Lunar Shaded Relief Map updated with Clementine Data. M. R. Rosiek and R. Aeschliman United States Geological Survey, Astrogeology Team, Flagstaff AZ 86001, (e-mail: mrosiek@usgs.gov).

Introduction: Lunar maps at 1:10,000,000 scale will show elevation in false color superimposed on the shaded relief airbrush base. This series will consist of three map sheets, each portraying two opposite hemispheres (near and far side, north and south, and east and west) in Orthographic projection.

Background: Interest in lunar studies has been renewed by the success of the Clementine mission in 1994 and the Lunar Prospector mission, yet the synoptic maps available to support lunar research reflect the state of knowledge in the 1970's - although the last sheet of the 1:5,000,000 shaded relief map series (I-2276) was printed in 1992, all the maps in this series were compiled from Earth-based, Lunar Orbiter, and Zond images tied to a control network based primarily on Apollo photographs [1]. This network was estimated at the time to contain positional errors of as much as 25 km. Quantitative topographic information from this era was limited in accuracy and coverage and is not portrayed. The proposed new maps will provide a global look at lunar topography as measured by Clementine, superimposed on the shaded relief base. In addition, modern computer techniques will be used to efficiently add selective morphologic detail to the relief base where previous image coverage was nonexistent or poor (i.e., near the poles) and to correct positional errors with respect to the modern, Clementine-derived control network. These changes will result in more complete and accurate maps than any now available and will facilitate the comparison of spectral and compositional data from the new lunar missions with morphology and elevation on a global basis.

Alignment: Digital files of the lunar shaded relief maps and the Clementine global mosaic were obtained. The lunar shaded relief base at a scale of 1:5,000,000 was scanned, merged into one digital file and is available at a resolution of 1/64° (~500 m) per pixel, which is more than adequate for publication at the desired scale. At this resolution, a 1:10,000,000-scale map of the Moon could be printed at 600 dots per inch. The Clementine global mosaic was reduced to be at a similar scale as the scanned base map.

The Integrated Software for Imagers and Spectrometers (ISIS) system was used to align the shaded relief base with the Clementine global mosaic. First match points were picked for corresponding features in both images and then the shaded relief base map was warped to the Clementine mosaic. The files were divided into three areas; north pole, equatorial region, and south pole. They were aligned first in the equatorial region and then in the polar region. Within the equatorial region, an area from 60° S to 60° N, approximately 1000 points were picked. Within the north polar region, an area from 57° N to 90° N, approximately 1900 points were picked. Within the south polar region, an area from 57° S to 90° S, approximately 1100 points were picked. These points were used to warp the shaded relief map to the Clementine mosaic. The warped map aligns with the mosaic.

Shaded Relief: Approximately $5x10^5$ km^2 near the south pole was not visible in any pre-Clementine images and are blank on the published map. The digitized relief base was revised to show features in this area, based on the Clementine mosaic and recent Earth-based radar images of the area [2]. Also, the warping process may cause some gross errors in the features, errors caused by warping and reprojection were corrected.

The interpretive process is the same as that for traditional airbrush mapping [3], but the use of digital image retouching software (Adobe Photoshop) speeds the mapping considerably. Considerable differences in control between the original mapping efforts and the Clementine data exist. There are still errors in the original interpretations of lunar morphology that exist in the warped shaded relief map base. These interpretations were based on scanty data, ambiguities introduced by highly oblique solar incidenence angles, and distortions created in generating orthophotos from oblique images. To produce a new shaded relief map based on Clementine data would be a major project. The revised map provides a synoptic view of the lunar surface.

Topographic data: The main source of topographic data will be the Clementine altimetry data. For the north and south polar areas where the Clementine altimeter was not able to collect data, topographic information was collected photogrammetrically. [4]

References: [1] Schimmerman, L. A., ed. (1975) *Lunar Cartography Dossier*, v. 1., DMA, St. Louis, Missouri, sections 3.1.10, 3.4.63 **[2]** Margot, J. L., and et al. (1999) Locations of Cold Traps and Possible Ice Deposits Near the Lunar Poles: A Survey Based on Radar Topographic Mapping (abstract #1897), *Lunar Planet. Sci*., XXX, CD-ROM, Lunar & Planetary Institute, Houston. **[3]** Inge, J. L., and at al. (1976) Applied Photointerpretation for Airbrush Cartography, *Photogramm. Engr. & Remote Sens., 42*, pp. 749–760. **[4]**Rosiek, M. R., and et al. (2000) Systematic Elevation Bias in Lunar South Pole Topography Derived from Clementine Imagery (abstract #1868), *Lunar Planet. Sci*., XXXI, CD-ROM, Lunar & Planetary Institute, Houston.