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CENTAMIN PLC

NI 43-101 TECHNICAL REPORT ON THE SUKARI GOLD MINE, EGYPT

Effective Date: June 30, 2023

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1 SUMMARY

1.1 Introduction

Centamin plc (Centamin or the Company) is a gold mining and exploration company, it is a public company, whose ordinary shares are dual-listed listed on the London Stock Exchange (LSE) under the ticker "CEY" and on the Toronto Stock Exchange (TSX) under the symbol "CEE". Centamin is incorporated in Jersey as a public company and headquartered and domiciled in St Helier, Jersey.

Centamin, through its wholly owned subsidiary Pharoah Gold Mines NL (PGM), owns 50% of Sukari Gold Mines (SGM) which operates the Sukari Gold Mine. The remaining 50% of SGM is owned by the Egyptian Mineral Resource Authority (EMRA), a department within the Ministry of Petroleum and Natural Resources. In addition, Centamin owns 18 exploration licences in the Egyptian Eastern Desert, and the Doropo and Archean-Birimian Contact (ABC) Gold Projects in Côte d'Ivoire.

Centamin commissioned Wardell Armstrong International Limited (WAI) to prepare this Technical Report in accordance with the disclosure requirements of National Instrument 43-101 *Standards of Disclosure for Mineral Projects* (NI 43-101) to disclose recent information about the Sukari Gold Mine (Sukari). This Technical Report includes updated Mineral Resource and Mineral Reserve estimates.

Sukari is Egypt's first large-scale modern mine and includes a low grade, bulk tonnage open pit and a high-grade underground operation, using Carbon in Leach (CIL) processing.

SGM commenced open pit mining in February, 2009, and uses conventional truck and shovel methods. Underground production commenced in 2011 with surface access provided by the Amun twin decline. Underground mining is fully mechanised and uses transverse and longitudinal long hole open stoping methods with waste rock backfill and Cemented Rock Fill (CRF) (replaced in 2023 with paste backfill).

The Sukari processing plant was commissioned in December 2009, with commercial production declared in April 2010, and has since undergone several expansions. The initial crushing, milling and CIL circuits were designed to process oxide ore at a rate of 4Mtpa. The circuit was expanded to process a 5Mtpa blend of oxide and sulphide ores with the addition of secondary crushers, a flotation circuit, flotation concentrate regrind circuit, flotation concentrate CIL circuit and expansion of the essential support services.

The processing plant was further expanded to process 10Mtpa in 2012 by the addition of a second crushing, milling and flotation circuit. Several other smaller circuit modifications to debottleneck the process plant were made including the addition of a second Zadra elution circuit and a second carbon regeneration kiln which allows the circuit to operate at a nominal throughput rate of 12.6Mtpa.

In 2022, the Sukari processing plant produced its five millionth ounce of gold since production began in 2009.

1.2 Reliance on Other Experts

The authors have relied on information provided by Centamin as of the agreed reserve depletion date of June 30, 2023, regarding the legal status of the rights pertaining to Sukari and have not independently verified the legality of surface land ownership, mineral tenure, legal status or ownership of the properties or any agreements that pertain to the licence areas. The extent of this reliance applies solely to the legal status of the rights detailed in Section 4.

The authors did not verify the legality of any underlying agreement(s) that may exist concerning the permits or other agreement(s) between third parties but have relied on information provided by Centamin as of June 30, 2023, for land title issues.

Centamin, SGM and/or PGM provided H&S Consulting Pty Ltd (H&SC) with electronic files that included drill logs, survey and collar data, lithology, and assay results for the complete dataset that was used in the open pit Mineral Resource Estimate (MRE).

1.3 Property Description

Sukari is located in the Eastern Desert of Egypt, approximately 25km southwest of the tourist town of Marsa Alam on the Red Sea, and approximately 750km southeast of Cairo. The Sukari operation includes: the open pit mine, underground mine, processing plant on site thermal power generation facilities, solar plant and associated facilities at the mine site, three pipelines and associated pumping stations to take seawater from the Red Sea to the Sukari mine site and the access road from Marsa Alam.

The geographic coordinates of Sukari are latitude 24°56’50”N and longitude 34°42’27”E (UTM Zone 36R; UTM coordinates 672393E, 2760187N).

1.4 History

Gold was mined at Sukari in Pharaonic and Roman times, with small-scale mining re-established between 1912 to 1914 and more substantial operations undertaken in the period 1937 to 1951 from underground workings. All mining activities terminated in 1958 due to political reasons.

The first systematic modern exploration in the Sukari area was carried out in the 1970s by the Egyptian Government with assistance from the former Union of Soviet Socialist Republics (USSR). Five diamond drillholes at Sukari during 1975-1977 confirmed the presence of gold mineralisation at depth.

Title, exploitation and development rights to the Sukari Project were granted under the terms of the Concession Agreement promulgated as Law No. 222 of 1994, signed on January 29, 1995 and effective from June 13, 1995 as between PGM, EMRA and the Government of Egypt (Concession Agreement). The Concession Agreement was issued by way of Presidential Decree after the approval of the People’s Assembly in accordance with the Egyptian Constitution and Law No. 61 of 1958. The Concession

Agreement was issued in accordance with the Egyptian Mines and Quarries Law No. 86 of 1956 which allows for the Ministry to grant the right to parties to explore and mine for minerals in Egypt.

Exploration by PGM commenced in 1995 with the establishment of a camp and consisted of a detailed literature search prior to gridding, traversing, mapping, geochemical sampling, trenching, channel sampling, heavy mineral sampling, augering and surveying. Drilling by PGM at Sukari commenced in April 1997 and has continued to the date of this report.

In 1999, Centamin acquired PGM. In November 2000, PGM submitted a feasibility study (dated October 26, 2000) relating to Sukari. On November 4, 2001, PGM was formally notified by the EMRA that the feasibility study had been accepted and had demonstrated the existence of a “Commercial Discovery” at Sukari.

On May 24, 2005, an Exploitation Lease covering an area of 160km^2, containing the proposed Sukari mine site and surrounding prospects, was officially granted by the Minister of Petroleum. PGM and EMRA were required to establish an operating company and SGM was incorporated under the laws of Egypt on April 13, 2006 to conduct exploration, development, exploitation and marketing operations. Modern mining operations commenced at Sukari in 2009, with commercial production achieved in April 2010

1.5 Geological Setting, Mineralisation and Deposit Type

Sukari is located in the Neoproterozoic (900-650Ma) Arabian Nubian Shield (ANS), one of a number of areas of African continental crust that accreted and stabilised during the Pan-African Orogeny. At a district scale, the host sequence at Sukari comprises an north-northeast (NNE**)** striking mélange of predominantly calc-alkaline igneous rocks and metasediments, which have undergone regional metamorphism to mid-upper greenschist facies.

Sukari is classified as an orogenic gold deposit and comprises a broadly mineralised granodiorite porphyry dislocated by major shear/vein hosted higher grade mineralised zones. Gold mineralisation is hosted mainly by granodiorite, with some mineralisation extending into the surrounding metasediments.

The Sukari granodiorite strikes north-northeast and typically dips between 50° and 75° to the east. The granodiorite has a strike length of approximately 2.3km, and ranges in thickness from approximately 100m in the south to 600m in the north. Gold mineralisation within is not homogenous and its deposition has been influenced by major long-lived structures that experienced continuous reactivation.

Gold mineralisation at Sukari is intimately related to sulphides; pyrite is the most abundant sulphide, followed by arsenopyrite. Sericite and silica are the most prevalent alteration products within the Sukari granodiorite, closely associated with mineralised zones.

Since 2021, an intensive relogging programme has been undertaken to review Sukari geology (lithologies, structure and alteration), produce a 3D geological model and improve the geological and structural understanding of the deposit. The resulting geological history, structural interpretation and 3D model have been developed in collaboration with industry experts and are now continually refined on-site via drillhole logging, section interpretation and underground mapping. The resulting model provides a robust tool for exploration targeting and resource modelling.

1.6 Exploration

Sukari is in commercial production and exploration is dominated by drilling activities. Exploration is currently focussed on defining targets close to existing infrastructure (within 10km) which can be quickly and cost effectively brought into the mine planning process, while also continuing to test the depth and strike extensions that underpin the longer-term potential of the underground mine and the mine expansion plan.

The Horus zone sits at depth beneath the Amun zone and represents the long-term future of the underground operations. Horus Deeps remains open to the north, south and down dip.

In addition, Sukari surface exploration has identified multiple shallow open pit gold satellite targets within the mining concession which have the potential to supplement Sukari mill feed, in the medium to long term, improving operational flexibility.

1.7 Drilling

As of June 30, 2023, the Sukari drillhole database comprised 85,833 drillholes for 3,853,425m of drilling. Current drill coverage extends to approximately 1500m below surface.

All drilling has been conducted by Sukari Goldmines using contractor operated reverse circulation, diamond and multi-purpose drill rigs, from surface and underground drill sites. Both sample recovery and location accuracy are considered acceptable, and no factors have been applied to the Sukari drillhole data. Drilling is orientated to ensure that drill intersections are as close to perpendicular with mineralisation as technically possible.

The authors consider that the drilling and sample collection at Sukari are undertaken by competent personnel using procedures that are consistent with industry best practice. The authors conclude that the samples are representative of the mineralisation and there is no evidence that the drilling or sample collection process has resulted in a bias that could materially impact the accuracy and reliability of the results.

1.8 Sample Preparation, Analyses, Security and Data Verification

Diamond and reverse circulation (RC) drilling are the primary sampling methods that provide data for the Sukari MRE. Underground face sampling is also used for modelling of geological contacts and grade interpolation. Other samples such as surface grab, channel, and soil samples are collected in the early stages of exploration to assess prospectivity, but are excluded from Mineral Resource estimation.

All samples are analysed by the SGM site laboratory. Centamin employs a comprehensive Quality Assurance and Quality Control (QA/QC) programme as part of the assaying procedure, involving regular insertion of Certified Reference Materials (CRMs), duplicates and blanks. 5% of all samples are sent to ALS Loughrea on a quarterly basis for check analysis.

Based on a desktop review and site visit, the authors consider that appropriate systems are in place to ensure that the Sukari drillhole database is sufficiently accurate and precise for Mineral Resource and Mineral Reserve estimation.

1.9 Mineral Processing, Metallurgical Testing and Recovery Methods

Significant historical metallurgical testwork has been conducted on samples of Sukari ore since 2000, with the latest testwork programmes conducted by Ammtec in 2011 and Gekko in 2023. The ore is generally siliceous rock with the gold contained in sulphides, principally pyrite. Arsenic levels are moderate. The ore is generally very hard and abrasive and can be considered somewhat refractory. Coarse gold is present and it is unusual that a gravity circuit was not included in the original plant design. The flowsheet consists of two process lines (plants), with crushing, grinding, flotation, ultra fine grinding and CIL of the combined flotation concentrates and additional leaching of high grade flotation tails from Line #1 (treating higher grade ore) and the flotation concentrate CIL tails.

The sulphide flotation circuit is the core process and greater than 98% gold recovery to concentrate was achieved in testwork, with reasonable and acceptable gold recoveries from leaching the flotation concentrate and from leaching the high grade flotation tails stream.

Significant gravity testwork has been conducted, the latest testwork conducted by Gekko in April 2023. These results clearly indicate the need for a gravity circuit. Further engineering studies, currently underway, will determine the maximum throughput, as a split of the mill discharge stream, to maximise gold recovery while maintaining the required solids and water balance for efficient milling. The potential significant benefits are higher gold recovery and lower operating costs.

The total plant tailings (flotation tails from Line #2 plus total CIL tails) are pumped to a conventional tailings storage facility (TSF) (TSF 2 is in operation with TSF 1 decommissioned). Metallurgical and production performance over the last few years has been very consistent, with throughput circa 12Mtpa and gold recovery circa 88-89% for a head grade range of 1.18-1.35g/t Au. Unit operating costs have significantly reduced in YTD 2023 to $13.92/t, due to significantly lower power costs (full commissioning of the solar power station and a lower cost of diesel), and with significant optimisation of the reagent preparation and dosing systems. Work is continuing towards a 50MW national grid connection, and a further, expansion of the solar power plant is planned with an additional 15-20MW to be installed.

The hardness and abrasivity of the ore inherently results in high grinding media consumption and the high reagent consumptions (cyanide in particular) are derived directly from the requirement for ultra-fine grinding to 10 microns and subsequent leaching. Grinding media and cyanide consumptions are by far the two major cost contributors.

A significant dump leach operation is successfully operated to cover the mining waste transportation costs. Gold is also recovered from treating the tailings dam return water.

Another project is the potential for a detoxification circuit, using a novel process developed by Sukari, similar to the INCO process, and currently being fully investigated through plant trials and testwork. The would allow Centamin to follow the International Cyanide Management Code guidelines (WAD cyanide limit of 50ppm entering the TSF compared to 150ppm currently) and to improve the core sulphide (pyrite) flotation process – although detoxification of the TSF return water is undertaken using ferrous sulphate, there still remains approximately 40ppm WAD cyanide in solution which can adversely affect pyrite flotation performance (cyanide acts as a depressant).

1.10 Mineral Resource Estimates

The Sukari open pit and underground Mineral Resource Estimates (MRE) were prepared according to the Canadian Institute of Mining, Metallurgy and Petroleum *Definition Standards for Mineral Resources and Mineral Reserves 2014* (CIM Definition Standards), as required by NI 43-101.

Open pit mining exploits the Sukari felsic porphyry over a broad extent, whereas underground mining targets discrete higher-grade zones, where gold mineralisation is concentrated in through-going quartz vein arrays, breccias, and shears. Modelling and estimation techniques have been appropriately tailored to these distinct mining scenarios, resulting in two separate Mineral Resource models. Open-pit Mineral Resources are estimates of recoverable tonnes and grade using Multiple Indicator Kriging (MIK) with direct lognormal change of support, whilst Underground Mineral Resources were estimated via Ordinary Kriging (OK).

All open pit Mineral Resources were reported within a US$2,000/oz pit shell and above a 0.3g/t Au cut-off grade. Underground Mineral Resources were reported above 1g/t Au cut-off grade below the US$2,000/oz pit shell.

The Sukari MRE with an effective date of June 30, 2023 is listed in Table 1.1. The stated Mineral Resources are not materially affected by any known environmental, permitting, legal, title, taxation, socio-economic, marketing, political or other relevant issues, to the best knowledge of the authors. There are no known mining, metallurgical, infrastructure, or other factors that materially affect this MRE, at this time.

All Mineral Resources are tabulated inclusive of that material which is then modified to form Mineral Reserves. The Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

Table 1.1: Sukari Gold Mine Mineral Resource Estimate as of June 30, 2023				
Type	**Classification**	**Tonnes (Mt)**	**Grade (g/t)**	**Gold Content (Moz)**
Open Pit	Measured	227.18	0.97	7.09
	Indicated	35.59	0.65	0.74
	Inferred	7.81	0.61	0.15
Underground	Measured	6.72	2.83	0.61
	Indicated	15.52	2.86	1.43
	Inferred	10.13	2.4	0.80
Stockpiles	Measured	18.01	0.47	0.27
Total	Measured	251.91	0.98	7.97
	Indicated	51.11	1.32	2.17
	Measured & Indicated	303.02	1.04	10.14
	Inferred	17.94	1.65	0.95

Notes:

1. All Mineral Resources are tabulated inclusive of that material which is then modified to form Mineral Reserves;
2. The open pit and underground Mineral Resource models are informed by drilling up to July 15, and June 30, 2022 respectively. Both models are depleted to June 30, 2023;
3. Open pit Mineral Resources are reported within a $2,000/oz pit shell and above a 0.3g/t Au cut-off grade;
4. Underground Mineral Resources are reported above 1g/t Au cut-off grade below the US$2,000/oz pit shell;
5. Mr Rolly Wasonga, MAIG, MAusIMM, Centamin's Senior Resource Geologist, an officer of the company and Qualified Person (QP), generated the Mineral Resources for Sukari;
6. Mr Craig Barker, FAIG, Centamin's Group Mineral Resource Manager, an officer of the company and QP, reviewed and signed off on the underground Mineral Resources;
7. Mr Arnold van der Heyden, Managing Director and Consulting Geologist for H&SC, a Member and Chartered Professional (Geology) of the Australasian Institute of Mining and Metallurgy (AusIMM) and QP generated and signed off on the Open Pit Resources; and
8. Numbers may not add due to rounding. In the Annual Information Form (AIF) summary format, 2 significant figures are used for millions of tonnes (Mt) and million ounces (Moz). Two decimal places are used for Measured and Indicated grades, and one decimal place is used for Inferred grades.

1.11 Mineral Reserve Estimates

1.11.1 Overview

Sukari consists of both an open pit and underground operation, and undertakes annual updates of its Mineral Resource and Mineral Reserve estimates which includes changes to various modifying factors such as gold price, process recoveries, geotechnical parameters, costs and estimates, dilution, ore loss, as well as additions and subtractions due to exploration and depletion.

General parameters and modifying factors, applicable to both the open pit and underground operations, includes the assumed gold price, sales costs, mineral royalty and diesel price. For the 2023 Mineral Reserve Estimation, the following general parameters are shown in Table 1.2 below.

Table 1.2: General Modifying Factors (2023 Mineral Reserves)			
Parameter	**Unit**	**2023 Reserves**	**Notes**
Gold Price	US$/oz	1,450	Consistent with 2022 reserves
Refining & Selling Costs	US$/oz	2.20	
Mineral Royalty	%	3.00	Apply to sales revenue
Diesel Price	US$/litre	0.75	

Open pit and underground mine optimisation has been carried out using best industry practice techniques in order to delineate the Mineral Reserves.

The operating costs and process recoveries for optimisation have been provided based upon production actuals defined by the SGM mining, metallurgical and processing department. SGM is currently undertaking metallurgical test work of samples to better understand the differences in recovery from the various ore sources.

Calculations of open pit dilution at Sukari have been based upon the regularisation of an original sub-celled MRE block model to a Standard Mining Unit (SMU) of 20m x 25m x 10m (XYZ). For the 2023 Reserve Estimate, calculation of underground dilution and ore loss factors was based on stope reconciliation data and calculation of dilution percentages and grades using dilution shells within the Deswik Stope Optimiser.

A Geotechnical review was carried out for the Stage 8 pit design “stg8_v8_230610” developed for the Sukari Mine Reserve 2023, and updated for the purposes of confirming the feasibility of the updated design for reserve estimation purposes.

1.11.2 Cut-off Grades

A summary of open pit cut off grades for the open pit operation are presented in below.

Table 1.3: Summary of Calculated COGs

Cut-Off Grade	Unit	CIL Process	Dump Leach OX	Dump Leach SG
Calculated COG	g/t	0.45	0.20	0.21
Marginal COG	g/t	0.32	0.11	0.23
In-situ COG	g/t	0.48	0.22	0.23
In-situ Marginal COG	g/t	0.35	0.12	0.25

The underground stope cut-off grade is calculated as 2.2 g/t whilst the cut-off value for treating development material as ore is 0.99 g/t. The stope cut-off is used for Deswik.SO stope optimisation and reserves reporting.

1.11.3 Mine Scheduling

SGM has developed a detailed production schedule driven by ROM tonnages from the open pit and underground operations, and augmented by stockpile feed where required in order to provide for a plant feed of 12.5Mtpa.

The mining schedule utilised to produce the Mineral Reserve Estimate considers only Measured and Indicated material as ore (which are converted to Proven and Probable Reserves). A secondary life-of-mine (LOM) plan which considered Inferred and unclassified material is also produced by the mine for internal purposes and to guide long-term planning and exploration.

1.11.4 Mineral Reserve Statement

Table 1.4 below presents the June 30, 2023, Mineral Reserve Estimate for Sukari

Table 1.4: Sukari Gold Mine Mineral Reserve Estimate (June 30, 2023)

Location	Cut-off Grade	Proven			Probable			Total		
		Tonnes	Grade	Metal	Tonnes	Grade	Metal	Tonnes	Grade	Metal
	g/t Au	Mt	g/t Au	Moz Au	Mt	g/t Au	Moz Au	Mt	g/t Au	Moz Au
Open Pit	0.4	88.5	1.13	3.22	21.1	1.16	0.79	109.6	1.13	3.99
Underground	2.2	3.6	3.75	0.43	4.4	4.10	0.56	8.1	3.94	1.02
Stockpiles	-	17.8	0.47	0.27	-	-	-	17.8	0.47	0.27
Total Mineral Reserves		**109.9**	**1.11**	**3.92**	**25.6**	**1.67**	**1.37**	**135.5**	**1.21**	**5.28**

1.12 Mining Methods

1.12.1 Overview – Open Pit

The Sukari open pit mine is operated as a conventional truck and shovel mine using face shovels and backhoe excavators to load ore and waste to CAT 785 haul trucks. All ore and waste material requires drilling and blasting. Ore is transported to a ROM pad adjacent to the processing plant and either stockpiled for blending purposes or direct tipped to the crusher. Waste is transported to waste rock dumps (WRDs) which are located around the perimeter of the pit. Working benches are of 10m height, whilst final benches are 10 to 20m in height, depending on geotechnical factors.

1.12.2 Overview - Underground

Underground operations at Sukari utilise a fully mechanised mining method for both development and stoping with access from surface via the Amun twin decline. The Ptah decline has been developed from the 710mRL to access the Ptah orebody to the north and Amun and Horus orebodies to the south.

Historically underground mining targeted high-grade zones which were followed by the open pit, but current and future underground operations are now planned to be deeper and below the final open pit shell. A minimum crown pillar of 40m is maintained between the pit and active underground workings.

The Sukari underground mine utilises two mining methods for ore production:

- Transverse long hole open stoping; and
- Longitudinal long hole open stoping.

1.12.3 Cemented Paste Fill System

Following commissioning of a paste plant in Q1 2023, Sukari uses Cemented Paste Fill (CPF) for stability with the Long Hole Open Stoping (LHOS) mining method.

Paste is delivered to the designated stope by the Underground Delivery System and will discharge from the top drive to fill the stope. A barricade will retain the initial plug pour that will cure before filling the bulk of the stope.

Allowing the system to operate up to 7,000kPa provides operating flexibility and gives the paste plant operator the time to take corrective actions if the CPF yield stress increases.

1.12.4 Ventilation

The total ventilation air movement at Sukari is some 270m_3/s with intake via the main decline portal, the Amun portal and via leakage through stoping which has caved to surface.

Air is exhausted via two circuits, specifically the main fan exhaust through the Ptah orebody and to the open pit via the Horus exhaust.

1.13 Project Infrastructure

Power supply for processing stages 1-3 and infrastructure is generated using five MAK and six Cummins generators capable of supplying 6.5MW (de-rated) and 1.2MW (de-rated) respectively. Processing stage 4 receives power generated from five Wartsila generator sets capable of supplying 7.8MW (de-rated). A diesel fuel storage facility is present on site with a combined capacity of 5,207m^3.

A 36MW_{DC} solar farm has been commissioned which produces a significant proportion of the mine's power, whilst the Company is also continuing to work towards a full national grid connection. This, combined with the solar farm, would displace the diesel generator sets which will then be retained in case of a loss of supply from the grid.

Sukari has two tailings storage facilities (TSFs), TSF No. 1 and TSF No. 2, located to the west and south of the main mine area, respectively. TSF No.1 was commissioned in 2009 and has been in continuous operation since, but is now near full capacity and provides emergency contingency storage only. The starter embankment (Stage 1) of TSF No.2 was constructed in 2020 and commissioned in January 2021 under the supervision of Knight Piésold. The next raise construction (Stage 3) has recently been constructed providing 36Mt of capacity for a production rate of 12Mtpa at a 50% solids by weight slurry. Stage 4 construction was started in 2023 under the supervision of engineer of record ("EOR") Epoch, to take the capacity to 48Mt, with commissioning expected in mid 2024.

A 125m^3/hour paste fill plant has also been recently constructed and was commissioned in early 2023.

1.14 Market Studies and Contracts

SGM are not dependent upon any one customer for the sale of gold. Since commencement of production, gold has been sold to various gold bullion dealers and smelters on a competitive basis. Gold doré bars are transported from the mine site to the chosen accredited gold refiner for smelting and refining into and LME grade gold bar on a regular basis. The refiner is selected on a competitive basis.

For the economic analysis used to determine the Mineral Reserves, a gold price of US$1,450/oz and a diesel price of US$0.75/litre was used.

SGM is engaged in numerous contracts with local and international companies relating to the operation of the mining and processing operations.

1.15 Environmental Studies, Permitting and Social or Community Impact

Generally, WAI concludes that no fatal flaws pertaining to the environmental, socioeconomic, and Health & Safety aspects that might affect the viability of the Project have been revealed during the study.

From review of the documentation provided, the Project is in compliance with in-country requirements and environmental legislation, namely Environment Law 4/1994 and WAI's review shows a commitment to international requirements and good industry practice. Overall, WAI perceive that the environmental and social aspects of the Sukari Project are well understood and managed. All required permits are in place and renewed when required, management plans are reviewed and updated on a regular basis, and any cases of non-conformance and incidents are subject to root cause analysis. The effective communication and engagement with local stakeholders are successful in ensuring a mutually beneficial project.

The ESIA studies, management plans and reports provided to WAI for review, indicate the Company's commitment to reduction of Environmental and Social risk. From the H&SC standpoint, WAI has not identified any risks or liabilities that may arise from the operations should the existing level of H&SC standards and practices is maintained.

