

A Robot Miner for Low Grade Narrow Tabular Ore Bodies: The Potential and the Challenge

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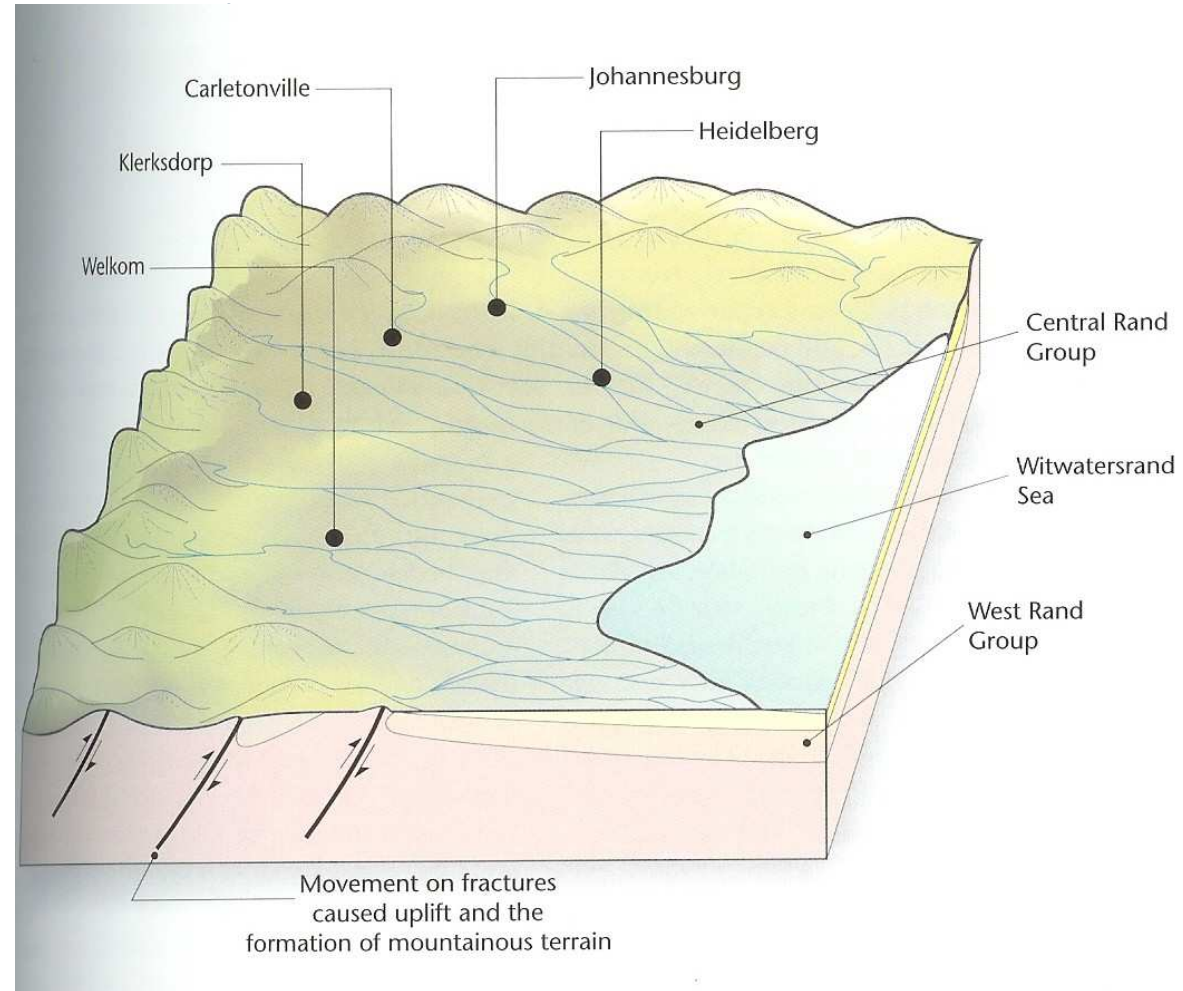


