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Mines MAGAZINE

Colorado School of Mines Alumni Association

February, 1990

Steel Research at Mines: Classical to Contemporary



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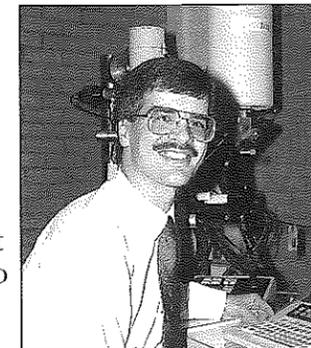
Public Service®

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4 Steel Research Center Comes of Age,
by Ellen Glover

Mines campus an unlikely spot for research into smokestack industries



15 Pre-College Education:

Mines is training Colorado's science teachers and high school students.

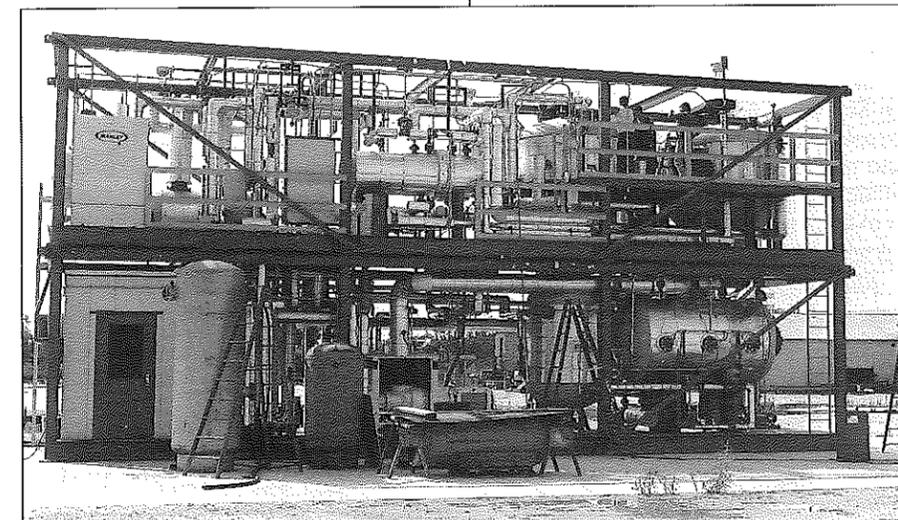


8 Sketches: China's Grand Old Man of Geophysics.

Professor Gu Gongxu recalls his days as a graduate student at Mines in the 1930s.

27 Global Insight:

Professor learns about smugglers and tourists,
by Dr. Eul-Soo Pang



12 New Technologies for Environmental Protection.

Mines alumnus develops a new technique to decontaminate hazardous waste.

- 19 Book Review
- 21 Director's Desk
- 22 Sections
- 23 Letters to the Editor
- 24 Under the "M"
- 28 Calendar
- 30 In Memoriam
- 35 Alumni Updates
- 41 Professional Cards

Cover

Left: Colorado blacksmith recreates 1880s technology.
(photo E. Glover)
Right: At Timken, researchers experiment with steel. (photo courtesy of Timken)

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F O R G I N G A H E A D

STEEL RESEARCH CENTER COMES OF AGE

by Ellen Glover

Success tastes sweet, especially after a long battle or tough project. George Krauss is savoring the success of weaning his five-year old Advanced Steel Processing and Products Research Center at Mines from a \$575,000 National Science Foundation grant to a financially independent organization sponsored by 20 American and Canadian steel producers and users.

Krauss, 56, AMAX Foundation professor of physical metallurgy at Mines since 1975, is also director of the Steel Center. The center is staffed with the university's faculty and graduate students. Its work is conducted in the school's metallurgical engineering laboratories, and though Golden may seem an unlikely spot for conducting research

into smokestack industries, Krauss and his team are performing some of the nation's most advanced research on the strength and formability of high-quality alloy steels.

The Golden-based center is recognized by industry leaders as one of the nation's premier steel research facilities, and with a budget approaching \$750,000, is one of the nation's largest university research efforts devoted to steels.

The energetic Krauss isn't content to sit back and treat the center with a "business as usual" attitude. He and his colleague, Dr. David Matlock of the metallurgy department, have diligently managed more than 30 projects and have strengthened valuable ties to industry. Each sponsor pays \$35,000 a year to

participate in cooperative research projects. Krauss and Matlock continue to search for more sponsors and more graduate students to conduct the research.

Krauss said companies like The Timken Company, a Canton, Ohio, manufacturer of precision roller bearings and special alloy steels, and other steel makers and users are turning to university-based research centers because they can no longer individually support research and development spending levels of the past.

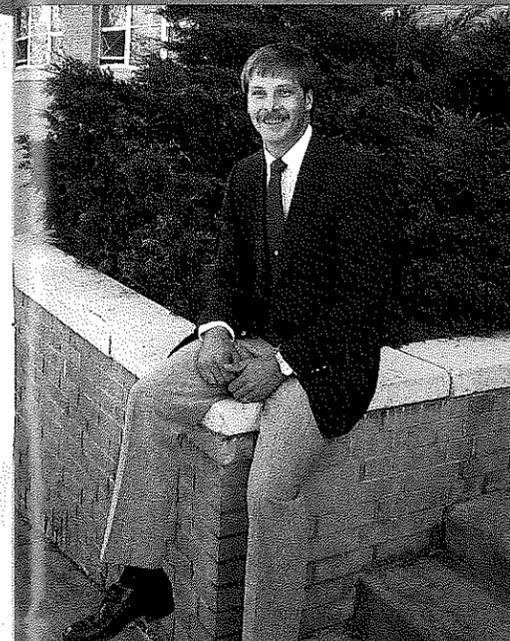
Krauss explained the steel research facility is performing a broad-based research effort with programs directed to sheet, plate, bar and special alloys. Of special interest is formability of coated sheet steels which include corrosion-resistant steels that are stamped by automobile makers into car bodies and components.

Graduate students in the Golden lab use sophisticated mechanical test equipment tied to computers to stress the coated steels to their limits, until they fracture or deform. The center's engineers then analyze the steels under electron microscopes to determine the microstructural basis of the deformation and fracture.

Other state-of-the-art projects include investigating ultralow-carbon vacuum-degassed steels with outstanding formability; direct-cast strip steels which require no hot rolling; carburized steels with fatigue strengths more than double those reported for existing steels; new direct-cooled forging steels; and hot deformation processing of Alloy 718, a special forging alloy widely used by the aerospace industry. Another project, under the direction of Professor Matlock and the subject of Mike Riendeau's M.S. thesis, has led to a patent for discoveries which improve the formability of stainless steel wires for fasteners.

Strong praise for research

Testimony to the center's high-quality researchers comes freely from sponsors like Dr. Terry Mohr, research director at Timken, one of the original sponsors of the Mines program. "While it is difficult to manage 19 to 25 graduate students and their projects with any success, Mines has developed a unique research center



Scott Deits

which gives sponsors answers to technical questions. One thesis builds on the next which reflects well on the professors at Mines," he said.

Timken manufactures tapered roller bearing and is known for the purity of its steel. Bearings are produced in seven locations worldwide, and the company employs 19,000 people with an average of \$1.6 billion in sales each year. In the last six years, six Mines graduates have been employed by Timken.

Dr. Terry W. Mohr and Kirk Erven



Mohr says his company is searching for a means to make its bearings smaller while retaining the properties of larger bearings. The same research could be applied to gears which would open up markets in power transmission systems like auto and truck axles, or off-road vehicles.

Timken is sponsoring Kirk Erven, a graduate student and former Timken employee, for an additional \$35,000 beyond its Steel Center sponsorship to simulate bending fatigue on gears like those found in an automobile transmissions. The gears are carburized, and Erven's work demonstrates how to achieve better performance with eight different steels. Timken believes Erven's research will enhance their share of the market for bearings and gears.

Erven is a graduate of Ohio State University and worked for Timken for three years before coming to Mines. He likes the relationship between Mines professors and graduate students, and the surprising ability on the part of the sponsors to share information.

He will finish his thesis in May if all goes well and the research can be wrapped up to a satisfactory point. He smiles when he says the research sometimes raises more questions than it answers, "but it will be good to get back to the working world." He says he enjoyed his three years at Timken and would like to return there to put his research into practice.

A cure for rust

Scott Deits, another graduate student and a 1984 Mines graduate, is working on a project which will ultimately help car manufacturers choose the best kind of coated sheet metal to extend the life of vehicles from five to seven years to nearly ten years, and prevent corrosion. Ronald Krupitzer, supervisor of sheet metal engineering at Chrysler, says Deits' work is very practical, yet fundamental for the automobile manufacturer.

"A lot of Chrysler's engineers are doing work on specific vehicles so this enables us to have a larger research effort by using a university like Mines without having to maintain a large research group within Chrysler's staff, Krupitzer said.

continued on page 7

STEEL RESEARCH CENTER SPONSORS

The Advanced Steel Processing and Products Research Center, a cooperative university/ industry/ government effort based at the Colorado School of Mines, was seeded with \$575,000 from the National Science Foundation for a five-year period. It has recently become self-sufficient and is supported with annual \$35,000 grants from corporate and government sponsors. Current sponsors are:

- U.S. Army Materials Technology Lab
- Bethlehem Steel Corporation
- Carpenter Technology Corporation
- Caterpillar Incorporated
- Chaparral Steel Company
- Chrysler Corporation
- DOFASCO Incorporated
- Eaton Corporation
- Ford Motor Company
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- The Timken Company
- United States Steel Division, USX
- Inco Alloys International

Wanted: graduate students with interest in steels.

The Advanced Steel Processing and Products Research Center (ASPPRC) at the Colorado School of Mines is rapidly becoming the largest university research effort in the United States devoted to steel research, and continually needs new waves of graduate students in its research programs.

At least ten openings will develop by late summer when current students finish advanced degrees. The Center hopes to attract graduate students with experience in the production and use of steels and other advanced materials. This process has already begun.

For example the Center has attracted:

- Karl Grassl (B.S., New Mexico Institute of Mining and Technology) who has entered an M.S. program from the Chaparral Steel Company.
- Diane Wilshynsky (B.S. and M.S. University of Toronto) who entered a PhD. program from DOFASCO Incorporated.
- Kirk Erven (B.S. Ohio State University) entered an M.S. program from The Timken Company.
- Bob Klug (B.S. Michigan Technology University) has entered a PhD. program from the Allison Gas Turbine Division of General Motors.

"We welcome CSM alumni to consider similar opportunities for graduate work. An annual stipend of about \$11,000 and full tuition are provided. Unique to the operation of ASPPRC are the semiannual program reviews where technical representatives from center sponsors gather to interact with CSM staff and students. Projects are evaluated, new research is proposed, and dinner at the Buffalo Rose, Senor Frogs, or other outstanding downtown Golden restaurant follows," said Prof. George Krauss.

For more information call (303) 273-3774.

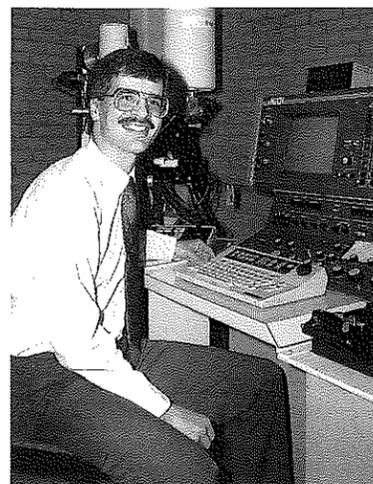
Research Faculty Grows with Steel Center

It's a little hard to believe the 32-year-old man sitting at the electron microscope is an assistant professor in the Metallurgy Department, but **Steve Thompson** is one of the newest members of the faculty, and is attracting attention and substantial grants.

Thompson's research interests are concerned with the interrelationships between processing, properties and microstructures of steel products with particular emphasis on alloy development and mechanisms of microstructural change. He came to Mines in 1986 on a post-doctoral assignment with the Steel Research Center to help students with their work in microstructures.

The Pennsylvania native says he likes Colorado and the focus of the Steel Research Center. While he looked for positions elsewhere following his post-doctoral work he wanted to establish roots at Mines because "...in the area of physical metallurgy of steel products this is one of the strongest, if not *the* strongest, programs in the United States as I see it," he said.

In November the Iron and Steel Society (ISS), a nationally recognized professional society, awarded Thompson a grant worth \$50,000 annually for three years. This is the third ISS grant awarded to young professors whose involvement with students, especially undergraduate students, "enables them to effectively sell the excitement of the new high tech steel industry." According



Dr. Steven Thompson

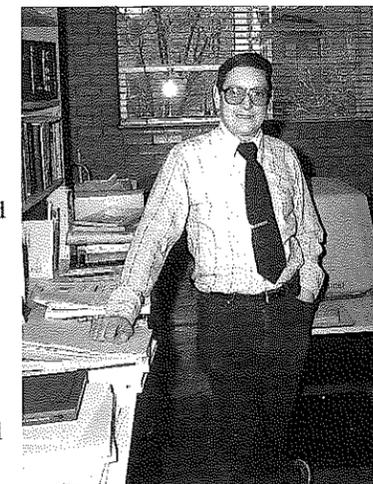
to the ISS, the goal of the society's Ferrous Metallurgy Grant Program is to enlarge the base of trained individuals in the industry.

This grant, combined with funding from the Steel Research Center sponsors for five years, is giving the Metallurgy Department the breadth they need in their faculty, and at the same time the financial support to compete in research

projects. Thompson credits Professors Matlock and Krauss with using an imaginative approach to bringing on a young faculty member with the hope that it will develop into something very positive for the school.

Drs. Krauss and Matlock were also successful in obtaining funding from the Forging Industry Educational Research Foundation (FIERF) for a second professorship within the department. **Dr. Chester Van Tyne** joined the faculty in June 1988 with a specialty in forging and computer modeling of hot deformation processing. He comes to Mines from Lafayette College in eastern Pennsylvania where he spent eight years as a professor.

"FIERF was looking for an innovative way to help the forging industry, and previously they distributed their grants among a number of research programs at several universities. Profs. Krauss and Matlock submitted a proposal to FIERF which called for the foundation to establish a new professorship over



Dr. Chester Van Tyne

continued on page 20

continued from page 5

"Fortunately we've built in a lot of safety factors in the way we build cars, and with reasonable care can last longer. We are trying to design a car with a considerably longer life as we use more and more corrosion products. Cars should now last twice as long as cars built in the late 1970s without a lot of galvanized protection which is a big asset to the consumer. Cars should not be a disposable commodity—people want to keep their cars."

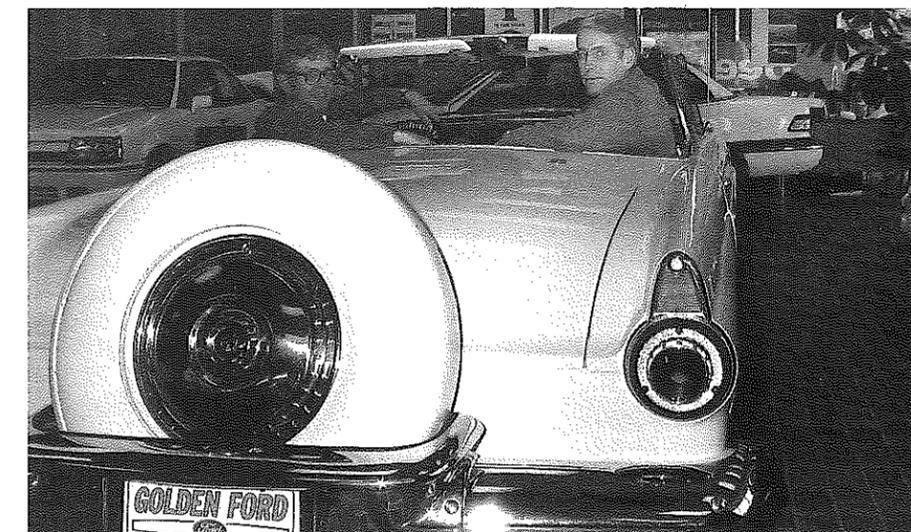
Krupitzer said that Deits' work mirrors Chrysler's research on an alloy form of galvanized steel they intend to use on future vehicles. Chrysler labs are also working on deformation of coatings; friction measurements; damage to coatings; and comparing coating available in sheet products.

"Like all good research, what Scott is discovering will lead to new projects and new opportunities for either himself or new students because we are just scratching the surface in understanding these new coatings," he added.

Close relationships

Krupitzer says one of the best benefits of the steel center is the close relationships between the students and the supporting institutions, including Chrysler. "In the last year we have had a number of students working on Chrysler-related projects both in Golden and at Chrysler's home office. We've seen the students' top-notch work, and have used that to recruit or identify talent for our engineering groups. It's one of the best ways to find future Chrysler engineers," he smiled.

Comments like that are exactly what Drs. Krauss and Matlock like to hear. Continued interest by major corporations will fuel the Advanced Steel Processing and Products Center for the next decade, while alumni like Erven and Deits will provide the necessary tie to Mines for graduate students and future research projects.



Drs. George Krauss and David Matlock of the Steel Research Center try out a Ford Classic, a 1956 Thunderbird. Ford Motor Company is a sponsor of the research center. (E. Glover photo)

See related metallurgy stories on page 26

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China's Grand Old Man of Geophysics

An interview with Professor Gu Gongxu
Past Chairman of the Chinese Geophysical Society

by Ken Larner
President, Society of Exploration Geophysicists



Dr. Larner and Professor Gu in front of sign advertising the Joint Geophysical Symposium.

Editor's Note: As President of the Society of Exploration Geophysicists (SEG), Dr. Ken Larner, Charles Henry Green Professor of Exploration Geophysics at CSM, led a delegation of geophysicists from the SEG to the UCEG/SEG Beijing (89) International Symposium and Exhibition in Beijing, China, sponsored jointly by the Union of Chinese Exploration Geophysicists (UCEG) and the SEG. The meeting, held August 21-26, 1989, provided an opportunity for Dr. Larner to go on assignment for Mines Magazine to interview China's most highly noted and respected geophysicist, Professor Gu Gongxu. Professor Gu, who is past chairman of the Chinese Geophysical Society and who was recognized as honorary member of SEG at its annual international meeting in November 1988, is a Mines graduate, having received an M.S. degree in exploration geophysics in 1936.

The leading figure in both exploration and earthquake geophysics in China for more than a half century, Professor Gu was also the individual in China most instrumental in forging the strong ties that have developed between Chinese geophysical societies and the SEG since their first contact, an exchange of delegations in 1979. At this year's symposium, Professors Gu and Larner exchanged mementos commemorating the ten years of continuing cooperation. (Also at the symposium, Dr. Cecil H. Green, a geophysicist who has done so much for CSM and other academic institutions, was recognized as the first foreign honorary member of the Chinese

Geophysical Society.)

The following interview was conducted on August 25 over breakfast in a suite of the Olympic Hotel in Beijing. Virtually every sentence was punctuated by Professor Gu's infectious smile and ever-present chuckle and good humor. As Dr. Larner puts it "I have never done an interview before, but conclude that if every interviewee was such a joy and so easy to talk with as Professor Gu, a reporter's job would be the easiest and most enjoyable task in the world."

Where were you born? Where did you live when you were young?

I lived in the province of Chekiang, in a rural district. My father was a school teacher.

How did you happen to go to the Colorado School of Mines?

Oh, in 1933, I think it was. I took the government examination to go to the United States to study after my graduation from the University. It was with a scholarship because only rich people at the time could go to the United States. The government assigned me to study geophysical exploration in the United States, and at that time not many schools taught geophysical exploration. We found that Colorado School of Mines had a good reputation in geophysical exploration. As a student in China I had three directors (one physicist and two geologists) and they knew of the Colorado School of Mines. Professor Heiland was at Mines; I decided to go there and my directors approved. I had to study geophysics because I was a physicist before. I had taught at

the University of Chekiang in Hangchow for three or four years.