The following recommendations can be made to ensure continuous improvement of environmental and social management of the Project:

- Continuous update of operational management systems and plans to ensure they are relevant and proportionate to risks, including alignment with ISO standards;
- Ongoing collaboration with contractors and suppliers to strengthen conformance to good practice environmental and social standards;
- Achievement of full conformance of the Sukari tailings management system to the requirements of the GISTM;

- Ongoing reduction of GHG emissions through the execution of projects identified under the 2030 decarbonisation roadmap, including the investigation of additional opportunities; and
- Develop a standalone Mine Closure Plan to reflect the current Project Description and ongoing activities.

1.16 Capital & Operating Costs

Centamin has, on the October 12, 2023, published a LOM production and cost forecast from 2024 onwards. The cost forecast includes operating costs, selling costs (royalties and refining costs) and sustaining and non-sustaining capital. A gold price of US$1,450/oz and a diesel price of US$0.75/litre was used.

Total capital expenditure for the 2023 LOM Mineral Reserve-only case has been estimated by SGM to total US$706M, with US$572M of the total estimated as the sustaining CAPEX.

Overall cash operating costs for the operation are US$818/oz of gold metal produced.

1.17 Economic Analysis

Centamin is a producing issuer and Sukari is in production. This technical report does not include a material expansion of production at Sukari. As such, this section is excluded.

1.18 Conclusions and Recommendations

The authors have reviewed the licensing, geology, exploration, Mineral Resource and Mineral Reserve estimation methods, mining, mineral processing, infrastructure requirements, environmental, permitting, social considerations and financial information and consider the Mineral Resources and Mineral Reserves estimates for Sukari, with an effective date of June 30, 2023, are reported in accordance with CIM Definition Standards.

The authors make the following recommendations:

1.18.1 Geology and Mineral Resource Estimates

- Continue exploration drilling at Sukari to extend the LOM and increase optionality. This includes testing strike and depth extensions to the underground mine, alongside development of potential satellite deposits.
- Consider the use of televiewer or other downhole tools to acquire oriented planar structural data during exploration diamond drilling;
- Recommendations specific to the open pit resource model include:
    - Improved interpretation and modelling of andesite dykes to ensure that high-grade samples are excluded, and all relevant low-grade intersections are captured;

  - Adjustment of panel size such that panel dimensions are divisible into SMU blocks;
  - Include comparison of block model and declustered composite grades in domain statistical checks; and
  - Align the resource classification approach with that used in the underground resource model.
- In the underground model, Centamin should consider adopting a mineable stope optimiser (MSO) tool to better constrain blocks with reasonable prospects of eventual economic extraction;
- WAI supports ongoing initiatives to improve model reconciliation, including on-site model ownership, alignment of resource and grade control model domain architecture, introduction of underground RC drilling, alongside expansion of the grade control inventory to 1 year ahead of underground production and 2 years ahead of open pit production;
- Further work to improve underground resource model reconciliation could include:
  - Calibration of top-caps and high yield limits, based on domain grade-tonnage curve comparisons with the grade control model; and
  - Calculation of resource to grade control model reconciliation over a common volume that encompasses both LOM stope and design stope extents.

1.18.2 Mineral Reserve Estimate & Mining Methods

Sukari, which consists of both an open pit and underground operation, undertakes annual updates of its Mineral Resource and Mineral Reserve estimates which includes changes to various modifying factors such as gold price, process recoveries, geotechnical parameters, costs and estimates, dilution, ore loss, as well as additions and subtractions due to exploration and depletion.

Since 2020, Centamin management and SGM have undertaken an in-depth review of the Sukari operation. The outcome has been numerous optimisation and improvement projects to improve understanding, confidence and productivity across the operation. Notably in terms of the resource modelling, geotechnical data, ventilation and introduction of paste fill; and WAI considers that SGM has made realistic assessments of the modifying factors based on these investigations with regards to the open pit slopes and base case assumptions.

WAI considers the process undertaken to delineate dilution and ore losses to be appropriate, taking due cognisance of operational factors and understanding of the ore body when measured against production actuals.

WAI believes that the operation and the parameters utilised for the calculation of cut-off-grades have been defined based upon robust initial data, augmented by operational knowledge from an active mining operation, and are of an appropriate confidence level to define a Mineral Reserve to international standards. Furthermore, the use of operational CoGs utilised at the mine site, which correlate well with the calculated CoGs, coupled with the stockpiling of marginal ore, represents good operational practice.

Based on both the desktop review and site visit, WAI is of the opinion that appropriate systems are in place in terms of mine optimisation, design, scheduling and modifying factors to allow a Mineral Reserve Estimate to be declared for Sukari.

2 INTRODUCTION

2.1 Overview

This NI 43-101 Technical Report has been prepared by WAI for Centamin, to disclose recent information about Sukari. This information includes updated LOM Planning, Mineral Resource and Mineral Reserve estimates.

Centamin is a gold mining and exploration company that owns 50% of SGM through its wholly owned subsidiary PGM. The remaining 50% of SGM is owned by the EMRA. In addition, Centamin owns exploration licences in the Egyptian Eastern Desert and the Doropo and ABC Gold Projects in Côte d'Ivoire. Centamin is a public company whose ordinary shares are dual-listed on the LSE under the symbol "CEY" and the TSX under the symbol "CEE". From a regulatory and reporting standpoint, the Company is qualified as a "Designated Foreign Issuer" within the meaning of Canadian National Instrument 71-102. The Company is headquartered and domiciled in St Helier, Jersey.

The effective date of the Mineral Resource and Mineral Reserve estimates contained in this Technical Report is June 30, 2023. This report updates the previous Technical Report titled "Technical Report, Mineral Resource and Mineral Reserves Estimate for the Sukari Gold Project, Egypt" and dated October 23, 2015 (effective date of June 30, 2015).

The Mineral Resource and Mineral Reserve estimates are reported in accordance with CIM Definition Standards, as referenced in NI 43-101. This Technical Report has been prepared in accordance with the requirements of Form 43-101F1.

2.2 Terms of Reference

The scope of work included a review of the technical information used to derive the Mineral Resources and Mineral Reserves estimates for Sukari and preparation of a Technical Report in accordance with the requirements of NI 43-101 to support the public disclosure of the updated LOM Plan and associated Mineral Resources and Mineral Reserves estimates.

2.3 Qualified Persons

QPs who have reviewed the Mineral Resource and Mineral Reserve estimates and supervised the production of this report are as listed below. All of the QPs are employees of Wardell Armstrong.

- Frank Browning, MSci, MSc (MCSM), PGCert, MAIG, FGS, Cgeol Principal Resource Geologist (Mineral Resources)
- Alison Allen, MSc, BSc, CEnv, FIMMM, MIEMA, MIEEM, Deputy Managing Director (Environmental and Social)
- Stuart Richardson, BEng, MSc, CEng, MIMMM, Technical Director, Mining (Mineral Reserves)

- James Turner ACSM, MCSM, BSc (Hons), MSc, CEng, MIMMM, Technical Director, Processing (Mineral Processing)

These consultants by virtue of their education, experience, and professional association are considered "qualified persons" within the meaning of NI 43-101 and are considered to be independent of Centamin for the purposes of NI 43-101. The QP are members in good standing of appropriate professional institutions. The responsibilities of the QPs in the preparation of this Technical Report are shown in Table 2.1.

Table 2.1: Qualified Persons Responsibilities

No.	Report Section	Qualified Person
1	Summary	A. Allen (1.15) F. Browning (1.5-1.8, 1.10, 1.18.1) S. Richardson (1.1-1.4, 1.11-1.12, 1.14, 1.16 (Mining), 1.17, 1.18.2) J. Turner (1.9, 1.13, 1.16 (Process))
2	Introduction	S. Richardson
3	Reliance on other Experts	S. Richardson
4	Property Description and Location	S. Richardson
5	Accessibility, Climate, Local Resources, Infrastructure and Physiography	S. Richardson
6	History	S. Richardson
7	Geological Setting and Mineralisation	F. Browning
8	Deposit Type	F. Browning
9	Exploration	F. Browning
10	Drilling	F. Browning
11	Sample Preparation, Analysis and Security	F. Browning
12	Data Verification	F. Browning
13	Mineral Processing and Metallurgical Testwork	J. Turner
14	Mineral Resource Estimates	F. Browning
15	Mineral Reserve Estimates	S. Richardson
16	Mining Methods	S. Richardson
17	Recovery Methods	J. Turner
18	Infrastructure	J. Turner
19	Market Studies and Contracts	S. Richardson
20	Environmental Studies, Permitting and Social or Community Impact	A. Allen
21	Capital and Operating Costs	S. Richardson (Mining) J. Turner (Processing)
22	Economic Analysis	S. Richardson
23	Adjacent Properties	S. Richardson
24	Other Relevant Data and Information	S. Richardson
25	Interpretation and Conclusions	A. Allen (25.9) F. Browning (25.2-25.5) S. Richardson (25.1, 25.7, 25.10, 25.11 (Mining)) J. Turner (25.6, 25.8, 25.11 (process))
26	Recommendations	A. Allen (26.8) F. Browning (26.1-26.3) S. Richardson (26.5) J. Turner (26.4, 26.6, 26.7)
27	References	F. Browning

Other WAI consultants who contributed to this report included:

- Philip Burris, BSc, MSc, Cgeol, ASoBRA, Technical Director (Hydrogeology)
- Samantha Hinks, BSc, MSc, ACSM, MCSM, MIMMM, (Geotechnical Engineering)
- Helen Robinson, PhD, MSc, Mgeol, IGA, IAVCEI, FGS (Hydrogeology)
- Allan Sim BSc (Hons), GMICE (Tailings Management)

2.4 Personal Inspections

A site visit to Sukari was undertaken by Frank Browning, Samantha Hinks, Stuart Richardson and James Turner from September 5, to September 7, 2023.

2.5 WAI Declaration

WAI has provided the mineral industry with specialised geological, mining and mineral processing expertise since 1987, initially as an independent company, but from 1999 as part of the Wardell Armstrong Group (WA). WAI's experience is worldwide and has been developed in the coal and metalliferous mining sector.

WAI's parent company, WA, is a mining engineering/environmental consultancy that services the industrial minerals sector from nine regional offices in the UK and an international office in Almaty, Kazakhstan. Total worldwide staff complement is in excess of 400.

WAI, its directors, employees and associates neither have nor hold:

- Any shares, nor rights to subscribe for shares in Centamin either now or in the future;
- Any vested interests in any mining or exploration concessions (licences) held by Centamin;
- Any rights to subscribe to any interests in any of the licences held by Centamin either now or in the future;
- Any vested interests in either any licences held by Centamin or any adjacent licences; and
- Any right to subscribe to any interests or licences adjacent to those held by Centamin, either now or in the future.

WAI's only financial interest is the right to charge professional fees at normal commercial rates, plus normal overhead costs, for work carried out in connection with the investigations reported here. Payment of professional fees is not dependent either on project success or project financing.

2.6 Units and Currency

All units of measurement used in this report are metric unless otherwise stated. Tonnages are reported as metric tonnes (t), precious metal grades in grams per tonne (g/t) or parts per million (ppm) and base metal grades in percentage (%).

Unless otherwise stated, all references to currency or “USD” are to United States Dollars (US$).

2.7 Forward-Looking Statements

This report (including information incorporated by reference) contains “forward-looking information” and “forward-looking statements” within the meaning of applicable securities laws (collectively “forward-looking statements”), including statements with respect to future financial or operating performance, which involve a number of risks and uncertainties.

Forward-looking statements include, but are not limited to, "future-oriented financial information" or "financial outlook" with respect to prospective financial performance, financial position, EBITDA, cash flows and other financial metrics that are based on assumptions about future economic conditions and courses of action, statements with respect to the future gold prices, the estimation of mineral resources and reserves, the realisation of mineral estimates, the timing and amount of estimated future production, costs of production, capital expenditures, costs (including capital costs, operating costs and other costs) and timing of the LOM, rates of production, annual revenues, requirements for additional capital, government regulation of mining operations, environmental risks, unanticipated reclamation expenses, title disputes or claims and limitations on insurance coverage.

Often, but not always, forward-looking statements can be identified by the use of words such as “plans”, “expects”, or “does not expect”, “is expected”, “budget”, “scheduled”, “estimates”, “forecasts”, “intends”, “anticipates”, or “does not anticipate”, or “believes”, or variations of such words and phrases or state that certain actions, events or results “may”, “could”, “would”, “might” or “will” be taken, occur or be achieved.

Although Centamin believes that the expectations reflected in such forward-looking statements are reasonable, Centamin can give no assurance that such expectations will prove to be correct. Forward-looking statements are based on the opinions, estimates and assumptions of contributors to this report. Certain key assumptions are discussed in more detail. Forward looking statements are prospective in nature and are not based on historical facts, but rather on current expectations and projections of the management of Centamin about future events and are therefore subject to known and unknown risks, uncertainties and other factors which may cause the actual results, performance or achievements of Centamin to be materially different from any other future results, performance or achievements expressed or implied by the forward-looking statements.

Such factors include, among others: the actual results of current development activities; conclusions of economic evaluations; changes in project parameters as plans continue to be refined; future gold prices; possible variations in ore grade or recovery rates; currency fluctuations; climatic conditions; political instability; decisions and regulatory changes enacted by government authorities; failure of plant, equipment or processes to operate as anticipated; accidents, labour disputes and other risks of the mining industry delays in obtaining governmental approvals or financing or completing development or construction activities; discovery of archaeological ruins; shortages of labour and materials, the impact on the supply chain and other complications associated with pandemics, including the COVID-19 (coronavirus) pandemic; as well as those risk factors discussed or referred to in this report and in Centamin's documents filed from time to time with the securities regulatory authorities in Canada. Financial outlook and future-ordinated financial information contained in this report is based on assumptions about future events, including economic conditions and proposed courses of action, based on management's assessment of the relevant information currently available. Readers are cautioned that any such financial outlook or future-ordinated financial information contained or referenced herein may not be appropriate and should not be used for purposes other than those for which it is disclosed herein. The Company and its management believe that the prospective financial information has been prepared on a reasonable basis, reflecting management's best estimates and judgments at the date hereof, and represent, to the best of management's knowledge and opinion, the Company's expected course of action. However, because this information is highly subjective, it should not be relied on as necessarily indicative of future results.

There may be other factors than those identified that could cause actual actions, events or results to differ materially from those described in forward-looking statements, there may be other factors that cause actions, events or results not to be anticipated, estimated or intended. There can be no assurance that forward-looking statements will prove to be accurate, as actual results and future events could differ materially from those anticipated in such information or statements, particularly in light of the current economic climate. Forward-looking statements contained herein are made as of the date of this report and the Company disclaims any obligation to update any forward-looking statement, whether as a result of new information, future events or results or otherwise. Accordingly, readers should not place undue reliance on forward-looking statements.

3 RELIANCE ON OTHER EXPERTS

The authors have relied on information provided by Centamin as of the agreed reserve depletion date of June 30, 2023, regarding the legal status of the rights pertaining to Sukari and have not independently verified the legality of surface land ownership, mineral tenure, legal status or ownership of the properties or any agreements that pertain to the licence areas. The extent of this reliance applies solely to the legal status of the rights detailed in Section 4.

The authors did not verify the legality of any underlying agreement(s) that may exist concerning the permits or other agreement(s) between third parties but have relied on information provided by Centamin as of June 30, 2023, for land title issues.

Centamin, SGM and/or PGM provided H&SC with electronic files that included drill logs, survey and collar data, lithology, and assay results for the complete dataset that was used in the open pit MRE.

4 PROPERTY DESCRIPTION AND LOCATION

4.1 Overview

Sukari is located in the Eastern Desert of Egypt, approximately 25km southwest of the tourist town of Marsa Alam on the Red Sea, and approximately 750km southeast of Cairo. The Sukari operation includes: the open pit mine, underground mine, processing plant and associated facilities at the mine site, three pipelines and associated pumping stations to take seawater from the Red Sea to the Sukari mine site and the access road from Marsa Alam.

The geographic coordinates of Sukari are latitude 24°56’50”N and longitude 34°42’27”E (UTM Zone 36R; UTM coordinates 672393E, 2760187N) and the location is shown in Figure 4.1.

Figure 4.1: Location of Sukari Gold Mine

4.2 Mineral Tenure

In 1994, PGM negotiated an exploration and mining agreement (Concession Agreement), with the Egyptian Geological Survey and Mining Authority (EGSMA; now the EMRA) and the Egyptian Government, to explore for gold and associated minerals in the Eastern Desert of Egypt. The Concession Agreement was declared into Law 222 of 1994 and came into effect on January 29, 1995, pursuant to which PGM had the right to explore and develop gold and associated metal deposits within the concession area.

On May 24, 2005, an Exploitation Lease (Sukari Mining Concession) covering an area of 160km^2 was officially granted by the Minister of Petroleum and was approved for 30 years (to run to 2035), extendable for a further 30 years (to 2065) upon PGM providing appropriate commercial justification. The Sukari Mining Concession contains Sukari and surrounding prospects and its extent is shown in Figure 4.2 and Table 4.1.

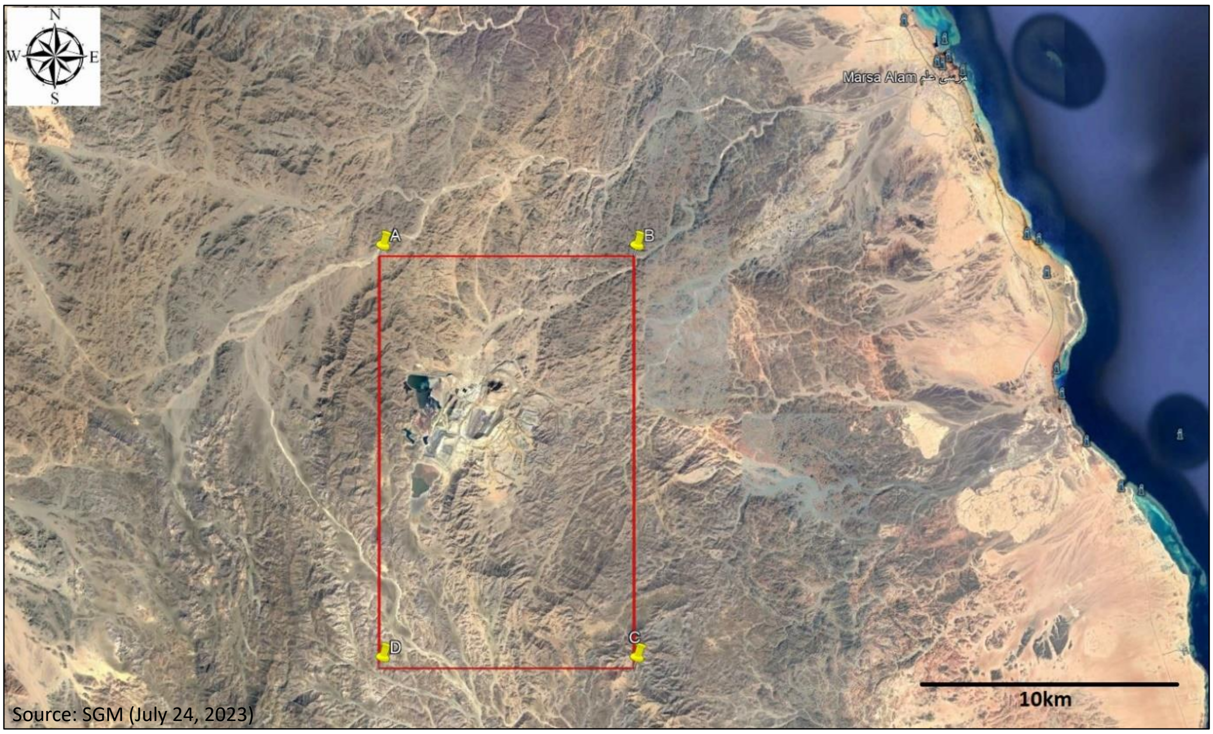


Figure 4.2: Sukari Mining Concession

Table 4.1: Sukari Mining Concession Coordinates		
Coordinate Point	**Longitude**	**Latitude**
A	34°40’40” E	25°00’20” N
B	34°46’30” E	25°00’20” N
C	34°46’30” E	24°51’45” N
D	34°40’40” E	24°51’45” N

4.3 Profit Share

After deduction of the recoverable expenses by PGM (as set out below) and payment of the Royalty to the Government of Egypt, the remainder of the net sales revenue from the Sukari is shared equally by PGM and EMRA.

4.4 Royalties

A 3% Net Smelter Return (NSR) is paid to the Government of Egypt each calendar half year.

4.5 Agreements

PGM are entitled to recover the following costs and expenses payable from sales revenue (excluding the government royalty):

- All current operating expenses incurred and paid after the initial commercial production;
- Exploration costs, including those accumulated prior to the commencement of commercial production at the rate of 33.3% per annum; and
- Exploitation capital costs, including those accumulated prior to the commencement of commercial production at the rate of 33.3% per annum.

If costs recoverable by PGM exceed the sales revenue (excluding the royalty payable to the government) in any financial year, the excess shall be carried forward for recovery in the next financial year or years until fully recovered, but in no case after the termination of the agreement.

4.6 Taxes

No other direct or indirect taxes are paid by Centamin. Starting from the date of commercial production, April 2010, PGM has a 15-year exemption from taxes imposed by the Egyptian government. PGM and EMRA also agree that the operating company will in due course file an application to extend the tax free period for a further 15 years.

4.7 Environmental Aspects

A summary of the valid environmental permits obtained by SGM and related obligations are detailed in Section 20.

The authors are not aware of any environmental liabilities relating to Sukari.

4.8 Other Permits

Relevant permits obtained by SGM are detailed in Section 20.

The authors are not aware of any other significant factors and risks that may affect access, title, or the right or ability to perform work on Sukari.

5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

5.1 Accessibility

Sukari is located in the southeast of Egypt, in the Red Sea Governorate; approximately 25km inland from the Red Sea Coast, and 180km east of the River Nile. The closest settlement is the coastal town of Marsa Alam, some 25km to the northeast.

A coastal highway runs along the west coast of the Red Sea from the border with Sudan in the south to Suez in the north, passing through Marsa Alam, and providing connectivity to Cairo. The distance from Cairo to Marsa Alam by highway is some 750km (or 8-10 hours travel time). There is also a bitumen highway from Edfu on the Nile to Marsa Alam.

The closest international airports are located at Marsa Alam (airport actually situated some 60km to the north, close to Port Ghalib) and in Hurghada (some four hours by car).

From the town of Marsa Alam, the Edfu highway is followed to the west for around 20km before taking a good, corrugated gravel road which runs southerly for approximately 8km, crossing a low divide and running down into Wadi Sukari before turning east to the Sukari operations complex. Drive time from Marsa Alam is around 30 minutes.

5.2 Climate

The climate at the Sukari site is typical of a desert environment. Average temperatures during the winter months (October to March) range from 17-27°C and during the summer months (April to September) from 26-36°C with maximum temperatures frequently exceeding 40°C. Humidity is normally very low but has been known to exceed 80% at the seawater intake near the coast, especially during the winter months. Precipitation is almost non-existent with rainfall rarely exceeding 10mm per year.

A steady wind from the northwest helps to lower the temperature near the coast. The Khamaseen is a wind that blows from the south in Egypt, usually in spring or summer, bringing sand and dust, and sometimes raises the temperature in the desert to more than 38°C.

Mining and processing operations are conducted year-round.

5.3 Local Resources

No permanent population is present in the immediate area. The nearest local town is Marsa Alam, which is a tourism-focused suburban town area with population estimated at approximately 10,000. The town offers hospital facilities, a police presence, and other municipal facilities associated with a tourist destination. There are numerous resort complexes located along the coastline and within close proximity of the town that also offer similar public facilities such as ATMs, restaurants and shops.

In addition, Centamin rents the Moon Resort in Marsa Alam town on a three-year contract which acts as additional accommodation for the mine with staffed bussed to and from the mine. A longer-term solution is under development. Egypt has an educated and skilled workforce and an established natural resources sector, local workforce of all skill levels is available.

5.4 Infrastructure

5.4.1 Overview

The main infrastructure associated with Sukari includes:

- Open pit mine.
- Underground mine.
- Run of Mine (ROM) pad.
- Processing plant (CIL).
- Dump leach operation (has been operating since the start of the operation but contributes only a small amount of the total gold production).
- Tailings Storage Facilities:
  - TSF No1 was commissioned in 2009 and has been in continuous operations since and is now scheduled for closure and restoration.
  - TSF No.2 starter embankment (Stage 1) was commissioned in January 2021 with the next raise construction (Stage 3) completed in 2022 with a capacity of 12Mt of tailings. The overall design of TSF No2 has a capacity of 150Mt of tailings and will be developed by a total of 13 downstream raises.
- Paste plant (commissioned in Q1 2023).
- Waste dumps.
- Power supply (further detailed in Section 5.4.2).
- Water supply (further detailed in Section 5.4.3).
- On site buildings for administration offices, first-aid clinic and security.
- On site buildings for the process plant including sub-stations, control rooms, plant offices, plant maintenance workshop, main warehouse, laboratory and reagent storage buildings.
- Mine facilities including mine offices, mine maintenance workshop and change room.
- Fire protection systems including fire pump with reserve storage and hydrants.
- A low security area fence is provided around the plant site offices/buildings, fuel depot, power station and water ponds. A high security area fence is provided around the process plant and gold room area.
- A communications network utilising satellite and fibre-optic cable has been established on the site. The fibre-optic cabling extends into the underground following the main decline. A "trunked" repeater system enables the system of hand-held and mobile radio sets to communicate around the site.
- An accommodation village to house up to 800 permanent operations personnel, complete with kitchen/mess, ablution blocks, laundry and recreation area.
- Access road (28km in length) from Marsa Alam to the Sukari site.

