ANALOG SITES IN FIELD WORK OF PETROLOGY: ROCK ASSEMBLY DELIVERED TO A PLAIN BY FLOODS ON EARTH AND MARS. ***Józsa S.[1], Bérczi Sz.[2],*** [1]Eötvös University, Dept. Petrology and Geochemistry, H-1117 Budapest, Pázmány P. sétány 1/c. Hungary, [1]Eötvös University, Dept. G. Physics, Cosmic Materials Space Res. Group, H-1117 Budapest, Pázmány P. sétány 1/a. Hungary.

Introduction: Field work was organized in petrology to study rocks transported by Danube to Dunavarsány, Hungary. We compared analog site situation of Martian Pathfinder's rock observations where on the landing site the floods of the Ares Vallis river transported the rock types of the southern highlands onto the Chryse Planitia.

The 3rd year geologists took part in this field work of petrologic study of pebbles of the polimict gravel in the Dunavarsány mine of U-Pleistocene age. The locality is south of Budapest. The surface gravel formation of the South Pest Plain Pliocene-Pleistocene Suite has 20-100 m thickness in this region. It consists of the sediments of the terraces of Danube [1]. It contains various rocks from the middle and upper flow of the Danube: quartzite from the Alps, (ca. 500 km of transporting distance), andesite (Miocene age, from the Börzsöny Mts. ca. 50 km transp. dist.), and sedimentary rocks, however, it contains also eclogite, granulite, amphibolite of unknown locality, probably more than 500 or as far as 1000 kilometers of transporting distance.

The samples were collected in the gravel pit of the Aqua Ltd., near Kisvarsány, on a gravel hill. Generally 5-10 cm sized pebbles can be found here, however sometimes some decimeter sized boulders were also found (Fig. 1.).

Fig. 1. The pebble pile in the gravel pit of Dunavarsány.

Description of the main rock pebble types:
The distribution of the pebble types:

quartzite:	36.3%
limestone:	17.6%
marl:	1.9%
granite:	5.9%
granulite:	4.9%
andesite:	15.7%
gneiss:	2.9%
amphibolite:	11.9%
sandstone:	7.8%
conglomerate:	3.9%
rhyolite:	0.9%

Textures of the main rock types:

Granite: These light tone pebbles are well rounded, only partly weathered rocks. Its texture is subhedral granular. The mineral constituents are feldspar (fresh, euhedral, or subhedral), quartz, micas (they begin to transform to chlorite, or biotite to limonite, some muscovites), garnet (rare small grains) (Fig. 2.). Among the variants of granites there can be found tourmaline granites with large tourmaline crystals.

Fig. 2. Biotite-granite from Dunavarsány. The resolution is similar to that of the best rover cameras and it allows identification of rock type.

Rhyolite: There can be found several types of rhyolites in Dunavarsány. Their size, roundness is variable their color is pale violet, but brown and grey also occur. Mineral constituents: feldspar, quartz, biotite and rarely amphibole. One type is the spherolitic rhyolite: it is a light yellow or pale violet rock. There are red spherolites with rounded shape, 1-6 mm sized.

Andesite: Brown or grey, rather weathered and rounded rocks. Its main mineral constituents are feldspar and amphibole (Fig. 3.).

Conglomerate: It is a grey or brown rock containing middle or well assorted quartz grains. Its grains size is 0.5 centimeter in average.

Limestone: Many types can be found in this gravel pit: nummulitic, lithotamniumic, krinoidic, snail or shell rocks. Its size and abrasion is variable and its color is in wide range from white-yellowish to greyish-brown.

Gneiss: There are many types of gneisses: garnet, biotite, double-mica containing variants. Their size is changing and they are a little rounded. They are frequently shaly, foliated, banded. Their main constituents are the quartz, feldspar, micas and sometimes sillimanite.

Fig. 3. Digit-camera resolution allows identification of minerals in the fresh broken fabrics. (Here the larger amphibole laths are visible in the amphibole-andesite texture.)

Amphibolite: There are many types in the gravel pit: garnet-amphibolite, banded gneiss-amphibolite. Their shape is isometric or elongated; their textures are directed or folded. Constituents: garnet (spherical claret-colored 1-2 millimeter sized grains); amphibole (it consist of the main mass of the rock); feldspar (white minerals appearing in bands); quartz (small, isometric grains).

Granulite: Light colored, partly rounded specimens with plained or isometric shape, in the 5-30 centimeter size range. Their mineral constituents are quartz, feldspar, garnets (2-3 millimeter sized), kyanite (light blue grains with 1 millimeter size), sillimanites (rarely occurring, elongated, fingerlike minerals with several centimeter length). The grain size is alternating in bands.

Classification of pebbles according to their transporting length in the river: The rock pebbles can be grouped into two groups. These groups are well separated on the basis of the shape and size of the pebbles. In one group there are the well abraded, well rounded smaller (less the 20 centimeter sized) grains. Most of the pebble rock types described occurs in this group.

In the other group we can find the larger pebbles, sometimes boulder sized rocks (they even may reach the 1 meter size). These larger rock fragments are more angular, worse abraded rocks. This group represents only a small part of the transported rocks of the river. Their rock type is mainly andesite (50 %), and much granite, granulite and gneiss boulders occur among them and rarely amphibolite. Sedimentary rock also occurs among them: limestone from Triassic or Jurassic, from Eocene and Miocene, sandstones or sandy limestone.

Considering their rounded and abraded shape the members of the first group could be transported from larger distances. They may origin from older conglomerate which later was resedimented and settled here. The members of the second group can not come from farther then some ten kilometers. But only parts of these rock types are known in the near vicinity of the gravel pit or from drilling cores in this region. Probably a mountain was on the surface in the Pleistocene near this place and this mountain has been covered and the basin was filled in by the sediments of various sources since Pleistocene and recently only the boulders represent the remnants of this mountain mixed with the pebbles transported from farther distances by the river.

Planetary comparisons of field works: Rock types on a lunar Apollo expedition or in the MPF landing site are mixed from the near or farther rock fragments delivered on the site by various processes. On the Moon the main process was the impact ejection. On Mars MPF case the flooding of the Ares Valley River was the main transporter of rocks. In any case the distance of transportation could be in the range of some 10s of kilometers till as far as 1000 kilometers. The great variability among the rock types can be seen on the Pathfinder's landing site where various rock surface textures were described [2, 3, 4,]. In the MPF landing site – as on the Dunavarsány gravel pit – both igneous and sedimentary rocks occur. Camera resolution approaches the visual resolution in a field work observer's one. Identification of rock types was increased in the laboratory, in the thin section studies; however the field work estimation is in the range of the space probe camera's resolution capability. The positions on the MPF site are also informative and the stratigraphic relations in a gravel pit may also add some information of the sedimentation process. The field work with preparation from the planetary surface knowledge adds some point of view which will not arise without planetary landers geologic knowledge. These are: 1) Estimation the textures from various distances. (Approaching to the boulder may increase the exactness of the identification of the rock texture.) 2) Identification of minerals in the rock textures. (In terrestrial conditions we may increase the resolution by lupe. Consequence: we must develop small lupe or microscope to the experimental university lander Hunveyor or onto its Husar rover.) However, today the resolution of some digital cameras is comparable to those of lupe.

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