You don't still feel forced to do geophysics now to you?

No (with a big chuckle). At that time I just wanted to go to the United States to study anything I could. Physicists can do different kinds of study. It doesn't matter; the ideas are the same.

What was Mines like when you got there?

I left Shanghai in August of 1934 and arrived in San Francisco by steamship, the S.S. President Hoover, and took the train to Laramie, Wyoming and changed trains to Denver. At that time I knew nothing about the United States. There were two American-born Chinese at Mines, and they took care of me. We lived in a boarding house. In the boarding house there were students from Rumania, the Philippines, India, and of course, America. The landlady was Mrs. Wilson and her daughter, Diantha.

Well, I took courses and because I was a physicist I had to take many geology courses, like general geology, mineralogy, petrology, and the geology of petroleum. They were not accepted for my Master's degree; they were just to make up deficiencies. In those days from Golden to Denver, there was a street car. Is it still there? I don't know. Four of us, two from China and two American-born, rode the street cars to Denver to go to Chinese restaurants once in awhile. Every weekend we went to the

movie house, the theatre in downtown Golden. In 1974, I went to Golden and it was still there.

How did it feel to return to the Colorado School of Mines after all those years?

Oh, it had changed. I couldn't find my boarding house. Guggenheim Hall was still there, but it looked small with all the new big buildings. It had all changed, but I still remembered the post office, the movie theatre, and of course, Table Mountain.

Are there professors who were particularly important to you in your life, both in China and in the United States?

In China, my physics teacher was Professor Nie, the old man that you met the other day; he is now 88 years old. (Note: Professors Nie and Larner participated in the opening ribbon-cutting ceremony for the Beijing (89) Symposium.) He taught us general physics and calculus, and differential equations. He was a very good teacher. He returned from France, where he had gotten his physics degree at Paris University. He is now vice chairman of the Peoples Congress, and is very respected.

Any professors in the United States?

Oh yes, Professor Heiland. I first met Professor Heiland and also Professor van Tuyl, who taught me geology and petroleum geology.

Both of these professors are very famous people at Colorado School of Mines.

Yes, and Professor Harlan Johnson, who taught paleontology. Two or three years ago, a delegation of scientists from Colorado came and I asked them about these professors, and they told me they had passed away.

When did you return to China?

1938, because the war broke out between Japan and China. I had to go back. At that time the Japanese occupied Shanghai and most of the cities, and I had to go to the interior to the province of Yunnan, where I worked for the Institute of

Physics, Academy of Peking. At that time Dr. Nie was director of that institute.

And what was it like returning to China after being in the United States?

Yes, oh, they were quite different - the two countries. In the old China after the civil war, the people were quite poor. Not very industrialized, just farming country. There were too many people and not much to eat. The Japanese occupied the country, and lots of people died of hunger. After the revolution life is getting better, of course, only in comparison with the old days. It is still not such a high level as in the United States.

Were you able to do geophysical work during the war; what kind of work were you able to do?

I did geophysics in the mountains, but the work was very simple; not much success. At that time I had no instruments, and I bought a used magnetometer for about \$400 from an American oil company. I received some electrical resistivity instruments made in England, and some self-potential equipment. We did only field work in the interior part of China, where there were some coal, copper, lead and zinc mines. But I think the results have been used very little. Since the revolution the government is now developing these mining districts.

So your work was primarily in exploration for minerals.

Yes, minerals, not oil.

At any point did you get directly involved in exploration for oil?

After the war, I became chief geophysicist in the Ministry of Geology; that was just after the revolution about 1952. At that time, people thought that the geologic conditions in China were not suitable for the accumulation of oil. Geologists had this theory that in China, we would not be able to find oil. In 1956, I think, the government had to decide that if the country had no oil, how could we develop the industry? It is a very important mineral resource. So they organized nationwide exploration, and they started to use geophysics; they had only used geology before. They did geophysics work in most of the basins.

At that time, in the '50s we had instruments imported from the Soviet Union and at last we discovered the Da Qing oil field which was really discovered by geophysics. They used aeromagnetic instruments first to delineate this basin in 1957. After one year of reconnaissance work, the area was all covered. And then we used a gravity and resistivity surveys and then finally, a seismic survey. And then we found the underground subsurface structure. They now call it the Da Qing structure.

You have had many accomplishments in your life. Which of those accomplishments do you think are most significant?

People here in China always ask me a question: How did a poor boy from a rural district, whose father was a school teacher, and with very limited funds get to be a scientist? That is a question they always ask me.

And how do you answer that?

Just by chance. I had a scholarship, I didn't have any money. I went to high school and after high school I went to the university. I always had difficulty with finances.

Another question is the same one you asked me. I think that my greatest achievement is organizing the geophysical prospecting industry (or work, in this country we don't call it an industry, just a career).

We started geophysics in the Ministry of Geology and the Ministry of Oil. I taught many students geophysical exploration, but I think the discovery of the oil field in Da Qing has to do with my work. You see, at that time I was the chief geophysical engineer for the Ministry of Geology and the leaders asked the Ministry of Geology to do a nationwide reconnaissance of geophysics and geology, and I did the designing and planning of the work. Sometimes I went to the field to inspect, but I didn't read the instruments. I arranged the profiles and designed the methods to be as physical as possible.

When you were talking about how you came to be so respected in this field after such humble beginnings, you said by chance. It may have been a chance in part, but I think, very much so from the love and dedication you have for this field. When did you then go back to the university?

There are lots of colleges of geology in China and sometimes I would go back to teach a course. There were lots of students. Always I would find some time to teach. I was working for the Ministry of Geology, the Bureau of Geological Prospecting.

Did you ever go back to the university to join a faculty, or just to teach when the opportunity arose?

Just teach. I was supposed to be a research professor in the Institute of Geophysics of the Science Academy. In 1950 or 1952 when the Institute of Geophysics of the Academy of Science was organized, I was supposed to be its vice-director. Then in 1952 I was asked to be the chief engineer in the geophysics branch of the Ministry of Geology. Nominally I was supposed to be working in the Academy of Science, but actually most of my business was in the Ministry of Geology.

What would you most like to see happen for geophysics in China?

We have to do *research* in the technology.

I think the Ministry of Geology has about 100 crews, and 300 in the Ministry of Oil industry. In the '70s we bought a lot of instruments from the United States. We even bought a factory to build seismic instruments. In Sian, there is a factory, with entirely American-made machinery.

Are there some projects that you think some American and Chinese geophysicists can do together?

I think that every year we send several people to the SEG annual meeting to see what's new. And many people make friends. I'm always thinking there could be

cooperation in doing fundamental research, just a start. You don't have to have lots of money. It is just the ideas. I always stress this point. In this country the leaders of the ministries do not understand what is fundamental research.

That's not any different from the United States. The only kind of research that leaders want to do is something that will produce results today.

Immediately...I always talk about this question, in meetings, and in writing papers. We need to be more far-sighted. And in earthquake prediction, we have to do fundamental research and not just predict from any phenomena. Sometimes a bird will fly abnormally, or something different will happen and they predict that an earthquake will come.

At least it would be interesting to study why the bird was behaving abnormally.

Yes, *that* would be interesting. We have to study the *cause* of earthquakes, the origin. Why in the crusts there are earthquakes. At this point we have to explore the earthquake source by deep seismic sounding. To study the source and wave propagation by theoretical and experimental means. There is a lot of work to do.

Are there any subjects that you encourage young scientists to pursue?

Yes, they should try to find out how to detect oil directly by seismic means. I have studied some papers in the English literature. There are theories of wave propagation in porous media. I read a paper by Meissner in West Germany who was discussing the so-called "flat spot" exploration in seismic data. And also a paper by Ansley, who tried to use the S-waves. The reflection from the surface of a layer containing porosity has a different coefficient for S-waves than for P-waves. So there is added information when we detect a difference in the change in P-wave property from the change in S-wave property at a reflector. This work is of course, preliminary. But I think we have to follow it.

There is some exciting new work being done and one of the leaders in the field is a professor at the Colorado School of Mines, Tom Davis. They are using multi-component seismic data to study shear-waves and isotropy and the information from that can give an idea of the orientation of fractures in the subsurface. The information comes from the difference in propagation speed for shear-waves polarized in different directions. But this work is at an early stage.

This is the type of research that is very difficult to support because the results may not pay off for ten years or more. I've always seen this kind of problem, even in earthquake prediction. They look for easy solutions. Anything anomalous will mean that it is some kind of precursor to an earthquake. We must look to deep science from deep inside the earth.

Do you have any thoughts as to what the Colorado School of Mines can do to help geophysics in China?

Yes, educate young students and cooperate in research. Some work (reported at the meeting) is in the preliminary stage and perhaps some Chinese students could come to the United States to work with Mines professors. Here we have some institutes of geophysical research, but they just copy work from the United States. They don't know what is good, they don't know what's the purpose of the work, or of a paper that they read on a topic.

Do you think that this situation is changing?

No, not really. I don't think that a leading researcher would be satisfied working in this country.

Considering your accomplishments, what you've done and the way you approach things, do you think there was any direct benefit from having gone to Colorado School of Mines? Did your education at Mines in some

particular way have an affect on how you approach your work?

I got my geophysical exploration education entirely from Colorado School of Mines and I think that the training that I got there was a solid foundation. When I came back to China I still knew something about physics and how to use it for exploration.

Would you favor training people in physics rather than geophysics in their undergraduate work and learning geophysics primarily in graduate school? What is your feeling about that?

In this country most of the geophysicists are engineers. They are short of physical ideas. They graduated from high school and went to one of the geology colleges, and their background in physics is not sufficient. Their thinking is not always physical. I think it's important to use the fundamental ideas of physics and not just do operation. Sometimes the instrument man just knows the instruments.

Do you still think there will be a benefit for Chinese geophysicists to study abroad?

I think so, in China I think that people cannot get to think as much as students in the United States in geophysical exploration. We have four institutes or colleges of geology that have geophysics departments, but they've taught the same thing for the last 40 years. The people just go to the field to observe, to read instruments and make maps, just technicians. I've told them that geophysics is not like making a cup; it can't be just routine. You need to think about the purpose of the profile and have a scientific mind rather than a technician's mind.

Are there young people who study physics and mathematics today who then go into geophysics?

Yes. In our institute and in Ministries of Geology and Oil Industry, there are many mathematicians, electronic

specialists, chemists and all branches of science and technology. When they work, they don't understand what is geophysical exploration. What it's for? Especially physicists, they have to know what is the purpose of exploration geophysics and all that's involved. I always stress this point, that now that "you're not in the mathematics department or the mathematics institute you are in geophysics exploration. You have to serve the purposes of exploration geophysics." Most of the students are not accustomed to changing from their original studies. My main idea is that for geophysical exploration we have to look far ahead so that the science and technology of geophysical exploration can be advanced. Not just by looking at field maps; that is only for production work. We need to do research to elevate some of the techniques.

You have mentioned that there has not been enough effort at working with fundamental principles. What are your thoughts about exploration geophysics today, as compared to ten years ago?

There has been some change, but not much. Not as much as I'd like. There has been much increase in cooperation, but the pace of development or transfer from research into geophysics practice has been slow. I think that in schools like Colorado School of Mines, they should stress, even more, the fundamentals that make the students think more widely and deeply, to become scientists—not just engineers. Teach them what is happening, but also teach them to question the assumptions.

I would like to ask you what new directions are open to geophysicists? You mentioned earthquake studies.

In oil prospecting, my idea is how can we detect oil directly. And other parts of exploration like exploring for coal or other minerals, some of them are very difficult to find. People are using geochemical methods to find gold. And iron deposits, perhaps geophysics can do something because iron always occurs in big deposits.

You've accomplished so much in your life and had this particular career path. If you had the opportunity, would you do anything differently?

I would stick to exploration geophysics, but I would like to do more to advance the science of geophysical exploration. Now in China, geophysics is always in the state of correction, no scientific research. People are always after the quick effect, and even in the field in production, they don't know why they are doing any particular profile. Their purpose is just to finish the profile. That's the trouble.

I still think that before the end of my life, I have to do some work to promote some of the research in earthquake prediction and exploration geophysics. In this country, I just want to do as much as I can for the few years left of my life.

Sketches is a feature of Mines Magazine. If you know of an alumnus (yourself included) with an interesting background or unusual accomplishments, please send some biographical information along with his/her name, address and phone number to "Sketches," Mines Magazine, P.O. Box 1410, Golden, CO 80402

NEW TECHNOLOGIES FOR ENVIRONMENTAL PROTECTION

Can the extensive contamination at the Rocky Mountain Arsenal be cleaned up soon? Can discharges from overflowing lagoons at Rocky Flats be prevented? New technology is being developed for both, *but* it can be used only if there are some structural changes to the current hazardous waste regulations that control how companies dispose of their wastes and remediate contaminated sites.

Much of the new technology being developed to protect the environment is coming from small companies. A Mines' graduate has been involved in developing one such technology, freeze crystallization. Here are some insights into the process and the unusual barriers facing technological developments in the environmental field.

There is a lesson in the environmental legislation of the last 10 years - the methods used to control wastes and manage the chemical output of industrialized society of the past has not been and will not be adequate for the future. A corollary is

that the methods of the future will also be more expensive than those of the past. The changes haven't been easy for anyone to accept or adapt to, whether it be the generator, the regulator or the public. Progress seems painfully slow to the public yet break-neck to the regulator and the generator who are charged with implementation. The companies that are developing the new technologies which will be at the core of the environmental controls of the future also find the pace excruciatingly slow.

A triad of hazardous waste legislation was passed in the late '70s: the Toxic Substances Control Act (TSCA), the Resource Control and Recovery Act (RCRA), and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). These created a whole new growth industry, providing services to the companies that generate hazardous wastes. It also established that there is a cost associated with land disposal of wastes, which has become the major incentive for recycling wastes. A number of companies with treatment technologies viewed the legislation as creating new markets for their services and products.

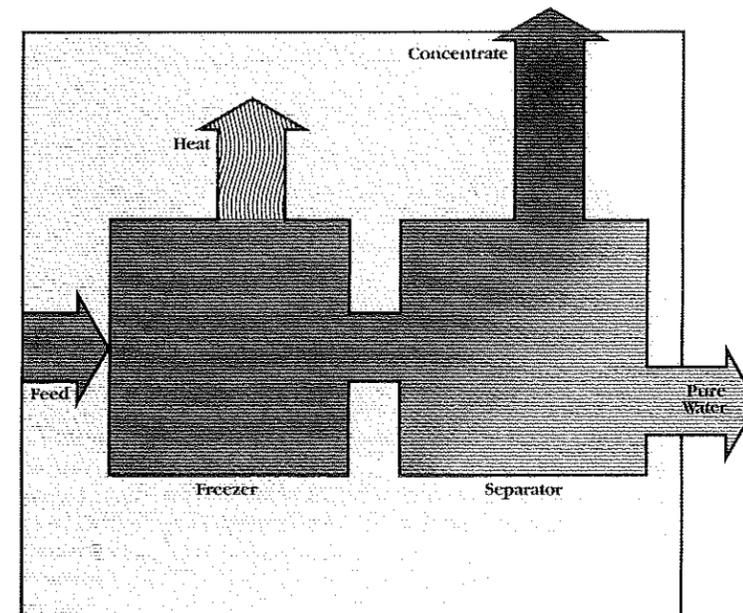
The role of new technologies

In implementing CERCLA, commonly known as Superfund, the Environmental Protection Agency (EPA) has been criticized for not using treatment technologies to the degree stipulated in the legislation. In the reauthorization of the program, called SARA - Superfund Amendments and Reauthorization Act, a program was set up to identify, test and evaluate new technologies. The program was implemented by the EPA and is called the Superfund Innovative Technologies Evaluation program, or S.I.T.E. In the three years since the program was started 40 technologies have been accepted for demonstration, judged by the EPA to be sufficiently developed to justify

demonstration in the field on actual Superfund site hazardous wastes. Of the companies selected for this program, only five are Fortune 500 companies, and the large majority are companies with less than 50 employees. The size of the technical innovators in this marketplace has a major influence on the barriers to implementation.

Freeze Technologies Corporation

One of the technologies chosen for demonstration in the S.I.T.E. program



Freeze crystallization is a technology which separates a liquid stream by freezing one or more components. The technology is more energy efficient and less expensive to build and operate than evaporation or distillation processes commonly used in industrial use.

is freeze crystallization, developed by Freeze Technologies Corporation of Raleigh, North Carolina. **Jim Heist (CPR '69)** is president of the company and one of its founders. Freeze crystallization is a broad-based purification technique that can be used with literally all hazardous wastes: aqueous wastewaters, organic solvents, and even solids and soils by first washing the contaminants into water or a solvent. Since radioactivity comes from isotopes dissolved in water or from the heavy isotopes of water which freeze at different temperature than water, freeze crystallization is the only process that can decontaminate mixed wastes

(radioactive and hazardous) in one step.

Reviewing the history of the technical changes is illustrative of the innovative process in smaller companies. Heist Engineering was formed in the early 1980s to provide engineering services to the process industries. Jim Heist had become aware of the freeze crystallization process when he worked with Monsanto, the Signal Companies (now part of Allied-Signal), and Bechtel. As environmental laws were passed in the early 1970s, both Monsanto and Signal were developing membrane

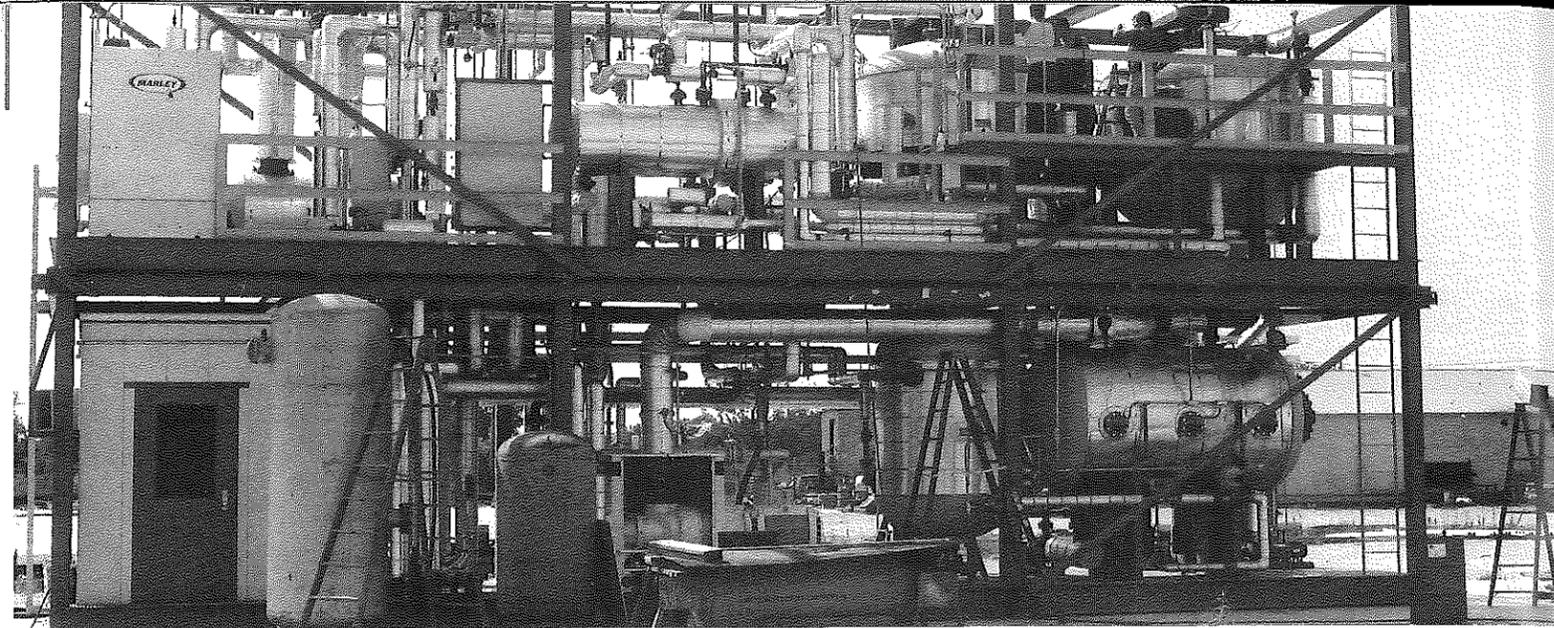
processes to address some of the more difficult liquid waste treatment needs of industry.

