RADIOACTIVITY AND MORPHOLOGY OF LUNA 24 SAMPLES.

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Cosmic ray induced ^{26}Al and natural ^{232}Th have been measured in the 87 cm layer taken from the Luna 24 core. In addition grains from six 1cm thick strata taken from 87,123,148,163,179 and 190 cms have been examined under a scanning electron microscope for their morphology and chemistry. For a comparative study grains from Luna 16 and 20 samples have also been examined. The preliminary results are presented here.

24087, a sample taken from 86-87 cm depth of the Luna 24 core has been analysed for ^{26}Al and ^{208}Tl. The measurement was performed by direct counting of 162 mg sample on a β-γ coincidence spectrometer following the technique described earlier(3). The counting details and results are given in Table 1 for 24087 and Apollo 16 scoop 67481. The positron(.511 MeV) peak, after due correction for U,Th daughter products, is attributed to (^{26}Al + ^{22}Na) whereas .580 MeV peak is due to ^{208}Tl, the daughter product of ^{232}Th. Since Apollo 16 soil was collected 5 years ago, the ^{22}Na contribution to the positron peak is mostly (96%) due to ^{26}Al, whereas in Luna 24 collected on 18th August, 1976, the ^{22}Na contribution to positron peak is about 11% if the following compositions are assumed : Apollo 16: Mg = 3.9%, Al = 13.9%, Na = 0.32%, Si = 21.2%; Luna 24: Mg = 6.25%, Al = 8%, Na= 0.25%, Si = 19.7%. The Apollo 16 composition was taken from an analysis of similar soils, whereas Luna 24 is somewhat arbitrary and based on available descriptions of the sample(1). The chemical analysis is in progress and actual composition should shortly become available. Using these compositions and solar and galactic cosmic ray fluxes, given by Bhandari et al(3) and Reedy and Arnold(5) respectively, we have calculated the depth profile of ^{26}Al and ^{22}Na. Figure 1 shows (^{26}Al + ^{22}Na) as expected at the (mean) time of counting. The observed activity is also shown in this figure. Although the statistical errors so far are large, they lead to the inference that the average depth on lunar surface was 3 ± 1.5 cms for the scoop sample 67481 and >35 cms for 24087, assuming the core density of 1.8 g cm^{-2}. Since the upper 60 cms of the Luna 24 core was empty(2), the actual depth of the core on the moon is debatable. The 86-87 cm strata could either refer to about 26-27 cms on the moon if the soil top in the core is the lunar top or 87 cm if the upper 60 cms of the lunar top is not contained in the tube. Our results indicate that atleast the upper 12 cm has been lost. ^{232}Th in this soil is estimated to be $1.5\pm.4$ ppm.

Other studies in the core relate to morphological and chemical studies using SEM and X-ray techniques. For a comparative study we have also examined Luna 16 and 20 soils. In Luna 20 we

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TABLE-1 : COUNTING DATA

Soil	Depth (cms)	Sample weight (mg)	Deposited area (cm^2)	Total counting time (Minutes)	GROSS COUNTS CPT 0.511 MeV	GROSS COUNTS CPT 0.580 MeV	$^{26}Al + ^{22}Na$ Net CPT	$^{26}Al + ^{22}Na$ dpm/kg
24087,1	86-87 In core	162	2.35	30,056	4.2±0.4	2.1±0.3	0.59±0.48	57±45
67481,7	Scoop	228	2.35	8,870	6.2±0.8	1.6±0.4	3.1±0.95	245±75
BACKGROUND	-	-	5.25	15,840	2.3±0.3	0.9±0.2	-	-

CPT = Counts per thousand minutes.

