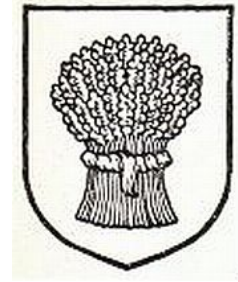


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HALLGARTEN + COMPANY

Mining Sub-Sector Review

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Shifting Sands: State of Play in Heavy Mineral Sands

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Shifting Sands

State of Play in Heavy Mineral Sands

- + HMS are a key source of more than just the Titanium products widely associated with them, as key strategic minerals like Zircon/Hafmium and Rare Earth elements are also (sometimes) in the mix
- + The return to respectability (and doability) of monazite sands as a source of Rare Earths is a trend gaining momentum
- + The very stability and unsexiness of the Heavy Minerals Sands (HMS) space mitigates against the participation of those investors that want to play fast and loose in the mining markets but it makes for a duller, more placid pace
- + The pace of corporate actions, particularly M&A and strategic investment positioning would suggest a more dynamic space rather than a sleepy backwater
- + There is talk of Russia restricting exports of Titanium (presumably sponge) to the West in a tit-for-tat action in response to Western sanctions
- ✗ The Heavy Mineral Sands space has a Greek chorus of doomsayers, particularly in Australian markets
- ✗ The rising tide of resource nationalism does not seem to have impinged upon HMS as yet, mainly as Titanium is not perceived to have potential shortages
- ✗ Ilmenite prices have weakened since mid-2022 as has Premium Zircon, to a lesser extent

The Riddle of the Sands

In Heavy Mineral Sands (HMS) the minerals rather than the constituent elements are the product being exploited. For those with an elementary grasp, it conjures up Titanium, but for the more nuanced, it also means Zircon and Hafmium and increasingly the suite of Rare Earths (REEs). Hafmium is most definitely a critical (and strategic) mineral without making reference to lists conjured up by bureaucrats. Its roles and uses are far beyond the humdrum.

Meanwhile, REEs were traditionally sourced from monazite sands, this source passed, largely in the history books from mid-last century and is now making a comeback, with a vengeance. That is upsetting the business plans of a lot of REE wannabes who had not calculated on this source of Rare Earths making such a strong comeback, compromising the economics of plain vanilla REE projects while enhancing the economics of HMS projects where the monazite component was long seen as a throwaway at worst or to be stockpiled at best.

In this overview of the HMS space, we look at some of the changing dynamics, the pricing, M&A, the role

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of China and other key factors. We also include a case study on Sheffield Resources, which has been doing almost everything right and yet still suffers to an extent from Cassandras in the investment community.

Heavy Mineral Sands – Origins & Occurrence

Heavy mineral sands are a class of ore deposit that is an important source of Zirconium, Titanium, Thorium, Tungsten, Rare-Earth elements as well as the industrial minerals diamond, sapphire, garnet, and occasionally precious metals or gemstones.

The main minerals that are exploited/sought are ilmenite and zircon.

Heavy mineral sands are placer deposits formed by wind and water, most usually in beach environments by concentration due to the specific gravity of the mineral grains. Hard rock is eroded by rivers and wind, or if near the coast, also by waves, tides, and coastal currents. The sediments derived from these rocks are transported, deposited, and then reworked by the same processes. This reworking causes them to become sorted by density, size, and shape. This sorting can concentrate denser and heavier mineral grains such as ilmenite, leucosene, and rutile (containing Titanium), monazite and xenotime (containing REEs), and zircon (containing zirconium), creating economic deposits.

Unsurprisingly mineral sands have their highest exploitable concentrations along coastlines (and former coastlines). The coasts of the Indian Ocean, and to a lesser extent the Atlantic Ocean, have been where most deposits of size have been exploited.

Heavy mineral deposits have several attractive advantages over other types of mineral deposits:

- Extraction is relatively simple, requiring only physical methods to separate out heavy minerals such as density, magnetic and electrical methods, rather than chemical methods that can introduce toxicity
- Remediation is also relatively simple because restoration methods are also physical

Applications

Critical minerals from heavy mineral sands are important for a variety of uses. The primary commodities are Titanium, Zirconium, and Rare Earth elements.

Titanium

Heavy mineral sands have long been seen as the prime source of Titanium which can also be sourced from hard rock deposits, but these typically have a higher mining/extraction cost.

Pigments are by far the largest application for Titanium (~90% of global demand), with titanium metal and welding rod each representing about 5% of global demand.

For pigment applications titanium dioxide (TiO₂) is extracted from minerals including ilmenite and rutile to produce titanium dioxide pigment which is used as an opacifier in paint, paper, inks and plastics. It has

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been estimated that Titanium dioxide is used in two-thirds of all pigments, and it is the most widely used white pigment because of its brightness and very high refractive index, in which it is surpassed only by a few other materials.

