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MINERALS & ENERGY CONSULTANTS

Resource Estimation for the Aurukun Bauxite Deposit

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Aurukun Bauxite Deposit - Resource

- Location
- Background
- Geology
- Density
- Modelling
- Resource Estimation
- Conclusions

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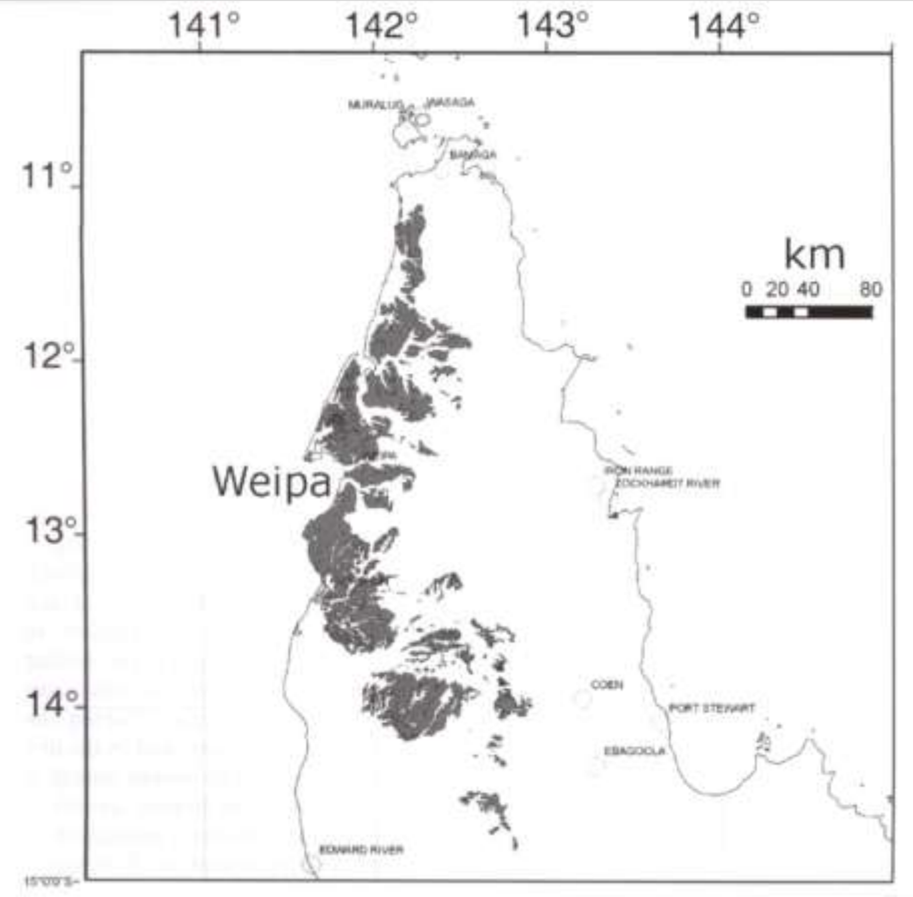
Location: Far North Queensland

Introduction



The Weipa bauxite deposits

- occur along and inland from the western coast of Cape York.
- Are confined to the lateritic unit known as the Weipa Plateau – modified Cretaceous regression surface
- Stretch 350km by 40 km
- Is incised by rivers and alluvial fans

