He, Ne AND Ar IN LUNAR SOIL MINERAL SEPARATES, D. Phinney, H. Baur, U. Frick, H. Funk, L. Schultz and P. Signer, Swiss Federal Institute of Technology, 8006 Zurich, Switzerland.

We have measured He, Ne, and Ar abundances and isotopic compositions in grain-size fractions of mineral separates from the soil 15421. The separates are: feldspars, green glasses, and a ferromagnesian mineral fraction which is labeled as olivine. The green glasses can be further subdivided into (i) clear green spherules, (ii) "milky" green rounded particles, and (iii) broken fragments of (i) and (ii).

Gas concentrations occur in the following order (highest to lowest): olivine, feldspar, clear green spherules, and milky green glasses.

Grain-size fractions of feldspar and of clear green spherules show smooth anticorrelations of gas content with grain size. The feldspar Ne pattern, moreover, exhibits the presence of a volume-correlated component in the manner discussed by Eberhardt et al. (1)

Olivine gas amounts also correlate with grain size but less smoothly. This is the result of variable amounts of devitrified glass in the olivine fractions. The milky green glasses, for which analyses of all grain sizes are not yet complete, have about a factor of 2 less trapped gases than the green spherules and give evidence of only a weak anticorrelation with grain size.

Phinney et al. (2) reported from preliminary results that each of the mineral fractions above has an elemental ratio "signature" expressed in terms of 4-He/20-Ne and 36-Ar/20-Ne ratios. Our present, more complete results substantiate this finding. Phinney et al. (2) further suggested that variations of the elemental ratios of He, Ne, and Ar in bulk lunar soils are generated by variable mixtures of soil constituents with different elemental ratio signatures (i.e., modal composition differences). It has come to our attention that a similar interpretation has been proposed by Heymann et al. (3) on the basis of bulk soil rare gas data.

Hintenberger and Weber (4) have recently discussed rare gas elemental ratio vs. TiO_2 correlations in lunar soils. Our work indicates that the same degree of correlation can be had by plotting elemental ratios vs. feldspar content, where the feldspar content includes the contribution from feldspar in soil breccia particles.

Among the isotopic ratio results, Ne in the green glasses and feldspars deserves special mention. Figure 1 summarizes our findings. The green glasses demonstrate simple 2-component behavior, the two components being solar and cosmogenic Ne.

Feldspar Ne shows 3-component behavior. From isotope intercept plots, one component emerges as a surface-correlated Ne with solar-like composition. Residual extractions (in connection with our diffusion studies on these minerals) indicate that cosmogenic Ne is also present. A third component (20/22<12, 21/22<0.15) is, however, necessary to explain the observations. Phinney et al. (2) reviewed some of the possibilities for the source of this third composition and a further evaluation of these alternatives is in progress.

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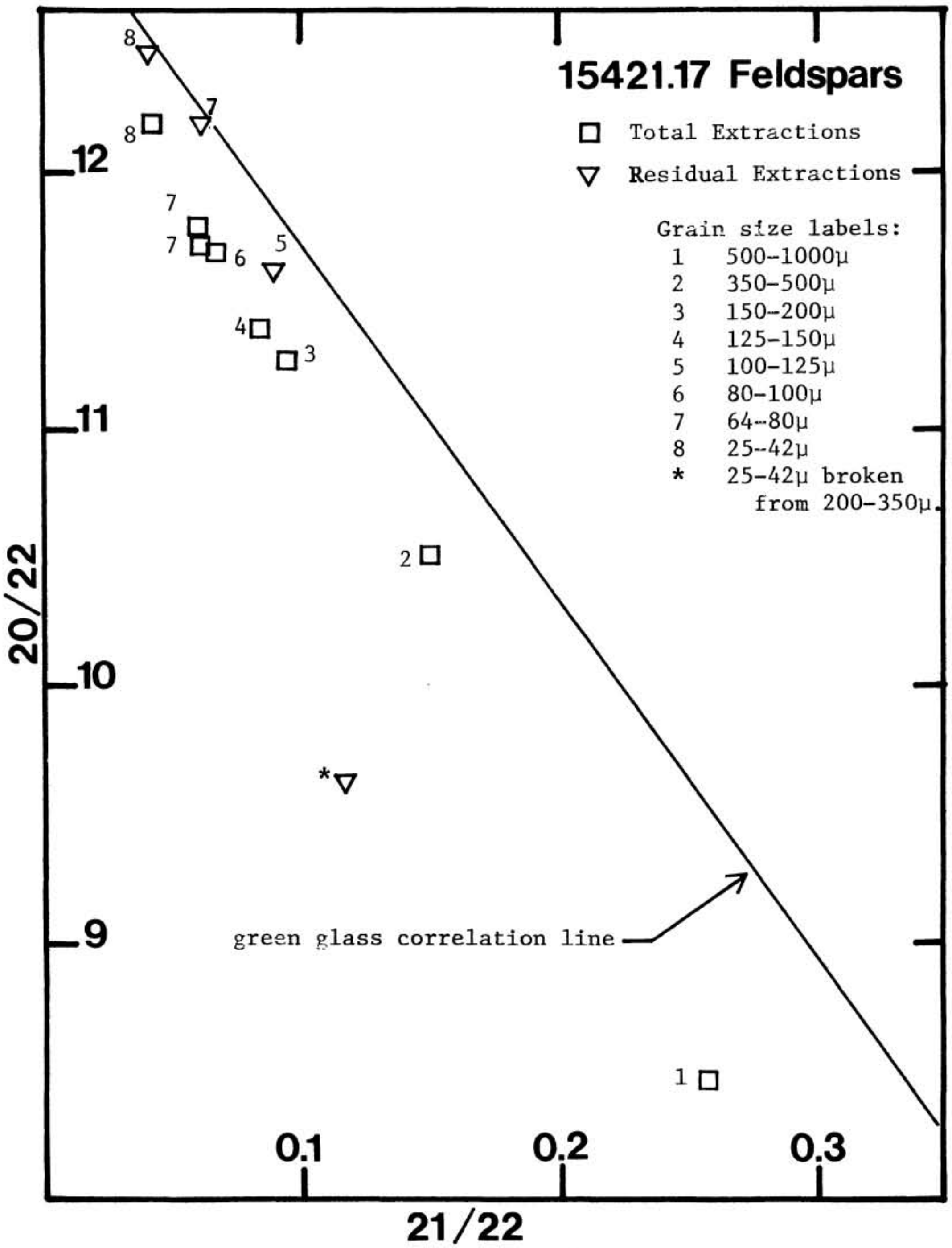

Figure 1. Ne isotope correlation diagram (error bars not shown). Residual extractions are melt extractions of samples heated to 900° C in linear heating experiments.