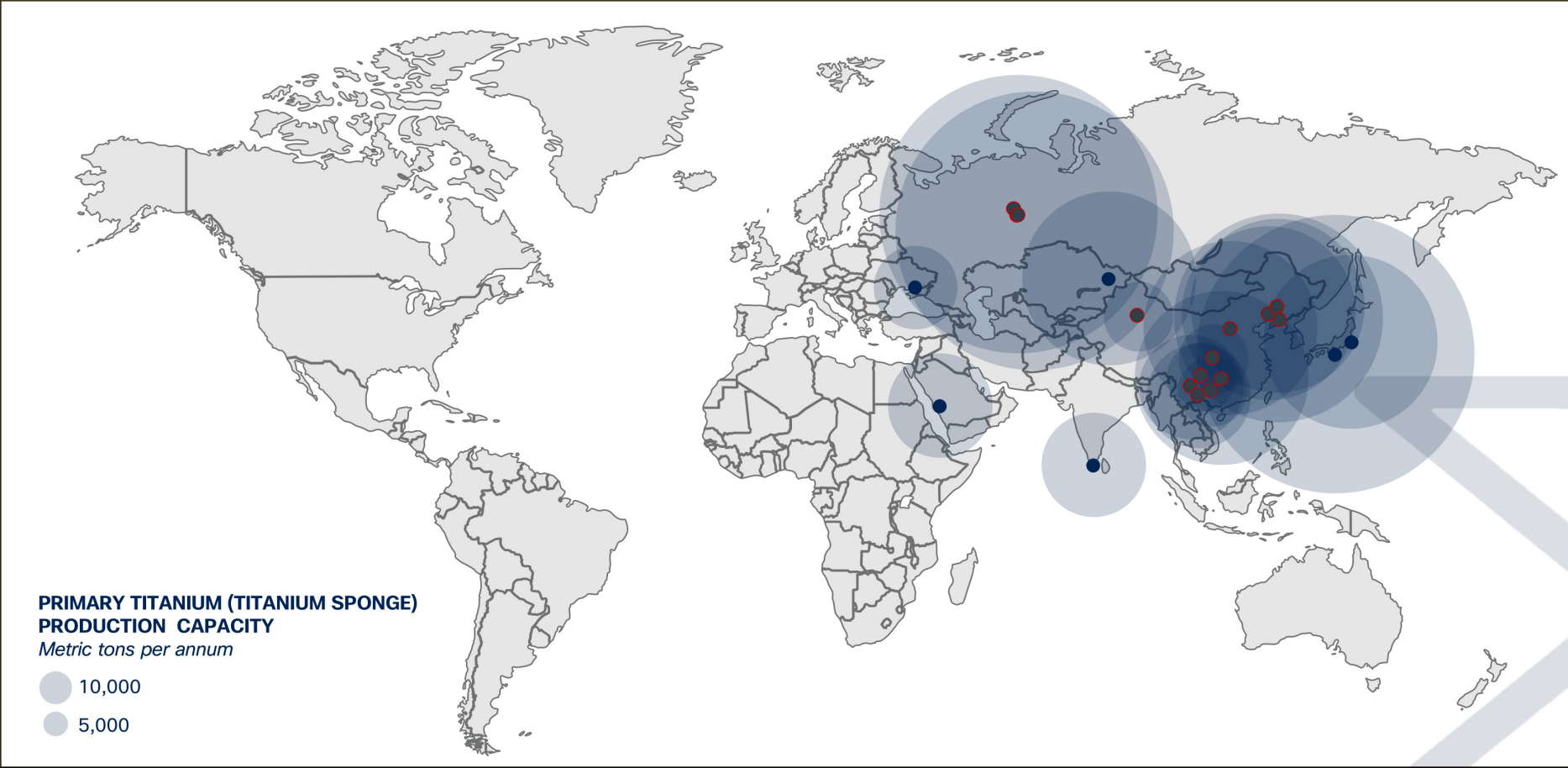
China is the largest producer and consumer of titanium dioxide pigments and is a net exporter.

Titanium in metal form (sponge) is notable for:

- Resistance to corrosion
- Fire and shock resistance
- Lightweight
- Low cost of maintenance
- Biocompatible
- Recyclable

Titanium sponge is the initial stage of the titanium metal value chain and is used as the base for Titanium alloys, billets, ingots etc. It is used for aircraft, shipbuilding, geothermal applications, and medical devices such as heart valves and artificial joints.

USGS - Titanium Stats				
World Sponge Metal Production and Sponge and Pigment Capacity:				
	Sponge Production		Capacity 2023	
	2022	2023	Sponge	Pigment
United States	Withheld	Withheld	500	1,360,000
Canada				260,000
Australia				108,000
China	180,000	220,000	260,000	5,500,000
Germany				339,000
India	300	300	500	91,000
Japan	47,000	60,000	65,200	322,000
Kazakhstan			26,000	-
Mexico				350,000
Russia	20,000	20,000	46,500	55,000
Saudi Arabia	9,700	12,000	15,600	200,000
Ukraine	1,000			122,000
United Kingdom				315,000
Other Countries				820,000
World Total (rounded)	270,000	330,000	410,000	9,800,000



Source: IperionX

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As can be noted from the graphic on the previous page the Chinese have come to dominate sponge production, albeit that Chinese sponge has not yet been certified for use in aerospace applications.

