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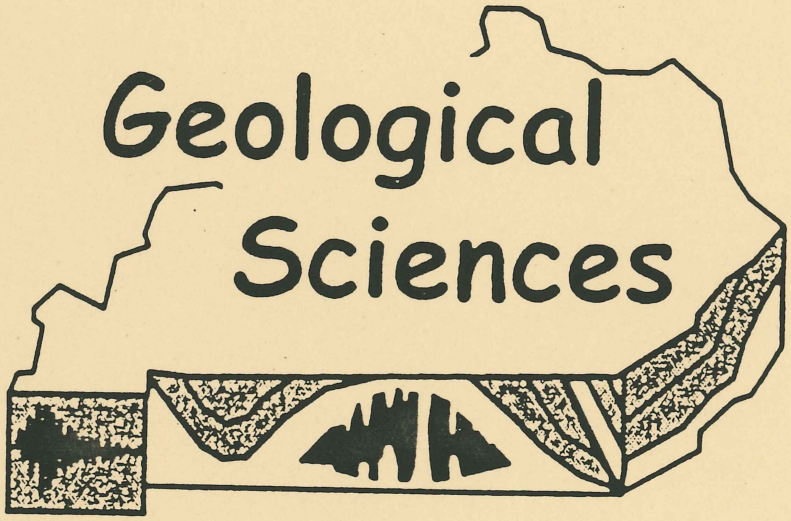

2002

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LETTER FROM THE CHAIRMAN

Dear Friends of the Department,

We begin the 2002-03 school year by celebrating several successes. First among those is the addition of three new members to our growing faculty. Ana Carmo is an organic geochemist with her degree from Indiana University, and complementing Ana's expertise is Harry Rowe, a stable-isotope geochemist with a degree from Stanford University. Both of these faculty have major start-up money for new equipment, and it is our hope that they will give us expanded research capabilities in both environmental and more traditional aspects of geology. They are already seeking collaboration with other faculty in the Department, with workers in other departments in the College of Arts and Sciences, and with workers in other colleges and universities. Finally, our lower level courses have become so popular with undergraduates, that we were unable to staff them all with regular faculty and expect these faculty at the same time to engage effectively in research and graduate teaching, so we requested a lecturer position from the College and were very pleased when they granted the request. As a result, the Department has its first lecturer, Michael Handke with his degree from Washington University in St. Louis. Although his research interests are in geochronology, as well as igneous petrology and geochemistry, he is now being kept very busy teaching. In addition, we have applied for new faculty position in climate systems to work with our geochemists and other faculty on campus, and we have "fighting chance" to get it because of the newly added positions above.

The Department has struggled for some time with inadequate teaching and research infrastructure, and we can report improvements on both fronts. Because of work done by Sue Rimmer and Dave Moecher in a University competition, most of our classrooms have been refurbished or renovated, and we have the latest in computer-teaching technology in many of those rooms. In addition, the Department was successful in its collaborative, NSF/EPSCoR, research-infrastructural improvement grant for nearly $2.4 million because of work done by Gail Brion of Civil Engineering, Alan Fryar of this Department and myself. As a result of this grant, we will be able to set up a state-of-the-art stable-isotope-ratio mass-spectrometer lab with its own technician as a part of the resulting environmental center. Our new faculty member Harry Rowe is very involved with establishing this lab. Moreover, start-up monies accompanying new faculty last year and this year are contributing importantly to improving our research infrastructure.

Of course, much of this is about students, without whom we would not be here. In addition to our 35 undergraduate majors and returning graduate students, we successfully recruited 11 high-quality graduate students into the program this year, and many of these, as well as several returning students, are supported by 10 research assistantships, our largest number in recent memory. This should tell you that our faculty are working hard to acquire external support.

Finally, I do not want to leave out the support of our alumni. Alumni contributions to our several student- and department-support funds (see pages 22-23) continue to be very important in providing for needs that State and University funds are inadequate to do. In particular I would like to note the $50,000 contribution of Charlie Holbrook (B.S., 64; M.S., 66), which was matched by the State late last year. This endowment, the Rast-Holbrook Fund, was set up to honor Professor Nick Rast, who passed away last year, and will be used to support our seminar program, which has at times in the distant past been an "on-and-off-again" program because of inadequate support. Charlie was honored at this Fall's alumni weekend, and a copy of his very pertinent presentation follows this letter.

As you can see, the positive energy and aspirations of our students, staff, faculty, and alumni continue to drive our work and Department forward. There is no doubt that we are improving, and we look forward to your continued involvement in the process!

Sincerely yours,

Frank Ettensohn
Professor and Chair

Energy, Economics, Environment and the Future
Charles Holbrook
Alumni Weekend
October, 2002

I would like to share with you some data on the current state of energy supply and demand, look at data on historical oil price trends, review the status of alternate energy resources, touch on a few environmental issues and philosophize about some disturbing trends.

There is probably no other aspect of our being that is so intricately woven within the fabric of our society as energy. Energy, particularly that derived from fossil fuels, is, on the one hand, critical to our standard of living and to our economic, political and social stability as a nation. On the other hand, it is a much-maligned necessity that is damned as the agent of destruction of our environment, yet expected to be always available and cheap. Vast areas are placed off limits to new exploration for oil and natural gas based on decades old perceptions of technology and threats to the environment. But, the demand for petroleum-derived products is expected to somehow always be satisfied. Society is constantly subjected to the siren song that conservation, the wind and the sun will take care of our energy needs for eternity if we but embrace and accept.

One need only consider the close correlation between energy consumption and economic growth and the reality of oil reserves distribution and consumption patterns to understand that our nation's vital interests will reside in the Middle East for the next several decades. According to the 2000 edition of the *International Petroleum Encyclopedia* published by PennWell Corp., and Carla Montgomery's *Environmental Geology* textbook, five Persian Gulf countries that are members of OPEC account for 64% of the world's proven oil reserves. These countries include Saudi Arabia (26%); Iraq (11%); Kuwait (9%); UAE (9%); and Iran (9%). Two of these countries are openly hostile to the United States. These OPEC nations also have most of the estimated 4 to 6 million barrels per day excess producing capacity that can be raised or lowered to control the marginal flow of oil that in turn dictates oil prices in the world market.

Energy is very much in the news these days. Some aspects of our energy dependent society, which regularly capture the headlines, include:

- The recent rolling electricity blackouts in California
- The oil price impact of the latest OPEC policy meeting.
- The current price of gasoline.
- The impact of higher oil prices on a struggling economy.
- Heating oil inventories for the coming winter.
- The growing trade imbalance exacerbated by the outflow of dollars for the purchase of crude oil.
- The threat of oil flow interruption through either terrorism or war in the Middle East.

While we struggle with these issues, we are also concerned as a society with the potential damage being inflicted upon our environment by the burning of fossil fuels. There is talk about global warming and the need to wean consumers from dependence on fossil fuels and transition to renewable energy resources. What are the facts involved in these debates and what are the realistic alternatives to fossil fuels?

Most forms of energy are interrelated. The objective of consuming virtually any form of energy is to either burn the fuel directly to generate heat, propel some piece of machinery or to convert one form of energy to another as in the use of falling water to generate electricity. Some non-combustible and / or renewable energy resources such as wind, water, geothermal energy and sunlight are being used to generate limited amounts of electricity. And, of course, fission nuclear energy is being used to generate electricity. But, what are the opportunities, limitations and environmental consequences of alternative energy resources?

As scientists, we are trained to think logically and objectively. We collect, organize and interpret data. We measure and experiment and search for compliance or exceptions in an attempt to place new facts and data into frameworks of established principles and natural laws while seeking answers to questions. We formulate new hypotheses when necessary to explain observations and data. As scientists, it doesn't matter much what we think, feel or believe. We are held accountable to document and support our assertions with facts and data.

Unfortunately, neither society in general nor many of our public figures in leadership positions seem to have a good understanding about what is happening in the world of energy. Their impressions and perceptions are too often molded by self-interest, hearsay, emotion or the messages put out by special interest groups who are skilled at shaping public opinion. Public opinion can be converted into monetary donations to support "mass movement" type causes and to influence politicians.

The World Oil Balance

It is now appropriate to review some factual data and see what can be learned from the numbers. Fossil fuels account for about 90% of energy consumed on a worldwide basis – petroleum 39.7 %, coal 27.2 % and

natural gas 23.1 %. The remaining 10 % of energy demand is satisfied by electricity that is generated by nuclear energy - 7.0 %, hydropower - 2.5%, and, geothermal, wind, etc. - 0.5%.

Fossil fuels are finite natural resources that are being used up at an alarming rate. Historical U.S. consumption trends show that overall energy consumption tripled between 1949 and 1995. Oil and natural gas account for the bulk of that increase. There appears to be sufficient coal in the world to last 200 to 500 years depending upon whether it is used as a supplementary fuel or relied upon as a sole source of energy. Most of that resource resides within the U.S. But, there are environmental constraints on its use. Wyoming is now the largest coal producing state due to its low sulfur content coals compared to eastern coals. About 90% of coal consumption are dedicated to generating 51% of domestic electricity. Two-thirds of coal moves by rail inextricably linking the economic health of coal and the railroads. In the current political / economic climate, a significant increase in reliance on coal to satisfy domestic energy needs will have to wait on a major culture changing event or technological advance that can cost effectively clean up the by-product pollutants of coal combustion. Many in our society condemn the U.S. failure to sign the Kyoto Treaty. Compliance with the treaty would have required the U.S. to reduce carbon consumption by the equivalent of about 400 million tons of coal per year.

Oil is another matter when it comes to reliance on other nations to satisfy U.S. fuel needs. Of an original resource of about 200 billion barrels of oil, the U.S. has consumed more than 175 billion barrels or 90% of the original. The current estimate of remaining proven U.S. oil reserves is 21 billion barrels or 2% of worldwide reserves.

Domestic production peaked in the mid-70s at around 10 million barrels a day and has since declined to less than 6 million barrels. In the meantime, consumption has climbed to almost 20 million barrels. Imports are now required to satisfy sixty percent of U.S. daily oil requirements. The trend toward increasing reliance on oil imports will continue. Oil production is on a fairly steep decline curve and the U.S. will never again be self sufficient in oil. A number of factors argue against being able to reverse this decline and close the gap between production and consumption:

- the mature state of exploration of oil prone areas,
- the political / environmental resistance to opening up new areas for exploration such as the Arctic National Wildlife Refuge
- the economics of conducting petroleum operations in high cost environments in the face of relatively low oil prices,
- the lead-time required to bring major new reserves to market.

Appeals are often heard for the Government to release oil from the Strategic Petroleum Reserve (SPR) to drive down prices at the pump during oil price spikes. The Strategic Petroleum Reserve was created for national security reasons to provide for an emergency reserve of oil in the event of a supply interruption. It was not envisioned to interfere with normal, free market forces. The SPR holds 700 million barrels, when fully stocked. That is enough to replace imports for two months at 12 million barrels per day. Complimentary conservation measures could extend that time frame by up to a few months. On relatively rare occasions, oil is released from the SPR into the domestic supply to serve a short-term, often political, need to calm the public.

America is the largest consuming nation. The U.S. makes up little more than 4.5 % of the world's 6.2 billion people, but consumes more than 25 % of worldwide oil production. There is a very close relationship between national energy consumption and Gross National Product (GNP). Nations like the U.S. with a huge appetite for energy enjoy a strong national economy and high standard of living relative to those countries that consume little energy. The reason is clear. Energy is required to drive the wheels of industry to produce consumer goods and move masses of people around in the conduct of business.

The "underdeveloped nations" of the world must consume more energy through industrialization to build their economies and improve living standards for their people. But the hard fact is that there are insufficient energy resources available to satisfy a significant increase in demand. It is a "Catch 22" situation, additional energy demand from poor nations would stress the supply driving up prices which would exacerbate their ability to pay for the energy needed to industrialize.

