A Message from Professor Jan D. Miller, Department Chair

Dear Alumni and Friends,

The 2002/03 school year was celebrated with graduation exercises in May and the awarding of five B.S. degrees and one M.S. degree in Metallurgical Engineering. Summer has gone by fast, as usual, and the new school year began 20 August 2003.

I am pleased to report that our undergraduate enrollment continues to be sustained with limited financial aid. Your contributions to our scholarship fund are essential to our program. Thank you for your continued support. The total undergraduate enrollment for 2003/04 is expected to be 33. Similarly, our research funding has been maintained with projects ranging from the processing of mineral resources to the synthesis of composite materials.

This past year marked the retirement of Professor R. Peter King who has been such an important asset to our department during the past 13 years, serving initially as the Director of the Comminution Center and later as Department Chair. This year Peter was elected to the National Academy of Engineering. Congratulations for a job well done! We will miss Peter’s full-time contributions, and I am sure you will join us in wishing Peter and Ellen, his wife of 42 years, all the best in this time of retirement. We are fortunate that Professor King will still have some influence on our program as Professor Emeritus, and he will continue to serve as editor of the International Journal of Mineral Processing from his office at the University of Utah.

Dr. King Retires

Professor R. Peter King retired to the status of Professor Emeritus July 31.

Dr. King was born in South Africa. He received his B.Sc. and M.Sc. degrees from the University of the Witwatersrand in Chemical Engineering. After completing his Ph.D. degree at the University of Manchester in England, he was a lecturer at the University of Natal and Witwatersrand. During 1967 to 1973, he established and led Mintek’s research group at the University of Natal. Dr. King held the Chamber of Mines’ Chair at the University of Witwatersrand from 1975 to 1990. In 1990, he joined the Metallurgical Engineering Department at the University of Utah as Professor and the Director of the Generic Mineral Technology Center for Comminution. Peter served as Chair for the Department from 1999 to 2002.

Professor King is an Honorary Life Member of the South African Institute of Mining and Metallurgy, and he was President of SAIMM from 1982 to 1983. He is currently editor-in-chief of the International Journal of Mineral Processing. He has authored two recent texts. Modeling and Simulation of Mineral Processing Systems covers the field of quantitative modeling of mineral processing equipment and the use of these models to simulate the actual behavior of mineral processing and coal washing plants as they are configured to work in industrial practice. Introduction to Practical Fluid Flow is unique in providing a uniform treatment for all types of fluids, from simple Newtonian fluids, to non-Newtonian slurries with emphasis on complex rheological properties.

Many of you will remember Professor George Healy who joined the faculty in 1974 and retired to emeritus status in 1989. Subsequently George and his wife, Trudy, established the George & Trudy Scholarship for undergraduate students in the Department of Metallurgical Engineering, which has been, and continues to be, used to good advantage. George died peacefully in Salt Lake City last year at the age of 93.

Also, we will miss Mrs. Eva Aoki, the department’s Administrative Assistant for many years until she retired in 1996. Eva passed on in April.

During 2002/03 the Graduate Council Review of our program was completed, and overall we received high marks. The department was commended for, “1. A strong faculty that is providing leadership in the metallurgical engineering profession. 2. A high level of research support and high production of Ph.D.s in metallurgical engineering. 3. Significant use of the internet to expand access to metallurgical engineering classes outside of the Salt Lake Valley. A review of such course development may provide a useful example to the University of the costs and benefits of such activities.”

Now we face a new school year. The challenges for our program are the same as they have always been – student recruitment, scholarship support, research funding, and administrative appreciation. You may be able to help in some of these areas, and such involvement certainly would be welcomed. The big challenge this year will be ABET accreditation which is scheduled for 26-28 October 2003.

Yours sincerely,

Jan D. Miller
Department Chair

His awards include the Ernest Oppenheimer Memorial Traveling Fellowship in 1980. In 1991 Professor King received the Gold Medal of the South African Institute of Mining and Metallurgy. He was awarded SME’s Stefanko Award for the best technical paper in the Coal & Energy Division in 1997. He received SME’s 2002 Antoine M. Gaudin Award “for his seminal contributions to mineral liberation in mineral processing.” In 2003 Professor King was elected to the National Academy of Engineering for “the development of techniques for quantifying mineral liberation and for leadership in Internet education about mineral processing engineers.”