Heist Engineering became a developer of new technology by a slightly different route. "We had clients with specific needs that couldn't be met by conventional technology - firms which needed the type of process that could only be met by freeze crystallization," Heist explained. "The few freeze processes available in the marketplace were designed for specialized chemical separations and too expensive for waste treatment applications. Since there wasn't

equipment available to do the job that was needed, we began developing suitable freeze crystallization process technology."

After the requisite laboratory demonstrations, two pilot plants were built to demonstrate the technical innovations proposed by Heist engineers. These pilot units provided the vehicle for testing, defining problem areas, and devising solutions until a complete, working process resulted.

In late 1987 Heist Engineering joined with Environmental Systems Company of Little Rock, Arkansas to form a new company—Freeze Technologies Corporation (FTC)—to



This plant has been built by Freeze Technologies for on-site remediation of contaminated facilities. It works on contaminated liquids that are either recovered on-site or generated by a soils washing process to decontaminate the soils and debris on a site. The mobile plant consists of two modules that sit one atop the other, separating for shipment on low-boy trailers. This unit processes up to 25,000 gallons per day of contaminated liquid waste.

commercialize the freeze crystallization technology for environmental applications.

Barriers

The barriers to implementing a technical innovation don't differ in concept between different technologies and markets. The degree, however, is influenced very markedly by the user (e.g. chemical company engineer and government environmental manager) and the use (is it a profit-making application or a 'cost containment' issue). Barriers to implementing a new technology can be categorized into three major headings: technical, institutional and financial. Technical barriers are exacerbated in the case of hazardous waste treatment by the difficulty of getting 'real wastes' to work with, which is an imposition of the institutional barriers. Technical risk is also much more heavily weighted in the public sector than the private.

Institutional barriers in the hazardous waste business range from the reluctance of program managers in a very visible position to 'gamble' with anything that isn't fully proven, to the paperwork involved in government contracting. Under the current hazardous waste framework, once a waste is produced, it must be manifested and tracked, or if treated, it must meet stringent discharge requirements. Facilities that treat wastes must obtain permits that define the kind of wastes that are generated or accepted for treatment, and the manner in which they will be treated.

Changes to the treatment systems must be submitted for approval before they are implemented.

Treatment of wastes at Superfund sites is done only after the site has been thoroughly evaluated for demonstrated technical proficiency and then for cost effectiveness. New technologies have a hard time meeting the 'demonstrated technical ability' of either situation. This is the barrier that the S.I.T.E. program is attempting to remedy.

In addition to the technical community reviews which must be passed before a new technology can be used, there is a public stigma that has been attached to many technical alternatives. Many of the 'engineered solutions' - i.e., containing hazardous wastes in confined lagoons and landfills - have failed to provide the protection specified. Other 'new technologies' have failed to perform as promised when they have been tried, so that the public is very skeptical of un-demonstrated alternatives. And yet, the public is generally dissatisfied with leave-in-place alternatives, requiring some sort of treatment. You can't have new technical alternatives without some sort of development and demonstration period.

An additional institutional problem is the general lack of technical sophistication by the public. This has been addressed in SARA as well; grants on any Superfund site allow local citizens to hire a technical consultant to provide unbiased advice on all aspects of the cleanup. None of the institutional remedies do anything

to speed up the process of accepting new technologies. Generally it takes a developer two years or longer, to have a method accepted. Many companies have been working for close to five years, without getting any revenues from Superfund work.

Financial barriers are a problem especially for the small company. Heist Engineering funded the development of its freeze crystallization technology through internal investment and outside contract research. The resources necessary to demonstrate the technology required capital restructuring of the company. Debt financing of pre-commercial process technology isn't generally available. "We concurrently approached the venture capital, investment banking and joint venture markets for capitalization and ended up forming Freeze Technologies as a new corporation owned by the Heist shareholders and Environmental Systems Company. Without the substantial capitalization provided by one of these means many promising technologies will find it impossible to become commercially viable," Heist commented.

Freeze Technologies was accepted in the EPA's S.I.T.E. program in the summer of 1988 and is currently performing demonstration tests at the Stringfellow National Priorities List (NPL) site near Riverside, California. A transportable pilot plant is also used to demonstrate treatment capabilities at generator sites.

CSM GAINS STUDENTS THROUGH PRE-COLLEGE EDUCATION

The year is 1999. You have a business meeting in the Golden area and decide to stop by the Mines campus for a brief visit. You note that the buildings look essentially the same, and the young freshmen are not too much different from your days at Mines. You pause to ask yourself, "I wonder why these students chose to attend Mines?" You think back to your decision and recall what factors influenced you. Possibly it was your family or a personal friend, but very likely it was an influential teacher or counselor. You probe a little deeper and ask "How do these influential teachers learn about Mines and what affiliation do they have with the school?" Interestingly, your thought processes have followed those of many administrators and faculty members at CSM.

To be sure, many educators know about Mines because it is their job to know such things, and the school makes available to these individuals any number of publications and information packets. Through the admissions office, the school reaches prospective students through college nights (often enlisting the assistance of loyal alumni), personal contacts,

and valuable activities, it is also important to have these key educators feel a kinship with the school and become personally familiar with the breadth and quality of the education provided at Mines. Involving these teachers in CSM-sponsored courses is one practical way to achieve this goal. For more than 20 years, Mines professors and staff have provided courses both on and off the campus for Colorado's science teachers. This "teacher enhancement" program has continued to grow over the years, providing the opportunity for the Mines community to pass on its knowledge to the youth of the state and nation. This educational process will not only yield more prospective students for Mines, but will produce better-educated high school graduates, regardless of where they go to college, and in general, will produce a more knowledgeable and better informed society.

When President Bush met with the

nation's governors in Virginia to discuss educational reform one message was clear: students in grades K-12 need help—fast—and that includes training teachers who currently lack skills in math and science and providing them with quality materials that make learning relevant. These have been, and continue to be, the goals of the CSM teacher enhancement program.

The Role of Mines

Dr. John Trefny, a professor in the CSM Physics Department and associate dean of research, has been involved in teacher enhancement programs for over 25 years. He serves as the chairman of the teacher enhancement committee at Mines, which helps coordinate various campus activities in this area. According to Dr. Trefny, Mines' reputation as a leader in earth science education is well-known among Colorado school districts. Over the past three years alone, approximately 2500 teachers have taken courses through CSM. Some of these courses were organized and conducted by CSM personnel on either a cash-funded basis or through grants from the National Science Foundation and other sponsoring agencies. Other courses were conducted by local school districts under the direction of CSM, which ensures that the courses meet the high educational standards of the school. In most cases, the teachers completing the courses

received credit from CSM applicable toward re-certification requirements within Colorado. Teachers from throughout the nation routinely take CSM courses, but the majority of the participants are from Colorado, and CSM has an extremely good working relationship with area school districts and their respective science coordinators.

For many years these courses were conducted or coordinated by individual faculty members, each responsible for developing, marketing, and delivering his or her own project or course. In 1987, the Office of

teacher enhancement activities, which may include new course development, curriculum writing, proposal preparation, and cooperative efforts with area school districts. Tuition income also covers direct operating expenses, including faculty salaries, educational materials, space rental, and clerical support. Through the teacher enhancement program, Mines offers a wide range of courses, some taught by CSM faculty, others by specialized off-campus instructors. Teachers say they like the practical, yet creative, approach employed by the courses; offerings such as "Energy

employed, on a part-time basis, Dr. John Brennan. Dr. Brennan recently retired as science coordinator for the Denver Public Schools, and now assists Mines with needs assessment studies, liaison with school districts, and instructional services.

Mines also offers ChemCom: Chemistry in the Community workshops. This course was developed by the American Chemical Society over a six-year period and has been tested in classrooms for the past three years. It represents a radical departure from traditional teaching because it puts facts into realistic settings rather than merely presenting chemistry as a collection of facts to be memorized or plugged into calculations. The principal CSM instructors and coordinators for these courses are Dr. Thomas Wildeman and Dr. Matt Cole, both professors in the Department of Chemistry and Geochemistry. According to Dr. Cole, ChemCom courses have probably reached 40 percent of the high schools in Colorado; and in several schools where the course has been introduced, additional chemistry sections have been required to meet student demand.

Alliances Established

CSM realizes that just as coordination of campus activities is desirable, cooperation with other institutions and organizations with similar missions is also advantageous. Thus, CSM is a member of the Colorado Alliance for Science. The Alliance is a statewide organization of educators, school districts, universities, government agencies, and businesses working together to create partnerships with the power to change and enhance science education in the schools. One of the major thrusts of the Alliance is the teaming of industry and government with various academic institutions. One of the more successful programs has been the "Executive-on-Loan" program, in which a corporate or government executive is loaned to an institution for a period of time (one to four years) to help organize programs, prepare proposals, etc. The Colorado School of Mines is fortunate to have been assigned John Matis, from the Bureau of Land Management. Now entering his second year on campus, Matis says the Alliance has greatly improved communication between

universities and has maximized the strengths of each institution. "The Alliance serves as an umbrella, or a place for identifying and nurturing emerging trends and needs in public schools," he said.

One of Matis' principal activities during his tenure at CSM has been development of the "Denver Earth Science Project." This curriculum development effort combines technical and financial support from a variety of corporate and governmental organizations as well as several area school districts. This combined expertise will lead to the production of educational packages, or modules, focusing on specific earth science topics, such as air pollution, groundwater contamination, resource exploration and management, hazardous waste disposal, and others. Two modules—one in oil and gas exploration and the other in groundwater contamination—are already under development. "The significance of this program is twofold," says Matis. "Not only does it represent a substantial collaborative effort between industry, government, and public schools, but the program can provide a model for earth science curriculum development elsewhere in

the United States."

The oil and gas exploration module is aimed at students in grades 9 through 12 and will offer hands-on laboratory experiments as well as well-founded classroom instruction. The module was developed during the Summer of 1989 and will be taught on a pilot basis during the Spring of 1990. Professionals in the Denver's earth science community will also be asked to help teach some of the new materials. "This variation on the team-teaching approach will add a 'real world' touch in the classroom," says Matis. The module has been developed as a partnership between CSM, Amoco Production Company, Jefferson County District R-1, and Adams County District #12. In addition to these four participants, financial support was provided by the Union Pacific Foundation and negotiations are underway with the Mineral Information Institute. Some 25 Amoco employees spent five weeks assisting the four curriculum development specialists, providing hard data on oil and gas exploration and production, thereby ensuring that the finished product will be both relevant and technically accurate. The curriculum was developed by the

following teachers: Marsha Barber, Jefferson County R-1; Steve Williams, Jefferson County R-1; Joseph Beydler, Adams County District #12; and Alan Swanson, Jefferson County R-1.

The second module, dealing with groundwater contamination is being developed in cooperation with the Department of Geology and Geological Engineering with funding provided by The Denver Foundation and the SPACE Office.

Future Growth

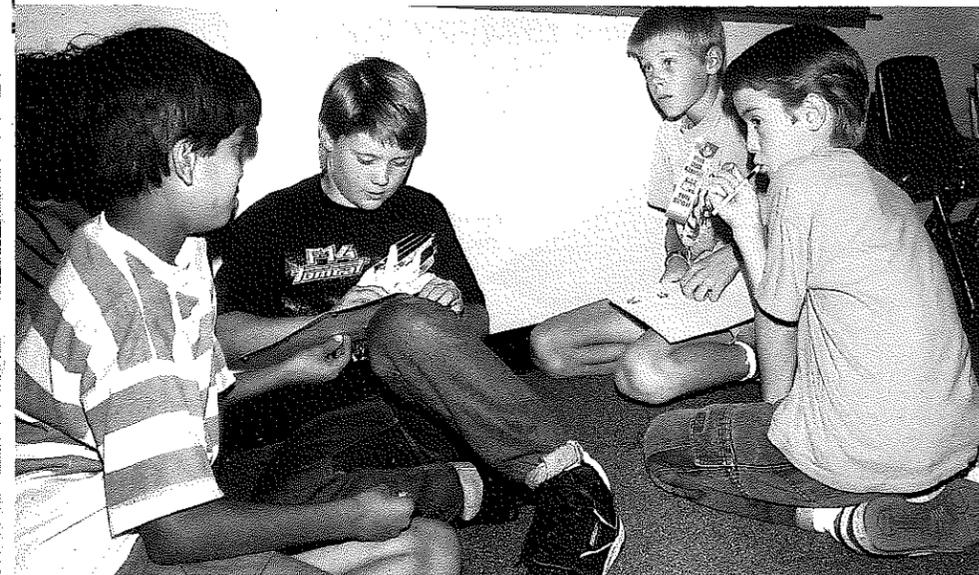
CSM envisions that the Denver Earth Science Project will develop a number of individual modules on a range of earth science topics. Each will be capable of standing on its own, to be used in the classroom as an adjunct to existing curricula or in conjunction with a number of other such modules. The modules will be related merely by their content and dependence on the partnership concept; the pedagogical approaches may vary significantly among the modules. The key to developing future modules is establishing working partnerships, and CSM is seeking additional industrial and governmental organizations interested in assisting with the development of new modules.

It is also recognized that the overall project must be carefully managed and coordinated. To this end, Mines is also seeking financial support to establish and staff a management team capable of coordinating existing modules and creating partnerships for future modules.

Mines sees its teacher enhancement programs as valuable outreach programs for a very deserving audience—those teachers who will ultimately determine the direction that the state and the nation will take regarding math and science education. The benefits of the program to Mines have been an increased awareness of the school, improved cooperation with area school districts (Mines' principal source of incoming students), and a very positive image among educators and other academic institutions.

So when you stroll across the Mines campus in 1999 and look at those students, think about that cadre of Mines professionals that laid the educational groundwork for them back in 1990.

(photos by E. Glover)



Team work at Stoney Creek Elementary School science class—(left to right) Stevie Bhatbhatryya, Bryan Percival, Tom Kelley, and Chad Baker. Tom and Chad's parents teach at the school.

Special Programs and Continuing Education (SPACE), under the direction of Dr. Gary L. Baughman, organized an ad hoc teacher enhancement committee to help coordinate all of the K-12 activities on campus, thereby fostering the development of cooperative programs and reducing redundant efforts. The SPACE Office now helps organize, market, and conduct nearly 40 courses each year and distributes teacher enhancement bulletins to over 2500 individuals and 16 school districts three times during the year.

Funding for the teacher enhancement program is provided through tuition income from the courses and payments from school districts offering courses on a "contract" basis. Operating funds thus generated are earmarked for future

Resources - Today and Tomorrow," "The Total Concept of the Mining Industry," and "Front Range Field Studies in Geology" follow Mines' traditional hands-on approach to teaching practical earth science. Courses like the popular "The Zoo as a Classroom" and "The Museum and Botanic Gardens: Natural History Come Alive" increase the participants' knowledge of the life sciences and help parents and teachers use the zoo, botanic gardens, and Natural History Museum as meaningful adjuncts to the classroom. Other recent courses have dealt with Grand Canyon ecology and geology, laboratory safety, dinosaurs, computers, Japanese art and culture, urban wildlife, and introductory physics.

To keep abreast of the educational needs of the community, CSM has



Stoney Creek Elementary School teacher Jill Frieberg is teaching a class called "Bolts and Batteries." With her are fifth graders Wendy Weber and Jenny Young.



Alumnus continues to serve industry

ART MEYER

For 21 years the Colorado Mining Association Education Foundation, through CSM, has been offering a continuing education program to inform Colorado teachers of the importance of the mining and metallurgical industries to the state. Through a combination of lectures and field trips, teachers take the six-week summer course to acquire a working knowledge of earth resources.



Meyer described the program as dynamic: every effort is made to keep the subjects up-to-date and present new innovations when the material becomes available. The program gives teachers techniques to help them better present material in their basic science classes, such as chemistry and

physics.

The program has been presented to 820 teachers from 28 states and Canada. Teachers receive six semester hours of credit that may be applied toward recertification requirements.

Art Meyer, Geol. E. '50, has served as an adjunct professor with the program for the last five years. Tall and fit, Meyer blends retirement with his professional experience as a geologist. He has been instrumental in coordinating the faculty of approximately 65 mining, metallurgy, and other industry authorities who lecture on subjects such as geology, geophysics, mining methods, metal applications, research, marketing and economics.

"The program is funded by the mineral industry and other organizations who provide money, in-kind support and volunteer time. Lecturers who are experts in their fields participate without charge. The field trips are arranged to various operations to supplement classroom time.

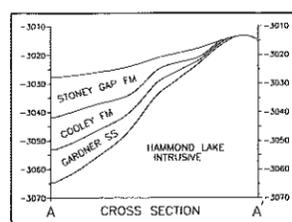
"We take the teachers to two surface mines and six underground mines. They also pan gold out of Clear Creek, and 30-50 percent of the group finds 'color'—flakes of gold," he said. Extra curricula activities include visiting the U.S. Geological Survey's National Earthquake Center on the Mines campus and an assay laboratory.

Meyer is very low-key about his role as an adjunct professor. He views it as one more step in a successful career as a geologist: after graduating from Mines in 1950, he worked for three mining companies. He is retired from Union Pacific Resources as chief geologist of technical resources. He continues to be a consulting geological engineer working from his home in Lakewood, Colorado.

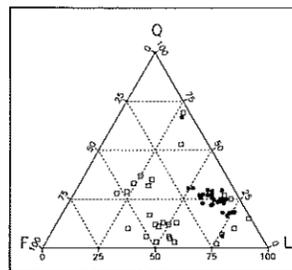
Serving Mines has been a life-long interest for Meyer who was president of the Alumni Association in 1977. In 1985, he and Ed Warren '50 were instrumental in initiating the CSMAA Annual Golf Tournament, an event that is not only a popular alumni event, but which has also raised more than \$16,600 in the past five years for the association's emergency student loan fund. Meyer and Warren have alternately chaired the event every year except 1986.

Art's latest project is serving at a NIFTY FIFTY Committee chairman for his 40th class reunion.

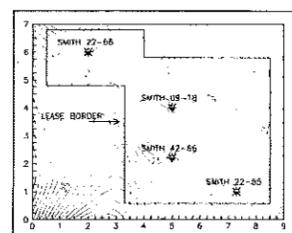
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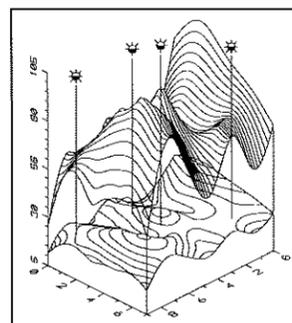
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BOOK REVIEWS

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Once a Coal Miner..., Hardcover, \$26.95. For more information contact: Pruett Publishing, 2928 Pearl St., Boulder, CO 80301, (303) 449-4919.

