

21ST CENTURY NATURAL HISTORY: USING PLANETARY GEOLOGY TO ENHANCE THE PRESENTATION OF GEOSCIENCE IN NATURAL HISTORY MUSEUMS J.C. Aubele¹ and L.S. Crumpler¹ ¹New Mexico Museum of Natural History and Science, 1801 Mountain Rd. NW, Albuquerque, NM, 87104, jayne.aubele@state.nm.us

Introduction: Over the past decade, the New Mexico Museum of Natural History & Science (NMMNHS) has successfully used planetary geology to enhance geoscience education. The addition of planetary geology to natural history museums' traditional range of science topics enables museums to teach planetary science, basic geoscience, and local or regional geology by linking all of these topics to the excitement of the exploration of space. This has allowed the NMMNHS to reach multiple and underrepresented audiences, to encourage interest in NASA exploration and basic geoscience, and to better serve the science education needs of the state of New Mexico.

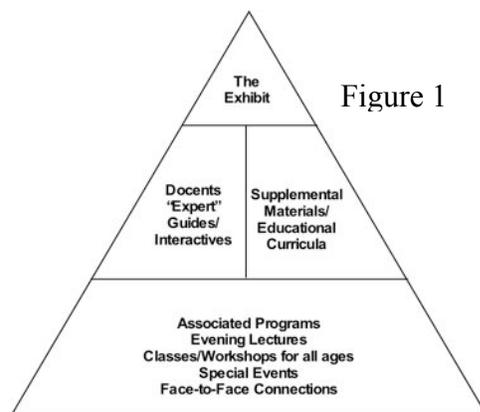


Figure 1

Natural history museums provide informal science education by incorporating associated educational programs with exhibits. A way to visualize this package of informal education is a pyramid (Fig.1). The associated educational programming enables the museum to leverage the science content, visuals, and interactives of an exhibit in order to increase the science content available to the average visitor with more information-intensive approaches. The NMMNHS has created a range of planetary geology-related exhibits and associated programming utilizing the following techniques: (1) geoscience related to a specific planet or mission; (2) geoscience related to a planetary problem; and (3) planetary geology related to art.

Geoscience Related to a Specific Planet or Mission:

Planetary geology incorporates the popular topics of "outer space" (space science) and "exotic new worlds" (planetary science) while using the techniques and principals of terrestrial geoscience. NMMNHS research curator (co-author Crumpler) is a team member on the Mars Exploration Rover mission (MER). Using our local scientist connection, the NMMNHS has presented the ongoing rover discoveries and focused on face-to-face connections with local scientists involved in planetary missions, while also teaching basic geoscience. Beginning in 2004, the NMMNHS developed a permanent exhibit entitled *Making Tracks on Mars* (Fig.2) and created and provided educational programs for all age groups from preK through senior citizens, families, and preK-12 teachers. We also formed a partnership with a regional



Figure 2

Native American Junior-Senior High School, developing a program using Mars-New Mexico analogs (Fig.3) and the concept of place-based geoscience, which is particularly effective in the education of Native American students [1]. The overarching theme of this ongoing educational program uses a newsworthy planetary mission to excite and interest the public, to increase support for NASA missions, and to teach about planetary science, basic geoscience,



Figure 3

Mars, and local New Mexico geology at the same time [2].

Since 2004, a minimum of 3 million visitors have visited the Mars-related exhibit, and participation in our Mars educational programming has totaled more than 20,000 adults and children. Our unique Mars rover curriculum [3] and teacher professional development workshops have reached approximately 6,000 classroom/science teachers over the past decade. The Mars programming is one of our most successful thematic geoscience education efforts.

This approach has also been used by the Royal Ontario Museum (ROM) in Toronto, which has a link to the OSIRIS-Rex mission through their Endowed Chair of Mineralogy who is a collaborating scientist on the mission [4]. Similarly, the Rose Center at the American Museum of Natural History & Science (AMNH) is planning to use their direct connection to the James Webb Space Telescope through an instrument component that was conceived and

designed at the museum by scientists in the museum's department of astrophysics [5].

