**REMOTE SENSING STUDIES OF THE ARISTARCHUS REGION OF THE MOON**
B.R. Hawke, C.A. Peterson, C.R. Coombs, P.G. Lucey, G.A.Smith, and G.J. Taylor, *Hawaii Institute of Geophysics and Planetology, SOEST, University of Hawaii, Honolulu, HI 96822*; A.S. McEwen and M.S. Robinson, *U.S. Geological Survey, Flagstaff, AZ 86001*; P.D. Spudis, *Lunar and Planetary Institute, Houston, TX 77058*

We combine near-infrared spectra from Earth-based telescopes with Clementine color images to unravel the stratigraphy and compositions of the Aristarchus Plateau, a complex area in the lunar Oceanus Procellarum. The plateau is a complex of both partly exposed highlands terrain, ultimately associated with the ejecta from the Imbrium basin, patchy plateau lavas, and red dark mantling deposits of probable pyroclastic origin. Highlands rock types present include anorthosite, gabbroic rocks, and troctolite and/or dunite. Sinuous rilles such as Vallis Schröteri emplaced, at least in part, the plateau lavas. The Aristarchus impact crater has blanketed the eastern plateau with ejecta, largely of highlands composition; this ejecta is distributed asymmetrically. Correlation of observed compositions with stratigraphically defined geological units continues.

The region that includes the Aristarchus Plateau and the Montes Harbinger is one of the most geologically and compositionally diverse areas of the Moon and exhibits a variety of spectral, radar, geochemical, and thermal anomalies [1]. In the course of a continuing spectral study of the Aristarchus region [2], we obtained eighty-six near-infrared (0.6-2.5 μm) reflectance spectra for a wide variety of surface units in the Aristarchus region. We analyzed these spectra to extract compositional data and combined this information with Clementine multispectral images [3] to improve our understanding of the geology and evolution of the Aristarchus region. Our objectives include: 1) understand the composition and distribution of surface units in the Aristarchus region, 2) search for compositional variations in the regional dark mantle deposit, 3) determine the lithology of highlands units (Imbrium ejecta, pre-Imbrian material) on the plateau, 4) investigate the nature and origin of the material exposed by Aristarchus crater, and 5) determine the composition of the material in Vallis Schröteri.

Near-IR spectra were collected for eighty-six small areas (2-6 km spots) in and around Aristarchus crater and on the plateau with the Planetary Geosciences CVF spectrometer at the UH 2.24 m telescope at Mauna Kea Observatory. The spectrometer successively measures intensity in each of 120 wavelength channels in the 0.6-2.5 μm region by rotating a filter with a continuously variable bandpass. Frequent observations were made of the Apollo 16 landing site and other lunar reflectance standard areas. These observations were used to monitor the atmospheric extinction throughout each night, and extinction corrections were made using the methods presented by McCord and Clark [4]. Analyses of mafic band positions and shapes as well as continuum slopes were made using techniques described previously [2, 5]. A mosaic of the entire Aristarchus region was created with images from three bandpasses of the Clementine UVVIS camera, centered at 0.415, 0.75, and 1.00 μm. The calibration and mosaic-making techniques used in the construction of the Aristarchus multispectral ratio image are described by McEwen *et al.* [3].

The spectra of highlands deposits can be divided into two distinct categories which reflect very different mineralogy. One group is concentrated in the vicinity of Aristarchus crater and includes most of the spectra of the interior and exterior deposits of Aristarchus, the Cobra Head of Vallis Schröteri, Aristarchus A, and other impact craters that expose highlands debris from beneath the regional dark mantle deposit (RDMD) on the Plateau. While this group can be divided into distinct subclasses [2], in general it can be characterized as having shallow infrared continuum slopes and fairly strong absorption bands centered between 0.97 and 1.0 μm. These characteristics are indicative of a feldspar-bearing material which has a mafic assemblage dominated by Ca-rich pyroxene.

Spectra collected for the central peak, east wall, and south floor of Aristarchus form a distinct subclass. They differ from the other spectra in that their continuum slopes are shallower and the absorptions are less deep, broader, and more asymmetric [2]. The areas for which these spectra were obtained also exhibit generally higher albedo. Feldspar may be more abundant in these areas. Clementine near-IR images

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indicate that that pure anorthosite is present in portions of the Aristarchus central peak [3]. Our near-IR spectral data are consistent with these findings. The Aristarchus impact event exposed a variety of diverse lithologies, including mare basalt, anorthosite, gabbroic rocks, and olivine-rich material.

Small impact craters on the plateau that excavate Imbrium ejecta display a gabbroic composition. If this composition is indeed basin ejecta, Imbrium ejecta exposed on the Aristarchus Plateau is very different from the noritic composition of Imbrium ejecta southeast of the basin (i.e., in the Apennines; [6, 7]). Another group of highlands spectra was obtained for widely separated locations in the region. These include the mountain peak Herodotus $\chi$, the southern rim crest of Aristarchus, and portions of the Agricola and Harbinger Mountains. Spectra in this group exhibit broad absorption bands centered at or beyond 1 $\mu m$, characteristic of the presence of large amounts of olivine [2]. This olivine may occur in either troctolites or dunites.

The dominant surface unit on the plateau proper is a regional dark mantle deposit (RDMD) of pyroclastic origin [8]. Spectra for several portions of the RDMD exhibit nearly identical characteristics, including steep infrared continua, low albedo, and very broad absorptions centered longward of 1 $\mu m$. The spectra are indicative of uncrystallized $Fe^{2+}$ - bearing glass. Both the near-IR spectra and the Clementine multispectral mosaic show that the composition of the dark mantle is very homogeneous and contamination on the plateau appears to be largely caused by the presence of Aristarchus ejecta.

Mare materials with diverse ages and compositions are present on and around the plateau. A spectrum obtained for the wall of Vallis Schröteri clearly indicates the presence of fresh mare basalt and the Clementine mosaic shows that the wall material of the valley is entirely basalt. Highlands-like compositions are present in the Cobra Head, the apparent origin of Vallis Schröteri; we are continuing work to determine whether this is caused by an *in situ* exposure of highland substrate or by an isolated deposit of Aristarchus crater ejecta. The basalt signature of some small craters on the plateau shows that basalt underlies the RDMD in some areas; we are studying spectra to determine the composition of the plateau lavas.

These results of our preliminary attempt to integrate the three major datasets of photogeology, Earth-based spectrophotometry, and Clementine multispectral imaging are very encouraging. We believe that continued work in this fascinating region will allow us to decipher the stratigraphy and composition of each geologic unit that makes up the plateau. When completed, we will possess new insight into the complex and protracted geological evolution of the Moon.

**References** [1] S. Zisk *et al.* (1977) *Moon* **17**, 59. [2] P. Lucey *et al.* (1986) *PLPSC* **16**, D344. [3] McEwen A.S. *et al.* (1994) *Science* **266**, 1858. [4] McCord T. and Clark R. (1979) *Proc. Astro. Soc. Pacific* **91**, 571. [5] T. McCord *et al.* (1981) *JGR* **86**, 10883. [6] Davis P. and Spudis P.D. (1985) *PLPSC* **16**, *JGR* **90**, D61. [7] Spudis P.D. *et al.* (1988) *PLPSC* **18**, 155. [8] L. Gaddis *et al.* (1985) *Icarus* **61**, 461.