as well as a field program for Geosciences and Geobiology BS students, and we encourage all students to pursue research as early as the freshman year. A new 5-year combined BS-MS program will enable outstanding students to carry their undergraduate research further before pursuing employment or doctoral programs. Enrollments in courses for non-majors have also increased substantially over the past 5 years, while those of other PSU science departments have decreased. We attribute this success to changes in pedagogic approaches, focusing on active learning exercises in large (200+) and small (< 75) courses. Innovative use of an electronic personal response system has also improved attendance, enrollment and student learning in our general education courses. This approach was developed by a fixed-term faculty hire in Geoscience Education. As per our departmental strategic plan, we plan to hire again in this area to further these successes and implement new approaches to learning and teaching in our undergraduate educational programs.

ED11C-05 1120h INVITED

Recruiting Minority Geoscientists: A 30 Year Success Story

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The University of New Orleans (UNO) is located in a city rich in diversity and industries that employ geoscientists. Thus, it is an ideal place to develop a strong diversity program in geology and geophysics. In 1974, Dr. Louis Fernandez received a grant from the NSF to formally develop a minority recruiting program. The focus of that initial program was a field trip for local minority high school students and that trip has gone continuously every year since then. It is still our best tool for recruiting outstanding minority students into our department. The initial NSF funding disappeared long ago and was replaced variously by support from private industry and creative use of departmental funds which kept the program alive through some lean funding years. As a result of this effort UNO has graduated more minority, particularly African-American, geoscientist than any other institution in the US for most of the past 30 years. The field trip is not the only reason for our success. Indeed, retaining and graduating students, regardless of their ethnicity, required a serious commitment to education on the part of our department. There are six universities in the city of New Orleans and several more within commuting distance from the city. Three of the six local universities are HBCU's with excellent reputations but, fortunately for us, no geoscience degree programs. There are several strong geoscience departments in the non-minority serving institutions in our area that attract many outstanding local students. To meet the competition, we have worked with local K-12 teachers, developed additional programs to interest local 7-12 students, and worked closely with our majors to keep them in the program and help them succeed once they are recruited. This has required a cohesive effort on the part of our faculty and students that is constantly changing to meet new demands as our department has expanded in size and developed its research activities sometimes at the expense of teaching. The result is something we are very proud of– 40% of our undergraduates and 20% of our graduate students are minority students. This is increasing each year, particularly the graduate enrollment, without any apparent decrease in non-minority enrollment or division within the student body.

URL: http://www.geology.uno.edu

ED11C-06 1135h INVITED

Faculty Activity to Reach Consensus and Develop the SF-ROCKS Outreach Program

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The Geosciences Department at San Francisco State University has prided itself on the excellent relationships among its faculty and students and on its proven ability to train students for careers in industry and academia. Yet, like many Geoscience departments, it recognized a need to generate higher enrollments in the undergraduate majors programs and to increase collaborations among departmental disciplines (in our case, geology, meteorology, and oceanography). To address these concerns, the department created a new outreach program that involves a majority of the faculty and that aims to increase the number of students (particularly those from underrepresented groups) who pursue a career in Geosciences at SFSU and who appreciate the role of the geosciences in their daily lives. The outreach idea was generated at a retreat of departmental faculty in January 2001. The department chair (Grove) used a classroom teaching technique to have faculty brainstorm ideas about increasing student enrollments and to reach consensus about actions to be taken. The faculty was divided into 4 groups of 3 members. Each group member spent 10 minutes brainstorming ideas and writing each idea on a post-it note. Group members then convened for 15 minutes to cluster their post-it note ideas into affinity groups. Each group subsequently had 10-15 minutes to present their ideas to the larger group, who then proceeded to decide on action items. From this activity came a clear consensus about the need for more outreach activities, and the faculty decided to submit a request for funding to a newly created NSF Geosciences program (OEDG—Opportunities for Enhancing Diversity in the Geosciences). Our proposal was successful and we received a 5-year grant to fund SF-ROCKS (Reaching out to Communities and Kids with Science in San Francisco), a program now in its second year and directed by the current department chair (White). The multi-layered program involves faculty and students from SFSU and City College of San Francisco with local high school teachers and their students (see session ED15 for high school student research results and program web site—http://sf-rocks.sfsu.edu—for more details). The program has created more cohesion among department faculty and has been an effective mechanism for engaging faculty and students from our range of Geoscience disciplines, and for providing college students with meaningful experiences in the discipline.

