

BULLION FOR BULLETS

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THE ROLE OF MINING IN SUDAN'S
CONFLICT ECONOMY



Acknowledgments

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C4ADS (www.c4ads.org) is a 501(c)(3) nonprofit organization dedicated to data-driven analysis and evidence-based reporting of conflict and security issues worldwide. Our approach leverages nontraditional investigative techniques and emerging analytical technologies. We recognize the value of working on the ground, capturing local knowledge, and collecting original data to inform our analysis. At the same time, we employ cutting-edge technology to manage and analyze that data. The result is an innovative analytical approach to conflict prevention and mitigation.

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C4ADS Conflict-Affected States Program

The Conflict-Affected States Program (CAS) works to reduce the humanitarian and security costs posed by wars, insurgencies, and gray zone conflicts. It promotes transparency and justice by strengthening local civil-society organizations and equipping partners with data-driven analysis. Since 2015, CAS analysis on Sudan has exposed financial drivers of conflict, tracked arms supply chains to conflict zones, and documented how external actors perpetuate violence.

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Cover Art

C4ADS was honored to commission Sudanese artist Obada Gabor to produce the art for this report.

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Executive Summary

On April 15, 2025, the armed conflict in Sudan entered its third year. The war—waged by the Sudanese Armed Forces (SAF), which seized control of the government in October 2021, and the paramilitary Rapid Support Forces (RSF)—has exacted a heavy toll on civilians, as it has brought widespread famine, displacement, and death. In addition, the U.S. government has renewed accusations of ethnic cleansing in Darfur, declaring that the RSF and allied militias have committed genocide in the region.¹ With no clear signs of a resolution or military victory in sight, it is critical to expose and disrupt the funding mechanisms of the warring parties.

Minerals, historically a crucial funding source for the SAF and RSF, are a growing but under-addressed pressure point.² Enforcement agents investigating these funding sources have largely focused on disrupting gold revenue from the point of export onward, including revenue from the refinement of Sudanese gold in countries like the United Arab Emirates (U.A.E.). Recent sanctions reflect this focus: in January 2025, the U.S. sanctioned U.A.E.-based gold purchaser Al Zumoroud and Al Yaqoot Gold & Jewellers L.L.C. and its manager.³ However, both the SAF and the RSF profit from unrestricted funding streams provided by the mining industry, both by controlling mines and collecting taxes, with the de facto Sudanese government’s pre-export gold flow revenue reportedly reaching US\$1.6 billion in 2024 alone.⁴

To more comprehensively understand how the SAF and RSF profit from minerals, we used trade data, corporate records, satellite imagery, and other types of publicly available information to analyze Sudanese warring parties’ control over pre-export steps in gold and non-gold mineral supply chains. This analysis backs recommendations for trade- and revenue-focused action against sanctioned drivers of violence in Sudan. Specifically, it proposes increased focus on the following:

- **Mining entities.** According to satellite imagery analysis, concessionary mining is still operational in Darfur, the Red Sea State, the River Nile State, and the Northern State. While sanctions in several jurisdictions have targeted a number of SAF- and RSF-associated companies, including the RSF-associated mining entity Al Junaid, many other concessionary mining entities that are linked to the warring parties by corporate ties remain unsanctioned. Extending sanctions to cover this gap—including to the companies operating the mines and key upstream facilitators, like Sudamin Company Ltd—could help stifle revenue streams for warring parties.⁵
- **Precursor chemical imports.** Precursor chemicals are essential to the mining process. It is crucial to target actors who supply the necessary materials for the

gold and mineral production from which the warring parties profit. Trade records indicate that Chinese entities such as Shandong Smart International Logistics and JYT (Qingdao) Logistics Co, Ltd. have shipped more than 2,800 drums of precursor chemical sodium cyanide to Sudanese state-owned enterprise Sudamin.⁶ Such conduct enables conflict financing for the SAF, but has thus far remained untargeted by enforcement efforts.

- **Gold taxation.** In 2020, the Sudanese Mineral Resources Company (SMRC), the regulatory authority for mining in Sudan, reported a total tax revenue from Sudan’s gold production of US\$418 million, extracted from 35.7 metric tons of gold in recorded production. In 2024, this value increased to US\$1.6 billion in government revenue.⁷ Export proceeds from nine months in 2024 reportedly reached US\$1.18 billion, indicating that the US\$1.6 billion brought in through the SMRC’s taxation is a significant, high-risk conflict financing node for SAF.⁸ The SMRC remains unsanctioned.
- **The broader mineral sector.** Trade data indicates that more than 70 cargoes of chrome ore, weighing more than 2 million kilograms (kg) total, have been shipped from Sudan to China since the start of the conflict. ⁹ China is the world’s largest chromium importer, with demand anticipated to continue to rise.¹⁰ Increasing Chinese demand for Sudanese chrome could result in chromium becoming a more stable form of revenue for the Sudanese government than gold.¹¹ Alternate minerals present a means of funding diversification for the warring parties that is insulated from sanctions on conflict gold.

Enforcement agencies and policymakers have largely overlooked key pressure points in the mineral sector. By taking a more comprehensive approach to throttling RSF and SAF mineral revenue, enforcement agents can take decisive steps to curb actors responsible for atrocities.

Introduction

Sudan's extractive sector has long been critical to its financial reserves. When South Sudan split from Sudan on July 9, 2011, Sudan lost approximately four billion dollars in oil revenue, which reportedly made up 90% of the country's foreign currency resources.¹² This significant revenue loss forced Sudan to increasingly rely on gold to offset the financial shortfall.¹³

Approximately 12 years later, the 2023 ongoing armed conflict in Sudan has disrupted the state's economy, and destroyed much of the banking infrastructure in Khartoum.¹⁴ The damage to Sudan's financial sector is further complicated by the RSF's reported attempts to destabilize currency exchange processes.¹⁵ This could hinder access to paper currency, at least in the short term, ultimately worsening the country's financial outlook by obstructing access to liquid assets.

Both the SAF and RSF will need to sustain their financial and logistical networks to fund their operations and continue fighting.¹⁶ One way they maintain funding during the conflict is by tapping into Sudan's substantial mining revenue. This includes gold mining taxation by the SAF, exploitation of non-gold minerals by the SAF, and the informal funding and control mechanisms employed by the RSF. Given the reliance on alternative payment methods and lack of cash, gold and other minerals serve as a more agile source of payment to fund the warring parties' operations.¹⁷

The use of minerals as an alternative payment method became apparent in September 2024, when a cargo plane reportedly landed at Nyala Airport in South Darfur State, unloading shipments of weapons and departing with a load of gold (presumably as payment for the weapons).¹⁸ Meanwhile, media sources allege that the RSF used gold revenue to purchase drones and train soldiers to use them, while the government-owned Sudan Gold Refinery has reportedly bought and exported gold to import fuel.^{19,20} The use of gold as payment for fuel is particularly noteworthy due to recent fuel shortages in Sudan and the destruction of Sudan's oil production infrastructure.²¹

However, U.S. targeting of Sudan's gold sector has thus far remained focused on gold exports. Executive Order 14098 (E.O. 14098) of May 4, 2023, authorized sanctions on individuals and entities linked to the October 2021 military seizure of power and the current conflict in Sudan.²² Of the 31 current sanctions under E.O. 14098, four relate directly to the gold and mineral industry. Of these four designations, three apply to entities and individuals involved in the export of gold from Sudan or the purchase of Sudanese gold in the U.A.E.²³ The United States has only sanctioned one entity, Al Junaid Multi Activities Co Ltd, that appears to be involved in pre-export mining operations in Sudan.²⁴ As the conflict continues, the warring parties' agile funding mechanisms and increased reliance on gold and other minerals make it critical to scrutinize all parts of the mineral supply chain. Through this approach, enforcement bodies can identify gaps and ensure that conflict financing flows are comprehensively targeted.

Glossary

Artisanal mining: Also called traditional mining, these are small, mobile mining operations that often use mercury during extraction.²⁵

CBOS: Central Bank of Sudan.

Concession: License to mine in a defined area.

Karta: Mining tailings (see tailings below).

LBMA: London Bullion Market Association.

Mercury: A mining precursor chemical that is mixed with ore and then heated, causing the mercury to evaporate and leave the gold particles behind.²⁶

NDWI: Normalized Difference Water Index; used to detect gold mining operations based on surface water present in satellite imagery, since gold refining processes create substantial wastewater and because mine tailings refining sites are held in large holding ponds.

Notify party: Seen in trade data; this is the person notified when a shipment reaches its destination.²⁷

OECD: Organisation for Economic Co-operation and Development.

OFAC: The U.S. Department of the Treasury's Office of Foreign Assets Control.

Post-export: For the purposes of this report, this refers to the parts of the mining supply chain from mineral export onward.

Pre-export: For the purposes of this report, this refers to the parts of the mining supply chain that precede export of minerals from Sudan.

RSF: Rapid Support Forces; one of the warring parties in the current conflict in Sudan, currently led by commander Mohamed Hamdan Dagalo (Hemedti).

SAF: Sudanese Armed Forces; one of the warring parties in the current conflict in Sudan.

SDG: Sudanese pound.

SMRC: Sudanese Mineral Resources Company, the Sudanese government's mining regulatory authority.

Sodium cyanide: A mining precursor chemical used to leach minerals like gold from their ore.²⁸

Tailings: Material leftover from inefficient extraction processes like those used in artisanal mining.

Transshipment: The use of intermediate destinations when shipping goods from one place to another.

Methodology and Limitations

This report primarily uses publicly available information (PAI) and limited human-sourced information to highlight the actors in Sudan's mining industry who contribute, whether directly or indirectly, to funding the warring parties of the conflict. The four sections of the report assess (1) active mining operations held in SAF- and RSF-controlled areas, (2) mining precursor chemical supply chains, (3) the SAF and RSF's mechanisms for profiting from gold mining, and (4) Sudan's non-gold mineral industry. Across these sections, the analysis relies on satellite imagery, human sourcing for primary source documentation, trade data, corporate data, and media reporting.

Satellite Methodology

This report leverages media reporting and multimodal remote sensing analysis to identify activity at mining sites with ties to the RSF and SAF, with the remote sensing analysis combining three methodologies: nighttime lights monitoring, on-site water area measurements derived from satellites (NDWI), and binary timestep change detection analysis using a PCA k-means algorithm. Due to the limited availability of high-resolution imagery, we were unable to conduct change detection analysis for the mines over a consistent set of dates. However, because all selected high-resolution imagery is dated between April 15, 2024, and April 15, 2025, change detection analysis is restricted to the wartime period and is not affected by developments prior to the conflict. Limitations associated with change detection analysis have decreased thanks to the layering of the three methodologies. The underlying data detailing the activity at these sites and the accompanying methodologies are available in more detail in Annexes 1 and 2.

Revenue Methodology

This report uses tax rate data from a confidential human source to assess the revenue collected in each sector by the SMRC per US\$ value of gold entering the formal system.²⁹ Taxation is not necessarily proportional to an entity's revenue. For instance, tailings processors are taxed partly by their profits, artisanal miners based on their income, and concessionaries through a blend of land fees, royalties, and profit-sharing mechanisms.³⁰ Here, we use the proportional taxation and royalty rates because they are a more conservative method of calculating taxation revenue. To project 2024 concessionary revenue, this methodology takes the 2024 concessionary production and multiplies it by the 2024 concessionary tax and royalty rates.³¹ Due to the absence of more specific statistics, we used an estimate sourced from news media for the 2024 concessionary production rate.³² A selection of calculations can be found in Annex 3 of this report.

The quantitative methodology focuses only on concessionary mining, as other forms of mining are subject to less consistent and less effective taxation. While the results of this analysis do not present a holistic view of gold taxation, they provide a benchmark for possible state revenue gained from high-risk concessionary mining directly associated with the state.

Limitations

Sudan trade data holdings were acquired from reliable third-party aggregators of trade data and cover imports and exports from January 2022 to November 2024. Trade data is subject to potential inaccuracies such as human error and intentional obfuscation; for this reason, we have sought to corroborate findings with other forms of PAI where possible. The trade data holdings do not include shipments shipped via air or smuggling. Wherever possible, we used other trade data of other countries for corroboration, including, but not limited to, Chinese and Russian trade data. Similar caveats regarding completeness and accuracy apply to these sources as well.

Given that the RSF's plans to establish a parallel government are quite recent and still ongoing as of the writing of this report, data on and access to RSF-controlled areas are more limited than that of SAF-controlled areas.³³ As a result, we have used some human-sourced information on activities in RSF-controlled areas to compensate for a lack of "official" RSF sources.

Updated Sudanese corporate records are not currently publicly available. This report leverages historic corporate records collected in 2021. C4ADS uses official corporate records whenever possible to verify corporate ownership networks. However, information cited from corporate records represents only a snapshot of corporate activity at a given time—records may not be updated regularly, may not be consistent or wholly accurate, and may not have the same reporting standards across all jurisdictions. In addition, public records do not reveal all details of a company's operations or relationships between entities. Therefore, C4ADS limits its analytical conclusions to those supported directly by underlying documentation.

As the ongoing conflict has disrupted access to data relating to Sudan, this report leverages limited human sourcing to provide primary source documentation. We assess all are credible sources with access to primary source material. Where possible, we draw on public reporting to further confirm reports before including them here. C4ADS anonymizes human sources to ensure the safety of our partner network.

Context: Mining in Sudan and the Associated Supply Chain

Types of Mining

In Sudan, gold is primarily extracted through three methods: artisanal mining, tailings processing, and concessionary mining.

- Artisanal mining comprises the majority of Sudanese gold production and is often mercury-based.³⁴ In 2016, Sudan’s Ministry of Minerals reported that approximately one million artisanal miners, along with an additional four million family dependents, directly benefited from artisanal mining, collectively representing 14% of Sudan’s population at the time.³⁵ Due to the small-scale nature of mercury-based artisanal mining, these operations are often not bound to a single location, making them difficult to monitor and tax.³⁶
- Dozens of companies (57 in 2020) in Sudan process gold tailings, or karta, which are the materials left over from inefficient extraction processes commonly used in artisanal gold mining.³⁷ Tailings processors crush, dissolve, and chemically treat the residual material to extract more gold.³⁸ Since the process demands larger and more advanced equipment, tailings processors typically operate from fixed locations and may need formal incorporation to handle the scale of their operations.
- Concessionary miners are formal mining operations that are granted a license or a concession to extract minerals from a designated area. As with artisanal miners, concessionary companies collect and process ore on their own, but they do so with much higher capital investment and in a defined location.³⁹

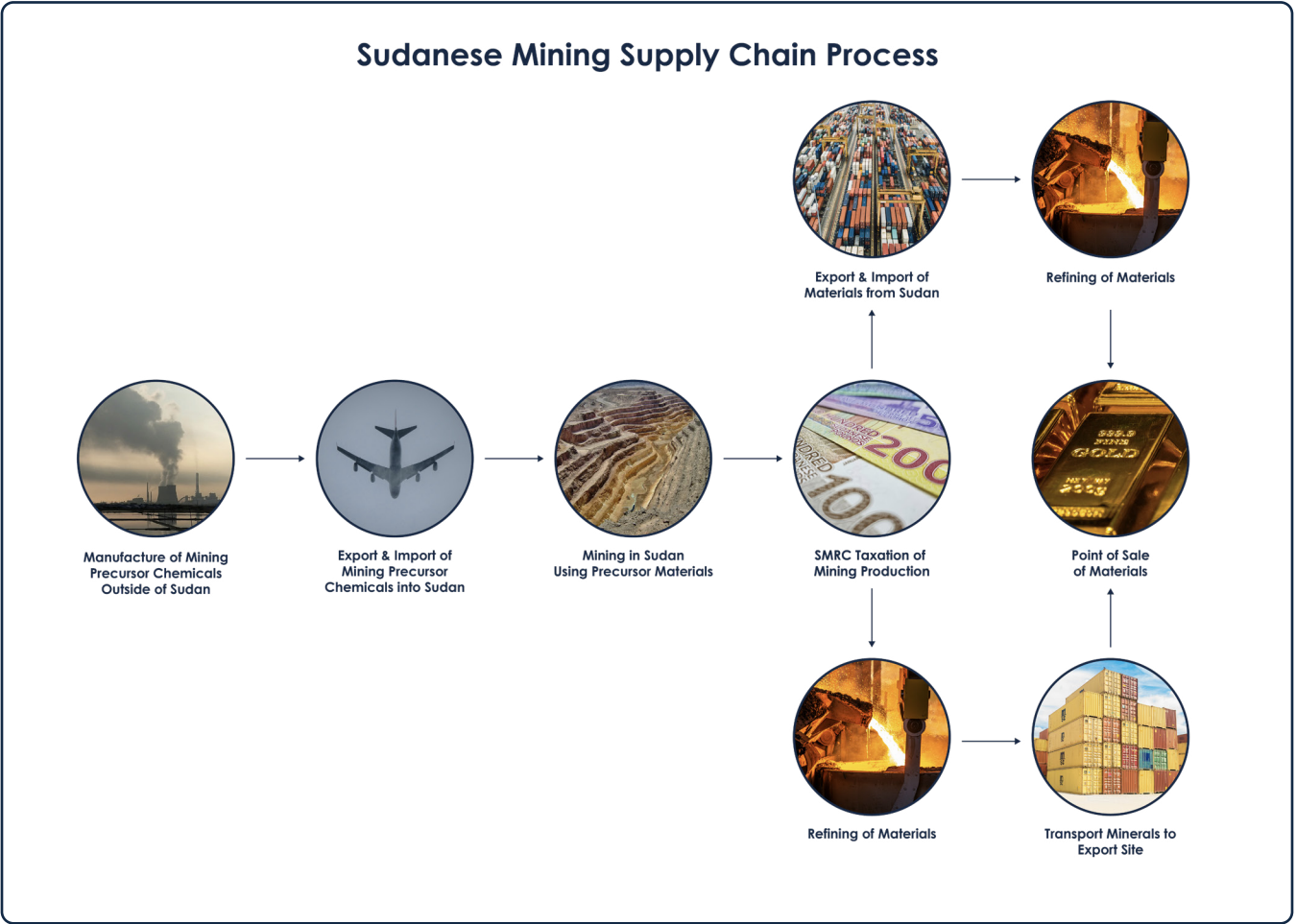
This report highlights specific actors in the concessionary mining space who are at higher risk of conflict financing due to their corporate ties with the warring parties. As detailed in this report, at least seven currently active concessionary miners have ownership ties to either the RSF or SAF. Nonetheless, other forms of mining (artisanal and tailing processors) remain subject to exploitation via auxiliary profit mechanisms, such as taxation, and constitute a large percentage of overall Sudanese gold production.⁴⁰

