DEPARTMENT OF GEOGRAPHY AND GEOLOGY
ACADEMIC PROGRAM REVIEW
COMPREHENSIVE REPORT: 2003-04

PROGRAM NAME: Geology

WKU REFERENCE NUMBER: 677 and 677P

DEPARTMENT NAME: Geography and Geology

NAME OF DEPARTMENT HEAD: David J. Keeling

NAMES OF FULL-TIME FACULTY WHO REGULARLY TEACH COURSES IN THIS PROGRAM:
Crowder, Margaret Kuehn, Ken May, Mike
Siewers, Fred Wulff, Andrew

** Chris Groves, Nicholas Crawford, and Scott Dobler also teach some courses in the geology program but are listed on the geography program page.

NAMES OF OPTIONAL RETIREES WHO REGULARLY TEACH COURSES IN THIS PROGRAM:
None

NAMES OF PERSONS PRIMARILY RESPONSIBLE FOR PREPARING THIS REPORT:
David J. Keeling, with contributions from the faculty

DATE OF SUBMISSION: December 1, 2003
OVERVIEW OF THE DEPARTMENT

The Department of Geography and Geology comprises 20 full-time faculty and serves about 210 undergraduate majors, 40 minors, and 28 graduate students in a variety of specializations. The Department offers a B.S in Geography, a B.S. in Geology, and an MS in Geoscience (with separate reports on each), as well as an AS in Meteorological Technology and a 12-hour GIS Certificate. Several educational, research, and public service facilities are housed within the Department that provide exciting opportunities for a combination of theoretical and practical work. A major goal of the Department is to involve undergraduate and graduate students actively in all aspects of research as an integrated part of their academic programs with the purpose of nurturing their intellectual growth, critical-thinking skills, and technical experience. The Center for Cave and Karst Studies serves as a major research center dealing with all aspects of cave and karst studies, with an emphasis on solving environmental problems associated with karst terrain. The Hoffman Environmental Research Institute, part of the Center for Water Resource Studies, another of the University's Applied Research centers, is a consortium of scientists and students dedicated to research and higher education at the cutting edge of environmental science. Its primary mission is to be a leader in the development of innovative, basic, and applied research programs aimed at understanding the dynamics of human-landscape-atmosphere interactions. The College Heights Weather Station maintains a fully equipped weather station with remote radar capability. The Kentucky Climate Center, directorship of the State Climatologist for Kentucky, is the certified state climate office for Kentucky and a member of the National Climate Services Partnership. The Center archives climatic data for Kentucky, provides access to state, national, and global climatic data, and is active in a wide variety of service, research, and educational outreach activities. The Department's new Geographic Information Science (GIS) Laboratory provides a state-of-the-art educational and research facility. The Lab maintains licenses for ArcGIS, ERDAS Imagine, and S-Plus software and provides access to a variety of spatial data, including digital geologic quads, digital elevation models, digital raster graphics, digital orthophotos, and other commonly used map data. Applied and basic field research by faculty and students is conducted continually in the local area, surrounding states, and throughout the world.

II.A. Mission Statement/Relation of the Program to the University Mission

The Department of Geography and Geology at Western Kentucky University offers the B.S. Degree in Geology. The mission of the program is to provide excellence in undergraduate instruction in a learning environment that is unsurpassed by other Kentucky institutions. Geology faculty fulfill this mission through innovative teaching, laboratory and field experiences, and the involvement of students in a wide array of research and service activities. The Department offers an academically rigorous and flexible program of study that prepares students for success in a global society. The goals of the program are to prepare Geology majors to begin professional careers or
enter graduate school, to train prospective science teachers, to offer appropriate
general education courses, and to bridge disciplines by interacting with other science
and engineering programs.

MISSION STATEMENT

The Department aims to provide students with an outstanding and practical
educational experience and it strives to achieve three fundamental goals: Excellence
in Teaching, Excellence in Research, and Excellence in Service. The Department is
committed to providing current knowledge and leadership development in the
geological sciences to enhance the career success of students, and to engage in
scholarly activities that develop new information in the geological sciences while
providing services to constituents.

Figure 1. Discipline-Centered Graphic of the Department Mission
The Department’s fundamental philosophical goal is to instill in each of its graduates the following qualities:

**STUDENT ENHANCEMENT GOALS**

- Openness to others and the ability to communicate with clarity and precision;
- Self-confidence and intellectual curiosity, with the geological and analytical skills required to satisfy both;
- A sense of scale and context in the worlds of nature and society;
- An appreciation for the richness and variety of human experience and expression;
- An intellectual mastery in and passion for the geological sciences;
- A commitment to ethical and responsible citizenship, including respect for, and an ability to get along with, others;
- A sense of direction, with the self-discipline, personal values, and moral conviction to pursue life-long learning goals.

**Vision and Mission of Western Kentucky University**

- Western aspires to be the best comprehensive public institution in Kentucky and among the best in the nation.

- Western aspires to be the university of choice for students and faculty who are dedicated to academic excellence.

- True to the Western spirit, the University offers an inviting, nurturing, and challenging environment, which is responsive to the intellectual, social, and cultural needs of a diverse learning community. Western’s success is reflected in the success of its alumni, who are known for their leadership, adaptability, enterprise, and commitment to Western.

- Western aspires to produce nationally and globally competitive graduates and to provide optimum service and life-long learning opportunities for its constituents.

- Western aims to prepare students for success in a global society.

These qualities are achieved in the undergraduate program through a solid grounding in geological analysis, critical thinking and reasoning, written and oral communication, student-centered research, and quantitative interpretation. However, the program also offers sufficient flexibility in course offerings and program tracks to allow students to develop emphases in traditional geology, hydrology, environmental geology, fossil fuels, and sustainable development. The Department also contributes to the General Education mission of the university by offering courses in Category D (Science). Indeed, the Department’s programs are critical to the institution’s mission of
preparing students for success in a global society, as success is predicated on a clear understanding of our global society, its mechanisms, structures, challenges, and opportunities. Programs and courses in the Department also clearly mesh with the vision and mission of Western Kentucky University.

Students in the B.S. in Geology must complete 44 hours in general education courses, of which 4 hours can be applied to the major or minor. Every student majoring in Geology must complete a 28-hour common core, and then may choose 8-11 additional hours based on the chosen program track (see Appendix G for details). The common core in Geology includes 8 lower-division hours of preparatory courses (of which 4 hours satisfy the designated laboratory experience requirement for General Education Category D - Science) and 20 upper-division hours of content-focused courses. The major in Geology is supported by a major or minor in another discipline, for a total of at least 48 unduplicated hours in a major-minor or double major combination.

The undergraduate geology program in particular is recognized by the Kentucky Geological Survey and other agencies as one of the strongest programs in the state, where faculty engage themselves and students in public service projects centered on geological education and research. Geological research takes advantage of state-of-the-art microscopes replete with digital photographing capabilities as well as scanning electron microscopes and other Ogden College analytical equipment (i.e. XRD, XRF, ICP-MS). Also available in the GIS laboratory is Aquifer Testing Software from Waterloo Hydrologic, the global leader in hydrogeologic software. On occasion the geology program provides opportunities at Lost River Cave for studying environmental geophysics and its application to karst. Students also have the opportunity to participate in the Wasatch-Uinta Field Geology Course during the summer along with geology students from Big-10 universities.

In summary, the Department’s mission is to recruit the best students possible, to continue to provide an up-to-date and relevant program, and to review the program and its graduates regularly through ongoing assessment, appropriate capstone courses, internships, examinations, and surveys. The program is continually enhanced through the assessment process by “closing the loop” between student-centered outcomes and program purpose and quality. With its broad spectrum of geologically centered analysis, interpretation, practice, and communication, the Geology undergraduate program subscribes to the University’s aspiration to be the best comprehensive public institution in Kentucky and among the best in the nation. The Department reflects Western’s emphasis on rigorous academic standards, creative and diverse scholarship, and appropriate and relevant service to the community, region, and profession. Geology program graduates have a strong impact on the Commonwealth and nation in the fields of energy development and management, hydrogeology, environmental management and consulting, science education, planning, and other professions requiring strong skills in spatial analysis, critical thinking, communication, and science-based reasoning. The Geology program prepares students for success in a global society.

B. Comments/Clarifications related to Institutional Research Data

Overall, the number of majors has remained steady over the past five years, with 32 majors recorded by the Department at the beginning of the Fall 2003 semester (see
Appendix E.2, Table E.2.3). Compared to geology program majors at other Kentucky institutions (see Appendix E.2, Table E.2.3) and at WKU's benchmark institutions (see Appendix E.2, Table E.2.4), the geology major is very healthy at Western, recording about the same number of majors as the University of Kentucky and more than twice as many majors as the other state comprehensive institutions.