URL: http://tornado.sfsu.edu/

ED11C-07 1150h

Integrating Research and Education: Preparing Graduate Students to Teach

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The link between research and teaching at all levels is increasingly recognized, and can be an attractive as well as an effective part of a graduate program in geoscience. At Brown we have a strong partnership between our department and the university's teaching center. The Sheridan Center for the Advancement of College Teaching provides resources and programs to help grad students improve their effectiveness as TAs and their qualifications for obtaining a teaching-related job, as well as to promote and facilitate improved teaching by faculty. Departments are encouraged to designate faculty and grad student liaisons to the Center and to take advantage of Center programs (including seminars on topics such as Persuasive Communication, Cognitive Diversity, Developing a Syllabus, Assessment, and Teaching Portfolios) and resources (such as books, tapes and videos and Individual Teaching Consultations), as well as to develop their own discipline-specific programs. The Geol. Sci. Dept. has been an active participant in Center activities from the start, but we have also developed our own activities and programs. Each year two geo faculty and two grad students serve as official liaisons to the Center, in addition to organizing and running a variety of programs within the department, including: orientation sessions for new graduate students and first-time TAs, 'microteaching' practise sessions with constructive feedback for new TAs, mid-semester discussion and feedback sessions for current and more experienced TAs, as well as lunch meetings for all interested faculty and grad students to discuss aspects of teaching. These activities have increased the awareness and effectiveness of teaching and learning in our department, for example promoting faculty and TAs to implement syllabi with stated goals, in-class active learning exercises, small group projects, a greater number and variety of writing assignments, and greater diversity in assessment. The effectiveness of our program depends in part on the University-backed Center to provide certain resources and general programs, but also on having a core of several faculty and grad students within the department who are strongly committed to the program. Another key element is the dedicated involvement of undergraduate TAs and Writing Fellows who are an invaluable part of our teaching teams. Overall we have found that the emphasis on teaching improvement is a strong recruiting tool in our graduate program, as well as significantly strengthening the credentials of our MS and PhDs.

ED11C-08 1205h

A Coordinated Approach to Curricular Review and Development in Undergraduate Geoscience Programs: Using a Matrix to Identify and Track Skills and Skill Development

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One approach to curriculum review and development is to construct a matrix of the desired skills versus courses in the departmental curriculum. The matrix approach requires faculty to articulate their goals, identify specific skills, and assess where in the curriculum students will learn and practice these skills and where there are major skills gaps. Faculty members in the Geology Department at Carleton College developed a matrix of skills covered in geology courses with the following objectives: 1) Geology majors should begin their "senior integrative exercise" having practiced multiple times all of the formal steps in the research process (recognizing problems, writing proposals, carrying out a project, reporting a project in several ways); 2) Geology majors should learn and practice a variety of professional and life skills life (e.g. computer skills, field skills, lab skills, and interpretive skills).The matrix was used to identify where in the curriculum various research methods and skills were addressed and to map potential student experiences to the objectives. In Carleton's non-hierarchical curriculum, the matrix was used to verify that students have many opportunities to practice research and life skills regardless of the path they take to completion of the major. In William and Mary's more structured curriculum, the matrix was used to ensure that skills build upon each other from course to course. Faculty members in the Geology Department at the College of William and Mary first used this approach to focus on teaching quantitative skills across the geology curriculum, and later used it in terms of teaching research, communication, and information literacy skills. After articulating goals and skills, faculty members in both departments developed more specific skill lists within each category of skills, then described the current assignments and activities in each course relative to the specific components of the matrix and discussed whether to add assignment or activities. We have found that much conversation among faculty and change within courses happens simply as a result of compiling the matrix. One effect of the use of the matrix is that faculty in the department know fairly specifically what skills students are learning and practicing in their other geology courses. Moreover, some faculty members are better suited by background or inclination to teach certain sets of skills. This coordinated approach avoids unnecessary duplication and allows faculty to build on skills and topics developed in previous courses. The matrix can also be used as a planning tool to identify gaps in the curriculum. In our experience, the skills matrix is a powerful organizational and communication tool. The skills matrix is a representation of what the department believes actually happens in the curriculum. Thus, development of a skills matrix provides a basis for departmental discussions of student learning goals and objectives as well as for describing the existing curriculum. The matrix is also a graphic representation, to college administrators and outside evaluators, of the "intentionality" of an entire curriculum, going beyond single courses and their syllabi. It can be used effectively to engage administration in discussions of departmental planning and needs analysis.

ED12A MCC: Level 1 Monday 1330h

Building Strong Geoscience Departments: Examples That Work II Posters *(joint with OS, C)*

Presiding: **C A Manduca,** Science Education Resource Center, Carleton College**; R H Macdonald,** College of William and Mary

ED12A-0117 1330h POSTER

Strong Geoscience Departments in Research-Intensive Universities: How do you Know you are One and how Much Planning is Needed to Stay One?