Mining Supply Chain

For the purposes of this report, the mining supply chain begins with the manufacture of mining precursor chemicals such as sodium cyanide and mercury, ordinarily in third-party countries like China or Russia. These chemicals are exported to Sudan, sometimes using transshipment through jurisdictions like the U.A.E. Once the chemicals are imported into Sudan and are transited to mining sites, they are used in the mining process. Sodium cyanide is used to leach minerals like gold from their ore.⁴¹ Meanwhile, mercury is mixed with ore and then heated, causing the mercury to evaporate and leaving the separated gold particles behind.⁴²

Based on the mining production rates, the Sudanese Mineral Resources Company (SMRC) taxes the miners. After production and taxation, the minerals are sometimes refined within Sudan at the government-owned Sudan Gold Refinery.⁴³ Subsequently, the minerals transit either from the mines or the refinery to export sites.⁴⁴

Extracted minerals are then exported from Sudan to countries like the U.A.E., where unrefined minerals may undergo refinement.⁴⁵ Lastly, the minerals reach their point of sale in countries including the U.A.E. and China, according to the U.S. Department of State.⁴⁶



Beneath the Battlefield: Currently Active Mines

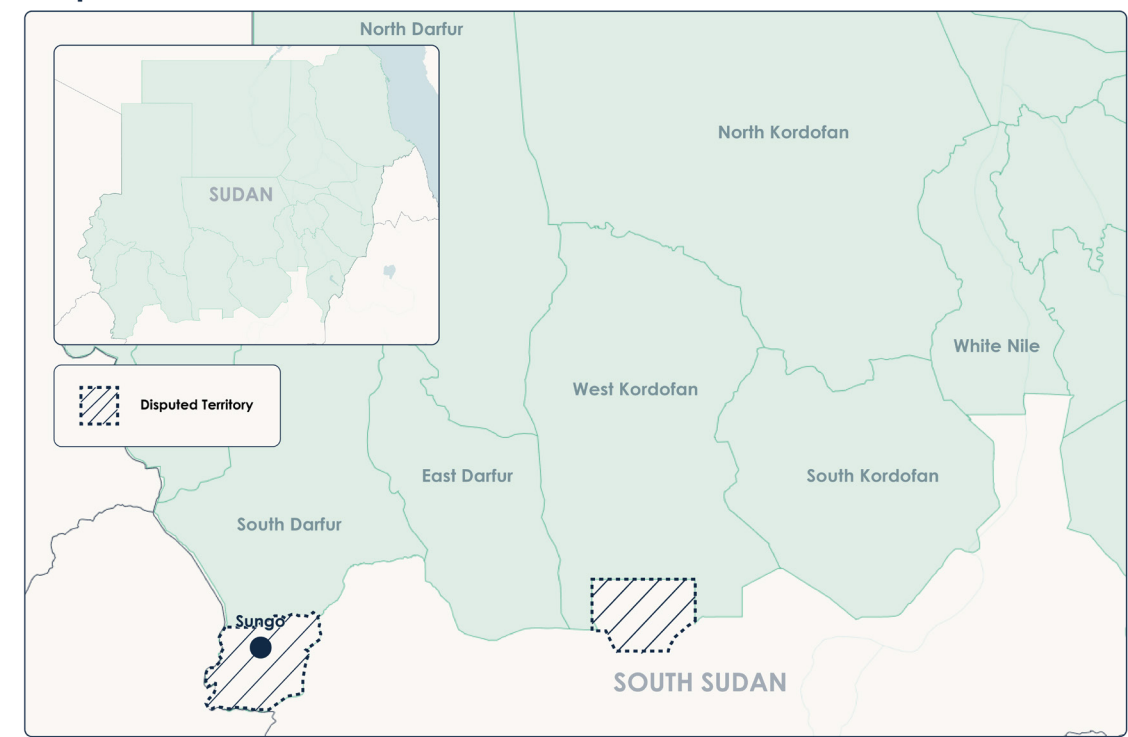
After the conflict began on April 15, 2023, some, but not all, of Sudanese mines temporarily halted operations due to disruptions and logistical challenges caused by the outbreak of hostilities.⁴⁷ This section highlights a selection of Sudanese mines where PAI indicates continued activity after that date. Using a combination of human-sourced information, satellite imagery analysis, primary source documentation, trade data, and other data sources, the following mines are assessed as likely to be active. These open and active mines support the premise that gold mining has restarted or continued despite the disruption of the conflict.

All of these active concessionary mines have ties to the RSF or the SAF, making them high-risk entities for facilitating conflict financing. So far, sanctions regimes have largely failed to target mines linked to the warring parties, presenting a gap in targeting conflict financing.

Gold Mines Likely in RSF-Controlled Areas

The RSF largely controls southwestern Sudan and Darfur, in addition to pockets of control in Sudan's northwest and southeast.⁴⁸ While production rates of mines in RSF-controlled areas are extremely difficult to quantify, RSF revenue from gold mining may be close to US\$1 billion per year, with US\$860 million worth of gold extracted from RSF-controlled areas in 2024.⁴⁹ Darfur is home to extensive and growing artisanal mining operations, including the Sungo mining area, which the RSF-affiliated company Al Junaid exploits for conflict financing.⁵⁰ Additional details about Sungo, Al Junaid, and the larger Al Junaid-corporate network are available in Annex 1.

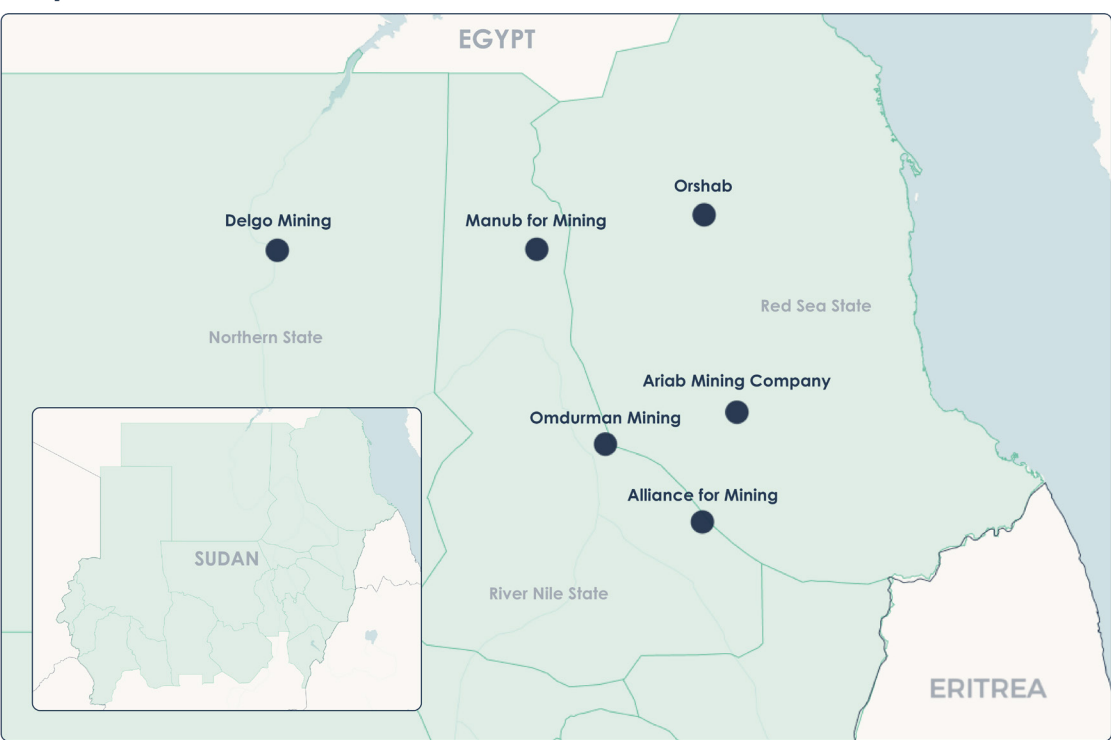
Map of Gold Mines in RSF-Controlled Areas



Gold Mines Likely in SAF-Controlled Areas

Sanctions regimes have largely neglected to target mines linked to the SAF, despite the fact that their current activity is at high risk of funding SAF operations. C4ADS identified six examples of mines in SAF-controlled areas where mining and ore extraction appear ongoing, as determined through the visible signals within the nighttime radiance and NDWI surface water data, combined with change detection analysis. This analysis additionally indicates that refining is ongoing in at least four of the sites, including Alliance for Mining, Ariab Mining Company, Manub for Mining, and Orshab.

Map of Gold Mines in SAF-Controlled Areas



All six of the mines analyzed have corporate ties to Sudanese state-owned enterprises (SOEs) or the government, making them high-risk entities for conflict financing. Their continued mining and refining activity, along with their ties to SOEs and the Sudanese government, indicates that these mines are a gap in existing enforcement mechanisms targeting the SAF and their ability to sustain their operations. See Annex 2 for the imagery, remote sensing analysis, and corporate ownership information for each mine.

Context Note: Sudamin Company Ltd

Sudamin Company Ltd (Sudamin) is a Sudanese SOE that specializes in the provision of mining equipment and materials.⁵¹ According to a confidential human source, Sudamin reportedly holds a monopoly over the import of key chemicals like mercury. It reportedly also has an ownership stake in a number of mining companies, including Alliance for Mining, Manub for Mining, and Omdurman Mining.⁵² While Sudamin is government-owned, media reports state that in 2020, RSF-affiliated company Al Junaid was granted a 34% share in the company.⁵³ If this ownership still holds, it could mean that the RSF and the SAF are profiting off some of the same mines. Sudamin is not subject to sanctions, nor are its mining affiliates.

The Alchemy of Mining: How Precursor Chemicals Fuel the Industry

Precursor chemicals are critical to mining processes, as chemicals like sodium cyanide and mercury are used to separate minerals, including gold, from extraneous material in ore.⁵⁴ These chemicals are often imported into Sudan, offering another pressure point on companies enabling the mining operations from which the warring parties profit.

Sodium Cyanide

Many miners use sodium cyanide to leach materials like gold from their ore, resulting in a demand for sodium cyanide in the Sudanese mining sector, which is fulfilled through imports.⁵⁵

Sudanese trade records indicate that mining companies affiliated with the Sudanese government and possibly the RSF have been importing sodium cyanide from China, the U.A.E., and the European Union. These shipments are at high risk of facilitating mining that lines the coffers of warring parties.

Chinese Companies Export Sodium Cyanide to Both SAF and RSF-Affiliated Mining Companies

Recent trade data reveals a significant concentration of sodium cyanide shipments from China to Sudanese government-affiliated entities, highlighting links between Chinese companies and Sudanese conflict gold.

Sudan trade data holdings show eight separate shipments from China containing a total of 2,840 drums of sodium cyanide, all of which were imported by the state-owned Sudamin on October 20, 2023.⁵⁶ These records show that “Shandong Smart International Logisti[cs]” acted as the consignor of three of the shipments, and JYT (Qingdao) Logistics Co, Ltd. sent the other five shipments; both entities are Chinese freight forwarding companies.⁵⁷

Hebei Chengxin Co. Ltd is another Chinese company that, according to trade records, has exported sodium cyanide to Sudan. Records show that it shipped sodium cyanide to Sudamin’s affiliate Alliance for Mining Co. Ltd and Sudanese-government-affiliated Orshab Gold Mining after April 15, 2023.⁵⁸ It apparently also acted as the notify party on two shipments of sodium cyanide in June 2023 from JYT (Qingdao) Logistics Co, Ltd. to another Sudamin affiliate, Manub for Mining.⁵⁹

Interestingly, JYT (Qingdao) Logistics Co, Ltd. is also the exporter of record for five shipments of sodium cyanide to a subsidiary of RSF-affiliated Al Junaid (Algunade for Mining Waste Treatment) that arrived in May 2023, shortly before the June 2023 implementation of OFAC sanctions against Al Junaid.⁶⁰ This suggests that JYT (Qingdao) Logistics Co, Ltd. has shipped sodium cyanide to entities affiliated with both the SAF and the RSF.

U.A.E. Company Transships UK Company’s Mining Precursors to Sudamin Affiliate

The precursor chemical supply chain is not limited to China: Records show the U.A.E.-based general retailer Rowfer LLC is associated with approximately 18 shipments of sodium cyanide to mining entities in Sudan.⁶¹

Rowfer LLC is listed as the notify party on four May 2024 shipments of sodium cyanide from consignor Golden Spring Trade Limited in China to Sudamin affiliate Omdurman Mining.⁶² Rowfer LLC has reportedly also shipped “Row Carbon” from India to Sudan, which is a patented brand of activated carbon for gold processing produced by the UK company Rowfer Limited.⁶³

UK company Rowfer Limited owns U.A.E. company Rowfer LLC. According to corporate records, Rowfer LLC in the U.A.E. and Rowfer Limited in the UK share two current directors with the same name and the same British nationality.⁶⁴ Rowfer Limited also advertises sodium cyanide for mining on its website.⁶⁵ Corporate records state that one of the directors of Rowfer Limited previously listed a country of residence of Sudan, and one of the directors of Rowfer LLC is a Sudanese national.⁶⁶ When contacted about its potential involvement in the shipment of row carbon to sanctioned entities in Sudan, Rowfer Limited deferred to the export control regimes of its product source countries, stating:

“All of our exports, whether from Germany or China, go through rigorous licensing and verification processes—including export controls by the German Ministry of Defence...Rowfer Ltd and Rowfer LLC do not deal with Sudamin or any governmental entity in Sudan.”

According to the German Implementing Act to Article 26 Paragraph 2 of the Basic Law (Law on the Control of War Weapons) Annex (to Section 1 Paragraph 1) War Weapons List, sodium cyanide and carbon are not on the list of items that are subject to export controls by the German Ministry of Defense.

EU Company Ships Sodium Cyanide to Sudamin Affiliate

Other cases demonstrate Western companies’ more direct trade involvement.

Trade records indicate that in 2024, Sudamin affiliate Manub for Mining was the consignee on a total of 15 shipments of sodium cyanide from Germany.⁶⁷ The consignor is reportedly the Czech chemical company Lučební závody Draslovka a.s. Kolín (Draslovka), which is reportedly the world’s largest producer of sodium cyanide.⁶⁸ This further supports the premise that Sudanese conflict financing extends not only the U.A.E., but also to a number of European countries.

Mercury

A review of commercially acquired trade records indicates that Sudanese companies are importing mercury, likely intended for use in mining. Artisanal mining methods often use mercury-based extraction techniques.⁶⁹ Mercury used in artisanal mining is at risk of facilitating conflict financing, whether via supporting mines affiliated with the warring parties or via auxiliary mechanisms. We have identified mercury shipments likely transshipped via the U.A.E. that were likely imported for mining purposes and may be supporting conflict financing.

Given the high volume of mercury reported in these shipments, additional scrutiny into U.A.E. mercury supply chains would be helpful to determine which warring parties may be ultimately profiting from the processed gold.

