

# How to Organize and Develop an ASM Mining Site

**Ishmael Quaicoe** (PhD, UniSA)

University of Mines and Technology, Tarkwa



# Presentation Outline



- Overview of Mine Development Process
- Mine Planning and Design
- Mining methods
- Mine Exploitation
- Mine ventilation
- Reclamation
- Manpower requirement

# Mine Development/Lifecycle

- The process of mining from discovery of an ore body through extraction of minerals and finally to returning the land to its natural state.
- The entire process consists of several distinct steps.

**“FROM STEPPING ON A STONE TO OPENING AND CLOSING OF  
A MINE”**



# Mine Development/Lifecycle

***Mine development may involve many activities such as:***

- The preparation of the mine site by clearing trees and blasting rock
- The construction of mining facilities such as head frames, administration buildings or mechanical shops
- The creation of infrastructure such as power lines and substations, roads or water lines





# Mine development process



❖ **Exploration provides :**

- Shape/size and site of an ore deposit
- Geological characteristics
- Average grade

❖ **Feasibility studies:**

- Analysis of the data available
- Decision-making to develop the property or not

# Focus: Activities prior to extraction



- ❖ Mine planning and design
- ❖ Factors used in pit design/optimisation
- ❖ Mining methods
- ❖ Equipment requirements / selection
- ❖ Mine Ventilation

# Mine Planning and Designing



**Mine Planning:** *A decision-making process that involves establishment of a mine and a mining sequence that leads to a profitable extraction of valuable minerals from a proposed mine in the safest manner possible.*



# Mine Planning and Design



## Key factors often considered in mine planning

### Economic factors

- Ore grade/Cut-off grade
- Stripping ratio
- Mining/Processing costs
- Market conditions
- Operating cost

### Natural and geological factors

- Geological conditions
- Ore types and grade
- Hydrological conditions
- Topography
- Metallurgical properties

### Technological factors

- Pit slopes
- Bench dimension (height, width)
- Transportation option
- Ventilation

## Environmental Impact factor



# Mine Exploitation

## Classification of mining methods

Category	Class	Sub-Class	Method	Commodity
Surface	Mechanical	-	Open pit mining* Quarrying* Open cast (strip) mining* Auger mining	Metallic Non-metallic Coal, non-metallic coal
	Aqueous	Placer  Solution	Hydraulicking Dredging* Borehole mining In-Situ leaching	Metallic/ non-metallic Metallic, non-metallic Non-metallic/Metallic
Underground	Unsupported		Room and pillar mining*	Metallic, non-metallic

