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Colluli: Positively Unique

**Mining advantages of the shallowest evaporite deposit
July 2015**

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ASX:DNK

Helping grow a better future

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Shallow mineralisation gives Colluli advantages that cannot be replicated by other potash projects

With mineralisation commencing at just 16m below surface, Colluli is the shallowest known evaporite deposit in the world and is amenable to open cut mining.

This provides the following advantages that cannot be replicated by other potash projects;

- ***Superior resource utilisation*** – approximately 90% of Mineral Resource Estimate converted to Ore Reserve
- ***Reduced capital intensity*** – lowering overall development costs
- ***Substantially reduced risk profile*** – in the areas of both safety and operations
- ***High degree of selectivity*** – which allows separation of the different potassium salt types in the resource, minimising risk of chemistry variations during processing and ensuring a consistent product
- ***Expandability*** – absence of shaft or decline eliminates mining rate constraints and provides low marginal cost expansions with shorter lead times
- ***Exploitation of upside*** – non potassium salts (magnesium chloride, high purity rock salt) extracted in the mining operation as “waste” material can be marketed

Colluli – a class of its own

- ✓ Economically favourable prefeasibility study
- ✓ Large, long life, expandable resource
- ✓ Unrivalled proximity to coast
- ✓ Colluli resource yields high purity, premium SOP
- ✓ Commercially proven process
- ✓ Potassium salts are mined in solid form
- ✓ Lowest capital intensity and operating costs
- ✓ Unmatched potash diversification potential
- ✓ Excellent access to the key markets of the future
- ✓ Stable and maturing mining jurisdiction

Focus of this presentation

Positively Unique

Commonly used potash and salt extraction methods



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Salt Lakes



Compass Minerals, Utah

Only 3 economically attractive sources. Economics driven by ambient conditions, land availability and proximity to coast

Harvest salts generated by **solar evaporation** from seawater or salt lakes, then subsequently processed

Open Cut¹

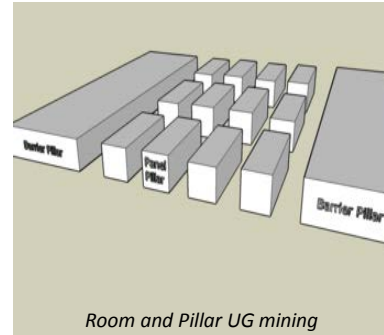


Salar Grande

Most common mining method globally. Planned mine method for the Colluli resource

Used for deposits with **shallow mineralisation**, by far the **lowest cost, highest recovery, and safest** mining method

Underground

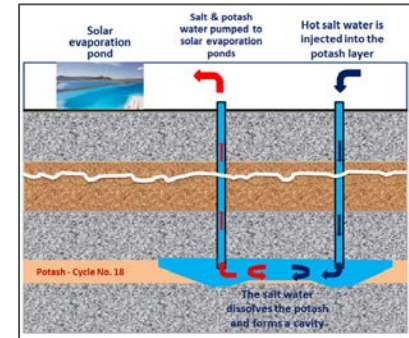


Room and Pillar UG mining

Most common method of Potash mining
Depth 400m – 1200m

Used for areas where **mineral seam is too far underground for open cut** mining – **400m – 1000m**
Most salt / potash mines use room and pillar for this reason

