

THE MELLOW MET NEWSLETTER

No. 22 —January 1999

An Extraction of the News for
Metallurgical Engineering
at the University of Utah



Professional Society Meetings

Happy New Year! We hope to see you at the professional societies' annual meetings, which will be held at the following locations this year.

TMS Annual Meeting —28 February-4 March 1999,
San Diego, California

SME Annual Meeting —28 February-3 March 1999,
Denver, Colorado

No alumni mixer will be held at the TMS Meeting this year due to a lack of attendance in previous years.

At the SME Meeting in Denver, the alumni will meet as part of the College of Mines and Earth Sciences Alumni Social scheduled for Tuesday 2 March 1999 from 5 to 7 p.m. in the Moulin Rouge Room, Hyatt Regency Denver.

A Message from Dr. Raj K. Rajamani, Interim Department Chairman

Dear friends:

I am happy to be the interim chair of the department until a permanent appointment is made. Realizing the acute need in undergraduate recruitment material, this year we arranged for a recruitment video to be prepared by Media Solutions. Media Solutions is part of the public television station here in Salt Lake City, KUED. We called on a number of students in the local area to be filmed for the video. The response was excellent. I would like to thank the Harveys [Malcolm (PhD '65), Malcolm "Randy" (BS '83), Ian (MS '88), and Nephi (BS '95)], Lynn Hales (BS '74), Clayton Walker (BS '95), Don Foot (BS '75), Shauna Schick (BS '98), Randy Ynchausti (BS '87), Mike Nelson (BS '75), Arthur Yakumo (BS '98), Debi Salmon (BS '94), Shannon Farey (senior student), and Cory Topham (BS '94) for the enthusiastic endorsement of our program in Metallurgical Engineering. It's been fun shooting you; on video, I should say!

I think it is important to note that Malcolm Harvey has consistently helped our department in recruiting undergraduates. He has brought us many students over the years for undergraduate study, including all his sons, two nephews and a niece (the Schicks), who have now completed degrees in Metallurgical Engineering from our department.

On behalf of the department I want to thank Bill Callister,

Ravi Nadkarni (PhD '67), Doug Halbe, Scott Hartman (BS '79), Jaroslaw Drelich (PhD '93), Malcolm Harvey, and others who have contributed substantially this past December to the department's gift account. As you might expect, the university, facing budget cuts from the State of Utah, passes on the cuts to the individual departments. This has been the story for about ten years now and we manage to float above it all. So any gift you can give significantly helps the department to overcome budget deficiencies. Think of us at the end of the year when you begin writing checks for charitable organizations.

I believe the new recruitment video will present our program in Metallurgical Engineering to students more forcefully, directly, and in a fun way. So, I am keeping my fingers crossed to see if more high school graduates and transfers will apply to study in our department.

Our research front is doing well as usual. We have been granted accreditation from ABET for another six years, which is a relief. Finally, the faculty have successfully adapted to the change-over to the semester system this academic year.

We wish you all the best for the new year.

Yours sincerely,

Raj K. Rajamani

Alumni Activities

Since last year we have heard from a number of you, and many alumni have commented that they enjoy reading about what their former classmates are doing. If you haven't responded recently (in the past two years) to our questionnaire, please do so this year.

Charles E. Bartlett (BS '27) has had five assignments with International Executive Service Corporation to assist with mineral-related problems in developing countries since his retirement—twice to Indonesia and Venezuela, and once to Colombia. He married Phyllis Watkins, class of '28, and has two children, Dr. R. W. Bartlett (BS '53, PhD '61) and Elinor, and six grandchildren, and as of February 1998 he was age 91.

He received the Professional Degree of Metallurgical Engineer from the U in 1927. From 1927 to '36 he was a Jr Engineer at the Tooele Smelter; Asst Supt of the flotation mill and gold and silver refinery at the Midvale Plant, Supt. of flotation mill at Peru Mining Co., Deming, New Mexico. '36-42 he was General Supt of a gold operation at Mercur, Utah; '42-46 U.S. Army, Field Artillery and Tank Destroyers, Col.; '46-54 staff and

management jobs, including assistant to the President and General Manager, with Combined Metals' substantial operations at Bauer, Utah and Pioche, Nevada; '54-56 minerals advisor to the Cuban government; '56-58 Resident Manager of lead-zinc-silver mining and milling operation in Guatemala; '58-68 General Manager of Reynolds Metals in Guyana (South America; bauxite mining and shipping, some calcination of refractory grade material), '68-71 Consultant for Reynolds Metals Alumina plant, prior to retirement. He lives in Walnut Creek, California.