* Adapted from Taylor et.al 2008

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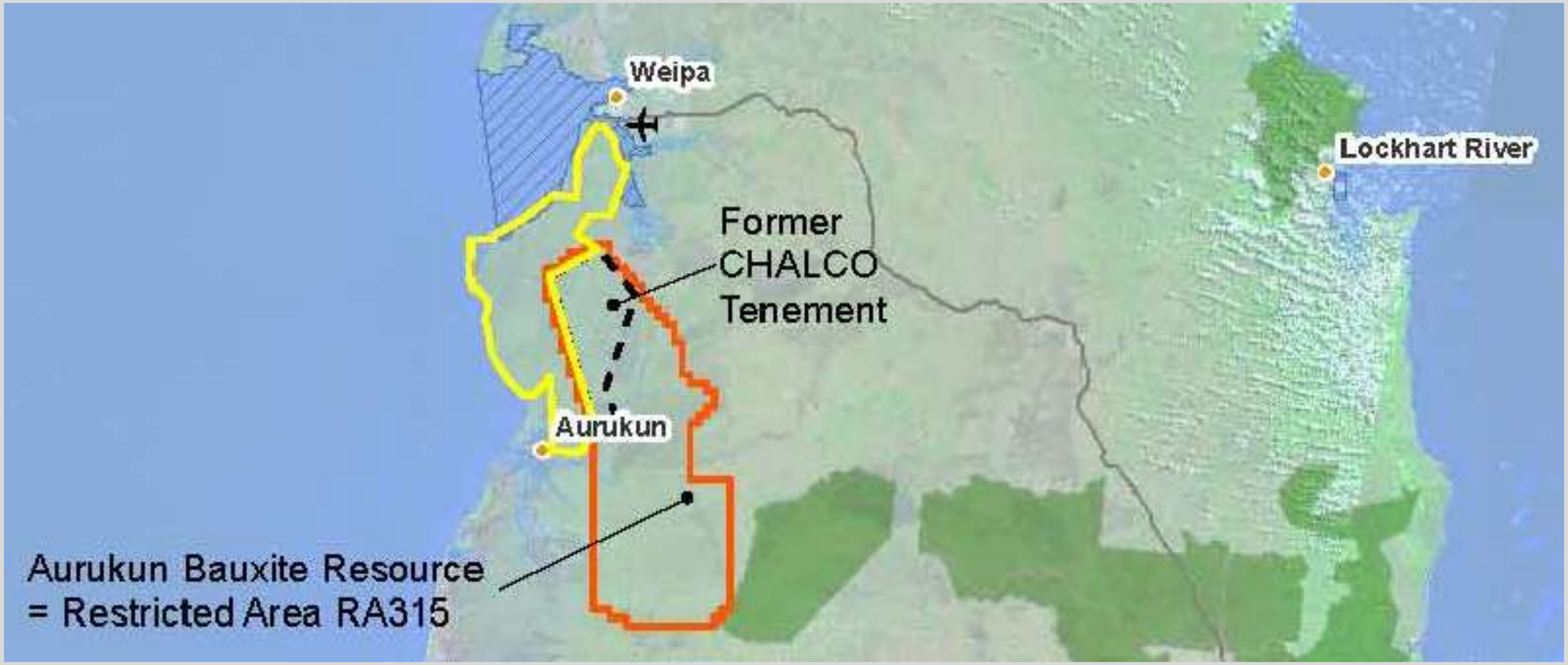
Introduction – Aurukun Deposit



Aurukun Bauxite Deposits

- South East Rim of the Weipa Bauxite Deposit
- 40 km south east of Weipa

* Adapted from EOI Aurukun Project2012

History

- During the 1950s and 1960s, the Aurukun bauxite resource area was explored through three different Authorities to Prospect from 1957 to 1968.
- The resource was subject to an exploration program run by the State during 2004 and 2005.
- During 2008, Chalco updated the resource prepared in compliance with the JORC Code, as reported in Qld QDEX system, CR-68138_1:

  Total mineral resources (Measured, Indicated, Inferred) of 357Mt @51.4% Al_2O_3, 11.2% SiO_2

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Current Status

- The Aurukun bauxite deposit was held by Chalco Australia Pty Ltd (Chalco) until it withdrew from the agreement with the Queensland government in 2010 and was put up for tender in 2012.
- April 2013 the government of Queensland finalised a shortlist of five bidders for tender:
  - Aluminium Corporation of China Limited (CHALCO),
  - Australian Indigenous Resources Pty Ltd,
  - Cape Alumina Consortium,
  - Glencore International AG,
  - Rio Tinto Aluminium Limited

Geology – Bauxite Deposits

- Laterite deposits are typically laterally extensive relatively thin ore bodies, and as such present specific issues related to the lateral changes in thickness and elevation of the various horizontal layers within the deposit.
- These deposits display horizontal dimensions orders of magnitude greater than the vertical dimension.
- Traditionally a 2 dimensional gridded model would be utilised.
- The objective was to develop a 3D block model for the Aurukun Bauxite Deposit that retained the vertical and lateral variation inherent in deposits of the type.

