The lunar soil sample was taken by the automatic space probe Luna 24 on August 18, 1976 at the south-eastern part of Mare Crisium at the point with coordinates 12°45' N, 62°12' E.

During the preliminary investigation in the receiving laboratory the magnetometer and X-ray pattern of the core tube with lunar soil were obtained. After the removal of the core tube the megascopic descriptions of the core as well as the corresponding photometric and X-ray investigations were carried out. The traces of dust on the core tube indicating the level of the lunar surface were observed at the distance of 37 cm from the upper edge of the tube; this corresponds to nominal depth of drill bit to 225 cm. The traces of soil on the core tube were observed up to 60 cm. Below, the tube is filled completely. The actual length of the core is about 160 cm, the total weight of the soil is 170 g.

The returned lunar sample is not uniform throughout the total length of the core. Certain areas are characterized by different grain size, reflectivity or metallic iron content. The borders of separate layers defined by different methods have different sharpness and not always coincide with each other. Preliminary investigation of the core allows to divide it in several zones; after more thorough investigation 10 to 20 layers can be defined depending on the principle of such separation.

The upper part of the section is represented with part of the core 10 cm thick consisting of large fragments (up to 6-8 cm) of different appearance gradually changing into common fine-grained regolith. Apparently this zone is composed of largest fragments from the upper part of the core which could not be captured by the core tube due to high looseness of the near-surface zone of the regolith.

The lower zone, about 60 cm thick, is represented by the externally uniform regolith of dark gray colour. The upper part of this zone contains numerous small fragments, the intermediate part is characterized by the presence of large fragments. The reflectivity coefficient in the visible and IR region of the spectrum is rather uniform for the whole zone and is lower than this parameter measured for other lower zones. This zone is rich in metallic iron; two areas within its limits are identified.
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with maximal iron content represented by very fine and uniform regolith.

The lower zone is megascopically similar to the above zone, its thickness is about 30 cm. It is characterized by larger amounts of coarse fragments irregularly distributed throughout the zone and more predominant in the lower part of the zone. This material is characterized by higher IR reflectivity and is unstable within this zone as a whole. The upper border of this zone is identified in terms of the decrease of metallic iron content in relation to the lower border of the higher zone.

The deepest part of the core is considered as the fourth zone with the thickness of about 50 cm. Megascopically it represents the most layered part of the core with the lightest colour. Within this zone among the gray layered material the layer composed of light coloured coarse-sized material was identified. Presumably this rather coarse-grained rock approximately similar to leucocratic microgabbro was destroyed by drilling. Lower in the zone, there is a layer of light gray regolith. Uneven, coarsely fragmented material shows nonuniform distribution along the whole zone. Note that within the lowest part of the core a few rock fragments were found. Presumably it is due to the effect of hard rock destruction at the end of drilling area where the "thumping" method of drilling was used. This zone as a whole is characterized with the maximal reflectivity coefficient in the IR spectral region and a minimal metallic iron content.

The investigation of coarse-size fraction (coarser than 0.4 mm) of randomly selected samples indicated the high content of igneous rock fragments having a rather fresh appearance. The fragments are mostly represented by leucocratic gabbro and by mineral grains of this rock. The fine-grained mare basalt fragments and fragments of highland rocks of ANT type are relatively rare. Secondary rocks which are the result of surface exogenic alteration processes are represented with regolith breccias and agglutinates, the content of the latter markedly decreasing to the bottom of the core.

The preliminary investigation of Luna 24 core indicate the relatively uniform character of material within the upper part of the core along with the distinct layering of the lower areas. The maturity of the regolith evaluated on the base of the ratio of agglutinates and primary igneous rocks as well as on metallic iron content was found to decrease in the lower part of the core with the sharp decrease within the light gray layer of the lower zone. The distribution pattern of the metallic iron suggests that at certain levels of the core parts of
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The comparison of the regolith core from Mare Crisium with the sample from the adjacent Mare Fecunditatis leads to the following conclusions: the Luna 24 samples is characterized with relatively lower content of the agglutinates and other secondary particles, the relatively higher content of rather coarse grained rock fragments as well as the grains of individual minerals, the lighter tint of the regolith especially within the lower part of the core.

Scheme of the regolith core returned by Luna 24 automatic space probe.

Explanation

- Light layers
- Lightest layer
- Fine uniform regolith
- Enriched by fragments of 1-2 mm
- Involving large (>3 mm) fragments; dark is X-ray dense one.