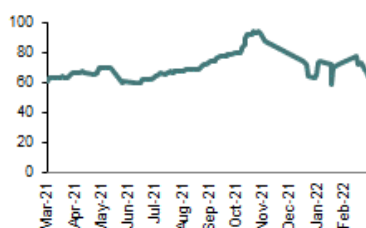


CORPORATE

Share price 75.8p

Ticker	PYX
Index	FTSE LSE
Sector	Mining
Market cap	£331m
Shares in issue	437m
NAV	14p

Performance	All-Share	Sector
1 month:	(11)%	5%
3 months:	(26)%	(0)%
12 months:	5%	(7)%
High/Low	94p / 58p	



Source: © 2022, S&P Global Market Intelligence

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Marketing Communication

This document has not been prepared in accordance with legal requirements designed to promote the independence of investment research. Please refer to important disclosures towards the end of this document.

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PYX Resources

A high-margin producer of premium zircon

PYX Resources (PYX) has two heavy mineral sands (HMS) projects in the Kalimantan region of Indonesia. The resources have a high assemblage value and the second-largest zircon resource base of any producer around the world. The company is at the start of its growth stage and we expect production, revenues and cashflow to grow quickly as it expands its Mandiri mine and brings its Tisma project into production. Against a strong and robust zircon market, we see fair value in PYX at 129p/share, using an SOTP valuation of a conservative CF and peer P/E multiplier.

PYX has developed its 100%-owned Mandiri mine selling high-grade (>65.5%) premium zircon (plus ilmenite and rutile) to high-tech buyers at historically high SPOT prices. It is now in a position to bring mining back in-house, expand production at Mandiri and commission production from Tisma, making it a producer on a global scale.

An investment in PYX provides investors with:

- **Interest in a profitable premium zircon producer:** The PYX team has a proven track record of delivery and has established a clear path to grow its business and become a producer of zircon on a global scale, producing 200kt/yr zircon by 2030 (WHIle).
- **Scalable business:** Mining and treatment of mineral sands is low impact, simple and scalable. PYX is investigating how to increase processing capacity at Mandiri and is evaluating taking Tisma into production.
- **Upside resource potential:** Further exploration resources are possible at Mandiri, and Tisma could be reclassified into higher-confidence categories with in-fill drilling. Additional upside exists to recover other components of the HMS assemblage.
- **In-demand, high-grade, low-impurity resource:** Zircon is often produced as a by-product and is typically sold in advance at fixed prices. PYX sells its high-grade zircon at SPOT prices to blue-chip high-tech customers. PYX's Mandiri premium zircon is in demand for its high grade (>65.5% zircon), high whiteness, low levels of impurities (Fe₂O₃, Al₂O₃ and TiO₂), and low radioactivity.
- **Low impact:** Mineral sands projects are low impact, removing the heavy sand fraction from surface shore, beach and dune areas and reclaiming the mined areas as mining moves forward. There is no waste and no trace from this sort of mining.

The zircon market is robust with decade-high prices, a poor project pipeline, supply disruption and growth into new technology sectors. PYX is an important component of necessary future production.

We see fair value in PYX at 129p/share. We have valued PYX on a mixed basis using a simple average between NPV₁₀ and a peer multiple P/E of 7x. PYX has a simple business model to produce zircon (and minor rutile and ilmenite) at high margins.

Y/E Dec (\$m)	2020A	2021E	2022E	2023E
Revenue (\$m)	9.0	12.4	33.9	34.6
EBITDA	(14.0)	(4.5)	14.1	15.4
PBT (\$m)	(14.1)	(4.5)	13.1	13.4
EPS (c)	(5.8)	(1.1)	2.0	1.9
P/E (x)	(12.0)	(65.4)	34.2	35.9
EV/EBITDA (x)	n/a	n/a	27.4	25.0
Net cash (\$m)	3.5	6.6	24.5	26.1
Net assets (\$m)	4.5	83.0	111.9	120.9

Source: Company accounts, WH Ireland estimates

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Important disclosures and certifications regarding companies that are the subject of this report can be found within the disclosures page at the end of this document.

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Investment case

Fair value at 129p/share

PYX Resources (PYX) is a major and sustainable global producer of premium zircon listed on the National Stock Exchange of Australia (NSX:PYX) and London Stock Exchange (LSE:PYX). The Mandiri and Tisma projects are located in the alluvium-rich region of Central Kalimantan, Indonesia. The deposits are large and prospective with production plans showing a scalable build-up. The simple processing technology has a low-capital cost and low operating costs. In the absence of new global zircon projects, we expect premium prices to allow for a healthy cashflow return from PYX's operations.

Profitable operations with plans to scale production

Existing producer with expansion plans: PYX has been producing high-grade zircon concentrate from Mandiri since 2015 and successfully marketing it to high-tech buyers. Production has steadily increased to 7kt/yr and PYX has plans to take production at Mandiri to 48kt/yr within five years. Increased production would reduce operational unit costs and boost operational margins. Processing operations are modular and can be scaled in 24kt increments, at a cost of \$15m per module (WHIe).

Existing producer lowers risk: We see PYX's plans as low risk given it already produces a premium product. PYX has demonstrated that it can process its mineral sands to produce valuable and clean products.

Significant potential

Large resource: Between Mandiri and Tisma, PYX has 263.5Mt of inferred resources (JORC) with an average assemblage value of \$1,680/t. Zircon and rutile are currently recovered and sold by PYX. Other components of the mineral assemblage, including ilmenite, leucoxene and others are not currently recovered and offer further potential value.

High grade: There are few other high-grade zircon projects in the world – Mandiri and Tisma stand out (Figure 5).

The deposits are at surface: Little or no stripping is required at Mandiri and the mineral sands are unconsolidated. Operating costs are low and will fall.

Fast-tracked

Short time to production – fast track: No long construction time – simple plant build, fed with material from the mineral resource quickly.

Low impact

No lasting trace: Mineral sand operations leave a light touch. Mining the sand at surface, removing the heavy mineral fraction and reclaiming the areas immediately means that little trace of mining is left.

High returns

Strong returns: Our simple DCF model returns an NPV₁₀ of \$874.3m. Returns are driven by the grade (high) and capex/opex (low) against our conservative pricing as the mineral sands sector enters a boom.

Low-cost, high-margin business model

Transfer to in-house mining will increase margins: PYX's operating model is low cost, it currently relies on local third party miners supplying heavy mineral concentrates after recovering gold for a share of the zircon price received. PYX processes the heavy mineral concentrate using established and industry standard processes. In-house mining will reduce any material supply risk and provide for increased scale and higher profit margins.

High value, highly saleable assemblage

Mineral assemblage sets PYX aside from its peers: PYX's resource base sets it apart from its competitors. Premium zircon – with its low radioactivity (U+Th <500ppm), low alumina and high whiteness – is ideal for high-tech applications and is sought after by blue-chip companies.

