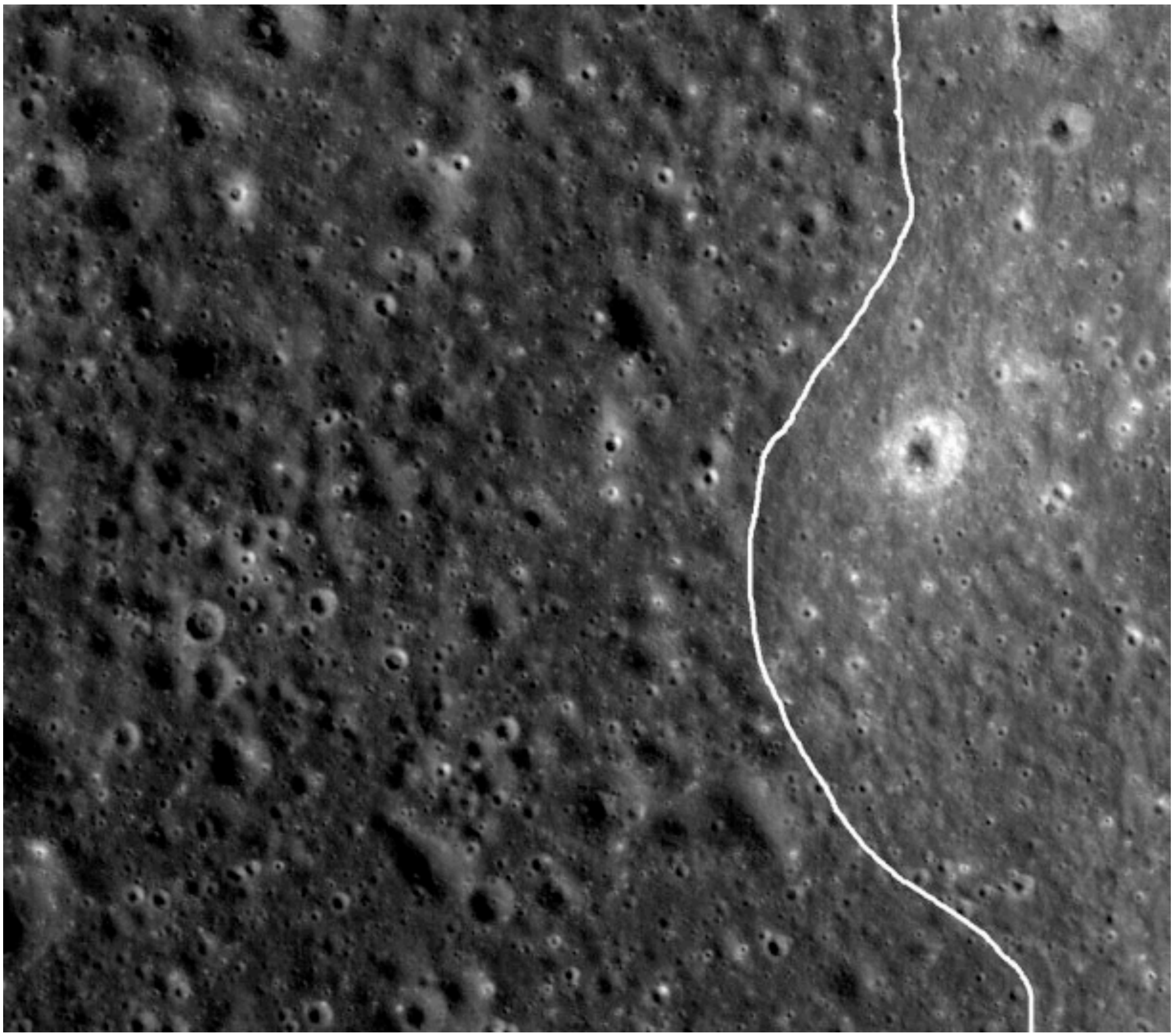
LRO Team Begins to Release New Image Series

Published by Matt on Fri Jan 8, 2010 11:41 am via: NASA

Today, the LROC Team begins a new series of Featured Images highlighting the regions of interest for potential future human and robotic lunar exploration that LRO is imaging for NASA's Constellation Program.