- Explosives magazines for the storage of explosives and accessories and an emulsion batching plant.
- Helipad

5.4.2 Power

Power supply for processing stages 1-3 and infrastructure is generated using five MAK and six Cummins generators capable of supplying 6.5MW (de-rated) and 1.2MW (de-rated) respectively. Processing stage 4 receives power generated from five Wartsila generator sets capable of supplying 7.8MW (de-rated). A diesel fuel storage facility is present on site with a combined capacity of 5,207m^3.

A 36MW$_{DC}$ (30MW$_{AC}$) solar plant and 7.5MW battery energy storage system was commissioned by Centamin in 2022 and has been operating at nameplate levels. As of September 2023, after one year of operations, the plant had successfully displaced 22 million litres of diesel fuel with renewable power to reduce greenhouse gas ("GHG") emissions by approximately 59,000 tonnes of CO2-e. The plant covers an area of 85 hectares and contains over 80,000 solar panels. In line with the stated decarbonisation roadmap, a feasibility study is underway on a 15-20MW$_{AC}$ expansion to the existing solar plant.

Following recent upgrades to Egyptian electrical infrastructure and supply the site is now able to access grid power. Having completed an extensive and competitive tender process a preferred contractor has been selected to supply 50MW of grid power to the site which will fully displace the need to use diesel for power generation. Construction is expected to take place in 2024 with commissioning expected during the second half of 2024.

5.4.3 Water

Due to the lack of a local source of fresh water in the Sukari area, seawater is used for process water and is pumped a distance of 25km from the Red Sea for process plant and mining requirements. Three pipelines have been installed and include two sets of seawater intake pumps and coastal wells, and booster pumping stations. The pipelines have been buried to a depth of 1m. The combined capacity of 1700m^3/h is sufficient to meet the process plant and mining water requirements at Sukari.

The seawater pipelines report to the raw water ponds located within the process plant area. Reverse osmosis water treatment plants draw a portion of the seawater for fresh water supplies to the process plant, offices and camp with a combined capacity of 2,000m^3 per day and stored in two freshwater tanks. Freshwater in the process plant is used for reagent make-up, carbon transfer and strip solution in the elution process. Freshwater is also reticulated to the camp, offices and the mining areas.

Potable water is delivered to site in a bulk tanker from Marsa Alam and stored in the potable water tank. Potable water is reticulated to the safety showers in the process plant and for domestic use in the camp and office buildings.

5.5 Physiography

The Sukari deposit is associated with a granodiorite outcrop, that prior to operations, formed a strong topographic high rising to 350m above the local wadi (intermittent water course) level and extending for up to 2,500m along strike. The surrounding topography comprises wadi drainage plains that pass to the east and west of the outcrop and the sharply incised green-brown, Red Sea Hills which surround these. Vegetation in the Sukari area is sparse due to the desert environment.

The authors are of the opinion that there is sufficient land, water, and power for the continued mining and processing operations.

6 HISTORY

6.1 Ownership History

Gold was mined at Sukari in Pharaonic and Roman times, with small-scale mining being re-established between 1912 to 1914 and more substantial operations undertaken in the period 1937 to 1951 from underground workings. All mining activities terminated in 1958 due to political reasons.

In 1994, PGM negotiated the Concession Agreement with the EGSMA; now the EMRA) and the Egyptian Government, to explore for gold and associated minerals in the Eastern Desert of Egypt. The Concession Agreement signed on January 25, 1995 and promulgated under special law no. 222 of 1994 which came into effect on June 13, 1995 pursuant to which PGM had the right to explore and develop gold and associated metal deposits within the concession area.

In 1999, Australian Stock Exchange ("ASX")-listed Centamin acquired PGM. In November 2000, PGM submitted a feasibility study (dated October 26, 2000) relating to Sukari, in accordance with the terms of the Concession Agreement. On November 4, 2001, PGM was formally notified by EMRA that the feasibility study had been accepted and had demonstrated the existence of a "Commercial Discovery" at Sukari.

On May 24, 2005, an Exploitation Lease covering an area of $160km^2$, containing the proposed Sukari mine site and surrounding prospects, was officially granted by the Minister of Petroleum. PGM and EMRA were required to establish an operating company under the Concession Agreement. SGM was accordingly incorporated under the laws of Egypt on April 13, 2006 to conduct exploration, development, exploitation and marketing operations in accordance with the Concession Agreement.

In 2007, Centamin listed on the TSX under the ticker CEE, and on the LSE in November 2009, under the ticker CEY. In 2010, to simplify listings and compliance costs, Centamin delisted from the ASX. In 2011, the Company redomiciled to Jersey and changed its name to Centamin PLC. Centamin's primary listing is on the LSE, and its ordinary shares are also listed on the TSX.

6.2 Exploration History

The first systematic modern exploration in the Sukari area was carried out in the 1970s by the Egyptian Government with assistance from the former USSR. Work completed consisted of geological mapping, trenching, geochemical sampling and the completion of five diamond drillholes at Sukari during the period 1975-1977. Assaying of the drill core confirmed the presence of gold mineralisation at depth.

Exploration by PGM commenced in 1995 with the establishment of a camp and work completed consisted of a detailed literature search prior to gridding, traversing, mapping, geochemical sampling, trenching, channel sampling, heavy mineral sampling, augering and surveying. Drilling by PGM at Sukari commenced in April 1997 and has continued to the date of this report. A summary of the exploration drilling undertaken at Sukari since 1997 is shown in Table 6.1.

Table 6.1: Summary of Sukari Exploration Drilling

Year	Company	Diamond Drill		Reverse Circulation		RC Collar + DD Tail	
		Holes	Metres	Holes	Metres	Holes	Metres
1997	PGM	59	8,694	-	-	-	-
1998	PGM	56	7,675	-	-	-	-
1999	PGM	54	6,122	-	-	-	-
2000	PGM	31	4,340	-	-	-	-
2001	PGM	57	8,189	-	-	-	-
2002	PGM	54	12,586	21	2,380	10	3,396
2003	PGM	29	8,046	6,957	245,391	-	-
2004	PGM	395	9,778	6	185	-	-
2005	PGM	83	16,926	9	1,086	58	21,992
2006	SGM	74	13,656	60	6,729	214	74,463
2007	SGM	116	31,807	668	51,504	55	22,939
2008	SGM	133	52,766	712	16,104	9	4,283
2009	SGM	116	56,674	6,618	111,475	-	-
2010	SGM	137	67,051	6,940	145,269	-	-
2011	SGM	390	73,965	6,622	131,920	-	-
2012	SGM	363	74,406	4,806	122,477	-	-
2013	SGM	452	77,654	6,263	219,344	1	521
2014	SGM	618	77,273	3,109	130,506	-	-
2015	SGM	733	78,456	3,255	121,007	-	-
2016	SGM	619	76,290	2,611	121,259	-	-
2017	SGM	571	75,854	4,198	184,659	-	-
2018	SGM	513	74,939	5,779	222,541	-	-
2019	SGM	870	88,445	4,616	170,946	1	174
2020	SGM	327	79,056	4,702	162,044	-	-
2021	SGM	399	96,082	3,899	151,696	-	-
2022	SGM	372	70,123	3,919	150,758	1	155
H1 2023	SGM	241	46,913	2,201	90,379	10	754
Total		**7,862**	**1,293,766**	**77,971**	**2,559,659**	**359**	**128,857**

PGM was acquired by Centamin in 1999
SGM is a joint owned (50/50) subsidiary of PGM and EMRA

6.3 Production History

Gold has been mined at Sukari since Pharaonic and Roman times. Numerous small pits were located over about two kilometres strike on Sukari Ridge. There were also small pits in wadi colluvium along the flanks of the ridge, most notably in Wadi Pharaoh to the east of the northern part of the ridge.

The old Sukari mine was established on an outcropping quartz vein (the "Sukari Main Lode") on the south-western flank of Sukari Ridge. In Pharaonic times, mining of this vein extended to about 50m from surface, intermittently, along about 200m strike, with stopes of approximately one metre wide. Small-scale mining was re-established in 1912 by British concerns, but appears to have ceased at the outbreak of the first World War.

In 1936, a renewed effort by government authorities to re-establish Egypt's gold mining industry saw Sukari selected as the first mine to be brought back into production. After preparatory work, production commenced in August 1937 and continued intermittently until February 1951.

Ore was sourced from the Sukari Main Lode, with the ancient underlay shaft being refurbished and extended to about 185m depth (on the underlay). An extraction level was established at 110m depth and stoping above this level extended over about a 100m strike length. Several subsidiary adits and underlay shafts accessed stopes along the length of the mined strike. Ore below the 110m level was also stoped over about a 50m strike length with stopes between 2m to 3m in width. A battery for ore treatment was located at Sukari from 1936 to 1944, at which time it was moved to Marsa Alam and used to treat ore from other prospects in the district.

A summary of recent history includes:

- 1997: Centamin began drilling the property, when it uncovered high-grade gold samples from historic underground workings;
- 2007: In February, Centamin completed its bankable feasibility study for Sukari;
- 2007 – 2009: Construction phase of Sukari;
- 2009: Centamin poured the first gold at Sukari. Open pit operations were performed by owner mining with the underground mining performed by contractor;
- 2010: Commerical production was achieved;
- 2010 – 2012: processing throughput was expanded from 4Mtpa to 10Mtpa;
- 2022: Underground mining operations transition from contractor to owner mining; and
- 2022: 36MW$_{DC}$ Solar Plant commissioned.

A summary of the recorded production since modern mining operations commenced is shown in Table 6.2.

Table 6.2: Production Summary for Sukari 2009 - H1 2023

Year	Tonnes Milled (kt)	Grade (g/t Au)	Contained Metal (oz Au)	Metallurgical Recovery (% Au)
2009	3,612	1.37	67,101	87.0
2010	1,378	2.06	83,432	85.4
2011	3,612	1.90	202,699	85.3
2012	4,526	2.04	262,828	87.8
2013	5,684	2.12	356,943	88.5
2014	8,427	1.53	377,261	87.8
2015	10,575	1.40	439,072	88.8
2016	11,559	1.65	551,036	89.4
2017	12,032	1.57	544,658	88.1
2018	12,568	1.26	472,418	88.7
2019	12,859	1.28	480,528	88.1
2020	11,913	1.35	452,320	87.8
2021	11,916	1.18	415,370	87.6
2022	12,114	1.26	440,974	88.2
H1 2023	6,082	1.23	220,561	88.5
Total	128,857	1.30	5,367,201	88.1

7 GEOLOGICAL SETTING AND MINERALISATION

7.1 Regional Geology

Sukari is located in the Neoproterozoic (900-650Ma) ANS, one of a number of areas of African continental crust that accreted and stabilised during the Pan-African Orogeny.

Formation of the ANS took place during closure of the Mozambique Ocean between the East and West Gondwana continental blocks. Ocean closure led to amalgamation of numerous ca. 870–625Ma juvenile arc and back-arc igneous and sedimentary rock sequences, with many resulting terrane sutures marked by mafic-ultramafic ophiolitic assemblages and fragments. The orogeny commenced at ca. 650Ma, continued for approximately 100Ma and included crustal shortening, lithospheric reworking, escape tectonics, and eventual orogenic collapse. Peak metamorphism was reached in different parts and depths of the orogen diachronously between 620 and 585Ma, magmatism was widespread during 650–580Ma, and rapid exhumation of the metamorphosed rocks and mid-crustal intrusions took place from ca. 600 to 580Ma.

Regional fault sets that controlled much of the gold occurrences were related to initial transpression by oblique convergence between the arcs and associated with subsequent sinistral shearing reported as overlapping the exhumation. As existing geological data are not adequate to fully evaluate the overall terrane history, work by Zoheir et al (2019) has subdivided the Eastern Desert into nine structural blocks, rather than arc terranes, based commonly on bounding shear zones and major faults (Figure 7.1).

The greatest abundance of gold deposits is associated with the NW-trending Najd Fault System that comprises many splays throughout the blocks in the Central Eastern Desert that underwent episodes of shearing at ca. 640–570Ma. Important deposits are also notably widespread along reactivated east-west thrust faults in the Allaqi-Sol Hamed block of the South Eastern Desert, with significant shearing at 610–580Ma.

Sulphide mineralogy of the Eastern Desert gold-bearing veins is dominated by pyrite, arsenopyrite, and (or) pyrrhotite, in addition to subordinate chalcopyrite, sphalerite, galena and tetrahedrite as well as alteration minerals that include white mica, chlorite, and carbonate, are those typical of orogenic gold deposits. Many gold occurrences are located along sheared margins to granitic intrusions or along contacts between different lithologies; sheared silica- and carbonate-altered ultramafic rocks along many fault zones are particularly widely associated with many of the gold occurrences.

At a district scale, the host sequence at Sukari comprises an NNE striking mélange of predominantly calc-alkaline igneous rocks and metasediments representing an accreted island arc or arcs. Several bodies of serpentinite, representing accreted slivers of highly deformed oceanic crustal rocks, occur in the hangingwall of the NNE striking, ESE verging, Sefein-Sukari thrust (Akaad, et al, 1993). This district-scale (circa 25km) structure is mapped as passing immediately to the east of Sukari, where it separates rocks of the Um Khariga Metapyroclastics (west of Sukari granitoid and enveloping serpentinite) from the Sukari Metavolcanics (east of Sukari). Vail (1983) assigns an age of 770-660Ma to rocks of the region. The entire sequence has undergone regional metamorphism to mid-upper greenschist facies.

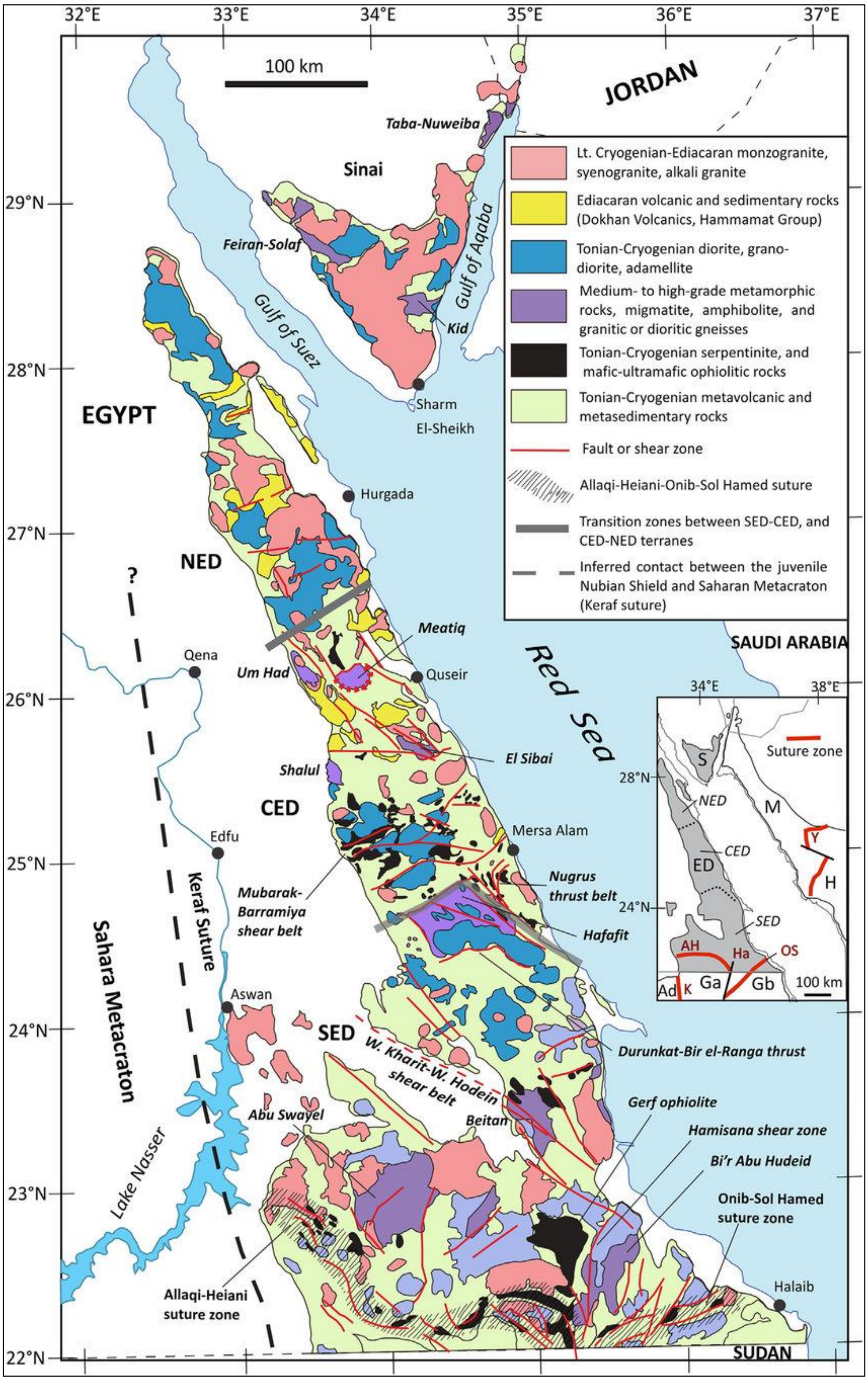


Figure 7.1: Geological Map of the Eastern Desert, Egypt (Zoheir et al, 2019)

7.2 Local and Property Geology

The Sukari felsic granodiorite outcrop is located in an easterly dipping sequence of andesite flows, serpentinites and associated volcanoclastic sediments, mainly tuffs and epiclastics. It strikes for 2.3km and is 100m to 600m thick. Drilling to date indicates that the Sukari granodiorite dips toward the east at between 50° and 75°. The western and eastern contacts of the granodiorite are thus regarded as footwall and hangingwall contacts respectively. Granodiorite/wall rock contacts are, in places, vertical or overturned. The geology of the Sukari area is presented in Figure 7.2.

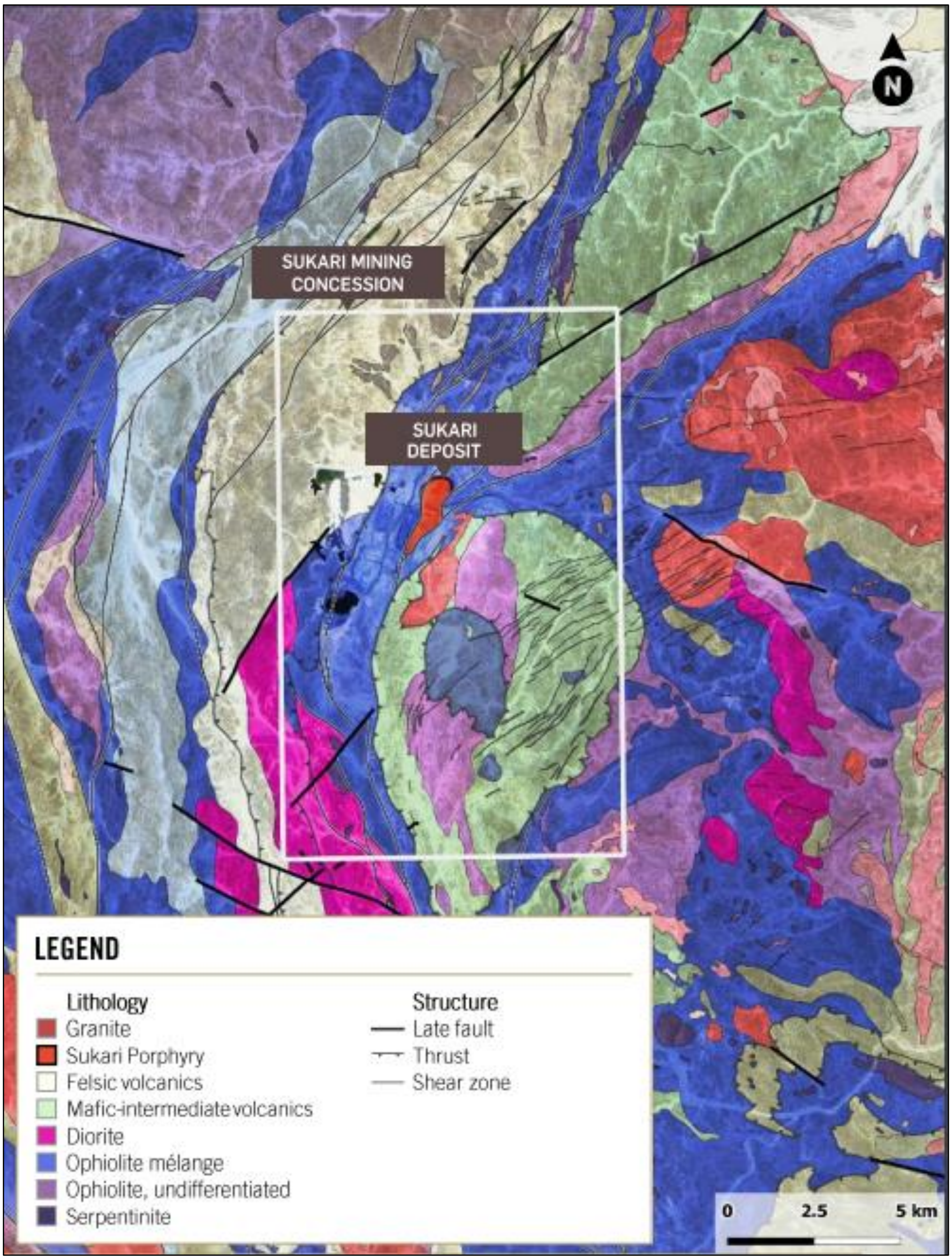


Figure 7.2: Geology of the Sukari Area (Centamin, 2023)

The original Sukari area was designated by four geographical zones namely Amun, Ra, Gazelle, and Pharaoh Zones from south to north respectively (Khalil et al, 2015), as shown in Figure 7.3 below.

Figure 7.3: Sukari Hill and Geographical Zones viewed from NW (Khalil et al, 2015)

The initial geology was reviewed as follows; hangingwall sequences comprised a mixture of serpentinite, meta-conglomerate, fine-grained metasediments, minor basalt and granodiorite dykes or sills. Drillhole logging clearly defined the hangingwall sequence as metasediments (i.e. lapilli and ash tuffs). Surface exposures indicated that these rocks were strongly deformed. It is reasonable to assume that the granodiorite dykes in the hangingwall sequence were genetically and temporally related to the main Sukari granodiorite. The footwall sequence was devoid of granodiorite dykes. This potentially indicated that the entire sequence was overturned as it would be reasonable to expect subsidiary or feeder dykes in the footwall of the main intrusion rather than the hangingwall.

In 2021, the recently established mineral resource management team adopted a revised approach to the geology of Sukari. They introduced an orebody stewardship model with the objective of developing a geologically driven model to improve our interpretation of the orebody and host rock, gain an improved understanding of factors influencing mineralisation, and, in turn, promote resource growth.

From 2021, an intensive relogging programme commenced covering the entire Sukari geology on 25 metre sections. The programme started with seven typical sections (Figure 7.4) on 200 – 400 metre centres through the Sukari granodiorite system to obtain a basic framework for the 2021 Mineral Resource update. This was subsequently infilled over a 16 month period with 108 infill sections completed. An example of the results is illustrated by Horus-Section_33-10200N (see Figure 7.5), which was specifically aimed at defining the HW and FW geological sequence with different intrusion events, determining the relative age of dykes, determining the geological control of mineralisation and defining potential extension of the mineralisation for Mineral Resource conversion.