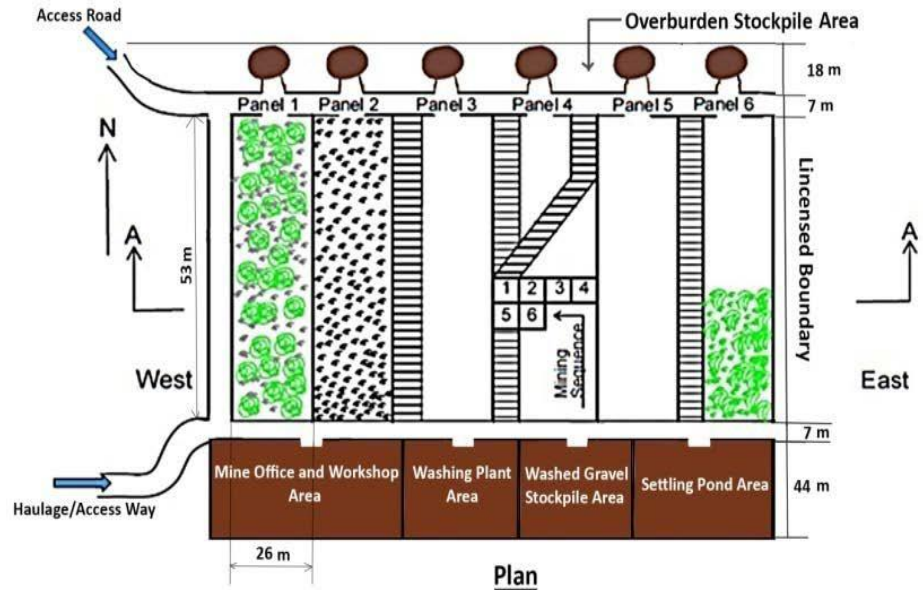
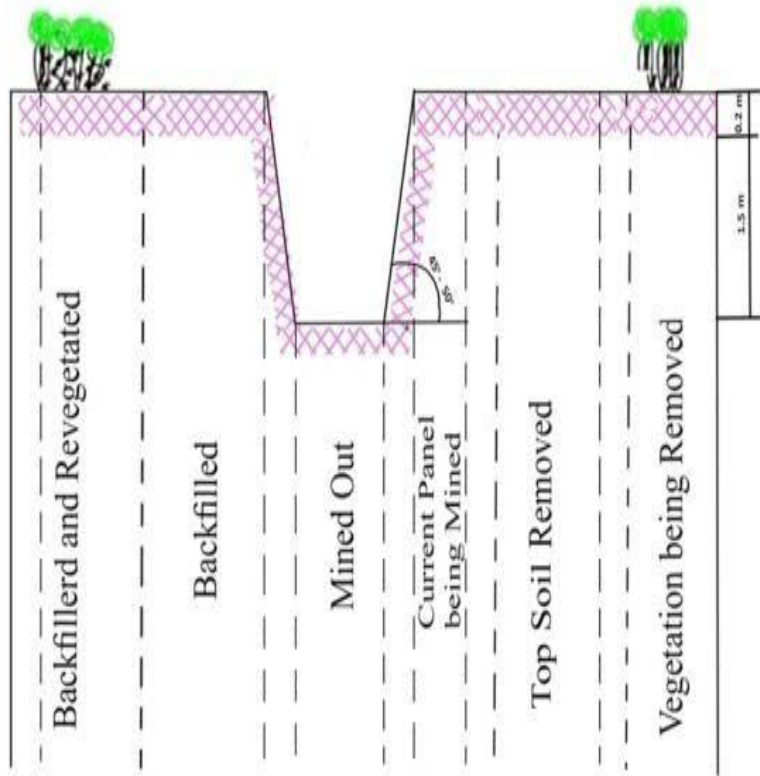
# Mine Exploitation



## Classification of mining methods that is/can be used by ASGM in Ghana

Category	Ore type	Method
Surface	Alluvial / Eluvial / Colluvial	Open cast (strip) mining
	Weathered gold lodes, phyllitic, quartzitic and lateritic materials	Terrace mining
	Auriferous lodes and quartz veins with depth $\leq 15$ m	Shallow open pit
Underground	Auriferous lode and quartz vein deposits in hilly terrains or flat plains with depth $> 15$ m and $< 50$ m	Adit or shaft opening
	Old tailings (Chemically treated)	Not to be mined for environmental and safety consideration