Zircon a growth sector: The use of zircon is growing and new-industry applications are being found for which zircon is proving necessary in the carbon transition. For example,

zircon alloys are used in many sectors (nuclear reactors and the automotive industry). Zircon is also used in hydrogen cells and in ceramic roof tiles to cool buildings.

Absence of a zircon project pipeline a positive for PYX: The value for PYX does not fully reflect the lack of availability of other global projects for zircon. With growing demand, an uncertain supply (the recent Richard's Bay force majeure, for example) and a poor project pipeline, we expect a robust zircon price for several years to come. It is during these years that PYX will be established as a significant global zircon producer, in our view.

Key risks and other considerations

Investing in natural resource companies does carry some risks. We have highlighted the most significant as we see them:

While the MRE is mostly in the Inferred category, we expect production to be in line with expectation

Mineral Resource Estimate (MRE) – The Mandiri and Tisma inferred resources are based on small and wide-spaced samples in what is an inherently highly variable environment. Although the modelling of the tabular alluvial body is overly simplistic, we expect production to be in line with expectations. There will be variability in the resource and this may affect production targets and therefore economic modelling, but we note that PYX has a track record of delivering high-grade zircon concentrate to international buyers.

Differences between resources creates a moderate risk

Mandiri and Tisma – Although mineral assemblages are similar, significant operational differences exist between the Mandiri and Tisma resources. The Mandiri resource outcrops, or is very near surface, whereas, at Tisma, the resource is under 6m to 10m of overburden and must therefore be stripped, and it underlies a thick forest, which must be cleared.

Sovereign risk is low

Sovereign risk – Indonesia is an emerging market. As with any market, PYX is exposed to potential political, economic and social risks. However, many international companies operate successfully in Indonesia and we see the country's risk in this case as low.

Product market risk is low

Product market risk – The market for high-grade zircon is bullish. Demand is high and supply to high-tech industry buyers is restricted. PYX is benefiting from higher prices for its premium product.

Operating risk is low

Operating risk – Operational risk is low and in line with other mineral sands producers. The process to separate the heavy minerals of interest from the sand matrix is very simple and well-established process circuits are used. We do not expect PYX to have any technical difficulties in separating by-product rutile from the zircon.

Permitting risk is low

Ownership/permitting risk – PYX has Exclusive Operation and Management Agreements for Mandiri and Tisma, it is not the direct owner. Permit renewal is subject to the direct owner honouring government, social and other commitments.

Supply risk is low

Supply risk – PYX currently relies on a supply of HMS from artisanal miners. Supply could be interrupted for any number of reasons. Plans to increase processing capacity at Mandiri to 5ktpd will be when PYX commences mining, which we expect to reduce risk.

Currency risk is low

Currency risk – 100% of PYX's revenues are US dollar denominated, limiting currency risk.

Capital market risk – All natural resource companies at the beginning of their growth cycles are reliant on the capital markets for equity funding; PYX is no different. To enable a quick ramp up to the production and profit expectations, we model in our research note presented here that PYX will need access to \$20m – be this via debt or equity. We choose to model this as an equity funding and, given the size of the potential rewards and that PYX is currently debt free, we expect funding to be available.

Valuation

We see fair value in PYX at 129p/share

We value PYX on a sum-of-the-parts (SOTP) mixed approach. We take the NPV₁₀ for the combined expanded output of Tisma and Mandiri (Table 1) and take a simple average between this and the P/E for 2028E, using a 7x multiplier – a conservative figure compared with its peers (Table 2). To this, we add in net cash from end-2023E post the expected funding for the Mandiri expansion.

We risk the DCF and P/E by 10% using 90% of the NAV and earnings. The risk is low, in our view, as PYX has already demonstrated that high-quality zircon can be extracted and that PYX can obtain a premium price for its products. Technical risk is low due to simple mining and processing of the mineral-rich sands and funding risk is expected to be low given the expected low capital cost for the Mandiri expansion.

PYX's proposed plans obviously have to be paid for and the company has two choices, as we see it: either to go slowly and build up its cash reserves, or to raise finance from the equity or debt markets. We choose to include in our model a £20m equity funding for a potential fundraise by PYX (£20m at 70p). The more quickly PYX can raise its production and cashflows, the quicker the returns for shareholders will be.

A recent placement by a US institutional investor, L1 Capital Global Opportunities Master Fund, for \$4.5m (and up to \$13.5m) shows there is appetite in the capital markets for PYX.

Table 1: PYX Resources – Base case valuation summary

Asset		\$m	£m	Risk*	GBp/sh**
Mandiri / Tisma DCF	NPV ₁₀	874.3	647.6	0.9x	123
PYX Resources	7x P/E 2028E	901.4	667.7	0.9x	127
Arithmetic average					125
Net cash	WHIe 2023	26.1	19.4	1.0x	4
PYX Resources					129

Source: WH Ireland research

* Subjective risk – risked for commissioning and funding of expansion. ** WHIe 475m shares in issue post funding

Upsides

Our model (Table 3) combines production from Mandiri and Tisma to produce ~200kt/yr (Table 4) of zircon, 9kt/yr of rutile and 23kt/yr of ilmenite. Economics are dominated by zircon, which provides ~95% of gross revenue, according to our production and price forecasts.

The price of zircon is currently at near historical highs (Figure 15). Higher zircon prices for longer would affect our fair value positively. We currently show the zircon price received for 2022 as \$3,000/t, falling back to our long-term price of \$2,000/t by 2028E.

The mineral sands mined by PYX also contain gold. This is currently recovered by artisanal miners and it is not known if PYX will also recover the gold because of its licence conditions. If PYX could recover gold, it could have a big impact on the project economics.

Further expansion is possible given the size and the scale of the resource. Simply by adding in new processing lines in a modular fashion, PYX will be able to increase production should it wish and should there be a market for the increased production.

Table 2: Peer producers and forward multiples

	Mkt cap \$m	EV/EBITDA FY +1	EV/EBITDA FY +2	PE FY +1	PE FY +2	EV/EBIT FY +1	EV/EBIT FY +2	P/CF FY +1	P/CF FY +2
PYX Resources Limited	405.8								
Iluka Resources Limited	3652.7	6.3	6.4	11.3	12.1	7.2	8.1	8.7	9.1
Base Resources Limited	287.7	1.8	2.3	4.6	5.4	2.9	3.9	-	-
Kenmare Resources plc	582.5	2.7	3.6	3.7	5.3	3.5	5.4	2.8	3.1
Average		3.6	4.1	6.5	7.6	4.5	5.8	3.8	4.1

Source: WH Ireland research, PYX, S&P Capital IQ Pro (data from 04/04/2022)

WH Ireland model cost inputs

In-house mining and expansion at Mandiri (2022/23) then expansion at Mandiri (2025) and then addition of Tisma to production (2026)

Capital cost: \$18m (WHIe) for bringing Mandiri in-house then \$15m for each 24kt modular unit at Mandiri and Tisma

Operating cost: \$400/t zircon when in full production

Revenue:

Ilmenite \$350/t

Rutile \$1,500/t

Zircon \$2,000/t

Royalty 1.5%

Export tax ~\$6/t exported

Assumed \$45/t land and ocean freight

Financial returns

IRR	n/a
NPV 5% (\$m)	1561m
NPV 8% (\$m)	1094m
NPV 10% (\$m)	874m
NPV 15% (\$m)	520m

Combined Tisma – Mandiri cashflow

Table 3: DCF for the Tisma and Mandiri projects, \$m

		2022	2023	2024	2025	2026	2027	2030
Ilmenite	kt	1.5	1.7	3.1	4.6	9.2	14.5	23.0
Zircon	kt	10.7	12.0	24.0	36.0	72.0	98.0	200.0
Rutile	kt	1.3	1.5	2.4	3.3	6.6	7.7	9.0
Total Production	kt	13.5	15.2	29.5	43.9	87.8	120.2	232.0
Ilmenite price	\$/t	350	350	350	350	350	350	350
Zircon price	\$/t	3,000	2,700	2,500	2,300	2,200	2,100	2,000
Rutile price	\$/t	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Ilmenite gross revenue	\$m	0.5	0.6	1.1	1.6	3.2	5.1	8.1
Zircon gross revenue	\$m	32.0	32.4	60.0	82.8	158.4	205.8	400.0
Rutile gross revenue	\$m	2.0	2.3	3.6	4.9	9.9	11.6	13.5
Gross revenue	\$m	34.5	35.2	64.7	89.3	171.5	222.5	421.6
Port plus Ocean Freight (SE Asia)	\$m	(0.6)	(0.7)	(1.3)	(2.0)	(4.0)	(5.4)	(10.4)
Net revenue	\$m	33.9	34.6	63.4	87.4	167.5	217.1	411.1
Direct operating costs	\$m	(14.1)	(12.9)	(19.2)	(21.9)	(39.5)	(54.1)	(104.4)
Royalty	\$m	(0.5)	(0.5)	(1.0)	(1.3)	(2.6)	(3.3)	(6.3)
Export tax	\$m							
EBITDA	\$m	19.2	21.1	43.2	64.1	125.5	159.6	300.4
Depreciation	\$m	(1.0)	(2.0)	(2.0)	(2.0)	(2.5)	(3.5)	(6.5)
EBIT	\$m	18.2	19.1	41.2	62.1	123.0	156.1	293.9
Interest	\$m							
Tax	\$m	(4.0)	(4.2)	(9.1)	(13.7)	(27.1)	(34.3)	(64.7)
Operating profit	\$m	14.2	14.9	32.1	48.4	95.9	121.8	229.2
Add back depreciation	\$m	1.0	2.0	2.0	2.0	2.5	3.5	6.5
PYX Corporate costs	\$m	(4.5)	(5.0)	(5.0)	(7.0)	(9.0)	(9.0)	(9.0)
Sustaining capex	\$m		(1.5)	(2.0)	(1.0)	(1.0)	(2.5)	(2.5)
Expansion capex	\$m	(10.0)	(8.0)		(15.0)	(15.0)	(15.0)	
Cashflow	\$m	0.7	2.4	27.1	27.4	73.4	113.8	224.2

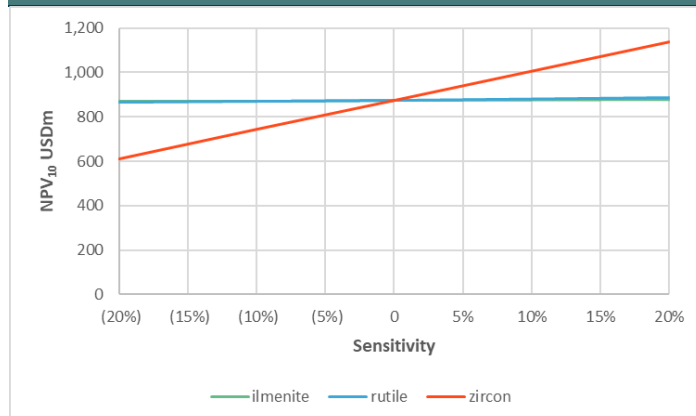
Source: WH Ireland estimates. NOTE GAP IN YEARS

Table 4: PYX Resources – Projected total zircon production (kt)

Asset	2022	2023	2024	2025	2026	2027	2028	2029	2030
Mandiri	10.7	12.0	18.0	24.0	48.0	50.0	75.0	100.0	100.0
Tisma	-	-	6.0	12.0	24.0	48.0	50.0	75.0	100.0
PYX total	10.7	12.0	24.0	36.0	72.0	98.0	125.0	175.0	200.0

Source: WH Ireland estimates

From 2030 onwards, zircon production is projected to remain constant at 200kt/yr

Figure 1: Sensitivity to individual mineral sand prices


Source: WH Ireland research

Figure 2: Sensitivity to model inputs


Source: WH Ireland research

Figure 3: Sensitivity to discount rate


Source: WH Ireland research

Sensitivity to model inputs

We have sensitised our DCF model for mineral sands pricing (ilmenite, rutile and zircon) in Figure 1, capex and opex (Figure 2), as well as discount rate (Figure 3).

The Mandiri and Tisma projects are robust projects, most sensitive to the zircon price. However, the low capex required to bring the deposits into production and the returns generated means it is not sensitive to discount rate.

Low capex, low opex and high grade imply that this is a project to produce meaningful returns, with a resource that we view as expandable, which will be company-changing for PYX.

Obviously, there are different sensitivities for discount rate. We use our standard mining 10% rate in our analysis; however, with its established production and simple expansion, a lower discount rate might be more appropriate for investors.

PYX Resources

Large, high-grade zircon deposits

PYX is the second-largest zircon producing mining company globally with two deposits, Mandiri and Tisma. With 263Mt of JORC-compliant resources and 10.5Mt of contained zircon (Figure 4), and the highest zircon grade (Figure 5) globally, PYX is a differentiated value proposition.

Figure 4: PYX – Zircon resource (Mt)

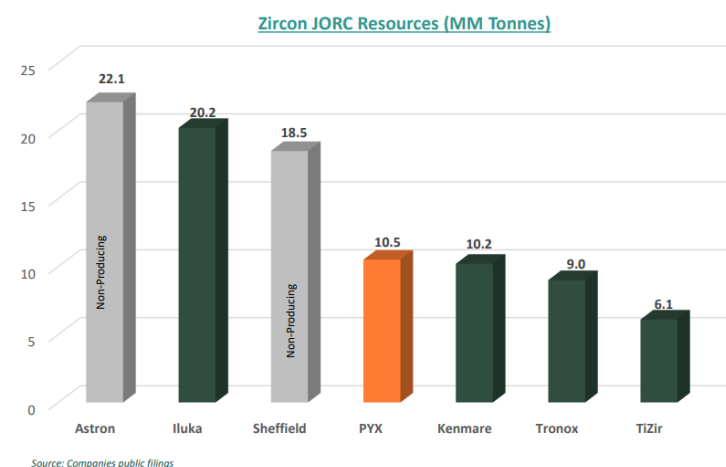
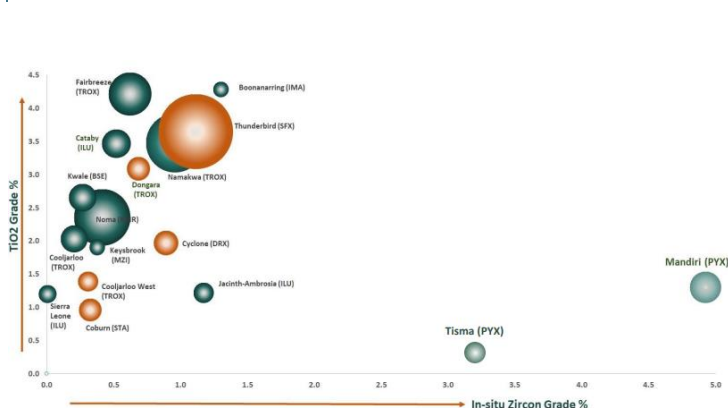


