

EXTRACTOR

The Metallurgical and Materials Engineering Newsletter of Montana Tech

Three years ago, a promise was made to continue this annual newsletter. Unfortunately, that did not happen and was a direct result of inconsistent and changing budgets. During those years, the department's administrative assistant position went from fulltime to halftime and is presently about one-quarter time. There simply was not enough of one secretary to go around. It is pleasing to note that this position is, once again, fulltime which ultimately has made this newsletter a reality. Please accept our apologies. Many other things have happened since our last Extractor newsletter and most of it has been good. Highlights have included Larry's retirement announcement, the hiring of two new faculty: Kevin Jaansalu and Jerry Downey, the re-hiring of Vern Griffiths, the establishment of nanotechnology at Montana Tech, and the concomitant growth in CAMP under the direction of Corby Anderson. This newsletter may be three years late but it's now back and annually. And, yes, there are pictures. Hope you enjoy it!

Larry Twidwell Retires!



Unbelievable - the icon of the department decided, after months of internal debate, to retire. The good news: it's for one-third time so his supposed departure is put off for three years. The bad news: the students only get to take 8-credits of his courses in a year instead of 18; but, from his perspective, that's also good news. **Dr. Larry Twidwell** will continue to teach Materials Characterization and Analysis, Processing of Precious Metal Resources in alteration with Waste Water Treatment every other year and Multiphase Diagrams in alteration with Flowsheet Design every other year. We congratulate Larry and his wife Carolyn on making this difficult decision, and while none of us look forward to 2008 when he completely retires, we do look forward to the next three years. A number of events are planned for the coming years to honor Larry but will not be revealed at this time. However, you should know that in late April, during the Advisory Board Dinner, a surprise party was held and, in the last faculty meeting, he was named Emeritus Professor. His nomination read "RESOLVED: Upon the occasion of the retirement of Dr. Larry G. Twidwell from the faculty of Montana Tech of The University of Montana, the faculty of the Department of Metallurgical and Materials Engineering wishes to express their appreciation for his many years of dedicated teaching and research service to the university and the State of Montana by recommending that the rank Professor Emeritus be conferred upon him by the Board of Regents of the Montana University System. WHEREAS, Professor Larry G. Twidwell has completed 36 years of distinguished teaching and research in Extractive Metallurgical Engineering at Montana Tech. He received his B.S. and M.S. in Metallurgical Engineering from the Missouri School of Mines and his D.Sc. from the Colorado School of Mines. Dr. Twidwell joined the Montana Tech faculty in 1969. During his tenure at Montana Tech, Professor Twidwell served as Head of the Metallurgical and Mineral Processing Department for three years,

Director of the Center from Advanced Mineral and Hazardous Waste Processing for five years, and was designated the Anaconda Distinguished Professor of Metallurgical Engineering in 1990; WHEREAS, Professor Twidwell's teaching and research has been acknowledged by a number of awards and honors including: AIME Frank Aplan Outstanding Mineral Engineering Award, 2004; Montana Tech Distinguished Researcher Lifetime Achievement Award, 2002; AIME Mineral Industry Outstanding Educator Award, 2001; Montana Academy of Sciences Merston Award as Outstanding Researcher, 1989; Outstanding Scholar Award, Montana Tech, 1985; and Outstanding Educator Awards, Montana Tech, 1970, 1971, 1973 and 1974; WHEREAS, Professor Twidwell's research career has emphasized the fields of Extractive Metallurgical Engineering and Environmental Engineering. Professor Twidwell has published over eighty papers in metallurgical and environmental related journals and conference proceedings, has presented over seventy national and international presentations, has authored four books, and has developed patented technologies that are now utilized in industrial settings; and WHEREAS, Dr. Twidwell's industrial, research, and teaching expertise, and knowledge and insight in his fields of interest are invaluable and have been shared unselfishly with his many undergraduate and over fifty graduate students and colleagues through the years, for which he is to be deeply congratulated and commended. With this recommendation go sincere thanks, congratulations, and best wishes for thirty-six years of invaluable service to the State of Montana, Montana School of Mines, Montana College of Mineral Science and Technology, and Montana Tech of The University of Montana. For these and numerous other contributions, the faculty of the Department of Metallurgical and Materials Engineering are pleased to nominate Dr. Larry Twidwell for the rank of Professor Emeritus of Metallurgical & Materials Engineering at Montana Tech of The University of Montana." Congratulations Larry!

Kevin Jaansalu Hired

In May of 2004, Carl Cross announced he too was retiring but, in this case, his decision was immediate. A search was launched that summer and concluded with the hiring of **Dr. Kevin Jaansalu**. Kevin will continue helping the Welding Option of the Department of General Engineering but, more importantly, is expected to help grow the materials side in keeping with the department's name change to Metallurgical and Materials Engineering 4 years ago. Kevin is teaching Ferrous Welding, Fundamentals of Materials, Materials Engineering and Design, Physical Metallurgy Lab, Microstructural Interpretation, and Casting and Solidification. He is also busy developing graduate level courses including Explosives Engineering which he will teach in the spring. Kevin, born and raised in Kingston, Ontario, enrolled in the Canadian Forces on 24 June 1985. He attended the Royal Military College of Canada, graduating with a degree in Fuels and Materials Engineering (First Class Honours). Kevin continued his academic studies with a scholarship from the Natural Sciences and Engineering Research Council at the Department of Mining and Metallurgical Engineering, McGill University. There, he performed research on the topic of Composites by Directed Oxidation of Aluminium Alloys, and graduated with a Master of Engineering in 1991. Kevin continued performing research in the summer of 1991 in the area of neutron radiography. In September,

he was posted to Canadian Forces Base Borden to continue his military career. In 1992, he became Captain and went to the 408 Tactical Helicopter Squadron as the Deputy Squadron Aircraft Maintenance and Engineering Officer. In September of 1994, he deployed with the Canadian Utility Helicopter Squadron (Haiti), responsible for a maintenance organization of 40 personnel providing aircraft servicing, inspection, and repair capabilities. Upon his return, he was posted to the Air Vehicle Research Detachment located with the National Research Council of Canada Institute for Aerospace Research. There, Captain Jaansalu managed aspects of the DND aero-propulsion program and he co-authored several reports on gas turbine costs and repair technologies. He was posted to RMC as a full-time student in July 1998 to further his studies in the Thermodynamic Stability of Phases in Third Generation Superalloys, graduating in November 2002. In September 2000, he joined the faculty of the Department of Chemistry and Chemical Engineering at RMC and was appointed to the position of assistant professor. Kevin has been recognized with several academic, industrial and military awards and has authored/co-authored numerous papers. Welcome Kevin!



Vern Griffiths Is Back



ABET paid a visit last November and after a very thorough evaluation and several correspondences, gave the department's program full accreditation. However, several concerns were shared and included an insufficient amount of materials courses being offered in the program. Changes were made immediately that required Ceramic Materials and Polymeric Materials. These changes are shown later. To make this happen, **Dr. Vern Griffiths** accepted an offer to come back on one-third time and additionally teach SEM/EDX as well as Electrical, Magnetic and Optical Properties of Materials. The

understanding with the administration is that he will be back for three years and, when he and Larry both fully retire, they will be replaced with a fulltime faculty member with sole expertise in materials engineering. Until then, Vern and Kevin will predominantly be responsible for the materials courses. In case you didn't know, Vern was born in Treorchy, Wales on May 4, 1929. He became a naturalized citizen of the USA in 1969. He earned his BSc. And MSc. in Metallurgy at the University of Wales, Swansea, in June 1949 and October 1951, respectively. Vern received his ScD. in Metallurgy with a minor in Nuclear Engineering and Chemistry from Massachusetts Institute of Technology (MIT) in 1955.

Jerry Downey Hired!

The understanding with the administration also included replacing Larry as soon as possible. In this regard, a search commenced over the summer and was concluded in early October with **Dr. Jerry Downey** accepting an offer to start in January of 2006. He will teach Survey of Metallurgical & Materials Engineering, Process Instrumentation and Control, Metallurgical and Materials Engineering Thermodynamics, and Processing of Elevated Temperature Systems along with several undetermined courses he will develop for senior and graduate offering.



Dr. Downey earned B.S. and M.S. degrees in Metallurgical Engineering at Montana Tech and a Ph.D. in Metallurgical and Materials Engineering at Colorado School of Mines. He is a registered Professional Engineer. Dr. Downey's twenty-eight years of professional experience encompass industrial operations, applied process research and development, and corporate management. He has specific technical expertise in chemical and metallurgical

thermodynamics, thermal processing, materials synthesis and processing, and hazardous materials treatment. Prior to accepting the position at Montana Tech, Dr. Downey was Vice President at Hazen Research, Inc. in Golden, Colorado. For the past ten years, he also served as the director of the Thermal Process Department and conducted hundreds of projects on behalf of clients in the mining, chemical, energy, and environmental sectors. Some of his recent research projects involved synthesis of non-oxide ceramic compounds, polymer and biomass gasification, and wastewater treatment. Dr. Downey began his professional career as a process engineer in the

metallurgical testing department at the Anaconda Minerals Corporation smelter in Anaconda, Montana. After the smelter permanently closed, Dr. Downey joined the Anschutz Mining Corporation where, as Project Metallurgist, he oversaw new process development. He later held the position of Metallurgical Engineer with the U.S. Bureau of Mines, where he performed technical and economic evaluations of mineral beneficiation, smelting, and refining operations throughout the world. Jerry and his wife, Kathy, have been married for over twenty-eight years. Both are Butte natives who have made their home in Parker, Colorado, for the past twenty-four years.

Gail Bergman and Tammy Ross Hired

It's hard to believe that Rosalie Murphy retired four years ago. Since then, as noted above, the department has seen the administrative assistant position decrease from fulltime to halftime to approximately one-quarter time. Essentially, with each change in status, a new person was hired. In 2003, *Gail Bergman* was hired initially to split time between Petroleum Engineering and us and to work out of two offices in two different buildings. The administration



decided that secretary's time would be better spent if they stayed in the same building. In this case, Outreach and Petroleum Engineering hired a new secretary and we gladly retained Gail; however, her time was effectively reduced to one-quarter time due to the position becoming shared in the ELC Building among the Geophysical Engineering and Business Departments as well as the Dean of the School of Business, Humanities, Social Science and Information Technology (BHSSIT). This was expressed

as a concern during the accreditation visit just last year. To offset this concern, the department gained the administration's support to once again increase the position to fulltime status but with assurances half the position would be funded by research or other means. Although we are sad to lose Gail to the others, we are more than pleased to announce the hiring of Tammy Ross. Gail, many thanks for your years of service and good luck in your sole office!



Tammy Ross graduated with honors from Montana Tech with a degree in Professional and Technical Communications in May 2004. Since graduation Tammy has worked for Horizon Air as a customer service agent. Tammy is thrilled to be working in the Metallurgical and Material Engineering Department and is excited to see what the future brings. Tammy, Welcome aboard!

Courtney Young - Bringing Materials and Nano to Montana Tech



When the department changed its name to Metallurgical and Materials Engineering, it was just another name that would smell just as sweet. However, it did open doors to increasing materials offerings as well as student enrollment. The administration continues to be supportive and reaches all the way to Missoula where President Dennison not only supports it but looks at it as a way to bring the two campuses closer together via research collaborations. In fact, this support has allowed the faculty number in the department to grow as just noted above and comes via recognition of the only entities on both campuses that have been working together for over 5 years. In this regard, Montana Tech's Metallurgical & Materials Engineering Department (Courtney Young) and The Center for Advanced Mineral and Metallurgical Processing (CAMP – Corby Anderson) have developed close ties with U of Montana's Chemistry Department (Ed Rosenberg). Their collaborations all began when Courtney heard about Ed's work and invited him to participate in a TMS Annual Meeting in San

Antonio in 1996 and introduced him to Corby. The trio's relationship has centered on advancing Ed's supramolecular technology for developing resin-like adsorption technologies with silica gels as the substrate. The technology for use in the mining industry. The technology involves modeling and synthesis and has since gone into production with Purity Systems Inc. (PSI), and has shown to work well on a number of processing (e.g., gallium and zinc) and environmental (e.g., arsenic and ARD) problems but needs to become cheaper to implement on an industrial scale. Their collaborations have also involved organizing two conferences both held on the Missoula campus, MAM'04 and Toyo/Montana, for which the themes involved supramolecular and nano systems. Courtney has also taken the initiative to develop a center headquartered at Montana Tech with these themes in mind: Center for Advanced Supramolecular and Nano Systems (CASANS). He has the support of both schools and is currently seeking the same from the Board of Regents with a Type I proposal and the Federal Government with an \$8M-initiative that our Congressional

Delegation supports, particularly the Honorable Senator Max Baucus. Dr. Young organized a workshop with several Montana companies attending, presenting, and agreeing to participate as advisory board members:

Jeff Ruffner, MSE-TA, Butte
Ron Reis, ASiMI, Butte
Larry Farrar, Resodyne, Butte
Hugh Craig, Polymeric Interconnect, Butte
Jim Feiler, BIFS Technology, Butte
Larry Twidwell, Montana Environment, Butte
Dan Brimhall, American ChemMet, Helena
Yuval Avniel, MicroPowder Solutions LLC, Missoula
Philip Barney, PSI, Missoula
Todd Johnson, Federal Technology Group, Bozeman
Dana Scranton, Semitool, Kalispell

The goals of the workshop are fourfold. The first is to provide the infrastructure for improved research and development activities in these systems. The second is to enhance and initiate new activities in these systems. The third is to apply these systems to historical and emerging fields in, but not limited to, the three identified niche areas of composite materials, green technology, and actuators/sensors. The fourth is to expand existing, attract outside, and start new businesses in Butte, Missoula, SW Montana and The State of Montana by providing the services and infrastructure for capabilities enhancement.

STABCAL – The Passion of Dr. H.H. Huang

For the past decade and a half, *Dr. Hsin-Hsuiin Huang* has focused on updating STABCAL, a world-class computer program that models chemical speciation based on thermodynamic stability calculations. During this time, STABCAL has gone from Version 1.0 when it was Fortran-based and capable of calculating simple E_H -pH and speciation-pH diagrams for aqueous (hydrometallurgy) systems to Version 10.0 where it now does the same in C++ language with or without mass-balanced constraints, considers ionic strength, temperature and pressure effects, models mixing/titration, and recently was adapted so that elevated temperature systems (pyrometallurgy) could also be considered including the calculation of Kellogg and Ellingham diagrams. Consequently, Dr. Huang has published several papers and typically involves other faculty members with expertise in the subject area at hand. The progression of STABCAL can be realized over the years:

Huang, H.H. and L. Cuentas. "Constructing E_H -pH and Other Stability Diagrams for Uranium in a Multicomponent System - I. Domain of Predominance Diagrams II: Distribution Diagrams," *Canadian Metallurgy Quarterly*, vol 28, 225-235, 1989.

Huang, H.H., "Estimation of Pitzer's Ion Interaction Parameters for Electrolytes Involved in Complex Formation Using a Chemical Equilibrium Model," *Journal of Solution Chemistry*, vol. 18, no 11, 1989.