Agenda/programme

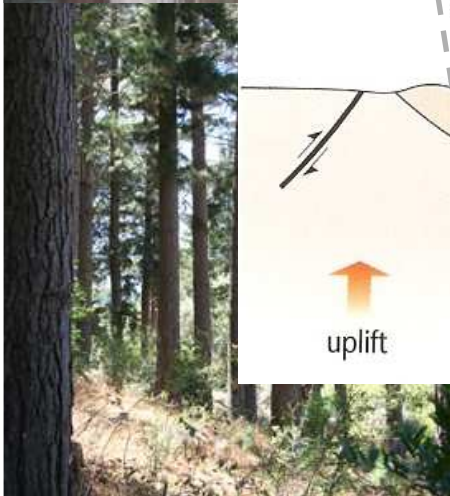
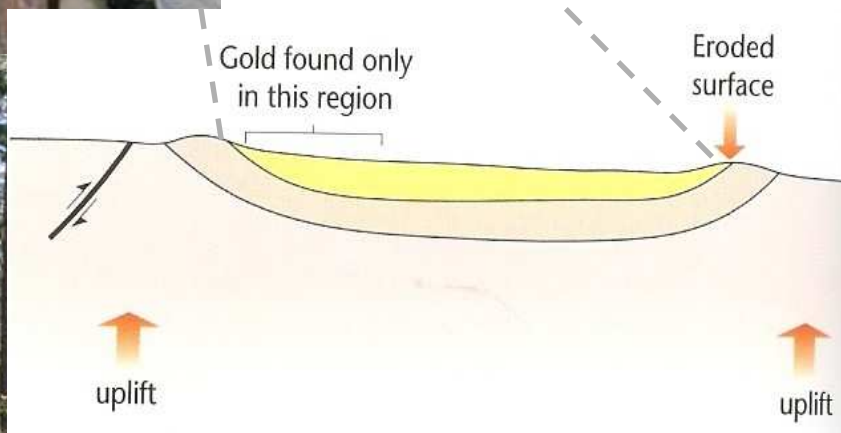
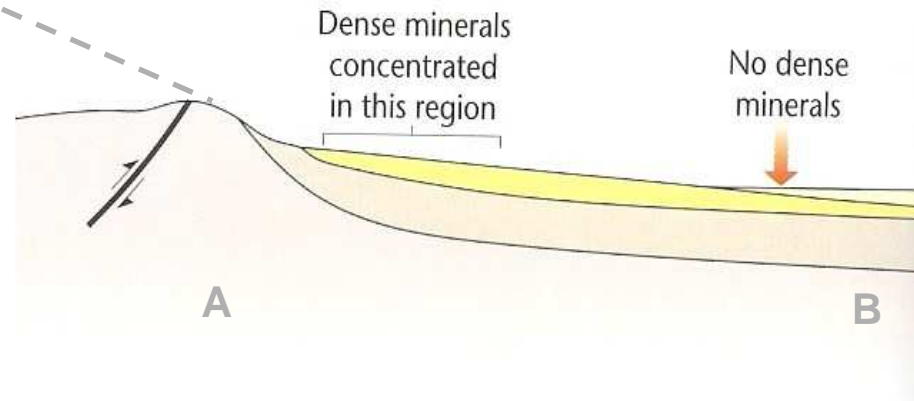
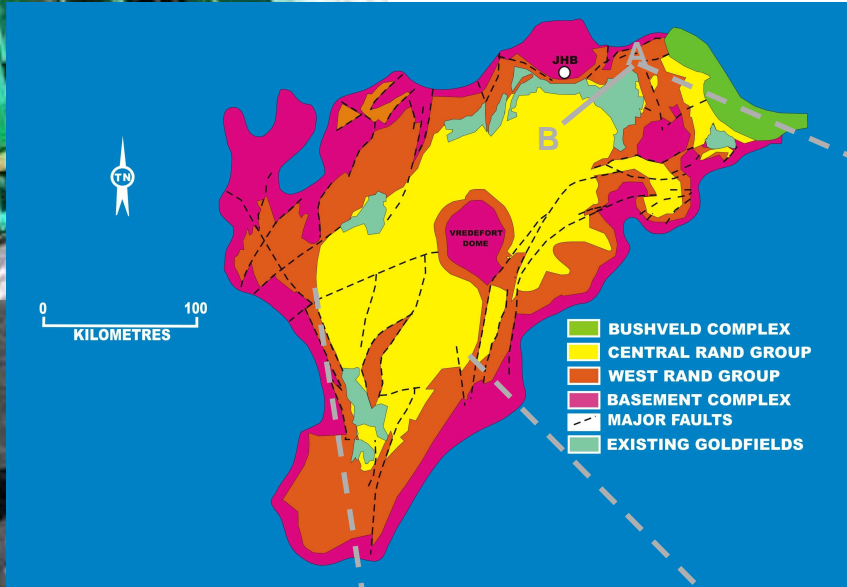
- Contextualise mining
- How it is done now
- What is proposed
- The financial justification
- The plan



Where did the gold come from?



