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MINEPLANNING

Technical and Social Program

July 24 · 26, 2013
Sheraton Hotel and Convention Center, Santiago, Chile

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**SEMINAR COORDINATOR**
Nathasha Soares  
+56 9 6646 0491

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**Tuesday, 23 July / Wednesday, 24 July**

**SHORT COURSES**

**Strategic mine planning & optimization / O’Higgins Ballroom**
**Dr. Hooman Askari-Nasab**, School of Mining and Petroleum Engineering, University of Alberta, Canada

**Sampling and quality control for exploration and mining**
San Cristóbal Ballroom A  
**Dr. Eduardo Magri** and **Dr. Antoni Magri**, Magri Consultores, Chile

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**Wednesday, 24 July**

**TECHNICAL AND SOCIAL PROGRAM**

**16:00** Registration / Foyer

**18:00** Authors and Session Chair Coordination Meeting  
San Cristóbal Ballroom A

**19:00** Inauguration Ceremony / San Cristóbal Ballroom B & C

**Words of Welcome**
**Carlos Barahona**, Geomin-Mineplanning 2013 Executive Director, Gecamin, Chile  
**Anthony Williams-Jones**, Geomin 2013 Co-Chair, SEG Distinguished Lecturer for 2013, Professor, McGill University (Geomin 2013 Institutional Collaborator), Canada  
**Hooman Askari-Nasab**, Mineplanning 2013 Co-Chair, Professor, University of Alberta (Mineplanning 2013 Co-Organizer), Canada

**Opening Address**
**Manuel Durán**, Geomin 2013 Chair, Independent Consultant, Chile

**Supercaves: Challenges in large scale underground mining**
**Octavio Araneda**, Mineplanning 2013 Chair, Vice-President of Operations, South-Central Region, Codelco, Chile

**Special Guest**
**Mining development in Peru and its contribution to society**
**Rómulo Mucho**, President of the Instituto de Ingenieros de Minas del Perú

**20:00** Welcome Reception / Foyer
Thursday, July 25
PLENARY SESSION 01
San Cristóbal Ballroom

Session Chair: Manuel Durán, Geomin 2013 Chair, Chile

08:20  Day 2 program update
Julio Beniscelli, Geomin-Mineplanning 2013 Technical Coordinator, Mining Consultant, Chile

08:30  Rare earth element ore genesis – the great unknown
Anthony Williams-Jones, SEG Distinguished Lecturer for 2013, Professor of Economic Geology and Geochemistry, McGill University, Canada

09:00  Advances in mine planning optimization: open pit and block cave case studies
Hooman Askari-Nasab, Professor, School of Mining and Petroleum Engineering, University of Alberta, Canada

09:30  Three-dimensional discontinuum and continuum stress analyses to study stability of a mine tunnel
Pinnaduwa Kulatilake, Professor and Director, Rock Mass Modeling and Computational Rock Mechanics Laboratories, University of Arizona, USA

10:00  How can an intensive preconditioning concept be implemented at mass mining method? Application to Cadia East panel caving project
Alex Catalán, Geotechnical Superintendent, Minera Esperanza, Chile

10:30  Poster Session and Coffee Break
Foyer, Courtesy of GeoInnova
**Modelling and geostatistics**  
Chair: **Felipe Ibarra**, Minera Los Pelambres, Chile

