

Rare Earth Minerals Monthly Report

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Outlook

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China Bastnaesite and Monazite Imports Up in December 2022

In December 2022, China imported █████ tonnes of high-grade bastnaesite mineral concentrate from the U.S., █████ more than it imported the month prior and █████ more than it imported the same month the year prior.

In December 2022, China imported █████ tonnes of low-grade monazite mineral concentrate, █████ more than it imported the month prior (following large shipment from Madagascar) and █████ more than it imported the same month the year prior.

In December 2022, China imported █████ tonnes of high-grade monazite mineral concentrate, █████ less than it imported the month prior and █████ less than it imported the same month the year prior.

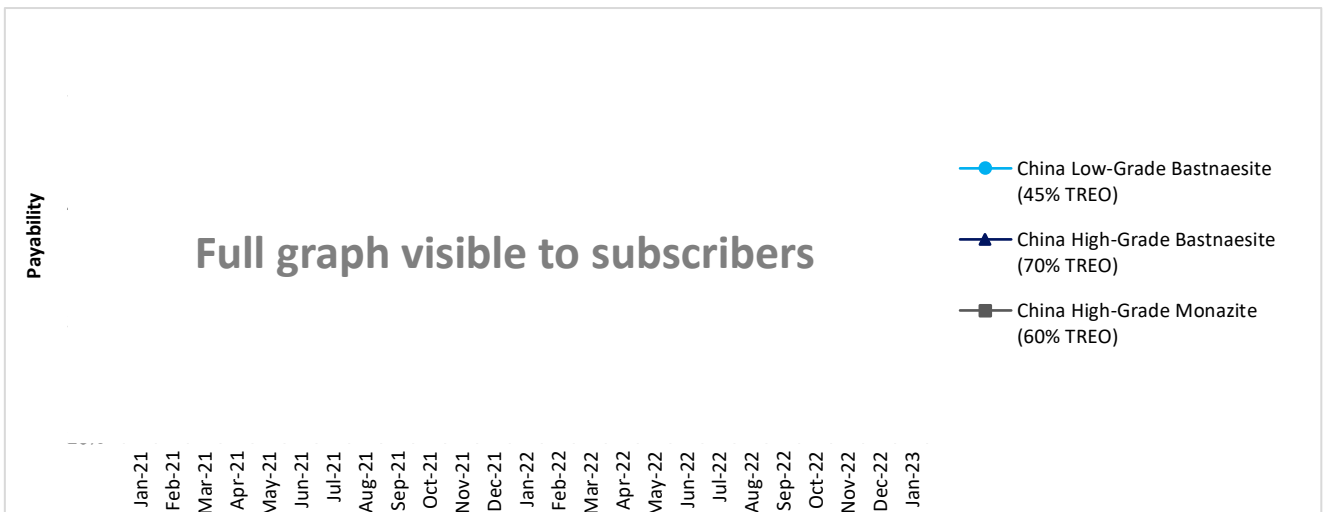
China Domestic Bastnaesite and Monazite Prices Increased Modestly in January 2023

After rising █████ in December 2022, the price of China domestic low grade (45% TREO) bastnaesite concentrate increased another █████ in January 2023, totaling █████ per kilogram at month-end.

Similarly, after rising █████ and █████ in December 2022, respectively, the price of China domestic high grade (70% TREO) bastnaesite concentrate rose another █████ in January 2023 to █████ per kilogram and the price of China domestic high grade (60% TREO) monazite concentrate rose █████ to █████ per kilogram.

Overall, China domestic low grade (45% TREO) and high grade (70% TREO) bastnaesite concentrate payability ratios went unchanged in January 2023 at █████ and █████ respectively, while that of China domestic high grade (60% TREO) monazite concentrate rose from █████ to █████

Mineral Concentrate Payability Ratios in January 2023





Supply-Side Market Developments

Sheffield's Thunderbird: Future Producer of Low-Grade Monazite?