Gold Deposition



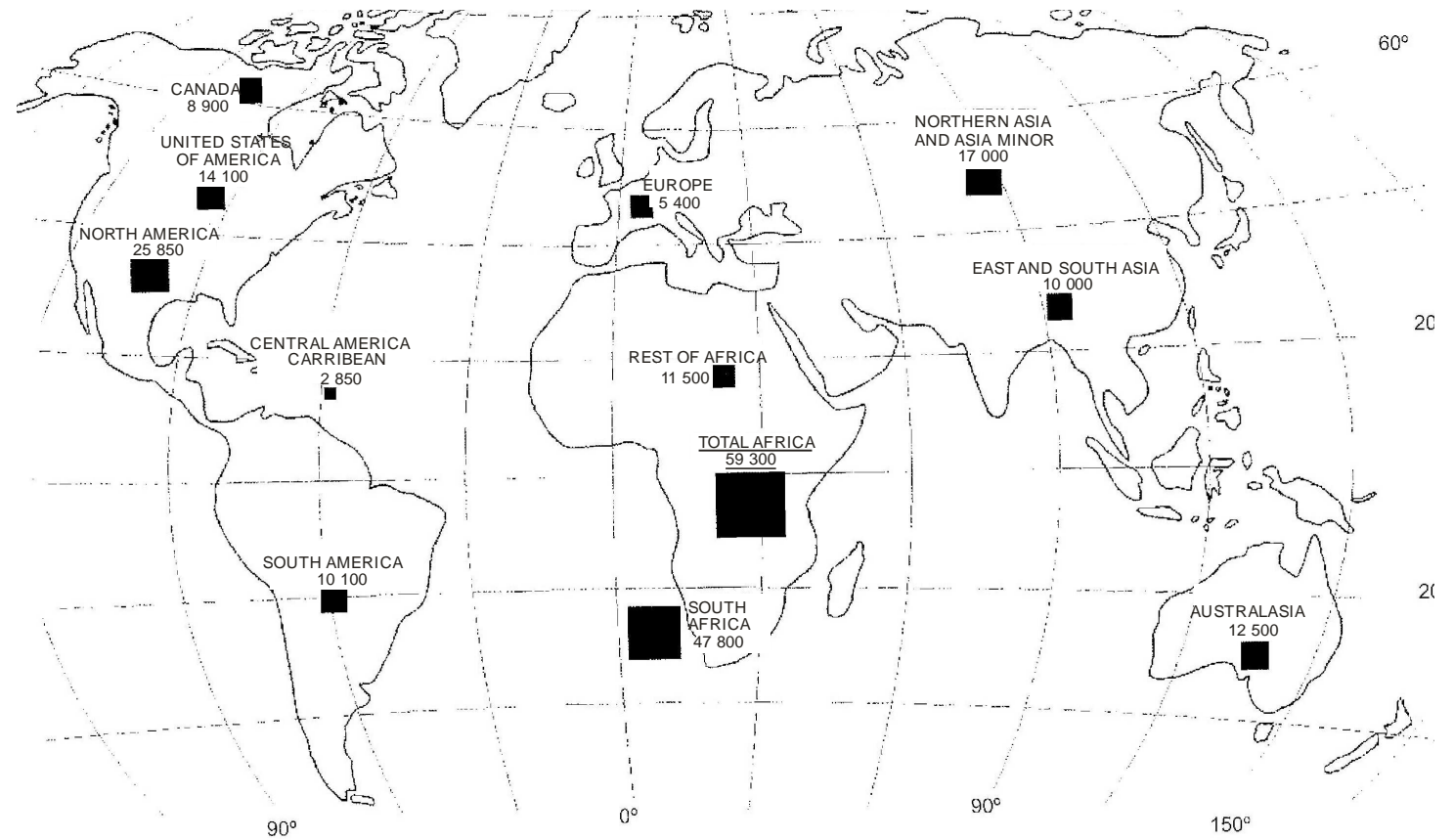
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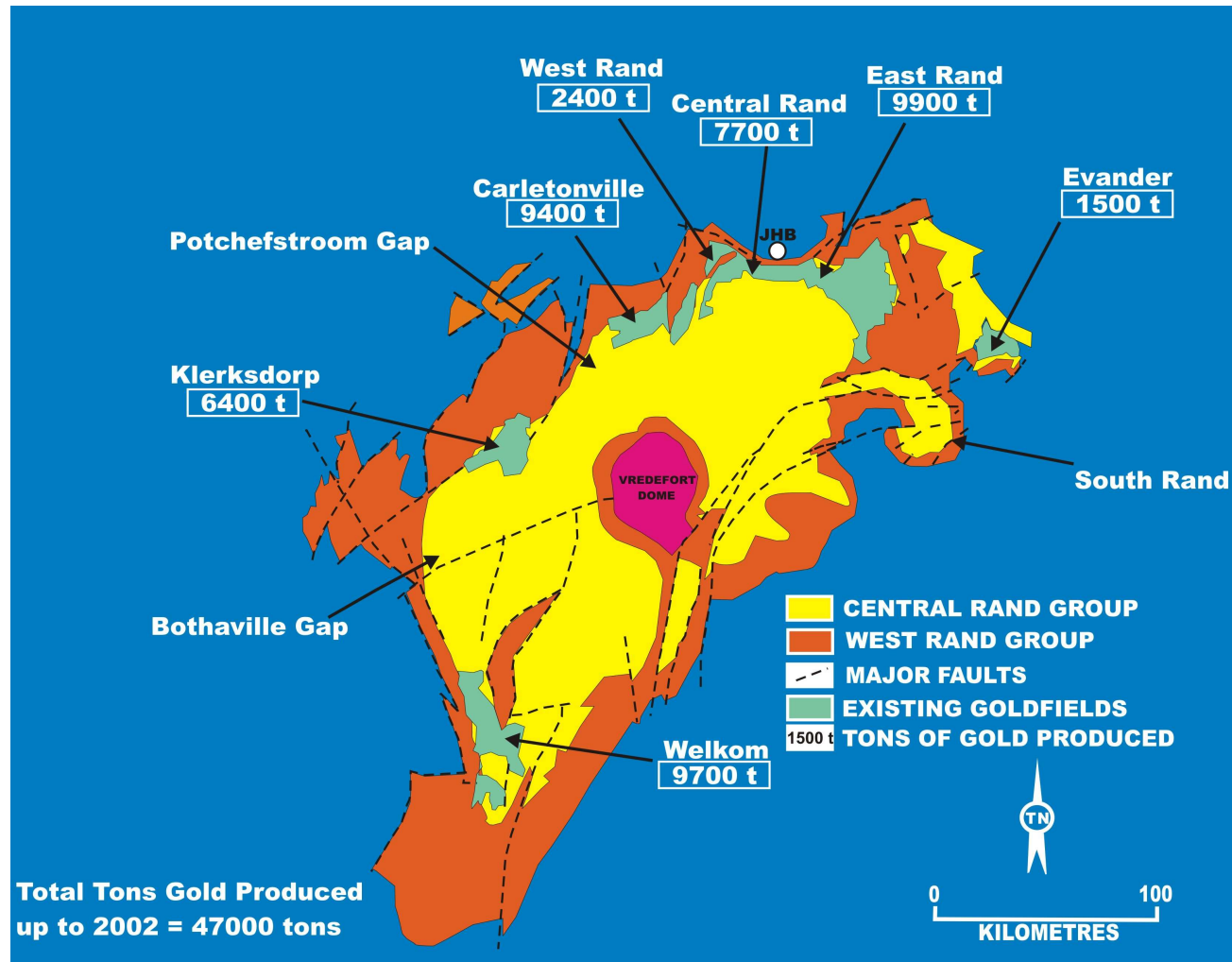
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modified after McCarthy and Rubidge, 2005