Regional Geology

<table>
<tr><th>Age</th><th>Basin</th><th>Group</th><th>Formation</th><th>Lithology</th></tr>
<tr><td>Quaternary</td><td></td><td></td><td></td><td>Quartzose gravels, sands and minor muds</td></tr>
<tr><td>Neogene</td><td rowspan="2">Karumba Basin</td><td></td><td></td><td>Limestone, sandstone, siltstone (mainly offshore)</td></tr>
<tr><td>Paleogene</td><td>Bauxite Development</td><td>Bulimba Formation</td><td>Quartzose sandstone, siltstone, coal claystone</td></tr>
<tr><td rowspan="2">Cretaceous</td><td rowspan="2">Carpentaria Basin</td><td rowspan="2">Rolling Downs Group</td><td>Normanton Formation</td><td>Glauconitic sandstone with carbonaceous phases</td></tr>
<tr><td colspan="2">Earlier formations with in the Rolling Downs Group</td></tr>
<tr><td></td><td></td><td>Coen Inlier</td><td colspan="2">Proterozoic metamorphics and Palaeozoic granites and volcanics</td></tr>
</table>

Bauxite Development is dominantly upon the Bulimba Formation.

* Adapted from Taylor et.al 2008

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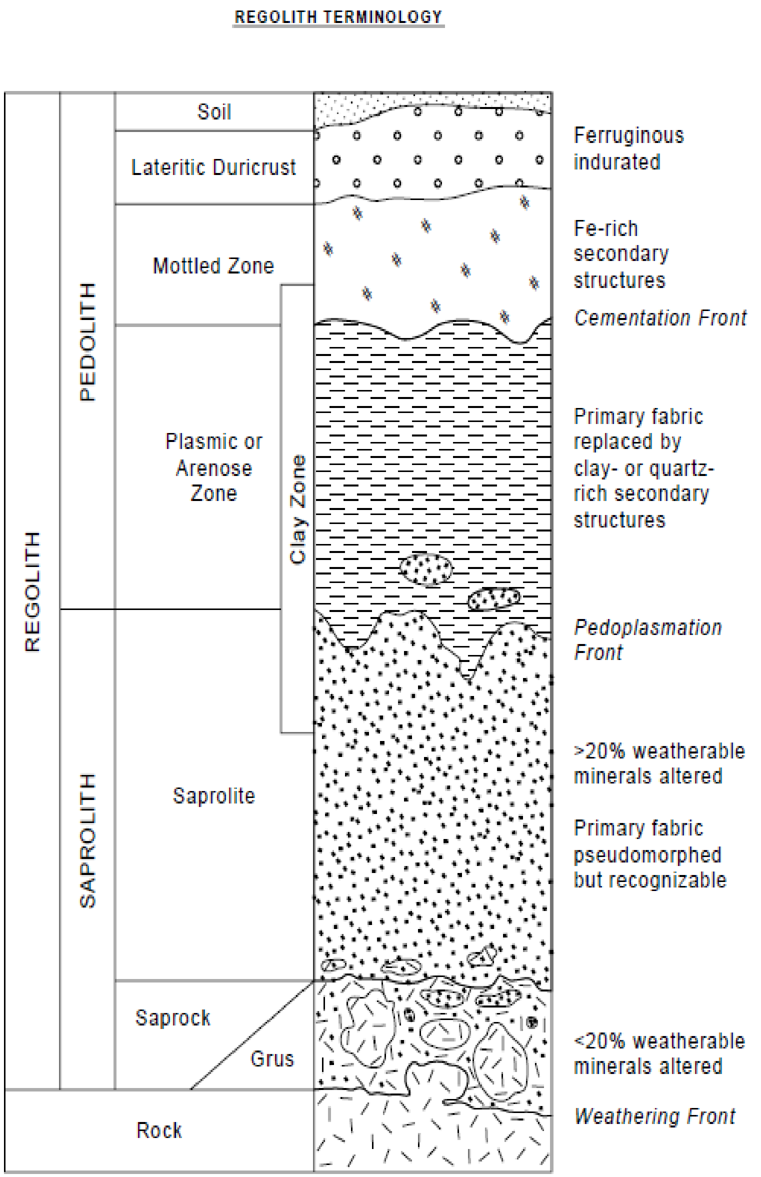
Deposit Geology

- Aurukun Bauxite Deposit is a chemical weathering product = Lateritisation;
- In tropical regions with suitable bedrock, the ferruginous zone is replaced by an aluminous zone and bauxite develops;
- Similarly if lateritisation occurs over an ultramafic there is potential for nickel laterites form.



