

## MINERAL SANDS EXPLORATION IN VICTORIA

Mineral sands are critical components in some of the most frequently used household products such as sunscreen, inks and paints and tiles, as well as medical devices, welding materials and purification systems.

Mineral sands are also increasingly used in energy transition infrastructure. This is a key driver for increasing interest in the exploration and development of mineral sands in Victoria.

### What are mineral sands?

Mineral sand deposits contain a concentrated amount of economically important minerals known as 'heavy minerals', which are much heavier than common sand minerals such as quartz.

Mineral sands deposits typically comprise the following minerals of economic interest:

- zircon
- rutile
- leucoxene
- ilmenite
- monazite
- xenotime.

Zircon is rich in the element zirconium. Rutile, leucoxene and ilmenite contain titanium. Monazite and xenotime contain rare earth elements. Other minerals such as magnetite and garnet may also be present including praseodymium and neodymium used in permanent batteries.

### Victoria's mineral sands deposits

Victoria's mineral sands deposits occur a long way from the modern coastline. Their locations reflect the presence of former inland seas and associated coastal processes that occurred tens of millions of years ago.

The potential for mineral sands was first recognised in the Murray Basin of northwest Victoria by the Geological Survey of Victoria in 1969.

Heavy mineral sands deposits occur in the Murray and Gippsland Basins in northwest and southeast Victoria.

The Murray Basin extends from Victoria into South Australia and New South Wales where mineral sands deposits have also been identified.

Two types of mineral sands deposits are recognised in the Murray Basin. These deposits are characterised as either strandline deposits or Wimmera-style (WIM) deposits, depending on the type of rock that hosts them.

### What are mineral sands used for?

Demand for Rare Earth Elements (REE) is growing significantly. REE found in monazites are key inputs to permanent magnets utilised in energy transition infrastructure. As an example, one wind turbine can use up to 2 tonnes of REE permanent magnets.<sup>1</sup>

Mineral sands are used for many purposes and can be found in a range of everyday household products.

Titanium minerals – which include ilmenite, leucoxene and rutile – are used as the feedstock to produce pigments for colourants in paints, paper and plastics. Titanium is also used in sunscreen and in joint replacement, such as knee and hip replacements.

Small amounts are also used in titanium metals and in welding materials.

Zircon is used in ceramic tiles and in metal casting, as well as in air and water purification systems.

# Mineral sands formation

## How are mineral sands deposits formed?

River systems transport sediment, including minerals created during erosion, to the coast where it may be deposited in a number of different coastal environments.

Beach sands contain the most important accumulations of heavy minerals. Waves deposit sand on beaches where heavier minerals are concentrated, while backwash carries lighter minerals such as quartz back into the sea.

Onshore winds that blow lighter grains inland can also concentrate heavier minerals at the front of coastal dunes. Old (former) shorelines, known as strandlines, which may occur some distance inland, can also be a source of heavier mineral sands.

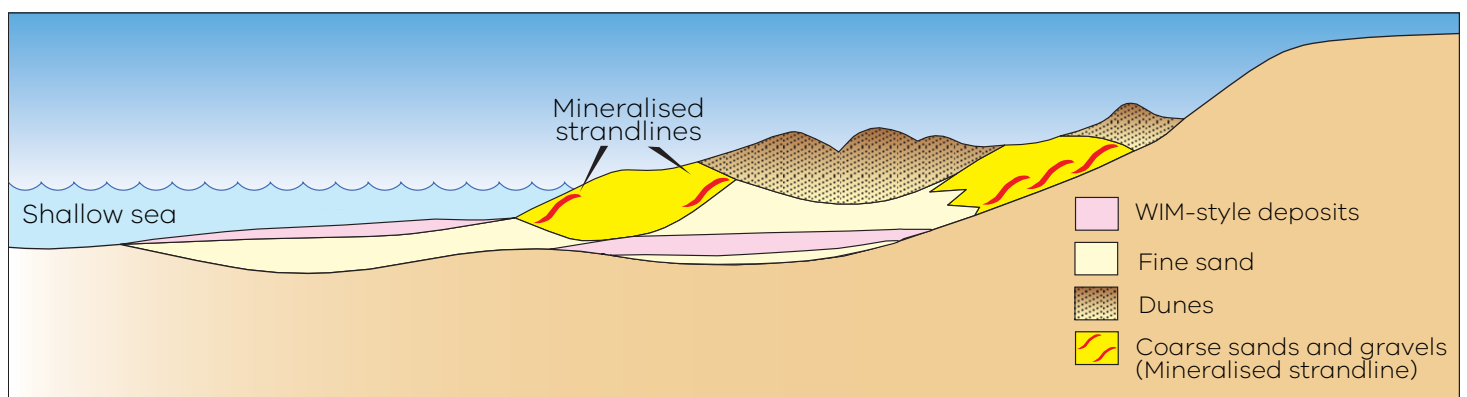
**Strandline deposits** have a linear geometry (up to 10 m thick, more than 2 km long and 300 m wide) and are characterised by relatively low tonnages and high grades (5%-20% mineral sand content) with coarse-grained (>100 micrometre) mineral sand assemblages.

In contrast, WIM-style deposits are sheet-like and up to 10 m thick, 10 km long and 3 km wide and are relatively high tonnage and low grade (2%-5% mineral sand content) with a fine-grained (<100 micrometre) mineral sand assemblage.

The strandline deposits of the Murray Basin in west and northwest Victoria are orientated northwest-southeast, which represents the general orientation of the former shoreline that advanced from current day South Australia and then retreated.

The top of the Murray Basin is the current flat landscape surface observed today.

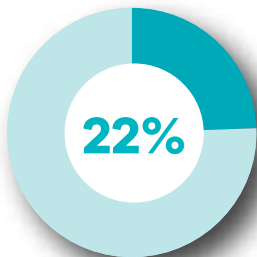
The youngest strandlines remain active in The Coorong in South Australia.



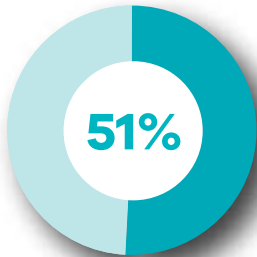
Idealised relationships between 'WIM' and 'strand-style' mineral sands deposits. *From Base Minerals Ltd.*

# Mineral sands mining

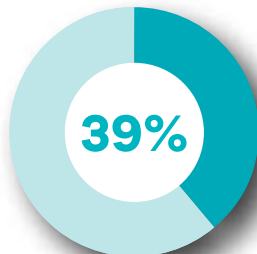
## Victoria's share of Australia's mineral sands



**Ilmenite**



**Rutile**



**Zircon**

Source: *Geoscience Australia & Minerals Council of Australia*<sup>1</sup>

## How are mineral sands mined?

Mineral sands deposits can be excavated using wet or dry mining techniques.

Wet mining involves dredging the mineral sands from under the surface of a pond created for extraction purposes.

Dry mining uses traditional earth moving equipment such as scrapers, trucks, excavators and front-end loaders to excavate the mineral sands deposit.

In both methods, after the deposit has been mined, the overburden material which comprises topsoil, subsoil and clay, is removed from the sand containing the minerals which is then processed to separate the high-value heavy minerals sands.

Once the sand deposit has been extracted the overburden material is replaced (generally within 12 months) and the land rehabilitated to be suitable for non-mining uses.



## FURTHER INFORMATION

For information visit:

[earthresources.vic.gov.au](http://earthresources.vic.gov.au)

Email: [gsv\\_info@ecodev.vic.gov.au](mailto:gsv_info@ecodev.vic.gov.au)

Phone: 1300 366 356 .

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