IUPUI and the School of Science

Indiana University/Purdue University at Indianapolis (IUPUI) was formed in 1969 by merger of Indiana University and Purdue University programs at various sites in the city of Indianapolis. Since that time, all programs within IUPUI have been relocated to the Michigan Street campus with the exception of the Herron School of Art.

The mission of IUPUI is to

1. raise educational achievement and intellectual aspiration in Indianapolis, the state, and beyond through leadership and access,
2. develop and apply knowledge to ever-changing issues of health and economic and social well-being through teaching, research and service,
3. enhance the public and private lives of students by offering the state's most comprehensive range of effective academic programs, from the liberal arts and sciences to a wide array of professional programs,
4. serve as a model for collaboration and interdisciplinary work through partnerships with Indiana University and Purdue University and the community, drawing upon the distinctive strengths of the academic health sciences center on the Indianapolis campus and the resources of the capital city and state, and to
5. build understanding and respect in academic and human relationships through cultural diversity.

The Geology Department is an Indiana University degree program within the Purdue School of Science on the IUPUI campus. Included in the school are departments of Biology, Chemistry, Computer and Information Science, Mathematics, Physics and Psychology, all of which grant Purdue University degrees.

The mission of the School of Science is to provide the highest quality learning experiences for undergraduate and graduate students, to generate new knowledge and educate through research, and to render professional service and provide opportunities for continuing education for the community.

History of the Geology Program at IUPUI

The Department of Geology at IUPUI was formally established in August, 1967, when Dr. Arthur Mirsky was hired by Indiana University (IU) as the first full-time geology faculty member in Indianapolis. Before IUPUI was established in 1969, Indiana University taught courses at what was then known as the Indianapolis Downtown Campus of IU. Purdue University had an Indianapolis extension campus on 38th Street across from the State Fair Grounds (about 5 miles northeast of the IU Downtown Campus). The Purdue extension was offering many of the same courses in liberal arts and sciences as IU was offering at its Downtown Campus. In 1969, therefore, the State Legislature mandated that IU and Purdue merge their Indianapolis curriculums to eliminate duplication of courses and reduce expenditures. The merged universities were named Indiana University-Purdue University at Indianapolis (IUPUI), and Indiana University assumed administrative control. In 1971 the sciences were organized into the Purdue School of Science with Purdue retaining academic

control. Consequently, all IU degree programs in the sciences were phased out over the next few years, leaving only Purdue science degree offerings, with the exception of Geology. Purdue had never offered any geology courses in Indianapolis, so at the merger, only the IU geology degree was involved. Thus, when the Purdue School of Science was formed, the two universities agreed that Geology would continue to be an IU academic degree, but it would be administratively a part of the Purdue School of Science.

As the IUPUI geology curriculum was introduced, the basic premise for scheduling was to accommodate students who were employed both in day-time and in night-time jobs. Thus, a schedule evolved whereby introductory 100-level courses were offered each semester in both day and evening sections (and later during weekends), whereas each offering of upper-level, single-section courses taken by majors were alternated between day and evening. In this way, any student could earn a baccalaureate degree in geology regardless of his or her employment schedule, a system that still is operational today.

At the start, it made sense for the Indianapolis geology department to adopt the same baccalaureate program as the one in use at Indiana University-Bloomington. A B.A. degree in geology was developed and approved in 1969, and the first four geology majors graduated with the B.A. in May 1971. In Fall 1973, Dr. Robert Hall joined the faculty as the third full-time member; he became the current Department Chair on July 1, 1993. By 1975, the Department had evolved sufficiently that it could develop and obtain approval of a B.S. degree in geology for those students who wished to have a broader and deeper training than the B. A. degree offered. Additional faculty were added in the later 70's 50 that by 1980, 6 full-time faculty and several part-time faculty were carrying out the geology academic program.

During the late 1970's and early 1980's, it became clear that a fairly large pool of geoscientists, who were employed locally by industry or federal or state government, were interested in undertaking graduate studies at IUPUI. Most of these geoscientists, including many alumni of the Department, were employed in various aspects of environmental geology. Consequently, the Department developed an M.S. degree program, with emphasis on Environmental Geology, which was formally approved in 1983, although it did not actually start until 1985, when funding became available.

The M.S. program developed very slowly, partly because of delay in adding several full-time faculty in needed disciplines, but primarily because almost all of the graduate enrollments until the early 1990's were by fully-employed geologists who were only part-time students at best. That is, these graduate students, who were very much pressed for academic time, were rarely around outside of classes, thereby missing the interaction with other graduate students and faculty, as well as participation in Department activities, such as serving as teaching and research assistants. As a result, the first nonthesis M.S. degree was awarded in December, 1989, and the first thesis M.S. degree in May, 1996. During the last two or three years, however, the faculty have changed the focus of the graduate program toward full time students and research theses and made more financial support available for graduate students.

The most recent development in the graduate environmental geology program involves the Center for Earth and Environmental Sciences (CEES). The roots for CEES began in Spring 1992, when the faculty developed a long range plan for expansion in the area of surficial geologic processes. This original concept was broadened into an Institute or Center by early Fall of 1992, and the Center for Earth and Environmental Sciences was created on July 1, 1996.