Student credit hours (SCH) have undergone significant fluctuation over the past five years for several reasons (see Appendix E.2, Table E.2.1, and Appendix F, Section 1.A.4). Part of the discrepancy between the number of enrolled students and the total SCHs reported by the Department and those recorded by OIR is that OIR typically records students in zero-credit supporting labs. For example, departmental data show 870 SCHs produced in Fall 2001 (see Appendix E.2, Table E.2.1), yet OIR data record 1004 SCHs produced in Fall 2001 (see Appendix F, Section 1.A.4). Moreover, significant program and course restructuring has occurred since 1998 as a consequence of several retirements and the hiring of younger faculty with new types of teaching and research expertise. Course changes in several advanced areas of study, including a reinvigoration of the MS program in Geoscience, have caused a downward trend in the average class size, as many of the lab-centered courses are now limited to 20 students each (see Appendix F, Section 1.A.5). The average class size in geology has been reduced from 30 in Fall 1998 to 21 in Fall 2003 (see Appendix F, Section 1.A.5). The Department has routinely had student/faculty ratios in the 22-27 range and has made a concerted effort to reduce this to a ratio more approximating the average for Ogden College (17:1) (see Appendix F, Section 1.A.8) and for other geology programs nationwide. This had been achieved for the geology program by Fall 2003. For most of the 1990s, the Department routinely proved to be one of the most efficient in terms of actual expenditures per SCHP, at $82 per student credit hour (see Appendix F, Section 1.C.2). The Department also has aimed to reduce the average student credit hours produced per full-time equivalent faculty (SCHP/FTEF) from an average of 425-450 to an average of 275-300, again more approximating the average for Ogden College and for many departments across the university and nationwide (see Appendix E.2, Table E.2.2). The target for the geology program is around 250 SCHP/FTEF. These changes are necessary to continue improving the quality of undergraduate instruction and to prepare students more effectively for success in a global society. Although instructional efficiencies can be achieved through offering larger sections of some introductory classes, many of the hands-on, skilled-based, laboratory centered, or technique-driven courses offered by the Department at both the lower- and upper-division levels require class sizes of 20 or less. Project-centered course work or courses that require demanding pedagogies cannot be delivered effectively or productively to large groups of students.

Other data, such as average ACT scores and high school GPA (see Appendix F, Section 1.B.1), show consistency over the review period, as the average GPA of students declaring geology as a major remained unchanged from 3.0 in 1998 to 3.0 in 2002. OIR data on the number of program graduates are consistent with departmental data, and show the average number of graduates per year at 8 (see Appendix F, Section 1.A.2), which was approximately one-third of all Geology degrees awarded in Kentucky in 2002 and approximately 50% more than graduated each year from the University of Kentucky (see Appendix I). The number of full-time equivalent faculty (FTEF) teaching geology courses grew from a nadir of 3.0 in 1999 to the current FTEF of 5 positions in Fall 2003. One of these positions is dedicated, effective Fall 2003, to
servicing general education courses in the program, with another faculty member receiving a ½ time assignment for serving in the Center for Teaching and Learning, and a ½-time equivalent position for the one adjunct teaching introductory Geology in the program.

C. Teaching and Learning

1. Program Faculty:
Five full-time faculty in the Department of Geography and Geology teach courses in the Geology program, with another three faculty teaching courses in the Geology program that have primary teaching duties in the Geography program.

- Rank of full-time geology faculty: 1 tenured professor, 1 tenured associate professor, 2 tenure-track assistant professors, and 1 instructor.
- The instructor holds an M.S. Degree in Teaching (Geology Major), and the four tenured or tenure-track faculty hold Ph.D. degrees in Geology.
- Faculty in the Geology program participate in on-line interdisciplinary earth science courses, the Freshman Seminar experience, and various Gifted Studies programs. The Ph.D. faculty also teach graduate-level courses in the Geoscience M.S. program.
- In addition to the full-time geology faculty, Dr. Groves (Ph.D. Environmental Science-Geology) and Dr. Crawford (Registered Professional Geologist in Kentucky, Tennessee, and Florida) teach geology-designated courses in the Department, often cross-listed with geography courses.
- The Department currently employs no optional retirees.
- The Department employs two adjunct faculty each semester; one at the extended campus in Glasgow and the other in the Department. Typically, their contributions equal 0.5 to 0.75 FTEF each semester.

2. Program Students:
Driven by the CPE mandate of “more students going to college,” enrollment has not been limited in the Department. The overall educational quality of students varies tremendously, with some students ranked in the top 10 percent of their high school class and others ranked in the lower 50 percent. OIR data, such as average ACT scores and high school GPA (see Appendix F, Section 1.B.1), show consistency over the review period, although the average GPA of students declaring geology as a major remained unchanged from 3.0 in 1998 to 3.0 in 2002. There is no geology requirement in the Kentucky high school curriculum (although some students do get introduced to earth science concepts), so most students come to the introductory, general-education classes completely unprepared for the geological sciences and generally ignorant about the physical world around them. Nonetheless, despite these challenges, many students successfully complete the program and go on to professional or graduate school or become productive members of the community.

In terms of recruiting majors, very few high-school graduates arrive at Western pre-declared in Geology. Approximately 90 percent of all Geology majors and minors are recruited from the introductory, general education courses, primarily Geol 102 (Introduction to Geology), Geol 111/113 (Physical Geology), and Geol 112/114
Historical Geology). Many of these students “discover” Geology well into their sophomore or junior year, and this often causes an extension of their college careers as they rush to catch up on required and sequenced courses.

3. Indicators of Teaching and Advising Quality:

From a philosophical perspective, the Department has articulated a set of program goals and outcomes related to teaching, advising, and learning.

**TEACHING GOALS AND OUTCOMES**

**PROGRAM GOALS:**
- To instill in students fundamental knowledge of the geological sciences;
- To develop students’ technical expertise in geological fieldwork and laboratory analyses;
- To develop students’ analytical, critical-thinking and problem-solving abilities;
- To develop students’ fundamental communication skills;
- To enable students to understand and engage with the concepts and practices of global interdependence;
- To develop students' professional proficiency;
- To promote in students a desire for continual personal development.
- To instill in students core values and ethics for life;
- To instill in students an awareness of their social and civic responsibilities;
- To encourage students to enhance their aesthetic perception and ability.

**PROGRAM OUTCOMES:**
- Students have demonstrated a clear understanding of the core content areas of the geological sciences and have demonstrated a capacity for critical thinking and concept synthesis.
- Students have learned, and can apply, the skills needed to collect and analyze data, solve geological problems, and effectively communicate results of geological investigations.
- Students have developed the knowledge, skills, and attitudes that lead toward life-long learning and enhanced life opportunities;
- Students can apply the technological knowledge, skills, attitudes, and flexibility needed to succeed in a rapidly changing global society;
- Students have developed the cognitive processes and dispositions necessary to think critically, to analyze problems in context, and to make sound and intelligent decisions;
- Students have acquired and utilize the body of knowledge, and have developed the constellation of skills, associated with their discipline, interdisciplinary areas of specialty, or professional field;
- Students can gather and utilize information to enhance knowledge, and can use communication skills to convey meaning effectively and accurately;
- Graduates from the program are prepared for success in the geological sciences and other professional endeavors.
Teaching Quality:
Since 1998, four Department faculty have been nominated for College awards in teaching (Dr. Siewers in the geology program won the Ogden Teaching Award in 2002). Four faculty were awarded sabbatical leaves to facilitate more in-depth research in their disciplines. Over the past five years, 15 of the Department’s students have gone on to advanced degree programs around the country (in addition to program graduates continuing on in the Department’s Geoscience Master’s program), a tribute to the educational preparation they receive in the Department. Most faculty in the Department have incorporated digital technology and web-assisted learning into the curriculum, with several faculty using personal web pages to support their teaching. Geology faculty have developed new web-based courses in Earth System Science Education, face-to-face courses in Oceanography, Rocks and Minerals, Backyard Geology, and Geology of the Movies, and a field-based course focusing on the geology of California. Several courses have been redesigned, including Mineralogy, Petrology, and the laboratory for Physical Geology. Faculty have also developed a series of one-hour introductory courses targeted at non-science students to attract them to the geosciences. These courses include geology sections for Volcanoes, Earthquakes, and Natural Disasters. A special section of University Experience (GEOG 175) is offered each Fall semester for students pre-declared in, or considering, Geography and Geology.

All faculty are willing to offer enhanced Honor’s designation to any upper-division course upon request. The Department of Geography and Geology is committed to ongoing faculty development in the area of teaching. Faculty members have attended 15 workshops or activities sponsored by the Center for Teaching and Learning, and the Department’s University Distinguished Professor has agreed to a half-time appointment with the CTL commencing during the 2003-2004 academic year to promote teaching quality.

Retention:
Over the past five years, the Geology program has averaged 8 graduates per year, with a calculated 5-year retention rate of approximately 85%, well above the University six-year graduation rate of 42 percent. Data show that over 90% of all students pre-declaring in Geology complete an official degree program and go on to finish the program. The Department has one or two “Peer Tutors” employed each semester, typically juniors or seniors who have earned “A” grades in each of the introductory-level courses, to assist students in the required geology labs. The Department relies on the University’s 6-week assessment process, as well as individual faculty reports, to identify poorly performing students in the introductory courses and to encourage them to seek assistance from the Peer Tutors. Internal investigations have determined that over 90% of pre-declared majors in Geology who fail an introductory course do so because of poor study habits (defined as chronic absenteeism, poor note-taking strategies, intellectual laziness, and an inability to read and interpret textual
material). The same problems affect non-geology majors taking general education, introductory-level courses, with approximately 6-9 percent of enrolled students each semester taking a "W" by the official drop date. Almost all of these students have problems with excessive absenteeism and a lack of serious engagement with the course material; only a few withdraw for financial or other personal reasons.

Advising Quality:
The Department has a student-centered, faculty responsive system for student advisement. Every faculty member is expected to be a good advisor, as the Geology program has four tracks that require discipline-centered expertise in terms of advising. All students meet with the Department Head for advising when completing the official degree program, and, typically, all pre-declared freshmen students meet with the Department Head or a faculty member who specializes in the chosen area prior to registering for courses.

