Kirkland Lake Gold

Minerals exploration

High tech. Low impact.

Mining is essential to modern life. Everything we use is either mined or grown. Minerals exploration is a scientific process that is low impact, short term and only rarely leads to a mining operation.

Exploration is not mining and exploration licences do not permit mining. Exploration can occur on public lands, such as Crown Land forests, and private land. Environmentally sensitive areas such as National Parks are excluded from mineral exploration and mining.

Minerals in the ground are owned by state governments on behalf of the community. Exploration can only happen under a minerals exploration licence granted by the state and stringent licence conditions apply.

Prior to undertaking any exploration activities, an explorer must negotiate a land access arrangement with the landholders. Licensees also have a duty to consult with the community and must meet environmental standards.

Victoria's Aboriginal cultural heritage protection framework provides significant legal protections for tangible and intangible heritage. Under the framework Traditional Owners can make decisions regarding their heritage in consultation with land use proponents.

Well-planned exploration projects have little or no lasting impact on the environment and impose minimal disruption to other land users and the community.

When exploration is successful, there is a separate, comprehensive environmental and social approval process involving community input for any proposed mine.

More resources

- **Land Use Guide for Mineral Exploration**
  Produced by MCA Victoria and VFF to help explorers and landholders negotiate a land access arrangement.
- **Code of Practice for Mineral Exploration**
  Explorers are subject to the Code of Practice which sets out how exploration activities should be conducted in Victoria.
- **Minerals Exploration in Victoria video**
  A short video produced by MCA Victoria explaining exploration, landowner access and environmental responsibility.

75 MOZ
ESTIMATED GOLD
There is almost as much gold in Victoria as has been extracted since the gold rush.
Source: Geoscience Victoria

1 in 660
DISCOVERY RATE
Likelihood that early stage exploration delivers a discovery.
Source: Victorian Govenment

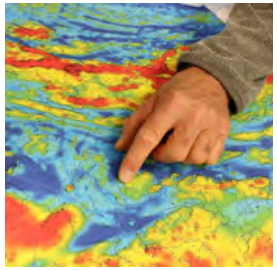
291
EXPLORATION LICENCES
The number of exploration licences in Victoria in 2020-21.
Source: Victorian Govenment

Stages of exploration

Exploration involves low impact scientific methods and only sometimes leads to drilling.

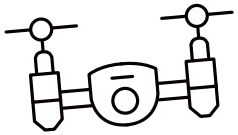
STAGE 1

Area selection



Activities

- Review of geological data
- Area visit
- Rock-chip sampling



STAGE 2

Target identification

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Activities

- Geological mapping
- Geophysical surveys
- Geochemical surveys

STAGE 3

Target testing

Currawong Resources

Activities

- Drilling
- Further geophysics and/or geochemistry
- 3D modelling

STAGE 4

Resource delineation

Activities

- Intensive drilling
- Metallurgical testing
- Bench-top processing trials

DID YOU KNOW?

Victoria has globally significant resources of mineral sands, in particularly zircon and titanium minerals.

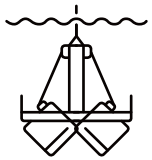
Target identification

Target identification is aimed at defining smaller areas which warrant further testing.

Early-stage exploration activities such as geological mapping, rock-chip sampling, local-scale airborne geophysical surveys and geochemical surveying will be completed at this stage. Ground geophysical surveys may be initiated and possibly shallow drilling for bedrock geochemistry.

Geochemistry

Geochemistry is the systematic sampling and chemical analysis of rocks, soils, water or vegetation. The results are used to assess the potential presence of a mineral deposit.



Stream sediment sampling involves the systematic collection of sediments from the active beds of rivers and creeks. Stream sediment surveys are used to carry out a first-pass assessment of the mineral potential of a large area and quickly identify anomalous sites.

Soil sampling surveys are used to hone in on the source of anomalies detected in other surveys. It targets the geochemical halo that forms around a mineral deposit under most weathering conditions.

X-ray fluorescence (XRF) analysis is a non-destructive technique for measuring a minerals' composition. Geologists in the field can use portable equipment like XRF and X-ray diffraction analysers (XRD) to get real-time material chemistry and mineralogy of geological samples.

