GEOSCIENCE NEWS

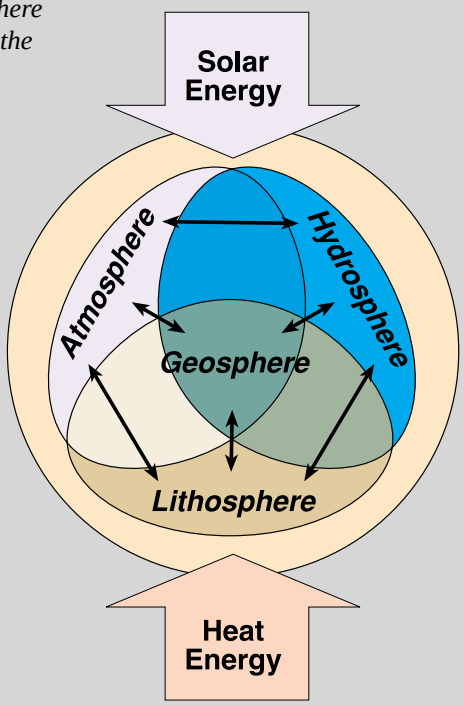
for the Alumni and Friends of the
Department of Geological Sciences
University of Michigan, Ann Arbor, Michigan

Summer 2002

Greetings from the Chair

During the past academic year the Department of Geological Sciences underwent an intensive self-study and formulated a comprehensive long-term plan for the next decade. The process began last summer with a series of committees and working groups charged with collecting and analyzing available data and trends in the field. This was followed in the fall by an off-campus faculty retreat, weekly faculty meetings, and input from the Alumni Advisory Board during their October meeting in Ann Arbor. A final document was presented to the Dean of LS&A and College Executive Committee in mid-December of 2001. I am very excited about the present position of the department as well as our faculty and alumni's forward looking views. I would like to devote this letter to sharing with you some of the department's thoughts and plans for the future of Geological Sciences outlined in the introduction to our Long-term plan.

Figure 1. The Earth Systems Science paradigm for The Geosphere (After Christensen, 1991). The flow of materials and energy in the Geosphere (the outermost circle) link together the lithosphere, atmosphere, hydrosphere and ecosphere



The geological sciences are by their very nature an interdisciplinary field of study. The broad subdivisions of our present department—geophysics, geochemistry and paleontology—reflect the traditional linkages of our science to the sister scientific disciplines of physics, chemistry and biology. The geological sciences are true integrators of nearly all of basic science (Figure 1). This statement is not simply rhetoric from geoscientists. Leon Lederman, Nobel Prize winner in physics, has, for example, suggested that the secondary school science curriculum be inverted. Begin with physics, he argues, followed by chemistry and biology, and capped with a course in Earth science. In his words—"I strongly recommend that the 4th year be devoted to Earth science for its integration of disciplines, its intrinsic importance and its daily applicability" (Physics Today, 2001). Today's academic environment at the University of Michigan similarly benefits from the broad, interdisciplinary nature of modern geological science.

The Department of Geological Sciences at the University of Michigan is among today's top Geological Sciences departments in the nation and one of the highest ranked science units on campus. However, within today's rapidly evolving academic environment, we cannot afford to be complacent. Our goals and vision for the next decade will require a broadening of our research mission through more integrative science and greater emphasis on societal relevance, while maintaining core strengths.

The challenges of the future lay in enhancing the interdisciplinarity of the Department, and being able to bring this broadened vision to bear on the central questions of geological and environmental science. To this end the Department is developing a full Earth Systems Science capability, representing an integrated

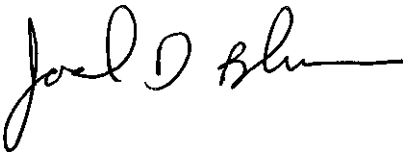
approach to the study of the Earth that ties together the four-fold geosphere: the lithosphere, atmosphere, hydrosphere and ecosphere. If there is a single most-important paradigm that has emerged in the last decade it is that no part of the Earth is disconnected and isolated. Climate is strongly dependent on the coupling of the atmosphere and oceans; life on the continents and in the oceans is dependent on the chemistry of its environment; human life is both influenced by the natural hazards associated with a dynamic Earth, and in turn human activities are now of such a scale as to alter the atmosphere and hydrosphere, and modify the global climate.

This year the National Research Council (an agency of the National Academy of Sciences) published a major assessment of the future of geological sciences entitled *"Basic Research Opportunities in Earth Science"* (National Academy Press 2001). These recommendations agree to a large degree with our departmental priorities and vision. The 2001 report emphasized the Earth System Science approach and greater emphasis on the societal relevance of geology, and identified three emerging research areas where major new investments or significant additional resources should be targeted.

1) Geobiology, "to permit studies of the interactions between biological and geological processes, the evolution of life on Earth, and the geological factors that have shaped the biosphere. *2) Research on Earth and planetary materials*, "to take advantage of major new facilities, advanced instrumentation and theory in an atomistic approach to properties and processes. *3) Integrative studies of the 'critical zone*', to support studies of "the heterogeneous, near-surface environment in which complex interactions involving rock, soil, water, air, and living organisms regulate the natural habitat and determine the availability of life-sustaining resources." The report also emphasized continued support of basic research in the more traditional geological endeavors of *Investigations of the continents, Studies of the Earth's deep interior*, and *Planetary science*.

The changing intellectual and funding climate in geological sciences requires both diversification and expansion of our research mission. We therefore plan to hire several new faculty in the next few years that will be supported by anticipated retirements and will also require some growth. By embracing the Earth System Science approach and having a greater focus on geological hazards, we will become a more integrated and societally relevant geological sciences department, which has been the engine of the recent success and growth in geological sciences. Beside an obvious impact on the research program, broadening of our research mission will significantly improve the appeal of our department for future undergraduate and graduate students. We envision new courses at the introductory level in newly added fields, such as Earth System Science, as well as changes to our upper level undergraduate curriculum and graduate education program. Rather than redistributing current enrollments, we expect that this will result in significant growth. Moreover, these developments will contribute significantly to the curriculum of the new Program in the Environment major on campus.

Sincerely,



Joel D. Blum
Chair

On the cover – Field Studies in the Snow and Ice: Paleogene sequence on Seymour Island, Antarctica (photo by Linda Ivany)

Honors, Awards, Kudos

Walter Oscar Kupsch (MS'48, PhD'50) received the GSA's History of Geology Award. Walter, Professor Emeritus of Geology in the University of Saskatchewan, has enjoyed a 60-year love affair with the science of geology, throughout which he has taken every reasonable opportunity to expose and interpret its history. He has done this in part through sustained service to a variety of professional organizations, but mainly through his own research, the pursuit of which straddles key events in his career and the rich comprisal of geological and related fields in which he has engaged. Three disparate examples make the point. A postdoctoral appointment to the faculty of Saskatchewan's provincial university in 1950 formed the backdrop to Kupsch's studies of certain critical geological blocks of the prairie heartland. Review of prior investigations in these led him to evaluate the written records left by three illustrious figures in medicine and science who had been members of exploratory expeditions to British North America in the early-to-middle nineteenth century. Exposition of this fascinating chapter in the history of the Canadian Great Plains can be found in *Pioneer Geologists in Saskatchewan* (1955), written by Kupsch for the province's golden jubilee.

Appointment as Executive Director of the Carrothers Commission on Government of the Northwest Territories in 1965 was the first of a series of prestigious positions held by Kupsch that fueled latent interest in the Canadian North and brought him face to face with the history of exploration of what he himself has called "a vast, empty, cold country". *Living Explorers of the Canadian Arctic (1986),* with Shirley Milligan, is merely one of the historical works that developed from his Arctic interests.

Finally, the discovery of rich uranium mineralization in the Athabasca Basin of northern Saskatchewan in 1972 generated in Kupsch an interest in the history of mineral exploration, one that burgeoned in subsequent years and led to the inclusion of other kinds of industrial and precious metal deposits. The uranium story was summarized historically in his lengthy 1978 paper, *From Erzgebirge to Cluff Lake – A Scientific Journal Through Time.*

Kupsch's predilection for the history of geology has its roots in the elementary and high school education he received prior to WW II in his native Netherlands – an education forcefully shaped by the historical tradition. In like fashion, his geological breadth and versatility can be traced to experiences in the University of Amsterdam and the University of Michigan. As an undergraduate student in the former, he had to satisfy a broad-based geological curriculum that did not permit elective specialization. As a graduate student (MSc–'48, PhD '50) at the University of Michigan, he was directed by one of North America's renowned geological generalists, A.J. Eardley, who, by engaging Kupsch in field-based regional interpretations, required that he draw upon the full range of his diverse undergraduate training.