Context Note: Environmental and Health Impacts of Mining Precursor Chemicals

In addition to enabling conflict financing, mining precursor chemicals can be environmentally detrimental. According to a paper from Sudan Transparency and Policy Tracker, the rampant use of mercury in the Sudanese mining sector has caused a significant amount of damage and mercury pollution, with reported effects including animal deaths and increased rates of miscarriages.⁷⁰ In one example from the paper, over 12% of the mercury used in the extraction process leached into the environment.⁷¹ As analyzed in this subsection, Russia trade data holdings indicate that at least 12,420 kg of mercury have been shipped from Russia to Sudan since the start of the current conflict.⁷² This would mean that approximately 1,490 kg of this mercury could have leached into the Sudanese environment as a result of its use in the Sudanese mining sector.

U.A.E. Company Transships Russian Mercury to Sudan

Analysis of recent trade data indicates that a significant number of mercury shipments to Sudan come from the U.A.E.

MBS for Trading & Investment Co, Ltd is listed as a consignee on four separate shipments of mercury after the start of the April 15, 2023 conflict.⁷³ Although mercury has several uses, mining is a likely use, as a Facebook advertisement for MBS for Trading & Investment Co, Ltd markets their products toward individuals working in the mining sector.⁷⁴

While Sudanese trade data indicates that the shipments came from the U.A.E., the mercury in question likely originated from Russia. MBS for Trading & Investment Co, Ltd advertises that it sells Russian mercury, which is corroborated through Russian trade data.⁷⁵ A review of Russian trade data reveals four shipments of mercury sent to U.A.E. companies with Sudan listed as the ultimate destination. It is likely that at least some of the mercury in these shipments was transshipped to Sudan, as the U.A.E.-based consignees in Russian export data also acted as U.A.E.-based consignors in the Sudanese import data.⁷⁶ The goods descriptions included in the Russia trade data indicate that a total net weight of 12,420 kg of mercury has been shipped in this fashion and is at an increased risk of enabling conflict gold mining.⁷⁷

U.A.E. Company Ships Mercury of Undetermined Origin to Sudan

Analysis of additional shipments gives further indication that the U.A.E. acts as a transshipment hub for mercury shipments to Sudan.

Sudanese trade data shows additional mercury shipments from the U.A.E. of undetermined origin. A shipment of mercury from the U.A.E. was recorded as arriving in Sudan on July 30, 2024 from consignor Timco Middle East FZE to consignee Muzun Mining Company.⁷⁸ On August 13, 2024, a shipment of mercury reportedly arrived from U.A.E. consignor GSB Solar Middle East FZE for consignee Cobra for Mining.⁷⁹ On August 26, 2024, another shipment of mercury from Timco Middle East FZE reportedly arrived in Sudan for consignee Mamor Comra Multi Activities Co.⁸⁰

The U.A.E. likely exports mercury that it acquires from abroad; in 2023, it was the number two importer of mercury worldwide.⁸¹ While the U.A.E. ranked as the number two exporter of mercury in the world in 2023, it was not among the world's top five mercury producers.⁸² Considering these statistics together, the U.A.E. likely functions as a global transshipment hub for mercury shipments.



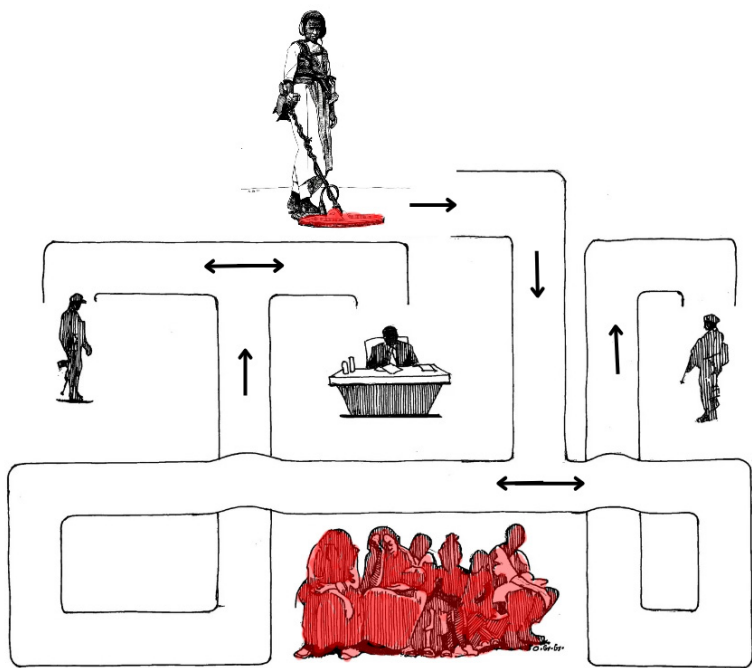
Extracting Profit: How the Armed Groups Monetize More Than Just Mining

Entities linked to the warring parties—such as Sudamin, which has ties to both the SAF and the RSF—have profited from gold mining through partial or full control of mines. However, the SAF and RSF have also availed themselves of auxiliary mechanisms such as taxation and security fees to maximize their profits, including for mines in which they do not hold an ownership stake.

While an estimated 80% to 85% of Sudan's gold production is from artisanal mining, we focus here on concessionary mining due to the increased reliability of the taxation system in this sector.⁸³ This section explores these auxiliary methods of profiting, with a particular focus on Sudanese government taxation as a funding source for the SAF. Because a Sudanese government entity collects this taxation revenue, it is liable to end up in the hands of the SAF to fund its conflict operations.

Auxiliary Profit Mechanisms in RSF-Controlled Areas

The RSF has likely faced little competition in establishing auxiliary profit mechanisms to maximize its revenue from gold mining operations. According to SMRC General Director Mohamed Taher Omar, the Sudanese government, and therefore the SMRC, does not have control over gold production in Darfur due to the current conflict.⁸⁴ In addition, RSF commander General Mohamed Hamdan “Hemedti” Dagalo has long been a key figure in Darfurian gold mining, predating the current conflict.⁸⁵ Therefore, it may be more accurate to say that the SMRC never had firm control over gold production in Darfur, making it a potentially profitable funding stream for the RSF.



Gold production in Sudan's peripheral areas (such as Darfur, South Kordofan, and Blue Nile states) might have been underrepresented in SMRC data before the outbreak of the conflict, suggesting possible lapses in data collection—and therefore in taxation—by the SMRC. According to the United Nations Panel of Experts on Sudan, Jebel Marra in Central Darfur produced 10 to 15 kg of gold per day in 2022, exceeding the production rate documented by the SMRC for Central Darfur in 2020.⁸⁶ The discrepancy could relate to the parallel taxation of this mine by the Sudan Liberation Movement–Abdul Wahid al Nur armed group, but may also reflect incomplete data collection by the SMRC.⁸⁷ As such, SMRC data may not necessarily represent gold production statistics accurately across the entirety of Sudan.

In the current conflict, one of the primary methods the RSF leverages to profit off gold mining in the areas it controls (in addition to the sale value of the gold it controls) is by charging security fees. According to one source, “A local mining committee and the RSF reached an agreement whereby RSF patrols would comb dangerous roads several times a day. Vehicles transporting gold for local miners then agreed to pay 50,000 Sudanese Pounds (roughly US\$20) for armed security to accompany the vehicle.”⁸⁸ This is similar to the structure reportedly used for the gum arabic trade, in which traders pay the RSF for protection during the production and transit of this key food industry ingredient.⁸⁹

Additionally, the RSF reportedly charges unofficial taxes and checkpoint fees on key transportation routes.⁹⁰ For example, in South Kordofan, miners reportedly pay 10% to 15% of their production value to the RSF.⁹¹ This layered system of security fees, unofficial taxation, and protection payments illustrates how the RSF has levied control over natural resource flows, turning gold mining into a consistent and strategic revenue stream to sustain ongoing conflict operations.

Amid allegations that the RSF is forming a parallel government, it could introduce additional formalized taxation mechanisms in areas under its control, which could lead to a greater availability of data and documentation.⁹²

The Sudanese Mineral Resources Company

Despite its name, the SMRC is a singular regulatory body that the Sudanese government uses to tax and regulate mines.

As an arm of the Sudanese Ministry of Minerals, the SMRC's mandate includes monitoring agreements and contracts between the Ministry of Energy and Mining and private mining companies, as well as monitoring the production of minerals and supporting tax collection efforts.⁹³

Mining operations in Sudan are highly decentralized, with a proliferation of small-scale artisanal mines that present a challenge for monitoring efforts.⁹⁴ To address this issue, in 2015, the SMRC established 13 provincial offices with delegates in 72 mineral markets, 52 of which remained open after the start of the conflict in April 2023.⁹⁵ Nonetheless, the SMRC itself has been forced to adopt some decentralization measures. After the outbreak of the armed conflict, it reportedly decided to empower security committees at the state level to secure gold production until it reaches export sites.⁹⁶

2024 Taxation Revenue Estimates

The SAF likely earns millions of dollars in revenue from the taxation of concessionary gold mining operations in the areas it controls, as demonstrated by the analysis below of the government of Sudan and the SAF’s potential revenue from taxation mechanisms in 2024. Because SAF is a pseudo-statal warring party, it can leverage government structures and institutions as a source of funding in a way that the RSF cannot.

In 2020, concessionaries contributed a reported 25% of the SMRC’s tax revenue, which equates to US\$104.7 million for 6.35 metric tons of gold.⁹⁷ To avoid the volatility and much higher margin of error that would be unavoidable in estimates of artisanal mining revenue, the estimates in this analysis will only focus on concessionary mining, which is more closely regulated and therefore more reliably taxed. Because a number of mines shut down at the start of the conflict in April 2023, we focus our estimates on 2024, when more regular mining patterns were in place.⁹⁸

To estimate the 2024 taxation yield from concessionaries, we use the following methodology, which is detailed in full in Annex 3:

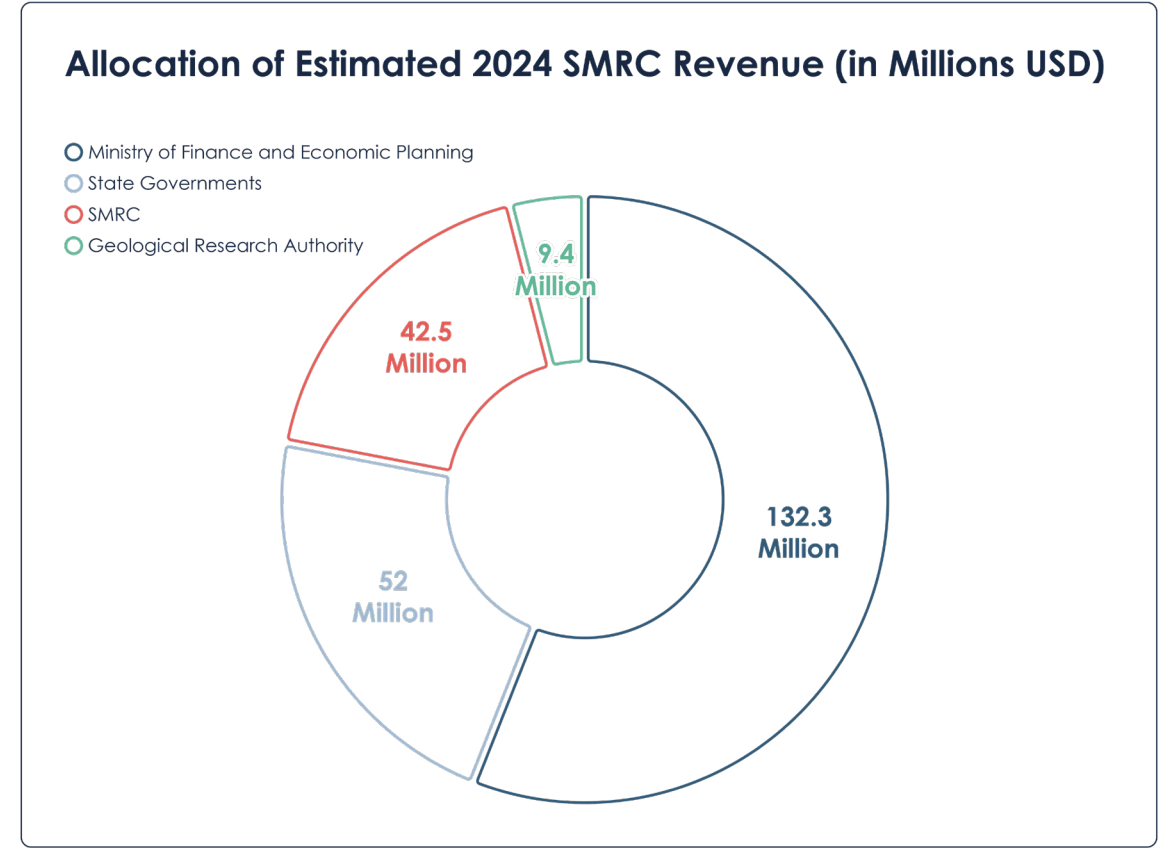
Quantitative Taxation Methodology

average 2024 close price of gold in USD/troy ounce	×	number of troy ounces/metric ton	=	average 2024 close price of gold in USD/metric ton
<hr/>				
average 2024 close price of gold in USD/metric ton	×	reported approximate 2024 concessionary production	=	value of gold produced from concessionary mines in 2024
<hr/>				
value of gold produced from concessionary mines in 2024	×	reported 2024 concessionary tax rate	=	2024 concessionary tax revenue

As the average price of gold in 2024 was US\$76,729,744.39 per metric ton, the approximate value of the 11 metric tons of gold produced by concessionary mines in 2024 was 844,027,188.28.⁹⁹¹⁰⁰ In 2024, the concessionary tax rate was 28%, yielding a tax revenue of US\$236,327,612.72.¹⁰¹

In addition to the tax revenue, concession agreements reportedly carry royalty fees of 2% to 5% charged by the Central Bank of Sudan, specifications and standardization authorities, and customs.¹⁰² As such, for 2024, we estimate a yearly concessionary taxation revenue of US\$236.33 million, plus royalties of between US\$16.88 million and US\$42.20 million, totaling between US\$253.21 million and US\$278.53 million. Despite the ongoing conflict, it is plausible for 2024 revenue and production to be higher than previous years due to such factors as increased global gold prices, a spike in gold prices and demand in Egypt (a significant gold trading partner for Sudan), and the vulnerability of production to meteorological events.¹⁰³

While the exact destination of the collected taxation money is unknown, the SMRC reportedly distributed its 2020 taxation revenue as follows: 56% to the Ministry of Finance and Economic Planning, 4% to the Geological Research Authority, 22% to the state governments, and 18% to the SMRC itself.¹⁰⁴ Based on these percentages, if a similar distribution of taxes took place in 2024, US\$132.34 million would have gone to the Ministry of Finance and Economic Planning, US\$9.45 million to the Geological Research



Authority, US\$51.99 million to the state governments, and US\$42.54 million to the SMRC. This indicates that wartime concessionary mining revenue has likely increased from pre-war levels, contrary to what was previously thought.¹⁰⁵ It also evidences that the SAF has a significant source of revenue from the taxation of production alone, and not just from export revenue, which has been the bulk of the focus of sanctions targeting thus far. This leaves an entire sector of revenue for the warring parties to exploit, if it continues unsanctioned.

This calculation, however, is likely an underestimation of revenue, as concessionary miners in Sudan are subject to multiple taxation mechanisms. For instance, Perseus Mining reportedly expected to pay 7% of its revenue in royalty taxes, 10% in ground fees, and 15% in profit tax, resulting in a total tax rate of 32%.¹⁰⁶ Additionally, concessionary miners are reportedly required to cede 30% of the shares to the government of Sudan and other Sudanese actors.¹⁰⁷ The Perseus Mining project, for example, is allegedly 20% owned by the government of Sudan and is 10% owned by a private Sudanese shareholder.¹⁰⁸ This indicates that the actual revenue the SAF and the Sudanese government derive from concessionary mining operations is likely higher when ownership shares are taken into account.

According to General Manager Mohamed Taher Omar, one of the goals of the SMRC is to improve gold-sector monitoring and oversight to reduce smuggling and tax evasion, as approximately 50% of gold production is currently being smuggled out of Sudan.¹⁰⁹ Should the SMRC be successful in this endeavor, it could yield a significant increase in revenue, and therefore, in conflict financing.

Not All That Glitters Is Gold: The Hidden Revenue Streams Beyond Gold

In addition to gold, Sudan is endowed with other mineral resources that it could use as a source of revenue. Diversifying mineral production has been a strategic goal of Sudan’s Ministry of Minerals; as early as 2013, then-Minister of Minerals Kamal Abdul-Latif indicated a desire to “focus on the diversification of mineral production that includes other minerals like iron-ore, copper, and precious stones,” as Sudan holds “huge reserves of more than 41 different minerals.”¹¹⁰ In addition, silver is reportedly sold separately as a byproduct of gold mining, further contributing to Sudan’s mineral output.¹¹¹

Mining companies in Sudan already have access to a wealth of mineral resources beyond gold. For example, Ariab Mining Company (Ariab), which is reportedly 100% owned by the state-controlled enterprise Industrial Development Bank, has access to minerals beyond gold.¹¹² Ariab’s concession Block 18 has an estimated US\$400 million worth of gold and silver, in addition to deposits of iron, manganese, and tungsten.¹¹³ According to estimates from the Sudanese Ministry of Minerals, one Ariab production site holds reserves of 1,300 metric tons of copper, 170 metric tons of gold, 3,000 metric tons of silver, and 700,000 tons of zinc.¹¹⁴ In 2019, the then-Director of Exploration at the SMRC, Naji Abdullah Mahmoud, claimed that Ariab alone could solve Sudan’s economic issues, as a study confirmed the existence of two copper mines worth US\$22 billion.¹¹⁵ All of these resources demonstrate the likely longevity of mining as a source of conflict financing. Effective enforcement measures should target the relevant actors before these resources can be exploited to their fullest potential.