Sheffield Resources continues to make headway at its fully funded Thunderbird ilmenite and zircon mining project in Western Australia, a joint venture with Chinese steel producer Yansteel.

The project is the largest of its kind under development globally and has received AUD \$160 million in support from the nation's Northern Australia Infrastructure Fund ("NAIF") since 2018. First production is targeted for 2024.

With incumbent zircon and ilmenite miners Iluka, Rio Tinto and others developing ways to concentrate and monetize the monazite (and xenotime) in production streams from similar deposits, it begs the question as to what if anything Thunderbird may bring to the rare earths market.

According to a Thunderbird Ore Reserve Update announcement from Sheffield in March 2022, the project will produce a paramagnetic concentrate ("PMC") stream containing 26% TiO₂, 8% ZrO₂ and "small quantities of monazite".

Adamas take: In years 1 through...

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Iluka Resources Advancing at Eneabba and Wimmera

As per Iluka's latest quarterly review announced late last month, bulk earthworks and ground improvement activities continue to progress at its Eneabba refinery project in Western Australia.

Importantly, the company achieved financial close on its strategic partnership with the Australian Government in calendar Q4 and first loan utilization in December 2022.

Moreover, Iluka aims to complete a PFS on its Wimmera project in Victoria in early-2023. The REE assemblage at Wimmera is similar to that in Iluka's Eneabba stockpile (albeit with more xenotime and thereby a greater relative concentration of heavy rare earths) making it a potential supplementary source of feedstock for the Eneabba plant.

Once operational, the AUD \$1.0 - \$1.2 billion Eneabba refinery will have capacity to produce 23,000 tonnes of TREO per annum (or 17,500 tonnes per annum from "various feed blends"). First production is targeted for 2025.

China Bastnaesite Concentrate Imports Hit Record Levels in 2022

In 2022, China imported ██████████ tonnes of bastnaesite mineral concentrate from the U.S., ██████████ more than it imported the year prior, according to China Customs data analyzed by Adamas.

In total, the value of China's imports from the U.S. amounted to ██████████ million last year, up by a whopping ██████████ over the year prior, and the average price paid for bastnaesite concentrate imports from the U.S. throughout the year was ██████████ per kilogram,

up ██████████ from ██████████ per kilogram in 2021.

Adamas take: Particularly...

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China Monazite Concentrate Imports Fell in 2022

In 2022, China imported ██████████ tonnes of monazite concentrate from abroad, ██████████ less than it imported the year prior, due mostly to a ██████████ drop in imports from Madagascar year-over-year.

Similarly, monazite concentrate imports from Brazil dropped ██████████ year-over-year in 2022 and imports from Thailand fell ██████████. Conversely, monazite imports from Vietnam jumped ██████████ year-over-year in 2022, while imports from Nigeria and Malaysia rose ██████████ and ██████████ respectively.

In total, the value of China's monazite imports amounted to ██████████ million last year, up by a massive ██████████ over the year prior, and the average price paid for monazite concentrate imports throughout the year was ██████████ per kilogram, up ██████████ from ██████████ per kilogram in 2021.

Adamas take: Madagascar was...

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Demand-Side Market Developments

Record EV Sales and NdFeB Magnet Consumption in 2022

In 2022, global passenger EV sales (HEVs, PHEVs and BEVs) totaled a record million units, up year-over-year in the face of the pandemic, strong economic headwinds and persistent auto industry bottlenecks that continue to hinder overall vehicle production.

With record EV sales came record NdFeB magnet consumption in permanent magnet synchronous motors (“PMSMs”). Overall, of passenger EVs sold globally in 2022 contained one or more PMSMs for driving the vehicle, up from the year prior.

In total, global NdFeB magnet consumption in the traction motors of newly-sold EVs amounted to tonnes in 2022, up year-over-year as PMSMs continue to dominate the EV industry.

For more information on the EV and motor markets, check out our “EV Motor Materials Monthly” subscription-based report.