Departmental facilities have improved considerably over the years. In 1967, the geology program began in the old Marott building at 902 N. Meridian Street. In 1969, geology moved into the just-opened Cavanaugh Hall. Space was much improved, but still very limited. In August 1991, geology moved to its current facilities in the Engineering, Science and Technology building. In this move, geology was involved in the planning process for the new building. Consequently, facilities in the new building are improved over Cavanaugh Hall, both in the quality of the laboratories and offices and in the amount of available space.

All of these accomplishments were made possible because of a basic philosophy that guided the Department from the beginning. Collegiality among faculty, and between faculty and students; dedication to excellence in teaching, both in courses for majors and in introductory courses; active research programs; and an open and friendly academic environment.

Overview of the Geology Department

Full Time Faculty

The Department of Geology currently has nine full-time faculty and one emeritus faculty member; the department's Search and Screen committee is currently advertising to fill a tenure-track position in hydrogeology for fall of 1998. Teaching and research interests for these faculty are listed below; complete curriculum vitae for all faculty are in Appendix A.

Andrew P. Barth

Teaching interests: Physical Geology, Mineralogy, Petrology, Structural Geology, Field Methods, Optical Mineralogy and Petrography, Plate Tectonics and Orogenesis

Research interests: Dr. Barth's principal research is focused on the evolution of the western margin of North America during the last 3 billion years. Current projects include studies of the origin of continental crust, deformation within ancient island-arc systems in southern California and western Arizona, and the role of faulting in the evolution of the continental margin. These projects involve field mapping and detailed geochemical, isotopic, and mineralogic analyses of rocks to understand environmental conditions of crystallization and processes of chemical evolution.

Internal grants since 1990:

Indiana University Faculty Development Grant, 9/92-6/93, $9,970, Formation of continental crust *in* southern California

Indiana University Faculty Development Grant, *5/95-5/96,* $4,700, Revised approach to teaching undergraduate mineralogy and petrology laboratories

Indiana University Faculty Development Grant, *5/97-5/98,* $1,790, Constraints on uplift of the Transverse Ranges from the Cajon Pass deep drillhole

External grants since 1990:

National Science Foundation, 3/91 - 8/94, $70,774, Petrogenesis and tectonic implications of Triassic plutonism in southern California.

National Science Foundation, 7/91 - 12/93, $81,297, Acquisition of an X-ray diffractometer for undergraduate geology education. Co-principal investigator: G.D. Rosenberg

American Chemical Society, 6/92 - 5/93, *$5,000,* Metamorphic and tectonic histories of suspect terranes, San Gabriel Mountains, California. Co-principal investigator: J.S. Schneiderman, Pomona College

National Geographic Society, 5/93 - 10/93, *$2,725*, Geology of the San Gabriel Wilderness, Southern California

National Geographic Society, 7/95 - 12/95, $3,215, Geology of Precambrian rocks in the San Gorgonio Wilderness, California

National Science Foundation, 1/97-12/99, $67,296, U-Pb geochronology of Precambrian gneisses in southern California: Constraints on Proterozoic plate tectonics of southwestern North America. Co-principal Investigator: D. Coleman, Boston University

Representative Publications:

Barth, A.P., Tosdal, R.M., Wooden, J.L., and Morrison, J., 1995, Crustal contamination in the petrogenesis of a calc-alkalic rock series: Josephine Mountain intrusion, California: Geological Society of America Bulletin 107, pp.201-212.

Barth, A.P., Wooden, J.L., Tosdal, R.M., Morrison, J., Dawson, D.L., and Hernly, B.M., 1995, Origin of gneisses in the aureole of the San Gabriel anorthosite complex, and implications for the Proterozoic crustal evolution of southern California: Tectonics 14, *pp.736-752.*

Douglas H. Clark

Teaching interests: Global Environmental Change, Geomorphology, Glacial Geology

Research interests: Paleoclimatic significance of alpine and lacustrine deposits; polar and alpine geomorphic processes; tectonic development of western North America and Asia.

External grants since 1996:

National Science Foundation, *311/97-4/30/2000,* $32,291, Ice-core analysis and physical glaciology of the Galena Creek Rock Glacier, Wyoming

Representative Publications:

Clark, D.H., Steig, E.J., Potter, N., Fitzpatrick, J., Updike, A.B., and Clark, G.M., 1996, Potential for old ice and long climate records in rock glaciers: EOS, 77, 23, pp.217-222.

Clark, D.H., Bierman, P.R., and Larsen, P., 1995, Improving in situ cosmogenic chronometers: Quaternary Research, 44, 3, pp.366-376.

Pascal de Caprarus

Teaching interests: Environmental Geology, Urban Geology

Research interests: Improving communication in large-enrollment lecture courses. Modifying statistical sampling theory to account for the effects of spatial correlation between samples.

Representative publications:

de Caprariis P., 1996, Writing exercises and teaching roles in large-enrollment courses: Journal of General Education, vol.45, no.1, p.39-52.

de Caprariis, P., 1996, A comparison of writing skills and test-taking skills in an Environmental Geology course: Journal of Geoscience Education, vol.44, no.1, p.18-22.

