“Importance of Latin America’s Contribution to the Global Supply of Copper, Lead, Zinc and Nickel and their By-product Metals”

Don Smale
Secretary-General

International Lead and Zinc Study Group
International Copper Study Group
International Nickel Study Group

EU- Latin America Dialogue on Raw Materials
Lima, Peru, 10-11 March 2014
INTERNATIONAL STUDY GROUPS

INTRODUCTION

- Shared headquarters in Lisbon, Portugal, since 2006
- Intergovernmental organizations consisting of member governments plus the European Union representing metals producing and using countries
  - **International Lead and Zinc Study Group**: established in 1959, has presently 30 members
  - **International Copper Study Group**: established in 1992, has presently 24 members
  - **International Nickel Study Group**: established in 1990, has presently 15 members
STUDY GROUPS
MAIN OBJECTIVES & FUNCTIONS

➢ To conduct **consultations** and **exchanges of information** on the international copper, nickel, lead & zinc economies.
➢ To improve **statistics** on these metals.
➢ To increase **market transparency**.
➢ To undertake **studies** on issues of interest to the Groups.
➢ To consider special problems or difficulties that exist or may arise in these metal’s international economies.

The Study Groups endeavour to provide its membership with the most accurate, comprehensive and timely **information** on capacities, production, usage, trade, stocks, prices, technologies, research and development, and other areas that may influence the supply and demand for **copper, nickel, lead & zinc**.
STUDY GROUPS
FORUMS FOR DISCUSSION

- **Markets**: forecasts of supply and demand for metals a year ahead

- **Trade**: monitoring of international trade in metals

- **Environmental policy**: sharing information on approaches to regulation

- **Industry Advisory Panel**: metals industry executives provide input to member governments

- Invite **observer countries, industry and observer organizations** such as UNCTAD, World Bank, UNIDO, Common Fund for Commodities and metals associations
ILZSG Membership

- Membership open to any country involved in lead and/or zinc production, usage, or trade.
- 30 members (>85% of global lead/zinc industry):

<table>
<thead>
<tr>
<th>Australia</th>
<th>Germany</th>
<th>Morocco</th>
<th>Serbia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>India</td>
<td>Namibia</td>
<td>South Africa</td>
</tr>
<tr>
<td>Brazil</td>
<td>Iran</td>
<td>Netherlands</td>
<td>Sweden</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Ireland</td>
<td>Norway</td>
<td>Thailand</td>
</tr>
<tr>
<td>Canada</td>
<td>Italy</td>
<td>Peru</td>
<td>United States</td>
</tr>
<tr>
<td>China</td>
<td>Japan</td>
<td>Poland</td>
<td>European Community</td>
</tr>
<tr>
<td>Finland</td>
<td>Korea Rep.</td>
<td>Portugal</td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>Mexico</td>
<td>Russian Fed.</td>
<td></td>
</tr>
</tbody>
</table>
ICSG Membership

- Membership open to any country involved in copper production, usage, or trade.
- 24 member governments (>80% of global copper industry)
INSG Member Countries

Australia  Brazil  Cuba  European Union
Finland  France  Germany  Greece
Italy  Japan  Norway  Portugal
Russian Federation  Sweden  United Kingdom
ILZSG Main Publications

- Lead and Zinc New Mine and Smelter Projects 2013
- Study on Chinese Zn First Use Market 2012
- The By-Products of Copper, Zinc, Lead and Nickel
- Indian Lead Market 2012
- World Directory: Primary and Secondary Lead Plants 2011
- Environment and Health Controls on Lead 2011
- Environment and Health Controls on Zinc 2011
- China Lead Acid Battery Market (prepared for ILZSG by BGRIMM)
- China Zinc Recycling Industry (prepared for ILZSG by BGRIMM)

50% Discount
For companies based in member countries
ICSG Main Outputs

**Copper Bulletin** (monthly): includes annual and monthly statistics, by country, on copper mine, smelter, refined and semis production, copper usage and trade, as well as stocks and exchange prices, providing a global view of supply and demand.