Solution Mining

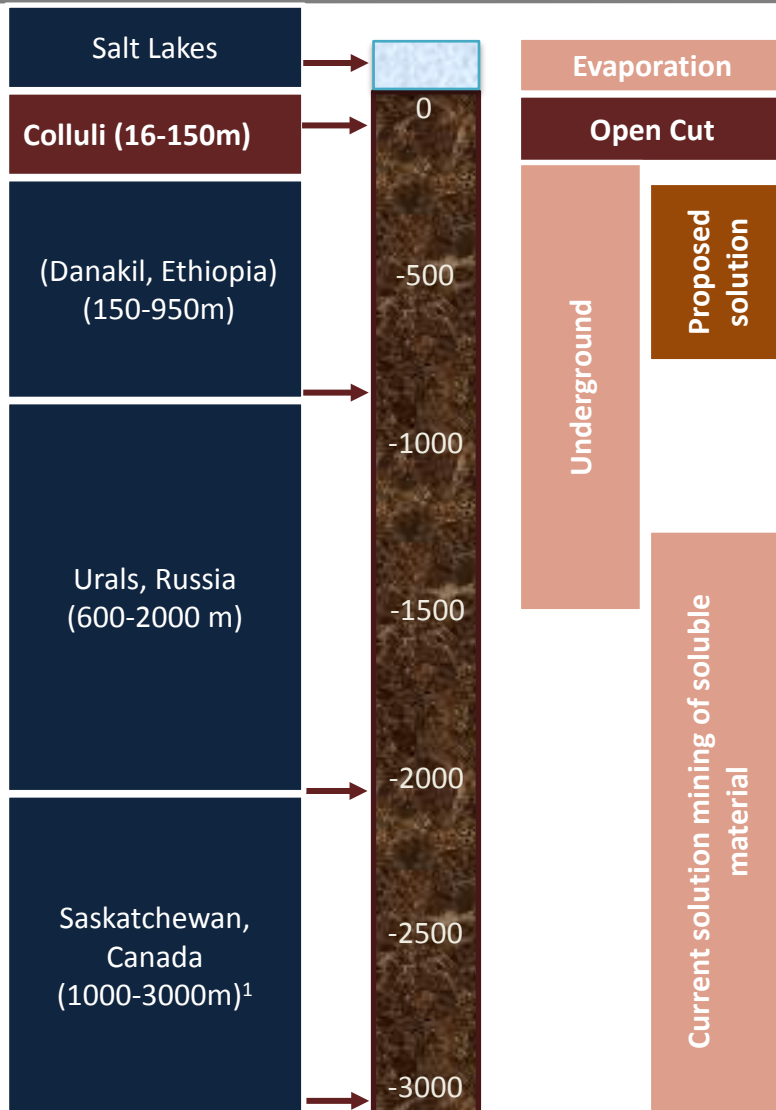


Readily soluble materials,
Depth > 1200m

Solution Mining (**only option for >1200m**), involves injecting heated solution into the resource, dissolving the valuable salts and pumping them to surface for subsequent processing

1. Colluli will be an open cut mine

Potash/Salt Extraction Methods – depth matters



Colluli contains the shallowest potash mineralisation globally

- Mineralisation commences at just 16m depth
- Excellent geological continuity
- Amenable to open cut mining

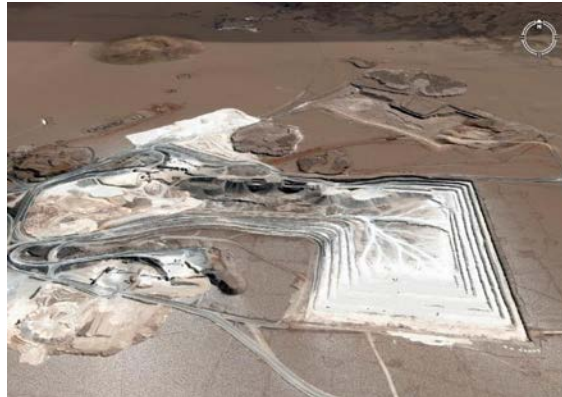
Resource depth is a unique advantage

- Open cut mining gives the highest resource recovery and is a safer mining method than underground
- It is not an option in the other major potash mining regions
- Majority of potash mines are underground due to resource depth
 - *Mine depth drives high development costs- shafts costs alone can cost \$500k / metre²*
- Solution mining currently focused on mineralisation at depths >1000m, where seismic issues are problematic

Open cut mining of salts – a proven mining method



Salt Mining, Western Australia



Open Pit Salt Mining, Salar Grande



Salt mining, near Murcia , Spain



Salt Lake Surface Mining, Turkey

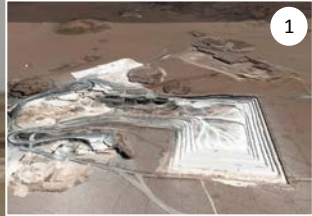


Wirtgen Surface Miner Cutting Salt



Salt extraction using surface miners

Colluli overview



1

1. Initially, two pits will be developed to access the required salts for potassium sulphate production

Ground water will be extracted from overburden layer in advance of mining



2

2. Clastics will be removed using truck and shovel



3

3. Surface miners will mine overlying rocks and selectively remove potassium bearing salts. Surface miners primary crush the mined salts.