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Bauxite Profile

Bauxite Profile	Description	Photograph
Zone 1 0 - 0.25 m depth	Topsoil - Grey, dry fines Fine dark nodules	
Zone 2/3 0 to 3m thickness	Reworked bauxite Higher fines and lower recoveries	
Zone 4 1 – 3 m thickness	High Boehmite-gibbsite Higher hematite Dry & reddish (rusty) Range of pisolite/nodule sizes	
Zone 5 3 - 5 m thickness **Zone 6** – transition to kaolinite	High Gibbsite, low Boehmite 0 - 7 % Boehmite Moist & red-brown Very uniform, smaller pisolites	
Zone 7 0.25 - 0.5 m thickness	Iron-stained kaolinite If sampled, then zone 7, If not sampled but drilled, Then zone 8	
Zone 8 Full thickness untested	Weakly mottled to pallid Kaolinite	

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Bulk Density

- Density values obtained from pitting were previously used.
- Densities were updated with sonic drill results through the full bauxite profile over much wider proportion of the deposit.

Density Results from Pitting were used to validate the sonic results

Sonic Sampling “core sausage”

Retrieving the “core sausage”

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Core Sausages – bagged and tagged

Individual sausages are divided into quarters, each quarter represents ¼ of a metre.

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Profile Composition of bauxite with depth