**Statistical Yearbook**: As above, covering the past 10 years.

**ICSG Online Statistical Database**: The ICSG maintains one of the world's most complete historical and current databases with statistics on copper production capacities, data on copper production, consumption, stocks, prices, recycling and trade for copper products.

**Monthly Press Release** on the state of the copper market and **Forecast Press Release** presenting twice a year ICSG forecasts for the copper market (to be included in the email distribution list please contact mail@icsg.org)

**Copper Factbook**: The Factbook provides a broad overview of all facets of copper, from production to trade, usage, recycling and more. It is designed to promote copper and educate readers about the importance and contribution of copper to society. Available on ICSG Website for download

**Directory of Copper & Copper Alloy Fabricators** (annual): provides a global overview of semis fabricators processing cathode and scrap into semi-finished products. The Directory covers wire rod plants, ingot makers, master alloy plants, brass mills, and electrodeposited copper foil mills.

**Special Reports**: ICSG undertakes regularly special reports on topics of interest to the copper Industry/Governments (list available in ICSG website)
Next Study Group Meetings in Lisbon, Portugal

- 31 March - 1 April 2014  International Copper Study Group
- Morning 2 April 2014    International Lead and Zinc Study Group
- 2.00pm 2 April 2014    Joint Study Groups Seminar “The Mining and Metals Industry in Europe”
- 3-4 April 2014         International Nickel Study Group
Copper Refined Production
Latin America Countries vs World

2013 share in World Production

82%
0% 1% 13%
Argentina
Brazil
Chile
Colombia
Mexico
Peru
Others

2016 share in World Production *

84%
0% 1% 11%
Argentina
Brazil
Chile
Colombia
Mexico
Peru
Others

<table>
<thead>
<tr>
<th>in '000 tons Cu</th>
<th>2013</th>
<th>2016 *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Brazil</td>
<td>249</td>
<td>280</td>
</tr>
<tr>
<td>Chile</td>
<td>2,753</td>
<td>3,222</td>
</tr>
<tr>
<td>Colombia</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Mexico</td>
<td>373</td>
<td>656</td>
</tr>
<tr>
<td>Peru</td>
<td>361</td>
<td>663</td>
</tr>
<tr>
<td>Others</td>
<td>17,245</td>
<td>24,328</td>
</tr>
<tr>
<td>World</td>
<td>21,007</td>
<td>29,165</td>
</tr>
<tr>
<td>Latin America</td>
<td>3,763</td>
<td>4,841</td>
</tr>
</tbody>
</table>

* Based on expected production capacity

Note: In the last 5 years, global refineries have operated at an average of 79% of the reported capacity
Copper Refined Production
Latin America Countries vs Latin America

2013 share in Latin America Production

2016 share in Latin America Production *

* Based on expected production capacity
**Copper Mine Production**
**Latin America Countries vs World**

2013 share in World Production

- Argentina: 55%
- Brazil: 32%
- Chile: 8%
- Colombia: 3%
- Mexico: 1%
- Peru: 1%
- Others: 1%

2016 share in World Production *

- Argentina: 25%
- Brazil: 0%
- Chile: 10%
- Colombia: 4%
- Mexico: 1%
- Peru: 0%
- Others: 2%

<table>
<thead>
<tr>
<th>Country</th>
<th>2013 ('000 tons Cu)</th>
<th>2016 ('000 tons Cu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>110</td>
<td>100</td>
</tr>
<tr>
<td>Brazil</td>
<td>275</td>
<td>483</td>
</tr>
<tr>
<td>Chile</td>
<td>5,776</td>
<td>6,458</td>
</tr>
<tr>
<td>Colombia</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Mexico</td>
<td>492</td>
<td>983</td>
</tr>
<tr>
<td>Peru</td>
<td>1,376</td>
<td>2,689</td>
</tr>
<tr>
<td>Others</td>
<td>9,986</td>
<td>15,488</td>
</tr>
<tr>
<td><strong>World</strong></td>
<td><strong>18,015</strong></td>
<td><strong>26,206</strong></td>
</tr>
<tr>
<td><strong>Latin America</strong></td>
<td><strong>8,050</strong></td>
<td><strong>10,802</strong></td>
</tr>
</tbody>
</table>

