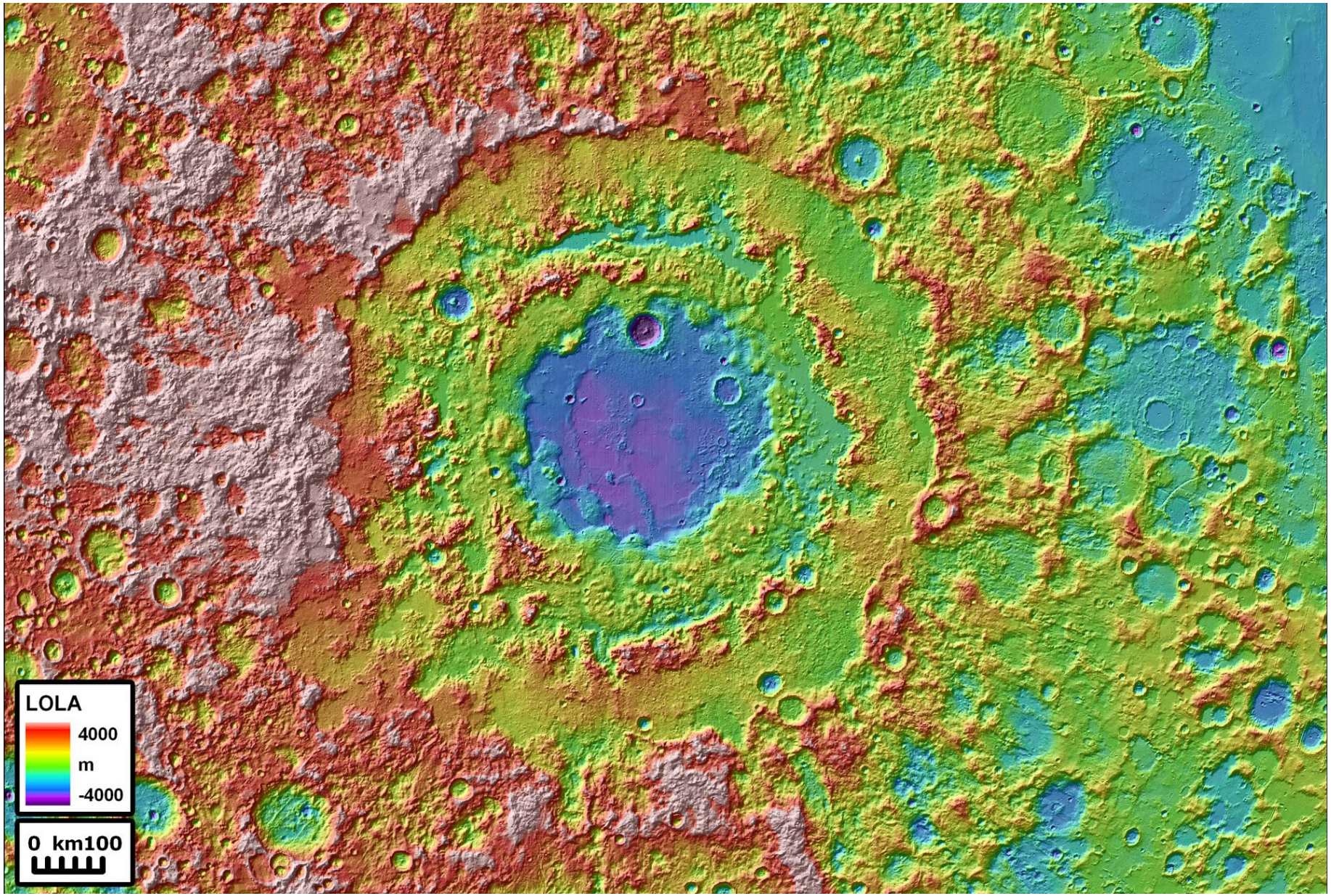
National Aeronautics and Space Administration



