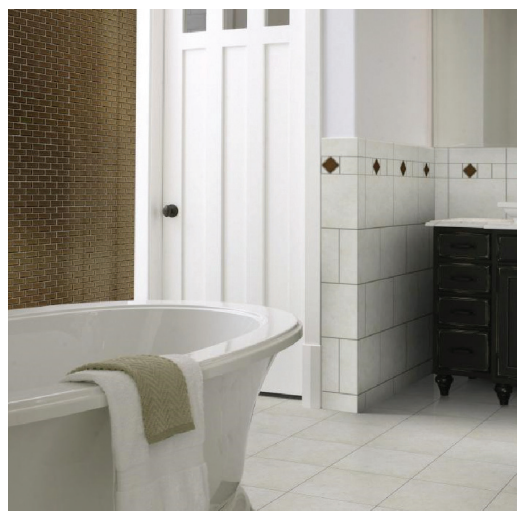


# MINERAL SANDS

## MINING AND MINERAL USES

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Factsheet





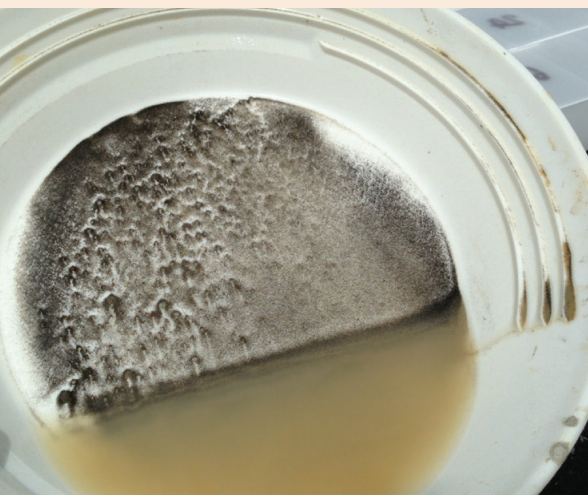
## HEAVY MINERAL SANDS

Heavy Mineral Sands are naturally occurring sands that contain minerals with a higher density than water and normal quartz sand.

These heavy minerals can be concentrated by marine processes, to form concentrations within beach and dunal environments.

Valuable Heavy Minerals include:

- Zircon (used for Ceramics)
- Ilmenite (paint pigment)
- Rutile and Leucoxene (welding rods and plane parts)
- Monazite and Xenotime (magnets)



## WHAT ARE HEAVY MINERAL SANDS?

Heavy Mineral Sands (HMS) are naturally occurring sands that contain concentrations of minerals with specific gravity of  $>2.85 \text{ g/cm}^3$ . Heavy Minerals include:

- Zircon
- Ilmenite
- Rutile
- Monazite and Xenotime

Heavy Minerals are then concentrated by marine processes to form concentrations within beach and sand dune environments. The HMS accumulates via a mechanical wet gravity sorting action, which occurs due to the HMS being more than twice the density of water and significantly heavier than normal quartz sand grains.

## WHERE ARE HEAVY MINERALS FOUND?

Heavy Minerals can be found in low concentrations, at most beaches and dunes we see today. Marine processes take advantage of the heavier nature of the heavy minerals — whereby waves and longshore drift carry and preferentially concentrate the heavier minerals on the shore face, or near the shoreline.

Heavy mineral deposits are found in ancient (now buried) beaches across the world. There are several of these beach-related deposits in the Wimmera region including Ouyen, Mildura and at Doon (WIM's Avonbank Project).



*Heavy Mineral Accumulating at a modern-day beach*

# MINERAL SAND MINING AND PROCESSING

## FOOTPRINT AND REHABILITATION

Mineral Sands mining typically involves a small area of disturbance at any one time, which is then progressively rehabilitated, using a moving-hole concept. Typically the mine path is rehabilitated back to its original state within around 4 years.

## MINING AND PROCESSING—MAIN STAGES

- The overburden is removed and stockpiled to ensure the integrity of the topsoil subsoil is maintained.
- HMS mining is typically completed using dozers and trucks to excavate the ore, whereby the ore is pumped to a processing plant—where spirals separate the lighter quartz from the Heavy Minerals, using wet gravity separation.
- The Heavy Mineral Concentrate is then stockpiled in a secure pad, before loading and transport to port.
- The barren sands and clay fraction are then returned to the pit, where after a period of settling, the overburden and upper soil units are restored. The topsoil is then replaced and any pre-existing vegetation is re-generated. This aims to re-instate the areas to a pre-mined state.



Ore mining



Gravity mineral separation using water



Progressive rehabilitation

## LOW IMPACT, LOW FOOTPRINT

- Low impact, small footprint mining model
- Continuous rehabilitation
- Well known, proven mining method to Victoria and Wimmera
- No environmental issues from processing
- Primary separation using water and spiral
- HMC transported to Port for export



# ZIRCON END-USE

## CERAMICS

Zircon is used as an opacifier in glazes and frits to enhance resistance of the finished product and as whitener in porcelain tiles.