According to Asian Metals, the United States, Europe and South Korea are the main export destinations for Chinese-produced Titanium sponge. Titanium production in the United States stopped in 2016 having gradually declined previously, and Titanium product manufacturers including TIMET are experiencing short supply of the material. As for the European market, it relies entirely on imported Titanium sponge.

Chinese Titanium sponge enterprises mainly focus on the production of industrial Titanium sponge.

Zircon/Hafnium – Icing on the Cake

These two minerals appear in some mineral sands formations and are present at most HMS projects. Reference should be made to our [Hafnium Review](#) of August 2020.

Zircon's primary usage is in ceramics where it is used as an opacifier.

Zirconium is resistant to both heat and corrosion. It is used for foundry and casting applications and as a corrosion-resistant material for construction in the chemical processing industry. It is also used to make superconducting magnets, with additional uses including surgical instruments, photographic flashbulbs and in making glass for televisions.

Hafnium is a small volume market, compared to Zircon, but an enormously strategic element. Its attraction is as a good absorber of neutrons and thus it is used to make control rods, such as those found in nuclear power stations and submarines. Hafnium has been alloyed with several metals including iron, Titanium and Niobium. It is also used for microprocessors/chips. It is combined with other elements to make compounds that can endure extreme temperatures. Hafnium oxide is used as an electrical insulator in microchips, while Hafnium catalysts have been used in polymerisation reactions.

Rare Earths – a Sleeper By-Product

Rare Earth elements (REEs) have multiple applications, particularly in super magnets (with usage in the likes of wind turbines, mobile phones, solar panels etc). They also have applications in lasers and the defence industries (e.g. night vision apparatus).

We would note that many HMS deposits often have a monazite component and that product is being sourced mainly from Madagascar currently (RTZ), Australia (Iluka) and from new players, like Sheffield Resources (ASX:SFX), that have monazite within their mineral sand ore.

In the last three years, the Rare Earths space has gone from mild buzzing to a full furore and back to a bust. Despite this there has not been a massive burgeoning of projects, as in 2009-11, nor has there been many additions to the number of viable projects in the United States.

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The awakening in Rare Earths has been spurred by the invective related to the almost total dependence of the US economy (and its military) upon externally sourced Rare Earths, primarily from China.

The renewed interest of politicians and investors coincides with the on-going slide in China's own internal production (particularly in Heavy Rare Earths). This changes the dynamic from the one which has reigned for the last eight years, where China definitively had the whiphand. With Chinese supplies under a cloud and the West having added no capacity in recent years, the scenario is one of shortages and rationing, particularly for REEs most used in EVs and 5G.

On Monazite Sands

In the first Rare Earths boom the overwhelming chatter of the REE promoters was related to bastnäsite, carbonatites, and even eudialyte. Monazite sands got some attention but were largely downplayed due to radioactivity.

While the other much vaunted mineralisations have fallen by the wayside, increasingly the focus, for better or worse, has been on lesser-known host mineralisations, with Ionic Adsorption Clays, monazite sands and recycling of urban waste and miscellaneous tailings all making a running.

Monazite is a primarily reddish-brown phosphate mineral that contains Rare Earth elements. It is an important ore for Thorium, Lanthanum, and Cerium. It is often found in placer deposits with India, Madagascar, Brazil, Australia and South Africa having large deposits of monazite sands. Deposits in India are particularly rich in monazite but there is limited supply from this source. Monazite is radioactive due to the presence of thorium and, less commonly, uranium.

In fact, monazite was the only significant source of commercial Lanthanides from the first exploitation of Rare Earths through until the start of the so-called Mountain Pass era. Before the Mountain Pass era in Rare Earths, the Brazilian monazite sands dominated the supply picture from WW1 onwards. Meanwhile India has been a constant producer of REEs from HMS over many decades, as well as being producers of Thorium. According to the Indian Mineral Resources Handbook of 2020, it occurs in concentrations of 0.4 – 4.3% of total heavies in the beach and inland placer deposits of the country.

The resource estimates of monazite in the beach and inland placer deposits have been enhanced from 12.47 million tonnes in 2016 to 12.73 million tonnes in 2020.

Concern over the disposal of the radioactive daughter products in monazite, such as Thorium, resulted in bastnäsite displacing monazite in the production of lanthanides in the 1960s due to its much lower thorium content.

Monazite ores can be transported internationally in Class 7 sealed shipping containers, but from HMS operations it is typically sold as part of a mixed concentrate (rather than shipped as Class 7).

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Energy Fuels – Start of a Trend?

The radioactive element of monazite sands has not stopped the evolution of projects such as that of Energy Fuels (NYSE: UUUU, TSX: EFR) in the US, which is processing sands sourced from the operations of Chemours (NYSE:CC) in Georgia. Reputedly though Energy Fuels are also importing material for processing at their White Mesa mill in Utah, where they extract the radioactive element from the ore. In May of 2022, EFR acquired over seventeen mineral concessions in the State of Bahia, Brazil totaling 15,089 hectares which hold significant quantities of heavy minerals, including monazite, to feed Energy Fuels' emerging REE supply chain. Then in mid-2024, it made an offer for Base Resources (ASX:BSE), which we shall discuss anon.