Gabriel M. Filippelli

Teaching interests: Global Environmental Change, Geochemistry

Research interests: Dr. Filippelli's present and future research interests involve a range of topics related to ocean biogeochemical cycling and climate change. These topics include sedimentary biogeochemical cycling, nutrient weathering and cycling on decadal to million year time scales, coupling Global Climate Models with oceanic geochemical models to assess past continental weathering rates, and assessing the future impact of anthropogenic nutrient inputs on terrestrial nutrient cycles. These research interests are generally related and have had a significant impact on the scientific community (a recent paper was the topic of a *Nature* Editorial); they also provide a range of activities and goals for the active and beneficial participation by graduate and undergraduate students. His overall goal is to continue integrating the exploration of biogeochemical processes, geologic records of climate change as recorded in ancient sediments, and modeling of these changes to provide testable hypotheses of earth processes. This goal has involved and will continue to involve pursuing research interests which cross traditional disciplinary boundaries.

Internal grants since 1995:

Indiana University Faculty Development Grant, 8/96-6/97, $2,500, Climate and Glacial Records from the San Gorgonio Wilderness, California

Indiana University Faculty Development Grant, *6/95-8/95,* $6,000, The Role of Carbon and Phosphorus Geochemistry in Global Climate Change

Indiana University Faculty Development Grant, 9/95-12/95, $2,400, The Role of Carbon and Phosphorus Geochemistry in Global Climate Change

Purdue Research Foundation Summer Faculty Grant, 8/96-9/96, *$5,000,* The Role of Carbon and Phosphorus Geochemistry in Global Climate Change

External grants since 1995:

American Chemical Society, 9/95-8/97, $20,000, Effects of diagenesis on phosphorus and carbon geochemistry in marine sediments: Implications for sedimentary C:P ratios

American Chemical Society, 9/97-8/99, $25,000, Phosphorus and carbon sedimentation in the Southern Ocean on Glacial/Interglacial time scales

Representative publications:

Filippelli G.M., 1997, Intensification of the Asian Monsoon and a chemical weathering event in the late Miocene/early Pliocene: Implications for late Neogene climate change: Geology *25*, 27-30.

Filippelli, G.M., 1997, Controls on phosphorus concentration and accumulation in oceanic sediments: Marine Geology 139, 231-240.

Robert D. Hall

Teaching interests: Physical Geology, Field Methods, Geomorphology, Glacial Geology

Research interests: Glacial chronology of the middle and northern Rocky Mountains; Pre-Woodfordian paleosols in Indiana; till stratigraphy in eastern Indiana and western Ohio

External grants since 1990:

National Science Foundation, 1990-1992, $184,801, Pre-Woodfordian paleosols in Indiana

Representative publications:

Hall, R.D., and Horn, L.L., 1993, Rates of hornblende etching in soils in glacial deposits of the northern Rocky Mountains (Wyoming-Montana, U.S.A.): Influence of climate and characteristics of the parent material: Chemical Geology 105, 17-29.

Hall, R.D., and Shroba, R.R., 1995, Soil evidence for a glaciation intermediate between the Bull Lake and Pinedale glaciations at Fremont Lake, Wind River Range, Wyoming, U.S.A.: Arctic and Alpine Research 27, 89-98.

Jerry R. Miller

Teaching interests: Physical Geology, Geomorphology

Research interests: Dr. Miller's research focuses largely on the transport and fate of heavy metals, particularly mercury, in fluvial (river) and lacustrine (lake) systems. These studies are currently being conducted along the Maderia River of Brazil, Bear Creek, Tennessee, and selected drainages of the western U.S. including the Carson and Pena Blanca Rivers. He also has an interest in deciphering the impact(s) of natural and anthropogenic disturbances on channel form and process and the restoration of riparian habitats. Investigations pertaining to these topics are currently being conducted in the Toiyabe Range of central Nevada.

External grants since 1996:

USDA, Forest Service/Intermountain Research Station, 1/96-12/97, $27,000, Drainage basin responses to natural and anthropogenic disturbance: Implications to land management within Kingston, Cottonwood, and San Juan Canyons, Nevada.

Representative publications:

Miller J.R., 1997, The role of fluvial geomorphic processes in the transport and storage of heavy metals from mine sites: Journal of Geochemical Exploration 58, 101-118.

Miller J.R., and Lechler, J.R., in press, Mercury partitioning within alluvial sediments of the Carson River valley, Nevada: Implications for sampling strategies in tropical environments, in J. Wasserman, E.V. Silva-Filho, and J~J. Abrao (eds.), Geochemistry of Tropical Environments: Springer.

Arthur Mirsky (Emeritus)

Teaching interests: Reporting Skills in Geoscience

Research interests: In recent years Dr. Mirsky has narrowed his research interests to two areas: 1) the influence of geologic factors on human history, a variation of applied geology, and

2) methods and practice in geologic education, particularly the role of written and oral reporting skills.

Representative publications:

Mirsky, A., 1991, Writing assignments as a continuum in geoscience education: Journal of Geologic Education 39, 232-236.

