Aristarchus Plateau as an Outpost Location. Bradley L. Jolliff[1] and Jiang Zhang[1,2,3], [1]Dept of Earth and Planetary Sciences and the McDonnell Center for the Space Sciences, Washington University, St. Louis, Missouri 63130, USA blj@wustl.edu; [2]Department of Space Science and Applied Physics, Shandong University ,Weihai, Shandong 264209, China; [3]School of Physics and Microelectronics, Shandong University, Jinan, Shandong 250100, China.

Introduction: The Aristarchus region of the Moon is one that has long fascinated scientists and telescope enthusiasts, alike. The Aristarchus Plateau, located around 25° N and 50° W, in the northwestern quadrant of the Earth-facing side of the Moon, includes the bright-rayed Aristarchus Crater, 40 km in diameter and some 3 km deep. The crater lies at the southeastern corner of a broad volcanic plateau that is known for its large pyroclastic deposit and for the prominent lave channel, Vallis Schröteri, that emanates from the "Cobra Head" vent just north of the 35 km flooded crater Herodotus. The area is rich with volcanic features and is surrounded by lava flows of Oceanus Procellarum (Fig. 1). Other interesting and scientifically important features are located in the region, including Lichtenberg crater, some 600 km to the west-northwest and the Gruithuisen domes, some 300 km to the northeast.

The purpose of the abstract is to recommend that the Aristarchus region continue to be considered as a possible candidate for a lunar Outpost [1,2] and to present some of the scientific rationale for such consideration.

Sited in a compositionally unique terrane: The Aristarchus region lies in the northwestern part of Oceanus Procellarum. This region is in a vast volcanically resurfaced area that includes volcanic domes (Mairan Domes, Gruithuisen Domes) and the huge pyroclastic deposit that is prominently shown in color ratio images (Fig. 2). Lunar Prospector gamma-ray data showed the region to be one of enrichment in the radiogenic element thorium, even though most mare basaltic lunar samples are low in thorium concentration. This led to the interpretation that some of the volcanic rocks of this region might be enriched, e.g., >5 ppm Th). Analysis of data for other elements especially FeO, indicates that materials from beneath the lava flows, especially those exhumed by Aristarchus crater itself might represent igneous bodies made up of the most chemically evolved and differentiated rock types known from the lunar samples [3-5]. At present, such rock types are known only as small fragments of rock found in regolith from Apollo 12, 14, and 15, and two lunar meteorites. Remote sensing data that demonstrate these relationships are shown in Fig. 3. The data for FeO vs. Th form a triangular mixing array with

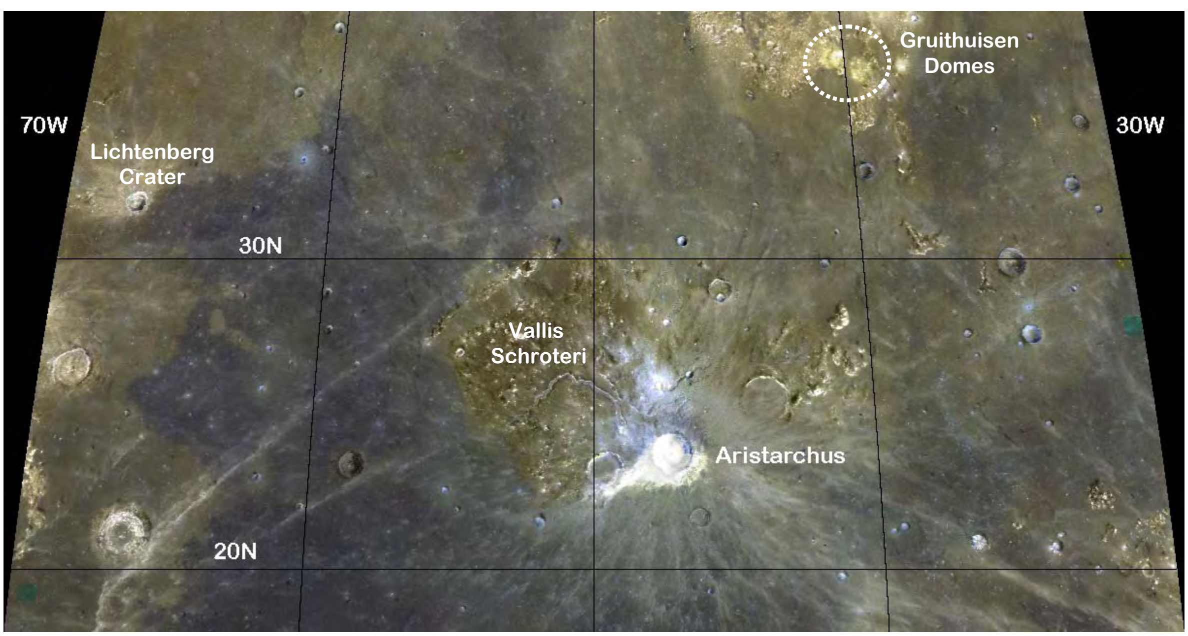

Figure 1. Aristarchus region in Clementine UV-VIS false color, overlain on shaded relief, with some of the prominent features labeled. Vallis Schröteri is about 160 km long, 11 km wide, and 1 km deep. The rille (lava channel) begins at a vent, named the "Cobra Head." Aristarchus Crater is about 40 km in diameter. Flooded crater Herodotus lies just to the west of Aristarchus.

