UTILIZING HIGH RESOLUTION PANORAMAS AS VIRTUAL FIELD EXPERIENCES IN UNDERGRADUATE PLANETARY SCIENCE COURSES. Jennifer L. Piatek[1] [1]Central Connecticut State University, Department of Physics and Earth Science, 1615 Stanley Street, New Britain, CT 06050 (piatekjel@ccsu.edu).

INTRODUCTION: Planetary geology and astronomy are inherently visual subjects and lend well to presentation of concepts via observation of images, either as a complement to or as a replacement for traditional text-based lectures. In addition to exploring extraterrestrial landscapes through spacecraft datasets, planetary science courses often explore basic concepts in terrestrial geology to help students understand and interpret those alien vistas. Although terrestrial analogs are a necessary component of a planetary science curriculum, it can be difficult (or impossible) to incorporate field experiences into courses. Virtual field trips that utilize zoomable high resolution panoramas allow students to explore terrestrial landscapes and outcrops as they might in the field. Additional scales of view can be added by including satellite images, hand samples, and thin sections as appropriate.

APPROACH: The virtual field trips described in this project are developed around high resolution digital panoramas. These images are acquired using a GigaPan Epic robotic camera mount (information about this unit and other models is available online [1]) and a standard digital point and shoot camera with optical zoom capability. The extent of the panorama is defined by selecting the locations of the upper left and lower right corners: the GigaPan unit uses this information and a pre-selected "field of view" setting (angular spacing between successive images) to describe an image grid. Individual digital photos are acquired at each point in the image grid by the robotic mount, which points the camera in the appropriate direction and automatically presses the shutter button. Images are stitched together to form a final panorama via software included with the unit (the GigaPan Stitcher) and are uploaded to a publicly accessible website [2]. Panoramas can be viewed directly from the website, embedded into external websites, or within the stitching software itself. Regardless of the viewing method, the end user can pan around the image and zoom in to see details at the limits of the camera's resolution. If desired, the user can be guided to specific points within the pan by "snapshots" - predefined image subsets with associated captions. Panoramas utilized for this project can be viewed at the GigaPan site [2] by searching for the tag 'CCSU-Planetary'.

INTEGRATION: The high resolution GigaPan panoramas can serve as stand-alone image exercises or lecture examples, but additional scales of view can be included. Satellite images, hand samples, and thin sections can be integrated into exercises as well. Satellite images (as well as associated topographic maps) may provide static context for viewing the location of the panorama and can act as analogs for spectral spacecraft datasets (compare terrestrial ASTER data to Mars Odyssey's THEMIS dataset, for example). Additional regional information can also be included by viewing the panorama via Google Earth. Placemarks can include only the panorama location or can link directly to the image to allow the user to view the pan within the Google Earth interface (although snapshots will not be accessible in this view). Hand samples and thin sections can be presented directly in classroom exercises, but also can be captured in GigaPan panoramas. While hands-on experience is preferable, the ability to access samples via online images allows more flexibility in the assignment.

APPLICATION: Previous work has shown that high resolution GigaPan panoramas can serve as virtual "field trips" in geoscience courses [e.g. 3-7] both at the introductory and more advanced levels: this project expands on this previous work to include exercises in planetary science courses. Terrestrial analogs allow students to explore how exposed rocks record past climate through exploration of sedimentary structures (the crossbeds examined in Figure 1) and changes in rock type related to changes in local climate (lake sediment sequences in Figure 2). Additional exercises explore the relationship of satellite imagery to panorama and hand sample, as well as relating the geologic structures observed in the real world examples to the concepts presented in textbook figures and in class presentations. A key to this application is comparison to features identified in spacecraft datasets, such as those acquired from the surface by the panoramic cameras on the Mars Exploration Rovers, and relating features identified in surface images to overhead views to aid in interpreting satellite data when no surface images are available.