Adamas take: Another...

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Drop in Overall Automobile Sales in 2022

In 2022, global passenger vehicle sales totaled million units, down from the year prior due to pervasive microchip shortages and pandemic-related manufacturing challenges.

Adamas take: With automobile micromotors, sensors and...

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Drop in Consumer Electronics Sales in 2022

In 2022, global PC shipments (a barometer for the consumer electronics sector) dropped 16.2% year-over-year to 286.2 million units according to Gartner, the greatest annual fall on record.

The drop comes on the back of concerns about a global recession, rising inflation and painfully higher interest rates, but is also a function of the fact that most consumers already have relatively new PCs that were purchased during the pandemic (as reflected in our “Rare Earth Magnet Market Outlook to 2035” report).

Similarly, in 2022 global smartphone shipments fell by 12.1% to 1.2 billion units according to Counterpoint, the lowest annual sales since 2013.

“The war in Ukraine, inflationary pressures, economic uncertainty and macroeconomic headwinds kept the consumer sentiment weak in 2022 while smartphone users reduced the frequency of their purchases”, the company noted.

Adamas take: With consume...

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China Rare Earth Exports Down in 2022, Increasingly Exporting More Value-Added Products

According to data from China Customs, the nation exported tonnes of rare earth oxides, chemicals, compounds, metals and alloys (excluding magnets) in 2022, less than it exported the year prior.

Overall, while exports of crude rare earth materials are slowing, China’s exports of value-added products and materials, from magnets to motors to EVs, is on the rise.

China NdFeB Magnet Exports Up in 2022, Germany and the U.S. Biggest Consumers

In 2022, China exported tonnes of NdFeB magnets globally, more than the tonnes it exported the year prior, according to China Customs data analyzed by Adamas.

In total, the nation exported billion worth of NdFeB magnets in 2022, up over the billion worth of magnets it exported in 2021.

Surpassing the U.S., Germany was the largest importer of China-made NdFeB magnets globally in 2022, importing tonnes of NdFeB, more than the nation imported the year prior.

In a distant second place, the U.S. imported tonnes of NdFeB magnets from China in 2022, less than it imported the year prior as some manufacturers in the nation import components and assemblies with magnets pre-installed from Mexico, Canada, Japan, China and elsewhere rather than the individual magnets themselves.



Mineral Concentrate Trade Flows

China High-Grade Bastnaesite Imports from the U.S. Up 22.1% in December 2022

In December 2022, China imported ██████████ tonnes of high-grade bastnaesite mineral concentrate from the U.S., ██████████ more than it imported the month prior and ██████████ more than it imported the same month the year prior.

The average price paid for U.S. bastnaesite mineral concentrate imports in China in October 2022 was ██████████ per kilogram, ██████████ lower than the month prior and ██████████ lower than the same month the year prior.

China Low-Grade Monazite Imports Surge 1,928% in December 2022 Following Shipment from Madagascar

In December 2022, China imported ██████████ tonnes of low-grade monazite mineral concentrate, ██████████ more than it imported the month prior and ██████████ more than it imported the same month the year prior.

The average price paid for low-grade monazite mineral concentrate imports in China in December 2022 was ██████████ per kilogram, ██████████ lower than the month prior but ██████████ higher than the same month the year prior.

China High-Grade Monazite Imports Down 62% in December 2022 on Drop from Nigeria, DRC, Thailand

In December 2022, China imported ██████████ tonnes of high-grade monazite mineral concentrate, ██████████ less than it imported the month prior and ██████████ less than it imported the same month the year prior.

The average price paid for high-grade monazite mineral concentrate imports in China in December 2022 was ██████████ per kilogram, ██████████ higher than the month prior and ██████████ higher than the same month the year prior.