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From spectacular shots of the new mountain railroads to the all-too-familiar expressions on the faces of the boys at the Juvenile Detention House, photojournalist Harry Hale Buckwalter showed Colorado with depth and skill. His photography ranged from the stark abstraction of the City Hall Fire in Denver in 1901, to the glowing portraits that capture a surprisingly natural audience. And now his work is beautifully reproduced in a new book entitled **Buckwalter: The Colorado Scenes of a Pioneer Photojournalist, 1890-1920.**

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The book describes his pioneering work with fast motion photography, x-ray photography, motion picture photography, and even early radio broadcasting. What is the most enjoyable, however, is the range of the western experience represented in his work.

Buckwalter is a fascinating book revealing the work of a skilled photographer who captured the depth and breadth of Colorado life in a time when the state was coming into its own in the rapidly changing American West.

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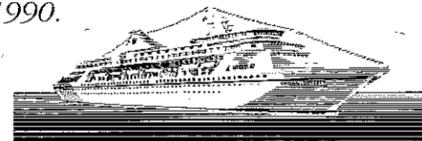
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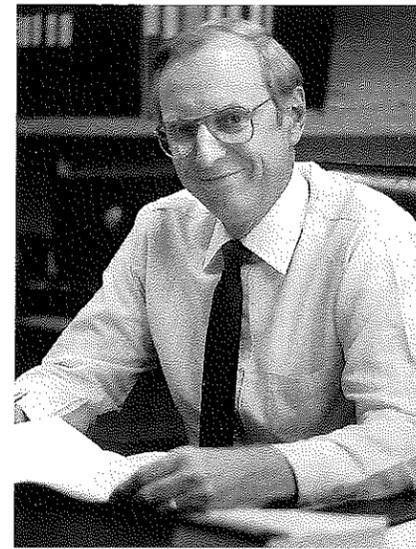
continued from page 6

three years. Because the Steel Center is here at Mines providing the right research environment for steel producers and users, it made the proposal more attractive to FIERF," Van Tyne explained.

Van Tyne says he was attracted to Mines through FIERF because of the grant's high profile within the forging industry, and its potential to open doors for his research program. The people at Mines were also a drawing card for him, including the graduate students who struck him as well-qualified and who were doing quality work with positive attitudes.

Van Tyne says his skills compliment the Steel Center; he is concerned with deformation modeling of steel, or how to turn steel into a final product which works well with the steel users in the Steel Center. Van Tyne, 38, is teaching a new graduate course in forging and deformation modeling, has four graduate students working with him, and is also teaching an undergraduate course in forging. He and his wife live on Lookout Mountain with their four daughters.

DIRECTOR'S DESK



by Norman Zehr, '52
Executive Director

Generally I have avoided any type of political comment in this column, trying to confine my writing to matters of Colorado School of Mines and its alumni. However, I am sure many people are aware that I hold some very definite political opinions. I think that is an integral part of being an American. At the risk of stirring up some of you I shall make some political comments.

As an amateur historian I believe we are now living in truly historic times. Most of us have lived through what later were labelled as "historic times". Technically all times are historic, but some periods leave a greater impact on world events than others.

Seldom do we realize this while it is happening - a bit like the bumper sticker which asks "Are we having a good time?" That is human nature, following the woods and the trees philosophy.

Obviously the World War II period brought great change to the world. I saw the beginning of the end of much

of the world's colonialism, at least by the traditional colonial powers. Some new faces appeared on that scene and are still around. The communist powers certainly were the greatest, if not the only, offenders in this regard following World War II.

Now it seems that a reversal of much of communism's reach is in process. I hope we will not be disappointed by reality.

Communism has been an essentially 20th century phenomenon. It began to "blossom" during the First World War, in Russia. After 1945 it spread through eastern Europe and Asia, and later into the Western Hemisphere. In many cases it replaced other dictatorships of an equally undesirable nature (e.g. Cuba and Nicaragua).

During my years in industry I was privileged to travel to places such as the Soviet Union, East Germany, Czechoslovakia, Poland, Hungary, Cuba (just after Castro took over), Chile (under Salvador Allende), and Nicaragua (before and after the Sandinistas took over).

These visits convinced me, if I were not already convinced, that our American way of life, while not perfect, is far superior to life in the communist countries.

Certainly my tour in Korea had something to do with what I believe. I was privileged to return to Korea twice after the Korean war. What I saw and heard convinced me that the United Nations effort there was correct. Their (South Korea's) society is not yet perfect, nor is ours, but

recent events in Eastern Europe and China should convince the most prejudiced observer that millions of people throughout the world are not satisfied with the way they live and probably have a strong desire to be allowed to live as we do.

It appears that this century could be viewed as the century of the rise and fall of communism. I personally hope it will fade from the world scene by the year 2000 and I hope to be around to see that happen.

Current events are encouraging in this respect. But we must not be lulled to sleep. Many of you are too young to remember the days of "peaceful co-existence", but we have had them. We are all too aware of last summer's events in China and current events in Southeast Asia and Central America. I am cautiously optimistic.

The United States must keep its guard up. Yes, the arguments for social programs for our own people are strong. But in the end, if we allow programs such as communism and fascism to rule us we will see "social programs" of a kind we never wanted nor imagined in our worst nightmares. I have seen these in action and do not wish to live under them.

Now that I have broken my own rule on this type of comment I shall be interested to hear what you, our alumni, think about these matters.

I feel sure I will hear about it.

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DENVER

Ninety-six alumni and guests met in the ballroom at the Denver Athletic Club, Tuesday, December 5, for the annual CSMAA Holiday Party. The 11:30 social hour, which gave everyone an opportunity to visit with old friends and meet some new ones, was followed by an excellent lunch and entertainment by Mines Little Theater. Executive Director Norm Zehr gave a few introductions, made a few comments, and called upon Dr. Ansell to say a few words. A special thank you to Jim Mulryan '54, Chris Oglesby '80 and Steve Sonnenberg '81 for being our callers. It was wonderful to see such a great turnout! Do you like to plan ahead? Our 1990 holiday party will be December 4, also at the DAC. Mark your calendar!

CALGARY

The Calgary section of CSM Alumni Association held a pre-Christmas lunch at the Petroleum Club at noon on Monday, December 4.

According to Nor Hannon '47, CSMAA board member representing the Rocky Mountain Region, 26 members enjoyed an informal visit with an animated discussion on the conflict between the administration and faculty and also on the direction the school should be taking. The group directed Hannon to express their opinions at the next alumni directors meeting.

For alumni in the Calgary area, Nor tells us that the next luncheon will be sometime in February.

TUCSON

"We had a most successful alumni luncheon in Tucson December 4 during the Arizona conference of AIME," writes W. Gordon Wieduwilt '53, coordinator of the Tucson section and CSMAA board member representing the Southwest Region. "In all 39 alumni and guests attended, the largest group since 1986."

Gordon said that Norm Zehr fielded questions about the school. "We were fortunate to have Orlo Childs, a past president of CSM, and Terry McNulty, a member of the board of trustees, attending. Both helped put the presently perceived administrative problems of the school into perspective. The alumni are most interested in being intelligently informed . . . again my thanks to Norm for coming to Tucson."

Others attending included Dan Andrews '82; Chuck Campbell '47; Vonda and Bruce Clark '48; Betty and Keith Davidson '49; Jonathan Duhamel '66; Dave Hackman '64; Jean and Walt Heinrichs '40; Fred Heinrichs; Jack Hill '44; B. E. Kilpatrick '66; Gene Klein '43; Martin Kuhn '63; Jim Link '59; David Mazer '47; Sam McClaren '54; John McIver '50; Bob Metz '55; Bill Meyer '62; Steve Milne '59; Dan Monchak '74; Allan Moran '70; Chris Pfalzgraff '72; Bob Price '35; Kevin Purdy '72; Bill Ransom '60; Nancy and Fred Rice '50; Charles Sorvisto '54; Dave Thompson '61; and Spence Tittley '51.

BAKERSFIELD

Kevin Smith '82, coordinator for the Bakersfield section, called to tell us that eight alumni attended the November 2 section meeting held at noon at the Bakersfield Petroleum Club.

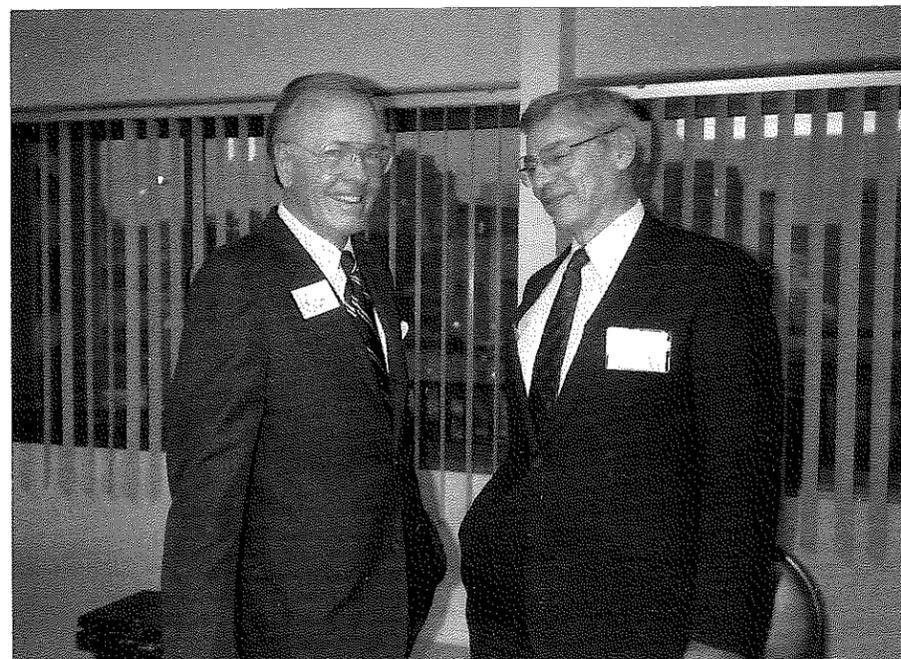
Joining Kevin were Tom Breninger '75; Tom Brinegar '84; John Closs '50; Paul Harness '78; Dave Huggins '79; Jack Rump '32; and Ed Stinemeyer '31.

The Bakersfield section meets the first Thursday of the month at noon. Kevin Smith can be reached during the day at (805) 321-4280 for additional information.

JUST A NOTE: If you make a reservation for a section event and find you are unable to attend, PLEASE GIVE THE SECTION COORDINATOR THE COURTESY OF A CANCELLATION CALL. We know circumstances sometimes demand a last minute cancellation, but often a section is billed by the hotel (restaurant, etc.) for "no shows". If this is the case, the "absent" guest can also be expected to be billed to help cover the expense.

If you have news to share about your section or would like to help us organize an alumni section in your area, please write or call Norm Zehr or me; inside Colorado 1-800/245-1060 ext. 3296 or 3290; outside Colorado 1-800/446-9488, ext. 3296 or 3290.

Mary Jo Giddings
Associate Director, Alumni Services



Dave Powers, vice president of institutional advancement, (left) chats with Wally McGregor '52, our alumni "section connection" in Spokane. Powers was the speaker at our alumni breakfast in Spokane on December 6 at the 95th Annual Convention of the Northwest Mining Association.

Dear Norm and Ellen:

Thank you for your respective letters regarding my dismay of no '39 Class Reunion class picture in the Reunion Issue of *Mines Magazine*. While I appreciate very much the picture and list of names sent by Ellen, I must reiterate that this does not help the rest of the non-'39 class alumni who like me, may be interested in such a picture.

Still unanswered is why, now that we have them, can't we publish the picture with the names captioned below, even if in a much later issue? My theory being better late than never — say by popular demand, or what ever, should excuses be needed. For the life of me, I cannot imagine why, and believe me I have a pretty good imagination, and I have tried very hard to imagine why not. To me it seems simple and basic.

By way of informal research, I polled some local alums. Some were not very interested. One said he NEVER read the magazine. But none disagreed with my point — regardless of age or class.

Please pardon this joint letter. If either of you can answer my question, one answer is enough. If neither of you can, please let me know and I will follow up accordingly.

Sorry to belabor this issue, but the name Heinrichs was inherited.

Thank in advance for your indulgences.

Regards,
Sincerely,
Walter E. Heinrichs, Jr., '40

Dear Ellen:

We are determined to find every member of the Class of 1950. As you know, our 40th Reunion is coming up May 9-12, 1990. In light of this effort, I enclose this last known picture of Charlie Fowlkes taken on Senior Day, 1950 and ask that you publish it. Hopefully, someone will recognize Charlie from this outstanding likeness and tell him we are looking for him. Charlie, "Come Home!" I also sent along a picture of Norm Korn taken on the same day. Norm has recently been found, but a picture like this ought to be published anyway.

Thanks for including the "NIFTY FIFTY MINERS PLAN 40TH REUNION" article about our reunion in the November issue.

Best regards,
Art Dickinson

Continued on page 29



▲ Charlie Fowlkes Norm Korn ▼



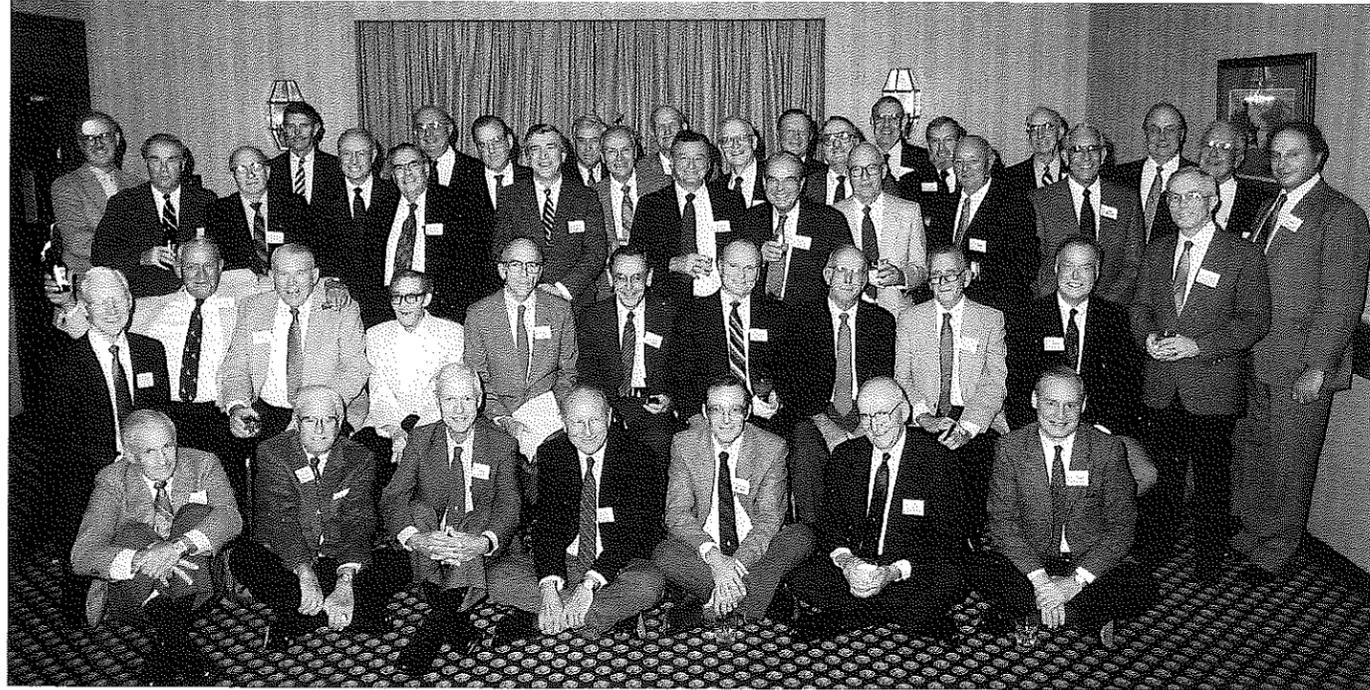
Class of 1939 50th Reunion



First Row (left to right) Stephen Bradford, Jim Bowler, Chuck Blomberg, James (Dan) Boone, Bob Blair, Bill Distler, Charles L. Smith, H. Ross Collins, John C. Mitchell. **Second Row** Bill Long, Don Caldwell, Van Donahoo, Larry S. Melzer, Don Gunther, William Blackwell, John Moody, V. A. (Bud) Vaseen, Art Detmar, Craig Hyslop, Fil Van Voris, Hildy Frost. **Third Row** Paul Davis, Fritz Weigand, Ken Rose, Elmer (Pete) Pederson, Jerry Dieckman, Phil Garrison, Charles Criss, Pete Golden, Sig Smith, Jose Caburian, Ken Hutchinson, **Fourth Row** Raoul Kahn, Howard Keil, Joe Monahan, Jim Vose, Bill Breeding, Herb Young, Russell M. Tripp, Harold Templeton, Irwin Marsh Rice, John Powers.

Miner 49er - SAE 40th Reunion

by Robert D. Sloan, '49



FRONT ROW: (1 to r) Jack Peeso, Gurnett Steinbauer, Vic Smith, Frank Seeton, Gordon Wieduwilt, Sam Sandusky, Hugh Evans
 SECOND ROW: Bob Sloan, Bob Garland, Joe Hill, Jim Mercier, Bob Olson, Bob Bowser, Claude Jenkins, Bob Murray, Cleve Dear, Howard Kaylor, Doug Brown, Irv Stumpf
 BACK ROW - STANDING: Harry Ellis, Leo Bradley, Charlie Fitch, Gene Van Arsdale, Bill Erickson, Hank Ebrlinger, Bob Arnim, John Capshaw, Gene Kaefer, Murray McKinnon, Kelly Bolender, Harv Kingry, Jim Quinn, Jack Joyce, Ben Slotbower, Jim Strob, Bob Joyce, Wayne Lebsack, Hank Otto, Don Adams, Chuck Dunn, Bruce Wentner, Pat Mercier, Dick Thixton, George Schonewald

You had to be at homecoming last fall to experience the magic that was taking place in Golden and on the Mines campus. The Miner 49er - SAE alumni group held its 40th reunion. To know who this group is and to understand the meaningfulness of this reunion, you need to relate to Mines at the end of the Second World War.

In 1945, as World War II was winding down, the total enrollment at Mines was 170 students. Within a year that figure tripled, and by 1949, enrollment increased to 1,285. Mature veterans who had fought for their lives to protect our freedom, shared locker rooms, laboratory benches and all aspects of campus life with 17-year-old freshmen who were straight out of high school and most likely away from home for the first time.

As we came to Mines and inquired

as to where to live, Dean Morgan told some of us that there were rooms to be had at the SAE fraternity house. Others were met at the train station by a black Model A driven by Bill Erickson or Jim Quinn, and some of us were picked out of rush and invited over to the SAE house for a meal. Eventually many of us joined the SAE fraternity. While Mines was providing us with a professional education, lessons in human relationships were being learned daily in the close-knit family which had developed in the fraternity.

As each year went by, seniors were graduated and a new class of freshmen began the basic courses. We weren't a graduating class, we were Miners who shared a very special era at the same school and in the same fraternity. The Miner 49er - SAE group was established; an era

begun in 1945 through the mid-'50s.

Fifty Miners and their wives gathered at homecoming last fall for the 40th reunion of this unique alumni group. The weather in Colorado cooperated perfectly, and while some participants played golf, others refreshed their memories of the Rocky Mountains, Golden and the Mines campus. Friday evening was the scene of dining, singing and reminiscing during which time we reviewed old yearbooks and photographs to remind us of what we were like back then.

Saturday morning began early with an outstanding breakfast at the Buffalo Rose Saloon in Golden. Interestingly enough, the Buffalo Rose is located in the same building where Dud Young held forth at the Chocolate Shop - one of the after school "hang-outs" of our era. The

homecoming parade, complete with three appearances of the Mines Marching Band, followed breakfast.

