
After milling, the Apollo 16 drill core segment 60003 broke into two "halves" revealing intricately laminated and marbled regions of light and dark lithologies. While one half was dissected in the standard manner, 95 small samples were taken at JSC from the other half with special techniques. Care was taken to remove the purest possible samples of the distinctive lithologies. Splits have been allocated from each parent for inert gas, magnetic, and track studies. We report here preliminary results and conclusions from our inert-gas study in 52 of these samples.

Fig. 1 shows certain of our results together with magnetic results from Housley(1) as a function of depth from the top of the segment. The two laminated zones, stratigraphic units 27 and 23, are of principal interest. In particular we have examined possible relations between the light lithologies of unit 27 and soils of the massive unit 28. Two models have been discussed for relationships such as seen at the interface of units 27 and 28.

A. The "drips and drabs" model envisions a slow accumulation of the thin strata in unit 27 due to small, local events. Unit 28 was deposited on top by a larger, more distant event without measurably mixing with the soils at the top of unit 27.

B. Alternatively one may suppose that unit 28 was laid upon a surface, probably in unit 26, in a single event so that turbulence at the interface causes the darker soil of unit 26 and the lighter soil of unit 28 to be swirled together forming marbled unit 27.

All isotopic and elemental ratios of He, Ne, and Ar (except for those involving Ar-40) indicate that unit 27 is quite homogeneous and uniform, independent of soil color, which is consistent with model A. The light/dark marbling could have resulted from in-place maturation of the thin strata after deposition(2), without altering the inert-gas relationships. However, Ar-40/Ar-36 shows a clear-cut gradient across unit 27. Inasmuch as unit 27 represents a time sequence in this model, one might assume an increase of about 25% of Ar-40 in the lunar atmosphere during the period of deposition of unit 27. Little is known about the vagaries of atmospheric Ar-40. It has been suggested that the 40/36 ratio may decrease as a result of maturation(3). In unit 27 there is no systematic difference of the ratio from light to dark lithologies. The only systematic difference is in gas concentrations (see figure). The light soils are systematically more gas-rich than the dark soils, which suggests that the light soils have either been exposed to solar wind longer (unlikely) or are finer, i.e. have larger specific surface areas. Model A, in its simple form, obviously cannot be correct;
some soil mixing seems to be required. Grain size variations may also explain the curious similarity of wt.% FeO of light and dark despite their supposed differences in maturity.

Model B can account for the marbling of unit 27 and the Ar-40/Ar-36 gradient in a straightforward way. However, the following observations speak against model B. The Ne-20/Ar-36 (Fig. 1) and Ar-36/Ar-38 ratios (not shown) argue strongly against this model. The absolute gas contents of (light) samples from unit 28 are systematically smaller than those of light lithologies in unit 27. On the other hand, the magnetic data of Gose and Morris (4) are consistent with model B. Unfortunately, magnetic data are available for only two dissection samples in unit 27, which, given the complex nature of this unit, may be inadequate.

In summary, we feel that our inert gas data agree better with the model of slow deposition of unit 27 by "drips and drabs" rather than by a turbulent single event. We cannot make such a categorical statement for unit 23 because of a lack of samples from the portion of the core immediately above this unit. However, the inert gas relationships in unit 23 are very similar to those in unit 27 with one exception. There is no Ar-40/Ar-36 gradient in unit 23, which was the strongest argument in favor of model B for unit 27. We tentatively conclude that model A is better for unit 23 also. We wish to point out in closing that, inert-gas-wise, segment 60003 is much more monotonous than segment 60002. Complete data of our measurements of the 52 special samples from 60003 are available at the conference upon request.

STRATIGRAPHY IN 60003

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Figure I, a-d

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