



DIVISION OF ECONOMICS AND BUSINESS

fall 2008

newsletter

Metal Prices and the “Super Cycle”

Are metal prices currently in the early phase of a ‘super-cycle’? Recent research by **JOHN CUDDINGTON**, Coulter Professor of Mineral Economics and **DANIEL JERRETT**, PhD student, suggests the answer is ‘yes!’ despite the recent plunge in prices. Just what are super-cycles and what are their underlying causes? They are long-period cycles with up-swings of roughly ten to thirty-five years, implying complete cycles of, say, twenty to seventy years. Moreover, they are broad based, affecting a range of industrial commodities, including metals and other nonrenewable resources. Cuddington and Jerrett conclude, based on a new econometric approach called band-pass filters, that there have been three earlier super cycles since the mid-1850s and that the world economy may be in the early stages of a fourth super-cycle. The first ran from the late 1800s through the early 1900s, driven by economic growth in the United States. The second and third were in the 1930s and 1940s, initiated by post-World War I reconstruction in Europe, and from 1962-77, fueled by Japanese post-war economic expansion.

The first phase of the Cuddington-Jerrett research takes an agnostic view on the presence of super-cycles, let alone their underlying causes. “Just the facts, ma’am,” they say. Given their empirical support for the presence of super cycles, their current research will try to develop formal structural models to explain the sources or causes of such long cycles. Super-cycle proponents argue that the current super-cycle is being caused primarily by Chinese industrialization and urbanization, whereas earlier super cycles were driven by similar developments in the U.S., Europe and Japan. They argue that this development phase is particularly metals intensive. As long as the resulting outward shifts in the demand curves for metals moves metals producers along upward sloping supply curves, higher prices will clearly accompany the sustained surge in metal’s demand.

Other Economics professors – Rod Eggert and John Tilton – question this view, arguing that high prices should bring about expansions in mine capacity which will bring prices back to historical average cost levels within 5-10 years. With reasonably rapid supply responses, even a sustained Chinese industrialization boom should not lead to decades of super-cycle expansion in metals prices.

John T. Cuddington and Daniel Jerrett have been researching and presenting this topic all over the world at conferences. Cuddington has presented at the International Molybdenum Association annual conference, the Energy and Commodities Surveillance Unit, and the Research Department at the International Monetary Fund. ■



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Message from the Division Director

As I write this message in mid November, the world is in the midst of financial and economic turmoil that few of us have experienced. We hope you are well, despite these volatile and uncertain times.

Regardless of how long the market turmoil lasts, the new US President and other world leaders should keep energy, natural resources, and technological innovation high on their policy agendas. For all three areas, CSM and the Division of Economics and Business are preparing future leaders. Faculty and student research continue to inform both public policy and company decision making.

The fall semester is coming to a close. Another group of outstanding students is preparing to graduate. Enrollments in all three of our degree programs—Economics, Engineering and Technology Management, and Mineral Economics—continue to be strong.

We hope you enjoy this newsletter. Please keep in touch!

Rod Eggert
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My Internship Experience at Climax Mine—Freeport McMoran Copper & Gold

By Luis Agapito

Greetings! I am Luis Agapito Tito, a current Mineral Economics student pursuing a M.S. degree. I graduated from the National University of Engineering in Peru with a degree in Civil Engineering. When deciding on a graduate program, I was repeatedly briefed by several distinguished alumni of Colorado School of Mines. These recommendations led me to Mines and eventually to my summer internship.

In the summer of 2008 I had the opportunity to intern with Freeport McMoRan Copper & Gold (FMI) at the Climax Mine located near Leadville, CO. What made this project attractive is the belief that the Climax Mine has the world's largest, highest grade and lowest cost undeveloped molybdenum deposit. I accepted the position as Project Engineer Intern and become a member of a select and small Freeport Project Development Team which is in charge of carrying out mining projects all around the world. Because of my past experience as an engineer and the well-known reputation of Colorado School of Mines in providing high class education, FMI gave me the responsibility to monitor, control and report the progress and status of engineering, procurement and construction activities (civil work, mechanical/piping, electrical), in the tailing & process water management areas. My responsibility was to start the underground activities of the rehabilitation and restart of a tunnel originally built in the 1950's. This tunnel is a critical component of the reclaim water management system for mill operations for the Climax project.