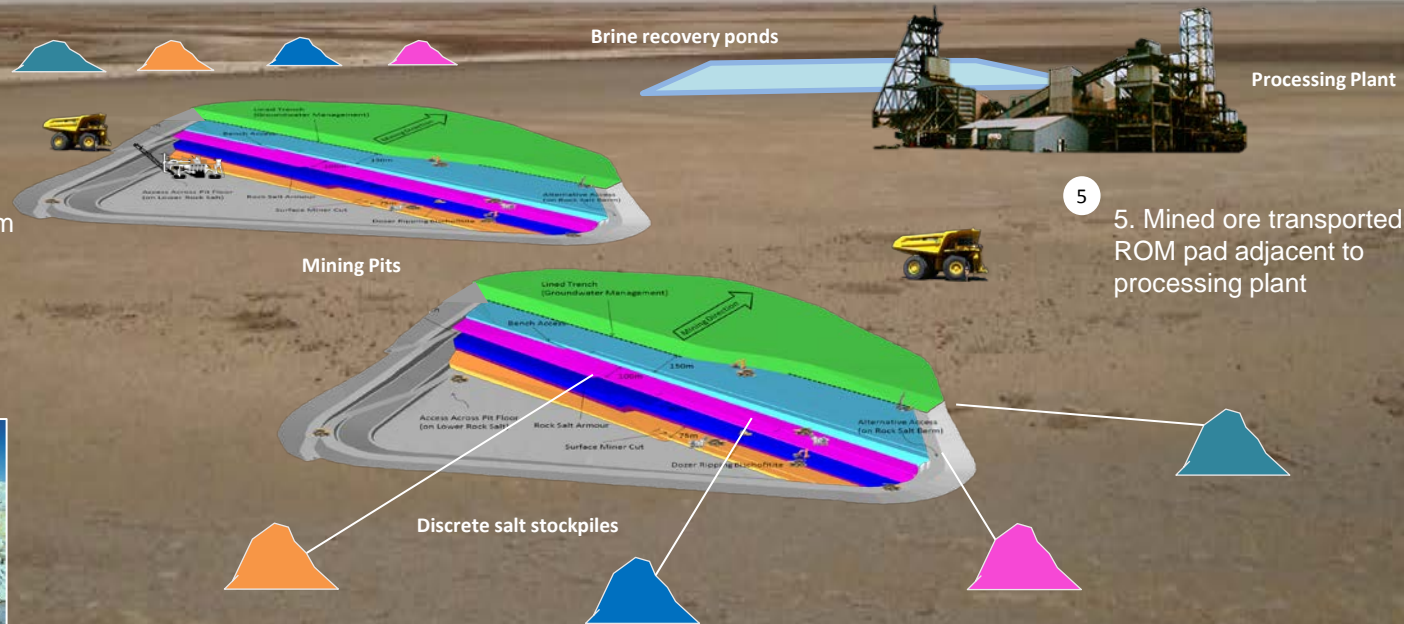
Life of mine strip ratio low – approx. 2.19



4

4. Overburden and waste materials (clastics, rock salt, bischofite) will be removed and stockpiled on site

Clean rock salt will be stockpiled separately in anticipation of future sales



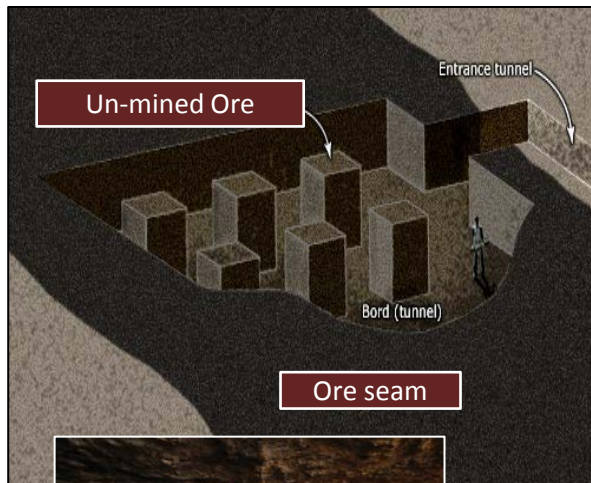
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5. Mined ore transported to ROM pad adjacent to processing plant

Recovery from open pit mines vastly superior

Underground Mining

Room and Pillar Mining

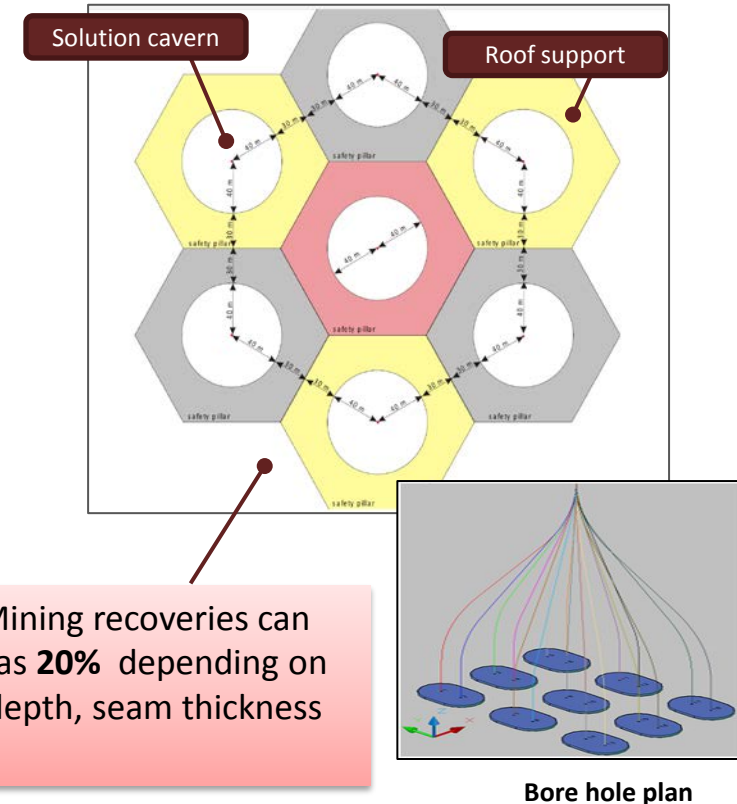


Room and pillar mining is the predominant method used for underground Potash mining