Iluka – Entering the REE Fray

Since the 1990's Iluka has strategically stockpiled, from its HMS production, the monazite stream from its Narngulu Mineral Separation Plant, at its operations at Eneabba, Western Australia. Iluka commissioned a concentrator plant at Eneabba to further process the stockpiled material. This separates the monazite (and additional zircon), producing a ~90% monazite concentrate material that provides a direct feed to Iluka's Rare Earths refinery.

Interestingly, Iluka enters the REE picture some 12 years after Lynas. Meanwhile, Lynas developed its new AUD\$575mnn processing facility, located near Kalgoorlie in Western Australia. The project entered its final construction stage in April 2023. The facility processes concentrate from the Lynas's Mt Weld mine near Laverton to produce Rare Earth materials to be exported to manufacturing markets in Asia, Europe, and the USA. This shows up the fallacy of Lynas's regrettable decision early last decade to site production in Malaysia.

Beyond the Eneabba stockpile, Iluka holds additional mineral sands deposits that could serve as feed source for the refinery, including the Wimmera project in Victoria and the Balranald project in New South Wales.

Demand and Pricing

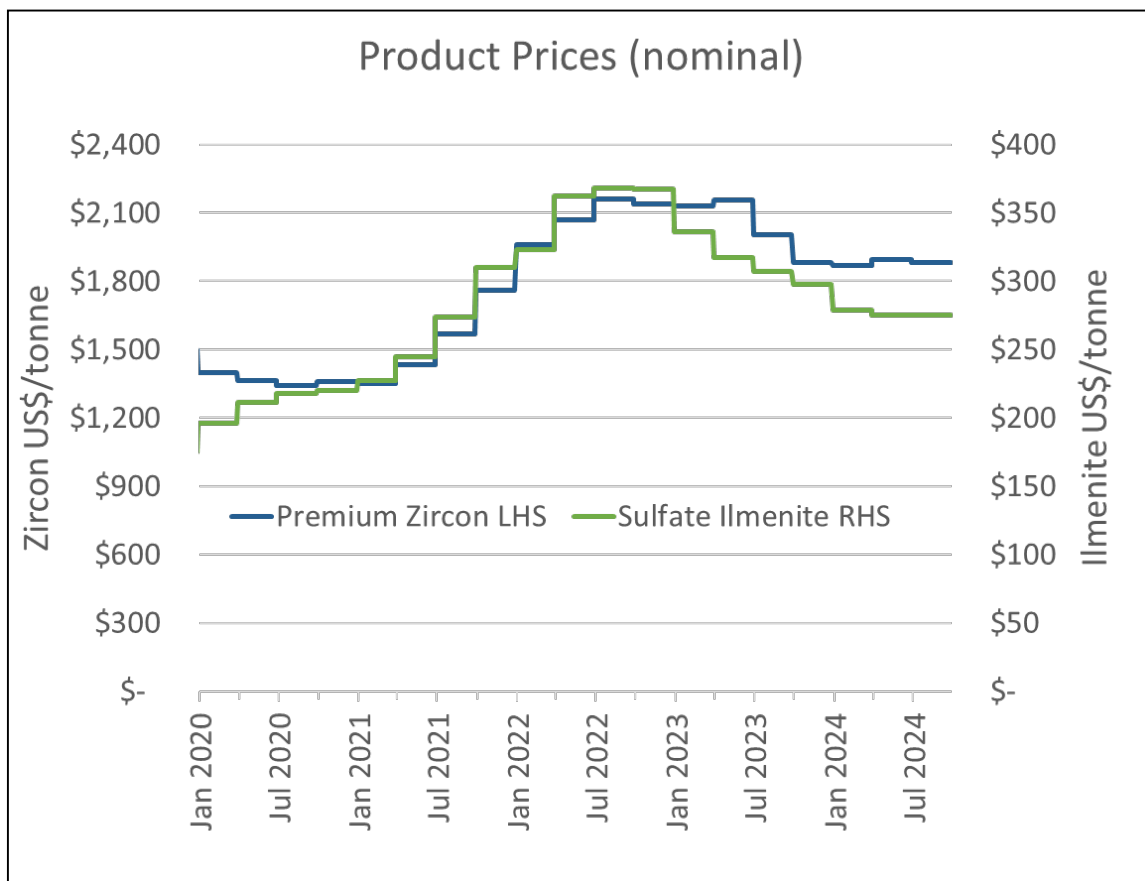
The pigment market, the largest part of Titanium usage, shows a close correlation with broader economic growth, which as we know has been less than ebullient in recent years.

While much smaller, the titanium metal market demand for Titanium is expected to remain robust, particularly in the aerospace and defense sectors, where the need for high-strength, lightweight materials is critical. According to recent reports, the global titanium market is projected to grow at a compound annual growth rate (CAGR) of approximately 6.8% from 2020 to 2027, driven by the increasing demand for lightweight and durable materials. The global titanium metal market was valued at approximately US\$26.07bn in 2023 and is anticipated to reach US\$27.62bn in 2024 powered along by growth in civil aviation and defense expenditure.

