



# World leader in fine iron ore beneficiation



# The world's leading producers rely on us to deliver fine iron ore beneficiation solutions

With over 80 years' proven experience, we bring unrivalled expertise and the latest technologies to help our customers beneficiate their fine iron ore into saleable products.

#### Our first step is understanding your project vision

Success is achieved through skilled, passionate people working together in pursuit of a shared vision and goals.

The very first step we take in working with our customers is to **listen and understand what success for the project looks like.** 

We then go out of our way to work collaboratively with our customer teams, based on our shared understanding of the project goals and timeframes.

Working from this understanding we deliver a comprehensive range of testing, plant design, equipment and services to achieve our customers' vision across all stages of the project lifecycle.

#### **Experience delivers results**

From our beginnings in the 1940s separating fine minerals in Australia we have expanded to become the world leader in fine iron ore beneficiation. Today, we are recognised by customers worldwide as the 'go to' partner for fine iron ore beneficiation solutions across the project lifecycle.

Customers call us when they need fast, cost effective beneficiation solutions to **lower costs, convert** tailings into revenue or design beneficiation plants.

Importantly, we also support NI 43-101 requirements as qualified experts for the processing section of technical reports.

Worldwide, our involvement and participation in projects provides customers with confidence in a successful outcome.

Zero Harm is embedded in our culture and is fundamental to our future success. We are committed to achieving our goal of Zero Harm across all regions in which we operate.









No one knows fine iron ore beneficiation like we do. From Canada's Labrador Trough region to India, Brazil, Africa and Australia's iron rich Pilbara, our expert teams deliver unrivaled expertise in fine iron ore beneficiation across the project lifecycle.

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Magnetic beneficiation of fine iron ore, Brazil

# Optimising metallurgical recovery and grade for fine iron ore

Helping to deliver your project vision, we provide core services from early analysis through to complete metallurgically balanced flowsheets suitable for process engineering and detailed plant design.

Iron ore beneficiation tailings plant design, Australia





#### No two ore bodies are the same

Our multi-disciplined engineering teams draw from proven global experience in fine iron ore beneficiation to deliver prefeasibility and feasibility studies that inform detailed design for new plants and upgrades to existing plants for fine iron ore beneficiation worldwide.

#### More than just a laboratory

Our process engineers begin with exploring and interrogating fine iron ore beneficiation solutions utilising testwork programs specifically designed to maximise the extraction of magnetite, hematite and goethite.

Drawing on 80 years' experience our process engineers develop flowsheets that extract ore of varying grades into saleable products.

We test samples as small as 100 grams for characterisation through to larger samples up to 2,000 kilograms. Our testing uses state-of-the-art beneficiation equipment for crushing, grinding, classification, and gravity separation as well as high and low intensity magnetic separation for wet and dry applications for fine iron ore.

Our laboratory has the capability to create multi-stage pilot scale circuits to treat bulk samples (80-100 tonnes) for process testing and circuit optimisation.

We deliver metallurgical testwork for iron ore samples from major mining regions worldwide including Canada, Brazil, Africa, Russia, Iran, India, Turkey and Australia.

#### **Concept and feasibility**

From our testwork we deliver concept, prefeasibility and feasibility studies as well as cost effective flowsheets to safely and efficiently extract the iron ore. Where the ore is different and challenging, we bring innovative capabilities to design new and unique solutions that augment and lift the potential of conventional flowsheets to extract the iron ore.

By way of example, we delivered extensive testwork and feasibility studies for Arrium's Iron Baron and Iron Duke projects in Australia.

The challenge for these projects was managing the high variability of the lowgrade and mine waste stockpiles. Mineral Technologies' know-how and experience in metallurgical testwork studies was a key part of the solution, uncovering a number of beneficiation options. The outcome was the delivery of robust tailings plants that delivered cost effective fine iron ore beneficiation for the highly variable low-grade ore.

#### **Innovative plant design**

Extending beyond traditional spiral plants our designs for fine iron ore beneficiation incorporate gravity and magnetic beneficiation equipment with capacities ranging from 5 to 7,000 tonnes per hour.

Plants include integrated feed preparation, stockpile management and bulk materials handling systems which we also deliver to direct ship ore (DSO) operations.

### Project execution and equipment selection

Our teams work onsite with customers throughout the installation and commissioning stages to ensure benefication targets are met.

We then continue to work with customers through project lifecycles to deliver ongoing support and beneficiation expertise to ensure ongoing project goals are achieved.