In addition to personal contact with a faculty member, students have access to specific departmental “major sheets” (see Appendix H, Tracks in the Geology Major) and to detailed program and course information posted on the Department’s website (www.wku.edu/geoweb/info/program.htm). Every major or minor track, along with descriptions of every course offered in the Department, is described on the website, and the Department has a four-year degree plan posted on the website to help students plan their progress through to graduation. Informational pages are available online for many courses, as are the syllabi. These offer an option for interested students to learn more about both content and approach for these courses. The Department strives to offer all sequenced courses on a regular schedule so that students can graduate on schedule.

4. Indicators of Student Learning:

Currently-enrolled students:
Geology students engage in supervised course-centered and independent research, presenting posters and papers at local, regional, national, and international conferences. During the review period, over 100 student-authored papers and posters were presented at scientific conferences and other academic meetings. These papers include an award for the best undergraduate paper in geology at the Joint Meeting of the Kentucky and Tennessee Academies of Science and 1st place and honorable mention awards at the Annual Sigma Xi Student Research Conference. For example, the presentation by students Chris Hall and Tim Perkins at the 2001 Joint Annual Meeting of the Kentucky and Tennessee Academies of Science was awarded the best undergraduate paper in Geology. Jessica Campbell received an honorable mention for her presentation at the 2003 Sigma Xi conference and, at the same conference, Mollie Laird and Laura DeMott received the 1st Place Award for Best Paper of Session.

The Department assesses each graduating senior through a written exam that comprises a basic discipline-centered knowledge survey and written analytical and critical-thinking essays based on the student’s track in the program. For the first time in Spring 2003, graduating seniors in Geology were required to take the standardized Area Concentration Achievement Test (ACAT) in Geology, which included nine content areas. The average score achieved by students taking the test was above the national average. Data and student feedback from the senior assessment are used to enhance
student learning through program and course revisions, thus “closing the loop” between student learning outcomes and program goals.

Many of the Department’s students choose an internship experience during their junior or senior year, and many have participated in local, national, and international supervised research projects. Forty-four students have completed external internships or internal practica since Summer 1999 (see Appendix K). Thirty-five of the Department’s students have participated in a study abroad or departmental field camp over the past five years (including geography, geology, and geoscience students).

Program Graduates

The majority of the graduates in Geology find employment in one of the many specialty areas of the discipline. Those students who have gone on for graduate study in major geology programs around the country (e.g., Kentucky, Tennessee, Vanderbilt, Florida, and Kansas) have progressed well. Several program graduates have successfully completed the M.S. at other institutions since 1998. According to data gathered through alumni surveys via the departmental GEOGRAM, over two-thirds of the respondents reported that they had found full-time employment in areas strongly or moderately related to their major focus within two years of graduation (see partial alumni data in Appendix G). A major barrier to successful career placement for many graduates is an unwillingness to seek employment beyond Kentucky. Moreover, a lack of career opportunities in environmental planning, energy, the coal industry, geophysics, and business enterprise within the state continue to limit the ability of graduates to find suitable employment beyond graduation. The Department is attempting to address this problem through program restructuring, a new focus on GIS-related courses, and more structured research-centered experiences that might better prepare students for career opportunities.

D. Research/Creative Activity

Faculty in the Department conduct applied and basic research in local, regional, national, and international environments on a wide variety of issues related to human-environment interactions. These include the extractive minerals industry (coal, oil & gas), groundwater supply and protection, natural geohazards such as radon gas, karst collapses, earthquakes, floods, slope stability, and volcanic geohazards, and also stratigraphic analysis, sedimentary petrography and diagenesis (chemical change in rocks), environmental mineralogy/geomedicine, depositional environments, paleo-ecology, geochronology, earth materials analysis, low- and high-temperature geochemistry, igneous and metamorphic petrology, paleogeographic reconstruction, planetary geology, and geology and public policy. The Department aims to involve all of its students in applied research activities, facilitated through the activities of the Programs of Distinction and the research institutes, with particular emphasis on local and regional development issues. Appendix A.2 details the scholarship of faculty assigned primarily to the Geology program, with 15 publications and 55 academic presentations recorded during the review period.

E. Service

The Geology program strives to provide relevant, practical service to the university, the community, the Commonwealth of Kentucky, and to the disciplines.
Faculty actively serve on committees, provide valuable expertise and advice to a variety of constituents, and are active in their communities. During the review period, hundreds of service activities were recorded, and Appendix D.2 details the myriad institutional, community, P-12, and discipline-related service activities engaged in by the geology faculty. The quality and volume of service provided to the department, college, institution, community, region, state, and nation distinguish this Department from many others on campus. Of note, the geology faculty have accomplished these activities with only four full-time faculty. Dr. Ken Kuehn received the Ogden College Award for Public Service in 1999 and was also named University Distinguished Professor in 2001. Dr. Kuehn also has received special recognition by the Kentucky Society of Professional Geologists and the Society for Organic Petrology for his distinguished service. Both Drs. Crawford and Kuehn have been recognized by the American Institute of Professional Geologists and the Kentucky Society of Professional Geologists respectively for distinguished service.

F. Grant Activity

Since 1998, Geology faculty have been actively seeking grants and contracts from a variety of external and internal sources to support student-centered research. The Department has three research centers that function as part of Ogden College’s Applied Research and Technology Program: The Center for Cave and Karst Studies, the Kentucky Climate Center, and the Hoffman Environmental Research Institute. Over the five-year period, Geology faculty applied for over $2 million in 42 individual grants and contracts and received total funding in the amount of $268,430 (approximately a 13 percent success rate). Of this amount, $43,913 came from internal sources and $224,517 came from external sources (see Appendix E.2, Table E.2.4, for summary details, and Appendix C.2 for grants detailed by faculty member).

G. Other Indicators of Program Achievement and Contributions

1. Program Viability:

A number of important considerations point to the continued good health and vitality of the Geology degree program at Western Kentucky University. Geology is one of the basic sciences, and it is an essential part of the curriculum at most universities. At WKU, Geology also plays a role in the general education of undergraduate students. The Geology program has established linkages with other departments and programs within the University. For example, a significant percentage of Geography majors are Geology minors, and vice versa. Three upper-division geology courses are cross-listed with Geography (GEOL 310, 420, and 492).

Several disciplines either require or recommend introductory geology courses for their majors. These include Civil Engineering, the Land Surveying, Earth Science, and Astronomy minors, and Middle Grades Education. The new WKU degree program in Engineering requires support from the geology program and cross-disciplinary courses in Geotechnical Engineering and Engineering Geology are under discussion. The two disciplines work side-by-side in matters of construction on our karst landscape, earthquake risk, and mitigation of other geologic hazards.

In conjunction with the College of Education, Geology faculty crafted, in February 2002, a certifiable B.S. degree (Earth/Space Science teaching emphasis) according to
the guidelines of the National Council for Accreditation of Teacher Education (NCATE). This program detailed a parallel track through the existing Geology B.S. program that will result in certification in the discipline for public school teachers. Moreover, the Commonwealth has recently approved a measure to change the minimum high school graduation requirements in science and other disciplines. Beginning with the class of 2002, every Kentucky high school student has been required to complete three science credits (life science, physical science and Earth/space science) in order to graduate. Changes in the "Program of Study" and the "Core Content for Science Assessment" also have been implemented, which require much more Earth/space Science to be taught in the high schools. These changes signify there will be an increasing demand for qualified Earth Science teachers and that our first-year students at WKU will have had some previous exposure to the geology discipline. Both of these prospects suggest the number of WKU Geology majors will continue to grow.

The Bachelor’s Degree in Geology is truly a professional degree. According to state law, a geologist must be registered in order to practice geology in the public interest. The minimum education requirement for professional registration is a bachelor's degree in geology. Although six Kentucky Universities offer a geology degree, WKU ranks a very close second in its number of graduates per year to the University of Kentucky. A national certification board was founded in 1963 to provide a vehicle for establishing a standard of excellence for the geology profession. Since then, many states have followed with professional certification or registration systems for geologists, similar to that for engineers and other professionals. In 1993, Kentucky instituted its own registration system for professional geologists and, to date, more than 2,300 registered geologists are practicing in the Commonwealth.

Geology is a demanding and difficult discipline, making a supply of skilled practitioners produced from within the Commonwealth’s varied regions essential for problem solving and economic development. WKU has the western Kentucky coalfield, the nation’s most productive limestone quarry, and Mammoth Cave in close proximity. Moreover, unique environmental and hydrological issues exist within our world-renowned karst region. Kentucky’s fuel and mineral resources bring more money into the economy than anything else, many more times than that of agriculture, for example. These topics are the purview of professional geologists and engineers.

