Successful Heap Leach Gold Mining the Tropics

Gold Exploration Muab River,
West Papua, Indonesia,2014

Doug Kirwin-GEOCON Manila, December 4-5th 2019

PRESENTATION OUTLINE

- What is heap leach gold mining?
- Some examples from Indonesia and Myanmar
- What are the important criteria?
- What are the economic and social advantages?
- Questions?

Heap Leaching has been around for 550 years

years

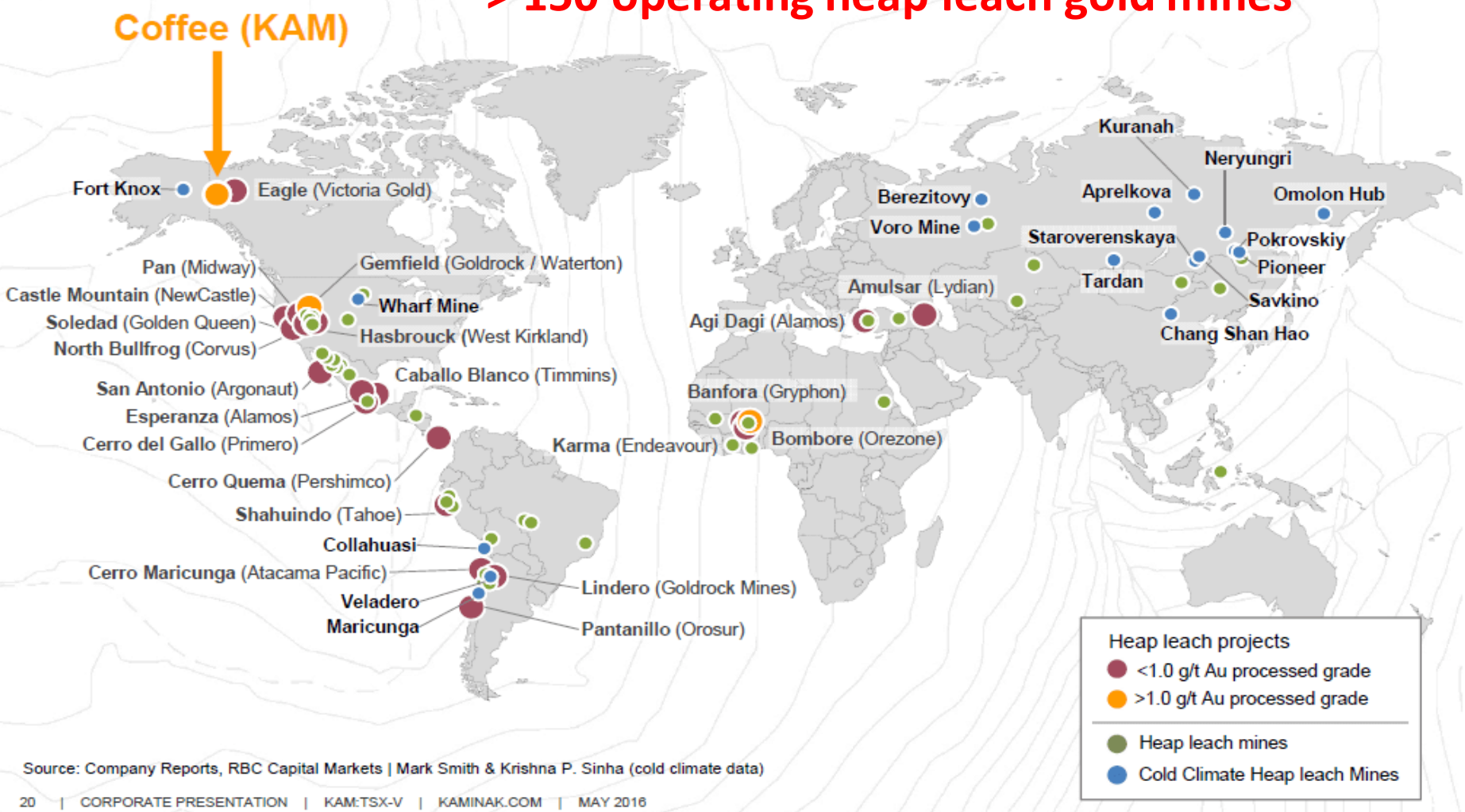
Figure 1. "The rocks are . . piled in . . heaps fifty feet long, eight feet wide and four feet high, which are sprinkled for forty days with water. The rocks begin to fall to pieces like slaked lime, and there originates a . . new material". Drawing and text from De Re Metallica, Herbert Hoover translation, published by Dover Publications, Inc.