- A significant portion of the resource is sterilised for roof support
- Canadian potash mines recover between 35-45%, at depths of around 1000m, mines in the UK recover approx. 35% ²



Solution Mining Cavern Pattern¹



Solution Mining recoveries can be as low as **20%** depending on resource depth, seam thickness and grade

1. Allana Resources, technical feasibility report – April 2015
2. Industrial Minerals and Rocks: Commodities Markets and Uses – pg 734

Open cut – no losses from roof support

Alternate mine methods sterilise a substantial portion of the resource

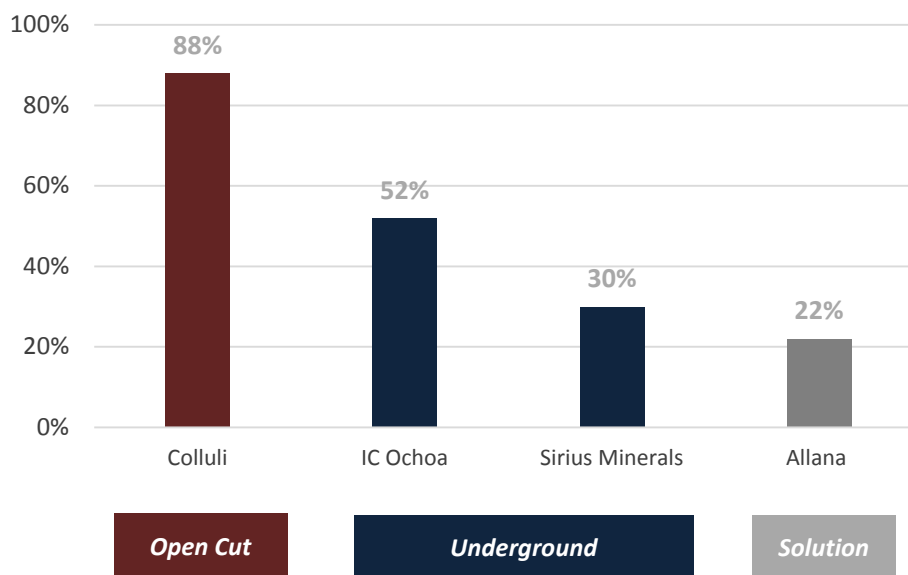
- Room and pillar mining for potash sterilises approximately 50 to 65% of the resource¹
- Solution mine resource recovery from thin seam deposits as low as 20%

Solution mining a resource containing a range of salts also presents the complexities of;

- Preferentially soluble salt types
- Chemistry control
- Water availability
- Impact of geological discontinuities

Conversion of Mineral Resource to Ore Reserve estimates for selected potash (MOP and SOP) projects

%^{2,3}



1. Underground mining methods and applications, company reports
2. Danakali Mineral Reserve, Allana Potash, IC Ochoa, Sirius Minerals
3. IC Ochoa mine life run over 50 years

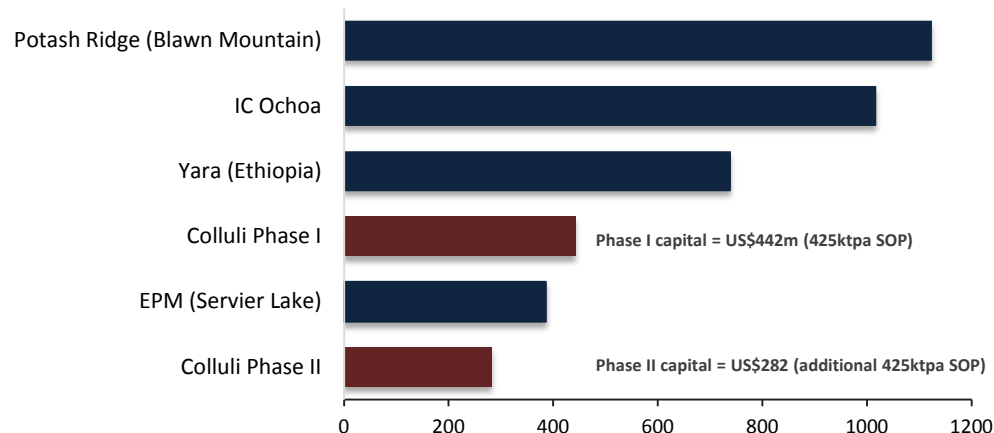
Distinct capital advantages of shallow mineralisation

