Innovations in the built environment for earth science

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INTRODUCTION

Earth-science buildings, at their best, should showcase intriguing and visual elements of the science. Innovative approaches to the built environment encourage inquisitive students.

An energy-efficient geosciences building at the University of Utah, "The Frederick Albert Sutton Building," has become one of the most attractive destinations on campus. The award-winning structure, grounded in its sustainable construction and operation, is a dynamic platform for showcasing the earth sciences. This novel environment enhances the department's visibility, raises user productivity, and creates a powerful outreach tool that promotes earth-science education.

The new facility highlights the discipline's central role in bringing about a sustainable society, and the principles that governed construction are also relevant to improvements to older buildings. The structure facilitates modern science through centralized lab spaces, exposed ceiling mechanical systems for ease-of-access and flexibility, and reinforced concrete for vibration-free measurements and seismic safety. What also sets this structure apart from other buildings on campus is the architectural design of space and the beautiful, artistic displays that exemplify the work of the building's users.

The Dept. of Geology & Geophysics at the University of Utah was blessed with a generous major donor, Rev. Marta Sutton Weeks, who comes from a distinguished petroleum industry family. She wanted a permanent remembrance to her father, Frederick Albert Sutton, an exploration geologist who received his degree from the university in 1917. The end result is a LEED-certified (Leadership in Energy and Environmental Design), twenty-five-million-dollar, 91,000-square-foot inviting home for earth-science teaching and research (Figs. 1–3).

SUSTAINABILITY

Early in construction planning, our department offered a class on sustainability, through which students learned about "green" design principles and were encouraged to propose LEED-eligible projects to be incorporated into the building. Their proposals included solar tube lighting, low-emissivity glass, light sensors, xeric landscaping, a xeric roof garden, rainwater collection, pervious cement in the loading dock, covered bike racks, and energy monitoring. The up-front costs of green design are compared with potential savings in energy over the lifetime of the building. Designated recycling areas on each floor are centrally located and close to elevators for easy access.

EDUCATIONAL THEMES

Planned displays throughout the building are designed to illustrate geologic concepts and invite exploration. A cross-bedding design is molded into the concrete foundation, visible to passersby. As an acknowledgment of the role rivers played in carving Utah's landscape, a stylized river of pebble tile runs through the building, merging with river cobble patterns in the outside landscape. The large, light-filled, round entry (Fig. 1), called *The Confluence*, marks where the new building adjoins an existing structure. A large aerial image of the confluence of Utah's Green and Colorado Rivers is prominently placed, along with a quote from John Wesley Powell about his exploration of those rivers. Nearby, large, polished rock slabs of cobble conglomerates show the types of deposits rivers leave behind. The red, black, and green colors of the slabs indicate different geochemical states of iron and oxygen.

The major entry display has more than one-hundred Eocene Green River Formation fish arranged like a school (Fig. 2). The scene is framed by the same marlstone, tilted on edge to show the cyclic lacustrine laminations and fish coprolites. This wall includes donor names; it is a work of art and a teaching tool. An additional 150 plant fossils from the Green River Formation are arranged as leaves blowing in the wind. Visitors can touch and rotate a unique stainless-steel skull cast of Utah's official state fossil, *Allosaurus*. Two matched, translucent travertine slabs in front of a large west window catch sun rays in the afternoon, making the rock glow a bright golden orange (Fig. 3).

Spectacular rock slabs, minerals, and fossils are mounted on the stable seismic restraint walls throughout the building. Explanatory signs convey the experience of strolling through a museum. On field trips in the building, students in an earth materials class examine brittle versus ductile properties of deformation in polished rock slabs. They look for cataclasites, orientations of stretched pebbles, en echelon tensile fractures, mixed-mode cracks, foliation generations, and geopetal indicators. Sedimentary geology classes determine provenance and depositional conditions in clastic rock slabs; paleontology classes reconstruct the paleoecology represented in fossiliferous slabs. Visitors use small magnets to find the magnetite-rich layers in a slab of banded iron formation. A field methods class takes strike and dip measurements on rock slabs in the building's outdoor xeriscape.

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The building's four floors are topically stratified. The first floor houses the seismology unit, department collections, and storage areas that require access to the loading dock. The displayed rock slabs on this floor are basement lithologies (e.g., garnet-biotite gneiss). The second floor is the home of the geophysics faculty; rock slabs of pillow basalt and granites relate to the solid earth. The third floor exhibits sedimentary and fossiliferous rock slabs that reflect studies of earth history. Geochemical and analytical laboratories on the fourth floor are close to the faculty hydrologists, geological engineers, and geochemists. Correspondingly, rock slabs of travertine-spring deposits and framed satellite images illustrate water and surficial studies.

OUTCOMES

The building has a transformational effect on its occupants, visitors, and the campus at large. Light, open spaces and informal gathering areas on each floor, with sweeping view windows and comfortable seating, give students a place to meet or study. Students and faculty certainly feel and have expressed a heightened sense of interaction, learning, and discovery in this supportive physical environment.

This building is a long-term outreach venue that attracts many visitors. Students and faculty also show off the displays and their own related work to family and friends. In the year since opening, about 2,000 visitors (not including regular university students) have come through the building. Building occupants give 10–20 informal tours each month to off-campus visitors. Groups of grammar-school students, high-school science classes, and participants in Utah Museum of Natural History youth programs tour our displays, led by undergraduate or graduate students. The department accommodates special events (e.g., social gatherings), workshops for professional groups, and small, informal meetings. The university administration has also hosted business discussions, interviews, and board meetings in this building because of its warm and attractive setting. The university's Office of Sustainability has arranged visits for groups, including a Korean delegation, to see this example of energy-efficient construction. The building is clearly a recruiting tool and a catalyst for creating a strong department of faculty, students, friends, and alumni.

SUMMARY

There has never been a more important time to understand Earth, teach, and inspire students. Our goal is to rise to the challenge of recruiting and educating the present and next generations on how crucial earth science is in the intersection of society and the environment. A creative building opens up multifaceted opportunities that strengthen the discipline. Geoscience can be a leader in transforming campuses through engaging and appealing visual material that is both educational and artistic. Innovations in earth-science buildings promote education and outreach and foster new approaches to interdisciplinary collaborations.

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Figure 1. Inside *The Confluence* with a "sinuous river" (foreground) cutting into Precambrian slate of Brazil. Part of the wall of Eocene fish fossils is visible on the right. Photo by Paul Richer (2009).

Figure 2. Eocene Green River fish are arranged like a school in a curved, tile art wall. The background color variation in the host rock resembles the shoaling and light of a lake setting. Words from Albert Einstein, "It is every man's obligation to put back into the world at least the equivalent of what he takes out of it," blend donor names (not shown) with the idea of giving back.

Figure 3. Translucent calcite rocks slabs filter light from the west (right), near old seismic helicorders. A metasomatite from Australia is "down under" at the left. The sandstone bench has time capsules in its pedestals. The front pedestal is a salvaged piece of the 1927 building cornerstone, formerly part of the Oligocene Little Cottonwood Stock, Utah. Photo by Paul Richer (2009).