

POSSIBLE MAFIC PATCHES AT MONS MALAPERT AND SCOTT CRATER HIGHLIGHT THE VALUE OF SITE SELECTION STUDIES. B. L. Cooper, Oceaneering Space Systems, 16665 Space Center Blvd., Houston TX (bcooper@oceaneering.com)

Introduction: Possible areas of mafic material on the rim and floor of Scott crater (82.1°S, 48.5°E) and on the northeast flank of Mons Malapert (85.5°S, 0°E) are suggested by analysis of shadow-masked Clementine false-color-ratio images using the technique of [1]. Mafic materials can produce more oxygen than can highlands materials [2], and mafic materials close to the south pole may be important for propellant production for a future lunar mission. If the dark patches are confirmed as mafic materials, this finding would suggest that other mafic patches may also exist, perhaps even closer to the poles. These preliminary findings illustrate the need for additional site selection studies in the lunar polar regions, to improve our capability to “live off the land”.

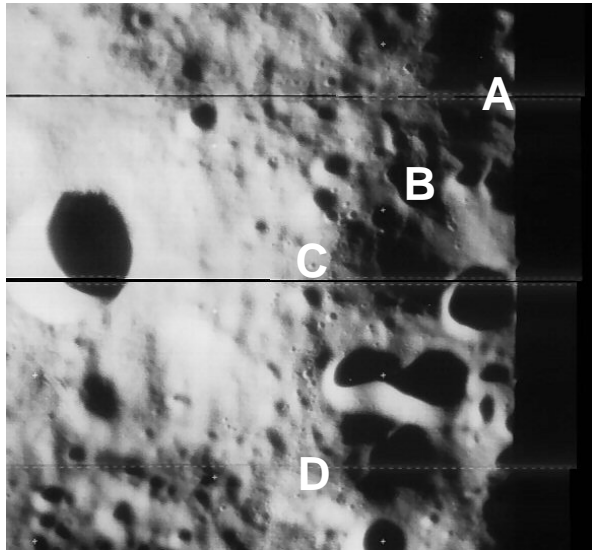


Figure 1. Lunar Orbiter IV Frame 118, showing the area that corresponds to the Clementine data in Figure 2.

Scott Crater: In the Lunar Orbiter visible-light image of the northeastern wall of Scott crater (Figure 1), the areas near letters “A” and “B” have a hummocky appearance and low albedo. The albedo contrast is noticeable between these areas and the crater floor material to the west (left side of image). “C” points out a sharp color change, where dark materials appear to be adjacent to a small (<10 km) crater and draped over its flank. “D” shows a more subtle albedo variation.

Figure 2, from the same area, was created by removing spurious data [4] from a Clementine false-color ratio image mosaic [1]. The remaining color variations may be interpreted using the method provided by [5]. The low-albedo areas of Figure 1 corre-

spond to areas of yellow and orange in Figure 2, suggesting high-Ti mafic materials or pyroclastic deposits [5, 6].

The areas near the letters “C” and “D” show the largest amount of yellow color, which changes gradually to blue. If the yellow color was caused only by shadows, the color change would be abrupt. The yellow colors also correspond to areas of low albedo in Figure 1, which strengthens the interpretation that they are caused by geochemical variation in surface materials. Nevertheless, uncertainty remains because of the sharpness of the transition at the crater rims. Finally, the orange area near “B” is more solidly colored and has a sharp edge, which makes its interpretation less certain than that of areas “A”, “C”, and “D”.

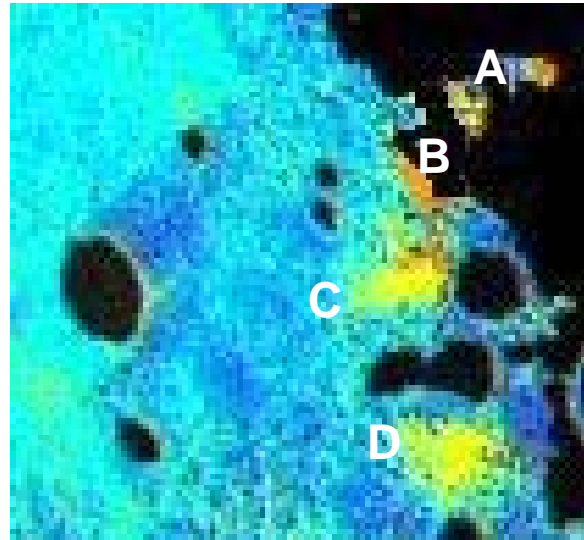


Figure 2. Clementine mosaic false-color data for the area along the northeast rim of Scott crater (82.1°S, 48.5°E).