For the remainder of the morning we were on our own to walk around the campus remembering where the fraternity house used to be and to marvel at the many new buildings. A highly successful tailgate luncheon was featured at Brooks Field prior to the homecoming football game. The game itself, with its not too surprising outcome (Ft. Lewis 30, Mines 10), filled out the afternoon.

The final event of the reunion weekend was a cocktail-buffet reception at the SAE fraternity house where we burned the mortgage. The active chapter, together with the Denver area alumni, did a fine job of welcoming us back to Golden.

The weekend went by too fast, and we wish that there had been more time for visiting. The total success of the venture was largely due to the excellent cooperation and help provided by the CSM Alumni Association and the Mines SAE active chapter and their alumni support group.

As the weekend came to a close we were already talking about the 50th reunion of the Miner 49er - SAE group which will be in the fall of '99. See you then!



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CSM Receives \$30,000 Burlington Grant

Burlington Resources Foundation, on behalf of the Meridian Oil Company, has granted Mines \$30,000 to hire adjunct professors for the graduate petroleum engineering program. The program employs selected engineers who work in various sectors of the petroleum industry to provide additional dimensions to the graduate classroom experience.

The Burlington Resources Foundation is the major supporter of

the 1989-1990 petroleum engineering adjunct program. Says Petroleum Engineering Department Head Dr. Craig W. Van Kirk, "The Petroleum Engineering Department is very appreciative of Burlington's support of the graduate-level teaching effort. Burlington, through the Meridian Oil Company, has hired many CSM graduates. Meridian is apparently impressed with the quality of CSM petroleum engineering education and wants to see it continue."

CCHE Cites Honors Program for Excellence

The Guy T. McBride Honors Program in Public Affairs for Engineers at Colorado School of Mines has been chosen by the Colorado Commission on Higher Education (CCHE) as one of five programs of excellence.

This designation makes the Honors Program eligible for \$150,000 in special incentive funding from the Colorado legislature. CCHE will request that amount for the program during the legislature's 1990 session.

"This recognition is extremely welcome for a nationally innovative program which is well-received by both CSM students and educators around the country," says Dr. Wilton E. Eckley, principal tutor of the McBride Honors Program and head of the Humanities and Social Sciences Department at CSM. "The funding will assist the program in the areas of faculty support and development, library support for course offerings, media material development, and visiting lecturer support."

The Honors Program, named after CSM President Emeritus Guy T. McBride, was established at CSM in 1978 to provide students greater insights on the social, political and cultural aspects of an engineering career. The 27 semester-hour program offers seminars, course work

and off-campus activities in the humanities, social sciences, sciences and engineering. Students strengthen communication skills, study other cultures, and learn how to solve problems on both an individual and team basis. The program is open by invitation only, and includes a summer internship following the junior year.

Along with the Honors Program, CCHE cited four other programs for excellence. They are the Southwest Studies Program at Ft. Lewis College, the Animal Reproduction Laboratory at CSU, the Faculty Development Program at Aurora Community College, and three departments at the University of Colorado-Boulder — the Molecular/Cellular Developmental Biology Program; the Division of Biochemistry; and the Department of Chemical Engineering. The five programs were chosen from among 34 submitted to the Commission.

"This is the highest designation given by the Commission in the state, and is reserved for programs that are nationally competitive," says Geri Reinardy, assistant to the executive director of CCHE. "With the additional funding, we hope to make these programs even more competitive."

JOHN MOORE TAKES OVER AT METALLURGY

Dr. John Moore, Mines' new head of the Department of Metallurgical and Materials Engineering, sees the Steel Research Center as a true asset to the iron and steel industry because the Center's research is highly in tune with industry's needs. (see page 4)

Moore replaced Dr. Bill Copeland who served for ten years and now has returned to teaching.

"Research and development has become a neglected area in the steel industry because of a shift in curriculum in metallurgy departments nationally away from classical metallurgy to materials and polymers. Mines has one of the few departments which teaches state-of-the-art metallurgical developments superimposed on classical metallurgy which makes the transfer of technology more easily achieved. The loss of corporate research and development divisions makes a good role for the Mines' Steel Center to fulfill," he said.

Moore said the combination of classical metallurgy with advanced ceramics (funded by the Coors Ceramics Center) gives Mines a balanced curriculum to keep up with the two directions of the department.

Moore is a graduate of the University of Surrey, England and received his PhD. from the School of

Materials Engineering, University of Birmingham, England in 1969. His academic and industrial experience covers three countries: England, the United States and New Zealand. He has worked at the Birmingham Aluminum Castings Company and the British Steel Corporation; served as a consultant to industry internationally; and was a professor in England before moving to the University of Minnesota in 1979 where he taught chemical metallurgy. While in Minnesota he became associate director of the Mineral Resources Research Center (MRRC).

In 1986 Moore and his family moved to New Zealand where he became the head of the Department of Chemical and Materials Engineering at the University of Auckland. He says he enjoyed the students and research there, but the slower pace of life in New Zealand was hard for his family to accept. He continues to serve as an honorary professor within the department and has three graduate students completing degrees under his supervision. He occasionally "commutes" to Auckland.

Moore's research has included continuous casting and applying chemical metallurgy to coated products which ties into research underway at Mines.

ALUMNI NIGHT WITH THE DENVER NUGGETS

Thirty-two alumni and friends met at McNichols Arena Tuesday, December 12, to watch the Denver Nuggets lose 121-108 to the World Champions Detroit Pistons. The Denver loss was its first at home for the season, but as Coach Doug Moe concluded to a *Denver Post* reporter, "Hell, you can't win **all** your home games."

Among those cheering the Nuggets were Helen and Max Coats '35; Chuck Blomberg '39 and his brother Clem; Steve Sonnenberg '81; Chris Oglesby '80 and Margaret Lessenger '81 and guest; Kay and Bill Mueller '40; Kathy and Stu Bennett '66 (who wondered why some of his other classmates weren't there—maybe next year!); Frank Horino '44 and guests; Fritz Weigand '39 with his party of eight; and Mary Jo Giddings from the Alumni Office. CSM staff members Marge Arnold, Betty Ames, and Sharon Kirts and her family also attended.

Encouraged by Steve Sonnenberg '81, we started our "Night with the Nuggets" last year, offering our alumni discounted tickets. We'll do it again next season. Join us!

CENTENNIAL REUNION

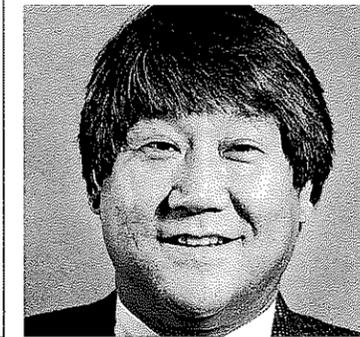
Mines Alumni who graduated in Metallurgical Engineering are being invited to a reunion to be held by the Department of Metallurgical and Materials Engineering to commemorate the 100th anniversary of the granting of degrees in metallurgical engineering at Mines.

According to John J. Moore, Department Head, this

reunion will be held on campus during June 14-16, 1990. A one-day conference on "The Materials Industries in the Twenty-First Century" will be presented on Friday, June 15. Former and current faculty and friends of alumni are encouraged to participate. Those interested should call (303) 273-3770 or write to the department.

A COUNTRY WITH TWO SETS OF RULES: SMUGGLERS AND TOURISTS

by Dr. Eul-Soo Pang
Head of the Department
of Global Systems &
Cultures



I am a seasoned traveler. Having been to South America over 40 times, I consider myself not just savvy but skilled in dealings with airline people, customs officials, border guards, and even local traffic cops. But I learned something new during a recent trip to the Caribbean that is worth gold, one experience that no post-doctoral fellowship can ever offer.

From Port of Spain (Trinidad & Tobago) on my way to Georgetown (Guyana), I was asked to identify my luggage among the pile of bags, suitcases, boxes, and sundry items strewn on the tarmac only a few yards from the plane. I readily identified my suitcase. An airline baggage handler chalk-marked it. I assumed that it was a security measure, making sure that each passenger identify his or her luggage and that those unclaimed should be left out. Who said a Third World airlines is sloppy? In fact, I felt more secure about the procedure than a U.S. airline security practice.

It was an uneventful flight and when the baggage was unloaded, mine was not among them. This never happened before. I went to the airline desk to file a lost luggage claim and found myself at the end of the line, which looked like all the passengers from the flight. It was a U.S. Department of State lecture tour and I had packed my best shirts, ties, and suits to make a good impression! For the next five days, I went through two countries in borrowed shirts, ties, socks, Reebok sneakers, and other intimate items.

With the help of diplomats of the three U.S. embassies in Paramaribo (Suriname), Georgetown, and Port of Spain, the luggage was located in Port of Spain. It never left. I should have tipped the airline baggage handler.

That might have helped, said one sympathetic diplomat stationed in Georgetown. But the trouble was that both national airlines of Suriname and Guyana have one plane each and neither flew to Port of Spain. The Trinidadian airline does not fly into Paramaribo. Due to my lecture schedule, I flew the Trinidadian airline to get to Guyana and then flew on to Paramaribo on the Suriname Air. I never learned who was responsible for flying my luggage.

Miraculously, thanks to the skilled diplomatic intervention by sympathetic U.S. embassy officers, the luggage caught up with me in the third country (Suriname), four days into my five-day stay. The flight time from Port of Spain to Paramaribo could have been no more than three hours, if there is a direct flight. It was the price I had to pay to go to the lower tier of the Third World.

On my way back to Port of Spain, a Guyanese businessman advised me that I should identify my bag on the tarmac, tip a baggage handler, and then get his name tag number before going on board. This way, I wouldn't lose a thing.

In fact, he is a professional smuggler who makes a fine living at ferrying things illegally between Port of Spain and Georgetown. I asked him if this has been his modus operandi. No, he said. It is strictly for tourists. Professionals like himself do not tip: they leave the baggage behind on the Port of Spain tarmac and then file lost claims in Georgetown. A few days later, the baggage arrives and is quarantined in the Guyanese customs warehouse. Then, he said with a grin, that his cousin, a public functionary, arranges the release of the quarantined baggage. The rest is history.

Feb. 4-15

AMAZON RIVER/GRENADINE ISLANDS - Alumni Travel Program.

Feb. 8

CMA CONFERENCE/CSMAA ANNUAL MEETING - Registry Hotel, Denver (32nd at Quebec St.); BREAKFAST 7:30-9:00 a.m.; \$10; RSVP 303/273-3290 by 2/6.

Feb. 8

HOUSTON ALUMNI - LUNCH. 11:30-12:30; Holiday Inn, Downtown; \$11; no speaker; RSVP 713/726-9477.

Feb. 10

CSMAA BOARD OF DIRECTORS MEETING - Golden. Board Room in Guggenheim; Coffee served at 8:00 a.m.; meeting at 8:30 a.m.

Feb. 10-28

TIGER TOPS (THAILAND/NEPAL/INDIA) - Alumni Travel Program.

Feb. 21

SOUTH PACIFIC - Alumni Travel Program - 2/21/90-3/9/90.

Feb. 28

SME ANNUAL MEETING AND EXHIBIT - Salt Lake City/Marriott Hotel. Alumni breakfast 7:30 a.m.-9:00 a.m. Speaker: Dr. Don Gentry, CSM Dean of Engineering & Undergraduate Studies \$12; RSVP 303/273-3290 or 3295 by Feb. 26.

March 20

DOWNTOWN DENVER ALUMNI - BREAKFAST MEETING. Holiday Inn Downtown. 7:00 a.m.; Speaker: Mark Monty, CSM Executive Director of Development. For reservations call Chris Oglesby (BSc. Geol. '80) or Steve Sonnenberg (PhD. Geol. '81) at (303) 292-1314.

March 31

ROTC MILITARY BALL

April 5-7

E-DAYS AT CSM

May 10-12

COMMENCEMENT/SPRING REUNION WEEKEND - A special invitation to the classes of 1980, 1975, 1970, 1965, 1960, 1955, 1950, 1945, 1940, 1935 and 1930; many events scheduled including Reunion Class Dinners May 11 and All Alumni Banquet May 12.

May 31

CSMAA SIXTH ANNUAL GOLF TOURNAMENT - Applewood Golf Course, Golden. Reserve the date! Ed Warren (Geol.E. 1950) Chairman; Art Meyer (Geol. E. 1950) Co-Chairman. Details to be announced.

June 14-16

REUNION/CONFERENCE - "THE MATERIALS INDUSTRIES IN THE TWENTY-FIRST CENTURY." Held on campus by CSM Department of Metallurgical and Materials Engineering to commemorate the 100th anniversary of granting the first Met. degree. Alumni with Met. degree, former and current faculty, & friends are invited. Call 303/273-3770 or write department for further details.

June 19

DOWNTOWN DENVER ALUMNI - BREAKFAST MEETING. Holiday Inn Downtown. For reservations call Chris Oglesby (BSc. Geol. '80) or Steve Sonnenberg (PhD. Geol. '81) at (303) 292-1314.

Sept. 18

DOWNTOWN DENVER ALUMNI - BREAKFAST MEETING. Holiday Inn Downtown. For reservations call Chris Oglesby (BSc. Geol. '80) or Steve Sonnenberg (PhD. Geol. '81) at (303) 292-1314.

Sept. 23-26

AMC MINING CONVENTION - New Orleans, details to be announced.

SOCIETY OF EXPLORATION GEOPHYSICISTS ANNUAL EXPOSITION - San Francisco, California. Details of alumni function to be announced. Speaker: Dr. Phil Romig, CSM Geophysics department head.

Sept. 23-26

SOCIETY OF PETROLEUM ENGINEERS ANNUAL MEETING - New Orleans, Louisiana. CSMAA Alumni Breakfast; details to be announced. Speaker: Dr. Craig Van Kirk, CSM Petroleum Engineering department head.

Sept. 24

CSMAA ALUMNI CRUISE IN CONJUNCTION WITH ROYAL CRUISE LINE. Seven day cruise to Bar Harbor, Halifax, Quebec & Montreal, Sept. 24 through Oct. 1, 1990; 25% discount on fares if booked

**ANNUAL MILITARY BALL
COLORADO SCHOOL
OF MINES ROTC
AND
115TH ENGINEER
REGIMENT**

SATURDAY, 31 MARCH 1990
HOLIDAY INN DENVER WEST,
GOLDEN, COLORADO

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AND THEIR GUESTS**

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ARE ENCOURAGED

by April 15, 1990. Personally hosted by Norm (E.M. '52) and Jan Zehr. For reservations call Jan Zehr at 1-800-950-2102 or 303/232-2103.

Oct. 20

HOMECOMING - Golden. 1:00 p.m. MINES vs. Chadron State (Nebraska).

Dec. 4

DENVER SECTION HOLIDAY PARTY - Denver Athletic Club. Cash bar 11:15 a.m.; lunch 12:00; Reservations required by Nov. 30.

Dec. 13

CSMAA BANQUET FOR GRADUATING SENIORS - Green Center. Social Hour, 6 p.m.; Dinner 7 p.m.

FOR RESERVATIONS AND ADDITIONAL INFORMATION, CALL 303/273-3290 OR 303/273-3295, OR, OUTSIDE COLORADO, CALL 1/800-446-9488, ext. 3290 or 3295.

Continued from page 23

Dear Ms. Glover:

In response to your inquiry about international activities of Mines graduates, I have spent about 95 percent of my time working outside of United States for the past 25 years. This has included working in 20 countries. In 1963 I worked for two months in Spain and in early 1965 I became an "ex-pat," headquartered in Manila. There are about 15 Mines men still in the Philippines, but all but two of us are senior citizens, 70 years or older. The annual harvest of Father Time is thinning our ranks. We had a luncheon to meet Dr. Gaye Christoffersen when she was here a short time ago.

I have worked with Mines men in Turkey, Bolivia, Mexico, Thailand, and of course in the Philippines. Almost all of my international work has been as a consultant but in the Philippines I have invested both time and money in projects on my own.

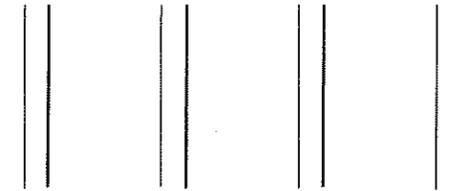
I was pleased to learn of the extensive international program at Mines which has been encouraged by Dr. Ansell. I had tried to interest

previous presidents in expanding on the international theme without success.

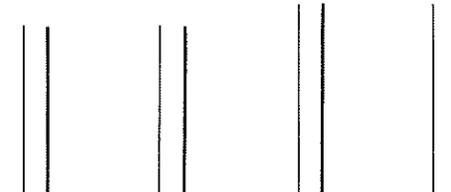
On one consulting assignment the allocation of funds included 30 international scholarships in the minerals industries, funded at about \$25,000 per year each. It did not even include Colorado School of Mines on the list of acceptable schools. I saw to it that Mines was added to a list.

English is the language most frequently spoken by international students and Australia, Canada, United States are the favorite nations to host the students. As Dr. Christoffersen said, we are nearing the era in which the countries of the Pacific Rim will dominate. A majority of the students may spend a significant part of their professional careers outside of the United States. They should plan to become proficient in one of the languages in these nations. Japanese, Chinese and Indonesian are not as easy to learn as English and Spanish but they are going to be languages of importance.

Sincerely,
John A. Wolfe '47



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Cecil Robert Walbridge

Cecil Robert Walbridge, E.M. 1929, of Denver and the founder of Walbridge Equipment Company, died September 15, 1989. He was 84.

He was born March 8, 1905, in Weld County, Colorado. He was associated with Ingersoll Rand for many years. Walbridge was an active alumnus and contributed to the school.

He is survived by his wife, Ella May Senechal Walbridge; and a sister, Lillie W. Cunningham, of Greeley, Colorado.

Contributions may be made to the American Heart Association, 1280 S. Parker Road, Denver 80231.

Duncan E. Harrison



Duncan E. Harrison, Associate 1924, of Golden, died October 7, 1989. He was born July 10, 1901 in Golden.

Harrison, who lived in Salt Lake City, Utah, approximately 20 years, as well as in other communities while working in mines, was a member of Golden City Lodge 1, AF & AM.

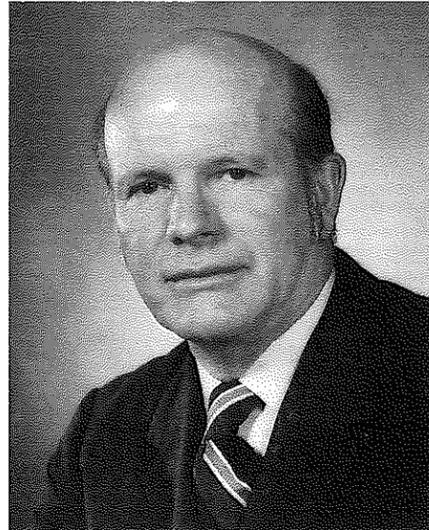
His entire career was devoted to the mining industry, and his interests took him to South America, Mexico and much of the western United States.

He married Violet Yates in Telluride in 1939. Memorial contributions may be made to the Lutheran Hospice Fund or the Colorado School of Mines.

In addition to his wife, Harrison is survived by two sons, Louis Harrison

of Puerto Rico and Clark Harrison of Nucla, Colorado; a stepson, Joe Watt of Arvada, Colorado; a stepdaughter, Alice Daughette of Mesa, Arizona; and numerous grandchildren and great-grandchildren.

Herbert D. Thornton



Herbert D. "Herb" Thornton, 71, died September 12, 1989 after a short illness. He was born May 26, 1918 in Silver Bell, Arizona. He graduated from Mines in 1940 with a degree in petroleum engineering.

He was an All Conference Center on the Mines football team during its only undefeated season. He was a co-founder of Mines' President's Council and was a distinguished achievement medalist in 1977. He served in the Navy during World War II.