Courtney notes that nano is really nothing new to Montana Tech. Larry Twidwell, for example, has been conducting research on ferrihydrite adsorption of arsenic and other oxyanions (thallium, selenium, etc.); the ferrihydrite must be high surface area and therefore nano-sized to maximize adsorption. H.H.Huang has updated his STABCAL program to include thermodynamic modeling of adsorption processes. Likewise, Courtney has been working with ASiMI on their nano-polysilicon powder (NPSP) product. Dr. Young further notes that nano is nothing more than doing the same thing but just at a smaller scale. Doing so, however, has opened the world to some new and fascinating areas in, for example, bioengineering, functional materials, sustainable development, recognition and smart technology, coating and catalysts, circuits and electronics, homeland security, health and safety, environmental remediation, resource recovery, and energy (hydrogen storage and fuel cells). He adds that trying to get CASANS established has been a three-plus-year and very time-consuming effort to get to this point and that there is still a lot to be done, but it is something the two campuses and the State of Montana need. Otherwise, industrial advancements and economic development in Montana will be slow in coming. Courtney and Ed will co-direct the center until funding is obtained and a full-time director is found. We hope the fruits of your labor and vision are realized soon. Sometimes thinking small is a big thing. Thanks Courtney!



Tahija, D. and H.H. Huang. "Characteristics and Treatment Problems of Surface and Underground Waters in Abandoned Mines at Butte, Montana," *Proceedings of Western Regional Symposium on Mining and Mineral Processing Waste*, May 30, 1990.

Huang, H.H. and Q. Liu. "Bench Scale Chemical Treatability Study of the Berkeley Pit Water," *Proceedings of Wastewater Treatment by Separation III, I&EC Special Symposium*, American Chemical Society, Atlanta, GA, 1993.

Huang, H.H. and C. A. Young, "Mass-Balanced Calculations of E_H -pH Diagrams with STABCAL," in: P.E. Richardson, R. Woods and F.M. Doyle (Editors), *Electrochemistry in Mineral and Metal Processing IV*, The Electrochemical Society, Pennington, NJ, 227-237, 1996.

Huang, H.H., "Berkeley Pit Water Treatment Research Project," *Mine Waste Technology Program, Activity IV, Project 1, Final Report to U.S. EPA*, 1996.

Huang, H.H., "Formation, Properties, and Stability of Sludge Generated During Treatment of Acid Mine Water," *Mine Waste Technology Program, Activity IV, Project 2, Final Report to U.S. EPA*, 1996.

Robins, R. G., R. B. Berg, D. K. Dysinger, T. E. Duaine, J. J. Metesh, F. E. Diebold, L. G. Twidwell, G. G. Mitman, W. H. Chatham, H. Huang, and C. A. Young, "Chemical, Physical, and Biological Interactions in the Berkeley Pit, Butte, MT," Proceedings of Tailings and Mine Waste '97, Colorado State University, Fort Collins, CO, 1997.

Tahija, D. and H.H. Huang, "Factors Influencing Arsenic Coprecipitation with Ferric Hydroxide," Minor Elements 2000, Society of Mining, Metallurgy, and Exploration, Inc., Salt Lake City, UT, 2000.

H.H. Huang, L.G. Twidwell and C.A. Young, "Utilization of an Equilibrium Computational Program for Teaching Hydrometallurgy," EPD Congress 2002, TMS, Warrendale PA, 723-739, 2002.

C.G. Anderson, D.L. Stacey, E. Dahlgreen, H. H. Huang, P. Miranda, I. Chandra and M.I. Jeffrey, "Fundamentals and Applications Of Alkaline Sulfide Leaching and Recovery Of Gold," Proceedings of the 44th Annual Conference of Metallurgists (COM) in Calgary, CIM, Montreal, QC, 2005.

H.H. Huang, L.G. Twidwell and C.A. Young, "Speciation For Aqueous Systems – An Equilibrium Calculation

Approach," Proceedings of the 44th Annual Conference of Metallurgists (COM) in Calgary, CIM, Montreal, QC, 2005.

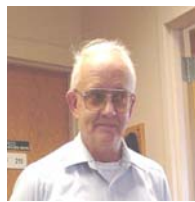
H.H. Huang, L.G. Twidwell, C.G. Anderson and C.A. Young, "Chemical Titration Simulation – An Equilibrium Calculation Approach," Proceedings of the 44th Annual Conference of Metallurgists (COM) in Calgary, CIM, Montreal, QC, 2005.

H.H. Huang, L.G. Twidwell and C.A. Young, "Point Of Zero Charge (PZC) and Double Layer Adsorption – An Equilibrium Calculation Approach," Proceedings of the 44th Annual Conference of Metallurgists (COM) in Calgary, CIM, Montreal, QC, 2005.

He presented the last three papers at the recent 2005 CIM Annual Meeting held in Calgary. You should look at the papers to see if it might help you in your efforts. Recently, Newmont viewed his papers and invited Dr. Huang to Denver to give their hydrometallurgical research group a short course on the program so it could be implemented ASAP. The short course was well-received. It's a pleasure watching him constantly taking STABCAL to the next level with such passion. STABCAL is a program in a class by itself. You're the man H³!

Bill Huestis - More Valuable Than Ever

Bill Huestis, Lab Director, is a huge reason why MetE students, both undergraduates and graduates, hit the ground running when hired temporarily as interns and as permanent engineers. Yes, it is the same story, verse 35 for Bill. Students love to work with him in the labs and, no matter the course load or the maintenance problem, Bill is there with a smile. He simply loves preparing for and then teaching the students. Consequently, Bill remains to be the laboratory workhorse, keeping busy with four labs: two in mineral processing, one in analysis, and the last in extractive metallurgy; while also helping Kevin Jaansalu



develop the two metallography labs. In essence, six labs spread throughout the year, three in each semester, keep him busy and will only get busier as student enrollment increases. His analytical skills and services continue to be invaluable to everyone's research as well. Clearly, he is an important cog in all we do. Hence, not only are the students thankful but so are the faculty and industry! It's a pleasure having you aboard Bill; none of us look forward to your retirement!

Organizing Symposia Increases Visibility

Part of the department's growth can be attributed to its increased visibility in the international mining community. This has been accomplished by the faculty increasing their participation with SME and TMS via presentations and publications as just noted by Dr. Huang above. Although all of the department is engaged in this manner, visibility has increased due to faculty organizing symposia as well. Looking back eight years ago, it began when Courtney was asked to organize two symposia for the TMS Annual Meeting in San Antonio for General Recycling and Waste Treatment and Minimization Committees. He later teamed up with both Larry and Corby to organize two specialized symposia, each with their own proceedings: Minor

Elements 2000 for SME in Salt Lake City and Cyanide 2001 for TMS in New Orleans. Both of them were extremely successful and ultimately led to Corby and Courtney leading the charge for Hydro 2003 – International Symposium Honoring Ian Ritchie – which included a two-volume proceedings. This symposium was the first time ever the TMS, SME and CIM collaborated on a meeting and set the tone for the future. As a result, both Corby and Courtney have been asked to help with Hydro 2008 and Precious Metals 2007 which are in the planning stages. Both are also members of the EPD Council of TMS. Courtney was recently named to MPD Board of SME, a position Corby held 3 years before.

..... As Do National and International Collaborations

The International Program at Montana Tech was established through the Office of Research and Graduate

Studies (OR&GS) with NSF funding and the idea that collaborative research would commence internationally.

Likewise, OR&GS also agreed to participate in the Center of Advanced Separation Technology (CAST) which is funded by DOE and led by Virginia Tech and U of West Virginia in a consortium with Montana Tech, U of Utah, New Mexico Tech, U of Kentucky and U of Nevada-Reno with the hopes to increase national collaborations. MetE and CAMP jumped at both opportunities. Courtney and Corby traveled to Australia in 2001, 2004 and 2005 and obtained agreements with Monash (Melbourne), Murdoch (Perth), New South Wales (Sydney), Griffiths (Brisbane) and James Cook (Townsville) Universities. To date, 4 students have been able to take advantage of these agreements and have traveled abroad for 2-3 months to conduct some of their thesis and/or project research. Research projects were conducted by Jason Gauer who

went to UNSW to study "Photocatalysis of Sulfate and Other Oxyanions Using Titanium Dioxide" with Dr. Tam Tran, Dave Douglas who went to James Cook to study "Electrowinning of Copper via Rotating Disk Electrode Technology Using Novel Solution Chemistry" with Dr. Ces Fabian, and Josh Junkert who went to Griffiths to examine "Thiosulfate Adsorption on Pretreated Activated Carbon Surfaces" with Dr. Greg Hope. The only thesis topic was conducted by Darby Stacey with Dr. Matthew Jeffrey on "Alkaline Sulfide Leaching of Gold." Josh's study was used to support a successful proposed CAST research project that should commence in January of 2006. Both Dave's and Darby's research efforts were additionally supported by CAST. Many thanks are extended to the host faculty and their universities!

..... the Latter Involving Faculty Exchanges and More Symposia Participation

Travel times for the students are typically conducted over the summer and often in conjunction with faculty travel as well as, if possible, international conferences. When Corby and Courtney helped to establish the various agreements in Australia, they also attended the 2001 and 2003 Copper Acta and Cobalt/Nickel Acta meetings with each presenting two papers. As it turns out, their presentations were prelude to submitting proposals to CAST in 2003 which helped support Darby and Dave until their graduation in May of 2005. Both returned to Australia in 2004 with an initial excursion to U of New Zealand but were unable to establish an agreement there. Courtney then went on to Sydney and then Brisbane and Corby went to Melbourne and later joined up with him in Brisbane. They were gone for two weeks, saw how their students were doing, gave presentations, and visited/stayed with their hosts. Finally, Corby returned in 2005 to present two papers at the Centenary of Flotation meeting held in Brisbane: one due to his work with a client and the other for Courtney. Courtney was expected to attend but could not due to a death in the family and his daughter's all-star team winning state and nearly going on to World Series in Junior Little League Softball. Greg Hope again played host but it is also a pleasure to note that we played host to Greg and his wife for six months during the latter half of 2003 for his sabbatical leave from Griffith University. During his time here, he presented a seminar, conducted research, helped advise two undergraduate researchers (Amber Linn and Jennifer Gambill), and initiated a CAST proposal which was later successfully updated with some of Josh Junkert's data. It is also worth noting that Dr. Hope will return for a 10 days later this year around Thanksgiving and plans to play a critical role helping our CASANS nano-center establish itself internationally with Griffith University due to his interests in using carbon nanotubes and quantum dots (of synthetic

minerals), both as nano-structured sensor materials. In 2001, we also played host for a week to Dr.'s Matthew Jeffrey, William Jay and Paul Breur prior to the Cyanide Symposium and Dr. Tam Tran and his two students afterwards. In 2003, following the Hydro/Ian Ritchie Symposium, Dr.'s Jay and Breur returned for a week. In December of 2003 and January of 2004, Larry Twidwell did a mini-sabbatical (with his wife Carolyn) at our sister university in Japan, Akita University, with the Department of Materials-Process Engineering & Applied Chemistry for Environment. While there, he worked with his host Dr. Takuo Sugawara and five of his graduate students on arsenic removal technologies from industrial waste waters. While there, Larry also presented two short courses and gave two distinguished lectures at Akita University and presented another at Nagoya University. At Nagoya, Larry befriended Dr. Kojima and agreed to be his host at Montana Tech in March of 2004. During this time, as noted already, seven students took him on a tour of 5 minerals, metals and materials companies in the Northwest. Larry and Dr.'s Sugawara and Kojima have agreed to jointly write proposals to conduct further research addressing environmental problems, particularly arsenic with the prospect of doing basic research here and adapting the results to industrial application there. Finally, both Courtney and Corby visited Akita University in 2002 and 2004 to present papers at respective ICMP meetings. Courtney presented a paper on "Remediation of Spent Potliner from Aluminum Industry" and Corby gave one on the "History of our Sister University Relationship" and another on "CAMP's Titanium Projects on TEMPER and Free Form Fabrication." It is understandable how these efforts, and the oh-so-many unmentioned ones, increase the visibility of the department and CAMP in the international mining community. Congratulations guys! Keep up the good work!

CAMP and MetE Collaborate on Short Courses

In the past, CAMP and MetE have collaborated by offering short courses on Thermodynamic Modeling of Aqueous Systems and Fire Assay. The successes of the thermodynamic modeling course with Dr. Bob "Arsenic" Robins of Sydney Australia led to the incorporation of STABCAL into the course. The course is now offered as a graduate course, METE 5260, and is team-taught by Dr.'s Huang and Young. Except for the one-on one time with Newmont, it has not been taught as a short course for a while but can be if enough parties are interested. Likewise, Dr.'s Young, Anderson and Twidwell team teach MetE 5040 Fire Assay but always as a short course. Although the course is usually offered in late summer the week before the Fall Semester starts, it was last held July 10th-14th, 2005 with great success. For the last 4 years, it has been co-hosted by the Best Western Butte Plaza Inn who provides rooms and pool-side gatherings at reduced rates. The course is comprehensive and designed to provide fundamental, laboratory and industrial training.

Lectures for two days cover sampling fundamentals, the fire assay process, and thermodynamic evaluation with mass balances and multi-component phase diagrams. Differences in Au, Ag and PGM Fire Assay procedures are examined along with alternatives to Pb which include using Bi and CuS as collectors. A third day provides hands-on experience in a lab setting. Finally, tours of industrial primary and secondary facilities are conducted and include Golden Sunlight's operations for Au, Bunker Hill's operations for Ag, and Stillwater's operations for Pt and Pd. An underground mine tour at either Bunker Hill or Stillwater is also offered. Complete details of the course can be found by clicking on 'Short Course' on CAMP's website (www.mtech.edu/CAMP). Fire Assay will be offered again July 30th - August 4th, 2006. Please contact DaNette Rule (DRule@mtech.edu; 406-496-4652) if you are interested or have questions. This is a great time to vacation in Montana!

CAMP Has Record Growth



Besides short courses and international activities, MetE and CAMP collaborate in a number of other ways but predominantly through research. Currently CAMP is engaged in a major titanium research effort with the TEMPER and Free Form Titanium

Fabrication Initiatives with the Department of Defense. Essentially, these programs will encompass cradle to grave production of titanium including exploration, mining, beneficiation, refining and fabrication. CAMP also has several other global projects including rare earths production, non-cyanide gold recovery, process control, copper enargite treatment and antimony metal production. Our mission statement is: The Center for Advanced Mineral and Metallurgical Processing will facilitate cooperation between the university system and industry to enhance the economy of the State of Montana by supporting, developing and adding value to the global mineral, metallurgical, and materials industry. Economic enhancement may be encouraged through added value processing of minerals, materials, and wastes while developing processes that minimize waste generation. Corby Anderson has 26 years of experience in process, chemical and metallurgical engineering, engineering services, research, consulting and industrial plant operations. He received his B.Sc. in Chemical Engineering from Montana State University in 1979, his M.Sc. in Metallurgical Engineering from Montana Tech in 1984, and his Ph.D. in Metallurgical Engineering from the University of Idaho in 1987. Experienced and trained in pyrometallurgy, he also has extensive industrial experience in hydrometallurgy, electrometallurgy, environmental

metallurgy and mineral processing. He has developed and implemented novel hydrometallurgical technologies for pressure leaching, vat leaching, precious metal recovery, base metal recovery, process control, separations, purifications, refining and electrolysis. He has been responsible for lab work, pilot plant work, research, process development, engineering design, start-up, operations, management, corporate budgeting, contracting and environmental affairs for mineral processing and hydrometallurgical plants producing silver, PGM's, gold, antimony, nickel, cobalt, zinc, germanium, gallium and copper. He has authored or co-authored over 100 papers and presentations and holds several international patents. He has served successfully as an expert witness on several international mining cases. He has been a Technical Editor for the Mineral and Metallurgical Processing Journal, Minerals Engineering, Hydrometallurgy, and Metallurgical Transactions B. As a Full Research Professor in the Department of Metallurgical and Materials Engineering at Montana Tech he has directed or co-directed 2 Ph.D. candidates and 12 M.Sc. candidates. He is active in many professional organizations including participation as an SME Director and Vice President, as an IPMI Director and as a Trustee for North West Mining Association. He also participates with the National Materials Advisory Board, The National Academy of Science, The National Research Council, The National Science Foundation and the National Academy of Engineering. In 1996 he was awarded the Extraction and Processing Technology Award from TMS. In 1999 and 2004, he was the Technical Chairman for the 23rd and 28th annual International Precious Metals Institute meetings. In 2001, he was a Co-organizer of a TMS International Symposium on Cyanide.