In further testament to the significance of his contributions to our profession, Peter was recognized with the Lifetime Achievement Award at the XXII International Mineral Processing Congress in 2003. He has received numerous teaching awards, including the MellowMet Outstanding Teaching Award in 1988, 1996, 2000, and 2002, and the College of Mines and Earth Sciences Outstanding Teaching Award in 1996.

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Yours sincerely,

Jan D. Miller

Peter King chats with Zak Fang (left) and Gerry Byrne (right) at a department get-together on his last day of work.
Department Research

Dr. Ravi Chandran’s group has developed technology to apply titanium boride (TiB) crystals to harden the surfaces of titanium for high-performance parts, components, and appliances requiring high surface hardness and wear and heat resistance. Part of a five-year federally funded project to develop titanium armor for the US Army, it paves the way for low-cost and lightweight commercial applications of titanium.

The unique aspect of the TiB-hardening technology is the combination of the structure, hardness, and wear resistance coupled with electrical and thermal conductivity of the surface layer, the benefits of which have been metallurgically determined to be superior to competing technologies. A 5X increase in surface hardness of titanium has been achieved. Possible applications include surface-hardened specialty bearings for aerospace and sports applications, hardening of lightweight titanium gun barrels, and hardened cutting edges for scalpels, razors and knives.

Prof. Zak Fang joined the department in March 2002. Eighteen months later, his research group consists of four graduate students and two undergraduate research assistants. Externally funded research projects open the window of advanced materials to these student, from one of the lightest and hardest man-made materials – synthetic diamond – to one of the heaviest metallic alloys – tungsten nickel iron alloy for armor penetrator applications. A novel composite material that is under investigation has a functionally designed honeycomb-like microstructure as shown in the micro x-ray CT image. The structure and its functionality are analogues to kitchen tiles. This unique “tile & grout” structure resulted in a dramatic improvement in chipping resistance of the surface by mitigating crack propagation and localizing chipping within a single tile or a small cluster of tiles.

Prof. Michael Free’s research group continues to investigate hydrometallurgical phenomena with an emphasis on electrometallurgy. Studies of corrosion inhibition using surfactants have resulted in a model that predicts the combined effects of surfactant hydrocarbon chain length and solution ionic strength on surfactant adsorption and corrosion inhibition. Work continues in the development of alternative anode chemistries for electrowinning with Professor Miller’s research group and other collaborators. In addition, Professor Free’s group is working on improving different aspects of the chemical mechanical polishing process used by the microelectronics manufacturing industry. Research is also underway to develop more innovative and efficient ways of recovering metals from toxic waste streams in a saleable form, rather than as concentrated wastes. Lei Chen and Wanlin Wang each received master’s degrees this past year for their electrodeposition and corrosion contributions in the group.

Dr. Siva Guruswamy’s research group is now engaged in developing high-performance magnetostrictive alloys for sensor and actuator applications, pursuant to their invention of the low-cost and highly magnetostrictive FeGa-based alloys, a major research effort supported by a National Science Foundation grant. A joint patent application along with the Naval Surface Warfare Center/ONR is pending. An ultrasonic resonance measurements system was acquired for elastic property characterization of magnetic and magnetostrictive alloys. Further capabilities for magnetostriction measurements under load and facilities for high-vacuum directional solidification and crystal growth of magnetic alloys were developed during the past two years. Continued efforts over the last decade have now led to the current capability, unique in the country, of going all the way from alloy preparation, crystal growth, thin film deposition, heat treatment, and magnetic, magnetostrictive, and structural characterization, to device development. Work on nanostructured data-storage media and permanent-magnet alloys is also being pursued. Research on solid-state thermal diode structures for hybrid thermoelectric/thermionic devices is currently underway with industrial support. Dr. Guruswamy was invited to the EPRI/LZRO Workshop where he participated in discussions dealing with aging underground lead-sheathed high-voltage power cables.