Mirsky, A., and Bland, E., 1996, Influence of geologic factors on ancient civilizations in the Aegean area:

Journal of Geoscience Education 44, *25-35.*

Joseph F. Pachut

Teaching interests: Historical Geology, Dinosaurs, Paleontology *Research interests:* Dr. Pachut's research has centered on determining evolutionary potentials of Paleozoic (570-230 million years ago) bryozoans under different inferred environmental conditions. This is accomplished statistically by comparing levels of morphologic variation occurring within-colonies (essentially non-genetic in these clonal organisms) to that among colonies (partially-genetic). Findings influence our models of where, under what types of conditions, and at what tempo evolutionary changes occur. He has also been interested in investigating environmental effects on developmental patterns. Findings illustrate that different environments elicit different patterns between populations of a single species, indicating that care must be exercised in defining species. Finally, he has begun analyzing patterns of evolutionary relationship (phylogeny) between families (approximately 63) and between genera (approximately *350)* of Paleozoic bryozoans, to provide an evolutionary framework for studies of form, function, biodiversity, and rates of evolution within the phylum.

External grants since 1990:

National Science Foundation, 1/95 - 12/98, $101,394, Microevolution in Two Lineages of Upper Ordovician (Cincinnatian) Bryozoans

Representative publications:

Pachut, J.F., R. J. Cuffey, and D. R. Koblu, 1995, Depth-related associations of cryptic-habitat bryozoans from the leeward fringing reef of Bonaire, Netherlands Antilles: Palaios 10:254-267.

Anstey, R. L. and J. F. Pachut, 1995, Phylogeny, diversity history, and speciation in Paleozoic bryozoans, in D. H. Erwin and R. L. Anstey, eds., New Approaches to Speciation in the Fossil Record: Columbia University Press, New York, pp.239-284.

Gary D. Rosenberg

Teaching interests: Historical Geology, Paleontology

Research interests: Paleontology

Lenore P. Tedesco

Teaching interests: Oceanography, Sedimentology and Stratigraphy, Field Methods

Research interests: Dr. Tedesco's current research interests involve studies that compare modern and ancient sedimentary environments and their record of environmental and climate change. This research examines the influences of catastrophic events, biologic community and sea level processes on sedimentary sequence development and evolution. Dr. Tedesco is currently working in Everglades National Park studying the role of sea level rise and catastrophic storms in controlling the stability of coastal wetlands. She is also using pollen analysis of high-resolution core sequences to evaluate natural vs. anthropogenic changes to the Everglades ecosystem as part of a larger project focused on ecosystem restoration efforts. Master's students are working in Rookery Bay National Estuarine Research Reserve determining the distribution of anthropogenic pollutants in surface sediments both within the estuarine ecosystem and in the adjacent nearshore shelf environments.

Internal grants since 1990:

Indiana University Faculty Development Grant, *5/96-9/97*, $10,000, Lake Sedimentation in the San Gorgonio Wilderness of Southern California: A Record of El Niño Periodicity

Indiana University Faculty Development Grant, 6/93-8/93, $6,000, Differentiating Environments of Qoid Formation Using Grain Characteristics

Indiana University Faculty Development Grant, 6/92-8/92, $6,000, Comparative Analysis of Modern and Ancient Oolitic Sediments: Petrology and Depositional Environments

Indiana University Faculty Development Grant, 3/91-12/92, $3,000, Comparative Analysis of Modern and Ancient Oolitic Sediments: Petrology and Depositional Environments

IUPUI Innovative Projects in General Education Planning Grant, *6/95-6/96*, $1,000, Geology/Geography G 185 Global Environmental Change (with T. Brothers, C. Souch, G. Filippelli)

IUPUI University Libraries, 11/96-7/97, $21,090, A Cooperative Program for the Conversion of Spatially Referenced Data for a Geographic Information System Archive - Center for Earth and Environmental Science (Co-Project Director with D. Jewett)

IUPUI Strategic Directions Initiative, 7/96-6/97, $50,000, Start-up Funding to Implement the Center for Earth and Environmental Sciences (Co-Project Director with R.D. Hall)

IU Strategic Directions Charter, 7/96-6/97, $299,496, Start-up Funding for the Center for Earth and Environmental Sciences (Co-Project Director with R.D. Hall)

External grants since 1990:

National Oceanographic and Atmospheric Administration, 8/95-8/97, $15,000, The Sediment Record As A Monitor of Natural and Anthropogenic Changes in the Lower Everglades/Florida Bay Ecosystem

Children's Museum of Indianapolis and Ameritech Corporation, 1/96-11/97, $15,000, Dino Dig: An Interactive Distance Learning Experience

National Park Service, 11/93-11/96, $63,579, Post-Hurricane Sediment Redistribution and Benthic Community Response and Evolution Within Biscayne Bay, The Coral Reef Platform, and the Southwest Florida Coast

National Science Foundation, 9/92-9/93, $8,933, Geologic Modification to Coastal and Shallow Marine Environments of South Florida Resulting From Hurricane Andrew

National Park Service, 8/95-8/96, $1,000, Dry Tortugas/Fort Jefferson National Monument Submerged Cultural Resources Site Stability Assessment

National Oceanographic & Atmospheric Administration, 7/97 - 7/99, $36,800, The Sediment Record as a Monitor of Natural and Anthropogenic Changes in the Lower Everglades/Florida Bay Ecosystem: A High Resolution Study

National Oceanographic and Atmospheric Administration, 7/97-6/98, $26,674, The Distribution of Trace Elements and Organics in Surficial Sediments of Rookery Bay National Estuarine Research Reserve, Southwest Florida: Implications for Anthropogenic Contaminant Inputs

Representative publications:

Tedesco, L.P., and Aller, R.C., 1997, ^{210}Pb Chronology of sequences affected by burrow excavation and infilling: Examples from shallow marine carbonate sediment sequences, Holocene of south Florida and Caicos Platform, British West Indies; *Journal of Sedimentary Research,* v.67, p.36-46.

