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

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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- 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

Mercury

- Amalgamation

Cyanide

- Cyanidation

Low Recovery

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

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;

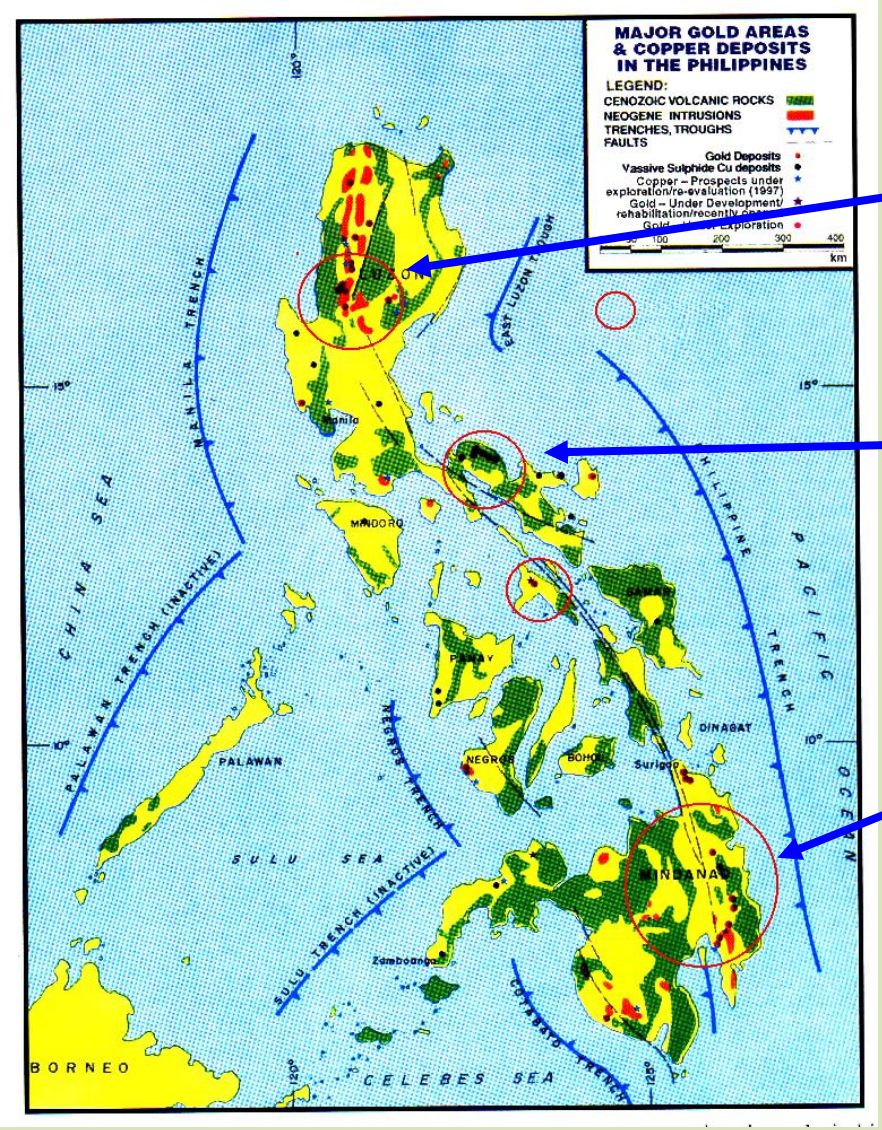
Background (Technical)

- 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%:

CHALLENGE

- **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

BICOL Area

Project Site: ***Paracale and Jose Panganiban, Camarines Norte***

DAVAO Area

Project Site: ***Diwalwal, Mt. Diwata, Compestela***

Types of Gold (Au) ores

Baguio

15.27 gm-Au/MT

with Copper and Zinc values

Bicol

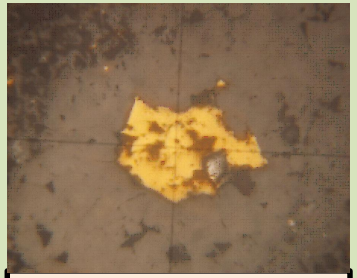
12.91 gm-Au/MT

with Copper values

Diwalwal

26.12 gm-Au/MT

FRAMEWORK Project Implementation



Mineralogical Examination

Sample Preparation

CONVENTIONAL PROCESS TESTS

ALTERNATE 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,

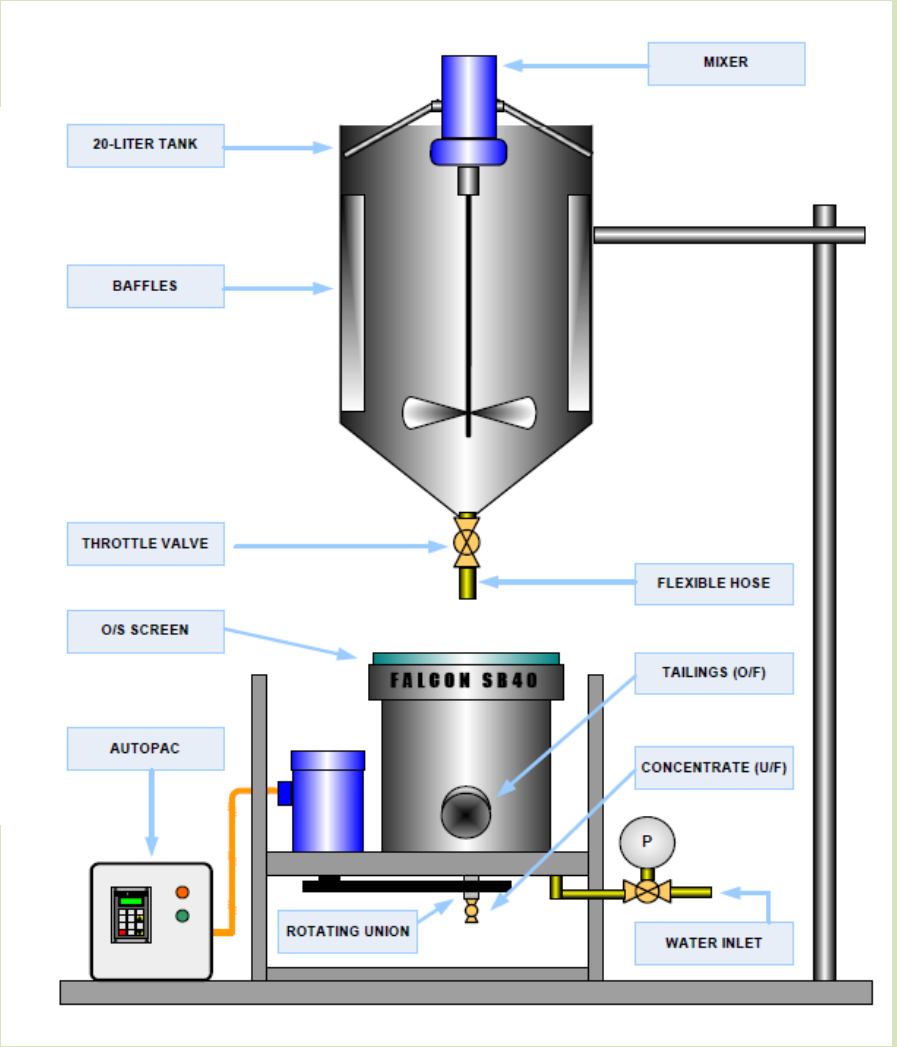
3. To implement a pilot-plant testing for gold and other mineral values with provisions of tailings disposal and treatment.

Metallurgical Testing

- **Enhanced Gravity Concentration**
  - Separation of fine gold values

- **Flotation**
  - Separation of fine gold values associated with sulphide minerals, like pyrite (FeS_2)