Colluli has the lowest capital intensity of advanced SOP projects

- Reduced solar pond size relative to brine and solution mining **due to extraction of salts in solid form**
- Reduced processing plant crushing infrastructure **due to crushing capability of surface miners**
- No requirement for capital/energy intensive high temperature crystallisers **due to favourable combination of salts for high potassium yield conversion to SOP**

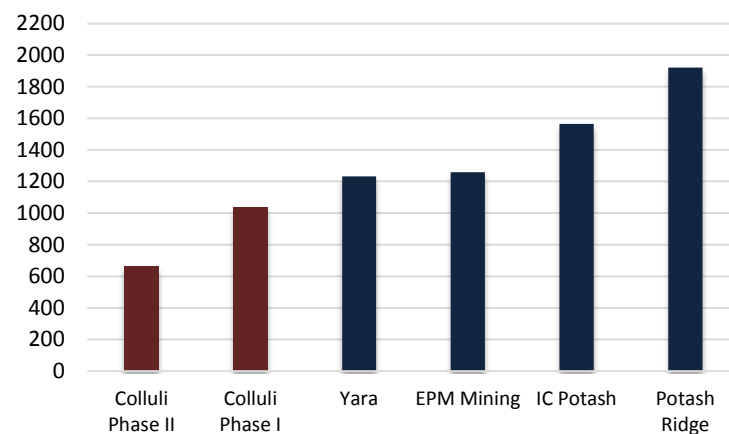
Project Capital Comparisons

\$US millions



Capital intensity of advanced SOP projects

US\$ per tonne²



1. Sirius Minerals
2. Company announcements

Reduced safety and operational risk profile

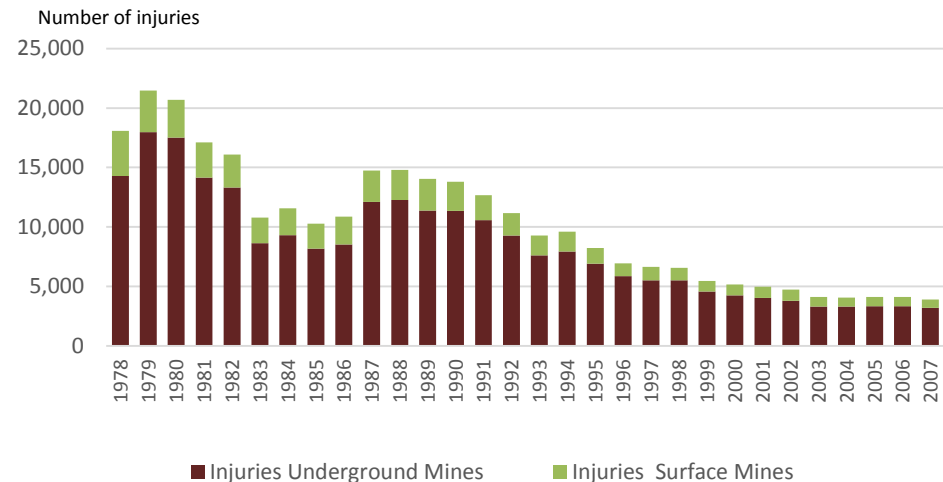
Open Cut mines safer working conditions and better safety record than underground mining

- Injury rate as low as 1/5th

Open cut mines avoid major issues with subsidence and mine collapse

- Potential subsidence issues with solution mining, particular significant if sedimentary layers are removed through dissolution
- Deep underground potash mines prone to water ingress resulting in costly underground brine pumping required to remove salted water and increasing resource risk exposure
- Open cut mine pits easily protected with dewatering

Injury Rates – Open cut and UG mining (United States)



Sinkhole at Potash Mine in Russia, 2014

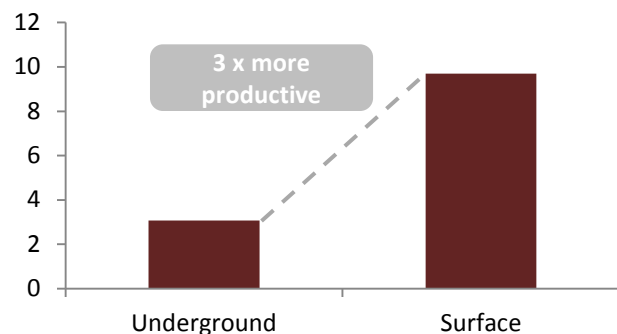


Source: NY Daily news

Surface mining offers productivity and operating benefits

Productivity of Surface mining significantly higher

Average production per employee hr (short ton)¹



	Open Cut	Underground
% Mines	98%	2%
Safety	Significantly safer working environment	Stringent safety requirements, require expensive, specialised equipment
Productivity	Larger machines operate with high capacity	Restricted by narrow working spaces greater transport time spent from mine entry to working face
Energy intensity	5-10kwh/t raw material – mostly diesel fuel, increasing use of electricity	20-50kwh/t raw material ⁴ higher energy requirement (most electricity) for drilling, blasting, loading, primary crushing, material transportation to the surface, ventilation, dewatering and pumping operations
Mining Cost	Highly efficient, low cost	>3-4 times surface mine cost ²
Labour costs	Open cut mining skills more readily available	5 times higher, due to specialist skills required ³
Equipment costs	Competitive market for equipment, keeps prices down	Higher specialised equipment with limited alternate applications