In December 2007, FMI announced the restart of the Climax molybdenum mine whose mining and milling operations were shut down in 1995 due to low molybdenum prices. However, reclamation and environmental projects have been continuously developed since that time. It is also interesting to point out the historical meaning of Climax as it began full production in 1918 and was very dependent on the two World Wars for the high demand of molybdenum. Molybdenum is useful as an alloy in producing very hard and tough steel which was used to produce weapons. The total cost of the project is \$500 million and covers the restart of open pit mining and the construction of new state of the art milling facilities. FMI had expected to start full production at the beginning of 2010; but this fall FMI decided to postpone reopening the mine due to falling molybdenum prices.

In addition to the valuable working experience, I enjoyed my time in the moun-

CLIMAX MINE cont'd on Page 3 >>>

Faculty News

GRAHAM DAVIS and MinEc MS graduate Jasper Bertisen published "Bias and Error in Mine Project Capital Cost Estimation" in *The Engineering Economist*. The paper documents the persistent downward bias in mine capital cost estimation, and proposes reasons for this bias. Davis also published "Measuring Unambiguously Pro-poor Growth" in *the Journal of Economic and Social Measurement* and "Strike When the Force Is with You: Optimal Stopping with Application to Resource Equilibria," with Professor Robert Cairns of McGill University, in the *American Journal of Agricultural Economics*. Professor Davis has been appointed to the editorial board of *Resources Policy*. ■

ETM Executive in Residence

Every fall the Engineering and Technology Management Program offers the Mines community seminars presented by industry executives on a variety of topics related to leadership and strategy. The focus this semester was entrepreneurship. Topics covered goal setting, leadership, competition, and business partners.

JP O'BRIEN, Chief Executive Officer of SageFire, Inc., was the Executive in Residence for fall 2008. He has a bachelor of science degree in Mechanical Engineering from Cornell University. O'Brien is a leader in web-based business work-flow solutions. SageFire is O'Brien's third startup, where he oversees SageFire's corporate financing strategy and overall business direction. SageFire's applications help businesses track and manage all aspects of the business – from lead generation to prospecting to servicing and delivery to accounting to reporting and business intelligence. O'Brien is passionate about small business success and has been a featured speaker on the topics of profitability, entrepreneurialism, and leadership at several national conventions including eBay Live. ■



New Faculty Member

JOY GODESIABOIS, Ph.D. joined the CSM faculty as Assistant Professor of Economics and Business. She received a BS in Accounting from Colorado State University and an MBA from Southern Methodist University. She earned a PhD in Business Strategy and Entrepreneurship from the University of Colorado. Her research focuses on how new firms use their social networks to access unique resources, providing a sustainable competitive advantage resulting in superior firm performance. Dr. Godesiabo's research is informed by her previous financial management experience, including seven years as CFO of high technology start-ups funded by Silicon Valley venture capitalists. ■



>> CLIMAX MINE cont'd from p.2

tains especially after the middle of July when summer fully appeared and allowed me to go hiking in the surrounding mountains, bicycling in the miles of trails or just walking around the area. Located at 11,400 feet I enjoyed the magnificent scenery on my drive every day as I drove my company truck to work from Copper Mountain, located approximately 10 miles from the Climax Mine site.

Come January 2009, I will be employed fulltime by FMI. But because of recent decisions to delay re-opening of the climax mines, I will either be in Arizona or Chile. The training that I have received

Climax mining was very dependent on the two World Wars for the demand of molybdenum.

from the mineral economics program is invaluable. It has prepared me to understand the mineral market and to apply different analytical techniques to any business scenario. This in turn will allow me to make better decisions based on quantitative results. My time at the Colorado School of Mines will influence my career path for years to come. ■



The Graduate Students Toured the Climax Mines in October 2008. Cold and Windy is how they described it.

Division Visitors

Tor Arnt Johnsen — holds a PhD in Economics from the University of Oslo. From 1988 to 2002, he worked in the Research Department, Statistics Norway. Since 2002, he has worked for the Norwegian Water Resources and Energy Directorate which is the energy market regulator in Norway. He has a part-time position at the Norwegian School of Management.

Monica Rodriquez — a Business Development Advisor with Petrobras, the Brazilian Petroleum Company. She is in charge of all negotiations involving Exploration and Production Assets in Brazil. Geologist by background, with a masters degree in Reservoir Engineering, she is enrolled in a doctoral program at Campinas State University.

Gabriel Sotomayo — a Petroleum Engineer with Petrobras. He works in the Headquarters-Well Technology Group. An Electrical Engineer by background, with a masters degree in Petroleum Engineering, he is also enrolled in a doctoral program at Campinas State University.

