Astromaterial Research and Training Opportunity (ASTRO) Student Report
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Fresh Transitional Lunar Impact Craters

My summer project focused on the transition from simple to complex impact craters on the lunar surface. Given that Earth is subject to many geological processes, such as erosion, plate tectonics, etc., studying this transition within terrestrial craters proves to be difficult. Studying impact craters on the Moon can therefore prove to be beneficial as they are well preserved, with little to no post impact modification.

On the Moon, the simple-to-complex transition diameter, D_t, has previously been defined as 16 km and 21 km for Mare and Highlands targets, respectively (Pike, 1980). There is a small, yet significant, group of craters that cannot be defined as simple or complex and are instead referred to as "transitional". The mechanisms by which transitional craters form and the relationships with large simple craters and small complex craters are poorly understood and are the focus of this study.

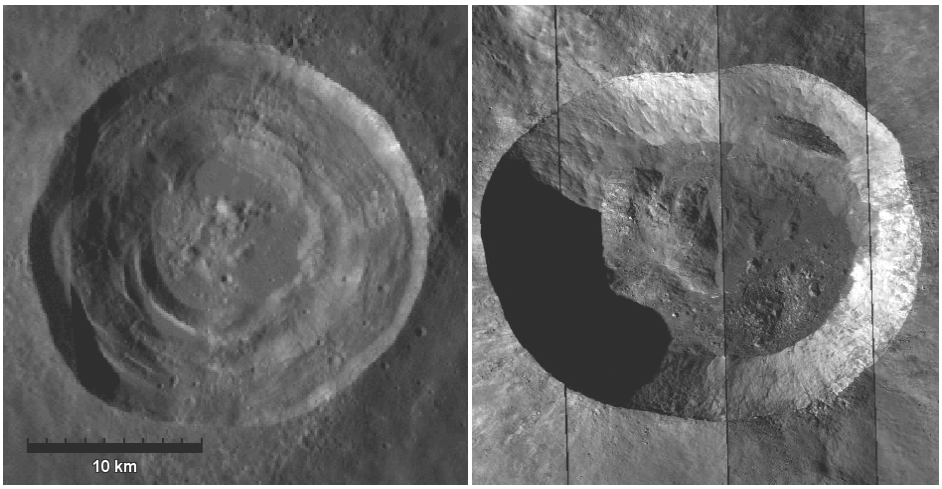

Figure 1: Comparison of terracing for similar sized craters. Left: Picard has concentric terracing (22 km; 14.60°N, 54.70°E; LROC WAC Mosaic). Right: Giordano Bruno with one apparent terrace in north-east quadrant. (22 km; 35.90°N, 102.8°E; LROC NAC images: M103838997LC, M103831840LC, M103831840RC, M106188285RC).

We constructed a database, emphasizing transitional craters, based on a recent database of 111 'fresh' craters, with diameters of 15 km and greater (Kalynn, 2013). We define a transitional crater as a flat-floored crater that lacks a central uplift. Lunar Reconnaissance Orbiter Camera (LROC) images were used in addition to other datasets such as the Lunar Orbiter Laser Altimeter (LOLA) 512 pixels per degree (ppd). Both datasets were visualized within the Java Mission and Remote Sensing (JMARS), a planetary Geographic Information System, and were used in order to map out terraces within craters as a function of crater diameter.

The number of terraces increases with diameter, in both target types. The formation of terraces occurs in smaller diameters in mare targets, compared to highlands targets. It is

hypothesized that this could be due to the layered nature of the mare target, not present in the highlands, aiding in crater collapse. Layering appears to be an important property in controlling this simple-to-complex transition.

In addition to mapping terraces within these craters, we also observed depth diameter relationships. Mare craters, both transitional and complex, plotted consistently lower compared to highlands. This could be the result of increased terracing which may aid in crater collapse.

The results of this research was written as an abstract and presented as an oral presentation at the Large Meteorite Impacts and Planetary Evolution V conference, hosted August 5 – 8, 2013 in Sudbury, Ontario. The aim is to publish this project as a research paper in the near future.

References: Pike R. J. (1980) Proc. Lunar Planet. Sci. Conf. 11th, 2159-2189, Kalynn J. et al. (2012) *Geophys. Res. Lett.* in press.