

A Comparison of Clementine and AMIE Lunar Polar Data. D. B. J. Bussey,¹ J-L. Josset², S. Beauvivre³, and P. D. Spudis¹ ¹Applied Physics Laboratory, Laurel MD 20723, ben.bussey@jhuapl.edu, ²Space Exploration Institute, Neuchâtel, Switzerland, ³Micro-Cameras and Space Exploration, Neuchâtel, Switzerland.

Introduction: The AMIE camera has taken images that have enhanced our knowledge of the lunar polar regions. These images show the illumination conditions of both poles including information on seasonal effects which were previously unknown. Additionally, the south polar images represent the highest resolution information available and permit the study of the geology surrounding the Moon's south pole, in particular, the area close to Shackleton crater.

The Instrument: AMIE was the primary scientific camera on board SMART-1. It took images of the Moon from 15 November 2005 to 3 September 2006. During this time, it took over twenty thousand images covering a large percentage of the lunar surface. The polar coverage was especially extensive, with data taken covering a full year's worth of seasons. Previous coverage from Clementine was acquired during winter in the southern hemisphere and summer in the northern hemisphere [1]. The AMIE camera (Figure 1) includes a tele-objective with a $5.3^\circ \times 5.3^\circ$ field of view and an imaging sensor of 1024x1024 pixels. The AMIE camera acquires images in three spectral filters, at wavelengths of 750, 915 and 960 nm; the filters are directly in front of the CCD covering an area of 11/16 of the total CCD area, with one 1/16 used by the laser filter at 847 nm, while the remaining 512 x 512 pixels (i.e., 1/4 of the CCD area) are not covered by filters and thus devoted to broadband imaging.



Figure 1. The AMIE camera

SMART-1 was in a 300 x 3000 km elliptical orbit with perilune over the south pole. This resulted in very different coverage between the two polar regions. The south polar coverage is relatively high resolution and optimal for detailed morphological study. The north

polar region has excellent field of view and is optimal for regional coverage.

South Pole: AMIE collected numerous images polewards of 80° south latitude. The images typically have a spatial resolution of approximately 50 m/pixel and cover a region roughly 50 km by 50 km. These data represent some of the highest resolution data available for the pole and are especially important in that they cover a portion of the lunar surface that was previously only seen at medium resolution (~ 250 m/pixel). Figure 2 shows an AMIE picture that shows Shackleton crater near the Moon's south pole. Previous analysis of the illumination conditions of the south polar regions discovered no areas of permanent illumination [1]. However several locations were discovered that were lit for large fractions of the winter day that were imaged by Clementine. The new AMIE data cover these regions and more importantly, cover them over an entire year of Sun elevations. Initial analysis of data acquired in southern lunar summer has led us to identify a region near the south pole (Fig. 2) that appears to be lit for the entire summer day.

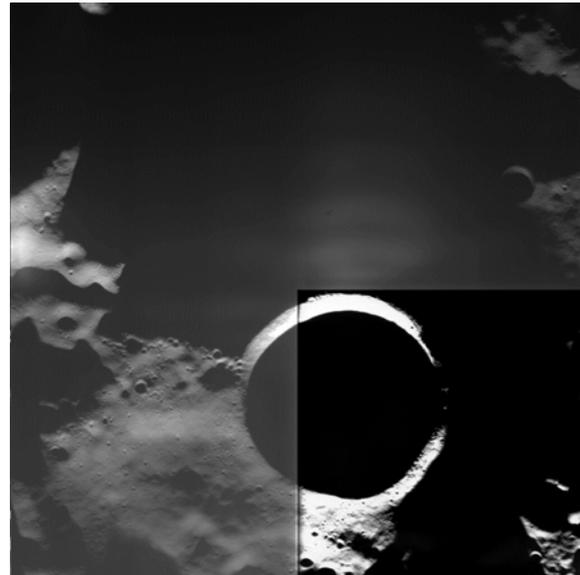


Figure 2. AMIE image showing a ridge near Shackleton crater that is illuminated for an entire lunar day. (Image courtesy of SPACE-X, Space Exploration Institute)

This area appears to be located on a ridge, extending radially from the Shackleton crater rim (Fig. 2). Interestingly, this sunlit area is prominent in the recently released “Earthset” image of the Kaguya mission (Figure 3) [4]. The area is a small peak about 10 km from the rim of Shackleton. Detailed study of the south pole has shown that Shackleton is located on the side of an inner ring massif of the SPA basin [5]. This small peak appears to be the summit of the massif, explaining its topographic prominence and why it receives so much sun illumination. Such a region is very important as a potential site for a future outpost on the Moon as it would have access to abundant solar energy.



Figure 3. South pole image taken by the Kaguya space craft. © JAXA.

North Pole: AMIE also acquired a large number of images of the lunar north pole region. These data were obtained from a much higher altitude than data from the south pole, making them ideal for regional study. These north polar images typically have a spatial resolution of 500 m/pixel and cover a region approximately 500 km by 500 km. Figure 4 shows an AMIE image of Peary crater near the north pole.

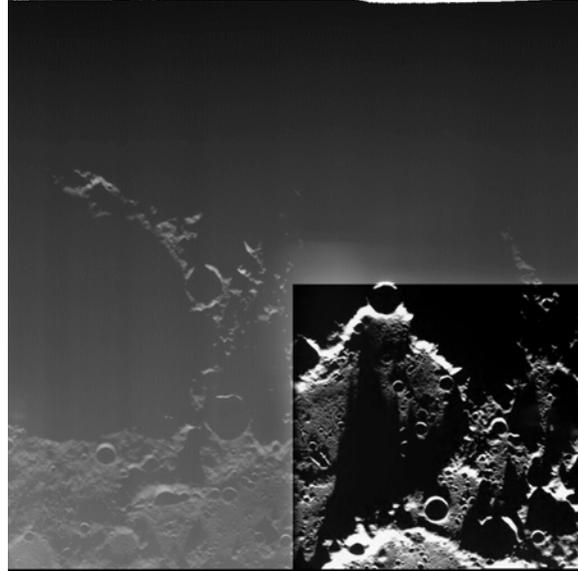


Figure 4. AMIE image showing Peary crater near the Moon’s north pole. (Image courtesy of SPACE-X, Space Exploration Institute)

Analysis of Clementine image of the lunar north pole identified regions that were lit for an entire day in northern summer [2]. As the AMIE data cover an entire year of illumination conditions, it will be possible to determine if these regions continue to receive sunlight during the winter. Analysis of the north pole lighting conditions is in progress.

References: [1] Bussey D. B. J. et al. (1999), *GRL*, V. 26, pp 1187-1190. [2] Bussey, D. B. J., et al. (2005), *Nature*, 434, 842. [3] Bussey, D.B.J., and Spudis, P.D. (2004), *The Clementine Atlas of the Moon*, CUP, Cambridge, pp. 316. [4] Jaxa (2007) Kaguya hi-res TV camera press release. [5] Spudis P. D. et al. (2008) this vol.