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<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:10</td>
<td>Conditional bias for multivariate resources estimation</td>
<td><strong>Diego Vergara</strong> and <strong>Xavier Emery</strong>, Universidad de Chile</td>
</tr>
<tr>
<td>11:30</td>
<td>A comparison of three approaches to calculate the variogram of regionalised data</td>
<td><strong>Nasser Madani</strong> and <strong>Xavier Emery</strong>, Universidad de Chile</td>
</tr>
<tr>
<td>11:50</td>
<td>An application of uniform conditioning to estimate grade-tonnage curves in a copper deposit</td>
<td><strong>Mario Ortiz</strong> and <strong>Xavier Emery</strong>, Universidad de Chile</td>
</tr>
<tr>
<td>12:10</td>
<td>Simulation of copper grade conditioned to rock type data in Sungun copper deposit, Iran</td>
<td><strong>Mohammad Maleki</strong> and <strong>Xavier Emery</strong>, Universidad de Chile; <strong>Omid Asghari</strong>, University of Tehran, Iran</td>
</tr>
<tr>
<td>12:30</td>
<td>A value-oriented declustering method</td>
<td><strong>Alejandro Cáceres</strong> and <strong>Xavier Emery</strong>, Universidad de Chile</td>
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<tr>
<td>12:50</td>
<td>Lunch / El Bohío Park (Pool area)</td>
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**Short and long term mine planning strategies**  
Chair: **Marco Maulen**, Compania Minera Antamina S.A., Peru

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<tr>
<th>Time</th>
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<tbody>
<tr>
<td>11:10</td>
<td>Grade control sampling and SMU size optimization using conditional simulation</td>
<td><strong>Ignacio Vélez</strong> and <strong>Iván González</strong>, IGAN consultores, Spain</td>
</tr>
<tr>
<td>11:30</td>
<td>Mine planning for Autonomous Haulage System</td>
<td><strong>Marcelo Navarrete</strong> and <strong>Chang Ja Kim</strong>, Codelco, Chile</td>
</tr>
<tr>
<td>11:50</td>
<td>Drill hole stratification helps to save explosives</td>
<td><strong>Andree Röttig</strong> and <strong>Constanza Paredes</strong>, Modular Mining Systems, Chile</td>
</tr>
<tr>
<td>12:10</td>
<td>Dynamic cut-off grade and its application to maximize mineral reserves inventory</td>
<td><strong>José Antônio Kurcewicz</strong> and <strong>Pablo de La Cruz</strong>, Minera Altos de Punitaqui Ltda., Chile; <strong>Mario Pacheco</strong>, Minera Los Quenuales S.A., Peru</td>
</tr>
<tr>
<td>12:30</td>
<td>Application of an evolutionary solver to the optimisation of an open pit mine</td>
<td><strong>Lorrie Fava</strong>, MIRARCO, Laurentian University, Canada</td>
</tr>
<tr>
<td>12:50</td>
<td>Lunch / El Bohío Park (Pool area)</td>
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</tbody>
</table>
Modelling and geostatistics II
Chair: Fernando Dibona, Cía. Minera Doña Inés de Collahuasi, Chile

14:10 Uncertainty estimation through geostatistical simulations
Barbara Namysłowska-Wilczyńska, Wrocław University of Technology, Poland

14:30 Geostatistical validation of geological logging
Alejandro Cáceres and Xavier Emery, Universidad de Chile

14:50 Kriging total and soluble copper grades at Minera Michilla
Alex Carpanetti, Minera Michilla, Chile; Xavier Emery, Universidad de Chile

15:10 Geometric restitution for improving mineral resource estimation applied to Peumo deposit
Fabían Soto, Julián Ortiz, Laboratorio ALGES, Advanced mining technology center, Universidad de Chile; Daíne Herreros, Marcos Valencia, Yamana Gold Inc., Chile

15:30 A mathematical approach applied over geological interpretation tasks
Arturo Martínez, MineSight Applications Chile - Division. of Mintec Inc., Chile

15:50 Poster Session and Coffee Break / Foyer, Courtesy of

Short and long term mine planning strategies II / Estimating risk and uncertainty of mining plans
Chair: Rodolfo Navarro, Minera Los Pelambres, Chile

14:10 Feasibility analysis of chemical stabilization technologies for closure plans
Sat Sansar Singh, MAYCO Consultores, Chile; Juan Rivadeneira, Universidad Adolfo Ibañez, Chile; Raimundo Bordagorry, Universidad Diego Portales, Chile

14:30 Market analysis, mine planning and cost estimation of quarries in southern Brazil
Eduardo da Silva and Rodrigo Peroni, Universidade Federal do Rio Grande do Sul (UFRGS), Brazil

