

RELEASE OF THE DIGITAL UNIFIED GLOBAL GEOLOGIC MAP OF THE MOON AT 1:5,000,000-SCALE. C. M. Fortezzo¹, P. D. Spudis²; and S. L. Harrel³ ¹U.S. Geological Survey, Astrogeology Science Center, 2255 N. Gemini Dr., Flagstaff, Arizona 86001 (cfortezzo@usgs.gov); ²Lunar and Planetary Institute, Houston, Texas; ³South Dakota School of Mines and Technology, Rapid City, South Dakota.

Introduction: We have released a seamless, globally consistent, 1:5,000,000-scale geologic map with a brief description of map units derived from the six digitally renovated geologic maps (<https://bit.ly/LunarGeology>). The goal of this project was to create a resource for science research and analysis, future geologic mapping efforts, be it local-, regional-, or global-scale products, and as a resource for the educators and the public interested in lunar geology. Here we present the results of the current digital version of the map product.

This effort builds on the original digital renovation of the six 1:5,000,000-scale lunar geologic maps [1] (near, central far, east, west, north, and south sides) [2-7] as released in 2013. This renovation allows the older geologic maps to be overlain on newer, higher resolution datasets including the Lunar Reconnaissance Orbiter Camera Wide Angle Camera mosaic and the Lunar Orbiter Laser Altimeter digital terrain model and involved redrafting the line work with only minor re-interpretations.

Methodology: Using geographic information system (GIS) software, we matched the abutting boundary areas of the east side, central far side, and west side maps and integrated the overlapping areas between the poles and near side maps. The polar maps overlap the boundaries of east, central far, west, and near side maps by 5° (**Figure 1**). And finally, the near side map overlaps both poles and the east and west side maps to varying degrees given its irregular bounding shape.

A NASA Space Grant student, S. Harrel, mapped the surface features in a consistent manner, something the original maps did not include. These features include crater rim crests, buried crater rim crests, fissures, grabens, scarps, mare wrinkle ridges, faults (generic unless type can be determined), troughs, rilles, and lineaments.

Datasets: The combined LRO LOLA SELENE Kaguya digital terrain model (DTM) covers from 60°N – 60°S, -180°E – 180°E at 60 m/pix [8]. The Lunar Orbiter Laser Altimeter digital terrain model covers the north and south poles at 20 m/pix [9]. Nomenclature annotation data from [10] was added to the GIS and pdf versions of the map.

Results: There are 203 units across the 6 maps with some units exactly the same, some similar, and some completely unique. We have devised a global unit scheme that will allow us to more consistently stitch together the maps, display the units within the

final global product, and correlate the units with respect to time and to each other. The final map consists of 43 geologic units across the entire lunar surface. These units are broken down into groups based on attributes and include materials of craters, basins, terra, plains, Imbrium Formation, Orientale Formation, and volcanic units.

This version of the map is a digital-only release presented in both in GIS and PDF formats. The GIS includes a geologic unit polygon feature class, geologic contact and linear features polyline feature classes, and annotation feature classes. The geologic unit feature class consists of 11,183 discrete polygons all attributed with UnitSymbol (the map abbreviation for the unit), UnitName (actual name of the unit), UnitAge (the period or span of periods of the unit), and Area_Geo (the geodesic area, more accurate than the ubiquitous Shape_Area included in every ArcMap feature class). For map aesthetics, the GIS project includes three data frames that show the map in the Mercator and North and South Polar views. It is important to note that these are all of the data in the three data frames are sourced from the same feature classes and that the feature classes represent a global analytical product.

The PDF version of the map includes the basemap data, GIS layers, grids, and the brief description of map unit and explanation of map symbols. It should be noted that this product is a 1:10,000,000-scale version of the map because of the dimensions of the map, and will match the earlier release of the WAC and LOLA outreach maps [10]. The description of map units from each of the maps were concatenated into a single, succinct document that describes the unit features and interpretations from multiple authors. The descriptions presented in this release version are brief and capture only the prominent, defining characteristics based on the original maps. These will be expanded in a later publication of the map.

Future Work: This work will be submitted for publication as a USGS Open File Report and will include a map write up that includes more detailed methodologies, description of map units, a correlation of map units, and a comparison of results from the original map units with those of the current product.

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