## **Industry leading technology**

Customers value our ongoing commitment to researching and developing new, innovative equipment designs that extract maximum value from fine iron ore.

### Equipment development and selection

When purchasing new equipment, we understand that our customers need to ensure the equipment fits within tight capital expenditure budgets and maximises grades and recovery while delivering low operational costs.

Mineral Technologies' equipment is designed and manufactured using the latest technologies and is fully tested in processing operations to ensure optimal performance. When we release new process equipment you can be assured that it will be fit-for-purpose and cost effective.

Mineral Technologies has recently completed delivery of the Bloom Lake Phase 1 Concentrator Redevelopment project in Quebec, Canada, utilising WW6 spirals, upcurrent classifiers and magnetic separators to provide vastly improved iron recovery.

Previously, we developed the HC33 spiral for use in ArcelorMittal's iron ore projects in Canada, Brazil and Africa. These operations utilise our HC33 and WW6 spirals in multi-stage circuits with the HC33 spirals installed in a rougher duty and the WW6 spirals in cleaner and recleaner duties.

More recently, we developed the WW7 spiral, which improves on the WW6 through a redesigned wash-water system. In addition, the MG12 spiral has also shown promise in upgrading certain types of feed and is being used in several operating plants. The latest range of equipment for the beneficiation of iron ore includes:

- HC33 High Capacity Spiral Separator
- WW6 & WW7 Spiral Separator series
- FM1 (Fine Mineral) Spiral Separator
- MG12 and HG11 Wash Waterless Spiral Separators
- Reading Wet High Intensity Magnetic Separator (WHIMS) and Low to Medium Intensity Magnetic Separators (LIMS & MIMS)
- Carrara High Tension Roll (HTR) Separator
- Innovative surge bin technology Lyons Feed Control Unit (LFCU).

Customers using our WHIMS equipment value the reliability and separation efficiency. For electrostatic separation, the recently released HTR400 incorporates robust composite electrodes, and delivers high throughput with low operating costs .

Our innovative surge bin technology, Lyons Feed Control Unit (LFCU), is being deployed into iron ore with the first installation in Western Australia. At 24 metres in diameter these LFCU's are the largest ever constructed.

#### Benefits of Mineral Technologies' equipment

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- High mineral recoveries over a wide particle size range
- Highly selective operation improving product grade
- Compact and low weight construction reduces installation costs
- Low equipment maintenance requirements for greater plant availability
- Spiral equipment is operator friendly, no need for skilled labour
- No reagents are used in the circuits; this delivers environmentally friendly processes reducing operating costs and lowering potential for environmental incidents
- Robust and proven designs incorporating innovation when applicable
- Energy efficient magnetic elements for reduced operating expenses.

#### **Completed projects**

- Mont Wright, ArcelorMittal, Canada
- Bloom Lake, Quebec Iron Ore, Canada
- Mount Tokadeh, ArcelorMittal, Liberia
- Iron Duke and Iron Baron, Arrium, Australia
- Bhushan Power and Steel, India
- Roy Hill Iron Ore, Australia
- Christmas Creek, FMG, Australia.

Fine iron ore beneficiation, Canada

YOUR IRON ORE BENEFICIATION SOLUTIONS | 7

# Relationships creating success

Our experience in delivering fine iron ore solutions ensures that we understand what's important for our customers' project success.

Fine iron ore benefication tailings plant, Australia

We work hard to create and sustain valued relationships that enable our teams to fully understand, predict and deliver solutions that turn possibilities into reality for our customers.

#### ArcelorMittal, Canada

Engaged by ArcelorMittal, the world's leading steel and mining company, we designed and delivered new equipment to replace the 30-year old GEC spiral assemblies at the Mont Wright iron ore mine in Canada.

#### In 2011, we delivered 5,760 spiral starts and in 2012 we delivered an additional 2,688 iron ore spiral starts to the mine. These represented the largest delivery of iron ore spirals to any one mine site.

To meet Mont Wright's specific beneficiation requirements, we embarked on an extensive research program which identified engineering innovations to our HC33 and WW6E spirals, as well as new manufacturing and assembly processes at our production facility in Australia which ensured delivery of the large volume of spirals in tight timeframes.

One of the key engineering innovations was the development of rubber alternatives to standard polyurethane (PU) parts to meet ArcelorMittal's objectives of extended spiral longevity and durability.

Mineral Technologies also delivered a commercial extended warranty to back our confidence in the product delivered.