Figure 5: Mandiri and Tisma – Zircon resource grade (%)

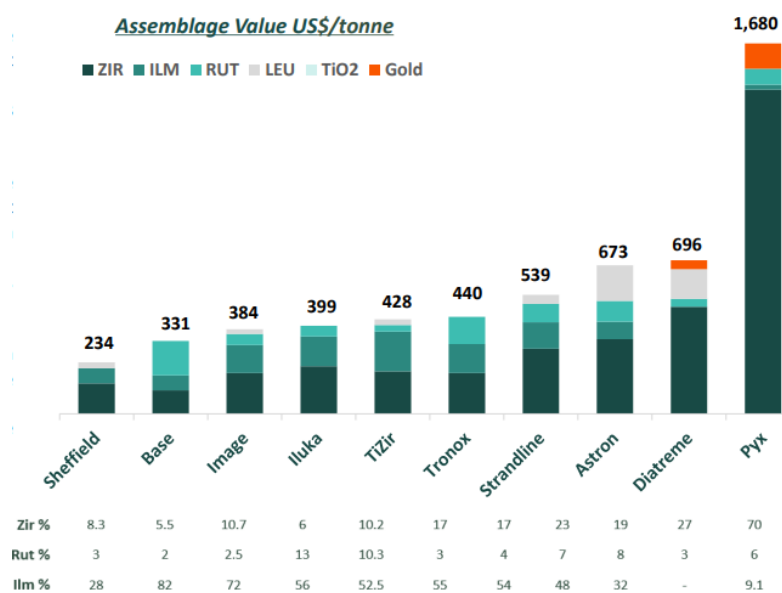


Source: WH Ireland research, PYX Resources

Standout assemblage value

The naturally high concentration of zircon in the Mandiri and Tisma resource sets the assemblage value (average \$1,680/t) of the PYX resource base apart from peer companies (Figure 6).

Figure 6: Assemblage value, \$/t



Source: WH Ireland research, PYX Resources

Mandiri resource and mineral sands operation

PYX's low-impact, high-margin Mandiri operation is recovering industry-beating zircon concentrate for sale to high-tech industry buyers.

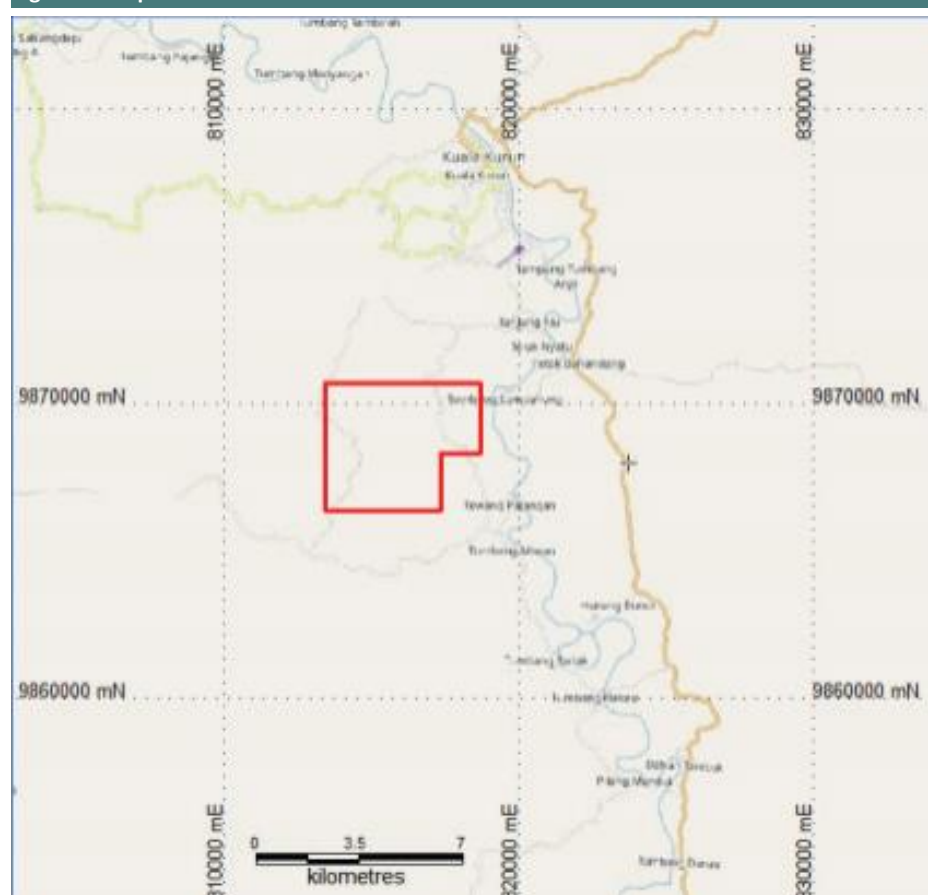
After recovering gold from heavy mineral sands (HMS), artisanal miners sell the HMS to PYX, which applies efficient processes to recover zircon and rutile.

Property location and description

Mandiri is near the city of Kuala Kurun in central Kalimantan, Indonesia (Figures 7 and 8). The property is in an area used for agriculture and forestry; alluvial mining is also established.

The licensed concession area has a footprint of 2,032 hectares devoted to the exploration and production of minerals sands.

Figure 7: Map of the Mandiri concession area



Source: WH Ireland research, PYX Resources

Geology and exploration history

The Mandiri Project is situated on the anticlinorium complex within Barito Basin, a Paleogene pull apart sedimentary basin. The HMS-bearing strata of the Mandiri deposit is composed of ancient Kahayan alluvium, which was deposited during the Holocene.

Historically, the sedimentary basins of Central and Western Kalimantan have been mined for alluvial gold and, in some areas, also for diamonds. More recently, it has been recognised that the alluvium hosting the gold is also prospective for HMS. In 2017, Indonesia was ranked fourth in the world for zircon production, producing 120kt.