World Wide Historical Gold production



Witwatersrand - historical



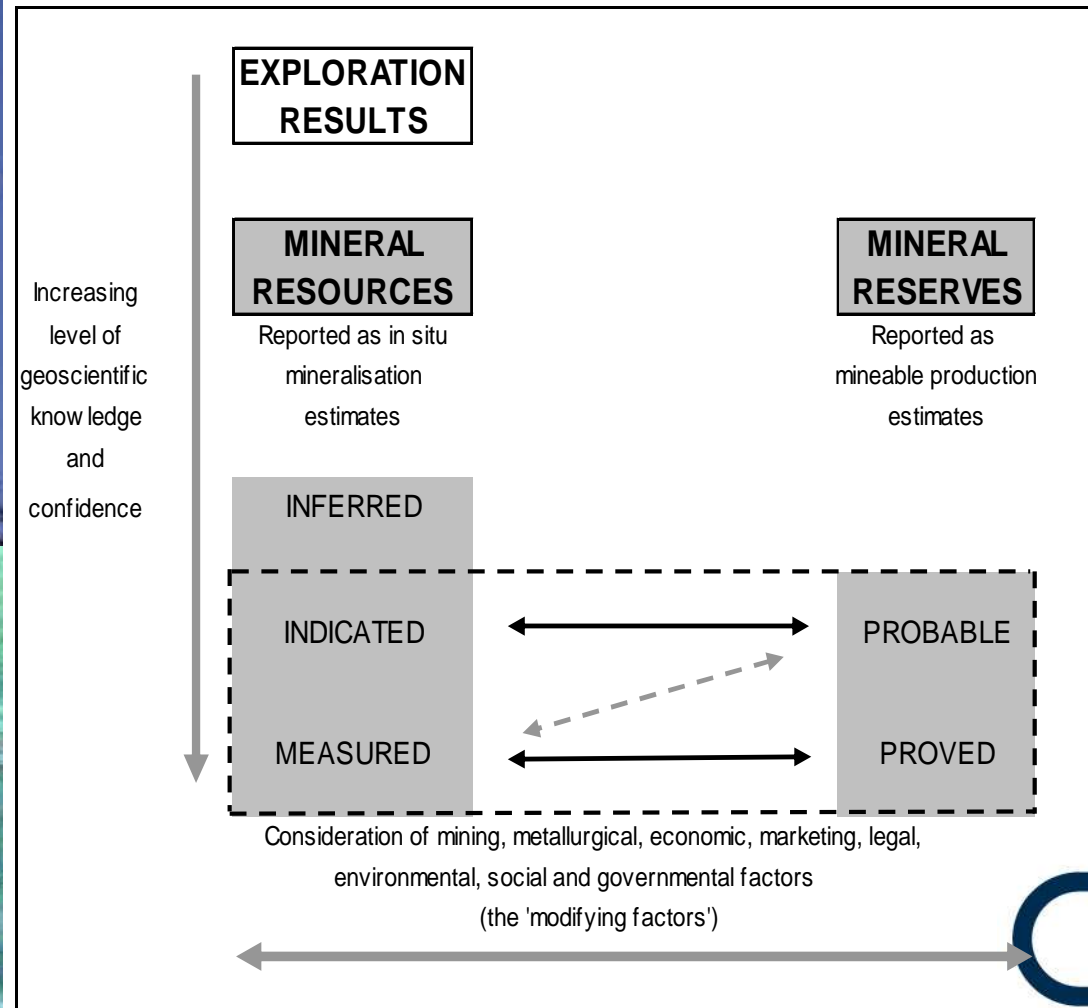


What is a mine

- Gold in the ground does not = money.
- To mine it you need to get to it.
- People mine it therefore it needs people sized holes to get to it.
- Minerals in the ground – with a mining plan = A mineral Reserve
- Uneconomical to mine narrow ore bodies of limited grade