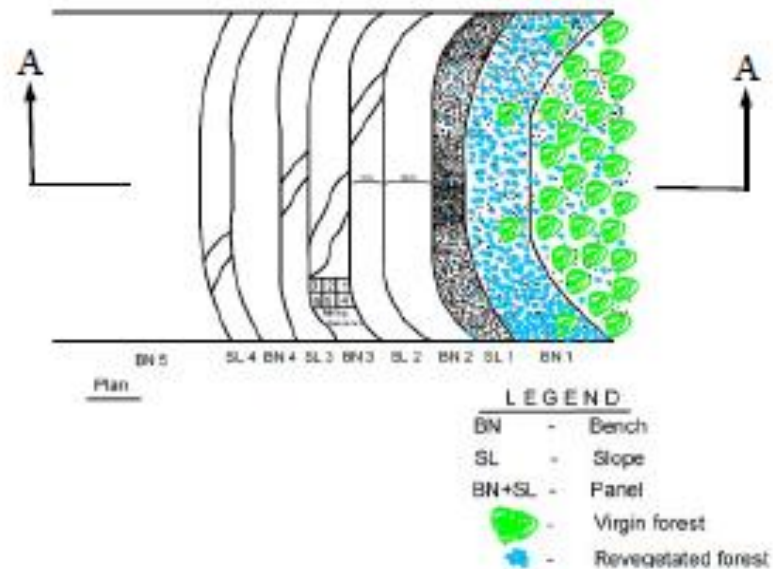
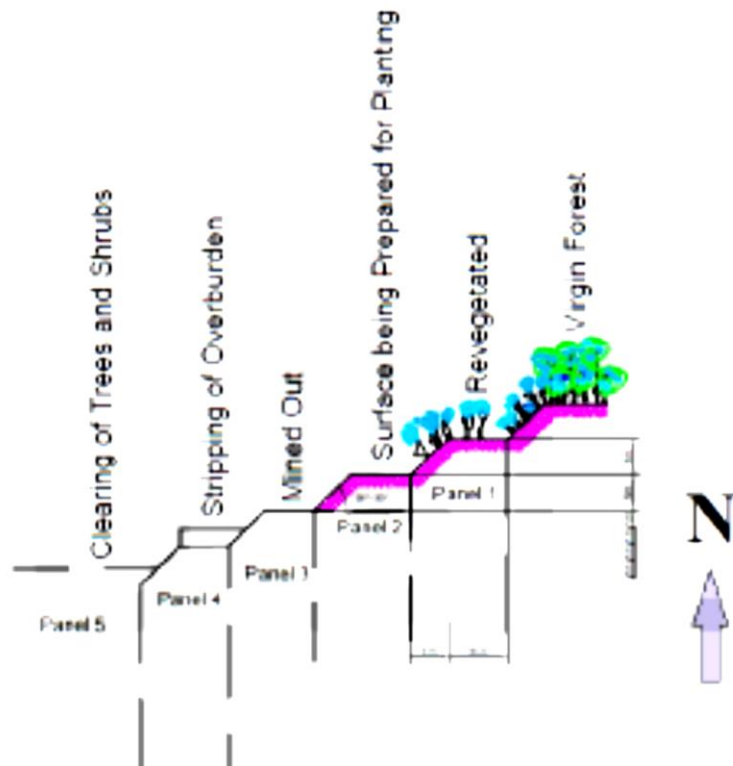
# Proposed strip mining method



Scale 1: 2100

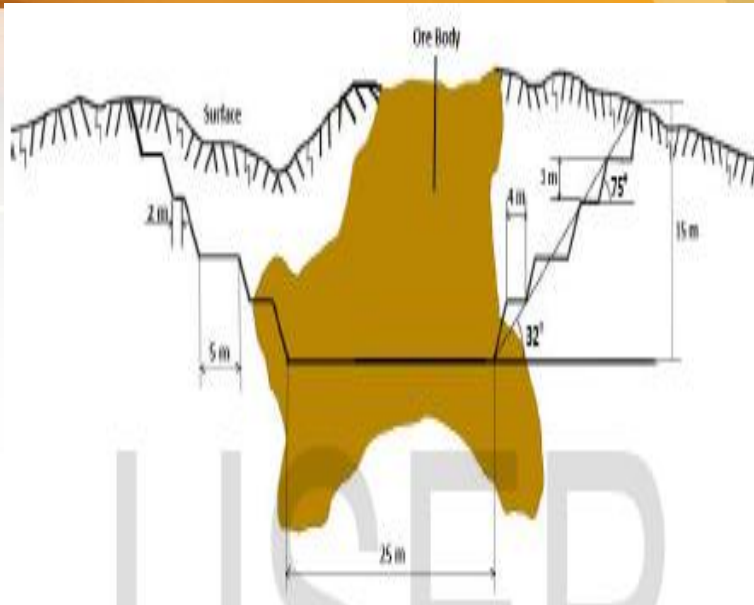
(Selati, 2016)

# Terrace Mining





# Shallow Open pit



# Pit design/Optimisation



## Technological Factors

- Bench dimension
- Pit slopes
- Cut-off grade
- Strip ratio
- Equipment

### Strip ratio

The of the number of tonnes of waste that must be removed for tonne of ore to be mined