In 2002 he was a Co-editor and Organizer for the Mineral Processing Plant Design, Practice & Control International Symposium. Also, in 2002 he received a Distinguished Alumni Award from Montana Tech. In 2003 he was a Co-organizer of the Fifth International Ian Ritchie Symposium on Hydrometallurgy as well as for the Symposium on Global Development of Copper and Gold Deposits. In 2005 he is co-chairman for the Northwest Mining Association Annual Meeting and an invited plenary speaker at the 27th meeting of the Institute of Mining Engineers of Peru. In 2005 he received the Distinguished Researcher Award from Montana Tech. In 2006 he is the chairman for the Northwest Mining Association meeting held for the first time in Reno, Nevada. In 2007 he will serve as co-Chairman for a joint SME-TMS Precious Metals Symposium. Lastly, in 2008 he will once again serve as a co-organizer for the Sixth International Symposium on Hydrometallurgy. His professional affiliations include: The International Precious Metals Institute – Director, The Society for Minerals, Metallurgy and Exploration – Director, Vice President and Executive Committee, The Order of the Engineer, The Northwest

Mining Association – Trustee, The Canadian Institute of Mining, Metallurgy and Petroleum, The Metallurgical and Materials Engineering Advisory Board of Montana Tech, The National Materials Advisory Board, Materials Technology for Process Industries, National Academy of Engineering, Consultation for Mineral Processing and Hydrometallurgy, The Mining and Metallurgical Society of America, The American Institute of Chemical Engineers, Nanoscale Science and Engineering Forum, Society for Biological Engineering, Institute of Chemical Engineering, The Minerals, Metals and Materials Society, Aqueous Processing, Copper Cobalt Nickel & Precious Metals Committees, Sigma Rho Mining Fraternity, Southwest Montana Technology Network, Montana Mining Association, Montana Academy of Sciences, The Society of Mineral Analysts, The International Titanium Association, Montana State University Alumni Association, Kokondo Karate Black Belt Level Instructor, American Hockey Coaches Association, USA Hockey Masters Certification and Head Coach of Butte High School Hockey Team.

CAMP Hires Two Research/Process Engineers



Along with record growth, of course, comes hiring of new personnel. *Dr. Paul Miranda* started in February of 2005. He has Bachelors in Chemistry and a Masters in Metallurgical

Engineering from Montana Tech and a Doctorate in Chemistry from The University of Montana. Paul has been traveling quite a bit since he started. His favorite place so far has been the Ukraine. Of the many various projects his favorite has been flotation projects. Current projects include floating rare earth and titanium ores. Paul has over 12 years of experience in metallurgical, process engineering, and academics. Experienced and trained in hydrometallurgy, he has extensive experience in hydrometallurgy and laboratory research. During his academic research has worked and implemented novel fundamental research in arsenic and selenium remediation, metal recoveries using ion exchange technologies. He has been responsible for lab work, pilot plant work, research, process development, engineering design, start-up, operations, management and environmental affairs for hydrometallurgical plants for managing arsenic containing

solutions. He has authored or co-authored 10 papers and presentations and holds several patents.



John J. Krstulich is the Associate Research Faculty for CAMP. He was born and raised in Butte by George and Betty Krstulich. He graduated from Butte Central High School in 1977 and double majored at Montana Tech receiving his BS in Metallurgical Engineering in 1983 and in Computer Science in 1986. Afterwards, he worked for two years as a Process Engineer for Pegasus Mining in Winnemucca and returned to Montana to pursue his MBA at the University Of Montana graduating in 1990. He then became a Production Engineer at KB Alloys, Inc., in Wenatchee, WA, where he worked until 1997. He then transferred to become Senior Production Engineer at Advanced Silicon Materials Inc. (ASiMI) where he worked before joining AMP. John married Janet Winter in 1993 and has four sons – Ryan (10), Jeff (8), Kyle (5) and Mark (2). He coaches baseball and football and is an avid golfer and softball player.

DaNette Rule Hired by CAMP



As just noted, CAMP has grown substantially over the last several years but, like the department, has learned that ends simply do not meet without an administrative assistant, particularly fulltime and effective ones. In this regard, DaNette Rule started in March of 2003. DaNette moved to Butte in 1963, when she was in

3rd Grade and graduated from Butte High School where she and her three brothers were very active in sports. “Our success taught us the discipline to succeed and introduced us to a wide variety of successful people in the business world,” she says. Danette has two grown daughters, Jennifer and Chris, who were born and raised in Butte. She has two grandchildren, Justin and Jessica, who she enjoys spending time with. “Butte is the best place to raise kids

and the nicest people live here,” she says. She enjoys working on the campus and after taking classes from Montana Tech, feels students are fortunate to get the best education at Montana Tech. She feels very privileged to have life long friends and family here in Butte, along with a great job working for CAMP and its employees. She enjoys the accounting aspects of her job most and loves

being able to meet so many new people: clients, students, perspective students, alumni, etc. DaNette replaced Tammy Cashell, who took a position at Carroll College in Helena and later moved to Anchorage/University of Alaska after becoming Tammy Choquette. Welcome DaNette and congratulations Tammy!

Industrial Crisis and Commodity Prices Equate To Student Opportunities

The mining industry is facing its greatest crisis. Over the next ten years, it is predicted that 40% of the workforce will retire and that there is not enough graduates in the pipeline to replace them. However, this crisis is coming at a most opportune time: commodity prices are skyrocketing with, for example, copper being over \$2.00/pound and gold hovering near \$485/oz. Furthermore, the market is expected to continue growing for years to come which ultimately will cause the industry to expand as well. Clearly, the demand for new graduates will increase on both counts. This creates a huge

opportunity for college students, both current and prospective! Competition for graduates is expected to be fierce; graduates are already receiving multiple offers and commanding high salaries with huge signing bonuses even in low cost-of-living places! By graduation next May, it is estimated that the average student will have received 3 offers at \$60K with \$10K signing bonuses. Furthermore, opportunities for early promotion will be paramount; 5 years from now, some members of the class of 2006 could easily be earning six-figures. It truly is the opportunity of a life-time!

..... Which are Enhanced by Industrial Support

With such an opportunity, students are expected to enroll in record numbers in Metallurgical and Materials Engineering and the other two traditional supporting programs to the mining industry: Mining Engineering and Geological Engineering. The mining industry cannot afford to miss out on this incredible market, which is why more and more companies are beginning to invest in the schools that still cater to the mining industry. In this regard, it is a pleasure to note that Montana Tech weathered the storm when lightning struck down several programs across the country including historical ones at, U of Idaho, SDSM&T, and Michigan Tech. The thunder was heard here, not as despair, but rather as an opportunity to grow. That hindsight is beginning to yield results too! Phelps Dodge has initiated an internship/scholarship program with the Foundation in which 2 freshmen can receive an internship as well as a \$2500 sophomore scholarship then go on to receive another internship as well as a \$3500 junior scholarship and finally a third internship with a \$5000 senior scholarship. In any given year, 6 students will be in the program which totals \$22,000 in scholarships and additionally pays wages for summer work. It is our understanding that John Marsden, VP of Phelps Dodge, worked hard with his company and its Foundation to get this fantastic opportunity for students. John is a member of the department’s advisory board.

Thanks John! Likewise, Newmont has created a \$30,000 Minerals and Metals Research account in the Foundation to help with graduate and undergraduate research as well as senior design projects with the hope of getting students experience with solving long and short-term problems faced by the mining industry. Currently, the funding has been used to support 8 undergraduate researchers working on various cyanide issues. Marc LeVier, Manager of Research with Newmont, was responsible for establishing this super on-campus opportunity for students. Although not an alum of Montana Tech, Marc also serves on the department advisory board and currently serves as its Vice Chair. Although he is a graduate of Michigan Tech, he is accordingly recognized as one of our honorary alums. Way to go Marc! Similarly, Positronics has established a \$20,000 Senior Design account as well as a \$60,000 Undergraduate Research account, both named after Jack T. Gentry who founded the company. Both will be used to support the current senior design project on “Lead-Free Electrical Connections.” The contributions were made possible by Jack and Ann Gentry and their son John. Jack was a 1958 graduate of the department. Jack has retired and John currently is president of the company. Thank you Jack, Ann and John!



Senior Design Projects Take Notice

Jack noticed, via correspondences with the department, that Senior Design projects were becoming more practical. It also helped him rekindle fond memories of his undergraduate days. This ultimately helped him decide to make a donation so that more real-world industrial projects

will continue to be tackled. Senior Design is the capstone course to the program and is now year-long. Students are required to form teams; design a system, component or process; conduct experiments in the laboratory to test the design; collect and evaluate data; perform first-order cost

analyses; and communicate a first class final report (both spoken and written). Examples of past projects include performing flotation tests to evaluate new reagents, developing a process with equipment sizing goals,

evaluating an industrial failure and material selection for casting molds, and conducting heat and mass balances for a cement-rotary kiln. Sponsoring companies were very satisfied so, if you have a project in mind, please suggest!

Foundation Fundraising Activities

For the past 5+ years, the department has identified a number of priority areas for fundraising and has worked closely with the Foundation and the School of Mines and Engineering at Montana Tech to help. A primary goal is to increase enrollment with the highest quality students as possible and thereby help industry replace its retiring workforce effectively. In this regard, efforts are under way to (1) get a recruiter for the mining industry programs only, (2) increase scholarship numbers and amounts, and (3) improve opportunities for student involvement. Obviously, recruiting should improve directly with the two former efforts and retention should improve with the latter two efforts. It is worth noting that scholarships become more effective if they can be renewed (i.e., they are awarded for more than a year) and/or can be associated with internship programs. Likewise, student involvement can be increased through more research/senior design

projects, improved attendance at professional meetings and increased participation in student club (i.e., Club Met) activities including field trips, social gatherings, etc. Clearly, the contributions from Phelps Dodge, Newmont and Positronics are helping to meet these goals but more support is needed. Other primary goals include obtaining professorships as well as laboratory endowments. Partial and full professorships are needed to grow the teaching and research capacity of the department whereas lab endowments are needed to help pay the salary and benefits of Lab Director Bill Huestis as well as help purchase and maintain equipment. The "News-n-Needs" brochure that was distributed along with the phonathon solicitation in October outline these needs in detail and are always being addressed by the Foundation to keep the department moving in the right direction with as much financial support as possible.

Annual Phonathon

One of the most important activities that the Foundation conducts is the Annual Phonathon which runs during the Fall Semester but, in all actuality, is year-round. This past year, the department and several of its students called during the first week of October and have since been periodically calling alumni and friends whom we were unable to reach. If you were never reached, we are likely still trying; however, it is possible the information we have on you is incorrect; if so, please call the Foundation to correct it. Because we thoroughly enjoy reaching out to you, we hope the information we have is correct. It is a pleasure to note that your kind donations for the past three years have averaged approximately \$20,000/year and have been distributed to a variety of funds per your specifications. These funds are all part of the **Metallurgical & Materials Engineering Student Excellence Program (MESEP)** and include:

Ted S. and Gloria L. Jordan Fund – Endowed fund used to finance a scholarship as well as help instructors and students to attend professional meetings, conduct club activities, acquire library materials, and purchase and maintain equipment particularly in mineral processing and extractive metallurgy.

Vern and Barbara Griffiths Fund – Endowed fund used to finance a scholarship as well as help instructors and students purchase and maintain equipment particularly those in physical metallurgy and materials science and engineering.

Louis V. Bender Lecture Series Fund – Endowed fund used to support lectures and seminars.

Metallurgical & Materials Engineering Fund – Annual fund used to support the instructors and students particularly those emphasizing materials and physical metallurgy.

Mineral Processing and Extractive Metallurgy Engineering Fund – Annual fund used to support the instructors and students particularly those emphasizing mineral processing and extractive metallurgy.

General Scholarship Fund – Annual fund used to support scholarships particularly MESEP Scholarships for juniors and seniors and MetE Alumni Recognition Scholarships for sophomores.

Minerals and Metals Research Fund – Annual fund used to support graduate and undergraduate research projects with emphasis on mineral processing and extractive metallurgy.

Materials Research Fund – Annual fund used to support graduate and undergraduate research projects with emphasis on physical metallurgy as well as materials science and engineering.

Jack T Gentry Research Scholarship for Metallurgical and Materials Engineering – Endowed fund used to support undergraduate research projects.

Jack T Gentry Metallurgical and Materials Engineering Senior Research Fund – Endowed fund used to support senior research projects.

As can be seen, the funds cover practically every aspect of student education. Normally, these funds are more than

enough to cover our basic needs but periodically something comes up that breaks the bank. This is particularly true with scholarships and student involvement, particularly since enrollment is on the increase and expected to continue for several years. As

E.G. Koch and D.W McGlashan
 D.W. McGlashan Memorial
 S.A. "Toby" and Sam Worcester Fund
 Russell E. Hoar Memorial
 Albert Raihl Memorial Fund
 Don Mahagin Fund

Rayworth Howe Memorial Trust
 Frank W. Bowdish Metallurgical
 Jon Boster Memorial (with Welding)
 Force F. Baney Jr. Fund
 Robert Macdonald
 Calvin E. Stevenson Annual

Barrick Goldstrike
 Phelps Dodge
 Stillwater Mining Company
 ASARCO Endowed
 Newmont Mining Company
 Walter R. Lawrence Memorial

All together, the value of scholarships awarded by the department is near \$25,000/year but will need to be increased to attract and keep the best of the students, particularly as enrollments increase. It is worth noting that an analysis of SAT and ACT scores as well as high school and overall college GPA's showed that our students indeed are among the best on campus and are comparable to similar programs at two other traditional mining schools. Furthermore, we have a higher percentage of incoming

outlined earlier, many of these are beginning to be addressed and, as a result, the MESEP has been expanded to include the variety of endowed and annual scholarships that are also available. These scholarships are named to recognize companies, alumni, and faculty:

students with better scholarships and who are high school valedictorians and salutatorians. Also, our returning students compete well for scholarships across campus (via the scholarship committee), nationally, and around the globe (via professional societies and groups). For example, many of our students receive Montana Tech's prestigious 4-year Moebus Presidential Scholarship whereas others are awarded scholarships from SME/MPD, TMS/EPD, ASM, Copper Club, ISEE, AIST, ACS, etc.

Two Juniors Awarded Internationally Competitive Scholarships

In early October, the Copper Club announced that *Kelly Murphey* had won their 2005-2007 Scholarship which is awarded as two \$5,000 checks in each of her junior and senior years. The Copper Club is a non-profit organization that consists of professionals from the mining, geology, and metallurgy fields and awards the scholarship based on academic excellence and financial need. To win, Kelly, who is originally from Houston, had to write an essay describing why she was involved in the extractive

industries. She has interned for Smith International and Barrack Gold Strike. Just one week earlier, *Nick Gow*, who double majors in Chemistry, was notified that he was awarded a \$1,000 scholarship from The International Society of Explosive Engineers (ISEE). Nick previously received a \$500 scholarship from them but was rewarded for his academic excellence this year. Nick has interned with Pacific Northwest National Lab. Both are active in Club Met and expect to graduate in May of 2007.