Furthermore, Sudan’s most recent concession map, dated February 2023, includes at least six iron mines, one feldspar mine, four copper mines, and one fluorite mine.¹¹⁶ More recently, in September 2024, Chinese state-owned company Norinco was in the final stages of producing a memorandum of understanding for copper mining with the SMRC.¹¹⁷ This highlights the importance of factoring in how revenue from other mineral resources could potentially fund the warring parties. The RSF and SAF’s ownership or taxation of some of these other mines is an additional source of conflict revenue.

Chrome in Ingessana Hills

Ingessana Hills contains one of the largest chromite ore deposits in Sudan, with an estimated two million metric tons of chromite reserves.¹¹⁸ Ingessana Hills and the Ingessana Chrome Factory are in Blue Nile State, which is under the control of the SAF and the Sudanese government.¹¹⁹ Ingessana Chrome Factory was reportedly a Sudanese-Chinese partnership as far back as 2011, and it reportedly exported exclusively to China with a production rate of approximately 400 metric tons of chromium per day.¹²⁰

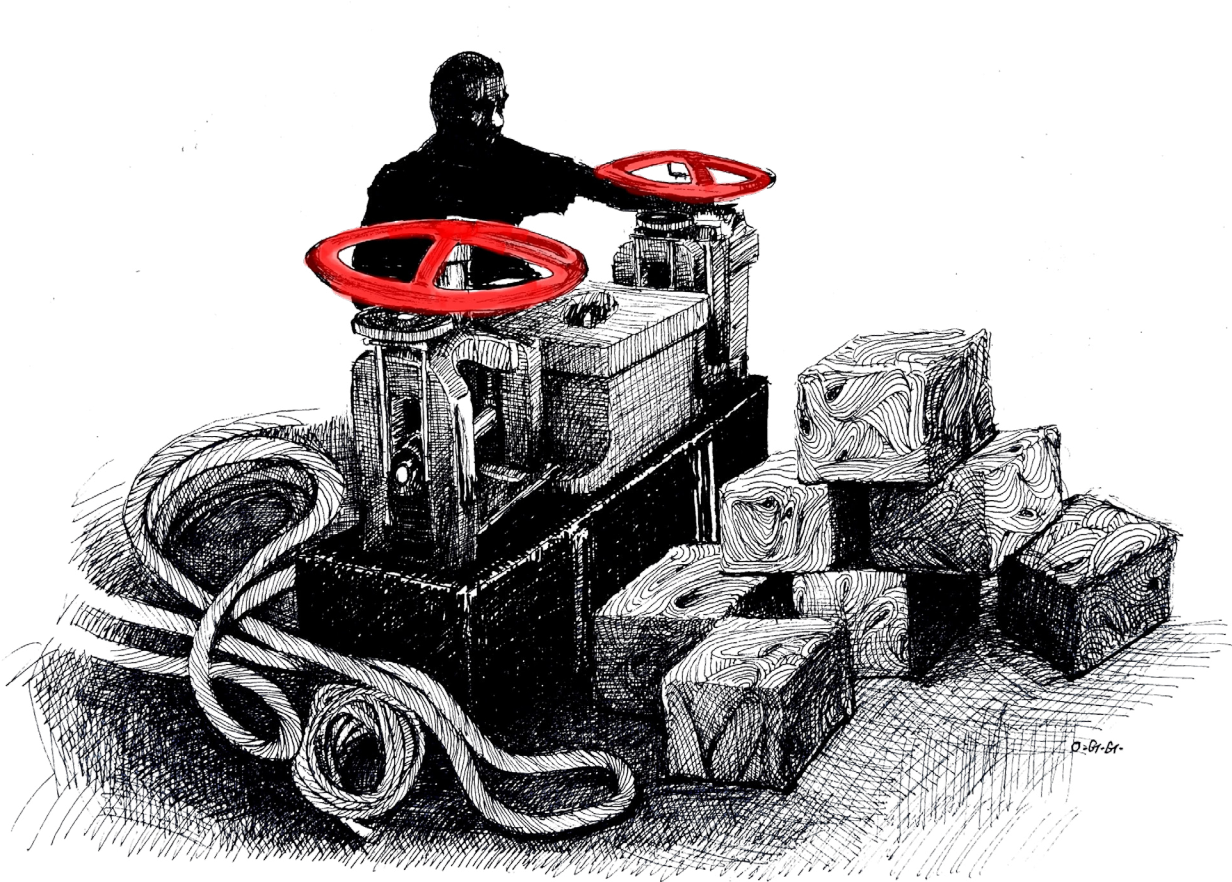
One of the owners of Ingessana Chrome Factory is allegedly Advanced Mining Works, which is 99% owned by Red Rock and 1% owned by Giad for Cars; all three are Sudanese companies.¹²¹ The United Kingdom sanctioned Red Rock in April 2024 for its central role in financing the SAF.¹²² Given that an entity financing the SAF reportedly has an indirect ownership stake in Ingessana Chrome Factory, the SAF's revenue from the company likely extends beyond the potential taxation revenue estimated above.¹²³ This is further evidenced by human-sourced reports that Advanced Mining Works, the alleged owner of the mine, exports chromite to Russia and Turkey.¹²⁴ As such, the SAF is likely deriving conflict funds from chromite exports to China, Russia, and Turkey.

Recent trade data reveals that chrome ore exports from Sudan to China have continued after the outbreak of conflict, suggesting potential financial gains for military-affiliated entities. Sudan trade data holdings show that in May 2023, after the start of the ongoing conflict, Ingessana Chrome Factory sent approximately 78 shipments of chrome ore concentrate from Sudan to China.¹²⁵ The consignee on the shipments was the Chinese state-owned investment and commodity supply chain company China Chengtong International Co Ltd.¹²⁶ The shipments weighed a combined 2,028,946 kg (or 2,028.95 metric tons), though available trade records do not specify whether this weight reflects the net or gross weight.¹²⁷ This indicates that if the ownership of Ingessana Chrome Factory has not changed, the SAF has very likely profited off of the sale of chrome ore to Chinese state-owned entities.

China trade data holdings reveal additional post-war chrome ore shipments from Sudan, though there is insufficient information in available trade records to determine from which mines and/or factories the chrome ore was sourced. In particular, in March 2024, a Chinese company imported at least 38 shipments of chrome ore labeled as containing a net weight of 995,670 kg (or 995.67 metric tons).¹²⁸ As of April 2025, the lowest price for chrome ore at the Shanghai Metal Market is US\$230/metric ton.¹²⁹ This trade, which represents one day's worth of imports by just one Chinese company, has a lowest approximated value of US\$229,004.10. This valuation underscores the potential economic significance of small-scale mineral exports in conflict-affected regions, particularly when aggregated over time and across multiple actors.

The reported SMRC taxation rate for industrial minerals is between 13% and 18%, depending on the type of mineral, the company size, and contract terms.¹³⁰ Assuming that the 2,028.95 metric tons of chrome ore shipped by Ingessana Chrome Factory to China in May 2023 reflected the shipments' net weight, this would give the SMRC an approximate revenue of about US\$60,000 to US\$80,000 from this single-day shipment of chrome from the Ingessana Chrome Factory. Additionally, industrial minerals like copper and chrome reportedly carry royalty fees of 3% to 4% charged by the Central Bank of Sudan, specifications and standardization authorities, and customs. This adds a potential estimated US\$13,000 to US\$18,000 in revenue for the Sudanese government from this shipment.¹³¹

In the case of chrome in particular, China is the world's largest chromium importer,¹³² and increasing demand from China could result in chromium becoming a more stable form of revenue for the Sudanese government when compared to gold.¹³³ While these numbers pale in comparison to the millions of dollars brought in by the gold industry, the case of Ingessana Chrome Factory is but one instance of how Sudan's myriad of other minerals could be leveraged for conflict financing by the warring parties, especially minerals that may be more insulated from current sanctions.



Conclusion and Recommendations

To date, targeting by enforcement bodies and policymakers has largely focused on gold export and post-export actors in the Sudanese mineral industry, overlooking pre-export actors like the precursor chemical supply chain, miners, processors, and taxation bodies, as well as actors in the non-gold mineral sectors.

Precursor chemical flows, auxiliary profiting mechanisms like the SMRC, and non-gold mineral producers and exporters are all critical in generating financial resources that allow the SAF and the RSF to operate more sustainably. With SMRC General Director Mohamed Taher Omar reporting that the Sudanese government is establishing a gold exchange and three domestic gold refineries, SAF's potential for extracting revenue from direct operations and taxation mechanisms will extend further into the gold supply chain, giving them more opportunities for profit before the mineral leaves Sudan.¹³⁴

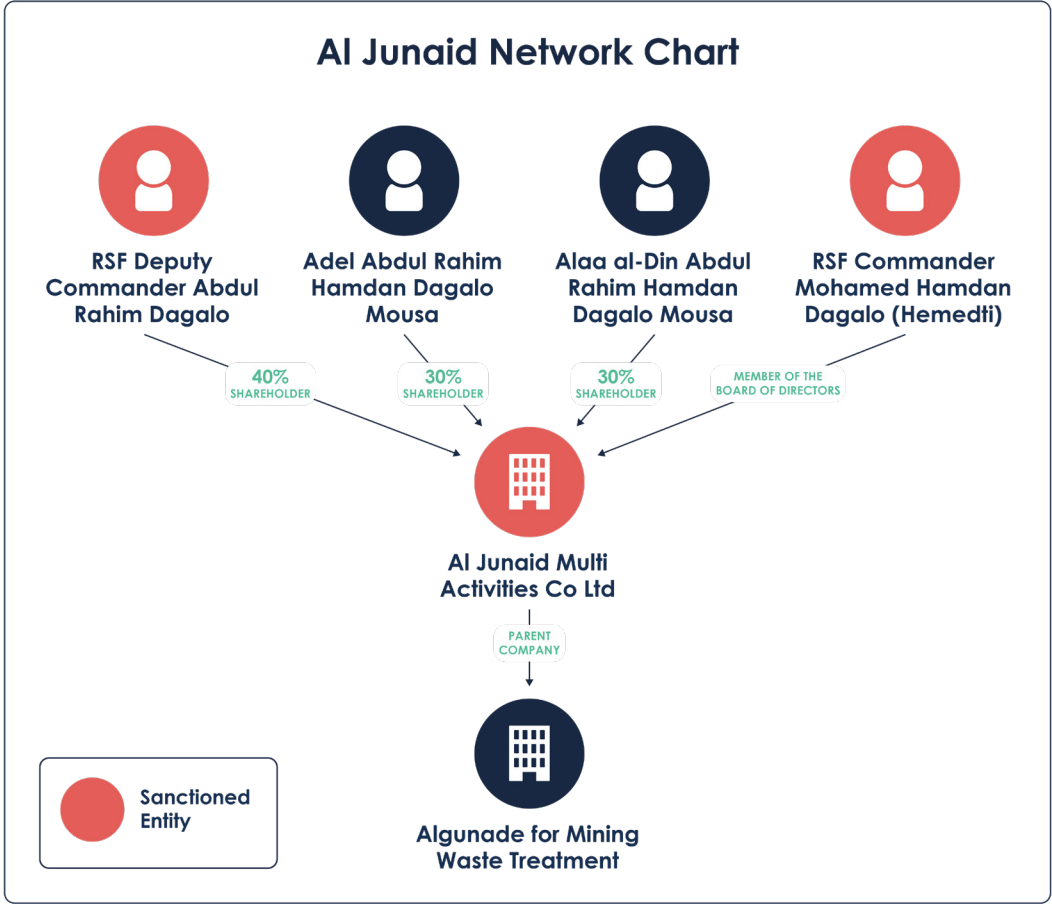
- Sanction mining companies and related government entities involved in conflict financing:** To effectively hinder mining companies—including precursor chemical providers—and related Sudanese government entities from serving as a source of funding for the SAF and RSF, sanctioning and enforcement bodies like the Department of the Treasury's Office of Foreign Assets Control should subject such entities to sanctions, asset freezes, and other enforcement actions. Because mining has become a key part of the war economy, these measures should be implemented with care to ensure that enforcement actions remain targeted toward the warring parties and do not cut off livelihoods for local, small-scale miners.
- Suspend and ban mining companies involved in conflict financing from private markets:** The London Bullion Market Association and other private markets should suspend or ban mining companies and related Sudanese government entities contributing to conflict financing.
- Enhance due diligence of mineral sourcing:** Private sector entities sourcing minerals should conduct robust due diligence to avoid indirectly funding the warring parties in Sudan; this includes following the Organisation for Economic Co-operation and Development's Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas.
- Follow international mining standards:** Policymakers and civil society should encourage adherence to standards like the World Gold Council's Responsible Gold Mining Principles.
- Scrutinize all parts of the mineral supply chain:** Investigators, enforcement bodies, policymakers, and civil society should adjust their understanding of the Sudanese mining industry to increase focus on and targeting of actors at the beginning of the mining supply chain, like precursor chemical providers and the miners themselves. Recent sanctions have, for example, targeted U.A.E.-based gold purchasers.¹³⁵ Similar measures should be leveraged across the entire supply chain to ensure that no part is overlooked.

Annex 1: Evidence of Gold Mining Activity in RSF-Controlled Areas

The Sudanese company Al Junaid is a holding company owned by RSF deputy commander Abdul Rahim Dagalo and his two sons, Adel Abdul Rahim Hamdan Dagalo Mousa and Alaa al-Din Abdul Rahim Hamdan Dagalo Mousa, while RSF commander Mohamed Hamdan Dagalo (Hemedti) serves on Al Junaid's board of directors.¹³⁶ Al Junaid is sanctioned in several jurisdictions, including the European Union, Canada, the United States, the UK, Monaco, and Switzerland.¹³⁷

One of the key mining areas for Al Junaid is Sungo in Darfur.¹³⁸ In December 2024, the SAF launched airstrikes on the mining site, reportedly targeting warehouses and housing, illustrating Al Junaid and Sungo's perceived importance to the RSF's operations.¹³⁹ According to investigative outlets Ayin and Darfur 24, Sungo has been "fully operational" since the start of the conflict.¹⁴⁰

While Hemedti, Abdul Rahim Dagalo, and Al Junaid itself are sanctioned, Abdul Rahim Dagalo's sons and the subsidiary company Aljunade for Mining Waste Treatment remain unsanctioned.¹⁴¹ Aljunade for Mining Waste Treatment has received shipments of sodium cyanide, a mining precursor chemical, after the start of the conflict, which makes it a node in the gold supply chain and RSF financing.¹⁴²



Annex 2: Evidence of Gold Mining Activity in SAF-Controlled Areas

The six companies and their accompanying mines featured in this annex are closely linked to the SAF through their ownership. Ongoing activity at the mines was determined and corroborated through the following methods:

- Change analysis. Identification of visible changes present in satellite imagery of mines, such as new construction, new or expanded mine sites, products of mining activity, and the presence and movement of vehicles.
- Analysis of the mean nighttime radiance at the site as a proxy for nighttime activity. Analysis of nighttime radiance as an indication of the mine's activity is effective and appropriate in these cases, given the mines' location in an uninhabited desert.¹⁴³ Radiance analysis was conducted using VIIRS (Visible Infrared Imaging Radiometer Suite) Nighttime Lights data.
- Analysis of the mine location's normalized difference water index (NDWI) value over time. In a desert environment, the extended presence of water can indicate mining and refining activity, which produces wastewater and mine tailings that are held in large holding ponds. NDWI is a value derived from the different amounts of light present in remote sensing imagery across the visible and infrared light spectrum, with NDWI values above 0 on a -1 to 1 scale indicating the likely presence of surface water.¹⁴⁴ This analysis used European Space Agency Sentinel-2 imagery of the six areas, which were collected approximately every five days from January 1, 2018 to April 9, 2025. Using these images, this analysis was able to calculate NDWI and the location's total surface water area over time. For all six sites, the NDWI cannot be fully explained by rain activity, corroborating and supporting the evidence of activity identified in satellite imagery and through analysis of nighttime radiance.

Alliance for Mining



Figure 1: Satellite imagery of a portion of an Alliance for Mining site, November 2023 . The site is on the border of Sudan's River Nile and Red Sea states. The site has three primary mining areas, along with several ponds and leach heaps for refining.

