

PROJECT SUMMARY: Collaborative Research: The Trail of Time: A Geoscience Exhibition at Grand Canyon National Park

Intellectual merit: The Trail of Time is a unique geoscience education exhibition at Grand Canyon that offers an exceptional opportunity for informal education in geoscience. The Trail is a paved 3-km-long fully accessible walking trail that is near the Visitors Center and along the rim of Grand Canyon. This trail will be marked as a time line such that one meter corresponds to one million years of Earth history. Walking the Trail, visitors will gain an understanding of the magnitude of geologic time, and will engage with key processes and events in the geologic evolution of the region at appropriate waypoints and vistas. The Trail of Time geoscience exhibition is place-based, using the Grand Canyon itself as an immersion environment. The project has strong strategic impact for addressing and researching the nationally-important need for public understanding of deep time, Earth processes, and the scientific method. It will reach 4 to 5 million annual visitors as well as an extended audience of online and formal learners. The geoscience interpretation plan is to move visitors up a ladder of learning hierarchies. It will catalyze significant innovations in informal science education, accessibility, and diversity for outdoor exhibits within the National Park Service (NPS), the nation's largest informal educator. Integrated, factually correct, and up-to-date knowledge gained about the Earth in this location, as well as increased visitor interest and awareness about geoscience, is transferable to other regions, other sciences, other parks, and to many formal education endeavors. Thus, the impact will be a long-term advance, gestated by repeat visits, web-based visits, and multi-generational interactions. The project is highly collaborative and innovative in many dimensions of informal science education. Our design, implementation, and evaluation plans effectively combine advanced and traditional technologies for outdoor exhibits. Andrew Merriell Associates bring new design ideas to enliven the exhibits. We also propose an online Virtual Trail of Time, and rigorous assessment plans and instruments that will be applicable to other parks and similar informal venues (Selinda Research Associates; Dodick and Orion, 2003a). Our research component includes: investigation of expert place-meanings, ethnogeology of Canyon-based Native American cultures (Cajete, 2000; Semken and Morgan, 1997); evaluation of knowledge hierarchies (Perry, 1989, 1993) and islands of expertise (Crowley and Jacobs, 2002), and research on cognition of deep time and geologic change in informal science settings (Dodick and Orion, in press), including the use of analogies in naturalistic settings (Dunbar, 2001; Blanchette and Dunbar, 2001). All of these are underdeveloped and potentially invaluable tools for use in many areas of informal science education. The project is at a mature stage, with excellent front end and formative evaluations, a diverse, expert Advisory Board, close coordination with the Park's Interpretation Division, including synergy with the planned opening of the Yavapai geology museum.

Broader impact: The Trail of Time is sited near the most-visited places on the South Rim of Grand Canyon and will directly impact at least 24 million visitors over the next 8 years. Many more learners will engage with the exhibition through the Virtual Trail of Time. The combined outdoor and Virtual Trail experiences are part of an initiative in the Rocky Mountain region to develop Trail of Time exhibits in several National Parks. The Trail of Time exhibition provides a unique opportunity for NSF to develop a partnership with the NPS to develop a larger vision for geoscience education that merges the large and motivated audiences of the NPS at the national level, research advances of the NSF research programs, and state-of-the-art informal science education innovations that go well beyond standard Park or museum outdoor exhibitions. We hope to establish an effective link between geoscientists and the public to better present the scientific method as well as the science of the Canyon; this is crucial as Grand Canyon is a high-visibility area explicitly targeted by creationists (Sever, 2004). Native American scholars will participate in the design (Ramona Sakiestewa) and research (Andrew Becenti) teams, and Native American Park Rangers, teachers, and students will be directly involved in design, implementation, and evaluation. Collectively, this will provide a template for culturally-responsive geoscience education in other National Parks and for cognitive research on geoscience education for under-represented minority learners.