Walter P. Henock (BS '29, MS 34) is deceased. Our condolences to his family and friends.

Robert R. Mates (MS '48) died October 11, 1997. He was living in Salt Lake City, Utah. Our sympathies to his family and friends.

Quentin M. Cohenour (BS '50) is deceased. Condolences to his family and friends.

Richard A. Derby (MS '50) is happily and healthily retired after accepting early retirement from USX Corporation (formerly US Steel Corp.) as Manager Raw Material Sales in 1980. He visited Salt Lake in March '96 for the first time since his graduation in 1950. He was honored to sing with the Tabernacle Choir at a practice rehearsal and was introduced to the Choir. He had been the baritone soloist with the Choir in the 1950 presentation of the Brahms's Requiem. He surprised Milt Wadsworth in his office and enjoyed a wonderful reunion and long conversation. He missed not seeing Dr. Mel Cook. He and his wife Ruth S. Derby live in Sigel, Pennsylvania and have two sons, Richard Jr. and John, and four grandchildren.

Robert W. Bartlett (BS '53, PhD '61) is semi-retired and consulting. His last position (until July 1997) was as Dean of the College of Mines, University of Idaho. Hopefully by now he and Bett have finished building their retirement home in El Dorado Hill, California, which they were working on last February.

Timothy E. Moss (BS '60, MS '62) worked 32 ½ years for Inland Steel Co. in Chicago, Illinois, and East Chicago, Indiana. He retired four years ago as Manager, Quality Dept, and has entered into a second career totally unrelated to metallurgy as Director, Development of Laity Leadership, in Nashville, Tennessee, working in consulting and resource publishing for an agency of the United Methodist Church. He has four grown children and four grandchildren, and makes fishing rods.

John R. Banta (BS '62) passed away March 16, 1994. Our sympathies to his family and friends.

Khin Maung Win (MS '62, PhD '65) retired March 5, 1996, after serving the government for over 36 years. However, he has been doing some part-time teaching of postgraduate metallurgical engineering courses at YIT and supervision of some research projects. He used to play "chinlone" (cane ball) the traditional way, which is excellent exercise for the whole body. However, because of poor health (not very serious though) his personal physician advised him to stop playing for a while. Now he plays three-ball billiard and does some reading as well. From 1965 to '68 he was a Research Metallurgist, Central Research Organization; Asst Lecturer, Lecturer, and Head of Metallurgical Engineering Department, Y.I.T., '68-83, and while Head also served as Chairman of Metals Processing Technology Group, Regional Colleges Project. Other positions include Secretary to the Ministry of Education Equipment Control Committee, '79-81;

Central Committee Member, Regional Colleges Supervisory Committee '79-84; Director-General, Dept of Technical, Agricultural and Vocational Education, Ministry of Education '83-96, full-time. As DG he was responsible for the management and administration of seventy-one institutions offering technical and vocational courses. He also served as chairman of the Myanmar Standards Committee '94-96 and Vice-Chairman of human resources development sector committee. He received a certificate of Merit for Service. His wife, Khin Than Nwe, holds a Bachelor of Engineering in textiles and a law degree and is the Director of Marketing, Myanmar Textiles Industries. They have three children. The eldest, Mr. Aung Naing Win, resides in San Francisco after graduating with an honor's degree from Yangon University in 1987. Ms. Hnin Nwe Win graduated with a Bachelor of Engineering in civil engineering in 1995 and is now studying at the Asian Institute of Technology, Bangkok, Thailand, for an MBA. The youngest, Ms. Thinn Lei Win, is in her sophomore year at the Yangon Institute of Technology. Khin Maung Win lives in Yangon, Myanmar.

Young H. Paik (PhD '70) has been a Professor in the Division of Materials Science and Engineering, Korea University, Seoul, since 1972, and is President of the Korean Institute of Metals and Materials, '98-present. Previous positions include Res. Scientist at University of Denver, '69-72; Visiting Professor at the U. of Michigan, '80-81; Dean of Facility Management, Korea University, '86-89; Visiting Professor at Waseda University, Japan, '90; Dean of College of Engineering, Korea University '94-96; President of Engineering Deans Association, Korea, '94-96; and Visiting Scholar, POSCO, Korea, '97. He has received the Best Paper Award from the Korean Institute of Metals and Materials, the Distinguished Member Award from the Korean Institute of Surface Engineering, and the Yeun-Dong-Suk Award from the Korean Institute of Metals and Materials. He has a golf handicap of 12 and is a Bronze Medalist in the Korean Professors Tennis Association. His wife, Hyun S. Park, has a Ph.D. in nutrition from Oregon State University and is Dean of School of Home Economy, Kyung Hee University, Seoul. His first son, Han Gene Paik, is a graduate student at the School of Visual Art, New York, and his second son, Han Sung Paik, is a student in the Department of Chemical Engineering, Korea University.