Club Met Activities

Club Met is as active as ever. Officers include: Jerry "Dusty" Leonhard, President; Matt O'Leary, Vice President; Kelly Murphey, Secretary; and Nick Gow, Treasurer. Last year, the club participated in TMS's annual membership drive, increased membership by twelve students; won the most members recruited award, and received a \$500 check from TMS. The club also helped with the phonathon and received \$3500 in pledges, and was rewarded by the department with \$1000 from unrestricted funds. Other fundraising activities included making/selling 60 dozen cocktail pasties (\$500), giving demonstrations at local elementary science classes (\$500 from Jordan Fund), and giving demonstrations to high school students during Tech Days as well as science class visits and Science Fair (\$1000 from unrestricted funds). They rewarded themselves by sending six students to the

TMS Annual Meeting and another four to the SME Annual Meeting. The year before, six students took a visiting faculty member, Dr. Kojima from Japan, on a 10-day senior fieldtrip from Butte to Elko, Boise, Portland, Seattle and Kellogg to visit Barrick/Newmont, Micron, Wah Chang, Boeing, and Couer-Silver Valley, respectively. Club Met also sponsored local field trips to ASIMI, MSE-TA, Montana Resources, Holcim, and Golden Sunlight. They also hosted/sponsored several professional seminars including the annual seminar symposium, both listed below. Most of these sponsorships are coordinated with class field trips and are paid for with student lab fees. These are, in fact, pretty common years but it is noted that some years are more active than others; the difference being the mindset of the officers. This year's crew should prove to be among the best!

Club Met Hosts and Sponsors Seminar Speakers

Over the past two years, Club Met has worked closely with faculty and CAMP to have a number of guest speakers for

seminars. Speakers from across campus and around the globe gave a variety of talks. If you are ever in Butte and

would like to visit with our students, please contact us to see if arrangements can be made! Some of the speakers included:

Greg Hope – Associate Professor, School of Science, Griffith University, Nathan Campus, Brisbane, Queensland, Australia “Raman Spectroscopy and Electrochemistry Studies in Extractive Metallurgy.”

Marilyn Cameron – Director, Office of Environmental Health and Safety, Montana Tech, “Laboratory Health and Safety in Academic Settings.”

Stacy Aguirre – Director, Career Services, Montana Tech, “Metallurgical Engineering Career Opportunities and Recruiting.”

Nestor Perez – Professor, U of Puerto Rico, “Electrochemical Behavior of Aged Al-Li 2195 Alloy in 3.5% NaCl.”

Cal Stevenson – CEO of Deltech Inc., Denver, Colorado, “High Temperature Ceramic Materials.”

Corby G. Anderson – Director, CAMP, Montana Tech, “Engineering Ethics in the Mining Industry: Part I and II.”

Krag Filius – Process Engineer, MSE-TA, Butte, “Plasma Arc Technology for Conventional Ammunition Demilitarization.”

Paul Miranda – Process Engineer, CAMP, Montana Tech, “Treatment of Arsenic-Bearing Waste Waters.”

Tom McIntyre – Process Engineer, ASiMI, “Production of Pb at the Former ASARCO Smelter in East Helena.”

Mark Danninger – Inspection Engineer, ASiMI, “Alloying and Welding Challenges at ASiMI.”

Ben Adair – Director, Julius Kruttschnitt Mineral Research Centre, Brisbane, Australia, “Mine and Mill Research in Australia and Beyond.”

Kevin Jaansalu – Assistant Professor, Chemistry and Chemical Engineering, Royal Military College, Kingston, Ontario, “Applications of Phase Diagram Modelling to Nickel-Based Superalloys.”

Yury Sukharnikov – Project Manager, National Center for Complex Mineral Raw Processing, Almaty, Kazakhstan, “Metallurgy in Kazakhstan” and “Silica Carbon (SiO₂ + C) Production from Rice Hulls.”

Club Met Organizes 9th Seminar Symposium

Club Met is sponsoring the Department’s 9th Seminar Symposium. The program, shown below, was organized by Mollie Powell in consultation with Dr. Courtney Young. The event is scheduled for Saturday, December 3, 2005 and begins at 8:00 am in the Kelly-Steward Room of the SUB at Montana Tech. You are welcome to attend!

8:00 am WELCOMING

8:25 am OPENING REMARKS

8:30 am Nano Polysilicon Nucleation: Phillip Teintze, 5-yr MS

The Nano Polysilicon Nucleation project is designed to determine the onset of nano polysilicon powder formation in a hydrogen/silane process system based on varying pressure and bulk gas temperature. It also measures changes in silane decomposition kinetics as a function of pressure and velocity. A simple tubing setup with an inconel reactor in a tube furnace was used for the study. Nano Polysilicon Nucleation research should clarify the process relationships and give direction for improved silane to polysilicon reactor performance.

9:10 am ASiMI Pressure Relief Device Failure Analysis: Matt O’Leary, BS

Correlations between failures of the ASiMI silane module pressure relief device (PRD) and certain metallurgical phenomena are discussed. A summary of the PRD’s basic features, qualification testing, and its continual evolution is given. A comparison and contrast of two key PRD suppliers is discussed and future research is recommended.

9:40 am Qatar Liquefied Gas Company: Ateeq Alkhulaifi, BS

Qatar is a country that is located in the Middle East and a major supplier of petroleum and natural gas products. Qatar Liquefied Gas Company, established in 1984, was formed to own and operate a world-class onshore LNG (Liquefied Natural Gas) plant. It is Qatar’s first and major LNG Company. Qatar Gas utilizes gas from the country’s giant North Field which is the largest in the world. Qatar Gas markets and exports LNG and it’s associated products worldwide and has set its vision and its goals to be the largest LNG Company in the world. By 2007, they will achieve that goal and vision.

10:10 am BREAK

10:30 am Outline of Free Form Titanium Fabrication Technologies: Alex Moroni, BS

Titanium is the ninth most abundant element in the earth’s crust and the fourth most abundant metal after aluminum, iron and magnesium. Titanium offers very desirable properties which include low density, high strength/weight ratio, immunity to seawater corrosion, high shock resistance, good ballistic properties, and good erosion resistance. Currently, problems occur with production of elemental titanium which includes fabrication costs and manufacturing final products for non-aerospace grade. Some of the Free Form Fabrication Technologies used today and include: laser powder forming, which is a generic term encompassing several technologies. It is typically metal or ceramic powder materials which are delivered directly into a melt pool created by a laser beam to form parts in layerwise fashion. Other technologies include three dimensional layered printing, which is a process that starts by depositing a layer of powder object material at the top of a fabrication chamber. Finally, cold isostatic pressing, which a method for the consolidation of

metal powders mixed with short fibers, whiskers or particulates subjected to uniform pressure in a flexible envelope. These different types of Free Form Fabrication Technologies will be discussed in detail and compared.

11:00 am Pouring Alloys in Artificial Environments with Special Attention on Use of Argon: Jerry Leonhard, BS

Most foundries in today's markets do not have the time or the available manpower to conduct proper experiments and; therefore, the use of artificial environments during alloy pouring has lagged behind as technology has advanced. Researchers have theorized substantial amounts of money could be saved by tweaking this system and have looked in depth at the use of argon as a barrier between the pour and atmosphere. Liquid argon is the most commonly used medium for this purpose but, now, new research has shown argon gas can be a major cost saving substitute. Argon is one of the heaviest gases on the periodic table and therefore settles over the pour and pushes other gasses away that could cause impurities in the pour. Argon gas has been used in welding processes for years with the same operational theory behind it. Old and new processes must be looked at in depth in order to determine the best decision for today's modern foundry.

11:30 am Mining and Milling Practices at Kennecott Greens Creek: Allen Linder, BS

Greens Creek is poly-metallic underground mine located in Juneau, Alaska. It employs approximately 220 people. Lead, zinc, and bulk cons are produced with a traditional flotation circuit, which has been modified to include a gravity circuit for concentrating gold. The mill throughput is approximately 2300 tons per day of high grade feed assaying 15% Zn, 3% Pb, 12 OPT Ag, and .019 OPT Au. Recoveries average 75% Zn, 65% Pb, and 71 % Ag. This paper will discuss in detail the milling process and includes discussions on R&D activities including: SMD pilot plant tests, JK SimFloat surveys, and tails thickener reduction studies.

Noon LUNCH BREAK

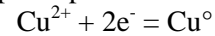
1:00 pm Leaching and Copper Recovery: Cara Taylor, BS

Hydrometallurgical methods of copper recovery are being researched with vigor and normally involve leaching with a sulfuric acid solution followed by solvent extraction and electrowinning as recovery processes. Heap leaching operations typically involve low acid concentrations for treating low-grade ore deposits of oxide and silicate minerals. Higher order deposits generally contain sulfide minerals at high-grades and require more aggressive conditions. These conditions may include increased acid concentrations, strong oxidants, elevated temperatures, and high pressures. In this regard, leaching has evolved to

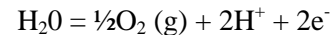
include vat, agitation, and autoclave technologies. In this paper, the features, advantages, and disadvantages of copper leaching and recovery processes are reviewed.

1:30 pm Copper Electrowinning and Nodulation: Hal Wente, BS

In 1997, 9.2 million tons of recoverable copper was mined. Of this, 1.8 million tons were recovered by electrowinning. In electrowinning, copper is plated out from a concentrated electrolyte by applying a voltage across two electrodes. The cathode is generally a "starter" sheet of stainless steel upon which the copper is produced:



Whereas, the anode is generally a sheet of lead upon which oxygen evolution occurs:



When oxygen escapes from the electrowinning cell, it creates a problem referred to as "acid misting". Another problem is termed "nodulation" and occurs when copper growth on the cathode predominates in localized areas as opposed to smoothly across the whole sheet. The nucleation growth mechanism produces "nodules" which can short circuit the system if they grow long enough to contact the anode. In this paper, the electrowinning process is reviewed. Emphasis is placed on discussing these problems along with their cause and prevention.

2:00 pm Statistical Software Optimization for Simultaneous Electrowinning of Copper (II) and Iron (II): Francis Dakubo, 5-yr MS

Copper solutions from acid/ferric leach operations are typically processed by solvent extraction and electrowinning to produce copper cathode. To do this on an industrial scale, 2.0 volts with resultant current densities of between 80-130 amperes/m² are normally applied. However, our research, aided by statistical software, has shown that energy savings of 20-25% is achievable with 1.5-1.7 applied voltages and current densities of 300-400 amperes/m². State-of-the-art membrane and anode materials make this possible. Furthermore, the process regenerates ferric ion for recycle back to the leaching stage. Results along with their pro's and con's of these R&D efforts are described in detail.

2:40 pm BREAK

3:00 pm A Comparison of Cyanide, Thiosulfate, and Alkaline Sulfide Leaching of Gold: Tim Martin, BS

Historically, there are many ways of extracting gold from the gangue material in an ore. Gravity separation has been used in the past, but this method is used mostly when the deposit contains native gold. For the most part, hydrometallurgical approaches are used and require a leaching step to produce dissolved gold as an intermediate product. Cyanide leaching has been one of the most widely used methods since the late nineteenth century.

However, the use of cyanide has been deemed as an environmental nuisance and has therefore come under heavy regulation. To overcome these issues, other processes have been and are being developed. These processes include thiosulfate and alkaline sulfide leaching and are reviewed along with the cyanide leaching process. Pro's and con's of each are discussed in detail.

3:30 pm Waste Treatment of Alkaline Sulfide Leaching Solution: Preliminary Investigation: Karel Pramono, MS

The Alkaline Sulfide Gold Leaching System (ASGLS) research and development has been going on at the Center for Advanced Mineral and Metallurgical Processing (CAMP) at Montana Tech since 2003. The project is driven by the desire to provide alternative gold leaching methods to cyanide. The electrochemistry and kinetics of the leaching process was successfully examined in a previous thesis project in 2003-2005 and, at present, investigation of the waste treatment of the leaching solution is being conducted. The treatment proposed to include an oxidation stage in a pressure vessel and a salt splitting stage using an electrodialysis process. Current progress and findings of the project will be discussed in this presentation.

4:10 pm Inorganic Data Validation: A Brief Summary: Amber Linn, BS

Many variables, such as sample preservation, holding times, matrices, etc, affect the usability of inorganic data. One way to ensure quality assessment/quality control (QA/QC) of inorganic data analyses is inorganic data validation. Data validation is a technical review of the analytical data presented in a sample delivery group (SDG) using EPA functional guidelines. These guidelines assess the instrumentation used for analyses and the variables that

can adversely affect inorganic data providing usability information for the end user.

4:40 pm Dual Ecosystem Enhancement: In-Situ Pitlake Remediation by Silicate-Slag Addition: Eric Streich, MS

This presentation covers the theory, past, and current work done on the Mine Waste Technology Program, Activity IV, Project 36: Dual Ecosystem Enhancement: In-Situ Pitlake Remediation by Silicate-Slag Addition. This project studies the use of silicate-laden slags, another by-product of the minerals industry, to treat acid rock drainage (ARD) and specifically, the Berkeley Pitlake (BPL). Three silicate-slag sources from around the state of Montana (ASARCO in East Helena, Anaconda Copper Co. in Anaconda, and Stauffer Chemical near Ramsay) have been collected and are undergoing tests to determine their effectiveness in treating BPL water in comparison to the current best demonstrated available technology (BDAT): lime treatment. It is hoped to be concluded that treatment of ARD, and specifically the BPL, with silicate-slugs is the equal or better than the BDAT. If successful, the treatment process using silicate-slugs will assist in the remediation of two mine wastes: both the ARD and the slag piles left over from smelting.

5:20 pm Closing Remarks

Seminar is required for both graduate and undergraduate students. This format gives them a life-learning experience because it mimics professional conferences. It also provides a forum for interaction of all students and faculty. Students enjoy it! Typically, Advisory Board members attend and give feedback. All of this is used as an effective assessment tool for ABET accreditation.

Advisory Board Increases Involvement

Part of the accreditation process involves assessment. When changes like those to the curriculum and various course offerings are proposed, various constituents need to be informed so their feedback can be received and approval gained. Three of the most important constituents are the students, recent graduates/new alumni, and the advisory board. It is worth noting that the changes above were approved unanimously by all. However, as 2000 ABET criteria continues to evolve, increasing emphasis is being placed on recent graduates and the advisory board. Furthermore, industry supports having its employers being active members of these advisory boards, particularly in regards to the mining industry in lieu of the crisis it is facing. The Metallurgical & Materials Engineering Advisory Board is comprised of the following individuals:

Corby Anderson– Director, CAMP, Montana Tech
Bret Boster – Engineer, Pan American Silver Corp.

Jim Brierley– Newmont Mining Corp.
Steve Busby- Sr. Vice President, Projects, Pan American Silver Corp.
David Dahnke- Engineer, Kaiser Aluminium
Edward Dowling Jr.- Senior Vice President, Operations Cleveland-Cliffs Inc
Mike Eislein- Plant Engineer, Ash Grove Cement Company
Todd Fayram- Metallurgical Engineering Consultant
Bud Gale- Former President, Summit Valley Equipment & Engineering
Mike Garska- Lead Process Engineer, Pigments & Additives Group Imerys
Ron Glovan- Staff Materials Engineer, MSE Technology Applications, Inc.
Jerry Harrington- Mining Consultant
Mary Ann Harrington-Baker- Quality Assurance Manager, MSE Technology Applications, Inc.

Stan Howard- Professor of Materials and Metallurgical Engineering, South Dakota School of Mines

Bob Johnson- Mining Industry Consultant

Debbie Laney- Chief Metallurgist, Barrick Goldstrike Mines Inc.