The university obtained another patent jointly with Medquest on the blood-compatible and conductive coating on surgical blades, artificial heart, and other implant products developed earlier in Dr. Guruswamy’s laboratory.

Participation in the DOE CAST Consortium has enabled Prof. J. D. Miller’s group to continue research on soluble salt flotation separation technology for the trona industry. Using a special flotation procedure they developed, researchers are pursuing a preferred processing strategy to concentrate trona by removing gangue mineral contaminants from the plant feed prior to chemical processing. It is expected that development and utilization of this new technology will allow energy conservation, improved resource utilization, increased productivity, and development of a new product for the marketplace.

In collaboration with Dr. Anh Nguyen of the University of Newcastle, Australia, through NSF/Australian Research Council international funding, research has been initiated on nanostructures of surfactants at solid-liquid and gas-liquid interfaces and their influence on interfacial properties, particularly the measurements of surface forces using the AFM colloidal probe technique.

NSF/IMR Program funding has finally made it possible to acquire a Sum Frequency Generator (SFG) spectrometer that is being used for surface spectroscopic research and student training. Of particular interest is the structure of water at selected surfaces and its relationship to wetting phenomena.

The current heap leaching research program involves X-ray microtomography (XMT) analysis of residual copper minerals in exhausted heaps. Residual copper minerals from exhausted heaps are being identified and associated texture established in order to determine the extent of exposure for each mineral type. In addition to these XMT measurements, software is being developed to distinguish copper mineral types including chrysocolla, brochantite, chalcopyrite, covellite, and chalcocite.

The magnetic activated carbon (MAC) project, a collaboration between Dr. Miller and Dr. S. Duyvesteyn, has been extended to involve pilot-plant production of the MAC material with industrial involvement for evaluation of the product in various applications. Who would have thought that good old minerals grinding would be used in nuclear engineering? A vast quantity of highly enriched uranium, spent reactor rods, etc., is stored in numerous sites around the U.S. DOE asked researchers to come up with a process to dispose of the highly enriched uranium. Dr. Raj Rajamani and a couple of engineers at Idaho National Lab came up with the idea of grinding highly enriched stock with depleted uranium stock. The end result is a blended product that more or less resembles uranium ore. Uranium ore is innocuous and is found in mine sites in Idaho and other states. Dr. Rajamani has developed a special planetary mill, driven by a pair of electric motors. The planetary mill concept is simply a pair of ball mill canisters which operate in a 30-g gravitational field produced by
In Memoriam

George W. Healy died November 20, 2002 in Salt Lake City at the age of 93. He was a skilled woodworker and enjoyed hiking, snowshoeing, and cross-country skiing, and reading, especially history, biography, and historical fiction.

George was born May 18, 1909 in Muehlau, Austria to James Edward Healy and Marie Wilhelmina Healy and grew up in France, Switzerland, and England. He attended the Sorbonne in Paris, and graduated from Yale University with a B.S. in Mechanical Engineering in 1933, before doing graduate work in Munich, Germany, doing research on age and heat hardening of copper-aluminum alloys.

Upon the outbreak of World War II, he took a position with Union Carbide in Niagara Falls, where he worked on many projects critical to the war effort.

George married Trudy Besag of Baden-Baden, Germany in 1941. They had six children together. He and D. C. Hilty received the Hunt Award in 1958 for studies on oxygen refining of stainless steel.

George joined the Pennsylvania State University as Associate Professor of Metallurgy in 1963. Following his retirement in 1974, he came to the U to fill what was supposed to be a temporary vacancy at the Department of Metallurgical Engineering. He was awarded a special prize in the Hoffman competition in 1982 for a paper on the application of selective oxygen enrichment in lead concentrate sintering and received the Mellow Met Award.

Eva Teruko Aoki passed away at home on April 2, 2003, age 75, due to complications from Parkinson’s disease. She was born April 23, 1927 in Salt Lake City to Kanji and Eiko Matsuda and graduated from Granite High School and the LDS Business College. She worked for 25 years at the University of Utah, retiring in 1996 as Office Support Coordinator to Metallurgical Engineering.

