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Chrome Ore

Global Dynamics, South African Leadership, and Strategic Trading Outlook

MAY

2025

OVERVIEW

The global chrome ore market is a key part of the mineral trade, mainly because chrome is used to make stainless steel, car parts, and strong special metals that can handle extreme heat, pressure, and corrosion. These strong metals are essential in industries like aerospace, defense, and chemical processing. Chrome ore is mined mostly from two types of deposits and is used to make ferrochrome and pure chromium, materials found in almost everything ranging from kitchenware to missile parts. Even the chemical industry uses chromium for leather tanning, wood treatment, and making pigments and dyes.

South Africa remains the leading global producer, contributing approximately 40% of global supply and possessing the largest known reserves. However, its dominance is increasingly challenged by rising electricity tariffs, persistent logistical constraints, and intensifying global competition, particularly from China and Turkey.

Despite these challenges particularly faced by the country that drives the chrome market, the industry recorded notable growth in 2023, with chrome ore trade volumes reaching an estimated $7.57 billion, representing a 65.5% year-on-year increase, largely attributed to the stainless steel sector's expansion.

This report provides a concise overview of the chrome ore market landscape and offers strategic insights for prospective traders, highlighting key risks, opportunities, and practical guidelines to support informed decision-making and sustainable participation in the trade.

Overview of the Mineral

Chromite is a brownish-black mineral composed primarily of iron, oxygen and chromium (a naturally occurring metal). In its purest form, it comprises chromium at 68% and iron oxide at 32%.

There are two main types of chromite deposits:

1. Stratiform Deposits – These are found mainly in South Africa, Canada, Finland, and Madagascar.
2. Podiform Deposits – These occur primarily in Kazakhstan, Turkey, and Albania.

Zimbabwe is the only country known to have significant reserves of both types of chromite deposits.

Chromite is the sole ore mineral of metallic chromium and its compounds, it is vital in various industrial sectors. It is a primary component in stainless steel production and is also used to improve the heat-resistance of other metals.
About 50% of global chromite production is utilized in stainless steel manufacturing, and there has been no replacement for chromium yet, which is a key component. According to the International Chromium Development Association (ICDA), about 95% of chromite mined globally is metallurgical grade — meaning it has the right quality and chromium content to be used in producing ferrochrome, an essential ingredient in stainless steel. Chromite is typically classified based on its elemental composition and what it is best used for, including:
High-chromium chromite (46–55% Cr_2O_3): Mostly used in the steel industry, where it is melted down in special electric furnaces to produce ferrochrome, a key ingredient in stainless steel.
High-iron chromite (40–46% Cr_2O_3): More often used to make chemicals and pigments, rather than steel.
Foundry grade chromite (with low silica and 44-46% Cr_2O_3): Used in foundries to produce high-precision steel castings with smooth surfaces.
Refractory grade chromite (with 33–38% Cr_2O_3 and higher aluminum): Used to make heat-resistant bricks and other materials for high-temperature industrial furnaces.

Chromite Ore Applications

Chromium, a key component of chromite ore, possesses remarkable properties such as high resistance to corrosion and tarnishing, the ability to form alloys that improve strength and durability, a high melting point, and chemical stability. Due to these characteristics, chromite ore is

Fig 1: Stratiform and Podiform

Stratiform deposits are seen as flat and layered in shape, are easier to mine and account for 95% of the world's chromite reserves.

Podiform deposits are irregular and pod-like in shape, more difficult to mine and account for about 5% of global chromite reserves.

Source: International Chromium Development Association

widely used in a range of applications, such as:

- Chrome plating and alloying: Essential for the production of corrosion-resistant superalloys, nichrome, and stainless steel.
- Refractory materials: Used to line the inside of furnaces and containers that hold molten metal, so they do not melt or break under extreme heat during metal production.
- Leather tanning: to prepare and treat animal hides so they can be turned into soft, durable leather.
- Pigments and dyes: Utilized in the production of vibrant pigments and dyes.
- Gemstones: Responsible for the green colour in emeralds and the red colour in rubies.
- Aerospace Industry: Used to make parts for aircraft engines and landing gear.

Typical Extraction and Beneficiation Process

When it comes to mining chromite, the method used depends on several important factors such as the type and quality of the ore, environmental impact, available equipment and technology, and how profitable the operation is expected to be. One special factor in the mining of chromite is to consider the presence of leftover rocks from platinum mining, which may contain usable chrome (referred to in the industry as UG2 tailings).

There are two main ways to mine chromite:

- **Open-pit mining:** This method is used when the ore is close to the surface. It's cost-effective and allows for the extraction of large amounts of material.
- **Underground mining:** This is used when the ore is deeper underground and requires more complex and costly techniques to reach it. The choice between these methods mostly depends on how deep the chromite deposit is located.