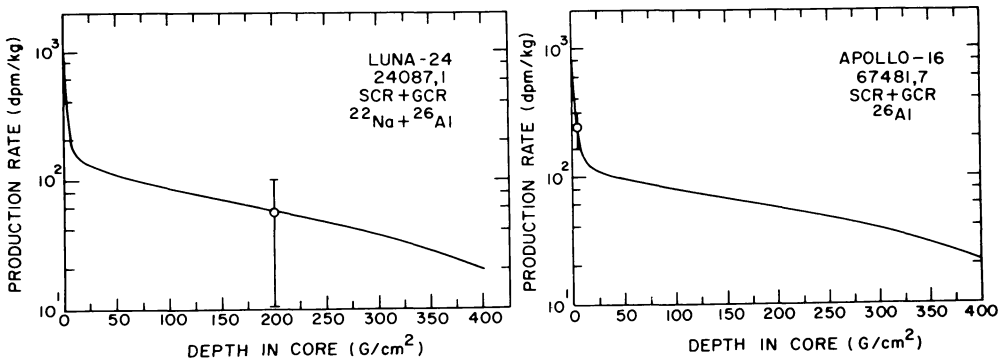

Fig. 1

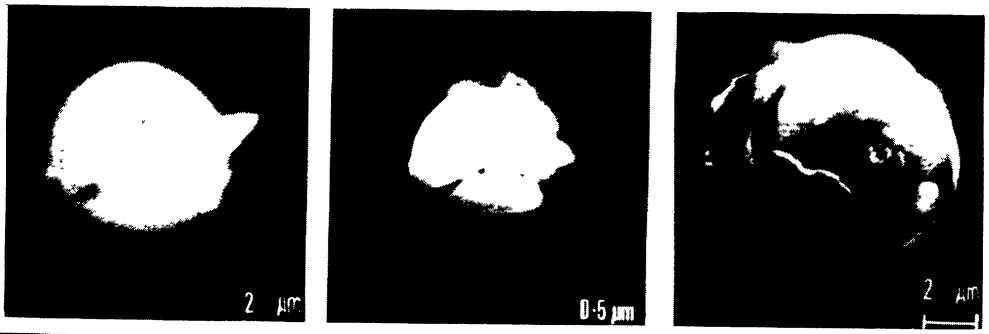

Fig. 2

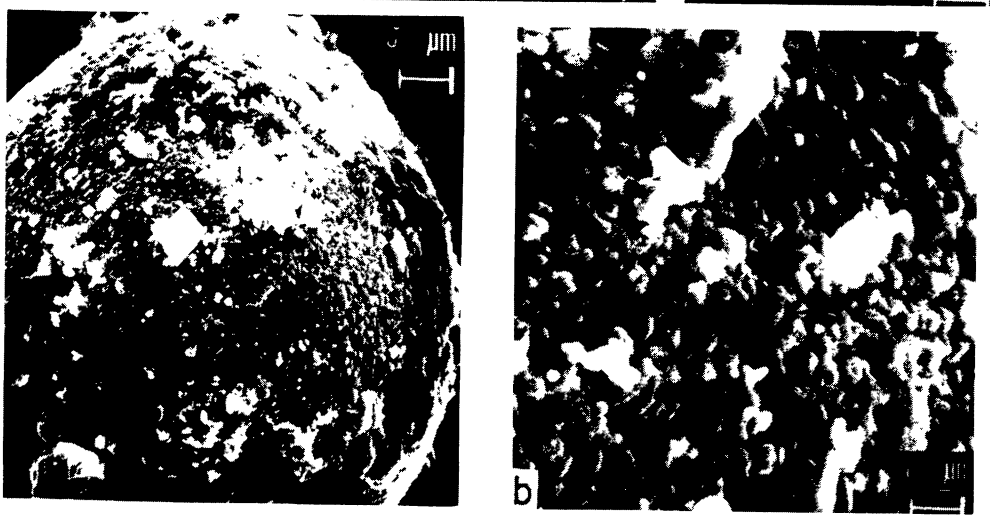

Fig. 3

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have found some microspheres, cenospheres (hollow spheres) and platelets, a few microns in size, which are extremely rich in potassium. These are shown in Fig.2. No element other than potassium with $Z \geq 11$ has been detected. Since the detection technique is insensitive to lighter elements ($Z < 11$), exact chemical nature of the spheres could not be ascertained so far. Carter(4) has reported growth of K-rich globules on Apollo 15 lunar samples, but they appear to be different from spherules observed here. So far none of the Luna 24 or Luna 16 samples have shown presence of such K-rich spherules. Morphological studies reveal several silicate spherules in Luna 24. A typical case from 24179 is shown in Fig.3, with a peculiar surface texture. These studies are currently in progress.

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References

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Captions

Fig.1 Depth profiles of (^{26}Al + ^{22}Na) in Luna 24 and Apollo 16 soil, corrected for decay to the time of measurement. For solar flare particles $(J, R_o) = (140, 150)$ are assumed(3) and for galactic cosmic rays the flux of 1.7 $P/cm^2.sec$ 4π , >1 GeV is taken from Reedy and Arnold(5).

Fig.2 Potassium-rich microspheres and platelets in Luna 20 sample. The middle micrograph shows a possible cenosphere.

Fig.3 A silicate spherule in Luna 24 sample taken from 179 cms depth(a). The surface structure is shown with high resolution in (b).