Few of the major oil export nations have been able to develop an industrial base upon which to build a self-sustaining economy that can survive beyond depletion of their natural resources. Too often, the proceeds from the oil of exporting nations flow into the hands of a relatively few powerful people and little of the money ends up being invested in the future of the nation. Sadly, underdeveloped nations are condemned, for the most part, to remain underdeveloped.

The earth's population is now estimated at 6.2 billion people compared to only 2.5 billion in 1950. By 2050, according to the October 2002 edition of *National Geographic*, that number is expected to rise to 9 billion, down from a recent estimate of 10 billion, assuming

recent declines in fertility continue. Each year 80 million people are added to the planet, the equivalent of the U.S. population every 3.5 years. The population of the 48 poorest nations, located primarily in sub-Saharan Africa, Asia and South America, is expected to triple in the next 50 years.

There is a gross imbalance in the world between where oil resources occur and where they are consumed. This inequity requires a vast and complex transportation system of pipelines, oil tankers and pressurized LNG carriers to move oil and natural gas from export nations to consuming nations and to individual consumers within nations. A complex oil trading business exists whereby large volumes of oil are traded daily in spot markets around the world. Futures traders in oil react swiftly to any news that could impact the supply or price of oil. That is why oil prices fluctuate so wildly during periods of uncertainty. There is always a large volume of oil in inventory – in pipelines, storage tanks, tankers at sea, etc. - so there is about a two month lag time until the reported oil price is reflected in the pump price. The local competitive environment also affects the pump price of gasoline and other products.

On a worldwide basis, estimated proven reserves of oil stand at about one trillion barrels. Eighty percent of these reserves reside within the 11 countries that make up OPEC: Algeria, Nigeria and Libya in Africa; Indonesia in Asia; Venezuela in South America; and, the Persian Gulf countries of Saudi Arabia, Iran, Iraq, Kuwait, United Arab Emirates, and Qatar. At a 1998 worldwide product consumption rate of about 27 billion barrels per year, including about 3 billion barrels of natural gas liquids, that represents a 42-year supply. However, consumption has been growing at about 1.5 % per year so consumption can be expected to double in 48 years. That is more or less equivalent to the rate of worldwide population growth not to mention additional energy requirements to fuel future economic growth.

Let us assume that 50 % more oil, for an additional one-half trillion barrels, will be found in the next 20 to 30 years through exploration and extraction of additional oil from old fields using new technology. One can still only reasonably expect to have enough oil for a couple more generations considering consumption growth equivalent to or slightly more than population growth.

The most alarming reality of the world oil supply and demand balance is that approximately 60% of global oil production come from the 20% of worldwide reserves that reside within non-OPEC nations. OPEC, with 803 billion barrels of proven oil reserves (80% of world oil reserves), provides only 40% of consumption demand. Simple math reveals that the 213 billion barrels of proven non-OPEC oil are being used up at the rate of about 14.4 billion barrels per year (60% of 24 billion barrels produced in 1998) for a life expectancy of less than 15 years. During this same period of time, OPEC nations will draw down their reserves by only 142 billion barrels retaining 661 billion barrels of reserves. The trend is clear, although the exact timing as to when non-OPEC oil reserves will be exhausted is dependent upon a number of variables. But, within as little as one or two decades, the rest of the world may be perilously close to running out of oil and five Persian Gulf nations will control virtually all the world's remaining oil reserves. Iraqi leader Saddam Hussein is a lot of objectionable things, but he is not a mad man. He clearly understands the future pivotal role that oil will play in global economics and politics. He also understands the power that will accrue to those who control the Persian Gulf region.

Oil Imports:

Where did the U.S. get the 11.6 million barrels of oil per day it imported in May 2002 to make up the deficit between domestic production and consumption:

• Canada	1,912 kbpd	16.5%
• Mexico	1,562	13.5%
• Saudi Arabia	1,547	13.3% *
• Venezuela	1,286	11.1% *
• Nigeria	552	4.8% *
• United Kingdom	487	4.2%
• Norway	476	4.1%
• Iraq	436	3.8% *
• Algeria	367	3.2% *
• Russia	363	3.1%
• Others	2,624	22.6%
Total	11,612	100.0%

The U.S. received 4,463,000 barrels of oil per day from OPEC * countries. This represents 38.4 % of domestic imports and 22.7% of total daily consumption.

Someone once said that oil will eventually become too valuable as a chemical and synthetic feedstock to burn up in the internal combustion engine. About 3000 products are made from crude oil. One immediately thinks of gasoline, diesel fuel and heating oil. But such diverse consumer products as ink, crayons, bubble gum, dishwashing liquids, deodorants, eyeglasses, records, tires, ammonia and artificial heart valves also come from oil.

There are other vast hydrocarbon resources stored as kerogen in oil shales and dead oil in tar sands. So far, these resources have not been able to compete economically with liquid hydrocarbons and little research is being done toward a future reliance on these resources.

It has long been the goal of OPEC to maintain the

price of oil in a range that makes competing sources of energy non-economic. The environmental implications of mining oil shale and tar sand present another problem in that the encasing rock must be mined, crushed and heated to liberate the hydrocarbon resulting in vast quantities of waste material and land restoration issues. While water is an essential element in the oil recovery process, most domestic oil shale and tar sand resources reside in dry areas of the U.S.

The Canadians are recovering oil from the Athabasca Tar Sands in Alberta utilizing both mining and steam injection processes. They appear to be getting a leg up on the technology and economics of extracting oil from that vast reserve.

Natural Gas

Natural gas accounts for about 23% of total energy consumed in the U.S. Proven U.S. gas reserves stand at about 164 trillion cubic feet or 3.2% of worldwide reserves. U.S. consumption of natural gas is more than 21 trillion cubic feet per year with a projected life expectancy of about 8 years. As with oil, domestic consumption of natural gas represents about 25% of worldwide consumption. The U.S. produces 19.6 tcf of gas per year while relying upon imports for 1.6 tcf, primarily from Canada and Mexico. Natural gas is used to heat 55% of American homes and to generate 16% of domestic electricity. It is also used as an industrial fuel and as a chemical feedstock.

Worldwide proven natural gas reserves stand at 5,146 trillion cubic feet. The former USSR has about 40% of gas reserves and OPEC, including Iran at 16%, has 34% of gas reserves. The remainder is spread among a large number of nations. OPEC produces only about half as much natural gas (11 tcf) as the U.S. Much of that gas is for internal consumption and for LNG export to countries such as Japan. Worldwide natural gas consumption in 1998 was about 82.5 tcf for a life expectancy of 62 years not considering consumption growth offset by additional reserves that will be found.

Virtually all gas prone basins in the U.S. that are open for exploration have been pretty thoroughly explored. The shallow, cheap, easy to find gas has, for the most part, been found. Consumption is increasing because gas is currently the most environmentally friendly fuel option for generating electricity. This rising popularity of natural gas can drive up the price during periods of peak demand as recently experienced.

The message here is that the existing, cheap, domestic reserves of natural gas will be used up within a few years. Additional reserves will continue to be discovered, but at a diminishing rate and at higher finding and development costs. Expect to see an increasing reliance on imported natural gas and significant price increases in the coming years.

Environmental Issues

There are numerous environmental issues facing mankind. The following comments are not intended to trivialize the seriousness of these issues. The fact is the planet is overpopulated and becoming more so every day. There is only 1.5 acres of arable land for each inhabitant and that number is decreasing as more and more land is rendered non-productive through habitation and overuse. Many critical or important natural resources, including water, are being stressed or depleted at rates that should arouse concern within our society. While environmental concerns are slowing, blocking or driving up the cost of infrastructure development in many parts of our country, population and demand continue to grow.

The recent rolling electricity blackouts in California serve as an example of the anti-development mentality. California's population has grown from 20 million in 1980 to about 35 million today. Yet, infrastructure development - highways, electric generating plants, water development projects, educational infrastructure, and petroleum refineries - remains at about 1980 levels. California regulates electricity rates. When electricity demand exceeded supply recently, the California providers were forced to buy electricity from neighboring states at prevailing market rates. After awhile, the California providers could no longer shoulder the cost differential between the cost of electricity and what they were allowed to charge the consumer resulting in rolling blackouts. Aging infrastructure, population growth and politicians giving in to the anti-development mentality are working together to ensure future problems in California as well as other parts of our nation.

The environmental impact of development must be carefully considered, but that does not mean that all future development be suspended. On the contrary, it is critically important that society evaluates development projects and makes decisions on the basis of objective cost / benefit analyses.

There are fundamental problems with the anti-development environmental movement. Self-appointed groups focus on a single or very narrow range of issues and attempt to forge public opinion and resultant political action against development through misrepresentation and exploitation of public fear and lack of understanding of issues.

Some facts concerning the sources of oil pollution may be of interest. According to the National Academy

of Sciences, natural oil seeps account for 63% of pollution, while cars, boats, etc. account for 32%, petroleum transportation (pipeline, shipping, & storage tank leaks) accounts for 4% and drilling and extraction operations account for 1%. But, where do the environmental activists focus their attention?

Great strides have and are being made toward reducing petroleum-based pollutants. For example, automobile tail pipe emissions have been reduced by more than 96% on average from 1960s levels. Advances have come about primarily as a result of technological breakthroughs in the formulation of cleaner burning gasoline and improved efficiency in automobile combustion systems. These technologies have advanced now to the point where harmful tailpipe emissions can be virtually eliminated. Expect to see further reductions as these new innovations are phased into automobiles nationwide over the next few years.

Energy Economics

The cost of energy is frequently discussed in the media in the context of its impact on the economy. Economists and other analysts fret about what OPEC will do at their next policy meeting. They worry about crude oil inventories, the prospect of war with Iraq, the economic impact of a potential terrorist attack, and how the government is driving up crude prices by competing in the market for oil to add to the Strategic Petroleum Reserve. A favorite expression is, "an increases in the price of fuel is like a tax on the economy".

Data on the historic price of gasoline adjusted for inflation are revealing when compared to other consumer items. Most of the data come from the American Petroleum Institute's website. Net of taxes, the retail price of an average blend of all types of gasoline declined from $2.93 per gallon in 1918 to $1.15 in inflation adjusted 2001dollars. There was only one grade of gasoline in 1918. The price of gasoline has shown a steady decline from 1918 until now except for temporary upward price spikes during extraordinary times such as WW II, the Arab Oil Embargo 1973-74, the Iranian Revolution in 1979, the Iraqi invasion of Kuwait in 1990-91 and the OPEC production cut in 2001. What has increased dramatically is the tax on gasoline. Combined state and federal taxes have grown from less than one cent per gallon in 1918 to an average of $0.42 today.

Using the period 1982-84 as a benchmark compared to April 2001, according to the American Petroleum Institute, a fixed basket of consumer goods increased in price by 76.3%. During that same period, gasoline increased 26.5% or about two-thirds less than the average of all items. For example:

All Items	76.3%	Airline Fares	138.6%
Gasoline	26.5%	Physician Services	151.0%
New Vehicles	42.2%	Dental Services	166.3%
Coffee	49.7%	Prescription Drugs	196.5%
Postage	70.7%	College Tuit/Fees	241.9%
Breakfast Cereal	94.9%	Tobacco/Smoking	307.7%
White Bread	107.1%		

It is interesting what consumers are willing to pay per gallon for selected consumer items:

Gasoline	$1.57	Real Maple Syrup	$27.60
Coca Cola	$1.87	Scope Mouthwash	$42.56
Milk	$3.40	Jack Daniels Bourbon	$98.41
Evian Water	$7.21	Visine Eyedrops	$766.72
Crisco Oil	$10.36	Flonase Nasal Spray	$5,669.84
Olive Oil	$22.70		

Between 1980 and April 2001, the cost per mile to operate a car dropped from 16.3 cents to 7.4 cents, a 55% drop, and for vans, trucks and s.u.v.s from 21.4 cents to 9.2 cents. Because our economy is so much larger than it was in the 70's and because energy prices have increased at a much slower rate than inflation, energy costs represent about 50% less as a proportion of our economy than in the mid-seventies.