One of the World's Highest Grade, Undeveloped Heap Leach Gold Projects

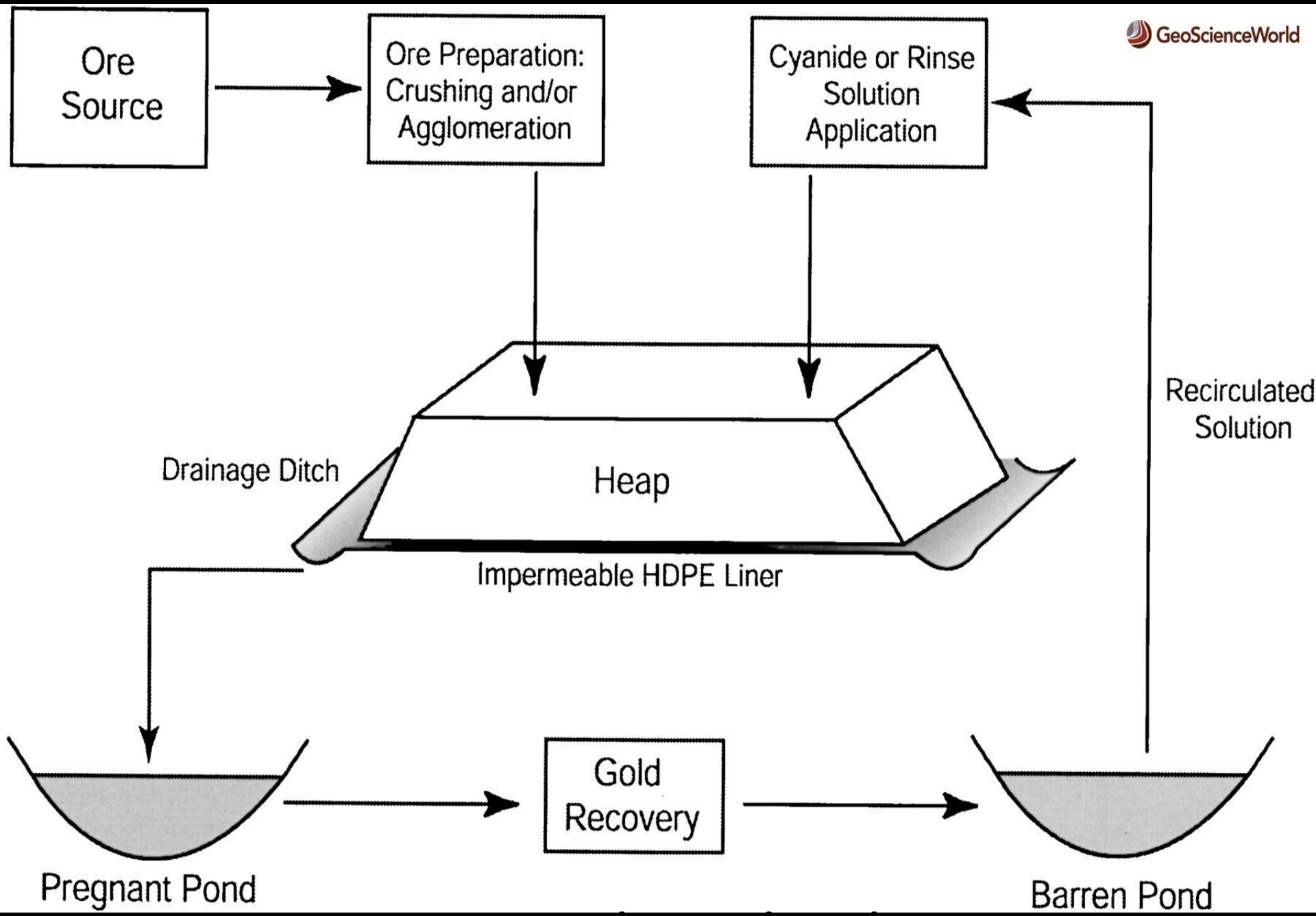
KAMINAK GOLD CORPORATION

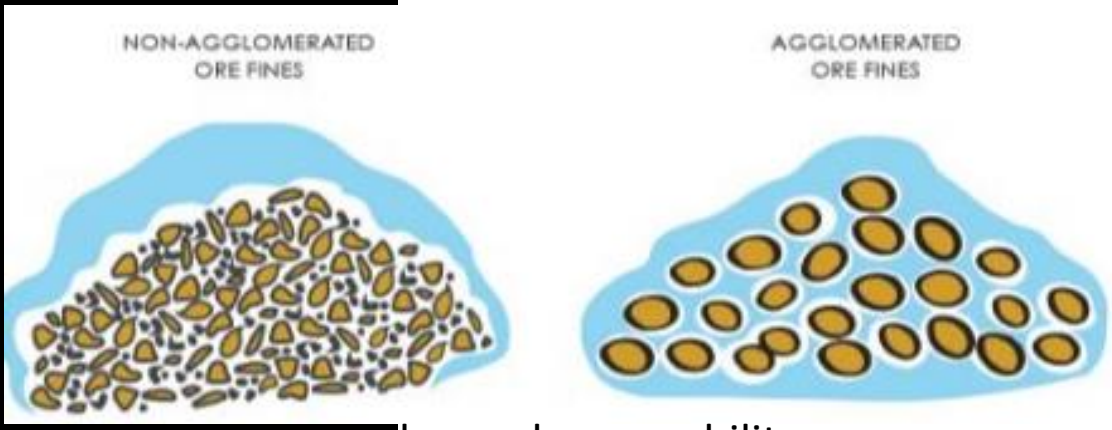
16 Cold Climate Heap Leach Gold Mines in Operation Worldwide