Marc LeVier- Director, Metallurgical Services Newmont Mining Company

John Mansanti- Mine General Manager, Turquoise Ridge Joint Venture

John Marsden- Vice President, Phelps Dodge Mining Company

Jerry May- Manager/Sr. Advisory Engineer, Bechtel BWXT Idaho

Tom McIntyre- Senior Process Engineer, ASiMI

Jay McCloskey- Project Manager, Water Treatment Remediation Services Division MSE, Inc

Terry McNulty- President, T.P. McNulty and Associates, Inc

Keith Prisbrey- Professor, Department of Metallurgical and Mining Engineering University of Idaho

Greg Roset- Smelter Manager, Stillwater Mining Company

Wally Schultz- Schultz Services

Amy Stepan- Associate Corrosion/Material, Martinez Refinery

Rob Stephens- Sr. Metallurgist-Technical, Teck Cominco Metals Limited

Rick Sutherlin- Manager, Technical Services, Teledyne-Wahchang

Laurie Tahija- Engineer, M3 Engineering

Patrick Taylor- Professor of Metallurgical and Materials Engineering, Colorado School of Mines

Gary Tuss- Senior Specialist Engineer, Boeing Materials Technology.

Steve Busby served as chair for the past two years and was replaced by then vice-chair Tom McIntyre this past May.

At that time, Marc LeVier was also named vice-chair;

Marc is not an alumnus but has shown genuine concern for the survival of the department and its heritage in mineral processing and extractive metallurgy. The board meets twice a year: once near graduation and the other during homecoming. The efforts of all of these board members are appreciated. They volunteer their time, mostly at the expense of their companies, to keep the department updated on the latest and greatest and therefore keep us going in the right direction in regards to both research and courses/course contents. We are very pleased to note that the board has grown large enough to break into sub-committees so that the various matters that affect the department can be addressed more quickly. The subcommittees include:

Fundraising- Jay McCloskey – Chair, Bret Boster, Mike Eislein, Jerry Downey, Bud Gale, John Mansanti, Bob Johnson, Mary-Ann Harrington-Baker, Marc Le Vier, Courtney Young.

Curriculum- Mary-Ann Harrington Baker – Chair, Todd Fayram, Debbie Laney, Jerry Harrington, Kevin Jaansalu, Frank Aplan

Faculty/Student- Tom McIntyre - Chair, Kevin Jaansalu, Rob Stephens, Amy Stepan

Accreditation- Keith Prisbrey – Chair, Courtney Young, Pat Taylor, Stan Howard

AB members typically serve three years terms and can be renewed for three-year increments for as long as they are willing to serve. As can be seen, the board is made up of alumni and non-alumni representing a wide variety of companies with an excellent distribution in experience and discipline. It is critical to note the participation of faculty from similarly-named departments at other universities as well. If you are interested in serving and help improve the diversity of the board, please let Courtney Young know so he can pass the information on to the board.

Montana Tech Honors Distinguished Alumni

Distinguished Alumni Awards are given to honor alumni who graduated more than 20 years ago and who have become distinguished among their peers. The awards are given during graduation in May. Anyone can nominate alumni for this award. Please contact Peggy McCoy for details by e-mail at PMcCoy@mtech.edu or by phone at 1-800-445-8324. Distinguished Alumni Awardees included three MetE Alumni: in 2003, Robert M. Shogren, (B MT 1964; M MT 1966); in 2004, Gordon R. Parker (M MP 1958); and, in 2005, Robert D. Macdonald (B MT 1937). Born in Billings, Montana on September 8, 1915, **Robert D. “Bob” Macdonald** had a long and distinguished career working in many capacities as a Metallurgical Engineer, a researcher, and a senior executive where he made many contributions to the technical fields of extractive

metallurgy in uranium processing, iron ore concentrating, nickel ore processing, and solar evaporation. Bob received his BS in Metallurgical Engineering from the Montana School of Mines in 1937 and a MS in Mining and Metallurgical Engineering from the Massachusetts Institute of Technology in 1940. Bob began his professional career as a Research Metallurgist for the General Engineering Company in Salt Lake City, Utah. In 1942, he moved to Columbus Ohio as a Research Engineer for Battelle Memorial Institute working on mineral processing problems primarily on iron and tin ores. From 1946 to 1951 Bob was the Chief Mineral Processing Engineer for the Watertown Laboratory at the Massachusetts Institute of Technology where he supervised a staff of 60 individuals working on methods of

extraction of uranium from its ores. During the decade of the 50's, Bob served as a Pilot Plant Supervisor for Chemical Construction Corporation in Ottawa, Ontario and later as Assistant Chief for the Mineral Processing Division of Battelle Memorial Institute in Columbus, Ohio. In 1960, Bob became the Vice President for Bonneville, Ltd. in Salt Lake City and held that capacity for three years, and then served as General Manager for Bonneville, Ltd. Division, Standard Magnesium and Chemical Company, also in Salt Lake City, Utah. In 1965, Bob was the Director of Research for US Smelting, Refining, and Mining Company in Midvale, Utah. Bob culminated his career as the Director of Metallurgy for Newmont Mining Company in Danbury Connecticut. He retired in 1983. During his career, Bob was instrumental in the design, operation, and development of one of the first pressure leaching projects for nickel and cobalt ores, which was a monumental achievement in hydrometallurgy. Married with six children, Bob has been an excellent donor to the Montana Tech Foundation with a scholarship established in his name. He is credited with frequently visiting campus and always remembering his alma mater.

Gordon R. Parker was born in Cape Town, South Africa, and as a youth became interested in Business and Law, particularly mining. This ultimately brought him to the United States, where he enrolled at the Montana School of Mines. He graduated in 1958 with a B.S. in mining engineering and in 1959 received his master's degree in mineral dressing engineering. He returned home for the next 16 years and worked in various technical and management positions with O'Kiep Copper Company and Tsumeb Corp., while working toward an MBA from the University of Cape Town. In 1966 he graduated and was named the Graduate School of Business Old Mutual Scholar. In 1975, he was promoted to managing director of both companies. In 1976 he received an honorary Engineer of Mines award from Montana Tech. In 1981, he became Vice President of Operations for Newmont Mining

Corporation and in 1985; he became Chairman, President and CEO. He also was awarded Montana Tech's honorary Doctorate of Engineering and was the commencement speaker. Because of his leadership, Newmont is one of the largest gold companies in the world today. He retired from Newmont in 1994 but continues to serve the mining industry as a consultant. He serves on the Board of Directors of three major mining companies. His endowed scholarship continues to raise money annually for students in mining, metallurgy and geology. Gordon and his wife Pam currently reside in Castlerock, Colorado.

In 1964, **Bob Shogren** received his B.S. from the Montana School of Mines and in 1966 an M.S. in Metallurgical Engineering from Montana College of Mineral Science and Technology. During these years, he went to work for the Anaconda Company in Great Falls and from 1966 to his retirement in 2000; Bob enjoyed a long career with Kaiser Aluminum in a variety of positions. He started as a product engineering manager and moved around the company learning its various facets. Bob was able to spend the last 15 years or so in critical positions and none more important than technical manager. Some of his major projects enabled Kaiser Aluminum to stay at the forefront of the aluminum industry. While he is now retired, he continues to serve the metallurgical/minerals industry in positive ways and has provided consulting engineering services to Valco Aluminum in Ghana, Africa, as well as the Todd Pacific Shipyards in Seattle. His devotion to Montana Tech is unending. Bob has contributed substantially to the metallurgical engineering department and the foundation and returned to campus to give seminars, hiring our students for internships, summer positions and permanent employment as well as recruiting. Professionally and privately, Bob has represented the college in the highest fashion. Bob's son, Paul graduated last year from Montana Tech. Bob and his wife Helen currently live in Newman Lake, Washington.

Homecoming Includes Alumni Recognition Awards

Alumni Recognition Awards honor alumni who graduated within the past 20 years and who are or have shown promise at being recognized professionally in their discipline. The Department typically works with the Advisory Board to name the awardees and is happy to receive nominees. Please contact Larry Twidwell (LTwidwell@mtech.edu; 406-496-4208) by June 1, 2006 for next year's considerations. The awards are given at the ceremonial dinner Friday night during Homecoming week which is usually in late September or early October. Homecoming festivities include a volleyball match Thursday night, the bed race and other games on Friday,

and, of course, concludes with a parade, the alumni vs. undergraduate flag football game, THE football game, and finally a dance. It's a fun time! Awardees in 2002 were Corby Anderson (M MT 1984) and Mike Garska (M MP 1985); in 2003 were Debbie Laney (M MT 1985) and Courtney Young (B MP 1984); in 2004 were Caroline Monaco (B MT 1984) and Todd Fayram (B MP 1983); and in 2005 were Doug McLeod (B MetE 1984) and John Cole (B MP 1984). Their biobriefs follow:

Doug McLeod received his Bachelors degree in metallurgical engineering in 1984 from Montana Tech. His 21 year career in the aluminum industry has led him

through various plant and corporate metallurgical, technical service, and planning roles, as well as leadership roles in Sales & Marketing. He is currently Director, Technical Services for ARCO Aluminum, Inc., a leading rolled can sheet producer headquartered in Louisville, KY and a subsidiary of BP Company North America, Inc. In his current role he is responsible for the Technical and Technical Service groups servicing more than 600 million pounds of sales. His role serves as the key link between ARCO's technical resources, its customers, its Logan Aluminum production joint venture and its R&D consortium. Doug and his 11 year old son Ian are outnumbered by the four beautiful women who graciously share their household – Jennifer, his wife of 17 years, Maggie, age 9, Kelsey, age 7 and the true head of household, Grace, age 4. They reside in Crestwood, Kentucky.

John Cole graduated in 1984 with a Bachelor of Science in Mineral Processing Engineering from Montana Tech. He joined Homestake Mining Co in 1984 at the McLaughlin Mine, starting as a Mill Control Room Supervisor and was later promoted to Shift Supervisor, participating in the start up and operation of the first commercial pressure oxidation plant for gold ore. In 1988 John joined FirstMiss Gold Inc. at the Getchell Mine as Chief Metallurgist. At FirstMiss he was involved in programming mill control systems, metallurgical accounting, operator training, and start up and operation of pressure oxidation plant. In 1992 John accepted the position of Process Operations Superintendent for Santa Fe Pacific Gold at the Lone Tree Mine and was project manager on a flotation plant built at Lone Tree. The flotation plant utilizes N2TEC, nitrogen blanketed flotation. Newmont Mining Corp. acquired Santa Fe in 1997 and subsequently John worked as Process Operations Superintendent at Twin Creeks Mine, Senior Process Engineer for Nevada, and Engineering Manager for Phoenix Mine Project and is currently Process Operations Manager for Lone Tree and Phoenix Mines. John is the recipient of Newmont Mining Corp. Chairman's Award and holds the patent on agitator design and pressure oxidation processing. Congratulations John!

Carolyn Monaco, known to most as Carrie, received her bachelor's degree in metallurgical engineering from Montana Tech in 1984. She currently works as manager of quality programs for U.S. Fuel in Columbia, South Carolina. Her focus is on corrective action effectiveness, quality oversight and general improvement in U.S. Fuel's corrective action process, and usage of CAPs across all of U.S. Fuel and Fuel Engineering, which has five locations in the United States. Carrie serves as deputy chair for the U.S. Fuel Quality Council, which includes product

assurance, supplier quality and fuel engineering quality. In her position, Carrie also identifies process changes and measures quality improvement effectiveness. In addition to her busy work life, Carrie is a member of AMS International, the American Welding Society, and the American Society for Quality. She is a founding member of the U.S. Women in Nuclear organization. She also actively supports several charities, including the Leukemia & Lymphoma Society and the Juvenile Diabetes Foundation.

Todd Fayram received his bachelor's degree in mineral processing engineering from Montana Tech in 1984. He currently works as consulting general manager for profile resources for the Watseca Mill, a 300-ton-per-day gold flotation and gravity custom mill for precious metals located at Twin Bridges, Montana. In this role, Todd has responsibility for the design, start-up and operations of a small custom precious metals mills. Projects include the revamp of the mill, improving recovery, developing cash flow, acquisitions, team development and completing environmental permitting. Current focus of the operation is on completion of environmental projects, mine procurement and development and funding. Todd also is currently the consulting metallurgist for Elkhorn Goldfields, a gold and copper flotation and gravity mill located at Elkhorn, Montana. In this position, Todd completes metallurgical testing and development of a 500,000-ounce gold and copper ore body, as well as develops all metallurgical flowsheets, cash flow models and operating scenarios. Todd and his wife Suzanne are parents to two children, Anthony and Tiffany, who have moved with him over the years to remote mine locations and supported his long hours of work. Anthony currently attends Montana Tech, and Todd's father, Burtis Fayram, also attended Montana Tech, making for three generations of Fayrams on our campus.

Debbie Laney was born and raised in Butte, the daughter of Dorothy Kelley and the late Harold A. Kelley. Debbie graduated with a Bachelor's Degree in Metallurgical Engineering from Montana Tech in May 1979 and with a Master's Degree in Metallurgical Engineering from Montana Tech in May 1984. Debbie started her career with Phelps Dodge/Morenci in 1979. While there, she worked as a plant metallurgist and shift supervisor in both concentrators and the dump leach plant. Upon leaving Phelps Dodge, Debbie returned to Montana Tech to complete her master's degree with a thesis titled "The Application of Solvent Extraction to Complex Metal Bearing Solutions." Upon graduation, Debbie headed to Nevada where she worked at the Alligator Ridge Gold Mine. At this plant she was the process engineer responsible for concept, design and construction of an

innovative plant to recover gold from carbonaceous ore using a low capital cost design of grinding in high pH, followed by a CIL circuit with high carbon concentration and low gold loadings. At the end of this mine's life, Debbie headed to Echo Bay's Cove/McCoy as chief metallurgist for a successful construction and startup of both an oxide gold/silver circuit and a polymetallic flotation plant and heated concentrate leach. After successful startup and operation, Debbie headed to Jerritt Canyon as metallurgical/technical superintendent at a chlorination and roasting facility. Becoming active in the Nevada Mining Association's Education Committee, Debbie wrote the script and developed a teachers' video and workbook titled "High School Chemistry at Work in a Nevada Gold Mine." Accepting a position as metallurgical manager for Rayrock Mines, Incorporated, and Debbie obtained overseas experience in gold mine permitting in Costa Rica and a bio-oxidation plant for processing copper ore in a high chloride environment via heap leaching in Chile. Debbie also spent a great deal of time in developing biooxidation processes for gold deposits in Nevada. After Rayrock, Debbie worked as a consultant for Oxidor Corporation on biooxidation projects for clients in Africa. Currently Debbie is heading up the process business development unit at Barrick Goldstrike in Elko, Nevada. BGMI has started to perform custom milling of outside ores and concentrates in addition to processing their own material at the 16,000 tpd roaster and 19,000 tpd autoclave facilities. Many small miners were left without processing facilities with the closure of so many smelters in the United States. Debbie has also found time to become a licensed professional engineer in the state of Nevada. For the last two years, she has served as president of the Women's Mining Coalition and for the last three years has visited Washington, D.C. to talk to members of Congress and the Senate about the importance of mining in the U.S. Debbie has also remained active as a Tech supporter through the hiring of summer and full-time engineers from Montana Tech and by sitting on the Metallurgical Engineering Advisory Board for Courtney Young. Debbie also is active in many activities in the community of Elko. Debbie and her husband Michael, who works in plant maintenance at the Cortez Gold Mine, have both remained in the mining industry throughout their careers. Their son Spencer is working as a diesel mechanic at the Cortez Gold Mine after serving as a corporal in the U.S. Army 82nd Airborne and receiving a medal for courage under fire. In their spare time, Mike and Debbie enjoy six grandchildren, hunting, fishing, boating, rock collecting, painting, sculpting and silver-smithing.