Once the ore is mined, it's called **Run-of-Mine (ROM) chromite**, basically raw material that still contains other unwanted minerals. Before it can be used, this raw ore has to go through a process called beneficiation, which cleans it up and increases its chromium content, turning it into a more valuable product known as **chrome concentrate.**

Sometimes, larger chunks of chromite called **lumpy ore** are separated out directly from the mine or from the ROM. These chunks typically range in size from 10mm to 300mm and need to be crushed and sorted before they can be used.

The end product, chrome concentrate, is a more refined form of chromite that typically contains 46% to 52% chromium oxide (Cr_2O_3). Its higher chromium content makes it more valuable and especially useful in industries that require strong, heat- or corrosion-resistant materials, such as protective coatings.

Beneficiation

After the initial crushing and grinding typically using jaw crushers (Fig 2) followed by ball or rod mills (Fig 3) to increase the surface area for effective mineral liberation, the ore undergoes screening. This step classifies the material into various size fractions using equipment such as circular or linear vibrating screens (Fig 4).

The next stage is gravity separation, which takes advantage of the difference in density between chromite and the surrounding unwanted materials typically referred to as gangue. Since chromite is significantly denser, separation is achieved using devices like jigs, spiral concentrators (Fig 5), and shaking tables (Fig 6).

Following gravity separation is the magnetic separation process. Although chromite exhibits weak magnetic properties which can impede its efficacy, this method has gained wide acceptance due to its simplicity, ease of control, and adaptability. It can enhance the ore grade by 4% to 10%.

The final stage involves dewatering and drying to produce a market-ready product. The result of this comprehensive beneficiation process is a **chrome concentrate** with a Cr_2O_3 content ranging between 46% and 52%, suitable for metallurgical and industrial applications alongside tailings which are the remaining waste materials.

Fig 2: Jaw Crusher

Fig 3: Ball Mill

Fig 4: Linear Vibrating Screen

Fig 5: Spiral Concentrators

Fig 6: Shaking Tables

Ferrochrome

Ferrochrome (FeCr) is primarily an iron-chromium alloy, though it may also contain additional elements such as silicon, aluminum, and manganese to achieve specific performance characteristics. Approximately 80% of the world's ferrochrome production is utilized in the manufacture of stainless steel, which typically contains around 18% chromium, with a minimum chromium threshold of 10.5% to qualify as stainless steel.

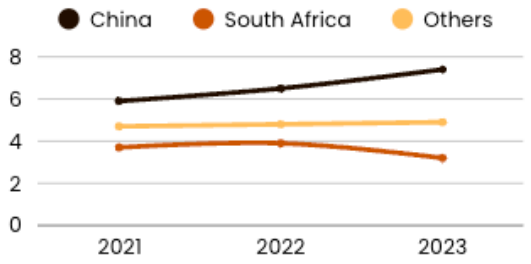
Ferrochrome is typically produced through the reduction of chrome concentrate with coke in an electric arc furnace.

The resulting alloy is classified based on its carbon content into the following categories:

- High Carbon Ferrochrome (HC FeCr): Contains 4% to 9% carbon. It is the most commonly produced and widely used grade, particularly in the manufacturing of stainless steel and other high-strength, wear-resistant chromium alloys.
- Medium Carbon Ferrochrome (MC FeCr): Contains 0.5% to 4% carbon, offering a balance between hardness and ductility.
- Low Carbon Ferrochrome (LC FeCr): Typically contains less than 0.5% carbon, and is used in applications that require minimal carbon content.

As of 2023, the global production of ferrochrome is dominated by China and South Africa, which account for approximately 48% and 21%, respectively.

Fig 7: Global Ferrochrome production in mt



Source: CRU, ICRA Research

Chrome

Chromium, often called chrome, sometimes confused with ferrochrome, but they are actually quite different. Both come from chromite ore and both contain chromium but ferrochrome is a metal alloy (a mix of iron and chromium), while chromium metal is nearly pure, with very small amounts of other elements like aluminum, silicon, or iron.

There are two main ways to produce pure chromium:

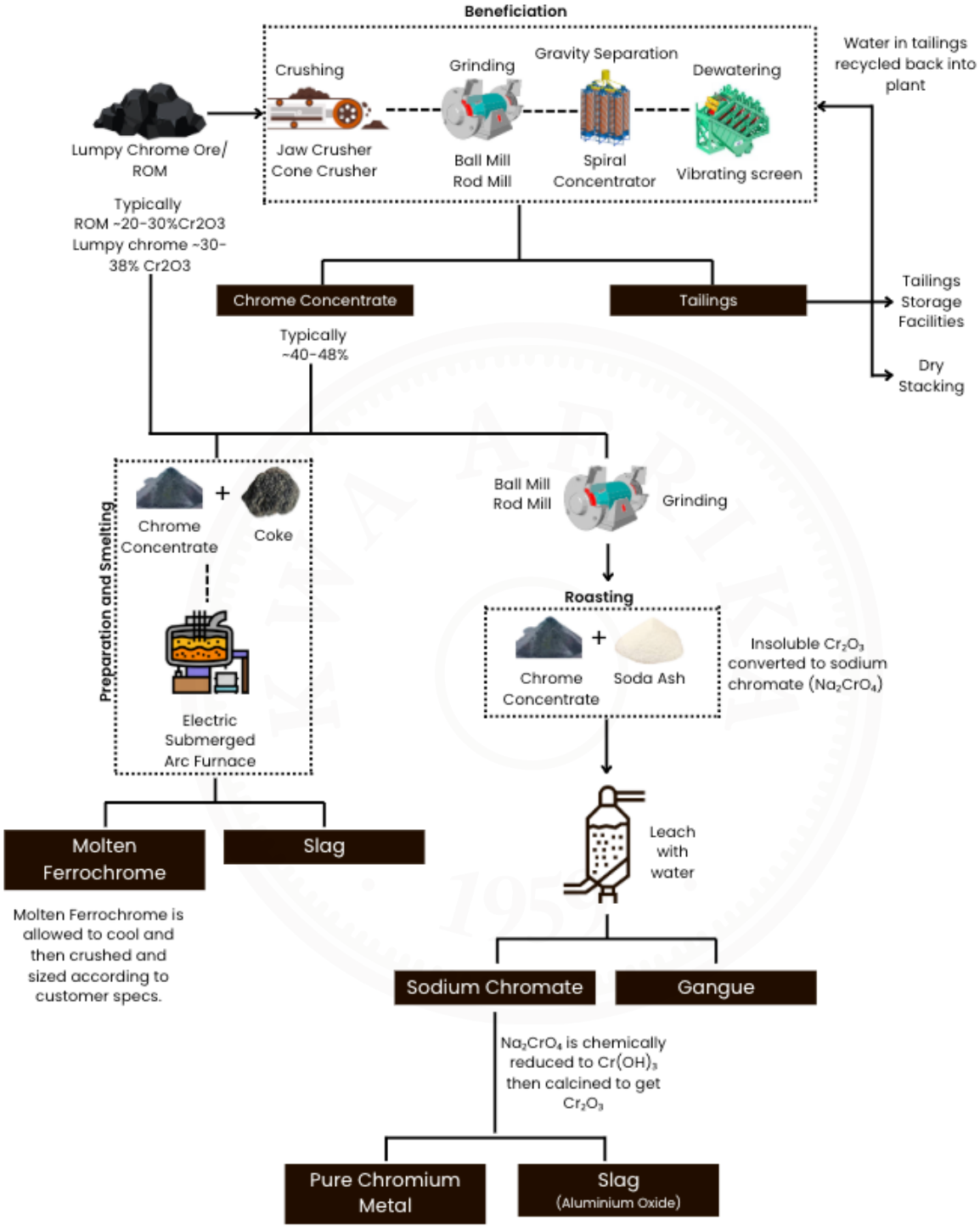
- Aluminothermic reduction using aluminum to extract chromium from its ore.
- Electrolytic extraction using electricity to separate out the metal.

Because of its impressive qualities like being strong, corrosion-resistant, and able to handle very high temperatures, chromium is an essential ingredient in superalloys, which are used in high-tech industries such as aerospace, energy, and advanced manufacturing.

Table 1: Difference between ferrochrome and chrome metal

Ferrochrome	Chrome Metal
An alloy of chromium and iron	Just chromium
Produces stainless steel	Used for plating and finishing
Contains 60-70% chromium	Contains about 99.5% chromium

