Revolutionising the hydrometallurgical extraction of base metals at the mine for the global mining industry
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Alexander Mining plc is an AIM quoted (code: AXM) mineral processing technology company with a reputation for strong technical management, allied with financial markets’ expertise.

Its core asset is its intellectual property:
## Corporate data

<table>
<thead>
<tr>
<th><strong>Recent Share Price:</strong></th>
<th><strong>3.75p</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shares issued:</strong></td>
<td>175,589,010</td>
</tr>
<tr>
<td><strong>Management, directors’ et al options:</strong></td>
<td>12,900,000</td>
</tr>
<tr>
<td><strong>Recent market capitalisation:</strong></td>
<td><strong>£6.6m</strong></td>
</tr>
<tr>
<td><strong>AIM Listing code:</strong></td>
<td>AXM</td>
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<tr>
<td><strong>Typical daily shares traded</strong></td>
<td>~0.5-1m</td>
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<tr>
<td><strong>Ownership:</strong></td>
<td></td>
</tr>
<tr>
<td>Private investors</td>
<td>40%</td>
</tr>
<tr>
<td>Ebullio Group</td>
<td>11.4%</td>
</tr>
<tr>
<td>Other institutions</td>
<td>~25%</td>
</tr>
<tr>
<td>Management and insiders</td>
<td>20%</td>
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2013 Highlights

Commercialising breakthrough mineral processing technology

Alexander has made important progress towards the commercialisation of its proprietary AmmLeach® mineral processing technology.

Notable patents granted and pending:

<table>
<thead>
<tr>
<th>MetaLeach Limited Granted Patents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title</strong></td>
</tr>
<tr>
<td>Method for Ammoniacal Leaching</td>
</tr>
<tr>
<td>Method for Extracting Zinc from Aqueous Ammoniacal Solutions</td>
</tr>
<tr>
<td>Method for Leaching Cobalt from Oxidised Cobalt Ores</td>
</tr>
<tr>
<td>Method for Leaching of a Copper-containing Ore</td>
</tr>
<tr>
<td>Method for Leaching Zinc from a Zinc Ore</td>
</tr>
<tr>
<td>Method of Leaching of Copper and Molybdenum</td>
</tr>
<tr>
<td>Method of Oxidative Leaching of Molybdenum</td>
</tr>
<tr>
<td>Method of Oxidative Leaching of Sulfide Ores and/or Concentrates</td>
</tr>
</tbody>
</table>

Notes: * Botswana, Mozambique, Namibia, Tanzania and Zambia
Highlights
Commercialising breakthrough mineral processing technology

- Excellent close working relationship developed during the year with Ebullio as part of its commitment to building a mining company in Turkey
- Working with Ebullio to establish commercial AmmLeach® processing plant for zinc in Turkey
- World’s first zinc cathode produced in April 2014 using AmmLeach® technology
- Notable success on granting of patents

Commercialisation will be achieved by licensing our IP, partnerships in producing mines and equity interests in advanced projects.
The background: Mining industry reality in a turbulent world

Technology has a significant role

- World economic growth, driven by developing countries, dependent upon raw materials

- Demand for main base metals, including copper & zinc set to double in next few decades

- Only a few prospects ever make it to become mines, let alone with a satisfactory return on capital

- World class deposit discovery rate falling sharply, plus sharply falling head grades -

- Many new mines will be costly underground

- Growing country risk & environmental aspects reduce development rates and increase costs

- Constant pressure to improve the odds of success and to lower costs
The background
Mining industry & technology

Major technology breakthroughs and developments:

- Exploration: geophysics/remote sensing, computer resource 3D modelling

- Mining: explosives, mechanisation and computer control

- Mineral processing: gold & copper heap leaching, ultrafine grinding, smelting and HPAL, ore-waste sorting .................

..... We believe the best potential is for Hydrometallurgy - an efficient and environmentally friendly leaching technology
Hydrometallurgy process has major benefits

- Higher returns by increasing mine-site metal product value.
- Can make uneconomic ore bodies economic.
- No associated concentrate costs ie: transport, smelter & refinery charges.
- Concentrate producers not paid for valuable metal by-products.
- Concentrate charges and costs can be > 40% of contained metal value.
- Environmental benefits significant
• Global mined copper production is around 17Mtpa (~US$110bn).

• Chalcopyrite (CuFeS$_2$) concentrates are invariably smelted and account for majority of global copper produced.

• Approx. quarter produced using hydrometallurgy and rising. Main process is copper sulphuric acid leaching and SX-EW of oxides and secondary sulphides.

• First commercial leach SX-EW plant started in late 1960’s in Arizona, then in 1973 in Zambia and, by 1980’s, major plants in USA, Mexico and Chile.