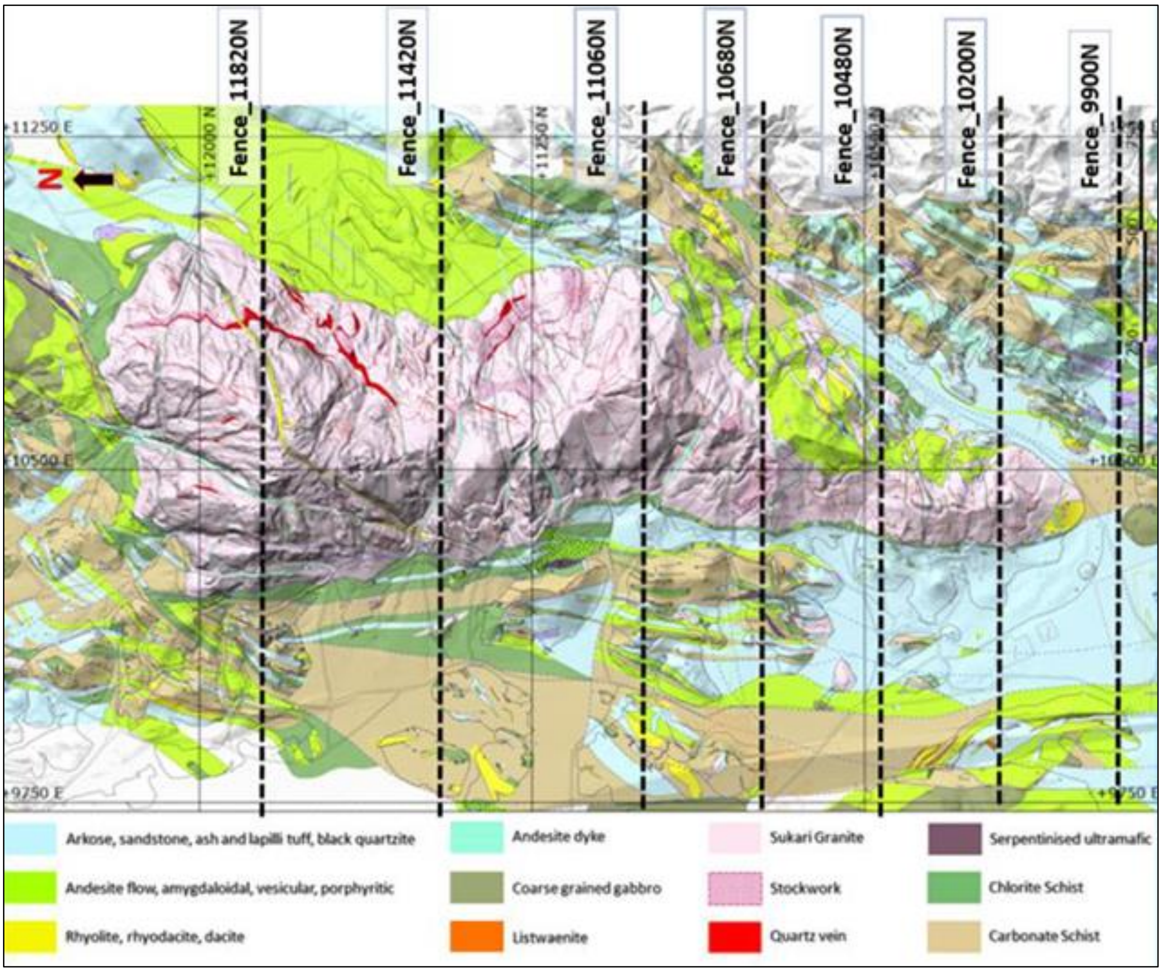


Figure 7.4: Map of Sukari Geology and Original Relogging Fences (Centamin, 2021)

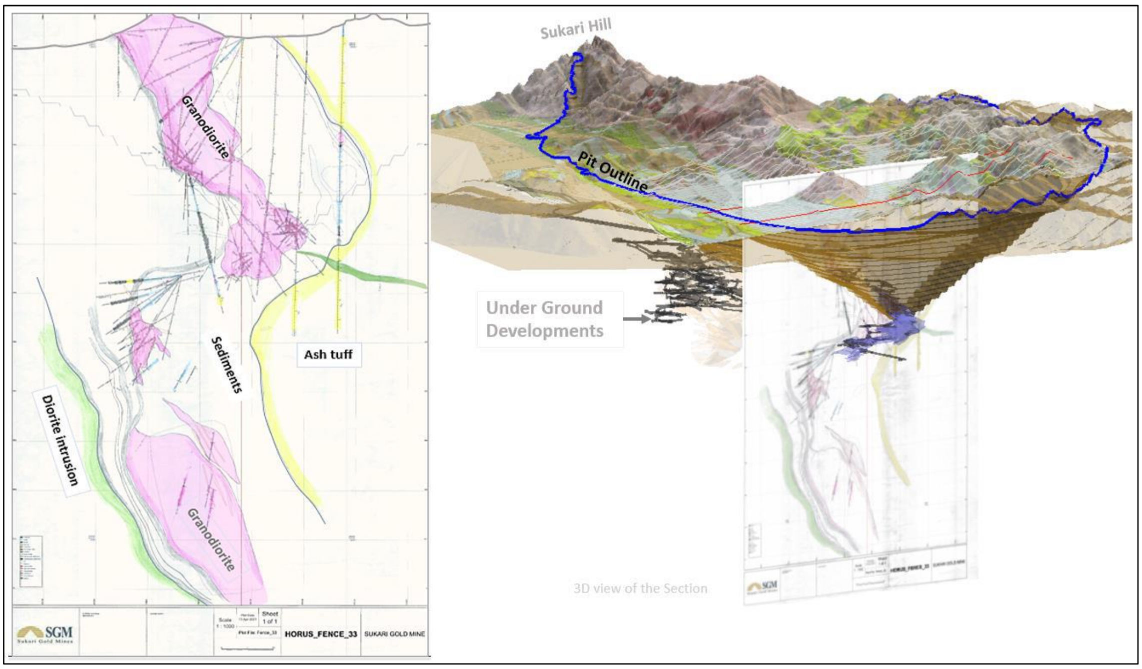


Figure 7.5: Geological Cross Section - Horus Fence 33, 10200N (Centamin, 2021)

7.3 Mineralised Zones

7.3.1 General

Gold mineralisation at Sukari is hosted mainly by granodiorite and to some extent in metasediments. Geochemical whole rock analysis confirmed the Sukari intrusion is a granodiorite (A-type granite) high in silica, zirconium, niobium, gallium, yttrium and cerium. The intrusion is a mid-crust melt which has been strongly fractionated to plagioclase and magnetite. Magmas that fractionate magnetite are generally sulphide saturated, and therefore depleted in gold, however the Sukari granodiorite is super-oxidised (i.e., sulphate not sulphide). Gold mineralisation sits within the magnetite fractionated portion of the granodiorite. This is supported by the enrichment of thorium, lanthanum, cerium, phosphorous, zirconium, hafnium, depletion of vanadium relative to titanium and decreasing vanadium/scandium ratio with decreasing scandium.

The whole rock geochemical data was combined with ASD mineralogical data to show that gold is spatially associated with muscovite while chlorite and phengite are distal. The geochemical pathfinders defined are sulphur and arsenic to gold, copper and nickel show the extents of the granodiorite, while antimony shows a high on the granodiorite margins, where molybdenum and bismuth are low.

The Sukari host is an oxidized granodiorite, confirmed by its pyrite-hematite-magnetite-anhydrite mineralogy. However, the very high arsenic within the orebody is evidence of a very strong reduction process. The ammonia detected in the ASD work further supports this interpretation. Therefore, gold bearing fluids are considered to have been sourced from the magma and the surrounding carbonaceous sediments.

The Sukari granodiorite represented a favourable host because of its composition relative to mineralising fluids, and its mechanical properties. Evidence includes that granodiorite dykes in the hangingwall of the main granodiorite body show gold mineralisation of essentially the same character as that in the main granodiorite, and wall rocks immediately adjacent to those dykes are barren. The dykes range in thickness from a few centimetres to several metres.

Structural observations indicate that the Sukari granodiorite acted as a rigid body surrounded by weaker rocks. Footwall and hanging wall rocks have taken up strain by development of strong schistosity, likely accompanied by large decreases in volume. The granodiorite has taken up strain by development of predominantly brittle fault structures.

7.3.2 Geometry

The granodiorite host for the mineralisation has a strike length of approximately 2.3km, and ranges in thickness from 100m in the south to approximately 600m in the north. Gold mineralisation within this is not continuous and its deposition has been influenced by major long-lived structures, the most important of which are tabular sheets of crackle breccia, the principal ones being the high-grade Main

Reef and Hapi Reef (Amun Zone). Figure 7.6 illustrates the overall shape and size of the granodiorite host and the geometry of the different ore zones.

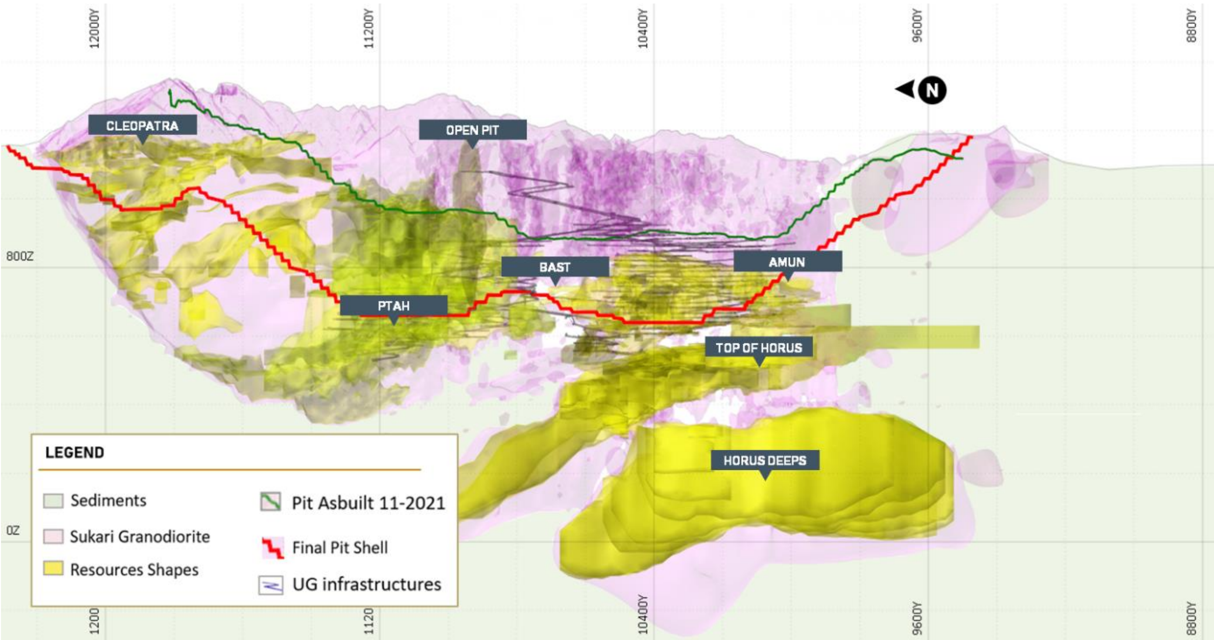


Figure 7.6: Long Section Showing the Geometry of the Porphyry System and Different Ore Zones (Centamin, 2023)

7.3.3 Structure

The Sukari deposit architecture and gold mineralisation are strongly influenced by two major deformation events (D1 and D2) and two principal periods of fluid flow. The D1 event, associated with subhorizontal E-W shortening, created a major permeability framework that later accommodated the deposition of multiple alteration and veining episodes, including the milky white veins hosting gold mineralisation.

The emplacement of the Sukari granodiorite on the contact of the melange and meta volcanoclastics, occurred early during the D1 event. This intrusion resulted in strong strain partitioning and intense strain accumulation at the pluton margins. Following a tectonic hiatus, the D2 event involved subvertical shortening and reactivated the D1 permeability framework. This led to the emplacement of several vein stages, with the final stages of structural development involving a gold-sulphide overprint.

Recent mapping and relogging activities, along with discussions and workshops with geologists, have allowed the formulation of a model for the deposits' architectural evolution. The geometries of low-dipping structures, such as the Osiris Fault, can be explained by D2 rotation of early-formed D1 structures (Figure 7.7).

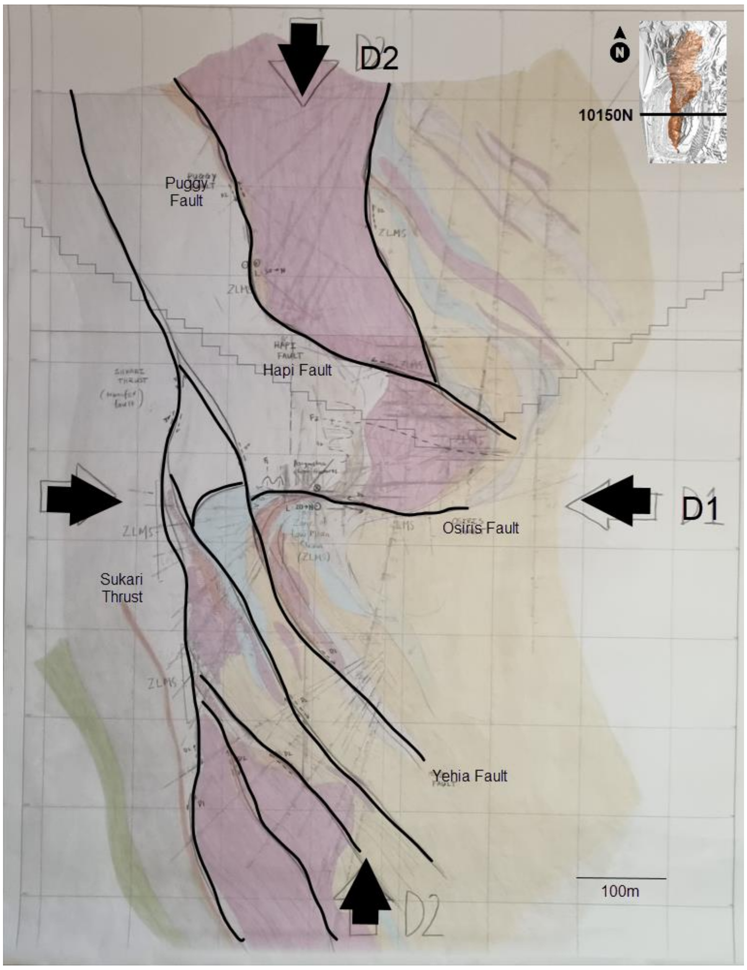


Figure 7.7: Cross Section 10150N Highlighting the Deposit-scale Structural Architecture, Including Inferred Kinematics of Major Structures and the Interpretation of Far-field Principal Stress Orientations for the Two Significant Deformation Events, D1 and D2 (Centamin, 2023)

Gold mineralisation at Sukari is found within quartz veins, breccia, and shears, hosted within disseminated sulphides and sulphide veinlets within stacked extensional veins. The gold mineralisation event occurred very late in the tectonic history, representing the final stages of the second major fluid flow cycle. Reactivation of a permeability network established during a protracted deformation history, combined with strain repartitioning, played a crucial role in gold deposition. Variation in mineralized volume size and gold content underscores the importance of size. Smaller intrusions allow pervasive deformation and permeability network growth, while larger intrusions, like Sukari's northern granodiorite, are too massive for such deformation and lack internal mineralisation.

The main structural observations at Sukari include shearing along the western contact of the Sukari granodiorite, a dominant north-south trending stacked shear set confined to the granodiorite, and a westerly dipping thrust shear zone that displaced the Sukari pluton westward into the serpentinite-ultramafic sequence at depth.

The Sukari Main Reef (SMR) and Hapi Reef are the most significant mineralized features in the Amun Zone. The SMR is a 0.2-2m thick quartz reef with massive, laminated, and breccia habit, while the Hapi Reef comprises a zone of stockwork quartz veins and stylolitic quartz, sulphide and sericite veins, as well as through-going laminated and massive quartz reefs.

Gold mineralisation is structurally controlled, with the southern end of the Sukari granodiorite containing the highest grades. The first order structural control is steep shear zones found mainly on the contacts of the porphyry. The second order control is a shallow angle short shear, parallel to bedding. The third order control is early east/west trending, north and south dipping transverse faults. Gold mineralisation is late and post-dates these structures. These structures have then been filled by andesitic dykes or altered to kaolonite. The most noticeable zone where transverse (conjugate) faults have formed to create an antiformal apex is Amun (Cowan 2021). This is the area of mineralisation which contains the most high-grade ore and ounces per vertical metre at Sukari (Figure 7.8).

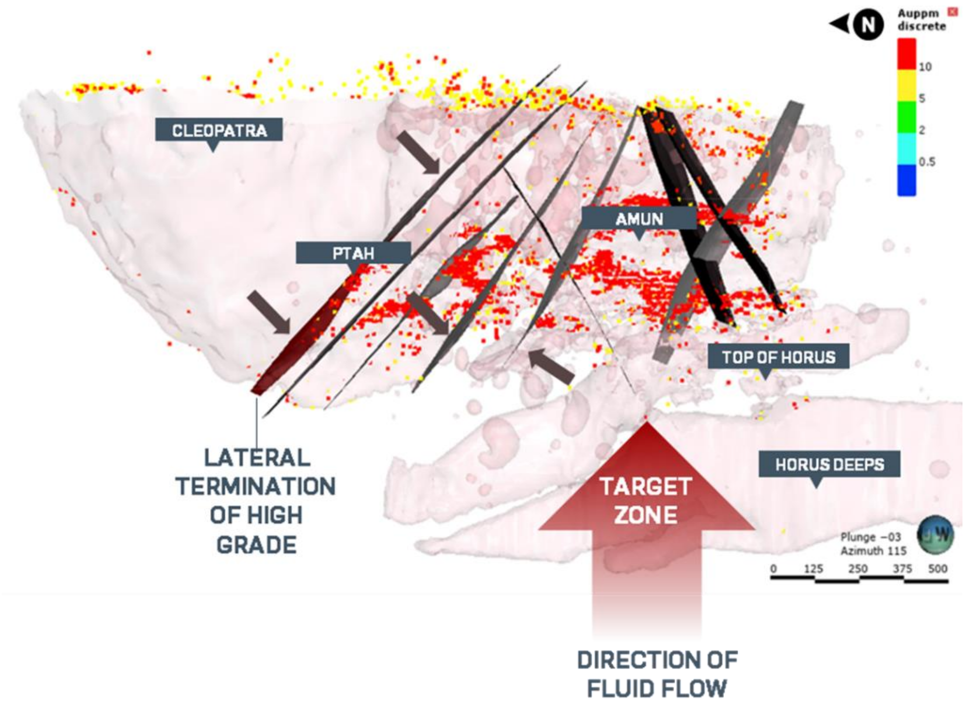


Figure 7.8: Long Section Showing East-West Transverse Faults Compartmentalising Gold and Forming Antiformal Traps. The Highest Grade and Concentration of Gold was Deposited at Amun (Cowan, 2021)

Overall, the structural architecture at Sukari is currently being compared to a boudinage model, with the structures possibly being more localized rather than extensive regional thrusts (Figure 7.8). The maximum dilation and most complex rotational deformation in a boudinage model will occur at the boudin neck (or keel). This is consistent with the deposition of mineralisation at the bottom of Amun and Ptah Keel. Knowing that the overall strain is non-coaxial (i.e., rotational), transverse structures have formed (Cowan, 2021). High grade mineralisation appears to be controlled by bedding/foliation, competency contrasts between the intrusive and country rock, transverse faults, and zones of maximum dilation.

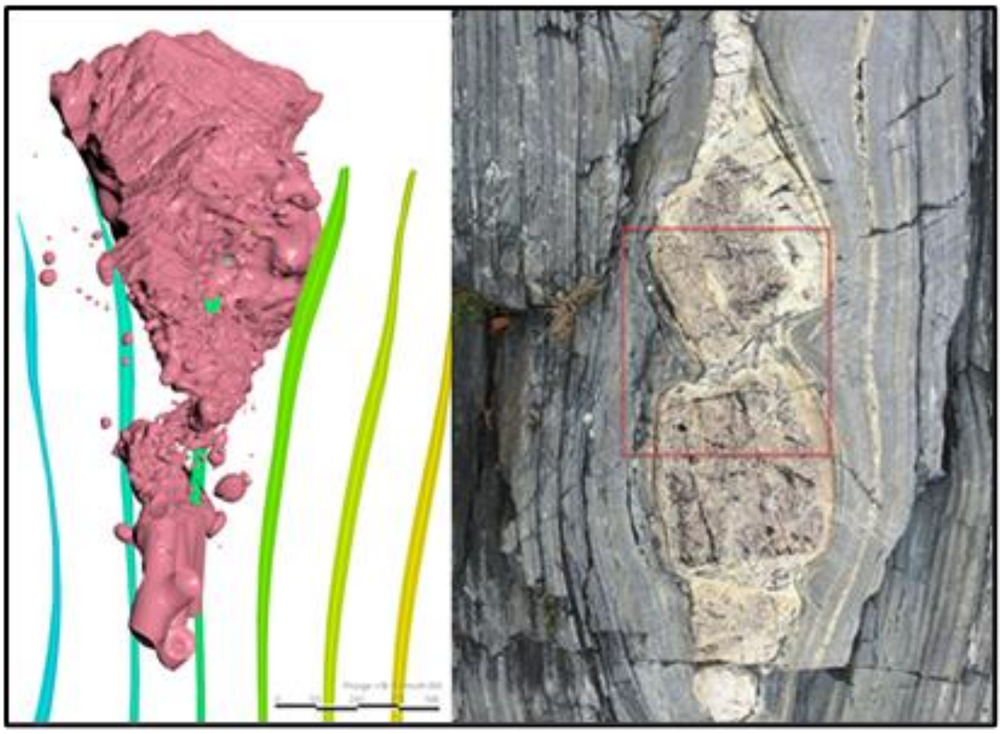


Figure 7.9: Sukari Granodiorite Intrusion with Foliation Form-lines (Left) vs. Field Example of a Boudinage Quartz Vein (Right) (Cowan, 2021)

A prominent low-plunging lineation is identified on north-south fault surfaces, prominently visible on the western shear surfaces of the open pit. This feature is seen as a combination of the transport direction along steeply dipping faults during D2, acting as transfer structures, along with the intersection lineation of low-plunging F2 folds with these shears. This interpretation aligns with the grade data trend previously modelled by Cowan in 2021.

The model in Figure 7.10 presents the latest advancement in understanding of the evolution of the deposits' structural architecture. The process initiates with a progressive phase labelled D1, marked by east-west shortening and a sinistral displacement on structures like the Sukari Thrust. This stage is followed by a period of tectonic inactivity. Subsequently, phase D2 emerges, characterized by renewed shortening accompanied by a shift in the principal stress direction to a subvertical orientation. This transformation leads to the development of F2 folds exhibiting low-dipping axial planes. Ongoing sinistral strike-slip occurs along steep structures, while top-to-the-north movement takes place along faults with shallow dips, such as the Osiris Fault (Davis, 2023).

A simplified model is proposed below to elucidate the sequential progression of fold formation and the ultimate geometries of key structures. The Osiris Fault is suggested to originate during D1 with a steep orientation, progressively undergoing rotation and folding. Over time, it assumes a configuration that becomes crucial for accommodating changes in volume and displacements related to the subvertical shortening observed in D2. This model sheds light on the complex interplay of tectonic forces that have shaped the deposit's structural features and highlights the significant role played by fault evolution in accommodating the evolving stresses and strain patterns (Davis, 2023).

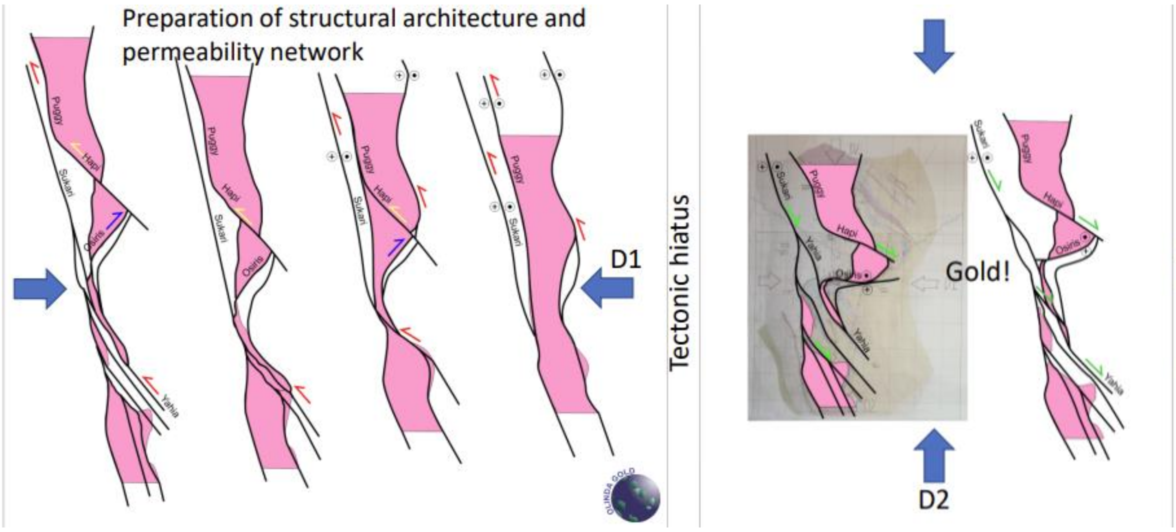


Figure 7.10: Current Conceptual Model for the Structural Evolution of the Sukari Deposit (North Facing Cross Section) (Davis, 2023)

7.3.4 Vein Geometry

Quartz veins and veinlets are commonly found intruding the granodiorite and the metavolcano-sedimentary association constituting a fissure-filling system. The thickness of the quartz veinlets varies between few millimetres up to 10-20m. The quartz veins are grouped into three sets:

- E-W (older)
- NW-SE (younger)
- NE-SW.

The main vein strikes 20–30° NE and dips 25– 50° SE. It attains a thickness of 2.5m at the upper level, and is composed of massive, milky white quartz with sulphides. In NE-SW directions, the mineralised zones are located along shear fractures paralleling the contact between the metavolcano-sedimentary country rocks and granodiorite. It is composed of the main NE auriferous quartz veins, accompanied by a series of subparallel contiguous veinlets and offshoots forming a vein system zone.

The most conspicuous feature of the Sukari mineralised granodiorite is the intensive hydrothermal alteration of the country rocks on both sides of the mineralised veins. Brecciated veins consist of brecciated vein quartz and granodiorite rock fragments or granodiorite fragments in a matrix of vein quartz ±sulphides ±hematite. Shear veins appear to be rare, whilst extensional veins are distinguished by their short strike lengths and normally form stacked arrays between thin linking shears.

The orientation of the shears, not the extensional veins, indicates the large-scale direction of continuity of a stacked vein array that are commonly arranged en-echelon.