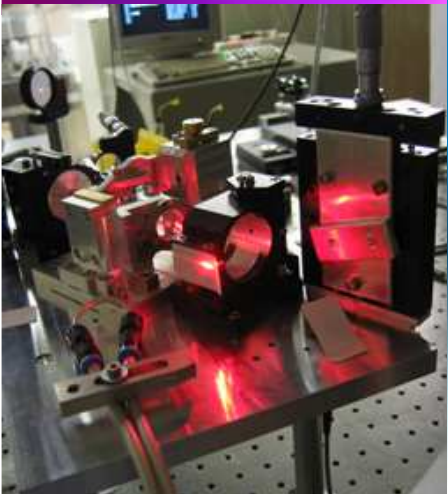


Ore Classification





Witwatersrand – available in stopes < 50 cm

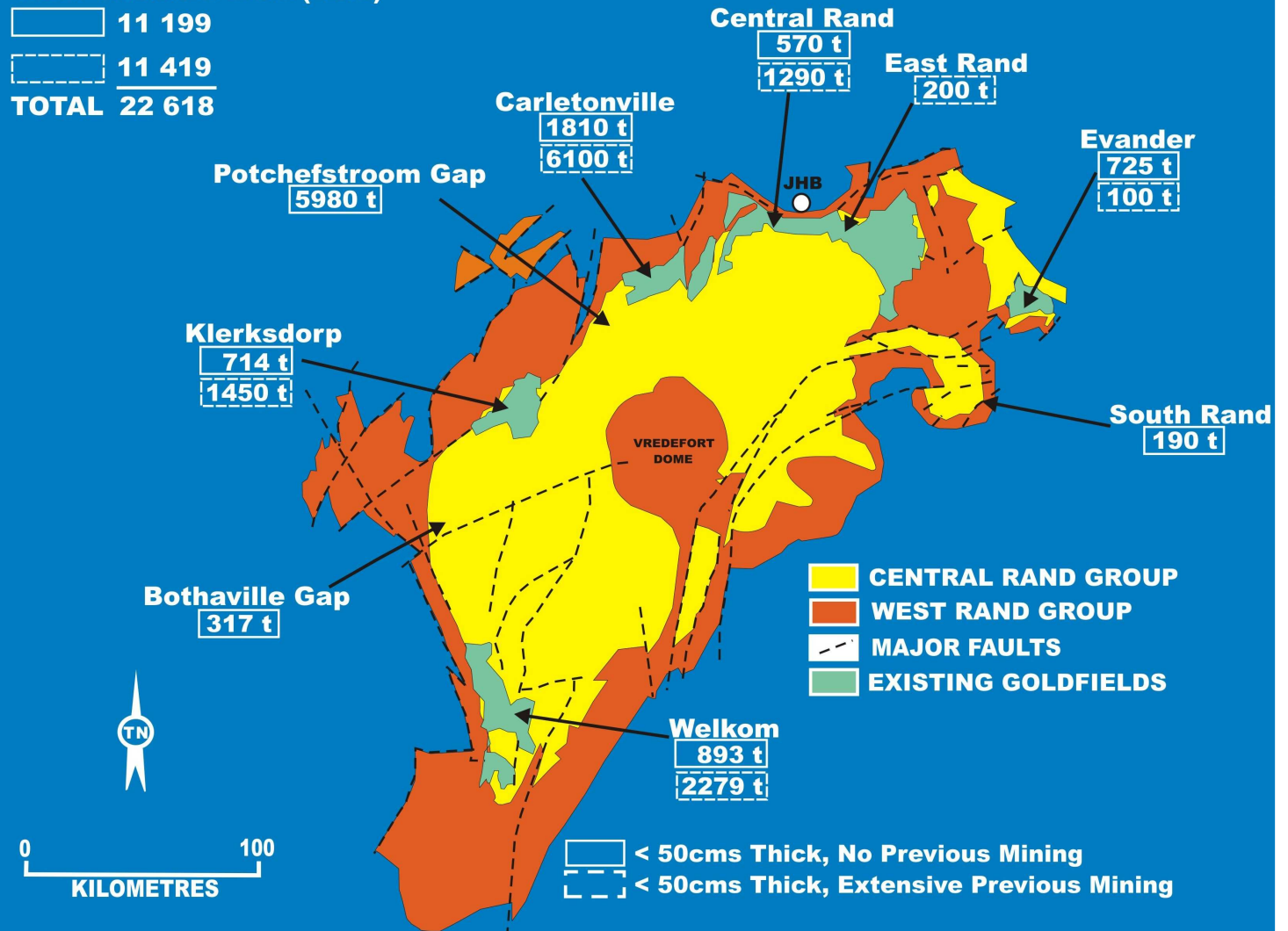


Total Unmined Gold (tons)

11 199

11 419

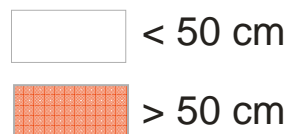
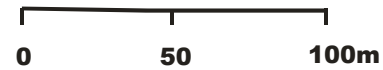
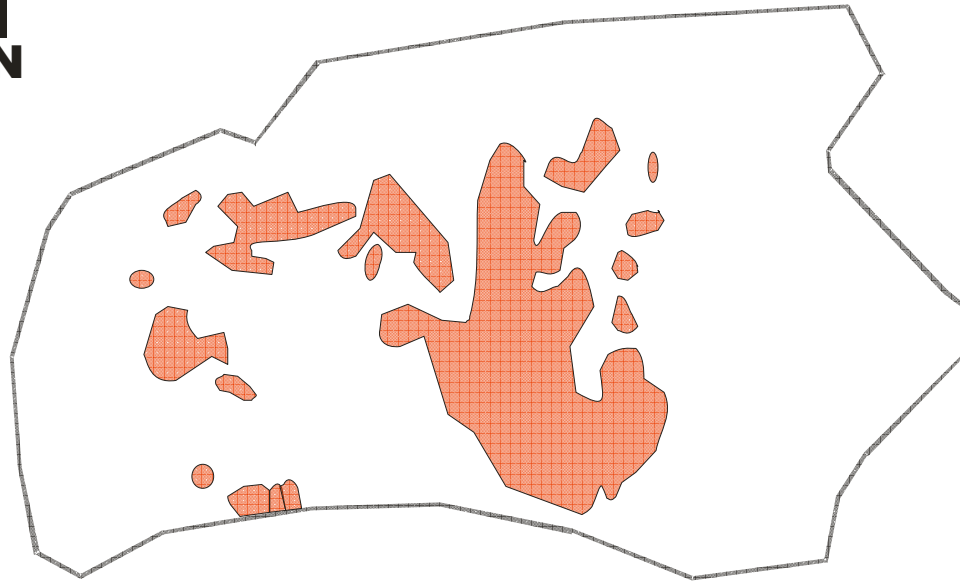
TOTAL 22 618





Case Study

Middelvlei Reef: Doornfontein Mine



Bottom Band thickness

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after Engelbrecht *et al.*, 1986





