Annual Report 2006-2007

Department of Geosciences

Executive Summary

Learning: Undergraduate
The Department had 86 undergraduate majors this past year; 22 graduated with degrees in one of our four degree options. Twenty-three students participated in research activities with faculty members, mostly through undergraduate research. We have an extremely high number of students who transfer into the Geosciences. Sixty-four percent of the most recent graduating class was transfer students. Over the past year 14 students transferred into the Department and 11 transferred out. Of the 86 majors, 2 are minorities, and 32 are women. We had 1 minority student complete degree requirements in 2007. The ratio of degrees conferred per full-time equivalent instructional faculty member is 1.2. The Department awarded $19,600 in undergraduate academic and research scholarships and excellence awards. In addition, 5 undergraduate students were selected to receive partial or full tuition scholarships from our foundation accounts (totaling $13,000) for the upcoming fall semester. This was the third year of our communication intensive senior capstone course that integrates all facets of our undergraduate curriculum with written, oral, and visual expressions of learning and communication. Ten students participated in study abroad programs.
Learning: Graduate
Fifty-seven graduate students were enrolled full time in the Department this past year; 4 graduated with MS degrees and 9 graduated with PhD degrees. Of these 57 students, 22 are from underrepresented racial and ethnic groups (in Science, women are considered underrepresented and of this total 19 were women). Of our 38 PhD students, approximately 50% were supported on research grants for at least one semester. One-hundred percent of our PhD students were supported on either teaching or research fellowships. Foundation funds in the amount of $54,000 were used to provide tuition and stipends for at least one semester for four graduate students. Research funds in the amount of $12,750 were awarded to 15 students; $28,500 was given as summer stipend support to 9 students; $3000 was allotted for teaching and other awards to 8 students. Laura Hamm received a 3-year NSF graduate research assistantship and Richard Kraus earned a Humboldt Fellowship.
Discovery
The Department was greatly honored this past year by the naming of both Robert Bodnar and Michael Hochella as Fellows to the American Association of the Advancement of Science (AAAS); both were also named as Fellows to the American Geophysical Union. The 22 full-time tenure-track and research faculty members in Geosciences have been awarded 7 new research grants to go along with 38 continuing research grants totaling $11,841,787 or $538,000 per faculty member. Total research expenditures for the past year were $2.5 million. Sixty-eight peer-reviewed research papers and 143 abstracts were published by the Department's faculty this past year. Six post-doctoral associates worked in the Department during the academic year along with four research associates and six visiting scholars.

Engagement

The Department continues to maintain strong ties with industry as nine companies visited and conducted interviews with graduate students. Six students received job offers or internships as a result of these interviews.

Madeline Schreiber participated in the International Faculty Development Program at Virginia Tech's CESA in Switzerland in May 2006. An MOU was established with the University of Naples, Italy, which has resulted in the successful exchange of graduate students between departments.

The Geology Museum welcomed 5,400 visitors during the past year.

Llyn Sharp, the outreach coordinator for the Department was awarded the College of Science Award for Outreach Excellence on the basis of her involvement in programs aimed at Geoscience education for K-12 students, teachers, and the public sector. Llyn served as one of the coordinators for VT STEM and works with VT STARS.

Diversity

The Department added two new female faculty—Ying Zhou, a seismologist who started her tenure in January 2007 and Erin Kraal, a planetary geomorphologist, who will begin in fall 2007. The Department currently has five female faculty members; however, with the addition of Kraal this will increase to six in August 2007.

Several faculty members continue to be involved in the University's Advance-VT program. For 2006-2007, we had 3 MAOP Scholar recipients (1 Native American and 2 women). Dr. Bekken's Earth Sustainability series is designed to be race and gender inclusive through its social justice modules and pedagogically inclusive through a learning community model. The series has been very popular with women and is expected to become racially diverse in the coming years.

Goals for 2007-08

This past academic year has been one of transition and growth for the Department of Geosciences. Using the University-wide cluster-hiring plan in Computational Science we began to implement our strategic initiatives last year by hiring 3 computational geophysicists (Rheodynamics) and one computational paleoclimatologist (Earth Systems). With the loss of two geophysicists (one retirement, one leaving the department) our hiring plan for 2007-2008 reflects the need to refill these positions along with other key areas. The four requested positions are: reflection seismology/exploration geophysics, magmatic petrology, Earth Systems, with emphasis on a stable isotope geochemist, and earthquake seismology. With the number of new faculty members, it is likely that the Department's undergraduate and graduate course offerings will begin to transition, especially with the retirement of several additional faculty members in the next few years. As a result the Department plans to charge the curriculum committee to evaluate its current degree program requirements and consider revamping the curriculum to better prepare our students both for employment and advanced degrees, and to handle new challenges facing the geosciences in the coming decades. Another major goal for the upcoming academic year is to conduct a five-year external review of the Geosciences program.

Undergraduate Learning

Curriculum: The primary goal of the Department of Geosciences in the education of its undergraduate students is to prepare them for productive careers either by directly entering the job market or after completing a graduate degree. Thus the undergraduate curriculum is simultaneously serving two somewhat divergent paths - immediate employment or continued education. The Geosciences, like many fields, is experiencing an unprecedented growth in technological development and it is necessary for the Department to maintain a balance between traditional basic knowledge and rapidly evolving technology in its undergraduate courses. The programs of study in the undergraduate curricula are designed for graduation in four years, albeit with a rigorous program of study. Traditionally, more than one-half of the students graduating in the Geosciences have transferred into the Department at some point in their undergraduate career. These transfers come from other departments within the College of Science, from other colleges within the University, from community colleges and from other universities. Many have some advanced placement credit and/or transfer credits. Their diverse backgrounds make generalizations impossible and require that each is separately evaluated and that each has a customized program of study. The impact on assessment is that they may have very diverse backgrounds and that some cannot graduate within four years of their initial enrollment in this, or some other, university. Nevertheless, the Department makes every effort to graduate students in four years and works with each transfer student to find the most feasible ways to achieve this goal.

Geosciences has 86 undergraduate majors distributed over four options—geology, geophysics, geochemistry and earth science education.

The Department strives to provide contacts for undergraduates with professionals in the Geosciences. This takes two principal forms - regular seminars offered by visiting scientists to the Department and visiting recruiters from major companies. Undergraduate students are encouraged to participate by attending the seminars and by attending special presentations given by recruiters. When recruiting schedules permit sufficient time (which is common) undergraduates are encouraged to interview with recruiters to gain experience and also to gain insight into job opportunities. In fact, many of the major oil companies now do most of their hiring from pools of students who have first served as interns at some point in their academic careers. Historically, many companies - particularly the major oil companies - have regarded the MS as the terminal degree for students entering industry. Due to work force demographics and large scale retirements now taking place in the oil industry, this hiring practice is beginning to change and oil companies are now starting to hire at the BS level. Hence, it is important for students to meet and talk with recruiters as early as possible in their careers.

Undergraduate Courses			
Courses	**No. Sections**	**No. Students**	**Credit Hours**
1st Summer 2006	3	35	117

2nd Summer 2006	1	16	66
Extended Summer 2006	0	0	0
Fall 2006	79	3342	8967
Spring 2007	72	3018	8482

The department will begin a discussion during Fall semester 2007, on curricular changes that might better serve our students in the changing earth science employment market and with respect to expectations of graduate schools.

ViEWS: In February 2007, the departmental ViEWS plan was revised and reapproved to accommodate easier tracking of student progress toward departmental ViEWS student learning goals. In 2004, most GEOS courses required for the major agreed to incorporate ViEWS projects into each course's curriculum. For assessment purposes, we are now asking faculty to guide students in uploading their ViEWS products from each course into an e-portfolio so that we can track student progress in learning over the course of the major. Using the Scholar classroom management system, we have created a ViEWS learning goals matrix and will acquaint faculty with it during a workshop at the beginning of fall semester 2007. If the system remains stable, students in all GEOS courses that assign communications-related projects will upload their projects into Scholar (e-portfolio) for evaluation and reflection beginning fall, 2007.

	ViEWS Program Goals: Geosciences Majors
Visual	Visual Expression as a form of ***observation*** or description of geologic information: • Create representative maps of observed geologic information • Create representative sketches of field or laboratory observations • Create graphics that describe experimental or modeling methods or procedures
	Visual Expression as a form of ***interpretation*** of geologic information: • Create sketches of interpreted information • Create 2-D (e.g., maps, cross-sections) and 3-D (e.g., mineral models or phase diagrams) that interpret geologic information. • Create graphs or charts of geologic variables as a function of a geologic parameter (e.g, distance, depth, or time). • Create graphs that show correlations or dependence between variables.
Written	Writing to communicate ***goals and progress*** • Write a project proposal • Write a progress report
	Writing to communicate ***methods and findings*** • Write a report that describes and interprets observational field, laboratory, library, or computer data (uses descriptive methods). • Write a report that describes and interprets experimental field, laboratory, library, or computer data (uses experimental methods)

	Writing to ***summarize findings*** • Create an annotated bibliography • Write a review of a geoscientific topic based on a literature search • Write a professional abstract for a scientific presentation such as GSRS.
	Writing as a ***review*** of a peer's work • Formally review a peer's performance
Spoken	Speaking to communicate geoscientific methods and findings ***using presentation software*** • Create and present a poster • Create and present a "professional" talk • Create and present a formal review of a topic, article, procedure, or method

No curricular changes or new courses were proposed as part of this program. The university ranked the plan as an ideal model and used it as an example for the entire university, validating the strength of our existing curriculum.