Eva was a member of the Salt Lake Buddhist Temple and Fujinkai and is survived by her husband of 46 years, Nobuo (“Nobi”) Aoki; four children, Alan Aoki, Bruce Aoki, Christine Munson, and Kenneth Aoki; two grandchildren, Emma and Henry Munson; four sisters, Taeko Yoshida, Ruth Hino, Elsie Doi, and May F. Matsuda; and two brothers, Dick and Karl Matsuda. She was preceded in death by her parents.

Program Status

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Student Recognition, 2002–03

Graduate. Gilsoo Han received the Graduate Seminar Award for Best Student Presentation for his seminar January 29, 2003 on “High-Temperature Corrosion of Fe3Al in Chlorine-Containing Environments.” Attendees rated his presentation an average 85.6 out of 100. Gilsoo was awarded a Cooper-Hansen Fellowship of $10,000 in 2002, and is completing a PhD with Dr. Munson.

The department Teaching Assistant Award was presented to Krutibas Panda. Krutibas was the T.A. for Met.E. 5450/6450 Fall Semester 2002. He received an M.S. degree Fall 2002 on “Synthesis and Characterization of Titanium-Titanium Boride Composites and Functionally Graded Materials;” and is now studying for his Ph.D. under the direction of Dr. Chandran.

Ronel du Plessis received the Utah Engineering Experiment Station’s Team of Excellence Award for demonstrating team building both as leader and follower. Ronel served the department as Student Advisory Committee Graduate Representative

Our alumni number 827. New graduates include:

B.S. Degree

- Thomas R. Chapman... S ’03
- Robert Elwin Crossman S ’03
- William Charles Fox..... S ’03

- Michael Edward Oja.. S ’03
- Jeffrey D. Winterton*. S ’03

*Oblad Medal for Excellence in Metallurgical Engineering; Outstanding Sophomore, Junior, & Senior Student Awards.

M.S. Degree

- Shampa Aich.......... U ’03
- Nan Boonyachut....... F ’02
- Chen Lei............. F ’02

- Minhua Li............ F ’02
- Krutibas Panda....... F ’02
- Wan-Lin Wang......... U ’03

Ph.D. Degree

- Shankar Pattamadai Srinivasan F ’02

from 1999 to 2002. She received her BE from Potchefstroom University in South Africa. Her awards include the 2001 International Precious Metal Institute Award for Graduate Research in Precious Metals Recovery by Sulfide Mineral Flotation and the 2000 Outstanding Graduate Seminar Award. She was given a Graduate Research Fellowship from the Graduate School and a Cooperative Fellowship from the College of Mines and Earth Sciences. She is working for Newmont Metallurgical Services in Englewood, Colorado while putting the finishing touches to her doctoral dissertation, “The Thiocarbonate Flotation Chemistry of Auriferous Pyrite,” done under the supervision of Dr. Miller.

Undergraduate. The College Valedictorian was Jeffrey Winterton. Jeff was also awarded the Oblad Medal for Excellence in Metallurgical Engineering for his four-year cumulative g.p.a. of 3.97, and his 3.968 senior-year g.p.a. earned the Outstanding Senior Student Award, to go with his previous Outstanding Sophomore and Junior Student Awards. He was in the university’s Honors Program and appeared regularly on the

(Continued on page 4)
Award from the U.S. Bureau of Mines, where he was a Group process technologies. He received the Innovator of the Year and general superintendent at Moab Potash. He is married with midwest and along the eastern seaboard. He has also been gen-

try industries. He manages four production facilities located in the production of phosphate products used by the livestock and poul-

ducts large capital process control projects for Emerson’s north-

as well as the U.S. Previously he was the Director of the Emer-

son Process Management Denver Regional Engineering Center, Northeast Office, for Emerson Process Manage-

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eastern U.S. customers. He has participated in process control projects in Taiwan, Ireland, England, Singapore, and Puerto Rico, as well as the U.S. Previously he was the Director of the Emer-

son Process Management Denver Regional Engineering Center and Project Manager for process control and automation projects.

