CORRELATIONS BETWEEN IRON ABUNDANCES AND LUNAR SURFACE FEATURES: CRATER KEPLER AREA. Lu Yangxiaoyi, Sternberg State Astronomical Institute, Moscow University, Moscow. marsplus@gmail.com

Introduction. Distribution of the iron abundances on the Moon's surface is important for addressing many lunar science problems. Since iron is one of the major mineral forming elements on the Moon, iron abundance can show composition and the stratigraphy of the lunar crust details, and it can help us to understand the formation, distribution and variety of lunar mare basalts. Beginning with the Apollo mis- sions, a number of regional iron abundance measurements have been made using a variety of remote sensing techniques including gamma-ray spectroscopy, UV-VIS multispectral imaging, and neutron spectroscopy.

Remote sensing data of iron abundances. For chemical analysis of the crater Kepler area we used Lunar Prospector results. Global measurements of iron abundances on the lunar surface were made using the Lunar Prospector Gamma-Ray Spectrometer and Neutron Spectrometer. In this study, we used data derived relative iron abundances from the low altitude, high spatial resolution (~ 45 km2 per pixel) Lunar Prospector data using the 7.6 MeV neutron capture gamma-ray doublet [1]. It was found from global Lunar Prospector data there are large ex- panses of mare basalt in the western mare regions that have very high iron abundances (22–23 wt. % FeO). These features are unusual for mare soils, which typically contain a significant amount of high- lands contamination. According to a previous analysis of the authors using thermal and epithermal neutrons the lunar highlands have the low iron abundances (~ 5 FeO wt. %) [2]. It may be demonstrated that the lunar crust formed by a relatively simple magma ocean process.

Crater Kepler area. Relatively fresh impact crater Kepler exposed in the center of the investigated area. Crater rays are relatively bright albedo features and extend radially away from the center crater. Usually rays appear to be formed by the excavation and deposition of material from both the main crater and secondary craters. Crater Kepler (32 km in diameter) has intermediate age [3]. It is younger than Copernicus (inferred age of ~ 810 Myr), but older than Tycho (inferred age of ~ 109 Myr). It's needed to note that crater Kepler placed on the background formation that is possibly part of highland near crater Copernicus. Low albedo basalts occur preferentially along the northwestern areas of Oceanus Procellarum and in the southeastern regions of the studied area, i.e., in Mare Insularum.

Distribution of the iron in the surface layer. To study iron distribution we prepared the local iron

pixel). The iron values are shown in the Fe weight percent (wt. %). The map is presented in the Fig. 1. The map square is about 600x600 km2. Counter interval is 1 wt. %.

Interpretation. The center formation of the investi- gated area is highland premare fragment around crater Kepler. According map shown in Fig. 1 iron con- tent in this surface material is about 15 – 16 wt. %. Using 1 km/pixel FeO abundances from Clementine and Lunar Prospector GRS spatial footprint information, authors of [5] have been able to obtain plausible thorium distributions around Kepler crater at a resolution of 1 km/pixel. The materials around Kepler crater appear to be a relatively simple mixing of thorium-rich mafic impact-melt breccias compositions and high-thorium mare basalts. Crater Kepler has depth a few kilometers (not more than 5 or 6 km). The material inside this depression has iron content about 13 – 14 wt. %, that is typical for a number of basalts (Fig. 1). According to these data it can suggest that formation around crater Kepler may be fragment of an old premare basaltic structure.

It's needed to note that we can't identify the crater ray structure around Kepler in Fig. 1. It's known that crater rays are bright because they excavate immature soils. The bright, optically immature materials gradually darken as a function of exposure time on the lunar surface. Another factor is the amount of mixing of ejecta with local, more mature material when the ejecta is deposited. The ejecta at a crater rim is thicker and less mixed with local materials than distal ejecta or rays, which are thinner and more mixed with local mature soils [6]. In Fig. 1 we can see that ray material has iron abundant about 15 – 16 wt. % near crater rim and about 20 wt. % at great distances from it. As note authors of [6] one is certainly the thickness of the ejecta deposit, which de- creases with increasing distance from the crater rim. In the case the process of the local material and ejecta material mixing will be very intensive.