Educational Research: In Spring 2007, Barbara Bekken together with a team of ten diverse faculty and graduate students from four different colleges, completed the second semester of the second phase of the experimental Earth Sustainability (ES) integrated Liberal Education project begun in Fall 2004. Sixty-seven students enrolled in phase II of the ES series and will receive credit for five of the seven areas of the LibEd core in six fewer credit hours than if they had enrolled in the traditional LibEd curriculum, thus providing greater elective flexibility.

The ES program is a teaching and learning laboratory that is designed in accord with a well-established curricular/developmental model that supports student development along three key domains: cognitive/epistemological, interpersonal, and intrapersonal. The series is augmented by a four-year long NSF-supported longitudinal study to evaluate student gains in learning and development along these three domains relative to a control group of students who are enrolled in the traditional LibEd curriculum. As funding is secured to expand the program, other interdisciplinary themes will be piloted that will be based on the developmental framework, multi-disciplinary approach, and learning community structure developed and tested in the ES series.

The second ES cohort is being taught by a new group of instructional faculty and graduate students who also are participating in a faculty development program that encourages them to rethink, revise and revitalize liberal education. Members of the Phase II ES instructor team are beginning a project in summer, 2007 to create a "learning community field guide" that will support other VT faculty in fostering learning communities in their courses or majors. It is the ES team's plan that programs and guides such as these become prototypes that encourage a paradigm shift in general education toward a more a learning-centered environment that encourages students to take far greater responsibility for deep learning, retention, and application, especially in STEM-related subjects.

Academic Advising: The Department strives to provide superior academic and career counseling for the undergraduate students. Every undergraduate is interviewed at the time he or she enters the Department as a new undergraduate or as a transfer and is given information on academic expectations, course requirements, departmental activities, employment opportunities and other professional opportunities. Each student is assigned

an academic advisor who oversees the student until graduation. Students are required to meet regularly before pre-registration each Fall and Spring semester to ensure that progress is being made towards their degrees. These meetings consist of two stages: first a meeting with Mrs. Connie Lowe (Student Coordinator) to check the technical details of their plan of studies and registration for the up-coming semester, and second a meeting with their academic advisor to discuss such broader issues as designing and maintaining a plan of study to achieve long term career goals. In combination with student course evaluations, these meetings have also proved to be an important (although un-quantified) source of student feedback on the curriculum.

Evaluation of Student Performances: The Department of Geosciences continues to administer an entry and exit exam (initiated in 1992) for in-coming Freshmen and graduating Seniors as a means of determining if students are learning and retaining new information from their courses. Data generated by this exam complement the data base generated by the Virginia Tech Academic Assessment Program's *Survey of Degree Candidates*. The exam which is currently being used was developed in a collaborative effort by the entire faculty and hence examines a broad spectrum of the Geosciences. Incoming Freshman take the exam at the beginning of the first semester (usually before any classes have met) and graduating seniors retake the exam in the last week of their undergraduate careers. They have no contact with the exam in between so there is no specific preparation for it. The results have been, and continue to be, gathered each year. However, this exam is in need of updating since many of the younger faculty were hired in the mid-late 1990s, and is now being modified to more accurately reflect the broad changes in curriculum associated with new course offerings.

Scholarship Activity: Undergraduate scholarship activity using Foundation endowed accounts for 2006-2007 was as follows (20 total awarded = $12,300):

Undergraduate Excellence Awards (Sears, Gose, Alumni, and Presley Scholarships, $6,250 total) conferred in Spring, 2007: Stuart Hyde, Sally Morgan, Laura Neser, Justin Ohlschlagger, Kara Smith, Cordell Viehweg, Lindsey Yann, David Greenawald

Undergraduate Research Fund Awards ($1050 total): Robert Dennen, Brianna Hetland, Claire Waller

Geosciences Outstanding Senior ($500): Kara Smith

Geosciences Outstanding Service Recognition Award: Kathleen Brutsche

Wally Lowry Field Camp Scholarships ($4500 total): Heather Baron, Megan Puncke, Kara Smith, Claire Waller

Geosciences undergraduates also receive significant scholarships at the College and University level each year.

In addition, 5 undergraduate students (Cable Warren, Will Nachlas, David Greenawald, Alice Lee, and Claire Waller) were selected to receive partial or full tuition scholarships for fall 2007, using the Presley, Meade, Gose, Alumni, and Lowry Endowed Accounts. These scholarships will total $13,000 and will be conferred in the 2007-2008 academic year.

Graduate Learning

Mentoring: The Department of Geosciences maintains a strong graduate program with a large number of students given the size of the faculty. Although graduate students work with a primary advisor, there is considerable interaction among individual research programs, as collaboration is fundamental in the diverse field of geosciences. The responsibility of mentoring graduate research falls first on the primary advisor, but significant support is provided by a student's thesis committee as well as other faculty within and outside of the department.

Graduate student mentoring, activities, awards, and admissions are coordinated by the Graduate Student Affairs Committee, which is lead by the Graduate Program Director and Associate Chair (J. Spotila).

Anne McNabb, Associate Dean of the Graduate School and Bob Jones, Head of Biological Sciences (BS) were invited to a spring faculty meeting to discuss a very good model for graduate mentoring that has recently been implemented in Biological Sciences. The parts of the mentoring plan that Geosciences is working to implement include (1) having all graduate students, with the exception of students who are finishing, complete a Checklist for Evaluation of Graduate Files; (2) having students submit a plan of study and a written research prospectus, (3) have students take responsibility for updating their files and scheduling two review meetings each academic year. The prospectus should outline the student's research and demonstrate how their research is growing and evolving; and (4) having the advisor provide feedback and expectations after each meeting. With this model, the responsibility of the Graduate Review Committee (GRC) is to examine the progress of each student and rate the student. McNabb emphasized that the primary responsibilities of the advisor are: (1) aiding student to move through the process of graduating in a timely fashion; (2) giving constructive guidance when problems are encountered; and (3) keeping adequate documentation of progress/problems. If the checklist is adhered to item 3 will be automatic.

The department also offers several programs to facilitate the overall mentoring of graduate students as a collective. Activities include an annual orientation and field trip (August, 2006), a faculty-seminar day and reception (September, 2006), the 2-day Graduate Student Research Symposium (GSRS) (March, 2007), an annual graduate student-faculty meeting, and several dinners, picnics, and socials throughout the academic year. This past year, we expanded the graduate student orientation (beyond the usual administrative and logistical information) to include a review via faculty presentations of the expectations of graduate students, scientific culture and ethics, and graduate career paths. The departmental seminar program is also largely geared to expanding the scholarly horizons of graduate students, nearly all of whom attend on a weekly basis.

As a result of these activities in graduate mentoring, the Department of Geosciences maintains not just a graduate student body, but a cohesive community of students that interact and help each other, thereby enriching their graduate experience at Virginia Tech.

Graduate Student Recruiting: At the beginning of fall semester 2007, Geosciences will have 13 M.S. and 43 Ph.D. students (56 total). This includes 15 new graduate students (6 M.S. and 9 Ph.D.). The following summarizes graduate applications and admissions for the 2006-2007 academic year:

Graduate students supported during the 2006-2007 Academic Year: 57
Graduate students successfully completed in 2006-2007: 4 M.S., 9 Ph.D.
New graduate applications: 64
New graduate applications accepted for admissions: 32
Graduate students offered support: 32
New graduate students accepting offer for admission: 15

Special student recruiting and information booths to promote the Department of Geosciences were set up and tended by faculty and graduate students at the following professional meetings: Geological Society of America (Philadelphia, Pennsylvania), Southeast Section of Geological Society of America (New Orleans, Louisiana), and the American Geophysical Union (San Francisco, CA). The new website is more accessible for individuals to create and upload content, and should enhance the department's visibility to potential graduate students. The department also continues to use a web-based pre-application survey to reach potential applicants and to match their research interests with potential faculty advisors.

Scholarship Activity: Foundation funds were used effectively to support graduate students in the past academic year. Four graduate students in fall 2007 and one graduate student in spring 2008 were funded (i.e. stipend and/or tuition) using Foundation funds as follows ($54,044):

David Loveday - Matthew Mikulich Scholarship (Fall and Spring)
Ellen Gilliand - Chevron-Texaco Scholarship (Fall)
Adam Wallace - Robinson-Holden Graduate RA Scholarship (Fall)
Benjamin Schwartz - Byron Cooper Graduate RA Scholarship (Fall)

In spring 2007, the department held an open competition for research funding for graduate students. Students wrote proposals that were evaluated by the Graduate Student Affairs Committee. A total of 33 proposals were received and evaluated. Awards for research funding, summer stipends (for summer 2007), and one RA for 2007-2008 were awarded as follows (included are other graduate awards, such as the Tillman Teaching Awards):

<u>Research Awards ($12,750)</u>
Matthew Bychowski - Byron Cooper Graduate Research Award
Kristyn DeMarco - Byron Cooper Graduate Research Award
Troy Dexter - Byron Cooper Graduate Research Award

Ellen Gilliland - Byron Cooper Graduate Research Award
Ryan Grimm - Petroleum Research Award
Kelly Haus - David Wones Graduate Research Award
Rachel Lauer - Byron Cooper Graduate Research Award
Kathleen McFadden - Tillman Graduate Research Award
Daniel Moncada - David Wones Graduate Research Award
James Schiffbauer - David Wones Graduate Research Award
Bing Shen - Geosciences Faculty Research Award
Ryan Thigpen - Wally Lowry Graduate Research Award
Lisa Tranel - Wally Lowry Graduate Research Award
Peter Voice - David Wones Graduate Research Award
Nicole West - David Wones Graduate Research Award

Summer Stipend Awards ($28,500)

Jamie Buscher - Chevron-Texaco Award
Matthew Bychowski - Leonard and Melva Harris Award
Troy Dexter - Leonard and Melva Harris Award
Rachel Lauer - Texaco Scholarship
David Loveday - Aubrey-Orange Award and Texaco Scholarship
Daniel Moncada - Robinson-Holden Award
Bing Shen - Texaco Award
Peter Voice - Thomas Jeffries and Robinson-Holden Awards
Tingting Yan - Charles Gose Scholarship

Other Awards ($3000)

Jamie Buscher - Outstanding Service Recognition Award
Elizabeth Diesel - Tillman Teaching Award
Linda Dong - Tillman Teaching Award
Ellen Gilliland - Tillman Teaching Award
Ryan Grimm - Tillman Teaching Award
Rachel Lauer - Tillman Teaching Award
Benjamin Schwartz - Outstanding Service Recognition Award
Nicholas Wiggington - Geosciences Outstanding Scholar for 2007-2008

The total Foundation scholarship funds granted to graduate students in the past academic year (including summer stipends for 2007) was $98,294, for a total of 37 awards.