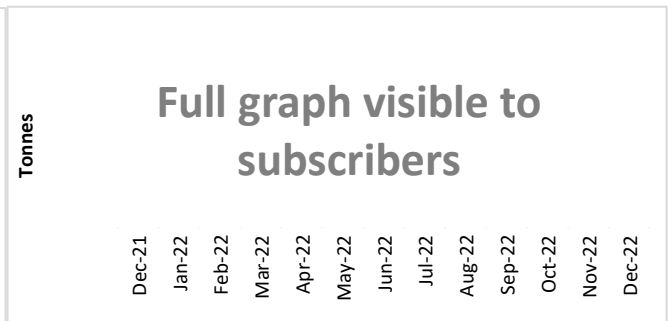
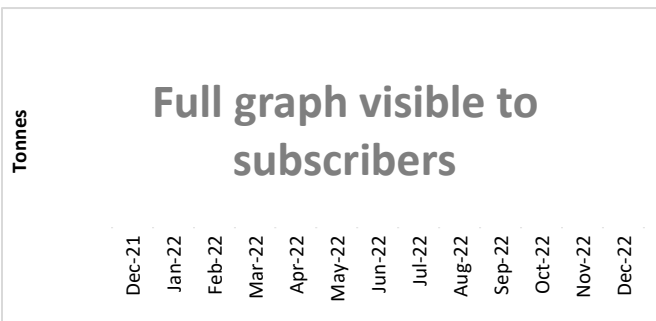
China Bastnaesite Imports Expected to Rise, Monazite Imports Expected to Fall in January 2023

MP Materials' past two shipments to China have been below average (one due to a scheduled maintenance shutdown) leading us to expect a rise in January.

Conversely, following a surge in monazite imports in December, mostly from Madagascar, we expect China's January monazite imports to be lower.

China Bastnaesite Concentrate Imports

China Monazite Concentrate Imports



High Grade Bastnaesite	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
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Low Grade Monazite	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
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Full table visible to subscribers

High Grade Monazite	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
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Bastnaesite Concentrate Price Developments

China Domestic Low-Grade Bastnaesite Mineral Concentrate Price Up Another 5% in January 2023

After posting a major rise in December 2022, in January 2023 the price of low-grade (45% TREO) bastnaesite concentrate in China rose another to per kilogram.

As of early February 2023, the prices of Nd and NdPr oxide in China were trending slightly lower, adding impetus for bastnaesite prices to follow suit.

China Domestic High-Grade Bastnaesite Mineral Concentrate Price Up Another 5% in January 2023

After leaping higher in December 2022, in January 2023 the price of high-grade (70% TREO) bastnaesite concentrate in China rose another to per kilogram, propped up by a pre-China-holiday rise in Nd, Pr and NdPr oxide prices.

As of early February 2023, the prices of Nd and NdPr oxide in China were edging incrementally lower, weakening the outlook for bastnaesite prices in the month ahead.

China Bastnaesite Import Price Down 1% Month-over-Month in December 2022

In December 2022, the average price paid for high-grade (62% TREO) bastnaesite concentrate imports from the U.S. was per kilogram, lower than the month prior and more than lower than April's record-high.

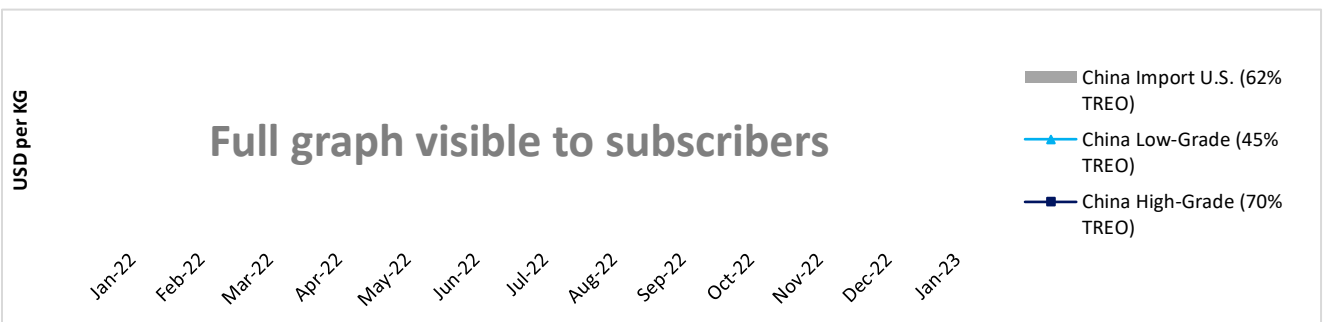
With Nd and NdPr oxide prices strengthening in December and January, we expect the January 2023 bastnaesite import price to rise modestly before falling again in February.

