

Academic Plan – Department of Geology & Geophysics October 16, 2008

Frame work, mission, and academic values:

Because our discipline encompasses the study of 4.5 billion years of Earth history, geoscientists have a unique perspective of our planet and the complex inter-related processes that underpin not just the geological but also biological, hydrological, and atmospheric Earth systems. We also accept special responsibility to understand and predict the consequences of human actions as we make use of Earth resources and modify our environment. The broad scope of the Earth sciences requires balancing mineral and energy production with preservation of air, water, and other environmental resources. The need for balance extends to other aspects of our mission: applied and basic geoscience, fostering a scientifically literate undergraduate student body and training highly sophisticated M.S.- and Ph.D.-level geoscientists; and maintaining breadth while developing depth in critical sub-disciplines.

Applied and basic geoscience. The University of Wyoming is a state-supported institution in a state whose economy depends almost entirely upon energy resources. The Department of Geology and Geophysics has a significant obligation to be a resource to the State in this context: to train students, to provide expertise, and to hire faculty who are an asset to the State as well as to our overall national/international academic stature. We also seek to augment our reputation for highest quality, fundamental contributions to our discipline. As such we need to establish a balance between applied and basic research in regard to achieving stature. This is especially appropriate as we become increasingly involved in the activities of the School of Energy Resources. This balance also relates directly to the focus of our graduate program in regard to training students for energy- and environmental-related employment.

General scientific literacy education and rigorous training in geoscience. We have a responsibility to provide a strong foundation in the geosciences to our undergraduate students (majors as well as other interested students; e.g., ENR students and Earth-Systems Science concentrators). Students taking our service courses must come away scientifically literate; we have a responsibility to improve the general public's scientific reasoning and understanding of science and technology. On the other hand, our undergraduate majors must know that they will get an education in geosciences that ranks among the best in the nation. They must have access to a reasonable breadth of subjects/topics that constitute the essential framework of the modern geological sciences. They must also be aware of our high expectations of undergraduate students. A major in geology and geophysics at the University of Wyoming should be a challenging, rigorous program that prepares our students for advanced studies in the geosciences and a life-long professional career in this discipline.

We also have a responsibility, as a top-ranked Ph.D. program at the University of Wyoming, to maintain the highest standards in scientific research (based on ethical behavior as scientists/teachers, publication in peer-reviewed journals, acquisition of extramural funding, national/international recognition, and other criteria commonly used to evaluate a thriving and an effective program in the geosciences). Our overall mission includes not only undergraduate

education, but also a M.S.- and Ph.D.-level educational, involving rigor in advanced scientific research. We have been, and remain, a key department in maintaining and improving the University's academic stature.

Breadth and depth of our programs. Our goal should be to be as highly ranked as possible in our research and associated Ph.D. program in the geosciences. At the same time we cannot expect to cover all of the sub-disciplines in the geosciences equally. We must, instead, focus on aspects of the geosciences that are pillars of strength based on number of faculty, synergy, facilities, and research support.

The above items essentially distill to the following: We cannot afford to respond to the demands for applied geoscience at the expense of fundamental science. We must not neglect general education as we train our majors and graduate students. Likewise, we cannot become a specialist department with a few areas of strength and nothing in between. We have to cover our bases broadly, yet still maintain a few areas of specialization in which we are exceptionally strong and provide enhanced stature at the national/international level.

Previous Planning Accomplishments (2004–2009):

Action Items	Completed	In Progress	No Action
#1	X*		
#2		X	
#3	X*		
#4	X*		
#5	X		
#6	X*		
#7		X	
#8		X	
#9			X
#10		X	
#11		X	
#12	X		

Key to topic of Action Items:

* = exceptional progress

#1. Strengthen co-ordination of freshman laboratories and update summer field camp

#2. Strengthen teaching and research in petroleum geology

#3. Develop an undergraduate and graduate assessment program

#4. Expand in the field of Earth-Systems Science

#5. Maintain strength in paleontology

#6. Expand in the field of computation geoscience

#7. Fill the Mears Chair as soon as funding is in place

#8. Upgrade undergraduate teaching facilities

#9. Establish a Board of Visitors for the Department and involve them in our future development