1. US Mine Safety and Health Administration; 2. Tanta University; 3. Principles of Mine Planning, Mining Magazine, 1981; 4. SME Mining Engineering Handbook

Selectivity of the potassium salts is key for the Danakil



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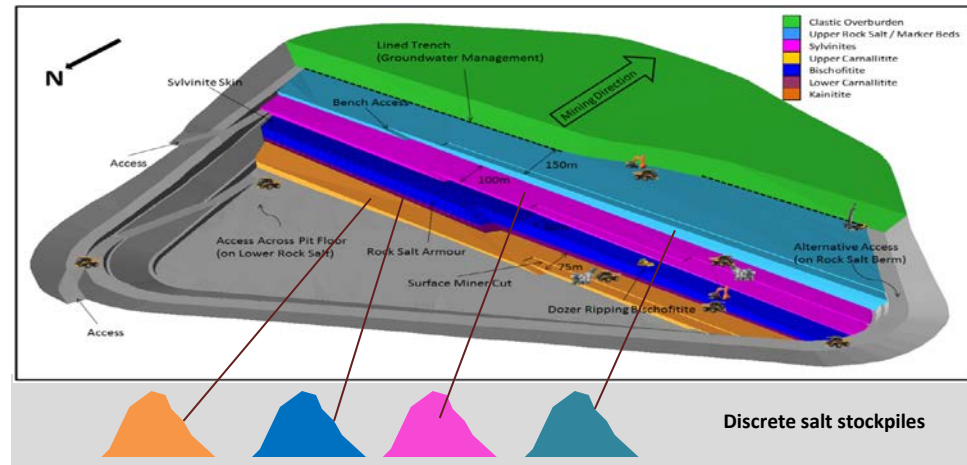
Surface mining enables salts to be selectively extracted, allowing consistent grade and stable processing operations

- Controlled extraction and stockpiling of different salts
- Higher overall resource recovery
- Improved grade control
- Ability to navigate thin or discontinuous mining seams with ease
- Optimal extraction method for the multi salt composition of the Danakil resource

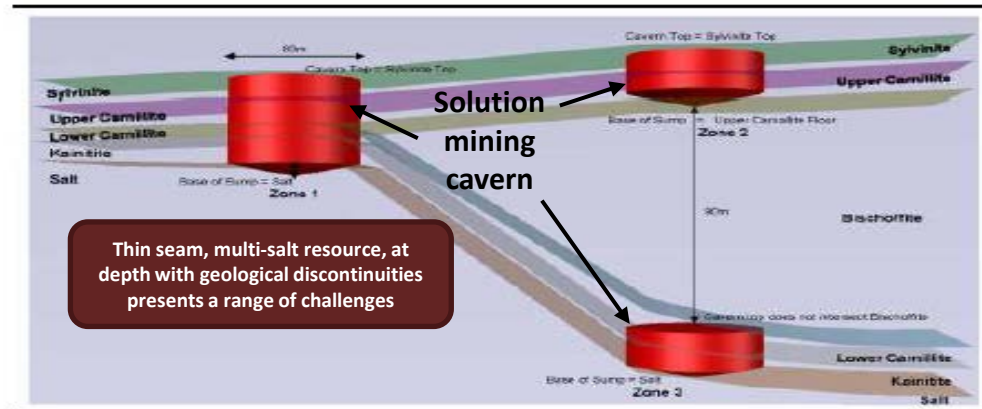
Ore selectivity ensures processing operations are not disrupted by chemical and solubility variations

- Measureable, predictable grade
- Ability to separate magnesium and chloride bearing salts avoids the brine chemistry complexities of solution mining

Open Cut mining method of Colluli resource



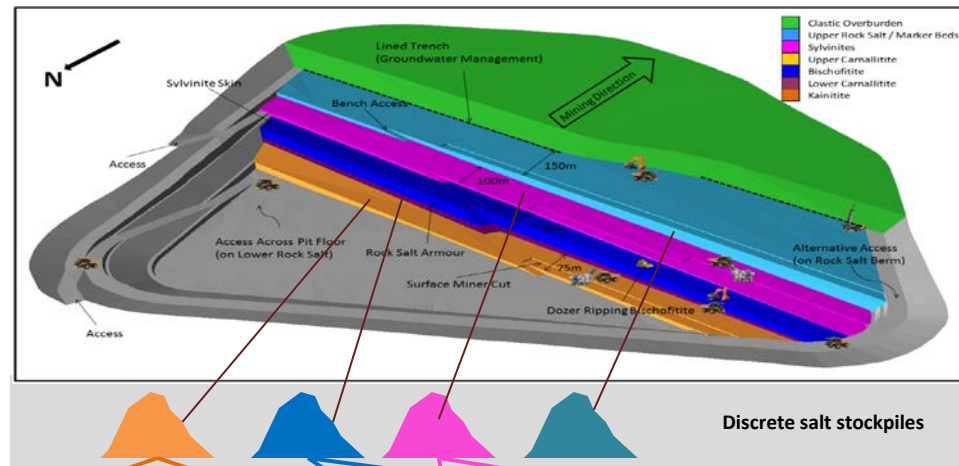
Selectivity challenge in Solution Mining operation ¹