Wanless, H.R., Parkinson, R.W., and Tedesco, L.P., 1994, Sea level control on stability of Everglades wetlands: in Evegrlades: The Ecosystem and Its Restoration S Davis and J. Ogden (eds.), St. Lucie Press, Delray Beach, FL, p.199-223.

Adjunct Faculty

The Department of Geology currently has seven adjunct faculty. **Timothy Brothers** is an Associate Professor of Geography and chairman of the Department of Geography at IUPUI, and specializes in biogeography and global environmental change. **Michael Cohen** is a Professor of Education at IUPUI specializing in science education. **Swapan Ghosh** is a geochemist with the Indiana Gas Company. **Fritz Kleinhans** is an Associate Professor of Physics at IUPUI who teaches astronomy and does research in biomedical applications of Electron Spin Resonance spectroscopy. **Greg Lindsey** is an Associate Professor in the School of Public and Environmental Affairs at IUPUI with expertise in water resource planning and management. Dr. Lindsey is also associate director of the Center for Earth and Environmental Sciences. **Dennis Prezbindowski** is an independent consultant specializing in geochemistry and hydrogeology. **Catherine Souch** is an Associate Professor of Geography at IUPUI specializing in climatology and global environmental change.

Professional Staff

The department has three full-time professional staff members. Nancy Fribley, senior administrative assistant, assists the Chairperson in managing affairs of the department. Nancy supervises the main office, acts as personnel officer, assists in preparation and routing of grant applications, and coordinates payroll, purchasing, and travel on Department accounts as well as faculty research grants. F. Vincent Hernly, laboratory technician, assists the department with acquisition and management of laboratory resources, assists faculty with management and execution of laboratory research. Vince is also a part-time instructor in introductory courses and an informal tutor for geology majors in upper level courses. Robert E. Hall, computer systems engineer, is responsible for acquisition, maintenance, coordination, and continued enhancement of computer facilities, including integration of hardware and software systems other than the department computer network. Bob is also responsible for coordinating computer hardware and software training for faculty and staff.

Physical Facilities

Geology occupies parts of the basement and first floor of the Engineering, Science and Technology building. Facilities on the first floor include the main office, conference room, and nine ~280 ft^2 faculty offices. Facilities in the basement include two teaching laboratories and associated preparation areas, totaling ~2000 ft^2. The faculty share five 575 ft^2 basement laboratories which provide multi-purpose research and teaching space, including a sample preparation laboratory, sedimentology, soil, hydrology and x-ray diffraction laboratories, as well as a 955 ft^2 geochemistry laboratory.

Student Computing Equipment

The Department of Geology maintains a computer cluster for undergraduate geology students, and supports distributed computing for graduate students in individual research groups. The geology cluster currently houses 5 Pentium and 4 Pentium II PCs, connected to a Compact ProLiant 1500 primary NT server. The cluster also contains laser printers, a color inkjet, and a large format HP DesignJet plotter. Three digitizing boards (60"-36"), a color scanner, and video-capture cards are utilized for data input. AutoCAD, Arclnfo, and ER-Mapper are the primary GIS applications. Several hydrologic modeling packages and other specialized geologic software

are available in addition to the word-processing, spreadsheet, database, scientific graphing, statistics, desktop publishing, and graphic programs.

Undergraduate Program in Geology

Principles of Undergraduate Education

General principles of undergraduate education were adopted in 1995 by the faculties of the Schools of Science and Liberal Arts. These principles are currently guiding discussions aimed at revising the general education curriculum, as well as discussions within individual departments regarding curriculum revision. The adoption of these principles and the adoption of a new general education curriculum may require substantial revision of undergraduate degree programs in 1998. The five principles of general education are

1. Communication and core skills: competence in reading, writing, speaking, listening, quantitative reasoning, and use of information technology
2. Analytical thinking: competence in reasoning clearly, including thinking logically and critically, competence in retrieving and interpreting information and applying the scientific method
3. Intellectual breadth, depth, and adaptiveness: thinking and knowing in a variety of disciplines, intellectual adaptability, and willingness to entertain other points of view
4. Integration of knowledge: ability to integrate and apply knowledge and experience from different disciplines and to bring together various elements of knowledge to form a whole
5. Understanding society and culture: knowledge of the similarities and differences among world cultures, including one's own, both past and present, knowledge of the natural environment and its relationship to human activity, and knowledge of ethics and values

Bachelors Degree Programs

The Geology Department offers both the Bachelor of Arts and the Bachelor of Science degree in Geology. The BA degree emphasizes preparation for careers in investigation of the environment through employment with local, state and federal governments and consulting firms. Two options are available; the General Geology Option and the Environmental Geology Option. These two options are identical except for the specification that 400-level elective courses in the Environmental Geology Option must be selected from among courses in geophysics, geochemistry, geomorphology, and hydrogeology. The BS degree requires more rigorous, quantitative preparation in the physical sciences, including a year of physics, a year of calculus, a course in statistics, and a field course. Students in the BS program may also elect to follow the General Geology or the Environmental Geology Option. All undergraduate students are required to complete an original, quantitative thesis during their final year in the bachelors degree program.