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How do you know your geoscience department is strong? Can it stay that way without conscious planning, relying instead primarily upon day-to-day decisions? The University of Arizona is a member of the American Association of Universities (AAU), a self-selected group of 63 of the most research-intensive public and private institutions in the United States. We

will present results of a concentrated look at our own department from both the perspective of the department head (SLB) and a newly reunited member of the department (RMR), returning from an extended stint in administration. In addition, we will present the results of a survey of selected geoscience departments at other AAU institutions. The survey will include demographic data on these departments in terms of numbers of faculty and students, and grant dollars if available, as well as what department heads see as the largest threats and opportunities for their departments in the next five years. We will also seek information on departmental efforts to recruit and retain both faculty and students, and efforts to integrate/balance research and education within the department and the institution. Finally, we will ask departments the extent to which they rely upon, or value, departmental planning efforts. As a beginning, the Department of Geosciences at the University currently has 27 tenure/tenure eligible faculty, 84 graduate students, and 68 undergraduate majors. Approximate annual grant dollars are on the order of $4M. The department head (SLB) feels that faculty retention and lack of space are among the largest threats to the department. Faculty retention is critical in an environment where funding is chronically short, and budget cuts have been significant over the last two years. Retention efforts typically involve collaborative efforts with the dean and/or provost. Among the opportunities for the department are the ability to extend and diversify funding within and beyond the NSF, typically multi- and inter-disciplinary science projects, especially bigger science.' Graduate recruitment efforts include early admission and financial aid decisions, partial reimbursement of visit costs, and faculty calls. Graduate retention efforts include having all first-year graduate students take the colloquium course together, an annual on-campus mini-conference for presenting papers, and the fact that all graduate students are guaranteed funding, subject to adequate progress. At the undergraduate level, the number of majors has decreased fairly steadily over the last decade, and the department has not been able to determine an effective strategy to reverse the trend. Finally, the department relies on an annual day-long retreat to both inform faculty members about the changing environment for the department and to seek input on future directions. The retreats have been useful on both fronts, but charting a future for the department is difficult given the large impact that unpredictable events can have, such as the national economy post 9-11-01.

URL: http://www.geo.arizona.edu

ED12A-0118 1330h POSTER

BRIE: The Penn State Biogeochemical Research Initiative for Education

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Few scientists are prepared to address the interdisciplinary challenges of biogeochemical research due to disciplinary differences in vocabulary, technique, and scientific paradigm. Thus scientists and engineers trained in traditional disciplines bring a restricted view to the study of environmental systems, which can limit their ability to exploit new techniques and opportunities for scientific advancement. Although the literature is effusive with enthusiasm for interdisciplinary approaches to biogeochemistry, there remains the basic difficulty of cross-training geological and biological scientists. The NSF-IGERT funded Biogeochemical Research Initiative for Education (BRIE) program at Penn State is specifically designed to break down both disciplinary and institutional barriers and it has fostered cross-disciplinary collaboration and training since 1999. Students and faculty are drawn from environmental engineering, geochemistry, soil science, chemistry and microbiology, and the program is regarded on the Penn State campus as a successful example of how interdisciplinary science can best be promoted. There are currently 23 Ph.D. students funded by the program, with an additional 7 affiliated students. At present, a total of 6 students have completed doctoral degrees, and they have done so within normal timeframes. The program is "discipline-plus," whereby students enroll in traditional disciplinary degree programs, and undertake broad training via 12 credits of graduate coursework in other departments. Students are co-advised by faculty from different disciplines, and engage in interdisciplinary research facilitated by research "credit cards." Funding is available for international research experiences, travel to meetings, and other opportunities for professional development. Students help institutionalize interdisciplinary training by designing and conducting a teaching module that shares their expertise with a class in another department or discipline. Community building through social activities and scientific forums is a priority in both the undergraduate and graduate programs. In addition, entering Ph.D. students build cohort identity by taking a course that introduces them to BRIE faculty and research facilities through hands-on laboratory and field-based research activities. The BRIE undergraduate summer internship program has provided interdisciplinary research opportunities for a total of 35 students over the past five summers. This program aims to recruit students to the Ph.D. program, and at present, two Ph.D. students have entered this way. Our efforts have focused on attracting students from under-represented groups. Diversity in this program has been above national norms: and summer students have include 10 (29 %) African-American or Hispanic-American students, and 25 (over 70 %) females. The Ph.D. students and graduates are 50% female, with three students from minority populations.