Case Study

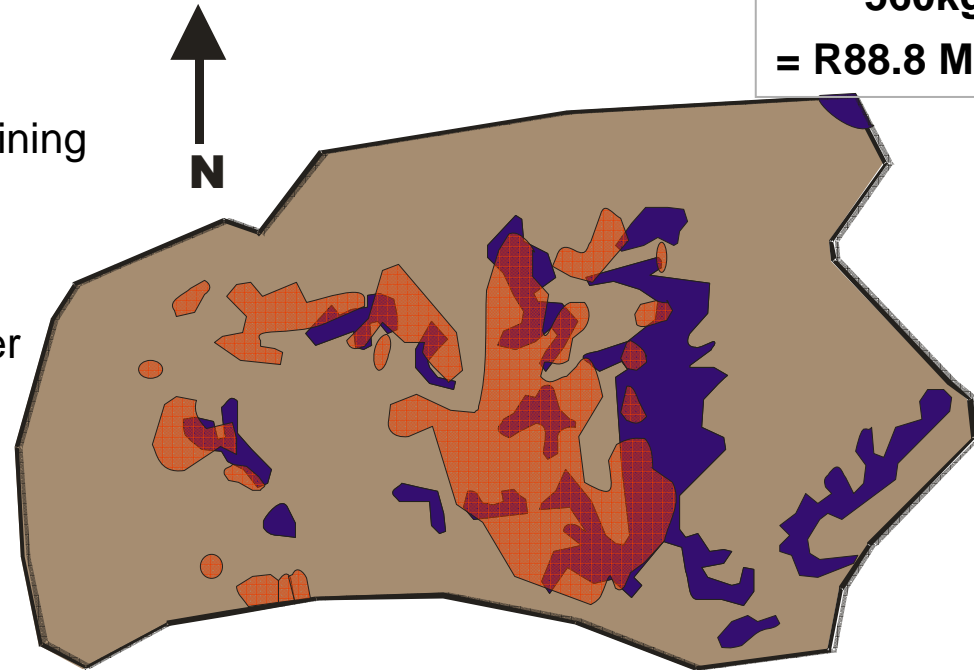
Middelvlei Reef: Doornfontein Mine

Additional Au
560kg
= R88.8 Million







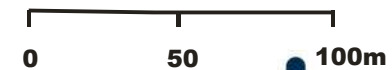
Total Au
Conventional Mining
495kg

Total Au
Nederburg Miner
1055kg



Bottom Band thickness

-  < 2 000 cmg/t
-  > 2 000 cmg/t
-  < 50 cm
-  > 50 cm

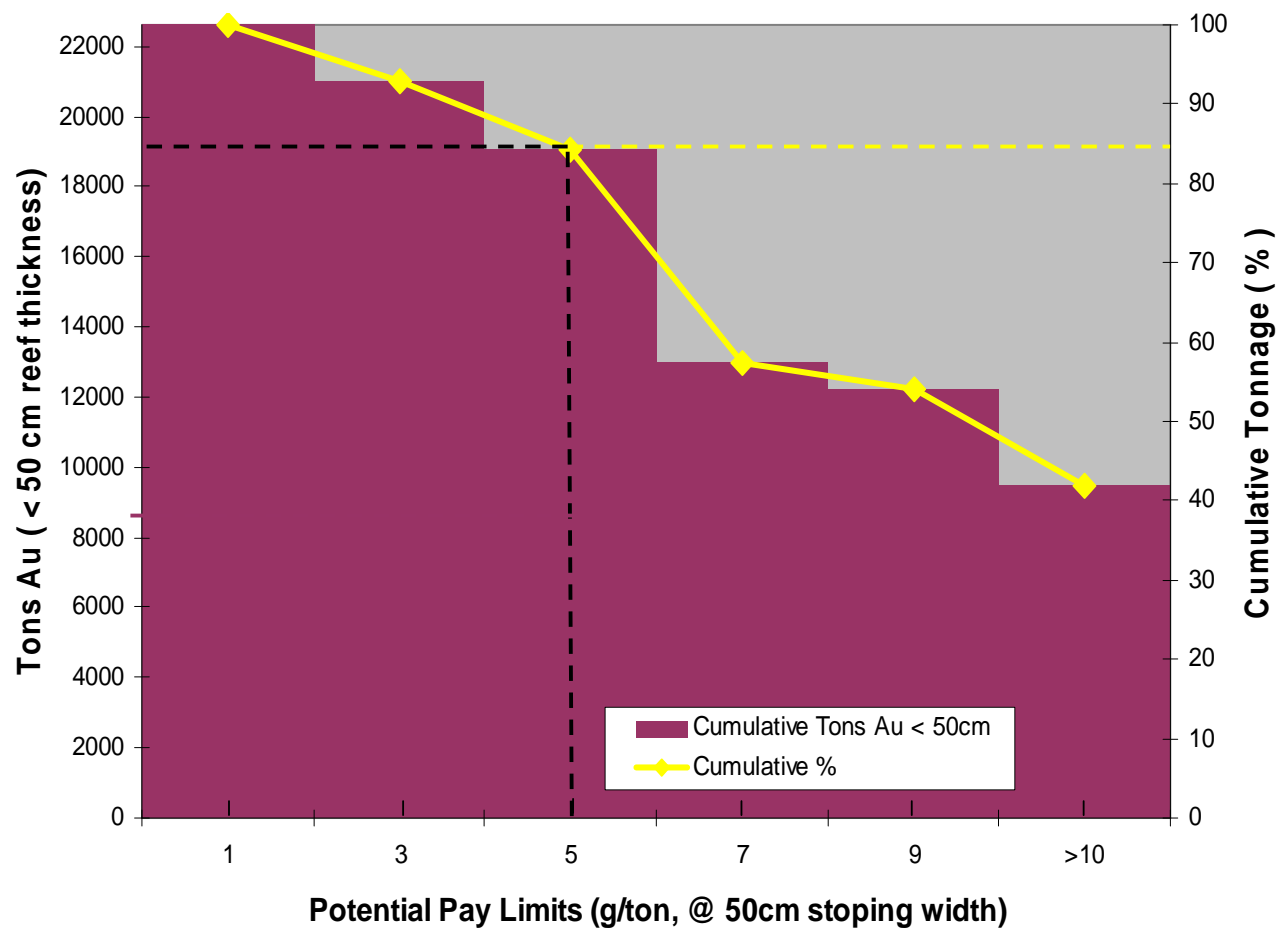
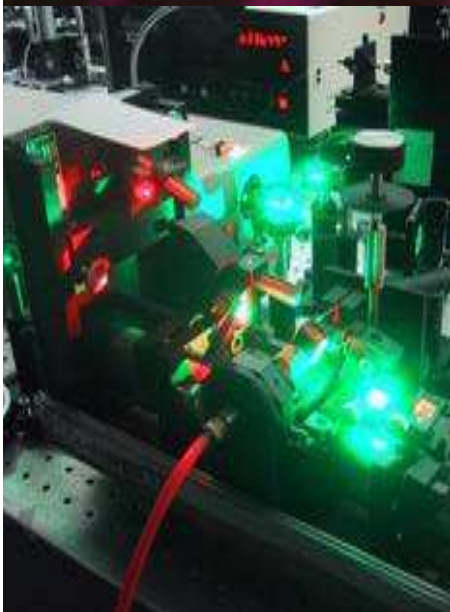
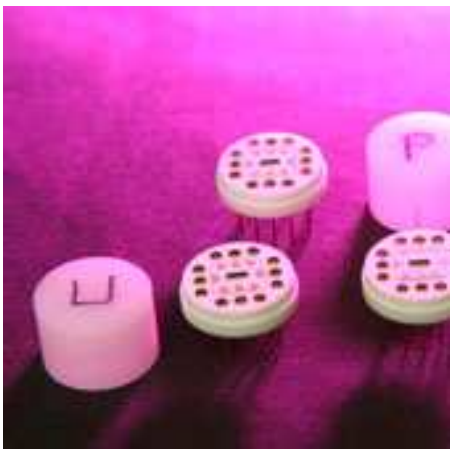