* Based on expected production capacity

Note: In the last 5 years, global mines have operated at an average of 83% of the reported capacity
Copper Mine Production
Latin America Countries vs Latin America

2013 share in Latin America Production

- Argentina: 17%
- Brazil: 6%
- Chile: 0%
- Colombia: 0%
- Mexico: 9%
- Peru: 25%
- Others: 1%

2016 share in Latin America Production *

- Argentina: 1%
- Brazil: 1%
- Chile: 4%
- Colombia: 1%
- Mexico: 1%
- Peru: 0%
- Others: 60%

* Based on expected production capacity
Copper Mine Production

New countries emerged, last decade, in Latin America as copper mine producers: Dominican Republic and Bolivia *

* Based on expected production
Copper Mine Production

New countries will potentially emerge in Latin America as significant copper mine producers: Panama and Ecuador *

* Based on expected production capacity
Lead Mine Output 2013
Selected Latin American Countries

- Argentina
- Brazil
- Chile
- Colombia
- Mexico
- Peru
- Uruguay
- Other

90%
Lead Mine Output 2016
Selected Latin American Countries

- Argentina: 5%
- Brazil: 0%
- Chile: 0%
- Colombia: 0%
- Mexico: 0%
- Peru: 5%
- Uruguay: 0%
- Other: 90%
Zinc Mine Output 2016
Selected Latin American Countries

- Argentina: 83%
- Brazil: 0%
- Chile: 0%
- Colombia: 0%
- Mexico: 0%
- Peru: 10%
- Uruguay: 0%
- Other: 6%
Zinc Mine Output 2013
Total Latin America
Zinc Mine Output 2016
Total Latin America

- Argentina: 80%
- Brazil: 0%
- Chile: 0%
- Colombia: 0%
- Mexico: 6%
- Peru: 0%
- Uruguay: 0%
- Bolivia: 10%
- Guatemala: 1%
- Honduras: 0%
- Other: 3%
- Total: 100%
Lead Metal 2013
Selected Latin American Countries

- Argentina
- Brazil
- Chile
- Colombia
- Mexico
- Peru
- Uruguay
- Other

94%
Lead Metal 2016
Selected Latin American Countries

- Argentina
- Brazil
- Chile
- Colombia
- Mexico
- Peru
- Uruguay
- Other

94%
Zinc Metal 2013
Selected Latin American Countries

- Argentina: 0%
- Brazil: 2%
- Chile: 0%
- Colombia: 3%
- Mexico: 0%
- Peru: 0%
- Uruguay: 0%
- Other: 93%
Zinc Metal 2016
Selected Latin American Countries
Primary Nickel Capacity by Country

2012: \( \approx 1.8 \text{Mt} \)

New committed developments: \( \approx 0.5 \text{Mt} \)

Note: no Chinese NPI projects included.
## New Nickel Capacity on Stream / Ramp Up - 2014