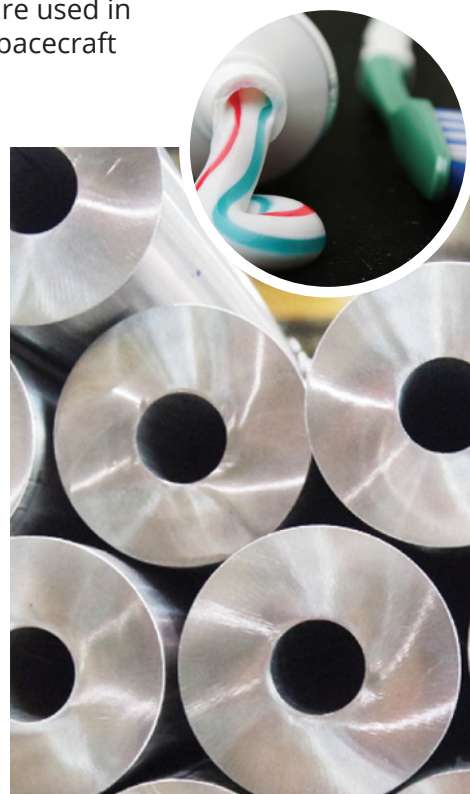


## CRITICAL FOR EVERYDAY LIVING

- Ceramics
- Dentistry
- iPhones
- Fuel Cells
- Pumps and Valves
- Pistons
- Optic Fibre Plugs
- Tooth-Paste

## ELECTRONICS, ENGINES AND SPACE CRAFT

Because zircon products are resistant to corrosion and heat, they are used in engines, electronics and spacecraft industry.



## ILMENITE END-USE

### PIGMENT

Titanium dioxide ( $\text{TiO}_2$ ) is the most important white pigment used in the coatings industry and even as a whitener for sunscreen. It is widely used because it efficiently scatters visible light, thereby imparting whiteness, brightness and opacity when incorporated into a coating.



## RUTILE AND LEUCOXENE END-USE

### PIGMENT

The heavy minerals Rutile and Leucoxene (Hi-Ti) are commonly used as high-grade input to produce final  $\text{TiO}_2$  pigment.

### WELDING RODS

Hi-Ti minerals are also used to manufacture welding rod electrodes—where about 35% of the rod coating is  $\text{TiO}_2$  which enables arc ignition. This enables welding with a soft arc and reduces spatter.

### TITANIUM ALLOYS

Hi-Ti is also used for the production of a wide range of Titanium alloys—for example Rutile is used as input into aerospace parts—due to its high strength to weight ratio and high temperature and corrosion resistance properties.



## TITANIA — WE USE IT EVERY DAY

- Sunscreen
- Paint
- White paper
- Welding rod electrodes
- Aeroplane parts
- Engines
- Knee replacements



## RARE EARTHS ARE CRITICAL TO EVERYDAY LIVING

- Medical Hardware (X-Rays)
- Battery Storage - hybrid cars
- Wind Powered Turbines
- UV filters in glass
- Mobile phones, speakers and headphones
- Camera and Telescope lenses

## RARE EARTH — END USES

Rare earths are a set of 17 chemical elements in the periodic table, more specifically, the 15 lanthanides, plus scandium and yttrium, which share similar chemical properties.

Rare earth minerals at Avonbank Project are Xenotime and Monazite.

Rare Earth minerals are critical for everyday living—they are used for a diverse range of end-uses:

- LCD TV's
- Medical Hardware
- Battery Storage
- UV filters in glass
- Wind Powered Turbines

### NEODYMIUM— HIGH POWERED MAGNETS

Neodymium's most important use is in high power magnets, which are found in hybrid vehicle motors, wind turbines, low voltage electric motors, but also mobile phones, microphones, speakers, and headphones.

### YTTRIUM—TV SCREENS AND LED LIGHTS

Yttrium is critical for television screens and monitors, as well as in fluorescent lights to produce brilliant white light.

### LANTHANUM—BATTERIES

Lanthanum is used for rechargeable batteries in hybrid cars, fluid catalytic cracking catalysts (FCC) used to produce gasoline efficiently, as a glass additive for camera and telescope lenses, and in lasers and x-ray films to reduce the amount of radiation exposure for patients.



*Wind turbines*



## ABOUT WIM RESOURCE

WIM Resource Pty Ltd (WIM) is a privately owned Australian heavy mineral sands (HMS) resource development company, with one of the largest portfolios of HMS projects in the world. WIM's vision is to become a long term producer of zircon, titanium and rare earth minerals that are critical to everyday living.

## AVONBANK PROJECT

The Avonbank Project, located 15km north of Horsham will produce a premium quality mineral sands product comprising mainly zircon, titanium-rich mineral concentrate and minor amounts of rare earth products.

The Avonbank Project has the potential to become a major economic contributor to the town of Horsham, the region and the State of Victoria.

Should the project proceed—the project could have a mine life of over 30 years—reflecting extensive economic and employment opportunities. The project has the potential to attract significant investment to Doon and Horsham.





*Completed rehabilitation in foreground*



# **WIM RESOURCE**

**Think Ahead, Move Ahead**

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