URL: http://www.essc.psu.edu/BRIE

ED12A-0119 1330h POSTER

Petroleum Geoscience Program at University of Oklahoma: 25 Years of Change

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The School of Geology and Geophysics at the University of Oklahoma has a long history and tradition of petroleum geoscience education and research. The 1980's and early 1990's downturn in the petroleum industry resulted in significantly fewer students seeking petroleum industry education and careers. Like many U.S. earth science departments, the School looked to geochemistry and hard rock geology to help fill the void. While this new emphasis complimented previous strengths by providing a solid foundation for earth science students, there were unintended consequences. Limited departmental resources caused a rift between traditional and new directions. Many incoming students found course work and faculty research interests differed from those in published recruiting materials. The relative merits of industry support vs academic research grants became an issue in employment decisions. Industry recruiters no longer felt they were working in partnership with the School. Many companies stopped recruiting at Oklahoma, alienating students and past/future alumni. In the mid- to late-1990's the leadership and faculty of the School found a more constructive balance, with strong support from a committed base of alumni. Two senior academic Chairs were filled by faculty with applied research interests and industry experience. In 2000, a third faculty member with a similar background became Director of the School. These additions provided a significant boost to the existing petroleum geoscience program. Other faculty hires provided new basic research directions such as paleoclimatology. These improvements have strengthened both industry and alumni support for the School, and have revived the image of a petroleum emphasis. There is now a very strong list of petroleum-oriented course offerings, improved interaction with the university's petroleum engineering school, company recruiters have returned in force, and alumni support has improved dramatically. At a time of decreasing government support of higher education, alumni financial support has been key to improving the department's overall program. This support has provided the means to substantially increase the graduate student enrollment in terms of both quality and quantity, and has provided many new undergraduate scholarships. Although there are still impediments, the School is approaching a state of equilibrium between applied petroleum (and environmental) education and education in the fundamentals of geoscience. Undergraduate students receive a balanced earth science education, and graduate students are offered a substantial platter of applied and fundamental topics for study and career options. However, with almost half of the faculty having expertise in soft-rock and petroleum geology and geophysics, this program remains the centerpiece of the School.

ED12A-0120 1330h POSTER

Carleton College Geology Department: Seventy Years of Planning for Change

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On the back of a fire door leading to the Carleton geology lounge and classroom, students have painted a geologic time scale representing the history of the geology department from its establishment in 1933 to its present configuration. Along the way, Laurence McKinley Gould, George Gibson, Duncan Stewart VII, Leonard Wilson, Eiler Henrickson, Ed Buchwald, Shelby Boardman, Mary Savina, David Bice, Clem Shearer, Bereket Haileab, Clint Cowan, Cam Davidson, Jenn Macalady and a host of other faculty have contributed to an excellent undergraduate program. Features that have maintained the strength of the program over the years include:
Outstanding support staff (Betty Bray and Tim Vick);
Weekly department meetings that include discussion of department goals and pedagogy, including attention to giving students the tools to complete the major and capstone project;
Regular department retreats that allow more comprehensive discussion;
Encouraging different teaching styles among the faculty;
A curriculum that emphasizes active learning from day one in introductory geology through the senior capstone experience;
Involving students in the department, from planning field trips to hiring to TAs;
Increasing student role models by having sophomore, junior and senior majors in most courses;
Emphasizing the liberal arts character of geology, rather than pre-professional;
Bringing alumni back to campus on a regular basis;
Publishing an annual alumni newsletter and maintaining a department web site;
Creating a social and intellectual space within the department for students and faculty;
Making a particular effort to be welcoming and affirming to people of all colors, ethnicities, affectional orientations and gender identities;

ED12A-0121 1330h POSTER

Renovating the Curriculum from the Ground Up

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The geology department at Lawrence University has entirely recreated itself in the past seven years, with three new faculty members, a new curriculum, and new facilities. Although the magnitude and rapidity of these changes have posed challenges, the opportunity to build the department almost entirely from scratch has allowed us to design a program that acknowledges the profound changes that have occurred within the geosciences in the past few decades. The major challenge that we(and many other programs) faced was how to offer a curriculum that reflects the diversity of the geosciences with a relatively small faculty. We addressed this issue by identifying our priorities, strengths, potentials, and limitations, and building the strongest possible curriculum given these resources and constraints. As new faculty members were hired, we deliberately sought out versatile, flexible candidates whose training embraced several subdisciplines. The primary interests of the three current faculty members are 1) mid- to deep crustal hard rock' geology, 2) physical surficial processes, and 3) the geochemistry of near-surface rocks and waters. This combination allows us to span a large intellectual space, but it would be difficult to offer all of the traditional courses in the geology canon. As we discussed the skills and concepts we considered for geology students and assessed the expertise of our faculty, we concluded that for us the most efficient curricular framework would emphasize 1) Earth processes (rather than entities) and 2) connections with cognate sciences(especially chemistry and physics). This shift in focus has also allowed us to serve the interdisciplinary Environmental studies curriculum in an integral way, without undercutting the department's own mission. Anecdotal evidence has shown that this approach is successful. Not only do more physics and chemistry students take our courses, but a number of them go on to minor or double major in geology. We've found also that a number of environmental studies students are taking our upper-level courses which not only helps bolster enrollment, but also exposes more students to the geosciences. Moreover, many of our majors that move on to graduate programs do so in interdisciplinary programs (e.g., geochemistry, geophysics, biogeochemistry, environmental sciences, science writing, science education). While our wholesale personnel changes allowed us unusual flexibility in redesigning our program, we feel that departments at other institutions - large and small - could benefit from a similar self-assessment. As the scope of the geosciences grows and the boundaries between disciplines become less sharp, there is no longer any possibility of comprehensive coverage' in the undergraduate curriculum (if indeed this ever was possible). We do not consider our curriculum a universally applicable template. But we do believe that the strongest geoscience programs will emerge in departments that know their strengths and build curricula from these intellectual centers of gravity.