Eric Olafson (BS '78) is Vice President-Plant Manager for Safety at the Deer Park (Texas) Facility of Safety Kleen. This facility is the largest hazardous waste incinerator in North America, with three rotary kilns. He has done research and development at Reynolds Metals and been Manager Process Engineering/Production Superintendent for Amax Magnesium; Incineration Project Manager, Aptus; Incineration Project Manager, Chemical Waste Management; and Incineration Project Manager and Technical Director, Rollins Environmental. He and wife Silvia have a seven-year-old daughter, Samantha, and make their home in Houston.

Garry W. Warren (PhD '78) is Professor of Metallurgical & Materials Engineering at the University of Alabama (Roll Tide!!). This year marks twenty years of university teaching, including eight years at Carnegie Mellon University in Pittsburgh. In Feb. '98 he was selected to receive the Distinguished Service Award from the Minerals, Metals & Materials Society (TMS) at the Annual TMS Meeting in San Antonio. He will also serve a three-year term on the TMS Board of Directors as Director of

Publications, beginning with the Annual TMS Meeting in 1999.

Michael Mooiman (PhD '84) has been promoted to Chief Operating Officer/General Manager at Metalor USA Refining Corp. In this capacity, Mike follows in the footsteps of Ravi Nadkarni, another U of U Metallurgy graduate, who in large part was responsible for establishing the refining operations at Metalor. Mike lives in North Attleboro, Massachusetts, with his wife Caryn and his children Kevin and Kendra. Mike has recently completed his MBA at Northeastern University in Boston and is now trying to find time to catch up with his guitar playing.

Syoni Soepriyanto (PhD '91) is Chair of the Department of Mining Engineering (1998-2001) and Head of Materials Research Center, Institute of Technology Bandung (ITB), Indonesia. He has been Vice Chairman for Student Affairs--First Common Year ITB, Head of Laboratory of Physical Metallurgy & Ceramics, and a Technical Advisor for Indonesian Coal Mining Co., Military Industry Inc. (Pindad), National Institute for Research, and Compact Microwave Indonesia, Inc. He received the National Research /academy Award ('94-97) in Magnetic Ferrite Ceramics, and the 20-year Medal for Government Service, 1997 (President of the Republic of Indonesia). He enjoys tennis, light music, student gatherings, and family gardening and fun with wife Ida Sundari and their two daughters, Rifa (8) and Tifa (7).

Qiang Yu (PhD '91) was recognized with the 1998 Technology Award by USG Corporation. Dr. Yu discovered and developed a method and formulation that brings increased strength, rigidity,

and dimensional stability to gypsum board products. This new formulation, for which USG has applied for patent protection, allows for superior sag resistance in ceiling board application, and enabled the development and launch of new ceiling products this year. "I used my background in mineral processing and surface chemistry to study gypsum board chemistry, processing and manufacturing technologies from new angles," he said. "We also gained an advantage by bringing together on this project from different background. I never thought our results would become this significant and important. It's a great achievement for [the Research Department] and for all of USG."

HanJin Lim (PhD '96) has joined the BST team in the Process Development Group and is now researching BST capacitor for Gb DRAM at Samsung. Samsung launched a mass product line for 256 MDRAM with 0.18 micron feature size. This line is using the same one as for 64 MDRAM and saved the cost of a new line. This technology is at least a year advanced compared to NEC or other competitors. He makes his home in Seoul, Korea.

Craig Thomson (BS '97) is Maintenance Reliability Engineering for BHP Coated Steep Corp., developing a maintenance structure for a coating plant. While Commissioning Project Engineer he worked on startup of a greenfield metal coating facility with cold mill, pick line, galv line and paint line. He has been married three years, with no kids yet, and lives in Vancouver, Washington.

Research Activities

K. S. Ravichandran, Associate Professor, has been performing research on titanium boride based functionally graded materials (FGMs) for possible applications in armor for the U.S. Army. This work is in collaboration with Cercom, Inc., Vista, California, a leading structural ceramics and cermets manufacturing company. FGMs are based on the novel concept that one can design a suitable spatial variation in material type of suit the application or fabrication needs. For armor, a hard and stiff front face is needed to deflect or stop the projectiles, while the back face needs to be metallic and machinable to attach to the body of an armored vehicle. Therefore, the research is concerned with integrating titanium monoboride (TiB) ceramic with titanium metal, with a gradual change from TiB to Ti through the thickness. Preliminary work indicates that the fabrication of this FGM will be challenging. In order to resolve the cracking problem during fabrication, basic research is performed on elastic and thermoelastic properties of Ti-TiB mixtures, crystallographic and volume changes accompanying phase transformations as well as finite element modeling of evolution of thermal stresses during fabrication.