Geoscience Related to a Planetary Problem: Because of the success of our MER-related exhibit/educational



program, the NMMNHS sought other ways of using planetary geology to teach geoscience. For example, an exhibit and associated programming entitled *It Came from Mars*, produced by the NMMNHS and on exhibit from May 2015 to May 2016, was used to introduce the general public to the geological subdisciplines of geochemistry and geochronology. The exhibit was designed to take advantage of popular culture, specifically the 1950s space invader movie theme (Fig.4) and Sherlock Holmes mysteries. Using meteorites from Mars and a Holmes-style series of clues and deductions, the exhibit presented detailed information about mineralogy/petrology, age dating, and atmospheric composition. Linking these topics to Mars allowed the museum to educate visitors about complicated concepts in a way that encouraged their interest in these subjects. Visitor attendance increased significantly during the year that it was on display, with an additional 16,000 visitors over the previous May-May time period. Associated programs, targeting K-6 students, teens, adults, and families, also experienced higher than average participant numbers. The exhibit culminated in a “Mars Fiesta” offering an opportunity for several hundred museum visitors to interact with local Mars scientists. The success of this special exhibit has led to additional plans to use planetary geology in the presentation of geoscience.

The American Museum of Natural History's permanent exhibit *Why is Earth Habitable* also presents geoscience subdiscipline topics by linking them with planetary topics.

Planetary Geoscience Related to Art: Teachers of science and technology have recently begun to incorporate the arts as a useful and effective way to interest the public and teach basic science. This is referred to as STEAM (science, technology, engineering, arts, and mathematics). The images taken by planetary spacecraft can be enjoyed as both art and science. NASA has acknowledged that fact with two recent books, *Earth as Art* and *Mars: The Pristine Beauty of the Red Planet* [6]. In the museum environment, the presentation of images acquired for scientific purposes is perhaps one of the simplest ways to engage visitors in the science of exploration while enveloping them in the familiar environment of an art gallery. An example of this approach is the photo exhibit *25 Years of Space Photography*, a collection of 140 first-time images acquired by the U.S. unmanned space program. Curated by Jay Belloli, Director of the Baxter Art Gallery (Cal Tech), the exhibit traveled the globe to more than 50 art galleries and museums in the 1990s [7]. In 2015, the complete collection was granted to the New Mexico Museum of

Natural History & Science (NMMNHS) and some of the images, along with more recent first-time planetary exploration images, were exhibited for the museum's special 30th anniversary celebration. The NMMNHS used the same technique in celebrating the 10th anniversary of the Mars Exploration Rover mission in 2014 by creating an exhibit entitled *Mars Landscape Art by Spirit and Opportunity*. This exhibit was designed to blend art and science and immerse the museum visitor in Mars with an art gallery-style exhibit of wall-size panoramic images



(Fig.5). The exhibit was reviewed locally by the arts editor (not the science writer) of our metropolitan newspaper [8] and drew increased visitor numbers to the museum.

Similarly, an exhibit in 2016 at the Natural History Museum, London (U.K.) entitled *Michael Benson's Other Worlds: Visions of Our Solar System* presented an artist's viewpoint concerning planetary images while an associated website included a video feature *Portrait of a Planetary Scientist* profiling the science [9]. An example of using Earth images as an art and science exhibit in museums is the Smithsonian Institution Traveling Exhibition Service (SITES) exhibition entitled *Earth from Space*, curated by Andrew K. Johnston.

Summary: In the twenty-first century, natural history museums can enhance their traditional role as providers of informal geoscience education by using the excitement of the space-age “voyages” of natural history explorations of new worlds. Based on the experience of the New Mexico Museum of Natural History & Science, and that of the other museums described here, planetary geology is a demonstrated method for presenting geoscience topics to a museum audience. Planetary geology offers an effective way to add content and technology to the traditional natural history museum, and a new way to educate the public about their own local geology. The inclusion of planetary geology also provides a way for natural history museums to continue their relevant role in informal science education as the science of geology continues to evolve and new geological discoveries are made on other planets. This will allow natural history museums to continue to be new, fresh, and relevant for future generations.

References:[1] Semken, 2005, J. Geosci Edu v53 [2] Aubele, 2013, LPSC44; Aubele & Stanley, 2007, LPSC39; Aubele, et al, 2004, LPSC36 [3] Aubele, et al, 2012, LPSC43 [4] Mader, et al, 2017, LPSC48; [5] <http://www.amnh.org/our-research/science-news/2010/rose-center-to-go-to-space/> [6] Friedl, ed, 2012; McEwan, et al, 2017 [7] Belloli & Dean, 1985 Exhibition Catalog; Knight, 2012, LA Times, 4.23.2012 [8] Gomez, 2014, The Sunday Journal, 2.2.2014, p.1 [9] <http://www.nhm.ac.uk/visit/exhibitions/otherworlds-visions-solar-system-exhibition.html>