#10. Provide increased support for the Radiogenic Isotope Laboratory

#11. Introduce digital mapping and geophysics components into the summer field course

#12. Provide resources to maintain Library budgets and departmental support budgets (*note:* this is a University rather than a departmental issue)

Relevant Institutional Issues:

The goals of the Department of Geology and Geophysics are well aligned with the planning motifs outlined in *Creation of the Future 3* for the period 2009–2014. Like the University as a whole, we work to create and share knowledge with our State and global constituencies and to garner acclaim internationally for our research. We take advantage of our outstanding geological setting to attract highly qualified, energetic students and faculty. In particular, our Departmental Plan addresses the following University priorities:

Motif 1: Building depth. As described above, we recognize a need to develop areas of excellence in geoscience while maintaining adequate breadth to fulfill our basic undergraduate educational goals. Our **Action Items** define areas of depth to include Earth-Surface Processes and Quaternary Geology, Geochemistry, Geophysics, Energy-related Geosciences, Computational Geosciences, and Crustal Evolution, all of which build upon our long-standing strength in field geology, geophysics, and geochemistry.

Motif 2: Reinforcing and refining areas of distinction. The Geology and Geophysics departmental plan supports three of the six areas of distinction originally identified in the 2004 academic plan and reiterated in *Creation of the Future 3*: (1) critical areas of science and technology, (2) environment and natural resources, and (3) professions critical to the State and region.

Motif 4: Fostering excellence. Our Department's focus on energy and environmental issues places it squarely as focusing on areas relevant to the State and region. Furthermore, these topics are the crux of the "grand challenges" that face the Earth sciences in the 21st century.

Motif 5: Cultivating leadership. Geology and Geophysics is a highly visible, nationally ranked department composed of faculty who work together towards a common goal of increased international stature. Our ability to attract outstanding new faculty in the past few years is evidence of our leadership, as is our record of grantsmanship and publication, participation in the international geoscience community as chief scientists on oceanographic research expeditions, panelists on grant selection committees, editors of geoscience journals, and officers in international scientific organizations.

Action Items:

(1) Enhance and diversify our undergraduate curriculum and degree programs in light of assessment results. Many modern geoscience curricula emphasize understanding process rather than just learning content. Also, the cutting-edge of curriculum development lies at boundaries between disciplines. We need to develop our undergraduate curriculum in such a manner that it both meets our basic mission outlined on the first page of this document as well as exposes our undergraduate students to the frontiers of the geosciences.

(2) Developing an Interdisciplinary Center for Quaternary Studies. The Quaternary Period of Earth's geologic history spans the last 2 million years, and contained repeated climate changes (Ice Ages), large changes in the chemistry of Earth's atmosphere, massive extinctions and other evolutionary and ecological changes, the evolution of modern humans, and emergence of civilization. The rich geological, fossil, and archeological record of the Quaternary Period provides a unique opportunity to learn about how the Earth's environment changes and how such changes affect natural resources, such as water and forests, and societies. The Faculty at UW has a newly developed strength in Quaternary studies with internationally recognized groups of

scholars in archeology, paleoecology, paleoclimatology, and land-surface processes; few institutions have equal depth and excellence in this area. This research/teaching center will focus on Earth-surface processes, paleoclimatology, engineering geology, water-related issues, neotectonics, and other topics related to the study of the Quaternary Period. The Center will be an interdisciplinary research/teaching center involving a variety of departments in the College of Arts & Sciences (e.g., Anthropology, Botany, Geography, and Geology & Geophysics) and hopefully departments from other colleges (e.g., Renewable Resources and Civil Engineering).

(3) Initiate a Field Geophysics Course. This would require equipment purchases at the \$250–300K level. We would seek support from industry as well as University support (e.g., the SER). The Marathon Oil Company has already agreed to provide a substantial endowment (\$335,000, which will be matched by State funds) to support this proposed course (total permanent endowment = \$670,000). These funds would be used to repair geophysical equipment (yearly routine maintenance and updating of parts and data reduction software) and provide scholarships for undergraduate and graduate students to participate in this course.