Other creative funding sources were also used to support graduate students, including a total of 8 semesters of funding from the University's 2010 program (i.e 4 students for the entire year), 3 semesters of funding from MAOP support (3 students), 4 semesters of support from IGERT (2 students), as well as support from GAANN and Cunningham Scholarships.

Geosciences graduate students also win other important external awards, including within and outside of the university. Of note, Benjamin Schwartz received honorable mention in the COS Oustanding Ph.D. Graduate Student Award for 2007. Adam Wallace was the COS Roundtable Scholarship Winner for 2007. Laura Hamm earned an NSF Graduate Research Assistantship Award (for 3 years). Many other students received awards and earned external grants.

Weekly Seminars: The following is a list of departmental seminars that took place over the 2006-2007 academic year. The seminars were presented by in-house faculty members, AAPG distinguished lecturers, and faculty members with related disciplines from other universities.

Ariel Anbar, Arizona State University, "A Whiff of Oxygen Before the Great Oxidation Event?"

Steven Bachtel, ConocoPhillips Company, AAPG Distinguished Lecturer, "Seismic Stratigraphy of the Miocene-Pliocene Segitiga Platform, East Natuna Sea Indonesia: The Origin, Growth and Demise of an Isolated Carbonate Platform"

David Blowes, University of Waterloo, GSA Birdsall-Dreiss Lecturer, "Predicting, Preventing and Remediating Acidic Drainage from Sulfide Bearing Mines and Mine Wastes"

Fred Boadu, Duke University, Joint seminar with Materials Science and Engineering, "Geotechnical and Petrophysical Properties of Unconsolidated Materials from Spectral Electrical Response Measurements"

Robert Bodnar, Virginia Tech Geosciences, "Water, Water Everywhere: The Earth's Geohydrologic Cycle"

Michael Brown, University of Maryland, "Duality of thermal regimes is the distinctive characteristic of plate tectonics since the Neoarchean"

Elizabeth Catlos, Oklahoma State University, "From Mineral Grain to Mountain Range: Perspectives on the Evolution of the Himalayas"

John Costain, Virginia Tech Professor Emeritus of Geophysics, "Hydroseismicity"

Sylvie Demouchy, University of Minnesota, "Diffusivity of Water in the Deep Earth: Reports from the Lab, Rumors from Patagonia"

Greg Druschel, University of Vermont, "New Insights on Sulfur Cycling and Microbial Ecology from *in situ* Voltammetric Measurement"

Kenneth Eriksson, Virginia Tech Geosciences, "When Did Plate Tectonics Begin? Evidence from the Early Stratigraphic Record"

Chris Fedo, University of Tennessee, "Critical Evaluation of the Geologic and Isotopic Evidence Concerning the Origin of Life: the Perspective from SW Greenland"

Karen Fischer, Brown University, **"**Mantle Structure, Dynamics and Melting in the Central American Subduction Zone"

Leonid Germanovich, Georgia Tech, "Hydraulic Fracturing in Industrial Applications and Earth Processes"

John Hanchar, University of Newfoundland, "Trace Elements in Accessory Minerals: A Window into Crustal Processes

Thomas Kammer, West Virginia University "The Age of Crinoids: A Mississippian Biodiversity Spike Coincident with Widespread Carbonate Ramps"

Erin Kraal, Utrecht University, "Shorelines and Alluvial Fans Using Geomorphology to Understand the Climate History of Mars"

Bob Lowell, Virginia Tech, "Mathematical Models of Ridge Crest Hydrothermal Systems: From the Basic to the Complex"

Timothy Lyons**,** University of California-Riverside, "In Search of Anoxia in the Proterozoic Ocean"

Lewis Owen, University of Cincinnati, "Quaternary Glaciation of Tibet and Himalaya"

R. Lee Penn, University of Minnesota, "Chemical, Physical, and Structural Properties of Oxide Nanoparticles"

Lindsay Schoenbohm**,** Ohio State University, "Tectonic-Climate Coupling: Erosion, Exhumation and High Topography in the Chinese Pamir"

J. W. Schopf, University of California-Los Angeles, "The Earliest History of Life: Solution to Darwin's Dilemma"

Fred Schroeder, ExxonMobil, "The Oil and Gas Industry and Career Opportunities"

Mike Searle, Oxford University, United Kingdom, "Origin and Emplacement Mechanism of the Oman Ophiolite"

John (Jack) Sharp**,** University of Texas-Austin, "Effects of Urbanization on Groundwater Systems"

Cliff Shaw, University of New Brunswick, "Insights into Magma Chamber and Eruption Dynamics in the Quaternary West Eifel Volcanic Field, Germany: A Combined Field and Experimental Study"

Leonard Srnka, ExxonMobil, SEG Distinguished Lecturer, "Illuminating Reservoirs with Electromagnetics"

Richard Tollo, George Washington University, "Mesoproterozoic Basement of the Blue Ridge Province in Virginia: Implications for the Tectonic Evolution of the Grenville Orogen and Magmatic Processes Associated with Crustal Convergence"

Discovery

2006-07 Honors and Awards: The department is pleased to report that **Robert Bodnar** and **Michael Hochella** were both named Fellows in the American Geophysical Union (AGU). Election as a fellow is an honor bestowed upon AGU members by their peers. Bodnar's peers rank him as the leading fluid-inclusion expert in the world. Hochella was recognized for excellence of research in nanobiogeochemistry. Additionally, **Bodnar** was elected a Fellow in the American Association for the Advancement of Science (AAAS). **Hochella** was also nominated for a University Distinguished Professorship by the College of Science, and selected as one of two new UDPs in May 2007. **Patricia Dove** was promoted to full professor in June 2006 as was **Michal Kowalewski** in June 2007. **Kowalewski** was also awarded a 2-month ISA Fellowship (summer 2006) by the Institute of Advanced Studies of the University of Bologna. ISA fellows present lectures for interdisciplinary student audiences at the ISA institute and professional seminars at relevant scientific departments. **Fred Read** received the A.I. Levorsen Award from the Eastern American Association of Petroleum Geologists section for the "best paper, with particular emphasis on creative thinking toward new ideas in exploration." **Read** also received the Francis J. Pettijohn Medal for "Excellence in Sedimentology," awarded by the Society of Sedimentary Geology (SEPM). **Krishna Sinha** was invited to serve as a visiting scholar at the San Diego Supercomputer Center, U.C. San Diego, 2006-present. **Shuhai Xiao** is the recipient of the 2006 Charles Schuchert Award, presented by the Paleontological Society to a person under 40 whose work reflects excellence and promise in the science of paleontology.

Statistical Information

Academics:

Present Enrollment:	Undergraduate majors	86
	Graduate majors	56
No. of Courses:	Undergraduate	41 (145 sections)
	Graduate	29 (29 sections)
Student Credit Hours:	Undergraduate	17,632
	Graduate	5,026
Degrees:	B.S.	22
	M.S.	4
	Ph.D.	9

Full-time Faculty and Staff:

Professors (includes 1 University Distinguished Professor)	12
Associate Professors	6
Assistant Professors	1
Research Professor	2
Research Assistant Professors	1
Instructor	1
Classified Staff	14

Part-time Faculty:

Assistant Professor	1

Other Affiliates:

Emeritus Faculty	13
Research Associates/Postdoctoral Associates	10
Adjunct and Cooperating Faculty	11

Publications:

Newsletters	2
Research Papers/Special Publications	68
Abstracts	143

Grants:

Externally funded	$11,841,787.00
Proposals pending	$6,550,736.00

Gifts:

Industry support	$61,000.00
Scholarships and Endowments	$86,110.00

Note, all numerical entries are based on statistics as of May 31, 2007.

Current Faculty and Staff:

Professors:

Robert Bodnar, Patricia Dove, Kenneth Eriksson, Michael Hochella, Michal Kowalewski, Richard Law, J. Fred Read, J. Donald Rimstidt, Nancy Ross, A. Krishna Sinha, J. Arthur Snoke, Robert Tracy

Associate Professors:

Thomas Burbey, John Hole, Matthias Imhof, Madeline Schreiber, James Spotila, Shuhai Xiao

Assistant Professors:

Barbara Bekken and Ying Zhou

Research Professor:

Ross Angel and Robert Lowell

Research Assistant Professor:

Martin Chapman

Instructor:

John Chermak

Emeritus Faculty:

Richard Bambach, Donald Bloss, Gil Bollinger, Cahit Çoruh, John Costain, James Craig, Gerald Gibbs, David Hewitt, Gordon Grender, Wallace Lowry, Dewey McLean, Edwin Robinson, Paul Ribbe

Research Associates/Postdoctoral Associates:

Deborah Aruguete, Claudia Cannatelli, Jens Engel, Luca Fedele, Nizhou Han, Richard Krause, John Huntley, Scott Mutchler, Jinyuan Yan, Yurena Yanes, Jing Zhao

Adjunct/Cooperating Faculty:

James Beard, John Chermak, Benedetto De Vivo, Nicholas Fraser, William Henika, Joerg Jinschek, Maureen Julian, James Martin, Matthew Mikulich, Stephen Scheckler, Lauck Ward

Classified Staff:

Linda Bland, Phillip Burcham, Charles Farley, Mark Fortney, Miles Gentry, Richard Godbee, James Langridge, Mark Lemon, Connie Lowe, Ellen Mathena, Mary McMurray, Llyn Sharp, Daniel Smith, Carolyn Williams

Scholarly Articles: Sixty-eight papers and special publications, including 1 textbook, and 143 abstracts were published by Geosciences faculty since the last reporting period. The following is a listing of the published papers.