An Engineering Foundation Conference on *Small Fatigue Cracks: Mechanics and Mechanisms*, organized by Dr. Ravichandran with Prof. R. O. Ritchie, University of California at Berkeley, and Prof. Y. Murakami, Kyushu University, Japan, as co-chairmen, was held during Dec. 6-11 in Hawaii. About sixty participants from the USA, Japan, and Europe attended the conference. A total of 46 papers and 8 posters were presented, addressing the issue of small fatigue cracks in high cycle fatigue of engineering components and structures.

S. Guruswamy, Professor, spent some of his sabbatical leave at Hyundai Electronics-Maxmedia Division working on advanced storage media and the summer at the U.S. Naval Research Laboratory in Washington, DC, working on magnetostrictive (piezo-magnetic) materials. Prof. Guruswamy is currently working on a book, *Lead and Lead Alloys*, under ILZRO sponsorship. During the year, an exciting patent on dynamic compaction of novel composite structures for magnetostrictive applications was filed. Two patents on biocompatible coatings for medical applications were filed jointly with Medquest Inc. based on the dissertation work of Dr. Ajit Kumar under Prof. Guruswamy's supervision. Current research work with his students involves processing and microstructural aspects of advanced magnetic data storage media, magnetostrictive thin film and bulk materials, high-energy density hard magnetic materials, and IV-VI compound-semiconductor-based thin film structures for device applications.

W. D. Cho, Assistant Professor, has been engaged in research projects on fluidized-bed processing of uranium oxide and on high-temperature oxidation of iron aluminide. The processing of UO₂ by oxidation of UN in a fluidized bed is being carried out with emphasis on reaction kinetics and heat transfer. The project is part of a program by Lawrence Livermore National laboratory to develop a technique for disposal or recovery of plutonium from the cores or pits of nuclear weapons.

The effect of yttrium addition on the oxidation behavior of Fe₃Al has been investigated in terms of oxidation kinetics and oxide adhesion. The addition of yttrium to Fe₃Al is found to

cause the change of microstructure and morphology to the oxide scale, the formation of pegs, and the modification of diffusion transport.

H. Y. Sohn, Professor, continues his research in flash smelting and converting processes, sulfur dioxide removal by calcined calcium magnesium acetate (CMA), conversion of sulfur dioxide to elemental sulfur by the use of calcium sulfide and calcium sulfate, and chemical synthesis of metallic and intermetallic compounds by the flash reduction of metal chlorides. Dong Hoon Han completed his Ph.D. degree under the supervision of Prof. Sohn, having written a dissertation on the superb properties of CMA for absorbing sulfur dioxide gas. Manuel Perez-Tello completed requirements for a Ph.D. degree in Chemical Engineering under Professor Sohn's direction on the subject of 3-D modeling of flash converting process.

Professor Sohn is currently developing a research program for applying a new solvent extraction process developed in his laboratory to the treatment of radioactive element-containing solutions. Its simplicity allows the process to easily overcome the problem of "criticality" in handling such solutions.

S. Duyvesteyn, Assistant Professor, has recently purchased an inductively-coupled plasma -- atomic emission spectrometer (ICP-AES) to replace the department's direct current plasma -- atomic emission spectrometer (DCP-AES). The new ICP has numerous advantages over the old DCP. As it is computer controlled, the operation is much simpler and more straightforward. The combination of the computer control and the wide range of scanning wavelengths makes it possible to do multiple element analysis, up to 30 elements, for a single liquid sample. With the 90-sample autosampler unit, it is much easier to process a large number of samples. A number of the faculty have been making extensive use of the ICP-AES for analysis of a wide range of elements, including base metals, precious metals, and alkali and alkaline earth metals, in both aqueous and organic matrices. It is also being used by undergraduates in certain lab classes for analyses. Other departments besides Metallurgical Engineering are also making use of the equipment, primarily through collaborative projects, including Geology, Chemical and Fuels Engineering, and Pharmaceutics.

M. L. Free, Assistant Professor, has investigated portions of five research projects during the past year in areas that involve metals and solutions. One project was designed to produce metal alloy particles by in-situ reduction. Another was focused on determining the corrosion tendencies of aluminum 6061-T6 and stainless steel 316 in solutions that may be used by various defense agencies to decontaminate areas exposed to biological warfare. Currently, the transport of impurities during copper electrorefining is being studied. Also, an electrochemical method of reducing mineral scaling in pipes is being pursued, along with a method of coating large metallic objects with metal coatings.