Process Flowchart: From Chrome Ore to Chrome Concentrate and Ferrochrome

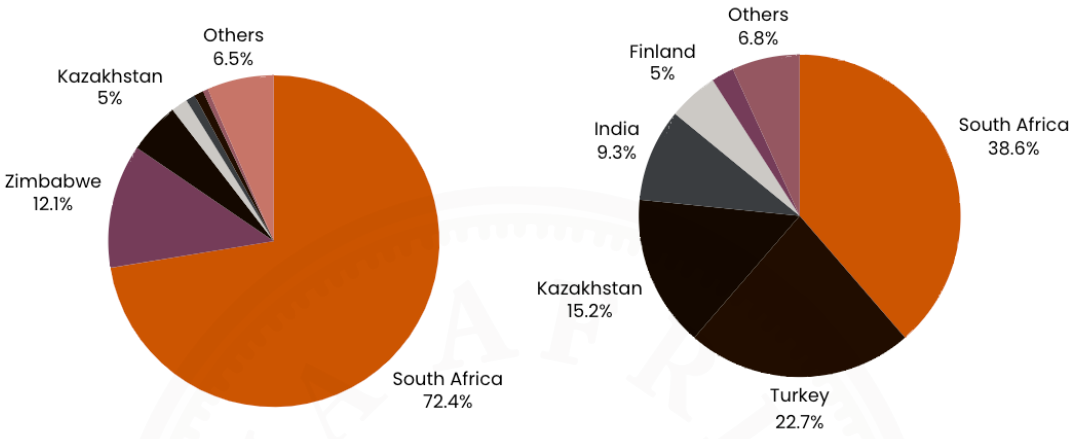


Source: Moneda Intelligence

Global Reserves and Production

As reported in the 2023 Mineral Commodity Summary by the U.S. Geological Survey (USGS), South Africa leads global chromite production with an output of around 18 million metric tonnes. The country also holds approximately 72% of the world's chromite reserves, estimated at 230 million tonnes. Dominating the global market, South Africa accounts for nearly 40% of total production. Turkey and Kazakhstan follow as the second and third largest producers, respectively.

Fig 8: Global Chromite Ore Reserves and Production by Country (%)



Source: ICDA, U.S. Geological Survey, Mineral Commodity, 2023

Key Players

Table 2: Top Chrome Ore Mining & Producing Companies

Company	Location	Market Role
Samancor Chrome	South Africa	Mining-Production
Glenco-Merafe JV	South Africa	Mining-Production
Tharisa Minerals	South Africa	Mining
Hernic Ferrochrome	Kazakhstan	Mining-Production
Eurasian Resources Group	Kazakhstan	Mining
Eti Krom	Turkey	Production
Tianyuan	China	Production-Trading
Tsingshan Holding Group	China	Production-Trading

The Market

In 2023, chrome ores and concentrates ranked 498th in global trade value, with total trade reaching $7.57 billion, marking a 65.5% increase compared to 2022. Over the past five years, the trade in this category has expanded at an average annual growth rate of 19.3%, largely fueled by rising demand for stainless steel across the automotive, aerospace, and construction industries.

The chrome ore market is largely dominated by two key players: South Africa and China.

South Africa, which holds the world's largest and highest-grade chromite reserves in the Bushveld Complex, continues to be a leading and preferred supplier due to the superior quality of its ore. Meanwhile, China stands as the world's largest chrome ore importer, mainly because it is the top producer of ferrochrome and stainless steel globally.

Fig 9: Global Exporters of Chromium Ores and Concentrates in 2023, (USD Millions)

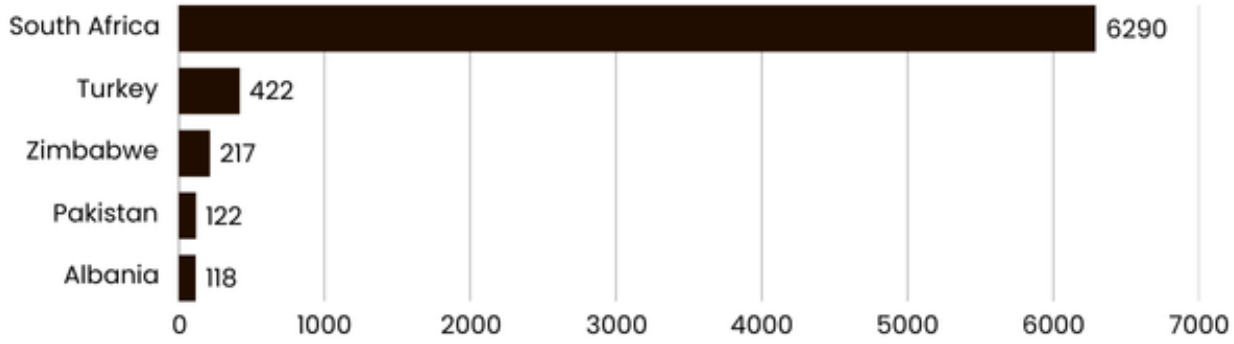
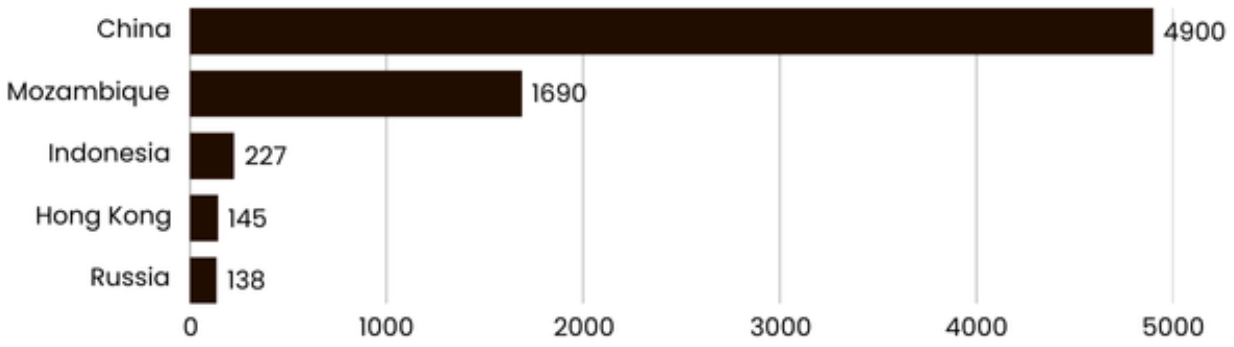