Courtney Young was born May 2, 1962 in Great Falls, Montana. He is a 1980 graduate of Great Falls High School. His love for the sciences brought him to Montana

Tech. Mineral processing engineering was Courtney's career choice due to the high level of chemistry involved, as well as an equal mixture of math and physics. Courtney graduated in 1984 with honors, earning a GPA of 3.66. After exploring his options, Courtney decided on pursuing his master's degree in mining and minerals engineering at Virginia Tech. He earned a 3.75 GPA and in 1987 successfully defended his thesis on "Non-stoichiometry of Chalcocite (Cu₂S) in Water-Xanthate Systems." His thesis was really a dissertation and led to five publications as well as the development of an electro-chemical technique for quantifying the amount of adsorbed surfactants at mineral surfaces. The technique led to three other students eventually obtaining their advanced degrees, including one PhD. Soon thereafter, Courtney began to pursue his PhD at Virginia Tech in much the same area as his master's, but extended his studies to coal pyrite. While enjoying the splendor of the East Coast, Courtney met, dated, courted and became engaged to Miriam. They married in Roanoke on September 24, 1988 (they just celebrated 15 years!). The couple decided to leave for Salt Lake City for him to pursue his PhD in metallurgical engineering and for Miriam to pursue her master's in nursing with an emphasis on nursing education. They enrolled at the University of Utah in January 1989. Courtney's subject matter was much to his liking and was significantly different from his master's. It involved using various Raman and FT-IR spectroscopic techniques to analyze and quantify the take-up and polymerization of fatty acid collectors on gangue minerals at elevated temperatures, particularly oleate on calcite. Courtney defended his dissertation in April 1995 and has published five other papers from that work. Prior to that, in January 1993, Courtney took a post-doctoral position in metallurgical engineering at Montana Tech. In January 1995, Courtney became a faculty member of the department, replacing Dr. Gordon Zucker as an assistant professor. In September 1996, Courtney was promoted to associate professor and simultaneously was named the ASARCO Distinguished Professor. Due to the retirement of Sam Worcester, Courtney was named department head in March 1998. Three years later, in September 2001, Courtney was tenured and promoted to full professor. Through his career, Courtney has been active in professional societies, namely TMS and SME. Almost every year, he has presented papers based on his research efforts in cyanide recycling and destruction, acid-rock drainage, mercury amalgamation, sulfate sequestering, spent potliner remediation, arsenic speciation and numerous projects through Montana Tech's undergraduate research program. These research efforts have culminated in more than \$1.5 million. Courtney has made such substantial contributions that the societies have recognized him in many capacities: SME's MPD Young Engineer Award, TMS and SME Young Leader Intern, ASM and

TMS Student Paper Contests, TMS Plenary Speaker for Cyanide Symposium, SME and TMS session chairs for more than 25 sessions, SME and TMS chair for organizing conferences such as Hydro 2003, Cyanide 2001, Adsorption, Ion Exchange and Solvent Extraction 1999; Recycling 1999, Minor Elements 2000 and JD Miller Symposium in 2005. Other accolades include being key reader for two mineral processing journals: European Journal of Mineral Processing and Environmental Protection and International Journal of Mineral Processing, being ICMR 2001 Symposium Plenary Speaker at Akita University in Japan, giving more than 10 guest and invited lectures to the public and governmental communities on cyanide and other environmental issues, but most importantly, being named by his fellow campus colleagues for this award as well as the Couer d'Alene Faculty Achievement Award in 1998 and the Anna and Rose Busch Award this past graduation in 2003. Courtney has been a member of the Montana Tech Foundation board for three years and serves as faculty representative. He has been active with the Foundation's gift acceptance committee as well as the finance committee. Courtney can almost always be found one day a week participating in the phonathon. Courtney has been generous financially over the years as well, averaging about \$500 a year in donations. He has been an active member of the Butte community as well by serving as a judge in a number of competitions and as a coach for two girls' softball teams. For the campus, in addition to serving as department head for metallurgical engineering, Courtney serves as chair of the undergraduate research committee, and has been on a variety of other committees, including Faculty Senate, Traffic/Parking Committee, Marketing/Promotion Committee, Internship Committee and Retention Committee. Over the years, Courtney has worked for several companies, including Duval Corporation, Chevron Resources, Pitson Coal, and, of course, numerous consulting efforts through Montana Tech's CAMP program and various personal endeavors. Courtney and Miriam have two daughters, 13-year-old Jessica and 8-year-old Jamie.

Mike Garska received his BS in Mineral Process Engineering from WVU in 1982 and his MS in Mineral Process Engineering from MT Tech in 1985. He has 18 years experience in the mineral industry ranging from bench-scale research and development, pilot plant scaleup, plant engineering and design, through plant startup and operation. He is currently a Lead Process Engineer with Imerys Pigments and Additives Group in the kaolin industry where he has developed and implemented novel technologies in selective flocculation, waste recovery and co-product recovery. Previous to that, he spent 6 years at North Carolina State University's Minerals Research Laboratory as a Senior Mineral Processing Engineer and 5 years at Western Energy Company as a Mineral Processing Engineer. There, he was responsible for research, lab work, pilot plant work, process development, engineering design, and plant audits for plants producing feldspar, mica, phosphate, glass sand, high purity quartz, pyrophyllite, iron ore, heavy minerals, bentonite, calcium carbonate, garnet, gold, coal, removing sand from tobacco wastes, and recovering precious metals from computer and dental wastes. He developed new applications for column flotation, hydraulic classification, steam drying, and ultra-fine grinding. He has authored numerous papers and reports on process technologies, most of which are company proprietary. Mike has been a member of SME since 1983 and has been active at both the local and national level. He has several patent applications pending and holds one patent for selective flocculation. He is a registered Professional Engineer and is active in professional organizations. Currently he is chairman of the Georgia section-SME, serves as a member of the SME Foundation Board of Trustees, and is a member of the ABET accreditation committee. He has been a past chairman of the Carolinas section-SME, past chairman of the national GEM committee, past chairman of the Southeast Regional Section Representatives, and past chairman of the Georgia section GEM committee. He has also participated with the Dept of Energy as a technical reviewer for the Mining Industries of the Future program.

Other Campus News

Accreditation. In October of 2004, ABET paid the campus a visit and notified Montana Tech in last July that all programs in the School of Mines & Engineering were accredited. The year before, all of Montana Tech received regional accreditation from Northwest evaluators. Finally, just one month ago, the Nursing program was notified that it too was being accredited. However, all evaluators listed concerns that need to be addressed as soon as possible and definitely by the time the next visits occur.

Full Deans. VCAAR Susan Patton worked hard with Board of Regents to obtain funds to have the Deans named as full Deans and thus eliminate their dual responsibility as department heads. This dual responsibility was often thought to be a conflict of interest. Diane Wolfgram was named interim Dept Head of Mining Engineering in place of Pete Knudsen. Likewise, Tim Kober was named Dept Head of Business and Information Technology in place of Doug Abbott and Doug Cameron was named Dept Head of

Chemistry in place of Doug Coe. No new deans were named.

Health Care Informatics. The HCI program graduated its first students. The program is the first of its kind across the country and was created via a collaboration of Montana Tech and St. James HealthCare. Doug Cameron was named its Dept Head (along with Chemistry as just noted). Ray Rogers was the lead person at Tech and Pat Dudley at St. James. The National Health Care Informatics Center also named Ray Rogers as its director. Tony Campeau was named to replace Ray in the Admissions Office.

Career Services. Career Services recently held its 4th Annual Career Fair. Over 80 companies set up booths to show their wares. Many companies stayed around to conduct interviews for permanent and internship placement. If your company was not represented at the

Career Fair, you should contact Suzanne Andrews at sandrews@mtech.edu or 800-445-8324 to inquire. A search is underway to replace Stacey Aguirre who retired to take a position in Glendive.

Bioengineering. Due to NSF funding from the OR&GS, a MS bioengineering program was created. A search landed Dr. Rajendra Kasinath to head the program. He has expertise in synthetic bone materials and is very interested in nanoscale materials as well. The program is currently incorporated in the Environmental Engineering Department.

Biology. Dept Head Rick Douglass has done extremely well garnering research for his department. He currently commands near \$1.5M in research annually which has allowed him to hire Martha Apple and recently Marissa Pedulla. Martha has expertise with plants and Marissa with biophytes which has nanotechnology implications.

Curricular Changes

The department has modified its curriculum to meet the changing needs of industry and interests of students and, of course, to satisfy ABET accreditation standards and criteria. As shown by the new program below, some courses have been renamed to emphasize “processing.” Some courses were also restructured so their credit requirements could be increased whereas others were given the new prefix “M&ME” to designate courses that have a significant amount of “materials” content in them. Most noteworthy are (1) the split of the old 3-credit Heat and Momentum Transport course into two 2-credit courses MetE 2500 and M&ME 4500 and (2) the increase of MetE 3020 Pyrometallurgy from 2 to 3 credits and it being

renamed and renumbered to M&ME 4020 Processing of Elevated Temperature Systems so that cement manufacture and other material systems could also be taught. This better shows prospective students what we have to offer and was needed to address concerns about our name change to Metallurgical & Materials Engineering four years ago (Note: Yes, it is coincidental that a bar on Main Street in uptown Butte bears a similar name!). At the same time, “METE” was retained to show that we still and always will honor our heritage in mineral processing and extractive metallurgy. All of these changes were duly accepted by ABET and hailed by the advisory board as well as other constituents including the students and CAMP.

Freshman Fall Semester

CHEM 1056 General Chemistry	3
CHEM 1136 General Chemistry Lab I	1
ENGL 1046 English Composition	3
MATH 1520 Calculus I	3
MIN 1010 Intro. to Eng. Calc. & Problems	3
Humanities Elective	3
Total	16

Freshman Spring Semester

CHEM 1066 General Chemistry	3
CHEM 1166 General Chemistry Lab II	1
MATH 1530 Calculus II	3
METE 1940 Freshman Seminar	1
PHYS 1046 General Physics-Mechanics	3
Humanities Elective	3
Social Science Elective	3
Total	17

Sophomore Fall Semester

ECON 2606 Principles of Economics	3
ENGR 2050 Statics	3
MATH 2510 Calculus III	4
METE 2320 Processing of Particulate Systems	2
METE 2340 Particulate Processing Lab I	1
PHYS 2076 Heat, Sound, & Optics	3
PHYS 2096 Physics Laboratory	1
Total	17

Sophomore Spring Semester

MATH 2236 Differential Equations	3
METE 2330 Design of Particulate Systems	2
METE 2350 Particulate Processing Lab II	1
METE 2500 Transport Phenomena & Design	2
M&ME 2510 Intro to Materials & Phys Met	2
M&ME 3220 Met & Mat Thermodynamics	3
PHYS 2086 Gen. Phys.-Elect, Mag, & Wave	3
PHYS 2106 Physics Laboratory	1
Total	17

Junior Fall Semester

CHEM 3356 Physical Chemistry	3
CHEM 3376 Physical Chemistry Lab	1
ENGR 2530 Electrical Circuits & Power	3
ENGR 2550 Electrical Circuits & Power Lab	1
MATH 3316 Statistics	3
METE 3400 Mass Transfer & Chem Kinetics	3
M&ME 3510 Fundamentals of Materials	2
M&ME 3530 Microstructural Interpretation	1
Total	17

Junior Spring Semester

ENGR 3210W Scientific and Technical Writing	3
ENGR 3350 Mechanics of Materials	3
ENGR 3360 Mechanics of Materials Lab	1
M.EC 3630 Eng. Economy & Financial Mgmt.	3
M&ME 3520 Mat Engineering & Design	2
M&ME 3540 Materials & Phys. Metallurgy Lab	1
M&ME 4500 Adv. Transport Phen. & Design	2
M&ME 4710 Mat Characterization & Analysis	3
Total	18

Senior Fall Semester

ENGR 4040 Professional Engineering	1
METE 4010 Processing of Aqueous Systems	3
M&ME 4020 Processing of Elev Temp Systems	3
METE 4050 Aqueous & Elev Temp Proc Lab	1
M&ME 4620 Ceramic Materials	2
M&ME 4750 Env Degradation of Materials	3
METE 4920 Senior Design I	1
METE 4940W Senior Seminar	1
Technical Electives	3
Total	18

Senior Spring Semester

M&ME 4230 Multicomp Phase Diagrams OR	
M&ME 4410 Met & Mat Flowsheet Design	3
M&ME 4510 Process Instrument & Control	3
M&ME 4860 Polymeric Materials	2
METE 4930W Senior Design II	2
Technical Electives	6
Total	16

Personal News of Alumni and Friends

Wilfred E. Nagel (B MT 1950) celebrated his 80th birthday in Butte on May 15th with his daughter Pamela Nagel organizing and hosting. Wil resides in Bend OR with his wife Jean.

Robert D. Macdonald (B MT 1937), lover of classical music, distinguished alumnus and scholarship donor, celebrated his 90th birthday and was given a surprise party

that included a live band playing the Cicada and Fugue from Vidor's 5th Organ Symphony. He also celebrated the one-year birthdays of his two great grand-daughters, Ellie Mae Nesline and Daisy Jo Chamberlain, as well as his 14th wedding anniversary to Eleanor. Robert and Eleanor reside in Golden CO and both were widowed nearly 15 years ago. Eleanor was married to *Al Schlechten* (B MD 1939) at that time. Al was a professor at CSM.

MetE Alumni and Friends Obituaries

We all hate this section because we simply do not like to lose our family and friends. Unfortunately, we have several deaths to report and need to let you know in case you did not hear yourself. If we have missed anyone, please let us know. We do our best to make sure the obituary is as unedited as possible.

Gordon Frederick Ziesing of Whitehall died suddenly Saturday February 22. He was born June 28, 1936, in Newark, N.J., where he was raised, the son of German immigrants. After graduating high school, Gordon traveled by train to Butte to attend the School of Mines. He graduated with a master's degree in metallurgical engineering. While attending college, he fell in love with a young nursing student, from Carroll College, named Lyndie Hill, of Billings. They were married Sept. 14, 1963. After graduating from the School of Mines, Gordon served in the Army through the Berlin crisis. He returned to Butte and received his master's degree in mineral

processing. Prior to attending graduate school at the University of Wisconsin, he spent a brief time at New Jersey Zinc in New Jersey. Gordon also worked at Eagle Pitcher Mining Co., Miami, Okla., and then moved back to Butte, where was a professor of mineral processing engineering for 10 years and served five years as head of metallurgy at Montana Tech. He performed the feasibility study for Golden Sunlight Mine, Whitehall, for processing and mine development and served as mill superintendent and chief metallurgist. Gordon also produced the feasibility study of mining projects for Western Energy, Butte, and consulted for many companies on projects in the United States, Canada, Mexico and especially enjoyed his work in the Yukon. Gordon retired and devoted his last years to his family and his relationship with God. Gordon is survived by his wife, Lyndie; children and their spouses, Rolf and Stephanie Ziesing of Westerly, R.I., Renate and Rob Leipheimer of Butte, Konrad and Sarahlee Ziesing of Minot, N.D. and Greta and James Treser of

Whitehall; grand children, Alexandra Ziesing, Gordon Ziesing, Zachary Ziesing, Heide Leipheimer, Robbie Leipheimer, Hannah Ziesing, Kaleb Ziesing, Joseph Ziesing, Karl Treser and Korinne Treser. He was preceded in death by his mother Kunigunde Ziesing, father Karl Frederick Ziesing, and granddaughter Gretchen Ziesing. Gordon was a great man and made a positive difference in so many lives. He loved God and remained faithful to him. He was a wise and generous man with a kind and loving nature. Gordon lovingly made sacrifices for his family and friends. He was a great teacher of life and love. Gordon liked to operate his ham radio, play with his grandchildren, listen to music and spend time out side. He was creative in the garden and inventive in the kitchen. Gordon had a quiet passion for trains and art. Gordon touched so many lives in so many ways he could not even imagine. Those who knew him loved and admired him are all truly blessed to have been able to spend time with this man who had shared so much of him self with others and had so much yet to give. He was more than he ever knew and he will be sadly missed by all.