In summary, the Geology program remains an important science-centered major at Western, with the average numbers of majors stable at between 30 and 35 over the past five years. The majority of majors in Geology are recruited directly from the introductory, general-education courses. The strength of the program is based on student-centered learning, good advising, excellent teaching, and faculty/student research that is integrated into the curriculum. Other changes occurring that are reinvigorating the discipline and drawing more students to the major are the development of advanced spatial mapping techniques, encapsulated in Geographic Information Science (GIS), and new satellite-based locational tools, such as Global Positioning Systems (GPS), which have captured the imagination of the latest generation of students. This interest in advanced spatial mapping tools and techniques will translate into a growing demand for spatially centered courses and programs over the coming years, and the Geology program is redesigning its curriculum to meet these changing demands. Tables E.1.6 and E.1.7 in Appendix E.1 detail the anticipated growth in demand for GIS-related courses and the 12-hour GIS certificate program.
2. Contributions to University Programs:

In addition to providing discipline-centered technical, theoretical, and applied courses in Geology, the Department offers several courses in General Education:

**Category D – Science**
- Geol 102 Introduction to Geology
- Geol 111/113 Physical Geology (Lab Designated)
- Geol 112/114 Historical Geology (Lab Designated)

Geology faculty offer upper-division Honors-augmented classes at the request of Honors students. Geology courses are also accepted as concentration requirements or electives, or suggested electives, in Elementary Education (#527) and Middle Grades Education (#579). Several courses in the Geology program are cross-listed with the Geography program, and the Department teaches one section each Fall of University Experience for Geography and Geology majors (Geog 175). As detailed in the previous section, the Geology program also contributes to Civil Engineering, the Land Surveying minor, the Earth Science minor, and the Astronomy minor. Geology faculty also collaborate with faculty in the Departments of Agriculture, Biology, Chemistry, Physics and Astronomy, Education, and Public Health in graduate and undergraduate research projects. The Department also contributes to the Program for Gifted Students (Super Saturdays) by providing instruction for 3rd, 4th, 5th, and 6th graders, as well as high-school students, in earth science. The Department firmly believes in collaboration with area P-12 teachers and schools in order to help prepare students for success in the sciences at WKU.

The Department of Geography and Geology also contributes to University programs by offering study abroad and geology field-camp opportunities. Study abroad programs help prepare students to participate in a global society. In July 2002, twenty students from five university programs (including geology) enrolled in courses offered by two Geography faculty through the Department’s summer program in Australia. This study abroad experience exposed students to global issues like World Heritage Site management, the effects of tourism on sensitive environments, deforestation, air and water pollution and planning issues in a way that is impossible to duplicate in the classroom. In summer 2003, eight students and two faculty toured the southwestern United States as part of a geoscience field camp. Students actively engaged in experiencing different cultures and physical landscapes, which broadened their understanding of national and regional peoples and lands. In 2004, the Department is offering study abroad courses in the Bahamas (Spring Break Geology program) and in the British Isles (field-based geoscience program). Approximately 40 students have expressed interest so far in these programs. Although geography and geology students constitute the majority of the students that participate in these programs, they are open to all students at WKU. Each summer, the Center for Cave and Karst Studies offers a series of workshops based at Mammoth Cave National Park. Now in its 26th year, this program offers both university credit and continuing education credit courses. These opportunities play a significant role in Western Kentucky University’s Quality Enhancement Plan as they enhance student “engagement” and prepare students to live and work in a global society.
3. Use of Technology:

The Geology program actively incorporates technology into its teaching, research and service programs. The Department has made a concerted commitment to the use of digital instruction technology to enhance student learning. Digital projectors and computers are available for instructional use in all classrooms, either permanently installed or on a mobile cart. Geology faculty routinely use presentation technology in conjunction with PowerPoint, interactive web sites, and various specialized software to advance student learning and the dissemination of course concepts and materials. Digital media's power lies in its ability to combine photographs, maps, and text, allowing instructors to illustrate abstract concepts with real world examples and to meet the needs of visual as well as aural learners. These same technologies are used by faculty for public-service initiatives and professional development workshops. Analytical technologies are used throughout the Geology degree program and support faculty research. Those technologies include basic rock preparation equipment, reflected and transmitted light microscopes, digital cameras for photomicroscopy and field work, the scanning electron microscope (SEM), energy dispersive X-ray microanalysis (EDS), X-ray fluorescence (XRF) and X-ray diffraction (XRD), inductively coupled plasma spectroscopy (ICP), and electron microprobe analysis. Aquifer Testing Software from Waterloo Hydrologic, the global leader in hydrogeologic software is used for aquifer slug testing and pumping tests. Through their coursework students become familiar with Macintosh, Windows, and UNIX-based computer platforms and software, and routinely use GEOREF and other web-based reference materials.

Additional technologies are used for geophysical investigations of the area’s karst terrain through the Department’s Center for Cave and Karst Studies and collaborations with the EPA. Those technologies include magnetometers, electrical resistivity meters, near-surface seismic, ground-penetrating radar, and microgravity meters. Unlike most undergraduate geology programs, these technologies are used by students during their undergraduate careers and form the foundation of student research projects in the geosciences.

Through institutional Action Agenda funds, the Department developed, in partnership with the Agriculture and Architectural and Manufacturing Sciences departments, a state-of-the-art GIS facility. GIS courses are taught in the facility, which seats twenty students. All computers are networked to the internet and to the campus network. Specialized hardware in the lab includes a flat bed scanner and nine digitizing tablets. A system-wide license with ESRI Corporation provides an unlimited number of licenses for ArcGIS 8.3, an advantageous arrangement vis-à-vis future expansion of GIS facilities. Additional software includes ERDAS Imagine, CorelDraw, Visual Basic, Java, C++, S-Plus, SPSS, Dreamweaver, Fireworks, AutoDesk Map, and Mathematica. In addition to regular use for GIS instruction, the lab is scheduled on an as-needed basis by other geography and geology classes for demonstrations and hands-on analysis. The GIS Research and Development lab, containing four workstation-class computers, two file servers, a large format scanner, large format printer, and two Trimble Pro GPS units, provides advanced GIS computing facilities for student and faculty research. The lab also meets, on a contractual basis, local business and community needs for GIS services.

Through judicious use of grant funds, specialized equipment has been purchased to support student-centered research activities, including computers and other electronic equipment, scanning electron microscopes, micro-gravity meters, and other
supporting materials. The Department has expended funds from its own operating budget to provide zip disks, memory-chip upgrades, faster computer processors, and other ancillary computer hardware needed to support faculty teaching and research activities. The standard computer set-up provided by the institution is completely inadequate for basic teaching and research needs in the sciences. Several of the more senior faculty are still running computers with outdated operating software, inadequate RAM and hard-drive capabilities, and without the ability to run more sophisticated analytical software (ArcGIS, S-Plus, etc.). The Department maintains a strong web presence with its departmental website (www.wku.edu/geoweb/) (see Appendix L, copy of the home page), which hosts several thousand visitors each year. The website has hundreds of information pages, with course descriptions, program summaries, and details about faculty and student research projects, as well as links to all of the important teaching, research, and service activities within the Department. The website is maintained by the Department Head and is updated monthly, or more frequently as news or changes occur.

4. **Uniqueness of Program:**

- The Department of Geography and Geology is the only one of its kind in the Commonwealth of Kentucky and it holds the largest concentration of Earth scientists in the state.
- The Department is strategically located near Mammoth Cave National Park, along the 31W Heritage Corridor, and near important coal resources. Its location offers significant research advantages.
- The Department has the only program in the United States with a specific emphasis on karst hydrogeology and on the numerous problems associated with development upon karst terrain.
- The Department's expertise in spatial and geologic analysis gives it a distinct advantage in teaching, developing, and promoting GIS (Geographical Information Science) approaches to problem solving. This is especially useful in investigations in the geological sciences.
- The Department is located on a diverse geologic terrain consisting of rocks ranging in age from Ordovician to Pennsylvanian, characterized by diverse structural components and depositional complexities that provide ample research and teaching opportunities.
- The Department is also strategically located near glacial and peri-glacial deposits (nonkarst areas to the immediate north and northwest) that provide students with an exposure to classic Pleistocene (Ice Age) and Holocene (Recent) outcrops for research.
- Geology programs address the economically important geologic features and concerns in the south-central Kentucky region including sinkhole collapse, water quality, solid waste disposal, coal mining and mine subsidence, erosion and land reclamation, earthquake risk, flooding and potential landslides, and radon, among others.
- The Department is internationally recognized for its high-quality summer programs at Mammoth Cave National Park that address karst geology and hydrology.
• The Department possesses a unique reference collection (the Gildersleeve collection) of historical documents and maps pertaining to geological investigations in Virginia, Tennessee, and Kentucky that is used by faculty and students for research.

• The Geology Program is one of only two programs in Kentucky to offer on-line professional development courses in Earth System Science Education. These courses are being taught via the “Kentucky Earth System Science Education Project,” a collaboration between WKU and Morehead State University to offer Earth System Science course to area teachers and beyond.

• Faculty are diverse in training and research interests, yet provide an integrative approach to human-environment issues that spans the physical and human sciences. Several faculty are internationally respected as experts in their research areas.

• The Department is distinctive in the University for its long history of successful professional public service related to human-environment issues in the local community, the Commonwealth, nationally, and internationally.

• Training of undergraduates in advanced analytical techniques and equipment (XRD, XRF, SEM-EDS, ICP-MS, electron microprobe) used in investigating geological materials.

• Two faculty in the Department recently launched the Human-Environment Linkages Program (HELP), which represents a new direction for the Department of Geography and Geology (see more on this initiative below in Section I).

5. Contributions to Diversity Goals:

The Department has a long history of integrating issues of ethnic diversity, gender equality, and personal orientation into the curriculum (see detail under this section in the Geography program review). In the Department, females comprise one-third of all majors, a trend that is average for Geography and Geology around the country, whereas most introductory-level classes are at least 50% female, also on a par with national statistics. The Department has made special efforts in past years to identify, recruit, and hire minorities and females into faculty positions, especially through personal contacts, listservs within the disciplines, recruiting at national and regional conferences, and by word of mouth. Out of twenty full-time faculty, three are female (one is Asian American), one is South Asian, and the rest are white males. The Department recognizes that it has work to do in creating a more diversified faculty and it continues to identify ways to attract a broader and more diverse pool of applicants for advertised vacancies.