14:50 Integrated production capacity for the system crusher platform - Truck Fleet
Marco Cornejo and Juan Pablo Cataldo, HATCH, Chile

15:10 Mine planning progress: Corocohuayco project
Carlos Pineda and Robert Copacondori, Xstrata Copper, Peru

15:30 Using real options to introduce flexibility in mine planning under uncertainty
Nelson Morales, Juan Quiroz and Bastian Rudloff, Universidad de Chile

15:50 Poster Session and Coffee Break / Foyer, Courtesy of
Geology for mining and production
Chair: Fabián Soto, Universidad de Chile

16:20  8.116 meters of exploration drilling to the discovery of 33
Felipe Matthews, Geoatacama, Chile

16:40  Fragmentation measurements to validate effect of rock
mass preconditioning at the El Teniente Mine
Andrés Brzovic and Juan Pablo Hurtado, Codelco, Chile

17:00  Cave modelling and material flow estimation in Block I,
Esmeralda mine, El Teniente deposit
José Millán and Andrés Brzovic, Codelco, Chile

17:20  Modern mining geology
Steve Rose and Gerry Fahey, CSA Global Pty Ltd, Australia

17:40  The vapour-transport of metals in epithermal systems
Anthony Williams-Jones, McGill University, Canada

18:00  Ore mineralization controls in Rosario porphyric
Cu-Mo system: Collahuasi District, Chile
Juan Hermosilla and Rodrigo Castagno, Compañía
Minera Doña Inés de Collahuasi, Chile; Maria Olivia Mejías,
Universidad de Concepción, Chile

18:20  Cocktail and Seminar Dinner / Pedro de Valdivia Ballroom

Underground Mine Planning and Designs Techniques / Transition from open pit to underground mining
Chair: Alfonso Ovalle, AMEC, Chile

16:20  The competent person and best practices in estimating
mineral reserves
Juan Pablo Gonzalez, Comisión Calificadora de Competencias
en Recursos y Reservas Mineras, Chile

16:40  State of the art in cave mining
Hugo Constanzo, Sixto López and Juan Videla, Codelco, Chile

17:00  Optimized Design of Models in Mining
Eduardo Córdova, Hugo Constanzo, Codelco, Chile

17:20  Estimation of maximum production capacity through
material handling system simulations
Eduardo Viera, Codelco, Chile

17:40  Improve the Collahuasi business case through an open
pit underground transition project
Andrés Solar, Cía. Minera Doña Inés de Collahuasi, Chile

18:00  A methodology to define transition from open pit to
underground operation of a mine
Antonio Navarro, Victor Encina and Leonardo Fenner, JRI
Ingeniería S.A, Chile