It is curious that airline fares increased 138 % during a period when fuel price, a major airline overhead cost component, increased only 27%. Yet, the airlines have dramatically reduced their level of service and rely upon Government (taxpayer) assistance to survive.

The sophistication of the technology employed to deliver a bottle of Evian water to the grocer's shelf pales in comparison to that required to place a gallon of gasoline in the tank at the neighborhood station. Evian bottled water is priced at a 500% mark-up to the price of a gallon of gasoline.

Technology Advances

What are some of the technological advances that make drilling for and producing oil and natural gas safer today than in the past?

- Better subsurface imaging using 3-D seismic and computer modeling enhance the understanding of the subsurface environment before drilling. Down hole logging devices incorporated into the drill string allow the drilling engineer to literally see ahead of the bit during actual drilling operations.
- More sophisticated well monitoring technology, control valves and other devices that prevent leaks and blowouts.
- Better drilling controls and bit steering capabilities that allow directional and even horizontal drilling.

This allows larger exposure of the reservoir to the well bore thereby reducing the number of wells required to efficiently drain a reservoir and limits the consequent operational footprint on the surface.

- Advances in technology that allow drilling and producing operations in almost any environment from 50-foot seas in the North Sea to 6,000 foot water depths in the Gulf of Mexico to drilling from manmade ice islands in the Arctic Ocean.
- Crude oil production from the Gulf of Mexico accounts for one-fourth of U.S. production. The tens of thousands of producing oil and gas wells there coexist with a thriving seafood industry that produces an abundance of fresh fish, shrimp, oysters, and crabs. The oil and gas producing structures serve as manmade reefs that attract abundant marine life and fishermen alike.

Alternative & Renewable Energy Resources

The environmental movement promotes conservation and renewable energy resources as the answer to our long rang energy problems. On the surface, this sounds reasonable and inviting. But, when examined closely, there are major issues with each of the frequently suggested alternative energy resources such as solar, wind, geothermal, hydropower, biomass, tidal power, etc. There are good reasons these alternatives have not been incorporated more extensively into our energy mix:

- Solar and wind energy resources are erratic and limited geographically. Energy storage and long distance transmission to high-density population centers also present problems.
- Geothermal resources are site specific and often last only a few decades.
- Tidal ranges are too small, except in a limited number of locations around the world, to serve as an energy source for generating electricity.
- Developing the remaining hydropower potential in is country would open up a whole range of environmental and water rights issues.
- Biomass energy is derived from living matter such as burning wood, converting organic waste to methane or fermenting agricultural grains to alcohol. Processing organic matter releases carbon dioxide, condemned as a greenhouse gas. There is also the issue of using food to produce fuel in a world with hungry people.
- Even nuclear power, out of favor in the U.S., has limitations in that uranium is also a finite resource with a life expectancy of several decades.

Politics – National Energy Policy

The United States, though not unique, often fails to anticipate future problems and devote the required resources to prepare for them in advance. Rather, the nation historically comes together and rises to the occasion in times of crisis. Somehow, it seems ironic that the U.S., being heavily and increasingly dependent on nations in politically unstable parts of the world to supply its energy needs, does not have a well-defined National Energy Policy.

The reality is that energy consumption and economic growth march hand in hand. The U.S. needs to be funding research into real alternative energy resources and clean technology that will permit broader use of coal and other fossil fuel options to be phased in as oil and natural gas resources are depleted. The usual suspects for satisfying future energy needs such as conservation, windmills and sunlight simply cannot solve the big problem of how to propel ships, trains, trucks and planes on the scale required to fuel continued economic growth for a growing population.

Our Energy Future

So what is the answer to supplying our long-range energy needs after fossil fuels are exhausted? Society is still tied to fire as a primary energy source and the long-range energy source is likely to be the basic building block of the universe – hydrogen. The technology required to efficiently and cost effectively liberate hydrogen from its chemical bonds on a large scale is yet to be developed. The cost to build a whole new infrastructure for producing, transporting, storing and distributing alternative energy resources will be great, but hopefully, spread over an extended period of time. Significant cultural changes in the way our society lives, works and plays will be an integral part of our long-range energy future.

ANNOUNCEMENTS

E-MAIL ADDRESSES

The alumni directory now includes e-mail addresses. Please send yours if it is not in the directory.

CO-OP PROGRAM

The co-op program (matching students with summer and/or part-time jobs) needs help to identify available jobs, and the requirements for staffing them. A similar search for qualified and interested students is underway in the Department. Contacts for the program are:

for the Advisory Board
Stephen B. Sullivan
1508 Cherokee Rd..
Louisville, KY 40205
Telephone 502-587-2641

for the Department
Frank R. Ettensohn
101 Slone Building
Lexington, KY 40506-0053
Telephone: 859-257-3758

If you know of a job opportunity (or a possibility of one), please contact Steve or the Department. We hope to provide some meaningful work experience for our students, and to provide employers with some enthusiastic young geoscientists as temporary workers. The potential for mutual recognition of future full-time opportunities is also present.

DEPARTMENT NEWS

GEOLOGICAL SCIENCES

Rast-Holbrook Fund Endowed

As many of you are aware, Nick Rast passed away in August, 2001. At the suggestion of Nick's family and friends, a memorial fund was established to honor Nick and his many contributions to the field of geology and the Department. We had hoped to accumulate enough contributions to get them matched by the state's Research Challenge Trust Fund, but really got started too late to meet the end-of-the-year deadline imposed by the state, or so we thought! Early in December, Charlie Holbrook (B.S. 1964, M.S. 1966), now retired from Chevron, called to indicate that he wished to contribute $50,000 toward the fund. The contribution was made and matched by the state, so the fund was originally endowed at $100,000 and the endowment continues to grow through additional contributions. The fund will be used to support our weekly seminar program, which now operates on a budget of about $1,000 per year. We know that Nick would approve of this, because for several years, he was seminar coordinator and often bemoaned the lack of support that was available to bring in speakers.

Anyway, that will all change, and we are especially appreciative for Charlie Holbrook's contribution, which made this possible. Charlie was honored at our Fall Alumni Weekend, and a copy of his talk is presented in this issue of the *Round Up*. Once again, our thanks to Charlie and the others who made this possible!

Mitch Rutledge Supports Dinosaur Trackway Study

Mitch Rutledge (B.S. 1956, M.S. 1957) of Austin, Texas, generously supported a senior-thesis student, Mike Caudill, to study the geology of a dinosaur trackway in the Cretaceous Glen Rose Formation at Sattler, Texas. The trackway is located at the Heritage Museum of the Texas Hill Country of which Mitch is a member. Although the tracks are being studied by an expert on dinosaur trackways, no one was studying the environmental and geological context of the trackway, and this is the task currently being undertaken by Caudill. Caudill and his advisor, Frank Ettensohn, made a trip to the site for five days in late May, 2002, and will probably make a follow-up trip in early spring. Caudill's senior thesis will be the basis for a museum pamphlet describing the geologic origin of the site and its trackway.

Dr. Lois Campbell, Petroleum Girl

A recent article in the Spring, 2002, *LSA Magazine*, of the University of Michigan featured Dr. Lois Campbell, Professor Emerita, of the Department and several of her female geologist cohorts. In 1942 when men began disappearing daily from the University to serve in the armed forces, the University of Michigan Department of Geology took a bold step and began aggressively recruiting women for their B.S. program. Because of the need for petroleum geologists to pursue domestic exploration, most of these women became

petroleum geologists and were know affectionately as "petroleum girls." Campbell went on to work briefly at Humble Oil Company and subsequently taught for 36 years at the University of Kentucky, Department of Geological Sciences.

Haynes Field-Trip Endowment Established

Field experience continues to be the basis for much of what we do in geology, but at the same time, the costs of getting students into the field continue to rise, especially for longer trips. In order to help students with expenses for pratical field experience, Elizabeth Haynes (M.S. 2000) has set up the beginnings of an endowed fund that will eventually help support students on such trips. An enclosed brochure describes the fund further.

Annual Southeast GSA Meeting Held in Lexington, Kentucky

Last April, the combined annual meeting of the Southeastern and North Central sections of the Geological Society of America was held in Lexington, Kentucky. The meeting was sponsored by the Kentucky Geological Survey, the U.K. Department of Geological Sciences, and the University of Cincinnati. Several faculty members and various students helped with the programs.

Seismite Volume Comes Out

Seismites are sediments that have experienced penecontemporaneous soft-sediment deformation due to seismicity. Although seismites were first proposed in the mid-1960's, they have not been widely accepted in the geologic community until recently. This volume, G.S.A. Special Paper 359, edited by Frank Ettensohn, Nick Rast, and Carlton Brett, is the first wholly geologic volume to deal with seismites. Twelve papers in the volume deal with the characteristics of seismites and how to differentiate them from soft-sediment deformation of other origins. This volume had its origin in Nick Rast's early interest in and interpretations of seismites from the Lexington Limestone.

Visiting Scholar from China

Professor Cheunheng Zhang from China University in Beijing, China, chose the Department as the place to come in order to study the influence of tectonics on stratigraphy and sedimentation. He will be working with Frank Ettensohn on a basin in western China for the remainder of the Fall and the Spring semesters.

ALUMNI NEWS

William "Drew" M. Andrews, Jr., B.S. 1993, M.S. 1997

I am still employed at the Kentucky Geological Survey. My research area has continued to migrate from coal-resource assessment toward landscape-oriented projects and geological interaction with archaeologists and historians. I'm making decent progress (in my opinion) on my dissertation, which is examining the controls on geologic evolution of the Kentucky River. I have also been working on a new physiographic map of Kentucky using digital elevation analysis and field observations. This project led in turn to my involvement with development of an Ecoregions Map of Kentucky in cooperation with scientists in several state and federal government agencies. My work with the Professional Geology Exam Review Course continues.

Claudia Cook, 1994-1996

Just started a job at CIGNA Medicare as a reporting analyst in the Anti-Fraud Department. It's not geology, that's for sure. But, it is analytical. And, it's great fun to be helping to catch the bad guys who are stealing from Medicare! I'm getting married in April, 2002, to a wonderful man named Tom Crowley.

Tim Elam, M.S. 1981

I continue to work in a development geology assignment in a San Joaquin Basin oil field. My wife and I have been in Bakersfield for twelve years. In the last year, I have picked up more production-engineering responsibilities. Most of my work now has to do with heat management of steam-driven, heavy-oil reservoirs, as a heat management engineer.

W. Brent Garry, M.S. 2001

After completing my M.S. at the University of Kentucky in October, 2001, I headed to sea for a month aboard the Woods Hole Oceanographic Institute research vessel, *Atlantis*. The cruise was there to study the East Pacific Rise at around 9^0 30'-50'. This was part of my fieldwork for my Ph.D. program at SUNY Buffalo where I am studying submarine volcanology.

Jerald D. Huffman, B.S. 1958, M.S. 1966
After living more than three decades in Ohio, I moved approximately 120 miles northeast of Cement Creek, Colorado. I can't get used to all this variety of geologic scenery in Colorado, especially the outcrops. I had to drive over an hour to see more than one outcrop when I lived in Columbus. My driving through the Rocky Mountains has become as dangerous as Dr. Mac's, but can't help checking it all out. There's everything from pre-Cambrian granite to Tertiary volcanic rocks, and that 90^0 dip is unbelievable. I catch myself driving real slow to take it all in, especially through the large roadcuts and canyons. Sometimes I slowly stop the car and get out the old rusty hammer from the trunk to do a little geologizing. Thank goodness most of these drivers following behind me are real friendly and patient. They blow their horns and wave. However, they only use their middle finger when waving...Westerners are weird. What can a displaced easterner do except wave back the same way, and yell, "Have a gneiss day you S.O.B."

Jack B. Llwewllyn, B.S. 1955
Retired from IBM 1989 as an industrial engineer.