Average Zone SG

Zone 1 -Soil

Zone 2
1.43

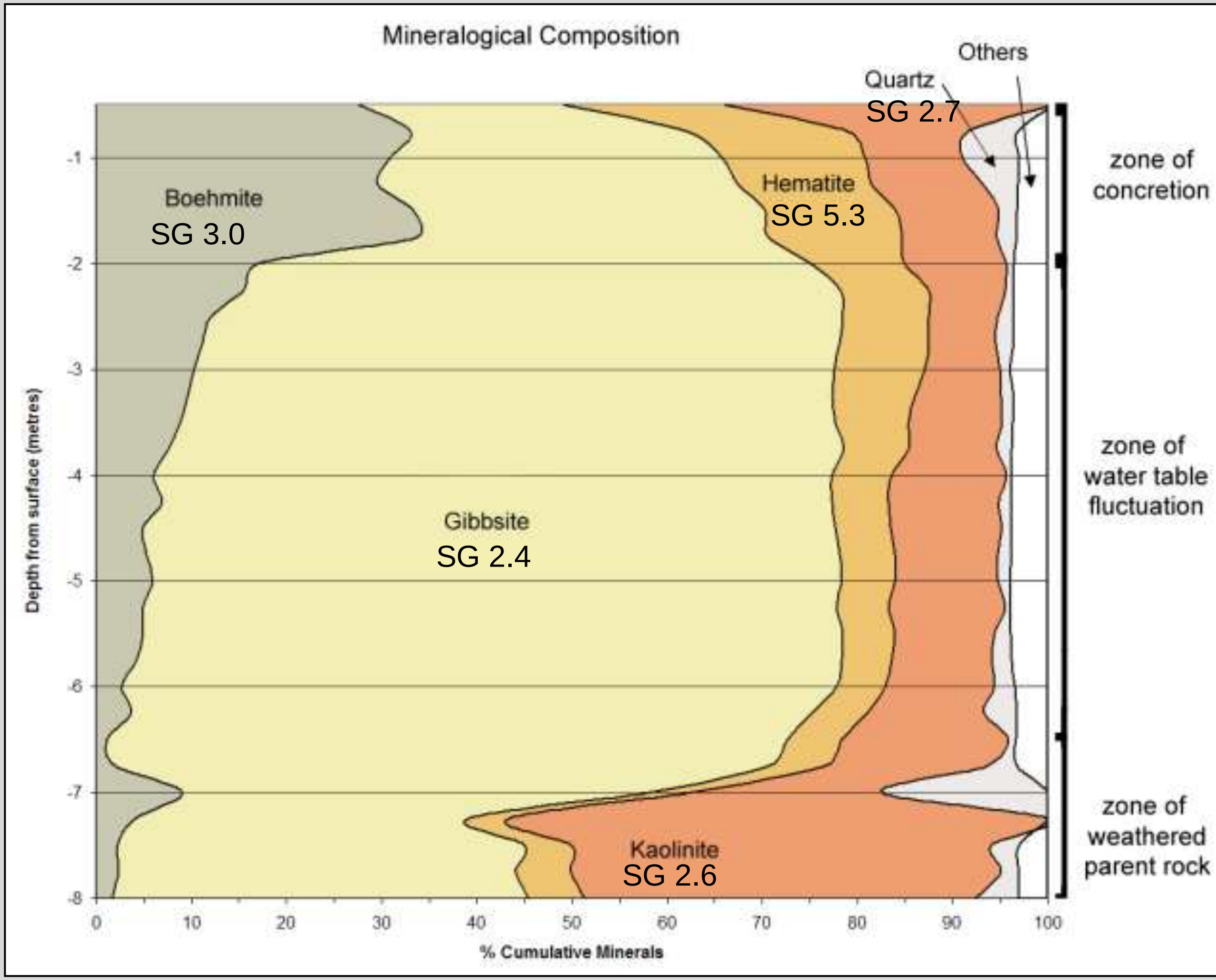
Zone 3
1.65

Zone 4
1.63

Zone 5
1.48

Zone 6
1.55

Zone 7
1.77



Typical Mineralogical composition of bauxite profile with depth.

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Modelling Approach

- Hard / Soft Boundaries

HARD BOUNDARIES - prevent assay data informing neighbouring domains, the domains are independent.

SOFT BOUNDARIES – permit assay data to inform neighbouring domains, the domains are related.

Aurukun Resource Model used a combination of soft and hard boundaries, determined by the Bauxite profile.

Bauxite Profile

Aurukun Bauxite Profile					
ZONE	LITHOLOGY		RECOVERY	Ksi	BOEHMITE
1	SOIL		UNSAMPLED		
2	REWORKED BX	EARTHY	low		
3		PISOLITIC	medium		
4	IN -SITU BX	HIGH BOEHMITE	high	low	high
5		LOW BOEHMITE			low
6		KAOLINITIC		medium	
7	KAOLINITE	SAMPLED		high	
8		UNSAMPLED	UNSAMPLED		

Boundary Type
Hard
Soft
Hard
Soft
Soft
Hard

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Modelling – Folding Unfolding

The resource estimate was conducted in unfolded space.

This approach:

- Preserves the laterite profile characteristics (both horizontally and vertically) irrespective of thickness or orientation;
- Constrains informing samples for estimation into the zone(s) required and improves stationarity/domaining concerns; and
- converts real RL to a relative position.