The last available ownership data for Alliance for Mining indicates that it is 68% owned by Kosh Exploration and Production Limited, 25% owned by Sudamin, and 7% owned by Exxon Advanced Projects Limited.¹⁴⁵

In 2014, the Sudanese government and Kosh Exploration and Production formed an agreement to develop gold resources, resulting in the formation of Alliance for Mining.¹⁴⁶ Kosh Exploration and Production and Alliance for Mining are subsidiaries of U.A.E.-based Emiral Resources, a company founded by Russian national Boris Ivanov.¹⁴⁷ U.A.E. government figures have also been reported to control the company.¹⁴⁸ In February 2025, Bloomberg reported that Alliance for Mining had restarted operations, and that it exported over a ton of gold in 2024.¹⁴⁹



Figure 2: Satellite imagery displaying earth movements at the Alliance for Mining site, November 2023 (left) and March 2024 (right). These include both large-scale movements of overburden rock/tailings (pictured), as well as the collection of small piles of what is presumably ore-bearing rock destined for downstream refining.

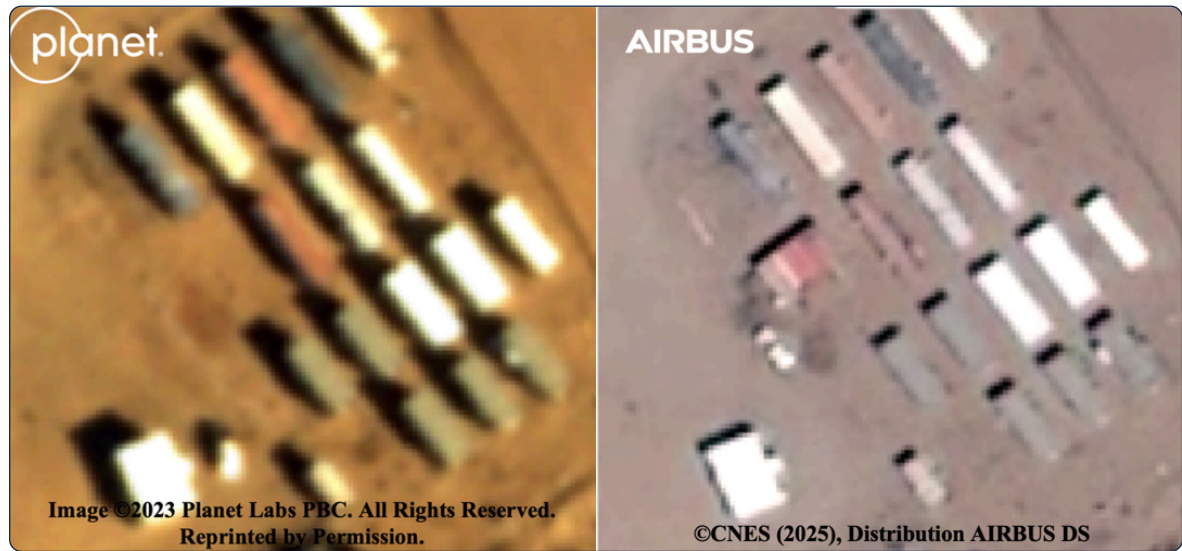


Figure 3: Satellite imagery before and after new construction at the Alliance for Mining site, November 2023 (left) and March 2024 (right). This construction includes several small structures near the site offices and worker accommodation (pictured).

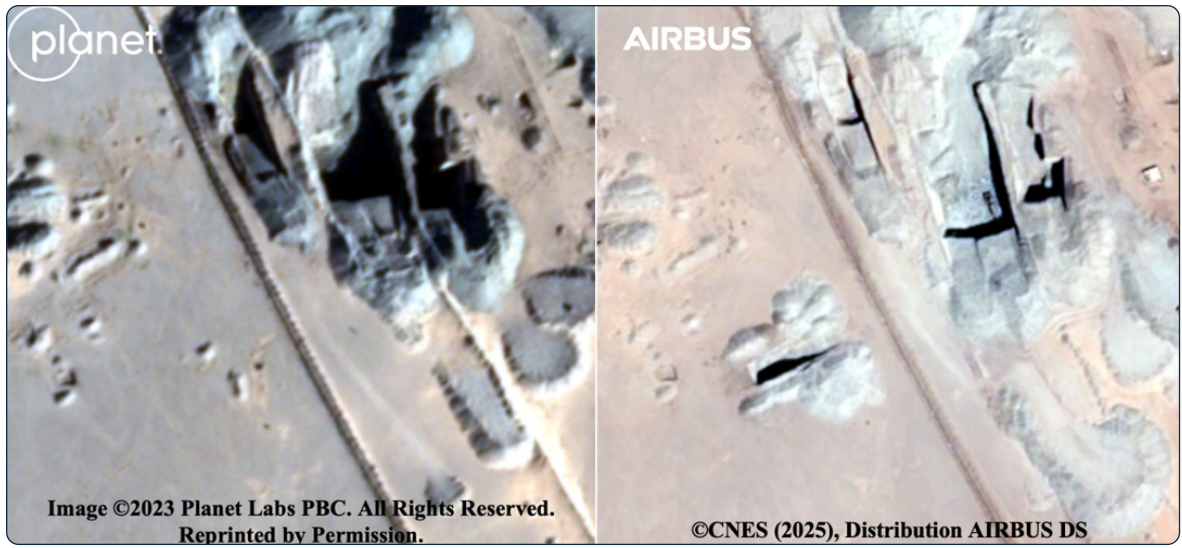


Figure 4: Satellite imagery before and after new excavation at the Alliance for Mining site, November 2023 (left) and March 2024 (right). Small-to-medium scale excavations were detected at several locations within the site.



Figure 5: Satellite imagery of vehicle movement at the Alliance for Mining site, November 2023 (left) and March 2024 (right). Many of the vehicles appear to be large construction and transport vehicles likely to be involved in mining operations.

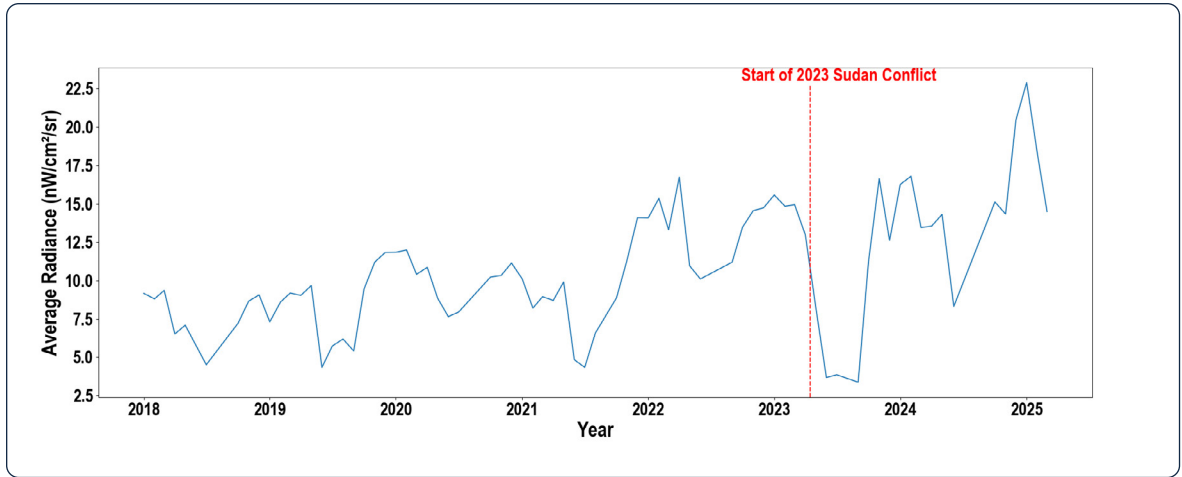


Figure 6: Mean nighttime radiance over the Alliance for Mining site.

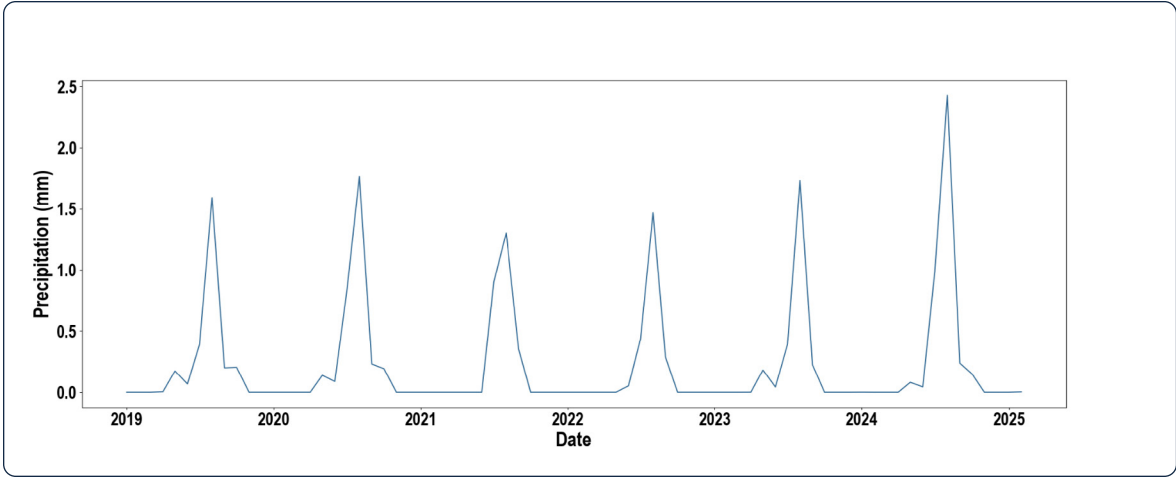


Figure 7: Monthly mean precipitation at the Alliance for Mining site.

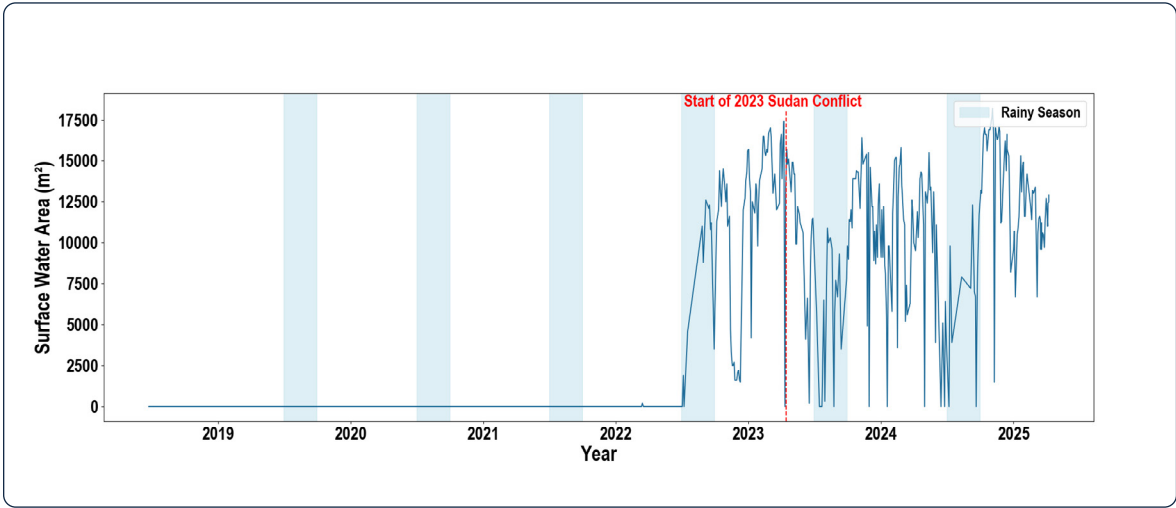


Figure 8: NDWI-detected surface water at the Alliance for Mining site.

Ariab Mining Company



Figure 9: Satellite imagery of the northern portion of the Ariab Mining Company site, December 2024. The site is located in Sudan's River Nile State. The site has a large open-pit mine, along with areas for refining, including holding ponds, leach heaps, and chemical storage tanks.

The last available ownership data indicates that the company is 100% owned by the Industrial Development Bank (which is, in turn, 75% owned by the Ministry of Finance and 25% by the Central Bank of Sudan).¹⁵⁰ Ariab Mining Company is therefore likely a fully state-owned company.¹⁵¹ The company published a press release on August 1, 2023 claiming to be the “only mining operation that has not been disturbed” in Sudan, touting its alleged ability to still export gold.¹⁵²

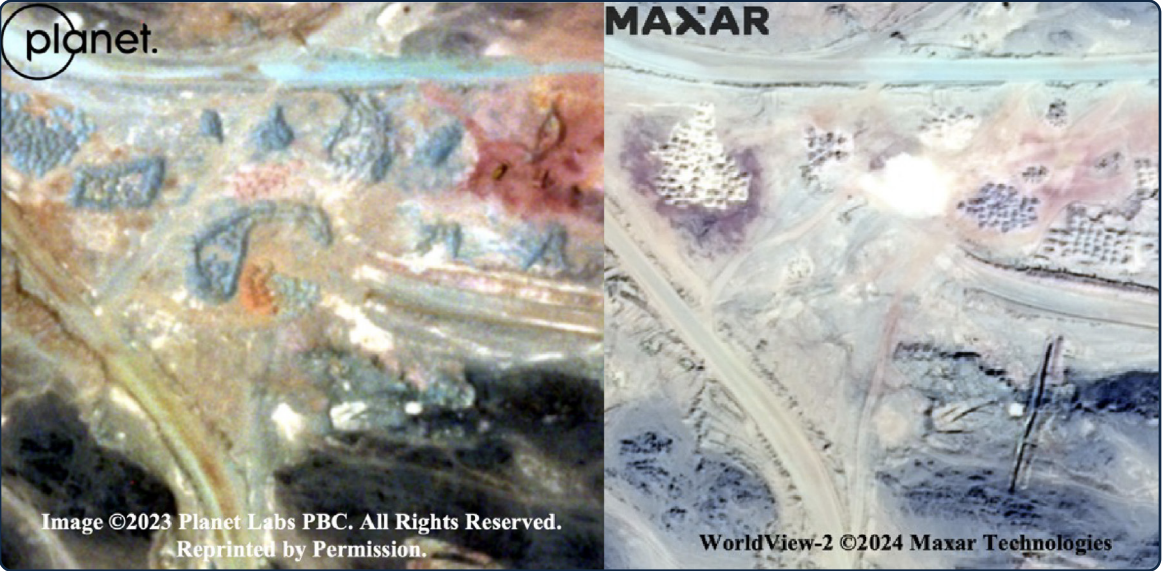


Figure 10: Satellite imagery of earth movement at the Ariab Mining Company site, July 2023 (left) and December 2024 (right). Comparison of site imagery showed movements of the collection of small piles of what is presumably ore-bearing rock (pictured).



Figure 11: Additional satellite imagery of earth movement at the Ariab Mining Company site, July 2023 (left) and December 2024 (right). Review of site imagery also revealed changes to the leach heap/tailings pile in the northern part of the area (pictured).

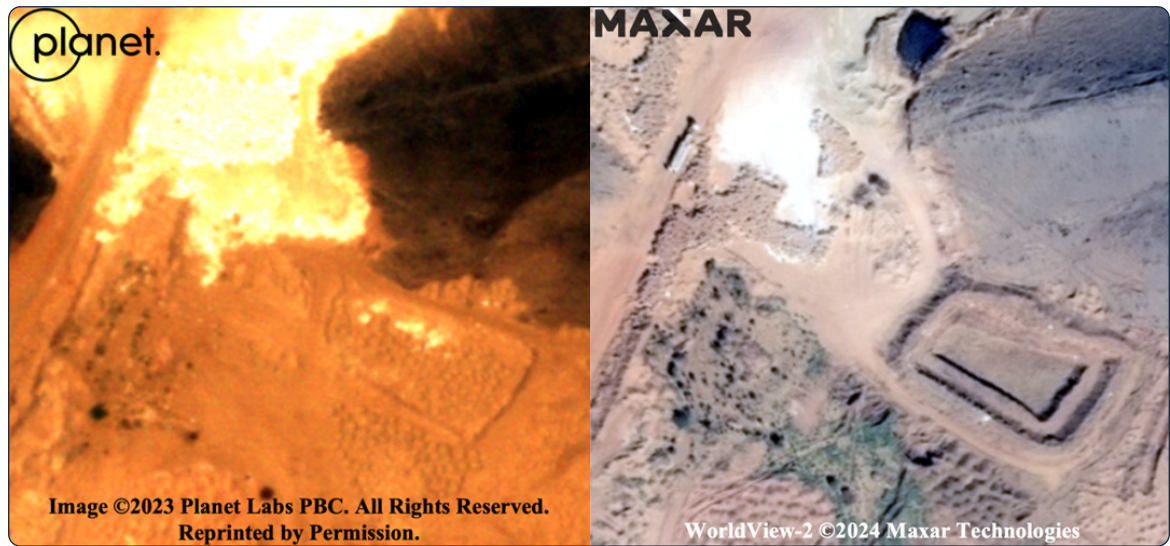


Figure 12: Satellite imagery before and after new excavation and vehicle movement at the Ariab Mining Company site, July 2023 (left) and December 2024 (right). Analysis of imagery indicated that excavation occurred both inside of the large open-cut mine, as well as beyond it.



