KRYPTON AND XENON IN LUNAR FINES, Basford J. R., *Bradley J. G., Dragon J. C. and R. O. Pepin, School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455; and Coscio M. R. and V. R. Murthy, Department of Geology and Geophysics, University of Minnesota, Minneapolis, Minnesota 55455.

Isotopic compositions of trapped surface-correlated krypton and xenon have been determined directly by application of the ordinate-intercept technique to data from grain size separates of < 1 mm fines from the Apollo 11, 14, 15 and Luna 16 sites. Measured Sr and Ba concentrations in individual separates are included in the correlations for all samples except Luna 16. Three-isotope correlations of Kr and Xe data from stepwise heating experiments on Apollo 11 and 12 fines and breccias yield trapped gas isotopic patterns relative to one assumed ratio. Concentrations and isotopic compositions of spallation Kr and Xe, together with effective exposure ages, have been calculated from ordinate-intercept and three-isotope correlations based on data from approximately 100 analyses of lunar fines and breccia samples.

Krypton. Ordinate-intercept measurements on five soil samples, together with three-isotope analysis of stepwise heating and bulk soil data from several additional samples, reveal the following isotopic characteristics of trapped lunar krypton: (a) The isotopic ratios ($^{M}Kr/^{82}Kr$) differ from the corresponding atmospheric krypton ratios by $\lesssim$ 10‰ (1%), for all M. (b) Isotope anomalies relative to atmospheric krypton are not random within the ± 10‰ spread, but tend to fall in coherent linear treads against mass. The most ubiquitous pattern, appearing in four samples, is a roughly linear variation from about +10‰ for ($^{78}Kr/^{82}Kr$) to -10‰ for ($^{86}Kr/^{82}Kr$). Other samples are close to "atmospheric": the composition of Kr in 15531 differs from the composition of terrestrial Kr by $\lesssim$ 1‰ at all masses. (c) None of the samples examined in this study show isotopic patterns similar to those published as the SUCOR[1] and BEOC 12001[2] trapped lunar krypton compositions; it is however at least possible that all observed compositions represent varying

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degrees of mass fractionation of a single initial solar wind reservoir. In addition, in comparing trapped and atmospheric Kr, we observe no apparent systematic perturbation of lunar trapped ^{86}Kr away from the anomaly patterns defined by the other isotopes, as would be the case if excess - presumably fissiogenic - ^{86}Kr were present in the terrestrial atmosphere[2].

Xenon. The average isotopic composition of trapped xenon in these samples is in excellent agreement with previous determinations, except perhaps at ^{126}Xe; the average (^{126}Xe/^{130}Xe) ratio in the present study is ~ 3% lower than the SUCOR and BEOC 12001 values[1,2]. But there are specific and apparently real isotopic deviations from the average pattern in Xe from particular samples which indicate that trapped Xe in lunar fines is not isotopically uniform. Examples include: (a) Fines 14149, from the bottom of the Apollo 14 trench, contains a significant excess of surface-correlated ^{128}Xe; such enrichment could result from neutron irradiation of grain surfaces enriched in impact mobilized iodine. (b) The extreme spread in trapped (^{129}Xe/^{130}Xe) among all samples is ~ 3%, large enough compared to spreads in neighboring ratios to suggest at least the possibility that varying amounts of radiogenic ^{129}Xe may be present. (c) There is a probable excess of surface-correlated ^{134}Xe, and a definite excess of ^{136}Xe, in sample 14149, possibly indicating the presence of fission Xe of the type found in three Apollo 14 breccias[3]. Heavy isotope enrichments are too small ($\lesssim$ 10‰) to permit accurate determination of the isotopic composition of the presumed fissiogenic component using present data. In this context it is interesting to note that ^{244}Pu fission Xe is apparently distributed inhomogeneously in the Apollo 14 breccias: a Minneapolis analysis of 14313, which is reported to contain the largest concentration of this component[3], showed no detectable enrichment of the heavy Xe isotopes.

References.

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