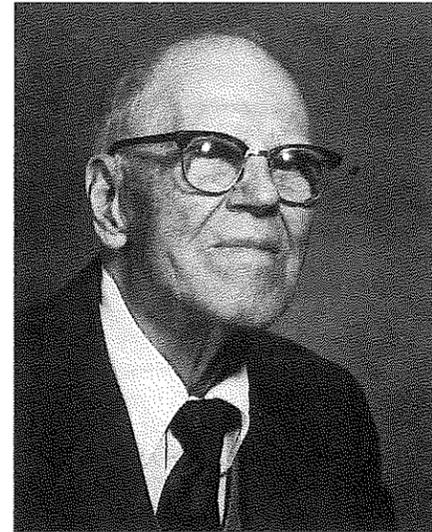
He then worked for a number of oil companies before forming Teal Petroleum Company for W.R. Grace Co. in 1973. He became an independent oil man in 1978. He belonged to The Petroleum Club, S.P.E.E., and many other organizations serving in various capacities.

He is survived by his wife, Genne Thorton; sons, Steven D. Lemmond and wife Angelia; Charles and his wife, Karen; Davey and his wife, Karen; and Theodore; his daughter, Robynn Pride and husband Joe; six grandchildren.

Memorial contributions may be made to the President's Council at

Mines, 1500 Illinois, Golden, Colorado 80401, or a favorite charity.

Daniel B. Gregg



Daniel B. Gregg, 100 years old, died October 9, 1989. He was born November 26, 1888, the oldest of seven children of Judge Ellis B. and Anna Elizebeth Bedinger Gregg of Cincinnati, Ohio.

In his life span, he shared a stage with President Theodore Roosevelt, and at President George Bush's request, he met and talked with him.

Dan attended Cincinnati Public School where he studied German in grade school. He was a high school track star in discus, quarter-mile and high jump. He was captain of the football and gym team, and he was a member of the Clifton Canoe club having earned money for his first canoe by emptying box cars at 7 cents per hour.

At the University of Cincinnati, he was president of his freshman class, played on the varsity football team, track team, swimming team, a member of the Mandolin Club and Beta Theta Pi fraternity. Dan played three more years of varsity football for Colorado School of Mines.

His mining engineering career took him to many parts of the country, and he contributed to a number of surveys by the United States Geological Survey, as well as supervising the plant construction and operation at a number of gold mines. When gold

bricks were poured too late in the day for shipment, Dan would sleep with the bricks and a pistol under his pillow to protect the shipment. He finally retired from an active career at age 82.

Even through the last years of his life, he was continually reading and seeking new knowledge in mining journals, geological reports, chemical texts, and electrical engineering books.

Dan married Rebecca Keyt Humphreys, his high school sweetheart. They raised four children: Dan Jr. and Harrison who survive him; Rebecca, who died in 1973; and Ellis, a first lieutenant in the Marines, who was killed in World War II.

Harrison Gregg said from the time he was very young, the family often gathered together in one room, with his father playing the mandolin, sometimes accompanied by his sister and brother. Even before they had radio, the home was often filled with music.

It was only after Dan was 98 and his fingers became less nimble that he gave up the mandolin in favor of a harmonica, which he would play when sitting with family and friends around a campfire.

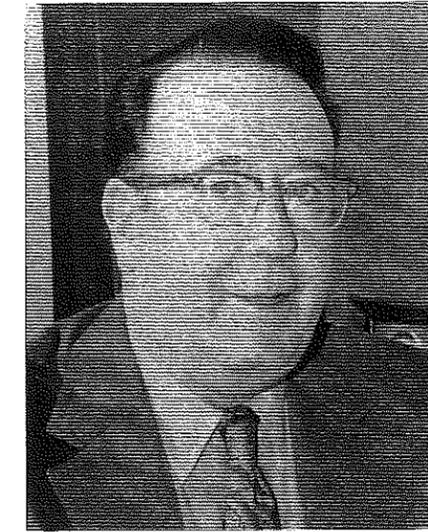
Later in life, Dan retired from his job at 82 to nurse his wife, night and day, through the last seven years of her life.

After his wife died in 1978, Daniel made his home with his son, Harrison and daughter-in-law, Anna Lee Gregg, in Holland, Michigan. He continued his life interest in gardening, canoeing, camping, and traveled through most of the 48 states. Two years ago Dan took a 200 mile, eight-day canoe trip and paddled all the way. Last summer, he traveled to Massachusetts to visit a 98 year-old fraternity brother (Madison E. Welsh) who he had played varsity football with at Colorado School of Mines. He toured the New England and Mid-Atlantic states visiting friends and relatives. A three-hour whale watch trip on the Atlantic Ocean was a sequel to a trip on the Pacific Ocean 80 years earlier, when the School of Mines football team took a trip to the west coast in celebration of winning the Rocky Mountain Championship.

In addition to Harrison and Ann; Dan Jr. and daughter-in-law Dorothy, of Indianapolis, Indiana; he is survived by a brother, Colonel Clifford C. Gregg, and sister-in-law Marian, of

La Jolla, California; four grandchildren and four great-grandchildren and a number of nieces and nephews.

Robert W. Tesch, Jr.



Robert W. Tesch, Jr., P.E. 1933, died September 2, 1989, in a Fort Worth, Texas hospital after suffering a stroke. He was 78 years old.

Bob, as he was known to friends and colleagues, was born in Denver and raised in Loveland and Denver. He was an accomplished musician who played the clarinet in silent theaters at the age of 12 while still wearing knickers. At 16 he played in orchestras of the Dollar Steamboat Line on cruises to the Orient and also around the world. Later, while at Mines, he financed his education by playing in the Denver Symphony as well as other orchestras and jazz groups. At that time he was a member of the Denver Musician's Union along with an unknown trombonist named Glenn Miller. While at Mines he was a Sigma Nu and Mason. Later he became a Shriner.

After graduation he began work with Stanolind Oil and Gas in west Texas. In 1935 he and Annie Laurie Hix of Midland were married. Bob and Annie moved to Fort Worth about 1936 where he attended night school at North Texas School of Law; he became a member of the Texas Bar in 1940. He entered the U.S. Army in 1941, serving as a captain in North Africa and placed on inactive status in 1945. He briefly rejoined Stanolind in Fort Worth before moving a Texas Pacific Coal and Oil as chief engineer. In 1949 he became a consultant and

independent oil operator, retiring in 1980.

In the mid '40s Mrs. Tesch was diagnosed as having multiple sclerosis and gave birth to their only child, Bob. As Annie's condition worsened, Bob became president of the local branch of the Multiple Sclerosis Society.

Mrs. Tesch died in May 1979. Tesch married Rebecca Woodson Ellis in 1980.

Bob's funeral was unusual. His son decided to use a piano rather than the organ. Bob's favorite tune, Clair de Lune, by Debussy, and popular songs from the '30s were played before the service which was short and sweet. The family suggests memorials be made to The Diabetic Association of Texas or Cook-Fort Worth Children's Medical Center.

Survivors include one son, Robert W. Tesch, III, daughter-in-law, Sharla and granddaughter, Diana, all of Fort Worth. Rebecca Tesch lives in Dallas.

Ross M. Lyon

Retired Lt. Col. Ross M. Lyon, 77, of Colorado Springs died October 11, 1989 in an Aurora, Colorado hospital. He retired after serving about 30 years in the Army. He also was college instructor at the Colorado School of Mines in Golden and at Otero Junior College in La Junta, Colorado.

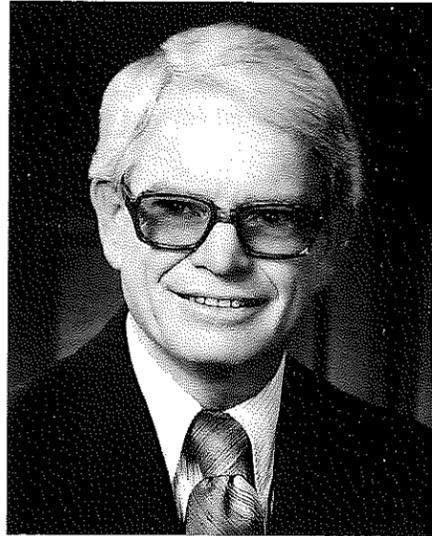
Lt. Col. Lyon was born January 13, 1912, in Galien, Michigan. He had been a resident of the area for many years. He graduated from Mines in 1936. He served in the Army during World War II, the Korean War and the Vietnam War and earned the Bronze Star and Legion of Merit among other honors. He was a member of the Retired Officers Association, the Colorado School of Mines Alumni Association and the Scottish Society of the Pikes Peak Region.

Lyon was married May 29, 1936, in Denver, to Margaret Ann Schnars, who survives.

He also is survived by a son, John R. of Tucson, Arizona; a daughter, Mareda "Marty" Salazar of Colorado Springs, Colorado; a sister, Johanna Chisholm of Wayzata, Minnesota; and a grandson, Christopher Lyon of Tucson.

Memorial contributions may be made to the Colorado School of Mines Alumni Association Scholarship Fund, P.O. Box 1410, Golden, CO 80402, or the American Cancer Society, 2255 So. Oneida St., Denver 80224.

James Richard Stringham



Jim Stringham, E.M. 1950, died in Tucson on April 1, 1989. He is survived by his wife, Joy and his six children. He worked for ASARCO his whole career retiring in 1986 after 35 years. He was a lifetime member of AIME and Tau Beta Pi.

The years Jim spent as the general manager at Neptune Gold Mining Company in Nicaragua were the height of his professional career. Running a gold mine in the middle of the Central American jungle posed a number of challenges which he took on and mastered. The isolated mining camp had many logistical problems as well as political ones. He was at home with Nicaragua's presidents and their ministers. He never lost sight of the mine's success in terms of profitability either.

Jim was rightfully proud of his accomplishments in Nicaragua. He molded a diverse group of foreign nationalities and Nicaraguans into a working team. He actively participated in the Lions Club, becoming the vice governor of the Lions for Nicaragua. As manager he worked very hard to improve the educational facilities in the mining town and set up scholarships for those who needed schooling beyond high school.

After retiring from ASARCO, using his math and science background, he got a Masters in Education from the University of Arizona. He taught at Cholla High School in Tucson for a year and a half before health problems forced him to quit in

December 1988. This January, with boundless will, even with bad health, he enrolled in a Masters program at the University of Arizona in English as a second language, allowing him to tutor adults in basic English.

Donald W. Roberts



Donald W. Roberts, 71, of Ridgewood, New Jersey, died October 20, while on his way to Homecoming '89 at Golden.

Don graduated from Mines in 1941, with a degree in geology. He later earned a master's degree in meteorology from the California Institute of Technology, and a master's in petroleum engineering from the University of Tulsa. He also graduated from the Industrial College of the Armed Forces, in Washington, D.C.

Don spent 26 years in the Air Force, mostly in research and development. He retired in 1965, with the rank of colonel.

Roberts spent 12 years with IIT Federal Electric Corporation, in systems management work. For three and one-half years he ran the DEW Line and BMEWS. He retired from IIT in 1977.

For seven years he owned and operated a travel agency in Ridgewood, with his wife, the former Mary Gee of Golden. At his death he was a travel consultant with Stratton Travel.

Don was a member of the Upper Ridgewood Tennis Club, Ridgewood Lions Club, and was on the board of the Red Cross. He loved skiing, tennis, travel, music and duplicate bridge.

Surviving are his wife, Mary; two daughters, Jean Roberts Kobe, of Indianapolis, Indiana and Kathleen Roberts of Boston, Massachusetts. A daughter, Susan, died in 1966, and a son, David, died in 1972.

Donald is buried in Massachusetts National Cemetary in Bourne, Massachusetts.

William C. Kellogg



William Crowe Kellogg, a civic leader with varied interests and responsibilities in Southern California, died of cancer October 9, 1989. He was 68.

Born August 31, 1921, in Altadena, Kellogg spent his boyhood in the Los Angeles suburb and made his home there even while working at the Beach and Tennis Club.

He attended the Flintridge Preparatory School and went on to complete a degree in geology and geophysics at the Colorado School of Mines in 1943.

During World War II, Kellogg studied electronics and meteorology at Harvard, the Massachusetts Institute of Technology, and New York University. He served in the Army Air Force as a lieutenant.

He later attended business school at Stanford.

Kellogg, a member of both the Kellogg and Scripps newspaper families, was publisher of the Santa Paula Chronicle in the early 1950s, but stayed in the newspaper business for only a few years.

He spent the bulk of his career doing land surveys as a geologist and a geophysicist. He ran his own firm, Kellogg Exploration Company, and

worked for two others: Fairchild Aerial Surveys and Lockwood, Kessler and Bartlett.

In his survey work, Kellogg looked for oil, radioactive minerals and other resources, from the air and on the ground. The work took him all over the world - to Africa, South America, Alaska and Spain. Often Kellogg's family traveled with him.

Kellogg's son, William Jackson Kellogg, recalls surveying land for freeways in remote parts of California. At times the survey party was less than welcome. "I remember a few irate farmers with their shotguns," the younger Kellogg said.

William Crowe Kellogg all but abandoned his geological work in 1974 when he took over operations of the family business - the La Jolla Beach and Tennis Club.

Not all was work at the club. Kellogg was an avid sportsman. Besides skiing and sailing, Kellogg loved tennis. William J. Kellogg recalled teaming up with his father to win a few father and son matches.

Still, Kellogg missed his old line of work. He had hoped to go back into geological exploration again, according to his son.

Marc Van Buskirk, a member of the Beach and Tennis Club, said he would see Kellogg keeping up with his field by reading technical journals at lunch.

Kellogg also immersed himself in civic affairs. Though he spread his residence between La Jolla and Altadena, he made his voice heard locally.

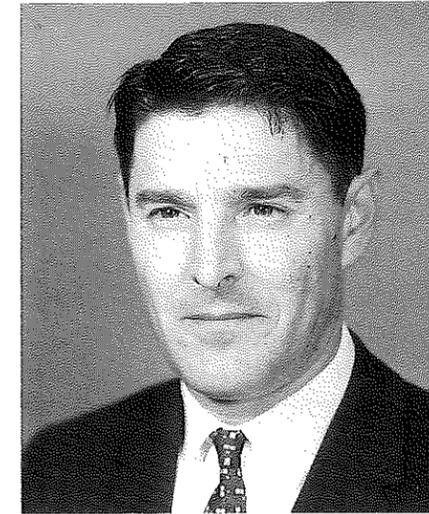
Kellogg was a member of the La Jolla Shores Planned District Ordinance Advisory Board and the La Jolla Shores Association. He was a trustee of the La Jolla Town Council, where he headed the Parks and Beaches Committee.

From 1981 to 1983 he was president of the La Jolla Town Council.

Kellogg is survived by his wife, Desdy Kellogg; three sons, William Jackson Kellogg, Robert Penfield Kellogg and Frederick Crowe Kellogg; a daughter, Jane Kellogg Cuddy; eight grandchildren; his mother, Alice Crowe Kellogg; a brother, Ogden E. Kellogg, and a sister, Jean K. Schuyler.

As a memorial to Kellogg, the family has requested that donations be made to the Colorado School of Mines Foundation Inc., William C. Kellogg Memorial Fund, P.O. Box 4005, Golden, Colorado 80401.

William F. Spain



William F. "Bill" Spain died September 26 in Houston, Texas, after a long illness.

He married Merlyn Viles, a former Golden resident, in January 1945. Spain was a 1947 graduate of the Colorado School of Mines and was a member of the Sigma Nu fraternity while a student there.

He served as a lieutenant in the U.S. Navy in the South Pacific during World War II, and during his 40-year professional career he worked and consulted for a variety of metallurgical operations throughout the world.

Spain is survived by his wife, Merlyn, Houston; sons, William F. Spain, Jr., Nimbin, Australia; Paul B. Spain, Houston; and Stephen C. Spain of Kemp, Texas; daughters, Carol A. Ming, Hawthorne, California, and Linda J. Spain, San Francisco, California; a sister, Patricia Lorick, Winston-Salem, North Carolina; and ten grandchildren. A memorial service was held in Houston on September 28.

David Crawford

David Moore Crawford, 64, P.E. 1951, died on May 21, 1989, from complications resulting from emphysema and heart problems. Crawford, executive director of the Colorado School of Mines Alumni Association from 1981 to 1984, had been ill for a lengthy period. He was born in Parkersburg, West Virginia on September 26, 1924.

David Crawford graduated from the Asheville School in North Carolina. He then entered the armed forces, and served for three years, assigned to

the European Theater of Operations. Prior to attending CSM, Crawford was a student at Princeton for one year.

At graduation, Crawford was hired as a petroleum engineer with the Plymouth Oil Company, and worked in their office in Sinton, Texas.

After three years in the oil patch, Crawford returned to Parkersburg where he worked for the Parkersburg Rig and Reel Company. Following this, he became president of the Ava Brick Corporation. He later became president of the Citizens Building Supplies Company.

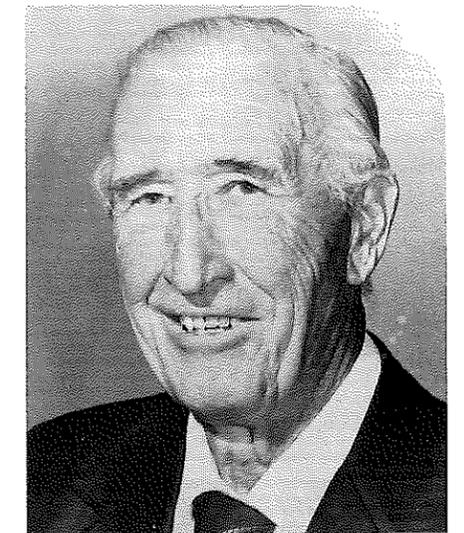
His next post was with Construction Specialties Company, where he was first manager of the material sales division, later president. Immediately prior to assuming the post of executive director for CSMMAA, he was president of RSI, Inc., a construction supply firm.

He was very active in the Masonic order and in the Presbyterian Church.

When Crawford left the Association, he accepted employment with Henderson Petroleum (Don Henderson, Geol. E. '61).

Crawford is survived by his three children, Christie Jones, of Parkersburg, David B. Crawford II, P.E. 1977, and Kimberley Crawford, both of whom reside in Houston, and both of whom are employed by Chevron. He is also survived by his second wife, Judith McNamara Crawford.

Robert S. Brummett



Robert S. Brummett, E.M. 1926, of San Gabriel, California died October 7, 1989. He was born December 3, 1905 in Missouri.

He was a member of the board of directors of the San Gabriel Valley County Water District for 43 years. He owned and operated Brummett & Demblon Contractors. He was a charter member of San Marino Masonic Lodge #685, F. & A.M.

He is survived by his wife, Phyllis; daughters, Patricia L. Ray and Roberta Young; grandchildren, Robert Young, Kathy Martin, Patty Robinson, Jeff Ray and Debbie Ray; and six great-grandchildren.

William R. Peavy



William Reader Peavy, 60, of St. Petersburg, Florida, died November 9 in his home. He was born April 17, 1929 in Ohio.

Peavy, a longtime Englewood, Colorado resident, was an aerospace engineer, retiring in 1982. He graduated from the Colorado School of Mines in 1953 with a degree in geological engineering.

He was a Korean War veteran. He was a member of Golden City Lodge No. 1 AF & AM, El Jebel Shrine, Royal Order of Jesters of Denver and the St. Petersburg Yacht Club and Power Squadron.

Survivors include his wife, Babette "Babs" Peavy; his mother, Pauline E. Swing, of Sarasota, Florida; two daughters, Cathy Club, of Kansas City, Missouri and Sally Stribling, of St. Petersburg; one son, William R. Peavy, III, of Los Angeles, California; one brother, David Peavy, of Dallas, Texas; two sisters, Judy Irvin, of Belpre, Ohio and Polly Cox, of Florence, Oregon; and three grandchildren.

