GEOTRAVERSE THROUGH THE TERRA ARABIA AREA OF LOW EPITHERMAL NEUTRON FLUX. Jouko Raitala[1] and Alexander T. Basilevsky[2]; [1]Deptartment of Astronomy, University of Oulu, Oulu, 02912, Finland, jouko.raitala@oulu.fi; [2]Vernadsky Institute, RAS, Moscow, 119991, Russia, atbas@geokhi.ru.

Introduction: Terra Arabia is one of two large-scale areas of low flux of epithermal neutrons in the low to middle latitudes of Mars discovered by High Energy Neutron Detector and Neutron Spectrometer on board of Mars Odyssey [1,2,3]. Joint consideration of the neutron flux values with a number of surface parameters (surface altitude, thermal inertia, albedo, radiophysical properties, the bedrock geology) and with theoretically calculated geographic distribution of zones free of ground ice led to conclusion that the low epithermal neutron flux in these anomalous areas is due to relatively high content of chemically bound water in the areas' surface mantle [4,5]. The analysis of high-resolution MOC images was suggested as a tool to study this mantle so this work implements this suggestion for the Terra Arabia area. Fig. 1 shows the map of epithermal neutron flux for the Terra Arabia anomaly as it was published by [2], superposed on MOLA shaded relief.

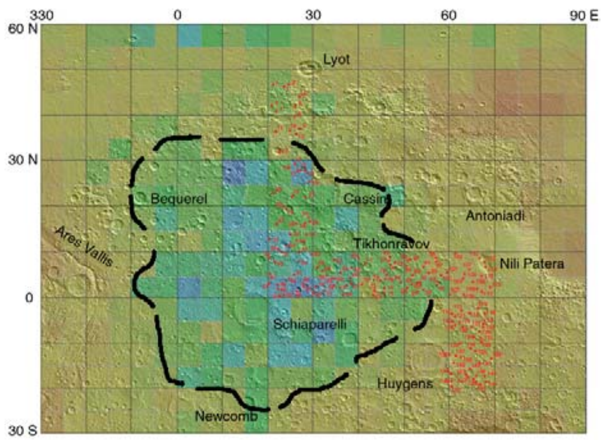

Figure 1. Blue and green pixels correspond to the lower flux while yellow and brown ones to the higher flux.

Study technique: In attempt to understand what is characteristic for the surface mantle of the low flux area and what differs it from the neighboring areas, where the flux is relatively high, we have studied 152 high resolution MOC images and their medium resolution context images. The images cover 10°-wide band going first southward from the area outside of anomaly to the anomaly center (sites 1-51), then to the east reaching the anomaly boundary and going by more than 700 km outside (sites 52-115), and then to the south (sites 116-152). This zig-zag band forms a 6,500 km long geotraverse from the zone of the Hesperian fretted terrain (sites 1-12) at the north through the Noachian cratered plains (sites 13-93), being typical for the anomaly, to the Hesperian Syrtis Major Formation (outside the anomaly, sites 93-115) and again to the Noachian cratered plains (also outside the anomaly, sites 116-152) (Fig. 2).

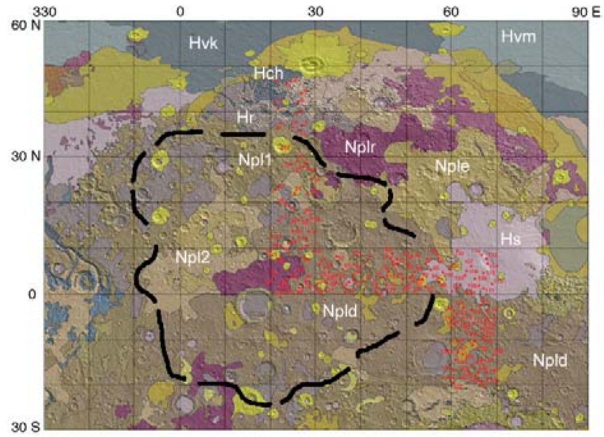

Figure 2. Sites (red dots) shown on the background of the geologic map [6].

The studied MOC images have the resolution of ~1.5 m (17 images), ~3 m (91 images), and 4.5 to 11.5 m/px (44 images), the contex images have the resolution ~240 m/px.

Geologic analysis: Taking in mind that low neutron flux is a signature of relatively high content of water in the surface material [1,2,3], it is probably the chemically bound water [4,5], we tried to look for signatures of water related processes. First we analyzed distribution of fluvial channel networks seen in the context images (Fig. 3).

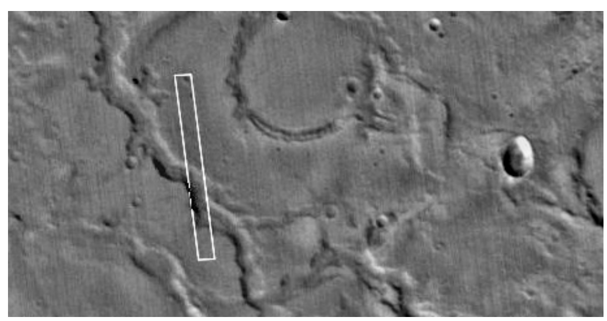

Figure 3. Context image for site 55 showing the channel network; high-res image (white box) covers area 3 x 34 km.

We identified the individual channels and channel networks in the context images of 76 of 152 sites. Fig. 4 shows that the channels have been identified within the Noachian plains (see also Fig. 2) both within the low flux anomaly and outside of it. So we did not find a positive link between the Terra Arabia low epithermal neutron flux anomaly and the channel networks presence.