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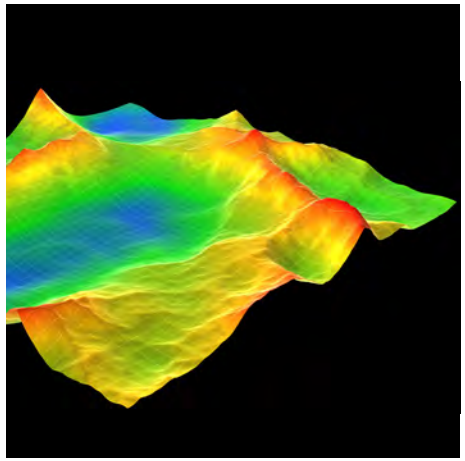
Target identification

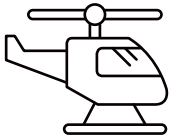
Geophysical surveys

Exploration geophysical surveys measure the physical properties of the subsurface and identify the variations in them. These variations can arise from changes in rock type, or more rarely, mineralisation.

Geophysical techniques

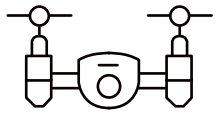
- Magnetics (aeromagnetic surveys)
- Gravity (gravity gradiometry)
- Electrical (induced polarization)
- Electromagnetics (time-domain electromagnetics and magnetotellurics)
- Reflection seismology and seismic refraction





Data collection

Data can be collected in ground surveys or from airborne platforms, mostly fixed wing aircraft and helicopters flying at 60 to 200m elevation but also from satellites up to 1000km above the Earth.



Drones

Drones are becoming increasingly important exploration tools (with landowner permission). Drones carry high-resolution true-colour cameras and laser-scanning sensors and produce high quality photography and digital terrain models. They can also carry lightweight magnetic and hyperspectral sensors.

Target testing

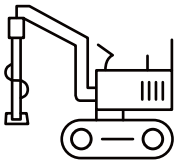
Testing for a mineral deposit generally involves drilling.

Drilling

Drill rigs can be quite compact or very large and mounted on trucks or tracked vehicles. Drilling collects physical data for chemical analysis and to identify the rocks that occur at any given depth below the surface. Continuous technological development means that holes can be drilled deeper and faster, but also in a manner that has significantly reduced the impact on the environment.

Drilling is temporary and takes several days to weeks to complete. Drill core gives rock samples which are logged by a geologist, sorted in core sheds offsite and sent away for laboratory analysis.

New exploration technologies continue to be developed. Drilling will remain a key component of mineral exploration, and a key objective of exploration is to develop even lower environmental and noise impact drilling technology.



Drill rigs

There are a number of techniques for drilling including Conventional Rotary Air Drilling (such as Rotary Air Blast and Air Core) for shallow holes, Percussion Drilling (including Reverse Circulation Drilling) and Diamond Core Drilling for deeper holes.

The drilling method selected depends on the type of information sought, the depth of the target, and the rock type involved. A drill hole is usually less than 200mm wide.

Navarre Minerals

Environmental impact

A key objective of all exploration programs is to minimise the environmental impact, such that little or no sign of exploration activity is evident following completion of the programs. Clearing is kept to a minimum and drilled areas are rehabilited.

Explorers must lodge a bond that is only returned once rehabilitation is complete. All drilling operations carefully manage waste water, reduce noise by operating at times as agreed with landowners and with noise abatement sheds, and protect biodiversity which is strictly monitored.

Drill core is a cylinder-shaped sample of solid rock generated by a diamond drill rig. It is examined by geologists for valuable elements like gold or base metals.

There's more to
Victorian Mining

Ph. (03) 8614 1851
Email. info.vic@minerals.org.au
Website. minerals.org.au/victoria

Diamond drilling exploration site

Floodlights
Floodlights are used for night shifts (when agreed with land owner).

Drill mast
Attached winches raise and lower the drill rods and drilled core.

Water tanks
Drill rigs carry their own water supply to site for use in the drilling process.

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Core recovery area
The drill core is placed into core trays. A protective liner prevents ground contamination.

Laydown area
Safety equipment such as fire extinguisher and also additional drill rods are on hand.

Diamond drill rig
Diamond impregnated bits are used to penetrate and collect a continuous rock sample.