Angel, R.J., Bujak, M., Zhao, J., Gatta, G.D., and Jacobsen, S.D. (2007) Effective hydrostatic limits of pressure media for high-pressure crystallographic studies. Journal of Applied Crystallography, 40, 26-32.sdf

Brown, J.M., Abramson, E.H., and **Angel, R.J.** (2006) Triclinic Elastic Constants for Low Albite. Physics and Chemistry of Minerals, 33(4), 256-265.

Bujak, M., and **Angel, R.J.** (2006) High pressure and low temperature induced changes in $[(CH_3)_2NH(CH_2)_2NH_3][SbCl_5]$. Journal of Physical Chemistry, part B, 110, 10322-10331.

Vanpeteghem, C.B., **Angel, R.J.**, **Ross, N.L.**, Jacobsen, S.D., Litasov, K.D. and Ohtani, E. (2006) A1, Fe substitution in $MgSiO_3$ perovskite structure: a single X-ray diffraction study. Physics of Earth and Planetary Interiors, 155, 96-103.

Vanpeteghem, C.B., Zhao, J., **Angel, R.J.**, **Ross , N.L.**, and Bolfan-Casanova, N. (2006) Crystal structure and equation of state of $MgSiO_3$ perovskite. Geophysical Research Letters 33*:* L03306

Zhao, J., **Ross, N.L.,** and **Angel, R.J.** (2006) Structural evolutions of perovskites under high pressure and high temperature (in chinese). Wuli (Physics), 35(6), 461-465.

Bodnar, R.J. and Student, J.J. (2006) Melt inclusions in plutonic rocks: Petrography and microthermometry. *In* Melt Inclusions in Plutonic Rocks (J. D. Webster, *ed.*) Mineral. Assoc. Canada, Short Course **36**, 1-26.

Elwood-Madden, M.E., Kring, D.A. and **Bodnar, R.J.** (2006) Shock reequilibration of fluid inclusions in Coconino Sandstone from Meteor Crater, Arizona. Earth and Planetary Science Letters, **241**, 32-46.

Elwood-Madden, M.E., Kring, D.A. and **Bodnar, R.J.** (2006) Shock reequilibration of fluid inclusions in crystalline basement rocks from the Ries Crater, Germany. Meteoritics and Planetary Sciences, **41**, no. 2, 247-262.

Azbej, T., Szabó, Cs., **Bodnar, R.J.** and Dobosi, G. (2006) Genesis of carbonate aggregates in lamprophyres from the Northeastern Transdanubian Central Range, Hungary: Magmatic or hydrothermal origin? Mineralogy and Petrology, **88**, 479-497.

Burbey, T.J. (2006) Three-dimensional deformation and strain induced by municipal pumping, Part 2: Numerical analysis. *Journal of Hydrology*, 330, 422-434.

Burbey, T.J., Warner, S.M., Blewitt, G., Bell, J.W., and Hill, E. (2006) Three-dimensional deformation and strain induced by municipal pumping, Part 1: Analysis of field data. *Journal of Hydrology*, 319, 123-142.

Chapman, M.C., Martin, J.R., Olgun, C.G., and Beale, J.N. (2006) Site-Response Models for Charleston, South Carolina, and Vicinity Developed from Shallow Geotechnical Investigations, Bulletin of the Seismological Society of America, 96, pp. 467 – 489.

Dunn, M.M. and **Chapman, M.C.** (2006) Fault Orientation in the Eastern Tennessee Seismic Zone: A Study Using the Double-Difference Earthquake Location Method, Seismological Research Letters, Vol. 77, no. 4, 494-504.

Wyatt, E.G., Miller, F.K., and **Chermak, J.A.**, (2006) Innovative water treatment plant utilizing the south mine pit at the copper basin mining site in Tennessee, USA*, ICARD Seventh international conference on Acid Rock Drainage.*

Elhadj, S., J.J. De Yoreo, J.J., Hoyer, J., **Dove, P.M.** (2006) Role of Molecular Charge and Hydrophilicity in Regulating the Kinetics of Crystal Growth. *Proceedings of the National Academy of Sciences*. 103, 19237-19242. **(impact factor = 10.23)**

Elhadj, S., Salter, A., Wierzbicki, A., Han, N., De Yoreo, J.J., **Dove, P.M.** (2006) Peptide controls on calcite mineralization: Polyaspartate chain length affects growth kinetics and acts as a stereochemical switch on morphology. *Crystal Growth and Design*. 6, 197-201. **(impact factor = 3.55).**

Noffke, N., **Eriksson, K.A.**, Hazen, R.M., and Simpson, E.L. (2006). A new window into early Archean life: microbial mats in Earth's oldest siliciclastic tidal deposits (3.2 Ga Moodies Group, South Africa). *Geology*, 34, 253-256.

Eriksson, K.A., Simpson, E.L. and Mueller, W. (2006) Depositional and geodynamic setting of fluvio-tidal facies in the ~3.2 Ga Moodies Group, South Africa. *Sedimentary Geology*, 190, 13-24.

Maynard, J.P., **Eriksson, K.A.,** and **Law, R.D.** (2006) The Upper Mississippian Bluefield Formation in the Central Appalachian Basin: a hierarchical sequence stratigraphic record of a greenhouse to icehouse transition. *Sedimentary Geology*, 192, 99-122.

Burt, J.B., **Gibbs, G.V.**, Cox, D.F., and **Ross, N.L.** (2006) ELF isosurface maps for the Al_2SiO_5 polymorphs. Physics and Chemistry of Minerals 33(2): 138-144.

Gibbs, G.V., Cox, D.F., Crawford, T.D., Rosso, K.M., **Ross, N.L**., and Downs, R.T. (2006) Classification of metal-oxide bonded interactions based on local potential- and kinetic-energy densities. Journal of Chemical Physics 124: 084704

Gibbs, G.V., Cox, D.F., Rosso, K.M., **Ross, N.L.**, Downs, R.T., Spackman, M.A. (2007) Theoretical Electron Density Distribution for Fe- and Cu-Sulfide Earth Materials: A Connection between Bond Length, Bond Critical Point Properties, Local Energy Densities, and Bonded Interactions. Journal of Physical Chemistry B 111(8), 1923-1931.

Gibbs, G.V., Jayatilaka, D., Spackman, M.A., Cox, D.F., Rosso, K.M. (2006) Si-O Bonded Interactions in Silicate Crystals and Molecules: A Comparison. Journal of Physical Chemistry A, 110(46), 12678-12683.

Gibbs, G.V., Spackman, M.A., Jayatilaka, D., Rosso, K.M., Cox, D.F. (2006) Bond Length and Local Energy Density Property Connections for Non-Transition-Metal Oxide-Bonded Interactions. Journal of Physical Chemistry A, 110(44), 12259-12266.

Madden, A., **Hochella, M.F.**, Jr., and Luxton, T. (2006) Insights for size dependent reactivity of hematite nanomineral surfaces using aqueous Cu as a probe. *Geochimica et Cosmochimica Acta*, 70, 4095-4104.

Xiong, Y., Shi, L., Chen, B., Mayer, U., Lower, B., Londer, Y., Bose, S., **Hochella, M.**, Fredrickson, J., and Squier, T. (2006) High-affinity binding and direct electron transfer to solid metals by the *Shewanella oneidensis* MR-1 outer membrane c-type cytochrome Omca. *Journal of the American Chemical Society*, 128, 13978-13979.

Hochella, M.F., Jr. (2006) The Case for Nanogeoscience. Progress in Convergence. Technologies for Human Wellbeing. W.S. Bainbridge and M.C. Roco, editors. *Annals of the New York Academy of Sciences*, 1093, 108-122.

Wigginton, N.S., Rosso, K.M., Lower, B.H., Shi, L., and **Hochella, M.F., Jr.** (2007) Scanning tunneling microscopy of bacterial decaheme outer-membrane cytochromes. *Geochimica et Cosmochimica Acta*, 71, 543-555.

Hole, J.A., Ryberg, T., Fuis, G.S., Bleibinhaus, F., and Sharma, A.K. (2006) Structure of the San Andreas fault zone at SAFOD from a seismic refraction survey, *Geophys. Res. Lett*., 33, L07312, doi:10.1029/2005GL025194.

Imhof , M.G., and Sharma, A. (2006) Quantitative Seismostratigraphic Inversion of a Prograding Delta from Seismic Data, *Marine and Petroleum Geology*, 23(7), 735-744.

Nowak, E., and **Imhof** , **M.G.** (2006) Amplitude preservation of Radon-based multiple-removal filters, *Geophysics*, 71(5), 123-126.

Huntley, J.W., **Xiao, S.**, and **Kowalewski, M.** (2006) On the morphological history of Proterozoic and Cambrian acritarchs. In: Xiao, S., And Kaufman, A.J., eds., *Neoproterozoic Geobiology and Paleobiology,* Kluwer, Plenum Press, New York, *Topics in Geobiology,* 27, 23-56.