January Import Price Expected to Notch Higher While February China Domestic Prices Expected to Fall on February Rare Earth Oxide Price Weakness

With China domestic concentrate prices leading import prices, we expect bastnaesite import prices to notch higher in January before falling again in February.

Similarly, after following magnet rare earth oxide prices up in December and January, we expect China domestic bastnaesite concentrate prices will fall slightly in February on current rare earth oxide price weakness.

January Import Price Expected to Notch Higher While February China Domestic Prices Expected to Fall on February Rare Earth Oxide Price Weakness



(USD per KG)	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23
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Monazite Concentrate Price Developments

China Domestic High-Grade Monazite Mineral Concentrate Price Up 3% in January 2023

In January 2023, the month-end price of China domestic monazite mineral concentrate was up from the month-end prior, led by comparable movements in NdPr and Nd oxide input prices over the same period.

Madagascar Low-Grade Monazite Import Price Down 6% in December 2022

In December 2022, the price of low-grade monazite concentrate imports from Madagascar was per kilogram, lower than the previous shipment made in September 2022.

Brazilian, Vietnam Low-Grade Monazite Import Prices Mostly Unchanged in December 2022

In December 2022, the price of low-grade monazite concentrate imports from Brazil and Vietnam were down and , respectively, from the previous shipment periods.

Nigerian High-Grade Monazite Import Price Up 26%, DRC Down 27% in December 2022

In December 2022, the price of high-grade monazite concentrate imports from Nigeria and the DRC were up and down and , respectively, versus the month prior.

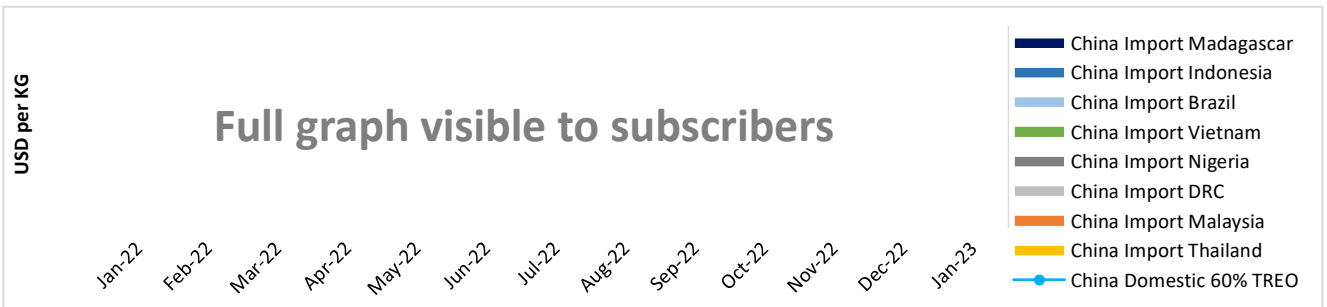
Malay High-Grade Monazite Import Price Down X%, Thai Down 7% in December 2022

In December 2022, the price of high-grade monazite concentrate imports from Malaysia and Thailand were down and , respectively, from the previous shipment periods.

December 2022 Rare Earth Oxide Price Increases to Propel January 2023 Monazite Import Prices Higher While February Domestic Monazite Prices Fall

We expect January 2023 monazite import prices to rise on the back of December 2022 rare earth oxide price increases. Conversely, we expect the China domestic monazite price to drop in February, undercut by a comparable drop in rare earth oxide prices.