J. D. Miller, Professor, continues to maintain an active research group in particulate technology and applied surface chemistry. Researchers are using advanced surface spectroscopy techniques such as FTIR/IRS to describe the nature of adsorption and interfacial reactions and how these reactions influence the wetting characteristics of the surface. In addition, interaction forces are being measured by the colloidal probe technique using the atomic force microscope. Based on these fundamental

measurements, improved particle separation processes are being developed, including magnetic deinking of office paper, flotation of phosphate rock, and soluble salt flotation.

In addition, collaboration with **Dr. C. L. Lin** continues. During the past few years, the image-based on-line particle size analyzer (OPSA) system has been developed to measure particle size distributions under plant conditions where overlapped and segregated particles are being transported on a moving belt conveyor. Evaluation of the OPSA system at four plant sites has been completed. The results show a consistent agreement between the particle size distributions obtained from the OPSA system and those obtained from laboratory screen analysis of belt samples. These results and the stable performance of the OPSA system during the field tests suggest that continuous quality control of crushed products is possible using the OPSA system. The system is now being considered for full-time plant use at a number of plant sites.

With regard to the research on the use of computed tomography, it is expected that a high-resolution x-ray micro CT system will be installed in 1999. This system will allow for phase discrimination at a resolution of at least 10 microns and for three-dimensional spatial reconstruction of multiphase samples. For example, the micro CT system may provide a new approach for liberation analysis. Using the x-ray micro CT together with an appropriate classification algorithm, multiphase particles can be examined in three dimensions to determine particle composition and grain size distribution for each particle in a packed bed. The applications of micro CT are numerous.

R. K. Rajamani, Professor and Interim Chair, and his associates have been developing software for animating the motion of rocks and balls in semi-autogenous mills and ball mills. After many years of development, the software has been licensed to Process Engineering Resources Inc., Salt Lake City. Mine sites in countries all around the world such as Canada, Argentina, Chile, Australia, Indonesia, British Guyana, and the USA access the program via the website www.processeng.com.

In particular, Minera Alumbrera in Argentina was the first one to implement lifter design changes as recommended by the program. They used the Millsoft software and implemented some lifter changes in their 36×17 ft SAG mill. After doing this on their brand-new circuit, the capacity increased from 50,000 to 85,000 tons per day. An additional benefit of the 48 lifter design instead of the traditional 72 lifter design was that the number of shell lifter pieces decreased from 144 pieces to 96 pieces (two pieces per lifter). As expected, 48 lifters lasted for six months instead of the nine months usually expected of 72 lifters. Most of all, the SAG mill began to consume 25% less steel media. A back-of-the-envelope calculation shows that this amounts to at least \$5,000 per day, assuming one pound steel loss per ton of ore! All in all, the mining operation is gaining a couple of million dollars a year.

The next mine that will be implementing this strategy is Barrick Goldstrike Mine at Carlin, Nevada, as well as the Newmont Mine at Carlin. This technology is spreading to Australian and Chilean mine sites as well.

As a result of this research development from our department, two established research and service institutions are

putting together teams to develop similar software. Already there is software competition from Japan. It is evident that these results from Prof. Rajamani's group have opened up an exciting new area for the design of tumbling mills in the 21st century.

R. P. King, Professor, has been involved on liberation analysis for coal this year. The Department of Energy has funded a research program aimed at the development of theoretical and practical methods for the evaluation of the liberation characteristics of pyrite and other ash-forming minerals from coal. A technique has been developed at the Center for Minerals Technology for measurement of the liberation characteristics of the three components of coal using image analysis methods. Images are generated from samples of coal both in the unbroken and particulate state, and linear-intercept analysis is used to generate the basic data that characterizes the geometrical texture of the coal components and also enables the three-phase washability characteristics of the coal to be measured without resort to expensive and time-consuming dense-liquid analysis. The liberation characteristics of the pyrite and ash can be predicted from a knowledge of the linear-intercept distribution through the three components in large lumps of coal as well as a quantitative measure of the mineral associations. These predictions can be tested by experimental observation.

The two most difficult problems that have been successfully solved during this project are the stereological correction of linear-intercept data for three-component systems and the development of the Andrews-Mike diagram that describes the liberation behavior of minerals in grinding mills.

The Center for Minerals Technology has been equipped with a new Topcon scanning electron microscope that is fully digital, and this has improved the efficiency of the image analysis laboratory.