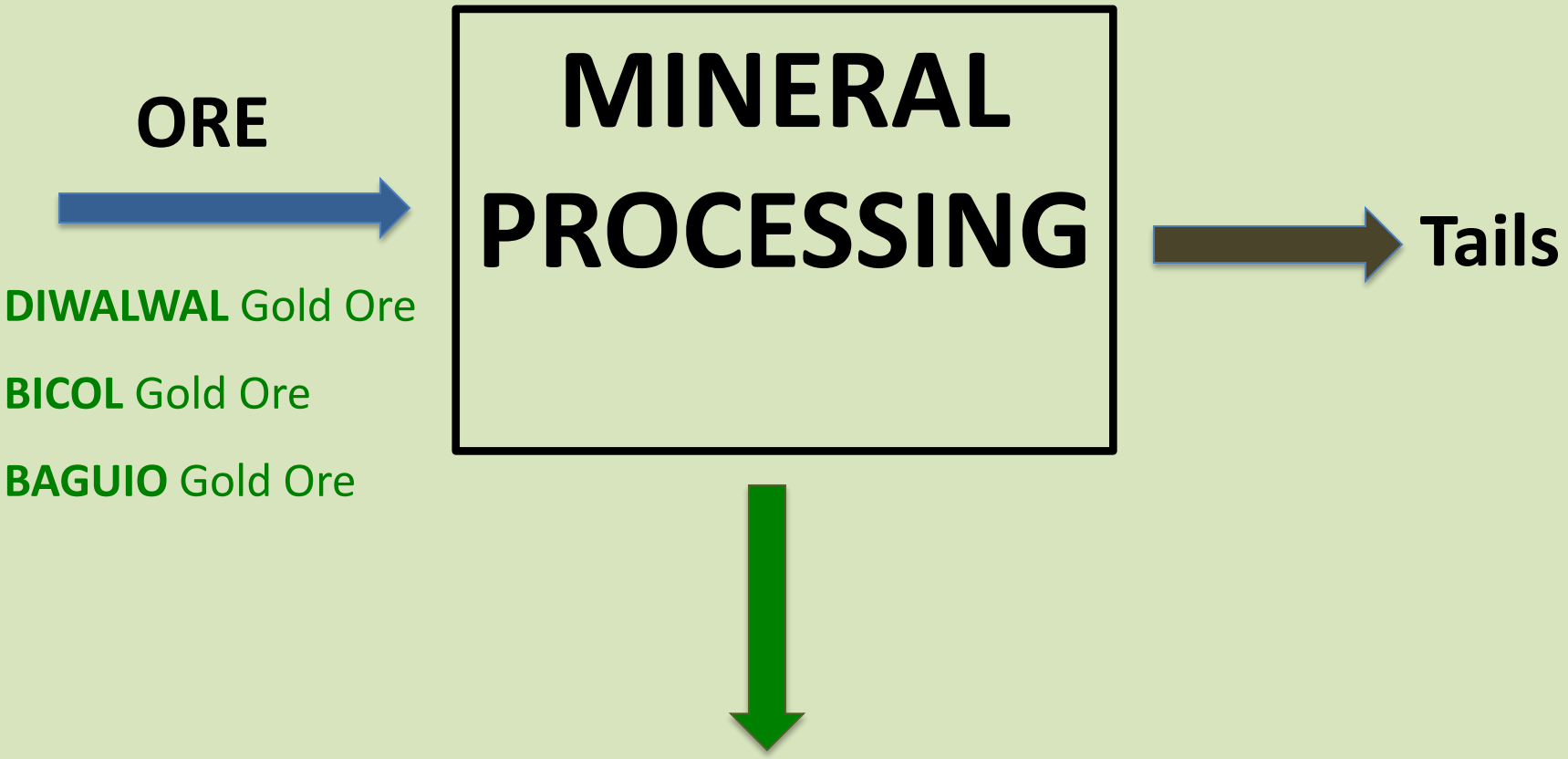
Enhanced Gravity Concentrator (FALCON)