ED12A-0122 1330h POSTER

Success With Offering a Diversity of Majors in the Earth Science Department at the University of Northern Colorado

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Today, the number of geology majors at the University of Northern Colorado (UNC) has declined to just 10 percent of the mid-1980s peak. At issue is the sustainability of a viable geology program, with a minimum of three tenure-track faculty and few graduating geology students. One solution to the sustainability issue is diversity of Earth Science Majors within a given department. At UNC we have five emphasis areas: Environmental Earth Science, General Earth Science, Geology, Meteorology, and Secondary and Middle Level Teaching. We have had the good fortune to add many Meteorology and Environmental Earth Science majors, while the Geology, Middle Level Teaching, and General Earth Science majors have declined in number. As students' academic goals fluctuate in the geosciences (often directly tied to the marketability), the diversity of major offerings allows for the department to maintain a balance in the number of majors. Today, we are close to the number of Earth Science majors we've averaged over the last 20 years (135 majors). Strong advising is essential for our evolving systems to work for the students and the Department. Another stabilizing factor for the Department is the masters program, which provides graduate student teaching assistants at a low cost to the universitymost of our teaching assistants teach General Geology labs, and that course continues to be an effective recruiting mechanism for all of the emphasis areas to some degree. State budget constraints have forced creativity in course offerings. For example, we still require a Geology Field Camp for graduation, but send our students to other university field camps - a cost saving for us. In addition, many of our courses serve multiple emphasis areas, mirroring the nature of earth system science. Moreover, we have managed to combine some upper division courses (mineralogy and earth materials, for example), offered others on an alternate-year basis, reduce the number of upper division electives, and increased teaching loads. What does the future hold? Undoubtedly, the number of majors in geology, meteorology, and teaching will fluctuate with the economy. More of our faculty will be subjected to paradigm shifts as low enrollment classes are combined. Our challenge is to continue offering a rigorous program in earth sciences by offering a diversity of curriculum in the geosciences.

ED12A-0123 1330h POSTER

Development of an Interdisciplinary Undergraduate Major in The Earth System, Environment and Society

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Humanity faces great challenges in the 21st Century to understand and limit our impact on the Earth System. To address these challenges, it is essential to understand the nature and implications of environmental change, and the complexity of the Earth system. We need to educate citizens that have the background to make new developments in understanding technical aspects of the Earth System, and to develop an understanding the interactions between society and the Earth System sufficient to make informed policy choices. Traditional disciplinary departments and majors don't fully address this; teaching and research talent in the study of the Earth System is spread over many disciplinary-oriented departments. At the University of Illinois, we are currently developing a new cross-disciplinary undergraduate major being called The Earth system, environment and Society. This development is co-sponsored by a number of departments centered in the College of Liberal Arts & Sciences (but including other departments throughout the university). Our intention is that this major will be a catalyst for bringing together the many disciplines involved in Earth System Science education. The curriculum and course for study will focus on the science and human dimensions of the Earth system, with special emphasis on the processes and issues related to the environment across a range of spatial scales from local and regional to global. Along with meeting the requirements expected of all students in a liberal arts and sciences major, students in The Earth System, Environment and Society major will be required to complete a core set of courses designed to introduce students to all of the different components of the Earth System (students will choose from course options in both the sciences and the social sciences). After completing the core courses, students will then focus their studies on one of the two options within the major, Science of the Earth System (this option will emphasize the full complexities of the science of the Earth system) and Human Dimensions of the Earth System (this option will have a heavier focus on the relationship of Earth System Science to policy and decision analysis and to society and social science interactions). The two options will allow students to prepare for career paths, including graduate study, in any number of possible areas.

ED12A-0124 1330h POSTER

New Challenges Facing Small Undergraduate Departments And The Role Of Faculty And Administrators.