Minerals Technology Inc. is a new company spun off from the Center for Minerals Technologies at the University of Utah in 1998. MTI was formed with a strong emphasis in comminution technology and mineral liberation analysis. The company offers services, software, hardware, training, and consulting to the mineral industry. The chief product of MTI is MODSIM, the Modular Ore-Dressing Simulator, to be officially launched at the Denver SME meeting in March 1999. MODSIM is a Windows

95/98/NT plant-wide simulation software that includes the best models for all mineral processing operations and coal dressing plants. MODSIM's main advantage over other simulators is its capability of manipulating liberation data. All models available in MODSIM are liberation ready, including comminution models that are capable of predicting liberation.

MTI will back MODSIM with technical support, training, and services. These services include a wide range of procedures for ore characterization, which generate valuable information that can be used in any mineral processing operation. Some examples are the measurement of breakage functions from ore samples for use in simulation and scale-up procedures, standard batch grinding tests including a description of selective, preferential, and differential breakage phenomena, the measurement of fracture energy and particle strength using the Utah Ultra-Fast Load Cell, and the measurement of liberation using scanning electron and optical imaging techniques.

MTI also offers high-level consulting services such as the calibration of simulators for complete mineral processing and coal dressing operations. MTI's novel approach to consulting is to provide customers with a tangible product that can be used for plant design and optimization. Clients include RTZ, Simplot, PCS Phosphates, and Carcpo.

MTI is headed by Ludovic Milin (MS '93) and Claudio Schneider (PhD '96), both alumni of the University of Utah Department of Metallurgical Engineering. The commissioning of MTI has only been possible through the support of the State of Utah Center of Excellence Program and of Professor Peter King, Director of the Center for Minerals Technologies. MTI represents the final stage of a long but successful research program that traces back to the USBM Comminution Center, where most of the fundamental technology was originally developed. The more commercial focus started with the establishment of the Center for Minerals Technologies, where most of the results from fundamental research carried out at the Comminution Center started to be shaped into tools for mineral processing engineers. MTI fulfills the important role of introducing and supporting the use of these new, important technologies.

International Visitors

International visitors to the department include:

Ms. Barbara Wawrzacz, NATO Scholar with Dr. Miller (Dec. '98-present), Technical University of Gdansk, Poland.

Dr. Humberto Terrazas Salas, Visiting Scholar with Center for Mineral Technologies (Sept.-Nov. '98), Center for Development of Nuclear Technology, Belo Horizonte, Brazil.

Dr. Lucio Carlos Martins Pinto, Visiting Scholar with Center for Mineral Technologies (Sept.-Nov. '98), Center for Development of Nuclear Technology, Belo Horizonte, Brazil.

Dr. Jose Parga (PhD, '88), Visiting Scholar with Dr. Miller (July-Sept '98), Saltillo, Mexico.

Ms. Ximena Diaz (ME '93), Visiting Scholar with Dr. Miller (June-Aug '98), Instituto de Investigacion Tecnologica,

Quito, Ecuador

Dr. Hyo-Joon Kim, Visiting Scholar with Dr. Cho (August '98-present), Yuhan College, Korea.

Dr. Kuo-Tai Alex Hsieh (PhD '89), Visiting Scholar with Dr. Miller (June-Aug '98), Chung Hua University, Taiwan.

Dr. Barada K. Mishra (PhD, '91), Visiting Scholar with Dr. Rajamani (May-July '98), Assoc. Prof., IIT Kanpur, India

Dr. Satyam S. Sahay (PhD '95), Visiting Scientist with Dr. Ravichandran (April-June '98), .Tata Research Center, Pune, India.

Dr. Xu-Dong Li, Postdoctoral Fellow with Dr. Ravichandran, (April '98-present), Open University, U.K.

Mr. Lukasz Szewczulak, Research Associates with Dr.

Miller (Feb.-June '98), Technical University of Gdansk, Poland.

Mr. George Valadão, Visiting Scholar with Dr. Miller (Aug. '97-Aug. '98), Associate Professor at UFMG, Belo Horizonte, Brazil.

Mr. Jakub Nalaskowski, Research Associate with Dr. Miller (March '97-present), Technical University of Gdansk, Poland.

Dr. Nanlin Han, Postdoctoral Fellow with Dr. Ravichandran (Sept. '97-June '98), Asst. Prof., Shanghai Jiao Tong University, Shanghai, P.R.C.

Mr. Ning Liu, Research Associate with Dr. Miller (July '96-October '98), Senior Engineer/Asst. Professor from Institute of Multipurpose Utilization of Mineral Resources of Ministry of Geology & Mineral Resources, Sichuan, PR China.

