

A VIEW ON INDUSTRIAL MINERALS

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TOPICS TO COVER

- **What are Industrial Minerals?**
- **What are they used for?**
- **What is their economic significance?**
- **How Can Zimbabwe optimise its IM Resources**
- **Some guidelines on exploration, Resource Definition**

WHAT IS AN INDUSTRIAL MINERAL

- **Mined & processed from naturally occurring minerals**
- **Exploited for their non-metallurgical value**
- **Non-metallic, non-fuel minerals for an extremely wide range of industrial & domestic applications
= *industrial minerals (Source IM)***

USES OF INDUSTRIAL MINERALS

- Uses are based on properties of the IM
 - Heat Resistance
 - Conductivity
 - Electrical Resistance
 - Acoustics
 - Cationic Exchange
 - Mechanical Strength
 - ETC

Main Applications

Abrasives-Corundum

Absorbents-

Agricultural Cement- Limestone

Ceramics-Kaolin

Chemicals Construction-Gypsum

Oil well drilling-Bentonite, Clays

Electronics

Filtration-DE, Perlite

Foundry- And/Ky

Glass-Quartz

Paint-Talc

Pigments-

Paper-GCC

Refractories-And

Flame retardants-Verm

EXPLORATION AND RESOURCE DEFINITION GUIDELINES

- **Industrial Minerals are bulky-High Volume- Logistics is Key**
 - Demand in developed economies
 - High logistics costs
 - Need to be close to infrastructure-Rail, Road, Port
 - A good quality deposit can be sterilised by high logistics costs
 - Also lose market share due to unreliability of supply
- **Volumes**
 - Generally >20years of LOM
 - This is a high volume, low margin business,
 - Customers require guarantee of supply over long periods-Cost of Innovation
- **Quality**
 - Typically High Purity
 - E.g Bentonite
 - Talc
 - Silica
 - Vermiculite- 0% asbestos/ asbestiform material

Quality Example

Bentonite

BENTONITE ORE SPECS

VISCOSITY GRIT	BEC	SINTERPLATE	GREEN ABSORPTION	DRY STRENGTH	CUT-OFF SR
24 min	5.5 max	70 min	500 min	45 min	200 min
					10

CLAY ORE SPECS

Al ₂ O ₃ on ash < 43%	Fe ₂ O ₃ on ash > 1%	K ₂ O on ash > 0.6%	L.O.I < 13%	ORE : All analysis are green
Al ₂ O ₃ on ash > 43%	Fe ₂ O ₃ on ash < 1%	K ₂ O on ash < 0.6%	13% < L.O.I > 19%	WASTE : At least one red analysis
			L.O.I > 19%	

ANDALUSITE ORE SPECS

Al ₂ O ₃	Fe ₂ O ₃	K ₂ O	Yield	SR (2013 budget)
56% min	1% max	0.25 max	7 min	0.55

Kaolin Deposit Characteristics

deposit size : many millions of tonnes (> 5 MT)

Brightness grades : > 88.7 after refining - around 78-85 crude iso brightness (457 nm)

Residue : if primary deposit < 80%, if secondary deposit < 70% and then depends on available resources

grades : pure kaolin with low amount of contaminants Fe and Ti

- quality considerations depends on application : could be for paper, perf min, ceramics (sanitaryware, tableware,..)
- mining considerations : - (Waste/ore ratio < 5), ore has to be weathered to avoid blasting as much as possible
 - Ore type from pegmatite, hydrothermal area, weathered granite, sedimentary deposits (Brazil, US

Georgia) -

- other information that would make a Kaolin deposit worth looking at :
 - Not too far from port facilities
 - Infrastructures close by

1/ The quality =mineralogically as pure as possible; high whiteness is a key point; low Fe. Low whiteness ($y < 83$) talc are used in industrial applications with low profit. No Pyrite, even at very low content is a poison; quartz and free silica must be avoided; residual carbonates to be sorted out when mining or processing. Graphite which may be some time found, damage whiteness.

2/ No Asbestos

3/ Deposit origin:

- the deposits deriving from transformation (metamorphic and hydrothermal) of carbonated rocks such as marble, dolomite, magnesite are the most wanted; they form generally concentrations of pure and white talc.

- soapstone deposits deriving from ultramafic formations, (such as peridotites, serpentinites) are quite common. In principle they are not really interesting from an economical view point. They normally give raise to talc carbonate concentrations with low whiteness. Further more talc from this origin are contaminated by trace elements such as Ni, Cr, Co, As. The only way to produce decent talc concentrate out of this talc-carbonate ores is flotation.

Talc Continued

- 4/ Geographic location: talc is not gold! The low value of the product doesn't allow talc to travel too far away. Apart from outstanding quality talc, which can be exported, for middle and low whiteness grades, outlets must exist in close vicinity.
- 5/ Mining; talc has to be mined in open pit. Underground mining is generally too expensive to be supported by the product, unless for premium grades. In all cases the mining method must allow selective mining.
- 6/ Size, in principle talc deposits are small. I would advise to rather target deposits on quality than quantity. The economical size for a talc deposit depends on its location and on the quality of the mineral itself. For good talc concentration, one million of tonnes can be an economical target.

EXPLORATION AND RESOURCE DEFINITION GUIDELINES

• **Market**

- Typically Developed countries (W. Europe and North America)
- Countries experiencing high GDP growths (BRICS)
- Highly populated countries with growing middle class (e.g Nigeria, China)
- No market=No mineral supply= no mineral development
- Demand Consistent and Long term

China

- China's growth economy
- Domestic market demand has soared
- Increased costs & shortages in power supply

ZIMBABWEAN CONTEXT

- A WIDE DIVERSITY OF INDUSTRIAL MINERALS AVAILABLE
 - Magnesite
 - Graphite
 - Vermiculite
 - Phosphate
 - Kyanite, Andalusite
 - Feldspar
 - Muscovite
 - Silica/Quartz
 - Talc
 - Clays-Bentonite, Kaolin,

WHAT ZIMBABWE/ANS NEEDS TO DO

- **Improve Infrastructure**
 - Rail, Road, Electricity and Access to Port (s)
- **Improve Operating Environment**
 - Too many Laws (>20 Statutory Instruments for mining)
 - Simplify laws (Indigenisation too complex)
- **Simplify export process**
 - Just in Time Delivery (e.g Japan)
- **Tax Incentives**
 - Lower Royalties
- **Develop factories for local market**
 - Tiles, Paper (tissues), toothpaste, foundry

WHAT ZIMBABWE/ANS NEEDS TO DO

- EVALUATE CURRENT KNOWN OCCURENCES
 - Little known about existing deposits in terms of size and quality- though locations mostly known
 - At least evaluate up to indicated Resources before seeking partners
- DO JOINT VENTURES/ PARTNERSHIPS WITH ESTABLISHED INDUSTRIAL MINERALS COMPANIES
 - Have Financial Resources
 - Have Market Intelligence
 - Have Pricing Power
 - Very difficult industry if small player
- ATTEND CONFERENCES ON INDUSTRIAL MINERALS
 - Make connections and establish right contacts
 - Have market Trends- Substitution- E.g Asbestos, Perlite Versus Diatomite in Russia

Conclusion

- **IM are high volume, low value, but vital commodities**
- **IM are prerequisite raw materials for a wide range of industrial and domestic products**
- **Market demand drives IM supply**
- **Employs people & businesses**
- **Revenues are consistent and predictable- low volatility on price= low risk**
- **Low set up costs**
- **We cannot live without**

Thank you for your attention



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