Robert H. Dott, Jr. (BS'50, MS'51) received the Laurence L. Sloss Award of the Geological Society of America. The Sloss Award is given in recognition of outstanding contributions to the interdisciplinary field of sedimentary geology. It's hard to imagine a geologist more interdisciplinary in outlook and practice than Bob. Trained in classical stratigraphy and biostratigraphy by Marshall Kay at Columbia, Bob first worked in the petroleum industry and then served as a first lieutenant in the U.S. Air Force, stationed in the geophysics division of the Cambridge Research Center. He arrived in Wisconsin as an assistant professor in 1958 and began a two-decade research program in sedimentary tectonics, with special emphasis on the Pacific Rim on North and South America. Along the way, Bob published landmark papers on the dynamics of gravity flow deposits, the geosyncline concept, paleocurrent analysis, and the proper approach to the classification of immature sandstones. He also authored studies in paleogeography and paleoclimate, as well as interpretations of depositional environments from desert to sea cliff to marine shelf to deep-sea fan. In the 1980s, his focus shifted to cratonic strata, as he and his

students broke new ground in the description and interpretation of hummocky stratification and of genetic sequences in eolian strata. Beyond his fame as a sedimentary geologist, Bob has long maintained a second career as a historian of science, including teaching an advanced course in the history of geologic thought and publishing scholarly articles and books.

In academia, Bob rose rapidly through the ranks, served as department chair, then became an endowed professor and president of SEPM. In addition, he became the Twenhofel Medalist, and now the Sloss awardee. He retired from teaching in 1994 and is currently the Stanley A. Tyler Emeritus Professor. As part of his career, he has directed 59 graduate students, taught extensively at all levels, and co-authored a premier undergraduate textbook, *Evolution of the Earth*. As SEPM president, he spoke out loudly and boldly against the resurgent creationist threat to education.

Stewart R. Wallace (MS'48, PhD'53) was inducted into the National Mining Hall of Fame on September 8, 2001. Stew, through his discoveries of the Henderson Mine and the Ceresco orebody at the Climax Mine, influenced molybdenum mining in Colorado and molybdenum exploration in western North America. These monumental discoveries and their subsequent exploitation contributed enormously to Colorado's mining industry and its overall economic well-being.

Stew earned his BA in Geology at Dartmouth College, graduating in 1941. After serving in the US Army from 1941-1946, he earned MS and PhD degrees in Geology at the University of Michigan. From 1948 through 1955, he served with the US Geological Survey (USGS) mapping mineral districts in the western United States. In 1955, Wallace went to work for Climax Molybdenum, first as resident geologist at Climax, CO, and later as chief geologist and then as chief of geology and exploration. While working for Climax Molybdenum, he and his team of geologists conducted detailed studies of the geology at Climax and Red Mountain, the location of the Henderson orebody. From that work, Stew developed a multiple-intrusion model to describe the complex magmatic and hydrothermal events that produced the Climax orebody. This model then allowed him to predict the presence of and find the Henderson orebody. At the Climax Mine, his work resulted in the discovery of the Ceresco orebody and the deep, offset portion of the Ceresco orebody that lies across a major fault. Wallace examined numerous deposits and prospects, largely for molybdenite, in the United States and in other countries.

In 1992-1993, he served as the President of the Society of Economic Geologists. Stew Wallace's larger legacy arises from his study of and insights into the origin of molybdenum orebodies. He guided and inspired a whole generation of exploration geologists, whose research and explorations fostered the discovery of several more molybdenum orebodies in western North America.

George H. Davis (PhD'71) the Regents Professor of Geosciences and Senior Vice-President of Academic Affairs and Provost of the University of Arizona, was honored at an April banquet hosted by his Department, for his distinguished accomplishments and contributions to the Department.

Congratulations to **Ruth Blake** (PhD'98) on receiving the Clarke Medal of the Geochemical Society for 2002. Ruth received her Ph.D. in 1997 from this Department under the supervision of Jim O'Neil and Lynn Walters. She currently is an Assistant Professor at Yale University in the Department of Geology and Geophysics

Rod Ewing (U-M Faculty) has had a banner year. He was elected President of the Mineralogical Society of America, awarded a Guggenheim Fellowship and won the Hawley Medal (best paper award given by the Mineralogical Association of Canada).

Dan Fisher (U-M Faculty) has been awarded a Collegiate Professorship in the College of LS&A.

The European Association of Geochemistry and the Geochemical Society selected **Phil Meyers** as a Geochemistry Fellow for 2002. Honors were bestowed at the Goldschmidt Conference in Davos Switzerland in August.

Congratulations to **Ted Moore** for being selected as an American Geophysical Union Fellow for 2002. This fellowship is awarded to only one in a thousand members of the AGU.

Just-graduated undergraduate major **Doug Boyer** (BS'02) was awarded an NSF graduate fellowship for use at the graduate school of his choice. Doug has consistently contributed to the academic and social character of the Department.

Congratulations to **Tony Goodman**! Tony has been selected by Joint Oceanographic Institutions in Washington DC for a 12-month internship starting in July. Competition for this position was fierce - Tony was one of the two finalists invited to DC for an interview out of an initial group of about 50 applicants. His duties will principally involve the Ocean Drilling Program and its successor, the Integrated Ocean Drilling Program. He will be helping the permanent JOI staffers with organizing meetings and producing documents, and he might even spend a little time at sea on a research cruise.

Graduate Student **Chris Palenik** was awarded a fellowship from the Office of Civilian Radioactive Waste Management to support his PhD research.

In addition to the number of external awards received by our alumni, faculty and students, the Department had the honor of bestowing several awards to current graduate and undergraduate students during this past semester. This year, **Andrew Jacobson** received the *Dorr Award* for excellence in graduate research. Andy has completed some highly significant research on the controls of weathering processes on the $^{87}Sr/^{86}Sr$ composition of the oceans. Andy is continuing his postdoctoral research at CalTech under the direction of Jerry Wasserberg. **Boris Kiefer** received the Department's *Graduate Academic Achievement Award* for his numerous contributions in the field of mineral physics. Boris completed his research this summer and is presently serving as a postdoctoral fellow at Princeton University.

Doug Boyer (BS'02)**, Tony Goodman** (BS'02)**, Geoff Horst** (BS'02)**, David Singer** (BS'02)**,** and **Demmy Spounias** (BS'02) graduated with Honors at the May Commencement ceremonies.

In recognition of their contributions to the Department as undergraduate students, several awards were presented at this year's Dorr Dinner. These include the award for *Undergraduate Academic Excellence* that was awarded jointly to **Doug Boyer** and **Demmy Spounias**. The *Undergraduate Camp Davis Field Geologist Award* was given to **Emily Johnson** for her insightful and energetic accomplishments in the GS 440, Geological Field Methods course, during this last summer. **Tracy Kolb** received the *Undergraduate Outstanding Citizen Award* for her numerous contributions to the Department's spirit. She has served on the Halls and Walls decoration committee and is an active and vocal member of the Geology Club. Our thanks and congratulations go to all of these excellent students.

Undergraduate Award Winners 2002: Emily Johnson, Tracy Kolb, Demmy Spounias, and Doug Boyer (left to right)

Kenneth Vanlier (BS'50) is still spending the summers on Lake Michigan and winters in Alaska with visits to Florida as well.

Charles W. Swithinbank (Research Associate and Lecturer '59-'63) has published four books on his polar field work. *An Alien in Antarctica* (Blacksburg, VA, McDonald & Woodward 1997), describes three U-M Antarctic expeditions; *Forty Years on Ice* (UK, The Book Guild, 1998), describes 12 other expeditions; *Foothold on Antarctica* (UK, The Book Guild, 1999), describes Charles' very first expedition (1949-1952); and *Vodka on Ice* (UK, The Book Guild, 2002) described a year he spent with the Soviet Antarctic Expedition (1963-1965). All are still in print. While at U-M, Charles collaborated with Professor Jim Zumberge.

Leon Reiter (MS'68, MA'70, PhD'71) celebrated his 70th birthday with family this year. Leon and wife Harriet live in the Washington DC area, where he retired after many years as a seismologist with the Nuclear Regulatory Commission and the National Research Council. Leon is the author of *Earthquake Hazard Analysis*, published by Columbia University Press in 1990.

Shelby Boardman (MS'69, PhD'71) has been appointed Dean of the College at Carleton College in Minnesota.

David Murphy (MS'78) is the Assistant Field Manager of Minerals and Lands for the U.S. Bureau of Land Management Kemmerer Field Office, in Kemmerer, Wyoming. He oversees the minerals, land and archaeology programs including a large oil and gas exploration and development program. Living in Southwestern Wyoming, Dave and his wife had the opportunity to attend the Salt Lake City Winter Olympics.