Kowalewski, M., Kiessling, W., Aberhan, M., Fürsich, F.T., Scarponi, D., Barbour Wood, S.L., and Hoffmeister, A.P. (2006) Ecological, taxonomic, and taphonomic components of the post-Paleozoic increase in sample-level species diversity of marine benthos. *Paleobiology,* 32, 533-561.

Barbour Wood, S., Krause, R.A., Jr., **Kowalewski, M.**, Wehmiller, J.A., and Simões, M.G. (2006) Aspartic acid (Asp) racemization dating of Holocene calcitic brachiopods and aragonitic bivalves from the Southern Brazilian Shelf, South Atlantic. *Quaternary Research,* 66, 323-331.

Rodland, D.L., **Kowalewski, M.**, Carroll, M., and Simões, M.G. (2006) The temporal resolution of epibiont assemblages: Are they ecological snapshots or overexposures? *Journal of Geology,* 114, 313-324.

Huntley, J.W., **Xiao, S.**, and **Kowalewski, M.** (2006) Morphological diversification of Proterozoic and Cambrian protists. *Precambrian Research,* 144, 52-68.

Godin, L., Grujic, D, **Law, R.D.,** and Searle, M.P. (2006) Channel flow, extrusion and exhumation in continental collision zones: an introduction. In: Law, R.D., Searle, M.P and Godin, L. (eds) *Channel Flow, Ductile Extrusion and Exhumation in Continental Collision Zones.* Geological Society of London Special Publications, 268, 1-23.

Searle, M.P., **Law, R.D.,** and Jessup, M. (2006) Crustal structure, restoration and evolution of the Greater Himalaya in Nepal - Tibet: implications for channel flow and ductile extrusion of the middle crust. In: Law, R.D., Searle, M.P and Godin, L. (eds.), *Channel Flow, Ductile Extrusion and Exhumation in Continental Collision Zones.* Geological Society of London Special Publications, 268, 355-378.

Jessup, M., **Law, R.D.**, Searle, M.P., and Hubbard, M. (2006) Structural evolution and vorticity of flow during extrusion and exhumation of the Greater Himalayan Slab, Mount Everest Massif, Tibet/Nepal: implications for orogen-scale flow partitioning. In: Law, R.D., Searle, M.P and Godin, L. (eds) *Channel Flow, Ductile Extrusion and Exhumation in Continental Collision Zones.* Geological Society of London Special Publications, 268, 379-413.

Collins, L.B., **Read, J.F.**, Hogarth, J.W., and Coffey, B.C. (2006) Facies and outcrop gamma ray signature of exposed Miocene subtropical continental shelf carbonates, North West Cape, Western Australia. *Sedimentary Geology*, 185, 1-19.

LaGesse, J., and **Read, J.F.** (2006) Updip sequence development on a wave- and current-dominated, mixed carbonate-siliciclastic continental shelf: Paleogene, North Carolina, eastern U.S.A. *Sedimentary Geology*, 184, 155-182.

Wynn, T.C., and **Read, J.F.** (2006) Regional high resolution sequence analysis via well cuttings, Mississippian Big Lime, West Virginia, USA. *American Association of Petroleum Geologists Bulletin* lead article, 90, 1-14.

Husinec, A., and **Read, J.F.** (2006) Oversized radial ooid facies in the Late Jurassic Dinaric platform interior: Low energy precipitates from highly supersaturated hypersaline waters. *Geological Society of America Bulletin*, 118, 551-556.

Liu, Y., Olsen, A. A., and **Rimstidt, J. D.** (2006) Mechanism for the dissolution of olivine series minerals in acidic solutions. *American Mineralogist* **91**, 455-458.

Burt, J.B, **Ross, N.L, Angel, R.J**, and Koch, M. (2006) Equations of state and structures of andalusite and sillimanite to 10 GPa, American Mineralogist 91: 319-326.

Zhao, J., **Ross, N.L.**, and **Angel, R.J.** (2006) Estimation of polyhedral compressibility and tilting in $GdFeO_3$-type perovskites through compression of unit-cell axes. Acta Crystallographica B, 62: 431-439.

Alley, M., **Schreiber, M.E.**, Ramsdell, K., Muffo, J. (2006) Case for sentence headlines in presentation slides: Testing of headline designs on audience retention. *Technical Communication* 53(2), 1-10.

Harvey, M., **Schreiber, M.E., Rimstidt J.D.**, Griffith M (2006) Scorodite dissolution kinetics: Implications for arsenic release. *Environmental Science and Technology 40:*6709-6714.

Walker, F.P., **Schreiber, M.E.**, **Rimstidt, J.D.** (2006) Kinetics of arsenopyrite oxidative dissolution by oxygen. *Geochimica et Cosmochimica Acta* 70: 1668-1676.

Larson, A.M., **Snoke, J.A.**, and James, D.E. (2006) S-wave Velocity structure, mantle xenoliths, and the upper mantle beneath the Kaapvaal Craton, *Geophys. J. Int.* 162, 171–186.

Hagadorn, J.W., **Xiao, S.,** Donoghue, P.C.J., Bengtson, S., Gostling, N.J., Pawlowska, M., Raff, E.C., Raff, R.A., Turner, F.R., Yin, C., Zhou, C., Yuan, X., McFeely, M.B., Stampanoni, M., and Nealson, K. H. (2006) Cellular and subcellular structure of Neoproterozoic embryos. *Science*, 314, 291–294.

Xiao, S., Hagadorn, J.W., Zhou, C., and Yuan, X. (2007) Rare helical spheroidal fossils from the Doushantuo Lagerstätte: Ediacaran animal embryos come of age? *Geology*, 35, 115-118.

Zhou, C. and **Xiao, S.** (2007) Ediacaran $\delta^{13}C$ chemostratigraphy of South China. *Chemical Geology*, 237, 107-126.

Xiao, S., and Dong, L. (2006) On the morphological and ecological history of Proterozoic macroalgae. p. 57-90. *In* S. Xiao and A. J. Kaufman (ed.), Neoproterozoic Geobiology. Kluwer Academic Publishers, Dordrecht, the Netherland.

Huntley, J. W., **Xiao, S.**, and **Kowalewski, M.** (2006) 1.3 billion years of acritarch history: An empirical morphospace approach. *Precambrian Research*, 144, 52-68.

Pyle, L.J., Narbonne, G.M., Nowlan, G.S., **Xiao, S.**, and James, N.P. (2006) Early Cambrian metazoan eggs, embryos, and phosphatic microfossils from northwestern Canada. *Journal of Paleontology*, 80:811-825.

Yuan, X., **Xiao, S.**, and Zhou, C. (2006) Evolutionary radiation of eukaryotes during the Neoproterozoic Doushantuo stage. p. *In* J. Rong (ed.), Origination, Radiation, and Biodiversity Changes: Evidence from the Chinese Fossil Record. Science Press, Beijing.

Special Publications:

Chapman, M.C. and Talwani, P. (2006) Seismic Hazard Mapping for Bridge and Highway Design in South Carolina, project FHWA-SC-06-09, Final Technical Report, December 8, 2006, for South Carolina Department of Transportation, Columbia, SC 29202, 88 pages, with additional software and user's guides.

Law, R.D., Searle, M.P., and Godin, L. (editors) 2006. *Channel Flow, Ductile Extrusion and Exhumation in Continental Collision Zones.* Geological Society of London Special Publications, No 268, 632 pp. ISBN: 978-1-86239-209-0.

Coffey, B.P., and **Read, J.F.,** (2006), Subtropical to temperate facies from a transition zone, mixed carbonate-siliciclastic system, Paleogene, North Carolina, U.S.A. *Sedimentology,* 1-27 (online prepublication, Blackwell Synergy).

Husinec, A., and **Read, J.F.,** (2006), The Late Jurassic Tithonian, a greenhouse phase in the Middle Jurassic cool mode: Evidence from the cyclic Adriatic (Dinaric) platform, Croatia. *Sedimentology*, 1-21 (online prepublication, Blackwell Synergy).

Ross, N.L. and Hoffmann, C. (2006) Single-Crystal Neutron Diffraction: Present and Future Applications. In: Reviews in Mineralogy and Geochemistry Vol. 63: Neutron Scattering in Earth Sciences, R. Wenk, Ed., pp. 59-80, Mineralogical Society of America, Washington D.C.

Sinha, A.K., Zendel, A., Brodaric, B., Barnes, C., and Najdi, J. Schema to Ontology for Igneous Rocks in, A.K. Sinha editor, Geoinformatics, Special Paper 397, *Geological Society of America*, 169-182.

Brady, S.R., **Sinha, A.K.**, and Gundersen, L.C. (2006) Geoinformatics 2006 Abstracts, U.S.Geological Survey Scientific Investigation Report 2006-5201, 70pp.

Blatt, H., **Tracy, R.J.**, and Owens, B.E., (2006) Petrology (Igneous, Sedimentary, and Metamorphic), Third Edition, 530 pages, W.H. Freeman and Company.

Xiao, S., and Kaufman, A.J., (2006), Neoproterozoic Geobiology and Paleobiology. Dordrecht, the Netherlands, Springer, 300 p.

Zhu, M., **Xiao, S.**, and Yin, C., (2006), The Second International Paleontological Congress Pre-Meeting Field Trip A8: The Cryogenian and Ediacaran of South China: Ice Ages, Animal Embryos, Acritarchs, and Algae. Beijing, 95 p.

New Equipment: Oxford Diffraction moved their US corporate headquarters to Blacksburg to co-locate with the **Virginia Tech X-ray Crystallography laboratory (VTX)**. This brought new diffractometers and upgrades worth $1,600,000 for a cost to VT of only $250,000 which we funded through the Commonwealth Research Initiative. A dual-source Gemini diffractometer from Oxford Diffraction was installed to provide improved facilities for small-molecule service crystallography. This is the first true dual-source diffractometer to be sold in the USA. The Xcalibur-2 diffractometer was converted to full-time high-pressure usage to relieve the over-demand on Xcalibur-1. And the protein diffractometer was upgraded to a PX-Nova with a much higher intensity microsourceXray system to enable us to measure much smaller protein crystals than before. The last part of these upgrades was the installation in October of a PX-scanner system from Oxford Diffraction, which is used to pre-screen protein crystals by diffraction while they are still growing in well plates. The PX-scanner is temporarily located at the VTX-outstation in the Fralin Biotechnology Institute on campus.