7.3.5 Sulphide Development

Gold mineralisation at Sukari is intimately related to sulphides; pyrite is the most abundant sulphide, followed by arsenopyrite. High gold grades are associated with increased arsenopyrite concentration. The sulphides, which are believed to belong to the same paragenesis, occur as fine grained, subhedral disseminations in altered granodiorite and as blebby sub- to euhedral crystals and finer disseminations in quartz veins, fractures and breccias. Pyrite is found in all the mineralised zones. Arsenopyrite is most common in the zones of higher-grade gold mineralisation, notably in the Main Reef and in the Hapi Reef, and breccias.

Arsenopyrite is not abundant in the stacked extensional zones and minor quartz veins.

Pyrite and arsenopyrite exhibit deformation and even brecciation textures, whilst younger, native gold fills stringers and tiny holes in this deformed pyrite and arsenopyrite. Other sulphides such as galena, chalcopyrite, sphalerite, pyrrhotite have been noted.

Sphalerite is sometimes a significant sulphide mineral. Abundant exsolved chalcopyrite bodies are randomly distributed in the sphalerite host. The sphalerite-chalcopyrite association seems to be filling and replacing the older pre-existing pyrite.

7.3.6 Gold

Visible gold in core occurs as anhedral grains in milky white extensional and breccia quartz veins and as intergrowths with pyrite and arsenopyrite, commonly in narrow shear veins at quartz vein margins and margins to clasts in hydraulic quartz vein breccias. An example of visible gold is presented in Figure 7.11.

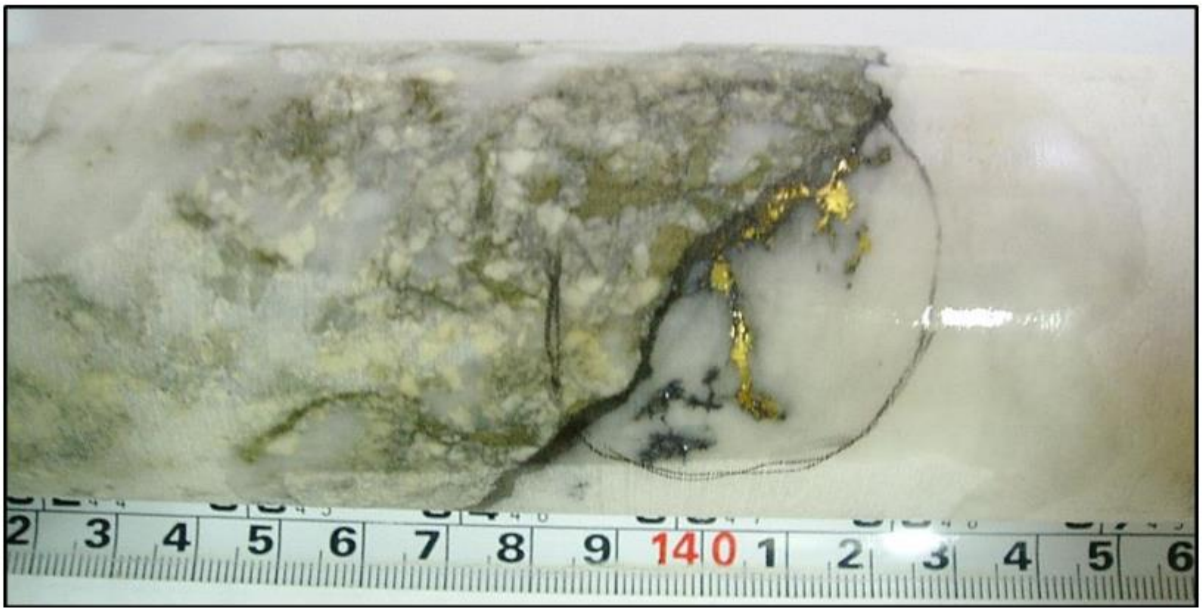


Figure 7.11: Example of Visible Gold at Sukari (DH395 at 352m, Assayed at 573g/t Au) (Centamin, 2023)

High-purity gold commonly occurs free in quartz and anhydrite veining, on the margins of pyrite and arsenopyrite crystals, and as microfracture fillings. Gold as electrum is para-genetically first as it is often occluded in pyrite and followed secondly by high purity gold (>900 fine) depleted in silver. Gold is fine grained and ranges from 1µm to 40µm.

The gold vs lithology proportions for each area in the mine are displayed in Figure 7.10. As expected, most of the gold is found in the granodiorite but can also be found in the metasediments, serpentinites and volcanoclastics in Amun, Horus and Ptah. This complies with distance analysis indicating that most of the gold sits 40 metres within and 20 metres away from the granodiorite contact.

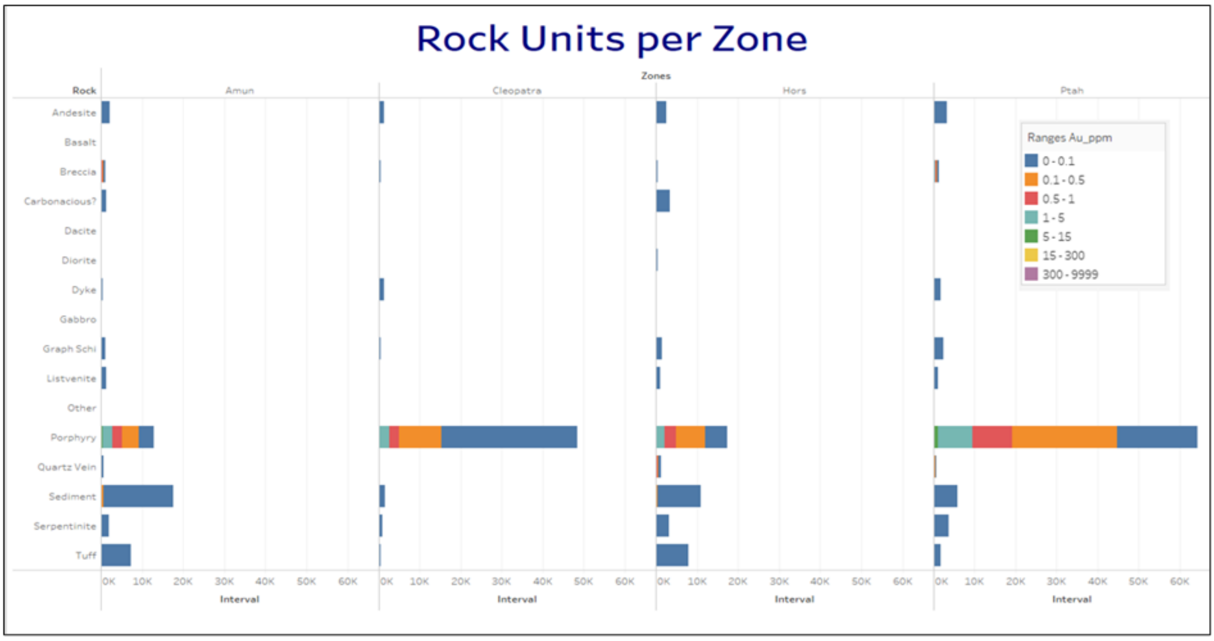


Figure 7.12: Gold Grade vs. Lithology for each Domain (Centamin, 2023)

7.3.7 Alteration

Preliminary findings derived from the analysis of alteration logging and ASD data indicate that Sukari exhibits a distinct mineralogical zonation. Additionally, conspicuous trends are observable within the Al-OH wavelengths found in the micas of the ASD data, suggesting the presence of a pH gradient. The alteration pattern transitions from Fuchsite → Calcite → Chlorite → Hematite → Silica → Sericite, portraying a progression from proximal to distal alteration halos (Cowan 2021). This sequence potentially reflects a chemical signature resulting from decreasing temperatures spanning from the inflow region beneath the Osiris Zone. The transverse faults exhibit disruption, hinting at their pre-existing state prior to fluid inundation of the host rocks, with subsequent alteration and mineralisation occurring at a later stage. Notably, Fuchsite is situated beneath the gold mineralisation at Amun, implying that the zone beneath Amun acts as a recharge area, while the broader region above, encompassing lower-grade gold mineralisation within the open pit's boundaries, constitutes the outflow zone.

The Fuchsite zone might serve as a distinctive 'marker zone,' where the highest-grade gold mineralisation is likely to be located in close proximity and above this alteration zone (Cowan 2021).

The intrusion-hosting intermediate andesitic volcano sedimentary rocks have generally been altered to a carbonate (ankerite, calcite)-silica-sericite-chlorite assemblage.

The granodiorite itself has undergrone varying degrees of alteration, involving silicification, sericitisation, carbonatisation, albitisation and more advanced kaolinisation. Sericite and silica are the most prevalent alteration products within the Sukari granodiorite, closely associated with mineralised zones such as shears and stockworks. The extent of granodiorite alteration corresponds to the intensity of the extensional veins and their proximity to major shear structures – areas with heightened fluid flow. This often manifests as a zonal alteration halo encircling breccia-quartz vein-shears, characterised by a central zone of intense kaolin-sulphide-sericite alteration, transitioning to a sericite-silica ±albite intermediate zone, and further outward to a weaker sericite-silica-carbonate environment.

Silica, sericite, and carbonate alterations are pre- to syn-mineralisation, with gold mineralisation spatially associated with phases of silica, kaolin, sericite, and sulphides.

Sericite occurs in all porphyries as well as in shears, as vein selvedge, veins, and blebby masses. Kaolinite alteration occurs along shear and fracture zones such as the Main Reef, but its occurrence is not consistent along these structures. The alteration is distinctly white, clayey to sandy (from resistant quartz grains in clay matrix), hosted in bleached rock and is associated with strong fine-grained pyrite and elevated gold grades. Poor core recovery is common in these zones. Dissolution textures and vuggy cavities in the porphyry where acidic fluids have dissolved minerals (mainly carbonates) are common. This indicates a late acidic fluid that has selectively penetrated shears and either deposited gold directly from the fluid, or perhaps remobilised it.

7.4 Geological History

A comprehensive geological history of the Sukari deposit has been meticulously constructed through a combination of open pit and underground observations, core analysis, mapping, and section interpretation. This history, depicted in Figure 7.13, reveals a complex narrative of alterations, veining, and structural shifts. The Sukari deposit is characterized by a substantial permeability system, primarily influenced by an early-established fault system that experienced continuous reactivation. The evolution of this deposit is marked by two distinct phases of fluid flow during D1 and then D2. The initial phase (during D1), although the largest, resulted in the deposition of sulphides and was not the primary event responsible for gold accumulation. This period of fluid activity led to the formation of an extensive milky quartz vein population, distinguishable for its unique appearance and long-lasting fluid passage system. The second period of fluid flow (D2), however, emerged as the principal event for gold deposition, involving the settling of quartz, carbonate, and sulphides (Davis 2023).

The milky quartz vein population stands out as a prominent feature within this complex geological history, embodying a visually identifiable and structurally significant trait. Unlike other vein populations, the milky quartz veins rarely display overlapping development stages with different vein types, suggesting an efficient and consistent fluid source during their formation. This vein system demonstrated a unique pattern of activation and deactivation, indicating that it functioned independently from other fluid sources. Overall, the Sukari deposits' geological history offers valuable insights into the interplay of various factors that contributed to its intricate mineralisation and highlights the pivotal role of different fluid flow periods in shaping the deposits' composition and structure (Davis 2023).

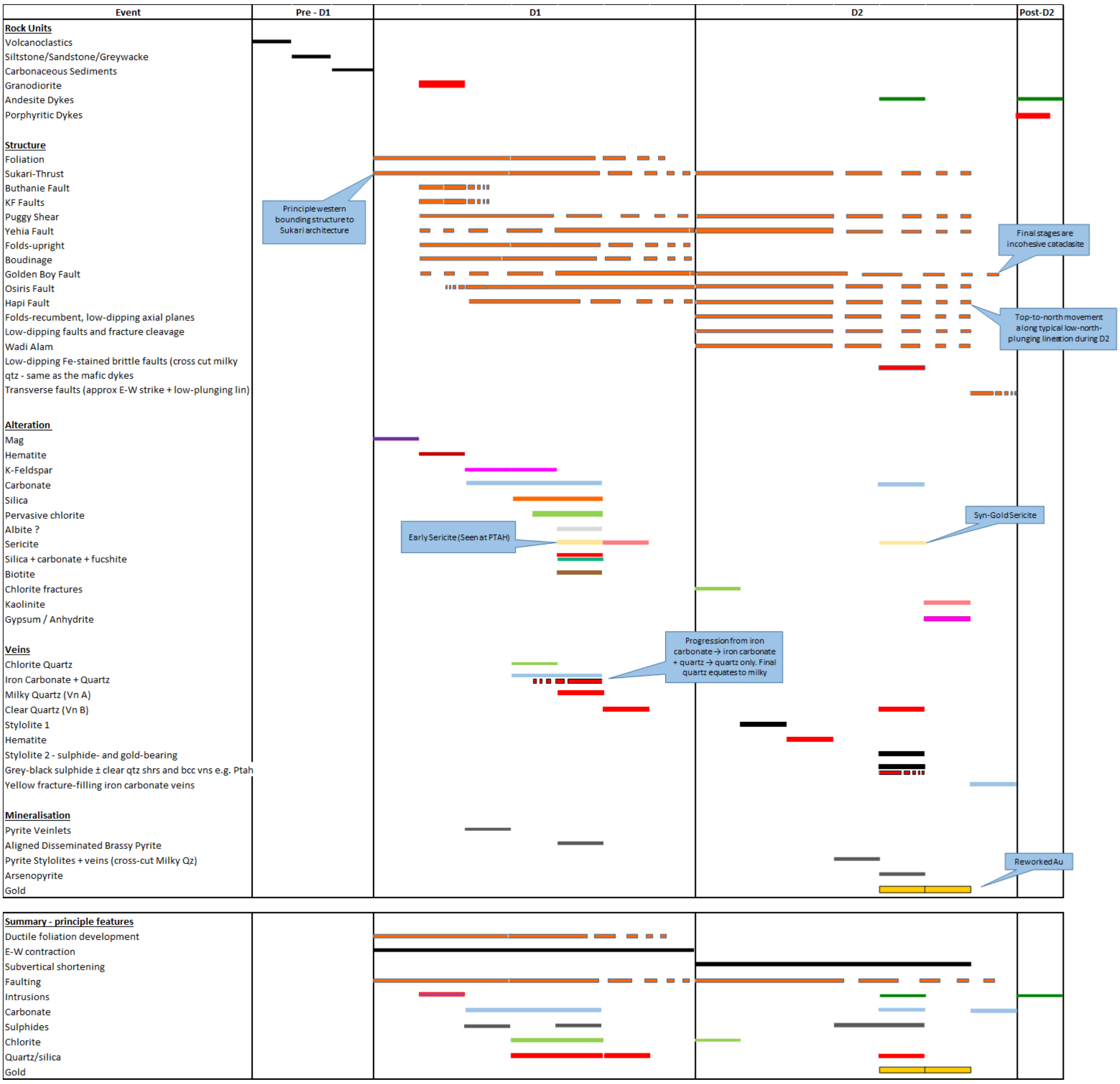


Figure 7.13: A Detailed Geological History of Sukari (Davis, 2023)

8 DEPOSIT TYPES

The Sukari gold deposit has characteristics of orogenic gold deposits which generally form at crustal depths between 3 and 15 km, are commonly associated with regional-scale fault zones or shear zones and formed from metamorphic fluids, either from metamorphism of intra-basinal rock sequences or de-volatilisation of a subducted sediment wedge, during a change from a compressional to transpressional stress regime, prior to orogenic collapse (Groves et al., 2018). The Sukari gold deposit is also considered to have characteristics of intrusion-related gold (IRG) due to mineralisation being hosted by felsic intrusive rocks (Abdelnasser and Kumral, 2017).

Regardless of the exact classification, mineralisation at Sukari comprises gold-bearing quartz stockworks and sheeted veins in brittle-ductile shears within the Sukari intrusion (Abd El-Wahed et al., 2016). Ore mineralogy in the veins, stockworks, and alteration zones includes pyrite, arsenopyrite, and less common sphalerite, chalcopyrite, galena, and gold. High gold grades are associated with concentrations of arsenopyrite. Gold is also found in alteration zones surrounding the quartz veins. The host intrusion is identified as an A-type (High Silica, Zr, Nb, Ga, Y and Ce), strongly fractionated plagioclase and magnetite-bearing, granodiorite to monzogranite. Country rocks to the intrusion include sheared volcanic, volcaniclastic, and sedimentary rocks, and lenses of serpentinite locally altered to listvenite (Helmy et al., 2004). Deformation of the Sukari intrusion (~695 ± 2Ma) was manifested by development of spaced, brittle-ductile reverse shears, whereas the surrounding host rocks developed strong foliation. This result reinforces the temporal and spatial relationships between gold mineralisation and extensive wrench faults/shears in the Sukari mine area and its surroundings.

The sheared contacts of the Sukari intrusion with the country rocks likely caused significant variations in the orientation of local principal maximum stress, providing anomalously low mean stress zones for fluid flux and ore deposition (e.g., Ridley and Diamond, 2000). Crust derived fluids, during regional transpression, focused into major existing fault conduits. The Sukari intrusion acted as a rigid body that allowed preferential strain localisation and repeated pressure-related fluid cycling, resulting in high-grade laminated quartz veins and low-grade sericitized/sulfidized wall rock. Gold deposition from hydrothermal ore fluids may have been triggered by pressure fluctuation causing silica deposition and associated changes in fluid chemistry at a favourable rheological boundary. Zoheir et al., 2023 determined 40Ar/39Ar age (~625 Ma) for hydrothermal sericite that associates with gold mineralisation in the Sukari deposit further emphasizes that gold deposition occurred during the onset of the oblique convergence and transpression in the late stages of the tectonic evolution of the Central Eastern Desert.

Given the abundant hydrothermal breccia in the ore zones, fluid immiscibility, and associated hydrofracturing, could have occurred during fluid pressure switching between supra-lithostatic and sub-hydrostatic regimes at the brittle-ductile transition. Further, the widespread recrystallisation, sub-grain development, deformation bands (lamellae), and cataclasis in the mineralized quartz veins collectively support the vein development under varied brittle-ductile conditions (e.g., Passchier and Trouw, 2005). The episodic nature of deformation and fluid infiltration is attested by superimposed pyrite generations with variable textures and trace element compositions (Zoheir et al., 2023).

Pervasive silica-sulphide-sericite ± carbonate alteration immediately adjacent to gold-bearing quartz veins in domains of intense deformation reflect fluid-dominated metasomatic reactions under sub- to mid-greenschist facies conditions (McCauig and Kerrich, 1998).

A conceptual genetic model of the formation of the Sukari gold deposit is shown in Figure 8.1.

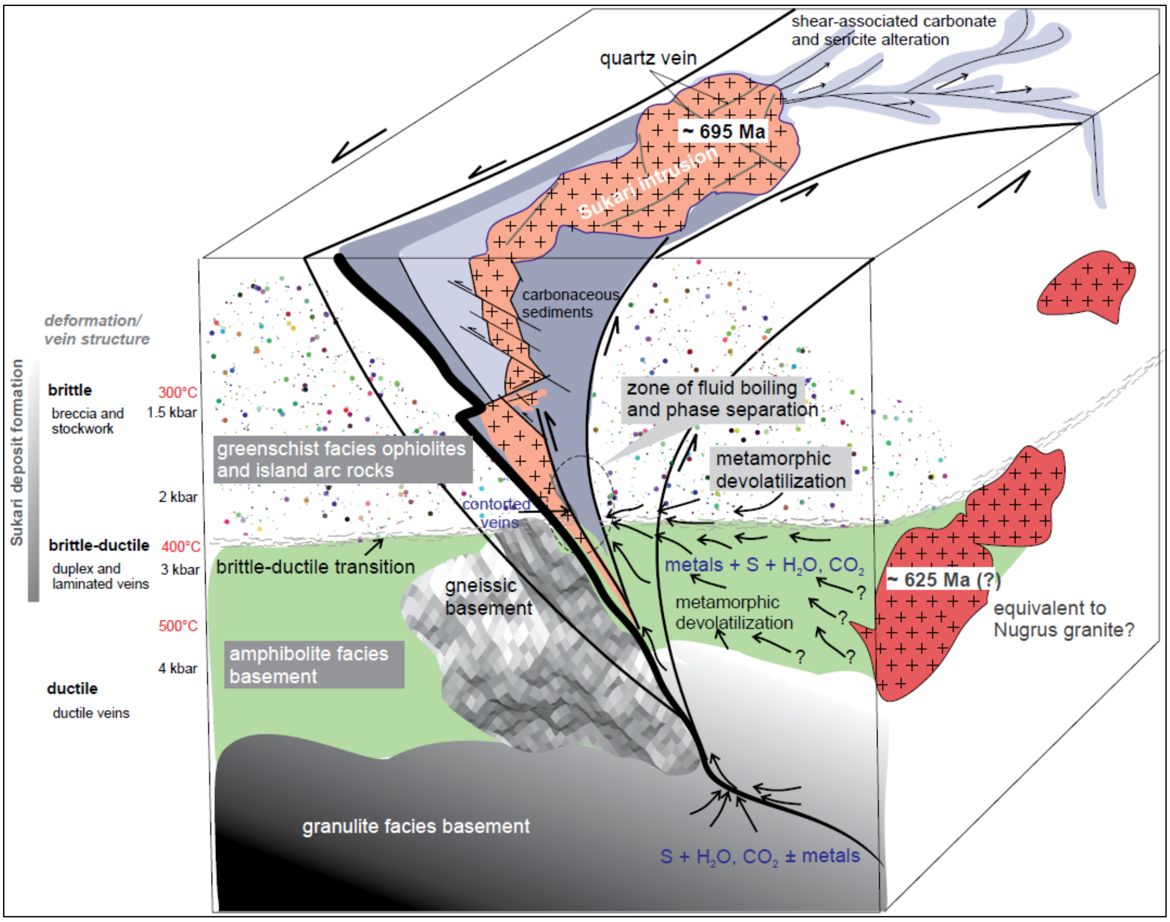


Figure 8.1: Conceptual Genetic Model of the Sukari Gold Deposit (Zoheir et al., 2023)

In order to use structural geology as an integral tool in gold exploration, the timing of gold mineralisation within the structural history of the orogenic belt is a crucial constraint. Studies on the timing of formation of orogenic gold deposits are most robust if they involve an understanding of tectonic and structural evolution within a geochronological framework which involves robust isotopic ages of the gold mineralisation itself. Similar interpretations of data from orogenic gold deposits worldwide indicate that they consistently formed late in the tectonic and structural evolution of their host terranes, largely during a transition from compression to transpression related to a change in far-field stresses. Thus, any pre-existing structures, and not solely syn-gold structures, can be mineralized and it is structural geometry not structural history which is the important exploration parameter (Groves et al., 2000).

9 EXPLORATION

9.1 Exploration Methods

Sukari is a producing mine and exploration is now dominated by the drilling activities described in Sections 10 and 11. Other exploration methods applied at the mine have included:

- Gridding and traversing carried out at 1:10,000 scale.
- Mapping carried out on a 1:500 scale (Amun Zone) and 1:1,000 scale.
- Trenching and channel sampling within the cut trenches, undertaken mainly within zones of intense silicification and sulphidisation. Total length of trenching was 1,143m.
- Channel sampling from historical underground workings. A total of 982 samples were submitted for analysis.
- Auger sampling across two heaps of tailings on a 10m by 10m grid to a maximum depth of 1m. A total of 327 samples were taken for gold analysis.
- Rock chip sampling initially on 160m spaced lines with some supplementary infill lines. In addition, dykes, quartz veins and zones of hydrothermal alteration were grab-sampled. Later rock chip sampling was undertaken on 100m spaced lines and samples were approximately 1m to 2m in length.
- Regional sampling and prospecting comprising rock chip and channel sampling at various small mines in the vicinity.
- Heavy mineral sampling at various suitable sites in wadis; and
- Airborne geophysical surveys.

9.2 Exploration Strategy

9.2.1 Introduction

Exploration at Sukari is currently focussed on defining targets close to existing infrastructure (within 10km) which can be quickly and cost effectively brought into the mine planning process, while also continuing to test the depth and strike extents (which remain open) that underpin the longer-term potential of the underground mine and the mine expansion plan. The underground mine is working to a rolling 5-year programme developed by the mineral resource management team. The overarching strategy revolves around replacing depletion from mining and expansion through drilling efforts distributed evenly, with one-third dedicated to grade control, another third to infill drilling of established resources to increase confidence, and the final third allocated for exploration of both new and existing targets. This multifaceted approach has led to substantial growth in resources and reserves within the underground, forming the foundation for the shift to owner mining and providing valuable insights for future capital investments.

In 2020, with the introduction of a new geological leadership team, a transformed orebody stewardship model was introduced. This model was built upon a disciplined and strategic approach to exploration, development, grade control and mine planning processes. The transformation began with a comprehensive review of the geological dataset and procedures in use. This involved relogging all diamond core and RC chips at Sukari and its satellite deposits, a process that took an initial 12 months. It also included sectional and 3D interpretations to establish the geological framework, identifying gaps in drilling and potential resource and reserve additions. This information was then provided to the newly introduced in-house resource estimation team, forming the foundation for long-term planning.

Notably, between 2020 and 2022, the underground measured and indicated resources grew from 1.51 million ounces to 2.07 million ounces, with proven and probable mineral reserves increasing from 0.4 million ounces to 1.2 million ounces, supporting the move to owner mining and increase in underground mining rates.

The adoption of this approach resulted in an optimized open pit and underground mine plan that solidifies a +10 year mine life, thus enhancing the overall value of the operations while mitigating associated operational risks. This optimized mine plan is the result of a strategic, value-driven long-term schedule, which also takes into account practical mining parameters and the feasibility of the mining equipment fleet and ore processing capabilities.