Dr. Yuehua Hu, Visiting Research Professor with Dr. Miller (Sept. '95-Feb. '98), Vice Chairman, Mineral Engineering Dept., Central South University of Technology, Changsha, China.

Ms. Kirsi Riihilahti, Research Associate with Dr. Sohn (Aug '94-Feb. '98), Helsinki University of Technology, Finland.

Program Status

Our enrollment during the past years is as follows:

Year	Under-graduates	Graduates	Year	Under-graduates	Graduates
1977-78	53	36	1988-89	37	46
1978-79	53	33	1989-90	47	48
1979-80	50	46	1990-91	53	49
1980-81	61	58	1991-92	63	46
1981-82	71	40	1992-93	53	42
1982-83	62	41	1993-94	54	43
1983-84	40	42	1994-95	45	43
1984-85	36	42	1995-96	25	38
1985-86	37	40	1996-97	27	38
1986-87	28	38	1997-98	27	32
1987-88	36	50	1998-99	29	30

Our alumni now number 781. New graduates as of June 1998 include:

B.S. Degree

Shauna Marie Schick* Arthur Ryutaro Yakumo[†]

*Oblad Medal of Excellence

[†]Outstanding Senior Student

M.S. Degree

Gustavo Alfredo Muñoz-Rivadeneira

Ph.D. Degree

Yongqiang Lu Michael Ray Loveless

Christopher E. Milliken Srinivas Veeramasoneni

Luis Augusto Colemborgue Klujso

Ajit Kumar Balakrishnan Nair

Student Recognition

The recipient of the department award for best teaching assistant went to **Gustavo A. Munoz– Rivadeneira**. He also won the College of Mines and Earth Sciences Teaching Assistant Award. He is originally from Quito, Ecuador, and did research with Dr. Miller on “Thiocyanate Leaching of Gold from an Auriferous Pyrite Ore” for his M.S. Currently he is working on a Ph.D.

The Graduate Seminar Award for best student presentation went to **Laurie L. LaPlante** for her seminar on January 21, 1998. Laurie majored in Environmental Engineering under the supervision of Dr. Miller. She successfully defended her master’s thesis, “Field Applications of Air– Sparged Hydrocyclone Stripping Technology for Removal of Volatile Organic Compounds from Contaminated Groundwater” on October 26th and is working for Kleinfelder Engineering. Laurie is originally from Evanston, Wyoming.

The Award for Outstanding Freshman Student for 1997-98 went to **Kevin Earl Petersen**. Kevin graduated from Skyline with a 3.95 g.p.a. (which included several AP courses), and his g.p.a. for his first quarters at the U was 3.79. He received a Special Departmental Scholarship. Kevin’s sister **Heidi Petersen** received the Ramaswami Woman in Metallurgy Scholarship this year. Kevin and Heidi are the children of alumnus Alan Petersen (BS '74).

The Outstanding Sophomore Student was **Michael Lynn Hales**. Mike's university g.p.a. is 3.82. He has received a Special Departmental Scholarship, served a mission to Chile, and upon his return was awarded a Continuing Student Scholarship. He is the son of alumnus Lynn B. Hales (BS '74).

Our Outstanding Junior Student was **Shannon Farey**. Shannon had a 3.896 g.p.a. at Taylorsville High School, graduated from Salt Lake Community College with High Honors and a g.p.a. of 3.957, and has achieved a university g.p.a. of 3.70. She has received the Newmont Metallurgical Services Scholarship and the Joe Rosenbaum Scholarship, and was a Kennecott Scholar last year. Shannon was also 1997's Outstanding Sophomore. This year she is serving as the department’s undergraduate SAC representative.

The Outstanding Senior for 1997-98 was **Arthur Ryutaro Yakumo**. Arthur graduated from Granite High with a 3.7 g.p.a., and his university g.p.a. was 3.45, achieved while holding down jobs in the department and at Lenscrafters, Structures, and Theratech, sometimes all at once. He was the President of the Asian– American Student Association and took part in a panel discussion with former Israeli Prime Minister Shimon Peres last year. He received scholarships from ASM, Newmont, Kennecott, Jackling, Chevron, the Department and the College. He plans on working for a couple of years and then getting an

MBA. Upon graduation he accepted a position with Bourns, Inc., of Ogden.

Most years the Outstanding Senior also receives the Oblad Medal, but this year it was so close that we decided to split the two awards. The Oblad Medal of Excellence in Metallurgical Engineering went to **Shauna Marie Schick**. Shauna's university g.p.a. was 3.55. She graduated from Davis High in 1993 with a 3.94 g.p.a. and received scholarships from ASM, MMRRI, Kennecott, George & Trudy Healy, MMPD, and Newmont. Shauna is working for Parker Hannifan Corporation in Ogden.