Current course requirements for the 122 credit BA and BS degrees are listed in Table 1. Pending changes in the general education requirements of the School of Science, School of Liberal Arts, and University College will require modification of the BS and perhaps the BA programs. Credit hour restrictions for both programs based on the currently proposed changes in general education requirements and probable allowed course substitutions are also shown in Table 1.

Table 1. Current and Projected Geology Undergraduate Curriculum

Discipline Areas		**BS (current)**	**(future)**	**BA (current)**	**(future)**
First Year Experience		0	1	1	0
Area I writing and speaking		9	9	9	9
Area II foreign language		0	8	0	12
Area IIIA arts and humanities		6	6	12	12
Area IIIB social sciences		6	3	12	12
Integration of Knowledge		0	6	0	6
Area IIIC physical sciences		29	29	19	19
Area IIID Math/computer science		16	16	9	9
Area IV geology core skills					
physical geology	[110/206]	5	5	5	5
reporting skills	[205]	3	3	3	3
historical geology	[209]	3	3	3	3
mineralogy/petrology	[221/222]	6	6	6	6
field methods	[303]	4	4	4	4
paleontology	[304]	3	3	3	3
sedimentology	[334]	3	3	3	3
structure	[323]	3	3	3	3
electives	[4xx]	9	9	9	9
field mapping	[420]	3	3	0	0
senior thesis	[495]	1	1	1	1
subtotal		43	43	43	40
advanced lab science	[3xx-4xx]	6	6	0	0
Total credits		115	127	101	120

Student Profile

Approximately 55 undergraduate students are currently enrolled in the BA and BS programs in the Geology Department. This figure represents an increase of nearly 100% since 1990 (Figure 1), whereas IUPUI undergraduate enrollment increased about 1.5% over the same time period. Most of this increase in geology enrollments *(50%)* has occurred since 1993. Most undergraduate students come to the Geology Department by intra-campus transfer from the University Education Center, while about 20% are new to IUPUI, either as inter-campus transfers within the Indiana University system or new admissions to Indiana University.

The majority of current undergraduate students in geology (Figure 2) are female (57%), over *25* years old (67%), and enrolled part time (57%). Ethnic minorities constitute 2% of the undergraduate student population. These proportions have fluctuated but have shown no systematic change since 1989 (Figure 3). The profile of the current undergraduate student population in geology is similar to the current IUPUI undergraduate student body as a whole, although the campus has a higher minority population (currently 13%) and has seen small, steady increases in the proportion of undergraduate students enrolled full time (currently 52%).

Assessment of Program Quality

The quality of the undergraduate program in geology can be assessed based on five criteria: student evaluations of individual courses, continuing student satisfaction, student' retention and graduation rates, alumni employment, and alumni satisfaction.

Virtually all courses in the Geology Department are evaluated by enrolled students using the standardized School of Science course evaluation form (Appendix B), and many faculty in introductory courses participate in peer review of their teaching using a modified version of the AAHE peer review system. Exceptions are certain team-taught courses (e.g. G303 Field Methods and G445 Analytical Methods), and short courses that conclude prior to the end of a given semester. Student course evaluations are summarized using a 'global score', which primarily ranks student satisfaction with the course instructor on a 1-5 scale. Geology department instructors ranked slightly above the School of Science average over the survey period 1983-1994 (3.86 and 3.84, respectively; reported by J. Kremer, Psychology Department).

A somewhat broader perspective on the satisfaction of continuing students with department and campus programs is provided by the IUPUI Continuing Student Satisfaction and Priorities Survey. Participation in this survey is based on enrollments, and thus participation by Geology students is generally small. However, over-sampling for the 1996 survey in anticipation of this review resulted in a better picture of Geology student satisfaction, based on results from 28 (~50%) returned survey questionnaires (Table 4; Appendices C and D).

The results of the 1996 survey indicate that continuing students in the Geology Department ranked quality of instruction, relevance of courses, and academic advising as their most important criteria for program evaluation, a ranking very similar to IUPUI students overall. Current geology students are satisfied to very satisfied with the quality of courses and instruction in the Geology Department, with an average rating of 1.08. Furthermore, Geology students rate these criteria similar to, or higher than, other School of Science students or IUPUI students in general. Current geology students are most dissatisfied with courses outside their major area,

availability of child care, and advising in the University Education Center (now University College).

The satisfaction of continuing students with, and the effectiveness of, the geology program may also be judged by student persistence in the program and achievement of the BS or BA degree. We have estimated our recent retention rates for new geology majors by examining student persistence through the 200-level course sequence in 1994-1996. The data for introductory courses for new geology majors in physical and historical geology (G206 and G209) are listed in Table 2, and for the first sophomore-level course (Introductory Mineralogy, G221) in Table 3.

