THE LUNA-GLOB CANDIDATE LANDING REGION: GEOLOGICAL MAPPING BASED ON LUNAR RECONNAISSANCE ORBITER DATA.

A. M. Abdrakhimov[1], M. A. Ivanov[1,2], A. T. Basilevsky[1,2], J. L. Dickson[2], J. W. Head[2], M. T. Zuber[3], D. E. Smith[4], E. Mazarico[4], C.D. Neish[5], and D. B. J. Bussey[5]. [1]Vernadsky Institute, RAS, Moscow, 119991, Russia, atbas@geokhi.ru; [2]Brown University; USA, [3]MIT, USA; [4]GSFC, USA; [5]JHUAPL, USA

Introduction: The main scientific goal of the Luna-Glob mission [1] is to study volatiles in the regolith of lunar polar regions. Volatile presence was recently confirmed by several missions [2-4]. Ballistic and direct visibility from Earth considerations constrained the region where the landings are possible as 70-85°N and 30°W-60°E. In this contribution we consider the general geology of this region, which is largely determined by ancient highlands associations, including large basin ejecta [5]. The M3 multispectral data for this region [6] highlight the surface compositional diversity mainly represented by feldspathic soils with orthopyroxene component, however some feldspathic areas and small areas of basaltic composition are also observed. The new regional detailed geologic map was made using recent LRO data [7,8]: WAC mosaic (100 mpp), LOLA, LRO Mini-RF data.

Regional topography: The topographic study based on LOLA data [7] allowed us to divide the area into three parts: 1) elevated and rugged terrains in the E, partly central, mostly W parts; 2) relatively smooth adjoining lowlands in the central W parts; 3) elevated and hilly terrains mainly in the W sub-meridional part and SE parts. The regional altitude difference is ~6 km. LOLA-derived slope data show that the relatively smooth areas are in the south central and western parts. The old highland terrains in the northeast part are characterized by very rugged relief.

Photogeologic analysis: Three groups of geological units have been identified and mapped (Fig. 1):

1) Large impact craters (*Cc, Ec, Ic, Nc, pNc*), including ejecta, crater floor (*Ccf, Ecf, Icf, Ncf*) and central peak facies (*Ccp, Ecp, Ncp*), which were divided based on different preservation states and maturity characteristics, and unit-to-unit stratigraphic relationships. The youngest rayed craters (*Cc*) are characterized by sharp relief features, high albedo, well-preserved rims, central peaks, and high rock fragment abundance. Older (*Ec*) craters lose rays and have fewer rock fragments. Next older *Ic* are partly embayed by plains materials, and the oldest (*Nc, pNc*) are characterized by partly or fully degraded smoothed rim crests and are embayed by plains and basin materials.

2) The ejecta deposits of impact basins (*If, Nbl*) sculptured older undivided underlain crater and terrain complexes (*IpNcl, IpNl*). Mainly the W and S parts of the study region are covered by a blanket of basin ejecta (*If*), which is radial to the Imbrium basin in the S and morphologically resembles the Fra Mauro Formation [5]. The hummocky *If* surface is made of sinuous, and straight wide ridges draping over the underlying landscape. The SE parts are covered by an older deposit of irregular hilly material (*Nbl*), with broadly undulating ridges and troughs and radial to the Humboldtanium basin.

3) Material of mare (*Im*), plains-forming (*Ip_2, Ip_1*) and older terrain units (*INtp, Ntp, IpNt*), fill intercrater space and crater floors. The dark and relatively smooth mare material *Im* is observed in the SE part as two small patches of several tens of km across, embaying *Ip*. According to M3 studies it has a basaltic composition [6]. The surface of the older plains-forming material (*Ip*) is represented by brighter and more heavily cratered smooth level plains of two generations with sharp boundaries. These plains materials cover >34% of the mapped area, filling the old crater floors and intercrater lowlands and resembling material of the Cayley Formation, considered to be Imbrium basin ejecta fluidized during emplacement [5].

In the intercrater highland areas we defined three terrain complexes *INtp, Ntp, IpNt*, mainly in the NE old highland part. Light, fairly smooth and leveled hummocky material *INtp* filling intercrater lowlands, and old *Nc* and *pNc* craters. It is similar to plains-forming *Ip*, but formed during earlier large impacts. A hummocky terra unit (*Ntp*) fills craters and mantles highlands. *Ntp* appears as blocks rising among planar complexes. *Ntp* is superposed by *INtp* and younger units, and filled old craters *Nc, pNc*. The oldest terra material *IpNt*, mantled intercrater highlands, and has a rough surface. *IpNt* probably represents remnants of degraded ancient craters and oldest overlapping ejecta blankets, formed during Pre-Nectarian to Imbrium times.

The results and conclusions: Unit relationships, their localities, and age estimations are summarized in Fig.1. They generally confirm the earlier global Lunar Orbiter mapping results [9]. The most probable unit which could be sampled by the lander is a smooth feldspathic Imbrian highland plains-forming material *Ip*, resembling the Cayley Formation.

References: [1] Mitrofanov I. G. et al. (2011) *LPS XLII,* Abstract #1798. [2] Feldman W. C. et al. (1998) *Science, 281,* 1496. [3] Mitrofanov I. G. et al. (2010) *Science, 330,* 483. [4] Colaprete A. et al. (2010) Science, *330,* 463-468. [5] Wilhelms G. H. et al. (1987) *USGS Prof. Paper,* 1348. [6] Cheek L. C. et al. (2011) *JGR, 116,* E00G02. [7] Smith D. E. et al. (2010) *GRL, 37,* L18204. [8] Bussey L. C. et al. (2010) *AGU,* Abstract # P34A-07. [9] Lucchitta B. K. et al. (1978) *USGS Prof. Paper,* I-1062. [10] Michael G. G. and Neukum G. (2010) *EPSL, 294,* 223-229.