Figure 13: Satellite imagery of vehicle movement at the Ariab Mining Company site, July 2023 (left) and December 2024 (right). Many of the vehicles appear to be large construction and transport vehicles likely to be involved in mining operations. However, despite this activity, no new construction was detected in this mining area.

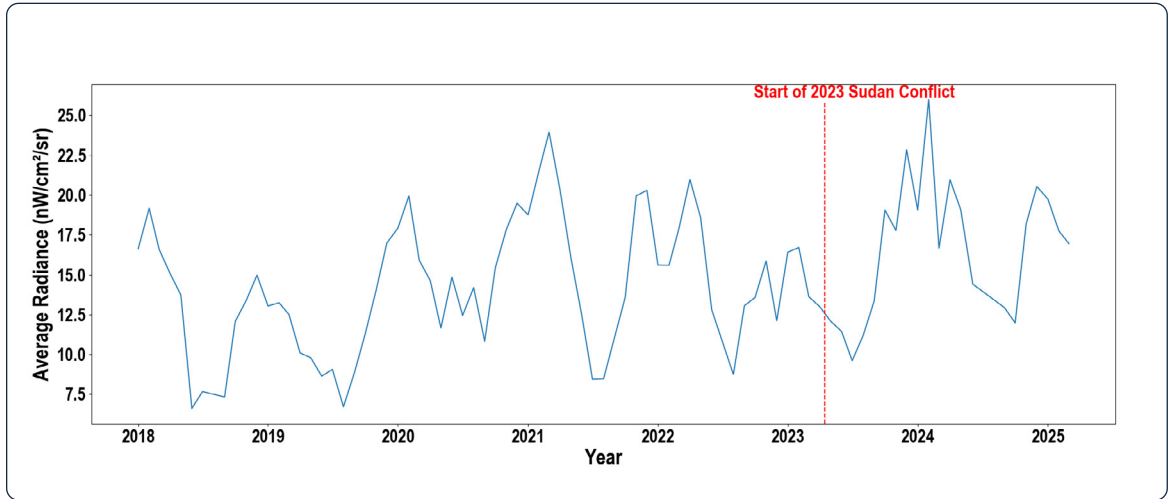


Figure 14: Mean nighttime radiance over the Ariab Mining Company site.

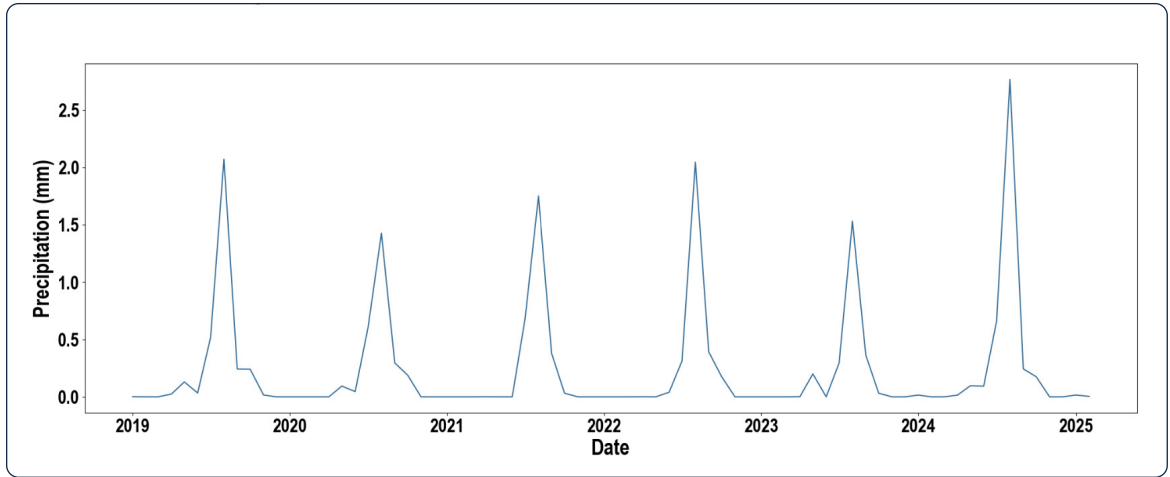


Figure 15: Monthly mean precipitation at the Ariab Mining Company site.

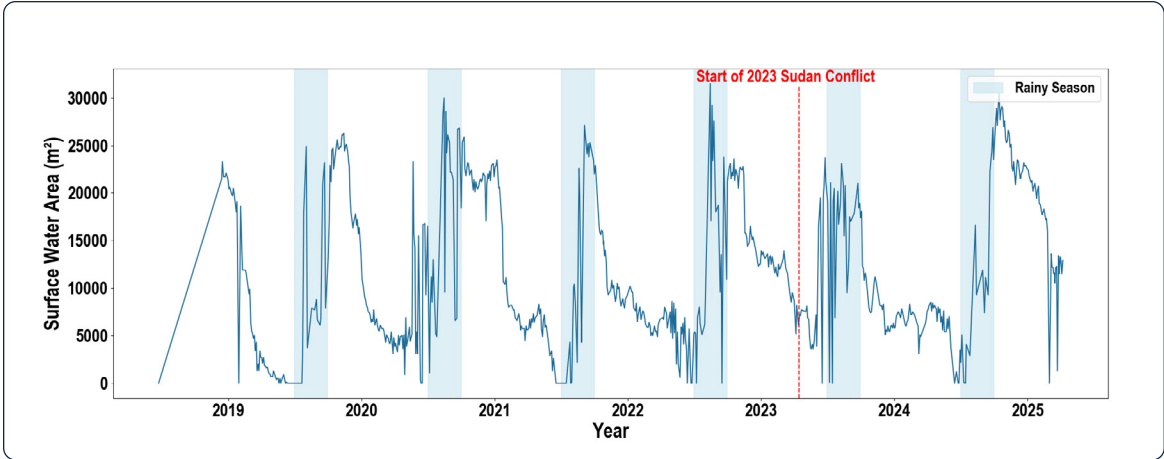


Figure 16: NDWI-detected surface water at the Ariab Mining Company site.

Delgo Mining



Figure 17: Satellite imagery of the Delgo Mining site, December 2024. The site is located in Sudan's Northern State. The site has several small open-pit mines, alongside ore heaps and tailings mounds. It also has an area for refining, including a holding pond, leach heaps, and leach ponds.

The last available ownership data indicates that Delgo Mining is 82% owned by Tahe International Metal Madencilik A.Ş. and 18% owned by the Sudanese government.¹⁵³



Figure 18: Satellite imagery before and after new construction at the northeast area of the Delgo Mining site, March 2024 (left) and December 2024 (right). However, it is unclear whether this construction, which appears to be part of an informal settlement, is related to mining operations.

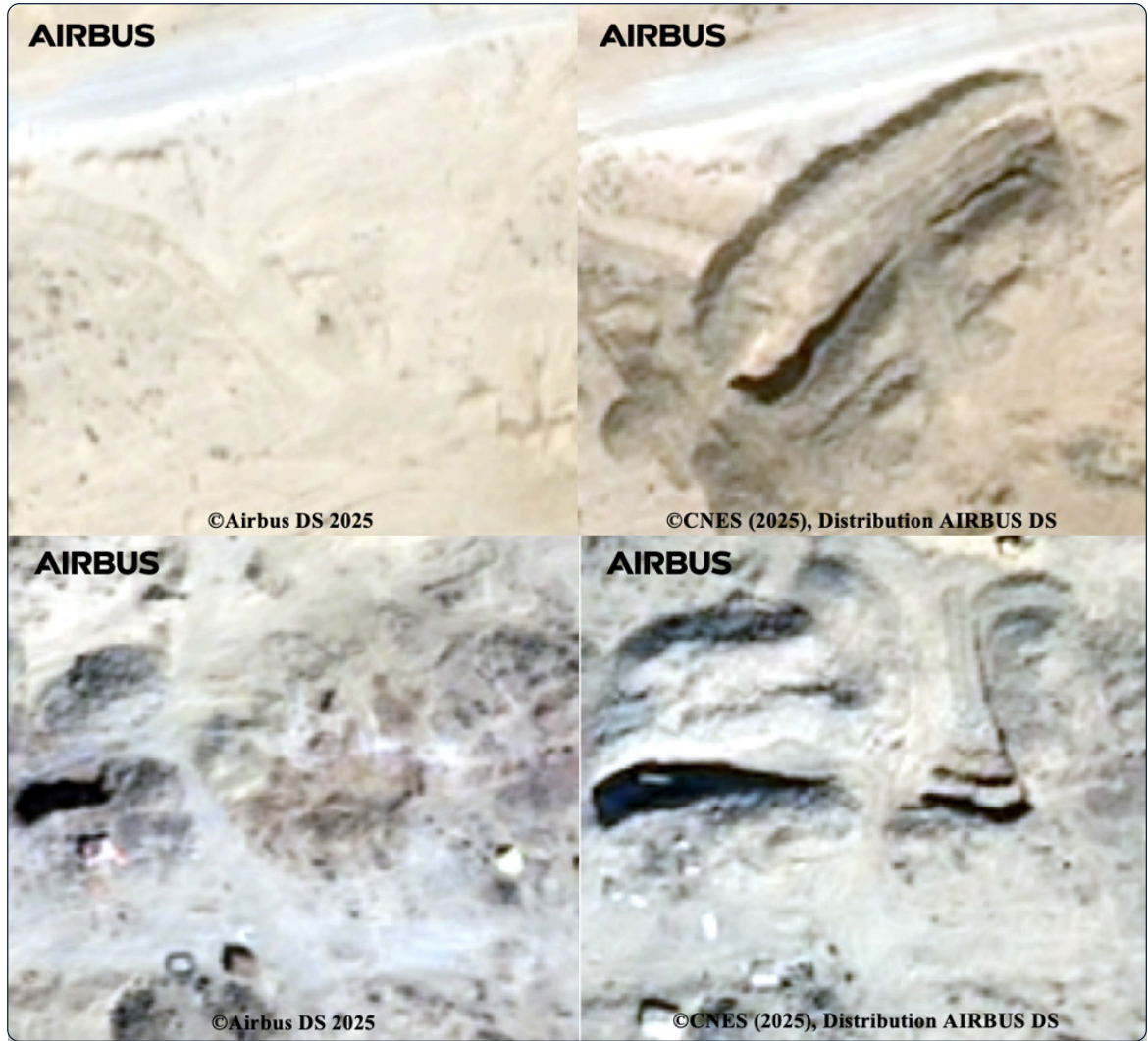


Figure 19: Satellite imagery before and after of one of the new excavations and vehicle movement at the Delgo Mining site, March 2024 (top left and bottom left) and December 2024 (top right and bottom right).

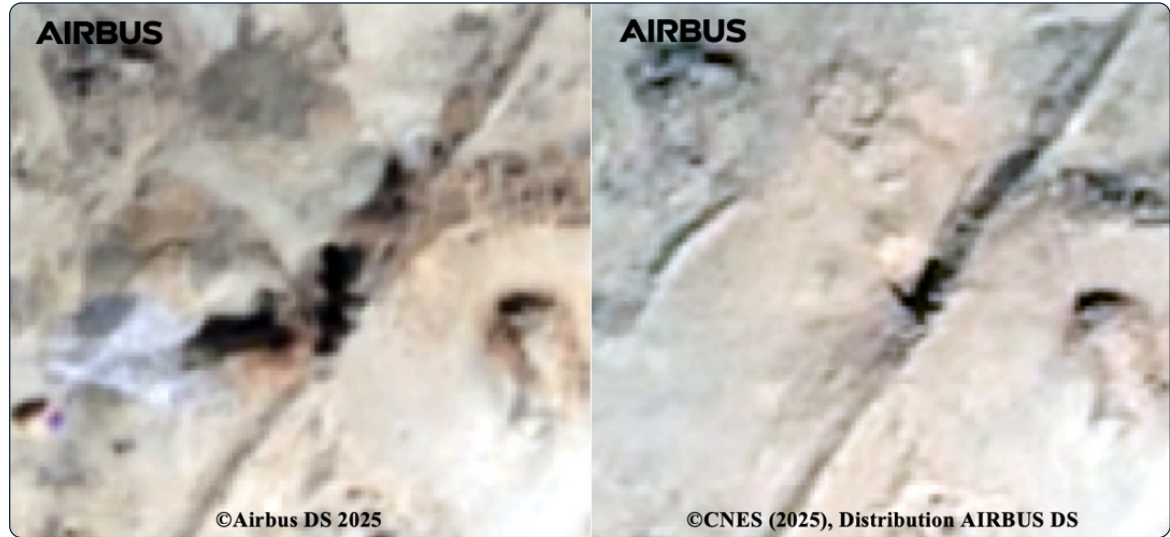


Figure 20: Satellite imagery before and after of one of the new excavations at the Delgo Mining site, March 2024 (left) and December 2024 (right). While analysis revealed a significant number of vehicle movements, including heavy mining excavators, no large-scale earth movements were detected.

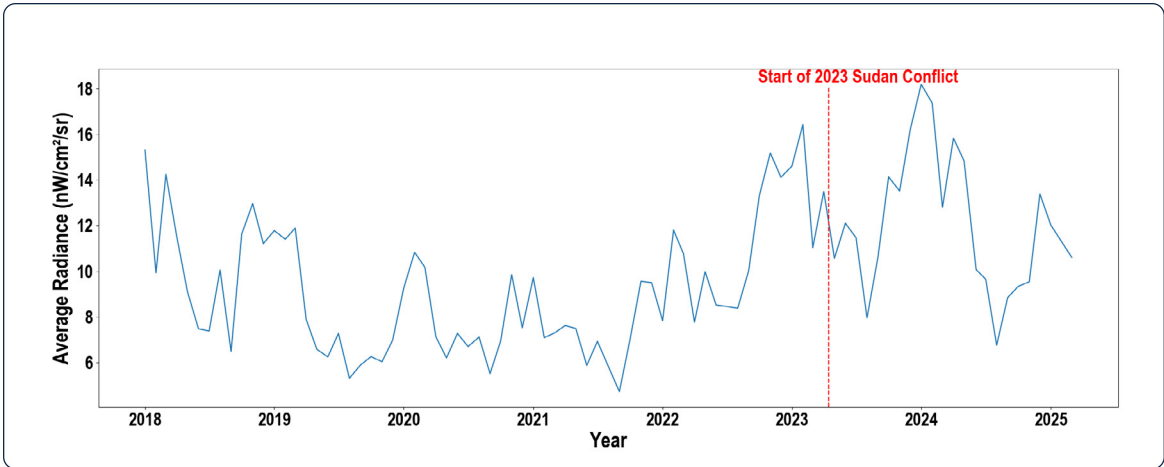


Figure 21: Mean nighttime radiance over the Delgo Mining site.

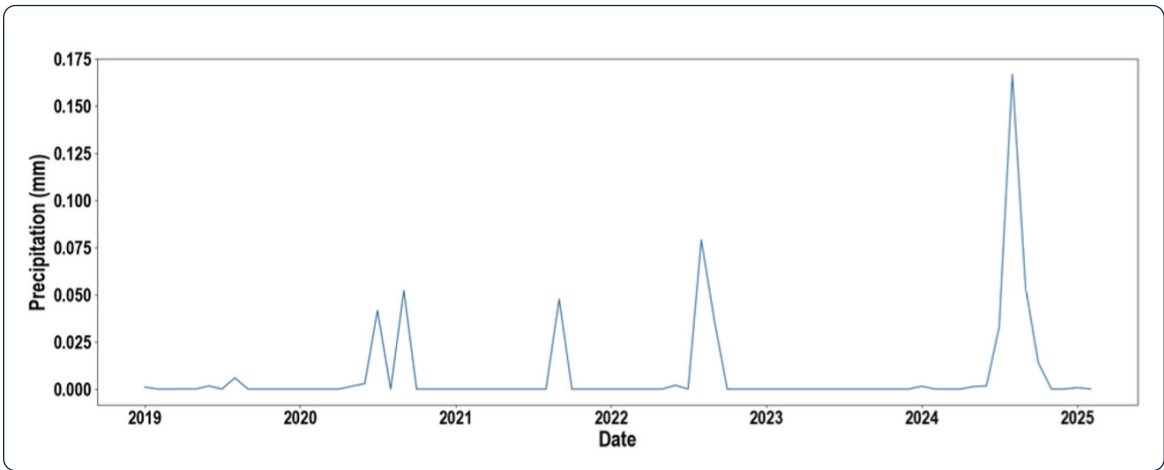


Figure 22: Monthly mean precipitation at the Delgo Mining site.

