Legacy of legacy mines: reflections, lessons

2015 IAIA Conference
23 April 2015
Florence, Italy
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A legacy mine in the Philippines
- Impacts
- Brief history

How EA professionals can help minimise legacy of legacy mines

1) Canada: ca 10,000 sites, responsibility w/ governments
2) Philippines: 800 sites, responsibility uncertain (Doyle et al 2006)
Other definitions...

- Abandoned, or orphaned mines – “mines for which the owner cannot be found or financially unable or unwilling to remediate the site”
- “zombies” sites – continue to exert some sort of malevolent effect during their afterlife (Sandlos & Keeling 2013).
To make sense of ...

- Legacy of legacy mines
- Understand the context of mining – science, policy, political
Starting argument

- Mining is impact intensive regardless of
  - product,
  - scale,
- location... and
- ? geography of capital?
Extraction and beneficiation

Mine waste (overburden, barren rocks)

Tailings

Leach piles

Mine water

Smelting & Refining

AIR
Toxics, acid, (NOx, SOx) dust

NOx, SOx, particulate matter

Solid waste (slag)

Waste water

TERRESTRIAL ECOSYSTEMS
- Accumulation of toxics
  - Acidification
- Erosion, loss of fertility
  - Damage to soil biota
  - Plant contamination

AQUATIC ECOSYSTEMS
- Acidification
- Multimetal contamination
- Food chain contamination

Mining operations and environmental outcomes
Philippine mineral reserves (Whitmore 2009)

1 of 10 most attractive countries in the world for mining – Fraser Institute

Philippine mineral reserves:
- Gold
- Copper
- Nickel
- Chromite
- Iron
- Bauxite
- Marble
- Limestone

Quantity of Mineral Resources per unit area:
- 3rd in the world for gold
- 4th in the world for copper
- 5th in the world for nickel
- 6th in the world for chromite
Contribution of Mining to Philippine economy

- Contribution of mining sector to 2013 GDP was **0.7%** (1.4% in previous decades)
  - **Ghana** at **6.3%**
  - Phil Agriculture GDP contribution is at **16.5%**

- Jobs created by 26 large mining firms – 158,000 in 2008 or **0.5%** to **0.6%**
  - **Ghana** – **4%**
- 26 large scale mines, ca 300,000 small miners
- More than 50% of active concessions, more than 2/3 of exploration are in active seismic zones
- 6 to 9 typhoons make landfall each year
- Half of staked lands are in ancestral domains (>100 IPs)
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<tbody>
<tr>
<td>Brazil</td>
<td>203.308</td>
<td>11,298</td>
<td>0.527 (2012)</td>
<td>21.4 (2009)</td>
<td>0.744 (79)</td>
<td>91.3%</td>
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<td>Ghana</td>
<td>27.043</td>
<td>1850</td>
<td>0.428 (2006)</td>
<td>28.5 (2007)</td>
<td>0.573 (138)</td>
<td>71.5%</td>
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<td>Philippines</td>
<td>100.410</td>
<td>2765 (2012)</td>
<td>0.430 (2009)</td>
<td>26.5 (2009)</td>
<td>0.660 (117)</td>
<td>97.6% [f] 97.4% [m]</td>
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Sources: various
http://data.worldbank.org/indicator/SI.POV.GINI
http://en.wikipedia.org/wiki/List_of_countries_by_population
http://en.wikipedia.org/wiki/List_of_countries_by_literacy_rate
http://www.transparency.org/country
Pioneering, precedent-setting policy instruments...

- PD 1586 – Environmental compliance certificate requires *social acceptability* from local govt
- Both SA and FPIC to be regularly renewed
- Multipartite monitoring team (MMT) required
Policy on abandoned mines

- Abandoned/Orphaned Mines Initiative
- NRCAN Inactive Mines Database
- Reqt of Closure plans (incl financial surety) at the mine development stage

- Mining Act of 1995: a mine decommissioning plan & fund
- S 7 of EO 79: “All valuable metals in abandoned ores…mine wastes … mill tailing…belong to the State ….”… PPP structure for financing rehabilitation, restoration of legacy mines for re-opening

Canada

Philippines
Case 1: Marcopper Mining Corp in Marinduque (managed by Placer Dome – 40% CDN) –1969 to 1996

- Mt Tapian reserve – first open pit mine – Employed ca 1000 mostly locals, spent $10M/yr on goods and services and provides electricity for the province
- **1969 to 1972** : waste & tailings dumped on land
- **1975** – granted permit to dump on Calancan Bay at 2.5 tons/sec WITH a tunnel to Boac River to drain rainwater
- **1975 – 2000** : 200 MMT (80sq km of tailings) dumped in Calancan Bay
- **1990** Mt Tapian depleted, San Antonio ore body opened; granted 10-yr permit to use Mt Tapian pit as tailings pond
- Marcopper constructed a dam in Mogpog River
- **1993**: Mogpog dam collapsed -> toxic silt covered nearby towns – >loss of homes, lives, farms, animals
- **1996** Tapian pit plug fractured – 200MMT tailings, 20 villages evacuated, wiped out PhP 2M freshwater & marine life, PhP 5M milkfish fry; Boac River – declared dead; 2001 hi levels Cu, Mn, Pb, Zn in marine sediments
1996 – PDI committed ca $70M to construct new dam plug, dredge a tunnel, build levees in the riverbank, constructed homes, airlifted food and supplies. $1M to compensate for lost livelihoods.