Alpay Sergi — from 1991 to 2004, he worked in the Feasibility Department, General Directorate of Mineral Research and Exploration, Ministry of Energy, Turkey. Since 2004, he has worked for Supreme Auditing Board of Prime Ministry which is auditing state economic enterprises in Turkey.

Outstanding Students for 2007-2008

Outstanding Undergraduate Senior Award:

Abdulaziz Al Fakhri, Bryan Florendo, and Nicholas Klausner

William Jesse Coulter Coulter Award in Economics: Kelsey O'Connor

William Jesse Coulter Award in Mineral Economics: Marty Gaupp

Hubert and Sarah Risser Award in Mineral Economics: Mark Helms

Broussard ETM Award: Melanie Mahoney



Faculty News

EDWARD J. BALISTRERI and James R. Markusen, University of Colorado, had their paper, "Sub-national differentiation and the role of the firm in optimal international pricing," accepted for publication in *Economic Modeling*. The paper developed out of a research project sponsored by the United States International Trade Commission. Balistreri was principal investigator on the grant. Balistreri is currently working on modeling the Kenya economy with Thomas F. Rutherford, Swiss Federal Institute of Technology (ETH) Zürich, and David Tarr of the World Bank. Balistreri also has papers under review that address commodity-mercury trade policy (with Christopher M. Worley, Mines PhD student), and methods for incorporating heterogeneous firms and their role in international trade (with Russell H. Hillberry, University of Melbourne, and Rutherford).

ALEXANDRA NEWMAN spent the summer advising PhD candidates Marty Gaupp and Andres Guerra. Gaupp worked on a Lagrangian procedure for solving the open pit block sequencing problem while Guerra addressed the problem of optimizing building design. Newman then went to Santiago to work with several collaborators at the University of Chile in the mining and industrial engineering departments. In July, she attended the International Federation of Operational Research Societies Conference in Johannesburg, South Africa, where she presented a paper in a session she chaired on the applications of operations research in mining. Newman recently became an associate editor at *Interfaces*, and had a paper accepted for that publication addressing optimal feeder movements in a quarry. She and her students are currently working on funded research in open pit mine planning.

Faculty News

In April 2008, **CIGDEM GURGUR** gave an invited talk on "Management of Financial Risk" at the Informs SouthWest Regional Conference. Gurgur continues her research in portfolio optimization for energy markets (stochastic analysis and optimization) and attended an international workshop in July at Oxford University, UK. A Mineral Economics Master's thesis student, Emily Klawon, a Primary Research Manager at Platts Analytics, is also involved in part of this research. The work involves optimization of portfolios of real and contractual assets, including derivative instruments in a multi-period setting, with applications to the energy industry.

Dr. Gurgur, with her colleagues at the Mining Engineering Department, gave a research presentation related to logistical transit and para-transit modeling, planning and scheduling under uncertainty with applications for open-pit mining operations at Texas A&M University and they will be presenting a related work at the coming meeting of Society of Mining Engineers Conference in Denver. ■

Save the Date February 11, 2009

The Division of Economics and Business will host an **alumni event** on February 11, 2009.

Our featured speaker will be alumnus Ross Bhappu, partner at Resource Capital Funds. Bhappu has a PhD in Mineral Economics. This will be an excellent time to talk with current students and former classmates. Watch your email for more details.



Some of our newest alumni- Graduation May 2008

Thanks to our Contributors and Supporters July 2007-June 2008

Contributions from our alumni and friends do make a difference. They enhance our ability to offer excellent education opportunities to our students. Contributions fund computer software, student recognition events, students attending professional conferences and scholarships. We are deeply grateful to each and every one of you.

Accenture Foundation, Inc.

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Leanne M. Baker

BP Foundation, Inc

Jerome & Rebecca Broussard

Chevron

Viola Vestal Coulter Foundation

Matthieu Delaby

Encana Oil & Gas (USA) Inc.

Mark A. Erickson

Joseph Garbee

Mauricio Gutierrez

Sam Hewitt

International Pig Iron Association

Michael Liedtke

Anthony Makowski VI

Ruthann Moomy & Rod Eggert

A. Scott Moore

Vladmir Morakhowsky

Damdinjav Munkbold

Louis H. Nasr

Newmont Mining Co.

RCF Management LLC

John A.L. Rense

Marcela Rosas

John Tilton

How to make a gift to the Economics and Business Alumni and Friends Fund:

Make a check payable to the CSM Foundation Inc. and indicate account 6-34059. Send to CSM Foundation, PO Box 4555, Golden, CO 80401-9595. Or go on-line to <https://www.oia.mines.edu/forms/pledge/pledge.htm> and make your donation on the secure website with your credit card.