### Cut off grade

The grade of mineral ore above which it can be exploited at a profit at the prevailing conditions and below which its exploitation is not viable

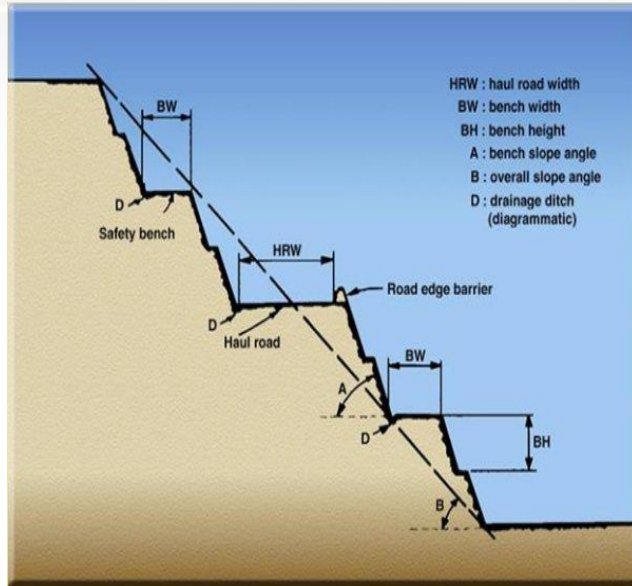


ore

Overburden



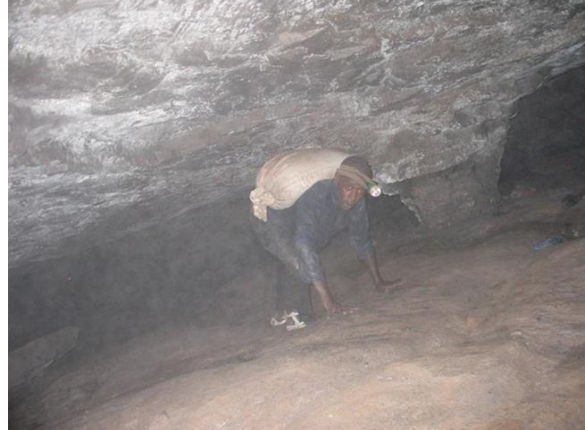