Joaquin Ruiz (MS'80, PhD'83) is enjoying his responsibilities as Dean of the College of Science at the University of Arizona. In spite of the pressures and fast pace in the Deanery, and the budgetary constraints imposed on the University by the state legislature, Joaquin still maintains his sense of humor.

Bernard Coakley (BS'81) has moved from Tulane University to the Geophysical Institute of the University of Alaska in Fairbanks.

Arijeet (Art) Sengupta (MS'84). After completing his studies, Art obtained professional licenses to practice Geology and Engineering. Currently, Art is working for South Florida Water Management Distribution managing two large components of the Everglades restoration. Art's wife works as an engineer for Motorola. He has twin daughters currently in grades 8. Both aspire to become doctors, not geologists or engineers.

Bart Tichelaar (PhD'91) informs us that sixteen years after he came to the USA to live, study, and work at U-M and ten years after he left U-M to join Shell Exploration and Production Research in Hague, The Netherlands, he will come back to live and work in the USA. Bart recently accepted a challenging job as a "rock doctor" at Shell Deepwater Services in New Orleans. His start date is August 1, 2002. Bart is currently living with his wife and two young children in Aberdeen, Scotland. This change will mean a move from the cold and foggy to the hot and muggy swamplands. Luckily the language remains more or less the same. Following six years at Shell Research, Bart moved to London, England, to take a job

as a senior geophysicist in the New Business Development directorate of Shell UK, working most of the time with state-of-the-art seismic imaging technology to explore the North Sea and UK Atlantic Margin. Subsequently, he moved to Aberdeen, Scotland, to lead a seismic imaging group of mainly PhDs to optimally develop oil and gas fields in the North Sea Basin. Following a few exciting (winter time) offshore adventures to keep up his research skills, the time has now come to move to warmer places.

Saskia Goes (postdoc'96) and **Mark Rehkamper** (PhD'97) have a new son named Jasper, born on June 4, 2002. Saskia and Mark both have research positions at the ETH in Zurich, Switzerland.

Gone Fishin'

Donald R. Peacor retired from the University of Michigan on May 31, 2002. Don was hired as a Lecturer in the Department of Mineralogy of the University of Michigan in 1963 after completion of his dissertation at MIT in 1962 and a BS at Tufts University in 1958. He was promoted rapidly to Associate Professor in 1967, followed by appointment to Professor in 1974 in the newly recombined Department of Geology and Mineralogy. Don's early research focused on the crystallography of rock-forming minerals. He designed and built a device for structure refinements of crystals at high temperature and evaluated phase transitions *in situ* for important compounds such as anorthite and cristobalite. He also described a very large number of new minerals over the years. In the last 25 years, he has been deeply involved with research using transmission electron microscopy. Working with graduate students, he completed many important studies on the structures, textures and the reaction histories of low temperature minerals, principally clays, oxides and carbonates. Don, in collaboration with Rob Van der Voo, also examined the structural and chemical changes in magnetic oxides from sea floor basalts to gain a deeper understanding of the causes of ocean floor magnetic anomalies.

Professor Peacor is well remembered to generations of geology majors for his engaging teaching style, especially in his Mineralogy GS 231, and for the famous field trip each fall to mineral collecting localities near Bancroft, Ontario. He directed the Electron Microbeam Analytical Laboratory between the years 1988 and 2002. Under his leadership this University facility, with branches both on North and Central Campus, grew markedly both in usage and the breadth of instrumental capabilities. Don has also been active in many outdoor activities, including birdwatching, butterfly collecting, mushroom hunting, and his greatest passion–flyfishing for trout–especially in Wyoming, New Zealand, and on Michigan's Au Sable River.

U-M Alums at AAPG Reception

Approximately thirty people attended the Alumni Reception held this year at the American Association of Petroleum Geologists annual meeting held in Houston, Texas. This was the first time for several years that the Department has sponsored such a gathering in the oil patch to provide a setting for colleagues and friends to rekindle their ties to the Department and reminisce on the good times at U-M. By announcing the reception to all of our alumni with a postcard reminder, the group included both those attending the meeting as well as several alumni living in the area. Given the success of this year's event, the Department will continue to announce these events for all of the major national conventions to encourage everyone to spend an evening visiting with U-M crew and old friends. In the coming year, receptions will be held at the annual meeting of GSA in Denver October 29-30, and also for the first time, at the American Geophysical Union meeting to be held in San Francisco December 6-10. We look forward to seeing you.

The Department looks forward to seeing you all at the upcoming receptions at GSA in Denver and AGU in San Francisco. We will keep you posted on the location and time of all of these upcoming events.

Volker Vahrenkamp (MS '83), Eva Moldovanyi (MS '82), Laura Ulrich (MS '79), and Larry Davis (MS '79)catch up on past events and future prospects.

Ken Keenmon(BS '46, MS '48, PhD '50) and Steve Henry (BS '73, MS '78, PhD '81) discuss the ups and downs of the petroleum industry. Ken has become a frequent attendee of activities for U-M alumni. In addition to this reception, he spent last summer at the Camp Davis Alumni Geology Camp in Jackson Hole Wyoming. The Department hopes that these events will provide the opportunity for all of the alumni to come together with faculty, students and classmates.

Karen Boven (BS '96, MS '98) and Chuck Kaiser (MS '83) share stories and encouragement about industry jobs in the post-ENRON world. Karen, who currently works with the pipeline industry, got married a few weeks after this meeting…Congratulations! Chuck, a member of the geologic division with ENRON, was searching for new opportunities in the petroleum field. Given his experience and background, we are certain that he will succeed in his quest.

Bob Breitenwischer (BS '52, MS '53) and Bruce Dice (BS '50) took advantage of the reception to visit with friends and rediscover members of the Department.

Spring Field Trips: 2002

This year, two major field excursions were undertaken to provide graduate and undergraduate students hands-on perspectives of sedimentary and metamorphic rock systems. These trips were supported through a combination of funds provided by CONOCO and the Field Excursion Endowment generously provided by an alumnus. The Department and students are grateful to both donors who have provided the opportunity to explore the wonders of geology in the natural field setting.

Hard Rockers Descend on New England and Canada

Eric Essene and Sam Mukasa took the first UM hard rock trip to New England and Montreal in twenty years, just after the end of the winter term. Chuck Carrigan (PhD '04), Casey Donahue (PhD '02), Holly Frey (PhD '03), Zeb Page (PhD '04) and his wife Lily and their two dogs, Chris Smith (PhD '04), Dave Singer (BS '02), and John Solum (PhD '04) were on the trip. They had much rain and even snow, but most of them survived. They saw a lot of rocks including the Gouveneur area and the Gouveneur Rod and Gun Club (this time they avoided updating their membership: the Cranberry Lake campground was still closed), Balmat, Harrisville (Scanlon's Bakery was closed except on weekends, a great disappointment), Wanakena, Cascade Slide and Gore Mountain in New York; Townshend Dam, Gassets and other stops in southern Vermont; the Portsmouth areas, White Mountains and a beautiful campground, Connecticut Lakes, in northern New Hampshire; Mt. St. Hilaire, Mt. Royal and Oka in Quebec; the Sarbout Lake Campground (which was locked, but…), Kaladar, the pillow lavas and conglomerates at Cloyne, black marbles and other stops at Madoc in Ontario. Many of these same rocks were studied by Larry Anovitz (PhD '87), Steve Bohlen (PhD '79), Phil Brown (MS '77), Jay Busch (PhD '95), Mike Cosca (PhD '90), Larry Edwards (MS '86), Karen Hoffman (MS '82), Klaus Mezger (Postdoc '92), Dave Moecher (PhD '90), Mark Rathmell (MS '93), Joe Sobol (MS, '73), Meg Streepey (PhD '01), Allan Treiman (PhD '86), John Valley (PhD '80) and Alex van den Berg (MS '75).

Texas 2002 – The Soft Rock Spring Field Excursion

During the first two weeks of May, Bruce Wilkinson, Kacey Lohmann, and Carola Stearns led an excursion of 26 students from Ann Arbor to a final destination on Matagorda Peninsula, Texas. Students visited the classic Paleozoic cratonic sequences of Indiana, Missouri, and Kansas. These included: the Silurian limestone reef at Pipe Creek Jr., Gas City, Indiana; Mississippian oolitic and skeletal limestones of central Indiana; the Cambro-Ordovician sequences of the St. Francois Mts., Viburnum Trend, Missouri (with informative explorations of the Precambrian volcanic rocks at Johnson Shut-Ins); and the classic cyclothems of eastern Kansas. Proceeding westward across north Texas, the group spent a day in the Mesozoic exposures around Palo Duro Canyon, studying the Triassic Dockum Group and features of the Pliocene Cap Rock caliche. Fortunately, the group headed further west just in time to miss the severe tornados that devastated parts of Amarillo, Texas.