Fig 10: Global Importers of Chromium Ores and Concentrates in 2023, (USD Millions)



Source: OECD

Growth Drivers

Rising Demand in the Automotive and Aerospace Industry

The global automotive chromium market was valued at $2.25 billion in 2023 and is expected to expand at a compound annual growth rate (CAGR) of 4.5% between 2024 and 2030. This growth is largely driven by the increasing use of chromium for decorative plating in vehicles and the rising demand for lightweight components to improve fuel efficiency and performance.

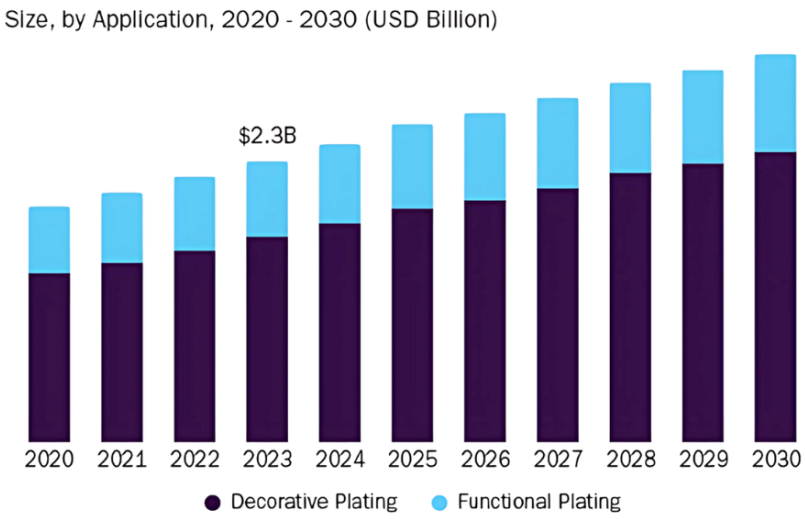
In 2023, the Asia-Pacific region led the global market, accounting for 54.5% of total revenue, with strong contributions from China, Japan, and South Korea.

However, future projections indicate a shifting market landscape, with North America and Europe, particularly the United States and Germany expected to gain ground, owing to their position as key hubs for high-end automobile manufacturing.

Growth in Stainless Steel Demand

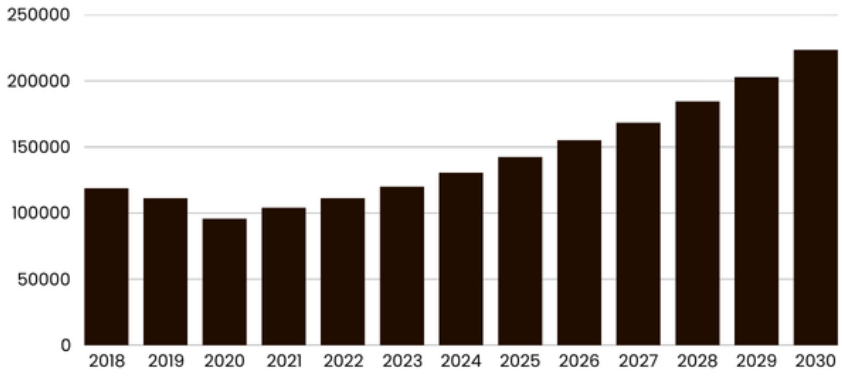
The rise in stainless steel production has been largely driven by increasing demand from the construction, automotive, and consumer goods sectors. As chromium is a critical alloying element in stainless steel, this upward trend has directly fueled greater demand for chromium, subsequently leading to a notable increase in chrome concentrate consumption.

Fig 11: Global Automotive Chromium Market



Source: Grand View Research

Fig 12: Global Stainless Steel Market, 2018-2030 (USD Million)



Source: Grand View Research

South Africa

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demand from the construction, automotive, and consumer goods sectors. As chromium is a critical alloying element in stainless steel, this upward trend has directly fueled greater demand for chromium, subsequently leading to a notable increase in chrome concentrate consumption.

The unique concentration of the world's largest chrome ore reserves in South Africa presents both significant opportunities and challenges across its top five mining regions.

North West Province

Often referred to as the "heart of chrome mining," the North West Province hosts major chrome-rich areas such as Mooinooi, Rustenburg, and the rapidly expanding Witrandjie near Sun City. This region is home to some of the world's most productive chrome mines, including Samancor Chrome's Western Chrome Mines, Tharisa Minerals, and Glencore's Waterval and Kroondal operations. Its strategic advantage lies in its proximity to the Bushveld Complex, which provides access to high-grade chrome reserves. The region's stable production and consistent output make it a key hub for both established producers and independent chrome concentrate suppliers.

