LROC EXPLORATION OF THE MOON. M.S. Robinson[1] and the LROC Team, [1]Arizona State University, School of Earth and Space Exploration, Box 871404, Tempe, AZ, 85287.

Since entering orbit in 2009 the Lunar Reconnaissance Orbiter Camera (LROC) has acquired over 700,000 Wide Angle Camera (WAC) and Narrow Angle Camera (NAC) images of the Moon. This new image collection is fueling research into the origin and evolution of the Moon (i.e. tectonism, volcanism, impact processes, photometry and space environment-surface interactions), unique advances in cartography, and provides the basis for stereo topography and mosaics. This abstract highlights a subset of LROC-based advances to date.

NAC images revealed an elevated silicic, nonmare volcanic complex 35 x 25 km (60˚N and 100˚E), between Compton and Belkovich craters (CB). The CB terrain sports numerous volcanic domes and irregular depressed areas interpreted to be caldera-like collapses. The volcanic complex corresponds to an area of high-silica content (Diviner) and high Th (Lunar Prospector). Volcanic constructs diameters range from 1 to 6 km in diameter with up to 800 m elevation and slopes >20˚. A low density of impact craters indicates that this volcanic complex is relatively young.

The LROC team mapped over 150 Marius Hills (MH) volcanic domes and 90 volcanic cones, many of which were not previously identified. Morphology and compositional estimates (Diviner) indicate that MH domes are not silica-rich, unlike most other lunar domes. These results indicate that the Marius Hills are a unique form of lunar volcanism and support the hypothesis that these landforms are products of low-effusion rate mare lavas.

Impact melt deposits are observed in most large Copernican impact craters (with diameters >10 km) in ponds and flows on exterior ejecta, the rim, inner wall, and crater floors. Preserved impact melt flow deposits are observed around craters as small as 2.4 km diameter, and the estimated melt volume is substantially higher than models predict. At small diameters (<5 km), the amount of melt predicted from modeling studies is small, and melt that is produced is expected to be ejected from the crater interior. However, we observe well-defined impact melt deposits on the floor of some highland impact craters as small as 200 m diameter. NAC digital elevation models (DEM) allow for a quantitative analysis of impact melt forms, from which properties such as viscosity, temperature, and clast content can be assessed. Observations show that melt deposits were highly fluid and superheated during emplacement.

A globally distributed population of previously undetected contractional and extensional structures were discovered in LROC images. Their crisp appearance, lack of superposed large-diameter impact craters, and crosscutting relations with small-diameter impact craters show that lobate scarps are relatively young landforms (<< 1 Ga). Because of their young age and wide distribution, the population of lobate scarps is interpreted as an expression of recent global radial contraction due to cooling of the lunar interior. NAC images also revealed small-scale extensional troughs or graben both in nearside mare and in the farside highlands. Crosscutting relations with small-diameter impact craters along with depths as shallow as 1 m indicate these pristine graben are <50 Ma old. The young, small-scale graben and lobate scarps place bounds on the amount of global radial contraction and the level of compressional stress in the lunar crust.

The polar orbit of LRO and the broad field of view of the WAC enable multi-temporal coverage of regions near the poles. From over 4000 WAC images several highly illuminated regions were discovered, including one site that remains illuminated for nearly 94% of the year, with its longest eclipse period lasting only 43 hours. Targeted NAC images provide higher resolution characterization of specific key sites with permanent shadowing and extended illumination.

Repeat imaging over a range of viewing and Sun angles revealed the presence of collapse pits both in the mare and impact melt deposits. For two of the mare pits LROC imaged into sublunarean voids with unknown extents.

The repeat WAC coverage provides an unparelled photometric dataset that allows spatially resolved solutions (currently 1°) to Hapke's photometric equation (7 bands, 300 to 700 nm) – data invaluable for photometric normalization and interpreting physical properties of the regolith. The WAC color also provides the means to better solve for titanium abundance within the mare, and distinguish subtle age differences within Copernican aged materials.

The longevity of the LRO mission allows follow up NAC and WAC observations of previously known and newly discovered science targets over a range of illumination and viewing geometries. Of particular merit is the continued acquisition of NAC stereo pairs and oblique sequences that provide amazing tools to unravel the complex and relatively unknown geologic history of the Moon. With the extended SMD phase, the LROC team is working towards the ultimate goal of imaging the whole Moon with pixel scales of 50 to 200 cm.