PLANETARY ANALOG STUDIES AND SIMULATIONS: MATERIALS, TERRAINS, MORPHOLOGIES, PROCESSES: CONCISE ATLAS IN THE SOLAR SYSTEM (9) EÖTVÖS UNIVERSITY, HUNGARY. ***Gy. Hudoba*[1], *S. Hegyi*[2], *H. Hargitai*[3], *A. Gucsik*[4], *S. Józsa.*[5], *A. Kereszturi*[3], *A. Sik*[3], *Gy. Szakmány*[5], *T. Földi*[6], *P. Gadányi*[7], *Sz. Bérczi*[3].**
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Introduction: Transfer of ideas from terrestrial works to planetary ones can be intensified by analog methods. Among others, analog studies of comparative planetary geology play a key role in planetary science education. The whole system of terrestrial geology knowledge can be transformed to other planetary conditions if we compare and fit them to the conditions on the other planet.

Analog site field works for Apollo astronauts: Various analog planetary geology studies were organized first for astronauts preparing to the lunar landing in the Apollo Era. American desert and mountainous regions were visited by them in the Grand Canyon and Arizona (Meteor crater) and other sites. Recently the Mars is the main object for manned and robotic research. Mars analog terrains can be found in several places on the Earth. Haughton crater in Devon Island, Canada and Antarctic terrains are cold desert places, where impact processes (Haughton crater) and extremely cold conditions (both places) are present. For analog sites with Martian volcanism together with ice, glaciers, ice-lava interactions the islands of Iceland and Svalbard seem excellent places.

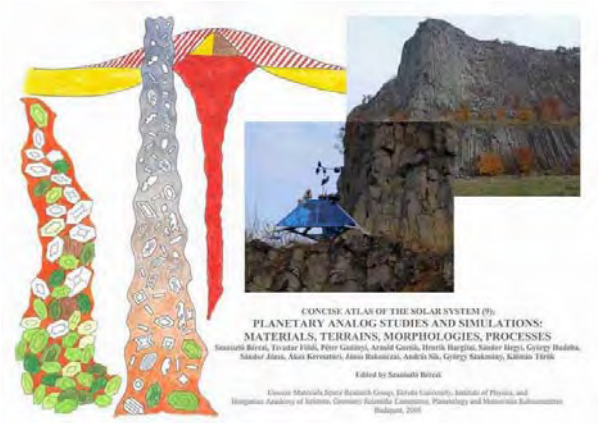

Fig. 1. The 9th member of the Concise Atlas of Solar System.

Planetary analog studies in or atlas series: For university education the analog studies may extend to various materials, terrains, processes and simulations which are related somehow to planetary ones. We began this work in the Concise Atlas on the Solar System (6): Atlas of Microenvironments on Planetary Surfaces [1]. There mainly the lander works on the surface of the Moon and Mars were overwieved. The next new concise atlas studied planetary environments visited by Apollo astronauts with cars, and by robotic rovers [2]. In this third Concise Atlas (9) of the Solar System planetary analog studies are focused on planetary material, terrain, morphology and processes comparisons and it includes planetary study simulations, too [3], as follows in the

Chapters:

I. Planetary space probe activity simulations

1.1. A Hunveyor type planetary voyage and planetary surface works simulator.

1.2. Hunveyor orientations and astronomical observations on Martian surface.

II. Terrain, morphology, material and process analogies from orbit and planetary surface

2.1. Proposed Europa analog ice-splitting measurements and experiments with ice-Hunveyor on the frozen Balaton-Lake, Hungary.

2.2. Meandering riverbed analogs on Mars and Earth.

2.3. Comparative study of periglacial mass movements on Mars and in Anatolia on Earth

2.4. The interaction of ice and volcanism on the Mars and in Iceland on Earth.

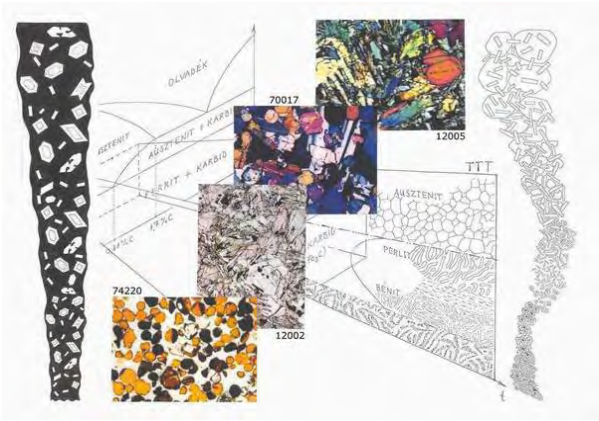

Fig. 2. The NASA Lunar Sample Educational Set basaltic textures compared with the steel tempering TTT diagram and textures on the back cover of the 9th Concise Atlas of Solar System.

