DIGITAL GLOBAL GEOLOGIC MAP OF THE MOON: ANALYSIS TOOL FOR LUNAR RESEARCH. C. M. Fortezzo[1] and P. D. Spudis[2]; [1]U.S. Geological Survey, Astrogeology Science Center, 2255 N. Gemini Dr., Flagstaff, Arizona 86001 (cfortezzo@usgs.gov); [2]Lunar and Planetary Institute, Houston, Texas.

Introduction: In 2013, we completed an initial 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]. 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. The renovations involved redrafting the line work from the previously published maps, with only minor reinterpretations.

We are currently in the final year of a project to create a seamless, globally consistent, 1:5,000,000-scale geologic map, a global correlation of map units, and their description of map units derived from the six digitally renovated geologic maps. The goal of this project is 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 progress and ongoing efforts to complete this mapping project.

Methodology: Using geographic information system (GIS) software, we matched the boundary areas of the east side, central far side, and west side maps and cleaned the overlapping areas between the poles and near side maps. The east, central far and west maps have abutting boundaries which allowed units to simply be matched across the boundary. The polar maps overlap the boundaries of east, central far, west, and near side maps by 5 degrees. And finally, the near side map overlaps both poles and the east and west side maps to varying degrees given its irregular bounding shape. Within these overlaps, we have created a seamless boundary between the maps that respects the original authors interpretations and fits the concatenated global unit scheme.

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 current iteration of the map contains 51 globally consistent units; however, this number is subject to change as we internally review the map.

A NASA Space Grant student mapped the surface features in a consistent manner globally, something the original maps did not do consistently between maps. These features include crests of crater rims, crests of buried crater rims, basin rings, grabens, mare wrinkle ridges, faults (generic unless type can be determined), rilles, and lineaments (a veritable potpourri of unidentified and/or indistinguishable linear features).

Datasets: The Lunar Reconnaissance Orbiter (LRO) Wide Angle Camera (WAC) global mosaic in the visible range provides 100% coverage, at 100 m/pix [8]. The LRO-Kaguya digital terrain model (DTM) covers from 60°N – 60°S, -180°E – 180°E at 60 m/pix [9]. The Lunar Orbiter Laser Altimeter digital terrain model covers the north and south poles at 20 m/pix [10]. All of these data are used in the stitching and mapping processes.

Year 2 progress: This year, we focused on getting the near side map incorporated. This was the first map that was renovated during the original project [1], and utilized the Lunar Orbiter global mosaic because the WAC mosaic was unavailable. As a result, the contact placement for the near side map has a significantly lower fidelity when compared to the other five rejuvenated maps. We redrafted the near side contacts using the WAC mosaic and LRO-Kaguya DTM. There were ~15,000 contacts in the original map, and between the overlapping areas with the north, south, east, and west side maps and the near side area there were >12,000 lines added. There is also an effort to thin the number of units from the original near side map as the scale of mapped units is incongruent with smaller units within the other five maps. Most of the units to be thinned will be smaller units, mostly craters, inconsequential for interpreting terrain evolution or establishing chronology of its surrounding unit.

The description of map units from each of the maps is also being concatenated into a single, succinct document that describes the unit features and interpretations from multiple authors. The descriptions will include type localities from each of the map areas from which the new unit is derived, will identify the original map's unique units, and will include the range of interpretations from the original maps as well as new interpretations from the existing literature.

The correlation of map units will be completed when the map is near completion and include the new units grouped by type with ages based on the original maps and recent changes documented in the peer reviewed literature.

Linear features mapped during the renovation of the original maps totaled ~1500 individual features, with over one-third coming from the west side map. We have mapped ~3800 features globally. This consistent mapping will allow for analysis of feature types with geologic units, as well as with raster data sets.

