# PLANETARY SCIENCE EDUCATION II: STUDIES OF THE NASA LUNAR SAMPLE SET USING THE ARRANGEMENT OF THE MEASUREMENTS IN A SYSTEM OF STRUCTURAL HIERARCHY OF MATERIALS.

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***Introduction:***

Earlier studies opened a strategy in the overview of the structural investigation of planetary solid materials. This strategy focuses on the structural hierarchy of materials. [1] This system view allows seeing the results of measurements in a joint structural connection background of the various hierarchy levels. In this paper we realize this system view for the NASA Lunar Samples on loan at the Eötvös University, Budapest, since 1994.

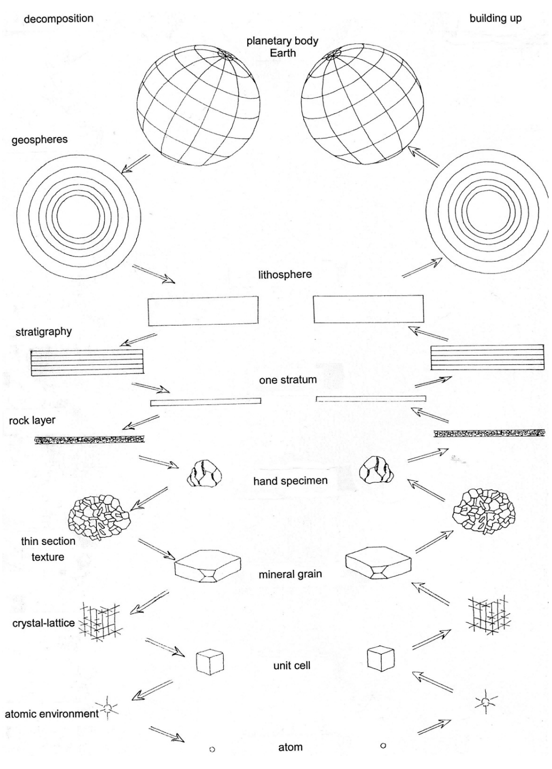


*Fig. 1. Structural hierarchy levels of a planetary body in a decomposition and a building up sequence.*

***Concise background for structural hierarchy in teaching textural level materials***

Optical microscopy is a „middle level" structural study of rocks. We may begin the structural sequence at the spherical decomposition of a planetary body. Through the litosphere and the stratigraphical level decomposition of the crust, a planetary surface rock-body serves as initial source of the rock specimens. This level is represented in the NASA Lunar Sample Educational Set by the disc with 6 samples (Fig. 2.). The most exciting level of the set is the thin sections of lunar samples which represent textural examples of rock formation (Figs. 3., 4., 5., and 6.). In our program we looked for parallel technological procedures, which formed similar textures to lunar rocks. However, the industrial procedures are precise, planned, strict steps, but the lunar ones are natural, randomly realized, containing great number of variations.

The structural hierarchy sequence begins at the whole planetary body. Litosphere subsystems contain the stratigraphy. Here the USGS lunar geological maps can be used in the hierarchy demonstrations. The selected lunar layer may be represented among the bulk samples of the disc (basalt, anorthosite and breccia are represented, Fig. 2.).

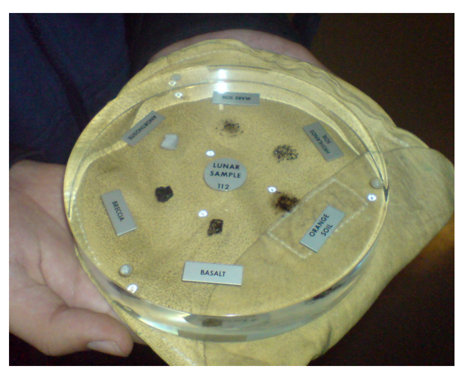


*Fig. 2. NASA lunar disc No. 112. exhibiting 6 samples.*

Thin sections cover more than one hierarchy levels: texture level and mineral level. Optical characteristics may refer to compositional aspects, too. If reflectance spectroscopy is applied, some elementary compositional level measurements can be carried out (for example the band of iron-compounds in pyroxenes at the 0.95 micrometer wavelength). [2]

In the case of the lunar set thin sections the stratigraphic layer of the source region is known. However, in the case of meteorites we follow the reversed way. We first identify – in a chondritic meteorite – the mineralogical and textural characteristics in the thin sections, and using the known processes we interpolate the sample to a van Schmus-Wood type, and the corresponding layer according to the onion-shell model.