January and February 2023 Import Prices Expected to Bounce Back on December 2022 and January 2023 Rare Earth Price Gains



(USD per KG)	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23
China Domestic 60% TREO													
Δ MoM													
China Import Madagascar													
Δ MoM													
China Import Indonesia													
Δ MoM													
China Import Brazil													
Δ MoM													
China Import Vietnam													
Δ MoM													
China Import Nigeria													
Δ MoM													
China Import DRC													
Δ MoM													
China Import Malaysia													
Δ MoM													
China Import Thailand													
Δ MoM													

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Rare Earth Oxide Price Developments

NdPr Oxide Price Up 4.6%, Nd Oxide Up 3.6% and Pr Oxide Up 3.2% in January 2023

In January 2023, the month-end NdPr oxide price was up \uparrow , the month-end Nd oxide price was up \uparrow , and the month-end Pr oxide price was up \uparrow over the month-end prior, lifted by the loosening of China lockdowns and a pre-China-holiday upswing in demand.

Spot market NdPr oxide and Nd oxide prices were around $\$$ and $\$$ per kilogram, respectively, at January month-end, versus a lower $\$$ and $\$$ per kilogram, respectively, quoted by China Northern Rare Earth Group as of early February 2023.

Dy Oxide Price Up 1.2% in January 2023, Gains Erased in Early February

Following an \uparrow jump in December, the January month-end price of Dy oxide was up another \uparrow month-over-month but those gains were erased in early February as China domestic and China export prices notched lower.

As of early February, the price of Dy oxide in China was trending slightly lower following a late-year surge in heavy rare earth feedstocks from Myanmar.

Tb Oxide Price Up 1.9% in January 2023, Holding Firm as of Early February

Following a \uparrow leap in December, the January month-end price of Tb oxide was up another \uparrow over the month-end prior.

As of early February, the price of Tb oxide in China was holding steady, foreshadowing a quiet month ahead for Tb prices.

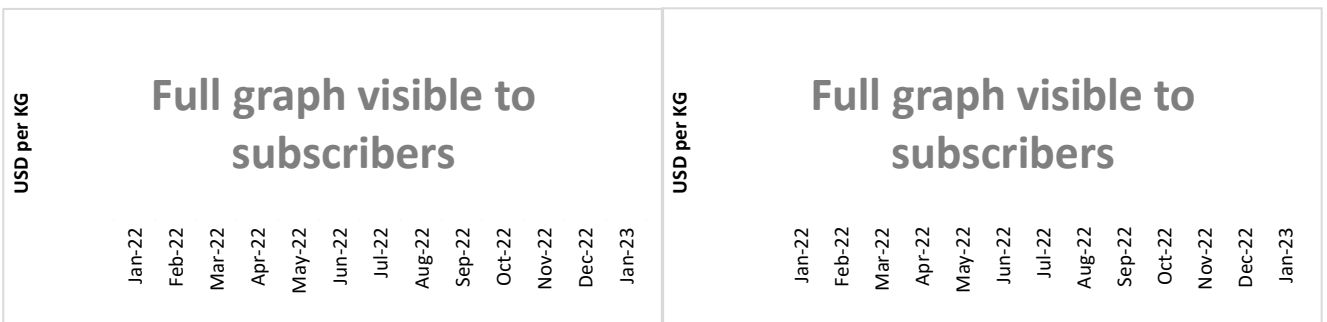
Post Holiday Lull in Demand, Surge in End-of-Year Concentrate Imports to Put Downward Pressure on Prices in February

With December's upward momentum in tow, mag-REO prices rose modestly higher in January, lifted by the loosening of China lockdowns and an upswing in demand in advance of the Chinese holiday season.

In early February, prices of lights and heavies were trending slightly lower on a post-holiday lull in demand and a surge in end-of-year concentrate imports now percolating through China's supply chain.

