

GEOLOGIC MAPPING OF THE ARISTARCHUS PLATEAU REGION ON THE MOON. T. A. Lough¹ and T.K.P. Gregg¹, ¹411 Cooke Hall, Geology Dept., University at Buffalo, Buffalo, NY 14260 (tlough@buffalo.edu).

Introduction: Aristarchus plateau is a volcanologically diverse region containing the highest concentration of sinuous rilles on the Moon, abundant volcanic depressions, mare material of various ages—including a candidate for the youngest mare unit on the lunar surface—pyroclastic deposits, and material of possible highland origin [1-5]. Here, we present preliminary mapping of a 13° x 10° area around Aristarchus plateau, located in Lunar Quadrangle 10 (LQ10) (Figure 1) [7], with the goal of inferring changes in magma properties and volcanic plumbing through detailed mapping of surficial deposits. Interpretations of the volcanic evolution near Aristarchus plateau have implications for the global history of lunar volcanism, the crustal and mantle development of the Moon, and may ultimately help support successful lunar exploration [8].

Background: Aristarchus plateau is one of the most geologically diverse and extensively studied regions on the Moon. Surface features include: mountainous highland terrain; primary and secondary impact craters; the highest concentration of sinuous rilles on the Moon (probably lava channels and/or collapsed lava tubes); volcanic depressions and hills

[1]; lava flows ranging in age from possibly as young as 1.2 b.y. to >3.4 b.y. [2]; and a blanket of dark mantling material interpreted to be pyroclastic deposits [e.g., 3-5]. Kiefer [9] found positive gravitational anomalies on the eastern and southern margins of the plateau that may correlate with a concentration of dense subsurface material such as a magma intrusion. Radon detection around the region suggests it is still actively degassing [10, 11].

Prior to the acquisition of Clementine data in 1993, researchers created several geologic maps of the Aristarchus region [e.g., 12-14]. More recently, scientists have used ground-based radar and orbital remote sensing data to create compositional maps of the entire region [e.g., 15-17]. The map presented here combines new observations from all available data sets with results from previous mapping efforts to create one geologic map to accurately assess timing and emplacement mechanisms for regional volcanism (Figure 2).

Methods: The USGS provided orthorectified digital basemaps of the Lunar Orbiter (LO) and Clementine data sets and a geodatabase containing the mapping features used to map the Copernicus

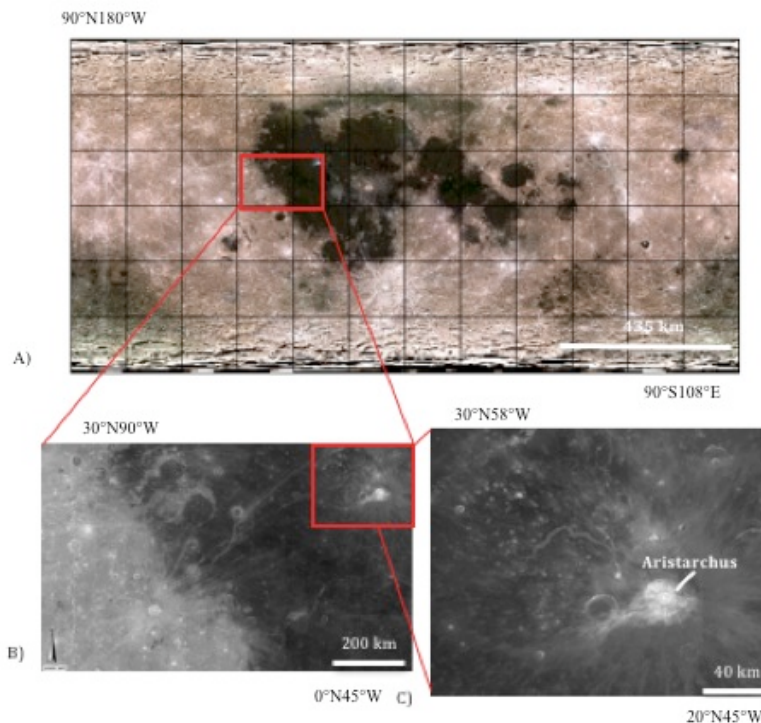


Figure 1. All three images are Clementine UVVIS, 750 nm; North is at the top A) The red box in this Mercator projection at 1:2.5 million is LQ10 B) Magnified image of LQ10 with a box enclosing the Aristarchus region to be mapped in this project C) Region to be mapped around Aristarchus plateau. Image credit [6]

Quadrangle [18].