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Zircon demand has remained in a range of 1mn to 1.2mn tonnes over the past decade or more and the price is driven more by supply side developments than demand. The three largest producers (Iluka, Tronox, RTZ) account for ~55% of global supply, mostly from older mines that are in decline. The largest current zircon mine (20-25%) of global supply, Jacinth Ambrosia in South Australia and owned by Iluka, has only a few years of life left and is expected before 2030. Iluka has matched supply from this mine to demand for nearly a decade minimizing short-term oversupply and its closure later this decade will create an attractive mid-term market dynamic.

Currently there is no shortage of Titanium minerals, Zircon, or indeed of HMS so it is no surprise prices have tracked lowed similar to most other metals over the last 18 months as shown in the chart below, though the complex seems to have bottomed out.



Source: TZMI

The Players

The participants in the HMS space outside China are much fewer than many in mining would imagine. The table that follows shows the producers, developers and explorers. Base Resources, if it had stayed independent would have been in the curious position of reverting from producer to developer.

Mineral Sands Universe						
	Exchange	Ticker	Mkt Cap	Location	Project	Notes
Producer						
Chemours	NYSE	CC	\$2.73bn	USA	Trail Ridge	Provider of monazite to UUUU
Sheffield Resources	ASX	SFX	\$94.753mn	Western Australia	Thunderbird	Thunderbird mine
PYX Resources	ASX/LSE	PYX	GBP £122.5mn	Indonesia	Mandiri	
Eramet	Euronext	ERA.PA	Euros 1.57bn	Senegal	Grande Côte	Diogo mine
Sierra Rutile	ASX	SRX	n/a	Sierra Leone	Pejebu/Ndendemoia	Taken over by Leonoil
Iluka Resources	ASX	ILU	\$2.5bn	South Australia	Jacinth/Ambrosia	
				Western Australia	Cataby	
Tronox	NYSE	TROX	\$2.11bn	South Africa	Namakwa/Fairbreeze	
Mineral Commodities	ASX	MRC	\$25.6m	South Africa	Tormin	
Rio Tinto	ASX/LSE	RIO	GBP£ 80.344bn	South Africa	Richards Bay	Force majeure
				Mozambique	Fort Dauphin	
Savannah Resources	LSE	SAV	GBP £86.9mn	Mozambique	Mutamba	JV with RTZ
Kenmare Resources	LSE	KMR	GBP £308.73mn	Mozambique	Moma	Resource in Namibia
Energy Fuels (inc. Base Resources)	NYSE	UUUU	\$1.244bn	Brazil	Bahia	Acquired Base Resources fo AUD\$375mn
				Kenya	Kwale	Almost at EOM
				Madagascar	Toliara	Under development
Strandline Resources	ASX	STA	\$138.94m	Western Australia	Coburn	Debt crisis/halted since Oct 2023
Developer						
Astron Corporation	ASX	ATR	\$120.73mn	Victoria, Aust	Donald	Pilot mode - JV with Energy Fuels
Sovereign Metals	ASX	SVM	\$367.5mn	Malawi	Kasiya	
Explorer						
Diatreme Resources	ASX	DRX	\$130.21m	Western Australia	Cyclone	Project up for sale/earn-in
Titanium Sands	ASX	TSL	\$13.27mn	Sri Lanka	Mannar Island	
MRG Metals	ASX	MRQ	\$10.906mn	Mozambique	Corridor	
Image Resources	ASX	IMA	\$107mn	Western Australia	Atlas	
Capital Metals PLC	LSE	CMET	GBP 7.07mn	Sri Lanka	Eastern MS	SFX has strategic stake

Some of the explorers are inevitably not going to make it, so the pipeline is even thinner than it looks.

As can be noted, there are several companies that far transcend the HMS space, most notably Rio Tinto, Eramet and Energy Fuels, while two names, Tronox and Chemours are fundamentally regarded as chemical companies rather than miners by the US markets where they are listed.

Astron, with the Donald project in Victoria, Australia, has entered the orbit of Energy Fuels in recent months thru a JV on the project.

The fate of Strandline remains in the lap of the gods (or the hands of creditors). As at the end of September, the company claimed to have reached an in-principle agreement to an extension of the existing standstill and deferral arrangement with its financiers (NAIF, National Australia Bank and Nordic Bondholders). The existing standstill and deferral arrangement will remain in place until 30 November 2024. The near-term interest payment obligations and principal repayment obligations have been extended until that date. Management says it continues to work on a “holistic” recapitalization in the December quarter.

In a side deal, it shed its Tanzanian HMS assets to Shenghe in August for AUD\$43mn.

M&A – Love is in the Air?

It might be said that the mineral sands sector is formed by the wave action of the sentiment towards the sub-space. In periods of high prices/interest there has historically been consolidation just as there has been at times when the sector has been unloved and battered by low prices/sentiment.

As an example, one of the industry majors, Iluka Resources, is itself the product of M&A activity. It was formed in July 1998 through a merger between Westralian Sands and the Titanium mineral business of RGC (Renison Goldfields Consolidated). Westralian Sands was established in 1954 and commenced operations in 1959, when it started mining and processing the Yoganup deposit near Capel in Western Australia.