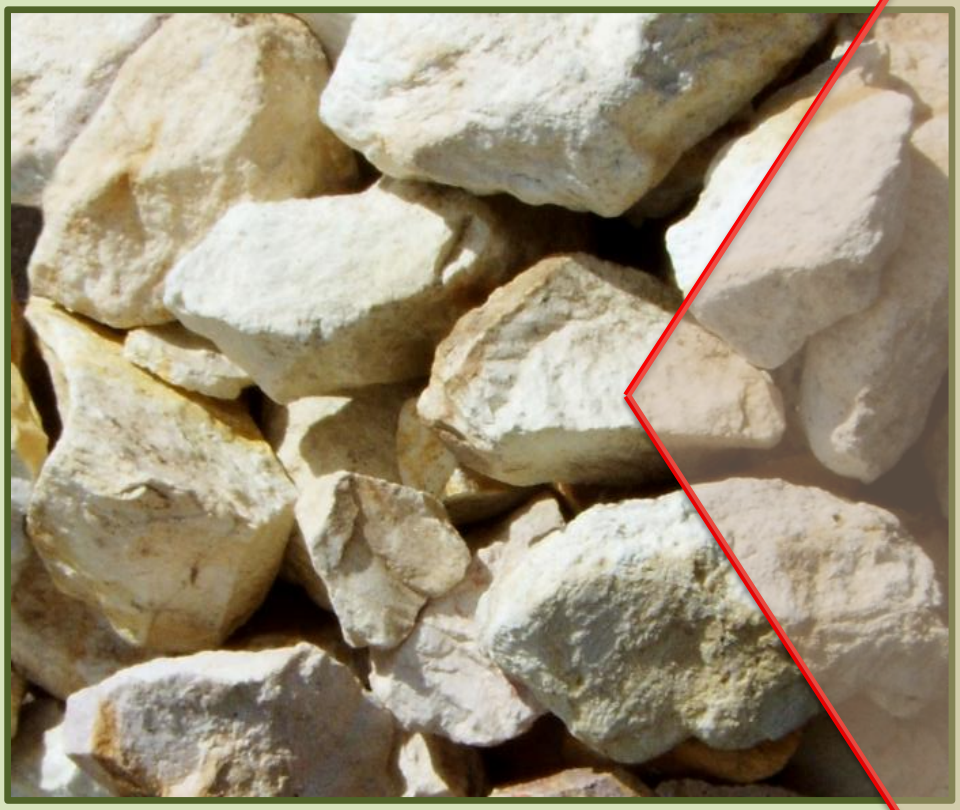
Flotation Tests

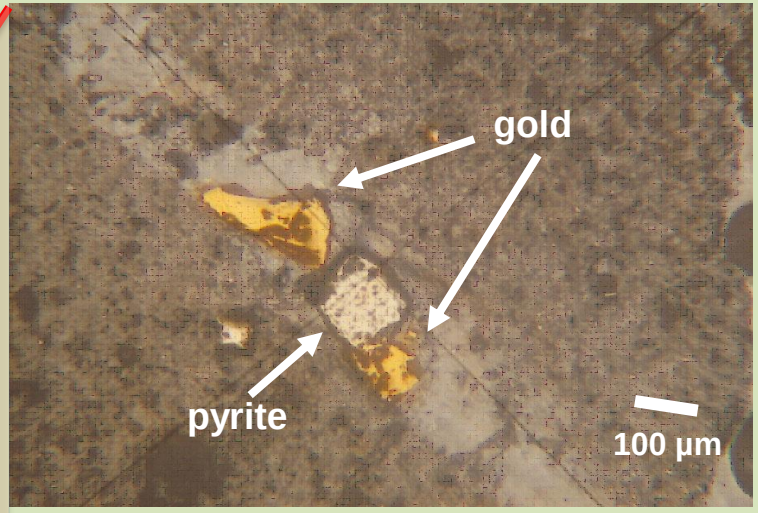
- The separation of valuable minerals from gangue by altering the surface properties of the minerals using reagents and recovering the valuable minerals in the froth phase

