

# Workshop report: Earth Systems Science

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On 19-20 October, 1996, the Keck Geology Consortium convened a workshop to study possible integration of an Earth Systems Science format in our undergraduate geology curricula. "Earth System Science" is the study of the natural cycling of matter and energy through Earth's near surface regime, including the atmosphere, oceans, and lithosphere. It bears on the great environmental issues of the day. Since many undergraduate students are drawn to geology precisely because of interest in the environment, with few other options available in the catalog, Earth Systems Science is a topic we ought to consider in improving and "modernizing" our curricula.

The meeting was held one day at Pomona College, in the Department of Geology, then the second at the Department of Earth Systems Science at the University of California in Irvine. On the evening of the first day of discussions, Dr. Debra Colodner, an environmental chemist heading up the Department of Education at the Biosphere 2 Project (Tucson) presented a discussion of educational opportunities for undergraduates in the environmental sciences at Biosphere 2.

During the first day of discussions, faculty exchanged course syllabi, offered opinions on relevant texts, recommended tantalizing computer applications, and described techniques and exercises introducing students to an Earth Systems approach in geology, some of them field based. It became clear that while geology plays an important role in Earth Systems Science, it by no means is the central discipline to advanced work in this field. It provides a physical context for what amounts primarily to a chemical approach in studying earth's natural cycles of circulating energy and matter. In fact, most of the students and faculty at the Department of Earth Systems Science come from backgrounds in undergraduate chemistry.

Issues that engaged discussion regarded not only curricular materials, but such fundamentals as how we must change departmental curricula to accommodate an Earth Systems approach, what exactly we seek to accomplish and how, if we commit ourselves to this approach, we should best go about presenting this material. A consensus seemed to build that most departments probably should not attempt wholesale reorganization of curricula, but rather integrate into existing courses Earth Systems concepts.

Among other conclusions reached were that different schools offer their own unique conditions and opportunities for introducing Earth System Science. Some institutions are attempting interdisciplinary minors with a global sustainability focus. Some are also taking advantage of their geographical locales to involve students with tackling regional environmental issues.

That our "traditional" liberal arts geology curricula lack introductory oceanography and climatology courses may hinder our teaching Earth Systems Science, and preparing students for the this career path. It is not clear where the teaching of these courses belong because they are transdisciplinary, and few of us are trained to deal with them.

Consensus seem to develop that we also are suffering from lack of appropriate lab materials dealing with the processes studies by Earth System Science. A lab manual that begins successfully to address this problem has been published as part of the "Blue Planet" text by B.J. Skinner and S.C. Porter (1995, John Wiley). There is much more that can be done, however.

During the second day of discussion, participants toured the reserach laboratories at U.C. Irvine, meeting with particular graduate students and faculty. Some faculty had an opportunity to meet and chat with Nobel Prize laureate Professor Sherry Rowland, who helped identify the magnitude and causes of polar ozone depletion. Too our U.C. hosts, many thanks!

We wrapped up planning next steps, including gathering course-development materials and possibly re-convening in near future at Biosphere 2 to continue exchanging information.

Please feel free to share ideas with any participant of this workshop. Undergraduates at many liberal arts schools, for lack of clear alternatives, are turning to geology departments at our schools for training that will lead them to environmental careers. The questions raised here concern us all in shaping future directions.

**TEACHING METHODS IN  
GROUNDWATER HYDROLOGY  
WORKSHOP**

PARTICIPANTS

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