Life-of-Mine reserves estimation in the Dimension Stone block industry South Africa

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Itinerary

A....Verde Mare

B....Background to paper

C....Introduction to Dimension Stone

D....Project Evaluation And Resource Estimation

E....Basis For Reporting

F....Conceptual Example

G....Conclusion:

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- The Verde Mare is a Granite
- Verde Mare also is known as Ocean Green

Verde Mare

- Requirement for a SAMREC compliant declaration for the quarry as part of the licencing
- No recognised benchmarks for declarations in the Dimension Stone industry
- Fundamental difference from metal bearing deposits
- Importance of the saleable product
- Market-acceptance assessment

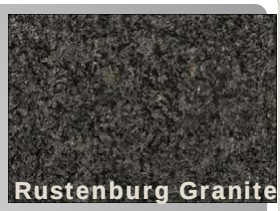
Background

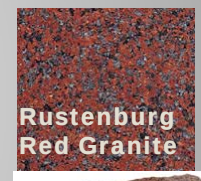
Dimension Stone - Granite

- The principal rock
  - granite,
  - limestone,
  - marble,
  - sandstone, and
  - slate.
- Commercially, the term 'granite' often used instead of Dimension Stone

Value of Dimension Sto...

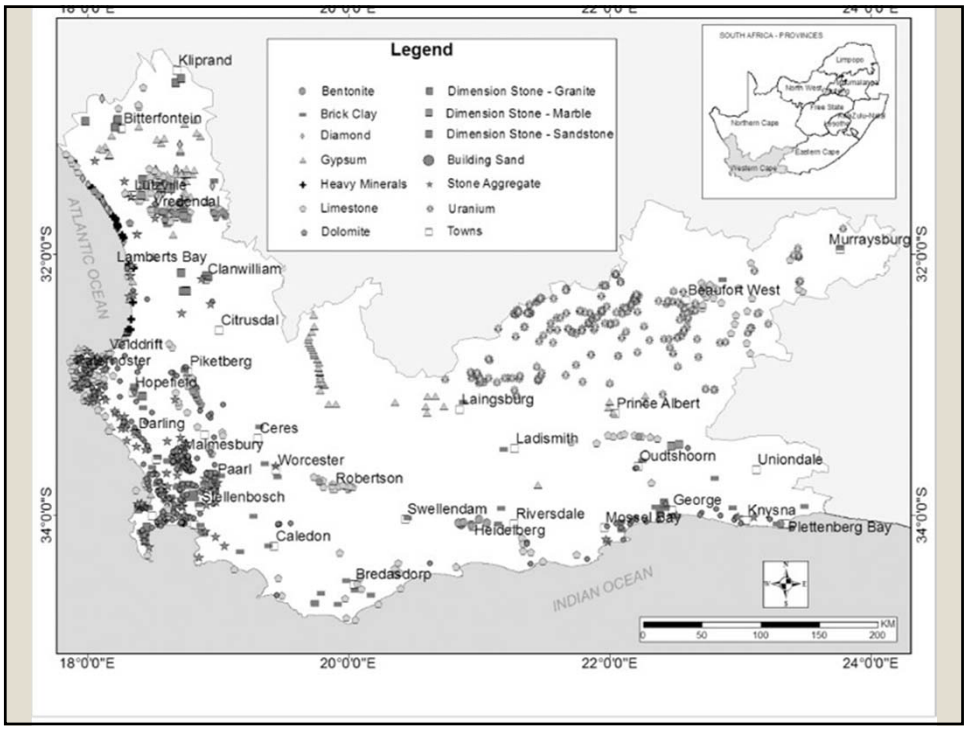
- Physical properties
  - strength
  - block size
  - presence or absence of discontinuities
- Appearance
  - Colour
  - texture





- Used in construction industry
- Local availability
- Low value product
- Recognised vagaries of market
- Few geologist and mining engineers involved
- Reliance on quarry operators
- Metals mining focuS

Background



- value
- dimensions appearance,
- physical properties strength parameters,
- workability,
- ability to take a polish, and
- resistance to physical and chemical weathering)

Value of Dimension Stone

Dimensions of the deposit	Homogeneity of the rock
• Thickness of productive units • Volume of the deposit • Spatial Disposition	• Colour • Texture • Discontinuities
Structural features e.g. Fracturing, discontinuities	**Geological Considerations**
• Preferential directions • Frequency • Density • Intensity • Type and morphology	• Colour variations • Textural characteristics and textural variation • Structural and macro-discontinuities • Micro-discontinuities • Intrusives • Inclusions • Accessory minerals • Contact zones • Alterations