6. Accreditation Status:

Not Applicable. There is no national or regional accreditation body for programs in geology. However, post-graduate, professional examinations are provided by the Association of State Boards of Geology (ASBOG). Most states require the successful completion of two section exams, Fundamentals of Geology and Practice of Geology, in addition to five years of professional experience as a practicing geologist in order to receive certification as a Professional Geologist (PG).
7. Planning, Development, and other Areas:

A copy of the Department’s 2001-2006 Strategic Plan is attached in Appendix L. All of the issues addressed in the Department’s Strategic Plan have been covered elsewhere in this document. The Department is pro-active in attracting development funds (with the excellent support of staff in the Development office) and it receives a steady flow of donations each year from a core group of alumni. This past year the Geology program received a $100,000 gift ($50,000 with a $50,000 state match) from the Gildersleeve family to support student research and travel. In 2001, the Department received a gift-in-kind of 55 acres of farmland from Dr and Mrs James Taylor (a former faculty member in the Department), with a value to be determined upon liquidation of the asset. Cash and in-kind donations from generous alumni contribute to student support each year for travel to conferences, field research sites, and for study abroad programs and field camps.

8. Additional Indicators for Career Preparation Programs:


In terms of general career preparation, the employment outlook in geology - as in any profession - varies with the country’s economic climate. Dwindling energy, mineral, and water resources, increasing environmental concerns, global issues such as rising sea levels, and hazard assessment all present significant challenges to geoscientists. Career opportunities are increasing in environmental science and hydrogeology with the growing need to maintain Earth’s natural environments and meet society’s demands for Earth materials. Over a decade ago, Money magazine (February 1992) ranked "geologist" second overall out of 100 best occupations and in the top nine for "jobs that satisfy." According to the American Geological Institute’s Geoscientific Employment and Hiring Survey (www.agiweb.org), more than 85,000 geoscientists work in the United States today. Most geologists are employed by industries related to oil and gas, mining and minerals and water resources. Many geologists are self-employed as geological consultants or work with consulting firms. Most consulting geologists have had extensive professional experience in industry, teaching, or research. Also, many geologists work for the federal or state government. Most work for the U.S. Geological Survey (Department of Interior), but others work for the Department of Energy, Forest Service, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, U.S. Army Corps of Engineers, or a state geological survey.

H. Response to Previous Program Reviews or Other Assessments

The Department submitted a program review in 1998, and received no constructive feedback from the submission. The response to the review was “maintain,” with the comment “This appears to be a strong program that also makes a good contribution to general education.”

In September 2003, the Department commissioned an external review of the Department, conducted by Dr. Robert Kent, Department Head in Geography and Regional Planning at Akron State University, Ohio. His review summary stated: "This is
a strong department. It has a collegial supportive workplace environment. Department members are loyal and display a strong \textit{esprit de corps}. The Department’s mission includes a strong general education component, besides granting associate degrees in meteorology, bachelors’ degrees in geography and geology, and a master’s degree in geosciences. Despite the heavy teaching load, faculty members are productive researchers, scholars, and teachers, and also are actively engaged in the local and regional community and indeed throughout the state. The Department is well respected within its college and could be considered one of the college’s more significant departments. The Department has a strong enrollment, many undergraduate majors, and a master’s program. With the recent creation of dedicated computer teaching labs, a GIS center, and a full time GIS lab manager, the Department is well positioned to build additional faculty strength in rapidly expanding areas like GIS and remote sensing. The Department should reinforce its expertise in planning and continue its outreach activities to local and regional planning agencies thorough internships, contracts, and professional interaction.”

I. Future Directions

- \textbf{Enhancing the Geology Program:}

  Department faculty are actively seeking new opportunities to enhance student engagement with the Geology programs. First, the faculty are restructuring the curriculum to make the program more responsive to the needs of constituents. Due to professional certification requirements, Geology faculty are developing a rigorous track that adequately prepares program pre-professionals for eventual practice and/or acceptance into quality graduate schools. However, a second, more general track is intended to draw students who have a variety of interests in geosciences and the environment and to engage them in cross-discipline studies. This track will involve new general education courses and on-line offerings. A third track is designed for pre-service teachers in Earth and Space Science to gain the discipline knowledge they will need to be effective in their future careers. As described previously under ‘program viability’, the Department anticipates that these changes will increase the number of program majors.

  In addition to these curricular changes, Geology faculty are actively working to develop new field and laboratory experiences for program majors. This will involve a concerted effort to enhance the existing technological infrastructure of the program as well. Geology faculty will continue to seek and develop collaborations with departmental colleagues and with other programs at WKU. To date, the geology program has been tremendously successful in training students to be productive in their profession. Nonetheless, there are several areas of programmatic need that cannot be adequately addressed because of an inadequate level of staffing. When compared to WKU’s benchmark institutions (see Appendix E.2, Table E.2.5), it is clear that WKU serves more than the average number of geology majors with significantly less than the average number of program faculty. The Department’s plans for future growth in the Geology program are dependent on its ability to add qualified faculty and staff positions.

- \textbf{Geographical Information Sciences:}

  The growth potential in GIS and related technologies is discussed elsewhere in this document (see also Appendix E.1, Tables E.1.6 and E.1.7). In summary, GIS use
has grown exponentially over the past decade and is now pervasive in academia, government, and industry. In environmental monitoring, urban planning, location analysis, public health, criminology, forestry, transportation, utility management and many other fields, the power of GIS is used to analyze spatial data, create comprehensible visual representations, and enhance the decision-making process. GIS technology will only continue to diffuse more widely into society. It is likely that the standard home or office computer of the future will include GIS software, much as word processors, spreadsheets, and presentation software are now standard. In the winter 1999-2000 issue of *ArcNews Online*, Roger Tomlinson, president of Tomlinson Associates and an early leader in GIS development, characterized the future of GIS as a pivotal technology for the twenty-first century:

Looking at GIS in the new millennium, one starts with the firm expectation that the adoption of GIS societywide and worldwide is inevitable and that GIS users will be advantaged in their work while nonusers will be relatively disadvantaged… An essential foundation of GIS usage is the availability of trained people. Perhaps the entire rate of technology take-up in the first part of the millennium will depend on training. The need is for persons who are geographically literate and able to learn how to use the technology. The training focus must be on the ability to solve geographical problems.

Western Kentucky University has an unparalleled opportunity to be a leader in this field, building on the foundation of the GIS certificate program already in place. The existing program has been singled out by ESRI Corporation, the developer of leading GIS software, as a distinguished GIS program. The certificate program provides a broad foundation in GIS concepts and techniques, familiarity with a wide variety of data sources and applications. To meet future needs, the program should be enhanced by the addition of advanced courses that focus on specialized and in-depth use of GIS in particular fields and by the greater integration of GIS into all geoscience courses. To achieve these goals, expanded lab facilities to accommodate larger number of classes and students and a commitment to ensuring adequate numbers of GIS-trained faculty are needed.

- **Environmental Science:**
  Two faculty in the Department recently launched the Human-Environment Linkages Program (HELP), which represents a new direction for the Department of Geography and Geology. HELP is not just a new research lab, although cutting-edge research will occur here. The mission of HELP is to extend the benefits of research into the community by conducting research of local, national, and global significance and then disseminating that research to a variety of outlets. Environmental issues commonly have both a scientific and a policy dimension and the HELP hopes to overcome the traditional failure to incorporate each in academic analyses. Coursework will focus on small sessions of motivated students doing research on environmental issues. A key component of the courses will be dissemination of the findings by the students through presentations at local high schools and to other interested stakeholders. HELP offers students training in computer skills, mapping, synthesis of data, and presentation skills all focused on research issues with "real-world" significance. This training and experience will be useful for students across their disciplines, it should improve
retention, and it could open more career and graduate school opportunities. For example, both HELP’s Residential Radon and Karst Stormwater projects have been successful areas of undergraduate research. Students have presented their findings at research conferences and to area high schools over the past year.

Related to this is an unexploited departmental expertise in hazards research. This is a unique but pressing gap in state expertise that the Department could fill, as it has both geographers and geologists. Radon, quartz, flooding, West Nile Virus, sinkhole collapse, drought, homeland security, and even mid-continent earthquakes are all aspects that the Department could address. For example, existing faculty could develop a medical geography and geology course and could research the emergence of new health risks such as West Nile Virus, new outbreaks of malaria, dengue fever, and SARS, as well as ecological vulnerabilities such as limits to food production due to global climate change.

- **Geoscience Outreach:**
  Outreach is another area of potential growth for the Department, which has the faculty expertise to address many local, national, and international problems. Through the Hoffman Environmental Research Institute, the Center for Cave and Karst Studies, the Kentucky Climate Center, and the Human Environment Linkages Program, the Department could expand its outreach opportunities, including local presentations, regional workshops, and media outlets. The Department’s faculty have a duty to the community to assist in issues of concern, especially hazards, and the Department is uniquely positioned to offer expertise for public planning and policy.

  Increased awareness of short-term climatic variability and concern about potential long-term change has contributed to growing interest in environmental monitoring from the local to the global scale. The Kentucky Climate Center is aggressively pursuing a strategic goal to develop a statewide environmental monitoring system. Realization of this goal will enhance Western Kentucky University’s national reputation for education, research, and service in the environmental sciences. The availability of real-time environmental data will contribute to the Department’s geology, especially in the area of environmental geology. In addition, the system will provide a basis for developing educational outreach programs for students and teachers in P-12. Finally, real-time environmental data have been demonstrated to have economic value and will create opportunities to develop value-added products for the public and private sectors. Efforts are currently underway through the University to acquire external funding for system infrastructure, and an ongoing commitment by the University will be necessary to realize the full range of opportunities created by this system.