(4) Continued recognition and development of geochemistry as an area of distinction. During 2009–2014, we must continue to strengthen and develop laboratory and computational facilities that support geochemistry through acquisition of new or updated equipment, reallocation of space to optimize teaching and research, engagement with the SER in energy-related geochemistry, and development of computational geochemistry in conjunction with *Action Item 7*.

(5) Fully develop the funding for the Brainerd and Ann Mears Chair in Earth-Surface Processes. Bring the funding of the Mears Chair to the required level (~\$4M) through the addition of State funds in support of endowed chairs in areas of distinction. This was the highest priority CPM item for G&G during spring semester 2008. Thus for UPIII, the Action Item would be filling this position at an early stage in the UPIII time interval. This *Action Item* also relates to #2 (please see above).

(6) Maintain and strengthen synergy with the School of Energy Resources (SER). The future of energy sciences in the Department of G&G and at the University is intimately allied with the success of SER. Recognizing the importance of providing well-trained professionals to the energy industry, the Department of G&G will request a tenure-track position jointly in SER and G&G in petroleum systems. This faculty position will be filled by an innovative scientist involved in the quantitative evaluation of petroleum reservoirs. Subfields may include: integrated field and reservoir management, reservoir characterization, fracture analysis and the simulation of fractured reservoirs, basin analysis, geostatistics and stochastic modeling, and organic geochemistry. This faculty member would be a leader within the Reservoir Characterization and Simulation Center of the SER, and would complement the positions currently being filled in this research center in the fields of geophysics and flow through porous media. Depending on subspecialty the proposed new G&G/SER faculty member may also collaborate with faculty in mathematics, statistics, economics, chemistry, and/or petroleum engineering.

(7) Increase our strength in computational geosciences by adding another tenure-track faculty member who would benefit from the new NCAR Supercomputer facility. The geosciences have

benefited tremendously from computational and technological advances, ranging from visualization to global data sets. These advances are revolutionizing how we think about the Earth and its place in the solar system. Our Department recognizes this on-going revolution and realizes that computational methods must play a growing role in our curriculum and how we educate our students. Furthermore, by building a critical mass in computational geosciences, we may attract a new kind of student to our science and thus foster interdisciplinary partnerships with biologists, physicists, engineers, environmental scientists, and other scientists who share our interest in the Earth sciences.

(8) Maintain strength in key disciplines through target-of-opportunity hires. Earth science is changing rapidly, creating new research opportunities and challenges. As our Department evolves with our changing science (e.g., through our recent hires in paleoclimatology and carbon sequestration), we must also maintain strength in areas where we have long-standing reputations for excellence. Examples of these traditional strengths include: crustal evolution, geophysics, sedimentology, and geochemistry. While the immediate future may not hold CPM hires in these fields, we will pursue other opportunities to bolster strength in these key disciplines, such as SER or target-of-opportunity hiring.

(9) Fully develop the funding for the D.L. Blackstone, Jr., Chair in Geology. Professor Blackstone's influence extends across five decades at UW, as a distinguished scholar, engaging teacher, and beloved mentor. His impact on hundreds of students is indelible and memorable. Many of these students led successful careers because of the lessons Professor Blackstone taught them, and others will soon join them in retirement. A group of these alumni believe the time has come to express their gratitude for their late teacher and embed forever his memory and scholarship at UW by creating an endowed chair in his honor.

Implementation:

The timeline for the implementation of our *Action Items* divides roughly into two subdivisions in the time interval of 2009–2014: early and late. The early *Action Items* include: **#1, #2, #3, #4, and #5**, whereas *Action Items* **#6, #7, #8 and #9** are more likely to be achieved later in the designated time interval.

Table 2. Implementation Schedule for Action Items

Action Items	Early (2009–2011)	Late (2011–2014)
#1	X	
#2	X	
#3	X	
#4	X	
#5	X	
#6		X
#7		X
#8		X
#9		X