The move of Oxford Diffraction and the expansion of the facilities in VTX were announced at a press conference in October:

> Oxford Diffractions decision to locate its North American office in Blacksburg is a testimony to the energy and world-class scholarship of our faculty, who have created this exciting partnership for scientific discovery,said Virginia Tech President Charles Steger. It also signifies Virginia Techs position as one of the leading materials science research universities in the United States. The partnership with Oxford Diffraction is an excellent example of the type of relationship we hoped the CRI funding would encourage,said Del. Harvey Morgan, chairman of the House Appropriations Higher Education Subcommittee. This partnership leverages state dollars to provide increased private sector and federal funding and promises to generate intellectual property that may well result in jobs for Virginians.

Professors Bodnar and Tracy have participated for two years with the Institute for Critical Technologies and Applied Science (ICTAS) toward acquisition of a **Secondary Ion Mass Spectrometer (SIMS)** - a Cameca IMS-7f GEO, the first instrument of its kind in the world. - for the Nanoscale Characterization and Fabrication Laboratory within ICTAS. NCFL is effectively a collaborative effort between the Departments of Geosciences, Materials Science and Engineering, and Chemistry. The NCFL is located ina new building at the CRC (ICTAS-A).

Prof. Bodnar visited Paris in November 2006 to perform an acceptance visit prior to shipping of the SIMS to Blacksburg and it was discovered that advertised specifications for oxygen isotope analysis were not met. This has delayed arrival of the instrument until May 2007. In April 2007, Prof. Tracy visited the Camca factory in France to do a final inspection and the instrument was shipped, and arrived in late May. Cameca will send an engineer to perform the installation during June 2007. This new instrument opens major analytical and research possibilities for analysis of light stable isotopes, trace elements and other critical geo-materials tracers that should strongly enhance our research visibility in the department. We anticipate that the lab should be up and running with a newly hired laboratory manager by the end of the summer, 2007.

The **Electron Beam Lab** in Derring contains a Cameca SX50 electron microprobe and a Camscan Series II SEM. During summer, 2006, we upgraded the Camscan with a new state-of-the-art high-sensitivity cathodoluminescence system (GATAN Chroma-CL) that enable us to image and analyze micro-scale and nano-scale compositional and structural features of geological and engineered materials.

We arranged during winter/spring 2007 to upgrade the now-obsolete SUN automation of the Cameca SX50 with a PC-based system called Probe for Windows. The upgrade involves both hardware and software modifications and will greatly enhance the research we can do on this work-horse instrument that is used by many faculty and both graduate and undergraduate students in the department. Installation is essentially complete at the end of May, 2007, and we are now receiving advanced training on the software.

The new **Laser-Ablation Inductively Coupled Mass Spectrometer Lab** was installed during 2006, and is supervised by Prof. Bodnar. It was funded through NSF-EAR Instrumentation and Facilities as a national center for analysis of melt and fluid inclusions. The initial lab manager, Scott Mutchler, left the department for other employment early in 2007, and has been replaced by Research Associate Dr. Luca Fedele. Following its initial setup during 2006, the lab is beginning to achieve routine operation during 2007.

DEPARTMENTAL ACTIVE RESEARCH GRANTS
2006-07

Angel, R	NSF	9/1/04 - 8/31/06	$46,200.00
Angel, R	Oxford Diffraction	9/1/02 - 8/31/07	$50,000.00
Bekken, B	NSF	3/15/05 - 2/29/08	$53,962.00
Bodnar, R	NSF	10/1-03 - 12/31/07	$199,748.00
Bodnar, R	NSF	12/15/05 - 11/30/07	$150,000.00
Bodnar, R	NSF	7/15/04 - 7/31/07	$400,866.00
Burbey, T	Va. Dept. of Env. Quality	4/15/03 - 9/30/06	$47,825.00
Burbey, T	Rockydale Quarries	7/1/06 - 8/31/08	$36,053.00
Chapman, M	Univ. of South Carolina	9/1/05 - 9/30/06	$36,434.00
Chapman, M	USGS	12/1/03 - 1/31/07	$81,525.00
Chapman, M	USGS	1/1/07 - 12/31/07	$59,950.00
Chapman, M	USGS	2/1/07 - 7/31/07	$14,323.00
Dove, P	DOE	8/10/00 - 10/31/07	$1,102,560.00
Dove, P	NSF	8/1/05 - 7/31/08	$379,989.00
Dove, P	NSF	9/15/06 - 8/31/07	$73,947.00
Hochella, M	DOE	8/10/02 - 5/14/08	$290,611.00
Hochella, M	NSF	7/1/05 - 6/30/10	$3,396,601.00
Hochella, M	PNNL	12/21/04 - 9/30/07	$240,000.00
Hochella, M	SANDIA	8/4/04-9/1/06	$49,700.00
Hole, J	NSF	8/1/03 - 8/31/07	$430,924.00
Kowalewski, M	NSF	5/1/06 - 6/30/09	$219,290.00
Kowalewski, M	PRF	12/15/03 - 8/31/06	$80,000.00
Law, R	NSF	1/1/06 - 12/31/08	$229,996.00
Law, R	NSF	4/12/02 - 5/31/07	$266,768.00
Read, J	NSF	2/15/04 - 3/31/08	$189,387.00
Read, J	NSF	4/1/07 - 3/31/08	$88,449.00
Rimstidt, D	DOE	5/1/03 - 12/31/06	$355,524.00
Ross, N	COMPRES	5/1/02 - 4/30/08	$34,625.00
Ross, N	DOE	5/15/05 - 5/14/08	$146,000.00
Ross, N	NSF	12/1/02 - 12/31/06	$208,995.00
Ross, N	NSF	6/28/04 - 6/30/08	$294,767.00
Ross, N	NSF	7/1/06 - 6/30/08	$160,862.00
Schreiber, M	NSF	6/1/05 - 8/31/07	$11,022.00
Schreiber, M	NSF	8/1/02 - 7/31/07	$219,998.00
Schreiber, M	USDA	7/1/02 - 9/14/06	$290,000.00
Sinha, A	NSF	9/6/02 - 9/30/07	$967,316.00
Sinha, A	NCAR	6/1/06 - 12/31/07	$35,963.00
Spotila, J	NSF	11/1/02 - 12/31/06	$155,071.00
Spotila, J	NSF	9/15/04 - 8/31/07	$164,576.00
Tracy, R	NSF	2/1/02 - 9/31/06	$44,512.00
Tracy, R	Va. Dept. of Mines	9/1/06 - 6/30/07	$14,100.00
Xiao, S	NASA	9/15/05 - 9/14/08	$136,219.00
Xiao, S	NSF	6/1/06 - 12/31/07	$140,154.00
Xiao, S	NSF	7/16-03 - 7/31/06	$150,573.00
Xiao, S	PRF	9/1/05 - 8/31/07	$80,000.00
Xiao, S	Va. Space Grant	5/1/05 - 5/31/07	$10,000.00
			$11,841,787.00

Engagement

Industrial Corporate Partnerships: Nine companies visited the Department of Geosciences to recruit our students during Fall semester: BP, Cabot Oil & Gas, Chevron Corp., Chesapeake Energy, ConocoPhillips, Hess, Iluka Resources, Marshall Miller, and Newmont Mining. The following graduate students received offers as a result of these interviews:

- Kathleen McFadden accepted an internship with ConocoPhillips
- Ellen Gilliland accepted an internship with Chesapeake Energy
- David Lovely accepted a position with Chevron Corp.
- Ryan Grimm accepted an internship with Cabot Oil and Gas Corp.
- Lin Dong accepted a position with BP
- Lisa Tranel accepted an internship with Chevron

International Education/Research:

- Memorandum of Understanding established between Virginia Tech and the Universitá di Napoli Federico II, Naples, Italy (University of Naples) was signed to establish an exchange program to study the volcanoes of southern Italy. Under this agreement, one Italian student, Claudia Cannatelli, has completed the requirements for the Masters degree at Virginia Tech, and two students from the University of Naples entered the PhD program at Virginia Tech in August 2006.
- Dr. Bodnar has visited the University of Naples several times during the term of the agreement to teach courses, and returned in November 2006, to present a week-long short course entitled Fluids in the Earth.
- Drs. Bodnar and Tracy attended the PhD defense in Naples in November, 2006, for Claudia Cannatelli, who has since returned in early 2007 to Blacksburg to perform research in the Department of Geosciences under auspices of the cooperative program.
- During the 2006-07 academic year, a PhD student from Virginia Tech (Matthew Severs) spent a portion of one semester at the University of Naples in Italy conducting research on the volcanic island of Procida in the Mediterranean Sea.
- Via the International Faculty Development Program (IFDP), Maddy Schreiber conducted individual research at the Swiss Aquatic Research Institute (EAWAG), and gave a talk at the Duebendorf (Zurich) facility. By participating in the IFDP, Schreiber developed connections with international researchers who are working on similar research problems as she.
- Robert Bodnar did extensive fieldwork in Italy and Mexico. Additionally, he gave short courses in Hungary and Italy and presented keynote lectures at meetings in Canada and England.
- Nancy Ross collaborated with Dr Mark Welch (Natural History Museum, London) on neutron studies of hydrous phases.