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Small geoscience departments with 5 faculty members or less in undergraduate institutions are facing serious challenges that will have a profound impact on their future, as well as the future of geoscience education. In addition to past and future budget cuts that affect all departments, small departments are more vulnerable to such problems as (i) decreased enrollments in introductory level classes, (ii) small number of geology majors, (iii) small number of graduates per year (iv) lack or paucity of equipment necessary for faculty and student research, (v) limited opportunities for external funding, (vi) need to offer upper division classes on an alternate year basis, (vii) difficulty in recruiting and retaining students, (viii) high teaching loads for faculty, and (ix) designing rigorous curricula based on 120 credit hours with a significant component of liberal art classes. These problems pose new challenges for faculty, department chairs and administrators. Faculty need to design curricula tailored to the need of the job market, without compromising rigor or the quality of the program. New classes/ concentrations in environmental science, hydrogeology and geographical information systems should be offered, and traditional classes in petrology, geophysics and tectonics should be maintained. Classes in Physics, Chemistry and Math should be core requirements. Student involvement in research should be encouraged at an early stage (sophomore/ junior levels). Department chairs need to assign duties in their department carefully to capitalize on the strengths of their faculty: faculty with strong research backgrounds should be helped in their efforts to pursue external funding opportunities, whereas those with strong teaching abilities should be evaluated primarily on their performance in the classroom. Student credit hour production should not be used as a criterion for evaluating faculty. Administrators should evaluate programs and departments based on the success of their graduates in the workplace/ graduate school, not their numbers, and the quality of faculty research and its impact on attracting new majors and acquisition of funds.

ED12A-0125 1330h POSTER

Recruiting and Retaining Geology Majors at CSUSB: Successes and Barriers

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Our efforts to build a strong geology department at CSUSB have focused on two main areas (1) increasing the number of geology majors, and (2) involving our majors more directly in the department through their involvement in scientific research and outreach activities. To increase the number of majors we have undertaken a three pronged approach: (a) by actively working with middle and high school teachers to better prepare them to teach Earth Sciences in their schools, by providing them with the necessary tools to accomplish this, and by developing a new course on Earth Sciences with emphasis on the California Earth Science Standards to be taken by students in the multi-subject credential program; (b) by showing middle school, high school, and college students that geology is interesting and exciting by involving them in geological activities such as field trips, hands on geological exercises, and in directed research projects; and (c) by conducting a public relations campaign to inform both potential students and the general public about activities being undertaken by the department. The latter has been accomplished by the use of a glossy color brochure designed to illustrate what geology is, and what kinds of careers are possible; by flyers sent to approximately 120 local schools outlining opportunities for field trips and for teachers to bring their students to our campus for various activities; by developing an outreach web site; and by various newspaper articles on departmental activities. We are also looking into the use of TV spots on geological subjects to be aired on public access television. Since the start of our efforts two years ago we have seen a positive response by local teachers, and an increase in the number of applications to study geology at CSUSB, including a significant increase in the number of minority applicants. A major barrier to recruitment has been the misconceived idea in local schools that a course in Earth Sciences does not count towards college entrance requirements. To better integrate our students into departmental activities, we have actively involved them in our outreach activities, and are currently strongly advising our majors to undertake directed research under the supervision of a faculty member. We are also discussing making a "research project" part of the graduation requirements. Representative projects involving our undergraduate students include GPS studies in the San Bernardino area, volcanological studies on the island of Dominica, West Indies, hydrological studies of the springs in the San Bernardino Mountains and studies of biostratigraphy and marine invertebrate paleoecology of the Death Valley region, California. Although a number of these projects have already resulted in students being co-authors on papers and abstracts, the extensive GE requirements and the fact that CSUSB is on the quarter system usually does not allow students sufficient time to develop a research project and take it to completion within an academic year.

ED12A-0126 1330h POSTER

Recruiting Quality Majors: New York High School Students Experience the Geology of Southern Utah

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Southern Utah University (SUU), Division of Geosciences, is faced with seriously increased competition for students within its traditional recruiting area, the direct result of nearby two-year institutions expanding their missions to four-year roles. Because of this increased competition, it is obvious that students must be recruited from new source areas. Research indicates that New York State has one of the most outstanding high school Earth Science programs in the United States, and it became a target area for recruiting quality students to the SUU geoscience program. Located in the Colorado Plateau to Basin and Range transition zone, SUU is situated in one of the most spectacular and diverse geologic regions in the world. SUU is surrounded by classic southwestern geologic exposures and extensive public lands. In order to use this resource to its maximum advantage, a one-week field program was arranged that would accommodate a maximum of 30 students from New York high schools. The target audience is comprised of juniors and seniors who have participated in an Earth science course, and have expressed an interest in a geoscience career. The field program provides students with a positive learning experience, and stresses basic geologic concepts while utilizing the stunning regional geology of southern Utah as an outdoor classroom. Students receive transferable college credit for participation. To make contact with potential participants, a letter was sent to high school principals requesting the name(s) of the earth sciences teacher(s) in the school. The response was limited (apparently principals do not forward materials to faculty members). However, there was sufficient response to conduct a field experience during late July, 2003. This initial offering was extremely successful and received positive reviews from all participants. The final results of this pilot offering are not yet known, but we are convinced that enrollment of students into SUU's program will result from an intense, and consistent, follow-up with the participants, until they are ready to enter university.

