DEPOSITIONAL AND IRRADIATIONAL HISTORY OF THE 15008 CORE.

D.D. Bogard, Geochemistry Branch, NASA Johnson Space Center, Houston, TX; R.V. Morris, NASA-JSC, Houston, TX; P. Johnson, Northrop Services, Inc., NASA-JSC, Houston, TX; and H.V. Lauer, Jr., Lockheed, 1830 NASA Road 1, Houston, TX.

The 15008/7 double drive tube is an ∿ 58 cm section of the lunar regolith taken on the rim crest of an ∿ 10 m diameter, relatively fresh crater which lies on the lower slope of the Apennine Front near the edge of Hadley Rille at the Apollo 15 site. The 15008 section is described in (1), and the 15007 section is described in (2). At this time only 15008, the uppermost 23.1 cm section of the core, has been allocated and studied in detail. Various cratering models predict that ejecta in the rim crest of the ∿ 10 m crater should be 10 to 35 cm thick (1). Some questions concerning the 15008/7 double drive core are what portion represents recent crater ejecta, is any stratigraphy preserved in this ejecta, what portion of the core represents pre-cratering regolith, and what was its depositional and irradiational history? Based on his dissection studies, Nagle (1) described five units in 15008. The four units from 0 to 17.5 cm depth contain soils which are generally lighter in color, coarser with abundant soil clasts, and more chaotically mixed compared to deeper soils. Nagle (1) concluded that the rim crest ejecta was 17.5 cm thick at this point and that no well-defined lithologic succession was sampled.

The core consortium led by D. McKay recieved six soils from 15008, and each of these were sieved into eight grain size fractions. Grain-size and petrographic data are reported in (3); chemical data are reported in (4); selected noble gas data are reported here. In addition, soils at 0.5 cm intervals from the first dissection layer of 15008 were measured for total iron content and maturity in terms of the FMR index I_s/FeO.

Figure 1 shows FeO and I_s/FeO as a function of 15008 core depth. The FeO concentrations vary only slightly about a mean value of ∿ 12%. Concentrations of several other elements also show little variation among the < 20 μm and 90-150 μm sizes of the six sieved soils (4). The soil surface maturity index, I_s/FeO, shows some systematic oscillation between submature and mature soils and has an average value of ∿ 60. For comparison, the uppermost 23 cm of the 15010/11 core and the 15006-15001 deep drill core showed average I_s/FeO values of ∿ 42 and ∿ 75, respectively. The I_s/FeO data near the core surface shows only little if any evidence of an <u>in situ</u> profile due to impact reworking of the soil. The 15010/11 core also showed no reworking profile. This suggests that the ∿ 10 m crater adjacent to the 15008/7 core formed more recently than ∿ 10-20 My ago, or that removal of rim material into the crater or down the Appenine Front has been a significant and continuous process. The I_s/FeO profile measured upward from 17.5 cm similarly does not show a significant surface reworking profile preserved in an overturned ejecta. There is some suggestion that inflection points in the I_s/FeO profile roughly coincide with boundaries between the five core units identified by (1), e.g., at ∿ 6, ∿ 10, and ∿ 18 cm. Alternatively, the entire I_s/FeO profile may be the result of random mixing of soils.

Figure 2 presents concentrations of cosmic ray-produced ^{3}He, ^{21}Ne, and ^{38}Ar (in 10^{-8} cm^3 STP/g), concentrations of cosmogenic ^{126}Xe (10^{-10} cm^3 STP/g), and the cosmogenic ^{131}Xe/^{126}Xe ratio as a function of core depth. Cosmogenic ^{3}He, ^{21}Ne, and ^{38}Ar were obtained by ordinate-intercept plots of analyses of < 20, 150-250, and 250-500 μm grain sizes. Cosmogenic ^{126}Xe and ^{126}Xe/^{131}Xe were calculated by assuming the composition of the trapped component to be that given in (5). The ^{38}Ar values have large uncertainties because only ∿ 2-4% of the measured ^{38}Ar in coarser size fractions was cosmogenic in origin. In general, ^{3}He, ^{21}Ne, and ^{38}Ar, and ^{126}Xe correlate well with one another in the

six soils. These depth profiles are not those expected by a single stage irradiation of the core. All of the six soils have experienced ∿ 300 My or more of cosmic ray irradiation, and most of this irradiation must predate the ∿ 10 m crater event. The $^{131}Xe/^{126}Xe$ ratio is indicative of average irradiation depth and for typical mare soils is expected to increase with depth (6). The $^{131}Xe/^{126}Xe$ ratios in Figure 2 suggest average irradiation depths of ∿ 30-80 cm. The approximate anti-correlation between $^{131}Xe/^{126}Xe$ and cosmogenic ^{38}Ar and ^{21}Ne would be expected if irradiation primarily occurred at depths greater than ∿ 20 cm.

Apparent inflections in the depth profiles of the cosmogenic data are roughly consistent with observed inflections in I_s/FeO and with zone boundaries at ∿ 6 and 18 cm depth (1). There also is a significant increase in agglutinate content of the 90-150 μm fraction below ∿ 18 cm depth (3). Each core zone may contain a preserved portion of an irradiation profile. However, it seems more likely that the depth profiles of both figures are due to random mixing of soils, possibly even predating the ∿ 10 m crater. If so, this suggests that the core site has had a long and active history of soil deposition and removal. The data reported here, by themselves, do not determine the thickness of ejecta from the ∿ 10 m crater at the core site. Further interpretations should await analyses of soils from 15007.

References:
(1) Nagle, J. Stewart (1980) Proc. Lunar and Planet. Sci. Conf. 11th, in press.
(2) Nagle, J. Stewart (1981) This volume.
(3) Basu, A. and McKay, D. (1981) This volume.
(4) Blanchard, D. (1981) This volume.
(5) Eberhardt, P., Geiss, J., Graf, H., Grogler, M., Mendia, M., Morgeli, M., Schwaller, H., and Stettler, A. (1972) Proc. Lunar Sci. Conf. 3rd, 1821-1856.
(6) Hohenberg, C.M., Marti, K., Podosek, F.A., Reedy, R.C., and Shirck, J.R. (1978) Proc. Lunar and Planet. Sci. Conf. 9th, 2311-2344.

DEPOSITIONAL AND IRRADIATIONAL HISTORY OF THE 15008 CORE

D. D. Bogard et al.