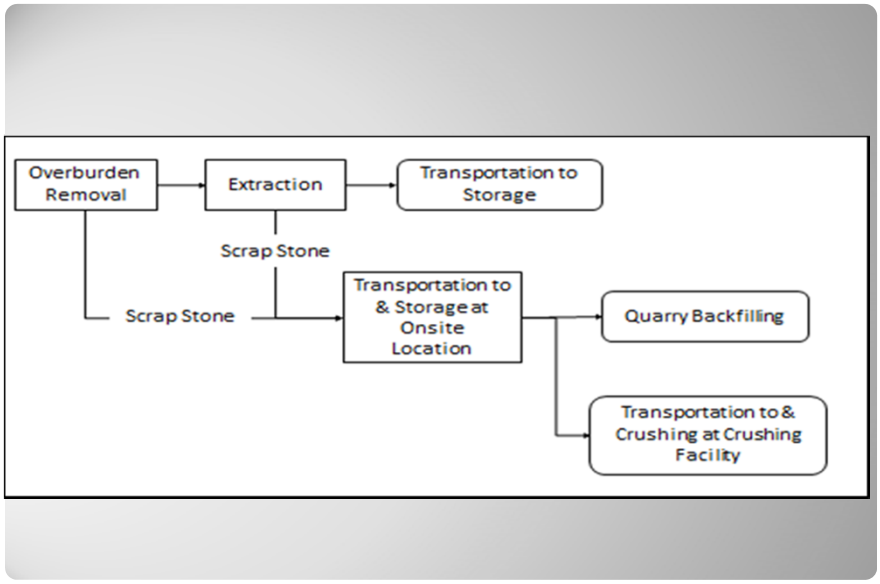
- to produce rectangular blocks of suitable dimensions that meet the customer's requirements and specifications.

Quarry Success

A Cat 988 transports a cut block, weighing up to 20tonnes, from the quarry to the nearby dressing yards on site

Rustenburg Imperial is characterised by its distinctive greyish black colour

Main tasks for Classic Dimension Stone Mining's Cat 336D Ls include opening up and clearing overburden



Dimension stone as “a technical/commercial term that includes all natural stones that can be quarried in blocks of different dimensions and processed by cutting or splitting, and that possess the technical and aesthetic properties required for their use in the building and construction industries”

In both mining methods and fields of application, dimension stone is distinct from any other material derived from natural rocks (such as. Aggregates, cement materials, crushed stone, etc.) Whilst other materials are almost exclusively used for load bearing and filling functions and are largely utilised in public works, dimension stone materials offer special qualitative features which mean they can be used for different purposes and they can perform both structural and decorative architectural functions.

In general, dimension stones can be quarried in regular and/or unshaped blocks by using different mining methods (drilling & splitting, diamond wire and diamond chain-saw cutting) and processed (cut, polished, and subjected to other surface treatments) to produce semi-finished products (slabs) and finished products (tiles and cut-to-size products).

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- Low value commodity
- prospecting and exploration by individuals with little formal geological or mining training
- seldom conducted formal investigations

PROJECT EVALUATION AND RESOURCE ESTIMATION

1. Desktop Study
2. Field evaluation
3. Detailed mapping
4. Structural geology and application of geophysics
5. Drilling
6. Bulk Sampling
7. Test Quarrying

The recognised sequence of investigation for Dimension Stone evaluation

- The qualitative and aesthetic qualities
- Relevant chemical analyses
- Chemical/compositional analysis
- existing mining plan and/or feasibility study
- established set of products and market assumptions and objectives.
- the final product specifications, proximity to markets, type, structure and demand of the market
- as mined" product is usually reported in all its forms, shapes and dimensions

BASIS FOR REPORTING

- The qualitative and aesthetic qualities (colour, grain, texture and their regularity in distribution) and/or their structural performance characteristics (compression and flexural strength, abrasion resistance, porosity, ability to be polished, radioactivity content, *etc.*) that may be more important for the market and applicable and acceptable as the basis of the reporting.
- Any chemical analyses that may be relevant for the material evaluation.
- Where necessary, chemical analysis may be used to verify the presence of possible minerals and related alteration that could produce important quality defects on finished products.
- Chemical/compositional analysis may also identify mineral components and/or assemblages and is used to predict the future technical requirements of the quarrying-processing equipment and related tools.

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- Where the Dimension Stone deposits are capable of yielding different products (different materials and/or different market grades within the same material), suitable for the production of more than one finished or semi-finished product, and for more than one final application and/or specification, they should be specified as they may be sold in the market with different prices.
- The Competent Person should normally report the Resources and Reserves within the framework of an existing mining plan and/or feasibility study or established set of products and market assumptions and objectives.
- Inclusion of the final product specifications, proximity to markets, type, structure and demand of the market which may vary from area to area except where there the material is well established.
- A correct professional evaluation of the Market Quality, made by the Competent Person in different ways, is the key to evaluating the final product marketability and is a key Modifying Factor in definition of Mineral Reserves for Dimension Stone.