- **Summary:**
  The Department is well-placed to take advantage of changing technologies and new approaches to geoscience teaching, research, and service. It serves an important role in Ogden College and in the institution, both in terms of providing important general education courses and in terms of providing training in GIS and other spatial-analytical geoscience techniques. The faculty are productive in all areas and continually engage students for success in a global society. The Department requests an “Enhance” designation to allow it to expand in the areas of GIS, geoscience techniques, and student-centered learning.
Appendix A.1. Publications by Geology Faculty, 1998-2003

PR (peer reviewed)

Nicholas Crawford, Ph.D.
See detail in the Geography Program Appendix A.

Chris, Groves, Ph.D.
See detail in the Geography Program Appendix A.

Kenneth Kuehn, Ph.D.


**Michael May, Ph.D.**


Other Publications:

**Fred Siewers, Ph.D.**

**Andrew Wulff, Ph.D. [2002]**
Appendix B. Academic Presentations by Geology Faculty, 1998-2003

Nicholas Crawford, Ph.D.
See detail in the Geography Program Appendix B.

Chris, Groves, Ph.D.
See detail in the Geography Program Appendix B.

Kenneth Kuehn, Ph.D.
(2002) with Milam, K.A. Shocked Conglomerates from the Middlesboro Impact Structure, Geological Society of America, North-Central Section (36th) and Southeastern Section (51st), GSA Joint Annual Meeting, April, Lexington, Kentucky.
(2002) with May, M.T. Geology and the Proposed Kentucky Trimodal Transpark. Geological Society of America, North-Central Section (36th) and Southeastern Section (51st), GSA Joint Annual Meeting, April, Lexington, Kentucky.

Michael May, Ph.D.
(2002) with Kuehn, Kenneth W. Geology and the Proposed Kentucky Trimodal Transpark. Geological Society of America, North-Central Section (36th) and Southeastern Section (51st), GSA Joint Annual Meeting (April), Lexington, Kentucky.


(2001) with Campbell, Jessica, E., Falin, Leslie, E., Hughes, Tassall A., Littell, Patricia D., and Polak, Dan L. *Grain-size Distribution of Select Chesterian Rocks in South Central Kentucky.* Joint Meeting of the Kentucky Academy of Science and the Tennessee Academy of Science, Middle Tennessee State University, Murfreesboro Tennessee, November.

(2001) with Neltner, Julie A., Parker, Alison, E., and Arndt, Tom E. *A Preliminary Grain-size Analysis of Basal Pennsylvanian Rocks in South Central Kentucky.* Joint Meeting of the Kentucky Academy of Science and the Tennessee Academy of Science, Middle Tennessee State University, Murfreesboro Tennessee, November.


(1998) What is effective pre-service education and how do we encourage our best students to become teachers? NOVA (NASA Opportunities for Visionary Academics) Leadership Conference, University of Maryland, College Park, Maryland, November.

Fred Siewers, Ph.D.


**Invited Seminars And Colloquia:**

2000-2003, "Coal balls" and the exceptional preservation of plant remains in ancient coal seams." Seminars presented at:

- Wisconsin Geological and Natural History Survey, Madison, WI (March, 27, 2003)
- Slippery Rock University, PA (March 20, 2001)
- Vanderbilt University (January 25, 2000)
- Oberlin College (March 19, 2001)
- Western Kentucky University (September 29, 2000)
- University of Kentucky/Kentucky Geological Survey (October 19, 2000)
- Appalachian State University (September 5, 2000)

**Sponsored Student Presentations – Sigma Xi & Kentucky Academy of Science:**

(2002) with Ballard, Jeremy, Hughes, Tassall, and Neltner, Julie. *Lithofacies depositional environments and proposed members of the Girkin Limestone near Richardsville, Kentucky*. Sigma Xi, WKU Student Research Conference, April

(2002) with Kleeman, Brian, Campbell, Jessica, Parker, Alison, and Tibbs, Jeff. *The sedimentology and stratigraphic subdivision of the lower Girkin Limestone (Mississippian), Natcher Parkway, Warren County, Kentucky*. Sigma Xi, WKU Student Research Conference, April.


(1999) with Hunt, W., Merideth, J. and Carney, K. *Sediments of the Mill Hole spring - a view of sediment transport through a karst aquifer*. Sigma Xi, WKU Student Research Conference, April.

Andrew Wulff, Ph.D. [2002]
Appendix C. Grant Activity by Geology Faculty, 1998-2003

Nicholas Crawford, Ph.D.
See detail in the Geography Program Appendix C.

Chris, Groves, Ph.D.
See detail in the Geography Program Appendix C.

Kenneth Kuehn, Ph.D.
Internal:
(2001) GEOTec, internal proposal for KY Council on Postsecondary Education, Regional University Excellence Trust Fund, Jan 2001, $303,000 (not funded).
(2000) Western Kentucky University, Office of Sponsored Programs, Grant Proposal Development Assistance, funded $240.
(1998) WKU Faculty Development Grant, $450 funded.
(1998) WKU Faculty Research Grant, $940 funded.

External:
(2003) American Institute of Professional Geologists (AIPG) Student Award Fund (competitive), served as sole nominator for Laura DeMott who won the award and was funded for $400.
(2002) City of Bowling Green, Select Neighborhood Action Program (S.N.A.P.) Grant, Strategic curbing and traffic control in the Bent Tree neighborhood, Phase III, $5,000 requested and funded.
(2002) with J. Islas, American Association of Petroleum Geologists (AAPG), submitted January 15. A small scale, positive flower structure located in southwestern Warren county, Kentucky. Objective was to relate structure to petroleum occurrences along the terminus of the Rough Creek Graben. $14,636 requested (not funded).
(2002) with J. Islas, NASA, Earth System Science Fellowship Program, submitted March 14. The characterization of a small-scale positive flower structure located in Warren County, Kentucky. Objective was to relate structure to an origin owing to meteor impact. $24,000 requested (not funded)
(2001) City of Bowling Green, Select Neighborhood Action Program (S.N.A.P.) Grant, Strategic curbing and traffic control in the Bent Tree neighborhood, Phase II, $6500 requested and funded.
(2000) KY Department of Transportation. Donation of approximately 200, 7.5-minute KY topographic maps and much drafting mylar. Estimate: $1,000 funded.

(2000) City of Bowling Green, Select Neighborhood Action Program (S.N.A.P.) Grant, Strategic curbing and traffic control in the Bent Tree neighborhood, $5000 requested and funded.

**Michael May, Ph.D.**

Internal:

(2003) Faculty Scholarship Research Grant, WKU Office of Sponsored Programs/ Faculty Scholarship Committee, February, for work on Terra Rossa soils– to aid in sabbatical project and subsequent costs for collaborative research at Indiana University and publication in the journal *Geology*. $1000

(2002) Faculty Development Grant, Ogden College, support travel to the Geological Society of America national convention in Denver, Colorado in October. $300

(2000) USGS National Earthquake Hazards Reduction Program: *Sinkhole-fill liquefaction potential in Karst Terrain*. Collaborative Research with Western Kentucky University (WKU) and Barren River Development Council (BRDC), proposal for $113,000 (submitted with Shannon Vaughan (BRADD) co-PI in May). Not Funded

(2000) Co-PI. Extending the NOVA (NASA Opportunities for Visionary Academics) Network Through Kentucky IDEAs (awarded from NASA for approximately $30K in March). $30,000

(2000) Grant Proposal Development Assistance Grant, WKU Office of Sponsored Programs for travel costs to participate in the workshop Building Skills of Students in Geoscience Courses sponsored by the National Association of Geology Teachers and the National Science Foundation. Workshop at Colorado College in Colorado Springs, CO (July). $240

(1999) Faculty Development Grant, Ogden College, support travel to Indianapolis, Indiana, to present a paper at the Eastern Section of the American Association of Petroleum Geologists (September). $500

(1999) Summer Faculty Research Fellowship (continued) *Environmental Geology of the Mississippian-Pennsylvanian Unconformity in Western Kentucky*. $5000

(1998) Summer Faculty Research Fellowship, *Environmental Geology of the Mississippian-Pennsylvanian Unconformity in Western Kentucky*. $5000

(1998) Faculty Development Grant, for travel to Columbus, Ohio to present a paper at the Eastern Section of the American Association of Petroleum Geologists (October). $500.

(1998) Faculty Research Grant, *Environmental Geology of the Mississippian-Pennsylvanian Unconformity in Western Kentucky*. The proposal was funded for a student to aid in rock prep for thin sectioning and for the cost of thin sectioning nearly 70 rock samples for petrographic work. $981.

External:

(2001) Drought and its economic, environmental and climatic effects in the Bluegrass submitted to Kentucky-American Water Company in Lexington, KY - outreach activity for the Kentucky Climate Center (in cooperation with Stuart Foster, Ritchie Taylor, and Scott Dobler) - contributed to Environmental Threats Analysis (drought related). Requested $50,000. Not Funded


Fred Siewers, Ph.D.
Internal:
(2003) CPE Action Agenda Grants (#s 120, 12OR, 63) Sigma Xi. Funded $4,000
(2000) WKU Grant Development Assistance Fund. Funded $240
(1999) WKU Junior Faculty Grant (Coal Balls). Funded $4,000

External:
(2003) Sigma Xi Distinguished Lectureship Award. Funded $325
(2002) Kentucky EPSCoR, Research Start-Up Fund Grant. Funded $75,000
(2001) Institute for Global Environmental Strategies/NASA. Funded $44,896

Andrew Wulff, Ph.D. [2002]
Internal:
(2003) Geochemical and Petrographic Evolution of Sixteen Lavas from the Casitas Shield, Volcan Cerro Azul, Chilean Andes. WKU Grant Incentive Faculty Fellowship. Funded $1000.