Mpumalanga

Mpumalanga plays a crucial role in South Africa's ferrochrome production. Key operators in this region include Glencore and Samancor. .

The province boasts of well-developed infrastructure for both processing and logistics, enabling efficient supply of chrome concentrate to local smelters. However, high energy costs and transportation challenges, particularly for exporting ferrochrome, can raise production expenses.

Limpopo

Limpopo is an emerging mining region, recognized for its rich but underexploited chrome reserves. It offers growth potential for smaller mining companies looking to enter the market, especially through partnerships with established operators. However, the region faces ongoing infrastructure development, leading to logistical and transportation constraints that can impact new entrants.

Gauteng

Although not a major mining area due to limited chrome deposits, Gauteng serves a strategic role in the chrome value chain. It hosts numerous processing facilities and acts as a logistics hub, facilitating the movement of chrome concentrate to key export terminals.

Fig 13: Minerals Mined in South Africa

KwaZulu-Natal

Similar to Gauteng in terms of chrome reserves, KwaZulu-Natal plays a vital role in the supply chain. Its port infrastructure, especially the Port of Durban makes it a key export gateway for chrome concentrate, significantly easing access to international markets.

Export Challenges

China remains the primary destination for South Africa's chrome ore exports. However, with rising global demand, particularly from emerging markets such as North America, South Africa's supply may face limitations. This is largely due to ongoing challenges in the country's chrome supply chain, including infrastructure bottlenecks, logistical inefficiencies, high electricity costs that directly impact smelting operations, and the growing issue of illegal mining. These factors contribute to increased production costs and may constrain South Africa's ability to meet growing international demand.

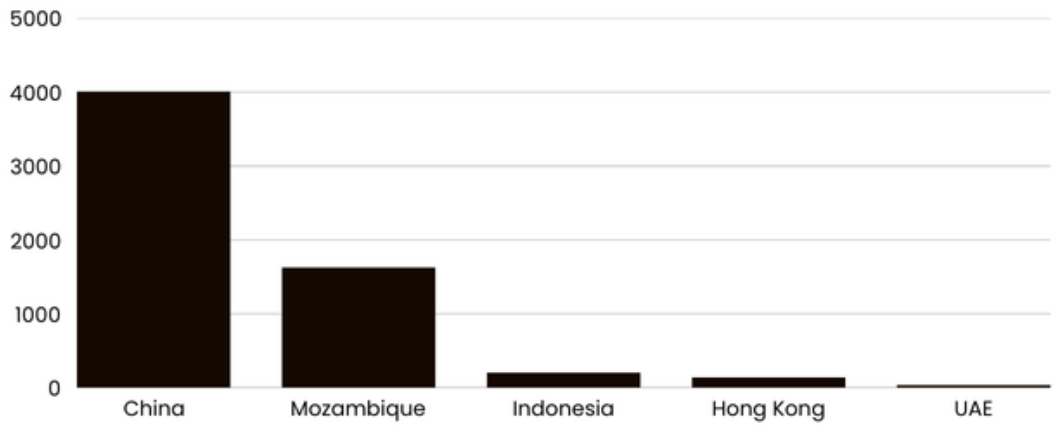
Electricity Tariffs Impact on South Africa's Ferrochrome Sector

Ferrochrome production is a highly energy-intensive process, requiring approximately 4 MWh of electricity per tonne of metal produced. In South Africa, the sharp rise in electricity tariffs—a cumulative 147% increase since 2014, with a further 12.74% hike expected in April 2025 has negatively affected the viability of local smelting operations. This escalating cost structure has led to a notable shift from domestic ferrochrome production to increased exports of unprocessed chrome ore, reducing the level of local beneficiation.

The consequences of this trend are far-reaching: diminished value addition within South Africa, lower tax revenues, job losses, and a weakened position in the global ferrochrome supply chain. South Africa, once the leading producer of ferrochrome, has since been overtaken by China.