LUNAR RECONNAISSANCE ORBITER: The Impact History of the Moon

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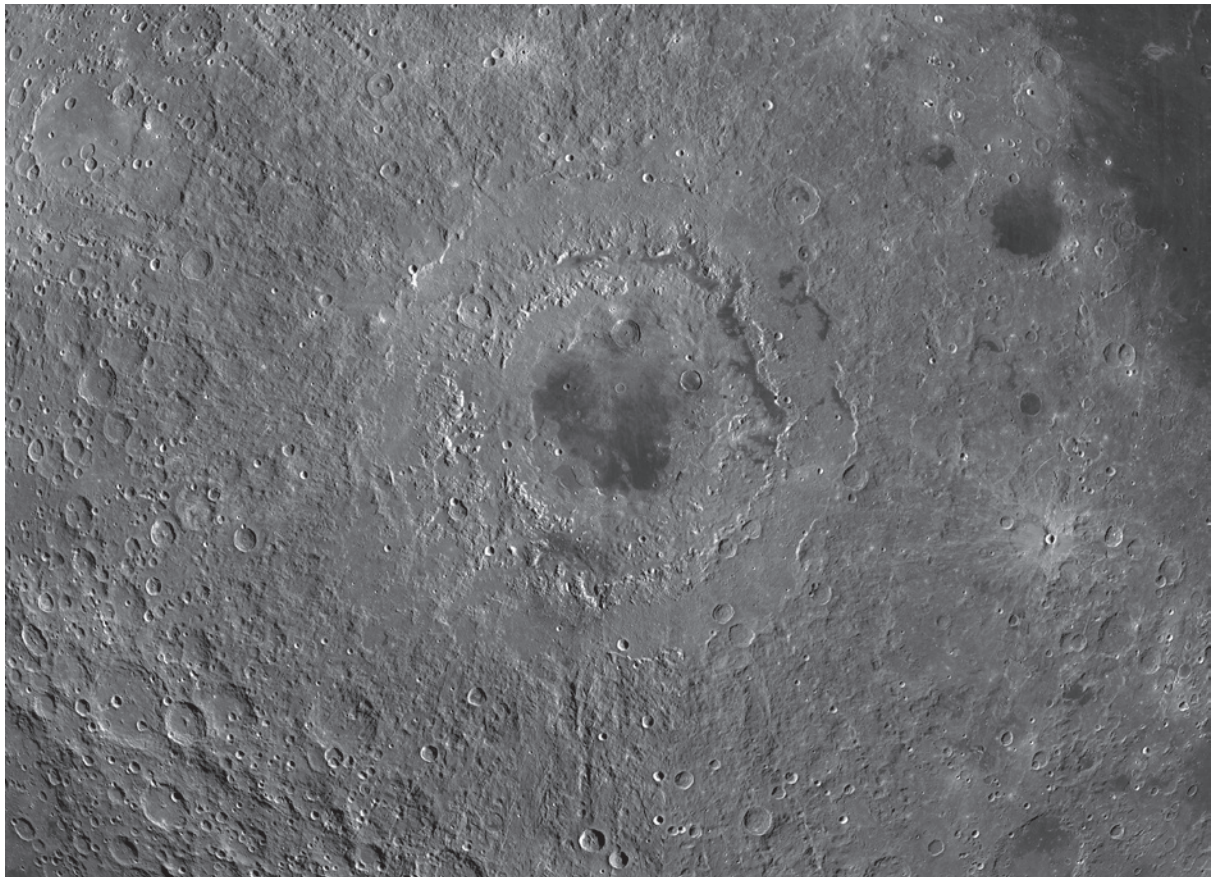
The Impact History of the Moon

Meteor impacts can radically alter the surface of a planet. The Moon, Mars, and Mercury all bear scars of ancient craters hundreds or even thousands of miles across. Because Earth was also subjected to this assault, these enormous impacts could have slowed the development of life on Earth. Large impacts that occurred geologically recently appear to have altered life's evolution. Chicxulub, a 110-mile diameter crater located in the Yucatan peninsula in Mexico, formed when an asteroid impacted the Earth about 65 million years ago. Chicxulub is now widely believed to have led or contributed to the demise of the dinosaurs and many other lifeforms.

Scientists trying to reconstruct the meteorite impact history of Earth face difficulty because terrestrial impact craters are eroded by wind and water, or destroyed by plate tectonics. However, a rich record of craters is preserved on the Moon because the only source of significant erosion is other impacts. The lunar record can be used to reconstruct the poorly preserved impact record on Earth.

Scientists used data from the Lunar Orbiter Laser Altimeter (LOLA) instrument on board LRO to build a map that highlights lunar craters with greater clarity than ever before. The instrument sends laser pulses to the lunar surface and measures the time that it takes for them to reflect back to the spacecraft. Scientists convert this information into a detailed topographic map of the Moon.

Different sizes of objects impacted bodies in the solar system at different times during solar system formation. The timing and sizing of these impactors can be classified into different 'populations.' The LOLA impact crater database shows that the transition between different populations of impactors occurred about the time of the Orientale impact basin, about 3.8 billion years ago. The data suggest that this change in populations occurred around the same time as the large impact basins stopped forming. Are the two related? Answering that question has implications for the earliest history of all the planets in the inner solar system, including Earth.



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Goddard Space Flight Center manages the Lunar Reconnaissance Orbiter for NASA's Science Mission Directorate.

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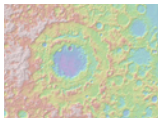
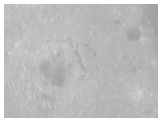


Front image: A topographic map of the Orientale Impact Basin from the LOLA instrument onboard LRO. Credit NASA/GSFC/MIT



Back image: An image of the Orientale Impact Basin by the Wide Angle Camera onboard LRO. Credit NASA/GSFC/ASU

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