> 150 operating heap leach gold mines

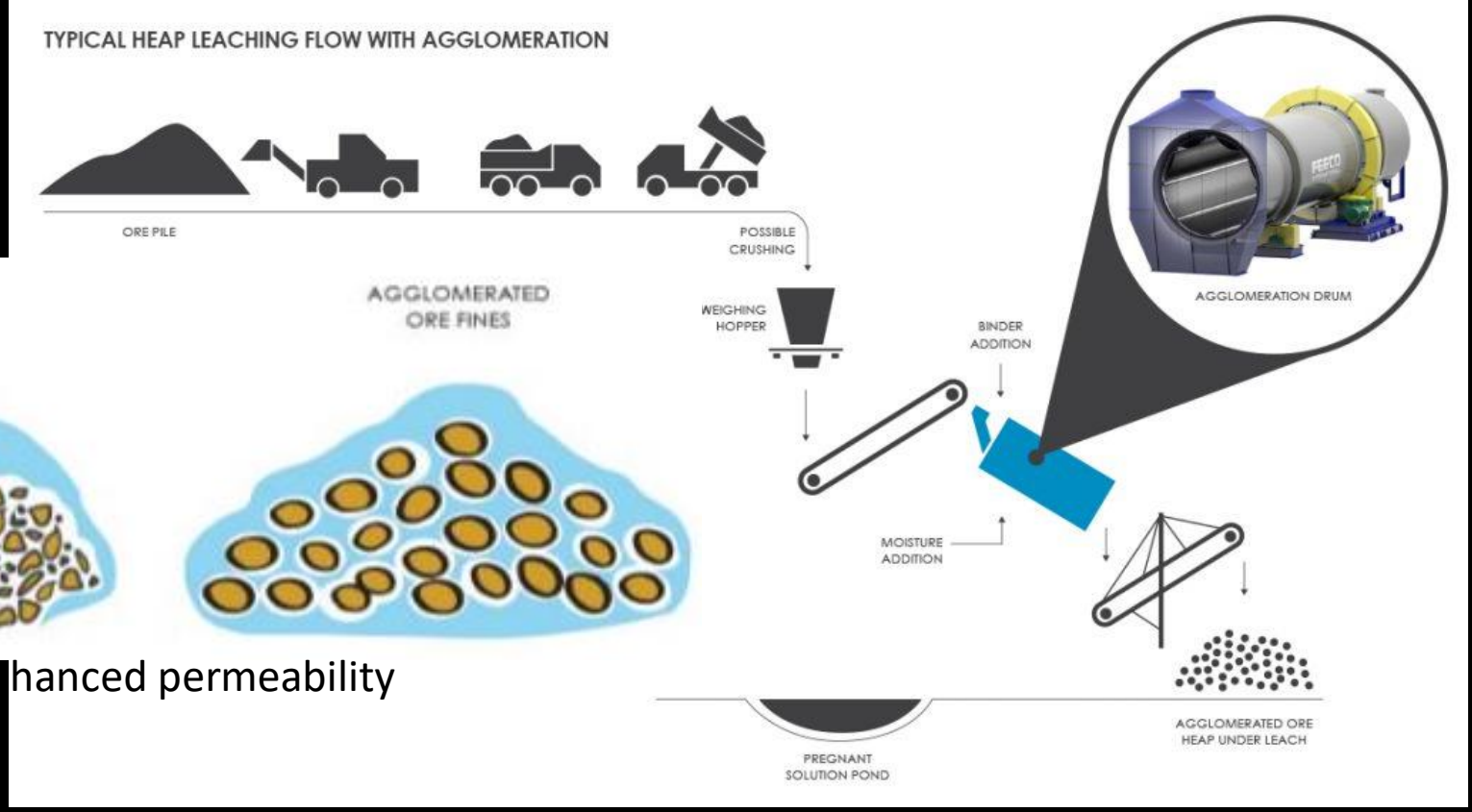


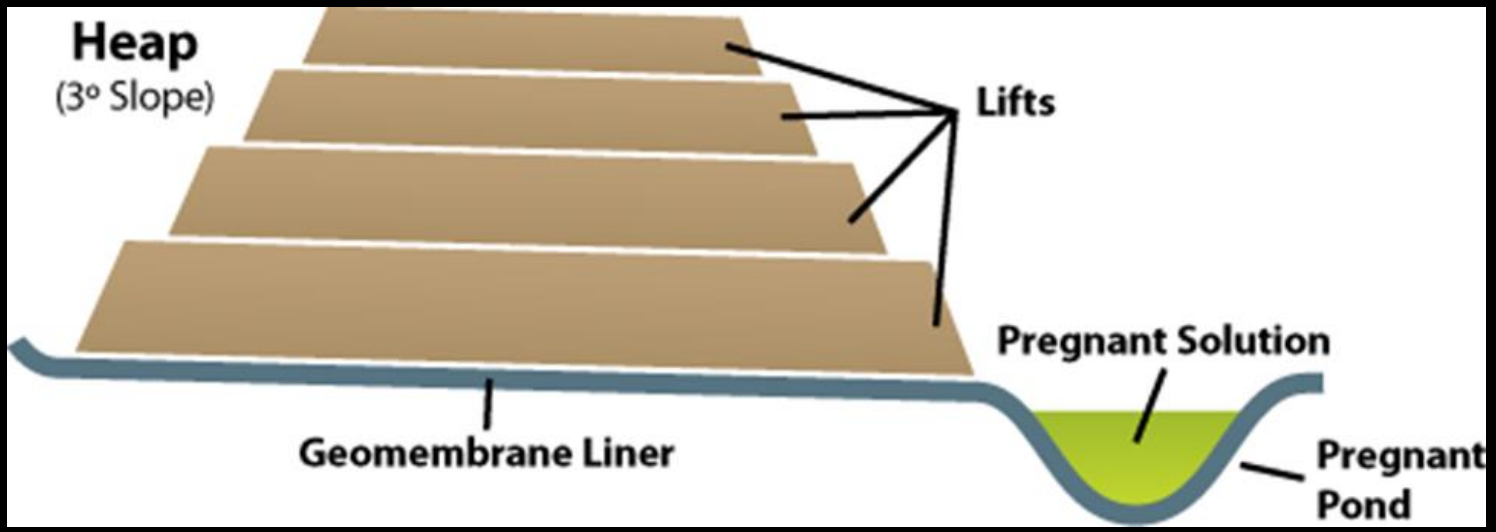
Source: Company Reports, RBC Capital Markets | Mark Smith & Krishna P. Sinha (cold climate data)


Ore Source
Ore Preparation: Crushing and/or Agglomeration
Cyanide or Rinse Solution Application
GeoScienceWorld
Recirculated Solution
Drainage Ditch
Heap
Impermeable HDPE Liner
Gold Recovery
Pregnant Pond
Barren Pond



hanced permeability





Heap leach gold mining in Nevada in the late 1960's

Heap Leach Gold Mining Kişladağ, Turkey (Eldorado Gold Corp).