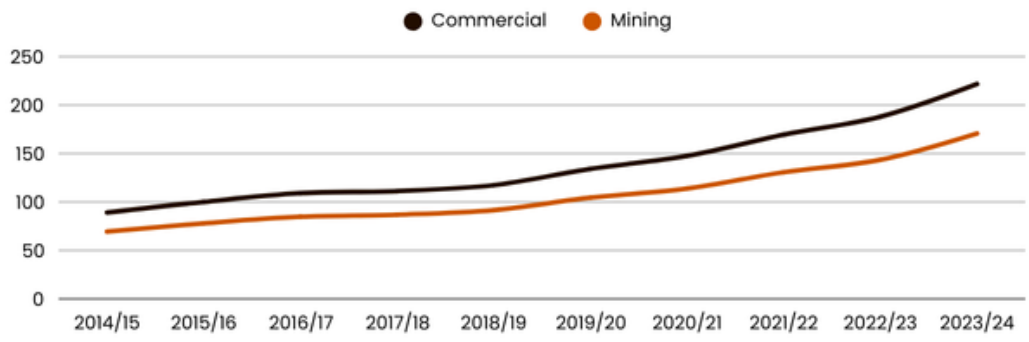
Leading industry players have started to scale down operations. Samancor Chrome, one of the world's largest ferrochrome producers, has announced job cuts, citing unsustainable electricity costs as a key driver. Similarly, the Glencore-Merafe Joint Venture has faced operational challenges. According to Merafe's 2023 annual report, ferrochrome production declined by 22%, while the total unit cost of production rose by 28%, with elevated electricity tariffs identified as a primary contributor.

Fig 14: Top Export Destinations for South African Chrome Ore 2023



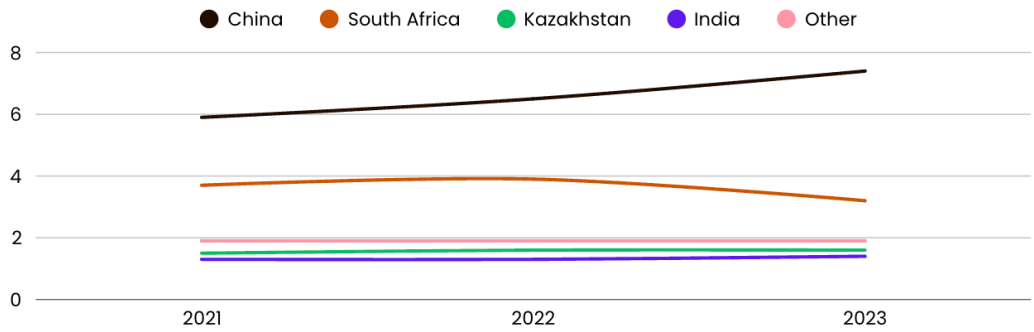
Source: OECD

Fig 15: Eskom Tariff for Commercial and Mining sectors, cents/kwh



Source: Eskom

Fig 16: Global Ferrochrome Production



Source: CRU, ICRA Research

Logistical Constraints in South Africa's Chrome Ore Supply Chain

Logistics remain a critical bottleneck in South Africa's chrome ore value chain, particularly in the movement of material from mine to export market. Key challenges include port congestion, loading and shipping delays, unreliable rail and road networks, and even weather-related disruptions such as flooding. Demurrage costs have been reported to reach $40,000 per day, significantly impacting exporters. For instance, a 10,000-tonne shipment of chrome ore delayed by just two days could incur an additional $80,000 in demurrage—equivalent to $8 per tonne, adding considerable cost to the supplier.

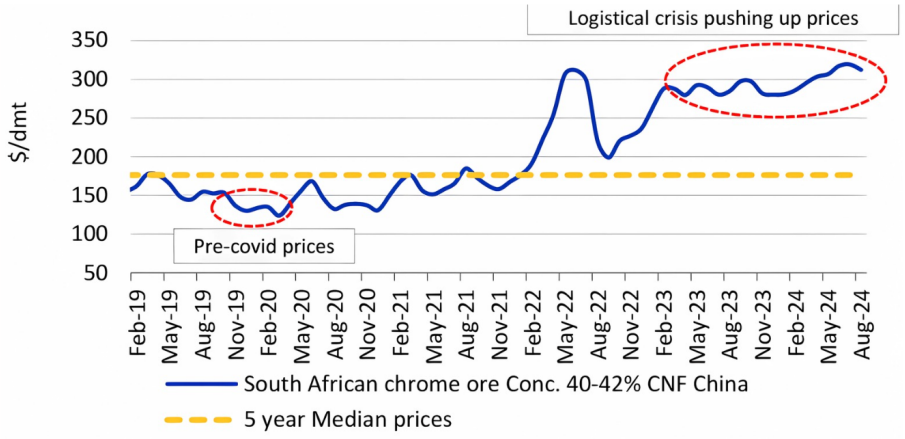
Delays within the logistics ecosystem are widespread. Bulk shipments, especially containers, can experience lead times of eight to ten weeks from mine or plant to sailing, creating inefficiencies and missed delivery windows.

Transnet, the state-owned entity managing much of South Africa's rail and port infrastructure, continues to face financial strain, structural inefficiencies, and theft-related disruptions. In the first half of its fiscal year, Transnet reported a loss of R2.2 billion, up from R1.6 billion during the same period the previous year. Rail inefficiencies alone are estimated to have cost the South African economy over R400 billion in 2022, with the Minerals Council noting that mining exports fell short by R50 billion due to transport constraints.