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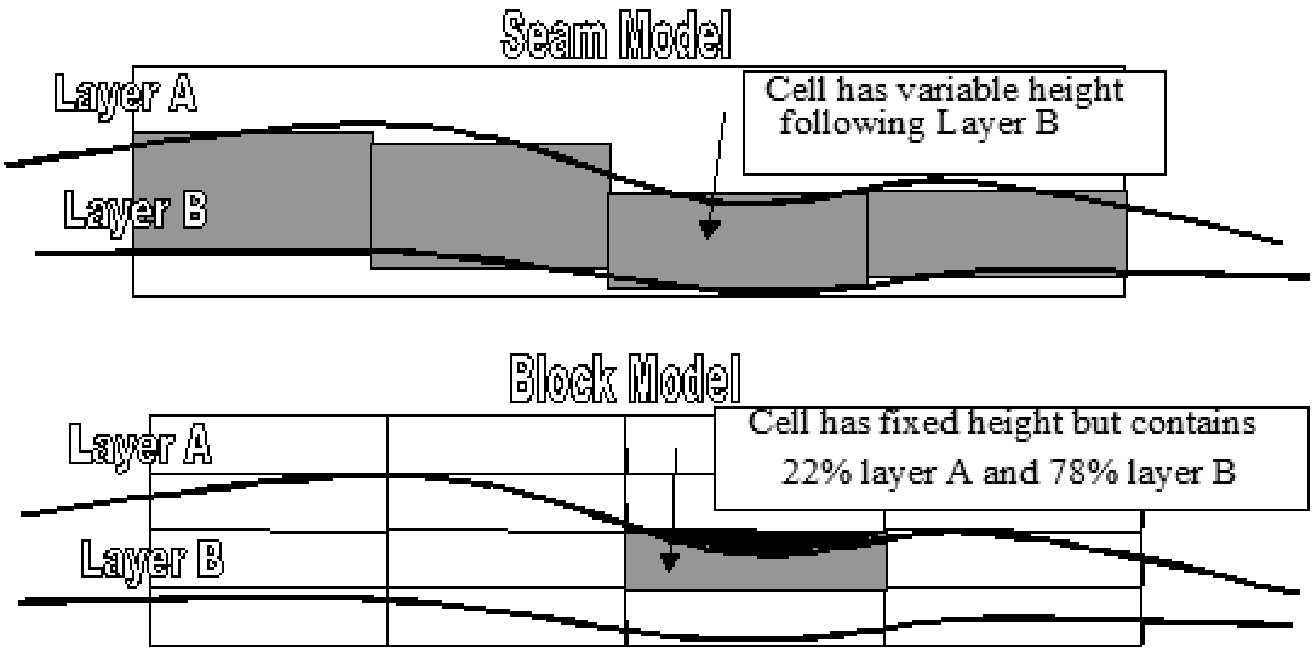