The majestic El Capitan, Permian Reef Complex, frames the crew the Soft Rock Field Trip during their excursion into the adjacent Delaware Basin.

The geologic focus of this trip was the Permian Reef Complex of west Texas. The group spent several days examining the transitions from restricted shelf sediments into the massive reef, across the forereef into the deep adjacent basin comprising debris flows, thick units of siliciclastics, and the intricately banded gypsum of the Castile Formation. The day-long hike up McKittrick Canyon was one of the highlights for everyone this year and they were fortunate to have cool weather during the entire day of the hike. While in the Carlsbad area, each day began with breakfast at Pete's Deluxe Cafe (healthy but not fancy cuisine) and ended with an evening exploration of Mexican food at the Lucy's (an intense experience even for those accustomed to spicy foods).

After examining spelean carbonates in Carlsbad Caverns, the group moved further west to spend a day measuring sections and examining algal reefs in the Pennsylvanian and Permian cycles in the Sacramento Mountains of New Mexico. The day ended with a scenic visit to White Sands National Park, the furthest point west of our journey, to view and study eolian processes in action. The next day, off to the Franklin Mountains in El Paso where the group took a long hike through Cambrian and Ordovician carbonate/clastic cycles. The day ended with several stops in the Precambrian-aged metamorphic rocks in the vicinity of Van Horn.

This year, the group spent two days exploring the geologic localities in and around Big Bend National Park including spectacular exposures of volcanic sequences and features associated with the Marathon Uplift. These were perhaps the most physically demanding days, with daily temperatures soaring to 107 degrees. Fortunately, the group camped in Cottonwood campground, which allowed for momentary periods of relaxation while wading into the shallow and refreshing waters of the Rio Grande River. Moving eastward, the caravan traversed the Edwards Plateau with frequent stops in the Cretaceous to examine rudist-rich limestones and collapse breccias related to the dissolution of evaporite horizons.

Off to the Hill Country — they spent a full day examining the area around the Llano Uplift where excellent of exposures are afforded of the Cambrian-aged glauconitic sandstones and of the pink Texas Granite. In addition to introducing students to the geology of this region, the group was fortunate to arrive in Fredericksburg in time to visit Opa's Smokehouse where students were able to experience first hand the joys of Texas cuisine. That evening, they stayed at the home Cliff Claflin, a former U-M students who provided an evening lecture on the local geology.

The trip culminated with a study of coastal processes in the area of Matagorda Peninsula, a region studied extensively by Bruce Wilkinson during his PhD research. A final night of camping on the beach included the traditional shrimp and potato boil — 40 pounds of shrimp steamed in seawater and beer. The next morning, after a brief shower in the local "do it yourself" car wash, they began the long journey back to Ann Arbor.

A complete set of photographs (and a QuickTime Movie) from this excursion can be viewed on line using your web browser — visit http://rigl.geo.lsa.umich.edu/RIGLfiles/PUB/srt/index.html

The morning after the shrimp boil on the coast of the Matagorda Peninsula.

Studying Eocene Climate Change

Scientists exploring outcrops and using cores from far below the ocean floor are uncovering details about the warmest period on Earth in the past 65 million years. During the Eocene period (34 to 55 million years ago), the first recognizable mammals appeared in North America, palm trees were found in the Rocky Mountain region, and alligators were found as far north as the Arctic. The Eocene time period and its associated oceanographic and climatic regime appears to have begun very quickly, with a warming on the scale and rate of modern global warming and ended almost as abruptly. Several projects are underway by researchers from Michigan to determine how and why this warm climate period began, maintained itself, and ultimately ended. These include studies by Kacey Lohmann, Andrea Dutton and Linda Ivany on Seymour Island in the Antarctic and by Ted Moore, Josep Pares, Peter Knoop, and David Rea on ocean floor sediments in the Pacific. The focus of these research projects is to understand the rate and magnitude of climate change during the transition from the Eocene to the modern world and to relate these to patterns in ocean circulation and to events of biotic evolution. The following articles provide insight into the nature of research and people involved in these studies.

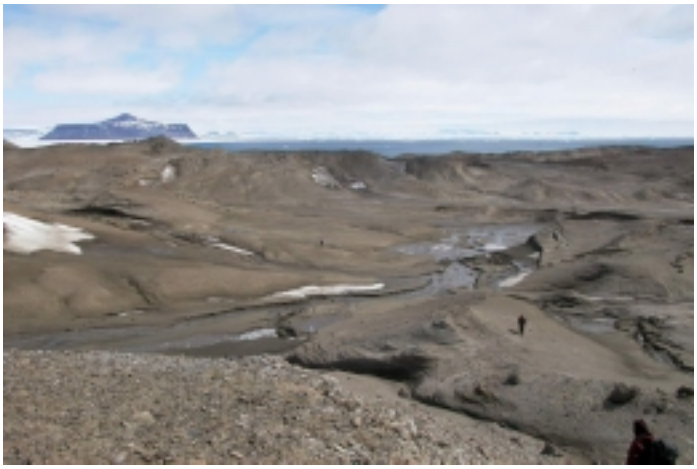
The Interplay of Climate Change and Biotic Evolution

***Linda Ivany**, a former Michigan Society Fellow and Visiting Assistant Professor in the Department (now on the faculty at Syracuse University) ventured to Antarctica this past December and January as part of her ongoing collaboration with **Kacey Lohmann**, **Andrea Dutton** (U-M graduate student), Dan Blake (U of Illinois) and Rich Aronson (Dauphin Island Sea Lab). This team is interested in the nature of climate change on Antarctica during the Paleogene and the effects it had on the evolution and ecology of shallow marine faunas.*

The Eocene is a particularly interesting period in Earth history because it encompasses perhaps the most dramatic climate change in the whole of the Cenozoic. Early in the Eocene, global climates were very warm and the Earth was essentially ice free. As the end of the Eocene approached, a cooling trend began, and by about 33 million years ago a continental ice sheet developed on Antarctica. This climate transition had a profound effect on the organisms living at the time. We are particularly interested in how predator-prey relationships were affected by this global scaled cooling event. For example, Antarctic waters today possess very few organisms that hunt, crush and consume shelled animals (mollusks). At lower latitudes, fish, rays, and crustaceans (crabs and mantis shrimp) fill this ecological role. In warmer waters, where these types of animals are abundant, clams and snails have developed a suite of defenses to protect themselves from such marauders. Some clams burrow into the sediment for refuge, while other clams and snails have grown stronger thicker shells, often with spines and/or coarse ribbing, to ensure against predation. Despite such elaborate defenses, the shells of these mollusks bear the scars of living in such a dangerous world with evidence of failed predation attempts recorded as breakage and repair of their shells. Animals that have not evolved defenses against such predators simply cannot live in the shallow warm waters of lower latitudes. In contrast today, Antarctic shallow coastal waters are inhabited by an abundance of mollusks with thin and unornamented shells because predators have been excluded by the extreme cold of the waters. In fact, Aronson and Blake's research has shown that this polar ecosystem has a distinctly ancient aspect. Echinoderms include not only starfish and urchins, but also brittle stars and crinoids – animals that are very vulnerable to the predatory behavior of fish and crabs. During most of the Paleozoic before duraphagous predators evolved, crinoids were one of the most abundant animals in the shallow seas of the oceans, but they are now nearly absent having been relegated to the deep sea or frigid polar waters as a refuge from predation. As one might predict, there are also virtually no fish, rays, or crabs in today's Antarctic waters. This was not the case during the early part of the Eocene, however, when crabs and shark were abundant and whose presence is evidenced by abundant fossil remains preserved in the Eocene sediments of Seymour Island. Correspondingly, the snails and clams that co-existed with these predators produced thick shells with lumpy ornamentation like those in present in warm water today. During the latest Eocene, crabs and shark disappeared as the

climate dramatically cooled. Nevertheless, in the absence of shell crushers, one predator remained, snails. Some snails are capable of drilling holes in their fellow mollusks, enabling them to effectively digest and ingest their prey's tissues through this small hole. Evidence of this type of predation is easy document in the fossil shells because these holes are often preserved. In Antarctica, when the shell crushers disappeared, the shell drilling snails were the only predators known to remain in this ecosystem.

Aronson and Blake have predicted that in response to the loss of shell crushers, there should be a trend in the mollusk fauna toward thinner, less ornamented shells and a noticeable decline in the evidence for shell-crushing predation in younger sediments. In addition, they predict an increase in the frequency of drilling predation as the predatory snails go unchecked by shell crushers. This may actually negate the trend toward thinner shells in their bivalve prey, since the thicker the shell, the more difficult it is for a snail to drill and penetrate. They further hypothesize that these trends are a direct result of the cooling temperatures that excluded the shell crushers from Antarctic waters. The scientific test of these hypotheses was to collect mollusks from this stratigraphic interval of climate change and to examine trends in shell morphology and drilling/crushing frequency relative to changes in temperature as inferred from the stable isotopic compositions of shell carbonate. Ivany, Lohmann, and Dutton are responsible for this third phase of the project. In their study, the $^{18}O/^{16}O$ of shell carbonate is used to determine the temperature of the water on annual to seasonal scales, and thus, to test of the hypothesis that ecological changes in the fauna were correlative with, and hence likely a result of, temperature change.