As chrome ore and ferrochrome exports grow, Transnet's infrastructure is increasingly overwhelmed. This has forced many producers to reroute shipments via Komatipoort to the Port of Maputo in Mozambique. In 2023, Maputo handled approximately 50% of South Africa's chrome exports.

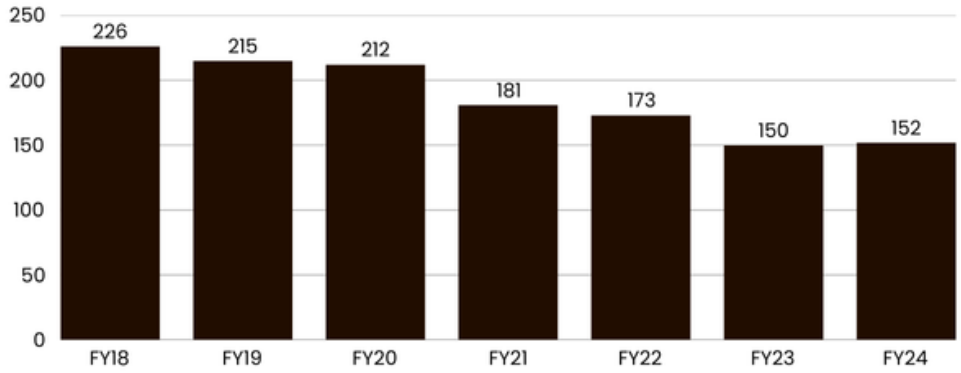
While this diversion has offered some relief, it introduces new vulnerabilities, such as the post-election unrest in Mozambique in late 2024, which led to the temporary closure of the Lebombo border, again disrupting the flow of goods.

Fig 17: Trend in South African Chrome Ore Prices (UG2 Grade)



Source: BigMint ICRA Research

Fig 18: Trend in South African Chrome Ore Prices (UG2 Grade)



Source: Transnet Annual Report, ICRA Research; FY refers to Year ended March 3

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STRATEGIC CONSIDERATIONS FOR

Chrome Ore Traders

Engaging in chrome ore trading requires a strategic understanding of product specifications, market dynamics, and logistical frameworks. Below are key considerations for prospective chrome ore traders:

1. Familiarize Yourself with Ore Grades and Applications

Chrome ore is primarily marketed as either chrome concentrate (46–52% Cr_2O_3) or lumpy ore (30–38% Cr_2O_3). Understanding the differences in grade and their respective applications whether for ferrochrome production, chemical processing, or refractory use is essential for aligning with buyer requirements and market pricing.

2. Identify and Monitor Key Export Markets

China remains the world's largest importer of chrome ore, driven by its robust stainless steel industry. Trade routes through Mozambique's Maputo Port have become increasingly important as exporters navigate infrastructural constraints within South Africa. Traders should remain vigilant of geopolitical risks, such as border closures or regional unrest, which can disrupt supply chains.

3. Establish Reliable Logistics Partnerships

The chrome ore market is highly sensitive to transport delays and associated costs such as demurrage, which can exceed $8 per tonne. Collaborating with experienced freight and logistics providers, particularly those familiar with mineral exports, is crucial. Attention to customs documentation and route planning can help avoid costly disruptions.

4. Track Exchange Rate Movements

As chrome is priced in US dollars while operating expenses in South Africa are incurred in South African Rand (ZAR), fluctuations in the ZAR/USD exchange rate can significantly impact profit margins. A depreciating ZAR may enhance local profitability, but traders must also account for cost volatility tied to currency movements.

5. Consider Energy Costs in Pricing Strategy

Ferrochrome smelting requires approximately 4 MWh of electricity per tonne, making it one of the most energy-intensive processes in the mining value chain. Rising electricity tariffs in South Africa have constrained local beneficiation. Traders should assess whether suppliers are exposed to high input costs or operate in regions with more stable energy pricing.

6. Understand Regulatory and Policy Environments

South Africa has discussed introducing export duties on raw chrome ore to encourage local processing. Traders must stay informed of such regulatory developments to anticipate changes in cost structures or export availability. Understanding export licensing, taxes, and trade compliance is essential for long-term planning.

7. Verify Product Quality and Ethical Sourcing

Reliable sourcing starts with technical quality assurance. Traders should ensure products are tested for Cr_2O_3 content, as well as for impurities like silica, iron oxide, and moisture levels. Additionally, verifying the legal and environmental standing of suppliers helps reduce reputational and compliance risks, especially in jurisdictions concerned with responsible sourcing.

8. Implement Secure Transaction Structures

Given the international nature of chrome trading, payment security is paramount. Utilization of Letters of Credit (LCs), escrow arrangements, or structured trade finance instruments is advisable. Clearly defined Incoterms (e.g., FOB, CIF) should be incorporated into contracts to avoid legal ambiguities and disputes over logistics responsibilities.

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