ECO-FRIENDLY Recovery of GOLD and COPPER for the Small-Scale Mining Industry

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27 June 2014
ERDT BetterMine Project

PROJECT D: Alternative Methods to Amalgamation and Cyanidation in the Recovery of Gold

PROJECT C: Copper Flotation Technology for Small Scale Mining

Gold-Copper INTEGRATED Mineral Processing PILOT PLANT

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Background

- There are around 300,000 small-scale miners operating in the Philippines;

- Small-scale miners in 30 of the country’s 80 provinces account for up to 70-75 percent of the gold mined in the Philippines;
Major Concerns

- Amalgamation

Mercury

- Only 40 – 50% recovery of gold
- Non-recovery of other valuable minerals of copper, lead, zinc, etc.

Cyanide

- Cyanidation

Low Recovery
Background

- Small Scale Mining operations recover gold by either **Cyanidation** and/or **Amalgamation** because it is simple;

- **Cyanidation** and **Amalgamation** are both hazardous processes because chemicals are used for recovery gold that have been long proven to cause adverse effects to health and the environment;
The use of low-end technologies in crushing and grinding of ores leads to lack of liberation and minimum exposure of gold values which results in inefficient separation and low recoveries of gold values during **Cyanidation and/or Amalgamation Processes**. Recovery is only 40 to 50%:
To develop CLEAN and SUSTAINABLE technology for the Small-Scale Mining Industry to separate and recover gold and other metal/mineral values effectively and efficiently from Philippine ores.
PROJECT PILOT AREAS

BAGUIO Area

BICOL Area

DAVAO Area
BAGUIO Area

Project Site: Camp 6 and Kias, Tuba, Benguet

SSM Organization:
Benguet Federation of Small Scale Miners Inc. (BFSSM)

Camp 6 Explorers Small Scale Miners,. Inc. (CESSMAI). Camp 6, Tuba, Benguet
DAVAO Area

Project Site: Diwalwal, Mt. Diwata, Compostela
Types of Gold (Au) ores

Baguio
15.27 gm-Au/MT
with Copper and Zinc values

Bicol
12.91 gm-Au/MT
with Copper values

Diwalwal
26.12 gm-Au/MT
FRAMEWORK  Project Implementation

Mineralogical Examination

Sample Preparation

ALTERNATE PROCESS TESTS

CONVENTIONAL PROCESS TESTS

OPTIMIZATION

PILOT PLANT TESTING

ECONOMIC ANALYSIS

IMPLEMENTATION
Project OBJECTIVES

1. To identify factors affecting the effective recovery of gold values by flotation and gravity concentration technologies;

2. To establish optimum operating conditions for the efficient and effective recovery of gold (including other minerals like copper and zinc) using flotation and gravity concentration technologies; and,

3. To implement a pilot-plant testing for gold and other mineral values with provisions of tailings disposal and treatment.
Metallurgical Testing

- Enhanced Gravity Concentration
  • Separation of fine gold values

- Flotation
  • Separation of fine gold values associated with sulphide minerals, like pyrite (FeS$_2$)
Enhanced Gravity Concentrator (FALCON)
Flotation Tests

- The separation of valuable minerals from gangue by altering the surface properties of the minerals using reagents and recovering the valuable minerals in the froth phase.
PROCESS FLOW

ORE

DIWALWAL Gold Ore
BICOLO Gold Ore
BAGUIO Gold Ore

MINERAL PROCESSING

CONCENTRATE

Tails
DIWALWAL Gold Ore
FLOWSHEET : Mineral Processing of DIWALWAL Gold Ore

Size Reduction and Sizing

Concentration

Dewatering

Tailings Treatment and Disposal

ORE

Jaw Crusher

Screen

Roll Crusher

Ball Mill

Hydrocyclone

FALCON Gravity Concentrator

TABLE

FLOTATION

Gold Concentrate

Thickener 1

Thickener 2

Thickener 3

Thickener 4

Water Reservoir

For Recycling

Tailings Settling Ponds

Solids

Wastewater

Remediation & Vegetation

Treatment

Clean Water
FINAL SET-UP OF PILOT PLANT
Summary

1. Environmentally-friendly process 
   *(Flotation-Gravity Concentration Process)*
   - NO Mercury
   - NO Cyanide

2. Increased Gold Recovery
   - 40-50% to 90%

3. Recover other valuable minerals
   - Copper and zinc minerals

4. Tailings Disposal and Treatment system

4. Flexible Operation

5. Low capital and operating expenses
Philippine Metallic Mineral Production

ACCORDING TO MINES AND GEOSCIENCES BUREAU OF DENR

70-80% of Gold production come from the small-scale mining industry

FIELD-TESTING of the INTEGRATED Gold-Copper Mineral Processing Pilot Plant in the Regions
Objectives:

1. To investigate the operating parameters for optimum recovery of gold and other mineral values using gravity concentration / flotation and extraction technologies, and the application of an integrated treatment and disposal of tailing materials;

2. To evaluate the operations and engineering aspects of gravity concentration-flotation technology in order to develop a custom-made gold-copper mineral processing facilities for local utilization; and,

3. To formulate operational protocols and recommend policies for the nationwide implementation of safe and environmentally-friendly integrated gold-copper processing plants for the Philippine small scale mining industry.
Field-Testing Project Framework

PRE-DEPLOYMENT
- Social/Community Preparation
- Technical Preparations
- Infrastructure Preparations
- Tailings System
- Economic Evaluation
- Legal/Environmental Preparations
- Procurement of Equipment

DEPLOYMENT
- Construction of Infrastructure
- Fabrication
- Installation and Instrumentation
- Safety/security provisions

COMMISSIONING
- Additional Mineral Processing/Testing
- Pilot Plant Testing/Evaluation

Operation and Management
- Production and Marketing
- Monitoring and Maintenance

Decommissioning
- Turn over activities
Field-Testing of the INTEGRATED Gold-Copper Mineral Processing Pilot Plant in the BENGUET
PROPOSED SITE 1: ITOGON, BENGUET
This NEW Technology

Responsibly **PRO-ENVIRONMENT**
(does not use hazardous processes thus SAFE for the people and the community)

Responsibly **PRO-FILIPINO**
(so that the nation is given its due share in the bounties of its natural patrimony)

Responsibly **PRO-POOR**
(so that those bounties are enjoyed by the SSM Community)
Thank you very much !!!