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Agreement Reached on Luna 24 Samples

A contingent including M. Duke, C. Simonds, and G. Wasserburg spent three days in Moscow, December 12-15, to arrange for the transfer of Luna 24 samples to the United States. Agreement was reached that the Russians would provide seven samples, including six soils representing distinctive stratigraphic intervals spaced along the length of the core, plus a sample of what appears to be a uniform layer of crushed gabbroic rock that may represent either a rock fragment crushed by the drill, or a uniform ejecta layer similar to the layer observed in the Apollo 12 drive tube.

The samples were obtained with a rotary drill which could be driven alternately by percussion if the core became lodged. The material flowed through the bit, which was 8 mm in diameter, into a plastic liner that was slightly wider. When drilling was complete, the liner was extracted from the drill by pulling on a series of strips attached to the inside of the liner along its length. The liner, which was flexible, was wound onto a drum on a spiral track, similar to winding a line onto a fishing reel. This device was inserted into a vacuum-sealed cannister for return to the Earth.

On opening in the laboratory, it was found that the upper 50-60 cm of the liner was empty. The total weight of material returned is 170 grams. The Russians tentatively have identified approximately 20 horizons on the basis of soil color, granularity, etc. The uppermost portion of the core may be relatively more disturbed than the lower. At the top of the core, a concentration of millimeter-sized fragments of soil breccia and agglutinaceous material occur, apparently devoid of fines. The explanation for this is unclear. In the lower portion of the core, some very sharply defined boundaries exist. At 170 cm, a uniform layer of crushed gabbroic rock, 2 cm thick, with sharp boundaries both above and below, is conspicuously lighter than the soil. The actual depth represented by any given layer must be considered undetermined at this point. The Russians plan to give a presentation of the core stratigraphy at the 8th Lunar Science Conference in March.

The Russians have preliminary chemical and petrographic data, which they will present at the Conference. There were few data other than their stratigraphic observations on which to base a sample selection. The size distribution is uncertain, although the material appears to be relatively coarse-grained in some horizons. The Russians have not plucked larger fragments from the core for study. The material appears to be largely mare-type material, including basalts and gabbroic rocks, but the abundance of fine-grained basalts may be lower than at other mare sites.

We attempted to select samples for transfer to the United States that we believed would allow the basic petrology, chemistry, and possibly the age of volcanism in Mare Crisium to be determined. This became translated, through negotiations with the Russians, into the following selection of samples.

Sample	(Depth)	Weight	Description
#1	77 cm	0.5 gm	Soil, close to top of soil retained in core.
#2	110 cm	0.5 gm	Soil, from broad undifferentiated upper unit.
#3	150 cm	0.5 gm	Soil
#4	173 cm	0.5 gm	Dark soil, from above sharp contact.
#5	182 cm	0.5 gm	Soil, distinctly lighter than unit above.
#6	210 cm	0.3 gm	Soil, dark.
#7	170 cm	0.2 gm	Crushed gabbroic fragment.

Two of these samples (#1 and #7).were returned by the U.S. delegation to Moscow; the rest will be presented to the U.S. at the time of the 8th Lunar Science Conference.

In order to begin work expeditiously on these samples, we would like to be able to formulate an allocation plan with the Lunar Sample Analysis Planning Team at their meeting in late January. To do this we ask that sample requests be submitted by PI's by January 25, 1977. At the end of January, we will determine the precise manner in which the samples will be handled in Houston. In the past, we have sieved the Luna samples at 125 μm and 500 μm to extract size fractions for study and especially to concentrate coarser material. This is likely to be done again with these samples. The mode of distribution, of consolidation of investigators into consortia, of subdivision of experiments by sample type (i.e., basalts, breccias, glasses, etc.) has not been determined.

We feel that it is unlikely that the Russians will provide supplementary information on the samples we are receiving, as they are concentrating their effort on a selected set of samples that do not overlap ours. We do not intend to carry out a preliminary analysis at JSC, beyond binocular microscope descriptions of the coarser sieve sizes. It is probable that all thin sections will be prepared at JSC and distributed according to the approved allocation plan. Although investigators may wish to withhold requests until some additional preliminary information is available, a major portion of each sample is likely to be distributed in the initial allocation.

The Russians have been bery cooperative throughout the negotiations of the sample transfer They have indicated strongly their interest in further cooperation. They intend to send a strong delegation to the Lunar Science Conference. They also have indicated an interest in translating and publishing in Russian the collected works of U.S. investigators on Luna 24 material. We expect to coordinate a joint publication of the Luna 24 data, and possibly a meeting for the presentation of the results, with papers being due around October 1977.

The deadline for receiving requests for Russian samples and any other sample requests is JANUARY 25, 1977.

GEOLOGY OF THE LUNA 24 LANDING SITE

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ABSTRACT:

On August 18, 1976, Luna 24 landed on the southeast edge of Mare Crisium at 62°12'E and 12°45'N, drilled, and returned a 2 meter core to Earth (1). The landing site is on the downthrown side of the fault and ridge complex that separates the inner mare from the raised mare shelf (2, 3).

The predominant components of the sample should be basalts, mostly low in Ti and K/U/Th, according to telescopic and orbital data (4, 5). Contributions of terra materials is likely from the highlands 35 km away. Possibly there also may be terra material from Giordana Bruno, 1200 km away on the lunar farside (6), because secondaries that are part of one of its rays are present at the landing site.

Basalts of a range in age may have been exposed by faulting. Although most of the elevation difference (200 to 500 meters) between the mare shelf and the inner mare surfaces must have occurred after the mare-filling, deeper burial of a radar-reflecting layer beneath the inner mare (7) suggests volcanic activity overlapped the faulting at least to some extent. The faults served as channels for lavas, of which the more viscous ones formed sharp mare ridges in the faulted area.

Two patches of dark mantle material 16 km from the Luna 24 site are suggestive of pyroclastic deposits like the orange and black soils of Apollo 17.

References:

(1) Aviation Week and Space Technology, Aug. 30, 1976, p. 22.

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(3) Elachi et al. (1975) The Moon, No. 15, 119.

(4) Pieters et al. (1976) Geophys. Res. Letters 3, 697.

(5) Metzger, A.E., et al. (1973) Science 179, 800.

(6) Hartung, J.B. (1976) Meteoritics 11, 187.

(7) May et al. (1976) Lunar Science 7, 540.