Through further rationalization and accumulation, it now has operations in the Australian states of Western Australia (Eneabba and Perth Basins), South Australia (Jacinth-Ambrosia Mine), Victoria and New South Wales (the Murray Basin) and the United States (Virginia).

Sierra Rutile & its Predators

Iluka briefly had operations in Africa, acquiring the Sierra Leone-based and London Stock Exchange-listed miner Sierra Rutile Limited for AUD\$393mn in 2016 and then demerging it in 2022.

Sierra Rutile was recently (August 2024) subject to an off-market takeover bid from Leonoil Company Limited, a company from Sierra Leone involved in oil & gas marketing in-country. The acquisition was for

A\$0.18 per SRX share (representing a total of AUD\$76.4mn) which was unanimously recommended by the board of SRX.

The Leonoil offer was favoured by the board over a previously proposed conditional off-market takeover bid from UK-based Gemcorp Commodities Assets Holdings Limited for A\$0.16 per SRX share.

SRX had previously received overtures from the US-based PRM Service LLC led by Gerald Group's CEO Craig Fuad Dean.

A Deal with REE as the Driver

In late April of 2024 it was announced that Energy Fuels (UUUU) had agreed to acquire the ASX-listed Base Resources (ASX: BSE) to "creating a global leader in critical minerals production with a focus on uranium, Rare Earth Elements and heavy mineral sands".

The offer, worth AUD\$375mn, was unanimously recommended by Base Resources' Board of Directors and two major shareholders, representing a majority of the shares on issue

The Logic

Base Resources was not quite a sunset stock, but the gradual decline in production towards its late 2024 end of mine life at Kwale in Kenya meant that it stands on the cusp of being an ex-producer and yet also a developer via its 100%-owned advanced, Toliara heavy mineral sands project in Madagascar.

The acquisition by Energy Fuels brings to the merged group, Base Resources' Toliara Project, which includes a long-life, high-value and low-cost monazite stream, produced as a byproduct of primary Titanium and zirconium production.

When developed, Toliara's monazite production is expected to be processed at Energy Fuels' 100%-owned White Mesa Mill into separated Rare Earth Element oxides (REO), at what is said to be a low capital and operating cost. Energy Fuels makes the claim that this creates a new paradigm for low-cost, globally competitive U.S.-centered REE oxide production.

The recent trajectory of Energy Fuels is reflective of changing strategies in the Rare Earths space. This company, ostensibly a uranium producer, has been upsetting the established order of things by processing mineral sands sourced from Chemours (NYSE: CC), removing the radioactive elements then dispatching them to Neo Performance Materials (TSX: NEO) separation facility at Silmet in Estonia for the production of Rare Earth Oxides.

In mid-April, Energy Fuels commissioned a 5,000 tpa SX plant dedicated to REE separation plant in Utah. It is notable that Energy Fuels is the US's only licensed refiner of uranium ores into yellowcake, which makes it the only location in the USA to which monazite concentrates (containing from 4%-7% radioactive Thorium) can be shipped, since Energy Fuels is licensed to store Thorium. In the

environmental regulation-driven atmosphere of the USA, Energy Fuels stands out as probably the only US company that is licensed to produce Yellowcake, Vanadium, and Rare Earths.

From its current arrangement with Chemours, Energy Fuels sources monazite sands to be processed in the US into individual REEs, along with Titanium (from rutile and ilmenite) and Zirconium and Hafnium (from zircon). The plan is to integrate Toliara, when it reaches production, and then possibly Brazil in the longer-term.

The Base Resources Deal

Energy Fuel agreed to acquire 100% of the issued shares of Base Resources in consideration for:

- 0.0260 Energy Fuels common shares
- A\$0.065 in cash, payable by way of a special dividend by Base Resources to its shareholders

Toliara Project

The goal for Energy Fuels was to secure control of Base's Toliara project in Madagascar.

The Toliara project is an advanced-stage, large-scale critical mineral deposit underpinned by the Ilmenite, Zircon and Monazite-rich Ranobe deposit in southwest Madagascar. In addition to its stand-alone, ilmenite, rutile (Titanium) and zircon (Zirconium) production capability, the Project also contains large quantities of Monazite which is a rich source of the 'magnet' REEs used in electric vehicles and a variety of clean energy and advanced technologies.

Subject to receipt of further required Government of Madagascar approvals, the Monazite can be recovered as a byproduct of Ilmenite and Zircon production at low incremental cost, thereby adding to Toliara's Ilmenite and Zircon capability at a cost of production that the company expects to be globally competitive and will position Energy Fuels to be a first-tier REE oxide producer.

The strategy is that, once in production, the monazite sands from Toliara will provide a large portion of the raw materials needed for Energy Fuels' REE oxide production facility at the White Mesa Mill. Since 2021, Energy Fuels has proven its technical capabilities, speed-to-market, and competitiveness in a manner that is not being accomplished by any other facility in North America, first by processing Monazite to produce a mixed REE carbonate at the mill, which it has been selling into the commercial REE market since 2021, and now by the commissioning of its Phase 1 NdPr separation facility at the Mill.

Monazite from Toliara will also provide material quantities of low-cost uranium production at the Mill over the life of the Project, which will supplement Energy Fuels' U.S.-leading uranium production capacity.