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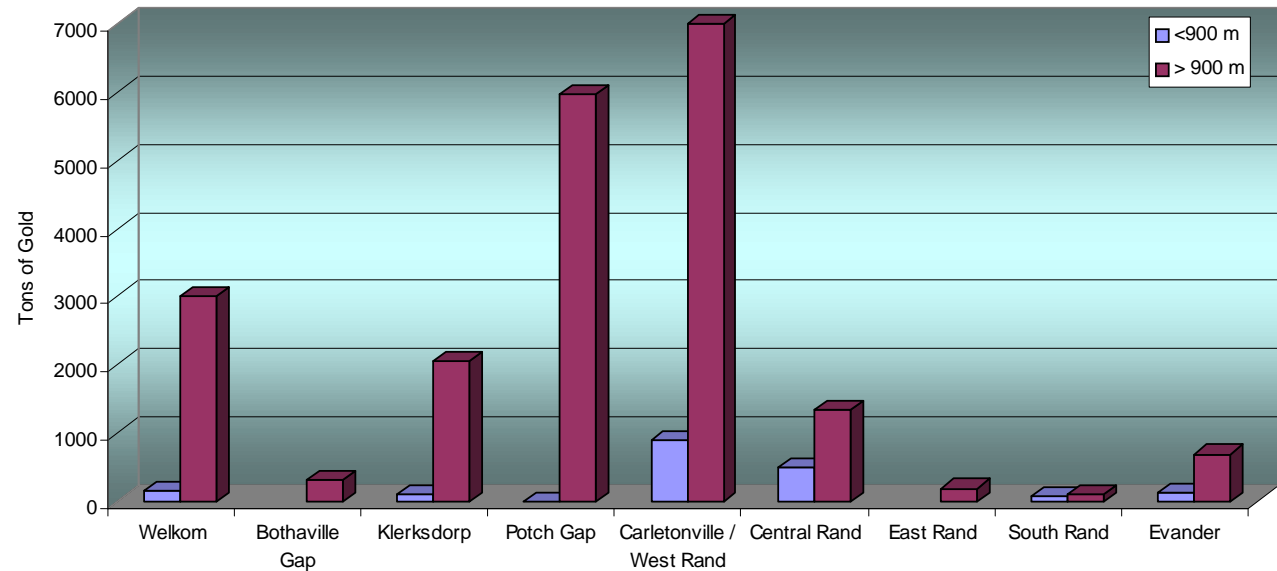
So how much gold is there?





Case Study

Middelvlei Reef: Doornfontein Mine -Extrapolated



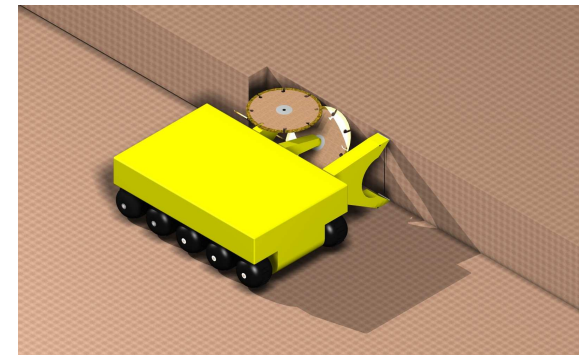
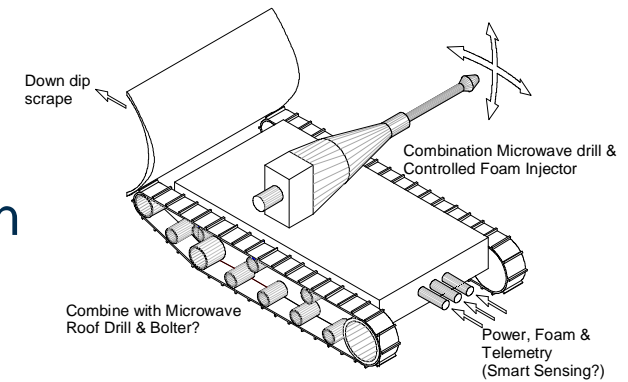
22 618 tonnes of gold
= R3.588 Trillion
(at \$638, R:\$ 7.05)



What is the Nederburg Miner?