<table>
<thead>
<tr>
<th>Project Name / Country</th>
<th>Product</th>
<th>Mode</th>
<th>Estimated Production</th>
<th>Projected Total Production</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambatovy / Madagascar</td>
<td>Class I</td>
<td>Ramp Up</td>
<td>≈ 40 000</td>
<td>60 000</td>
<td>Open market</td>
</tr>
<tr>
<td>Long Harbour / Canada</td>
<td>Class I</td>
<td>Start Up</td>
<td>≈ 10 000</td>
<td>50 000</td>
<td>Mainly replacement</td>
</tr>
<tr>
<td>Tagaung Taung / Myanmar</td>
<td>FeNi</td>
<td>Start Up</td>
<td>≈ 15 000</td>
<td>22 000</td>
<td>China</td>
</tr>
<tr>
<td>Koniambo / New Caledonia</td>
<td>FeNi</td>
<td>Start Up</td>
<td>≈ 26 000</td>
<td>60 000</td>
<td>Open market</td>
</tr>
<tr>
<td>Onça Puma / Brazil</td>
<td>FeNi</td>
<td>Ramp Up</td>
<td>≈ 12 000</td>
<td>58 000</td>
<td>Open market</td>
</tr>
<tr>
<td>Barro Alto / Brazil</td>
<td>FeNi</td>
<td>Ramp Up</td>
<td>≈ 25 000</td>
<td>36 000</td>
<td>Open market</td>
</tr>
<tr>
<td>Goro / New Caledonia</td>
<td>Semi / Class I</td>
<td>Ramp Up</td>
<td>≈ 25 000</td>
<td>60 000</td>
<td>Australia &amp; China</td>
</tr>
<tr>
<td>Ramu / PNG</td>
<td>Semi</td>
<td>Ramp Up</td>
<td>≈ 20 000</td>
<td>30 000</td>
<td>China &amp; Other</td>
</tr>
<tr>
<td>Talvivaara / Finland</td>
<td>Semi</td>
<td>Ramp Up</td>
<td>≈ 15 000</td>
<td>35 000</td>
<td>Finland</td>
</tr>
<tr>
<td>Raventhorpe / Australia</td>
<td>Semi</td>
<td>Ramp Up</td>
<td>≈ 35 000</td>
<td>39 000</td>
<td>Australia &amp; Other</td>
</tr>
<tr>
<td>Taganito / The Philippines</td>
<td>Semi</td>
<td>Start Up</td>
<td>≈ 20 000</td>
<td>30 000</td>
<td>Japan</td>
</tr>
<tr>
<td>Santa Rita / Brazil</td>
<td>Conc.</td>
<td>Ramp Up</td>
<td>≈ 20 000</td>
<td>25 000</td>
<td>Brazil &amp; Finland</td>
</tr>
<tr>
<td>Kevitsa / Finland</td>
<td>Conc.</td>
<td>Ramp Up</td>
<td>≈ 10 000</td>
<td>10 000</td>
<td>Open market</td>
</tr>
</tbody>
</table>

*Note: no Chinese NPI projects included.*
• Guatemala restarted mining in 2012 and may start producing FeNi later this year
• Brazil: Onça Puma ramping up but Barro Alto will rebuild 2 furnaces
• Dominican Rep. (2014) and Venezuela stopped producing
• The Indonesian legislation on nickel ore export restrictions, what effect will that have on ore availability in China and NPI in the near and medium future?

• Building up of NPI capacity in Indonesia, what effect will that have on nickel prices, NPI production in China and the world nickel supply/demand balance in coming years?

• High world nickel stocks, particularly LME, what effect will that have on nickel prices and availability of primary nickel in coming years?
Joint Report on By-Product Metals

- Information on the by-product metals of copper, zinc, lead and nickel published in a Report and a Directory.
- Metals covered: bismuth, germanium, indium, cobalt, platinum group metals, scandium, molybdenum, rhenium, selenium, tellurium and rare earth elements.
- Data on sources, refinery processes, recycling, markets, contracts, pricing, uses, government regulations, REACH status of compounds, government stockpiles and trade restrictions.
## Joint Report on By-Product Metals