To investigate this issue, Ivany, Blake, and two grad students (Alex Glass and Ryan Moody) traveled to Seymour Island, a small island off the coast of the Antarctic Peninsula, to collect fossils. Seymour Island is unique because it is one of the only places in Antarctica that preserves fossiliferous Eocene sediments that isn't covered with snow or ice year round. The island is in the snow shadow of the Antarctic Peninsula and does not generally accumulate enough snow to persist through the summer months. Hence, for two or three months each year, the island exposes its stratigraphic treasures. With no plants on the island whatsoever, save for the very rare lichen, the outcrop is interrupted only by patches of weathered rock and slope wash. A geologist's paradise… if it weren't for the wind, the snow, the mud, and the fiercely protective nesting seabirds that the team encountered throughout their stay in the field.

Despite the less-than-optimal conditions, the team managed to collect representative collections of mollusks up through the section to document trends in morphology, predation intensity, and temperature. Shells collected for stable isotopic analysis were sent to Syracuse University, where Ivany and her students will prepare and sample them. The shells are sectioned, polished, and milled along chosen paths to generate sample powders, which are then analyzed at Michigan for their isotopic composition. Ivany and Lohmann will then coordinate with Blake and Aronson to reconstruct the integrated story of ecological, evolutionary, and climate change throughout the Eocene in Antarctica.

One final sidelight of this research may bear relevance to our current situation with respect to climate change and potential effects on the biosphere. By studying the effects of global cooling on ecosystems, the results of this project may shed light on what may be in store for marine faunas in a time of global warming. As the seas warm, predators may be reintroduced to areas from which they had been formerly excluded, and the story could run in reverse. This research is being funded by grants from the National Science Foundation's Office of Polar Programs to Aronson and Blake and to Ivany and Lohmann.

Excerpts from the Journal of Linda Ivany

Presented here are excerpts from Linda Ivany's journal entries during her stay on the island, along with some of the photos from the expedition. The team traveled to the island from Punta Arenas, Chile, in early December on board the icebreaker Nathaniel B. Palmer. Deployment was via zodiacs, and a base camp was established on shore consisting of three tents and a weatherport shelter, in which the researchers lived and worked for a month. They brought on shore with them everything they would need for a month, including all of their water and food. In all, they had 30 days on the island to get their work done. Due to unusually poor weather conditions, they managed to get out into the field to collect for only 11 of those days…

December 13, 2001 3:00pm (day 3 on the island)

Guess it's a good thing we put all those extra ropes on our tents. It's the middle of the afternoon, and I'm sitting in my sleeping bag writing this as the maelstrom howls outside. We were awakened about 4:30 this morning with the wind howling and the tents flapping and smacking and the dust pelting the fabric like a sandblaster. Three hours later, it hadn't let up a bit, in fact seemed even worse, and so we hunkered down to see how long it would last. Given that we were all so beat from the last 2 days of field work, the wind was blowing hard enough to make walking difficult, and it had started raining to boot, we decided to just make it a camp day. The wind has been blowing steadily at ~25 knots, and frequently gusting to near 40. You can't keep the sand out of your eyes. In the weatherport, where we spent most of the morning, the wind would hit the sides of the structure so hard that it sounded like what an earthquake must sound like, violently shaking the whole thing with the force of a locomotive running over us. We're pleased, though, that the little shelter has held up so well. It seems to be withstanding the blow with no troubles (knock on wood). The thing is trussed up and tied down with so much rope that I'd be surprised if even Mother Nature could move it. Some of these gusts are downright scary; they hit so hard. I'm a little afraid this tent will just fold up around me and roll on down to the ocean. They're supposed to be designed for just these conditions though, and worse, so I guess I'll have to have faith. The sound it makes in the ropes is a real howl, and there is so much sand being hurled at the tent it's like someone has turned up a radio or TV with no reception on the highest volume. Now I can see why some of those starfish fossils we found the other day looked like they'd been sand blasted. They had.

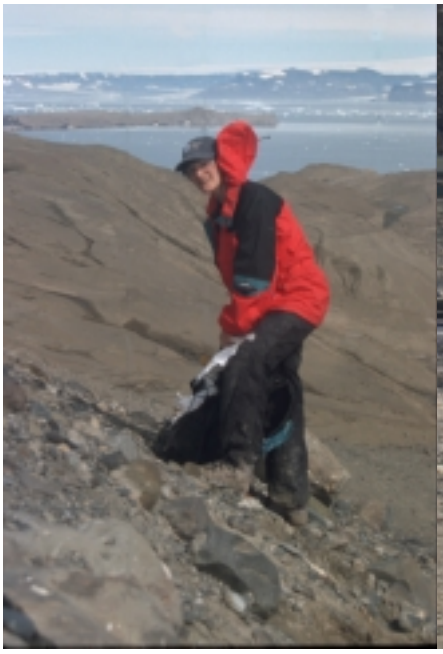
December 14, 2001

About all you can do when you get weathered out is hang around in the tents or the weatherport. We pass the time by some combination of eating, sleeping, and sitting around yakking about things you'd never dream of spending so much time talking about normally. Bodily functions are a big favorite, seeing as how they are inevitable and unavoidable, but often extremely unpleasant or difficult in weather like this. The penguins are a favorite topic of conversation too. Watching them has been really interesting. We must be in their spot, because there are consistently between 1 and 2 dozen of them around, sitting or sleeping or gathered in little bunches talking back and forth. They don't just come up to the beach to hang out, either. They go hiking too. We've seen them hopping and flopping their way up the slopes to surprisingly high elevations. You'd look up and there would

be a little face peering down at you from on high. And they seem to like to pick up rocks too. They pick them up and put them back down somewhere else, then pick them up, etc…. Alex and Dan were wondering what was going through their little penguin brains to make them do this. Walking up steep slopes and picking up rocks over and over… who could imagine why anyone would want to spend so much time doing such things?! Hmmm….

December 23, 2001 3:30 pm

We finally got a break in the weather and returned to base camp from Marambio [small Argentine air force base on the top of the island] after 4 days being snowbound. We got up the morning of the 21st and found the skies clear and blue and the sun shining, with scarcely a breath of wind, so we decided to pack up, go out and work for half a day, return to Marambio to get our things, and then hike home. By the time we actually left the buildings, the sky had clouded over again and it was bitingly cold. We got as far as the edge of the mesa and the wind hit us like a ton of very cold bricks. It was amazing how fast the weather had deteriorated again, and how much difference there was between the conditions at the base, set well back from the edge of the mesa, and the edge itself. Brrr… So, despite our best intentions, we turned around and slogged back to the base through the mud and snow. We packed up all our things, and not wanting to be stuck there for even longer, high-tailed it for the base camp through the weather.



When we dropped below the lip of the mesa on our descent, the wind died back and it got almost pleasant. The going was rough because the snow was piled up deep in places, and where it had blown away or melted, everything had turned to a deep, sticky, slippery mud. So we were constantly slipping and sliding, or our boots suddenly disappearing down into trenches filled with snow and hidden from view.

When we finally got back to camp, the penguins came running, literally, to greet us. It really seemed as if they were welcoming us back. Alex and Ryan emerged from the weatherport and welcomed us back to what they had dubbed “Camp Mud”. The place was entirely surrounded by this deep sticky sinking gooey mud. Where we had formerly been able to walk around in the slippers we wore in the weatherport, there were now a good 4-5 inches of mud, with every depression filled with cold muddy water. The stuff stuck to our boots like no tomorrow too, gobbing on until we had inches of the stuff stuck to them. And you couldn’t get it off no matter how industrious you were. Ick.

December 26, 2001 11:25PM

The wind picked up all through the evening, and by 7 or 8 we had sustained winds of 30 mph. The highest gust we measured was 44 mph, but there were a number of others that had that one beat, we just weren't standing outside with the anemometer to measure them. This has really been the worst wind we've had the whole time, and that's saying a lot. The sides of the weatherport bend way in and shudder with those gusts, sounding like thunder, and it makes you wonder how much more it could stand before the whole thing rips open. After everyone else went to bed, Dan and I were sitting and listening and watching, musing about how well tethered the thing was to the ground. He seems pretty convinced that there won't be a problem, but the wind is hitting full force from the west, straight at one of the long sides of the structure. Seems to me that it could, in theory, roll the whole thing right over. That would take some doing, but I suppose it's possible.

