

# Ores ain't ores

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**IN iron ore, much of the low-hanging fruit of direct shipping ore projects has already been plucked but there is plenty of scope for beneficiating lower grade deposits. Kate Haycock spoke to Damian Connelly from Mineral Engineering Technical Services.**

The high grade deposits that have been the backbone of the iron ore industry are a finite resource, even in the massive fields of the Pilbara.



The “cream” of the Pilbara projects, such as Tom Price, Mount Whaleback and Mount Newman, are relatively rare deposits in global terms, but the Pilbara and the Mid West regions of Western Australia are host to billions of tonnes of not quite so high grade iron ore.

METS principal Damian Connelly told *MiningNews.net* the quality of the ore is a key issue, but much of the lower-grade iron ore in the Pilbara and the Mid West region can be successfully beneficiated, especially with the current historically high iron ore prices.

“Quality will be an issue for smaller companies,” he said.

“BHP and Rio did pick the eyes out of the Pilbara – they left all the other stuff and said it was too hard ... but I think juniors can make it.”

Connelly said Fortescue Metals Group proved that a Pilbara-based company could create a market for a different type of ore that required additional beneficiation.

In other parts of the world, magnetite iron ore is mined at grades as low as 18% and Connelly said the industry in Australia had been “spoilt” with such high grade direct shipping ores.

“In the longer term, we will have to exploit the lower grade resources. Australia is blessed with iron ore resources, as is Brazil, but I think globally and maybe for long term sustainability we will have to treat those lower grade resources through blending and beneficiation,” he added.

Connelly said the majors such as Rio Tinto and BHP Billiton also used techniques to get the right balance of contaminants and grade in their ores, including beneficiation, even if it was just to separate shale from the iron ore.

Rio Tinto, for example, blended its ores to control levels of contaminants.

However, Connelly said there were some sorts of ore which were simply not saleable.

“Some of these other deposits are a different matter ... some ores, you can’t beneficiate,” he said.

“You have to do the test work – and even if you have direct shipping ore, the lump-fines ratio is very important.”

METS is involved at the initial stage of any iron ore development, focusing on processing and how its clients can make a marketable product. This work needs to come early in the process.

The group has done work on some projects, mainly overseas, where the ore was simply unsuitable for commercial use.

“We can use things like Qemscan or mineralogy to look at what minerals are there and if they can be liberated. But the fatal flaw is high phosphorous,” Connelly said.

“The phosphorous ends up in the steel and has to be burnt out or it causes the steel to be more brittle ... it produces more slag and it is more costly for the steel mills.

“The phosphorous is in the mineral lattice, so you can’t scrub it out, you can’t leach it, you can’t get rid of it easily.”

High silica and alumina levels, while not as serious, also produce more slag and require more coke in a steel mill’s furnace to get more heat.

“If you’ve got a really difficult ore and you’re a junior, you should move on. If it is complex and difficult, juniors can’t really do those,” Connelly said.

In the Pilbara the water table can also pose an issue especially as iron ore mines become deeper, with chlorides from the salty groundwater also an extra that steel mills don’t want with their iron ore.

Nevertheless, Connelly said most beneficiation techniques for iron ore were generally low cost, “until you start getting into grinding”, but the cost-benefit ratio had to be considered carefully.

In the Pilbara, iron ore can be beneficiated using heavy medium drum separators, cyclones and wet high intensity magnetic separation (WHIMS), which can upgrade iron levels from around 59% to 65%.

Magnetite iron ore, of the sort being mined by CITIC Pacific at its Sino Iron project at Cape Preston in the Pilbara, requires a different process entirely that includes cobbing or coarse magnetic separation before fine grinding and then more magnetic concentration. This means more processing and more cost.

Despite this, magnetite can make money – the product is more costly for iron ore producers to make, but the concentrate can produce high quality pellets or sinter for blast furnaces, which fetches a higher price.

“If you look at the hematite ores, the Brockmans and the Tom Prices, it was pretty dumb ...

once you start getting into beneficiating low grade ores or processing magnetite it starts to get a lot more interesting,” Connelly added.

New technologies in beneficiating are making it easier as well. These include much stronger magnets which can produce up to 25,000 gauss (a measure of magnetism).

“The technology in jigs has improved in capacity and efficiency,” Connelly said.

“Even in crushing, you have some of the biggest crushers in the world up at FMG’s Cloudbreak at 800,000 kilowatts, and now companies are looking at 1 megawatt crushers – they are just getting larger and more efficient with better economies of scale.”