. Lavielle[1], K. Marti[1] and P. Pellas[2]; [1]Chem. Dept., B-017, Univ. of Calif., San Diego, La Jolla 92093, [2]Lab. de Mineralogie du Museum, 75005, Paris, France.

The solar system abundance of ^{244}Pu and its use as a meteoritic chronometer have been plagued by the lack of a stable or long-lived reference isotope. Various chemical analogs have been proposed which did not stand the tests of chemical fractionation. The suggestion of Nd as pseudo-Pu isotopes (1,2) appears to offer at least a partial solution. However, some fractionation of the Pu/Nd is indicated in unequilibrated chondrites (3), and ^{244}Pu/Nd chronologies may not be applicable to unequilibrated meteorites. ^{244}Pu chronologies could be further complicated by the presence of fission products, due to extinct ^{248}Cm (4). The Pu story took a new twist, with the report (5) at last year's Lunar and Planetary Science Conference, that the inferred high ratio of ^{244}Pu/Nd in Forest Vale (H4) might actually be due to fission tracts of ^{248}Cm in the phosphates. The evidence is not only based on high track densities in the phosphates merrillite and apatite, but also on excess tracks in contact minerals. Furthermore, the number of "excess" tracks in apatites in contact with merrillite is small, suggesting a source with a short half-life. Although the track evidence appears to be supporting a 0.34 Ma ^{248}Cm source, it is clear that this needs to be confirmed by fission Xe measurements. The fission yields of ^{248}Cm and ^{244}Pu are known (6,7), and the relative ^{134}Xe yields are different for ^{248}Cm and ^{244}Pu. The ~13% difference in the ^{134}Xe/^{136}Xe ratios offers the possibility to isolate the two potential progenitors, if the fission component can be sufficiently enriched, relative to trapped meteoritic Xe (see Fig. 1 for systematics). If the reported track density is due to ^{244}Pu only, a ^{244}Pu/Ne ratio $>3 \times 10^{-4}$ is required. Forest Vale is a type-4.0 chondrite (12.0×10^{-10} cm^{3}STP g^{-1} ^{132}Xe) and is possibly unequilibrated. If ^{248}Cm can be confirmed as existent in the solar system, the implications for early solar system time-scales will be profound.

We have chosen a stepwise approach in this study in order to assess the required amounts of separates, separation techniques of trapped components and extraction temperature steps. Some of the data obtained from bulk Acapulco, from magnetic separates thereof, as well as from a 0.5mg sample of St. Severin phosphates (courtesy R. Lewis), are shown in the figure and are consistent with mixtures of trapped and ^{244}Pu-fission xenon. Bulk samples, as well as size and magnetic separates of Forest Vale, were then analysed in four pyrolysis steps and in an overnight combustion step at 600°C, which allowed the extraction of 20 to 50% of trapped Xe without loss of fission Xe. The signature of this component is discussed in a separate paper (9). Figure 1 indicates the presence of fission gas, but the identification of the progenitors is not possible at this point. A close association of Forest Vale phosphates with the metal phase is observed. Because of the possibly siderophile or chalcophile character of P in the precursor material (3), we think that it is essential to study high-purity separates of the metallic phase, in addition to the phosphates. Trapped Xe in the metal phase is expected to be quite small. Xenon analyses of high-purity metal and phosphate phases are in progress. Preliminary data from a small metal fraction already reveal significant isotopic shifts, due to the presence of fission Xe.

Evidence for Extinct ^{248}Cm in Meteorites?

B. Lavielle, K. Marti and P. Pellas

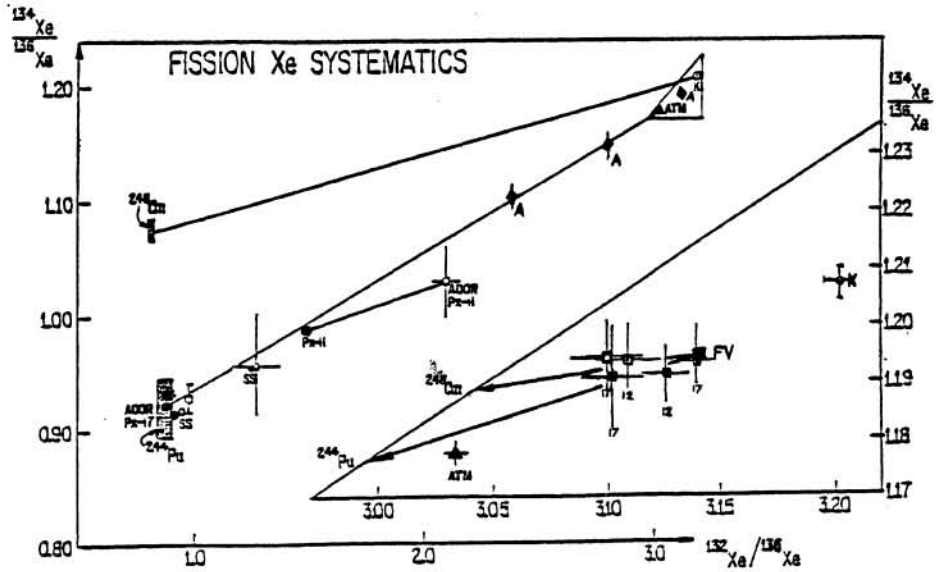

Fig. 1: The ratios $^{134}Xe/^{136}Xe$ and $^{132}Xe/^{136}Xe$ are used to isolate the following constituents of meteoritic Xe: Trapped Xe, ^{244}Pu-fission and ^{248}Cm-fission Xe. Pure fission components are shown by rectangular boxes; trapped components plot inside the triangular box, which is shown on an expanded scale in the inset. The following symbols are used: A = Acapulco data, ADOR = Angra dos Reis, K = Kenna (8), FV = Forest Vale trapped (9), SS = St. Severin data. Filled squares represent Forest Vale bulk sample data, open squares non-magnetic and open square w/dot magnetic separates; temperatures are given in hundreds of °C.

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