Thomas Reopelle, “A great oak has fallen and left a mighty space in the forest.” Thomas John Reopelle of Butte died near Flat Iron Mountain in the Beaverhead National Forest about 2:30 p.m. Sunday, March 2, 2003 while enjoying the outdoors as he did best. Tom's relatives have received ample evidence of what they already knew: He was sincere, strong and kind with a circle of loyal friends who have passionate memories of the young man they called “Gunner.” The greatest of these memories is best mentioned as his “infectious smile.” Tom, who was a general contractor and an avid, well-known snowmobile racer, shared his energy and enthusiasm in all aspects of his life: his racing, his family, his business and his close friends. A man whose conduct proceeded from goodwill and an acute sense of propriety, Tommy was born July 14, 1972, in Butte to Kathy E. Osier and Thomas P. Reopelle. (Tommy's father may better be known as his lifelong best friend.) Extremely proud of his Montana roots and heritage, Tommy was raised in Elk Park and graduated from Butte High School in 1990. He was the Montana High School Weight Lifting State Champion for the 181 pound all class divisions and also received best lifter for the 165 pound and up class. In 1995 he attained a bachelor's degree in metallurgical engineering from Montana Tech and shortly after moved to Nevada where he spent a short time working as a metallurgist. In 1996 Tom moved back home to Butte and married his good friend, Michele A. “Mickey” Quilici on Sept. 14, 1996, where he resided at the time of his death as a contractor. Tom and Mickey had two beautiful children together, Tanner Patrick Reopelle, 3, and Tyler Joseph Reopelle, 1. “How we shall miss him.” Tom is survived by his wife, Mickey; their children Tanner and Tyler; mother, Kathy

Osier, his father and family, Thomas and Heidi Reopelle, Jim and Jordan Schofield, his sibling and her husband and good friend, Mandie and Rex Leipheimer; close friends and cousins, Bob and Jamie Reopelle; grandmother, Rose Reopelle; mother-in-law and father-in-law, Georgia and Joe Quilici; brother-in-law and sister-in-law, Joe and Sandy Quilici; brother-in-law, Bobby Quilici; sister-in-law, Theresa NewBreast; sister-in-law and brother-in-law, Andy and Paul McCaughey; several aunts, uncles, cousins, in-laws and outlaws. Religiously traveling the snowmobile racing circuit with his father by his side, Tom was presented with several awards, including the honoree Sportsmanship Award, the Semi-Pro 600 Snow-cross Class Champion, and all series Semi-Pro High Point Champion in the 440, 600 and Modified divisions. For the past two years he had been working his way through the pro ranks of the Rocky Mountain Snow-cross Circuit, acquiring several additional awards. His improvements were instrumental and show with each passing race. As his father said, “It wasn't so much the winning, but more so the camaraderie of the entire event.” He was so relaxed when he was getting prepared for a race. Even though he was very well fit to take all classes, it was Tom's modesty that led him to believe that he needed to capture the respect of his fellow racers first. A very driven and focused man, once Tom was told or read something, he never for got it. His recall was instantaneous. Tom loved to teach from his experiences. With his quick, inquiring mind, he would learn all he could about a subject and then share it with others. His sense of ethics was so exemplary, if only we could emulate. Tom represented a true gentle man, in every definition of the word. He was never at a loss for things to do and couldn't sit still for 30 seconds. His greatest treasures were his family and friends. Time spent with his two sons became more precious with each passing year. There was just so much he needed to teach them. Tom's greatest sadness was that his tragic accident cut that time entirely too short. A memorial trust fund in the name of Tanner and Tyler Reopelle is being established at US Bank Corp Piper Jaffray, 1940 Dewey Blvd., Butte, MT. 59701 c/o Joe McClafferty.

In Memory of Tom Reopelle: Tom – three years ago we met you. Big Tom and Bobby when you built our house on Moulton Reservoir Road. For us, you became more than a builder...you were patient and helpful...you were always smiling and full of good things to say...you were a problem solver and most importantly, you became a great friend. We will always remember you as a man, who in such a short time had reached and blended such a wonderful combination of wit, gentleness, compassion and sincerity into his life and his relationships with others. You will truly be missed by all who were so very lucky to have been a part of your life. Our hearts are filled with sadness for your wonderful wife, father, sons and family,

but we know that Heaven has welcomed you with open arms. We see you now in a bigger picture, contributing the spirit and wonderful values you provided all of us in a trouble world that could surely use your input and guidance. So we will miss you Tom, but we know in our hearts your beautiful gifts to all of mankind are just beginning. "We were born to die and we die to live. As seedlings of God, we begin to blossom on earth and fully flower in Heaven - Russell Nelson" Love, The Jones Family.

Dr. Frank W. Bowdish of Pasco died on December 13, 2002. He had suffered from heart disease for several years and passed away at home in his sleep. Frank was born June 5, 1917 in Kalispell, Montana. He married Virginia Jones July 8, 1944 in Peoria, Illinois, where he worked for Caterpillar Tractor. During their marriage they raised four children. The family lived in several locales in the United States, including Boston, MA, Duluth, MN, Lawrence, KS, Socorro, NM and Reno, NV. They also spent two years in Paris, France, from 1956-58. After retirement, he and Virginia moved to Pasco, WA to be closer to their grandchildren. He earned his bachelor's degree in Mineral Dressing from the Montana School of Mines in 1939, his master's degree from the Massachusetts Institute of Technology in 1943, and his Ph.D. in chemical and metallurgical engineering from the University of Kansas in 1956. During his career, he was a researcher for IRSID, a private French research and development company, taught chemical engineering at the New Mexico Institute of Mining and Technology, and most significantly, created and taught in the chemical engineering department at the Mackay School of Mines at the University of Nevada until his retirement in 1981. He was named Montana Tech Distinguished Alumni during graduation ceremonies there in May of 2002. Independently, he also was an inventor and held several patents relating to processes for refining river sand into material suitable for glass making. During World War II, he worked in two MIT labs on the Manhattan Project. When asked what his most important accomplishment was during this period he indicated that he had cast the first crucibles able to withstand the temperatures required to hold molten plutonium used for building the first atom bombs. He was happiest when working in a research environment. Even in retirement he continued his work at Viatec Recovery Systems in Richland, WA. He is survived by his four children, Caroline Bowdish of Pasco, Harriet Ullman of Newton, MA, Dana Bowdish, of Long Beach, CA, and Keith Bowdish of Spokane, WA. He also leaves five grandchildren, Colin and Cameron Stewart, Catherine and Samuel Ullman and Matthew Bowdish. Memorial services were held at the Community Unitarian Universalist Church, 619 W. Albany Avenue, Kennewick, on January 18, 2002 at 2 p.m. Contributions in his memory may be

made to Frank Bowdish Chemical Engineering Endowed Scholarship Fund, Mackay School of Mines, University of Nevada, Reno, Nevada 89501 or Frank Bowdish Memorial Scholarship, Montana Tech, Butte, MT 59701.

Oscar Frank Tangel, cherished husband, father, grandfather, and great-grandfather passed away from heart failure, peacefully in his sleep at home on February 9, 2005 at age 95. He was preceded in death by his beloved wife, Dorothy, of 65 years. Oscar was born in Philadelphia, PA to Anna Amon and Oskar Frank Tangel on January 11, 1910. He attended grade school in Brooklyn, NY. At age 13, Oscar moved to Cranford, NJ where he graduated from the Cranford High School in 1928. It was during those years that he fell in love with his high-school sweetheart, Dorothy, whom he married nine years later. Oscar attended Lafayette College in Easton, PA graduating in 1932 with a Bachelor of Science degree Mining Engineering, Magna cum Laude. He was a member of the Phi Beta Kappa and Phi Kappa Tau fraternities. After graduating, Oscar was given a commission as Second Lt., in the Infantry, US Army Reserve Corp. After one year of futile efforts to find work (the first half of the 1930 was the period of the Great Depression), Oscar attended the Montana School of Mines where he graduated with a Master of Science degree in Metallurgical Engineering. Before graduation, the Institute of International Education offered Oscar a two-year fellowship. Oscar chose to attend the oldest mining school in the world, Freiberg Bergakademie in Freiberg, Saxony, Germany. Oscar was fluent in German because his parents both spoke German and his mother made him practice writing German script every Saturday morning. Before completing his fellowship at Freiberg in 1935, Oscar was offered a German fellowship to obtain a Doctorate degree. He declined the German fellowship feeling that opportunities for work in the United States were improving and he had no desire to become a professional" student. When Oscar returned to the U.S. he worked for seven different mining companies in the western U.S. and one mining company in Mexico until September 1941. Oscar and Dorothy were married in Berkeley, CA on February 28, 1936 between mining jobs. Oscar worked as an Assistant Mill Superintendent for Fresnillo Company, located in Fresnillo, Zacatecas, Mexico. Because of the lack of good hospitals in the area, Dorothy returned to the U.S. to give birth to their first two children. In 1941 Oscar was offered a job as a Research Engineer with Battelle Memorial Institute, a non-profit research organization. He re-entered the United States on Sept. 1, 1941 with his wife and two children, moving to Columbus, Ohio. Oscar's ten-year commission with the Army Reserve Corp. was due to expire in June 1942. However, in January 1942, Oscar was ordered to active duty, to report at the Aberdeen Proving Grounds, in Maryland. Oscar stated, "Why Uncle Sam

went through all the trouble of choosing our anniversary date for that occasion, I will never know." In May 1942, Oscar and his family were transferred to Washington D.C. where he began work in the Research and Development section of the Office Chief of Ordinance at the Pentagon, which was still under construction. From May 1942 until September 1945, at which time Oscar's tour of active duty ceased, he served as Chief, Loading Sub-Group, Production Engineering Section, Ammunition Division, Office Chief of Ordinance, Army of the United States. In March 1943 Oscar and Dorothy's third child was born. After retiring in 1945 as a Captain in the United States Army, Oscar returned to Battelle as Assistant Supervisor, Minerals Beneficiation Division. Subsequently, he became Technical Advisor for the Metallurgy Department. In 1966, Oscar accepted a job offer from Newmont Mining Corporation in New York City as a consultant. Oscar and his family made Greenwich, Connecticut their new home and Oscar became a commuter. In 1969, Oscar became Vice President of Newmont Exploration Limited, a subsidiary, and in 1972 advanced to Vice President of Research and Development for Newmont Mining Corporation. Oscar retired from Newmont Mining Corporation at the end of 1977. He was requested by Newmont to become a consultant and did so for five years. Oscar became a member of several Board of Directors and remained on those Boards until he retired at the end of 1977: Atlantic Cement Company; Newmont Exploration Limited; Idarado Mining Company; Tsumeb Corporation; Foote Mineral Company; Magma Copper Company; and Smelter Control Research Association. In 1995, Oscar and Dorothy moved from their Greenwich home to Goleta, CA where their son, Robert, and his family reside. Oscar is survived by his three children, Robert (Sharon), Richard and Joan; four grandchildren, Tamara (Joel), Andy (Jennifer), Elizabeth (Michael) and Tawnya (Bill); and eight great-grandchildren, Jeremy, Kaitlyn, Branden, Kyle, Jessica, Julia, Jaidyn and Abigail. Oscar will be greatly missed by all who knew and loved him throughout his wonderful life. Memorial contributions can be donated to the Salvation Army Corps. Community Center, 4849 Hollister Ave., Santa Barbara, CA and the Visiting Nurse & Hospice Care of Santa Barbara, 222 E. Canon Perdido, Santa Barbara, CA.

Bernard 'Barney' McDonald died Sunday, July 4, 2004 at the age of 80. Barney was born Feb. 15, 1924, in Anaconda, Montana to Hugh T. and Catherine "Kate" (Sullivan) McDonald. He graduated from St. Peter's High School in 1941 and the Montana School of Mines in 1947. He served in the Navy during World War II from 1944 to 1946. Barney worked for the Anaconda Company from 1947 until his retirement in 1982. He married Ruth T. Spelman November 24, 1962, in Anaconda. Barney was active in numerous Anaconda civic, veterans' and religious groups, including the Anaconda Catholic Community.

Barney was preceded in death by his parents, sister Catherine and brothers Hugh, John and Pete. Survivors include his wife Ruth of Anaconda; son, Michael of Anaconda; daughter, Cathy Desjardin of 'Spokane, Washington'; and numerous cousins including Francis "Tiny" Sullivan of Anaconda.

William D. Trethewey of Minneapolis died in March of 2003 at the age of 87. He is survived by his wife Rita of 60 happy years; his son, Richard; daughter, Donna & son-in-law James LeJeune. Also survived by his nephew, William (Raynee) Bretherton of St. Cloud and great-nephew, Jeffrey (Julie) Bretherton; great-great-niece, Annie of Albany, MN; brother-in-law, Ellsworth Cardey and nephew, Roy (Dee) Cardey of Tacoma, WA. He will be missed by step-grandchildren, John LeJuene, Heather (Jeffrey) Zappo, Sara (Derek) Schmitt and step-great-grandchildren, Helena and Anthony. He was a research scientist at the U of M for 35 years and last survivor of the group of metallurgists who developed the taconite process. Member of the VFW, American Legion and the Military Officers of America, and recently inducted into the Engineer Officers Hall of Fame. For many years, he was a volunteer at the Armed Forces Center at the International Airport. He served during WWII in North Africa and Europe, where he commanded an Army Engineer company. He remained in the Army Reserve for 27 years, rising to the rank of Colonel. He was born and raised in Butte, MT, and was a graduate of the Montana School of Mines (B.S., 1940; M.S., 1942).

Henry Albright passed away October 25, 2003. Henry was residing in Bishop California at the time of his death. He obtained his Bachelor's degree in Metallurgical Engineering in 1952.

Andre Rey passed away on February 22, 2002. Andre was residing in Saddlebrook, New Jersey at the time of his death. He received his Bachelors and Masters degrees from Montana Tech in Metallurgical Engineering in 1951 and 1958 respectively.

James "Jim" Lee Owings of Spokane, WA, passed away May 15, 2005 at the age of 76 in his home after a long and courageous battle with lymphoma. Born and raised in Great Falls, Montana, he was the only son of the late Harry and Gladys (Huston) Owings. Jim was married 57 years to Virginia (Brown) Owings and was a loving parent to three children, James Lee Owings Jr. (Dennise) of Oregon, Steven T. Owings (Kimberley) of Ohio, and Beverlee O. Millard (David) of Spokane, WA, all surviving. He will be dearly missed by his six grandchildren, Griffin J. Owings, James L. Owings III, Kelly C. Owings, Wesley D. Millard, Lauren M. Millard and Anne C. Millard. He was predeceased by his sister, Jean Mulchahy and her husband,

Elmo, and is survived by his sister, Iva June Barber and her husband, John. After graduating from Great Falls High School and serving in the United States Navy, he attended the Montana School of Mines in Butte, Montana, where he graduated in 1952 with a degree in Metallurgical Engineering. He then started his career with the Anaconda Copper Mining Company. Over 28 years of service, he held a number of engineering, and management positions in the Great Falls and Anaconda operations and the Butte corporate offices. His last five years with the Anaconda Company were as the Plant Manager of the Great Falls Copper Refinery. He then worked for the Inspiration Copper Company in Claypool, Arizona and the Phelps Dodge Copper Company in Morenci Arizona and El Paso Texas, where he retired after ten years of service. He completed his career by consulting in the copper industry for a number of years. These contracts took him around the world and afforded him many adventures, the highlight of which was a weeklong journey down the Amazon River. Jim was an avid sport enthusiast and enjoyed playing golf. He followed all sports on the Professional and Collegiate levels and particularly enjoyed watching his children and grandchildren compete on the youth sport, Jr./Sr. High School, and collegiate levels. His family and many friends will miss his faithful support, love for the game, and warm humor at these events. Donations can be made in his memory to the Lymphoma Research Foundation, 111 Broadway 19th floor, New York, New York 10006.