- Shuhai Xiao gave keynote addresses at international conferences in China and Switzerland. Additionally, he led a field trip to examine Neoproterozoic successions in South China, with 32 participants from 6 countries.
- The Virginia Tech Crystallography Laboratory has hosted a number of research visits by faculty from Universities in Europe: Dr. Tiziana Boffa-Ballaran, Bayerisches Geoinstitut, Bayreuth, Germany; Prof. Maciej Bujak, University of Opole, Poland; Dr. Diego Gatta, University of Milan, Italy; Dr. Fabrizio Nestola, University of Padua, Italy, Prof. Boriana Mihailova, Universitaet Hamburg; Ms. Polina Gavrilenko (PhD student), Bayerisches Geoinstitut in Bayreuth and Dr. Elinor Spencer (Post-doc), University of Durham. In collaboration with Prof. Mihailova a joint research proposal was submitted to the NSF and DFG to fund further collaboration.

Outreach: The Department of Geosciences has a commitment to outreach: increasing public understanding of the value and relevance of the geosciences through publications, presentations, exhibits, and formal and "free-choice" (informal and non-formal) science education programs.

In addition to engagement of faculty as part of their professional activities, the Department of Geosciences demonstrates its commitment to outreach through a staffed program that includes support for K-12 field science studies and in-class experiences, mentoring students in projects and service-learning, Education Resource Center (ERC) kit and material loans, earth and environmental education training workshops and teacher institutes, facilitation of community partnerships, and the Museum of Geosciences programs, tours, exhibits, and collections.

The professional development of students in the Department includes encouragement to practice communicating with a variety of audiences on geoscience content and the value of geosciences to society. The skills they gain will serve them well throughout their careers. Service Learning, volunteer, assistantship, intern, and student wage opportunities are provided. Students may lead museum tours, manage outreach projects, visit K-12 classes with hands-on programs, build exhibits, make hands-on teaching kits, create inquiry-based programs for K-12 youth, assist with field experiences, develop informational materials for the web and other media, work in research projects (including REU), work with community projects, or participate in conferences and events. Interdisciplinary, collaborative teamwork is encouraged in these activities.

Llyn Sharp serves as the Department's outreach coordinator. She is the recipient of the **2006 College of Science Award for Outreach Excellence**. Her degrees are in Geology and Instructional Technology and Design, with a research emphasis on informal science education and distance learning. She is a trainer for national earth and environmental science programs including GLOBE (www.globe.gov), Project WET (www.projectwet.org), and Save Our Streams (www.vasos.org). She has a background in community and K-12 informal science education and was an early advocate for expanding the educational uses of natural history collections through institutional changes and technology. Most museum and university research collections now have a strong educational outreach component, and our departmental Museum and collections are no exception. She is available to help integrate outreach into research programs so

that innovative products and activities increase the impact of the Department's research agenda.

During 2006-2008, Llyn is serving as one of the coordinators for VT STEM, the University's K-12 Outreach Initiative in Science, Technology, Engineering, and Math. Sponsored by the Division of Outreach and International Affairs, this is a group of over 50 people and programs seeking to promote excellence in STEM education in Virginia through links to schools, teachers, and VT projects.

Outreach Outcomes: So far during AY 2006-07 over 50,000 people have been contacted as a result of Llyn's activities as outreach coordinator. These activities included supervision of the Museum of Geosciences (MoGs); supervision of the Education Resources Center (ERC) and collaboration with the Science Outreach Program; supervision of undergraduate labs; support for K-12 field science studies; coordination of the VT STEM K-12 Outreach Initiative; mentoring students and student organizations in projects; loans of kits, materials, and specimens; and training workshops for WET, GLOBE, and SOS.

Llyn has a leadership role with a Montgomery County Public Schools Learn and Serve grant for watershed education. She will be working with teachers at all levels from schools across the county to help them develop real-world activities based on the Standards of Learning, then shared with the community. Other partners include the Virginia Water Resources Research Center and the Center for Geospatial Information Technology.

Llyn's work with VT-STARS in summer 2006 introduced high school students under-represented in Science, Technology, Engineering, and Math (STEM) to water quality field work, data collection and interpretation, and community watershed planning. During AY 2006-07 Llyn worked with the College of Science Diversity Committee to involve additional COS departments and faculty in this effort for summer 2007. VT-STARS works with Southside, Virginia to address pipeline issues (getting more, and more diverse, students) in science and technology. [www.vtstars.vt.edu]

Llyn served on the steering committee and as one of the primary trainers for the New River Valley Chapter of the Virginia Master Naturalist program, a new statewide effort co-sponsored by Virginia Tech to build a cadre of knowledgeable environmental educators volunteering with Virginia state agencies. We hope to benefit from having community volunteers in addition to our student volunteers.

The Museum of Geosciences is working with faculty to help highlight their research programs in hall displays and by making educational kits and programs available.

Outreach Audiences and Activities: The Museum of Geosciences welcomed 5,400 visitors. Those visiting include individuals and families, a Paleontology program for Auburn High School, 4-H tours bringing all the 4th graders from Tazewell County, Dublin Middle School 7th grade tours, VT course uses, New River Valley Master Naturalists, meetings, and receptions for various events.

The following is a listing of other Outreach venues:

- Second-floor hallway exhibits in Derring (outside Museum of the Geosciences).

- "Argyle Diamonds and Inclusions" exhibit at Tucson International Gem and Mineral Show, February 2007, developed as part of an independent study by Logan Cutshall (GEOS 07).
- "Minerals of South America" exhibit at Denver Gem and Mineral Show, September 2006, developed by Cenk Ozerdem and Logan Cutshall.
- ERC, SOuP, and Museum of Geosciences loans and direct program contacts, "Meaningful Watershed Educational Experiences" as recommended in the 2005 renewal of Virginia's Bay Recovery Program.
- Colleagues and stakeholders in meetings of VT STEM, the Virginia Resource Use Education Council, the New River Watershed Roundtable, the Blacksburg Comprehensive Plan Task Force, the Virginia Watersheds Alliance, the Virginia Association of Science Teachers, the Stroubles Creek Watershed Initiative, and other groups.
- Students in GEOS 1104: Physical Geology Lab**.** Llyn Sharp supervised the 8 GTAs for this course during AY 06-07. (270 F, 125 Sp, 10 Su). Llyn also co-supervised GRAD 5974 Independent Study for Pedagogy in Geosciences Lab.
- Other Courses include GEOS 4974 (Independent Study in "Museology"), LAR 4244 (Landscape Techniques and Hydrology), and GEOS 3504 (Mineralogy). Llyn also co-supervised GRAD 5974 (Independent Study for Pedagogy in Geosciences Lab).

*Outreach Personnel***:** (this is only a partial list of people involved; all are from the Department of Geosciences unless noted.)

Llyn Sharp, coordinator
Sarah Windes, on-site museum programs
Logan Cutshall, museology independent study, Fall 06
Faculty assistance: Jim Beard, Bob Bodnar, Martin Chapman, Patricia Dove, Bill Henika, Mike Hochella, Kathleen Jamison (VCE-4H), Vik Liogys, Penny McCallum (OIA), Don Rimstidt, Mike Rosenzweig (BIOL), Nancy Ross, Maddy Schreiber, Bob Tracy, Shuhai Xiao, Tamim Younos (VWRRC)

Staff assistance: Linda Bland, Miles Gentry, Richard Godbee, Jim Langridge, Mark Lemon, Connie Lowe, Ellen Mathena, Mary McMurray, Dan Smith, Carolyn Williams

Alumni and Friends: Summer Brown, Don Dalton, Frank Smith, Keith Williams

Graduate Student Volunteers:

In-school programs and science fairs: Kristyn DeMarco, Beth Diesel, Deric Learman, Kelly Haus, Nick Wiggington, Allison Stephenson

On-site programs: Aaron Berger, John Huntley, Jim Shiffbauer, Jen Stempien

Exhibit development: Cenk Ozerdem

Undergraduate Volunteers: Joan Baker, Jason Betzner, Katie Brutsch, Elizabeth Buckner (AOE), John Frame, Alice Lee, Justin Ohlschlager, Megan Punke, Asa Spiller (CSES), Jason Waters, Lindsay Yann

Student Organizations: Sigma Gamma Epsilon (SGE), Geology Club, American Society of Agricultural and Biosystems Engineers (ASABE), American Water Resources Association (AWRA), Soil and Water Conservation Society (SWCS), Society of Environmentally Focused Students (SEFS).

Outreach Partners: Biological Sciences, Biological Systems Engineering, Montgomery County Public Schools, New River Watershed Roundtable, New River Valley Master Naturalists, Science Outreach Program, Stroubles Creek Watershed Initiative, Virginia 4-H, VT STARS, VT STEM K-12 Outreach Initiative, Virginia Water Resources Research Center, Wilderness Conservancy at Mountain Lake.

Outreach Activity Related to Formal Educational Programs: Assistant Professor Barbara Bekken has worked steadily since May 2003 to promote the *Living in the 21st Century* alternative and integrative core-curriculum program which is now a recognized option in VT Pathways and is evident in the language of the 2006-2012 university strategic plan.

Outreach Activity Related to Virginia Tech Seismological Observatory: Research Assistant Professor Martin Chapman is Director of the VTSO. In September, 2006, he was asked by the U.S. Geological Survey to serve on a panel of experts to review the next generation of strong ground motion prediction models for western North America. The panel met for three days in Berkeley, CA. The panel report provided guidance to the developers of the models (the work is sponsored by the USGS and the PEER center), and advised the U.S. Geological Survey as to the use of the models in the next generation (2007 version) of the National Seismic Hazard Maps and Building Codes.