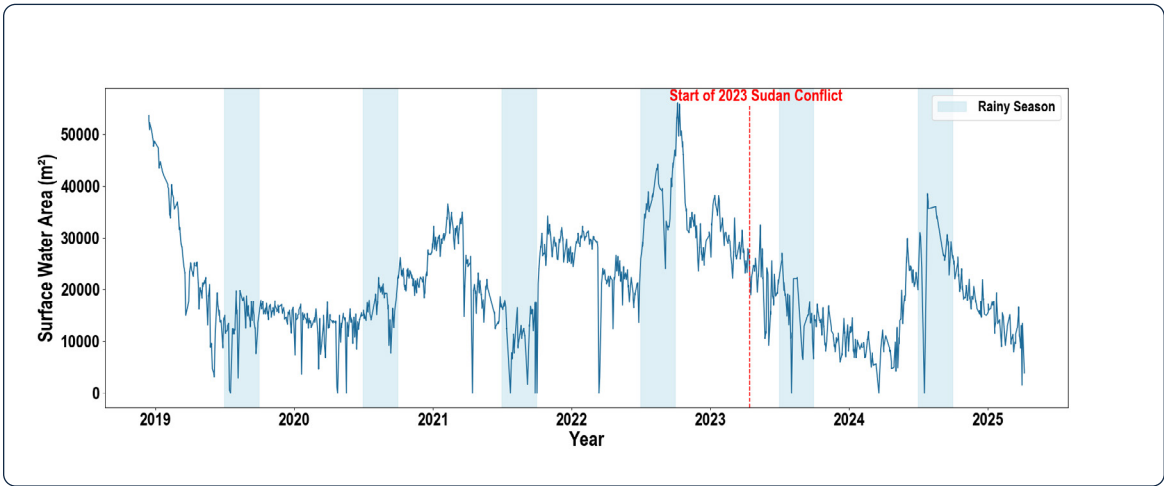


Figure 23: NDWI-detected surface water at the Delgo Mining site.

Manub for Mining



Figure 24: Satellite imagery of the Manub for Mining site, November 2024. The site is located in Sudan's River Nile State. The site has a series of small, open-pit mines, each with its own heaps and tailings mounds, along with a central area for refining that contains several holding ponds, leach heaps, chemical tanks, and leach ponds

The last available ownership data indicates that Manub for Mining is 78% owned by Managem for International Mining (Managem) and 22% owned by the state-owned Sudamin.¹⁵⁴ Managem for International Mining is a Moroccan company controlled by pan-African investment fund Al Mada, which is, in turn, primarily owned by the Moroccan royal family.¹⁵⁵ Shortly after the outbreak of hostilities, Managem reportedly halted production at the site and repatriated its workers.¹⁵⁶

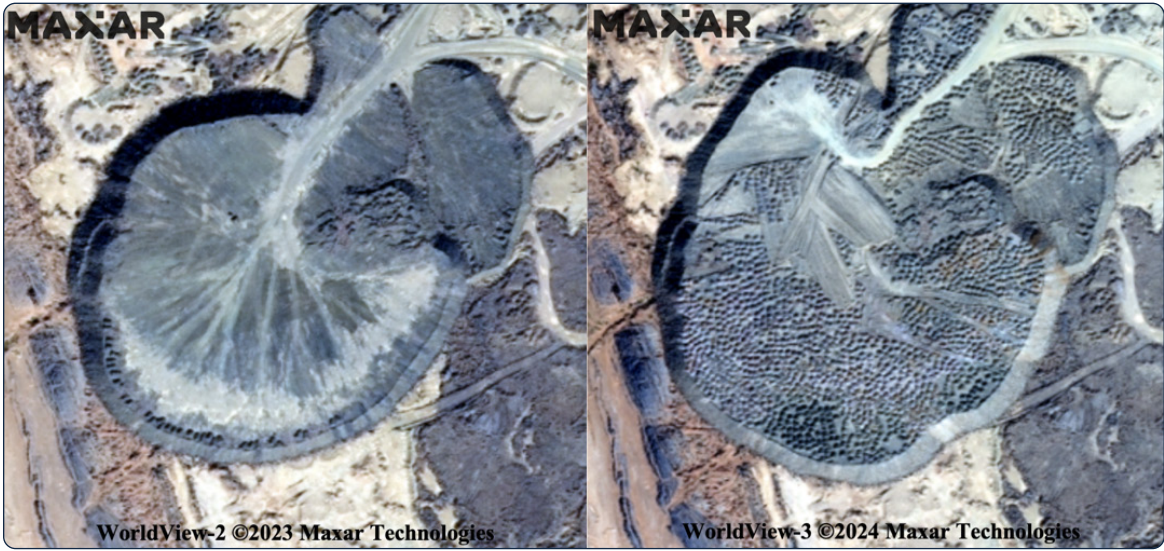


Figure 25: Satellite imagery of earth movement at Manub for Mining, December 2023 (left) and November 2024 (right). Observed earth movements included large-scale movements of overburden rock/tailings (pictured), as well as large movements of piles of ore.



Figure 26: Satellite imagery before and after new construction at Manub for Mining, December 2023 (left) and November 2024 (right). This construction appears to be the frames of new office buildings or worker accommodations.



Figure 27: Satellite imagery before and after new excavation at Manub for Mining, December 2023 (left) and November 2024 (right). Analysis revealed fresh excavation in both the primary open-cut mine (pictured), as well as outside of it.



Figure 28: Satellite imagery of vehicle movement at Manub for Mining, December 2023 (left) and November 2024 (right). Many locations at the mine exhibited vehicular movements, particularly within the main built-up area.

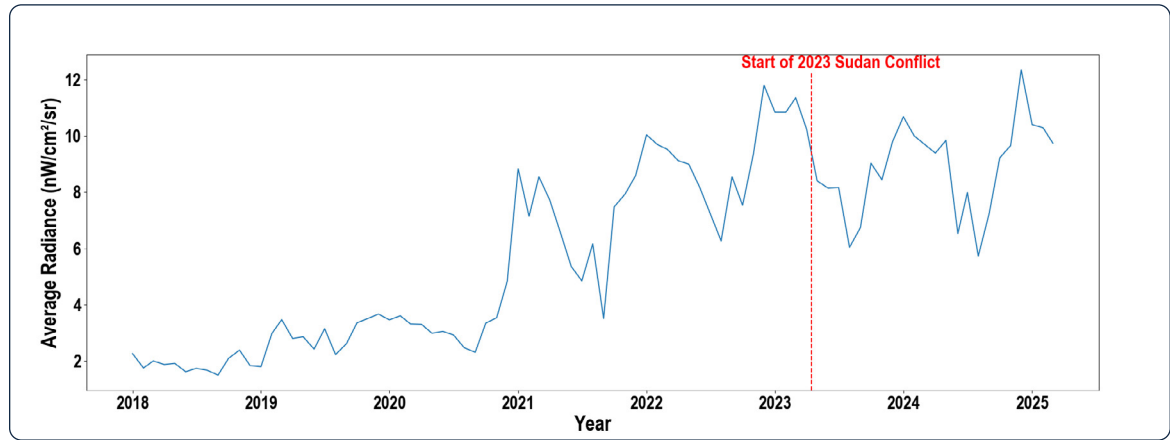


Figure 29: Mean nighttime radiance over the Manub for Mining site.

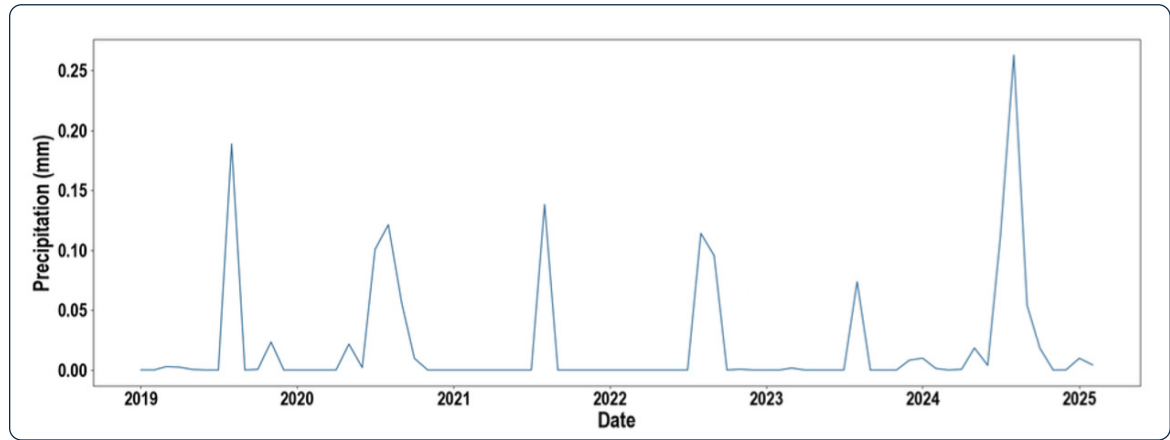


Figure 30: Monthly mean precipitation at the Manub for Mining site.

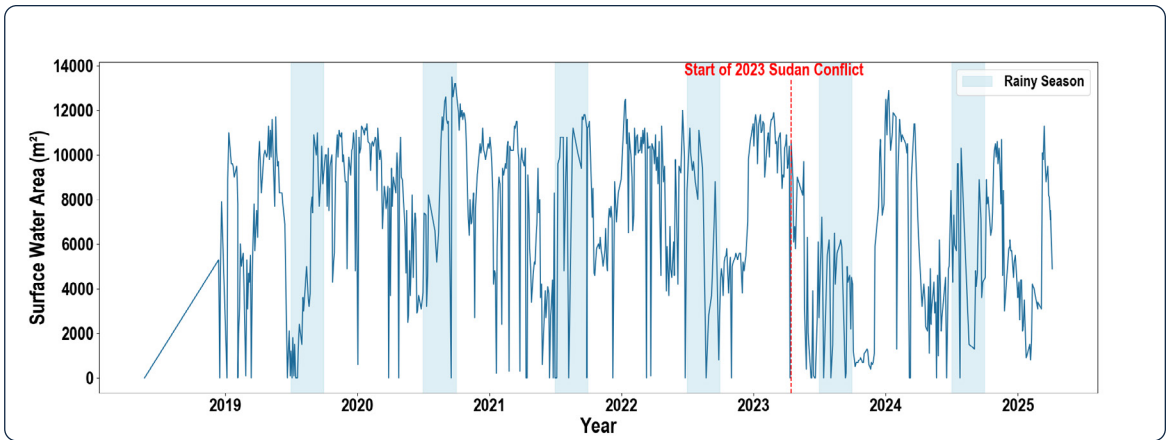


Figure 31: NDWI-detected surface water at the Manub for Mining site.

Omdurman Mining



Figure 32: Satellite imagery of the Omdurman Mining site, March 2025. The site is located in Sudan's River Nile State. The site has a large open-pit mine with ore heaps and tailings mounds scattered nearby. A location for refining is located in the south, with a single leach heap draining into smaller ponds.

The last available ownership data indicates that Omdurman Mining is 82% owned by Rida Engineering and Construction and 18% owned by the state-owned Sudamin.¹⁵⁷ Rida Engineering and Construction and Omdurman Mining are subsidiaries of Sudanese and U.A.E. company, Rida Group, which claims to be a Sudanese company with an office in the U.A.E.¹⁵⁸

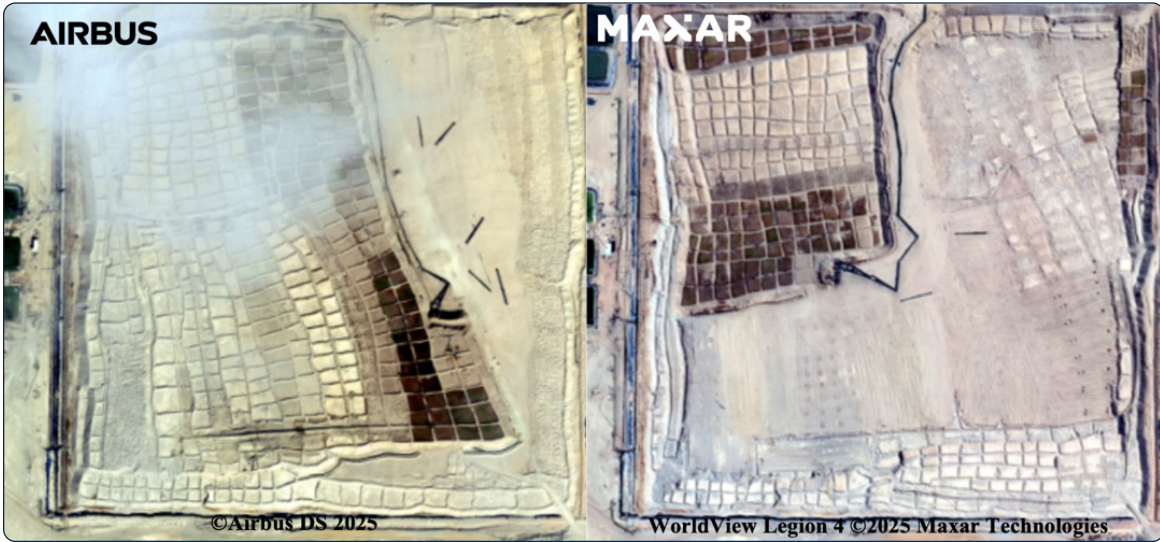


Figure 33: Satellite imagery showing large surface features atop a tailings/ore heap that were reorganized into the form of grid-like structures, which is likely related to mining operations, at Omdurman Mining, January 2024 (left) and March 2025 (right).

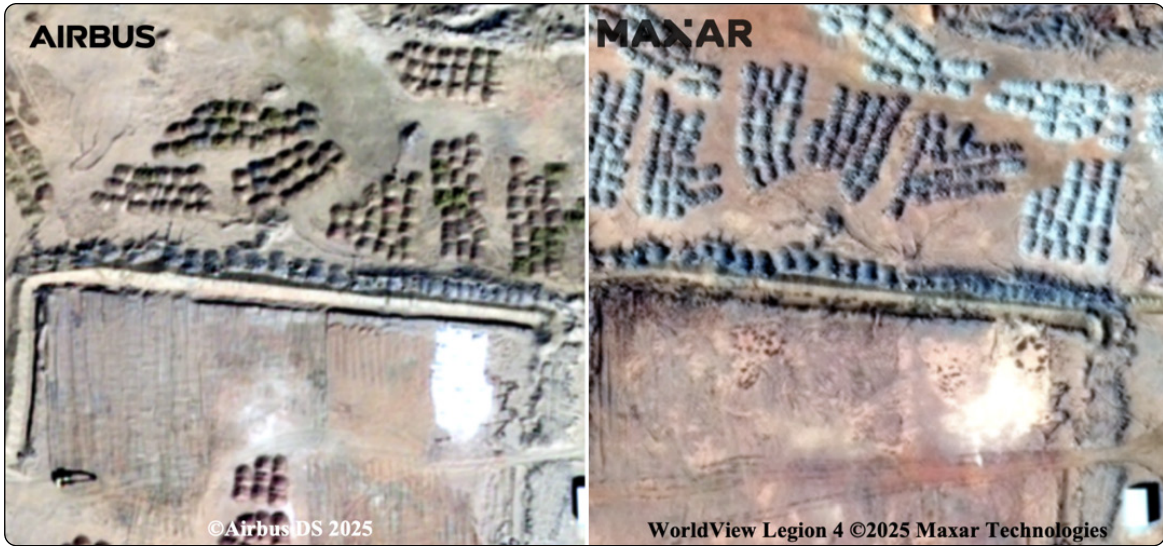


Figure 34: Additional satellite imagery showing changes in the arrangement and density of ore piles at Omdurman Mining, January 2024 (left) and March 2025 (right).



Figure 35: Satellite imagery showing clusters of vehicles shifting positions, with several newly appearing or reappearing, at Omdurman Mining, January 2024 (top left and bottom left) and March 2025 (top right and bottom right). These included movements of heavy mining, construction, and transport vehicles.