Mine	Country	Major owner	Gold recovered at HL in 2014, troy ounces*
Yanacocha	Peru	Newmont	970,000
Veladero	Argentina	Barrick Gold	722,000
Lagunas Norte	Peru	Barrick Gold	582,000
Round Mountain	USA	Barrick Gold	328,000
Kisladag	Turkey	Eldorado Gold	311,000

Heap leaching in the tropics – too much water ??

Location of significant Indonesian heap leach gold mines

Seruyung Hill prior to mining


WELCOME TO
PT. SAGO PRIMA PRATAMA
JRESOURCES
SERUYUNG GOLD MINE

Ada Rey open pit, Seruyung gold mine

Central Zone and Western Breccias, Seruyung

2012-2018 360,000 ozs ASIC <$450/oz

Overview of leach pads and gold plant, Bacan mine.

2013 - 2018 434,600 ozs ASIC $600

Main Ridge pit, Bacan gold mine, Suluwesi

Overview of the Bakan gold processing plant

Mobile crushers, Bacan leach pads

Stacking and lime mixing at the leach pads

Oxide ore 0.7 g/t Au, Osela North pit

View looking towards Osela South pit.

Tujuh Bukit Project

Aerial view looking SE at the Tujuh Bukit Project (2012)

Tujuh Bukit Project

Aerial view looking West towards Pulau Merah

Tujuh Bukit Project

Aerial view looking North towards Pulau Merah

Main leach pad >180,000 Au ozs 2019.