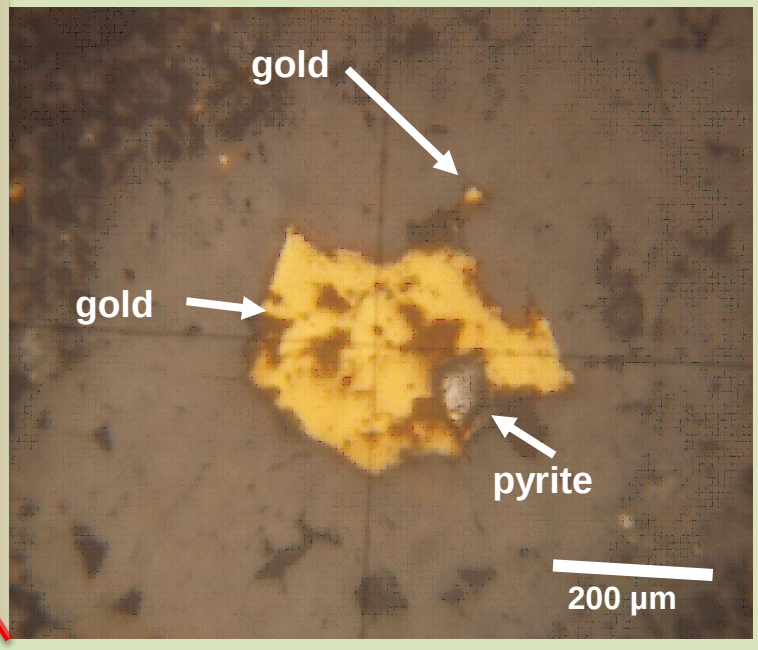
PROCESS FLOW



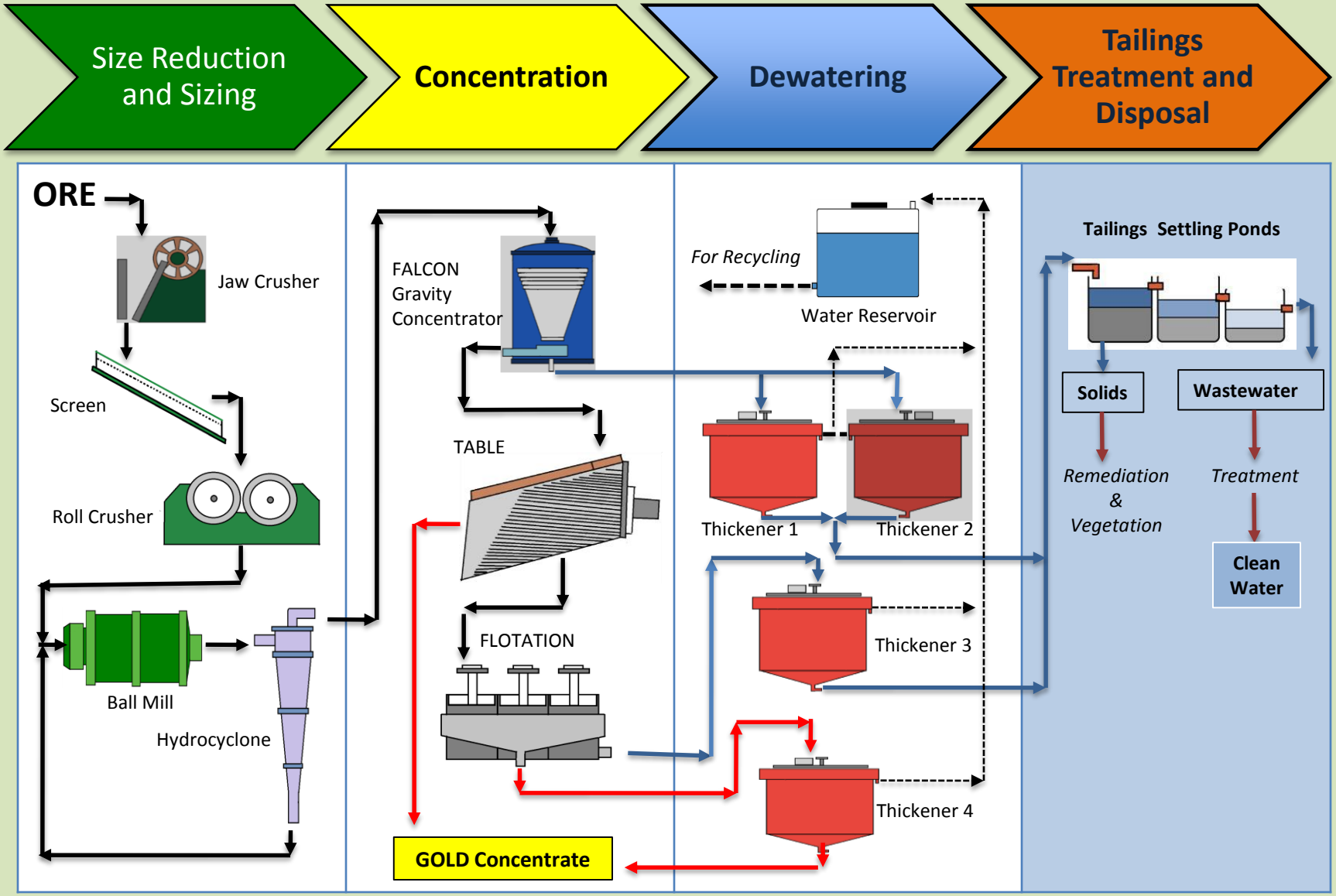
DIWALWAL Gold Ore







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



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

Quantity: In kilograms
Value: In PhP

Name Of Producer	Project Name	JAN-JUN, 2012		JAN - JUN, 2011		% Change	
		Qty.	Value	Qty.	Value	Qty.	Value
PRIMARY PRODUCERS		5,356	12,056,783,782	19,902	39,071,863,372	(73)	(69)
Lepanto Cons. Mng. Corp.	Victoria Gold Project	445	1,015,453,967	285	565,966,178	56	79
Johson Gold Mning Corp.	Paracale Gold Project	0	0	12	21,830,923		
Benguet Corporation	Acupan Contract Mng. Project	188	432,196,169	96	195,075,935	96	122
Philsaga Mining Corp.	Banahaw Gold Project	692	1,549,859,122	1,407	2,855,517,079	(51)	(46)
APEX Mining Company Inc.	APEX Maco Operation	359	814,209,192	424	867,261,869	(15)	(6)
Various Small Scale Mines based on Purchases of BSP*		598	1,253,586,708	14,907	28,958,174,923	(96)	(96)
Phil. Gold Processing & Refining Corp.	Masbate Gold Project	2,989	6,798,624,333	2,771	5,608,036,465	8	21