We believe prices will continue to perform poorly through February, giving up all or more of January's gains by month-end.

Post Holiday Lull in Demand, Surge in End-of-Year Concentrate Imports to Put Downward Pressure on Prices in February



(USD per KG)	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23
NdPr Oxide													
Δ MoM													
Nd Oxide													
Δ MoM													
Pr Oxide													
Δ MoM													
Dy Oxide													
Δ MoM													
Tb Oxide													
Δ MoM													

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* Prices reflect the estimated global volume-weighted average at month-end (including 13% VAT) converted to USD at month-end FX rates
 Source: Adamas Intelligence's "EV Motor Materials Monthly" subscription-based report



Mineral Concentrate Payability Ratios

Low-Grade Bastnaesite Payability Ratio Unchanged in January 2023

In January 2023, the TREO basket value of China domestic low-grade bastnaesite concentrate (45% TREO) rose while the price of concentrate increased by a lower .

As a result, the payability ratio of China domestic low-grade bastnaesite concentrate increased slightly in January 2023 but went unchanged at when rounded to the nearest percent.

High-Grade Bastnaesite Payability Ratio Unchanged in January 2023

Similarly, in January 2023 the TREO basket value of China domestic high-grade bastnaesite concentrate (70% TREO) rose while the price of concentrate increased by a lower .

As a result, the payability ratio of China domestic high-grade bastnaesite concentrate increased slightly in January 2023 but went unchanged at when rounded to the nearest percent.

High-Grade Monazite Payability Ratio Rose in January 2023

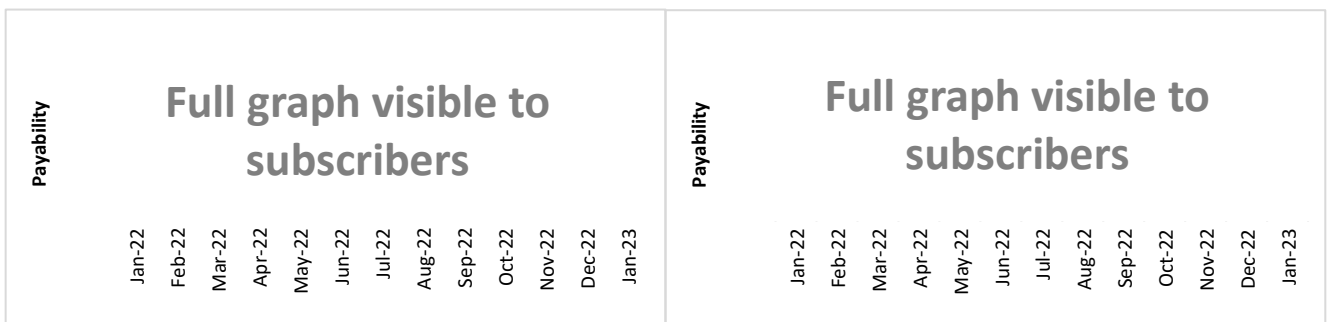
In January 2023, the TREO basket value of China domestic high-grade monazite concentrate (60% TREO) rose by while the price of concentrate increased by a greater , propping up the payability ratio versus the month prior.

In January 2023, the payability ratio of China domestic high-grade monazite concentrate rose from to .

Payability Ratios Expected to see Little Change in February As Rare Earth and Concentrate Prices Cool Off

With the rare earths market in a post-holiday quiet period and prices cooling off, we expect mineral concentrate payability ratios will see little change, if any, in February 2023 as both oxide and concentrate prices recede.