Figure 8: Indonesia, Kalimantan – Alluvial deposits



Source: WH Ireland research, PYX Resources

The Mandiri deposit is a zircon, rutile, leucoxene (+others) placer formed in a flood plain of the ancient Kahayan river. Gold, platinum and cassiterite have also been identified. Drilling has revealed that mineralisation occurs as a tabular body within alluvium as a layer between 2m and 11.5m, with an average thickness of 6m. The top of the HMS deposit is shallow, outcropping in many instances and not more than 4.5m under loose cover (Figure 9).

Economic concentrations of HMS derived from the uplift and deep erosion of the Paleozoic to Cretaceous basement rocks, which contains low-grade disseminated and vein gold mineralisation.

Mandiri has been explored using auger drilling and XRF analyses, and mineral assemblage data has been recorded.

Resource

An inferred mineral resource estimate (MRE) aligned to the JORC Code (2012) was completed for the Mandiri HMS deposit by Continental Resource Management (CRM) in June 2021 (Table 5). The MRE has been depleted since it was reported; depletion is not reflected in Table 5.

The resource estimate was determined based on auger drilling completed on 200, 400, or 800m grids. Collar locations (X,Y) are based on handheld GPS, with an estimated accuracy of +/-15m. Elevation has not been recorded.

Figure 9: Mandiri – Artisanal workings in alluvial sediment



Source: WH Ireland research, CRM Australia, PYX Resources

Resource estimation is based on Inverse distance (ID3) interpolation of grade, density and mineralised interval. A spherical search range was set at 550m and block-model cell dimensions were set at X:Y:Z 100m:100m:variable.

Table 5: Mandiri – MRE (30 June 2021)

Category	Tonnage (Mt)	HM (%)	Slimes (%)	Oversize (%)
Inferred	126.3	7.43	8.98	16.14

Source: WH Ireland Research, PYX Resources

The mineral assemblage of Mandiri has been determined by laboratory analysis and past production records (Table 6). The Mandiri resource is currently estimated to the depth of the water table at a maximum of 11m below surface. There is potential to define additional resources below the water table.

Table 6: Mandiri – Mineral resource assemblage

Component	Zircon	Ilmenite	Rutile	Other	Waste + H ₂ O	Total
Relative %	68.0%	9.5%	8.5%	1.0%	13.0%	100%
Contained mineral	6Mt	0.84Mt	0.75Mt	0.09Mt	1.15Mt	8.82Mt

Source: WH Ireland Research, PYX Resources

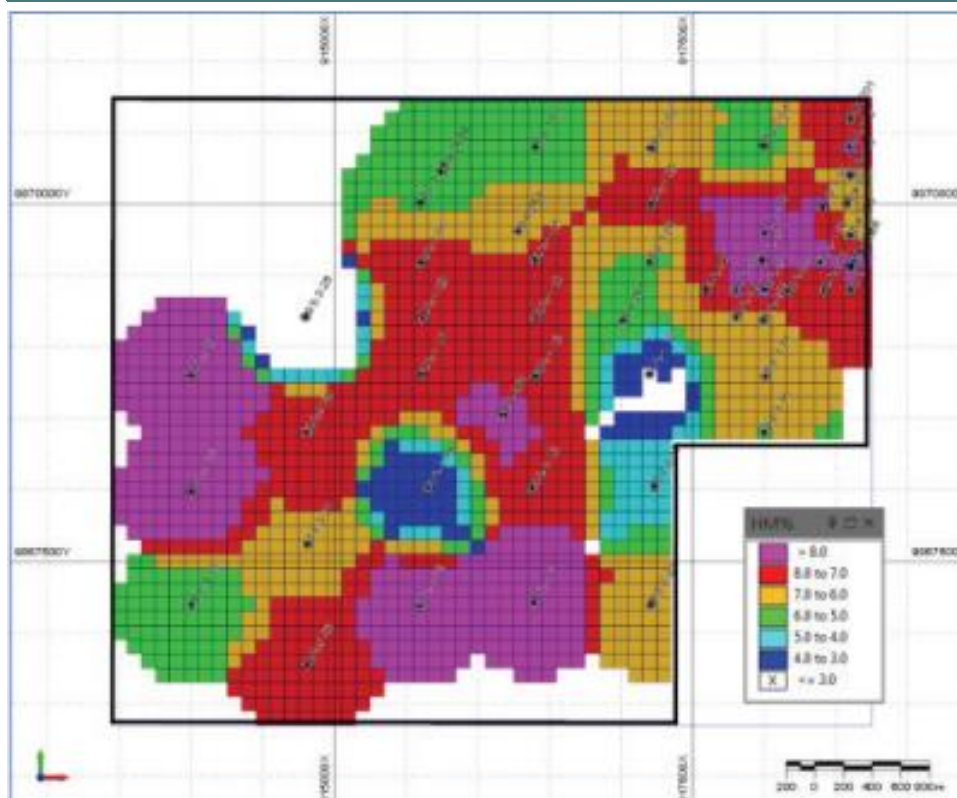
The Kalimantan region is known to host alluvial gold, and artisanal miners active at Mandiri recover gold before selling HMS to PYX. PYX has not assayed samples for gold and we recognise the potential to include gold as a value component of the resource.

Infrastructure and operations

Mandiri has been in operation since 2015 and has expanded to process 2,000tpd of HMS. HMS is purchased from artisanal miners after they recover gold; the efficiency of artisanal gold recovery is not known.

PYX pays the artisanal miners based on the production of high-grade (65.5%) zircon concentrate recovered from the HMS they deliver to PYX.

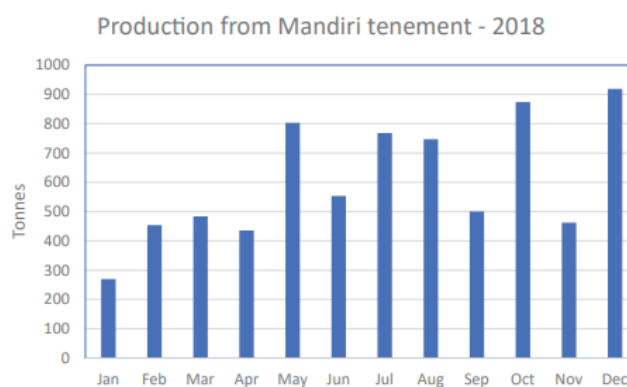
Figure 10: Level section of the Mandiri Resource



Source: WH Ireland research, CRM Australia, PYX Resources

2018 artisanal production tonnages from Mandiri demonstrate a variability of supply throughout the year (Figure 11); supply is greatest when rainfall is lowest.

Figure 11: Mandiri – Artisanal production



Source: WH Ireland research, CRM Australia, PYX Resources

The processing plant is 23km south of the Mandiri Project area. The plant incorporates the standard HM processing equipment in the form of dryers, gravity shaking tables, electro-static separators and electro-magnetic separators (Figure 12).

Figure 12: Processing plant – (Left: shaking table, Right: electrostatic & electromagnetic separators)



Source: WH Ireland research, CRM Australia, PYX Resources

Tisma deposit

Tisma hosts a large JORC-inferred resource.