CONCLUSIONS: An ideal classroom experience would allow students to explore in the field real world examples of concepts presented in the classroom. Practically, this can be accomplished by utilizing images of terrestrial analogs viewable at multiple scales as a "virtual field trip". The panoramas presented here represent the start of a longer term project to incorporate this type of observational exercise into planetary science courses at both the introductory and more advanced levels.

REFERENCES: [1] http://www.gigapansystems.com [2] http://www.gigapan.org [3] Kairies Beatty, C. and W.L. Beatty. 2009. GSA Abstracts 41(7), 500. [4] Piatek, J.L. et al. 2009. GSA Abstracts 41(3), 13. [5] Schott, R.C. and L.M. Nondorf. 2008. Transact. Kansas Acad of Sci. 111, 185. [6] Schott, R.C. 2009. GSA Abstracts 41(7), 165. [7] Steullet, A. et al. 2010. GSA Abstracts 42(1), 114.

Figure 1: Suite of images from terrestrial cross bedding example. Google Earth overview image (right) provides an overview of the outcrop location, identified by the GigaPan placemark near image center. The panorama (small scale version above, online at http://www.gigapan.org/gigapans/32031) illustrates the outcrop scale view, while the close-up view (inset below, location indicated by the box on the panorama) explores detail of the structure.

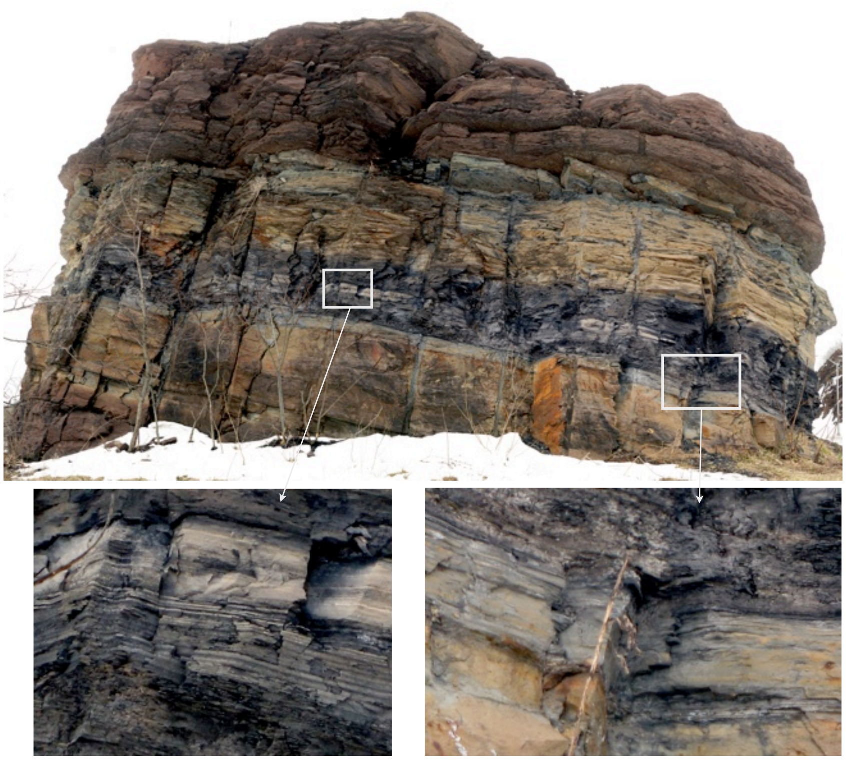

Figure 2: Suite of images from terrestrial sedimentary bedding example. The panorama (small scale version above, online at http://www.gigapan.org/gigapans/18667) illustrates the outcrop scale view, while the close-up views (insets below, locations indicated by box panorama) illustrate the detail of the bedding recorded in the panorama.

This particular outcrop is part of a series of Mesozoic lake sediment sequences exposed in the Berlin Formation in central Connecticut. The change in sediment character represents a change from sub-aqueous (dark shales) to sub-aerial deposition (red units) due to a change in local climate.

The close-up detail in the bedding in these images is ideal for comparison with hand samples and/or thin sections in upper level courses.