

The Keck Geology Consortium

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The Keck Geology Consortium is a group of twelve small geology departments from predominantly undergraduate, liberal arts institutions that work together to improve student and faculty research opportunities and earth science education. The primary activity of the consortium is to sponsor research projects where faculty and undergraduate students from throughout the consortium collaborate on earth science research. The results from research projects are presented in oral or poster presentations at the Keck Research Symposium in Geology and are summarized in this volume. The consortium also sponsors workshops for students and faculty that focus on research and educational topics of interest to people from all twelve schools.

The consortium was formed in 1987 with funds from the W.M. Keck Foundation to improve the quality of geologic education at all member schools. The W.M. Keck Foundation remains the principal supporter of the program and has contributed in excess of three million dollars, funding the research of more than 380 students since 1987. Since 1991, funding from the National Science Foundation has allowed the consortium to include students from other parts of the academic community and has insured the participation of students of color in the program. This year funding from the National Science Foundation permitted four students from outside the consortium to participate in the Cyprus project, five students of color to participate in each of the sophomore projects, and three students of color to participate in the junior projects. The individual schools also contribute to the support of the consortium program.

UNDERGRADUATE STUDENT-FACULTY RESEARCH PROGRAM

Students can participate in consortium research projects at two levels in their education: 1) a year-long research experience is offered to senior-level geology majors; 2) a five-week introduction to earth science research is offered to students who have completed their sophomore year.

Senior-level students define individual research projects, collect and synthesize data, and report their results over the course of an academic year. Students prepare in the spring of their junior year by reading suggested selections from the geological literature and considering topics for their individual research projects. The group pursues four weeks of field or laboratory work in the summer that provides each student with half to two-thirds of the data for their project. During the following academic year, the students continue their work as independent research projects or senior honors theses at their home institutions under the guidance of an on-campus sponsor. Students analyze data in conjunction with extensive library research as is expected of a professional earth scientist. In most cases, the student project culminates in a research paper or thesis evaluated for credit at the home institution. Each student also gives an oral or poster presentation at the Keck Research Symposium in April, and prepares an extended abstract published in this volume. This year 47 students participated in the five senior-level projects located in California, Cyprus, Italy, Montana, and Oregon.

The sophomore program is completed during four or five weeks in the summer. Participants form teams of two or three students that pursue small research projects for four weeks and spend the final week writing and illustrating reports on their team's research. Each team also writes an extended abstract published in this volume and presents its results in poster form at the research symposium in April. Sophomore research projects are chosen to allow students with limited background to appreciate the importance of the overall problem, design a meaningful project, and produce results in five weeks. This year 22 students participated in two sophomore projects located in Wyoming and Massachusetts.

Each student who participates in a research project has an on-campus faculty sponsor who oversees work done at their home institution. Experience has shown that student research results are greatly enhanced when on-campus sponsors visit their students in the field. This year 16 on-campus sponsors visited their students for several days during the summer project. In addition, one student and sponsor made a return winter visit to the field site.

COLLABORATIONS WITH PROFESSIONALS FROM OUTSIDE THE CONSORTIUM

The consortium research program is strengthened by collaboration with professionals from outside the 12 colleges who bring both scientific expertise and experiences from other parts of the earth science community to share with students. This year staff for the projects included three faculty of minority heritage. Dr. Joe Cepeda, a petrologist of Hispanic heritage from West Texas A&M, worked with students on the Wyoming project. Dr. John

Leftwich, a structural geologist of African American heritage from Old Dominion University, worked with the Massachusetts project. Dr. Kathleen Johnson, a petrologist and isotope chemist of African American heritage from University of Florida, worked with the Montana project. The Italy project was based at the Osservatorio Geologico di Coldigioco and worked closely with its director, Dr. Sandro Montanari. The project was visited by Dr. Tanya Atwater of the University of California at Santa Barbara and Dr. Christian Koerberl, a geochemist from Vienna. Dr. Cheryl Jawozowski, a geomorphologist at the Institute for Energy Research at the University of Wyoming in Laramie, was part of the staff for the Wyoming project. The Wyoming project benefited further from field trips led by Dr. Dan Stanley of Crown Butte Mines, Inc. and Dr. Grant Meyer of Middlebury College, and from working with a team of scientists drilling an active rock glacier in their field area: Dr. Noel Potter of Dickinson College, Dr. Joan Fitzick of the U.S. Geological Survey, Dr. Mike Clark of the University of Tennessee, and Drs. Doug Clark and Eric Steig of the University of Washington. The Cyprus project enjoyed a field trip led by Dr. George Constantinou, Director of the Cyprus Geological Survey, to the historic massive sulfide mines of Cyprus and a two-day trip to the archaeological sites of southern Cyprus led by an archaeologist from the Cyprus Antiquities department. Dr. Eldrige Moores from the University of California at Davis provided additional expertise for the Cyprus project workshop. Dr. Carol Prentice from the U.S. Geological Survey worked closely with the San Andreas project, supervising trenching across the San Andreas fault. Dr. Dan Bodin from the Center for Earthquake Research and Information at University of Memphis also worked with students on the California project looking at strain occurring in this section of the fault. Dr. Ramon Arrowsmith of Arizona State University led the group on a field trip along the fault south of the field area. Members of the San Andreas project and their collaborators jointly authored two papers presenting their results at the annual meeting of the Geological Society of America in the fall of 1996.