Property location and description

Tisma is 110km from Mandiri and 50km northwest of Palangkaraya in central Kalimantan, Indonesia. The Tisma area is heavily vegetated (Figure 13).

Tisma consists of a single tenement (N0. 545/244/KPTS/VIII/2012) occupying an area of 1,500 hectares (Figure 14). The tenement is issued for exploration, production and export of zircon.

Geology and exploration history

Historically, the sedimentary basins of Central and Western Kalimantan have been mined for alluvial gold and, in some areas, also for diamonds. More recently, it has been recognised that the alluvium hosting the gold is also prospective for HMS. In 2017, Indonesia was ranked fourth in the world for zircon production, with production of 120,000 metric tonnes.

Tisma is an HMS placer deposit (zircon with minor rutile and ilmenite) developed in a flood plain. Gold has also been identified via visual inspection of panned concentrate. Placer sediment includes carbonaceous marl, shale, and coarse, quartz-rich sand. The placer deposit is a tabular body between 3.5m and 8.3m thick, below between 6m and 10m of overburden.

Figure 13: Tisma – Vegetation and drilling



Source: WH Ireland research, PYX Resources

Figure 14: Map of the Tisma concession area



Source: WH Ireland research, PYX Resources

There is clear evidence of artisanal exploration, probably related to alluvial gold exploration; historical production is not documented.

Resource

MRE was completed for the Tisma Project HMS deposit by CRM in November 2020 (Table 7). Mineral assemblages are presented in Table 8. The Tisma resource has been estimated based on auger and air-core (3" diameter) completed in 2020. Recovery was low initially and drilling methods were adapted in an attempt to improve core.

Thirty-six (36) air-core holes were completed to between 11.3m and 16.5m depth (average 13.0m). Drilling terminated at the base of alluvium, or if holes collapsed.

Drill collar locations (X,Y) were determined using handheld GPS, with an estimated accuracy of +/-15m. Elevation has not been recorded.

Resource estimation is based on Inverse distance cubed (ID3) interpolation of grade, density and mineralised interval. A spherical search range was set at 550m and block-model cell dimensions were set at X:Y:Z 200m:200m:variable.

The Kalimantan region is known to host alluvial gold. Samples have not been assayed for gold and there is potential to grow the resource by including gold analysis.

Table 7: Tisma – MRE (30 June 2021)

Category	Tonnage (Mt)	HM (%)	Zircon (%)	Slimes (%)	Oversize (%)
Inferred	137.2	3.99	3.27	14.75	24.90

Source: WH Ireland research, PYX Resources

Table 8: Tisma – Mineral resource assemblage

Component	Zircon	Ilmenite	Rutile	Other	Waste + H ₂ O	Total
Relative %	68.0%	9.5%	8.5%	1.0%	13.0%	100%
Contained mineral	6Mt	0.84Mt	0.75Mt	0.09Mt	1.15Mt	8.82Mt

Source: WH Ireland research, PYX Resources

Exploratory drilling covers most of the Tisma tenement to bedrock. There is little scope to expand the Tisma resource.

Mineral sands outlook

Mineral sands are old beach and dunal sands that contain significant proportions of “heavy” minerals, which have been separated out by physical processes (wave, wind, river, tide) due to their physical (and chemical) resistance and their specific gravity. They usually lie at or close to the surface and are unconsolidated, meaning they are easy to dig or dredge, and are separated firstly into heavy mineral concentrate (HMC) and then into their constituent parts by physical process – density, magnetic and electrostatic properties. Deposits actively form at the beach, with further upgrade possible due to wind on old dunes away from the sea. Due to changes in sea level, over time, there can also be a series of “fossil” deposits behind the new coast where the former coastline used to be.

Ilmenite [FeTiO₃] and **rutile** [TiO₂] are principally (90%) used as feedstocks to produce titanium dioxide (TiO₂) pigment for the manufacture of paints and other coatings (50%), plastics (25%) and paper as well as a number of other applications, including cosmetics, food additives, ceramics and textiles. TiO₂ pigment is favoured for its brilliant whiteness, ultraviolet protection, non-toxicity, inertness, and its “covering power” (it disperses light as a result of its high refractive index). Titanium metal and welding electrode applications account for the remaining 10% of global TiO₂ feedstock consumption. Titanium metal’s unique properties, including its high strength-to-weight ratio, high melting point and its resistance to corrosion and chemical attack make it the preferred metal for a number of demanding applications.

Zircon [ZrSiO₄] is an opaque, hard-wearing, inert mineral, belonging to the group of nesosilicates. Zircon’s chemical name, zirconium silicate, has a general chemical composition of 67% zirconia, 32% silica, and a small percentage of hafnium, typically about 1%. Zircon exists in varying colours including colourless, yellow-golden, red, brown, blue and green. After the mining and production of HMC, zircon is separated, beneficiated and commercialised as zircon sand (zircon). Zircon exists in many different forms, such as sand and flour, allowing it to be used in a wide range of applications.

The largest end-use sector of zircon is the ceramics industry, accounting for around 55% of all zircon used. Within the ceramics sector, zircon is mainly used as a raw material in the production of ceramic bodies, glazes, enamels, frits and pigments applied to traditional ceramics, including wall and floor ceramic tiles, porcelain tiles, sanitary ware, bathroom basins, dinnerware and industrial tiles. Its ability to be used as an opacity enhancer (whiteness), in combination with its hard-wearing characteristics, specifically water, heat, chemical and wear resistance, results in high demand for zircon within the ceramics industry.

As a raw material in ceramic glazes, increasing the zircon content enhances the resistance to corrosion and chemical attack. In advanced ceramic applications, such as the production of biocompatible ceramics, zircon is used as a raw material for the production of fused and chemically derived zirconia.

Other important uses of zircon include those in the foundry industry as a form of sand and milled sand for casing and refractory application. Its suitability for this purpose is largely due to its temperature stability, consisting of a high and stable melting point, high thermal conductivity range and low thermal expansion coefficient, as well as its low wettability by molten metal. Furthermore, zircon’s dielectric and piezoelectric properties make it highly suitable for use in the telecommunications and automotive sectors, and production of special electro-ceramics in aerospace. Zircon can also be commonly found in lead zirconate titanate (PZT) electroceramics, used in a wide range of products such as microphones, microwave dielectrics and radio frequency power capacitors.