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ERDE MARE MINING

- A correct professional evaluation of the Market Quality, made by the Competent Person in different ways, is the key to evaluating the final product marketability and is a key Modifying Factor in definition of Mineral Reserves for Dimension Stone.
- The Competent Person should explain in detail in the report, the method utilised for the Market Quality evaluation of the target Dimension Stones, and in case of the market the references cited, together with documents referenced or used.
- ” product, for Dimension Stones production the raw block or “as mined” product is usually reported in all its forms, shapes and dimensions. These are also factors that drive the market and then the success of a Dimension Stone project, and should be declared.
- The Public Report may contain either the geological or commercial names of target Dimension Stones.
- In certain cases commercial sensitivity may prevent the publication of detailed information and data associated with Mineral Resources and Reserves, and in such cases this should be clearly justified in the report (either prepared for an individual site or on an aggregated basis).

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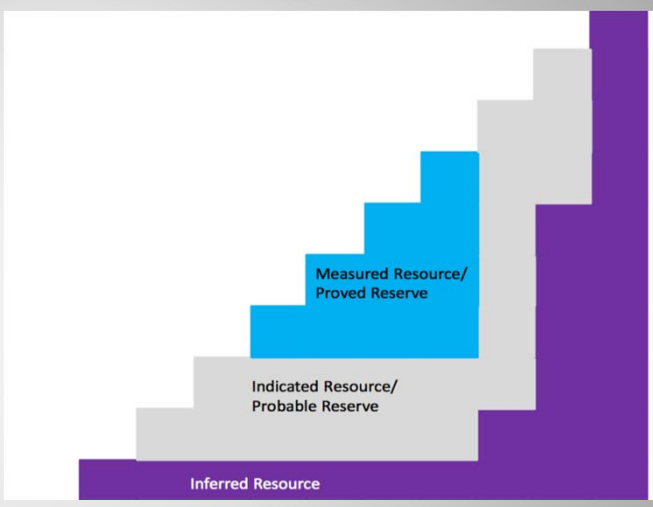
- practical, technical and economical reachable amount of the benched quarry operation
- maximum yield of demarcated area
- identify the different levels of risk and uncertainty involved in each category
- specification of a number of products including aggregates

CONCEPTUAL EXAMPLE

Risk	Estimated Volume in m^3	Total mined in m^3 p.a.	Life in years	Yield for Dimension Stone in %	Volume Dimension Stone per year in m^3
Low risk easily accessed	1 000 000	40 000	25	15%	6 000
Medium Risk, accessible	2 000 000	50 000	40	10%	5 000
High Risk not easily accessed	3 000 000	60 000	50	6%	3 600
Resource	**6 000 000**	**150 000**	**115**	**13.2%**	**14 600**

Classification		Estimated Volume in m^3	Yield for Dimension Stone in %	Volume Dimension Stone in m^3
Resource	**Reserve**			
Measured	Proved	1 000 000	15%	150 000
Indicated	Probable	2 000 000	10%	200 000
Inferred		3 000 000	6%	180 000
	Total	**6 000 000**	**13.2%**	**530 000**
				Specification:



(already accessed and clearly usable & tested)

- The Proven Reserves indicate a high level of certainty as to the quality and quantity of a particular resource.
- If a quarry operation is active then quarry faces are often exposed which clearly indicates the geology of the resource in a given area.
- In addition the quarry material is also processed and regularly tested to establish its consistency for the market.
- Proved Reserves generally consist of resources at the back of a known quarry face.

Proved Reserves
Measured Resource
Low Risk

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(very little geological testing)

- The Probable Reserves indicate a medium level of certainty as to the quality and quantity of a particular resource.
- Although the extension of the Resource has been demonstrated.
- As workings progress in the quarry, and quarry faces removed, and as further geology is exposed and the consistency confirmed.

Probable Reserves
Indicated Resource
Medium Risk

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(No geological testing)

- Either be Resources in extended area, or deposits at greater depths than records available.
- Unknown geological conditions.
- The presence structures that can significantly change the geological understanding of a given area.

Inferred Resource High Risk

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- The assessment of Reserves and Resources involves a high degree of specialist knowledge
- The geology is the most important factor in relation to all quarries
- location to the market, planning, licensing, access, operating costs etc are some of the other factors involved
- market-acceptance assessment is in reality the final arbiter

Conclusion