Faculty Awards for 2007-2008

EXCELLENCE IN TEACHING

The faculty awards are much coveted because our current students vote on and select the recipients.

Mineral Economics : Graham Davis
 Engineering and Technology Management: Cigdem Gurgur
 Economics: Scott Houser

Outstanding Economics and Business Faculty Member as voted by all graduating CSM students:
 Undergraduate - John Stermole
 Graduate - Cigdem Gurgur

For the first time the Division of Economics and Business recognized "Researcher of the Year" amongst the faculty. This award acknowledges the publications, writings, and research that were produced during the past year. We are pleased to announce Dr. Alexandra Newman as the recipient of this honor. She received a monetary award to encourage and support her endeavors. ■



Congratulations to our 2007-2008 Graduates

MS, MINERAL ECONOMICS

Nader Alarfaj
 Ramon Alvarado
 Babak Salman Banaei
 Bayee Besong
 Irene Castillo
 Lauren Davis
 Babatunde Egunjobi
 Mark Helms
 Rong Lao
 Changwei Li
 Benjamin MacFarlane
 Anthony Makowski IV
 Lauren Nagy
 John Nowoslawski
 Joshua Parrill
 Lindsay Rothfelder
 Anthony Scott
 Ayoub Semaan
 Omar Sharaf
 Christopher Worley
 Christopher Wyatt

William Garrett Eller
 Claudia Farfan-Lorono
 Joseph Fenske
 Lous Giguere
 Michael Jones
 Zachary Kreider
 David Kultala
 Rocio Lauer
 Burke Lowrey
 Melanie Mahoney
 Christopher Marafine
 Garrett Mehl
 Ryan Mills

Christopher Montoya
 Jack Pecoraro
 Caleb Ring
 Ronald Salomonson, Jr.
 Daniel Schell
 Martin Schmidt
 Scott Smith
 Angela Targhetta Suarez
 Joel Chad TeBeest
 Monica Teff
 Janelle Wadas
 Shaine Wieber
 Hidemichi Yonezawa ■

Undergraduates will be recognized in our Spring newsletter.

MS, ENGINEERING AND TECHNOLOGY MANAGEMENT

Zackory Akin
 Rafat Al-Dhuhayain
 Abdulaziz Alfakhri



Alumni Corner

1974

Dick Collins, MSc MinEc, is currently a construction manager on an Oil-Sands upgrader nearing completion near Fort McMurray in Alberta, Canada.

1976

Robert Davidoff, MS MinEc, is at the Office of Minerals Evaluation. He leads a staff that is responsible for performing the mineral assessment and market analyses of mineral estates for all Indian lands. He is located in Lakewood, CO.

1980

Donald Ratcliff, MSc MinEc, is VP of Marketing and Commodity Risk Management for Apex Silver Mines in Denver.

1982

Alec Neville, MSc MinEc, is a partner at PetroCap, an energy private equity firm in Dallas, TX.

1985

Jerry Kyckelhahn, MSc MinEc, after a full life of management in the concrete industry, he has been able to follow his true dream of racing and competing on road bikes. Lately he has taken up triathlons also.

1992

Sue McFaddin, Phd MinEc, is a partner of Seven Generations, LLC, a sustainable development company in Fort Collins, CO. The company does consulting for both existing and new commercial office buildings.

Rich Rein, MSc MinEc, has just completed construction of the first 3 underground diamond mines in North America for BHP Billiton. The last mine, the Koala Project was completed safely, under budget and ahead of schedule. He has returned to Colorado for a sabbatical.

1994

John DeCooman, Jr., MSc MinEc, is the VP of Finance and Corporate Development for Candente Resource Corp.

1995

Scott Wilson, MSc MinEc, is the VP of Business Development for Rockies Optigas, LLC/Piceance Basin Gas Gathering, LLC in Denver.

1996

Thorsten Viertel, MSc MinEc, is the BDM XTL & CO₂ Manager CCE-XTL for Shell Gas & Power International.

Michael Flavin, BS Econ, is the Rocky Mountain Regional Manager for Hanes Geo Components based in Denver.

Darvin Jones, MSc MinEc, retired as a Lieutenant Colonel in the US Army 2 ½ years ago. He now is a manager of the consulting service with Twachtman Snyder & Byd, Inc. in Houston TX.

1997

Brandi Lewis Goodman, MSc MinEc, is the manager of Supply Chain Engineering at Schneider National in Green Bay, WI.