• Heap and dump leaching dominates as the leaching process.
Copper

Hydrometallurgy has a significant role

The World Copper Factbook 2013

Copper Mine Production

World Copper Mine Production, 1900-2012
(thousand metric tonnes)
Source: ICSG

Since 1900, when world production was less than 500 thousand tonnes copper, world copper mine production has grown by 3.2% per year to 16.7 million tonnes in 2012. SX-EW production, virtually non-existent before the 1960s, reached nearly 3.7 million tonnes copper in 2012.
Copper

Supply constraints

- Falling **head grades** - copper average 1990 ~1.6% cf today ~1.2%
- Project **finance** availability
- Major capital **cost overruns** due to complexity and management quality
- Unfavourable tax & investment regimes - **resource nationalism**
- **Water** supply - a critical issue
- Rising **operating costs**, growing move to underground mine production – typically +40%
- Technically challenging **mineralogy** for oxide/transition sulphide deposits
- **Sulphuric acid** supply and price: significant and, increasingly, often prohibitive cost factor for SX-EW projects
- Availability of skilled **labour and management**
Global mined zinc production was 13.3Mtpa (US$27bn) in 2013.

Most world zinc metal production (~ >95%) uses smelting to recover and refine zinc metal from zinc concentrates (from sulphides) or zinc oxides.

Major mine supply deficit forecast.

New AmmLeach® technology has potential to simplify metal or high value added product recovery.
Successful test, using conventional equipment, at ambient temperature & pressure to produce zinc cathode.

First successful test of AmmLeach® technology for zinc and the first solvent extraction of zinc from primary oxide ores using ammoniacal leaching.

Zinc oxides considered largely untreatable and represent some of the highest grade undeveloped base metal near surface deposits.

AmmLeach® technology for a high marketable grade primary zinc product from oxide ore cf traditional refining.

AmmLeach® technology allows great flexibility to tailor extraction conditions to suit varying mineralogy.
Major operational and economic advantages

- Alkaline/ammonia leach process at ambient pressure and temperature

- Proprietary two stage leaching process
  - Ore specific pre-treatment stage
  - Heap or tank leaching

- Proprietary solvent extraction step to avoid ammonia carry-over into electrolyte

- Greatly reduced AmmLeach® reagent consumption of high-acid-consuming ores means significant capex and opex savings

- Clean target metals PLS, unlike acid leach

- Uses conventional equipment
  - Electro-winning is identical to conventional acid circuits
  - Direct replacement for acid leaching in current operations
  - Minimal changes to plant; higher organic transfer efficiencies requires smaller plant

- Environmental benefits
  - Reduced transport/shipping impact and costs
  - Minimal likelihood of Acid Mine Drainage (AMD)
• Major (typically 30-40%) capital and operating cost savings possible due to magnitude of reagent (ammonia cf acid) consumption differential.

• AmmLeach® can produce more metal per unit capacity than in a corresponding acid leach-SX-EW plant due to much higher copper solution concentrations.

• Aside from the very substantial capital and cost savings, AmmLeach® has several major operational and environmental advantages over conventional acid leaching.

• Much simpler process circuits because of the low level of impurities in the leach solutions, and hence lower capital to clean up

• Significantly lower decommissioning/closure costs – no acid mine drainage liability
The following metals are main targets for the AmmLeach® process:

- **Copper** and **Copper/Cobalt** oxide deposits
- **Zinc** oxides deposits
- **Gold/Copper** oxides and **Silver/Zinc** oxides (alkali leaching)
Geographic diversification is offered as the countries with the most prospective geology for hosting high acid consuming copper (Cu) and zinc (Zn) oxides are:

- Turkey (Zn, Cu, Ni)
- Australia (Cu, Ni)
- DRC (Cu, Cu/Co)
- Zambia (Cu)
- Peru (Cu & Zn)
- Chile (Cu)
- Mexico (Cu & Zn)
- Central America (Zn)
- USA (Cu)

Testwork done on many different opportunities world wide
• Investigating potential exciting use of AmmLeach® technology for range of base metals projects in Turkey.

• AmmLeach® amenability testwork on selected zinc oxide deposits reported excellent results – similar to prevalent zinc mineralisation in other deposits in the country.

• Excellent potential for high carbonate copper and base/precious metals mix deposits too.
• Working in partnership with Ebullio group - intending to build a large copper and zinc mining group in Turkey.

• Potential accelerated route to production for AmmLeach®.

• Significant opportunity to establish a profitable commercial scale zinc cathode production plant in Turkey using AmmLeach® technology.

• Key next step is pilot plant.

• Intention would be for a plant taking feed from a combination of the future acquisition of suitably attractive zinc oxide properties and third party sources.
Summary

• Hydrometallurgical extraction of base metals at the mine is ultimate production route
• Major operating and capital cost savings using AmmLeach® technology possible
• Key patents granted and pending
• Focused on royalty and/or licence fee structure, or minority project interests
• Major step towards commercialisation in partnership with Ebullio in Turkey
• Valuation models based on royalties alone show substantial upside.
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