18:20  Cocktail and Seminar Dinner / Pedro de Valdivia Ballroom
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<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
<th>Speaker</th>
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<tbody>
<tr>
<td>08:20</td>
<td>Day 3 program update</td>
<td>Julio Beniscelli, Geomin-Mineplanning 2013 Technical Coordinator, Mining Consultant, Chile</td>
</tr>
<tr>
<td>08:30</td>
<td>Marathon runner to triathlete: business planning in Antamina</td>
<td>Susan Knoerr, Vicepresident of Business Development and Planning, Compania Minera Antamina S.A., Peru</td>
</tr>
<tr>
<td>09:00</td>
<td>Codelco’s structural projects, present and future</td>
<td>Sergio Fuentes, Vicepresidente de Proyectos, Codelco, Chile</td>
</tr>
<tr>
<td>09:30</td>
<td>Newcrest mining and its development plan</td>
<td>German Flores, Corporate Development Manager, Newcrest Mining Limited, Australia</td>
</tr>
<tr>
<td>10:00</td>
<td>Successful exploration in a mature belt: the Centinela District, Northern Chile</td>
<td>José Perello, International Exploration Corporate Manager, Antofagasta Minerals, Chile</td>
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<tr>
<td>10:30</td>
<td>Poster Session and Coffee Break</td>
<td>Foyer</td>
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<td>Time</td>
<td>Session</td>
<td>Speakers</td>
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<tr>
<td>11:10</td>
<td>Bench mapping process: Structural-geological model update using Shape Metrix 3D, El Soldado mine</td>
<td><strong>Ricardo Lau</strong> and <strong>Laura Torres</strong>, Anglo American Sur - El Soldado División, Chile</td>
</tr>
<tr>
<td>11:30</td>
<td>Geotechnical properties on cemented and healed stockwork veins at the El Teniente mine</td>
<td><strong>Carlos de los Santos</strong> and <strong>Andrés Brzovic</strong>, Codelco, Chile</td>
</tr>
<tr>
<td>11:50</td>
<td>Rock mass geotechnical characterization based on the weak stockwork veins at the El Teniente Mine</td>
<td><strong>Andrés Brzovic</strong> and <strong>Paulina Schachter</strong>, Codelco, Chile</td>
</tr>
<tr>
<td>12:10</td>
<td>2D and 3D Roughness profile of weak stokwork veins at mine scale in the El Teniente Mine</td>
<td><strong>Diego Díaz</strong> and <strong>Andres Brzovic</strong>, Codelco, Chile</td>
</tr>
<tr>
<td>12:30</td>
<td>Stress measurement and the interpretation of stresses using the tectonic strain approach</td>
<td><strong>Ian Gray</strong> and <strong>Ian Saltikov</strong>, Sigra Pty Ltd, Australia</td>
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<tr>
<td>12:50</td>
<td>Lunch / Pedro de Valdivia Ballroom</td>
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**SESSION 08**

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<tr>
<th>Time</th>
<th>Session</th>
<th>Speakers</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>11:10</td>
<td>Modern planning practices for cave mining</td>
<td><strong>Lino Manca</strong> and <strong>German Flores</strong>, Newcrest Mining Limited, Australia</td>
<td>San Cristóbal Ballroom</td>
</tr>
<tr>
<td>11:30</td>
<td>Cadia East – a case study in applied innovative design</td>
<td><strong>Lino Manca</strong> and <strong>Geoff Dunstan</strong>, Newcrest Mining Limited, Australia</td>
<td>San Cristóbal Ballroom</td>
</tr>
<tr>
<td>11:50</td>
<td>Planning lateral dilution at large panel caving mines</td>
<td><strong>Raúl Castro</strong>, Universidad de Chile; <strong>Francisco Armijo</strong>, BCTec Ingeniería y Tecnología, Chile</td>
<td>San Cristóbal Ballroom</td>
</tr>
<tr>
<td>12:10</td>
<td>Challenges in the construction plan of access and transport tunnels at Chuquicamata Underground</td>
<td><strong>Winston Rocher</strong> and <strong>Gabriel Espina</strong>, Codelco, Chile</td>
<td>San Cristóbal Ballroom</td>
</tr>
<tr>
<td>12:30</td>
<td>Challenges and opportunities in rib pillar recovery at Chuquicamata Underground Mine Project</td>
<td><strong>Francisco Carrasco</strong> and <strong>Matías Ferrada</strong>, Codelco, Chile</td>
<td>San Cristóbal Ballroom</td>
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<tr>
<td>12:50</td>
<td>Lunch / Pedro de Valdivia Ballroom</td>
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</table>
**Applied Mineralogy / Geometallurgy**

**Chair:** Patricia Jaime, FEI Natural Resources Solutions, Australia

14:10  **Mineral liberation analysis using INCAMineral and large-area X-MaxN silicon drift detectors**

Matthew Hiscock, Christian Lang and Simon Burgess, Oxford Instruments, United Kingdom; Jussi Liipo, Outotec Research Center, United Kingdom; Hans Otterstrom and Hugo Person, Ottab Technologies, Sweden; and Pertti Lamberg, Luleå University of Technology, Sweden