**World production of the by-product metals and the principal metals (2011 estimates)**

<table>
<thead>
<tr>
<th>Principal Metal</th>
<th>Mine Production (tonnes)</th>
<th>By-product Metal</th>
<th>Production (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead</td>
<td>4,500,000</td>
<td>Bismuth</td>
<td>8,500</td>
</tr>
<tr>
<td>Zinc</td>
<td>12,400,000</td>
<td>Germanium*</td>
<td>118</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Indium*</td>
<td>640</td>
</tr>
<tr>
<td>Nickel</td>
<td>1,800,000</td>
<td>Cobalt</td>
<td>98,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Platinum Group Metals</td>
<td>472</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scandium*</td>
<td>10#</td>
</tr>
<tr>
<td>Copper</td>
<td>16,100,000</td>
<td>Cobalt</td>
<td>98,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Molybdenum</td>
<td>250,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rhenium</td>
<td>46#</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Selenium*</td>
<td>2,600#</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tellurium*</td>
<td>450#</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rare Earth Elements</td>
<td>130,000</td>
</tr>
</tbody>
</table>
By-Product Metals in Latin America

The Joint Study Group Report and Directory provide information on the following metals from Latin American Producers

- Bismuth
- Indium
- Cobalt
- Molybdenum
- Rhenium
- Selenium
- Tellurium
- Rare Earth Elements
By-Product Metals in Latin America

Latin American Countries identified in the Directory include
- Argentina
- Bolivia
- Brazil
- Chile
- Cuba
- Mexico
- Peru

Other sources indicate that by-product metals resources exist in
- Columbia (Cobalt)
- Dominican Republic (Cobalt)
By-Product Metals in Latin America

An example of a by-product metal – Indium

In the Western world (excluding China & CIS) ~ 1000 MT Indium mined
- 25-30% of Indium mined yearly becomes refined indium
- 25-30% accumulates in residues
- 40-50% goes to non-Indium-capable refineries and is (now) lost

- **Indium extraction is still currently inefficient and can be expanded**
- **Indium is often found in combination with Zn and Pb**
- **Ores in Bolivia and Peru have relatively high Indium content**

*Source: Indium Corporation figures*
By-Product Metals in Latin America

**Bismuth**
- Mexico
  - Grupo Penoles
- Peru
  - Xstrata Antamina Mine
- Peru
  - Doe Run La Oroya
- Brazil
  - Verena Minerals Corp

**Indium**
- Brazil
  - Votorantim Tres Marias
- Bolivia
  - SOAM (South American Silver Corp) Ag-In-Ga-Cu-Pb

**Cobalt**
- Brazil
  - Mirabela Nickel Santa Rita Mine
- Brazil
  - Votorantim Metais Niquel S.A.
- Cuba
  - Moa Nickel & Sherritt International Corp
- Cuba
  - Cubaniquel
- Mexico
  - Baja Mining/Korean Consortium
# By-Product Metals in Latin America

## Molybdenum

- **Argentina**
  - Alumbrera/Xstrata/Goldcorp/Yamana

- **Chile**
  - Amerigo Resources Ltd
  - Minera Valle Central
  - Anglo American/Falconbridge
  - Collahausi
  - Antofagasta
  - Esperanza/ Telégrafo Sur
  - Antofagasta/Minera
  - Los Pelambres
  - Codelco
  - El Teniente / Andina
  - Molibdenos y Metales SA (MOLYMET)

- **Mexico**
  - Mercator Minerals Ltd
  - El Creston
  - Molymex SA de CV

- **Peru**
  - Anglo American
  - Quellaveco/Michiquillay
  - Freeport-McMoRan
  - Cerro Verde II
  - Southern Copper
  - Toquepala/Cuajone
## By-Product Metals in Latin America