December 27, 2001 10:30AM

The sunset yesterday was spectacular. Well, it really wasn't sunset because the sun didn't set, but it got really low and cast that beautiful golden glow with long shadows that I remember so well from last year. We haven't really seen much of that all season this time, because the weather's been so bad. Last night made up for it though. The light on the rocks turned them a deep glowing umber, and the sea below the cliffs turned an almost surreal aqua color. The bergs floating offshore were brilliant white against the water and sky, and the sky itself was a pastel blue and pink and pale purple. With no wind, the water was tranquil and flat, with long low waves that swashed up on the beach rhythmically. Just magic.

December 28, 2001 1 PM:

Snowing like hell now. Not a whole lot of wind, but it's mighty cold. All is gray and formless and ethereal around the camp. The nearest landforms are dusted with accumulating snow, but most of the landscape disappears off into a gray snowy fog. The ocean is a hard gray color, and the waves are kicked up with whitecaps as they approach. The snow makes a quiet hissing sound on the tent–almost a peaceful relaxing sound when the wind isn't blowing. We've given up all hope of the sun coming out and drying up the mud any time soon. We'll be here all day today, and almost assuredly tomorrow too.

December 30, 2001 3:55 PM

I'm beginning to hate mud. It's everywhere. I can't get in and out of my tent without getting it on me. I can't go anywhere without hearing it shlucking and schlooking under my boots, or feeling like my feet are about to slide out from under me and land me on my tush in the middle of it. My boots instantly collect a good 5 pounds of extra weight as soon as I step into it. I have it in my hair. All over both pairs of Gortex pants. Covering all my boots. It's creeping ever farther into the recesses of my tent. Soon I'll be dreaming about it in my sleep. What a nightmare.

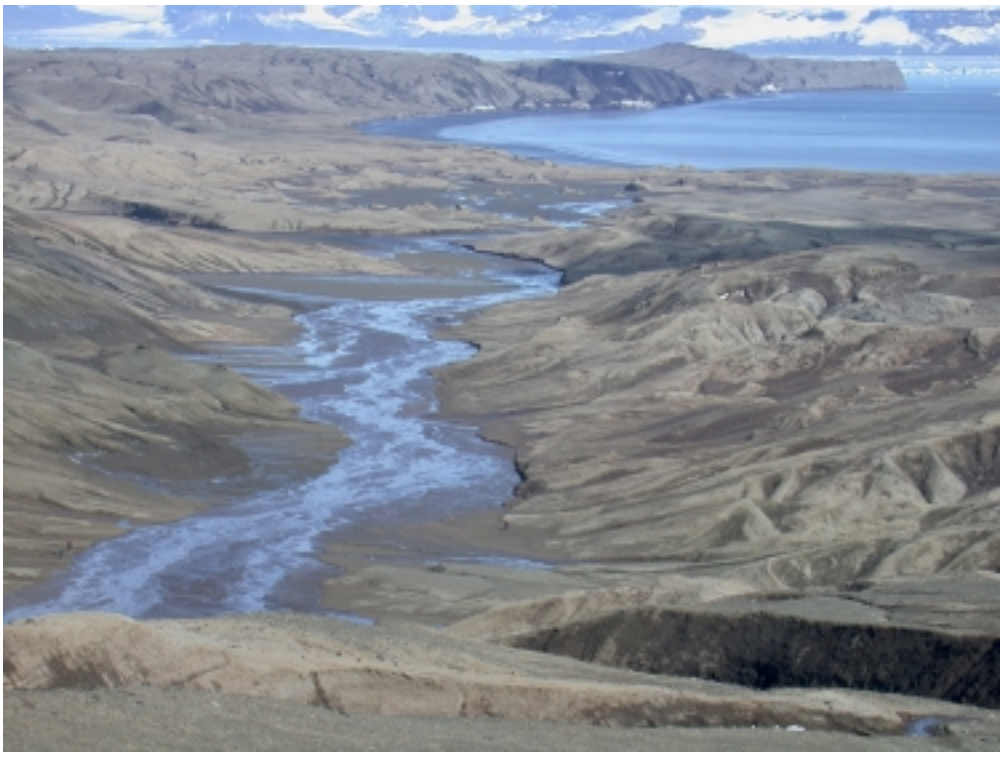
As one might imagine given that intro, we didn't get into the field again today. Way too wet and slippery. It wasn't snowing in the morning though, and the tide was way out, so we decided to take a couple hours and walk down the beach to the penguin colony a few miles down. With the tide being that

far out, we didn't have to worry about the sea cliffs collapsing on us (which they frequently do – collapse, that is), and the intertidal sand was well enough packed that the going was easy. Or would have been if the wind wasn't blowing a steady 25 mph, right in our faces. We toughed it out though and made it down to the colony. There were thousands of pairs of Adelie penguins nesting and cavorting on the slopes of rock by the beach.

The pattern of their black and white bodies against the golden-brown rock and blue sky was almost surreal. When you would stand in the middle of them, and someone would walk up from the beach, they'd all turn at once to check them out, and the whole slope would flash to black, as their little backs faced you all at once. The sound was a continuous din of long, low, drawn out squawking, punctuated by bursts of loud, pulsed, higher pitched squawks. The smell was really something too – a blend of penguin excrement galore tainted with the decay of the unfortunate ones that didn't make it. The youngsters here were softball-sized blobs of gray fuzz with little peeping heads that wobbled around seemingly independent of their bodies. They were a little bit further along in development than those I saw last year at Palmer. Some of them were venturing out a little bit away from the nest, and a few had even been left alone for short periods by their parents, I guess while they went out for food. Those that were wandering about seemed to have a hard time telling their little bodies how to move, because they'd just stick their heads out in the direction they wanted to go and their bodies would just roll that way, feet over stubby wings, and their heads would still be craning out in the right direction and twisting about as they rolled. Pretty funny!

December 31, 2001 10:15 PM New Year's Eve

We finally made it out into the field today! It was still pretty muddy last night, but by morning things had dried out considerably, the sun was shining, and the wind wasn't blowing. Dan and I went up the



mesa, planning to reconnoiter and sample in the uppermost part of the section. When we first got to the top, there wasn't a breath of wind and the sun was out in full. Just a gorgeous day to be out. The views on top were spectacular, and we sat for a while savoring them. The sun shone brilliant white off patches of snow, the bergs in the ocean, and off the glaciers to the west streaming off James Ross Island. Ice dotted the bay to the west, and huge slabs stretched out in the Weddell Sea to the east.

January 3, 2002 8:05 PM

Yesterday was an eventful day. John and I took off to get some work done on top of the mesa, all the way to the north. We had a long walk to get up and out there, but the weather was good and there was no wind, so it was a very pleasant trip. We were looking for shell beds in the top of the section, as high up (young) as we could find them. I was scrounging about looking at the sediments when something unusual struck me. I was trying to clear away what I thought was just material pushed over the edge by weathering and/or the folks at Marambio when they made the landing strip, because it looked like lots of pebbles and cobbles held together with mud. I noticed that the more I dug into this stuff, the further it went into the cliff face and the more it started looking like real rock. It occurred to me that the top of this section is somewhere in the upper Eocene or maybe even the early Oligocene, and some time in there is when glaciation started on Antarctica. The deposit I was looking at looked exactly like a diamict – the sediments left behind by a glacier as it plows up dirt and rock and flows over it.

I dug further, underneath the layer, and there was a sharp contact with the normal marine muddy sandy sediment that made up the island. The layer itself was about 2 feet thick, and on top of it was more marine mud, only this time the mud had big pebbles and cobbles floating in it on occasion. Those are dropstones, rocks dropped out of floating ice bergs as they melt and deposit their load of frozen sediment. What I was looking at seemed to be the evidence of the first pulse of glaciation in this region. I collected samples of the sediment above and below the diamict, to send to colleagues who look at microfossils of plankton that lived at the time. From those fossils, they can tell how old the sediment was. One of the controversies about Antarctica is when glaciation first started. Was it the earliest Oligocene, about 33 million years ago, when we know there was a big expansion of ice here? Or did the first pulses happen earlier? How extensive were they? The sediments on top of Seymour Island, forming a veneer over the surface of the mesa, are Oligocene glacial deposits. If I'm interpreting this section correctly, we have evidence for the first pulse of glacial ice that reaches to sea level, and it must have happened before the major interval of ice expansion that generated the till well above it, because there are marine sediments separating the two intervals. Once the dates come back for the sediment above and below, we'll know how old it is. The coolest part of the whole thing is that we found encrusting barnacles living on the cobbled in the top part of the diamict, all on the upper surfaces. It looks like after the layer was deposited by/under ice, the sea came back in and barnacles grew on the surface of the layer, taking advantage of the hard substrate available to colonize. After that, deposition of normal marine muds ensued and everything went back to more or less normal again for a while, except for the dropstones occasionally falling out of the bits of melting ice floating on the surface. This whole thing may make a very interesting story once the pieces come together.