1) Yara Ethiopia – Danakil depression

Selectivity and salt composition of Colluli enables unrivalled long term potash product diversity

Open Cut mining method of Colluli resource



Potassium magnesium sulphate (SOP-M) from kainite



Potassium sulphate (SOP) from kainite, sylvinite and carnallite



Potassium chloride from sylvinite and carnallite

Low cost expandability

Open cut mining offers ease of growth using the principles of modularity

- Marginal mine development capital post module I
- Clear economies of scale – 13% reduction in operating costs with introduction of Colluli second module

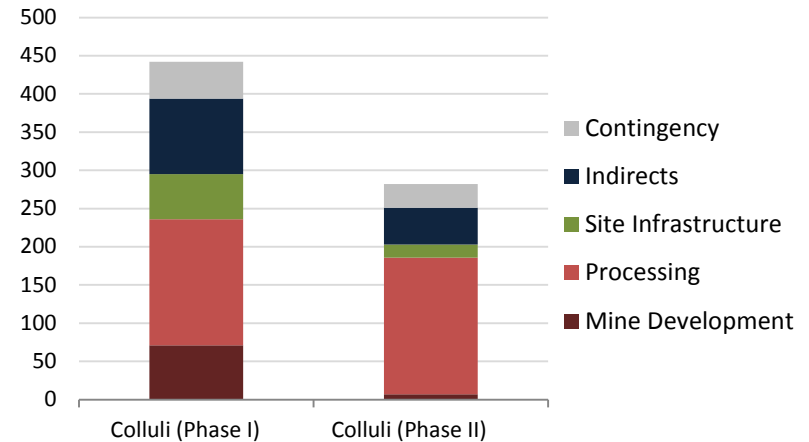
The open cut mining method enables lower capital intensity growth modules

- Underground mining expansion increments dictated by need to optimise around hoist shaft capacity
- Shafts (particular at 1000m+), which are generally the system constraint, are costly and time intensive to develop and throughput value of expansion tonnes needs support high development costs¹

1. Sirius Minerals - Mine shaft cost - \$500k/m - \$750m for 1500m

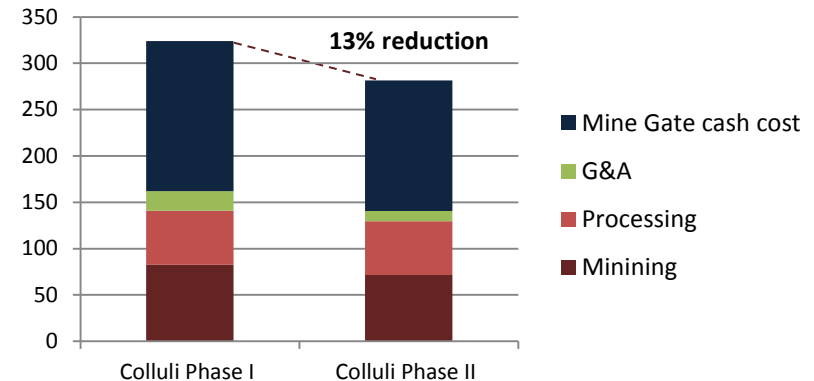
Capital Cost for expansion from Phase I to Phase II

\$US millions










Mine cash cost reduction from Phase I to Phase II

\$US per tonne



Operational and risk reduction benefits of surface mining are clear

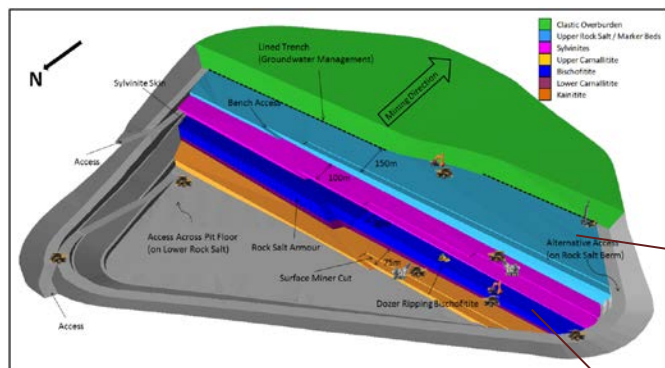
Mine Method ¹	Open cut	Underground Mining	Solution Mining	Brine Lakes
Operational Considerations				
Expandability				
Selectivity				
Production cycle time				
Water Requirements				
Specialised skills				
Risks				
Safety Risks				
Weather impact on output				
Subsistence risks				