Capital Metals (AIM: CMET) – Bite-Sized

In mid-March of 2024, Sheffield Resources (ASX:SFX) announced that it was taking a 10% stake in the

AIM-listed Capital Metals PLC, the owner of the Eastern Minerals Project in Sri Lanka.

The 10% stake involved an investment of £1.25mn with a 12-month option to acquire more shares to increase its interest to approximately 14% of total issued capital.

This transaction is reflective of one new producer positioning itself potentially for the long-term by exploiting relative price weakness of those companies even lower down the totem pole.

Whither the Chinese?

The Chinese operate the largest Titanium processing industry in the world and also largest producer, and consumer, of Titanium dioxide in the world. It is also the largest ilmenite producer. The majority of Chinese ilmenite supply is domestic (hard rock VTM). This can only be used for sulphate pigment and so China imports ilmenite to supplement domestic supplies for sulphate and to provide feedstock to make chloride slag for use in Chloride pigment production.

Despite this the Chinese have not been a major presence in acquiring outright Titanium mines and advanced projects in the main jurisdictions where the mineral is mined. They have instead stuck to a strategy that appears to be mainly JVs and strategic stakes in exchange for offtakes which keep them below the radar and out of the firing line of critics that attack any investment they might make in minerals that might be described as strategic.

We would not expect this to change. Indeed, it seems to be working as a strategy, making Titanium and the other metals one of the least controversial subjects of discussion when it comes to market dominance, despite China, in fact, having an overwhelming position in mid-stream and downstream processing in Titanium.

Conclusion

Heavy mineral sands are a sizeable mining sub-space that nevertheless is not on the radar of many mining players/investors. It is not inhabited by a large number of players, but most of those that are in public markets are in Australia (where it is well understood) and to a lesser extent London. There is little to no representation of HMS in Canadian stock markets, even though there are some Titanium oriented stories, focused on hard-rock sources.

While HMS and Titanium prospects/demand are joined at the hip it is simplistic to limit interest to just that nexus, for Zircon/Hafnium are also sourced from HMS, while REEs from monazite sands a new (though actually old) by-product.

Titanium, Hafnium/Zircon and REEs are all undeniably strategic minerals. However, the vast bulk of Titanium is used for non-critical pigments and Zirconium for non-critical ceramics. Arguably, Titanium is thus strategic, but not critical, because there is no shortage of the chief source (i.e. HMS) and neither are the original sources under Chinese control. Indeed, it could be argued that Titanium is critical for the West, but that HMS are critical for China.

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The Rare Earth nexus with HMS has become a game-changer in the REE space. Long mired in bloated pharaonic projects in outlandish locations with challenging mineralisations, the onset of monazite sands (well, really a reboot of the pre-1960s situation) has indeed been a paradigm shift. The radioactive component of these sands is a bogeyman that has been grappled with and will be definitively buried. Interestingly, though while REEs from HMS are moving the dial in the REE space (and acting potentially as a major spoiler) they are a relative sideshow in the HMS space, though as the Base Resource deal shows they may become a motor for some M&A action in unexpected quarters from previously unconsidered predators.

Appendix I: Case Study

Sheffield Resources (ASX: SFX)

- + Sheffield achieved the seemingly impossible trifecta of getting itself fully funded without dilution (beyond the sell down of 50% to partner Yansteel) and then building its plan on time and to budget
- + The company has all its ilmenite concentrate production from Phase I presold to its Chinese partner in the project
- + Initial teething problem with the size of feed is expected to be overcome through improved recovery of fine material and ultimately increased mine capacity
- + The company has reached its throughput goal of 2.5 to 3 million tonnes per quarter of ore mined
- + The second project in the portfolio is a joint venture in Brazil where redrilling of historic resources has commenced
- + A strategic investment of 10% in the AIM-listed HMS developer in Sri Lanka gives Sheffield yet another strategic foothold with the potential to move to control at some juncture
- ✗ An initial problem with oversized material combined with operating cost and revenue pressure smacked down the stock price severely, giving the sceptics their “I told you so” moment
- ✗ The woes of Strandline have unjustly cast a pall over Sheffield

New Kid on the Block in HMS in WA

Sheffield Resources, which listed on the ASX in 2010, is focused on developing its flagship Thunderbird Mineral Sands Project, the world’s biggest zircon-rich mineral sands deposit.

Thunderbird is located midway between Broome and Derby in northern Western Australia, a low-risk mining jurisdiction with close proximity to Asian markets. Thunderbird is one of the largest and highest-grade mineral sands discoveries in the last 30 years. The Bankable Feasibility Study from 2022 showed Thunderbird to be a technically low-risk, project which generates strong cash margins from globally significant levels of production over a 36-year mine-life.

Thunderbird is owned by Kimberley Mineral Sands Pty Ltd, a 50/50 joint venture between Sheffield and YGH Australia Investment Pty Ltd (Yansteel), formed specifically in 2021 to develop the project.

The project produces a suite of mineral sands concentrate products, including a zircon concentrate and a magnetic concentrate that contains a high-quality ilmenite suitable for smelting into chloride slag or for manufacturing Titanium dioxide pigment.