Table 2. Enrollment in Introductory Courses and Persistence of Geology Majors

		enrollment	majors	% majors	transient*	non-majors	Persistence[+]
Fall1993	G206	13	6	46	0	7	91%
Spring 1994	G206	13	5	38	2	6	-
Fall 1994	G206	18	7	39	1	10	-
Spring 1995	G206	17	5	29	2	10	79%
Fall 1995	G209	4	2	50	0	2	-
Springl996	G209	13	4	31	2	7	-
Fall 1995	G206	22	5	23	3	14	-
Springl996	G206	18	5	28	3	10	-
S11996	G206	5	2	40	0	3	55% / 80%
Fall 1996	G209	15	10	67	0	5	-
Spring 1997	G209	10	2	20	2	6	-
Fall 1996	G206	18	7	39	5	6	-
Spring 1997	G206	9	4	44	1	4	n.a. / l00%

* education majors seeking earth science certification, graduate non-degree students, and self-selected potential geology majors

[+] G206 geology majors matriculated to G221/ G206 geology majors still enrolled, but not yet in G221

Table 3. Enrollment in Introductory Mineralogy and Persistence of Geology Majors

		enrollment	majors	%majors	transient	non-majors	Persistence[+]
Fall 1992	0221	13	8	62	2	3	100%
Fall1993	0221	12	9	75	1	2	78%
Fall 1994	0221	19	10	53	8	1	90%
Fall1995	0221	18	11	61	6	1	91%
Fall 1996	0221	9	7	78	2	0	86%

+ G221 geology majors matriculated to 300-leyel geology courses

The first lesson from these data is that the courses for new majors (G206 and G209) are predominantly serving non-majors, even if we assume that all transients are eventual majors of some sort. Thus, in judging student retention it is crucial to know the student profiles of these courses. We use G206 geology majors matriculating to G221 as a measure of new student persistence in the geology program. Only one value is given in each academic year, because the G221 /G222 sequence can only be entered in the fall semester. This measure yields a persistence rate of about 60% over the last two years. However, some majors take these courses concurrent with or prior to making up chemistry and/or mathematics deficiencies. Therefore, the second percentage includes any of these students who are still enrolling, yielding a persistence rate of about 80% over the last two years for freshman geology students.

Persistence of sophomores to junior level courses in geology may be estimated from G22 1 student enrollment over the same period. Because transients in this course include many self-selected potential geology graduate students, as well as education majors seeking earth science certificates, G221 is best regarded as predominantly a course for majors. We use G221 geology majors successfully completing G221/G222 and consequently enrolling in any 300-level geology course as a measure of sophomore student persistence in the geology program. This measure yields a persistence rate of about 90% over the last four years.

Student persistence rates may be compared to long term graduation rates (Figure 4). Graduation rates for BA and BS student have historically fluctuated between approximately 4 and 15 per year. Recent graduation rates have declined in 1993 to 1995, reflecting the decline in undergraduate geology enrollments in 1989 and 1990 (cf. Figure 1). However, in view of recent significant increases in undergraduate enrollments, the large percentage of freshman and sophomore level majors, and assuming continued student persistence in geology major courses, we project a return to historically high BA and BS graduation rates by 1998-1999.

The perspectives of current students regarding program quality may be compared to alumni perceptions based on the IUPUI Survey of 1994-95 Undergraduate Degree Recipients (Appendix E). Participation in this survey is also based on enrollments, and over-sampling in anticipation of this review was not done. Therefore, we surveyed all Geology degree recipients using a slightly modified version of the same instrument, with the assistance of IUPUI Information Management and Institutional Research. Results are based on 56 (~35%) completed questionnaires (Table 5; Appendix F).

The results of the Geology alumni survey indicate that 90% of alumni are working full time, 83% in a geology-related field, with an average salary of $40,000. These figures are significantly higher than School of Science and other IUPUI alumni, probably reflecting in large measure the older age and longer time since earning a bachelors degree for alumni in our survey. Alumni are employed primarily in federal, state and local government and in environmental consulting firms, reflecting the growth in employment in these field at the expense of the extractive minerals industry observed in data for first time employment of Geology Department graduates (Figure 5).

In evaluating the program, geology alumni rank criteria which they regard as most important which are very similar to other IUPUI alumni and Geology continuing students. Geology alumni are satisfied to very satisfied with the quality of geology courses and instruction, and with the personal attention they received and the help fullness of department staff, with an average rating of 1.32. Furthermore, geology alumni rate their satisfaction with these criteria similar to, or higher than, 1994-1995 School of Science and other IUPUI alumni. Alumni are most dissatisfied with their development of computer skills while in the Geology Department, 77% responding that too little emphasis was placed on these skills during their course work. We believe that this result reflects the rapid growth in the influence of computer technology in the physical sciences and the longer time since earning a degree for the alumni in our survey - this number is reduced to 19% among current geology undergraduates.

