INERT GAS SYSTEMATICS OF FINES AT THE APOLLO-17 LANDING SITE: LOCALIZED REGOLITH DEPOSITS AT APOLLO 15, 16, AND 17. J.L. Jordan and D. Heymann. Departments of Geology and Space Physics, Rice University, Houston, Texas, 77001.

Inert gases have been measured in bulk samples and sieve fractions of 20 A-17 fines and in handpicked separates of 75121. The samples come from Stas.: 1, 2, 2A, 4, 5, 8, 9, LRV-2, 3, 7, and 11.

Trapped gases. (Ar-36 reference gas). The regolith at A-17 is rich in trapped inert gases, with Ar-36 contents ranging from 1500 to 62,000 P. (1). The most striking "peculiarity" occurs at Sta. 4 (Shorty) where the orange soil and its associated grey soils (424, 426; these digits stand for 74241, etc.) are relatively gas-poor. Only one other soil, 850(Sta.8) contains less than 20,000 P. of Ar-36. Strikingly high values occur at the top of the trench of Sta.9 (Van Serg), ~60,000 P., and at LRV-2 and 3 (soils 214, 216 with ~50,000 P). In fact, 214 and 216, which were collected within ~500 m during EVA-2 are quite similar in several respects. Soils from the light mantle (Stas. 2 + 2A) are only slightly poorer in trapped gases than soils from the central part of the landing site.

The geochemistry of the soils shows up clearly in the trapped He-4/Ne-20 ratios. Plagioclase-rich; Fe,Ti-poor soils from the avalanche at Stas.2 + 2A have values < 50, whereas the Fe, Ti-rich soils from the central part of the site have ratios generally >60. Particularly large ratios >90 occur at Stas. 1 + 4. At LRV-2 + 3 the ratios are intermediate (59,64). Apparently, the soils here (and at Sta.9 and LRV-11) contain substantial proportions of massiv- as well as of valley-derived materials. Soil 850 (Sta.8), however, resembles Sta.2 soils, and is therefore probably mainly derived from massiv materials (i.e. North Massiv and/or Sculptured Hills).

Ar-40/Ar-36 ratios vary from 0.7 to >10. Again the most striking peculiarity occurs at Sta.4 where the orange and grey soils from the trench have exceptionally large values of ~ 7 or greater.

Cosmogenic Ne-21. The cosmic-ray exposure record of a soil can only be related to a lunar "event" or "feature" if the whole soil had become exposed at the time of the event, and had remained unmixed ever since. Such is rarely the case on the Moon, hence cosmogenic Ne-21 contents reveal, at best, the localized absence of new or ancient materials. The average Ne-21 content of the site is ~ 40 P., which corresponds roughly to an exposure of ~ 200 myr near the surface. The most striking peculiarity in the Ne-21 record occurs at Sta.9 (Van Serg), where high values show up clearly. Relatively low values are prevalent at Stas.2 + 2A on the avalanche, and at Sta. 1. None of the five separates from soil 512 (LRV-7): plagioclase, basalt, breccia, agglutinate, dark
materials show the high Ne-21 contents seen at Sta. 9.

Summary conclusions. The A-17 site is much more complex than A-16, where most soils fall in one of three major groups. The "oldest" regolith (in the sense of having been on or near the surface) seems to occur in the eastern part of the landing site, especially in the ejecta blanket of Van Serg crater, where relatively high Ar-36 contents, Ar-40/Ar-36, and cosmogenic Ne-21 contents occur. This is consistent with the conclusions of Muehlberger et al. (2).

Judging from the soil at Sta.1, where Ar-40/Ar-36 and Ne-21 are relatively low, the central cluster is characterized by a relatively young ejecta blanket, but with only one datum, the conclusion cannot be firm.

The avalanche at the base of South Massiv is characterized by relatively low Ne-21 values. The most likely explanation is either that the avalanche is relatively young, or that repeated landslides have diluted the regolith at Stas.2 + 2A with unirradiated or relatively briefly irradiated material at a relatively rapid rate. Soils now at the surface are, however, "mature" in terms of their Ar-36 contents.

The unique soils (424,426) seen at Sta.4 (a very high Ar-40 /Ar-36, relatively low Ar-36 content) are not present in great abundance at the three closest localities from which we have samples: LRV-2, 3, and 7. These, however, are not on the continuous ejecta blanket of Shorty Crater. Some of this peculiar material may be present at LRV-7 (Ar-40/Ar-36 = 2.0) and at Camelot (2.8), but soils from sizeable deposits, rich in this material are not known to occur elsewhere at A-17.

It is noteworthy that the regolith at the three best-studied sites shows strongly localized "peculiar surface soils" at or near the rims of what are, or appear to be, relatively young craters (Table). These soils were recognized by the astronauts because of some unique visible characteristics (e.g. green glass, very high albedo, orange glass). In each case, the soils show the largest trapped Ar-40/Ar-36 ratios of the whole site. They are generally poor in trapped gases. The deep drill cores at the three sites do not seem to contain substantial units, if any, consisting of the respective "peculiar soils". From these observations and from the known formation ages of orange and green glasses, we surmise that the regolith at all three landing sites still contains "strongly localized deposits" (horizons, pockets, lenses) at some depth, consisting of materials that were laid down during the "infancy" of the regolith at each site; that these deposits were buried quite soon after their formation; and that significant "blobs" of such deposits have survived deep turnover for very long periods of time. Maybe such deposits, known or unknown, have been the regional sources for unique leads Zn, halogens, and other volatiles.
INERT GASES AT A-17: LOCALIZED DEPOSITS

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(1) P stands for "Paneth", a unit of gas content equal to $10^{-8} \text{cm}^3 \text{STP}/g$.


<table>
<thead>
<tr>
<th>Site</th>
<th>Crater(s)</th>
<th>Soils recognized for:</th>
<th>Ar$<em>{40}$/Ar$</em>{36}$ systematics</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-15</td>
<td>Spur</td>
<td>Green glass</td>
<td>1.6 ~ 8 in green glass-rich material; 0.7 ~ 1.3 elsewhere.</td>
</tr>
<tr>
<td>A-16</td>
<td>Flag/Plum/Buster</td>
<td>High to very high albedo</td>
<td>2.5 ~ 4 in light soils; 0.39 ~ 1.8 elsewhere.</td>
</tr>
<tr>
<td>A-17</td>
<td>Shorty</td>
<td>Orange glass</td>
<td>~ 7 or greater; 0.7 ~ 2.8 elsewhere.</td>
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