McDowell, Steve, M.S. 2001
After graduating in February, 2001, I took a geophysicist position at SDII Global Corporation in Tampa, Florida. We do contract geophysical investigations all over the U.S. and several countries, with the majority of our work using GPR and electromagnetics. I was offered a job with a national geophysics company called Blackhawk Geoservices. They have opened a branch office in Oak Ridge, Tennessee. The company contacted me through Ed Woolery, who is acting as a technical advisor on the PGDP seismic risk assessment, which Blackhawk is performing. It was a good opportunity for me to get involved in larger and more complex engineering and environmental geophysics topics.

David Metzner, M.S. 1983
My family and I moved to Tyler, Texas, in 2001. I am currently working as a Senior Geophysicist for EOG Resources. We are exploring rocks from east Texas to Alabama. I recently contributed a chapter on 3-D seismic interpretation to a new edition of an industry textbook titled *Applied Subsurface Geologic Mapping*, by Dan Tearpock and Richard E. Bischke (Prentice Hall). My wife, Marcia (UK Pharmacy, 1982), and I have been married for 20 years and have two children, Maren (8/87) and Paul (8/88).

Mike Reed, B.S. 1982
Owner of Aspen Energy, Inc. Oil and gas exploration is focused primarily in Alabama, Mississippi, Louisiana, and Michigan. My wife and I have three children—Kathleen 14, Andrew 11 and Michaela 6.

W. Thomas Schick, B.S. 1994
It has been a very busy year. I am now a professional geologist with Geo-Technology Associates, Inc. in Delaware. I am currently working on two geological hazard assessment projects in northern New Jersey and multiple subsurface investigations in Deleware, Pennsylvania, and New Jersey. On a more personal note. Jennifer and I are expecting our third child in September and are building a new house in Dover, Deleware, with a completion date scheduled for October.

Jerry I. Wilkins, M.S. 1983
I came back to the United States about twelve years ago...right at the beginning of the civil war in Liberia. I was evacuated out of Liberia because my children are American citizens. I went back to school and did a second Masters in Information Systems and Technology at Johnson and Wales University in Rhode Island. I am currently working with the U.S. Navy at the Navel base in Newport, Rhode Island, as a LAN Manager. I reside with my family in Providence. My oldest daughter graduated from the University of Rhode Island with a B.S. in Textile Management and Fashion Design and will work on an MBA in the coming year.

IN MEMORIAM

This year the department received word of the passing of the following alumni and friends. We are saddened by the loss of these friends, and we extend our sincere sympathy to their families.

Lloyd N. Baker, 1997
A. Edward Barnes, March 31, 2001
Lamar R. Evans, Jr.
Roy E. Greenfield, Jr.
Bernard J. Olup
James A. Warren

STUDENT NEWS

DEGREES AWARDED

BACHELOR OF SCIENCE

Michael C. Ashcraft
William L. Brab
Tara L. Campbell
Sarah J. Hawkins
Robert B. Jewell
Casey R. Mobley
Rebecca A. Ross
Tanaporn Sakulpitakphon
Kristin S. Toth
James A. Wimberg

MASTER OF SCIENCE

Robert E. Andrews, 2002, M.S., Evaluating fracture-flow solutions to analyze aquifer test data collected from wells in the eastern Kentucky coal fields.
Advisors: Alan Fryar and David Wunsch

Brian S. Cook, 2001, M.S., Lateral compression within a lateral ramp in the Pell City thrust fault, Appalachian Thrust Belt, Alabama.
Advisor: William A. Thomas

Gregory C. Cornett, 2002, M.S. Penecontemporaneous faulting within the Pennsylvanian Pikeville to Four Corners Formations, Breathitt Group, southeastern Kentucky.
Advisors: Frank R. Ettensohn and Gerald Weisenfluh

William Brent Garry, 2001, M.S. Stratigraphy and structure of the Dunaway Mountain thrust sheet revealed through geologic mapping and interpretation of the Ashville 7.5 minute quadrangle, Alabama (Geo Wars... Episode II...attack of the Rome).
Advisor: William A. Thomas

Karen Exton Thompson, 2002, M.S., Ground water flow in the Ledbetter Creek watershed, Calloway County, Kentucky.
Advisor: Alan E. Fryar

DOCTOR OF PHILOSOPHY

Steven J. Jusczuk, Ph.D., 2002, How do the structures of the Late Paleozoic Ouachita thrust belt relate to the structures of the Southern Oklahoma Aulacogen.
Advisor: William A. Thomas

GRADUATE STUDENT RESEARCH

William M. (Drew) Andrews (B.S., M.S. Kentucky)
Ph.D. dissertation: Geologic evolution of the Kentucky River in central Kentucky.
In collaboration with Kentucky Geological Survey.
Advisor: William A. Thomas

Todd A. Aseltyne (B.S., Dayton; M.S., Akron)
Ph.D. dissertation: Ground-water flow and solute transport to the Ledbetter Creek embayment, Calloway County, Kentucky
Advisor: Alan E. Fryar

German Bayona (B.S., Columbia—Bogota; M.S., New Mexico State)
Ph.D. dissertation: Controls on Middle to Late Ordovician (Taconian) synorogenic deposition in the southeasternmost part of the North American craton (Laurentia). Supported by National Science Foundation, Petroleum Research Fund and Geological Society of America research grant. Advisor: William A. Thomas

Thomas P. Becker (B.S., Case Western Reserve; M.S., Lehigh)
Ph.D. dissertation: Distinguishing provenance in foreland basins. Supported by USGS EDMAP.
Advisor: William A. Thomas

Margaret C. Brewer (B.S., Hunter; M.S., Kentucky)
Ph.D. dissertation: The Bessemer transverse zone in Alabama, structure and stratigraphy.
Supported by USGS EDMAP and Petroleum Research Fund.
Advisor: William A. Thomas

Matt Dahlem (B.S., Wisconsin, Oskosh)
M.S. thesis: Paleoecology of a Middle Ordovician edrioasterioid firm ground.
Advsior: Frank R. Ettensohn

E. Lee Gatterdam (B.S., Furman)
M.S. thesis: Reactions of trichloroethene with pyrite.
Advisor: Alan E. Fryar

Shane Goodnight (B.S., Western Kentucky)
M.S., thesis, Stable isotope composition of Kerogen concentrates from Devonian-Mississippian black shales.
Advisor: Susan Rimmer

Walter Johnson (B.S., Louisville)
M.S. thesis: Stratigraphy of the Ste. Genevieve-Girken contact in western Kentucky.
Advisor: Frank. R. Ettensohn

Ravi Kanda (B.Tech, Indian Institute of Technology; M.S., University of Cincinnati)
M.S. thesis: A mathematical model of frictional melting on the asperity scale.
Advisor: Kieran O'Hara

Jen Klein (M.S., Texas A&M)
Ph.D. dissertation: The Effects of Mire Type and Depositional Environment upon Coalbed Methane reservoir Properties in the Olmos Formation, South Texas.
Advisor: James Hower

Danita LaSage (B.S., Eastern Kentucky; M.S., Alaska—Anchorage)
Ph.D. dissertation: Natural attenuation along a first-order stream receiving contaminated ground-water discharge.
Advisors: Alan E. Fryar and Susan M. Rimmer

Ting-li Lin (B.S., National Chung-Hsing)
M.S. thesis: Local soil-induced site effects on strong ground motion at Maysville, Kentucky.
Support: USGS-NEHRP, Kentucky Cabinet for Health Services
Advisor: Ed Woolery

Charles Mason (B.S., Morehead; M.S., George Washington)
Ph.D. dissertation: Ammonite biostratigraphy of the Lower-Middle Mississippian Borden Formation.
Advisor: Frank R. Ettensohn

Matt Massey (B.S., Tennesse, Knoxville)
M.S. thesis: Metamorphic and structural evolution of the Eastern Blue Ridge-Western Blue Ridge Boundary ("The Hayesville Fault") along the Blue Ridge Parkway, Western NC.
Advisor: David Moecher

J. Todd McFarland (B.S., Kentucky)
M.S. thesis: Sediment fluxes through a karst-conduit system in the Inner Bluegrass.
Advisor: Alan E. Fryar

Abhijit Mukherjee (B.Sc., M.Sc., Calcutta)
M.S. thesis: Natural attenuation of trichloroethene and technetium-99 within Little Bayou Creek, McCracken County, Kentucky
Advisor: Alan E. Fryar

Thomas M. Reed (B.S., Kentucky)
M.S. thesis: Role of suspended sediment in facilitating pathogen transport in Inner Bluegrass in karst aquifers
Supported by the UK College of Agriculture Senate Bill 271 program
Advisor: Alan E. Fryar

William F. Reid (B.S., Millsaps)
M.S. thesis: High-resolution geophysical imaging of Middle Ordovician dolomitic structures.
Support: Department of Energy
Advisor: Ed Woolery

F. Alexander Rutledge (B.S., West Virginia)
High-resolution geophysical investigations of Lat Quaternary deformation in the Lower Wabash Valley fault zone.
Support: UAFA-NWHEP, Kentucky Transportation Center, McFarland Scholarship
Advisor: Ed Woolery

Michael Shultz (B.S., Ohio)
M.S. thesis: Characterization of paleochannels and their impact on underground mining in southeastern Kentucky.
Advisor: Gerald Weisenfluh

Michael P. Solis (B.S., Alabama at Birmingham)
M.S. thesis: Tectonic controls on Ordovician through Mississippian facies patterns, near Ellisville and Spring Garden, Alabama.
Supported by USGS EDMAP.
Advisor: William A. Thomas

D. Matthew Surles (B.S., Montana; M.S., Louisiana, Monroe)

Ph.D. dissertation: The effects of diachronous orthogonally converging thrust belts on foreland basin evolution. Supported by USGS EDMAP.
Advisor: William A. Thomas

Alexander Stewart (B.S., Cincinnati)
M.S. thesis: Seismite horizons in the Tanglewood Buildup, Lexington, Limestone.
Advisor: Frank R. Ettensohn

Kristin Toth (B.S., Kentucky)
M.S. thesis: The role of clay minerals in organic carbon accumulation in the Devonian Appalachian Basin.
Advisor: Susan Rimmer

Clay Wilcox (B.S., West Virginia)
M.S. thesis: Origin and geochemistry of Ordovician hydrothermal dolomite bodies in central Kentucky.
Advisor: James Drahovzal

NEW GRADUATE STUDENTS
Eric Anderson
Todd Aseltyne
Marta Clepper
John Coates
Robert Jewell
Ting-Li Lin
Thomas Reed
William Reid
Alex Rutledge
Mark Thompson
Kristin Toth

TEACHING ASSISTANTS
Eric Anderson
Todd Aseltyne
Thomas Becker
Marta Clepper
Jeff Crevier
Matthew Dahlem
Rachel Galvin
Todd McFarland
Abhijit Mukherjee
William Reid
Alex Rutledge
Michael Solis
D. Matthew Surles
Kristin Toth

RESEARCH ASSISTANTS AND FELLOWS
German Bayona
Thomas Becker
John Coates
Robert Jewell
Ravi Kanda
Ting-Li Lin
Thomas Reed
Michael Solis
Clay Wilcox

STUDENT AWARDS

Graduate School Dissertation Enhancement Award
Germán Bayona

Brown-McFarlan Fund
German Bayona
Thomas Becker
Jeff Crevier
Ravi Kanda
Jennifer Klein
Matthew Massey
Abhijit Mukherjee

Geological Society of America (Southeastern Section) Student Research Grant
Abhijit Mukherjee

Pirtle Fellowship
Todd McFarland

Tarr Award (Sigma Gamma Epsilon) - Outstanding Graduating Senior
Sarah Hawkins

Pirtle Award - Outstanding Junior Showing Promise in Geology
Sarah Davidson
Rachel Galvin
Jennifer Wilson

TA's of the Year
John Todd McFarland
Alexander Stewart
Sarah Davidson (undergraduate TA)
Rachel Galvin (undergraduate TA)
Chad Parish (undergraduate TA)
Goe Sakulpitakphon (undergraduate TA)

University of Kentucky Graduate School Research Grant
Todd McFarland

Abhijit Mukherjee

STUDENT PRESENTATIONS

Andrews, William M. Jr., Geological evolution of the Kentucky River," presented to UK Dept. of Geology Graduate Student Symposium, February 22.