Professor Chapman serves as a member of the expert review panels/ technical advisory groups for several commercial nuclear projects in Virginia and elsewhere in the southeast. His role is to provide technical guidance to the utilities and their consultants on issues of earthquake engineering and seismic hazard for sites in the eastern United States:

1) Dominion North Anna Nuclear Power Facility
2) Southern Services Vogtle Nuclear Power Facility
3) TVA Bellefont facility
4) Nustart/Grand Gulf facility
5) Constellation Calvert Cliffs facility

In addition to its seismological research mission, another objective of the VTSO seismic network operation is to compile and distribute information directly useful for hazard assessment and mitigation. The Bulletin of the Southeastern United States maintained by this project contains hypocenter location and phase arrival data contributed since 1977 by all seismic network operators in the region. Chapman's project compiles and maintains a comprehensive catalog of both historical and instrumental earthquakes in the region. This catalog is a primary data set for probabilistic hazard assessment in the region, and is currently being used by many of the utilities in the region for updating their hazard assessments of critical facilities. These products are available electronically at the VTSO website.

The VTSO network records an immense number of events associated with mining activity in the Appalachian basin. During 2006, Chapman contributed much useful information to state and federal agencies such as MSHA, as well as to mining companies,

such as Consolidated Coal, Inc. The examples included his contribution to understanding the cause of the tragedy at the Sago mine in WV, and a chronological assessment of events leading up to the series of major roof failures at the Buchanan #1 mine.

Professor Chapman responds to a continuous stream of public and professional requests for information in the field of earthquake seismology, and as a result frequently represents the Department of Geosciences, the College of Science and Virginia Tech in the press, on TV and radio. He interacts closely with the Virginia Department of Emergency Management as well as the Richmond city Office of Emergency Management.

Diversity

The Department of Geosciences has been active in improving diversity within our student and faculty populations. We currently have 4 female faculty (out of 19 tenure-track faculty). As of Spring 2006, our graduate population was over one-third female (19 out of 57 students). Several faculty members, including Nancy Ross and Madeline Schreiber, are active in the AdvanceVT Program.

In terms of increasing the number of ethnic minority students, we have struggled, as have other Geoscience Departments around the U.S. A July 2005 article in Eos, a weekly journal of the American Geophysical Union, reported on a study of ethnic differences in geoscience attitudes of college students. The study found that both cultural and social factors, including exposure to what geoscientists do, involvement in outdoor activities, and family support, play a role in explaining the poor representation of ethnic minorities in Geosciences (see Whitney et al., 2005). With that said, the department has recruited 1 African-American undergraduate major in Geosciences. In our graduate program, we have 1 Native American and 2 Hispanics. The Department has several graduate students that are MAOP Scholars. For 2006-2007, we had 3 MAOP Scholar recipients (1 Native American and 2 women).

The College of Science Diversity Committee has recognized that each department in the College has different strategies for addressing diversity issues. This spring, the committee set forth to gather data from each COS department to determine what diversity activities are already occurring in departments, and to inquire about what type of assistance departments need in the area of diversity enhancement. Responses from the survey showed that Geosciences is very similar to other COS departments with respect to diversity initiatives. All departments that responded, including Geosciences, participate in MAOP academic year graduate programs and expressed interest in pursuing graduate recruiting at HBCUs or other minority institutions. Several COS departments are currently hosting MAOP summer interns; Geosciences is not one of those departments but expressed interest in participating in the future. Geosciences also has a faculty mentoring program for new faculty, as does several other COS departments.

Although we are closing the gender gap in Geosciences, we have yet to significantly improve the participation of ethnic minorities in our field. As this is a national trend, our struggles are not unusual, but we hope to increase minority students in our field in the coming years through more active recruiting of graduate students in HBCUs and other minority institutions. We also hope to participate in supporting minority students in high

school and college summer research programs, and to increase the number of minorities in our undergraduate major.

The Department of Geosciences is a partner in a new curricular effort in distributed core education which has been spearheaded by Barbara Bekken of Geosciences. The Earth Sustainability series is designed to be race and gender inclusive through its social justice modules and pedagogically inclusive through a learning community model. The series has been very popular with women, and while it is not as racially diverse (yet) as we might have hoped, we have made a special effort to recruit international students to it and to incorporate students from broad and diverse socioeconomic groups. In the first learning community discussions, we introduce the Principles of Community and revisit them each term. In either the second or third term, we introduce service learning projects that link students to issues of concern to residents of the Appalachia. Many of our students join advocacy groups rooted in social justice issues while participants in the series.

In addition, Bekken and other faculty continue to informally mentor younger women in Geosciences and other science departments who seek professional roles that are non-traditional. We especially encourage those who think that working "outside of the box" is not an option and we challenge them to reconsider their perspective and revisit their assumptions about what is possible.

Reference:

Whitney DJ, Behl RJ, Ambos EL, Francis RD, Holk G, Larson DO, Lee CT, Rodriguez CM, and Wechsler SP. 2005. Ethnic differences in geosciences attitudes of college students. EOS, Transactions of the American Geophysical Union 86 (30): 277.

Plans and Goals for 2007-2008

In early 2005 the department conducted a retreat to focus on the future strategic directions of the department. The two strategic focus areas that emerged with a strong faculty consensus from this process were two broad interdisciplinary programs that explore new research areas for the department as well as connect with existing strengths. These two "umbrella" strategic initiatives are ***Rheodynamics*** and ***Integrated Studies of Earth Systems***.

> ***Rheodynamics*** focuses on evolution of the upper mantle and crust of the earth, with emphasis on deformation processes within the earth, from large scale geodynamics through tectonics to the rheological properties of rocks and minerals. This strategic area involves several disciplinary areas within geosciences but a central component is geophysics, including geodynamics, geodesy, seismology, and rock and mineral physics. Other disciplinary areas within this initiative are structure and tectonics, volcanology and magmatic petrology.
>
> ***Integrated Studies of Earth Systems*** involves synergistic and collaborative research within the broad disciplinary areas of global climate change, paleoceanography, carbon cycle geochemistry, glaciology, geomorphology, marine geology and planetary geology. This area would both enhance and complement our existing faculty strengths in sedimentology, stratigraphy, paleobiology, hydrogeosciences, and geomorphology.

During 2006 the Department of Geosciences was able to take advantage of a university-wide cluster-hiring plan in Computational Science to begin the process of implementing our strategic initiatives through hiring of 3 computational geophysicists (Rheodynamics) and one computational paleoclimatologist (Earth Systems). The Geophysics faculty had been reduced by Fall 2006 to retiring professor Arthur Snoke, one associate professor (John Hole) and one non-tenure track research assistant professor (Martin Chapman). The Department has now hired a senior candidate Scott King (Professor) in geodynamics, and three junior candidates: Chester Weiss (Associate Professor) in EM geophysics, Ying Zhou (Assistant Professor) in mantle seismology, and Jacob Sewall (Assistant Professor) in paleoclimatology. Ying Zhou arrived in January 2007 and the others will join the Department in August of 2007. In addition to these, we have also hired as a Research Scientist Erin Kraal (Geomorphology/Planetary Geology).

The hiring of additional candidates who fit our strategic initiatives is imperative for the future growth and goals of the Department. Our principal goal is to become a top-15 Geoscience program, and a top-5 program in public universities, and the faculty agree that expansion into these new growth research areas is essential. Our plan is to augment faculty size from the current twenty tenure-track positions (as of Fall, 2007) into the low- to mid-thirties of tenure-track positions by 2015 and simultaneously to increase our graduate student population from the current 65 to about 100+. In addition to expansion into the two new strategic interdisciplinary areas, the Department must also address critical needs in its disciplinary profile. In the next five years we anticipate five additional retirements in geochemistry, petrology, carbonate and clastic sedimentology and in tectonics, beginning with the departure of Krishna Sinha in 2008, followed by at least two others who have indicated an intended departure in 2010. A healthy departmental profile requires addressing these disciplinary needs and will add additional challenges that the existing faculty must address in order to keep the Department on a course of growth and enhanced national standing, while providing students with a world-class education. We MUST increase the size of the geophysics faculty to roughly one-third of total faculty size in order to be competitive with our peer departments. This means aiming at having eight tenure-track faculty out of roughly 24 positions within two years time. Since we will have four in fall 2007 (King, Hole, Weiss and Zhou), this means adding three to four more as soon as manageable. Departure of three geochemistry-petrology faculty (Sinha, Rimstidt, Tracy) by 2011 requires attention to this general area if departmental status and visibility is to be maintained.

Toward this end we have submitted to the dean a hiring plan for 2007-2008 that requests four positions: reflection seismology/exploration geophysics, magmatic petrology, Earth Systems, with emphasis on a stable isotope geochemist, and earthquake seismology. Further positions high in priority for succeeding years include geomorphology/planetary surfaces, volcanology, geodesy, fault mechanisms, tectonics and stratigraphy.

The Department's current administration also continues to work diligently to enhance alumni relations. We recognize that the future intellectual and fiscal well-being of the Department of Geosciences is closely tied to the generosity of its alumni and friends. We have already begun, during the spring of 2007, to publicize the centennial graduation of

the first geology student from Virginia Tech in 1907. Our celebration will culminate in the fall of 2007 with a special alumni reunion weekend in early October.

The strong commitment to development by the department and the College of Science has already led to several large donations that we hope will result in a new state-of-the-art Geosciences Building and Geology Museum in the near future, as well as the potential for at least two endowed chairs (in geophysics and in tectonics). We expect to be given the opportunity to begin the planning process for a new building in the next academic year, and hope that endowed chairs will enable us to proceed more rapidly with our expansion plans.

During the 2007-2008 AY, the Department of Geosciences is scheduled to undergo a thorough five-year review of its operations and programs. We have nominated six candidates for selection as external review committee members to the dean and await appointment of three. We have just begun the internal process of data-gathering and self-assessment that will be a major part of the final report.