A system for mining reefs of less than 30cm thickness with no dilution

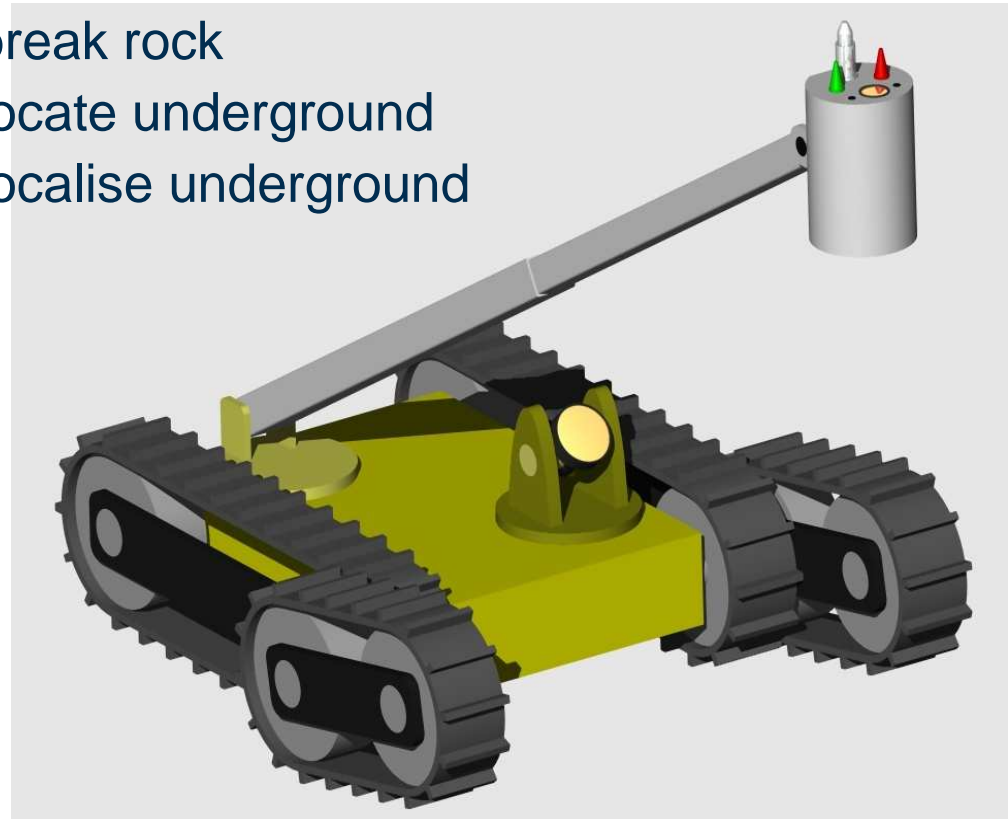
- Mechanized
- South African
- Novel – not scaled down
- Probably
 - Low cost
 - Low height
 - Not automated at first

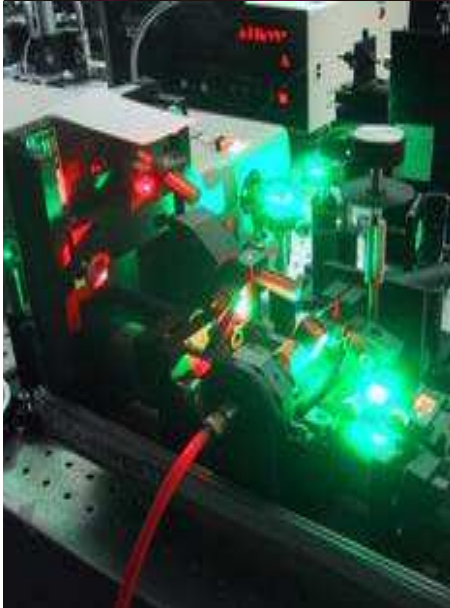
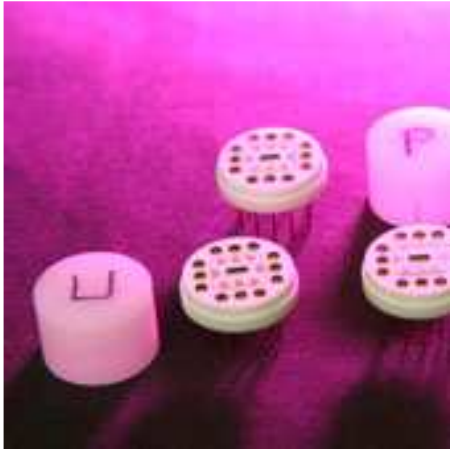




The Plan? More like the challenges

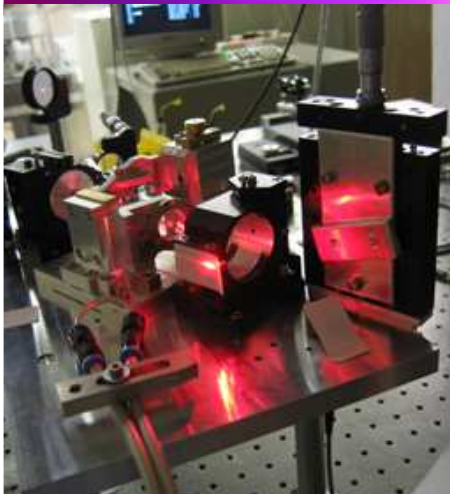
- How to break rock
- How to locate underground
- How to localise underground





Where are we now? The Concept

- 30cm height
- Swarm of mini mining robots
- Each with their own job to do
 - Break rock
 - Clean up the broken rock
 - Measure the environment
 - Track the reef
 - Provide power for rock breaking
 - Positioning of locating beacons



The Plan

current decisions

- Ultra sonic beacon system for underground localisation
 - Single prototype goal (not the entire team yet)
 - WiFi communication methodology
 - South African Built platform
 - Electric Rock breaking technology
-
- Interim deliverable of a safety platform



What we don't know yet

- How to track the ore deposit
- How to provide the required power for the system (aim for a non tethered system)
- How to manage to power for the system
- How to control a team of robots
- How to manage a team of teams
- What the mine design will look like
- What the impact of narrow stopes will be in the host rock
- How to control the rock breaking tool
- What we don't know



Questions

- Looking for partners
- Interesting and challenging journey

Thank you

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