Andrews, William M. Jr., Using GIS to develop a new physiographic map of Kentucky. (poster) Geological Society of America, Lexington, KY, April 4.

Barnett, S.F., and Ettensohn, F.R., 2002, Tsunamites as seismites: A probable example from Middle Devonian Buffin Bed, New Albany Shale, southcentral Kentucky: Geological Society of America Abstracts with Programs, v. 34, p. A-102.

Bayona, G., Thomas, W. A., Finney, S.C., and Repetski, J. E., 2001, Flexural uplifting and forebulge migration as reflection of collisional tectonism: An example from the Alabama promontory, southeastern USA: American Association of Petroleum Geologists, 2001 Annual Convention Official Program, v. 10, p. A14. American Association of Petroleum Geologists Annual Meeting, Denver, Colorado, June, 2001.

Bayona, G., Thomas, W. A., Finney, S.C., and Repetski, J. E., 2001, Differentiating the effects of basement structures, elastic flexure, and eustasy in the evolution of the early Taconic (Blountian) foreland basin of southeastern Laurentia (North American craton): Geological Society of America Abstracts with Programs, v. 33, no. 6, p. A-213-214. Geological Society of America Annual Meeting, Boston, Massachusetts, November, 2001.

Bayona, G., Van der Voo, R., and Thomas, W. A., 2001, A structural and paleomagnetic investigation in the foreland thrust belt of Georgia and Alabama to constrain rotations in lateral and oblique structures: Eos, Transactions, American Geophysical Union, v. 82, no. 47, Fall Meeting Supplement, Abstract GP11A-0180, p. F312. American Geophysical Union Meeting, San Francisco, California, December, 2001.

Bayona, G., and Thomas, W.A., 2002, Location and composition of source areas for the Middle and Late Ordovician Blountian (Taconic) foreland basin, southeastern corner of Laurentia: Geological Society of America Abstracts with Programs, v. 34, no. 2, p. 118. Southeastern & North-Central Sections Meeting of Geological Society of America, Lexington, Kentucky, March, 2002.

Bayona, G., Van der Voo, R., y Thomas, W.A., 2002, Influencia de la configuración palinspástica de cuencas sedimentarias y estructura del basamento en la evolución de fajas de cabalgamiento que no involucran basamento: Memorias de la Segunda convencion técnica de la Asociación Colombiana de Geólogos y Geofísicos de el Petróleo, 5 p. Segunda convencion técnica de la Asociación Colombiana de Geólogos y Geofísicos de el Petróleo, Bogotá, Colombia, May, 2002.

Bayona, G., Interacciones entre basamento, arquitectura-composición de secuencias sedimentarias, y geometría de fajas de cabalgamiento. Short course presented at Segunda convencion técnica de la Asociación Colombiana de Geólogos y Geofísicos de el Petróleo, Bogotá, Colombia, May 14 y 15, and Ingeominas, Colombia, May 20, 2002.

Bayona, G., Análisis integrado de cinturones orogénicos y secuencias sedimentarias. Short course presented at Instituto Colombiano del Petróleo–ECOPETROL, Bucaramanga, Colombia, July 12, 2002.

Becker, T. P., Pazzaglia, F. J., Zeitler, P. K., Idleman, B. D. and Ault, A., 2001, The importance of lithology in the interpretation of U-Th/He ages: Eos, Transactions, American Geophysical Union, v. 82, no. 47, p. 1320. American Geophysical Union Meeting, San Francisco, California, December, 2001.

Ettensohn, F.R. and **Kasl, J.M.**, 2002, Changes across the Trenton-Maquoketa sub-Sulpher Well unconformity: Stratigraphic responses to structural inversion and initiation of the Tanglewood buildup, Middle and Upper Ordovician Lexington Limestone, central Kentucky: Geological Society of America Abstracts with Programs, v. 34, p. 15.

Ghosh, Anindya Ranjan, and **Mukherjee, Abhijit**, Arsenic contamination of groundwater and human health impacts in Burdwan District, West Bengal, India: North-Central and Southeastern Sections Meeting, Geological Society of America, Lexington, Kentucky, April, 2002

Goodnight, S.A., Rimmer, S.M., Crelling, J.C., Huggett, W.W., and Atudorei, V., 2002, Carbon isotope variability in kerogen from Devonian-Mississippian marine black shales: Geological Society of America, Abstracts with Program, v. 34, no. 6, p. 134.

Kanda, R. V. S., A Spherical Two Dimensional Asperity Scale Frictional Melting Model, Eos Trans. AGU, 82(47), Fall Meet. Suppl., Abstract S22B-0647, 2001.

Kanda, R. V. S., and O'Hara, K., A Spherical Two Dimensional Asperity Scale Frictional Melting Model: Southeastern and North-Central Section Meeting, GSA, 34(2), Program and Abstracts.

Mardon, S.M., and Hower, J.C., 2002, Impact of coal properties on coal combustion by-product quality: Examples from a Kentucky power plant: International Pittsburgh Coal Conference, 19th, 23-27 Sept. 2002, Pittsburgh, paper 47-4.

Mastalerz, M., Hower, J.C., **Mardon, S.M.**, Drobniak, A., and Lis, G., 2002, Impact of coal properties on coal combustion by-product quality: Examples from Indiana mines and power plants: International Pittsburgh Coal Conference, 19th, 23-27 Sept. 2002, Pittsburgh, paper 47-3.

Massey, M.A., Metamorphic and structural evolution of the Eastern Blue Ridge-Western Blue Ridge Boundary ("The Hayesville Fault") along the Blue Ridge Parkway, Western NC, Geological Society of America, Denver, Colorado.

Sakulpitakphon, T., Hower, J.C., and Taulbee, D.N., 2002, Predicted CO_2 Content of Maceral Concentrates from Kentucky and Illinois Coals: North-Central Section (36th) and Southeastern Section (51st), Geological Society of America Joint Annual Meeting, April 3–5, 2002, Abstracts with Programs, v. 34, p. A-120. (and: The Society for Organic Petrology, 18th annual meeting, Houston, 23-26 September 2001, p. 107.)

Bulut, Y., Hower, J.C., Karayigit, A.I., and **Sakulpitakphon, T.**, 2002, Characterization of feed coal, fly ash, and bottom ash from the Soma Power Plant, Manisa, Turkey: International Pittsburgh Coal Conference, 19th, 23-27 Sept. 2002, Pittsburgh, paper 16-4.

Stewart, A., and Ettensohn, F.R., 2001, Understanding soft-sediment deformation in a Middle/Late Ordovician calcarentic shoal complex: Geological Society of America Abstracts with Programs, v. 33, p. A-256

Shultz, M.G., Klein, J.M., McKenzie, F.M., Rimmer, S.M., Hower, J.C., and Popp, J.T., On the Road to Paradise: Depositional Setting of the Herrin and Paradise Coals, Western Kentucky Coalfield: International Pittsburgh Coal Conference, 19th, 23-27 Sept. 2002, Pittsburgh, paper 47-1.

FACULTY NEWS

Ana Carmo

Greetings! I am one of the new faculty members that joined the Department of Geological Sciences this year. First, let me tell you a little bit about my academic background and previous research. I am an organic and isotope geochemist, with a Ph.D. from Indiana University, Bloomington. For my dissertation, I studied the organic geochemistry of Turonian limestone/marlstone couplets from Sergipe Basin, Brazil. Because the couplets may have formed in response to wet/dry climate cycles, the idea was to determine possible climate controls on the cycling of organic carbon. Soon after graduating I did a post-doc at Iowa State University, Dept. of Agronomy where we investigated the role of soil organic matter in sequestering organic pollutants.

My current research interests are on reconstructing biogeochemical processes leading to the transformations of organic carbon in modern and ancient environments. This Fall I have been engaged in furnishing my organic geochemical laboratory which will be capable of investigating the molecular structure of organic compounds in sedimentary organic matter using gas chromatography/mass spectrometry. I have already outlined a project to work in collaboration with other faculty here at the Department who are interested in understanding the genesis of Devonian-Mississippian organic-rich shales in the Appalachian Basin. I am also engaged in cultivating collaborative projects with researchers elsewhere. Last August I joined scientists from Woods Hole Oceanographic Institution, on a three-week research cruise to the Chukchi Sea in the Arctic

Region on board of the Coast Guard Icebreaker USCGC Healy. Multiple piston and vibra-cores were taken from sediments at several locations. The participating scientists plan to apply various geochemical proxies to decipher decadal to millennial climate-related variations in the biogeochemistry of Arctic region

You can find out more about me and my work at http://www.uky.edu/AS/Geology/faculty/carmo.html. I am looking forward to a productive career with my colleagues in the Department and to future interactions with students.

Frank R. Ettensohn (Chair)

I wish I could say otherwise, but as usual, this has been an all too busy year for me. The GSA Special Paper on ancient seismites, edited by Nick Rast and myself, a first for the geologic literature, has finally been published. I only wish that Nick could be around to see it, for he spent so much of his last years trying to convince other workers that seismites were "real." Last April many in the Department were involved with the Kentucky Geological Survey in planning for and running the Joint North-Central Southeastern Sectional Meeting of the Geological Society of America in Lexington. I think that the meeting was a major success, and my particular part involved coordinating and running field trips for the meeting and in helping to edit the field-trip volume. In the fall, I also contributed to the Kentucky Society of Professional Geologists Field Trip to the Camp Nelson area and helped to edit the field guide for it. We also had a successful field trip to the Bahamas last year, and as I write this I am preparing to take 10 freshman students from my Freshman Discovery Seminar to the Bahamas during the Thanksgiving holiday. If any of you would ever like to go and do not mind student-class accommodations, I would welcome you on the trip. And speaking of trips, at the end of September, I participated in a week-long field trip to examine modern carbonate environments on the Belizean shelf. The Belizean shelf demonstrates a unique combination of clastic and carbonate environments, not unlike many Paleozoic situations that we see in the ancient geologic record. Much of the time was spent on a boat at sea looking at modern reef environments, because in the last two years major hurricanes had devastated hotels on the Belizean mainland.

Many of you may remember the tent camp that we ran for summer field camp until 1988. We had maintained that equipment in Gunnison until this year, when we decided that it was unlikely that we would use it all again. So this summer, I spent a week in Gunnison trying to sell that equipment. Even though most of that equipment was WW II surplus, I was able to put it up for auction and we made a slight profit selling it.

When time allows, I continue to do research with my students in paleontology and sedimentary geology; lately, most of my work has involved the Lexington Limestone and its seismites. Two students completed their theses: Greg Cornett, working together with Gerry Weisenfluh, completed a study examining synsedimentary tectonic influence in the generation of some coal-bearing rocks in eastern Kentucky, and Alex Stewart completed his thesis on seismites in the middle tongue of the Tanglewood Member of the Lexington Limestone. Matt Dahlem is my only paleontology student, and he is working on an edrioasteroid firmground from the Lexington Limestone. Two new Ph.D. students, Marta Clepper and John Coates, have come on board to help decipher the nature and origin of the Lexington Limestone.

Alan E. Fryar (Director of Graduate Studies)

This past year I learned that one of the rewards for achieving tenure is the opportunity for unlimited professional service. I became Director of Graduate Studies; co-editor of *Environmental & Engineering Geoscience*, a quarterly journal jointly published by GSA and the Association of Engineering Geologists; and the person responsible for organizing hydrogeology offerings for next year's GSA Annual Meeting. (This is only a partial list; I actually turned down or limited my involvement in several other activities.) Some days I feel like I've been hit by an anvil (or a piano, or a safe) out of the clear blue sky, like in an old Warner Brothers cartoon, but Frank Ettensohn warned me this might happen. The Department did negotiate a course release for me, without which I'd probably be locked up some place.