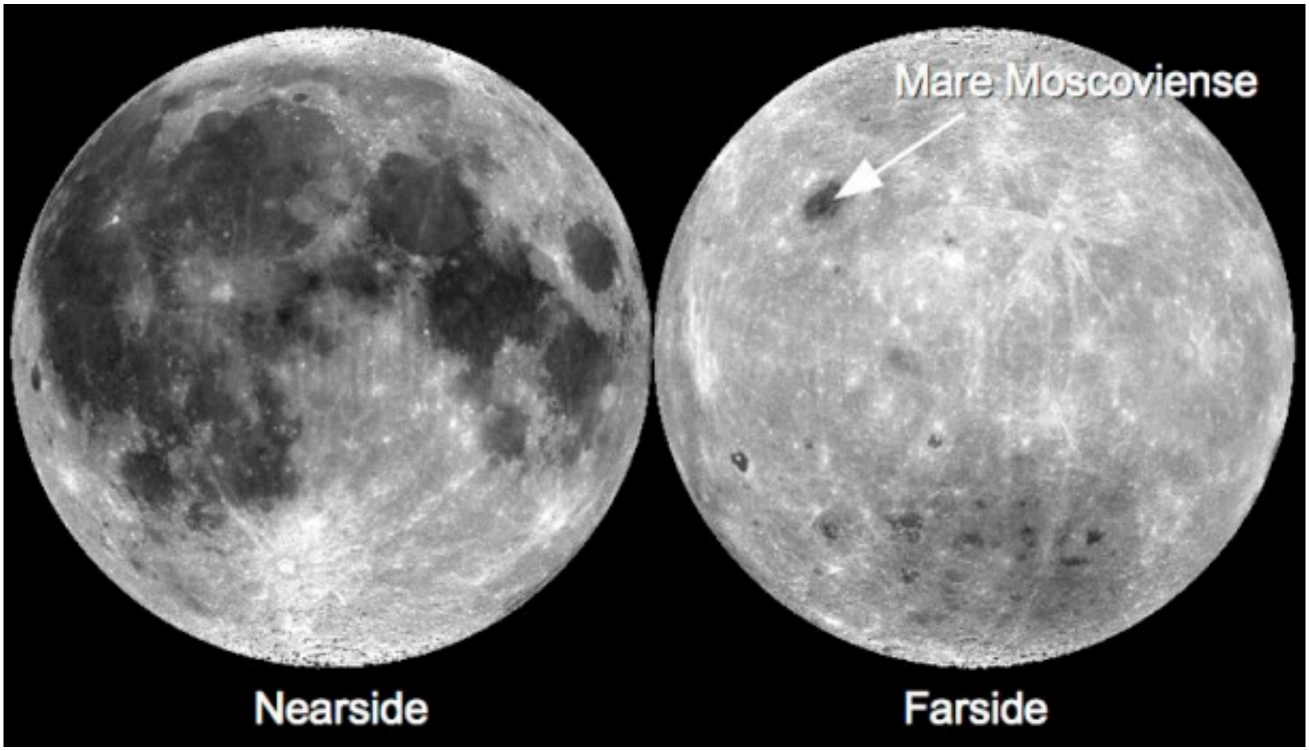
There are 50 of these regions, which were selected prior to LRO's launch based on expert input from the lunar science community and NASA engineers. For each of these 50 regions, the LROC Team is collecting a comprehensive set of image data.



A very subtle mare-highlands boundary in Mare Moscoviense on the lunar farside, near the center of the Constellation Program region of interest. The generalized geologic contact between the mare and the highlands has been highlighted (mare to the left, highlands to the right). Image width is 1.8 km. Credit: NASA

These images, and the associated information products derived from them (such as boulder distribution maps, slope maps and digital terrain models), will guide engineers and scientists as they develop their plans for how they would continue to explore the moon both robotically and with humans.

Lunar scientists have been studying the vast data returned from the Apollo missions for almost 40 years. As a result, much is known about the moon. Even so, there remains much that we do not know about the moon. Accordingly, each of these 50 regions is associated with either an immensely compelling lunar science question or an explorationenabling resource, or both, that will be useful to future explorers. However, these 50 regions aren't intended as actual NASA landing sites, but instead are representative locations whose study will provide mission planners and lunar scientists working on future human and robotic lunar exploration with lots of data for a comprehensive suite of interesting and relevant terrains all over the lunar surface.