14:30  **Mineralogical association and occurrence of silver in concentrates from Andina Division, Codelco**

Héctor Suazo, Codelco, Chile

14:50  **Variability of the rheological and sedimentological behavior of rougher flotation tailings**

Nélida Heresi, Claudia Castillo and Ramón Fuentes, Centro de Investigación JRI S.A., Chile

15:10  **Economic value optimization of smelting and refining plants, Chuquicamata Division: a practical case**

Ricardo Lau, Juan Moya, Angloamerican, Chile; Gustavo Aguirre, Codelco, Chile

15:30  **Density and mechanical competence, main physical and mechanical variables in Geometallurgical Models**

Samuel Canchaya, Cía. de Minas Buenaventura S. A. A., Peru

15:50  **Poster Session and Coffee Break / Foyer**

**Underground Mine Planning and Designs Techniques II**

**Chair:** Carlos Vega, DGA Min Ltda, Chile

14:10  **Effect of the collapsed area on productivity and allocation of Semi-Autonomous LHD using simulations**

Yerko Yávar, Francisco Carrasco and Pamela Zapata, Codelco, Chile

14:30  **Variating extraction rate due to technology improvements: mine planning implications**

Francisco Carrasco, Emilio Castillo, Edisson Pizarro, Codelco, Chile

14:50  **Design criteria and its impact on production capacity in mines operated by panel caving method**

Francisco Rodriguez and Hugo Constanzzo, Codelco, Chile

15:10  **Technical Back-Analysis Crinkle Cut Method El Teniente Mine**

Sixto López, Hugo Constanzzo and Antonio Madrid, Codelco, Chile

15:30  **Operational Definition of the Three Undercutting Fronts for the New Level Mine Project**

Antonio Madrid and Hugo Constanzzo, Codelco, Chile

15:50  **Poster Session and Coffee Break / Foyer**
### SESSION 11

**Development of tools for mine planning II / Estimating risk and uncertainty of mining plan II**

**Chair:** Hans Göpfert, AMEC, Chile

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<tr>
<td>16:20</td>
<td>Relincho Project Geology</td>
<td>Fabián Figueroa, Teck Resources Limited, Chile</td>
</tr>
<tr>
<td>16:40</td>
<td>Virtual Reality Environment and its Applications on Mine Engineering</td>
<td>Felipe Silva, Rodrigo Peroni, Paulo Roberto Mello and Flora Jones, Universidade Federal do Rio Grande do Sul (UFRGS), Brazil</td>
</tr>
<tr>
<td>17:00</td>
<td>Scheduling based on activities: a new approach</td>
<td>Miguel Péndola, MineSight Applications Chile - Division. of Mintec Inc., Chile</td>
</tr>
<tr>
<td>17:20</td>
<td>Evaluation of congestion in mining operations</td>
<td>Jhon Cuaresma and Juan Velasco, Compañía Minera Antamina S.A., Peru</td>
</tr>
<tr>
<td>17:40</td>
<td>Simulation and optimization of hauling in mining plans</td>
<td>Jorge Lozano, Compañía Minera Antamina S.A., Peru</td>
</tr>
<tr>
<td>18:00</td>
<td>A framework to increase the slope angle for open pit mines</td>
<td>Maria Teresa Zandarin, Antonio Navarro, Claudio Bravo and Erika Valdes, JRI Ingeniería S.A, Chile</td>
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### SESSION 12