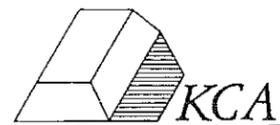
Contributions may be made to the American Heart Association (Colorado) Inc., 1280 So. Parker Rd., Denver, CO 80231.

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Dan Kappes, '66
W. Robert Rose, '81
Charles E. Hauntz, '74
Richard Ellwanger, '70

ALUMNI UPDATES

'42

'42 **Frank M. Stephens, Jr., Met. E.** is president of Iron Carbide Holdings, Ltd.

'43 **George J. Featherstone, E.M.** has retired - faculty emeritus from Bluefield State College in Bluefield, West Virginia.

'49 **Russell L. Wood, E.M. and Hon. Mem. '86** has been appointed senior associate of Behre Dolbear & Company, Inc. in Denver.

'50

'50 **John D. McIver, Met. E.** is president of Las Brisas Enterprises, Inc. in Oracle, Arizona. **R.C. (Dick) Siegfried, Geop. E.** is with Siegfried & Siegfried Ltd., a resource consulting firm in Calgary, Alberta, Canada.

Robert L. Marsh, Geol. E. is a geologist with Groundwater Technology, Inc. in Milpitas, California. **Donald L. Johnson, Met. E. and MSc. Met. '56** is professor emeritus with the University of Nebraska/Department of Mechanical Engineering. He will be a visiting professor at the Tatung Institute of Technology in Taipei, Taiwan, January-August 1990.

'52 **Charles N. McCollough, Geol. E.** retired December 31, 1989 as vice president of exploration from Occidental Exploration & Production. **John C. Dingman, P.R.E.** is president of Dingman Enterprises, Inc. in Houston, Texas.

'53 **Edgar T. Hunter, E.M.** is senior project engineer with Pikes Peak Mining Co. in Victor, Colorado. **Thomas W. Rollins, Geol. E.** is founder of Rollins Resources in Houston, Texas.

'54 **Donald E. Graves, P.R.E.** is staff technologist with Star Enterprises in Houston, Texas. **Charles J. Marquardt, Geop. E.** is staff professional geologist for Oryx Energy Co. in Dallas, Texas. **Joe S. Irwin, Geol. E.** is president of Jubilee Resources, Inc. in Calgary, Alberta, Canada.

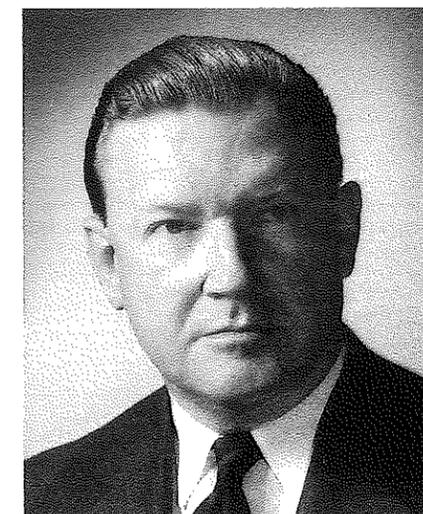
'57 **George C. Beals, MSc. Met.** is technical director with RTZ



'53 **Thomas W. Rollins**

Corporation in London, England. **Robert A. Ourada, Geol. E.** is a councilman for the City of Golden.

'58 **Charles R. Wilderson, P.E.** has retired from Panhandle Eastern Pipeline Co. and is now living in Basehor, Kansas. **William C. Bagby, P.E.** is president of PSE Energy Co. in Houston, Texas. **Anthony G. Dempster, E.M.** is executive



'58 **Anthony G. Dempster**

director/strategic planning at Texas A & M University in Houston, Texas.

'59 **John H.W. Haig, P.R.E.** is senior project director with The Pritchard Corporation in Overland Park, Kansas. **Frank J. Ucciardi, E.M.** is senior mining engineer for

Consolidation Coal Co. in Pittsburg, Pennsylvania.

'60

'60 **Walter I. Knudsen, Jr., Geol. E.** is principal water resource engineer with the Division of Water Resources of the State of Colorado in Denver.

Euclid P. Worden, E.M. is with Zeni Drilling Co. in Morgantown, West Virginia. **S. Bruce Heister, Met. E.** is president of Alcan Pacific, Ltd. in Tokyo, Japan.

'61 **Floyd F. McGurk, E.M.** is resident engineer with Industrial Design Corporation in Fishkill, New York. **David A. Chasis, Geol. E.** is director of marketing and sales with CHEMTROL (a division of NIBCO, Inc.) in Indianapolis, Indiana.

William S. Price, E.M. is president of Turnmark Corporation in Irving, Texas. **Charles E. Shultz, Geol. E.** is president and ceo/Gulf Canada Resources, Ltd. in Calgary, Alberta, Canada.

'62 **Richard Waissar, MSc. Min.** is vice president and general manager of Behre Dolbear & Company, Inc. in Denver.



'59 **Frank J. Ucciardi**

'63 **Stephen P. McCandless, Geol. E.** is senior vice president of The Personalized Mass Media Corporation in New York, New York. **Richard E. Baxter, Met. E.** is owner of Gulf Corrosion Consultants in Houston, Texas. **Donald D. Ott, Geop. E.** is

president of Seismic Data Services in Tulsa, Oklahoma. **John R. Leahy, E.M.** has joined Pegasus Gold, Inc. as general manager of its Florida Canyon and Relief Canyon mines. **J. Paul Mathias, P.E.** became a Distinguished Member of SPE last October at the 64th SPE Annual Meeting in San Antonio, Texas. The award recognizes members who attain eminence in the petroleum industry or the academic community, or who make unusually significant contributions to the Society. **Donald W. Bennett, BSc. Geol.** is construction and mining coordinator/program developer for North Idaho College in Coeur d'Alene, Idaho.

'64 **John H. Gray, P.R.E.** is president of Torch Energy Marketing, Inc. in Houston, Texas.

'65 **Barry D. Quackenbush, P.E.** is production manager with Vintage Petroleum, Inc. in Tulsa, Oklahoma. **William R. Wilson, Met. E.** has been appointed vice president responsible for business development and project manager for key clients of Behre Dolbear & Company, Inc. in Denver, Colorado.

'66 **Richards C. Thomas, E.M.** is president of Belliss & Morcom USA, Inc. in Lombard, Illinois. **Martin F. Miller, P.E.** is vice president/Louisiana Region for UNOCAL, Inc. in Lafayette, Louisiana. Robert C. Johnson, P.E. is president/owner of Cyclo Manufacturing Co. in Denver.

'67 **Loren L. Pritzel, P.R.E.** is manager/industrial and community relations for Frontier Refining, Incorporated. **Gary E. Butts, Met. E.** is vice president of Sindor in Englewood, Colorado.

'68 **Robert E. Irelan, P.E.** is manager/production and project engineering, worldwide engineering with Conoco in Houston, Texas. **Thomas M. Leonard, E.M.** is a mining manager for Bellefonte Lime Co. in Bellefonte, Pennsylvania.

'69 **Michael K. Dreher, Met. E.** is a material engineer with Coors Brewing Co. in Golden.

'70

'70 **Howard W. Musgrove, Geol. E.** is area geologist for Enron Oil & Gas Company. **Thomas J. Slade, BSc. CPR** is western sales manager for Salomon/N.A. in Littleton, Colorado.

'71 **Michael E. McNamara, BSc.**

Pet. is senior engineer with Envirocorp Services & Technology, Inc. in South Bend, Indiana.

Christiaan M. Crous, MSc. Geop. is chief geophysicist with BP Canada in Calgary, Alberta, Canada. **Harry J. Briscoe, BSc. Geol. and MSc. Geol.** '73 is managing partner of Dover Energy, Inc. in Houston, Texas. **Gary W. Priddy, BSc. Pet.** is a supervisor for Texaco in Houston, Texas.

'72 **John R. Johnstone, BSc. Pet.** is a drilling and remedial engineering manager with Texaco USA in Ventura, California. **John Leif Colson, BSc. Phy.** is applications development engineer with Schlumberger Well Services in Houston, Texas. **Steven R. Chilcoat, BSc. Geop. and MSc. Geop.** '77 is research geophysicist for Sierra Geophysics in Woodinville, Washington. **Jerry L. Gubka, BSc. Geol. and BSc. Min.** '73 is mine planner with Kennecott Denton/Rawhide Mine in Fallon, Nevada. **John M. Neubauer, BSc. Pet.** is president of Neubauer Oil & Gas in Lafayette, Louisiana. **Kevin L. Purdy, BSc. Met. and BSc. Chem.** '72 is senior metallurgist for Cyprus Serrita in Green Valley, Arizona.

'73 **George L. Lane, BSc. CPR** is senior engineer with Marathon Oil Co. in Littleton, Colorado. **John E. Lee, BSc. Pet.** is an attorney in Oklahoma City, Oklahoma. **Dennis M. Kerstiens, BSc. Met.** is a refinery manager for Kennecott in Magna, Utah. **Eugene D. Clower, BSc. Geop.** is division geophysical specialist with Enron Oil & Gas in Denver. **Joe Phillips, BSc. Geol.** is manager/mining operations for Seminole Fertilizer Corp. in Bartow, Florida. **Clyde H. Peppin, BSc. Min.** is mine superintendent/Campbird Mine for Royal Gold in Ouray, Colorado.

'74 **Robert N. Benko, BSc. CPR** is a student at Georgia Institute of Technology. **John D. Beatty, BSc. Geop.** is a project geophysicist with Axem Resources, Inc. in Denver.

'75 **Michael T. Borah, BSc. Pet.** is a staff engineer with Conoco in Casper, Wyoming. **Alan W. Czarnowsky, BSc. Min.** is president of Red Dog, Inc. in Steamboat Springs, Colorado. **Glen A. Gravender, BSc. Pet.** is production manager with Deck Oil Co. in Tulsa, Oklahoma. **Michael L. McGonagill, BSc. Pet.** is division manager/Texas Operations with Tennessee Gas Pipeline in Houston, Texas. **S. Arthur Stewart, BSc. Pet.**

is senior drilling supervisor for Amoseas Indonesia, Inc. in Jakarta, Indonesia.

'76 **Andrew T. Hunter, BSc. Phy.** is project manager for Hughes Aircraft Co. in Malibu, California. **M. Stephen Enders, BSc. Geol.** is senior project geologist with Phelps Dodge Mining Co. in Sparks, Nevada. **John R. Underhill, BSc. Pet.** is drilling manager for UNOCAL in The Netherlands. **Brad Schwartz, PhD. Met.** is a senior engineer/photoconductor development information products division with IBM in Boulder, Colorado. **Stephen J. Herrman, BSc. Math.** is field software engineer for Pentastar Support Services, Inc. in Denver.

'77 **Dean G. Liley, BSc. Pet.** is a petroleum engineer with Presidio Oil Co. in Englewood, Colorado. **Randal S. Barnes, BSc. Met.** is a process metallurgist with Teberebie Goldfield, Ltd. in Ghana, West Africa. **Jeff O'Kelley, Geop. E.** is a geophysicist for Fina Oil & Chemical in Texas. **William A. Sargent, BSc. Pet.** is senior reservoir engineering specialist for Phillips Petroleum Co. in Bartlesville, Oklahoma. **P. Michael Rivera, BSc. Geol.** is on shore operations manager for Great Western Resources in Houston, Texas. **Russell R. Opfer, Geop. E. and BSc. Geop.** '77 is a geophysicist/aerogravity division with Carson Services, Inc. in Perkasie, Pennsylvania. **Jeffrey A. Russell, BSc. CPR** is a market development representative/polymers group for Vista Chemical in Houston, Texas.

'78 **John M. Herr, BSc. Met.** is manager/material cost reduction projects with Deere & Co. in Waterloo, Iowa. **Vincent M. DeBonis, BSc. CPR** is manager/United Kingdom Training Centre with Dowell Schlumberger in England. **Philip E. Harms, BSc. Min.** is senior engineer with Magma Copper in Tucson, Arizona. **Jill C. Ivey, BSc. Min.** is senior mine engineer with Santa Fe Pacific Coal in Grants, New Mexico. **Mark L. Bricker, BSc. Min.** is manager of engineering with Bridger Coal Co. in Rock Springs, Wyoming. **M. Charlotte Hiza, BSc. CPR** is air quality control engineer with the San Bernardino, California Air Pollution Control District. **Michael W. Calahan, BSc. Met.** is manager/engineering with Ball Packaging Products Canada, Inc. in Whitby,

Ontario, Canada. **Mark H. Wood, BSc. Min.** is assistant shift foreman for Homestake Mining Co. in California. **Gary C. Muller, BSc. Min.** is an engineer for Black Beauty Coal Co. in Evansville, Indiana. **Janice D. Williams, BSc. Geol.** is a senior environmental engineer with Westinghouse Hanford Co. in Richland, Washington. **Joseph Kuchinski, BSc. CPR** is a group supervisor/production engineering for Phillips Petroleum Co. in Odessa, Texas.

'79 **Roe C. Brown, BSc. Min.** is supervisor/Human Resource Systems with BHP-Utah International in Farmington, New Mexico. **James K.B. Hesketh, BSc. Min. and MSc. Min. Econ.** '87 is coordinator/business development for Cyprus Minerals Co. in Englewood, Colorado. **Craig S. Onodera, BSc. Pet.** is an engineer with General Atlantic Resources, Incorporated. **Anthony R. Kenck, BSc. Geop.** has been transferred to Texaco Petrolera Argentina, SA in Buenos Aires, Argentina. **Curt L. Golike, BSc. Pet.** is staff engineer/Eastern Hemisphere with Oxy International in Bakersfield, California. **John W. Rozelle, MSc. Geoche.** is principal geologist with Pincock, Allen & Holt in Lakewood. **David M. Edgerley, BSc. Min.** is a cost analyst for Northwestern Resources Co. in Jewett, Texas.

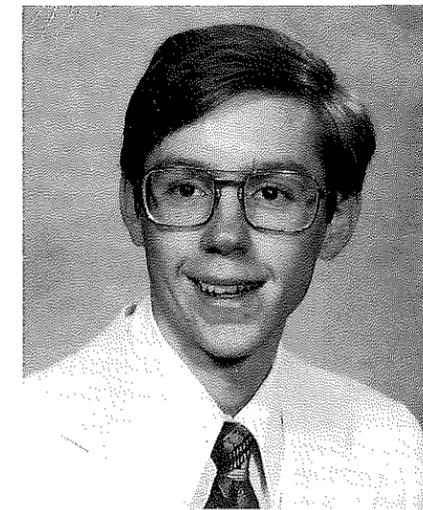
'80

'80 **Roger Eustance, BSc. Geol.** is an energy analyst for John S. Herald and Associates in Greenwich, Connecticut. **Paul A. Bartel, BSc. Pet.** is senior production engineer with BP Exploration in Anchorage, Alaska. **Nanette A. Avril, BSc. Geol.** is an attorney with Nutter, McClennen & Fish in Boston, Massachusetts. **Douglas D. Colby, BSc. Pet.** is staff operations engineer with Mobil Exploration & Producing U.S., Inc. in Big Piney, Wyoming. **Bruce D. Hansen, BSc. Min.** is manager/business development with Santa Fe Pacific Minerals in Albuquerque, New Mexico. **Jay E. Johnson, BSc. CPR** is engineering manager with Graham Resources, Inc. in Dallas, Texas. **Sandra (Holliman) Huzyk, MSc. CPR** is a staff plant engineer with AMOCO Production Co. in Denver. **Ronald L. Breninger, BSc. CPR** is a captain/U.S. Air Force in Bangor,

Maine. **Kevin H. Bjornen, BSc. Geol.** is a district engineer with Dowell Schlumberger in Hobbs, New Mexico. **Timothy E. Mower, BSc. Geol.** is a hydrologist with USGS. **Alex F. Ritter, BSc. Min.** is president of ARESCO in Coeur d'Alene, Idaho. **Robert B. Elder, MSc. Pet.** is senior reservoir engineer with Chevron in Scotland. **Bruce A. Williams, BSc. Geol.** is a senior environmental engineer with Westinghouse Hanford Co. in Richland, Washington.

'81 **Stephen A. Johnson, PhD. Geol.** is a project geologist with Roy F. Weston in West Chester, Pennsylvania. **Vicki L. Hayden-Furey, BSc. Geop. and MSc. Geop.** '84 is a corporate finance associate with Citicorp in New York, New York. **Christopher E. Herald, MSc. Geop.** is vice president/exploration with Crown Resources Corporation in Denver. **Jere B. Harper, BSc. Geol.** is a lieutenant junior grade/U.S. Coast Guard in Sitka, Alaska. **Kevin P. Woehr, BSc. CPR** is director of production for Institut Fuer Medizintechnik in West Germany. **Daniel J. Pompea, BSc. Phy.** is president of Lamb Software in Colorado Springs, Colorado. **Todd T. Grimmett, BSc. Geop.** is senior financial analyst for Ask Computer Systems, Inc. in Mountain View, California.

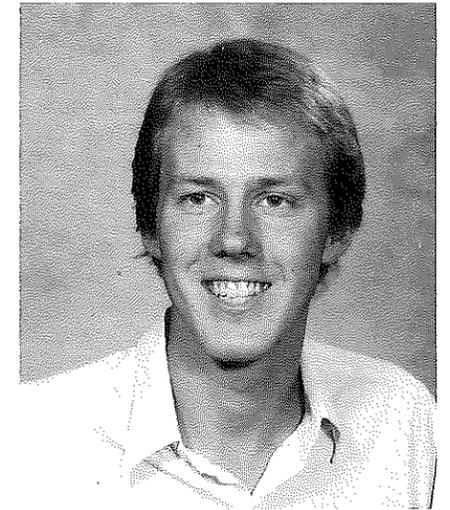
'82 **David H. Jerome, BSc. CPR** is an engineer with Simulation Sciences,



'82 David H. Jerome

Inc. in Fullerton, California. **Barbara L. Ganong, BSc. Pet.** is a senior engineer with Western Geologic Resources, Inc. in San Rafael, California. **Michael J. Ryan, MSc. Min.** is a mining engineer for Empire

Coal Co. in Gnadenuhnen, Ohio. **Michael T. Schwein, BSc. Pet.** is a financial analyst for Storage Technology. **Stefan G. Magnusson, BSc. Geop. and MSc. Geop.** '85 is a

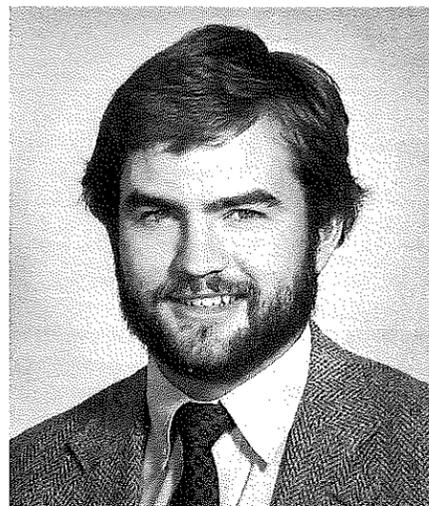


'82 Stefan G. Magnusson

research geophysicist for Orkustofnun, National Energy Authority. **John M. McCoury, BSc. B.E.** works for Chrysler Technologies/Airborne System in stress analysis and engineering in Waco, Texas.