WORKSHOPS

Workshops were developed by the Keck Geology Consortium to support the exchange of information and ideas among faculty and students during the academic year. Three workshops bringing together students, faculty, and sponsors from senior-level projects were held this winter to allow additional collection of data, data synthesis, and meetings with appropriate resource people. Reports from these workshops related to the San Andreas, Montana, and Cyprus projects are given in this volume. Three workshops bringing approximately 14 faculty from throughout the consortium together to discuss teaching methods are also being held this year. The first, a workshop on teaching geophysics, was organized by Dr. Rob Sternberg at Franklin & Marshall College in collaboration with Dr. Randy Richardson at the University of Arizona and held at the University of Arizona, March 14 to 17. Digital mapping and Geographic Information Systems in undergraduate geology curricula will be discussed at Trinity University in a workshop organized by Dr. Glenn Kroeger. A workshop on teaching groundwater geology is being organized by Dr. Bob Newton (Smith College) and Dr. Steve Mabee (Amherst College). Finally, the consortium cooperated with Project Kaleidoscope, a national organization working to improve undergraduate science education, to sponsor a workshop entitled "Innovations in Teaching Earth and Planetary Science" at Franklin & Marshall College on March 1 to 3. This workshop, organized by Dr. Roger Thomas, brought about 80 faculty and administrators from all parts of academia together to discuss both the content of modern curricula and new methodologies for teaching.

OTHER ACTIVITIES

One of the consortium's great achievements has been to create a community of students, faculty, and alumni from the 12 college geology departments. We were very pleased to have 58 members of this community together at the Keck Consortium breakfast at the fall Geological Society of America meeting in New Orleans. We have strengthened our communications with alumni this year by asking them for information on their current employment and their impressions of the value of their Keck experience. Much of this information was summarized in the first Keck Alumni Newsletter distributed to all alumni this February. An article describing the value of an undergraduate research experience, particularly for students entering directly into the job market, based on letters from alumni was published in the Council on Undergraduate Research Quarterly this spring.

Communication by e-mail continues to strengthen the consortium community. For several years many projects have maintained strong communication during the academic year using e-mail. This year activity on the internet increased as workshops organized discussion groups and the representatives increased their use of e-mail for discussing the consortium's business. Student selection was accomplished for the first time using electronic communication and the consortium now maintains web pages that describe our program.

The geologic community has been increasingly interested in learning about our program. This year Dr. Hank Woodard gave an invited presentation on the sophomore research projects to the North Central Section of the Geological Society of America. Dr. Cathy Manduca gave invited presentations on the undergraduate research program at Caltech and CalState Fullerton. Together Cathy and Hank published an article entitled "Research Groups

for Undergraduate Students and Faculty in the Keck Geology Consortium" in the September issue of the Journal of Geological Education.

The activities of the consortium are directed by a board containing one representative from each school and the consortium coordinator. The representatives met twice during the year: at the April 1995 symposium at Pomona College and at the November 1995 Geological Society of America meeting in New Orleans. Business included project and workshop selection for the upcoming year, discussion of the e-mail selection procedure, criteria for student selection, and submittal of renewal proposals to the National Science Foundation and the W.M. Keck Foundation.

ACKNOWLEDGEMENTS

The continued commitment of the W.M. Keck Foundation to the consortium for the past nine years has allowed the program to grow and thrive. We are particularly pleased to work with Dr. Sandra Glass in their office and benefit from her insights into science education and research. The National Science Foundation has also provided substantial support for our program. Their program officer, Dr. Judith Hannah, has been exceptionally helpful and has provided excellent insight into the selection and recruiting of members from under-represented groups. Finally, we have been supported by our own institutions: by their financial contributions directly to our program, by department and institutional funds used to augment student research and travel to professional meetings, and by their intellectual support of our activities.

The administration of the program has benefited from the cooperation of the Carleton College business office and in particular from the work of Beverlee DeCoux, Comptroller, Barb Fowler, Accounting Assistant, and Shirley Dulski, Accounts Payable Specialist. The coordinator has received tremendous assistance from Elizabeth Rider, Administrative Assistant and student workers Megan Andersen, Josh Feinberg, and Karissa Baker. I am also indebted to Hank Woodard (Beloit College) who has eased the transition of the consortium office by patiently answering thousands of questions. The most pleasurable aspect of coordinating the consortium is working with the consortium faculty. Thank you very much for your dedication to the consortium, your enthusiasm about each new idea, and your help in making things run smoothly.

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