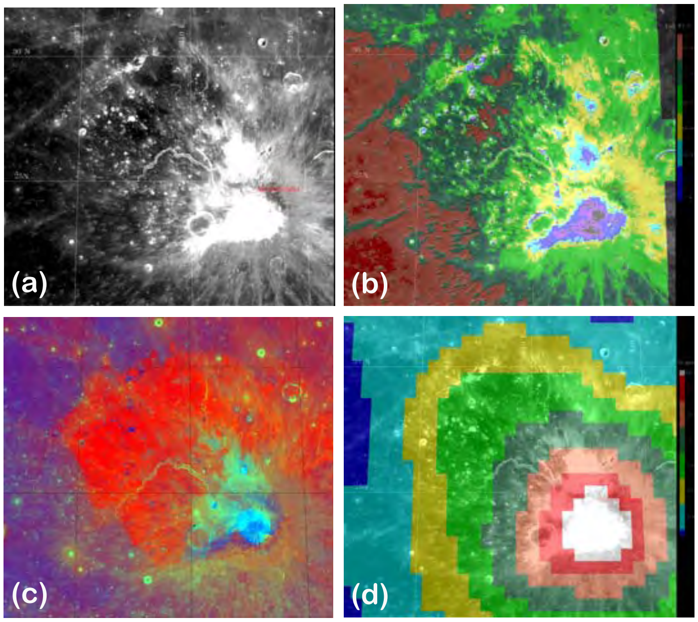

Figure 2. Aristarchus region (a) Clementine 750 nm image, showing very high albedo fresh Aristarchus Crater surrounded by low-albedo mare basalts; (b) Clementine UVVIS-derived FeO "image" (c) Clementine ratio image: Red = 750/415nm Green = 750/950nm Blue = 415/750nm, with dark mantle deposit [e.g., 6] showing up as red; (d) Lunar Prospector half-degree Th image [7] and. Compared to surrounding mare basalts, Aristarchus Crater has lower FeO (< 14 wt.%) and very high Th (~11 ppm) concentrations. In (b), some of the lowest FeO pixels (black in the FeO image) suggest that perhaps anorthosite or granite were excavated. If anorthosite, then high Th concentration suggests it is "alkali" anorthosite.

thorium-rich basalt at the high-FeO apex, feldspathic non-mare material at the low-FeO and low Th apex, and KREEP at the high-Th apex. When all of the data in the region are plotted, a trend extends to very high Th content, significantly higher than KREEP. The extrapolation of this trend, which we refer to here as the "Aristarchus effect," indicates the presence of "monzogabbro" as a major rock type, perhaps as a subsurface intrusive rock body that, along with alkali anorthosite, was partly excavated by the Aristarchus impact.

Conclusion: In terms of science interest, diversity of geological features, and potential public interest, both through the capability to see Earth and be seen from Earth, the Aristarchus region is ideal in many aspects for an Outpost location. Besides being one of the brightest and most prominent features on the Moon's Earth-facing side, the region lies within a compositionally extreme location of the Moon, one that promises new and important discoveries for lunar geoscience in terms of evolved igneous rock types and new varieties of volcanic materials. The site should be given high priori to determine the resource potential of exposed materials and for consideration as a potential location for astrophysics, heliophysics, and Earth observation experiments.

References: [1] Santa Cruz Summer Study (1967) NASA SP-157; [2] LEAG (2005) Science Activities and Site Selection - Specific Action Team Rpt 7-11-05; [3] Flor et al. (2002) *LPSC33*, abstract #1909; [4] Flor et al. (2003) *LPSC34*, abstract #2086; [5] Jolliff et al. (2004) LPSC35, #2032; [6] Gaddis et al. (1985) *Icarus*, **61**, 461-489. [7] Lawrence et al. (2000) *J. Geophys. Res.*, **105**, 20,307-320,331.

Acknowledgements. Jeff Gillis and Erica Flor are thanked for their excellent work on remote sensing of northwestern Oceanus Procellarum which forms the basis of much of what is presented here. This work was supported by NASA grant NNG05GI38G.

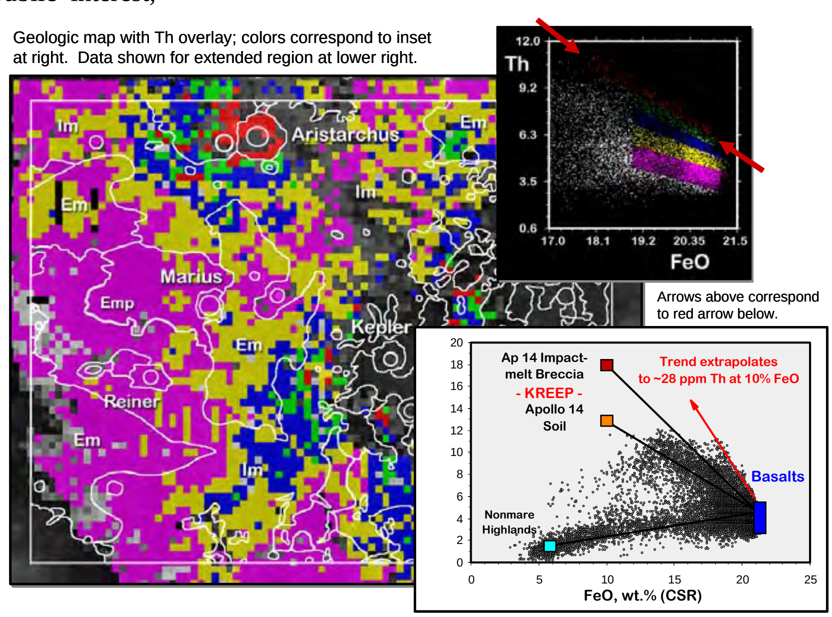

Figure 3. Chemistry of Aristarchus region.