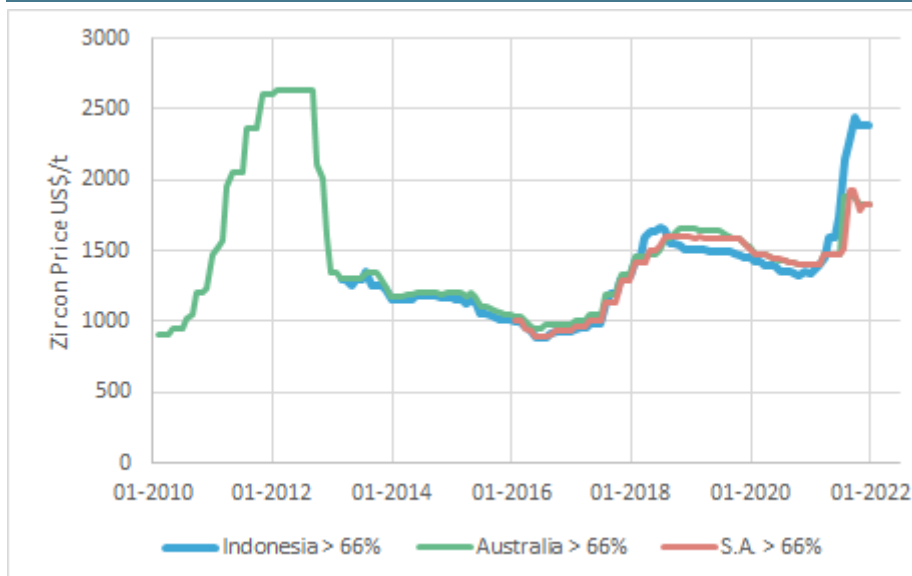
Zircon's growing usage and under-supply – especially for high-grade zircon – has fostered favourable market conditions; particularly, since existing reserves are being depleted, while a limited number of new large deposits have entered into operation over the past 20 years. Demand for zircon has been increasing rapidly since the year 2000, largely due to the growth in demand from China for zircon sand. In recent times, the chemical and foundry industry have been contributing significantly to growth in demand, exhibited by the increased market share of ceramic manufacturers with respect to global zircon consumption.

Zircon's wide-ranging applications are highly present in home, construction and design, as well as home appliances. Moreover, zircon is a key raw material in the field of medicine, fuel cells and industrial manufacturing processes.

Market overview

The widespread use of titanium and zirconium in industrial and consumer goods links demand with global GDP. There can be an element of seasonality in demand, especially in the northern hemisphere, where new housing and the summer “painting season” are all key drivers of consumption. The outlook for global GDP is expected to be good as we exit the COVID-19 pandemic and, in the context of all sorts of government support for the economy, we see a good outlook for mineral prices. The history of zircon pricing is summarised in Figure 15.

Figure 15: PYX – Zircon price history



Source: WH Ireland research, PYX Resources, Bloomberg

Outlook and price

The price of zircon, the main value component of PYX concentrate, has risen on five occasions since January 2021, increasing from \$1,316/t to \$2,305, and then recently in March 2022, to \$3,100/t. With continued high demand and scarcity of high-quality zircon, prices are expected to remain robust.

PYX's high-quality zircon is sought by high-tech buyers; the high-tech sector is projected to be the major source of growth in zircon demand in the coming years.

We set our long-term pricing in our fair value DCF at \$350/t for ilmenite, \$1,500/t rutile and \$2,000/t zircon.

Indonesia

Indonesia is an archipelago of more than 13,000 islands located between the Indian and Pacific Oceans. Its nearest neighbours include Timor-Leste, Papua New Guinea, and Malaysia (Figure 16). Located in the ring of fire of active volcanoes formed at tectonic margins, environmental hazards include, tsunamis, earthquakes, and volcanoes.

More than 700 languages are spoken in Indonesia with Malay, English and Dutch being the most widely spoken. Despite having a large population and high population density, Indonesia is the most heavily forested region on earth outside of the Amazon.

Indonesia gained independence from the Netherlands in 1945. Today, the governmental system is described as a Presidential Republic. Indonesia's system of civil law is based on the Roman-Dutch model and influenced by customary law.

In terms of Foreign Direct Investment and mining, we highlight the following:

- Indonesia is a significant player in the global mining industry and is considered to be one of the most mineral rich countries; it ranked 24th in the OECD global 2020 Best Foreign Direct Investment Opportunities Ranking, one of the highest among all mining jurisdictions.
- Indonesia received 2.3bn of Foreign Direct Investment into its mining sector in 2020 to support sustainable growth.
- Indonesia has a stable social environment with minimal interruption of production due to social disturbances.
- Indonesia is committed to continue improving its infrastructure, aiming to invest \$430bn on infrastructure by 2024, up 20% compared with the past five years.
- Indonesia has a long history of scientific exploration activity since the 1800s and exploration costs are relatively low in Indonesia; in 2020, the minimum monthly wage was established at \$204.
- Investments into mining projects is better protected after the introduction of the IUP-OP regime in 2009, replacing the Contracts of Works (CoW) regime.

Figure 16: Indonesia



Source: WH Ireland research, CIA Factbook

PYX board

Oliver B. Hasler – Chairman and Chief Executive Officer: Oliver is an accomplished Chief Executive, president and board member successfully leading world-class businesses and brands spanning multiple industries and markets, including natural resources, agroindustry, innovative manufacturing and various industrial sectors. He was named Top 50 CEO's in Spain by Forbes magazine.

Within a short time span of three years, he led the successful transformation of the publicly traded Spanish packaging company, Europac Group, into a mid-cap company, which was then acquired for a value exceeding \$2bn. Major projects that Oliver has participated in include a revision to the strategy of the Professional Division of Douwe Egberts, which is headquartered in the Netherlands, and its joint venture with US-based Mondelez, and the restructuring of France's Arc International.

Oliver has more than 20 years' experience of doing business in Asia, where he has built and operated factories, as well as setting up distribution networks throughout the region while managing significant export and import operations.

Oliver is a Swiss citizen with a degree in Materials Engineering and a master's degree in Metallurgy from the Federal Institute of Technology in Zurich, Switzerland and an MBA with Honours from the Universidad Iberoamericana in Mexico City. He is fluent in English, German, Spanish and French.

Gary J. Artmont – Non-Executive Director: Gary has 46 years of experience in the mining business operating in 21 countries and is familiar with all aspects of mineral exploration from grassroots to project pre-feasibility studies through to mining operations.

Gary is a fellow of the Australasian Institute of Mining and Metallurgy, AusIMM" #312718 qualified to write Ni 43-101 or JORC Competent Person reports. He is experienced in the management of large multifaceted regional and detailed exploration programmes in overseas locations with 14 years' experience working in tropical environments.

Gary has worked as a geologist and project manager for multiple organisations over the past four decades, including Geostar Consulting. Rio Tinto, PT Pelsart Indonesia, PT Freeport Indonesia and Ivanhoe Mining China.

Gary received a bachelor's degree from Waterloo University, Ontario.

Alvin Tan – Non-Executive Director: Alvin has more than 25 years' corporate experience in Australia and Asia, including mergers, acquisitions, capital raisings and listings on the Australian Stock Exchange (ASX), the AIM market of the London Stock Exchange, Kuala Lumpur Stock Exchange (KLSE) and the German Stock Exchange.

Alvin studied at the University of Western Australia, gaining a Bachelor of Commerce with honours, and subsequently was employed by KPMG in Kuala Lumpur from 1993-95 as a financial consultant. Returning to Australia, Alvin worked with the stockbroking firm of DJ Carmichael before pursuing other business interests. He was a founding director of various companies, which are now listed on the ASX. Alvin served on the board of ASX listed Advanced Share Registries Ltd and previously listed BKM Management Ltd. He also has interests in companies in technology, mining, exploration, property development, plantation and corporate services both in Australia and overseas.