Payability Ratios Expected to see Little Change in February As Rare Earth and Concentrate Prices Cool Off



(USD per KG)	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23
China Low-Grade Bastnaesite (45% TREO)													
China High-Grade Bastnaesite (70% TREO)													
China High-Grade Monazite (60% TREO)													

Full table visible to subscribers

Payability ratio = [(Concentrate Price* / % TREO in Concentrate) / TREO Basket Value of Concentrate] x 100%
 * Concentrate price less reseller margin for imported and resold material

Source: Adamas Intelligence

Monthly Outlook

December Rare Earth Price Strength to Fuel a Rise in January China Concentrate Import Prices

With China domestic concentrate prices leading import prices, we expect bastnaesite and monazite import prices to increase modestly in January 2023 on the back of December’s noteworthy rare earth oxide price increases. Similarly, in February 2023, we expect bastnaesite and monazite import prices to increase slightly on the back of January’s slight rare earth oxide price increases.

February Rare Earth Price Weakness to Fuel Dip in February China Domestic Concentrate Prices

After following magnet rare earth oxide prices up in December and January, we expect China domestic bastnaesite and monazite concentrate prices will fall slightly in February on current rare earth oxide price weakness.

Consumer Confidence Improving in China, Europe the U.S. and Japan

As of February 2023, consumer confidence continues to increase in all key demand markets globally. This is a positive signal for consumer-driven rare earth demand.

Manufacturing PMI Inching Cautiously Higher in January 2023

In January 2023, China, Europe and the U.S. recorded manufacturing purchasing managers’ index (“PMI”) increases. This is a positive signal for automotive, renewable power and industrial-driven rare earth demand.

Speed and Extent of China Economic Recovery Key to Near-Term Price Performance

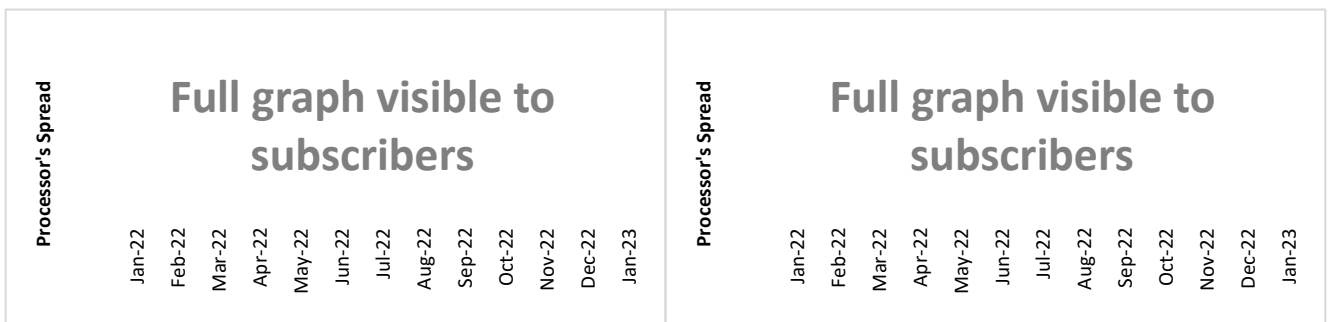
The quicker and deeper the economic recovery in China the greater the latent demand pop that can be enabled by rising consumer and manufacturer confidence.

Nominal Spread Between Basket Value and Contained Value Up for All Concentrate Types in January 2023

In January 2023, the “processor’s spread” for China low-grade (45% TREO) and high-grade (70% TREO) bastnaesite concentrate increased and , respectively.

Moreover, in January 2023 the processor’s spread for China high-grade (60% TREO) monazite concentrate rose .

Nominal Spread Between Basket Value and Contained Value Up for All Concentrate Types in January 2023



(USD per KG)	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23
China Low-Grade Bastnaesite (45% TREO)	<h2>Full table visible to subscribers</h2>												
China High-Grade Bastnaesite (70% TREO)													
China High-Grade Monazite (60% TREO)													

* Processor’s Spread = TREO Basket Value – Value of TREO Contained in Concentrate



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Important Notes:

All prices referred to herein are in U.S. dollars unless specified otherwise.

Due to rounding, numbers presented throughout each monthly report may not add up precisely to the totals provided and percentages may not precisely reflect the absolute figures.