GOLD AMALGAMATION PROCESS IN MZ

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PRESENTATION LAYOUT

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INTRODUCTION AND CONTEXT

- ASM SECTOR
  - 10 to 15 million artisanal gold miners producing 400-600 tonnes Au/a in more than 70 countries
  - About 50-100 million people directly and indirectly involved in artisanal gold mining

- In 2008, Brazil produced 54 tonnes of gold, of which 5.2 tonnes were produced by ASM
- Between 10 to 15 tonnes of Hg were lost by ASM
- 6,000,000 tonnes/a of Hg contaminated tailings into the rivers (Brazil)
In the world as many as 9 million women and 2 million children directly employed (50% involved in gold mining).

Worldwide >1000 t/a Hg is used and lost by artisanal miners. 1/3 of the global Hg use is for ASM.
ASM IN MOZAMBIQUE

- Gold panning has been widespread in the Archaean part of Mozambique since the Monomotapa Empire C. 1500 AD.
- Presently around 100,000 people are directly involved in the sector providing subsistence to at least half a million people in the rural and poorest areas of Mozambique.
- ASM produce in average 0.7 grams of gold per day per miner. Working in groups of 5.
- Low recovery and mining and processing technologies
- Labour intensive
- Lack of geological knowledge
- Produces negative impacts on the physical and social environment.
- Mercury is used intensively in gold processing in Manica, Zambezia and Niassa Provinces, where primary gold quartz veins are worked.
- Manica show levels of contamination around 8.23 μg/m³, about 8 times the WHO recommended levels of Hg in humans. The amount of mercury that is used for processing one gram of Au, range between <1 and 15g.
PRE AMALGAMATION PHASE
AMALGAMATION PROCESS

- Amalgamation of the whole ore
  - and/or
  - Cyanidation of Hg-contaminated tailings

- Huge Hg losses
  - $\text{Hg}^{0} \rightarrow \text{CH}_3\text{Hg}$ in fish

- Burning Amalgams in Pans

- Health problem for miners, and community

- $\text{Hg}^{0}$ vapor \(\rightarrow\) lungs
AMALGAMATION IN MZ

Whole ore amalgamation is used for primary gold. The ratio of 4-15:1 Hg:Au is estimated in whole ore amalgamation. In some countries you can find ratios of 50:1 (Indonesia)

The process of amalgamation itself frees up to 60% of mercury into the atmosphere.

- For fine grain alluvial gold the Hg is added after pre concentration
- The ratio mercury gold is as little as <1- 2:1
Amalgam roasting and whole ore amalgamation
Solutions for Hg Pollution in Mining

Alternative Processes
- Gravity Concentration
- Flotation
- Agglomeration
- Electrolytic Process
- Cyanidation
- Chlorine Leaching

Hg Bioavailability Control
- Polluted Sites
  - Bioaccumulation
    - YES
      - Covering
      - Dredging & Treatment
    - NO
      - Monitoring Biota
- Mercury Dispersed
  - Bioaccumulation
    - YES
      - Re-suspension of Sediments
      - Change of Food Habits
    - NO

Reduction of Emissions
- Systemic Solutions
  - Education (schools)
  - Processing Centers
  - Organization
  - Law Enforcement
  - Permanent Biological Monitoring & Technical Assistance
- Individual Solutions
  - Awareness (brochures, etc)
  - Technical Support
  - Retorts
  - Special Pieces of Equipment

UNIDO, 1997
Existing Mercury Reduction Technologies

- Reducing open burning: Vapour Capture
- Reducing open burning: Retort use
- Moving away from mercury whole-ore amalgamation
- Reactivation of mercury
- Avoiding combining mercury and cyanide
- Zero Mercury Processing by direct smelting
PRE-CONCENTRATION OF ORE

- The most important step in reducing mercury usage is concentration
- Concentration of gold from ores into smaller masses either (a) reduces the amount of mercury needed; or (b) allows a zero mercury technology to be employed – such as direct smelting
- Key aspects of good concentration are gold liberation (milling) followed by appropriate concentration technology
- Both require adequate capital – often a function of community stability/legality
Thank you