A COMPOSITIONAL STUDY OF LUNAR SINUOUS RILLES: D.B.J. Bussey and P.D. Spudis, Lunar and Planetary Institute, Houston, Texas.

Sinuous rilles are a common feature in the mare regions of the moon. They consist of a meandering channel of remarkably constant width often originating from an irregular depression at the topographic high of the feature. There has been much debate as to the processes that formed them. Whilst it is now generally accepted that they are of volcanic origin, there is controversy as to whether they were formed predominantly by erosional (either thermal or mechanical) [1-4] or constructional [5-7] processes.

The Clementine mission to the moon has provided, for the first time, a global multi-spectral data set of the lunar surface [8], mapping the moon at eleven different wavelengths at a resolution of approximately 100 m pixel^{-1}. By making ratioed images of different wavelengths, it is possible to infer compositional information [9].

We are making colour-composite images of all the major lunar rilles to study the compositional relations associated with rilles to try and better understand their formation. Rilles were chosen from known databases [10] and new targets of opportunity were also selected from Lunar Orbiter images. Each Clementine frame covers an area approximately 30 km square, so in order to image an entire rille and its environs, it is necessary to mosaic several images from a number of orbits. Apart from tying these images together, dark and flat field corrections are also required. This results in one mosaiced image per filter (wavelength) which is then co-registered with others into consistent ratios in order to facilitate comparison between rilles. The final product consists of a full colour image, the blue channel being the 415/750 nm ratio, green is 750/1000 nm and the red channel is the 750/415 nm ratio [11]. In the resulting false colour-composites, highland material is blue, fresh basalt is yellow and mature basalt is reddish - purple to red in colour. At the moment these images display qualitative colour differences, though once the data is fully calibrated we hope to integrate these images with Earth based spectra and lunar sample data in order to glean quantitative compositional information.

So far approximately 12 rilles have been studied, including Rimae Hadley, Sharp, Herigonius and Prinz. Preliminary findings indicate that it is possible to obtain information on sub-rille composition using the Clementine data. A particularly good example of this is Vallis Schröteri in the Aristarchus plateau where the small rille within the main rille can be seen to have a different composition to the floor of the main rille. It appears to be made up of fresher basalt

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than the floor of the main rille. The cobra head source of Vallis Schröteri exposes highland material and indeed small traces of highland material can be seen in the walls of the main channel, although these walls are dominantly made of fresh basalt. In general, the composition of the walls of rilles varies, some rilles such as Herigonius contain fresh basalt walls whilst others have walls made up solely of highland material, an example being the rille Plato. Rima Sharp has basaltic walls close to its source, which become entirely made up of highland material further away.

Another area studied is the Marius hills region which contains 2 rilles. Even though the proximity of the rilles to each other suggests that they were formed at the same time Clementine data reveals them to have slightly different compositional relations [12]. The northern rille appears to consist solely of fresh basalt while the southern rille contains both fresh basalt and highland material. There are other interesting features in the Marius hills region. The small topographic highs are found to be of a different composition to the rest of the region. Also small impact craters have yellow (fresh basalt) floors whilst larger diameter craters have varying amounts of blue highland material. Thus by applying standard models for the depths of craters as a function of their diameter it will be possible to reconstruct a three dimensional stratigraphic picture of the region.

We will combine the Clementine data with other data sets such as high resolution lunar orbiter images and digital elevation models. From these studies, we hope to assess the relative importance of lava erosion in the creation of sinuous rilles.

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