In northwestern and southwestern regions of the studied area we can see two anomalies of iron con- tents (*A, A1, B*) where iron abundances are more than 25 wt. %. We suggest these anomalies are places of the volcanic centers – sources of young basalts. Using craters that excavated highland mate- rial from beneath the mare basalts in Oceanus Procellarum, authors of [7] estimates that the basalt are 160–625 m thick, with thicknesses ranging from tens to hundreds of meters near the mare/highland boundaries and several hundreds of meters closer to the center of the mare. Data of [3] show that volcan- ism in the investigated region was active over a long

map on the base of the Lunar Prospector catalog data [4]. Surface resolution of the data is 0.5 x0.5 (per period of time from 3.93 to 1.2 b.y., a total of 2.7 possible the small areas *A, A1, B* contain youngest basalts from most depth of basaltic lava layers.

Conclusions. In this paper we can try to better understand the current spatial resolution of iron surface distribution in an effort to recognize how well we resolve small area features. For example, the presented map of Fig. 1 shows many small areas in the highland fragment around crater Kepler and western part of Oceanus Procellarum that may or may not be real. By means of the data presented here we try to analyse what we currently under- stand about the Moon. For example, do lunar mare basalts indeed occur in areas with Fe abundances greater than 25 wt. % in the regolith(fig.2)? What does this apparent limit means both about how mare basalt is formed in the source regions, where these b.y. It's regions are, and how basalts with different age were erupted to the surface?

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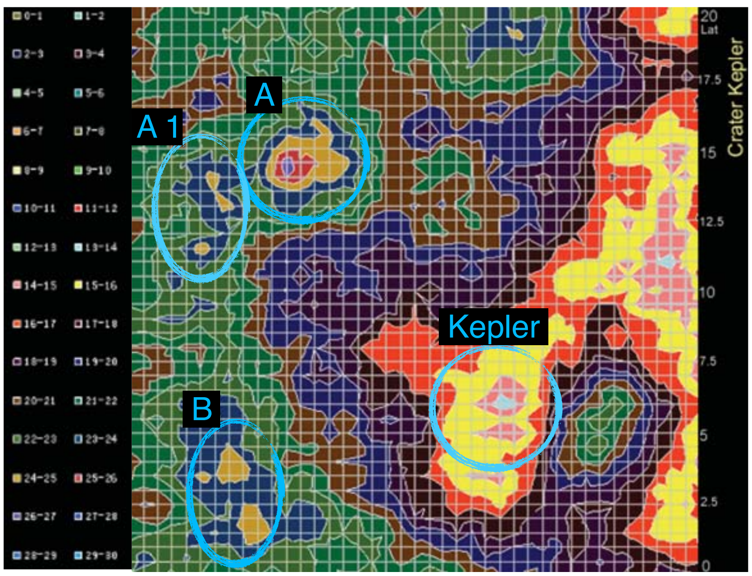

fig.1

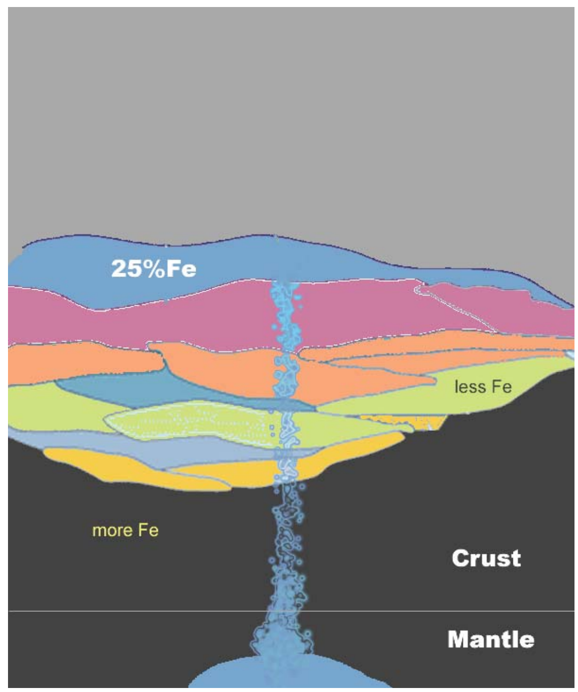

fig.2