As Dr. Rajamani mentioned, Shannon, Shauna, and Arthur are among the stars in our new recruiting video.

As you can see, 1998 was a good year for relatives of alumni. Shauna is the third member of her family to graduate from our department (or the seventh, if you count her uncle and cousins the Harveys!), and we're sorry that she's the youngest, since they've been such great students.

Congratulations to all our students for their scholastic achievements!

Faculty and Staff

Department staff includes Office Support Coordinator **Mrs. Karen Haynes**, Administrative Secretary **Ms. Kay Argyle**, and Technician **Mr. Jim Davis**. We've had a little trouble hanging onto our part-time secretarial staff this year, hiring and losing **Ms. Chanthy Moeung**, **Ms. Kim Urbom**, and **Ms. Laura Ririe**.

The recipient of this year's Mellow Met Award for Excellence in Teaching Metallurgical Engineering goes to **Dr. Michael L. Free**. Dr. Free taught Met.E. 560 and 570 this year, for which his students gave him straight A's. They said his course was well organized and his tests and homework were challenging, and praised his interaction with students—he was relaxed, patient, easy to approach for help, and concerned about student understanding. Congratulations Mike!

Shortly after being appointed Research Assistant Professor, **Dr. Srinivas Veeramasoneni** accepted employment with USG Corp. at their Research Laboratories at Libertyville, Illinois. Dr. Vas had contributed substantially to Prof. Miller's research group, and his participation in department activities is greatly missed. Recently AIME announced that Srinivas has been selected to receive the 1999 AIME Rossiter W. Raymond Memorial Award for his paper "Influence of Surface Charge on Interaction Forces in Soluble Salt Flotation Systems as Determined by Atomic Force Microscopy." The award will be presented to Dr. Vas at the 128th AIME Annual Banquet and Awards Ceremony on October 4, 1999 in Houston, Texas.

This year **Prof. J. G. Byrne** stepped down from the position of Department Chair after eleven years of service. I know all of you and the faculty and staff will want to extend your thanks and best wishes to Gerry for his leadership. Prof. Raj K. Rajamani has agreed to serve as Interim Chair while the Department begins the search for a new leader for the 21st century.

Professor H. Y. Sohn together with **Sohini Pal Dey** (PhD '96) will receive the TMS Extraction and Processing Best Science Award at the 1999 San Diego Annual Meeting, based on their two-part paper entitled "Synthesis of Ultrafine Particles of Intermetallic Compounds by the Vapor-Phase Magnesium Reduction of Chloride Mixtures: Part I. Titanium Aluminides; Part II. Nickel Aluminides," *Metall. Mater. Trans. B*, **29B**, 457, 465 (1998). This is the third TMS Best Science Award received by Prof. Sohn's group, a record. It should also be mentioned that Professor Sohn has been elected to membership in the Korean Academy of Science and Technology.

The Department is also quite proud of **Prof. Doug Halbe**, Adjunct Professor, who will receive the Robert H. Richards Award at the 1999 Annual SME Meeting in Denver, Colorado. In conjunction with this award Prof. Halbe will give the Richards lecture, "Changing Our Approach for a New Era," at 1:15 p.m., Wednesday 3 March 1999 in Ballroom 1 of the Colorado Convention Center. Prof. Halbe continues to help the department by assisting Prof. King in teaching the Design course for our senior students.

The faculty now totals twenty seven, which includes three research, nine adjunct, three emeritus, and two research emeritus appointments.

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D. Halbe	Adjunct Professor		
S. L. Halgedahl	Adjunct Associate Professor		
G. W. Healy	Research Professor Emeritus		
J. A. Herbst	Research Professor	808/324-6100 (Hawaii)	

J. Hupka	Research Professor		
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R. Woods	Adjunct Professor		
G. Yamauchi	Adjunct Associate Professor		
Y. Ye	Adjunct Associate Professor		

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

Once more we are able to distribute the Mellow Met Newsletter without charge. The cost for publication and distribution is paid by the Department. I'm sure you recognize the financial squeeze on higher education budgets during the past years, and in this regard we request your financial support of Department activities by making an appropriate donation to the Department Development fund. Thank you for your generosity. Please make your check payable to Department of Metallurgical Engineering Development Fund.

This year we would like to make a special effort to expand our alumni directory to include email addresses. Please respond

with this information ASAP (to jdmiller@mines.utah.edu or metallurgy@mines.utah.edu). We would like to begin more complete electronic transmission next year.

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

Your faithful correspondent,
J. D. Miller

Professor of Metallurgy