**Development of tools for mine planning**

**Chair:** Nelson Morales, Universidad de Chile

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<tbody>
<tr>
<td>16:20</td>
<td>Combining and comparing strategies for open-pit block scheduling</td>
<td>Enrique Jélvez, Diego Mancilla, Nelson Morales and Pierre Nancel-Penard, Universidad de Chile</td>
</tr>
<tr>
<td>16:40</td>
<td>Integrated optimisation systems for strategic open pit mine planning</td>
<td>Marcos Goycoolea and Eduardo Moreno, Universidad Adolfo Ibañez, Chile</td>
</tr>
<tr>
<td>17:00</td>
<td>Flexible stochastic planning: the ultimate frontier</td>
<td>Juan Guzmán, C. Deck, C. Hinrichsen, C. Lichtin, M. Rademacher, Gestión y Economía Minera, Chile; R. Cancino, J. Henríquez, E. Jara, G. Morales, Codelco, Chile; A. Echeverría, G. Juárez, M. Recabarren, J. Ronda and E. Vila-Echague, BOAMine, Chile</td>
</tr>
<tr>
<td>17:20</td>
<td>Controlling mine planning performance indicators to improve reconciliation</td>
<td>Tais Câmara and Rodrigo Peroni, UFRGS, Brazil; Daniel Fontoura, Vale Fertilizantes, Brazil</td>
</tr>
<tr>
<td>17:40</td>
<td>Mine planning technological platform at El Teniente mine</td>
<td>Antonio Pinochet, Rodrigo Sierralta, Eliseo Huenul, Jorge Ramirez, Rodrigo Barrera, Mauricio Méndez and Jaime Henríquez, Codelco, Chile</td>
</tr>
<tr>
<td>18:00</td>
<td>Managing Operational Mine Cost through Robust Medium Term Planning</td>
<td>Enrique Rubio, Gabriel País, Edgardo Madariaga, REDCO Mining Consultants, Chile</td>
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</table>
18:30 Closing Ceremony

Seminars Balance and Final Comments

Julio Beniscelli, Geomin-Mineplanning 2013 Technical Coordinator, Mining Consultant, Chile

Carlos Barahona, Geomin-Mineplanning 2013 Executive Director, Gecamin, Chile

Manuel Durán, Geomin 2013 Chair, Independent Consultant, Chile

Octavio Araneda, Mineplanning 2013 Chair, Vice-President of Operations, South-Central Region, Codelco, Chile

POSTER PRESENTATIONS / FOYER

1. Mining investment risk reduction through the use of CRM in QA/QC of the drilling
César Pastén and Víctor Anabalón, Instituto Nacional de Tecnología, Estandarización y Metrología (INTEM), Chile

2. Categorical variables simulation incorporating local varying anisotropy
Rodrigo Gutiérrez and Julián Ortiz, Universidad de Chile

3. Physicochemistry of water-rock interactions in alkaline media
Pía Lois, Brian Townley, Willy Kratch and Julián Ortiz, Universidad de Chile

4. Geological and geochemical exploration of Maciso mine (~26°56’S/70°37’W), NW of Sierra El Roble, III region, Chile
Diego Venegas and Wolfgang Griem, Universidad de Atacama, Chile

5. Integration of geochemical and mineralogical techniques to characterize a Porphyry Cu-Mo Deposit
Rocío Vargas and Brian Townley, Universidad de Chile

6. A fast way to design phases in variable slope angles mines
Orlando Rivera, Universidad Adolfo Ibáñez, Chile
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<th>Seminar</th>
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<tr>
<td>Tailings</td>
<td>August 28 – 30</td>
<td>Santiago, Chile</td>
<td>tailings2013.com</td>
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<td>Procemín</td>
<td>October 15 – 18</td>
<td>Santiago, Chile</td>
<td>procemin.com</td>
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<tr>
<td>MAPLA</td>
<td>September 4 – 6</td>
<td>Santiago, Chile</td>
<td>mapla2013.com</td>
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<td>SRMINING</td>
<td>November 5 – 8</td>
<td>Santiago, Chile</td>
<td>srmining.com</td>
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<td>MANTEMIN</td>
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<td>WCSB6</td>
<td>November 19 – 22</td>
<td>Lima, Peru</td>
<td>wcqb2013.com</td>
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<td>IBS</td>
<td>October 8 – 11</td>
<td>Antofagasta, Chile</td>
<td>ibs2013.com</td>
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<td>Enviromine</td>
<td>December 4 – 6</td>
<td>Santiago, Chile</td>
<td>enviromine2013.com</td>
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