

South Pole Aitken Basin Sample Return Mission

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The South Pole Aitken Basin is an ancient impact scar on the Moon, 2500km in diameter, which penetrated through the plagioclase-rich upper lunar crust into lower crust and possibly the lunar mantle. The composition as observed by Clementine and Lunar Prospector is noritic, but it is not clear whether the basin is filled with meltrock from the impact or some other mixture of materials with noritic composition. The principal scientific objectives of the mission would be to determine the age of Basin formation, the composition of the lower crust and, if possible, the composition of the underlying mantle. The mission would test at least two major hypotheses, the lunar magma ocean hypothesis for lunar differentiation and the terminal cataclysm hypothesis for the formation of great basins on the Moon in the 4.3-3.9by time period. A South Pole Aitken Basin Sample Return Mission is proposed that will retrieve a one kilogram sample from a location within the Basin. The mission could be launched in 2004-2005 as part of NASA's Discovery Program. The sample will consist of regolith fines and 2-10mm rock fragments concentrated from the regolith with a screen allowing the removal of finer-grained material. The samples would be returned to the lunar curatorial facility at the Johnson Space Center for description, distribution for analysis and archival storage. A concept for the mission has been developed that will allow the spacecraft to be launched using a Delta II launcher with a large mass margin. A communications orbiter is included in the concept, because the Basin lies on the lunar far side. Various possibilities include a libration point halo orbit, a nodal reencounter strategy for a free-flying communication link, or the use of an existing lunar orbiter's communication capability.