III. Planetary material analog studies

3.1. Martian shergottites and their counterparts from the Szentbékkálla series of mantle lherzolite inclusions and the host basalts in North-Balaton Mountains, Hungary.

3.2. Terrestrial impact melt rock and breccia from the Mien Crater, Ramsö Island central peak, Sweden.

3.3. Impact materials of the Ries Crater, Germany.

3.4. Analog studies on rock assemblages delivered to a plain by floods, on Earth (Dunavarsány) and on Mars (Chryse-plains).

IV. Lunar, Martian, chondritic and achondritic meteorite samples compared to their textural and formation process industrial material analogs

4.1. Textures of basalts and basaltic clasts of the NASA lunar educational set: comparisons to terrestrial basalts.

4.2. Cooling rate sequence of chondrule textures

4.3. Martian nakhlite textural layers in the cumulate pile of a thick flow: terrestrial analog: Theo's flow, Canada.

4.4. Comparison of breccias from the Moon, the Earth, and the asteroids.

4.5. Analog studies on textures: comparison of lunar basalts and breccias with industrial materials of steels and ceramics.

V. Planetary analog terrains and rocks visited on field works in Hungary.

5.1. Igneous rocks and terrain morphology

5.2. Eroded, fluvial, transported rocks and morphology.

Fig. 3. The map of field trips with Hunveyors and Husar rovers in planetary analog sites in Hungary.

Summary: The volumes of the series Concise Atlas on the Solar System: After 5 years of editing the following educational materials have been worked out by the members of our space science education and space research group on the Eötvös University, Budapest:

(1): *Planetary and Material Maps on: Lunar Rocks, Meteorites* (2000);

(2): *Investigating Planetary Surfaces with the Experimental Space Probe Hunveyor Constructed on the Basis of Surveyor* (2001); (**E**)

(3): *Atlas of Planetary Bodies* (2001); (**E**)

(4): *Atlas of Planetary Atmospheres* (2002);

(5): *Space Research and Geometry* (2002);

(6)*: Atlas of Micro Environments of Planetary Surfaces* (2003); (**E**)

(7): Atlas of Rovers and Activities on Planetary Surfaces (2004);

(8): Space Research and Chemistry (2005);

(9):Planetary Analog Studies and Simulations: Materials, Terrains, Morphologies, Processes. (2005); (**E**)

Sign (**E**) marks the English language editions of the series issues. Other members of the series are written in Hungarian and we gradually translate them and publish in English.

Our group follows the main activities in planetary science education and adapts them in Hungary by using educational robots for field analog site studies and loaning NASA and NIPR samples in order to study their textures and compare their formation processes with other planetary and industrial materials. This booklet series summarizes our works in the last 12 years of loan period.

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References: [1] Bérczi Sz., Fabriczy A., Hargitai H., Hegyi S., Illés E., Kabai S., Kovács Zs., Kereszturi A., Opitz A., Sik A., Varga T., Weidinger T. (2003): Atlas Series of the Solar System (5 booklets) and other Works for Education and Public Outreach by Cosmic Materials, Planetology and Hunveyor Groups of the Eötvös University, Budapest. *LPSC XXXIV*, #1305, LPI Houston; [2] Mészáros I., Hargitai H., Horváth A., Kereszturi A., Sik A., Bérczi Sz. (2005): Second unusual guidebook to terrestrial field work studies: astronauts with roving vehicle, robotic rovers on planetary surfaces (seventh concise atlas in the solar system series of textbooks at Eötvös University, Hungary). #1177. LPI, Houston; [3] Szaniszló Bérczi, Tivadar Földi, Péter Gadányi, Arnold Gucsik, Henrik Hargitai, Sándor Hegyi, György Hudoba, Sándor Józsa, Ákos Kereszturi, János Rakonczai, András Sik, György Szakmány, Kálmán Török (2005): *Concise Atlas on the Solar System (9): Planetary Analog Studies and Simulations: Materials, Terrains, Morphologies, Processes*. (Szaniszló Bérczi, editor) ELTE TTK Kozmikus Anyagokat Vizsgáló Űrkutató Csoport, UNICONSTANT, Budapest-Püspökladány.