External:
(2003) Petrogenesis of Lavas from the Casitas Shield, Volcan Cerro Azul, Chilean Andes; Implications for Tectonic Controls on Volcanism. ORAU Grant submitted February. Requested $10,000, Not Funded.
Appendix D. Service Activity by Geology Faculty, 1998-2003

Nicholas Crawford, Ph.D.
See detail in the Geography Program Appendix D.

Margaret Crowder, M.S. [2003]
Community and P-12:
(2003) Taught a Super Saturdays course on Geology for the Gifted Studies Program at WKU. The course was for 3rd and 4th graders. Enrollment in individual class was 12 students, with the course lasting 2 hours on 5 consecutive Saturdays.

Discipline:

Chris, Groves, Ph.D.
See detail in the Geography Program Appendix D.

Kenneth Kuehn, Ph.D.
Institution:
(2003-present) WKU NCAA recertification, Governance subcommittee.
(2003-2001) Interim Associate Dean, OCSE.
(2002-present) WKU Honorary Doctorate Committee.
(2002-present) WKU Center for Teaching and Learning, Faculty Advisory Committee.
(2002-2003) OCSE Representative to University Curriculum Committee.
(2001-2002) OCSE Dean’s Search Committee.
(2001) Kentucky Climate Center, developed and defined new initiatives for expanding the scope of Center activities including paleoclimatology, natural hazards, and geoscience education. Assembling new lab facility for some of these initiatives in EST 307.
(2001) Chair, OCSE Information Technology specialist selection committee.
(2000) Chair, 2000 OCSE Faculty Awards Committee.
(1999) University Committee on Faculty Consulting.

Community and P-12:
(2003-2000) Big Brothers and Big Sisters Annual Fundraiser ‘Bowl for kids sake’
(2002-present) Active member and “Big Wheel”, Friends of Lost River, for significant contributions.
(2002-01) Developed, with Fred Siewers, a Bachelor’s program for teacher certification in Earth and Space Science (grades 8-12). Submitted to National Council for the Accreditation of Teacher Education (NCATE).

Discipline:
(2003-1998) 15 workshops, seminars, or field trips conducted.
(2001) Kentucky County Geology Summaries. Cooperative work with the Kentucky Geological Survey (KGS) for eventual posting on the internet; 11 counties in progress each involving one undergrad student. Students begin with geological maps for their county, analyze them and compile data according to a format derived by the KGS.
(2000) Organizer of cooperative effort among Kentucky’s academic geology programs. Attended initial meeting in Lexington convened by Dr. Jim Cobb, the State Geologist. Group formed and officially named “Coalition of Kentucky Geoscience Departments.”
(1998-99) Secretary/Treasurer, Kentucky Society of Professional Geologists.
(1998) Program Coordinator, Joint International Meeting of Friends of Karst and IGCP #379, Sept. 23-25. WKU and Mammoth Cave National Park, Kentucky. Responsible for all aspects of meeting planning, coordination, and bookkeeping for this highly successful meeting.

Michael May, Ph.D.
Internal:
Dozens of service activities. See detailed list in Appendix L.

Community and P-12:
Significant number of service activities. See detailed list in Appendix L.

(2001) Cumberland Chapter (Kentucky) Sierra Club Annual Meeting, November. Field Trip to Mill Cave and Proposed Kentucky TriModal Transpark Site, Warren County, Kentucky. Field Trip Guide included 6 p., 6 figures. Led field trip and provided field trip guides to approximately 30 Sierra Club members.


Discipline:

*Dozens of service activities. See detailed list in Appendix L.*


Fred Siewers, Ph.D.

Institution:

(2002-2003) At-large Senator, Ogden College, University Senate.


(2001-2002) Vice President, WKU Sigma Xi Chapter.

(2000-2001) Secretary and Treasurer, WKU Sigma Xi Chapter.

(2000) Judge “Czar,” WKU Student Research Conference


Community and P-12:


(2003) Science Expo, Drakes Creek Middle School.


(1999-present) Speaker to multiple K-12 Classes.

Discipline:
(2002-present) Secretary, Geology Section, Kentucky Academy of Science.
(2002) Reviewer for the journal *Southeastern Geology*.
(2001-2002) Chair, Geology Section, Kentucky Academy of Science.
(2001-present) SEPM Campus Representative to Western Kentucky University.
(2000-2001) Secretary, Geology Section, Kentucky Academy of Science.
(2000-present) GSA Campus Representative to Western Kentucky University.

Andrew Wulff, Ph.D. [2002]

Internal:
(2002) On several occasions met with members of the WKU staff (Gay Perkins, Cassandra and Brody Cantrell, Tricia Callahan) interested in learning more about volcanoes. Composed a PowerPoint presentation and demonstrations using the petrographic microscope.

Community and P-12:
(2003) April 2 – 4H Shadow day. I was shadowed for one day by a ten-year old (name) who accompanied me during the days activities. We examined rocks and minerals through both petrographic and binocular microscopes, identified specimens in a large box that she brought, talked about various careers in the geosciences, and she participated in a lecture/discussion group and a seminar, and enjoyed a lunch with several women undergraduate geology majors.
(2002-2003) On many occasions met with public to discuss and identify rocks and minerals and to take them on tours of the department and displays. Analyzed samples either by hand sample methods or petrographic methods, or more advanced analytical methods (XRD, XRF). Visited several local farms to examine samples on the premises.
(2002-2003) Trained undergraduate students for outreach lectures/demonstrations to local elementary schools. These students then went to three local schools and gave presentations/labs and donated rock and mineral kits.


**Discipline:**

(2003) Organized Geology of National Parks field trip for a group of students (graduate and undergraduate) and faculty from Univ. of Iowa.


(2002-2003) Campus representative for American Geophysical Union; responsible for disseminating information about AGU.

(2002-2003) Director of the Wasatch-Uinta Field Geology Course. This has been one of the premier field geology courses since its inception 38 years ago, attracting students from Univ. of Iowa, Univ. of Wisconsin-Madison, Univ. of Illinois, Univ. of Minnesota-Duluth, and Michigan State Univ. Top students are offered USGS and NAGT internships, and many smaller field course watch the Wasatch-Uinta course closely for leadership in field-mapping training.

## Appendix E.2. Comparative Data

### Table E.2.1. Geology Program Credit Hours Produced

<table>
<thead>
<tr>
<th>Semester</th>
<th>Credit Hours</th>
<th>FTEF</th>
<th>SCHP/FTEF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2003</td>
<td>1220</td>
<td>5.0</td>
<td>244</td>
</tr>
<tr>
<td>Spring 2003</td>
<td>787</td>
<td>3.5</td>
<td>225</td>
</tr>
<tr>
<td>Fall 2002</td>
<td>1058</td>
<td>4.25</td>
<td>249</td>
</tr>
<tr>
<td>Spring 2002</td>
<td>944</td>
<td>4.25</td>
<td>222</td>
</tr>
<tr>
<td>Fall 2001</td>
<td>870</td>
<td>4.50</td>
<td>193</td>
</tr>
<tr>
<td>Spring 2001</td>
<td>763</td>
<td>4.25</td>
<td>180</td>
</tr>
<tr>
<td>Fall 1999</td>
<td>790</td>
<td>3.0</td>
<td>263</td>
</tr>
<tr>
<td>Fall 1997</td>
<td>914</td>
<td>4.5</td>
<td>203</td>
</tr>
</tbody>
</table>

### Table E.2.2. Geology Courses Fall 2003, with enrollment data

<table>
<thead>
<tr>
<th>Course</th>
<th>Students</th>
<th>Credit Hours</th>
<th>Audience/Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol 102 Introduction Geology</td>
<td>255</td>
<td>765</td>
<td>Gen-Ed Category D</td>
</tr>
<tr>
<td>Geol 111 Physical Geology</td>
<td>49</td>
<td>147</td>
<td>Gen-Ed Cat. D/Major</td>
</tr>
<tr>
<td>Geol 113 Lab Physical Geology</td>
<td>49</td>
<td>49</td>
<td>Gen-Ed Cat. D/Major</td>
</tr>
<tr>
<td>Geol 112 Historical Geology</td>
<td>12</td>
<td>36</td>
<td>Gen-Ed Cat. D/Major</td>
</tr>
<tr>
<td>Geol 114 Lab Historical Geology</td>
<td>11</td>
<td>11</td>
<td>Gen-Ed Cat. D/Major</td>
</tr>
<tr>
<td>Geol 325 Rocks and Minerals</td>
<td>5</td>
<td>15</td>
<td>Specialized Lab/Major</td>
</tr>
<tr>
<td>Geol 330 Mineralogy with Lab</td>
<td>11</td>
<td>44</td>
<td>Major Required Crse</td>
</tr>
<tr>
<td>Geol 370 Stratigraphy with Lab</td>
<td>14</td>
<td>56</td>
<td>Major Required Crse</td>
</tr>
<tr>
<td>Geol 399 Applied Projects</td>
<td>2</td>
<td>5</td>
<td>Research Projects</td>
</tr>
<tr>
<td>Geol 405 Paleontology with Lab</td>
<td>11</td>
<td>44</td>
<td>Major Required Crse</td>
</tr>
<tr>
<td>Geol 415 Environment Geology</td>
<td>8</td>
<td>24</td>
<td>Major Elective</td>
</tr>
<tr>
<td>Geol 475 Field Camp Geology</td>
<td>8</td>
<td>24</td>
<td>California Field Trip</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>435</strong></td>
<td><strong>1220</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Table E.2.3. Geology Majors compared to other Kentucky Institutions