Greenstone Resources Corporation	Siana Gold Project	86	192,854,292	0	0		
SECONDARY PRODUCERS		3,026	6,122,453,465	2,903	5,445,771,389	4	12
Philex Mining Corp.	Padcal Copper Project	1,825	4,093,813,615	2,264	4,357,167,186	(19)	(6)
Rapu-Rapu Processing Inc.	Rapu-Rapu Polymetallic Project	602	1,282,055,817	487	787,793,116	24	63
Lepanto Cons. Mng. Corp.	Energite Project	0	0	0	0		
TVI resources Dev't Phil. Inc.	Canatuan Mining Project	153	343,217,289	75	143,822,322	104	139
Carmen Copper Corporation	Toledo Copper Corp.	445	403,366,744	77	156,988,765	482	157
TOTAL		8,382	18,179,237,246	22,804	44,517,634,761	(63)	(59)

http://www.mgb.gov.ph/Files/Statistics/MetallicProduction.pdf

ACCORDING TO MINES AND GEOSCIENCES BUREAU OF DENR

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

SOURCE: http://www.tribune.net.ph/index.php/business/item/6846-tax-sends-bsp-gold-purchase-down-to-75

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

Department of Mining, Metallurgical, and Materials Engineering
College of Engineering, University of the Philippines

JUNE 2014

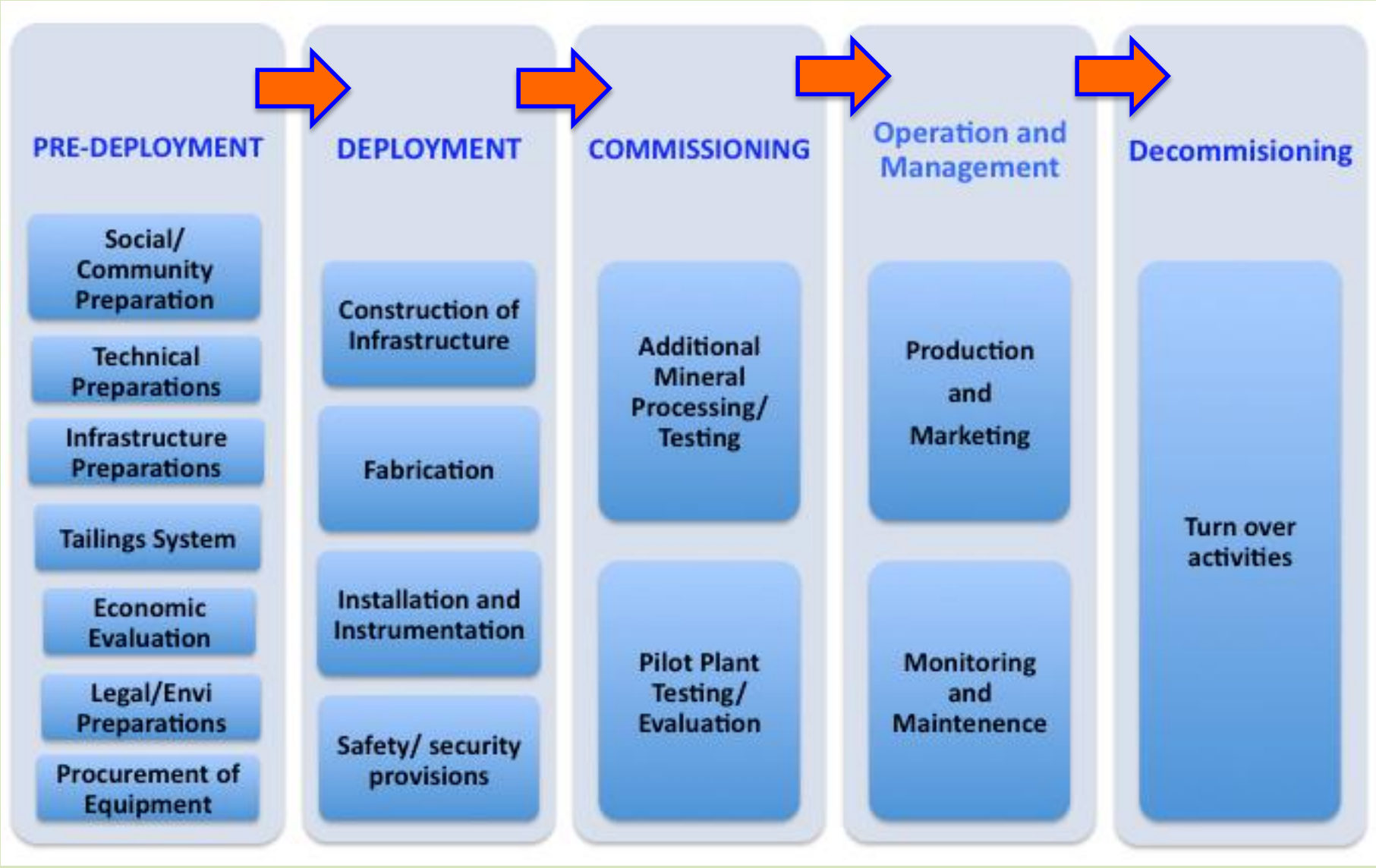
Objectives:

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;

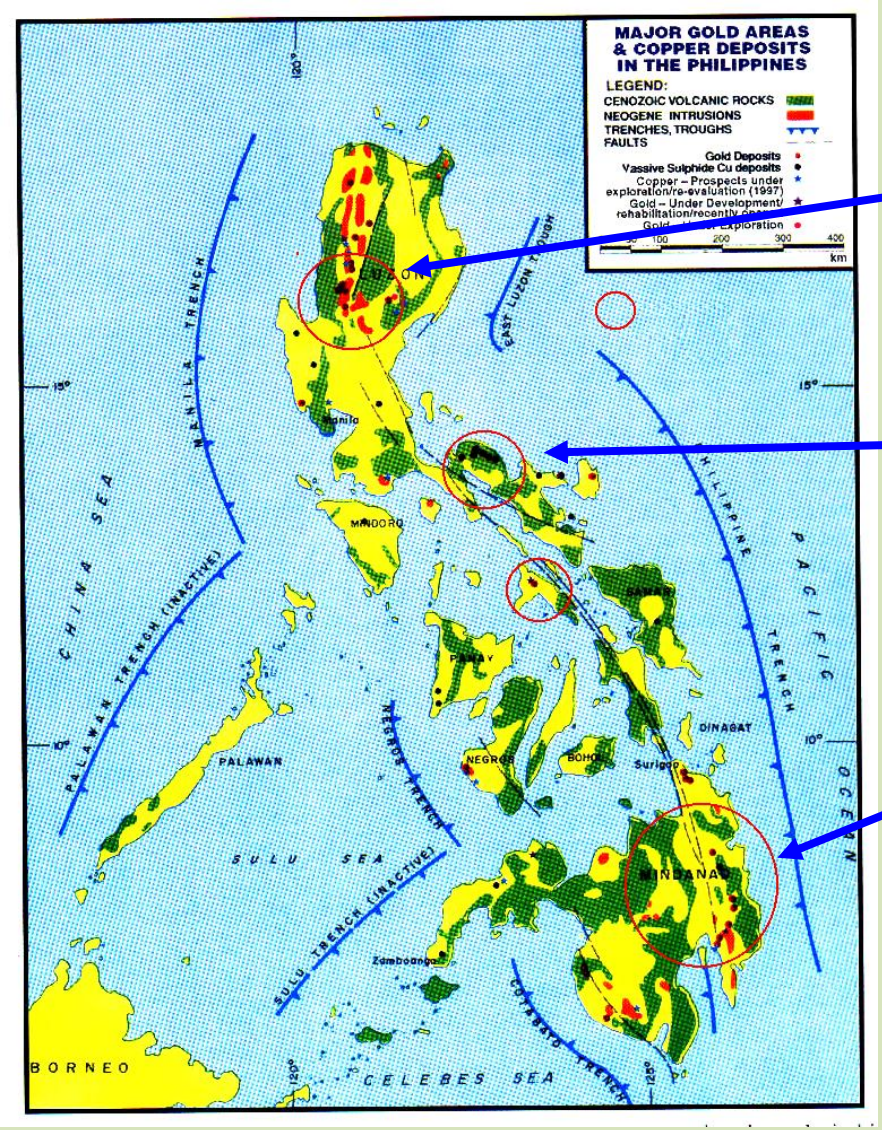
2. To evaluate the operations and engineering aspects of gravity concentration-flotation technology in order to develop a custom-made gold-copper mineral processing facilities for local utilization; and,

