

**A New Moon. An initiative to integrate new lunar information into our fundamental understanding of the Moon and the next stages of lunar exploration.** C.K. Shearer<sup>1</sup>, C.R. Neal<sup>2</sup>, B.L. Jolliff<sup>3</sup>, M.A. Wieczorek<sup>4</sup>, and S. Mackwell<sup>5</sup>. <sup>1</sup>Institute of Meteoritics, Department of Earth and Planetary Sciences, University of New Mexico, Albuquerque, New Mexico 87131 ([cshearer@unm.edu](mailto:cshearer@unm.edu)), <sup>2</sup>University of Notre Dame, Notre Dame, Indiana, 46556, <sup>3</sup>Department of Earth and Planetary Sciences, Washington University in St. Louis, St. Louis, Missouri, 63130, <sup>4</sup>Insitut de Physique de Globe de Paris, Saint Maur, France, <sup>5</sup>Lunar and Planetary Institute, Houston, Texas, 77058.

**Introduction:** In 1998, Curation and Analysis Planning Team for Extraterrestrial Materials sponsored a long-term initiative to improve our understanding of the Moon and its history by integrating all available types of data: in situ investigations, analyses of lunar samples, telescopic observations, and spacecraft datasets. This initiative, New Views of the Moon (NVM), was supported by NASA's Science Mission Directorate and the Lunar and Planetary Institute. The initiative was guided principally by Brad Jolliff, Charles Shearer, Mark Wieczorek and Clive Neal. The goals of the initiative were (1) to summarize new insights that have been gained about the Moon as a result of recent global data sets and their integration with sample and other data; (2) to define current understanding of the Moon's geologic history, resources, and potential for scientific exploration; and (3) to communicate implications of knowledge gained from research and exploration of the Moon for planetary science and exploration beyond the Moon. This initiative involved over 100 individual scientists and engineers, consisted of numerous workshops and special sessions at national and international meetings, and cumulated in a book "New Views of the Moon" that was published in 2006 as volume 60 of *Reviews in Mineralogy and Geochemistry* (Fig. 1). In 2012 the book was translated into Chinese. Unfortunately, NVM went to press prior to analysis of the data from missions flown since 2000, and before the major discoveries from sample analyses made this century.



**FIG 1. End products of the NVM initiative.**

Our view of the Moon has dramatically changed since NVM was published, based on mission observations and new measurements made on lunar samples. We propose to start a new lunar initiative that will integrate these new observations into producing a richer understanding of our nearest neighbor in space, revealing new clues about the history of the Solar System, and providing new information for renewed exploration of the Moon with robotic and human missions.

**A New Perspective from Missions:** Following the publication of NVM, numerous missions to the Moon have been launched by a variety of space agencies examined the surface and interior of the Moon. These include SMART-1 (ESA), Kaguya (Japan), Chang'e 1, 2, 3 (China), Chandrayaan-1 (India), LRO, LCROSS, ARTEMIS, GRAIL, and LADEE (USA). The resulting new datasets have rewritten our view of the Moon with regards to lunar evolution, terrain formation, tectonic and geochemical processes, volatile reservoirs, and potential resources. During the duration of the proposed initiative a variety of orbiter, rover, and sample return missions are possible.

**A New Perspective from Samples:** Since 2006, using new or improved analytical approaches, sample studies have shed light on the nature, behavior, and role of volatile reservoirs in the lunar mantle and crust, the age and evolution of the lunar highlands, age and origin of the Moon, and dynamical processes in the early Solar System. For example, ion microprobe studies of volcanic glasses and apatite in mare basalts indicate distinct volatile reservoirs in the lunar mantle.

**A New Perspective from Engineering and Resource Utilization:** In addition to the vast science return from recent missions, these missions have also generated new observations that will enable future human missions to the Moon. They also provide a foundation for future human activity in the Earth-Moon system and beyond enabled by potential lunar resources. For example, new gravity and illumination maps enable future human activity by characterizing the distribution and nature of volatile and solar resources on the lunar surface, permitting optimization of future utilization of resources to sustain exploration and commerce.

**Proposal for a New Lunar Initiative:** The time is right to synthesize data from all of these new observations and integrate them with our understanding of the Moon prior to 2006. This new lunar initiative will build upon both NVM and the Lunar Sourcebook (a user's guide to the Moon), and produce a new science and engineering assessment of the Moon. The initiative will consist of several topical workshops, meeting special sessions, web-based resource collections, and a final book product. This abstract and presentation is the first solicitation for input from LEAG and the lunar community (both USA and internationals).