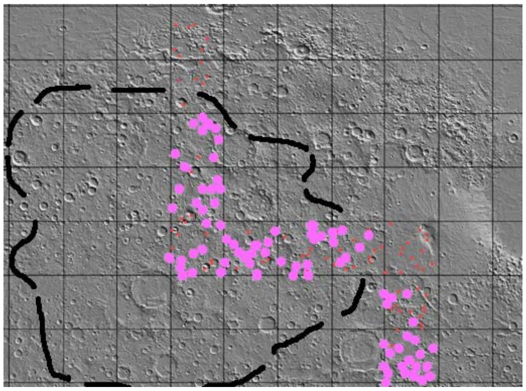

Figure 4. Sites with channels (pink dots).

Then we looked for layered deposits (Fig. 5) which were considered for Terra Arabia and geographically antipodal to it Medusa Fossae area as remnants of ancient polar layered deposits [7]. Some of the identified layered deposits look very similar to the layered deposits of present poles (Fig. 5. left) while others look rather different (Fig. 5, right).

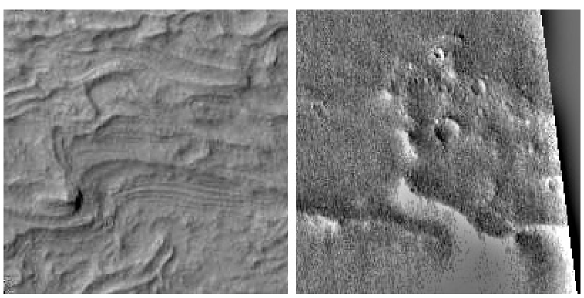

Figure 5. Layered deposits of sites 49 and 56. Each image covers area of 600 x 600 m.

We identified layered deposits in high resolution images of 54 sites (Fig. 6). Although most of them (34 sites) are within the anomaly, significant part (20 sites) are outside the anomaly, including similar to those seen around the present poles.

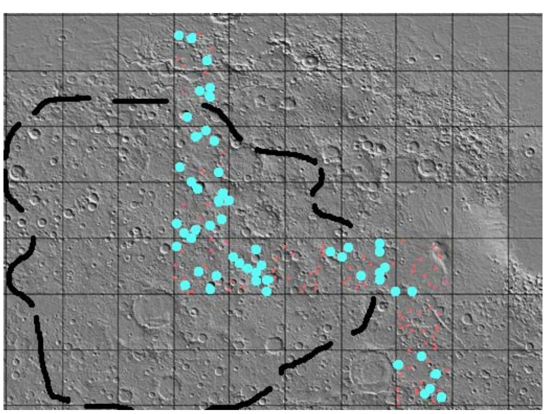

Figure 6. Sites with layerd deposits (turquoise dots).

Our analysis of high resolution images within the geotraverse showed that like in other areas of the planet [8] almost all the surface is covered with a mantle. We have distinguished mantles with six types of their apparent surface texture and the seventh type is presented by the bedforms (ripples, dunes, barchans) (dots of different colors on Fig. 7). We have found, that at some extent, the texture type depends on the image resolution. For example on 17 of 18 images with 1.5 m resolution, the surface mantle is fine-textured while among 89 images with 3 m resolution the fine-textured surface is seen in 22 cases of 89 and the dominated type is smooth texture (44 cases). This is why on Fig. 7 are shown only sites imaged at 3 m resolution. It is seen that there is meaningful preference of any surface texture type neither to the anomaly nor outside of it.

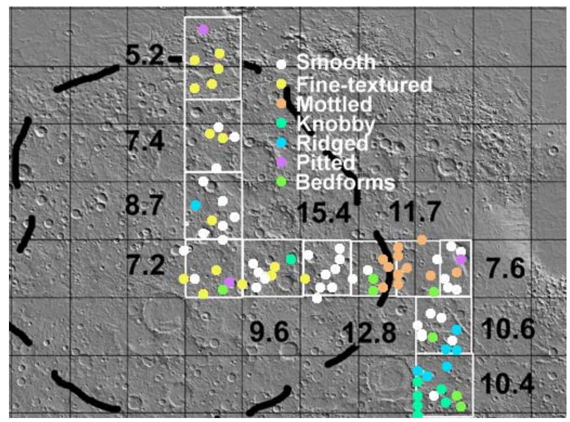

Figure 7. Surface mantle textures and thickness (m)

Also we have estimated thickness of the surface mantle through the maximum diameters of craters (3 for each given site) which rims are buried by the mantle [9]. The estimates showed that the minimum thicknes of the mantle varies from 5.2±1.2 m (2σ) to 15.4±3.7 m without any preference of smaller or larger values to the anomaly (Fig.7).

Conclusions: The geologic analysis of high-resolution and context MOC images for 152 sites has shown that the Terra Arabia low epithermal neutrom flux anomaly differs noticeably from its non-anomalous neighborhood neither in abundance of fluvial channels and layerd deposits, nor in thickness and apparent texture of the surface mantle, the upper 1-2 m of which are responsible for the anomaly (higher contents of bound water).

References: [1] Feldman et al., 297, 2002, 75-78. [2] Mitrofanov et al., *Science*, *ibid*, 78-81. [3] Boynton et al., *ibid*, 81-85. [4] Basilevsky et al., *LPSC 34*, 2003, abs #1088. [5] Basilevsky et al., *Solar System Research*, 2003 (submitted). [6] Tanaka et al., Maps I-1802-A,B, 1986-87. [7] Schultz & Lutz, Icarus, 73, 1988, 91-141. [8] Malin & Edgett, JGR, 106, 2001, 3,429-23,570. [9] Edgett et al., JGr, 102, 1997, 21,545-21,567.