ED12A-0127 1330h POSTER

Integrating Current Meteorological Research Through Club Fundraising

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Earth science programs whose focus is primarily an undergraduate education do not often have the funding to take students to very many conferences which could expose the student to new research as well as possible graduate programs and employment opportunities. Conferences also give the more enthusiastic and hardworking students a venue in which to present their research to the meteorological community. In addition, the California University services largely lower income counties, which make student attendance at conferences even more difficult even though the student in SW PA may be individually motivated. This issue is compounded by the fact that the Meteorology Concentration within the Earth Science department at Cal U is composed of only two full-time Professors, which limits the amount of research students can be exposed to within a classroom setting. New research ideas presented at conferences are thus an important mechanism for broadening what could be an isolated program. One way in which the meteorology program has circumvented the funding problem to a certain extent is through an active student club. With nearly 60 majors (3/4 of which are active in club activities, the meteorology club is able to execute a variety of fundraising activities. Money that is raised can then request from student services matching funds. Further money is given to clubs, which are very active not only in fundraising, but using that money for academic related activities. For the last 3 years the club budget has been in the neighborhood of $4500. The money has then been used to partially finance student registration and accommodation costs making conference attendance much more affordable. Normally 8-16 students attend conferences that they would otherwise not be able to attend without great expense. There are times when more than 16 students wish to attend, but travel arrangements prohibit more than 16. Moreover club money is also use to supplement student costs on a summer storm chasing intercept course.

ED12A-0128 1330h POSTER

The NOAA Center in Atmospheric Sciences (NCAS) at Howard University

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The National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce established the NOAA Center for Atmospheric Sciences (NCAS), a Cooperative Science Center, in fall 2001 to support the development of quality education to students at minority serving institutions while meeting the prescribed goals of NOAA and the nation. NCAS was established to research some of the critical environmental conditions occurring nationally and globally, and to provide opportunities and programs for students to pursue careers in atmospheric, environmental, and oceanic sciences and remote sensing. A primary goal is to increase the number of highly qualified, well trained graduates in the fields of NOAA related atmospheric sciences. NCAS is led by Howard University, in collaboration with three partners - Jackson State University, the University of Texas at El Paso, and the University of Puerto Rico at Mayaguez. This presentation will highlight the activities and accomplishments in research, education, and outreach of NCAS over its first two years of existence. The primary benefactor of NCAS has been the Howard University Program in Atmospheric Sciences (HUPAS), a comprehensive graduate program in atmospheric sciences with core focus areas of atmospheric chemistry, atmospheric physics, and geophysical fluid dynamics.

ED12A-0129 1330h POSTER

A Non-science Major Undergraduate Seminar on the NASA Earth Observing System (EOS): A Student Perspective

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Titled "Observing Climate Change From Space-what tools do we have?", this non-science major freshman seminar at UCLA is the culmination of a year-long interdisciplinary program sponsored by the Institute of the Environment and the College Honors programs at the University. Focusing on the anthropogenic and natural causes of climate change, students study climate forcings and learn about satellite and other technological means of monitoring climate and weather. NASA's Terra satellite is highlighted as one of the most recent and comprehensive monitoring systems put into space and the role of future NASA platforms in the "A-train"-constellation of satellites is discussed. Course material is typically presented in a Power-Point presentation by the instructor, with assigned supplementary reading to stimulate class discussion. In addition to preparing lectures for class presentation, students work on a final term paper and oral presentation which constitutes the majority of their grade. Field trips to the San Gabriel mountains to take atmospheric measurements with handheld sunphotometers and to JPL, Pasadena (CA) to listen to a NASA scientist discuss the MISR instrument aboard the Terra satellite help bring a real-world perspective to the science learned in the classroom. In this paper, we will describe the objectives and structure of this class and present measurement results taken during the field trip to the San Gabriel Mountains. In this context we will discuss the potential relevance of hands-on experience to meeting class objectives and give a student perspective of the overall class experience.