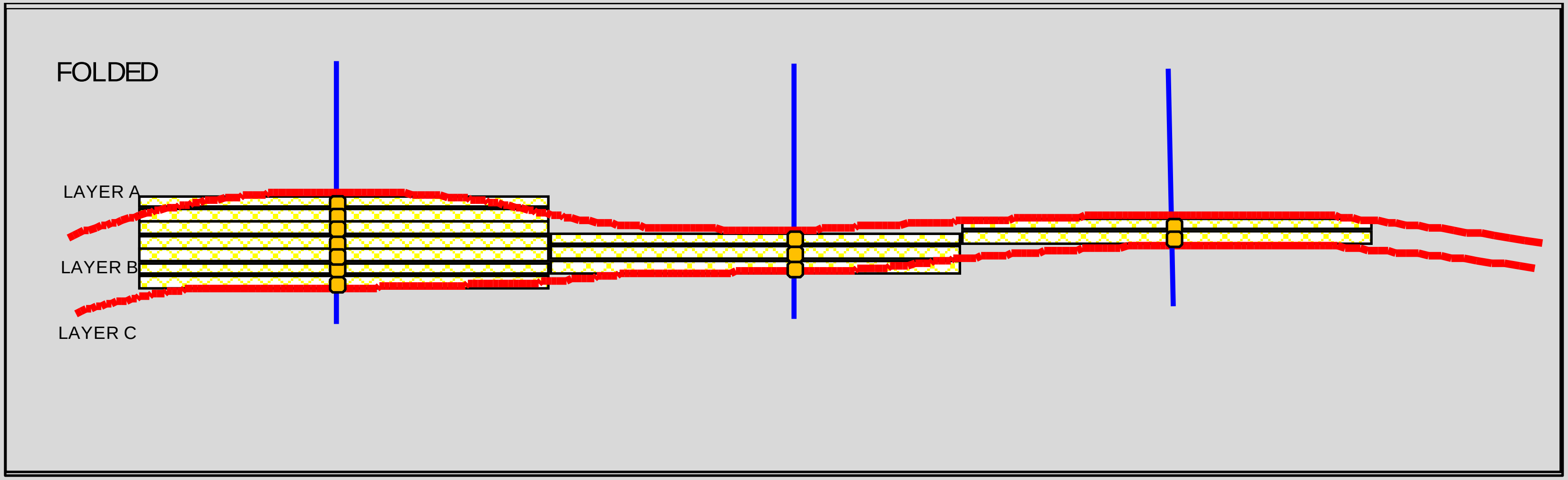
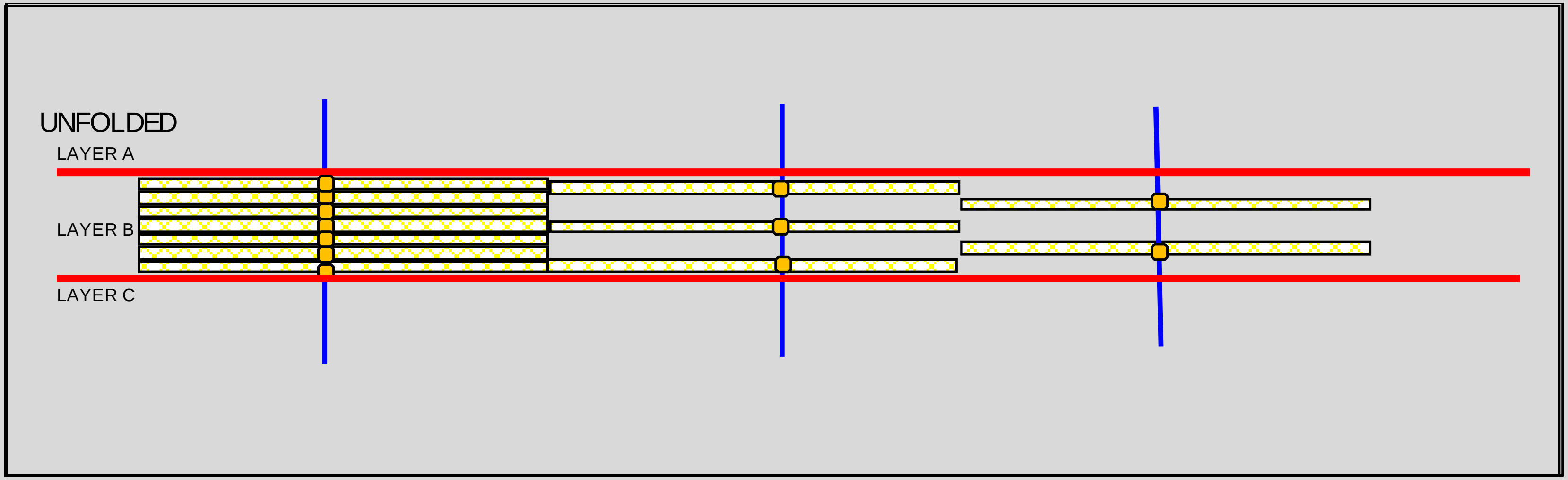
Block Models