My students are managing to keep our research going with occasional, semi-informed input from me. In May, Karen Thompson finished her thesis on ground-water flow in the Ledbetter Creek watershed, which drains to Kentucky Lake in Calloway County. She started work with Shield Environmental in July. Danita LaSage and Lee Gatterdam are continuing to tie up loose ends on their projects as they work full-time at EKU and Shield Environmental, respectively. After a summer-long drought in the Bluegrass, our prayers for rain were finally answered in late

September: as the remnants of Tropical Storm Isidore passed through the area, Todd McFarland was able to finish his monitoring of sediment transport through the Blue Hole karst basin in Versailles. In contrast, Abhijit Mukherjee and I got rained on at some point during every trip to western Kentucky this summer (go figure), but we still managed to finish four rounds of tracer tests and monitoring of baseflow and solute transport in Little Bayou Creek in McCracken County. Two new students joined me this summer. Tom Reed, one of our former undergrads, is extending Todd McFarland's work by examining the transport of suspended sediment and pathogens (certain viruses and bacteria) in the Blue Hole basin and a nearby spring basin at UK's Animal Research Center. This work is funded by the College of Agriculture and involves collaboration with colleagues in Agronomy, Biosystems and Agricultural Engineering, Civil Engineering, and the KGS. Todd Aseltyne, who received his MS at the University of Akron, is building upon Karen Thompson's work with the intent of delineating sources, transformations, and fluxes of solutes (particularly nitrogen, which can cause undesirable nutrient blooms) to the Ledbetter Creek embayment. This project will continue our collaboration with colleagues at Murray State, and the presence of our new Environmental Research and Training Laboratories and our new geochemistry faculty should help tremendously.

My introductory hydrogeology course (GLY 585) last spring and my seminar in contaminant hydrogeology (GLY 610) this term had their largest enrollments ever; in part, this is tied to our recent success in graduate student recruitment. We took 11 new graduate students in 2001 and again in 2002, at a time when larger programs in the region have had difficulty recruiting. All of our full-time students are supported on teaching or research assistantships, and the number of RAs this term (nine) is approaching half of our total number of assistantships (22). Our challenge is to build on these successes while helping graduate students to finish in a reasonable amount of time.

Michael Handke

This August I was hired as a full-time Lecturer in the department. I come to UK from Washington University in St. Louis, Missouri, where I received my Ph.D. in Earth and Planetary Sciences in 2001. I teach four courses per semester and handle both introductory (Endangered Planet and Sustainable Planet) and advanced courses (Fundamentals of Geology I and II, and Mineralogy). I also plan to teach introductory courses in the summer sessions. My research interests include U-Pb geochronology (zircon and sphene), high-temperature geochemistry, igneous petrology, and Precambrian tectonics, and I hope to contribute to ongoing collaborative research projects in Madagascar and Norway with faculty from Washington University.

Kevin Henke

Dr. Kevin R. Henke is now working full time for the University of Kentucky Center for Applied Energy Research. He continues to teach evening introductory courses in the Department. A second edition and a Spanish version of *Minerals in Thin Section* by Drs. Dexter Perkins and Kevin R. Henke will be published by Prentice-Hall in 2003.

Paul D. Howell

Over the past several years, I've moved toward investigations of geoscience education, and in particular toward aspects of multimedia and "e-learning" using web-based approaches to teaching. I spent the 2001-02 academic year on sabbatical, working on three different e-learning initiatives for the geosciences. The first of these was a pair of multimedia projects for introductory geoscience textbooks by Stan Chernicoff, and published by Houghton Mifflin (Boston). I wrote, and directed the multimedia development for, fourteen chapters' worth of materials distributed on CD-ROMs with Stan's "Geology" and "Essentials of Geology" textbooks. These works range from groundwater simulations (how the water table fluctuates in response to seasonal precipitation changes) to rotating 3D silicate mineral models (and a silicate mineral construction factory exercise), to a rather whimsical simulation of slope stability where the student gets to determine whether to increase or decrease the likelihood of slope failure (and, hence, determine the ultimate fate of the house at the base of the hill). If you don't have access to the CD-ROM, several of these multimedia modules may be viewed on the web (http://www.smoothstone.com/elearning/explorer.htm Make sure you have a recent Macromedia Flash plugin for your browser for these to work properly.

The second of these e-learning initiatives is a pilot project for e-training of geoscience professionals working with Underground Storage Tanks (USTs) for state agencies associated with EPA Region IV. New UST professionals commonly need training to bring

them up to speed on the current state of the science in groundwater geology, contaminant transport in porous media, remediation techniques and more. We created an e-training website with sample materials covering groundwater geology principles, with multimedia enhancements to better convey concepts such as hydraulic gradient and Darcy's Law. The website won a first prize at the "State Fair" of the 2002 UST/LUST national meeting in Orlando, received positive attention from national EPA personnel, and the project is currently awaiting funding for full-scale development.

The third project is my brainchild for a web-based, multimedia-rich textbook for introductory geology courses. After the sample materials received very positive peer reviews when sent out from one national publishing house, the project was turned down for the "lack of a significant market segment". I personally believe that the market segment willing to adopt a digital geoscience textbook is significant and growing, so I redeveloped the prospectus, pushed harder toward other publishers, and am currently in negotiations with another national publisher over a contract for development of the text. With any luck, by the next *Round Up* (December, 2003) you'll be receiving more news on the progress of this project. If you'd care to see any of these materials, feel free to get on the Department website, look up my email address and send me a message! I'd love to hear from you.

Shelley Kenner

During the last year, I have been involved in a variety of research projects. I continue to work in the New Madrid Seismic Zone and am attempting to determine the sources of the stresses that are driving Holocene seismicity in the area. More generally, I am attempting to understand more about the behavior of zones of relative weakness, e.g., the New Madrid Seismic Zone, in whatever tectonic environment they happen to occur. Secondly, in collaboration with Mark Simons at the California Institute of Technology, I am developing a mechanical model for temporal clustering of large earthquakes on a single fault. Paleoseismologists often observe such behavior, especially in places like the Basin and Range and the Dead Sea Transform. Just as predicted by our model, these are low strain-rate environments with relatively low viscosities in the non-seismogenic lithosphere. Finally, I am beginning projects involving postseismic deformation following the 1992 Landers and 1999 Hector Mine earthquakes in the Eastern California Shear Zone and post-rifting deformation following a decade-long eruptive episode at Krafla Volcano, Iceland that started in 1975. Both of these projects will make use of extensive geodetic data obtained from the Global Positioning System (GPS) and Interferometric Synthetic Aperture Radar (InSAR).

The last year has been very successful with regard to proposals. Two new, multi-year proposals have just been funded to continue work on a number of the topics described above. As a result, I have two new research assistanceships available for next year. The proposals will also allow for continued collaboration with and visits to the California Institute of Technology, where I spent 3 weeks during the last summer concentrating on post-rifting deformation in Iceland and temporal clustering of major earthquakes.

David P. Moecher (Director of Undergraduate Studies)

Another year has flown by! What has happened since last year? Well, the number of Geology majors is up by about 15%. That modest but important increase is due mainly to the several new freshman students who are enrolling as Geology majors as true freshman. Many of us were "refugees" from Engineering, pre-medicine, Chemistry, Math, or maybe even English. This was also true for most of our undergraduate majors in the 90's. All these new students stated that they got into geology because of a genuine scientific interest in the Earth or the environment. We have educational reform at the state level to thank for some of this, because Earth Science is now required up through the secondary education level. Students who were interested in minerals and fossils as grade-schoolers will now be able to continue those interests farther up the academic ladder and not have it dampened by being able to take only other sciences.

We took our quadrennial field trip to Ontario this past May. This is a traverse from Toronto to Sudbury through the Grenville and Southern Provinces of the Canadian Shield. It was the coldest weather we've ever experienced up there! Winter and spring came late to southern Ontario, and we ran into the tail end of winter; well, it was winter by Kentucky standards. The most exhausting aspect was the wind. It never seemed to stop blowing! If it did, then the temperature dropped below freezing. Aside from the weather, however, the geology and scenery were spectacular as usual, especially that of the Sudbury Complex, Huronian Supergroup, along the north shore of Lake Huron, and the tip of the Bruce

Peninsula. We had a big group-26 students (four vehicles!), ranging from freshmen to graduate students. We were treated to some great Canadian hospitality (NHL playoffs while sipping a cold Canadian) by the hosts of a couple lodges where we stay for a night in order to dry out and warm up. Some of the costs of this trip were underwritten by Elizabeth Haynes (M.S. '00; currently a Ph.D candidate at Colorado School of Miners), who established the Haynes Field Trip Fund with a very generous donation. Please support this fund, and know that the students are getting an extremely valuable experience on our annual Spring Field Trips.

Chris Berg (M.S. '01) finished his Master's Thesis (see section on recent degrees granted for the title) upon our return from Down Under, headed off to the University of Texas to enroll in their Ph.D. program. Last I heard he was doing field work in the Italian Alps. Life is tough for a petrologist! Matt Massey is currently on schedule to complete his Master's thesis late this year or early next year. Matt is working on the structure and petrology of the Hayesville Fault as exposed along the Blue Ridge Parkway in North Carolina. Eric Anderson (M.S. '96) has returned to UK to enroll in our Ph.D. program, and he will probably work with me on some aspect of the petrology and geochronology of the Great Smoky Mountains.

Kieran O'Hara

Last year I took over teaching undergraduate structural geology since Nick Rast passed away. It was an enjoyable experience largely due to the very high quality of our undergraduate majors. Even the engineers enjoyed the course! Last year was also my last year as director of graduate studies and the program is now in the very capable hands of Alan Fryar. Mixing metaphors, my advice to Alan is: don't tilt at windmills lest the camel gets his nose under the tent in which case you'll be herding cats. On the research front Ravi Kanda and myself presented our research results on frictional melts at national and regional GSA meetings and also AGU in San Francisco and Boston. Ravi has his computer program, which models frictional heat during an earthquake, running on the campus supercomputer and hopes to defend in January 2003. Joe Allen, Dave Moecher and myself ran a recent GSA field trip from Denver to look at pseudotachylytes- using brooms we cleared the outcrops of two feet of snow! Frank Huggins from engineering and myself also completed the first Mossbauer analysis of pseudotachylyte. The results indicate that if water is present during frictional melting that oxidation of the melt takes place, stabilizing hematite. Hematite in frictional melts therefore appears to be an indicator of seismic slip in the presence of water. This Fall I am on sabbatical trying to catch up on previously unfinished projects.

Sue Rimmer

This has been a busy year for our group. We are still working on our NSF-funded project on stable isotope composition of kerogens in the Devonian-Mississippian black shales here in central Kentucky, and we made several presentations on this and other aspects of our black shale work. This is a project we are doing with colleagues at Southern Illinois University and the University of New Mexico. In the spring, I co-convened a full-day session on "Black Shales - Old Problems, New Solutions" (with Maria Mastalerz of the Indiana Geological Survey) here in Lexington at the Joint NC-SE GSA Sectional Meeting. This fall I co-convened another session with Rich Schultz of Elmhurst College at the national GSA meeting in Denver, "Chemostratigraphy: An Emphasis on Metal-Rich Black Shale Deposits." Rich and I are currently putting together a special paper along these lines. Meanwhile, it's been fun having two new colleagues on board, Ana Carmo and Harry Rowe, and we have already put in two proposals to NSF together. It's great to be so busy!!

Shane Goodnight, an MS student, is working with me on the kerogen isotope project, and also Kristin Toth joined us this fall and will work on the role of clay minerals in carbon accumulation in the black shales. Sarah Hawkins, who worked with us for the last two years, graduated this summer and we miss her insights and lively input in the lab.

On the home front, things are equally busy. Evan turns 4 at the end of November and is an absolute delight! Steve is working hard with his nursery and landscape business....this keeps him busy even as the snow flakes begin to appear. James graduated with a DVM from Auburn and is now a veterinarian working in Louisville. All in all, a very good year.

