

ABSENCE OF PORPHYRINS IN APOLLO 12 LUNAR SAMPLES

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The lunar returned sample (LRS) studied was made up by pooling samples 12023,17 (10.7311 gm) and 12023,18 (4.1689 gm). This sample was collected in a Lunar Environment Sample Container (LESC) from a trench 20 cm deep at a location 440 m from the lunar module (MSC-01512, Lunar Sample Information Catalog for Apollo 12, page 33, January 13, 1970).

The pooled sample was Soxhlet extracted for 24 hours sequentially with benzene-methanol (9:1, by volume) and with methanol. Each extract was examined separately for fluorescent residues as with the Apollo 11 sample. Parallel experiments were carried out on an equivalent weight of Ottawa sand which had been similarly exposed to the environment of vacuum chamber F-201 at the LRL. A second blank experiment was carried out on a 200-mesh sample of optical quartz in order to check the purity of the solvents used.

In each case, the extracts were taken to dryness, and taken up in a benzene water two-phase partition system in order to remove fluorescence quenching impurities such as ferric ion from the benzene phase. The benzene portion was treated with methane sulfonic acid to demetallate any porphyrins which might be present and partitioned with aqueous phase again after neutralizing the methane sulfonic acid, with saturated sodium acetate. After discarding the aqueous phase the benzene fraction was washed with 6 N HCl in order to extract any demetallated porphyrin which might be present in the

benzene fraction. In this system one would find free base porphyrins in the first benzene phase and demetallated porphyrins in the HCl phase.

The organic solvent phases of both the LRS and sand blank extracts showed strong absorption peaks at 225, 275 and 380 nm. The sand blank aqueous phase differed insignificantly from that of the LRS, with absorption peaks at 235, 275 and 370 nm.

Fluorescence examination of the LRS benzene phase showed the presence of species fluorescing at 365 to 380 nm when activated at 300 nm. This peak was also found in equivalent intensity in the sand blank benzene phase. The corresponding aqueous phases showed fluorescence at 415 nm when activated at 330 to 340 nm for both the LRS and the sand blank.

No fluorescence which might be attributed to the presence of porphyrins was found in any extract of the LRS. Porphyrins, either indigenous or contaminant, would have been detected had they been present in the amount of 10^{-14} moles per 15 gms. Indeed no fluorescence attributable to any organic material was found in the LRS in an amount greater than that found in LRL sand blank.

These findings suggest that both the sand monitor and the LRS were contaminated by the same classes of compounds, probably aromatic hydrocarbons. A rough order-of-magnitude estimates of the amount present would be 5-10 μg in each sample extracted (0.3-0.7 $\mu\text{g}/\text{gm}$).