# Pit design/Optimisation



- Bench dimension
- Pit slopes

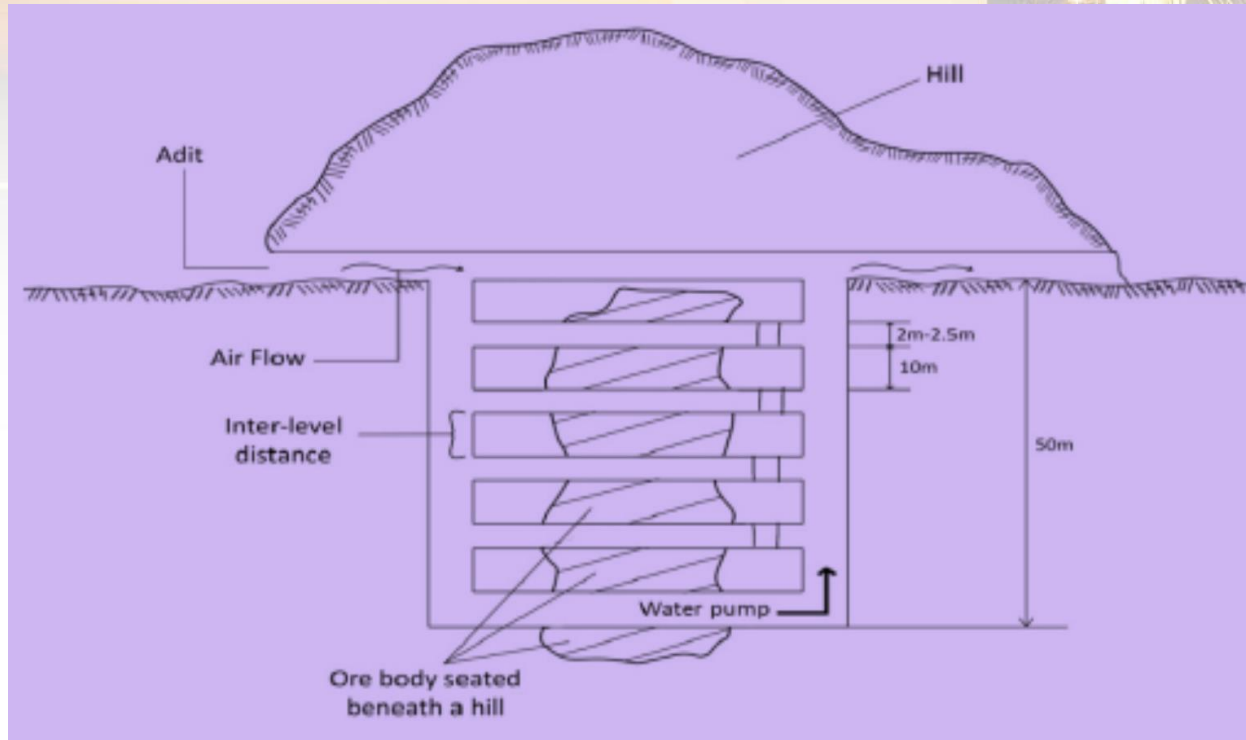


# Underground mining



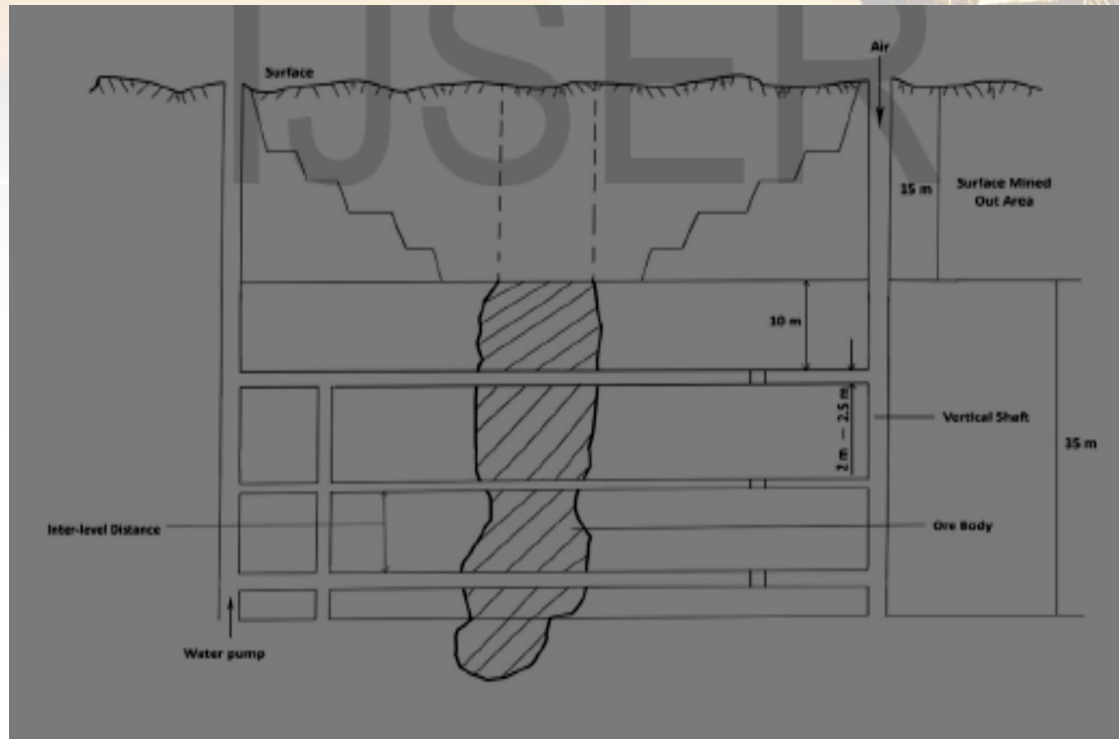


# Underground Adit



Proposed Underground Adit for Auriferous Lodes and Quartz Veins in Hilly Terrains beyond 15 m  
(Selati, 2016)