January 8, 2002 3:00 PM

Ok, I take back everything I ever said about the wind. What we really need now is a good strong cranking wind out of the west. All this month, we've been complaining about exactly that, and now it's what we need more than

anything. I'm supposed to be back on the ship by now, freshly showered and laundered and snuggled down with a good book, en route for home. Instead, I'm still stuck in this Scott tent, my bags packed around my, waiting out the storm. We woke up this morning to about 4 inches of snow on the ground, and no water in sight anywhere. What was ocean last night is now a jumbled broken mass of ice, pushed up onto the shore, covered with snow, and extending out as far as we can see. It will take a good strong west wind to blow it all out, and right now it's only gusting out of the east, packing it in tighter. The ship is out there somewhere, waiting for a break in the weather, but we can't see it. For now, we're stuck here. And chances are we'll be here for a while

January 11, 2002 8:25 AM

We got really lucky getting off the island. The wind really did blow up, out of the west (or at least southwest, which was good enough), and the ice loosened up enough to allow for our escape. The morning of the 9th dawned clear and sunny and calm – a really beautiful day. The beach was stunning that morning, and it was one of the quietest ones we'd had. With all the ice just offshore, and almost no wind, there were no waves to speak of. It was like a big quiet bathtub. Only there were big blocks of ice floating in it and stranded all along the high tide line. The sun was shining on them, making them look like big crystal sculptures in strange irregular shapes. Every now and then, one would pop in the warmth of the sun, like ice cubes put in a glass of water, and send a little shower of water droplets and ice bits into the air. With blocks of ice that big, up to Volkswagen size, there were some pretty big pops.

Leg 199: Ocean Drilling Reveals Clues about Warmer Earth

The Ocean Drilling Program drilling ship *JOIDES Resolution* left Honolulu in late October with 28 scientists from 8 nations gathered to focus on understanding the Eocene. Participants with U-M connections included faculty **Ted Moore, Josep Pares, and David Rea, Tom Janecek** (BS'78, MS'80, PhD'83),'**Steve Hovan** (BS'87, MS'90),'**Mitch Lyle** (BS'73) who served as co-chief scientist, graduate student **Peter Knoop** (MS'94), and research associate **Cathy Nigrini**. The shipboard scientists analyzed drillcores from 8 sites near the Eocene equator. Because the drift of the Earth's plates moves north in the Pacific, the area studied was north of the modern equator, about half way between Hawaii and Mexico. From these sites, cores were recovered that contain continuous records from this warm period that were not previously available.

Results of the on-board studies reveal a very different equatorial oceanographic world in the Eocene. Today, wind systems from the northern and southern hemispheres come together and stir the ocean near the equator such that deep, nutrient-rich waters come to the surface and support a thriving and diverse community of plankton. Fossil remains of these plankton provide the primary geological record of equatorial processes. During the Eocene, the equatorial circulation system was quite broad, but had very low plankton productivity. The ecology of the area was dominated by a group called radiolarians, a small zooplankton that builds its shell of silica. After the end of the Eocene, these organisms never again attained their earlier dominance. The dominance of different organisms indicate that the Eocene low latitude oceanic system was fundamentally different than that which developed at the end of Eocene time.

Shipboard scientists also recovered sediment that recorded the transition from the warm Eocene to the cool Oligocene climates that occurred at 33.7 million years ago. This transition coincides with the first build up of significant ice on Antarctica and marks a change in oceanic ecology from siliceous plankton to an assemblage dominated by calcium carbonate-producing plankton. This shift also marks the beginning of an oceanic biological system where all the action is focused at the equator, in stark contrast to the broad and diffuse system that preceded it.

This transition from warm to cool climates and from diffuse to focused equatorial systems took place in less than 100,000 years – an interval of time similar to the time humans have been influencing our planet. Rates of change are important clues to causes of change and the stability of the climate system as a whole. The rapidity of the change from warm to cool climates suggests that the warm climate system as it existed in the Eocene was relatively unstable.

The recovered cores will also be used to inter-calibrate different–"yardsticks" for measuring geologic time, a fundamental earth science problem. The cores contain a continuous record of reversals of the Earth's magnetic field and clearly show the evolutionary history of siliceous and calcareous plankton. The sediments are ideal for developing a common time scale. Much of this material has not been inter-calibrated before.

The Ocean Drilling Program (ODP) is an international partnership of scientists and research institutions organized to study the evolution and structure of the Earth. ODP is funded principally by the National Science Foundation, with substantial contributions from its international partners.

In Memoriam

Allen Ehlers (BS'36) died March 24, 2001 at Younger Center, Manor Park in Midland, Texas. He was born November 1, 1914 in Ann Arbor, Michigan and was the eldest son of George M. and Mabel Ehlers. His father, G.M. (Jim) Ehlers was a long time faculty member in the Department and in the Museum of Paleontology.

All of Allen's education was received in Ann Arbor, including graduation from University High School in 1932 and a Bachelors Degree in Geology from the University of Michigan in June 1936. He was an honorary member of Sigma Gamma Epsilon fraternity. In March 1937, Allen was employed by Carter Oil Company, Tulsa, Oklahoma as a petroleum geologist. From 1937 to 1945 with Carter Oil he worked in Kansas, Kentucky, Ohio, Michigan, Illinois, North Dakota and Oklahoma. In 1942 he was promoted to District Geologist at Seminole, Oklahoma.

In 1945, he joined Skelly Oil Company as Senior Staff Geologist in Tulsa, Oklahoma. Allen was promoted by Skelly in 1948 to District Geologist, Midland, Texas for West Texas and Southeastern New Mexico. He resigned from Skelly in 1954 rather than accept a senior position and return to Tulsa. He was a consulting geologist from 1954 up to his retirement in 1980, involved in oil, gas and uranium exploration in South Texas, Michigan, Illinois, and Kentucky.

Ehlers was elected President of the Midland Geological Society in 1950 and was later instrumental in consolidating that organization with the West Texas Geological Society. He was a long-term member of the American Association of Petroleum Geologists.

Allen's wife, Mary Shinkle Ehlers, preceded him in death on May 8, 1995. Survivors are a son, John A. Ehlers and daughter-in-law Dolores Parham Ehlers of Canon City, Colorado; grandson Cary A. Ehlers, Aurora, Colorado; granddaughter Laura L. Wenholz, Littleton, Colorado; two great grandchildren; brother John N. Ehlers, St. Louis, Missouri and a sister Priscilla Fischer of Chapel Hill, North Carolina.

John D. Herman (MS'85) age 47, passed away February 26, 2002. John was a resident of Ann Arbor for 26 years. He was born July 26, 1954 in St. Louis, Missouri on one of the hottest days on record. John enjoyed running, volleyball, rock hounding, hiking, and the ocean. John earned his undergraduate degree in Geology from the University of Missouri, Rolla, and earned his Master's Degree in Geophysics from U-M. John worked as senior environmental scientist and project manager with ENCOTECH in Ann Arbor from 1991-1999. He was a geologist and geophysicist at GeoSpectra Corporation in Ann Arbor from 1981-1991 engaged in the processing, interpretation, and integration of remote sensing, geophysical, and geological data for oil and gas exploration, mineral exploration and environmental damage assessments. He also served as an exploration geologist and geophysicist from 1976-1980 for Phillips Petroleum Company, Missouri Geological Survey and St. Joe American Mining Company in oil and gas, coal and mineral exploration projects. He also worked as a teaching assistant of geology classes at U-M. John was well-respected and showed passion for every aspect of his geology work from field trips to research projects.

John is survived by his wife of 19 years, Lori; two daughters, Rachel and Robyn; and many other relatives and friends.

Jean Petermann Kemp (MS'40) passed away December 29, 2001. Jean did her undergraduate work at the Michigan College of Mining and Technology and obtained her MS at the University of Michigan. She returned to Michigan Tech where she taught Mineralogy and Geology and assisted in the Seaman Mineralogical Museum. In 1975 she became Curator of the Museum, a position she held until she

retired in 1985. Jean is survived by her husband Paul W. Zimmer, three daughters, one son, seven grand children, and two great-grandchildren.

Jay Rane Pray (BA'35) passed away in July 2000 in Laguna Hills, California at the age of 89. Most of Jay's life was spent in the Ann Arbor/Whitmore Lake area where he was engaged in the real estate business.