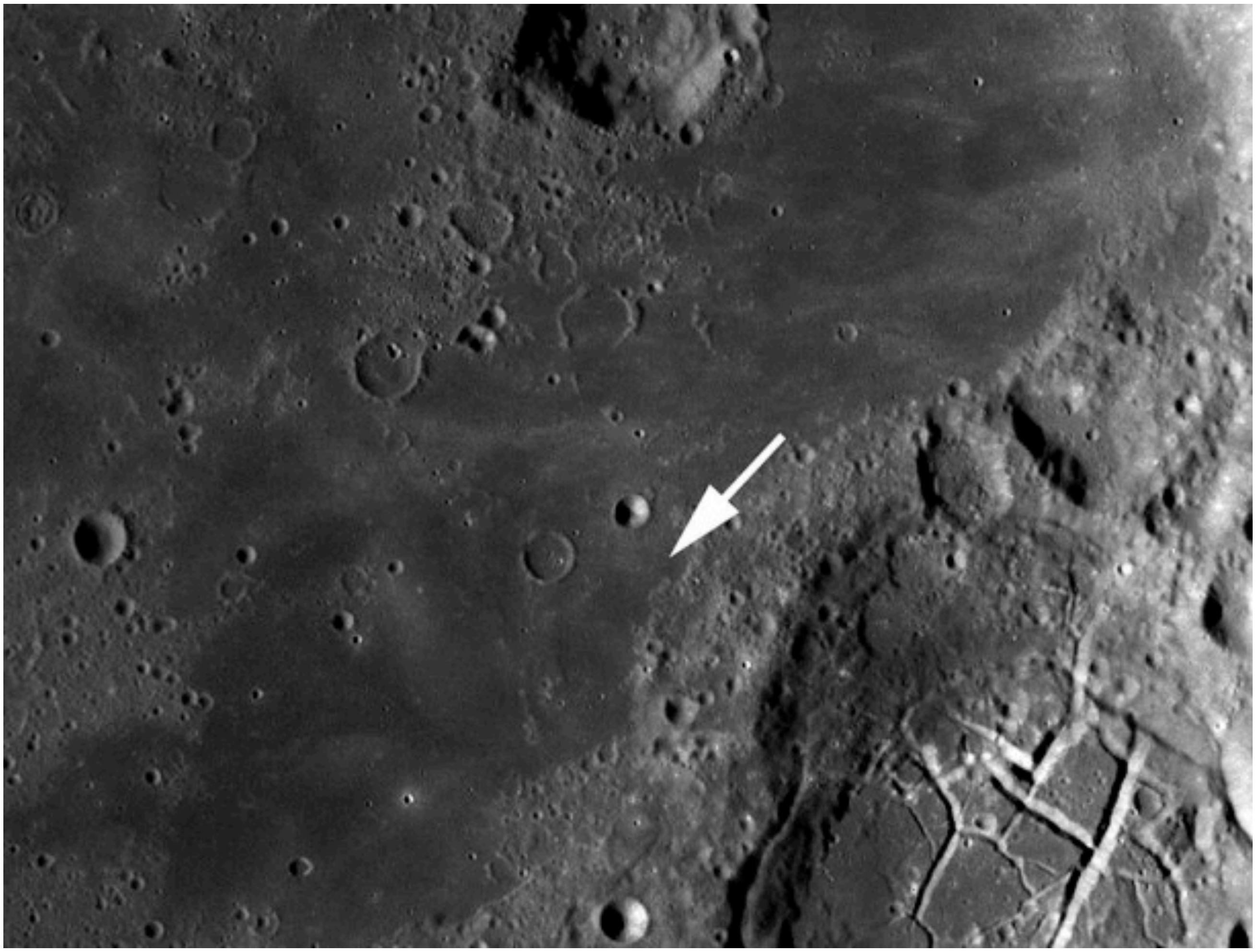


Mosaics from the Clementine mission showing the lunar near side and lunar far side, with the location of Mare Moscoviense highlighted. Credit: U.S. Geological Survey/Arizona State University

Mare Moscoviense: Window to Far Side Volcanism

It's clear from looking at pictures of the moon that the near side and the far side are very different from a geologic standpoint. The darker, basaltic mare deposits dominate the near side, whereas the far side is dominated by bright deposits of anorthosite thought to be remnants of the moon's original crust. Mare Moscoviense is one of the few (and also the largest) deposits of mare basalts on the lunar far side.

Why are there so many mare basalts on the near side, but so few on the far side? Lunar scientists simply don't know the answer to that question. One idea is that the far side crust is simply thicker than the near side crust, and rising basaltic magma simply solidified before it was able to push through the thicker far side crust. That's where Moscoviense comes in. We know enough about the Moscoviense region from previous missions that we have a well-defined set of questions that potential future missions might be able to answer. For example, the Lunar Prospector mission showed that there are high concentrations of thorium in the Moscoviense basin. Thorium acts as a tracer for the lunar KREEP (potassium K, rare earth elements, and phosphorus) geochemical component found in abundance on the near side but not on the far side. Understanding the extent and distribution of thorium in the basin may tell us about the global distribution of the lunar KREEP component and thus the evolution of the lunar mantle. We also know from the Clementine mission that the Moscoviense basalts are rich in both iron and titanium. Since basalts form by partial melting of the lunar mantle, sampling Moscoviense basalts provides lunar scientists with vital insights into how the lunar mantle on the far side differs from the near side mantle, which in turn would help us to learn why mare basalts are so much rarer on the far side and provide key insights about the formation of all of the terrestrial planets, including Mars and Earth.



LROC WAC mosaic with the location of the proposed Constellation region of interest indicated with an arrow. Credit:NASA

For these reasons, a Constellation Program region of interest is located within Mare Moscoviense. As you can see in Figures 3 and 4, the region is at the edge of Moscoviense, allowing explorers to collect samples from both the mare basalts and the surrounding highlands terrain during their traverses. The materials at the edge of the basin provide important insights into the formation of the Moscoviense basin itself. By exploring and sampling the Moscoviense region, we would date the basalt flows and definitively determine their composition. This sampling would let us determine how Moscoviense basalts differ from the near side basalts sampled during Apollo. Age-dating Moscoviense basalts also provides important insights into the history of lunar volcanism by determining whether the Moscoviense basalts are older or younger than near side basalts.

While the scientific goals of exploring the Moscoviense region are certainly important, no less important is access to key lunar resources. The lunar regolith (the broken-up rocks and impact products that make up the first 10 meters or so of the lunar surface) in this region is derived in part from the local titanium-rich Moscoviense basalts. This regolith material could be used for a variety of vital purposes, including the construction of human habitats, radiation shielding, or as feedstock for local resource utilization. Taking a longer view, titanium is an important industrial material on Earth, and it will be very important for indigenous lunar industrial development.