Harry Rowe

Another new addition to the department is Dr. Harry Rowe, who received his Ph.D. from Stanford University in January of this year. The major emphasis of Dr. Rowe's research is to find evidence from the geologic record that offers a better estimate of boundary conditions for Pleistocene/Holocene

climates and models that simulate future climate change. Dr. Rowe is establishing a field- and laboratory-based research program that concentrates on reconstructing environmental change and identifying the linkages between environments and natural/anthropogenic forcing mechanisms responsible for change. In June and July of this year, Dr. Rowe participated in a research cruise in the Bering Sea aboard the US Coast Guard Ice Breaker Healy. The aim of the research is to reconstruct paleoceanographic conditions since the last interglacial episode (125,000 years ago) using sediment cores from the south-central and southeastern margins of the Bering Sea. Using the new stable isotope laboratory that he is establishing under the framework of the UK Environmental Research and Teaching Laboratory, Dr. Rowe and his students will analyze the carbon and nitrogen stable isotopic composition of Bering Sea sediments in order to reconstruct surface-water conditions across the last glacial/interglacial period. In conjunction with this work, an undergraduate geology student is analyzing down-core biogenic silica and phosphorus in several of the cores in order to better understand the timing and magnitude of changes in surface-water conditions that are ultimately linked to the large-scale climate of the North Pacific Ocean. Dr. Rowe is a strong believer in providing research projects for undergraduates and he hopes to be able to provide undergraduate ship-based research experiences that supplement the traditional field experiences of undergraduate geology students at UK. In addition to ocean-based research, Dr. Rowe has been busy teaching the 500-level Low-Temperature Geochemistry course, and earlier in the fall semester he spearheaded a pre-proposal request to the National Science Foundation that was geared at creating a Biogeochemistry Program at UK. The $2.6 million dollar request is aimed at establishing an interdisciplinary teaching/research program between Geological Sciences, Forestry, and Agronomy.

William A. Thomas (Hudnall Professor of Geology)

In September, 1952, having recently graduated from McKee High School, I arrived at UK to become a geology major. A dozen or so new freshman geology majors gathered for advisement with John Stokley in Miller Hall, in a room just off the first-floor hallway that was lined with photographs from field camps of the previous two decades. I remember meeting Mitch Rutledge that day, beginning a friendship that has continued to the present. I think all of us freshmen were interested in those out-of-door activities associated with geology and field camp, and we began our studies with that anticipation.

In September, 2002, I arrived back at UK to begin a new fall semester. Things have changed a lot in fifty years. The department is now in the Slone Building; along with the evolution of geology as a science and profession, the Department has changed over the years. One thing has not changed; I am happy to be associated with a hard-working and intellectually stimulating group of graduate students who are enthused about geology. During the past year, Brent Garry and Brian Cook completed M.S. degrees; both of them did theses based on geologic mapping in the Appalachian thrust belt. Brian is now a Ph.D. student at Virginia Tech, and Brent is working on his Ph.D. at the University of Buffalo. Steve Jusczuk completed his Ph.D. dissertation on the relationship between the Ouachita thin-skinned thrust belt and the Arbuckle basement uplift, primarily using seismic reflection profiles and data from deep wells in Oklahoma and Texas. Germán Bayona is nearing completion of his Ph.D. dissertation on the Ordovician foreland basin associated with the Taconic (Blountian) orogeny in Alabama and Georgia. Germán received a UK Graduate School Dissertation Enhancement Award to support his research in the paleomagnetics laboratory of Dr. Rob Van der Voo at the University of Michigan. Germán presented papers at AAPG in Denver, GSA in Boston, AGU in San Francisco, and the Colombian petroleum association in Bogota; in addition, he conducted three short courses in Colombia. Mike Solis completed field work in Alabama for a geologic map that will be the basis of his M.S. thesis, and Tom Becker mapped a quadrangle in Pennsylvania to provide the basis for part of his Ph.D. dissertation. Tom presented a paper summarizing his M.S. thesis research at AGU. Drew Andrews has begun work on his Ph.D. dissertation on evolution of the Kentucky River drainage. Matt Surles is ready to begin his Ph.D. dissertation, using both outcrop and subsurface data to work out the relationship between the Appalachian and Ouachita thrust belts in Mississippi and Alabama. We have funding for Matt to do geologic mapping in Alabama during the coming winter. The mapping projects have all been supported by the USGS EDMAP program.

With these students, I feel like the coach of a really good team; I turn them loose and stay out of the way. To keep my hand in, I did present papers at

GSA in Boston; at the Latin American Geological Congress in Montevideo, Uruguay; at the GSA section meeting in Lexington; at an AAPG Hedberg Conference in Vail; and at the Gondwana meeting in Christchurch, New Zealand. Germán Bayona and I published two papers and have another in press. I can't imagine anything more satisfying than to see students succeed.

Edward Woolery

The two words best describing activity in the Seismic Lab during the past year are "production" and "expansion." The productivity has largely stemmed from several research grants that we have been fortunate to obtain, as well as, the addition of a new group of highly motivated graduate students. A few highlights from the ongoing research include: 1) the successful drilling and borehole installation of a 260-m vertical strong-motion array in the central New Madrid seismic zone (NMSZ), 2) the first geophysical imaging of neotectonic deformation (Holocene) in the unlithified sediment of the northernmost Mississippi embayment, 3) the deployment of seven additional short-period seismometers near the NMSZ's ambiguous northern boundary, and 4) a better understanding of the role of uncertainty in the probabilistic seismic hazard calculations of western Kentucky. These results, as well as significant findings from last year's field campaigns, have resulted in four published peer-reviewed journal articles, four additional journal articles now in review/revision, and six conference abstracts.

More importantly, the Seismic Lab has expanded in the area of personnel, because without full student participation, successful research cannot be pursued. During the past year we have recruited a post-doctoral scholar (Dr. Baoping Shi) from the world-renowned Seismic Lab at the University of Nevada-Reno, two M.S. students (Ting-Li Lin and Alex Rutledge), and one undergraduate research assistant (David Vance). We are also co-advising one M.S. student (Bill Reid) with Dr. Jim Drahovzal, and look forward to the arrival of Jen Sorrels (M.S.) for the Spring Semester.

The influx of new students and instrumentation this past year has allowed us to begin offering geophysics-focused courses once again. From a teaching perspective, this has been very satisfying. Applied geophysics courses (i.e., Engineering Earthquake Seismology, Exploration Seismology, and Geophysical Field Methods) that prepare students for the growing industry demand has seen enrollment not only from our in-house students, but from other departments (e.g., Civil Engineering) too. These early successes have led us, in conjunction with Dr. Kenner, to design an official core geophysics curriculum that we hope to implement in the coming year.

ADJUNCT FACULTY

James Drahovzl

My primary task at the University of Kentucky is providing leadership to the Energy and Minerals Section at the Kentucky Geological Survey (KGS). The section is responsible for oil, natural gas, coal, and mineral research and service. We are just ending our second year in of a three- year research contract from the U.S. Department of Energy to investigate potential sites for carbon dioxide sequestration. This is a cooperative research project with the Kansas, Illinois, Indiana and Ohio geological surveys in a study entitled, "Midcontinent Interactive Digital Carbon Atlas and Relational Database (MIDCARB). In the study, we are identifying oil and gas fields, coal beds, black shales, mines, and saline acquifers that could serve as carbon dioxide sinks for major stationary sources of anthropogenic carbon dioxide in the Midwest. In related work, we are just starting work on a DOE-sponsored study to examine the Devonian black shales in Kentucky as a possible future carbon dioxide sink.

In another new project, we are examining a hydrothermal dolomite body near Lexington for geochemical and seismic clues that would help such bodies be delineated in the subsurface. Such dolomite bodies constitute important oil and gas reservoirs in Eastern North America. This two-year study is jointly sponsored by the New York Research and Development Authority and DOE. Work in this project is sponsoring two Geological Science students, Clay Wilcox and Bill Reid, who are involved in Master's theses that will contribute to the project.

Rome Trough investigations continue and graduate student, Tina White worked for KGS in this project as part of her Masters thesis that she is finishing up on fault kinematics.

Personally, I continue to conduct research on the Cambrian and Precambrian rift basins of the eastern Midcontinent and the mapping of Precambrian basement. A group of us are defining the Proterozoic layered seismic sequences that underlie the Eastern

Midcontinent.

As an adjunct associate professor in the Department, I participated on the committees of six M.S. and four Ph.D. candidates this year, chairing the committee for three of the M.S. candidates. Their research topics include goniatite biostratigraphy, geologic mapping, structural geology, seismic interpretation, geochemistry, and stratigraphy. During the year, two of the Department's undergraduate students and one of its graduate students have held student appointments with the Energy and Minerals Section at KGS. I continue to work on the Coosa Deformed Belt project in the Alabama Appalachians with Dr.Thomas.

Becky, my wife, and I continue to enjoy living in the Bluegrass and being a part of Department activities.

Steve Fisher

The past year was filled with activities related to the design and implementation of groundwater quality monitoring networks, and reporting on regional geochemical patterns in Kentucky groundwater. In May I participated in the National Monitoring Conference of the National Water Quality Monitoring Council, a meeting that draws an international audience of scientists and resource managers that are concerned with collecting, preserving, and disseminating regional water quality information. Peter Goodmann (Kentucky Division of Water) and I presented a poster session on the Kentucky groundwater monitoring network and published a paper titled, "Characterizing groundwater quality in Kentucky: From site selection to published information,", which summarized our experience with monitoring networks. Discussions at this meeting confirmed the need for interagency and interstate cooperation in groundwater monitoring programs and the difficulty of establishing and maintaining such programs. Most of the rest of the year was focused on systematically examining groundwater quality data from the KGS Groundwater Data Repository, translating analytical data reports into useful information, and communicating the results.

Stephen Greb

As an adjunct in the Department, I am happy to teach GLY 130, the Dinosaurs and Disasters class. This semester we moved to the Classroom Building to accommodate the increased enrollment of the course. My research interests at KGS include coal-mining geology, coal-field depositional systems, Carboniferous basin analysis, paleontology, and sedimentology. It was a busy year for me in coal. I helped organize coal sessions and run field trips at the Eastern Sectional Meeting of GSA, which was held in Lexington, and organized the GSA Coal Division sessions at the annual meeting in Denver, where I became the Division Chair. In my sedimentological activities, I was fortunate this summer to attend the International Tidal Sedimentology Conference in Hangzhou, China. During my trip, I was able to visit the expansive coastal tidal flats fringing the Changjiang Delta and set the groundwork for possible future collaboration with Chinese colleagues. This is an interesting area because the South China Sea is a possible analogue for the shallow seas that covered much of the U.S. during the Paleozoic. I continue my work in earth-science outreach at the Kentucky Geological Survey, helping to organize and participate in teacher workshops, field trips, tours at KGS, school visits, as well as adding to the web-based Earth Science Education Network (http://www.uky.edu/KGS).

James Hower

Much of our research continues to be on the petrographic and chemical properties of fly ash. We are conducting studies of mercury and arsenic capture in fly ash and we are expanding our studies of the impact of co-combustion of tires on fly ash petrology and chemistry. In 2002 we sampled all of the coal-fired power plants in Kentucky, a survey we conduct every five years. This keeps us busy but it is also a vital part of staying in touch with the electric power industry in the state.

Goe Sakulpitakphon finished three years at the CAER and has now moved on to graduate school at the University of New Orleans. Sarah Mardon, a senior in geology, started work in my laboratory in August 2001. Sarah has been partially supported on a grant from the National Coal Quality Inventory, with some support in 2001 from a grant from CONSOL Energy. Lee Clark, also a senior in geology, started work in May 2002. Initial support for Clark was on a grant from CONSOL Energy. Sakulpitakphon was also supported by CONSOL Energy for the summer of 1999.

I am continuing as editor-in-chief of *International Journal of Coal Geology* and have been named to the board for *Acta Geologica.* I have also been named as the eastern region director for the U.S. Department of Energy's Combustion Byproducts Recycling Corsortium.