**Molybdenum Future Projects**

<table>
<thead>
<tr>
<th>Country</th>
<th>Company Name</th>
<th>Project Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>Lumina Copper Corp</td>
<td>Taca Taca</td>
</tr>
<tr>
<td>Argentina</td>
<td>Yamana Gold Inc</td>
<td>Agua Rica</td>
</tr>
<tr>
<td>Chile</td>
<td>Pan Pacific Copper</td>
<td>Caserones</td>
</tr>
<tr>
<td>Chile</td>
<td>KGHM, Sumitomo</td>
<td>Serra Gorda</td>
</tr>
<tr>
<td>Chile</td>
<td>Teck</td>
<td>Andacollo Expansion</td>
</tr>
<tr>
<td>Peru</td>
<td>Aluminum Corp. of China (CHINALCO)</td>
<td>Toromocho</td>
</tr>
<tr>
<td>Peru</td>
<td>Anglo American</td>
<td>Los Bronces Expansion &amp; Quellaveco</td>
</tr>
<tr>
<td>Peru</td>
<td>China Minmetals/Jiangxi Copper</td>
<td>El Galeno</td>
</tr>
<tr>
<td>Peru</td>
<td>Mercator Minerals</td>
<td>Creston</td>
</tr>
<tr>
<td>Peru</td>
<td>SCC - Southern Copper</td>
<td>Cuajone &amp; Toquepala Expansions</td>
</tr>
<tr>
<td>Peru</td>
<td>Xstrata</td>
<td>Las Bambas</td>
</tr>
</tbody>
</table>
# By-Product Metals in Latin America

## Rhenium
- **Chile**
  - Teck Codelco
  - Chuquicamata
- **Chile**
  - Molymet
  - Disputada and Los Pelambres
- **Mexico**
  - Mexicana de Cobre
  - La Caridad
- **Mexico**
  - Molymex
  - Maria
- **Peru**
  - Southern Copper
  - Mine

## Rhenium Future Projects
- **Chile**
  - Xstrata
  - Altonorte Metallurgical Facility
- **Chile**
  - Molymet
  - Production
By-Product Metals in Latin America

**Selenium**
- Chile  Codelco  Chuquicamata Refinery
- Chile  Cormiqium  Lonquen Facility
- Peru  Southern Copper

**Tellurium**
- Chile  Anglo-American/Xstrata/Mitsui and Nippon  Collahuasi
- Chile  Codelco  Chuquicamata Refinery/Codelco Norte
- Peru  Doe Run  Oroya Smelter
- Mexico  Mexivada Mining  La Bambolla & AuroTellurio
## By-Product Metals in Latin America

### Rare Earth Elements

- **Brazil**  Industrias Nucleares do Brasil SA  Buena Norte
- **Brazil**  CBMM  Morro Dos Seis Lagos
- **Brazil**  Mitsubishi/Neo Material Technoliges Inc/Mineracao Taboca SA  Pitinga
- **Brazil**  MBAC Fertilizer  Araxá
# By-Product Metals in Latin America

Latin American production is significant, especially in Molybdenum and Rhenium.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Latin American Production (mt)</th>
<th>Latin American Production (%)</th>
<th>Global Production (mt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bismuth</td>
<td>1,112</td>
<td>(9.4)</td>
<td>11,744</td>
</tr>
<tr>
<td>Cobalt</td>
<td>4,969</td>
<td>(5.4)</td>
<td>91,039</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>80,096</td>
<td>(31.9)</td>
<td>251,186</td>
</tr>
<tr>
<td>New Molybdenum Projects</td>
<td>15,200</td>
<td>(33.7)</td>
<td>45,000</td>
</tr>
<tr>
<td>Rhenium</td>
<td>28,000</td>
<td>(59.5)</td>
<td>47,000</td>
</tr>
<tr>
<td>New Rhenium Projects</td>
<td>6,500</td>
<td>(36.7)</td>
<td>17,700</td>
</tr>
<tr>
<td>Selenium (refined)</td>
<td>195</td>
<td>(8.6)</td>
<td>2,265</td>
</tr>
<tr>
<td>Rare Earth Elements</td>
<td>10,500</td>
<td>(9.0)</td>
<td>116,175</td>
</tr>
</tbody>
</table>

Data from Joint Directory – Figures for 2011. Note that not all projects reported production for 2011. Future projects are intended capacity.
“Importance of Latin America’s Contribution to the Global Supply of Copper, Lead, Zinc and Nickel and their By-product Metals”

Don Smale
Secretary-General

International Lead and Zinc Study Group
International Copper Study Group
International Nickel Study Group

EU- Latin America Dialogue on Raw Materials
Lima, Peru, 10-11 March 2014