'83 **Craig E. Burson, BSc. Min.** is a market development manager/industrial gas operations for Dow Chemical in Houston, Texas. **Gregory A. Bruce, BSc. Min.** is a development engineer for Magma Copper Co. in Tucson, Arizona. **Jolene (Baker) Kramer, BSc. CPR** is a lead process engineer for Chevron USA, Inc./Richmond Refinery in Richmond, California. **Mark D. Loeffelholz, BSc. Met.** is a research group leader for The J.E. Baker Co. in York, Pennsylvania. **Connor M. Hannon, BSc. Pet.** is an engineer with Canadian Hydrodynamics Ltd. in Calgary, Alberta, Canada. **Dawn C. (Beck) Friesen, BSc. Geop.** is a geochemist with Harding Lawson Associates in Denver, Colorado. **Tracey (Smink) Vangolen, BSc. Pet.** is district engineer for Lindsey Completion Systems in Oklahoma City, Oklahoma. **Thomas P. Young, BSc. Min.** is services cost engineer for EBASCO Services, Inc. in Lakewood, Colorado. **Susan G. Thomas, BSc. Geop.** is a senior associate engineer for IBM. **Eric A. deMontigny, BSc. Min.** is an engineer/geologist for Intra Search, Inc. in Englewood, Colorado. **'84 Cynthia A. Kraver, BSc. Math.**

is a security consultant with Perot Systems. **Ty S. McKercher, BSc. Math.** is a systems engineer for Sun Microsystems, Inc. in Houston, Texas. **Kathy J. Ayers, BSc. Met.** is with the firm of Gendel, Raskoff, Shapiro & Quittner in Los Angeles, California. **Randall R. Cox, BSc. CPR** is senior software engineer with Pillar Corporation in Foster City, California. **Howard L. Holden, BSc. Met.** is chief metallurgist with Bond Gold Colosseum, Inc. in Las Vegas, Nevada.

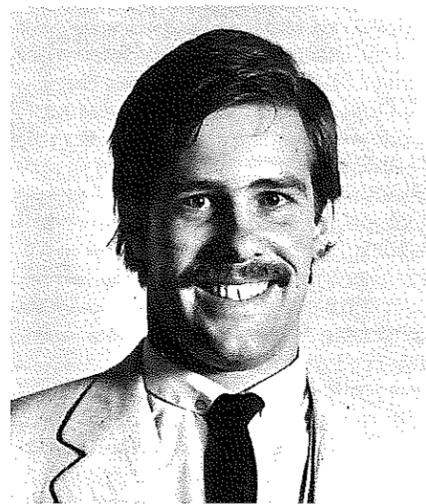


'84 John R. Guffey

John R. Guffey, BSc. Pet. is an engineer with Roy Guffey Oil Co. in Dallas, Texas. **Joseph M. Culkin, BSc. Min.** is a sales engineer with R.B. Scott Co. in Waukesha, Wisconsin. **Jay W. Clements, BSc. CPR** is a refining engineer with Marathon Petroleum Co. in Garyville, Louisiana. **Eric L. Brudie, BSc. Geol.** is a project engineer for Yukon Pacific Corp. in Anchorage, Alaska. **John M. Patterson, BSc. Met. and Met. E.** '84 is quality control manager/metallurgist for Hinderliter Heat Treating in Tulsa, Oklahoma. **Thomas D. Reed, Jr., BSc. Eng.** is engineer II/systems lead for Universities Research Association in Dallas, Texas. **Peter G. O'Donnell, BSc. Pet.** is advisor to the Commissioner of the California Public Utilities Commission in San Francisco. **Paul H. Wolfe, BSc. Pet.** is a graduate student in public affairs at UCCS. **Kristi L. Lofgren, BSc. Met.** and **Steve J. Wysocki, BSc. Pet.** '85 were married August 26, 1989. Kristi is field operations engineer for ARCO Alaska at Prudhoe Bay, Alaska. Steve also works for ARCO Alaska at Prudhoe Bay as a production well supervisor. **Brenda (Crumb) Wolfe,**

BSc. CPR is program manager for Eagle-Picher Industries in Colorado Springs, Colorado. **Brian R. Love, BSc. Eng.** is an assistant engineer with the Arapahoe County Department of Engineering in Littleton, Colorado. **James R. Logan, BSc. Geop.** is a member of the technical staff of MITRE in Colorado Springs, Colorado.

'85 **Elizabeth A. Kostiuik, BSc. CPR** is a graduate student/environmental engineering at the University of Arizona in Tucson. **Michael L. Gurch, BSc. Geop. and MSc. Geop.** '89 is a geophysicist with EXXON Co., USA in Houston, Texas. **Erik E. Hansen, BSc. Geol.** is an environmental hydrogeologist with Shell Oil Co. in Houston, Texas.



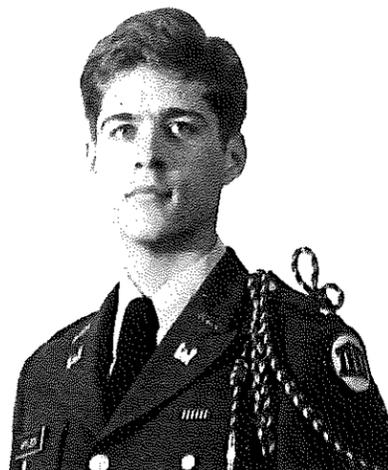
'85 Thomas J. Dinger

Thomas J. Dinger, BSc. CPR is a software engineer with Pillar Corporation in Foster City, California. **Glen M. Gallo, BSc. Met.** is a metallurgical engineer with Bechtel Corp. in Houston, Texas. **Stephen B. Batman, BSc. Min.** is a planning and design engineer with Amax Gold, Inc. in Golden, Colorado. **Lee P. Johnson, BSc. Min.** is a production supervisor for Millington Quarries in Millington, New Jersey. **James V. Ierubino, M. Eng. Pet.** is a senior production engineer with Mobil Oil Corporation in San Ardo, California. **Robert L. Bates, BSc. Geol.** is a general field engineer with Schlumberger Well Service in Bakersfield, California. **Haakon J. Bjorum, BSc. Pet.** is a graduate student/Kellogg Graduate School of Management at Northwestern University in Evanston, Illinois. **John F. Calkins, BSc. Geol.** is a senior



'85 John F. Calkins

technical support analyst with Prime Computer, Inc. in Englewood, Colorado. **Ann Mattson, BSc. Geop.** and **William S. Curtin, BSc. CPR** were married September 16 in Aspen, Colorado. She is an exploration geophysicist with Pecten International, Co. in Houston, Texas and he is with M.W. Kellogg Co. also in Houston. **C. Mitchell Cox, BSc. Pet.** is regional business developer/West Africa and Latin America for New Venture Marketing/ARCO International Oil & Gas in Plano, Texas. **Thomas C. Anderson, BSc. Min.** is a mining engineer with Western State Minerals/Northumberland Mine in Round Mountain, Nevada. **John W. Flanigan, BSc. CPR and MSc. CPR** '87 is a process engineer/agricultural division for American Cynamid Co. in Hannibal, Missouri. **Robert B. Affleck, BSc. Math.** is a captain in



'85 Robert B. Affleck

the 20th Engineer Battalion, U.S. Army Corps of Engineers stationed at Fort Campbell, Kentucky. **Jeffrey R. Blackwell, BSc. Eng.** is a civil engineer with Church Engineering in Newport Beach, California. **Steven J. Wysocki, BSc. Pet.** and **Kristi L. Lofgren, BSc. Met.** '84 were married August 26, 1989. Steven is a production well supervisor for ARCO Alaska at Prudhoe Bay, Alaska. Kristi also works for ARCO Alaska at Prudhoe Bay and is a field operations engineer. **Donald L. MacKenzie, BSc. Pet.** is a production engineer for Conoco Canada Ltd. **Sandra L. Perry, MSc. Geol.** is project geologist with Barringer Laboratories in Golden. **Maria Major-Sosias, BSc. Geop.** is a geophysicist with Berrong Enterprises Ltd. in Golden. **Gary L. Pratt, BSc. Math.** is a math instructor at Front Range Community College.

'86 **Elwood (Mac) Burriss, BSc. Min.** is a mining engineer/quarry supervisor with Georgia Pacific in Fort Dodge, Iowa. **Russell G. Bundschuh, BSc. Geop. and BSc. Eng.** '87 is a systems engineer with IBM in New York. **Margaret J. Brannigan, BSc. CPR** is an environmental engineer with BP Oil/Toledo Refinery in Toledo, Ohio. **Scott A. McKittrick, BSc. Geol.** is a geologist with Cactus Gold Mine Co. in Mojave, California. **Kirk A. Lindahl, BSc. Eng.** is an advanced engineer with Rockwell International in Golden. **Barbara (Smetana) Helmkamp, BSc. Phy.** is a petrophysical engineer with Shell Offshore, Inc. in New Orleans, Louisiana. **Stephen Collins, BSc. Phy.** is a member of the faculty at Colorado State University in Fort Collins, Colorado. **Gerald L. Berry, BSc. Met. and MSc. Met.** '88 is a metallurgical engineer with Micro Motion in Boulder, Colorado. **Edwin M. Hall, BSc. Met. and MSc. Met.** '88 is a process engineer with Sherritt Gordon, Ltd. in Fort Saskatchewan, Alberta, Canada. **Eric Friedland, BSc. Geop.** is president of Fairbanks Gold Ltd. in Vancouver, British Columbia. **Scott A. Stephens, BSc. Geop.** is a geophysicist for LCT, Inc. in Houston, Texas. **Ellen J. Sagal, BSc. Min.** is a mining engineer for Cyprus Minerals in Tucson, Arizona. **Kevin J. Shimoda, BSc. Chem.** and **Lisa M. Wagner, BSc. Phy.** were married August 6, 1989 in Golden, Colorado. They now reside in

Vienna, West Virginia. Kevin is employed by Shell Chemical and Lisa is consulting.

'87 **Daniel B. Hurlbut, BSc. Chem. and BSc. CPR** '87 is a junior chemist with Geneva Generics, Inc. in Broomfield, Colorado. **Daniel J. McElhinney, BSc. Eng.** is a design engineer with the California Department of Transportation in Redding, California. **Henry E. Heyser, III, BSc. CPR** is a marketing representative with Chevron Chemical Co. in Houston, Texas. **Cheryl D. Leighton, MSc. Geol.** is a geological technician with Louisiana Land & Exploration in Denver. **Mark Levorsen, MSc. Geol.** and **Laura Bevier, MSc. Geol.** have a new addition to their family, her name is Hannah. **Patricia M. Howe, BSc. Met.** is a first lieutenant/U.S. Army in Ft. Lewis, Washington. **Timothy M. Thomas, BSc. Geol.** was designated a naval aviator after completing 18 months of flight training. **Byron J. Lindros, BSc. Pet.** is an associate production engineer with Shell Western Exploration & Production, Inc. in Bakersfield, California. **Leslie Rush Kahihikolo, BSc. Geop.** is a civil/cost engineer for the Army Corps of Engineers, Omaha District in Nebraska. **Lonney P. Heisel, BSc. CPR** is a resident appraiser with Factory Mutual Engineering. **Anna M. Logan, BSc. Pet.** is a geophysicist with Downhole Seismic Services in Houston, Texas.

'88 **Hope H. Eiseman, MSc. Geol.** is a geologist with Camp, Dresser & McKee in New York, New York. **Scott M. Kelly, BSc. CPR** is a sales engineer with Shade, Inc. in Fremont, California. **Jeffrey B. Kaiser, BSc. Eng.** is an engineer with Kiewit Eastern Co. in Villanova, Pennsylvania. **Anita R. Gebbie-Deisch, BSc. Geol.** was married to John Deisch, August 26, 1989 and is now living in Sitka, Alaska. **David A. Beck, BSc. Eng.** is an environmental engineer with Union Carbide Corp. in Hahnville, Louisiana. **Amir Assar, BSc. CPR** is a process engineer with M.W. Kellogg Co. in Rockville, Maryland. **Richard H. Kerr, BSc. Eng.** is a field engineer with Peter Kiewit & Sons. **Robert D. Krehbiel, BSc. Eng.** is an engineer/estimator with Kiewit Western Co. in Littleton, Colorado. **Catherine (Wightman) Collins, BSc. CPR** is an environmental engineer with

EPA/Region VIII in Denver, Colorado. **Richard C. Lansdowne, BSc. Min.** is a mining engineer with Kennecott in Ely, Nevada. **Raymond M. Baca, BSc. Eng.** is a design engineer with Manville Sales Corporation in Lompoc, California. **Gregory Flaherty, BSc. Eng.** is a structural engineer with Mistry Associates, Inc. (on loan to Bechtel, Parsons, Brinckerhoff) in Boston, Massachusetts. **Robert E. Farrar, BSc. Eng.** is an electrical engineer with Black & Veatch in Aurora, Colorado. **Eric W. Vestal, BSc. Math.** is a research geophysicist with Western Geophysical in Houston, Texas. He is also a graduate student in applied mathematics at the University of Houston and was commissioned in October 1989 as an ensign/U.S. Naval Reserves as an engineering duty officer. **John C. Stites, BSc. Eng.** is an area engineer/Eastern Wyoming for FHWA in Cheyenne, Wyoming. **Matthew M. Weaver, BSc. Eng.** is a maintenance engineer for Kennecott in Magna, Utah. **Robert T. Mero, BSc. Chem.** is a chemist for the Colorado Dept. of Health in Denver. **David A. Rose, BSc. Geop.** is a field engineer for Schlumberger in Kokstad, Norway. **Monte L. Madsen, BSc. Pet.** is a field engineer for The Western Co. of North America in Aztec, New Mexico. **Wilfredo A. Lopez, MSc. Min.** is an ore reserve estimation engineer with Geostat Systems in Golden. **Trent M. Doyle, BSc. Math.** is a graduate student at William & Mary in Williamsburg, Virginia. **Scott R. Fahrney, BSc. Eng.** is a project engineer for ARCO Alaska, Inc. in Anchorage, Alaska.

'89 **Robert A. Lenahan, MSc. CPR** is a production engineer with Union Carbide Corp. in Texas City, Texas. **Drue J. Hardy, MSc. Geol.** is a geologist (contract) with Stoakes-Campbell Geoconsulting Ltd. in Calgary, Alberta, Canada. **Nathan S. Abelein, BSc. Eng.** is an engineer with Hitachi Metals Int'l, Ltd. in San Ysidro, California. **Stuart K. Koyanagi, BSc. Geop.** is a graduate student at the University of Southern California in Los Angeles, California. **Paul J. Kyed, BSc. Met.** is a graduate student/materials science at Stanford University in California. **Tina L. Crabtree, BSc. CPR** is a developmental engineer with Phillips Petroleum Co. in Odessa, Texas. **Robert F. Cairncross, MSc. CPR** is a

systems engineer/plastics with Caterpillar, Inc. in Peoria, Illinois.

Dino A. Domenico, BSc. CPR is a process engineer with Total Petroleum Co., Inc. in Arkansas City, Kansas.

Bryan J. Kinderman, BSc. Chem. is an instrument engineer with UOP, Inc. in Des Plaines, Illinois.

Gary E. Grove, BSc. Pet. is an applications petroleum engineer with Baker Sand Control in Houma, Louisiana.

Jonathan J. Jambor, BSc. Eng. is manager/engineering and quality control for Curtis Machine Co., Inc. in Dodge City, Kansas.

Eric S. Thurston, BSc. Eng. is an engineer with Shell Oil in Martinez, California.

Andrew D. Stewart, BSc. Eng. was commissioned a naval ensign upon his graduation from Officer Candidate School.

Mark H. Gosselin, BSc. Pet. is a highway engineer with the Colorado Dept. of Highways.

Kimberly G. Halbert, BSc. Pet. is a geological technician with Mobil Oil in Denver, Colorado.

Stephanie M. Gork, BSc. CPR is a production design engineer with Bechtel Corporation in San Francisco, California.

Gregor J.M. Layman, BSc. CPR is a chemical engineer with Dow Chemical.

Gregory L. Davoll, BSc. Math. is a computer programmer with IBM in San Jose, California.

Jody L. Perry, BSc. CPR has been commissioned a naval ensign upon graduation from Officer Candidate School.

Bradley G. Christiansen, BSc. Eng. is a project engineer with Kiewit Western.

Craig M. Friesen, BSc. Eng. is an engineer I with Centennial Engineering in Arvada, Colorado.

Michael J. Young, BSc. Eng. has been commissioned an ensign/U.S. Navy upon his graduation from Officer Candidate School.

A. Michael Ghere, BSc. Eng. is a field engineer with Sonat Offshore in New Orleans, Louisiana.

Leonard K. Jewkes, BSc. Eng. is a civil engineer with USA (Underground Support Assistance) in Santa Fe, New Mexico.

Stephanie (Sangaline) Heggie, BSc. Eng. is an engineer I with Howard, Needles, Tamment & Bergendoff Engineers in Denver, Colorado.

Sean J. Foley, BSc. Pet. is a drilling engineer with Chevron USA in Bakersfield, California.

Eric R. Bauer, BSc. Pet. is a petroleum engineer with UNOCAL in Midland, Texas.

R. Patrick Highsmith, BSc. Geol. is an exploration geologist with Westmont Mining, Inc. in Charlotte, North Carolina.

Bradley R. Blair,

BSc. Geol. is a graduate student in mining at CSM.

Douglas G. Kearney, BSc. Met. is a quality control manager with Hinderliter Heat

Treating.

Richard C. Hugo, BSc. Met. is a graduate research assistant for the Los Alamos National Laboratory.

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ELKO	PHOENIX	TRI-CITIES

A MEMBER OF THE **HHI** GROUP OF COMPANIES

The National Society of Professional Engineers (NSPE) is inviting fellow engineers to participate in their MATHCOUNTS program. Each year, NSPE challenges seventh and eighth grade students with school, local, state, and national math competitions. The program is exciting and rewarding to the students and also the engineers that participate. As the MATHCOUNTS programs expand each year, additional volunteers are needed for administering the tests, grading, judging, organizing competitions and other tasks. Volunteer efforts can take as little as one or two hours or up to dozens of hours.

Local competitions will be held on the following dates:

<i>Jefferson County Area</i>	<i>February 9, 1990</i> <i>Colorado School of Mines</i>
<i>Metropolitan Denver</i>	<i>February 24, 1990</i> <i>Scanticon Center</i>
<i>Northern Colorado</i>	<i>February 10, 1990</i> <i>University of Northern Colorado</i>
<i>Southern Colorado</i>	<i>February 24, 1990</i> <i>University of Southern Colorado</i>
<i>Western Slope</i>	<i>February 3, 1990</i> <i>Mesa State College</i>

Boulder Area
Colorado Springs Area

Dates and locations confirmed

Local winners advance to the State Competition to be held on March 24, 1990 at the Colorado School of Mines.

Engineers, spouses, friends, and students are invited to join in the fun and enthusiasm of the MATHCOUNTS program. For more information, or to determine the MATHCOUNTS coordinator in your area, contact one of the following NSPE members: Paul Gulman (303) 971-4262, Noelle Sears (303) 779-0578, or Richard Bogdanovich (303) 758-8840.

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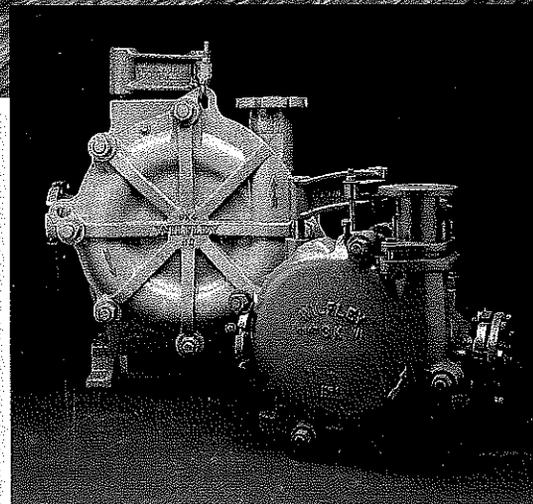


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