Rollien R (Ray) Wells was born in Pendleton, Oregon, to James R. and Ora Pearl (Cole) Wells on August 16, 1915. He went to grade school in Langdon, Alberta, Canada and Mountain View School, Lewisburg, Oregon and attended high school at Cottage Grove in Joseph, Oregon and graduated from Anaconda High (Montana) in 1932. (Eleventh in class of 172.) In summers of 1931-36 he worked at the State Game Farm, Warm Springs, Montana for 35 cents an hour, 10 hours a day, 6 days a week. This allowed him to save sufficient money for tuition and books, and by living at home, was able to register at Montana School of Mines in Butte, Montana. He received a Bachelor of Science degree in Metallurgical Engineering in 1936, (second in class of 17). He married his high school sweetheart, Carnelia Frances Visser, January 1, 1938. After graduation, Wells, worked for the Anaconda Copper Mining Company as a laborer in the zinc plant, chemical analyst, Assistant Zinc Plant Research Engineer and Gas Engineer. In November 1938 he was employed by the Utah Copper Company at the concentration plant at Magna, Utah. For the next four years he held positions as flotation operator, chemical analyst, and flotation research engineer. In August 1942 he joined the federal Bureau of Mine's Salt Lake City laboratory as an assistant metallurgist and was recognized for his research in copper and cobalt flotation and for his writing ability. In 1948 he

moved to Albany, Oregon laboratory where he headed the Ore Dressing Section until 1950. He then became Station Superintendent and Director of Metallurgy Research at the Bureau's Alaska unit. For a four-month period in 1957 he was the Acting Director of the Alaskan operations. In 1959 Wells transferred to the Bureau's Washington DC headquarters and during the next 13 years served in a series of increasing responsible positions including Director of the Bureau of Mines. Later he served in line positions: Assistant Chief Division of Metallurgy, Deputy Assistant Director of Research (Mining, Metallurgy, Coal, Petroleum), Chief Division of Metallurgy (manager of programs at seven Research Centers). He was the author of more than 60 published technical reports and numerous "in house" reviews and advisory papers. In 1970 he completed a two-month assignment as advisor to the Australian Government. His report served as the basis for establishment of Commonwealth Scientific and Industrial Research Director at the Albany Metallurgy Research Center March 1972 until his retirement June 30, 1978. From 1978 until 1992 he was in the cast of sixteen plays at the Linn Benton and Albany Civic Theatres. He and his wife have traveled extensively in the United States and Canada and have made visits to Australia, New Zealand, Fiji, Cook Islands, Norway, Britain, Holland, Belgium, France, Austria, Italy, Switzerland, and South Africa.

Koehler Sheridan Stout died Tuesday evening in a Butte hospital. He was born Sept. 1, 1922, in Deer Lodge, to Ernest L. and Katherine L. Stout. He attended grade school in Helmville and graduated from Powell County High School in Deer Lodge in 1940. He began his education at the Montana School of Mines in 1941. In 1943, he enlisted in the Army and served in the European Theater of Operations in England and Germany and was discharged in 1946. He continued his education at the Montana School of Mines and graduated with a degree in mining engineering in 1948 and received a master's degree in geological engineering in 1949. In 1985, Koehler was awarded a degree of Doctor of Engineering (Honoris Causa), by Montana Tech and the Montana University System. On May 21, 1950, he married Phyllis Storer of Walkerville and spent the next two years living in Dover, N.J. Koehler returned to Butte in 1952 and began his long teaching career at Montana School of Mines, now Montana Tech. He held various titles such as the chairman of the Engineering College, acting dean of academic affairs and associate dean of the Engineering Division until his retirement in 1984. During this time he studied law and was admitted to the Montana Bar as a practicing attorney. He wrote two books on mining that were published, and was very active in many mining and engineering organizations. Koehler lived a very full and rich life. He loved his wife, daughters, sons-in-law, grandchildren and his beloved dog, Cody. He spent tireless hours every day

ensuring that Cody got his walk, and was well known around the Montana Tech campus while walking his dog. Traveling was one of his greatest passions. He had been on six of the seven continents, and has crossed every ocean on a ship. He had been north to Alaska where he once caught a 64-pound trophy king salmon, which he proudly displayed on his wall. He viewed the Taj Mahal in India and witnessed the circle of life in the African Serengeti. He was astounded at the sights of the great pyramids in Egypt and the historical splendors of Europe. Koehler realized his ultimate dreams when in 1993, he took his wife to Europe to show where he had served in World War II. In 2001, he traveled around the world by air and by ship with his daughter Karen. Koehler has touched many lives — those of his family and his friends, but also the thousands of students who passed through the doors of Montana Tech. Not only was he a teacher of the sciences, but a mechanic, carpenter, plumber and electrician. He completely remodeled the house he lived in until he became ill. He was a mentor to many whose lives he touched. Koehler is survived by daughters, Karen Stout of Spokane, Wash., Karla and Rich Gremley of Palmer, Alaska, and Janet and Rich Johanson of Richland, Wash.; grandchildren, Nick Gremley, and Julie, Jackie and Lisa Johanson; one nephew and three nieces. He was preceded in death by his parents, sister, and beloved wife, Phyllis, who died on Oct. 11, 1998. Koehler will always be grateful for the wonderful friends and neighbors who made him part of their families since the passing of his wife. They were truly a gift to him and enriched his life so much. Memorials may be made to the Stout Family Endowment at Montana Tech or to Highlands Hospice.

Ione Christine Edstrom De Money passed away October 18, 2005 in Butte, Montana. She was born in Cannon Falls, Minnesota on December 6, 1921 to Arthur and Nannie (Lundell) Edstrom. She received her education in Cannon Falls, and attended two years of medical technology school in Minneapolis. She had to forgo continued medical training when her mother and brothers were in a car accident leaving Ione to come home to help run the family farm. During World War II, Ione worked at Parton Machinery in Minneapolis where she met her husband. She married Fred W. De Money in Cannon Falls at the Spring Garden Lutheran Church on June 3, 1944. Ione and Fred lived in Chicago, IL; Minneapolis, MN; Midland, Michigan; Spokane, WA; Livermore, CA; Butte, MT; and Whidbey Island, WA. During this time, they had 6 children. Ione was the ultimate mom, always available for her children. They came to Butte in 1972 where Fred was President of Montana Tech from 1972 to 1985. During this time, Ione worked side by side with Fred to continue the heritage of Montana Tech. Ione was instrumental in making Tech an integral part of the local,

national and international community, through her planning and coordinating of all college social activities. She was a member of WAIMME for almost 50 years. During that time she was the fifth national Vice President of WAIMME traveling often to New York for board meetings. She was also a member of the Homer Club, Chapter X of PEO, the Daughters of Norway, past member of the Symphony Guild, a member of the Democratic Committee and Burros Club and was an officer of the campaigns of many candidates, the United Congregational Church, and the Montana Institute of the Arts. Ione was an artist, working in watercolor, oils and collage. She had many shows in Montana and was honored to have her works on permanent display at various locations around the United States. She enjoyed traveling to various art classes. She and Fred had traveled to Europe, Scandinavian Countries, the Middle East where they were guests of the Shah of Iran, Canada, Australia, Indonesia, Singapore, Japan, Mexico, and all over the United States. She is survived by her: Daughters and sons-in-law: Jennifer and Murray McCord, Seattle, WA, Dale and Tom Ahlskog, Snohomish, WA, Sarah De Money and Paul Blumenthal, Butte, MT, Elizabeth De Money and Mike Galloy, Boulder, CO, Ellen De Money and Kirk Thoning, Boulder, CO, Granddaughters and spouses: Shannon McCord and Mark Gurwell, Boston, MA, Andrea and Derek Mittleider, Maine, Grandson and spouse: Brock Ahlskog and Rania Aboulhosn, Seattle, WA. Granddaughters: Lisa Johnson, Brigit Galloy, Grandsons: Andrew, Ian, and Brychan De Money-Gross, Evan, Jordan, and Jacob Thoning, Great grandchildren: Kierstin and Cameron Gurwell, Caden and Serena Ahlskog, Brendan and Brynne Mittleider, Ione's twin sister: Irene Edstrom Krause, Minneapolis, MN. Preceded in death by Ione's parents, Husband, Fred W. De Money, died in 1998, Son, Charles De Money, died in 1957, Brothers: Orton, Harlan, Lowell, and Earle Edstrom, Sister: Harriett Edstrom Brittain. Memorials may be made to the Fred and Ione Scholarship Fund, Montana Tech Foundation, 1300 W. Park Street, Butte, Montana 59701.

Great Falls native ***David Solberg Gleason***, 79, died in an accidental fall September 14, 2005 in Billings. He married Bette Brenner in Carmel, CA. At his request, no services are planned. Michelotti-Sawyers Mortuary in Billings is in charge of arrangements. Survivors include his wife of 50 years, Bette Gleason; and nieces and nephews. David was born March 12, 1926, in Great Falls, the son of Dr. Archie and Solveig Gleason. He graduated from Montana Schools of Mines with a Bachelors in Metallurgical Engineering in 1949 and Masters in Metallurgical Engineering in 1951. He worked as a mineral consultant. Memorials may be made to the Schools of Mines or a charity of the donor's choice.



Our loving husband, father, grandpa and son, **Robert "Bob" Brewer**, age 57, passed away at his home in Park City, July 31, 2005. He was born Aug. 8, 1947, in San Diego, Calif. to Clarence Tim and Beverly Crowells Brewer. Bob graduated from Geraldine High School in Montana, and went on to Eastern Montana College in Billings, then to Montana Tech in Butte. He received his degree in chemistry and metallurgical engineering. On March 25, 1978, he married Susan "Suzie" Pinkham Scalise in Anaconda, Mont. Some of Bob's favorite pastimes were traveling, golfing, spending time with his grandchildren and his friends, racquetball, handball and scuba diving. He lived life to its fullest every day. At the time of his death he was employed at Phelps Dodge in Phoenix, Ariz. He is survived by his loving wife of 27 years, Suzie, of Park City; parents, Tim and Beverly Brewer of St. George; two children: Jim (Wendy) of Elko, Nev., Jenny (Ab) Rees of Salt Lake City; four grandchildren: Shannee, Alexa, Bracken and Abigail. His brother, Bill Brewer, preceded him in death.



Robert "Bob" A. Wilson was born February 1, 1914 in Butte, Montana. The eldest of five children, he pursued BA and MS degrees in Metallurgical Engineering at the Montana School of Mines. In 1941, he married Evelyn Harrison and they had a daughter, Pat (Chet) Banta of Salinas, CA; and two grandchildren, Ryan (Bridget) Banta of Reno, Melinda (Jim) Ronka of Sydney Australia; and one great-grandson, Connor Ronka. After the death of his wife, Evelyn, he married Gloria Allison in 1987 and became stepfather to Sue (Lee) Miller of Gilbert, Arizona and Diane (Kent) Chartrand, of Salt Lake City. Initially he worked as a metallurgist and as an inspector for the U.S. Army Engineers during the construction of the Fort Peck Dam on

the Missouri River. He worked for Ingersoll-Rand Company in 1941 in New Jersey and supervised production of Naval Ordnance during World War II. In 1948 he joined the Galigher Company in Salt Lake, and served as senior consulting engineer. A week after his retirement in 1979, he was instrumental in starting Custom Equipment, which became CEC Industries. His name appears on 18 patents. Business travels took him to So. Africa, Australia, New Zealand, Hong Kong, Singapore, North Ailica, Ireland, Peru, Chile and Ecuador. Bob was an active part of First Presbyterian Church, serving as Elder then transferring to Wasatch Presbyterian Church. He is survived by his family and by brothers, Bill Wilson of Amarillo Texas and John (Irene) Wilson of Butte, Montana. Bob's motto was "leave it better than you found it". His life experiences will certainly attest to that.

Antoni Jozef Waldon died November 29, 2004 after a short illness of cancer. Toni was born August 30, 1924 in Rybnik, Poland. He served in World War II under the British forces, then studied and worked in England before immigrating to Canada in 1958. He married Angelina in Montreal and together they came West in 1959. Toni received his Master Degree in Metallurgical Engineering from Montana Tech in 1973. Toni was a metallurgical engineer and worked for Cominco and various big construction companies. The last thirty years he spent in Calgary, teaching at SAIT until his retirement. He loved the mountains, fishing, skiing, and the outdoors. Toni was a vibrant man and a wonderful father and husband who lived his life with energy and passion. Toni is survived by his beloved wife Angelina; and sons Stephen and Dan. In loving memory of Toni, a tree will be planted at Nose Creek Valley.

Fredrick A. Hames passed away on August 11, 2005. Fredrick graduated in 1940 with a bachelor's degree in Metallurgical Engineering.

A Message from the Department Head

In 1896, the Montana School of Mines opened its doors and, four years later, the first class graduated. Among the graduates was Louis V. Bender. Louis is remembered because he was the first ever to accept a position. This happened to be in metallurgy. His legacy lives on through the Louis V. Bender Lecture Series Fund, the first and only fund of its kind in the Foundation. It is also interesting to note that, during Louis's time as a student, and for over 20 years since, the school did not have departments. The campus has changed considerably since then by changing names on two occasions and growing from one instructional building (i.e., Main Hall still exists) to 11 as well as 5 other structures including two Physical Plant facilities, two dormitories, and the Chancellor's House. However, there will soon be a total of 12 instructional buildings: Yes, funding for a new building is being sought and is nearly complete. The Petroleum Department as well as Montana Bureau of Mines and Geology will be moving into it, and when constructed, the current Petroleum Building and Main Hall will become vacant and likely to house the Registered Nursing Program which is in need of moving to the North Campus. The new building will also relieve some pressure on office space caused by the addition of the new programs such as HCI and Bioengineering as well as the growth of others including Biology and General Engineering. It is a good problem to have! Finally, as another tidbit of interest, did you know that Montana Tech has seven members in the National Academy of Engineering and all seven are affiliated solely with the Metallurgical &

Materials Engineering Department? Those seven members are: Plato Malozemoff, Doug Fuerstenau, Robert Beebe, Antoine Gaudin, Frank Aplan, William R. Opie, Reinhardt Schumann. These and many other interesting facts can be found soon on the Department's homepage of the Montana Tech website (www.mtech.edu). I hope you have enjoyed this rather long newsletter but it's that way because we just have not been able to follow through with it until now. We look forward to the many years ahead having a full-time secretary and being able to correspond with you better. Please send us your information so we can include it in next year's letter. Get married? Have a child? Birthday? Just let us know! News from our alumni and friends was just too short! I also want to take the time to thank you personally for all your donations! MetE alums account for 15% of all the alums but donate 25% of the funds to the Foundation. That is absolutely incredible! If you have never donated before or think you can increase your donation, please consider it. Your help is needed. Take Care, God Bless and Happy Holidays!

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