# Proposed Underground Vertical Shaft



Underground Vertical Shaft for Auriferous Lodes and Quartz in Flat Plains beneath 15 m  
(Selati, 2016)

# Mine Exploitation

## Guidelines and procedure for selecting mining methods

- Spatial characteristics of the deposit
- Geological, geomechanical /geotechnical and hydrological conditions
- Productivities and machinery capacities
- Capital requirements and operating costs
- Ore recoveries and revenues
- Safety and Health aspects associated with the mining methods
- Reclamation and restoration requirements and costs
- Environmental impacts, during and after mining

# Reclamation of mined out Areas



- Mine reclamation is the process of restoring land that has been mined to a natural or economically usable state.
- Although the process of mine reclamation occurs once mining is completed, the planning of mine reclamation activities occurs prior to a mine being permitted or started.
- A standing mine reclamation committee should be set up to oversee and monitor the proposed reclamation programme



# Reclamation of mined out Areas

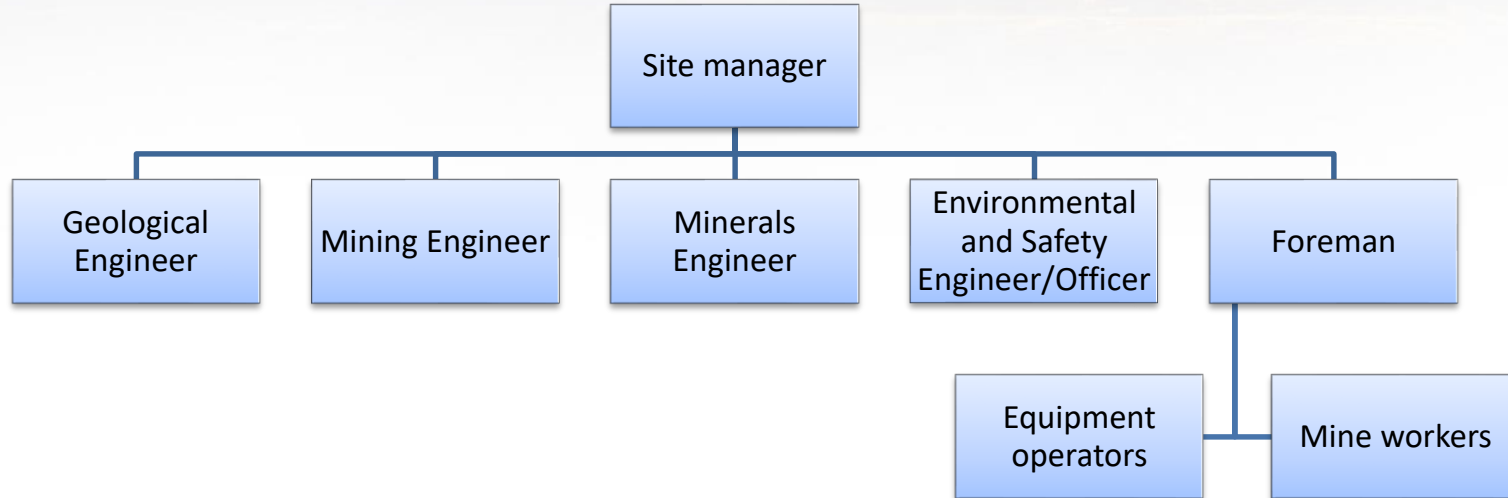


## General process

- The overburden materials and tailings should be used directly to fill the mined out areas
- To promote natural vegetation , the mined areas should be covered with top soil prior to abandonment or pit closure
- The final pit limits should be fenced from public to prevent intrusion and possible misuse until vegetation is mature

# Manpower requirement

Moving forward from “**gut feeling operation**” to “Sustainable and environmental friendly-ASM operations”- Skilled labour need to be engaged





**Thank you for your audience**



<https://www.azomining.com/Article.aspx?ArticleID=16>