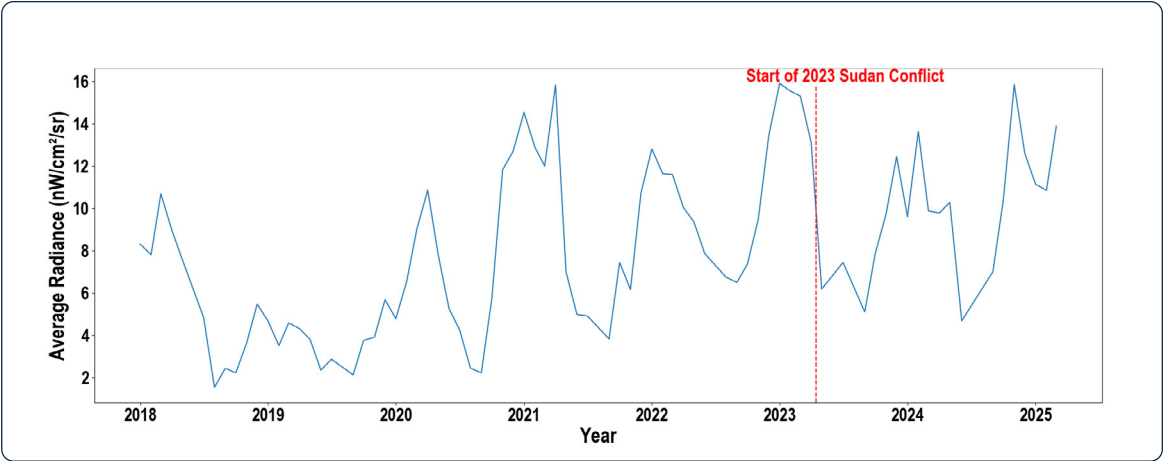


Figure 36: Mean nighttime radiance over the Omdurman Mining site.

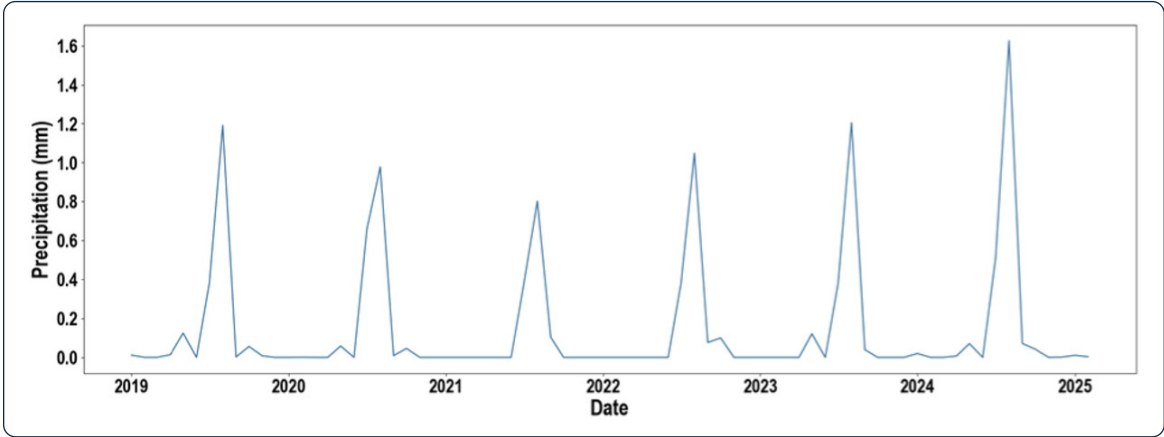


Figure 37: Monthly mean precipitation at the Omdurman Mining site.

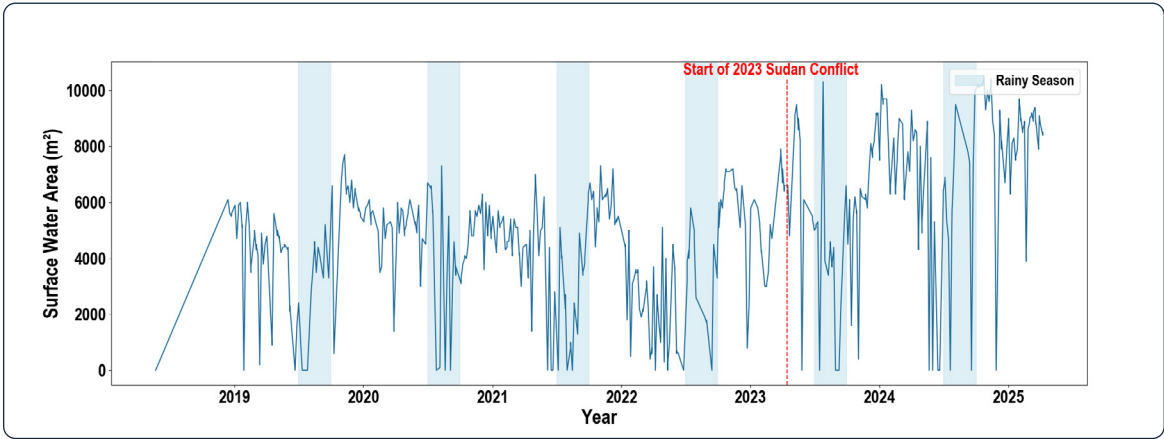


Figure 38: NDWI-detected surface water at the Omdurman Mining site.

Orshab¹⁵⁹



Figure 39: Satellite imagery of the Orshab site, November 2024. The site is located in Sudan's Red Sea State. The site has a large open-pit mine that is surrounded by ore and tailings piles. The southeast portion of the site contains an area for refining using the carbon-in-leach process.

The last available ownership data indicates that Orshab is 73% owned by Princely Enterprise and 27% owned by the government of the Republic of Sudan.¹⁶⁰



Figure 40: Satellite imagery of shifts in material along a curved containment area, possibly indicating the clearing, relocation, or expansion of ore or tailing storage, at Orshab, November 2024 (left) and January 2025 (right). The overall volume and surface texture of the deposit appear visibly altered.

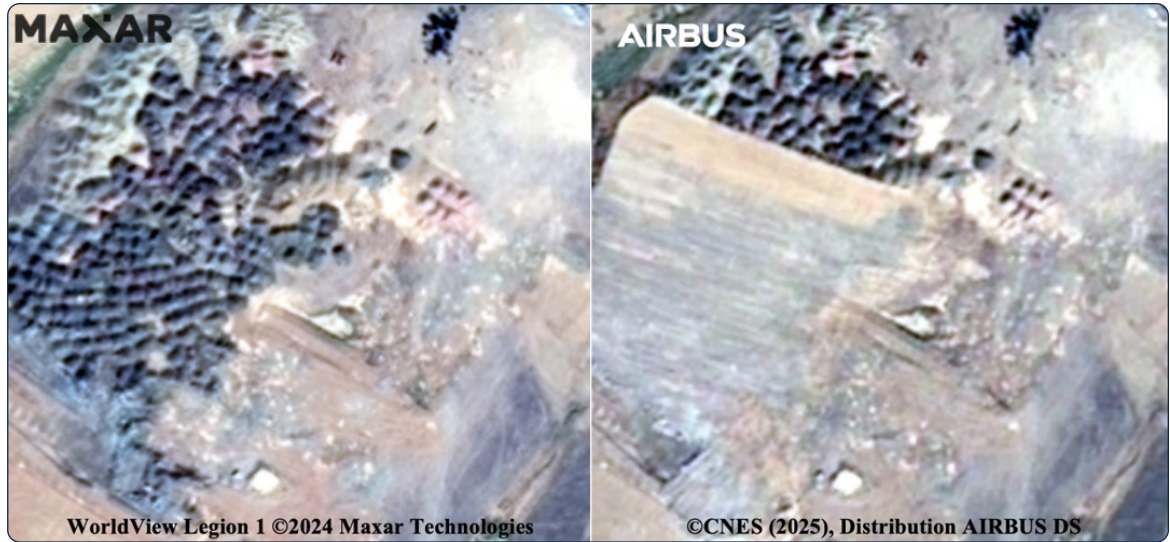


Figure 41: Satellite imagery of redistributed loose material, including what appears to be large piles of extracted rock or soil that have been removed or flattened, at Orshab, November 2024 (left) and January 2025 (right). These changes may indicate stockpile processing or further excavation at the site perimeter.



Figure 42: Satellite imagery before and after new excavation in a separate area at Orshab, November 2024 (left) and January 2025 (right). Deepened cuts and new trench-like formations are visible in the later image. This suggests expansion into a previously untouched area of terrain, consistent with continued extraction activity.



Figure 43: Satellite imagery of vehicle movement in the built-up portion of the Orshab site, November 2024 (left) and January 2025 (right). Several large transport and construction vehicles appear in different positions, with some vehicles newly introduced and others absent, indicating active on-site operations.

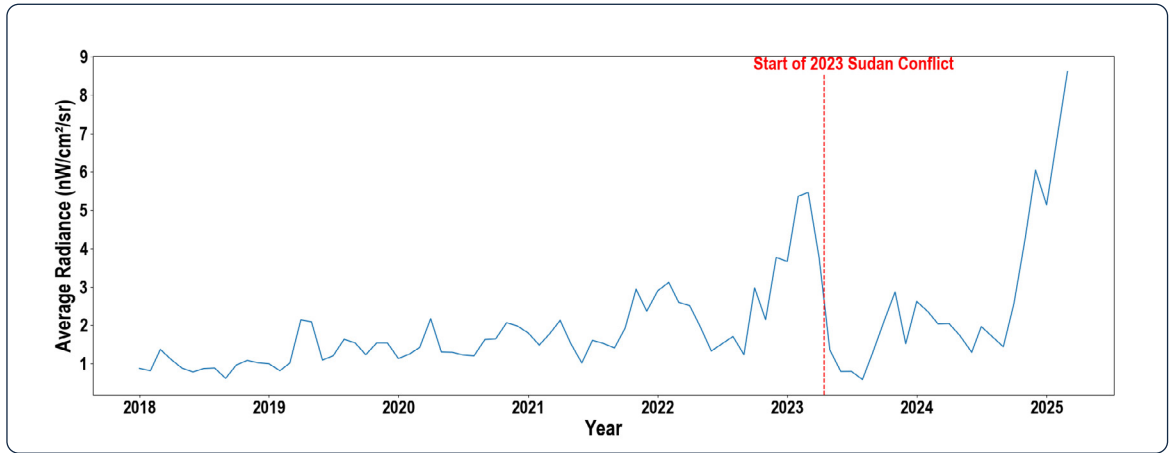


Figure 44: Mean nighttime radiance over the Orshab site.

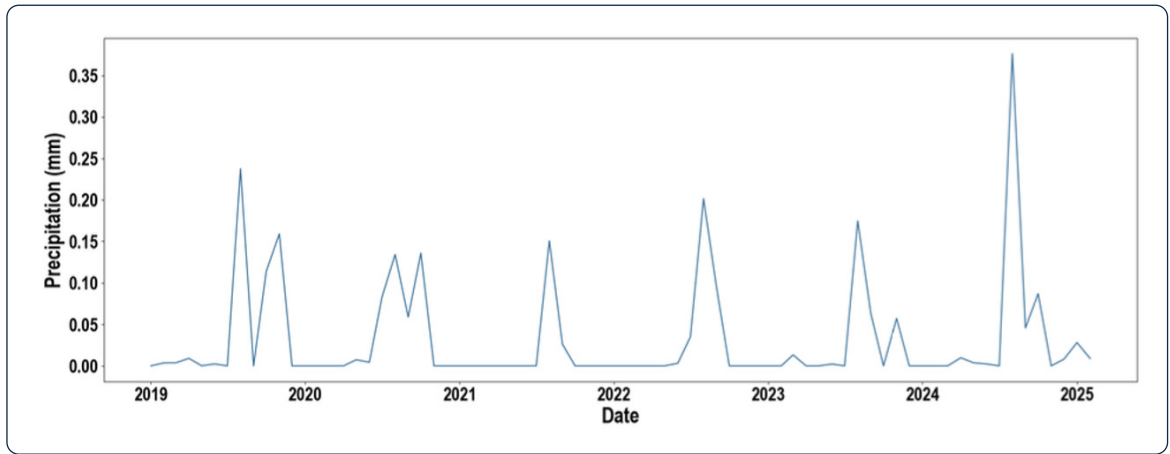


Figure 45: Monthly mean precipitation at the Orshab site.

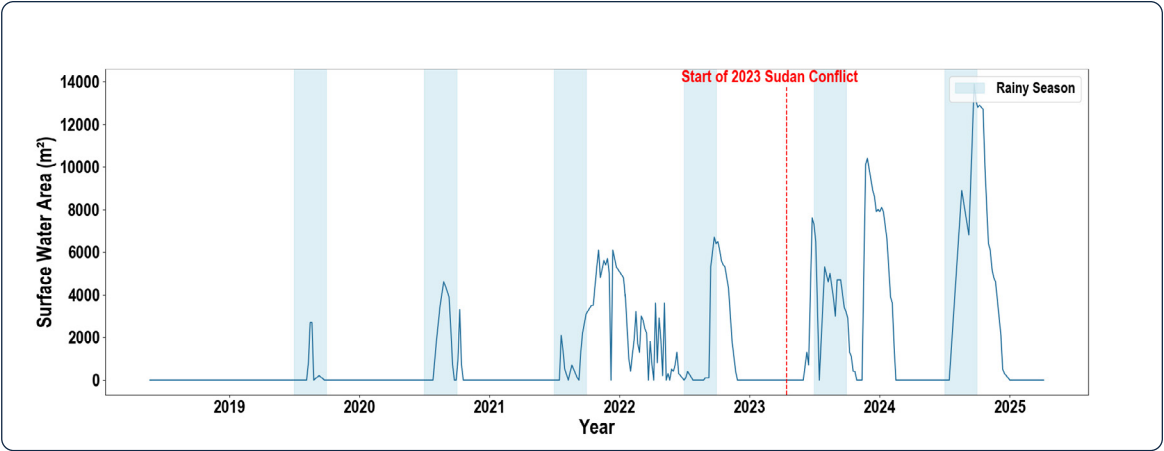


Figure 46: NDWI-detected surface water at the Orshab site.

Annex 3: Quantitative Methodology

To estimate 2024 taxation yield from concessionaries, we use the following methodology. Note that while original calculations were computed with unrounded numbers, all numbers here have been rounded to two decimal places to facilitate legibility.

First, we calculate the average price of gold in 2024 in US\$/metric ton.

- We acquired the closing price in US\$/troy ounce (troy ounce is a unit measurement of precious gems and minerals) for all days in 2024 and take the average, which equals an average price of gold in 2024 of 2,386.56 US\$/troy ounce.¹⁶¹
- In order to facilitate subsequent calculations, we convert this to the average price of gold in 2024 in US\$/metric ton. Because there are approximately 32150.74 troy ounces in one metric ton, we multiply 2386.56 US\$/troy ounce by 32150.74 troy ounces/metric ton to get an approximate average price of gold in 2024 of 76,729,744.39 USD/metric ton.¹⁶²

US\$ 2386.56
per metric ton

×

32150.74
troy ounces/metric ton

=

US\$ 76,729,744.39
per metric ton

Second, we multiply the reported approximate 2024 concessionary production, 11 metric tons, by the average price of gold in 2024 (calculated in Step 1) to get the approximate US\$ value of the gold produced from concessionary mines in 2024.¹⁶³

11
metric tons

×

US\$ 76,729,744.39
per metric ton

=

US\$ 844,027,188.28

We subsequently find 28% of this value, the 2024 concessionary taxation rate, to get the 2024 concessionary taxation revenue.¹⁶⁴

US\$ 844,027,188.28

×

0.28

=

US\$236,327,612.72

We can also calculate the royalties gained from 2024 concessionary production by repeating Step 3, but using the minimum and maximum 2024 concessionary royalty rates.¹⁶⁵

US\$ 844,027,188.28	×	0.02	=	US\$ 16,880,543.77
US\$ 844,027,188.28	×	0.05	=	US\$ 42,201,359.41

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73. Sudan Trade Data. There is limited publicly available information on MBS for Trading & Investment Co. Ltd. The first shipment’s arrival is dated October 15, 2023, and lists a quantity of 10 packages with a total weight of 1,348 kg; the consignor is Sun Global Freight LLC. The second shipment’s arrival is dated June 23, 2024, and lists a quantity of six boxes with a total weight of 6,493 kg; the consignor is Prime Shipping Agency LLC. The third and fourth shipments’ arrival is dated August 01, 2024, and each list a quantity of six boxes with a total weight of 6,488 kg and 6,476 kg, respectively; the consignor on both is Prime Shipping Agency LLC.
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78. Sudan Trade Data. The shipment lists a quantity of 12 packages with a total weight of 10,585 kg.
79. Sudan Trade Data. The shipment lists a quantity of 7 “PL” (presumably a misspelling of “PK”, or “packages”) with a total weight of 6,351 kg.
80. Sudan Trade Data. The shipment lists a quantity of 1,800 packages with a total weight of 27,100 kg.
81. By reported net weight. By trade value US\$, the U.A.E. was the top importer of mercury in 2023. “Trade Data,” UN Comtrade Database, <https://comtradeplus.un.org/TradeFlow?Frequency=A&Flows=X&CommodityCodes=280540&Partners=all&Reporters=all&period=2023&AggregateBy=none&BreakdownMode=plus>, accessed April 08, 2025; Madhumitha Jaganmohan, “Production of Mercury worldwide in 2023, by country,” May 22, 2024, <https://www.statista.com/statistics/1005602/global-mercury-production-by-country/#:~:text=Despite%20not%20being%20a%20significant,to%2010.35%20million%20U.S.%20dollars;and> “Trade Data,” UN Comtrade Data.
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