We used mosaicked Lunar Orbiter (LO) IV and V images as a basemap. The LO basemap provides a good frame of reference for mapping for two reasons: 1) it is the highest resolution comprehensive dataset available for this region (~1 - ~150 m/pixel); and 2) low sun angles in the LO image highlight relative morphologic and topographic features. We also consulted iron and titanium ratio maps [19] as well as high-resolution Apollo and LO images. The map is being created using ArcGIS software.

Discussion: As of this writing, we have identified the following features and units within the Aristarchus plateau map are.

Sinuuous rilles. Sinuuous rilles in the map area are concentrated in the northeast corner. They typically trend downhill, radiating away from the plateau, suggestive of flow by low-viscosity fluid. Secondary orientation trends align with local structural features such as impact-induced topography and linear depressions interpreted to be fractures [20]. Small rilles, typically <20 km long, are found originating on the northern and southern plateau margins and extending into the smooth, mafic terrain. To date, only Schrodinger Valley, the largest sinuuous rille on the Moon, is observed to contain a younger rille cutting the primary rille floor, suggesting multiple episodes of volcanism and possibly source reactivation.

Hills. As of this writing, only one hill composed of non-highland material has been identified within the map area. This irregular, ~2.5-kmdiameter, elevated region is within a kilometer of a depression located at the source for a sinuuous rille and appears to have the same iron content as the surrounding mare units. Multiple interpretations of this feature are possible and include: highland material mantled by a fluid, low-viscosity, mafic lava or by a mafic regolith; or a volcanic construct.

Highlands. Mare units surround hummocky-to-mountainous silicic material of probable crustal origin. The crustal material is topographically higher than the surrounding mare units. A sinuuous rille >106 km long flanks the southern margin of Montes Agricola in the northwestern corner of the map, suggestive of topographic control of sinuuous rilles. Impact craters excavate dark mantling material and mare material that cover highlands terrain.

Irregular Depressions. Irregular depressions of volcanic origin are typically associated proximal to rille heads.

Mare-type wrinkle Ridges. Wrinkle ridges pass through the region in complicated crosscutting patterns, typically trending from the northwest to the southeast. A 26-km-diameter crater that has subsequently been modified by volcanism crosscuts one wrinkle ridge with a northeast/southwest orientation.

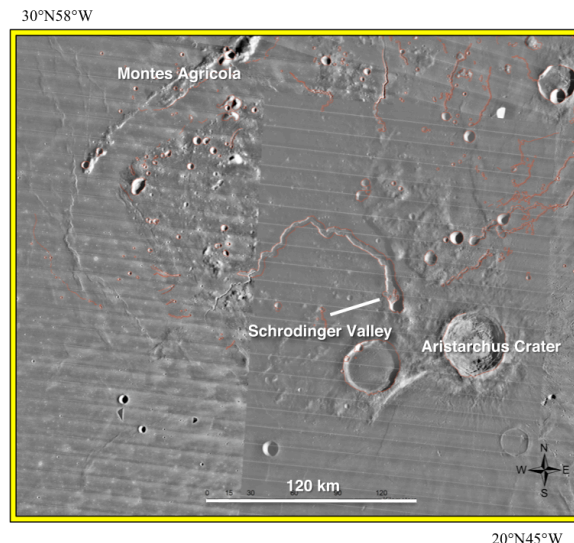


Figure 2. Mercator projection of Lunar Orbiter Mosaicked basemap of mapping area. Red lines represent mapped features.

Summary: Volcanic features around Aristarchus plateau have complex stratigraphic relationships with volcanic and non-volcanic features. This map will help disambiguate these relationships to provide insight into the volcanic evolution of the region.

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