In summary, geology majors and alumni are satisfied to very satisfied with their geology course work and the quality of instruction provided by geology faculty. Most graduates are successful at finding geology employment, primarily in federal, state, and local governmental agencies and in private environmental consulting firms. Enrollment of new geology majors has increased approximately 50% since 1993, leading us to project a return to near historically high BS and BA graduation levels of the early 1980's by 1998.

Master of Science Program in Geology

Masters Degree Program

The involvement of Geology faculty in sponsoring graduate studies came in the late 1970's with 4 Masters students from Indiana University - Bloomington, whose research was directed by Robert Hall. Much of their course work was taken at IUPUI. One completed an M.A.T. degree and two others an M.A. degree with thesis. The fourth individual did not complete his thesis.

By 1983, a Masters in Environmental Geology was established at IUPUI based upon the belief that most students who would enroll in the IUPUI program would be environmental professionals who would not be able to travel to Bloomington (or West Lafayette) to earn a Masters degree. The IUPUI program complemented, but did not significantly duplicate or compete with the IUB program. The mission of the new program was to provide a high-quality advanced geology curriculum to environmental professionals seeking job improvement, including higher salaries. It was expected that most students would be part-time. This program originally offered a thesis option, in which a 6-credit thesis is added to 24 credits of course work, and a non-thesis option requiring 36 credit hours that must include a 3 credit research course.

Prior to summer 1993, only 4 students had graduated in 10 years, all of whom followed the non-thesis option. The chair, Dr. Hall, then made a decision to invest a large amount of money in building a program consisting mostly of full-time students who were financially supported by

fellowships, teaching assistantships, research assistantships, and internships. The results are that 95% of graduate students are now on the thesis option, and 70% are full-time students. Full-time graduate students are expected to complete their degrees, including thesis, in 2 years. The first 4 students who were admitted under those conditions are now approaching the end of their two years and should be completing theses in the next two months.

Student Profile

A total of 43 applicants have entered the Masters program at IUPUI to date. Of these, 12% have withdrawn or otherwise ended their participation and have eventually been dismissed, 58% are still in the program, and 30% have graduated. Tables 6 and 7 list completed theses and advisors and theses in progress. Emphasis on full-time students with theses has inevitably increased the Department's research productivity for faculty who sponsor thesis students.

TABLE 6. COMPLETED MASTERS THESES

STUDENT	ADVISOR	TITLE
1997		
Reuter, Steve	Hall	Forms and reaction rates of Iron minerals responsible for color variations in paleosols
1996		
Hemly, Vince	Hall	Determination of parent material changes in paleosols using detailed grain-size analysis
Knollenberg, Camie	Hall	Organic zones associated with the Sangamon Soil and the Sidney Soil
Maier, Randy	Hall	Genetic classification and correlation of pre-Late Wisconsinan glacial diamicts in east-central Indiana and west-central Ohio
Yarling, Mike	Filippelli	The occurrence and origin of sulfates in a sand and gravel aquifer system near Fort Wayne, Indiana
1995		
Koelpin, Roger	Hall	A comparison of soil development inside and outside of four lineaments in Indiana
1983		
Morgan, W. Tony*	Hall	Sedimentological, hydrological, and engineering controls on slope form, Indiana Dunes National Lakeshore
1980		
Roy, William*	Hall	Glacial chronology of the South Boulder Valley, Tobacco Root Range, Montana.

*IUB Student (prior to establishment of IUPUI program)

TABLE 7. MASTERS THESES IN PROGRESS

STUDENT	ADVISOR	TITLE
Carnahan, Jeff	Filippelli	Germanium/Silicon ratios in freshwater diatoms as an indicator of chemical weathering rates in a glaciated alpine watershed
Farleigh, Karen	Miller	Geomorphic responses to natural and anthropogenic disturbances in the San Juan and Cottonwood Creeks watersheds, Toiyabe Mountains, Central Nevada: Implications for riparian ecosystem management
Grow, Dave	Hall	Soil horizons in welded soils, northwestern Morgan County, Indiana
Hall, Bob E.	Jewett	Characterization of sediment *flux* through Sullivan marsh, Indianapolis, Indiana.
Laidlaw, Mark	Filippelli	Background concentrations and spatial distributions of heavy metals in soils surrounding the Indianapolis metropolitan area: Implications for anthropogenic contaminant inputs
Latimer, Jennifer	Filippelli	Phosphorus and Iron sedimentation in the Southern Ocean over glacial/interglacial intervals
O'Neal, Mike	Tedesco	The sediment record as a proxy of Late Holocene sea level rise, southwestern Florida
Perkins, Steve	Filippelli	Heavy metal accumulation in wetland sediments in Indiana Dunes National Lakeshore, Indiana.
Richardson, Dee	Miller	Interactions between groundwater and surface water in a wet meadow, Big Creek, Toiyabe Mountains, Central Nevada
Rickabaugh, Toby	Tedesco	The distribution of trace elements in surficial sediments of Rookery Bay National Estuarine Research Reserve: Implications for anthropogenic impacts
Woodfield, Catharine	Hall	Wabash and Ohio River megasequences in the Little Pigeon Creek basin near Evansville, Indiana
Zbieszkowski, Dave	Hall	Characterization and paleoenvironmental interpretation of the Sangamon Soil and other paleosols in central Indiana