1998

Christiaan Huizer, MSc MinEc, is working as the Upstream Commercial Finance Manager with Shell International Exploration & Production in Houston, TX.

1999

Brice Lodugnon, MSc MinEc, is a Director with Emerging Capital Partners LLC, a private equity fund manager focusing on investment in Africa. He is based in Abidjan, Cote d'Ivoire.

2000

Shinsuke Murakami, MSc MinEc, is at the Graduate School of Engineering, the University of Tokyo. He works on issues of international recycling in the Asian region and natural resource developments.

Andrea Capra, MSc ETM, is a systems engineer for the Boeing Company in Renton, WA.

2002

Claudio Valencia Montero, PhD MinEc, is the Director of Strategic Design at Codelco in Santiago, Chile.

Tanya Barb Hanford, MSc ETM, is the Project Manager at Winter Ridge Energy.

Kathryn Heidrich Valdez, BS Econ, is a regional manager of Fuel Supply Operations for Xcel Energy, Inc. in Denver. In November she will earn her MBA from Daniels College of Business at the University of Denver.

Mark Ruthven, MSc ETM, is Product Manager for Western Union in Englewood, CO.

2003

Charles Douglas-Hamilton, MSc MinEc, is a Senior Geologist for Anvil Mining Services in the Democratic Republic of Congo. He is taking Anvil's Kolwezi Cobalt-Copper-Gold polymetallic projects into mine development.

William Parker, MSc MinEc, is currently working in Huntsville, Alabama on the Ground-Based Midcourse Defense Program in the area of modeling, simulation, wargaming and analysis.

John Reinsma, MSc MinEc, is the Senior Development Manager for Weston Solutions in Lakewood, CO.

Peter McCarty, BS Econ, is a Natural Gas Marketing Analyst for Enserco Energy, Inc, in Golden, CO.

2004

Freddy Aird, MSc MinEc, is a Mine Manager at Chemical Lime Co in new Braufels, TX.

Robert Gray, MSc MinEc, is a Director of RMB Resources Limited – the specialist resources merchant banking division of Rand Merchant Bank.

Tony Hahn, MSc ETM, is the Executive Officer for Coast Guard Air Station Borinquen in Aguadilla Puerto Rico.

Kumail Said, BS Econ, is a supervisor with Ernst & Young's Transaction Advisory Services in Muscat, Oman.

Ricardo Labo, MSc MinEc, was promoted July 1, 2008 to the position of Communications and External Affairs Manager for the La Granja Copper Project owned by the mining group Rio Tinto. He is located in Lima, Peru.

Josh Burgher, MSc ETM, is working at Columbia University as the Director of Strategic Planning and Analytics. He is also enrolled in the Executive MBA program at the Columbia Business School. He lives in Manhattan, NY.

2005

John Antwi, MSc MinEc, is the Manager of Corporate Development with Newmont Mining Corporation in Denver, CO.

Derk Trebilcock, MSc ETM, is the IT Manager with Sun Microsystems in Broomfield, CO.

Donald Walker, MSc MinEc, is a geologist for ConocoPhillips in Houston, TX.

Jennifer Walker, MSc MinEc, is in invest-

ment appraisals for ConocoPhillips in Houston, TX.

2006

Angela Blea, BS Econ, is employed at URS Corporation as a roadway engineer in their Transportation Division in Denver, CO.

Alicia Jessop, BS Econ, is in her 3rd year of law school at Chapman University in Orange, CA. She is also the Senior Symposium Editor for the Chapman Law Review.

Mandi Stewart, BS Econ, is a Mutual Funds Analyst at Lipper in Denver, CO.

Michael Martinez, PhD Min Ec, is teaching in the math department at the Air Force Academy in Colorado Springs, CO.

Emmanuel Barrois, MSc MinEc, is working for Total E&P Nigeria in Port-Harcourt as a Reservoir Engineer.

Stephanie Savage, MSc MinEc, is a Senior Project Analyst for Entegriy Wind Systems, Inc in Boulder, CO.

2007

Irene Castillo, MSc MinEc, is in Norway working for the petroleum company StatoilHydro.

Ayoub Semaan, Msc MinEc, is a Management Consultant for McKinsey and Company in Dubai, United Arab Emirates.

Amar Sharkhuu, MSc MinEc, is in engineering operations management with Powder River Coal, LLC in Gillette, WY.

Please send me your email address and any updates.

DIVISION OF ECONOMICS AND BUSINESS NEWSLETTER

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