ED12A-0130 1330h POSTER

The Role of Geoscience Departments in Developing the Earth Science Teacher Workforce: A Workshop Report

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Undergraduate geoscience departments play a critical role in the preparation of future teachers. This workshop sponsored by AGU and NAGT with funding from NSF brought together geoscience faculty known for their work in teacher preparation, Earth Science teachers and representatives from schools of education. Discussion focused on critical contributions of geoscience departments in recruiting, mentoring and advising future teachers; designing research and teaching experiences for future teachers; developing links between education and geoscience departments; supporting alumni in the teaching profession; and the role of introductory courses in teacher preparation. Each participant contributed a short essay describing the strengths of their program for teachers. The essay collection provides a snapshot of the breadth and innovative nature of current practice in geoscience departments around the country (serc.carleton.edu/NAGTWorkshops/teacherprep03). A summary of the program, powerpoint presentations, and discussion highlights are also available on the website. Of special interest are 1) approaches to introductory courses including revision of teaching methods in the general introductory course to demonstrate a range of pedagogy; separate introductory course sections or laboratory sections for pre-service teachers; and an integrated science approach for pre-service elementary teachers; 2) results of brainstorming sessions on mechanisms for recruiting and supporting Earth Science teachers suggesting a range of activities taking place before, during, and after participation in the geoscience program; 3) a summary of why teaching and research experiences are important for pre-service teachers and recommendations for program elements that lead to successful experiences and 4) plenary presentations on lessons learned from the NSF programs (Prival) and effective program design (Ridkey).

URL: http://serc.carleton.edu/NAGTWorkshops/teacherprep03

ED12A-0131 1330h POSTER

Opportunity to Participate in ESSE 21: The 2003 Call for Participation

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Earth System Science Education for the 21st Century (ESSE 21), sponsored by NASA through the Universities Space Research Association (USRA), is a collaborative undergraduate/graduate education program offering small grants to colleges and universities to engage a diverse interdisciplinary community of faculty and scientists in the development of courses, curricula and degree programs and sharing of learning resources focused on the fundamental understanding and application of Earth system principles for the classroom and laboratory. Through an expanded focus including partnerships with minority institutions, ESSE 21 is further developing broadly based courses, educational resources, electronic learning materials and degree programs that extend Earth system science concepts in both undergraduate and graduate classrooms and laboratories. These resources emphasizing the fundamentals of Earth system science advance the nation's broader agenda for improving science, technology, engineering and mathematics competency. The thrust to establish Earth system and global change science within the classrooms of colleges and universities is critical to laying and extending the foundation for knowledge-based decision making in the 21st century by both scientists and society in an effort to achieve sustainability. ESSE 21 released a Call for Participation (CFP) in the Fall of 2002 soliciting proposals from undergraduate institutions to create and adopt undergraduate and graduate level Earth system science content in courses, curricula and degree programs. In February 2003, twelve college and university teams were competitively selected through the CFP as the Year 1 and Year 2 Program participants. Eight of the participating teams are from minority institutions. The goal for all is to effect systemic change through developing Earth system science learning materials, courses, curricula, degree tracks or programs, and departments that are self-sustaining in the coming decades. ESSE 21 offers an expanded infrastructure for an interactive community of educators and researchers including minority participants that develops interdisciplinary Earth system science content. Emphasis is on the utilization of NASA resources involving global change data, models, visualizations and electronic media and networks. The ultimate aim of ESSE 21 is to expand and accelerate the nation's realization of sound, scientific interdisciplinary educational resources for informed learning and decision-making by all from the perspective of sustainability of the Earth as a system. The next Call for Participation will be released in late 2003.

URL: http://esse21.usra.edu

ED12B MCC: Level 1 Monday 1330h

Building a Better Classroom: Improving Teacher Education Through the Earth System Science Education Alliance Posters

Presiding: **T G Schwerin,** Institute for Global Environmental Strategies**; R Myers,** Wheeling Jesuit University

ED12B-0132 1330h INVITED POSTER

Facilitation: An Essential Ingredient in Online Coursework

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Mid-continent Research for Education and Learning (McREL) partnered with the Colorado School of Mines (CSM) to offer the ESSEA Earth System Science Online Course for Middle School Teachers during the 2002-2003 school year. During the two semesters that the course was offered, we were able to retain 75% of our enrollees. We found that course facilitation was the key ingredient in retaining this large number of studentswho are not only scattered across the U.S., but around the worldin a rigorous online course. In this poster session, we will share what we have learned about online facilitation as part of this course, and how this knowledge might translate into other online coursework. Online facilitation begins as soon as a student enrolls in the course. When a student registers online or at CSM, McREL receives notification and then sends course materials and e-mail and written confirmation to the enrollee within 24 hours. This sets the tone for the type of communications that students can expect during the 16-week course. McREL facilitators know how time consuming monitoring participant progress can be, but feel strongly about its importance when facilitating learners who are working in small groups and are completing independent research. Timely monitoring of discussion spaces and e-mail messages is essential to maintaining a high student-retention rate. Kearsley (2000) confirms this when he states that, "the most