Centamin released an exploration update on July 7, 2022, the highlights of which are included in this section.

9.2.2 Underground Exploration

Sukari underground drilling has focussed on delineating the full potential of the underground orebody to deliver both mine life extension and operational expansion (Figure 9.1). Drilling is completed across all areas of the underground.

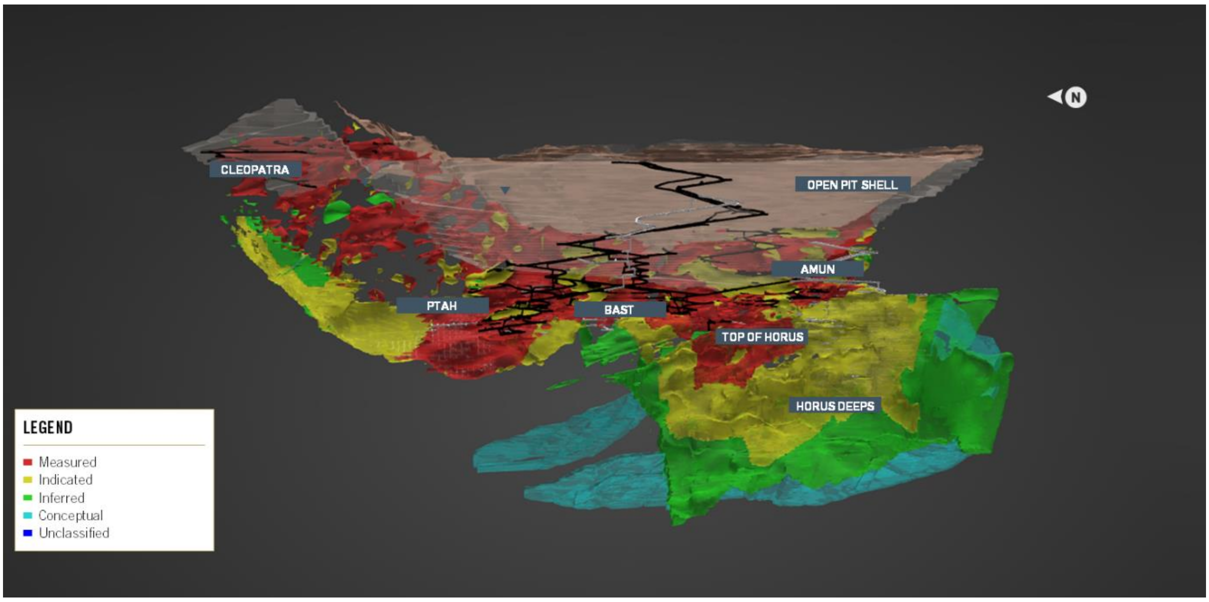


Figure 9.1: Long Section Outlining Sukari Underground Mineral Resource Classification and Targeted Growth Areas (Centamin, 2022)

The Horus zone sits at depth beneath the Amun zone. Mining development has pushed into the upper levels of Horus enabling the establishment of drill platforms from which the Horus Deeps zone is being developed (Photo 9.1).

Photo 9.1: Core Drilling for Horus Deeps (Centamin, 2022)

At Horus Deeps, drilling has intersected the highest-grade mineralisation in that zone to date. Significant results reported include:

- Horus Deeps - 54m at 15.1g/t Au, including 3.8m at 161g/t Au and 2.15m at 44.84g/t Au (Figure 9.2);.
- Ptah - 23m at 7.2g/t Au, including 2m at 14.29g/t Au and 6m at 17.72g/t Au;
- Amun - 17m at 9.6g/t Au, including 1m at 136g/t Au; and
- Amun - 8.5m at 7.6g/t Au, including 1m at 52.8g/t Au.

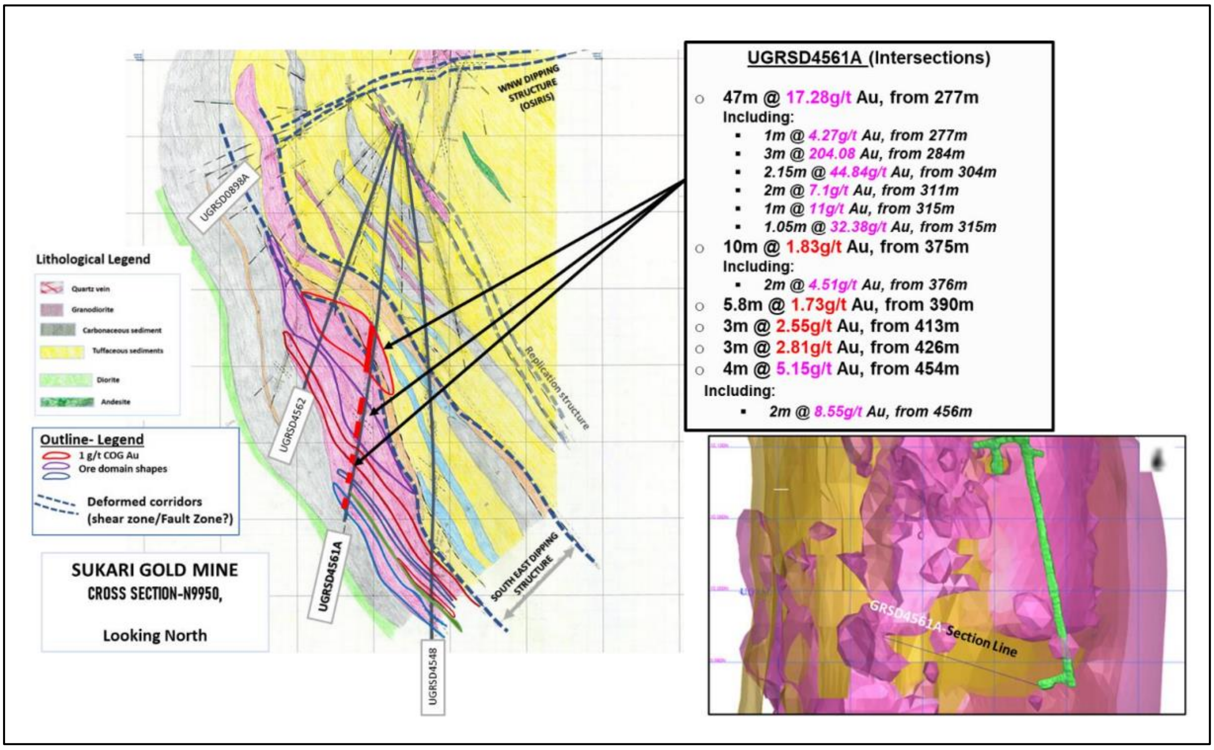


Figure 9.2: Hand-drawn Oblique Cross Section Showing DDH UGRSD4561A, Horus Deeps (Centamin, 2022)

Horus Deeps remains open to the north, south and down dip and represents the long-term future of the operation. Drilling is currently being performed to the north and above the 100mRL in Top of Horus to convert and define medium term reserves and the structural/lithological controls. Drilling to the south to test the extents of the Sukari Porphyry is planned for 2024, with exploration platforms currently being developed off Amun 625mRL.

The Bast area between Ptah and Amun continues to return high grade underground zones of Bonanza style mineralisation. Drilling in this area demonstrated a consistent geological host within 100m of existing infrastructure, which will improve underground operational flexibility through the development of a new high-grade mining area in the near-term. Drilling will continue in this area into 2024 and beyond to determine the extents of the zone. Drilling highlights include:

- 10m at 64g/t Au, including 2m at 199g/t Au;
- 4.5m at 267g/t Au, including 4m at 301.29g/t Au (Figure 9.3); and
- 17m at 12.5g/t Au, including 2.5m at 6.84g/t Au and 4m at 47.09g/t Au.

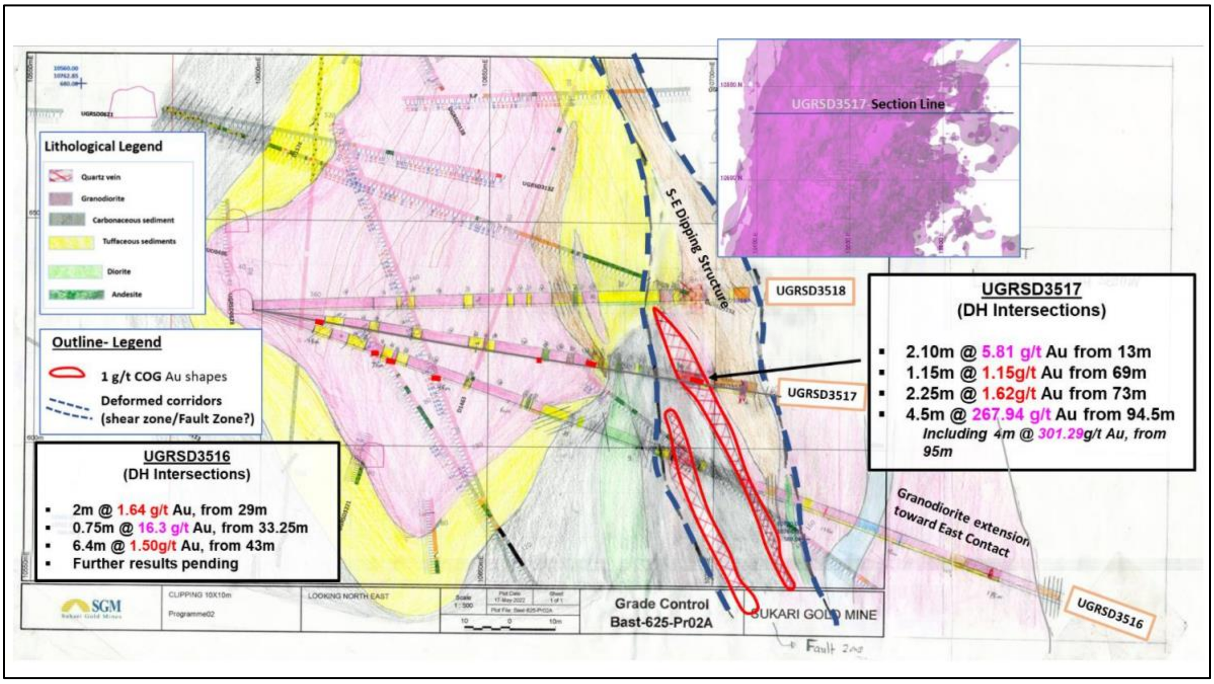


Figure 9.3: Hand-drawn Cross Section Showing DDH UGRSD3517, Bast Area (Centamin, 2022)

Additional targets for discovery, resource expansion, and reserve enhancement include the extensions of Top of Horus and the Horus Porphyry to the north, beneath Ptah. Although these have not yet been subjected to drilling, they are currently under evaluation. The evaluation process involves the development of a comprehensive structural model, which encompasses deposit, permit, and regional scale data. This model is being developed collaboratively by the mineral resource management, exploration, and mine geotechnical teams, following a review conducted in early 2023 in consultation with Dr. Brett Davis.

The initial version of the model is anticipated to be finalized by the first quarter of 2024. It will serve as a foundation for generating further potential exploration targets using a wide range of data sources, including seismic, geophysics, geochemistry, alteration, scanline analysis, drilling data, relogging information, mapping data, and on-site observations.

9.2.3 Near-Mine Surface Exploration

A systematic exploration programme, consisting of mapping and soils, undertaken by a dedicated surface exploration team has identified multiple shallow open pit gold satellite targets within the Sukari Mining Concession. These have the potential to supplement Sukari mill feed, in the short to medium term, improving operational flexibility. Initial drill results from two of the identified areas include:

- Wadi Alam - 22m at 2.9g/t Au from 41m; and
- V Shear East - 10m at 2.9g/t Au from 41m.

A map showing the principal near-mine exploration targets is shown in Figure 9.4 below.

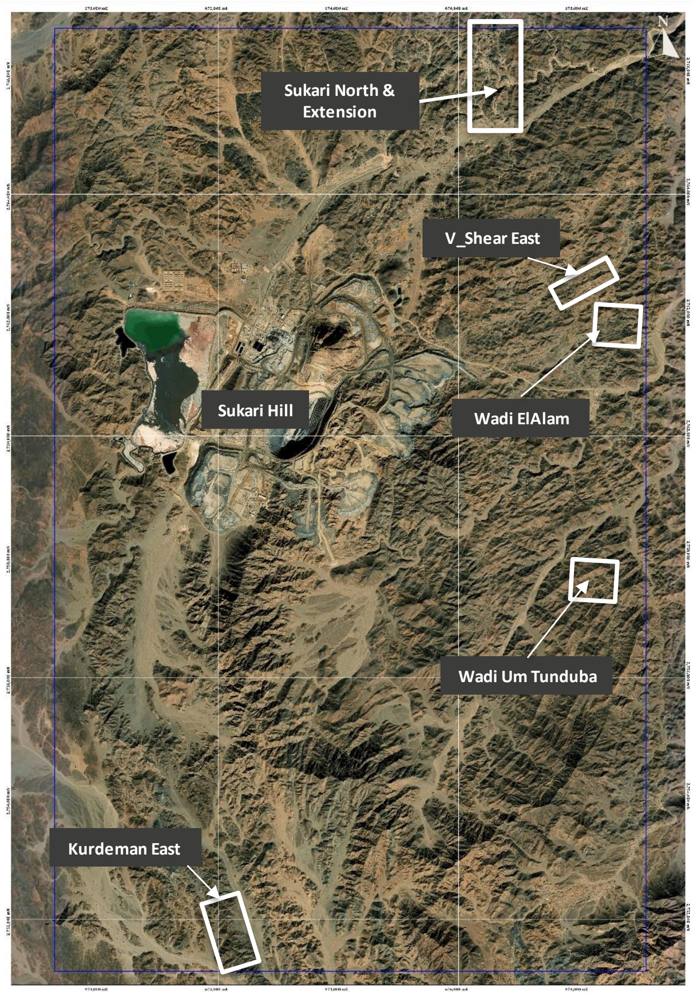


Figure 9.4: Important Prospects within the Sukari Concession (Centamin, 2022)

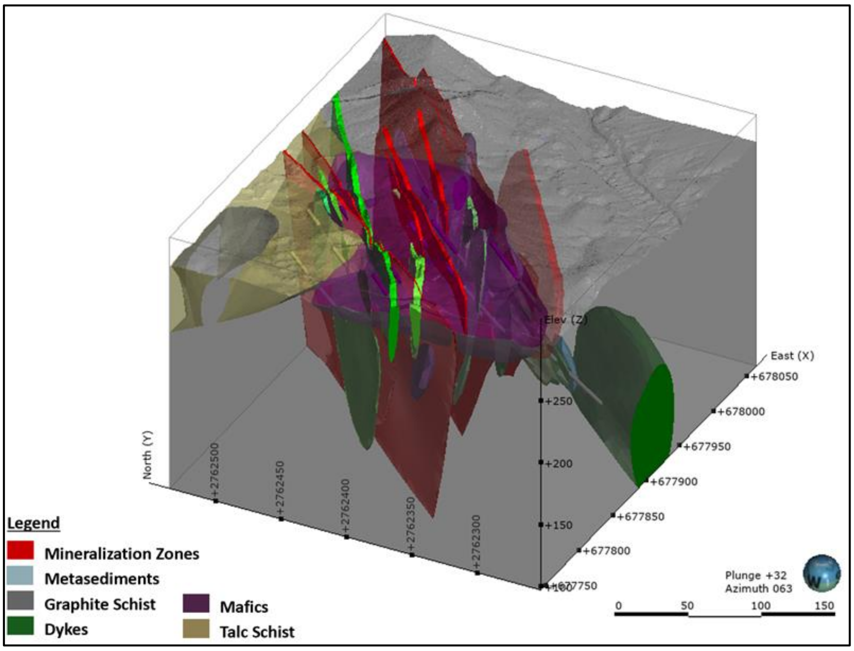


Figure 9.5: Sheeted Vein Structure, V_Shear East (Centamin, 2022)

As an example of the styles of mineralisation identified to date, drilling at V Shear East has delineated a sheeted vein structure which requires further investigation (Figure 9.5). Sukari North also shows similar structures, but again, is at an early stage of investigation. As an additional exercise, the Company has re-logged all the old exploration holes with a view for re-interpretation. The Kurdeman site appears to be of particular interest.

Concurrently with this work in 2022, the Company undertook an extensive soil sampling programme which collected over 5,000 samples. This work generated 32 targets with 14 having a length of more than 400m which are now currently subject for field mapping and validation. These targets exclude the very recent results from Kurdeman, Sami South and Horus South Extension (the projected up-dip continuation of the Horus Deep mineralisation), which appear to shift the target selection more to this southern area. Figure 9.6 shows the results of the soil sampling work.

The authors consider the sample collection at Sukari is undertaken by competent personnel using procedures that are consistent with industry best practices. The authors conclude that the samples are representative of the mineralisation and there is no evidence that the sample collection process has resulted in a bias that could materially impact the accuracy and reliability of the results.

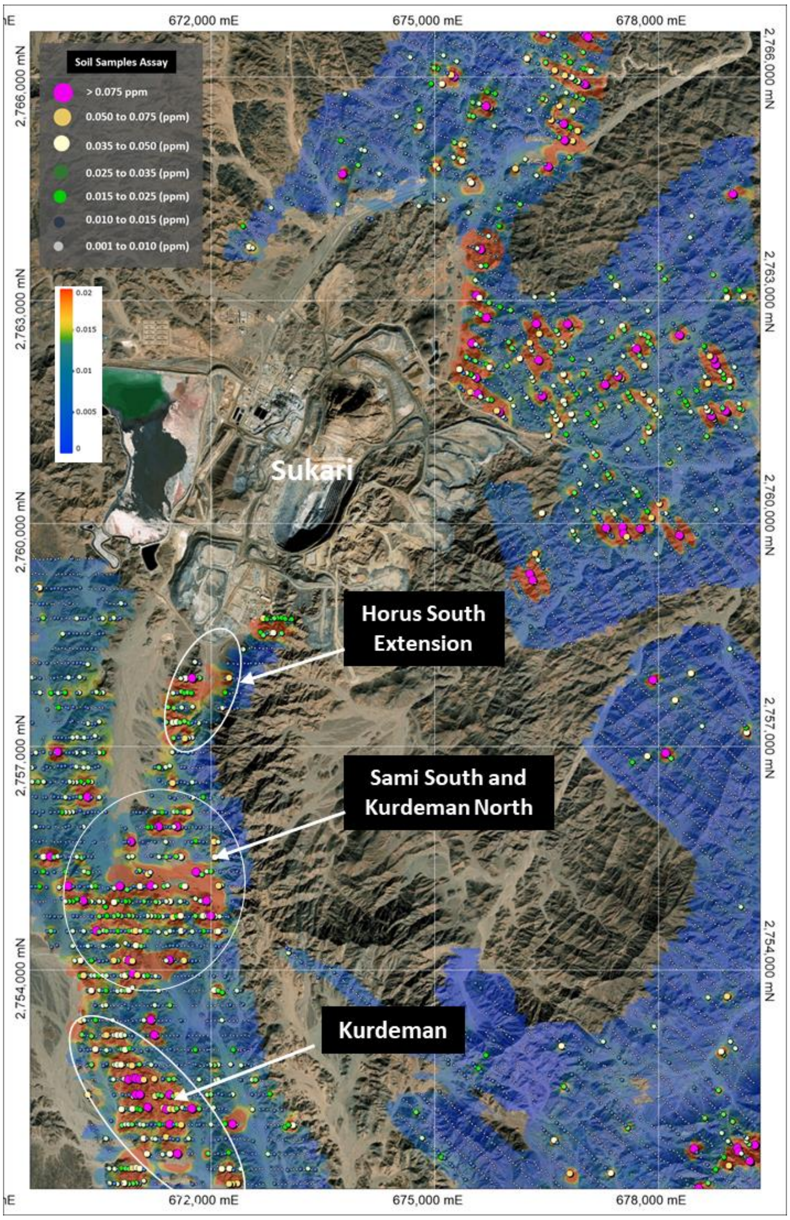


Figure 9.6: Sukari Licence, Soil Sampling Results (Centamin, 2022)

In addition, an airborne geophysical survey, covering the entire 160km^2 Sukari mining concession area, was completed during Q2 2022. The heliborne survey combined VTEM, Magnetic and Radiometric techniques, flown at 100m line spacing. The programme was designed to further the understanding of the geological and structural setting of the Sukari mineralised system itself as well as the numerous gold prospects across the concession area.

Figure 9.7 below shows the flight lines of the VTEM survey which further defined the arcuate nature of the Sukari mineralised corridor, supporting the soil geochemistry results presented in Figure 9.6 above.

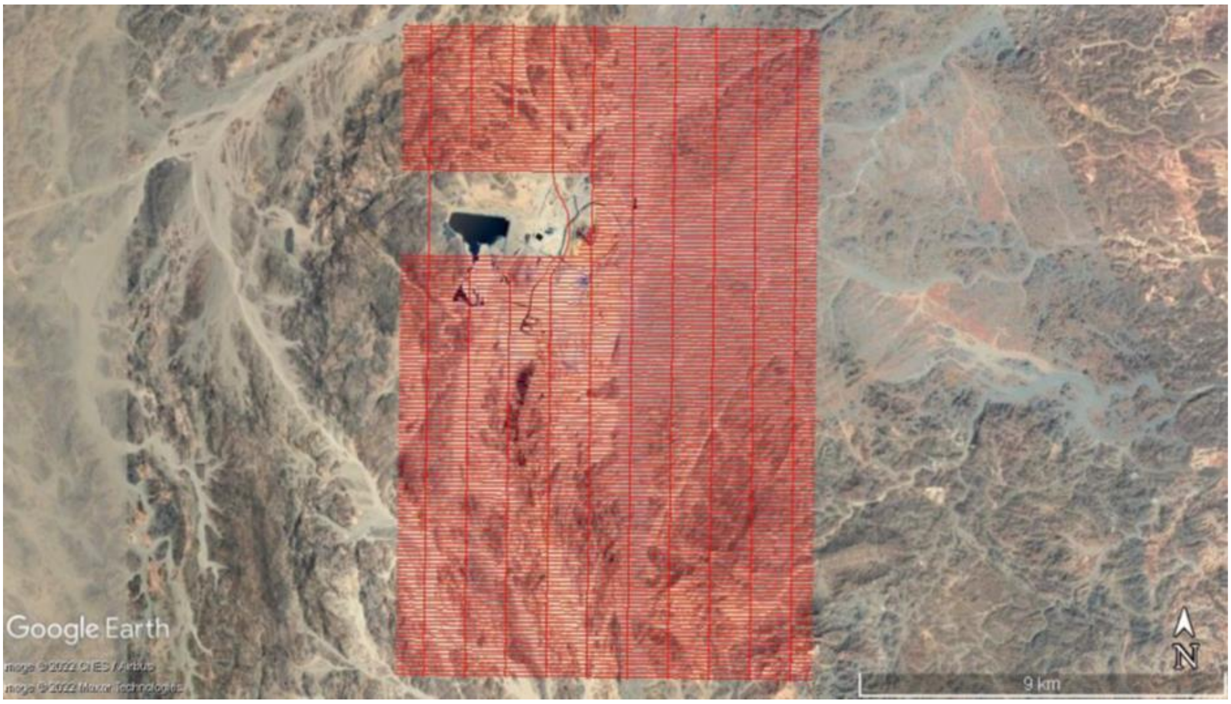


Figure 9.7: Airborne Geophysics Flight Lines, Sukari Licence (Geotech, 2022)

Combining the results from this work, the Company has been able to produce a target generation map (excludes Kurdeman as results were not available at the time of map production), which gives a good indication of the potential of the immediate Sukari licence area (Figure 9.8).