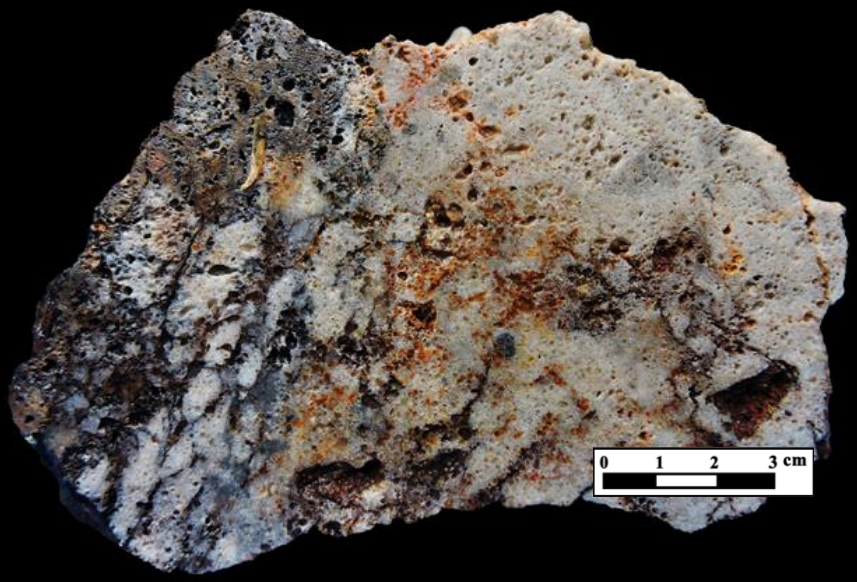
2017 -2018 308,000 ozs Au ASIC <$530

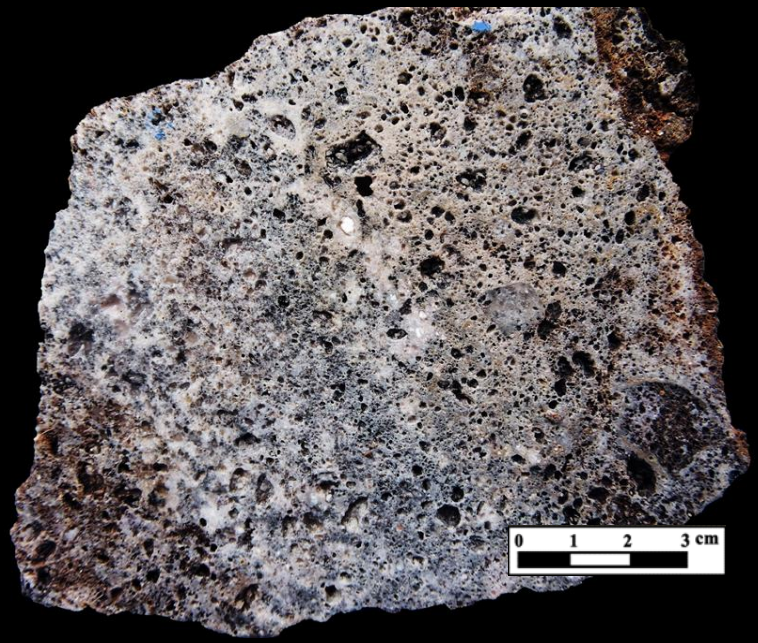
Tampangpitu overview

Water retention reservoir

Stacked heaps 10m lifts

Cyanide reticulation grid network





High grade vuggy silica ores 2 – 5 g/t Au

3a. Corporate Social Responsibility

Linked to sustainable development goals

MERDEKA
COPPER GOLD

Agriculture Improvement


Farmer school


Road Infrastructure


Duck Rearing


School Infrastructure

General Overview

Base 802945AI (C00355) 4-06

Öksüt: Funded High Margin Gold Production

Project Highlights	
Mine Type	Open Pit, Heap Leach
Avg. LOM Annual Production	110koz Au
Avg. LOM AISC[1] (US$/oz)	$490
Reserve Mine Life	8 years
Development Capex (US$MM)	$221
LOM Sustaining Capital[1] (US$MM)	$10
P&P Reserves[2](Moz)	1.3
Au grade (g/t)[2]	1.4
Life of Mine Strip Ratio (w:o)	2:1
First Gold Pour [3]	Q1-2020

Catalyst Schedule

- EIA approval received in November 2015
- Forestry Permit & GSM License received July 2016
- Pastureland Permit received January 2018
- Investment Incentive Certificate received February 2018
- Start construction 2018 on track for Q1 2020 gold pour
- Bought back Stratex and Teck royalties in 2015 & 2016
- US$150MM low-cost financing in-place

Installing Road Barriers

(1) Non-GAAP measure see "Non-GAAP Measures" in Centerra's MD&A and news release of May 1, 2019.
(2) Refer to February 22, 2019 news release and Technical Report on Öksüt Gold Project dated Sept. 3, 2015.
(3) Forward-looking information refer to news release of May 1, 2019.

FIGURE 7-5 ALUNITE BRECCIA (LEFT) AND MASSIVE SILICA BRECCIA (RIGHT)

FIGURE 7-6 SILICA-HEMATITE-LIMONITE BRECCIA AND QUARTZ-KAOLINITE ± ALUNITE BRECCIA

Possibilities in the Philippines

Mapawa
Tampakan
Paracale
Nalisbitan
Placer
Minlawi
Hixbar
King King
Marcopper
Marian
Others


SMI
SAGITTARIUS MINES, INC.
POSTPONED: TAMPAKAN COPPER-GOLD MINE OPERATIONS

WHAT WE REALLY NEED TO KNOW

- Crushing size - leach well tests/bottle roll
- Clay analysis – distribution (Screening-clogging)
- % oxide-mixed oxide and primary
- Cu contents
- RQD model
- Sources for aggregate (base for pads)
- Sources for cement (agglomeration)
- Space for leach pads, water retention system
- Environmental and social impact study

Illegal large scale open cast strip mining, Loi Kham, northeast Myanmar

Large scale Illegal heap leach gold mining, Loi Kham, northwest Myanmar

(50 sq kms of total environmental devastation)

Responsible Heap Leach Gold Mining Can Be Very Successful

- ✓ Low CAPEX and OPEX compared to conventional mining
- ✓ Simple mining and well understood metallurgy
- ✓ No requirements for tailings dams
- ✓ Proven ability to operate in high rainfall situations
- ✓ No acid rock drainage issues with oxide deposits
- ✓ Compelling economics at 0.3 g/t Au cut off (>500,000 ozs)
- ✓ Could have application for waste dumps from previous mining
- ✓ Straight forward environmental rehabilitation

Thank you for your kind attention