#### Arrium<sup>\*</sup>, Australia

Reflecting the emerging trend to beneficiate low-grade tailings stockpiles to produce high-grade ore, we introduced the latest technologies and clever design to deliver costeffective beneficiation process plants for the Iron Baron and Iron Duke projects in South Australia.

The challenge for these projects was managing the high variability

of the low-grade tailings stockpiles. Our know-how and experience in metallurgical testwork helped us to uncover a number of beneficiation options including process designs which achieved cost-effective solutions using the latest HC33 gravity separation spiral technology, coupled with coarse and fine jig technology.

Arrium engaged our expertise for the Iron Baron project from concept through design and execution.

Awarded the Engineering, Procurement and Construction (EPC) contract in 2010, Mineral Technologies worked with Downer to deliver the construction phase. Based on our extensive testwork, the total solution also included a process guarantee which significantly reduced project risk for Arrium.

The project was delivered as an open book Target Cost Estimate (TCE) contract giving transparent value and confidence to Arrium. The plant passed performance testing 46 days from first ore.

#### The Iron Baron plant beneficates highly variable low-grade ore from a nominal 50% Fe to an Fe content of 64%. At full feed capacity the plant is capable of 2.2 million tonnes per annum (MTPA) feed capacity.

Due to the success of the Iron Baron project, we were engaged to deliver a complete solution including testwork, design, delivery and commissioning for the new Iron Duke spiral processing plant which was successfully delivered in 2013.

This spiral upgrade delivered 15% more iron recovery with an on- site modular build of two weeks and 48-hour tie-in; delivering more profit with minimal interference.

#### **Quebec Iron Ore, Canada**

Bloom Lake is one of Canada's long-life iron ore mines and a major supplier of high quality iron ore to global markets.

Mineral Technologies was awarded the CAD\$40 million circuit upgrade project in 2016. The operational focus was to optimise the separation circuit to recover high grade 66% Fe iron concentrate.

Initially engaged at Bloom Lake in 2011 through delivery of over 1,400 spirals, Mineral Technologies utilised working knowledge of the mine and expertise in iron ore beneficiation to design the new circuit.

Samples were tested at Mineral Technologies' Australian metallurgical testing facility. This work informed the flowsheet development, which highlighted the benefits of incorporating magnetic separation and UCC equipment to enhance recovery.

To ensure maximum value for Quebec Iron Ore (QIO), Mineral Technologies deployed core expertise on site and collaborated with local suppliers to ensure cost effective delivery of the construction stage. The first shipment was achieved on schedule in February 2018 with the first train load of high grade 66% Fe iron.

During the project Mineral Technologies was pleased to have the opportunity to work with Quebec Iron Ore to donate a new spiral test rig to the local Technical College Laboratory at Cégep de Sept-Îles. The test rig gives students the opportunity to gain practical experience as part of their mineral processing studies.

\* Arrium is now owned by Simec Mining.

## Iron ore processing

We are the go-to partner for fine iron ore beneficiation solutions across the project lifecycle. Our expert teams are based in major iron ore regions worldwide. Talk to us today about how we can bring our proven fine iron ore beneficiation solutions to help your projects succeed.



Metallurgical testing and process design We know that no two ore bodies are the same so a 'one size fits all' solution never works. Our multi-disciplined engineering team draws from proven global experience in fine iron ore beneficiation to deliver prefeasibility and feasibility studies that inform detailed design for new plants and upgrades to existing plants for fine iron ore beneficiation worldwide.

Project exe equipmen

More than just a laboratory, our process engineers explore and interrogate beneficiation solutions utilising testwork programs specifically designed to extract fine ore from magnetite, hematite and goethite. Drawing on 80 years' experience our process engineers develop flowsheets that extract ore of varying grades into saleable product.

Engineering design and studies



2 ecution and t selection With over 80 years' experience we confidently deliver our process solutions and plant designs to customers worldwide. We carefully guide customers through each stage of the process - from delivery to initial set-up and commissioning.

Ongoing support is a key part of our commitment to ensuring project success. This includes site visits and monitoring tools to maximise process performance.



Our engineering team of over 150 people across multiple offices develops plant designs incorporating the latest technologies for fine iron ore beneficiation and work onsite with customers throughout the installation and commissioning stages.

#### Ongoing plant optimisation to meet project objectives



Our end-to-end fine iron ore beneficiation solutions help customers achieve project goals efficiently and profitably. Talk to us today about how we can bring our proven fine iron ore beneficiation solutions to help your projects succeed.



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