3. **To formulate operational protocols and recommend policies for the nationwide imlplementation of safe and environmentally-friendly integrated gold-copper processing plants for the Philippine small scale mining industry.**

Field-Testing Project Framework



PROJECT PILOT AREAS



BAGUIO Area

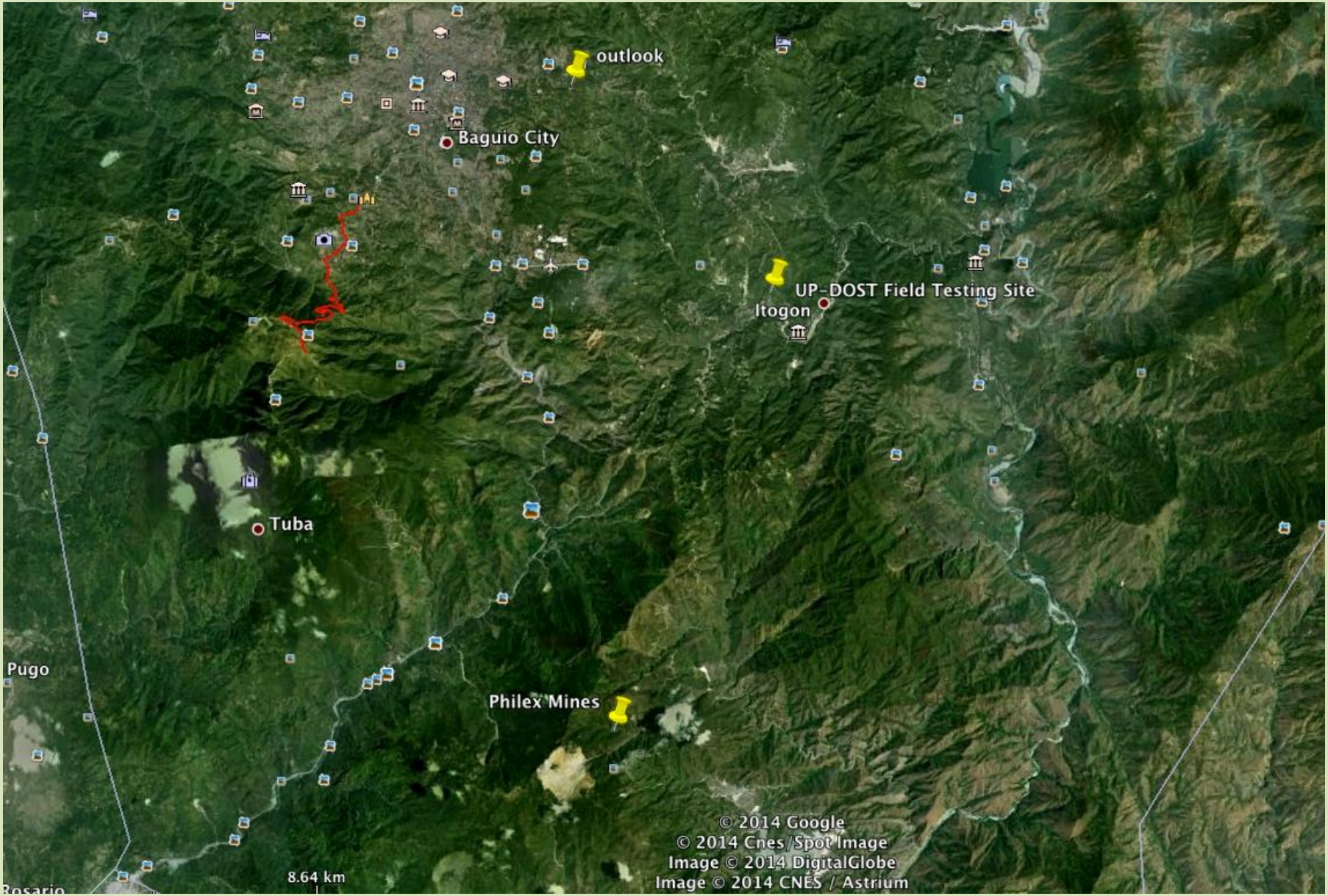
BICOL Area

DAVAO Area

First SITE

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 !!!