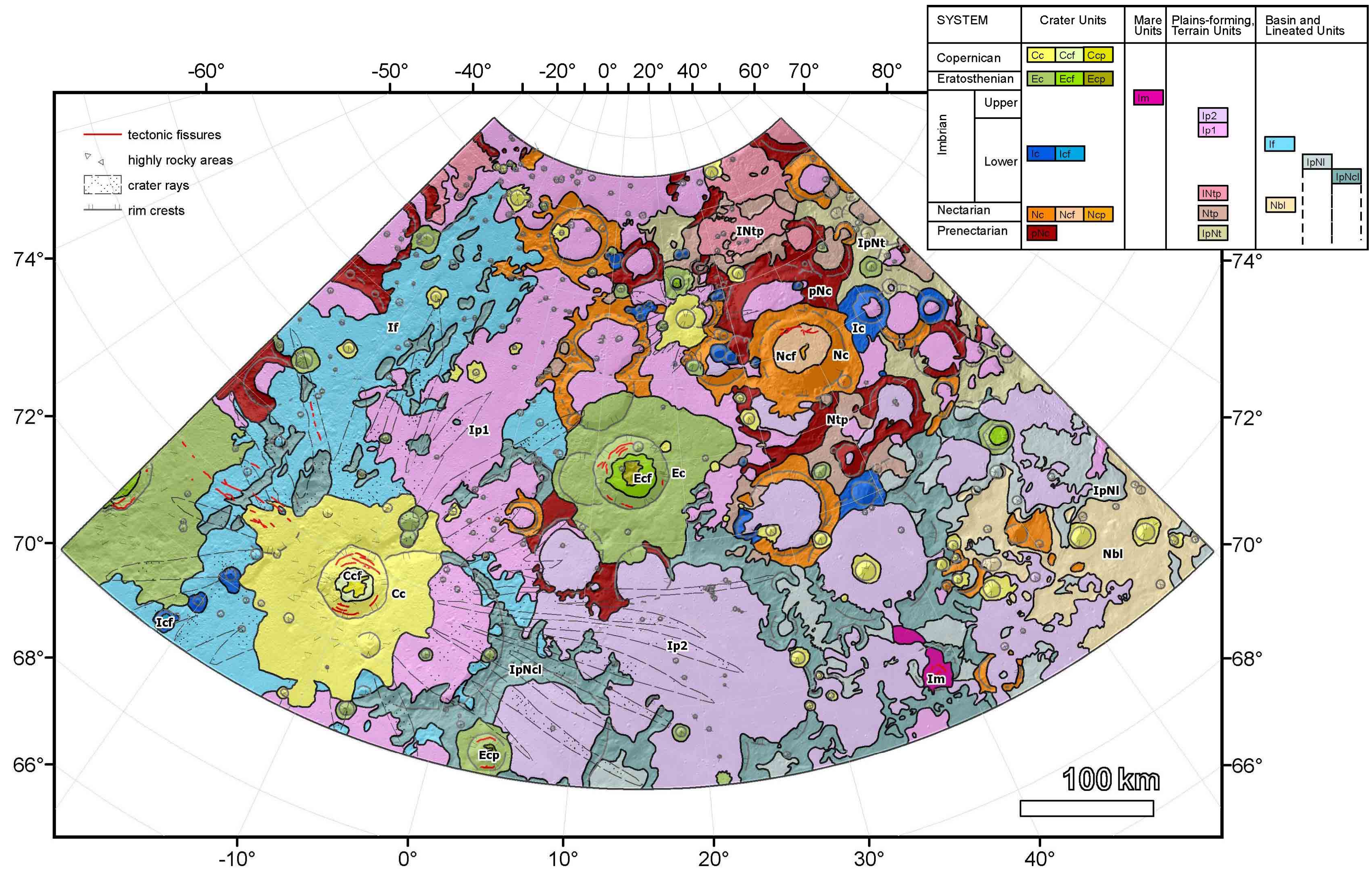

Fig. 1. Geologic map of the Luna-Glob polar landing area and stratigraphic correlation chart. Unit abbreviations described in the text. Total area – 277785 sq. km, units area: crater units: Cc,Ccf,Ccp - 8%; Ec,Ecf,Ecp - 10%; Ic, Icf - 1%; Nc ,Ncf, Ncp - 6%; pNc - 5%; basin units: If - 11%; Nbl - 4%;IpNcl - 10%;IpNl - 4%; mare units: Im - 0.3%; plains-forming units: Ip1 - 16%; Ip2 - 18% (Ip_{total} – 34%); old terra and plains units: INtp - 2%; Ntp - 2%; IpNt - 2%. Crater statistics age estimation use the method of [10]: Im - $3.74^{+0.04}_{-0.06}$; Ip_2 - $3.93^{+0.00}_{-0.00}$; Ip_1 - $3.98^{+0.00}_{-0.00}$; INtp, Ntp -$4.05^{+0.02}_{-0.02}$; IpNt-$4.07^{+0.02}_{-0.02}$; If - $4.01^{+0.01}_{-0.01}$; Nbl - $4.05^{+0.02}_{-0.02}$ Ga.