<table>
<thead>
<tr>
<th>Year</th>
<th>WKU*</th>
<th>UK</th>
<th>NKU</th>
<th>MSU</th>
<th>MoSU</th>
<th>EKU</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>32 **</td>
<td>36</td>
<td>20</td>
<td>2</td>
<td>21</td>
<td>23</td>
</tr>
<tr>
<td>2002</td>
<td>32</td>
<td>35</td>
<td>19</td>
<td>2</td>
<td>4</td>
<td>23</td>
</tr>
<tr>
<td>2001</td>
<td>35</td>
<td>14</td>
<td>19</td>
<td>11</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>2000</td>
<td>11</td>
<td>11</td>
<td>14</td>
<td>15</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>1999</td>
<td>26</td>
<td>32</td>
<td>11</td>
<td>11</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>1998</td>
<td>35</td>
<td>43</td>
<td>14</td>
<td>15</td>
<td>12</td>
<td>22</td>
</tr>
</tbody>
</table>

* Significant underreporting of majors is occurring at WKU.
** Designated majors in Geology (677) based on Department records.
Table E.2.4. Combined Grants and Contracts, 1998-2003
Department of Geography and Geology (Geology Faculty)

<table>
<thead>
<tr>
<th>Year</th>
<th>Submitted</th>
<th>Funded</th>
<th>Total Grants and Contracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003 YTD</td>
<td>$ 113,016</td>
<td>$ 63,016</td>
<td>11</td>
</tr>
<tr>
<td>2002</td>
<td>$ 276,065</td>
<td>$ 99,417</td>
<td>9</td>
</tr>
<tr>
<td>2001</td>
<td>$ 1,102,332</td>
<td>$ 51,396</td>
<td>6</td>
</tr>
<tr>
<td>2000</td>
<td>$ 150,220</td>
<td>$ 37,220</td>
<td>7</td>
</tr>
<tr>
<td>1999</td>
<td>$ 363,250</td>
<td>$ 9,500</td>
<td>4</td>
</tr>
<tr>
<td>1998</td>
<td>$ 7,881</td>
<td>$ 7,881</td>
<td>5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$ 2,012,764</td>
<td>$ 268,430</td>
<td>42</td>
</tr>
</tbody>
</table>

Table E.2.5. Comparative Data from Other Regional Geology Departments

<table>
<thead>
<tr>
<th>Data</th>
<th>FTE/Fac</th>
<th>SCHP</th>
<th>Sem. Ave.</th>
<th>Majors</th>
<th>Degrees</th>
<th>Majors/FTEF</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 02-03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WKU</td>
<td>4.5</td>
<td>1863</td>
<td>207</td>
<td>36</td>
<td>7</td>
<td>7.2</td>
</tr>
<tr>
<td>Georgia Southern</td>
<td>7.1</td>
<td>5611</td>
<td>395</td>
<td>34</td>
<td>6</td>
<td>4.8</td>
</tr>
<tr>
<td>UA – Little Rock</td>
<td>6</td>
<td>3329</td>
<td>277</td>
<td>22</td>
<td>1</td>
<td>3.7</td>
</tr>
<tr>
<td>South Alabama</td>
<td>4</td>
<td>2508</td>
<td>314</td>
<td>27</td>
<td>11</td>
<td>6.8</td>
</tr>
<tr>
<td>UNC Charlotte</td>
<td>7.5</td>
<td>5026</td>
<td>335</td>
<td>19</td>
<td>6</td>
<td>2.5</td>
</tr>
<tr>
<td>WKU Benchmark</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>App. State</td>
<td>8</td>
<td>4142</td>
<td>259</td>
<td>65</td>
<td>12</td>
<td>8.2</td>
</tr>
<tr>
<td>Ball State</td>
<td>6.5</td>
<td>35</td>
<td></td>
<td>35</td>
<td></td>
<td>5.4</td>
</tr>
<tr>
<td>BG State - Ohio</td>
<td>11</td>
<td>40</td>
<td></td>
<td>40</td>
<td></td>
<td>3.6</td>
</tr>
<tr>
<td>Cal State Fresno</td>
<td>9.75</td>
<td>31</td>
<td></td>
<td>31</td>
<td></td>
<td>3.2</td>
</tr>
<tr>
<td>Central Missouri</td>
<td>5</td>
<td>40</td>
<td></td>
<td>40</td>
<td></td>
<td>8.0</td>
</tr>
<tr>
<td>Eastern Illinois</td>
<td>8</td>
<td>20</td>
<td></td>
<td>20</td>
<td></td>
<td>2.5</td>
</tr>
<tr>
<td>Eastern Michigan</td>
<td>6</td>
<td>46</td>
<td></td>
<td>46</td>
<td></td>
<td>7.7</td>
</tr>
<tr>
<td>Illinois State</td>
<td>7</td>
<td>40</td>
<td></td>
<td>40</td>
<td></td>
<td>5.7</td>
</tr>
<tr>
<td>Indiana State</td>
<td>4.5</td>
<td>20</td>
<td></td>
<td>20</td>
<td></td>
<td>4.4</td>
</tr>
<tr>
<td>Little Rock – UA</td>
<td>4.5</td>
<td>24</td>
<td></td>
<td>24</td>
<td></td>
<td>5.3</td>
</tr>
<tr>
<td>Northern Iowa</td>
<td>5*</td>
<td>18</td>
<td></td>
<td>18</td>
<td></td>
<td>3.6</td>
</tr>
<tr>
<td>Nth Michigan</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>SE Missouri St.</td>
<td>5.25</td>
<td>24</td>
<td></td>
<td>24</td>
<td></td>
<td>4.6</td>
</tr>
<tr>
<td>UNC Greensboro</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>West Chester</td>
<td>11**</td>
<td>33</td>
<td></td>
<td>33</td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>Western Carolina</td>
<td>4.5</td>
<td>21</td>
<td></td>
<td>21</td>
<td></td>
<td>4.7</td>
</tr>
<tr>
<td>Western Illinois</td>
<td>6.5</td>
<td>26</td>
<td></td>
<td>26</td>
<td></td>
<td>4.0</td>
</tr>
<tr>
<td>Youngstown St.</td>
<td>6.25</td>
<td>19</td>
<td></td>
<td>19</td>
<td></td>
<td>3.0</td>
</tr>
</tbody>
</table>

* Program also serves 60 majors in Earth Science Teaching, combined with Astronomy
** Program also serves 45 BS Ed. In Earth and Space Science.
^ Majors include 15 in hydrogeology.
Table E.1.5. Geology Faculty Publications and Academic Presentations, 1998-2003

<table>
<thead>
<tr>
<th>Faculty Member - Date</th>
<th>Publications</th>
<th>Presentations</th>
<th>Technical Reports, Reviews, Guides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kuehn, Ken</td>
<td>2</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>May, Mike</td>
<td>1</td>
<td>22</td>
<td>1</td>
</tr>
<tr>
<td>Siewers, Fred</td>
<td>1</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>Wulff, Andrew [2002]</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4</strong></td>
<td><strong>46</strong></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>

Average per faculty per year\(^2\) = 0.25, 2.875, 0.375

Notes: 1. Only Ph.D. faculty are listed here, as non-tenured instructors are not expected to present research at conferences or to publish.
2. Pro-rated for faculty that commenced employment since 1998 (3.2 FTEF).

Table E.1.6. Comparative SCHP, Ogden College

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>4,207</td>
<td>15.3</td>
<td>3,915</td>
<td>15.2</td>
<td>4,020</td>
<td>16.1</td>
<td>250</td>
</tr>
<tr>
<td>AMS</td>
<td>1,894</td>
<td>8.8</td>
<td>1,999</td>
<td>9.3</td>
<td>2,114</td>
<td>10.3</td>
<td>205</td>
</tr>
<tr>
<td>Biology</td>
<td>8,784</td>
<td>18.2</td>
<td>9,003</td>
<td>19.3</td>
<td>9,287</td>
<td>18.9</td>
<td>491</td>
</tr>
<tr>
<td>Chemistry</td>
<td>4,864</td>
<td>13.4</td>
<td>5,054</td>
<td>14.1</td>
<td>4,947</td>
<td>13.3</td>
<td>372</td>
</tr>
<tr>
<td>Computer Science</td>
<td>3,917</td>
<td>13.6</td>
<td>3,884</td>
<td>14.7</td>
<td>2,704</td>
<td>12.4</td>
<td>218</td>
</tr>
<tr>
<td>Engineering</td>
<td>1,627</td>
<td>8.3</td>
<td>1,849</td>
<td>10.5</td>
<td>1,516</td>
<td>8.4</td>
<td>180</td>
</tr>
<tr>
<td>Geography &amp; Geology</td>
<td>6,715</td>
<td>18.5</td>
<td>7,032</td>
<td>19.2</td>
<td>7,048</td>
<td>20.4</td>
<td>345</td>
</tr>
<tr>
<td>(Geology)</td>
<td>(1300)</td>
<td>(5.5)</td>
<td>(1378)</td>
<td>(5)</td>
<td>(1270)</td>
<td>(5)</td>
<td>(254)</td>
</tr>
<tr>
<td>Physics and Astronomy</td>
<td>4,336</td>
<td>9.8</td>
<td>3,935</td>
<td>9.5</td>
<td>3,843</td>
<td>10.0</td>
<td>384</td>
</tr>
</tbody>
</table>

Note: FTEF values do not include classes with enrollments of less than 5 students