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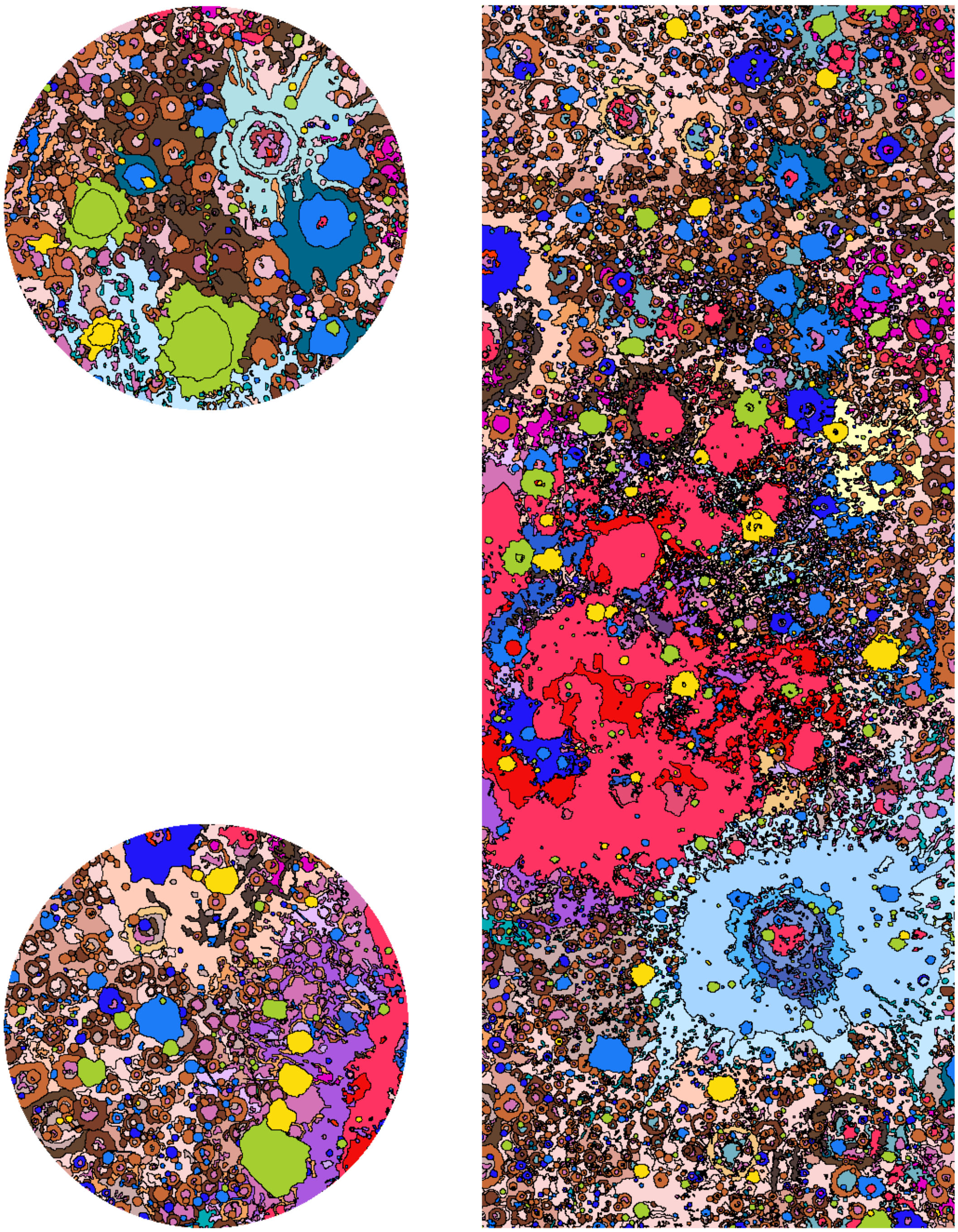

Figure 1: Global Lunar geologic units and contacts presented in Mercator projection with equatorial view from 57°N to 57°S and Polar Stereo Graphic projections showing the polar regions from 55°N- 90°N (upper left) and 55°S-90°S (upper right). Mapped for 1:5,000,000-scale. As of the abstract, the map incudes ~32,000 contacts and ~12,500 units.