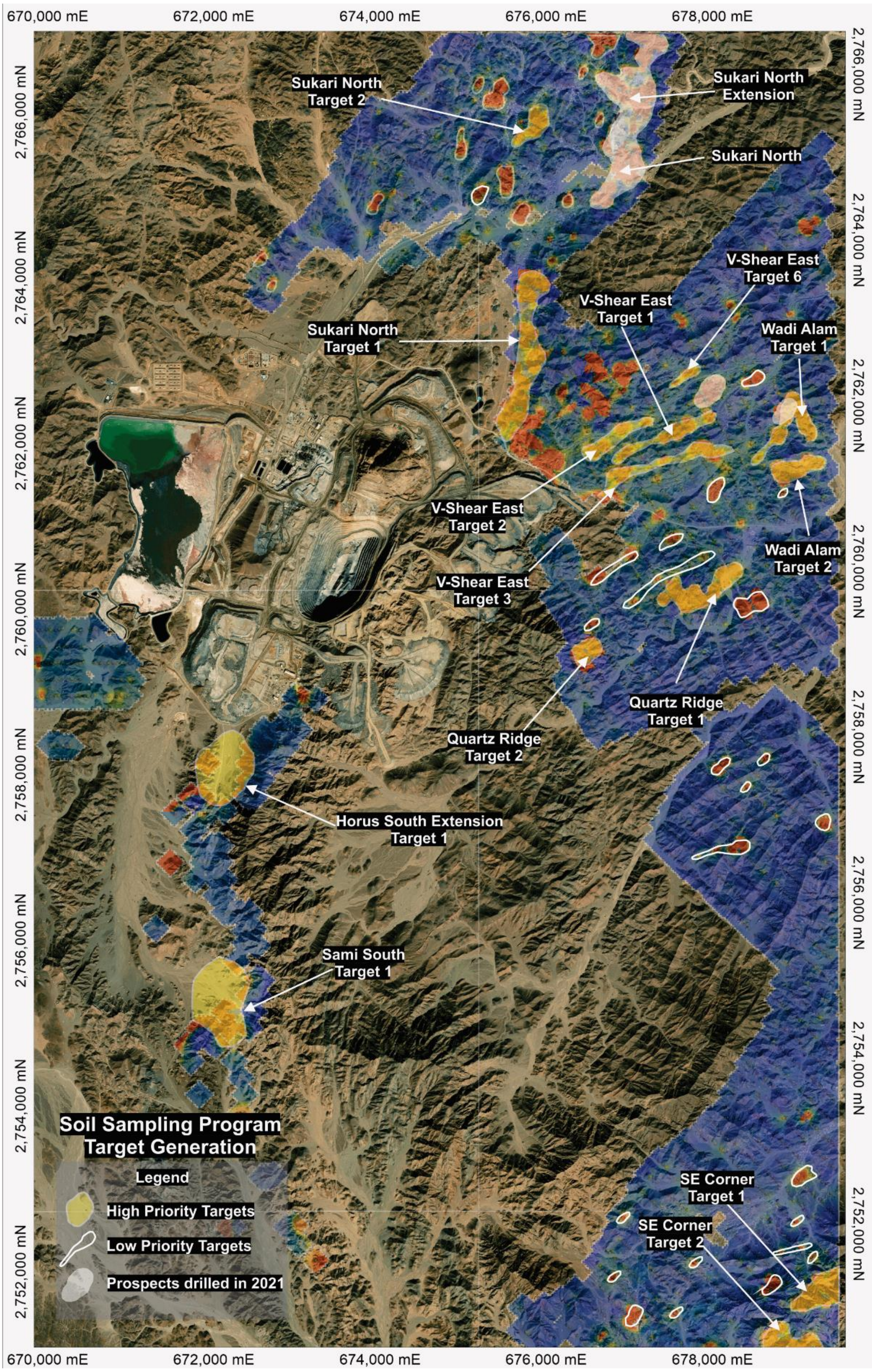


Figure 9.8: Sukari Licence Target Generation Map (Centamin, 2022)

9.2.4 Regional Exploration

As stated above, apart from the near-mine exploration opportunities within the Sukari Concession area, the Company also controls approximately 3,000km^2 of highly prospective terrain in the Eastern Desert comprising:

- Najd Block (1,374km^2) - located 100km northwest of Sukari in the Central Eastern Desert, exploring for a potential standalone operation;
- Um Rus Block (524km^2) - located 50km north of Sukari, exploring for a potential standalone operation; and
- Nugrus Block (1,086km^2) - surrounding the Sukari Mining Concession targeting potential satellite deposits and low capex mill feed to the Sukari processing plant.

Figure 9.9 shows the location of the blocks with known gold occurrences and geological and structural features of note.

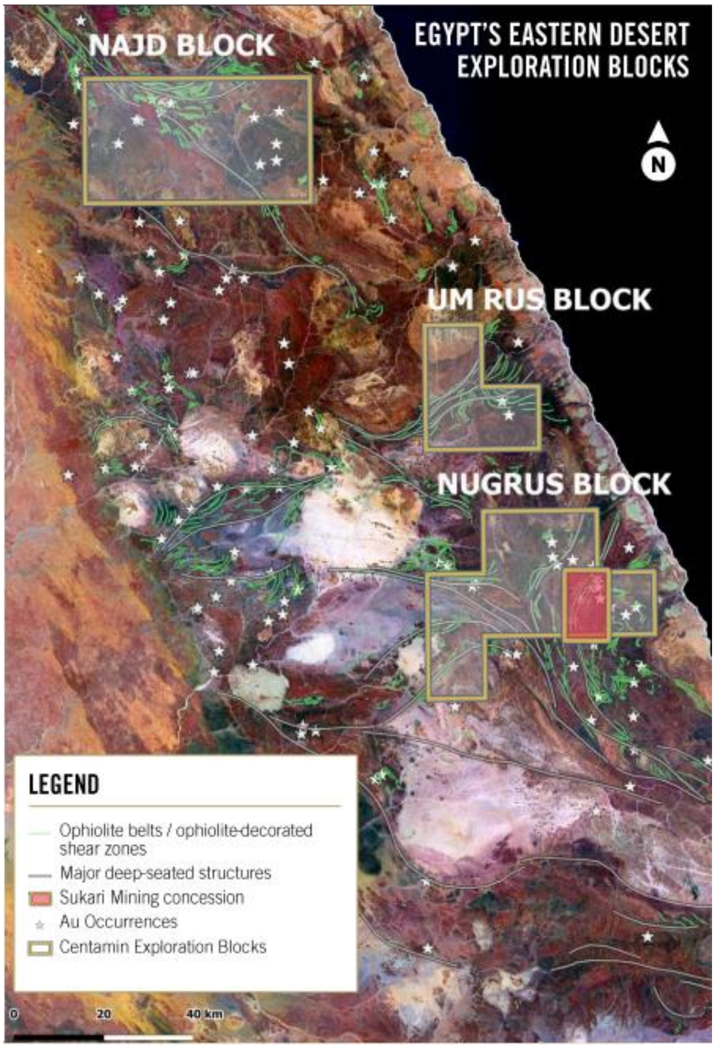


Figure 9.9: Regional Exploration Blocks (Centamin, 2022)

The Company has set aside a $10M two-year exploration budget to follow up these areas with initial focus on the Nugrus Block which envelops the Sukari Mining Concession.

Based on remote sensing studies – mapping of artisanal mining sites, the interpretation of satellite imagery and mineral mapping techniques - all three blocks of ground are known to be highly prospective.

Consequently, fieldwork commenced in 2022 with a systematic exploration approach aimed at identifying and prioritising commercial scale opportunities. The initial exploration strategy is based on two principal objectives:

- Systematic reconnaissance scale exploration covering all three Blocks of ground, using BLEG sampling of the extensive dry Wadi (drainage) systems. This will enable the safe relinquishment of ground following the first two-year exploration cycle as well as to identify areas of potential gold mineralisation that have not been already discovered by artisanal miners; and
- Systematic surface exploration using exploration geochemistry and geological mapping of high priority targets, that have already been identified based on remote sensing studies, to generate early drill targets.

10 DRILLING

10.1 Drilling Procedures

Sukari uses a combination of RC drilling and diamond core drilling (DD). A summary of drilling by type and year is provided in Table 10.1. All drilling has been conducted by SGM using contractors Capital Drilling, Barminco and more recently Geodrill. Drilling commenced in April 1997 and is ongoing at the time of this report. As of June 30, 2023, the Sukari drillhole database comprised 85,833 drillholes for 3,853,425m of drilling.

Table 10.1: Sukari Drilling Summary as of June 30, 2023

Year	Company	Diamond Drill		Reverse Circulation		RC Collar + DD Tail	
		Holes	Metres	Holes	Metres	Holes	Metres
1997	SGM	59	8,694				
1998	SGM	56	7,675				
1999	SGM	54	6,122				
2000	SGM	31	4,340				
2001	SGM	57	8,189				
2002	SGM	54	12,586	21	2,380	10	3,396
2003	SGM	29	8,046	6,957	245,391		
2004	SGM	395	9,778	6	185		
2005	SGM	83	16,926	9	1,086	58	21,992
2006	SGM	74	13,656	60	6,729	214	74,463
2007	SGM	116	31,807	668	51,504	55	22,939
2008	SGM	133	52,766	712	16,104	9	4,283
2009	SGM	116	56,674	6,618	111,475		
2010	SGM	137	67,051	6,940	145,269		
2011	SGM	390	73,965	6,622	131,920		
2012	SGM	363	74,406	4,806	122,477		
2013	SGM	452	77,654	6,263	219,344	1	521
2014	SGM	618	77,273	3,109	130,506		
2015	SGM	733	78,456	3,255	121,007		
2016	SGM	619	76,290	2,611	121,259		
2017	SGM	571	75,854	4,198	184,659		
2018	SGM	513	74,939	5,779	222,541		
2019	SGM	870	88,445	4,616	170,946	1	174
2020	SGM	327	79,056	4,702	162,044		
2021	SGM	399	96,082	3,899	151,696		
2022	SGM	372	70,123	3,919	150,758	1	155
H1 2023	SGM	241	46,913	2,201	90,379	10	754
Total		**7,862**	**1,293,766**	**77,971**	**2,559,659**	**359**	**128,857**

Drilling operations have been completed by a range of DD, multi-purpose, and RC drill rigs. Programmes have mainly been executed using Atlas Copco (252, 262, CS14, CS3001, CS1000), Boart Longyear (LM90, LMP850), Epiroc (Explorac 235 and 100) and Newland Erubus (MCR) rigs.

From 2010, underground exploration DD was completed by contractors Barminco Australia using 6 rigs (4 LM and 2 MCR). Most core was NQ2 (47.6mm) and orientated using the Reflex EZ-Trac digital core orientation tool. All underground grade control DD was completed by Barminco Australia using

MCR rigs, using NQ2 (47.6 mm). In 2022, the underground drilling contract was awarded to Geodrill Ltd for a 5-year period. They commenced using the same listed equipment but to date have replaced two LM90 rigs and are in the process of purchasing a Sandvik DU431 Track Mounted ITH Drill Rig and all ancillary equipment for RC drilling which will be commissioned in Q4, 2024.

2022 surface exploration RC drilling was completed using contractors Capital Drilling's Explorac 100 rig and compressor. Exploration RC holes were drilled using 114mm diameter rods with a 140mm (5.5") face-sampling bit and 146 casing bits. 2022 open pit grade control RC drilling was completed by Capital Drilling Australia using an Atlas Copco rig with a maximum depth of 48m and 3 Explorac rigs (Photo 10.1) that are capable of drilling deeper holes (utilised in advanced grade control). Grade control RC holes were drilled using 131mm diameter rods with a 5.5-inch face-sampling bit.

Photo 10.1: Explorac 100 RC Rig (Centamin, 2022)

Drill sample recovery is captured for both DD and RC drilling. Core recovery (by length) is measured during logging, with core loss marked out clearly. RC sample recovery is measured by weighing the total weight of sample collected over the sample interval drilled and compared to the theoretical weight for each lithological unit and weathering type.

A 2015 review of all prior drilling showed average core recovery of 94.7% and RC recovery of 86%. More recent checks of 2022 data found average core recovery of 98% and RC recovery of 85%. Whilst there are intervals of low recovery, no correlation exists between gold grade and drill sample recovery for either drilling type. No drilling, sampling, or recovery factors have been applied to the Sukari drillhole data.

Surface collar location is measured with high accuracy Trimble GPS with an accuracy of 10mm. Underground drill collars are surveyed using a Leica total station by Sukari Surveyors. Down hole survey is carried out using both Reflex EZ-Trac and conventional GYRO instruments. The downhole survey is ranked in terms of priority where the GYRO results are the top priority, and the design directions are the bottom priority. Down hole survey equipment is checked weekly in a designated testing frame, calibrated yearly and checked every quarter by Qualified Technicians from the supplier. Coordinate system conversion is automated within the drillhole database.

DD core is geologically logged and includes weathering, veining, mineralisation, alteration, lithology, and structure onto paper logging templates. The paper logs are transcribed into the central database using a digital data entry template after verification. Tablets were introduced in 2022 for logging. The core is photographed both wet and dry before sampling. RC chip samples are logged with the same lithological, weathering, veining, mineralogical, and alteration information as DD core.

Detailed geotechnical logging is performed on holes drilled specifically for geotechnical assessment as required for projects, however the resource DD holes still capture some geo-mechanical parameters such as rock quality designation [RQD] and fracture frequency for each logged metre.

Specific gravity (SG) values are measured from DD core every 2.5m via the Archimedes method.

10.2 Drilling Location, Spacing and Orientation

Plan, cross section and long section views of Sukari drilling are shown in Figure 10.1.

There are three categories of drilling at Sukari, each with distinct drill spacings:

1. Exploration Drilling
    a. Wide spaced exploratory and resource definition drilling that typically delineates Inferred Mineral Resources.
    b. Open pit spacing of 48mE by 72mN. Underground spacing of 50mE by 100mN.

2. Advanced Grade Control Drilling (Resource development)
    a. Closer spaced drilling to position underground footwall drives and upgrade to Indicated Mineral Resources / Probable Mineral Reserves.
    b. Open pit spacing of 24mE by 36mN. Underground spacing of 25mE by 50mN.

3. Grade Control Drilling
    a. Used for final production definition to inform Measured Mineral Resources / Proven Mineral Reserves in the open pit and underground.

b. Open pit spacing of 6mE by 8mN or 8mE by 12mN. Underground spacing of 10mE by 20mN or 10mE by 25mN.
c. Sukari's inventory of infill GC drilling is typically some 2 to 3 months for open pit and approximately 3 to 6 months for underground. There is a target to take the open pit to 2 years of inventory GC drilled over the next 3 years with the creation of a single working bench allowing advanced GC drilling. With the underground, the target is to take GC inventory to 12 months over the next 2 years, with the required development part of the planning cycle.

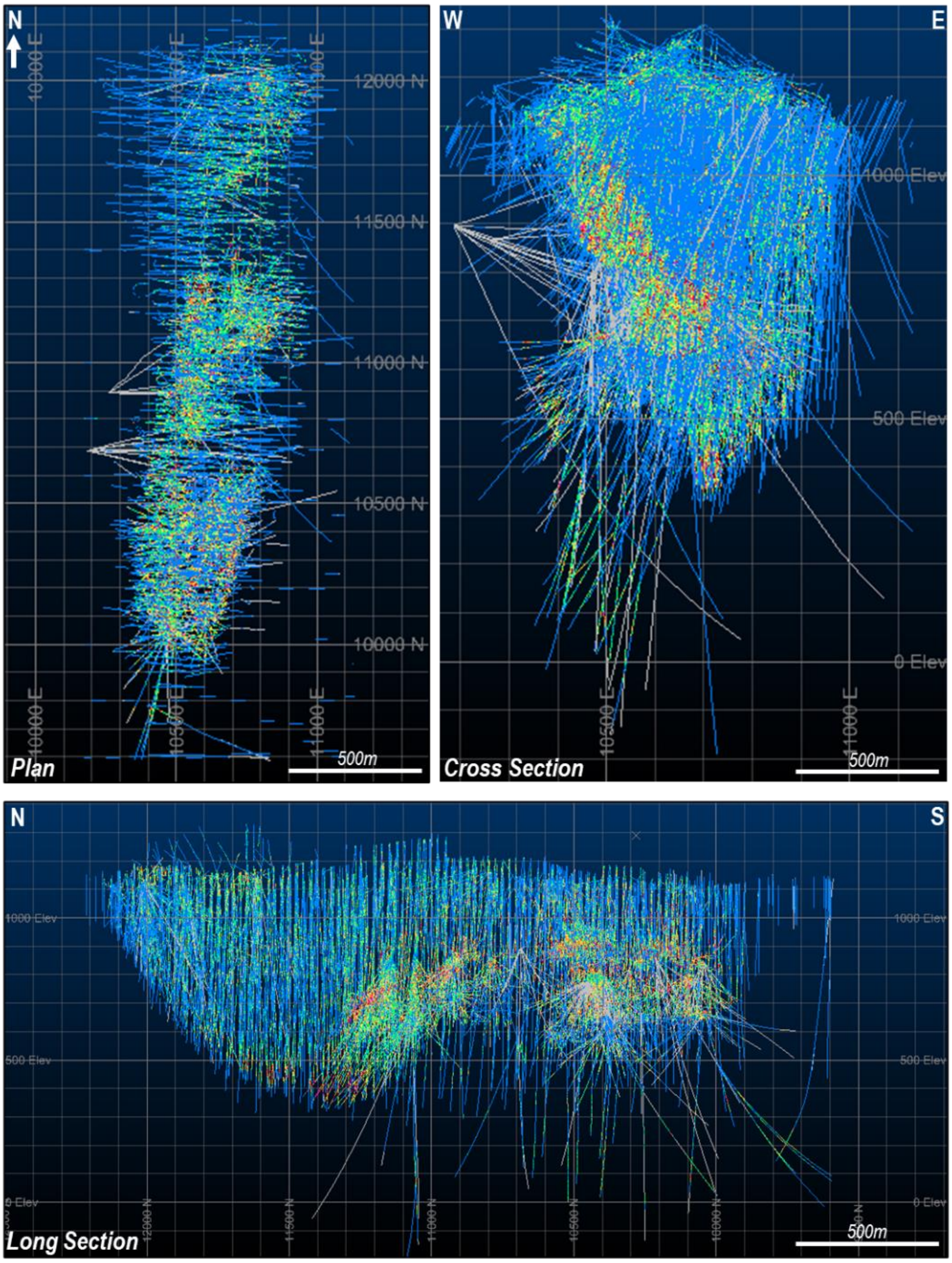


Figure 10.1: Plan, Cross Section and Long Section Views of Sukari Drilling (Centamin, 2022)

Current drill sampling at Sukari extends to approximately 1500m below surface. Drilling is orientated to ensure that drill intersections are as close to perpendicular with mineralisation as technically possible. In the open pit, drilling is oriented E-W perpendicular to mineralisation strike, whilst hole dip is steep to sub-vertical (except at the edges of the grid).

The Sukari underground drilling is mostly fan drilling, with the majority orientated east to west and drilled over a broad range of hole dips.

10.3 Adequacy of Procedures

The authors consider the drilling and sample collection at Sukari are undertaken by competent personnel using procedures that are consistent with industry best practices. The authors conclude that the samples are representative of the mineralisation and there is no evidence that the drilling or sample collection process has resulted in a bias that could materially impact the accuracy and reliability of the results.

11 SAMPLE PREPARATION, ANALYSES AND SECURITY

11.1 Sampling Methods

11.1.1 Introduction

Diamond drilling and RC drilling are the primary sampling methods that provide the data for the Sukari MRE. Underground face sampling is also used for modelling of geological contacts and grade interpolation. Other samples such as surface grab, channel, and soil samples are collected in the early stages of exploration to assess prospectivity but are excluded from Mineral Resource estimation.

11.1.2 Diamond Core

Drill core is placed into core boxes marked with hole ID, sequence numbering and depth interval. Half core samples are taken within geological units and are normally between 0.8m and 1.2m long. One-half is submitted for assay analysis whilst the other half is either submitted as a field duplicate (5% of samples) or stored for future reference.

11.1.3 RC Chips

All RC samples are collected through a static cone splitter attached to the cyclone. Approximately 7% of the total sample interval is split into a calico bag. The remaining bulk sample is collected and stored in large plastic bags.

RC sample length varies between drill programmes including:

- Exploration RC drilling with 1m intervals;
- Grade control samples with 1m intervals (Holes prefixed: UGRSD and UGDD);
- Grade control samples with 1.5m intervals (Holes in project number Suk_GC1.5); and
- Grade control samples with 2.5m intervals (Holes in project number Sukari_GC).

All RC drilling was carried out using face sampling hammers and rigs with large air capacity and pressure, to effectively flush samples from the hole face through the rod string and hoses. Prior to drilling and sampling each metre, the driller is instructed to clean the sample system by lifting off the bottom of hole and blowing back through the rods and cyclone to clear all sample from the previous metre. This is undertaken to minimise any potential downhole contamination.

11.2 Sample Preparation and Assay Methods

All samples are analysed by the SGM Laboratory based at Sukari. The OMAC Laboratories Ltd ALS Loughrea laboratory in Galway, Ireland (ALS Laboratory) is used as an umpire Laboratory, with 5% of all samples sent to the ALS Laboratory on a quarterly basis for check analysis.

The ALS Laboratory is accredited by the Irish National Accreditation Board (INAB) to undertake testing as detailed in the scope bearing the registration number 173T, in conformity with ISO/IEC 17025:2017. The ALS Laboratory is independent of Centamin.

The onsite SGM Laboratory is audited by Geostats in Australia and joins round robin checks.

The sample preparation procedure conducted by SGM Laboratory involves drying, crushing to 2mm (for DD and face samples only), splitting of a 1kg sub-sample, which is then pulverised to 90% passing 75 microns. Prepared samples are analysed using lead collection 30g fire assay with atomic absorption (AA) finish.

11.3 Quality Assurance and Quality Control (QA/QC)

SGM regularly monitors sampling and laboratory performance by inserting QA/QC samples into the sample stream (Figure 11.1). QA/QC samples include:

- Certified Referenced Materials (CRM);
- Blanks – coarse & pulp; and
- Duplicates – RC field duplicates (RS), diamond core duplicates (Hdup), coarse reject (CR), RC duplicate (LS), pulp duplicates (pulp) and umpire lab check assays.

QA/QC results from 2022 were used for this report. The number of samples, QA/QC samples and QA/QC insertion rates in 2022 are listed in Table 11.1.

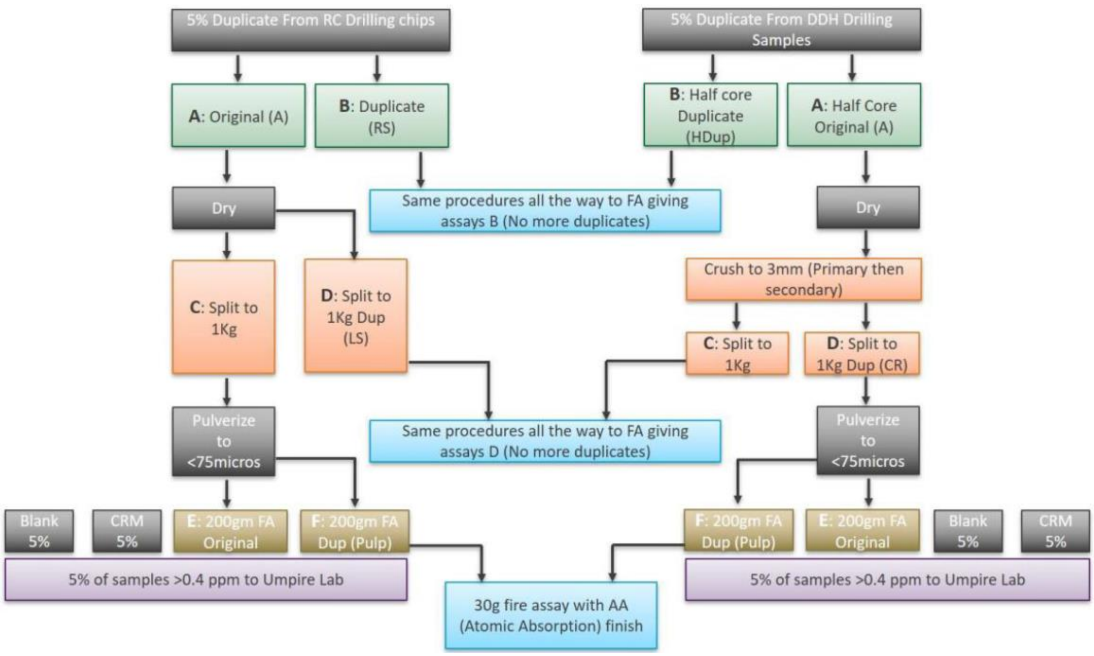


Figure 11.1: Flowchart Showing Sample Preparation, Analysis and QA/QC Protocol (RS = RC field duplicates, Hdup = diamond core duplicate, CR = coarse reject, LS = RC duplicate, Pulp = pulp duplicate) (Centamin, 2022)

Table 11.1: Summary of Samples Received by Laboratory in 2022		
Sample Type	**Number of Samples**	**Percentage of Total Samples**
DD	54,604	28%
RC	58,007	30%
DDGC	28,253	15%
UG FS	12,123	6%
Subtotal Samples	152,987	79%
CRM (Standards)	8,430	4%
Blanks (Coarse & Pulp)	8,571	4%
Duplicates (Rs, Hdup, CR, LS)	15,975	8%
Pulp Duplicates	8,413	4%
Total QA/QC Samples	41,223	21%
Total Samples	194,210	100%

11.3.1 CRM Performance

The pulp CRMs used during 2022 were sourced from two commercial laboratories: GEOSTATS PTY LTD (Geostats) and ORE Research & Exploration Pty Ltd (OREAS). Multiple CRM samples were inserted into the sample batches to cover a wide range of gold grades (0.34g/t to 15.70g/t).

CRMs monitor the accuracy and precision of results received from the laboratory by comparing them against the certified value, with 2 times standard deviation applied for the upper and lower limits of acceptable error. 97% of 2022 CRM results meet this benchmark (Table 11.2).

A scatter plot comparing expected and laboratory assay values, shows no evidence of systematic bias (Figure 11.2).