During the past three years, Alvin has held the following directorships in other ASX-listed companies: Non-Executive Director of Advanced Share Registry Ltd (11 September 2007- 6 October 2020) and previously listed BKM Management Limited (5 February 2002- Current).

Bakhos Georges – Non- Executive Director: Bakhos has more than 40 years of experience in management and operation in the wholesale, retail and pharmaceutical sectors with significant direct involvement in internationally focused import and export operations.

Bakhos received the Order of Australia Medal (OAM) in 2019 for service to the community. He currently serves as Director of Saint Charbel's Aged Care Centre and is a Justice of the Peace (JP) in and for the State of New South Wales.

Bakhos received a B.Ph.Chem from the University of Santa Maria in Caracas, Venezuela, in 1982.

Shareholders

Significant shareholders are summarised below in Table 9.

Table 9: Top PYX shareholders (30 March 2022)

Shareholder	Shares (m)	Percentage holding (%)
Phoenix Fund Solutions Ltd.	92.5	21.2
Takmiur Spc Ltd.	84.1	19.3
Phoenician Group Ltd	62.6	14.3
TGN Holdings (Hk) Ltd.	51.6	11.8
Sino Ventures Ltd.	10.9	2.5
Total *	301.7	69.1%
Total PYX	437	100%

Source: WH Ireland research, S&P Capital IQ, PYX Resources

* 35.1% of shares are not in Public hands (i.e. held by Institutions, Private Corporation, and Individuals/Insiders).

Financials

We have constructed a future-looking financial model based on our cashflow inputs and outputs for PYX's operations (Table 10).

Table 10: Financial scenario							
Key ratios/metrics	2020	2021	2022E	2023E	2024E	2025E	2026E
EPS	(5.8)	(1.1)	2.0	1.9	5.4	8.3	17.5
P/E	(12.0)x	(65.4)x	34.2x	35.9x	12.8x	8.4x	4.0x
FCFPS	(1.2)	(0.8)	(0.3)	0.3	4.6	4.7	13.7
Dividend/share	-	-	-	-	-	-	-
Dividend yield	-	-	-	-	-	-	-
Weight average shares in issue	238	405	446	475	475	475	475
Currency	USD	USD	USD	USD	USD	USD	USD
Year-end June							
Income statement (\$m)	2020	2021	2022E	2023E	2024E	2025E	2026E
Revenue	9.0	12.4	33.9	34.6	63.4	87.4	167.5
Operating costs	(7.6)	(10.5)	(15.7)	(15.4)	(22.2)	(25.3)	(44.6)
Gross profit	1.3	1.9	18.2	19.1	41.2	62.1	123.0
Other	(7.1)	(1.3)	1.0	2.0	2.0	2.0	2.5
Overheads	(8.2)	(5.1)	(5.1)	(5.7)	(6.3)	(9.0)	(13.0)
Depreciation	(0.1)	0.0	(1.0)	(2.0)	(2.0)	(2.0)	(2.5)
Operating profit/(loss)	(14.1)	(4.5)	13.1	13.4	34.9	53.1	110.0
Other adjustments	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Profit before tax	(14.1)	(4.5)	13.1	13.4	34.9	53.1	110.0
Tax	0.3	0.2	(4.0)	(4.2)	(9.1)	(13.7)	(27.1)
Profit after tax	(13.8)	(4.3)	9.1	9.2	25.8	39.4	83.0
Balance sheet (\$m)	2020	2021	2022E	2023E	2024E	2025E	2026E
Non-current assets	1.7	76.1	86.8	99.3	99.3	113.3	124.8
Cash and cash equivalents	3.5	6.6	24.5	26.1	48.0	70.5	135.7
Other current assets	0.9	2.1	2.6	3.5	3.5	3.5	3.5
Current assets	4.4	8.7	27.1	29.6	51.5	74.0	139.2
Total assets	6.2	84.8	113.9	128.9	150.8	187.3	264.0
Total non-current liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total current liabilities	1.6	1.8	2.0	8.0	5.0	5.0	5.0
Total equity	4.5	83.0	111.9	120.9	145.8	182.3	259.0
Total equity and liabilities	6.2	84.8	113.9	128.9	150.8	187.3	264.0
Net assets	4.5	83.0	111.9	120.9	145.8	182.3	259.0
Cashflow statement (\$m)	2020	2021	2022E	2023E	2024E	2025E	2026E
Profit for the year	8.6	11.9	32.9	32.6	61.4	85.4	165.0
Depreciation	0.1	0.0	1.0	2.0	2.0	2.0	2.5
Other	(10.8)	(14.2)	(25.0)	(23.4)	(39.5)	(48.9)	(86.3)
Cash from operating activities	(2.1)	(2.3)	8.9	11.1	23.9	38.5	81.2
Net cash used in investing	(0.8)	(1.1)	(10.0)	(9.5)	(2.0)	(16.0)	(16.0)
Net cash used in financing	6.3	6.8	19.0	0.0	0.0	0.0	0.0
Net change in cash and cash	3.4	3.4	17.9	1.6	21.9	22.5	65.2
Opening cash and cash equiv.	0.1	3.5	6.6	24.5	26.1	48.0	70.5
Effect of FX	0.1	(0.3)	0.0	0.0	0.0	0.0	0.0
Closing cash and cash equiv.	3.5	6.6	24.5	26.1	48.0	70.5	135.7

Source: WH Ireland research estimates

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As at the quarter ending 31 March 2022 the distribution of all our published recommendations is as follows:

Recommendation	Total Stocks	Percentage %	Corporate	Percentage %
Corporate	61	96.8	61	100.0
Buy	2	3.2	0	0.0
Speculative Buy	0	0.0	0	0.0
Outperform	0	0.0	0	0.0
Market Perform	0	0.0	0	0.0
Underperform	0	0.0	0	0.0
Sell	0	0.0	0	0.0
Total	63.0	100.0	61.0	100.0

Valuation and Risks

For details relating to valuation and risks for subject issuers, please refer to the comments contained herein or in previously published research reports or sector notes.

Time and date of recommendation and financial instruments in the recommendation

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A draft of this research report has been shown to the company following which factual amendments have been made.

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Company/Issuer Disclosures

Company Name	Table of interest number	12-month recommendation history	Date
PYX Resources (PYX)	4,5	Corporate	05.04.22

<https://www.whirelandplc.com/capital-markets/research-recommendations>

Companies Mentioned

Company Name	Recommendation	Price	Price Date/Time
Iluka Resources Limited	No Rec	AUD 11.29	30/03/2022 16:30
Kenmare Resources plc	No Rec	GBP 4.73	30/03/2022 16:30
Base Resources Limited	No Rec	GBP 0.18	30/03/2022 16:30

Headline	Date
A high-margin producer of premium zircon	05.04.2022

Recommendation	From	To	Analyst
Corporate	05.04.2022	present	CA

Current Analyst (CA), Previous Analyst (PA)

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