EXPLORATION EXPLAINED

AMEC
ASSOCIATION OF MINING AND EXPLORATION COMPANIES

MINERAL EXPLORATION AND MINING

Mineral exploration and mining are often used interchangeably, despite having separate functions and a distinct purpose. Mineral exploration precedes mining. Without mineral exploration, mines cannot be developed, and mining cannot occur.

Exploration encompasses many different methods. This fact sheet provides an overview of what exploration is and the different methods of exploration.

WHAT IS EXPLORATION?

Mineral exploration is the process in which geologists gather information through a range of scientific methods to assess the economic potential of minerals. The Wheatbelt region is rich with mineral potential, with gold, nickel and iron ore deposits across the region.

"The Wheatbelt has a strong mining sector with an output of $1.8 billion in 2019, contributing 14% of the region's economic output and generating 1,370 jobs."

- Wheatbelt Development Commission Annual Report 2019-2020

The type of exploration activity undertaken depends on a number of factors, including the nature of the mineral being sought and the geology of the area. Exploration generally progresses from early-stage activities to more intense and costly alternatives like drilling. A company will explain to a landholder what activities are happening and when.
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EXPLORATION LICENCE

In order to begin any exploration activity, an explorer must be granted an Exploration Licence by the Department of Mines, Industry Regulation and Safety (DMIRS). DMIRS requires a range of detailed documents to be submitted in support of an application for an exploration licence. An exploration licence is granted for five years, with possible extension periods of two to five years.

Exploration is highly speculative, with estimates that only one in 10,000 areas of interest (prospects) will ever be mined

Exploration licences authorise the holder to explore for minerals on the land. Exploration does not permit mining, nor does it guarantee that mining will ever be approved.

A drill site in the Wheatbelt

EXPLORATION EXPLAINED

COMMON EXPLORATION ACTIVITIES

N Negligible Impact L Low Impact

Field Geological Mapping

Field geological mapping generally involves a geologist observing the location, orientation and characteristics of rocks on the ground's surface. In practice, a geologist walks the area on foot taking notes. This information can be used to prepare a geological map of the area. Geological mapping may lead to further geochemical sampling, such as rock chipping and soil sampling.

N **Rock Chip Sampling**

Typically involves collecting up to a few kilograms of rock material using hand-held tools.

N **Soil Sampling**

Involves the collection of small samples of soils and subsoils using hand-held tools. Holes excavated during the program are typically backfilled and vegetation replaced immediately following sampling.

A geologist undertaking soil sampling

N **Stream Sediment Sampling**

Approximately two-kilogram samples of sediment are collected within drainage lines. At the junction of two creeks three samples are usually taken; one downstream of the junction and two upstream of the junction, to determine the presence of mineralisation further upstream.

Geophysical Surveys

Geophysical surveys help to identify different rock types and can help identify the resources. It is usually undertaken with minimal surface disturbance or from the air. Different geophysical surveys measure various physical properties of the earth and any mineral deposits using a variety of different applications and equipment. Geophysicists use instruments to take scientific readings of the earth's response to certain stimulus.

N **Airborne Surveys**

Airborne geophysical surveys are typically conducted from low-flying helicopters or light aircraft that fly in a grid pattern. If there is a requirement to provide ground support (fuel or a landing site) for these airborne surveys, it is usually done on existing road infrastructure or known disturbed areas.

Airborne geophysical surveys may comprise of magnetic, radiometric, gravity, or electromagnetic surveys. Above is an image of the measurement apparatus which is used

Ground-based Surveys

Ground-based surveys may compromise magnetic, seismic, radiometric, IP, gravity or electromagnetics surveys. The type of survey being undertaken will determine the resourcing required; from a survey consisting of one single geophysicist to a team of geophysicists, walking a survey area or the use of quadbikes, light vehicles, or seismic trucks.

N **Seismic Surveys**

Seismic surveys measure variation in reflected ground vibration as it passes through the earth. Whether a seismic survey uses high-frequency vibrations created by external energy sources including truck-mounted

vibrating weights or devices placed on the ground's surface will depend on the scale of the survey.

Data being collected by a geologist in the field

Drilling

Drilling is often conducted to obtain detailed information about the rock and mineral deposits below the ground surface. There are different drilling methods which will be used, based on the stage of exploration, budgeting, the type of rock material, and the information sought. The associated level of ground disturbance around drilling holes will vary with each drilling method. This is usually the final stage of exploration.

Shallow Drilling

N Or L Auger Drilling -

Uses either a hand-held power auger or one mounted on a small vehicle. It is similar to a post-hole digger used by farmers when fencing.

L Air Drilling -

There are two main shallow air drilling methods, air core and rotary air blast (RAB). These methods usually involve a utility or small truck-mounted rig with an air compressor carried onboard or towed separately. This type of drilling creates rock fragments (chips). These are removed from the drill hole by compressed air, which is forced down the hole and lifts the rock chips to the surface. This type of drilling requires minimal site preparation.

A drill site on in the Wheatbelt area

Deeper Drilling

L Air Drilling -

There are two main types of air drilling used to drill deeper holes – open hole percussion (rotary air blast/ RAB) and reverse circulation (RC). These drilling techniques involve the use of compressed air to drive a slowly rotating percussion drill bit, which operates in a similar manner to a jackhammer. This drilling method is relatively fast, can penetrate hard rock, and is capable of drilling holes in excess of 250 metres deep. These methods do not necessarily require significant site preparation and rehabilitation. They usually involve truck-mounted rigs with one or two support vehicles to carry drill rods and air compressor capacity.

L Diamond Drilling -

Uses a truck-mounted rig with support vehicles to extract a continuous cylinder of rock. Using a rapidly rotating drill bit, rocks are ground or cut to produce a cylindrical stick of rock, known as a 'core' sample. Reaches the greatest depth, generally ranging from 100 metres to several kilometres. Diamond drill rigs can range in size from compact, such as helicopter transported or underground drill rigs, to large drill rigs mounted on trucks or tracked vehicles. Each drill hole may take several days to complete, with some sites opting to run drilling operations for 24-hour shifts. Portable shelters, storage containers and lighting plants may be required due to the possible long duration and scale of drilling programs, especially in the case of larger diameter deep holes.

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Diamond drilling is the most expensive type of mineral exploration drilling, with costs incurred from site preparation requirements, possible water contaminants, and rehabilitation requirements.

Sampling in progress

L Rotary Mud Drilling -

Most often used for deep drilling through the layers of the Earth or stratigraphy. This method produces fine rock fragments and uses water and drilling fluids to lubricate the drill bit and return the rock fragments to the surface. The drilling rigs are usually larger than for other methods and require more support vehicles and site preparation. Depending on the depth of the drill hole, each hole can take several weeks or months to complete, with shifts often undertaken 24 hours a day where practical.

FURTHER INFORMATION

Department of Mines, Industry Regulation and Safety (DMIRS)
www.dmirs.wa.gov.au

Commonwealth Scientific and Industrial Research Organisation (CSIRO)
www.csiro.au/en

Geological Survey of Western Australia (GSWA)
www.dmp.wa.gov.au/Geological-Survey/Mineral-exploration-1398.aspx

Geoscience Australia
www.ga.gov.au

The Association of Mining and Exploration Companies (AMEC)
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WANT TO SPEAK TO AN EXPERT?

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Images Courtesy of Chalice Mining Limited and Caspin Resources Limited.