

## USING A FIELD EXPERIENCE TO BUILD UNDERSTANDING OF PLANETARY GEOLOGY

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**Introduction:** In the summer of 2004, the Lunar and Planetary Institute hosted 25 middle- and high-school teachers on a week-long field experience in Idaho and Montana. The “Floods and Flows: Exploring Mars Geology on Earth” workshop (<http://www.lpi.usra.edu/education/fieldtrips/2004/>) mixed fieldwork with classroom experiences and provided educators and scientists the opportunity to interact. The educators investigated deposits associated with Glacial Lake Missoula floods and lava flows in the Craters of the Moon National Monument and Preserve. Participants applied what they learned about Earth-based processes to develop an understanding of processes operating on Mars and the most recent results from NASA’s missions to Mars. This was the most recent of five field-based experiences that used Earth-planet comparisons as a basis for experiential learning.



2004 participants: “Floods and Flows: Exploring Mars Geology from Earth”

These field experiences all are designed to strengthen content knowledge of geologic processes and planetary sciences. Learning geology through fieldwork enables participants to take ownership of the content through real-life experience; in essence, the teacher becomes the student. Establishing deeper knowledge of the content increases their confidence in facilitating inquiry based science in their own classrooms. In addition to content, the educators were immersed in the process of science. Participants made observations, compiled notes and illustrations, debated interpretations, drew conclusions, and communicated findings. Care was taken to separate observations and interpretations to help build an understanding of scientific reasoning. Discussions often involved questions without solutions, or with multiple solutions. While some participants expressed discomfort with these aspects of the nature of science at the beginning of the workshop, most were more comfortable with open-

ended, inquiry based exploration at the close of the experience.

The fieldwork is coupled with discussion and activities in the classroom. Participants reflected on the field sites and placed them in the context of the geologic history of the region. Observations and interpretations at individual field stops were related to planetary observations. The educators worked in small groups to develop a virtual tour of the different field stops. The Web-based tour was intended for use by their students. Development of the virtual tour allowed participants to solidify knowledge and enabled instructors to verify comprehension. The Web site became an educational tool, prompting further discussion and investigation.



Hands-on, inquiry based, standards-based classroom activities supplemented the field experience. Because the activities related directly to processes observed in the field, the participants were able to make detailed observations and were better able to make connections with the content. They were more confident in identifying where the activities served as strong models and where the activities failed to model the real world. The participants were more comfortable asking questions and experimenting with variables. In the next several months, the participants will be surveyed in an effort to track how the experience is incorporated into the classroom and leveraged across the educational community.

**Model for a field experience:** Over the past five workshops the coordinators have learned some helpful lessons about the preparation, field, and classroom components that have improved efficiency and quality. An application process and evaluation procedures have significantly increased the overall effectiveness and leveragability of the workshop. Workshops should be held in summer, often July, as some schools continue into June and others start in early August. Involvement of 25-30

participants with similar foundations of knowledge enables practical undertaking of logistics, one-on-one discussions, and access to the scientists. It also allows presentations to be geared to a focused level. Our workshops have been tailored for middle-and high-school science teachers, pre-service teachers, informal educators, education specialists, early college instructors, and junior college instructors. Supplemental funding from other institutions or industries should be sought to defray costs for the participants.



*Upcoming Workshops:*

**LIFE AT THE LIMITS: EARTH, MARS, AND  
BEYOND  
July 10-17, 2005**

At field sites in Nevada and California, participants will investigate some extreme geological and chemical conditions in which life on Earth can thrive. This hands-on, real-world experience will enhance classroom teaching about earth and space science, especially about what organisms need to survive and the search for past and present extraterrestrial life. Astrobiologists and Planetary scientists will lead the field and laboratory experiences, helping to connect the field observations with the search for life in our Solar System and beyond through discussions and proven, hands-on, standards-based classroom and laboratory activities that are ready to share with students! For more information please visit <http://www.lpi.usra.edu/education/fieldtrips/2005/>

Applications Due: March 23, 2005