Martha Wheeler Wilson (wife of Professor James T. Wilson, U-M Faculty '41-'78) A long time resident of Ann Arbor, died October 10, 2001 at University of Michigan Hospital. She was born in Detroit on February 24, 1912. After living in Toledo, Ohio and Berkeley, California she moved to Ann Arbor in 1925. She received a BA from the University of Michigan in 1932. She married James T. Wilson in 1942. They have one daughter Deborah. She will be remembered for her gracious manner toward all she met, her sense of humor and her love of animals and travel.

Joint Environmental Degree Program

At their November meeting, the Regents approved the creation of a new joint undergraduate degree from LS&A and the School of Natural Resources and Environment (SNRE). The new concentration, to be called the *Program in the Environment*, will begin during the fall semester, 2002. Students will earn either a BS or a BA degree in the environment, depending on their specialization within the concentration. SNRE's graduate programs will continue without change.

The faculties of both schools have approved the new concentration and the concept of a joint degree, which will be awarded jointly by LS&A and SNRE, with the names of both schools on the diploma. LS&A Dean Shirley Neuman and SNRE Dean Rosina Bierbaum stressed the uniqueness of the program and the novel form of collaboration that it represents.

"Solving the complex environmental problems of today requires experience beyond the traditional natural resources area, and we see this as an opportunity to broaden the scope of our programs and the range of people we can reach," Bierbaum said. "The demand for a broad-based degree in the environment is growing, and the U-M has stepped up to offer that degree. Students will be able to draw on SNRE's depth as a leader in environment and natural resource education and LS&A's breadth as an outstanding liberal arts institution. It's a win-win situation for everyone."

Dean Neuman called the new program . . . "an exciting interdisciplinary collaboration. Many LS&A students are interested in environmental studies and will benefit from this program, which draws on the rich vein of faculty expertise in environmental science and policy across LS&A and in SNRE. Given that LS&A has some wonderful field resources at the Biological Station in northern Michigan and at its geological field camp in Wyoming, it is especially gratifying to have been able to work with SNRE to develop a program that will allow students to use these facilities in field courses and internships."

Among the architects of the program were Department faculty **Catherine Badgley, Ben van der Pluijm**, and **Henry Pollack**.

Degrees Granted: 2002

BS

Nicholas Bayma	Oceanography
Douglas Boyer	Geological Sciences
Laurie Cotsonika	Oceanography
Tamara Gipprich	Geological Sciences
Anthony Goodman	Geological Sciences
Alison Hastings	Environmental Geosciences
Geoffrey Horst	Oceanography
James Kyle	Environmental Geosciences
Elizabeth Newton	Environmental Geosciences
Rebecca Parzen	Geological Sciences
Brandon Preblich	Earth Sciences
David Singer	Geological Sciences
Demetra Spounias	Geological Sciences
Amy Thompson	Oceanography
Julia Weddell	Geological Sciences

MS

Michela Arnaboldi — *High-resolution Geochemical Comparison of Two Pliocene Sapropels from the Urica Sections (Southern Italy)*

Bret Peppard — *Geology and Geochemistry of the Ivanhoe Vein System, Elko County, Nevada*

Jianlong Chen — *Self-diffusion in Crystalline Iron at Conditions of the Earth's Inner Core*

Katherine Szramek — *Controls on Carbonate Equilibria and Mass Transport in a Glaciated Mid-Continent Watershed*

Iyad Zalmout — *Postcranial Skeletons of Protosiren from Egypt and Pakistan and Their Bearing on Locomotion in Early Sirenia (Mammalia)*

Adam Collins — *Early Paleozoic Latitudes of Northeastern Kazakhstan: Implications for the Path to Eurasian Amalgamation*

PhD

Allen McNamara — *Exploring the Cause of Lower Most Mantle Seismic Anisotropy*

Boris Kiefer — *Mineral Physics of the Mantle Transition Zone: Solid Solutions and Elasticity*

Turner Lectures: 2001-2002

The Turner endowment in the Department (the gift of Scott Turner, a former director of the U.S. Bureau of Mines) enables a weekly series of visitors who present a lecture or seminar to the faculty and students, and interact with them for a few days in informal ways. The exchange is truly bi-directional: the Department becomes better acquainted with the visitor's teaching and research activities, and the visitors learn of the scientific activity in the Department. The lecture series during the past academic year included the following presentations:

September 14, 2001	**Dr. Jerry Mitrovica** University of Toronto	*Taking the Fingerprints of Global Sea-Level Change*
September 21, 2001	**Dr. Jan Amend** Washington University	*Geochemical Controls on Microbial Metabolism in Hydrothermal Ecosystems*
September 28, 2001	**Dr. Patrizia Fumagalli** University of Michigan	*Fluid Fluxes in Subduction Zones: Desperately Seeking Hydrodgen*
October 5, 2001	**Dr. Raymond Jeanloz** University of California	*From Earth to Stars: High-Pressure Studies of Planetary Interiors*
October 12, 2001	**Dr. Hope Jahren** Johns Hopkins University	*The Stable Isotope Relationship Between Carbon in Land Plants and Carbon in the Atmosphere: Applications in Deep Time*
October 19, 2001	**Dr. Clark Burchfiel** MIT	*Evolution of the Tibetan Plateau Viewed from an Eastern Tibetan Perspective*
October 23, 2001	**Dr. David Jablonski** University of Chicago	*The Evolutionary Role of Mass Extinction: Disaster, Recovery, and Something-In-Between*
October 26, 2001	**Dr. Jake Lowenstern** USGS	*Uncovering the Buried Secrets of an Active Volcano: Medicine Lake, California*
November 2, 2001	**Dr. Steve Ingebritsen** USGS	*Land Subsidence in the United States*
November 9, 2001	**Dr. Dave Montgomery** University of Washington	*Climate, Tectonics, and Geomorphology*
November 16, 2001	**Dr. Francis Albarede** Ecole Normale Superieure-Lyon	*From Terrestrial Accretion to the Modern Mantle: The Memories of Mantle Convection*
November 30, 2001	**Dr. Ed Evenson** Lehigh University	*Glaciohydraulic Supercooling, Underplating, and the Formation of Debris Laden Basal Ice – Why does it Happen and Why is it Important?*
December 7, 2001	**Dr. Ronald Amundson** University of California	*The Nitrogen Isotope Composition of Soils and Ecosystems*
January 11, 2002	**Dr. Kazuhiro Toyoda** Hokkaido University	*Microbial Geochemistry – Oxidation Kinetics of Manganese (II) by Spore Coats of SG-1*
January 18, 2002	**Dr. Chris Hall** University of Michigan	*Seeing Beacon of Light on an Ocean of Argon: The Development of Modern Argon Geochronology from an Insider's Perspective*
January 25, 2002	**Dr. Brian Kennedy** University of Michigan	*Geochemical Records and Their Use in Aquatic Ecology*
February 1, 2002	**Dr. Jeffrey Gee** Scripps Institution of Oceanography	*Geomagnetic Intensity Records from the Oceanic Crust*
February 8, 2002	**Dr. Matthew Carrano** State University of New York at Stony Brook	*Large-Scale Patterns in Dinosaur Evolution*
February 15, 2002	**Dr. Bonnie Jacobs** Southern Methodist University	*Dorr Lecture: Leaves, and How They Measure Up as Representatives of Tertiary Climate in Tropical East Africa: Examples from Tanzania and Kenya*
February 22, 2002	**Dr. David Evans** Yale University	*The Non-Uniformitarian Menu of Late Precambrian Geodynamics and Global Climate*
March 8, 2002	**Dr. Thorne Lay** University of California at Santa Cruz	*Complex Structures in the Core-Mantle Boundary Mantle Boundary Layer*
March 15, 2002	**Dr. Paul Silver** Carnegie Institution of Washington	*Which Way Does the Mantle Wind Blow? Measuring the Mantle Flow Field Beneath Western North America*
March 22, 2002	**Dr. Kelin Whipple** MIT	*Does Erosion Drive Uplift? Bedrock Channels, Landscape Relief, and Critical Wedge Tectonics*
March 29, 2002	**Dr. Robert Poreda** University of Rochester	*Extra-Terrestrial Bucky Balls at the Permo-Triassic Boundary: Impacts, Mass Extinctions and the Origin of the Atmosphere*
April 5, 2002	**Dr. Gary Sposito** University of California at Berkeley	*Distinguished Weber Lecture: Three Memos for the Millennium*
April 12, 2002	**Dr. Catherine Johnson** Scripps Institution of Oceanography	*Planetary Lithospheres: Key Records of the Thermal and Tectonic Evolution of Terrestrial Planets*

Geoscience News is compiled twice a year for alumni and friends by the Department of Geological Sciences at the University of Michigan, Ann Arbor MI 48109-1063.

Phone: (734) 764-1435

e-mail: geo.alum@umich.edu
Web: http://www.geo.lsa.umich.edu

Editors: K. C Lohmann and H. N. Pollack