 Most favourable
  Least favourable

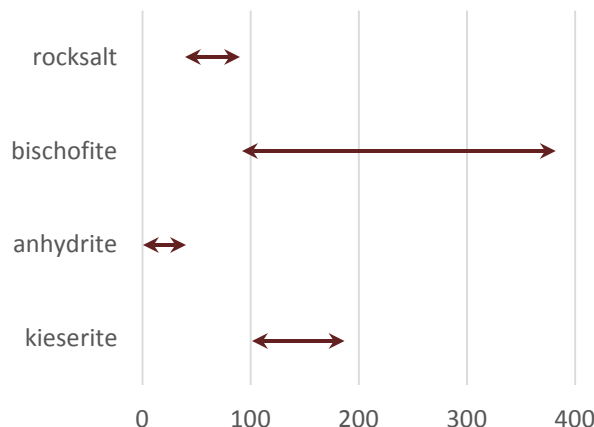
1 – Depends on the form and depth of salts in the resource

Potential monetisation of extracted waste salts

Other salts stockpiled during mining process can be monetised, with very low marginal cost



Current Market Prices
US\$/ metric tonne



Source: Tradekey

Potential Markets for Various Resource Mineralisation

Mineral Present at Colluli	Colluli Resource	Global Market Context	Application
rock salt (NaCl) halite (NaCl)	+ 650Mt	300Mtpa global salt market	chemical manufacturing, road deicing, food processing, livestock
bischofite (MgCl ₂)	+200Mt	6 – 7Mtpa global market	construction, agriculture, oil extraction, medical and chemical industries
anhydrite	Avg 4% (~40Mt)	187Mtpa Gypsum market	construction and chemical industries
kieserite (MgSO ₄)	40Mt	Established fertiliser segment	magnesium sulphate fertiliser

Note: additional mineralisation not yet included in project valuation

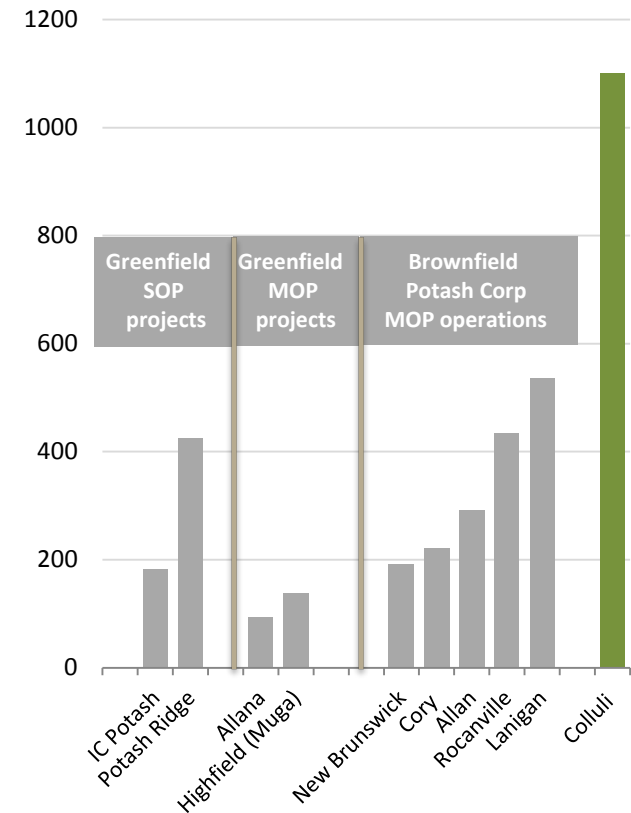
The ultimate production capacity of Colluli extends well beyond module I and II

Colluli Ore Reserve estimate dwarfs many planned and current large scale operations

Company	Project	Design Capacity (Mtpa)	Mine Life (yrs)
IC Potash	Ochoa	0.75	50
Potash Ridge	Blawn Mountain	0.65	40
Allana	Danakhil Project	1.00	20
Highfield	Muga	1.12	24
Potash Corp	New Brunswick	0.80	107
	Cory	1.50	125
	Allan	1.40	100
	Rocanville	2.80	74
	Lanigan	3.40	85
Danakali	Colluli	0.850	243

Ore Reserve estimates for selected potash (MOP and SOP) projects

Million tonnes^{1,2}



1. Company websites, Potash Corp annual report
2. MOP = Muriate of Potash, otherwise known as potassium chloride
3. SOP = sulphate of potash, otherwise known as potassium sulphate

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Thank you

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