Unfolded Block Model





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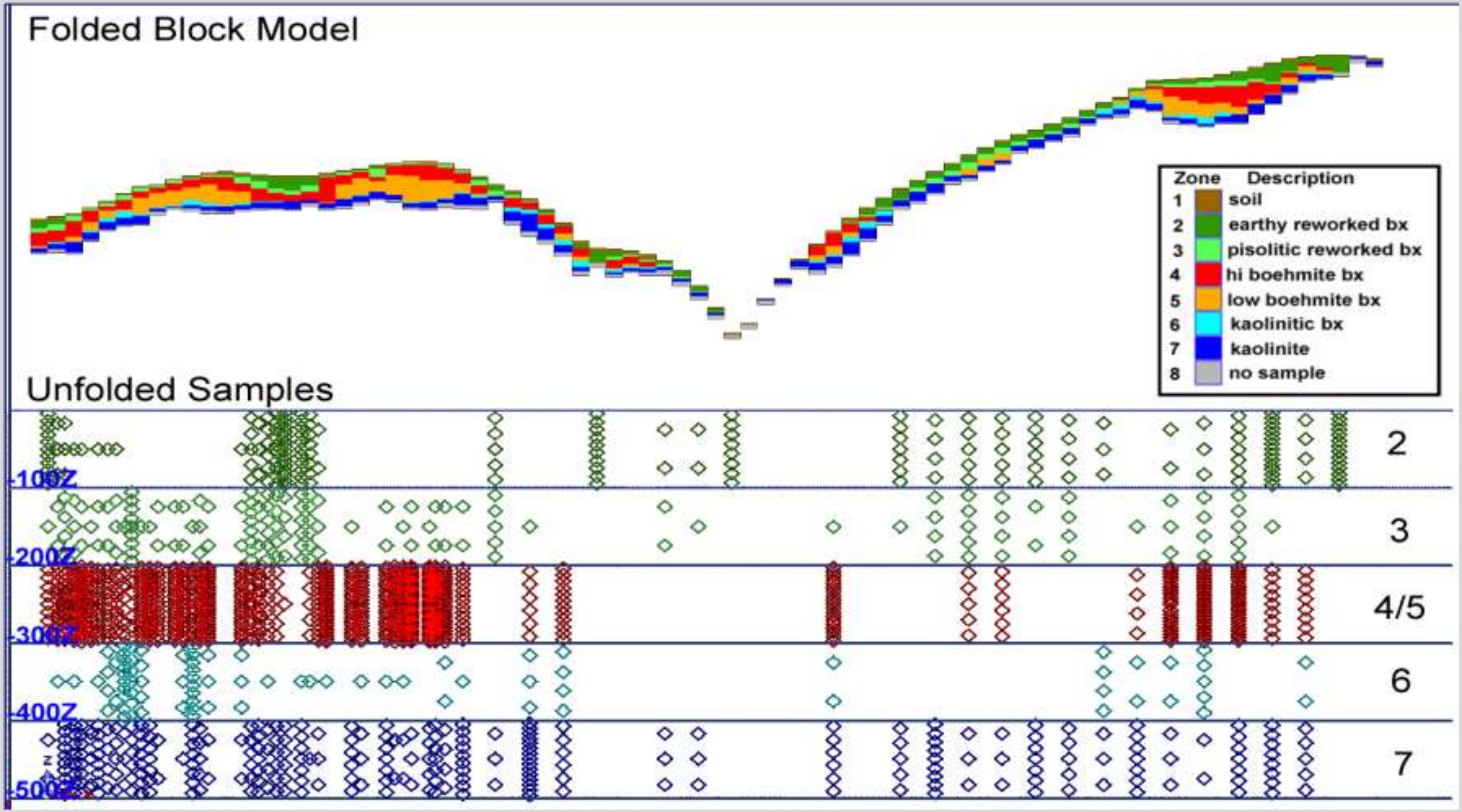
Folded Block Model



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Resource Estimation - Sequence

1. Bauxite layers were generally above the economic cut-off, as such, the concentration of contaminants were considered more important to model;
2. Experimental variography was undertaken using unfolded data;
3. Modelled variograms were based on total silica, and confirmed as representative of all major elements in all layers;
4. To limit order relation issues a single modelled variogram is preferred;
5. Kriging neighbourhood analysis was carried out using the modelled silica variogram;
6. Estimation was conducted in unfolded space using ordinary kriging;
7. Relative block levels were re-set of original block levels thus re-folding the block model.

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Resource Classification

A number of selection criteria were used in consultation with the project engineers and owners to meet the JORC criteria for classification of the resource.

- Zone 1 (soil) & Zone 8 (unsampled Kaolinite) were excluded;
- Zone 2 to 7 were categorised in a two step process;
  - Vertical column selection using metallurgical and mining parameters.
  - Lateral resource categorisation based on estimation confidence parameters.

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Resource Classification

The result is the vertical selection of intervals relating to reasonable prospects of economic extraction and classified as:

- Mineable bauxite – meets reactive silica, alumina recovery;
- High silica bauxite – meets alumina and recovery criteria but has high silica and is not internal waste within the mineable bauxite interval;
- Thin bauxite – meets the above criteria but is too thin.

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Resource Classification

Only material classified as Mineable bauxite was subject to lateral classification which incorporated a number of outputs from the kriging run.

- number of informing samples;
- drill pattern density;
- average distance of informing samples;
- kriging variance for the silica estimation run.

Based on these parameters, ”Mineable Bauxite” in high confidence areas were assigned as measured resource, low confidence areas were assigned as inferred resource and the remainder is as assigned as indicated resource.

Conclusions

- The resource estimation of the Aurukun lateritic deposits presented specific issues related to the lateral changes in thickness and elevation of the various zones within the deposit where the x and y dimensions are orders of magnitude greater than the z dimension.
- The solution was to do the resource estimation in “unfolded” space which maintains the zone layering irrespective of zone thickness or orientation. The block model estimation method was Ordinary Kriging done in unfolded space and then refolded.
- A number of selection criteria, developed in consultation with the project engineers and owners, were applied to the deposit to define resource categories.

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