1997 – PDI sold its shares to Barrick Gold, clean up & compensation delayed implementation for 6 yrs.

Dec 2001 – Placer Dome pulled personnel out, abandoned commitments to clean up.

2014 Barrick Bold signed an agreement with GOP to reopen the mine with the following provisions.
(iv) PDI and Barrick Gold Corporation are not subject to the jurisdiction of the Courts of the Republic of the Philippines;

(v) Marcopper's disposal of mine tailings into the Calancan Bay was at all relevant times conducted pursuant to and in accordance with government permits;

(x) the weight of scientific evidence demonstrates that the mine tailings present in the Province's waterways do not currently and have not had an unacceptable impact on the environment;

(xi) the Maguila-guila Dam was constructed and operated by Marcopper in accordance with government permits and approvals and conformed to government approved plans and specifications;

(xii) the principal cause of flooding of the village of Mogpog in December, 1993 was typhoon Monang;

(xiii) the breach of the Maguila-guila dam was the result of force-majeure and not the result of any act, omission or breach of obligation by either Marcopper or PDI;
Mogpog River toxic silt from 1993 tailings dam collapse

Calancay Bay – (1975–2000) 200MMT wastes 7kmx0.5 km land mass formed
Case 1: Marcupper Mining Corp in Marinduque (managed by Placer Dome – 1969 to 1996

20 years later
3 towns: much higher incidence and rise in diabetes, goiter, renal disease, spontaneous abortion, cancer, & symptoms of heavy metal poisoning

30-year old fisher
Arsenic poisoning
April 1951, a two year old Yellowknives Dene boy on Latham Island (today’s Ndilo) died. Cause of death: “acute gastroenteritis caused by arsenical poisoning in drinking water.”

Giant and Con Mines both emitted large amounts of untreated $\text{As}_2\text{O}_3$ dust from their roaster stacks, Con from 1948–49 and Giant from 1949 to 1951;

Reductions in $\text{As}_2\text{O}_3$ emissions were incremental over time, leaving the Yellowknife population continually exposed to As in food and in drinking water, from 1950s and 1960s at levels above accepted thresholds at the time;

Water trucked to Ndilo and Dettah – residents were forced to pay for delivery, often from meager welfare payments.

Archival evidence – many Native people continued to draw drinking water from polluted Back Bay.

Epidemiological surveys from other regions suggest that the long term exposure to low levels of As in drinking water supplies would have produced higher cancer rates in Yellowknife.
Negative legacies of legacy mines...

**Socio-economic**
- Loss of income & revenues
- Loss of livelihoods

**Health**
- Contaminated land, water food chain (AMD, heavy metal, radioactivity)

**Safety**
- Abandoned structures
- And no EWS

**Political**
- Loss of public trust in govt & industry
- Conflict
Analysis

Concluding thoughts
Analysis: Environmental, social and development impacts of legacy mines

- result from failure to control, manage environmental impacts of mine operations
- are cumulative effects of the mine during its active life
Rehabilitation, remediation, restoration, regeneration ...

- Emphasis on the visual aesthetics of obscures as much as it reveals about abandoned mines.
- Real rehabilitation requires dealing with sources of AMD, land and structure stabilisation, toxic waste removal – extremely expensive some are difficult or impossible to treat on site
- Poses its own risks (where does it go, how secure is the new site, how will it be managed and monitored forever?)
Legacy of legacy mines

- **COMPLEX** – tremendous financial costs of remediation; complicated or ambiguous legal liability implications.
- **URGENT** – residual environmental impacts pose real & potential threats to human health
- **MORAL** callousness – cultural & economic impacts from devastated landscapes & loss of livelihoods.
EA practitioners can reduce the legacy of legacy mines

1) improve impact prediction, mitigation and management

2) push (guilt) the client:
   1) ISO 14001, EITI
   2) Plan for, fund closure before commencing development; progressive rehabilitation, closure to meet international standards and post-closure monitoring
Thank you.

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Bebbington, A., Hinajosa, L., Bebbington, D., Warnaars. X. Contention and Ambiguity; Mining and the possibilities of development.


Walker, D. Whipping legacy mines into shape *Mining Magazine*  May 2014.

[http://www.umich.edu/~snre492/Jones/marcopper.htm](http://www.umich.edu/~snre492/Jones/marcopper.htm)