Abe Dayani (BS 1980) is President and CEO of Refining Sys-
tems in Henderson, Nevada. He directs R&D projects in product developement and marketing. The company manufactures fila-

ments for sensing devices and scientific instruments, sputtering targets for scanning electron microscopes and semiconductor thin film deposition. He appears in Who Is Who among Rising Young Americans, recognizing company presidents before age 40. Pre-

viously he was a plant metallurgist and laboratory manager for gold mining companies in Nevada. He is married and has two daughters, both of whom are honors students at Bonanza High School in Las Vegas, Nevada, and now attending UNLV.

Sue Anne Sheya (BS 1983) completed her PhD in Material Science and has joined Sierra Research, Sacramento, California, as an Air Pollution Research and Control Consultant.

Cary Darrel Young (BS 1983) is a Staff Process Engineer at Nolntex LLC in Texas, where he does operator supervision, proc-
et simulation to obtain material and energy balances, capital

This year’s Outstanding Sophomore Student was Curtis Dixon Lee. Curtis’s g.p.a. was 3.896. He was outstanding Freshman in 2000 and has been on the Dean’s List. The scholarships Curtis has received include Honors at Entrance, a Thomas Parry Billings, a George & Trudy Healy, a Franklin Alex, and a Departmental Scholarship.

The Outstanding Freshman Student Award for 2002/03 went to Eric Riddle. Eric graduated from Viewmont High School. He received a Cooper-Hansen Scholarship, and his g.p.a. for his first semester at the U was 3.958.

Congratulations to all our students for their scholastic achievements!

Dr. John Ralston, with Dr. Miller, March 2003, Ian Wark Research Institute, University of South Australia.

Dr. Jaime Sepulveda, presented a Short Course on process optimization with Moly-Cop Tools, Moly-Cop Grinding Systems, March 2003, Santiago, Chile.

Dr. Ahmed Yehia Abdel-Rahman, with Dr. Miller, 24 June–8 July 2003, Central Metallurgical Research & Development Institute (CMRDI), Helwan, Cairo, Egypt.

Mr. Khaled Abdel Aal Selim Eliwa, with Dr. Miller, 24 June–8 July 2003, Central Metallurgical Research & Development Institute (CMRDI), Helwan, Cairo, Egypt.

Mr. Cengiz Karaguzel, with Dr. Miller, July–September 2003, Istanbul Technical University, Turkey.

Dr. Rafael Padilla, with Dr. Sohn, 4 September 2003–14 March 2004, Universidad Técnica de Oruro, Oruro, Bolivia.

M. Curtis Nielson (BS 1976) is Minerals Manager at Bateman Engineering. He manages daily office activities, proposal prepa-

ration and new technology development and interfaces with other Bateman offices worldwide. As a process engineer at Bateman Engineering he focused on solvent extraction, electrowinning, electrolefining, and copper casting. He held various positions at Magma Copper in the electrolytic refinery, rod plant casting facil-

ity, solvent extraction, and electrowinning.

William Karl Carver (BS 1977) is Principal Systems Engineer at Raytheon in Tucson, Arizona, where he conducts and super-

vises the systems engineering of projects, developing perform-

ance and engineering requirements, establishing and overseeing verification that products meet needs or exceed requirements, conducting performance analysis, and presenting information desired by the customer. Previously he was a submarine officer in the U.S. Navy.

Stephen Rigby (BS 1978) is Director of the Life Sciences Indus-


try Center, Northeast Office, for Emerson Process Manage-

ment in Royersford, Pennsylvania. The Engineering Center exe-

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eastern U.S. customers. He has participated in process control projects in Taiwan, Ireland, England, Singapore, and Puerto Rico, as well as the U.S. Previously he was the Director of the Emer-

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Cary Darrel Young (BS 1983) is a Staff Process Engineer at Nolntex LLC in Texas, where he does operator supervision, proc-
et simulation to obtain material and energy balances, capital
Faculty and Staff

The department support staff are our Office Support Coordinator, Ms. Karen Haynes, Executive Secretary Ms. Kay Argyle, Technician Mr. Jim Davis, and Ms. Dorrie Spurlock, who works with Dr. Miller. Research staff includes Dr. Zhoro Nikolov, Postdoctoral Research Associate, in Dr. Miller’s group.

