

Inaugural Student-Dedicated Field Course: Porphyry Systems of Northern Chile

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The inaugural Society of Economic Geologists Foundation, Inc. Student-Dedicated Field Course was undertaken January 5–13, 2007, and comprised a series of visits to major porphyry Cu-Mo systems in northern Chile. Attending were 16 students representing 14 universities and 7 countries; the students were selected from a group of 47 applicants, and were joined by four professionals representing exploration companies and academe.

Emphasizing hydrothermal and supergene processes, as well as social and economic aspects of ore search and mine development, the field course began in the Paleocene-Eocene belt of northern Chile (and southern Perú) at the Lomas Bayas porphyry system. Students noted the importance of protolith compositions in the genesis of copper oxides and the occurrence of hydrothermal breccia in controlling copper distribution and wall-rock alteration development. This was followed by a trip to the Quetena prospect west of Calama. The Quetena breccia system displays well-developed supergene oxidation in a pyritic host; the oxidation produced abundant iron and copper sulfates, and gave students the chance to identify some rare minerals found only in very arid terrains—or in very low-pH mine environments!

The El Abra and Radomiro Tomic porphyry systems provided excellent exposures of K-silicate constructive alteration associated with dioritic and monzonitic intrusive rocks, respectively, and the development of essentially in-situ copper oxide assemblages. Distinguishing the various green copper oxide minerals was a challenge for everyone, as was identification of the ubiquitous—and often copper-bearing—iron and manganese oxides! The importance of the Domeyko fault zone as a metallotect was discussed throughout the course, with observations from a distance at each of the Oligocene-age porphyry systems contributing to the group's general understanding of regional faulting and the significance of intersecting cross-structures.

Exotic copper ore deposit formation was discussed at the El Tesoro mine, where Miocene-age ganglomerates host atacamite-chrysocolla, along with manganese and lesser iron oxides. Tracking the source porphyry system for the El Tesoro

ores was discussed by the mine geologists, who now believe that the source ore deposit was essentially removed by erosion during the early-mid Miocene.

The group's final visits were to the newly producing Spence porphyry system, where high-grade atacamite ores are yielding the initial harvest of copper cathodes from the world's newest major copper mine. We were the first student group to visit this impressive and well-organized operation. The last mine visited—the Oligocene Zaldivar porphyry system—provided excellent exposures of the top-to-bottom development of a leached capping-oxide zone-sulfide supergene profile. Here, the students observed classic iron oxides in a well-developed leached capping (they came away with many thumb-sized iron oxide smudges in their field books!), a series of copper oxides overprinted on a characteristic chalcocite enrichment profile, and the importance of regional structures in controlling intrusion emplacement during and post-mineralization.

Notably, discussions among students and professional participants highlighted not only the essential geologic aspects of minerals exploration, but also touched on the importance of social and economic issues affecting “economic” geology. Geologists at each of the mines emphasized the

need to really distinguish “ore” from simple mineralized rock, and how companies define ore targets during the various stages of exploration and development. In the process, students were exposed to the basics of what makes a geologist—and a company—successful at exploration.

A farewell dinner at Wally's Bar in Antofagasta, hosted by professional participants from Rio Tinto and Phelps Dodge Exploration, gave all the chance to say goodbye . . . for now.

On behalf of the students, the authors would like to thank the mines that provided us the opportunity to see what features really comprise ore deposits, and to the Society of Economic Geologists Foundation, Inc., for their immense financial and logistical support (John and Sue, our hats—hardhats, that is—are off to you).

Finally, the idea of supporting a student-dedicated field course began at the Keystone Conference, when a number of SEG members followed the lead of Borden Putnam in contributing seed money for such a course. To each of you, we are delighted to express our sincere thanks and appreciation; know that what you started here will continue to provide unforgettable *and essential* field experiences for students for many years to come. SEG



Pablo Iradi, Pablo Morelli, Romina Caba, Dave Shinkle, John Porter, Jane Stammer, Gabriel Graf, Edward Lewis, Thomas Eggers, David Lentz, Jean-Francois Ravenelle, Constanza Jara, César Vilca, Jean-Phillip Paiement, Regina Baumgartner, Diane Kuiper, John Morken, Todd Bonsall, Edgardo Guizado, Amy Shute, William X Chávez, Erich U. Petersen

SEG Field Trip — January 5–13, 2007



Borden Putnam, Founder of the Student Field Trip Fund



... it was an excellent trip, everything was very well organized, superbly professional and very safe. . . . [W. Chavez and E. Petersen] are phenomenally gifted with student teaching.

Prof. David Lentz, Dept. of Geology, Univ. of New Brunswick, Fredericton, NB, Canada

I was fortunate to be a member of the first SEG student chapter trip to Chile . . . The leadership of Erich Petersen and Bill Chavez was flawless, the logistics of the trip were executed perfectly, and I can certainly say that I learned and saw more than I expected from all the mines. Please thank SEG and all the donors who made this trip possible.

Jane Stammer, Colorado School of Mines, Golden CO

I am a Ghanaian and currently a graduate student studying Mineral Engineering with exploration option. The importance of the trip to me can not be over emphasized . . . from the interactions with the professionals, to discussions with fellow students, [to] the knowledge acquired from professors Bill and Eric.

John Morkeh, New Mexico Institute of Mining and Technology, Socorro, NM

I am learning so much—it is tough to keep up . . . this has been an awesome experience. Dr Chavez and Dr Peterson are excellent teachers.

Diana Kuiper, University of Ottawa, Ottawa, ON

Buenas, les escribo para agradecerles por haberme eligido para participar en el Field Trip de Chile, fue muy valioso para mi, aprendi muchas cosas nuevas que me serviran para mi futura profesion de Geologo. Por otro lado, quiero remarcar la muy buena coordinacion y predisposicion de los Profesores William y Erich, los cuales me brindaron sus conocimientos en un nivel realmente destacable.

Pablo José Iradi, Univ. Nacional de Salta, Salta, Argentina

The trip was amazing and wouldn't have been possible without the help from the SEG travel grant. Being a geologist, I truly believe the best way to learn is hands-on in the field, . . . The trip has broadened my knowledge of porphyry copper deposits and has prepared me for what I may see in the future as an economic geologist. I would like to thank you, the Society of Economic Geologists, and all the sponsors for this wonderful opportunity to participate on the SEG inaugural student dedicated field trip. It has been a fantastic experience.

Gabriel Graf, New Mexico Institute of Mining Technology, Socorro, NM



Lomas Bayas



Jara



El Tesoro



Bonsall & Lewis



Stammer