Bang on Time

Such is the negative mood of “disaster foretold” in HMS shorting circles that Sheffield long struggled to get upward momentum despite a fairly stable price for Heavy Mineral Sands cons, production being presold at the major offtaker and its project coming in on time and below budget with all funding in place well before advancing that the naysayers still had a field day.

Expecting the Worse

It is almost like the observers of (though not necessarily the investors in) the mineral sands miners are always on the look-out for bad news. Despite the initiation of production coming in under budget and on-time, positive recognition eluded the company in the first months of production.

In April and May of 2024, the company was caught in a squall of bad news when it was revealed that oversized material was causing problems in reaching optimal throughput with additional oversize material resulting in only approximately 75% of the expected spiral feed being delivered to the Wet Concentrator Plant (WCP). This was followed up with the revelation of higher operating costs and weaker initial sales prices for the zircon concentrate and the combined negative news sent the stock down from 50cts to 30cts, coming on the heels of the debacle at Strandline Resources (ASX: STA), a similar (but substantially different) story.

Shucking Off the Blues

In late June, Sheffield provided an update regarding the ramp up of production and shipments from its Thunderbird Mineral Sands Mine that managed to dispel some of the gloom that has dogged it since it came out with its warning on the oversized material issue.

Changes in the in mine process flow sheet resulted in the company being able to announce positive news. These process improvements were modifications to the Dry Mining Unit, undertaken early in the June quarter, which enabled sustained improved availability and production performance. Beyond that, the infill drilling program of the near-term mine plan continued and analysis of observed oversize streams and identification of remediation measures are underway.

Mine production at Thunderbird has demonstrated continued month on month production gains, with total ore mined in June 2024 of approximately 1,000,000 tonnes. For the June 2024 quarter, total ore mined was 2,482,000 tonnes, approximately 20% higher than the operating rate assumed within the 2022 Bankable Feasibility Study.

The increase in mine production resulted in increased production of concentrates with approximately 55,000 tonnes of ilmenite concentrate produced in June and 120,000 tonnes for the quarter. Production of zircon concentrate was approximately 13,000 tonnes for June and 33,000 tonnes for the quarter.

The metrics for the June quarter were well received and turned the stock price around before the sector malaise pulled it back down again.

Recoveries from the WCP and Concentrate Upgrade Plant (CUP) have been above design from the outset, resulting in higher than design recovery of both ilmenite and zircon concentrates. The net impact of observed higher oversize and higher WCP and CUP recovery is an approximate 85% yield of expected final products from the volume of ore mined. The excess recovery continues to be weighted towards ilmenite concentrate. Plant optimisation and continuous improvement opportunities are now underway with a focus on increasing zircon concentrate recovery.

Then in late October the company published its metrics for the September quarter:

- Mine production throughout the quarter of 2.6mn tonnes of ore
- Mine production of 2.5mn – 3mn tonnes targeted throughout FY2025
- Concentrate production totalled 154,260 tonnes for the quarter
- Product shipments totalled 121,591 metric tonnes of ilmenite concentrate

It should be noted that Zircon concentrate shipments were deferred into the December quarter, commencing with a shipment of 6,300 tonnes dispatched in early October.

The company reported continued process plant product quality and recovery outperformance.

As far as liquidity is concerned the company reported an (unaudited) cash balance of \$9mn as of 30th September 2024 (unaudited). The Joint Venture had an (unaudited) cash balance of \$5.6mn and subsequently received a US\$14mn offtake prepayment from Yansteel following end of the quarter.

Monazite Sands

Recoverable monazite is in the Zircon concentrate and it is included in the concentrate pricing (alongside ZrO₂ and TiO₂ content). Thus, if buyers are prepared to take and process the material from the Thunderbird project, then the radioactive element should not prove a hindrance to expanding REE as a revenue silo for Sheffield.

Summation

The unfortunate outcome of the oversized material “scare” was that the damage was done, and undoing it is a long process of delivery to belie the naysayers. If anything, it allows cheaper entry for investors now, but what was a temporary bump in the road moved the stock’s trading range 40% lower. Thus, instead of building on the start of production the stock price moves are only recuperating ground lost due to the “oversize disaster”. This “disaster” has been overblown by naysayers (dare we say, shorters).

To be short this name (or playing some waiting game to initiate a LONG position) is becoming somewhat fraught as the final quarter of the financial year saw significant DMU productivity improvements following modification. The September 2024 quarter performance of 2.6mn tonnes, with the process plant performing at or above design, lays out a path for a strong performance for the FY2025, with mine

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production expected to be sustained at 2.5mn–3mn tonnes of ore mined per quarter. Hopefully this will prompt a rerating in the market, eventually.

This leads us to reiterate our **LONG** rating on the company and our 12-month target price of 72cts, despite this being quite a mountain to climb from current levels.



Important disclosures

I, Christopher Ecclestone, hereby certify that the views expressed in this research report accurately reflect my personal views about the subject securities and issuers. I also certify that no part of my compensation was, is, or will be, directly or indirectly, related to the specific recommendations or view expressed in this research report.

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