The 2002/03 recipient of the Mellow Met Award for Excellence in Teaching Metallurgical Engineering was Dr. Hong Yong Sohn. He was rated a perfect 4 out of 4 by his ten students in MetE 5750/6750, Spring 2002. Students said it was challenging and a lot of hard work, but they learned a lot — although one complained he couldn’t afford to miss class to go skiing! Students in MetE 5710/6710, Fall 2002, liked his good pace and clear explanations, praised his up-to-date knowledge of the field, and said they had been stimulated to pursue the subject further.

Dr. Sohn traveled to Chile under the auspices of the Andes Foundation and presented an intensive short course on “The Principles and Practice of High-Temperature Chemical Metallurgy,” at the University of Concepcion, Concepcion, Chile, September 2002.


Dr. Jan D. Miller, Dr. Roman Bokotko, and Dr. Jan Hupka received the 2002 Stefanko Best Paper Award from the Society of Mining, Metallurgy and Exploration for their paper “Flue Gas Treatment for SO2 Removal with Air-Sparged Hydrocyclone Technology.” AIME will award Dr. Miller the Frank Aplan Award at the Annual Meeting in Denver, October 2003, for his outstanding and prolific contributions in research and education in mineral processing, surface chemistry, and hydrometallurgy.

Dr. R. Peter King was elected February 2003 to the National Academy of Engineering, which makes four NAE members among our faculty. This October he was presented with the Lifetime Achievement Award at the XXII International Mineral Processing Congress in CapeTown, South Africa.
spinning about a shaft and also about their own axis — hence the name “planetary mill.”

Now the highly enriched uranium, ground and blended to the state of natural ore, can be packaged and driven across the interstates to its burial ground in Nevada or elsewhere. The project has been a success, and a pilot facility has been designed. In the not-so-distant future, we may see grinding operations being used to dispose of solid nuclear waste.


The faculty now totals twenty-seven, which includes six research, eight adjunct, and five emeritus appointments.

- J. Gerald Byrne  
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- William D. Callister  
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- Ravi Chandran  
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- Susan L. Halgedahl  
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  shalgi@mines.utah.edu

- John A. Herbst  
  Research Professor  
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  hupkajchem.pg.gda.pl

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- Jakub Nalaskowski  
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- Ferron A. Olson  
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  C. H. Pitt  
  Professor Emeritus  
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- Rong Yu Wan  
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  r.wan@worldnet.att.net

- Q. Yu  
  Adjunct Associate Professor  
  847/970-5135 (Illinois)  
  qyu@usgres.com

Give Us a Hand – Donations and Accreditation Questionnaire

Donations to scholarships or other department programs may be made using the enclosed card and (from U.S. addresses) business-reply envelope, or by credit card at the University’s secure website, www.ugive.utah.edu. Please designate the specific program or thing you wish to support (we hope that’s us!).

U of U BS graduates – especially 1985–2002 grads:

If you have not filled out the accreditation questionnaire, please help us by doing it now.

For those who received a Bachelor’s degree from our department, enclosed with this newsletter is a questionnaire asking for information that the ABET Accreditation team will require. I would be most grateful if as many of you as possible would take the time to complete the questionnaire as fully as possible and return it to us by October 2003 using the enclosed business-reply envelope, or if you prefer, you may complete it on-line via our Department website at www.mines.utah.edu/metalurgy/.

You may visit us at our website, http://www.mines.utah.edu/metalurgy.

If any of you, especially those living and working locally, would be interested in receiving notices of our weekly graduate seminar, we can send these by email or by fax (local calls only, to a dedicated fax line). To get on our distribution list, contact Kay by phone (801) 581-6386, fax 581-4937, or email argyle@mines.utah.edu.

Send address updates to argyle@mines.utah.edu or metalurgy@mines.utah.edu. On-line transmission of the newsletter is an option if you provide us with an email address.

The faculty and staff wish you a prosperous year and hope you will visit us when the opportunity arises.

Yours,

Saskia Duyvesteyn  
Asst Professor of Metallurgy

Gone Missing

If you know where any of the following alumni have moved, please provide contact information for us:

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