It is possible that the yellow colors in these areas represent both shadows (near the craters) and pyroclastic deposits (distal to the craters). An examination of LRO data will be helpful in determining which of these is the predominant cause of the color variations.

Mons Malapert: Clementine mosaic images from the Mons Malapert area are shown in Figures 3 and 4 (750 nm basemap and color ratio maps, respectively). Areas with orange and yellow colors are seen here also, but their interpretation is more challenging. They do not correspond to dramatic changes in albedo, as was seen in the Scott crater area. They occur on the northeast flank of Mons Malapert and in the area east of the peak, and do not appear to be associated with nearby craters.

Because minor variations in sun angle cause dramatic changes in the appearance of terrain in the polar regions [7], images that provide illumination of the areas adjacent to the mountain east and northeast are not available in the highest resolution (south periapsis) data. A study of the Lunar Orbiter imagery for this area has also not revealed any clues to the geologic context of these patches.

One possibility that can be explored with LRO and other future lunar missions is that these are patches of cryptomare material, as described by [9]. Another possibility is that they are related to the rim of the South-Pole Aitken Basin (SPA), which is mapped to this general area by [8] and others.

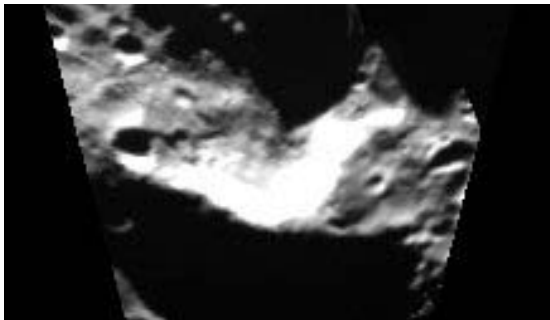


Figure 3. Clementine 750nm mosaic image of Mons Malapert area (85.5°S, 0°E).

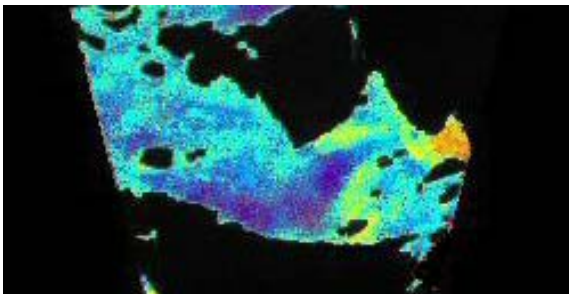


Figure 4. Clementine color ratio mosaic image of Mons Malapert area (compare to Figure 3). Orange, yellow and green colors are suggestive of mafic materials which are important for ISRU; however additional data is needed to confirm the interpretation of these areas as mafic.

Other factors for site selection: Eight factors affect the value of an area for a landing site (either for an initial outpost or for an advanced lunar base). These include: (1) having areas nearby that would be useful for ISRU (oxygen extraction from regolith) for life support, habitations and propellant; (2) proximity to a suitable landing site; (3) availability of sunlight; (4) scientific interest; (5) proximity to permanently-shadowed areas for potential in-situ water ice and scientific discovery; (6) capability for line-of-sight communications with Earth; (7) navigability; and (8) access to shelter from Solar Energetic Particle Events.

Mons Malapert appears to have all of these qualities, and ongoing studies of Scott crater will provide a second potential landing site for which each of these criteria may be compared. When it becomes available LRO data will be incorporated into these analyses to provide an improved assessment. Meanwhile, these early studies give us confidence that the ISRU technologies being developed now can be used at the first lunar landing site.

Conclusion: Additional high-resolution analyses are needed to confirm the nature of the possible mafic areas at Mons Malapert and Scott crater, and to determine the value of these and other locations as potential landing sites. This information can then be used to develop requirements for lunar surface systems. Confirmation of mafic materials in the lunar south polar region is important both for lunar mission planning and to elucidate the geology of the South-Pole-Aitken basin. Preliminary studies of Scott crater and Mons Malapert suggest that more detailed studies of selected areas in the lunar south polar region will be valuable for lunar landing site and lunar base planning.

References: [1] Cooper B. L. (2007) LPSC 38th, Abstract #1377. [2] Allen, C. C. *et al.* (1994), *Space '94*, 1157-1166. [3] Wilhelms *et al.* (1979), *Map I-1162*, USGS. [4] Lucey *et al.* (1998) *JGR*, 103, 3679. [5] Pieters *et al.* (1994) *Science*, 266, 1844. [6] Farrand *et al.* (1999), *New Views of the Moon II*. [7] Cooper B. L. (2006) *Space Resources Roundtable VIII*. [8] Wilhelms (1979) USGS Map I-1162. [9] Pieters *et al.* (2001) *JGR*, 106, E-11, 28,001.