EMERITUS FACULTY

William Dennen

I continue my snowbird existence moving every six months between Rockport, Maine, and Bonita Springs, Florida, on a six-months schedule—between a glaciated mid-Paleozoic plutonic series and quaternary limestones.

Over the past half dozen years, a former student at MIT and I have given a public "talk and walk" presentation based on an abandoned granite quarry in a state park in Rockport. The turnout has been good enough that I put together a booklet on "The Rocks of Cape Ann" to introduce the public to geologic processes and products with a strong dash of scales—time and distance (depth).

Family news: my daughter in Mexico City has been ordained as an Anglican priest and both her son and daughter are in medical school. Also, I am informed that I will be a "great grandparent" by my granddaughter in Kentucky.

Bruce R. Moore

Attended the Southeast Meeting of AAPG in Urbana, Illinois, in October and participated in an impromptu mini-alumni lunch with Warren Anderson, Dennis Swager, Greg Maynor, Mike Reed, and Dan Wells. It was a very interesting session on the Illinois Basin structure and petroleum geology. I've been busy flying my airborne multispectural microfracture system in Michigan, Illinois, Kentucky, and Louisiana and testing associated trace geochemical leakage. I have developed a fully computerized GPS moving map, sampling and soil analysis sytem in a field vehicle with help from the Kentucky Geological Survey.

Charles Ratté, 1991-1992

It has been ten years since I had the good fortune to do some professoring at the UK Geology Department, and meet a lot of wonderful people. Judy and I are fine. We are enjoying living on the island of Martha's Vineyard where our two daughters live. So the family is all together. We have added a golden retriever to our family and she (Emme) has bonded to me like sticky paper. I stay in shape via many miles of dog walking and trying to "out swim" her in the summer (a lost cause). I've sort of become the Vineyard Geology GURU, teaching in the evening Adult Ed. program, and an occasional "off campus" course for Boston University. We still get a big thrill watching Big Blue basketball as well as the Boston Celtics who now have three former UK players on their team-Antwan Walker, Tony Delk and Walter McCarthy. I'm trying to get Kentucky Bluegrass to grow in my lawn which requires a great deal of lime in these acid glacial sediments, but only two "red buds" (out of four) are doing reasonably well. Their large leaf makes them very susceptible to wind damage. If John Bonita happens to read this *Round Up*. I have a question. Are you still wearing those great neckties. It was a fun contest, but I was never a threat to your good taste.

Hope everyone at UK is fine, and I enjoy reading about all those students that were in my classes.

FACULTY RESEARCH SUPPORT

Kentucky Council on Post-Secondary Education
Understanding scientific process through modeling past and present causes in the earth, life, and environmental sciences.
Frank R. Ettensohn

National Science Foundation\ EPSCoR
Kentucky Environmental and Research Consortium (KEREC): University of Kentucky Environmental and Research Training Laboratories (ERTL).
Gail Brion, Frank Ettensohn, and Alan Fryar

Kentucky Department for Environmental Protection
Natural attenuation of TCE and Tc-99 during seepage to and flow within Little Bayou Creek.
Alan Fryar

University of Kentucky College of Agriculture, Senate Bill 271 program
Role of suspended sediment in facilitating pathogen transport in Inner Bluegrass karst aquifers.
Alan Fryar

UK Special Summer Faculty Research Fellowship, Office of the Vice President for Research and Graduate Studies
Modeling of chemical evolution during ground-water recharge and flow, Southern High Plains, Texas.
Alan E. Fryar

U.S. Geological Survey, National Earthquake Hazard Reduction Program
Fault loading processes in the New Madrid Seismic Zone (collaborative research with Stanford University).
Shelley Kenner

U.S. Geological Survey, National Earthquake Hazard Reduction Program
Earthquake generation within intraplate seismic zones: Sources of stress and geometric considerations.
Shelley Kenner

National Science Foundation
Interpreting high resolution geodetic data with viscoelastic models (collaborative research with California Institute of Technology).
Shelley Kenner

National Science Foundation, Petrology and Geochemistry
Oxygen isotope systematics in polymetamorphic rocks: The effects of multiple periods of deformation and mineral growth.
David P. Moecher

National Science Foundation
Redox conditions during frictional melting: A Mossbauer study of frictional melts.
Kieran O'Hara

National Science Foundation
Testing a pseudotachylyte geothermometer.
Kieran O'Hara

Kentucky National Science Foundation EPSCoR Summer Research Program
Undergraduate Research Opportunities in the Geological Sciences: A focus on Future Women Geoscientists.
Sue Rimmer

National Science Foundation
POWRE: $\delta^{13}C$ Heterogeneity in Devonian-Mississippian Marine Shales: Integration of Density-Gradient Centrifugation (DGC) and Organic Petrography into Isotopic Studies.
Sue Rimmer

National Science Foundation, EPSCoR
Pyrite framboid size: A paleoredox indicator in Devonian-Mississippian black shales.
Sue Rimmer

Research Committee Grant, University of Kentucky
Evaluation of vitrinite suppression in Devonian-Mississippian shales: Application of electron-microprobe and fluorescence alteration (FAMM) Methods.
Sue Rimmer

U.S. Geological Survey
Shear-wave velocities of the post-Paleozoic sediments in the Memphis, Tennessee, Metropolitan area.
Ron L. Street

Petroleum Research Fund of the American Chemical Society
Geometry and kinematics of lateral ramps in thrust belts: Keys to translation direction and three-dimensional balancing.
William A. Thomas

U.S. Geological Survey, EDMAP
Geological mapping in the Appalachian thrust belt in eastern Alabama.
William A. Thomas

U.S. Geological Survey, EDMAP
Geologic mapping in Pennsylvanian rocks in the Appalachian thrust belt.
William A. Thomas

Department of Energy
Installation of a vertical strong-motion array in McCracken County, Kentucky.
Ed Woolery

Kentucky Cabinet of Health Services
Earthquake-hazard assessment of CERCLA Cell, Paducah Gaseous Diffusion Plant.
Edward Woolery

Kentucky Department of Transportation
Seismic hazards maps and time histories for the seismic design of highway bridges in Kentucky.
Ed Woolery

Kentucky Division of Waste Management
Ground-motion assessment of the C-746-U Landfill, Paducah Gaseous Diffusion Plant.
Ed Woolery

Seismic Micro-Technology (Educational Grant)
Acquisition of seismic modeling algorithms:

KINGDOM SUITE+software.
Ed Woolery

U.S. Geological Survey
A comprehensive geotechnical investigation and borehole accelerometer array installation in the New Madrid Seismic Zone.
Ed Woolery

U.S. Geological Survey
An integrated geophysical assessment of Late Quaternary Neotectonics along the Northern Mississippi Embayment Extension of the Fluorspare Area Fault Complex.
Ed Woolery

U.S. Geological Survey
Shear-wave velocities of the Post-Paleozoic sediments in the Northern Mississippi Embayment. (Collaborative Research with the University of Memphis)
Ed Woolery

Western Kentucky Energy Consortium/Kentucky Council for Economic Development
Preliminary seismic hazard assessment for Paducah, Kentucky.
Ed Woolery

REPRESENTATIVE PUBLICATIONS

This list provides examples of faculty and student publications; a complete list is available on request.

Faculty - Bold
Students and former students – italics

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DEPARTMENTAL SEMINARS 2001-2002

Chemical evolution during ground-water recharge and flow, Southern High Plans, Texas. Alan Fryar, Geological Sciences, University of Kentucky.

Views and impressions of Down Under, part I: volcanoes and glaciers in New Zealand. David Moecher, Geological Sciences, University of Kentucky.

Impact of Mn (III, IV) (hydr)oxides on soil organic carbon fate. Christopher Matocha, Agronomy, University of Kentucky.

Midcontinent interactive digitial carbon atlas and relational database (MIDCARB). Jim Drahovzal, Kentucky Geological Survey.

Stone weathering in urban environments. Alice Turkington, Geography, University of Kentucky.

Geology and karst. Walter Johnson, Geolocial Sciences, University of Kentucky.

American Association of Petroleum Geologists Distinguished Lecture
Outcrop/behind-outcrop characterization of deep-water (turbidite) petroleum reservoir analogs: why and how. Roger Slatt, Geology and Geophysics, University of Oklahoma.

A tour of Iceland: a land of fire and ice. John Kiefer, Kentucky Geological Survey.

Tectonic controls on the hydrogeology of the Rio Grande Rift. Mark Person, Geological Sciences, Indiana University.

Monitoring ground-water quality in Kentucky: activities of the Kentucky Interagency Ground-Water Monitoring Network. Stephen Fisher, Kentucky Geological Survey.

Biogeochemical processes affecting the preservation of organic matter during deposition of Cretaceous marine carbonates in Sergipe Basin, Brazil. Ana Carmo, Iowa State University.

GSA Birdsall-Dreiss Distinguished Lecture
Groundwater vulnerability and the meaning of groundwater age dates. Graham Fogg, Land, Air, and Water Resources, University of California at Davis.

Lake Titicaca, El Niño, and tropical climate change during the Holocene. Harry Rowe, Earth & Environmental Sciences, University of Illinois, Chicago.

Hudnall Lecture
The "lost continent" of Madagascar: It's geology and role in Neoproterozoic supercontinental assembly. Robert Tucker, Earth and Planetary Sciences, Washington University.

Calibrating the geological column with tiny bits of time: Theory and practice of U-Pb geochronology. Robert Tucker, Earth and Planetary Sciences, Washington University.

Otolith oxygen isotope record of mid-Holocene El Niño in coastal Peru. Fred Andrus, Geology, University of Georgia.

Kentucky oil and gas data on the Web. Brandon Nuttall, Kentucky Geological Survey, University of Kentucky.

Bugs and rust: using stable isotope geochemistry to examine conditions of ore deposit oxidation and acid mine drainage generation. Erik Melchiorre, Geology and Geography, DePauw University.

Serendipity and science: discovery of an additional signigicant source of sulfate depletion in deep-water, methane-rich, marine sediments associated with gas hydrates. Walter Borowski, Earth Sciences, Eastern Kentucky University.

"Hindered" erosion and breaching in fine sand: significance to dike bursts and development of quasi-steady surbidites. Janrik van den Berg, Physical Geography, University of Utrecht.

Isotopic evidence for the origin of soil salts in the Atacama Desert, Chile. Jason Rech, Geology, Miami University.

Engineering geology of karst in Missouri. John Rockaway, Physics and Geology, Northern Kentucky University.
Unique record through Late Proterozoic snowball Earth and hothouse aftermath stages in the core of South America and its bearing on Gondwana assembly, Ricardo Astini, Cáedra de Estratigrafia y Geologia Histórica, Universidad Nacional de Córdoba, Argentina.

AEG/GSA Richard H. Jahns Distinguished Lecture
Flood hazards, Perry Rahn, Geology and Geological Engineering, South Dakota Schools of Mines and Technology.
The tectonic assembly of Asia deduced from paleomagnetism and seismic tomography, Rob van der Voo, Geological Sciences, University of Michigan.

Testing folding geometries and vertical-axis rotations with paleomagnetic techniques. Rob van der Voo, Geological Sciences, University of Michigan.

Kentucky Geological Survey and American Association of Petroleum Geologists Distinguished Lecture
Opportunities and challenges for the U.S. petroleum industry: the next 50 years.
The Midcontinent Rift system: an unusual frontier hydrocarbon province.
Susan Landon, Thomasson Partner Associates.

DEPARTMENTAL FUNDS

Several important Departmental funds continue to be supported by contributions from alumni and friends of the Department. The special uses of these funds are as follows:

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- student research grants; student prepares proposal including itemized budget
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- enhancement of Departmental programs in teaching and research through improvement of equipment and facilities

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- support of the Departmental seminar program
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- to support student travel on field trips.

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- to support Department seminars and speakers

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- scholarships for participation in the summer field course

Pirtle Scholarship Fund
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- undergraduate scholarship for outstanding junior ($1,000 per year)
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Chevron Fellowship
- graduate fellowship

Chevron Support Fund
- support for student research
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