Here we show the four most beautiful examples of the NASA thin section set: representing the most characteristic lunar samples.

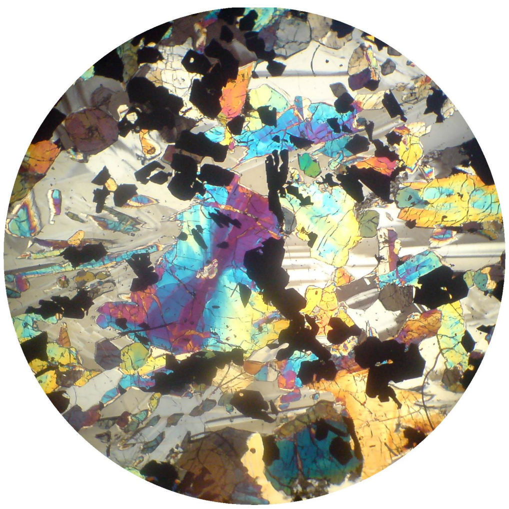

*Fig. 3. 70017 basaltic sample with sector zoned pyroxene in the center.*

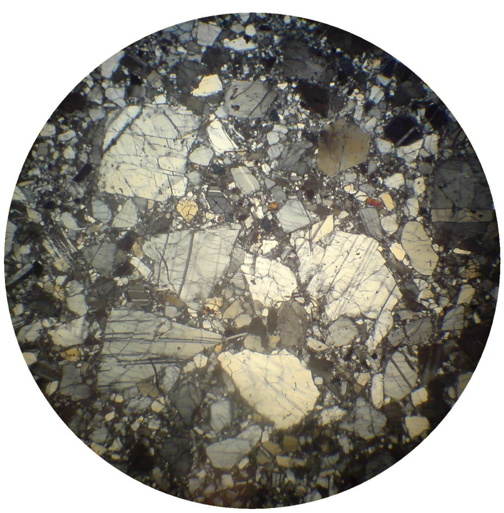

*Fig. 4. 60025 anorthosite sample with locally broken fragments and offset mineral tables.*

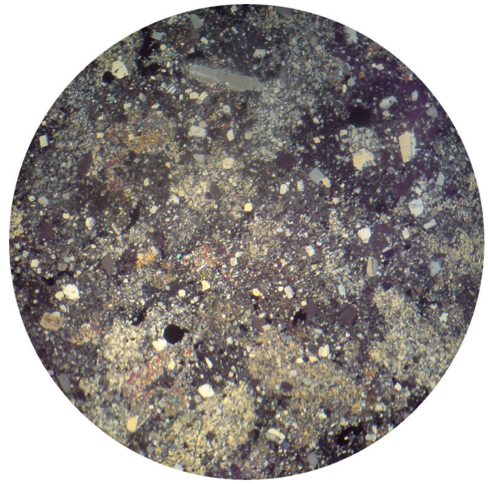

*Fig. 5. 65015 breccia sample.*

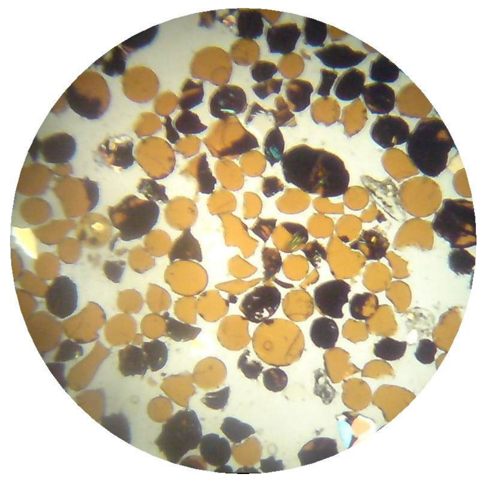

*Fig. 6. 74220 orange soil sample.*

***Summary:*** 5 years of loan of NASA lunar samples made it possible for a generation of young scientist to study primary lunar materials in Hungarian universities.

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***References:***

[1] Bérczi Sz. (2017): Planning Science Experiments According to the Multihierarchical Structural System of Planetary Objects. *Planetary Science Vision 2050* Conference, *Washington D.C. #8003*. [2] F. Roskó, T. Diósy, Sz. Bérczi, A. Fabriczy, V. Cech, S. Hegyi (2000): Spectrometry of the NASA Lunar Sample Educational Set. In *Lunar and Planetary Science XXXI*, Abstract *#1572*, Lunar and Planetary Institute, Houston (CD-ROM).