INTERACTIVE TECHNOLOGY ENABLING A VIRTUAL EXPLORATION OF OUR EVOLVING PLANET. G. Bruce[1], S. Semken[1], R. Summons[2], L. Horodyskyj[1], B. Kotrc[2], S. Buxner[3], J. Swann[4], S. Klug Boonstra[4], C. Oliver[5], A.D. Anbar[1]. [1]Arizona State University, [2]Massachusetts Institute of Technology, [3]Planetary Science Institute Tuscon, [4]Mars Space Flight Facility, [5]University of New South Wales

Abstract: Traditional introductory STEM courses often reinforce misconceptions because the large scale of many classes forces a structured, lecture-centric model of teaching that emphasizes delivery of facts rather than exploration, inquiry, and scientific reasoning. This problem is especially acute in teaching about the co-evolution of Earth and life, where classroom learning and textbook teaching are far removed from the immersive and affective aspects of field-based science, and where the challenges of taking large numbers of students into the field make it difficult to expose them to the complex context of the geologic record.

We are developing digital technologies, delivered online, to address this challenge, using immersive and engaging virtual environments that are more like games than like lectures, grounded in active learning, and deliverable at scale via the internet. The goal is to invert the traditional lecture-centric paradigm by placing lectures at the periphery and inquiry-driven, integrative virtual investigations at the center, and to do so at scale.

To this end, we are applying a technology platform we devised, supported by NASA and the NSF, that integrates a variety of digital media in a format that we call an immersive virtual field trip (iVFT). This technology utilizes hardware and software that gives developers the tools needed to capture high-resolution spherical content, 360° panoramic video, giga-pixel imagery, and unique viewpoints via unmanned aerial vehicles as they explore remote and physically challenging regions of our planet. In addition, advanced software enables integration of these data into dynamic, immersive, interactive, learner-driven virtual field explorations, experienced online via HTML5.

In iVFTs, students engage directly with virtual representations of real field sites, with which they interact non-linearly at a variety of scales via game-like exploration while guided by an adaptive tutoring system. This platform has already been used to develop pilot iVFTs useful in teaching anthropology, archeology, ecology, and geoscience.

With support from the Howard Hughes Medical Institute, we are now developing and evaluating a coherent suite of ~ 12 iVFTs that span the sweep of life's history on Earth, from the 3.8 Ga metasediments of West Greenland to ancient hominid sites in East Africa. These iVFTs will teach fundamental principles of geology and practices of scientific inquiry, and expose students to the evidence from which evolutionary and paleoenvironmental inferences are derived. In addition to making these iVFT available to the geoscience community for EPO, we will evaluate the comparative effectiveness of iVFT and traditional lecture and lab approaches to achieving geoscience learning objectives.