Table 11.2: Summary of 2022 CRM Performance								
CRM	**Count**	**Min**	**Max**	**Mean**	**Expected**	**STD**	**%Pass -/+ 2STD**	**%Pass -/+ 3STD**
OREAS 610	835	1.05	10.2	9.75	9.83	0.254	99%	100%
OREAS 524	1361	0.53	1.64	1.53	1.54	0.046	98%	99%
OREAS 252B	480	0.01	0.92	0.83	0.837	0.028	97%	100%
OREAS 240	1431	4.96	5.88	5.42	5.51	0.139	92%	100%
OREAS 235	501	0.33	1.66	1.55	1.59	0.038	88%	98%
OREAS 232	1308	0.53	1.57	0.91	0.902	0.023	95%	98%
OREAS 231	476	0.5	0.58	0.55	0.542	0.015	98%	100%
OREAS 230	474	0.31	1.56	0.34	0.34	0.01	100%	100%
OREAS 611	596	5.3	16.6	15.57	15.70	0.061	100%	100%
OREAS 233	478	0.88	1.11	1.06	1.1	0.03	99%	99%
OREAS 222	3	1.2	1.27	1.24	1.22	0.033	100%	100%
OOREAS 229b	176	11.26	12.7	11.85	11.95	0.288	98%	100%
OREAS 218	145	0.51	0.58	0.54	0.531	0.017	93%	100%
Total	-	-	-	-	-	-	**97%**	**99%**

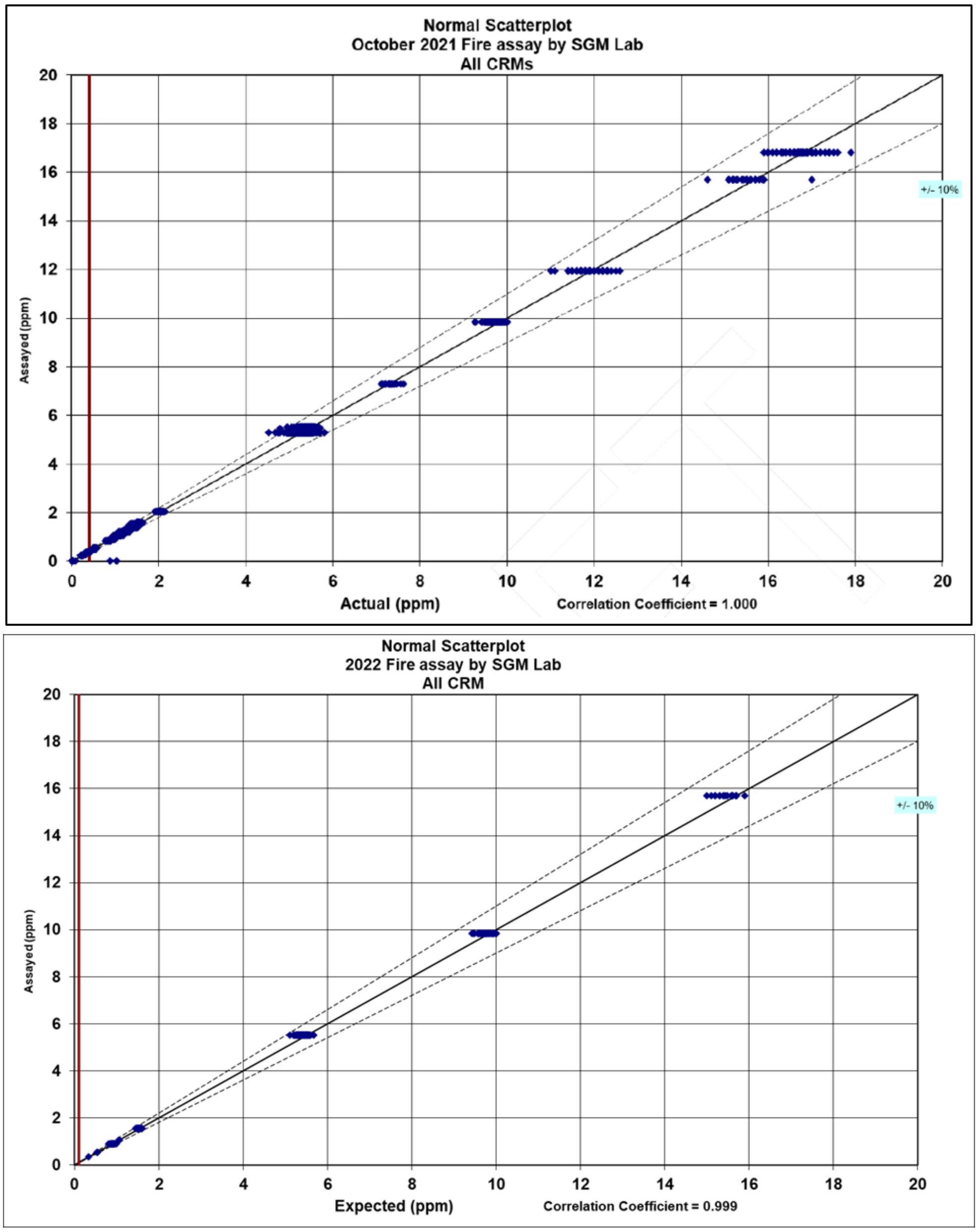


Figure 11.2: Scatter Plot of 2022 CRMs Comparing Expected with Laboratory Assay Values

11.3.2 Blank Performance

In-house coarse blanks are sourced from barren gabbro and serpentine aggregate from the Sukari concession (GBLANK). Pulp blanks from Geostats (GLG316-4) and OREAS (OREAS 23b) are also used. Expected gold values for all blanks are below the analytical detection limit (i.e. <0.01 g/t Au).

The coarse blank samples were used to check for contamination during the entire sample preparation and analytical process at the laboratory. The pulp blank sample were used to check the contamination after the sample preparation process. Pulp and Coarse blank assay results are presented in Table 11.3 and Figure 11.3, showing no evidence of significant contamination.

Table 11.3: Summary Statistics of Pulp and Coarse Blank Assay Results								
CRM	**Count**	**Min**	**Max**	**Mean**	**Expected**	**STD**	**%Pass -/+ 2STD**	**%Pass -/+ 3STD**
GLG316-4	155	0.005	0.02	0.01	0.00252	0.00169	79%	79%
OREAS 23b	11	0.005	0.02	0.01	0.003	0.007	82%	100%
GBLANK	8405	0.00	2.29	0.01	0.01	0.007	99.8%	99.9%

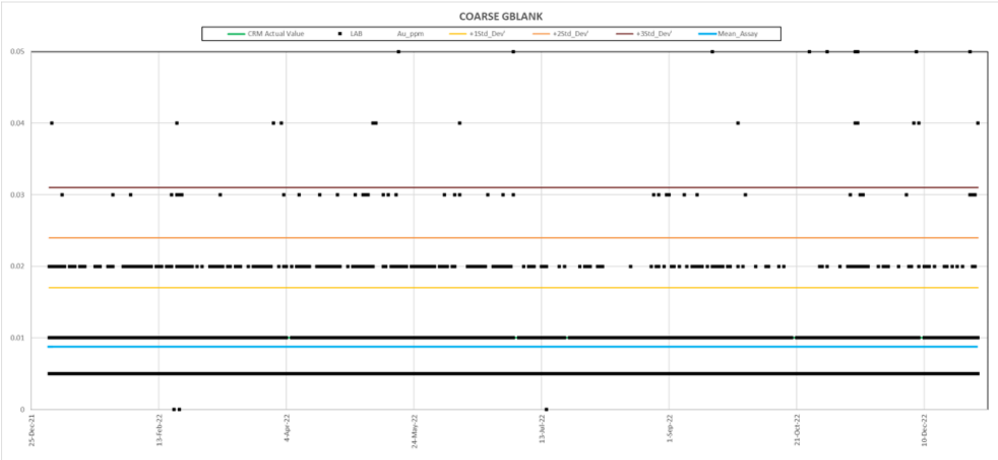


Figure 11.3: 2022 Coarse Blank Assay Results Excluding Two Outliers

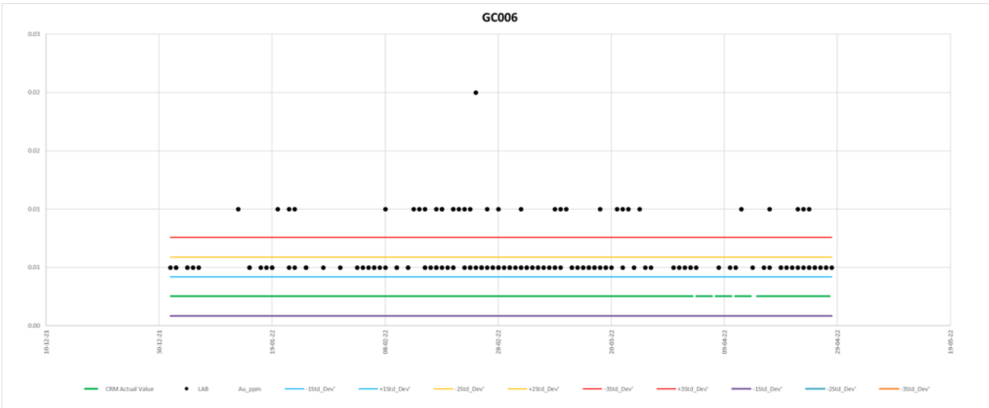


Figure 11.4: 2022 Pulp Blank Results for GLG316-4 (Standard Code – GC006)

11.3.3 Duplicate Performance

11.3.3.1 Summary

Duplicate results are presented for 2022 underground DD only. Data analysis utilises:

- A comparison of summary statistics for the primary and duplicate assays;
- Scatter plots of the primary assay against the duplicate assay that give an overall visualisation of precision and bias over selected grade ranges;
- Quantile–Quantile [QQ] plots comparing quantiles of primary assay against duplicate assay to determine whether the populations have a common distribution; and
- Thompson-Howarth (T-H) plots showing precision over different grade ranges.

11.3.3.2 Field Duplicates

Field duplicates comprise a second sample taken from drill core or RC chips and submitted for the same sample preparation and analysis as the primary sample. Field duplicates check the repeatability of the sub-sampling, sample preparation and analytical procedures, as well as an indication of the short-range variability of the mineralisation. Half core duplicate results are shown in Figure 11.5.

A total of 3,642 duplicate samples (½ core) were analysed returning a correlation coefficient of 0.917 with 74% of pairs within the 20% benchmark. Coarse duplicate performance is excellent (Figure 11.6), meaning field duplicate errors are either derived from sub-sampling (core cutting) or small-scale variability.

Visible gold is common at Sukari, whilst the QQ plot highlights how differences between the primary and duplicate assay distributions increase beyond 10g/t, consistent with coarse gold being more prevalent in higher grade samples.

	Assay	Dup	Distribution	Assay	Dup	Units
Population	3642	3642	25.0%	0.01	0.01	ppm
Minimum	0.01	0.01	50.0%	0.01	0.01	ppm
Maximum	382.00	462.00	75.0%	0.01	0.01	ppm
Mean	0.87	0.89	80.0%	0.05	0.05	ppm
Std Dev	8.33	9.03	90.0%	0.13	0.13	ppm
CV	9.63	10.18	97.5%	0.27	0.27	ppm
Correlation	0.917		99.9%	0.38	0.38	ppm

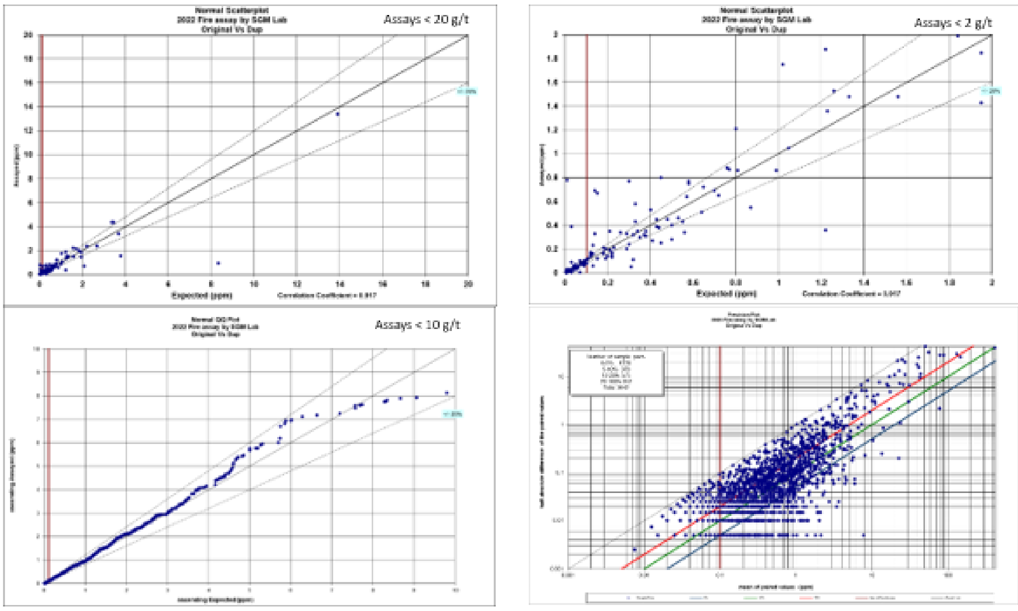


Figure 11.5: 2022 Field Duplicate Summary Statistics and Plots

11.3.3.3 Coarse Duplicates

Coarse duplicates comprise a second sample taken after the crushing stage during laboratory sample preparation. The coarse samples are returned and subsequently re-submitted for analysis to check the repeatability of laboratory sample preparation and analytical procedures.

Figure 11.6 shows there is consistently a strong correlation between the original and coarse duplicate sample over most grade ranges, with 88% of sample pairs falling within the 10% tolerance and 93% within 20% error. This indicates highly repeatable sample preparation and analysis at the SGM onsite laboratory.

	Assay	Crusher	Distribution	Assay	Crusher	Units
Population	3859	3859	25.0%	0.01	0.01	ppm
Minimum	0.01	0.01	50.0%	0.01	0.01	ppm
Maximum	593.00	585.00	75.0%	0.01	0.01	ppm
Mean	1.04	1.03	80.0%	0.04	0.04	ppm
Std Dev	12.74	12.83	90.0%	0.11	0.11	ppm
CV	12.31	12.46	97.5%	0.25	0.25	ppm
Correlation	0.9983		99.9%	0.36	0.36	ppm

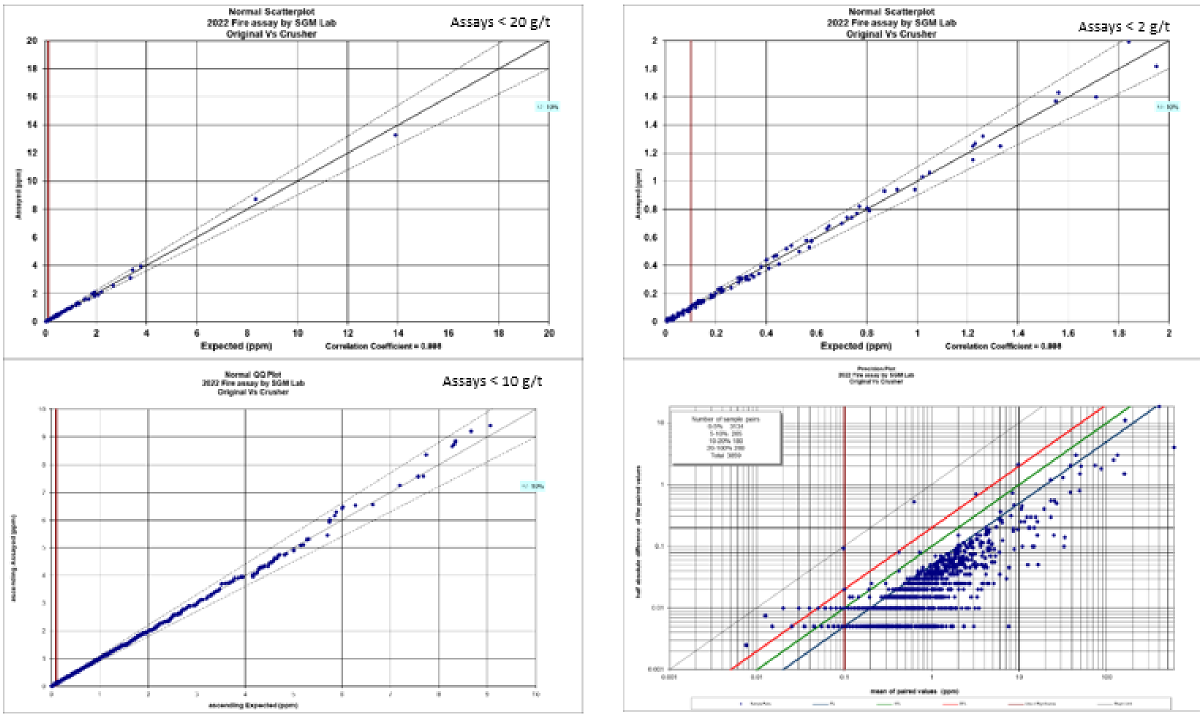


Figure 11.6: 2022 Coarse Duplicate Summary Statistics and Plots

11.3.3.4 Pulp Duplicates

Internal pulp duplicates comprise a second sample taken after the pulverisation stage during laboratory sample preparation. The pulp samples are re-submitted to the laboratory, thereby testing sampling and analytical errors after pulverisation.

Figure 11.7 shows there is consistently a strong correlation between the original and pulp duplicate sample over most grade ranges, with 79% of sample pairs below the 5% error benchmark and 91% within 20% error. This indicates that sampling and analytical procedures beyond pulverisation are largely reproducible.

	Assay	Pulp	Distribution	Assay	Pulp	Units
Population	3891	3891	25.0%	0.01	0.01	ppm
Minimum	0.01	0.01	50.0%	0.01	0.01	ppm
Maximum	1022.00	899.00	75.0%	0.01	0.01	ppm
Mean	1.60	1.58	80.0%	0.04	0.04	ppm
Std Dev	23.90	23.12	90.0%	0.11	0.11	ppm
CV	14.95	14.64	97.5%	0.25	0.25	ppm
Correlation	0.9950		99.9%	0.36	0.36	ppm

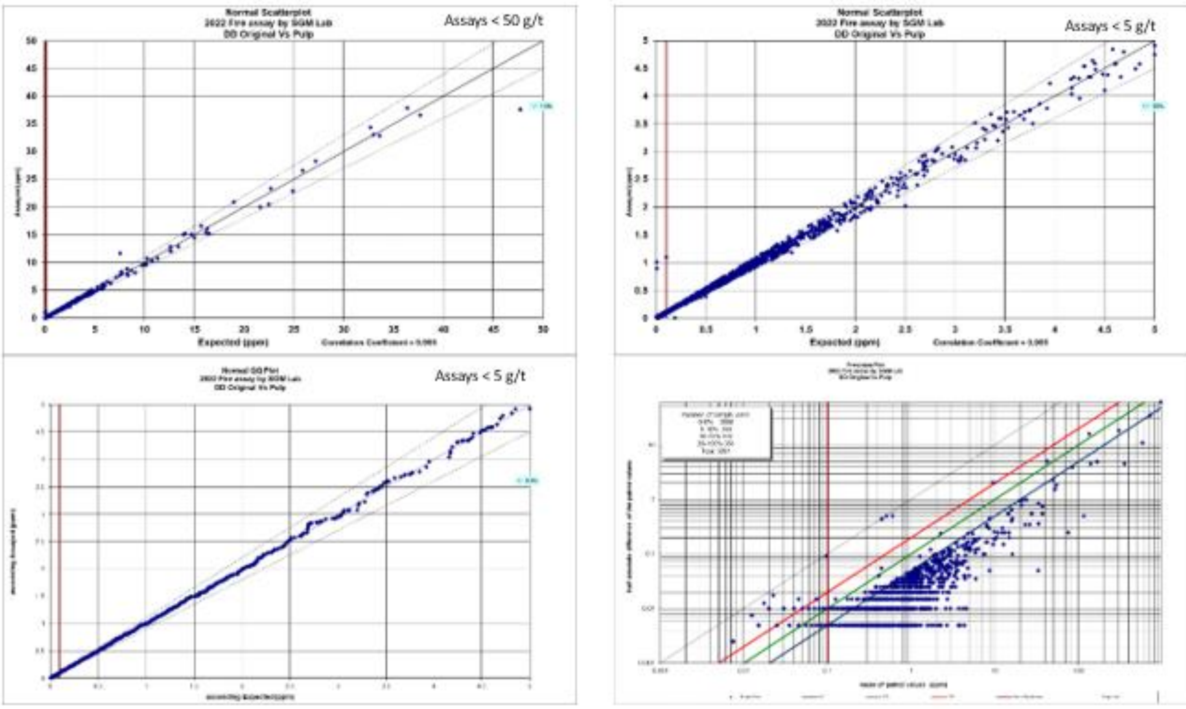


Figure 11.7: 2022 Pulp Duplicate Summary Statistics and Plots

11.3.3.5 Umpire Check Assays – ALS

External pulp duplicates or check assays are pulp samples returned following sample preparation and then submitted to another independent laboratory (umpire) to provide a check on the primary assay laboratory analysis. At Sukari, pulp samples >0.4g/t are sent to ALS Loughrea in Ireland.

Figure 11.8 shows a strong correlation (0.97) between the internal SGM and external ALS laboratory results. A significant proportion of pairs (61%) meet the 5% difference benchmark, whilst 97.4% of assay pairs are within 20% error.

	SGM	ALS	Distribution	SGM	ALS	Units
Population	7225	7225	25.0%	0.72	0.70	ppm
Minimum	0.01	0.01	50.0%	0.82	0.80	ppm
Maximum	101.00	96.40	75.0%	1.05	1.03	ppm
Mean	3.66	3.62	80.0%	1.33	1.30	ppm
Std Dev	8.97	8.82	90.0%	1.70	1.67	ppm
CV	2.45	2.44	97.5%	2.21	2.21	ppm
Correlation	0.970		99.9%	2.59	2.59	ppm

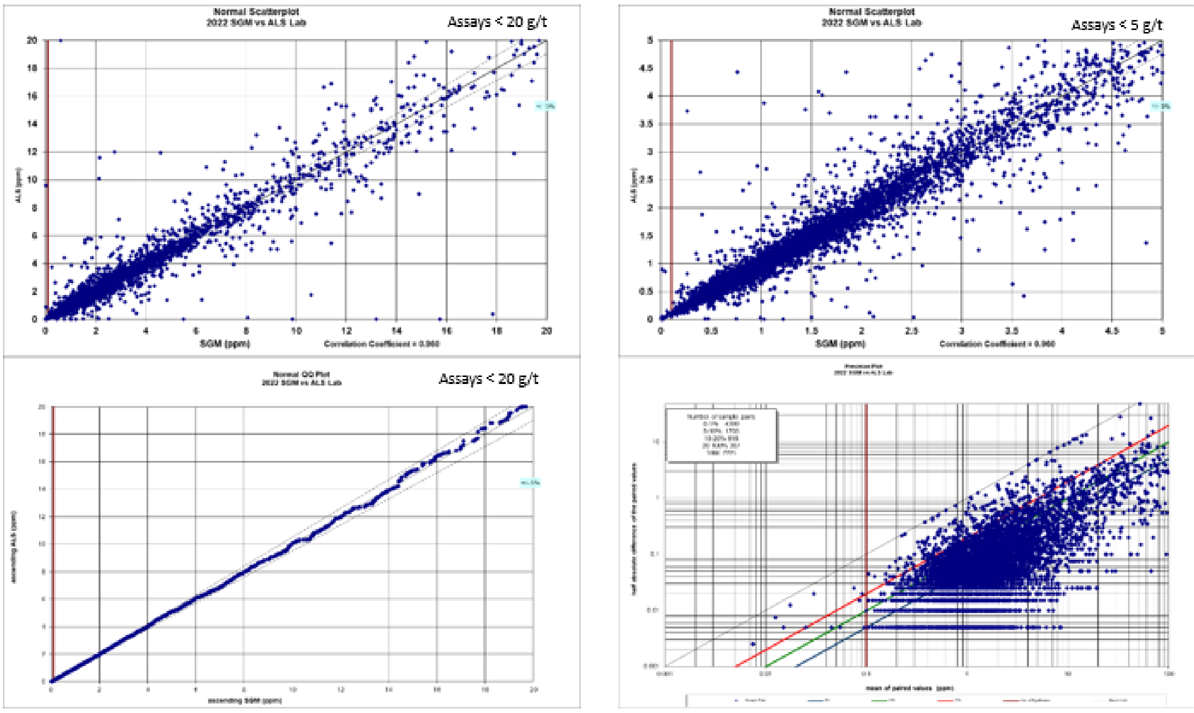


Figure 11.8: 2022 Check Assay Summary Statistics and Plots

11.4 Sample Security

Samples are under security observation from collection at the rig to delivery at the SGM onsite laboratory. Samples are bagged, sealed, numbered, and delivered to the laboratory from the company core storage facility in the case of DD samples and from the pit area in the case of GC samples. A hard copy sample submission form is sent with the samples and a digital copy is emailed to the laboratory.

Upon receipt at the laboratory, the submission is sorted and checked against the sample submission form and the core shed geologists and database specialist are notified of any missing and/or additional samples. Pulp reject samples are catalogued and stored in a dedicated container in the core yard area. These samples are retained for re-assay or umpire laboratory checks until a given area is mined out.

Umpire laboratory check samples are analysed outside the mine site. Sukari staff and security deliver the pulp samples to the ALS sample preparation Laboratory at Marsa Alam. A duplicate of the pulp sample is sent to EMRA and kept for reference. ALS organise approvals to dispatch the samples outside the country for analysis.

11.5 Adequacy of Procedures

The authors consider the sample preparation, security and analytical procedures for samples sent to the Sukari laboratory, have been conducted in accordance with acceptable industry standards and the assay results generated following these procedures are suitable for use in Mineral Resource estimation.

12 DATA VERIFICATION

12.1 Data Verification by SGM

Data entry, validation, storage and database maintenance is carried out by SGM staff using established procedures. Data used for the MRE included DD and RC drilling. All data are stored in a central Fusion SQL database located at the Sukari site. The database has a series of automated validation tools during import and export for error identification and data that fails validation is rejected and stored for further verification.

Assay data are imported directly from laboratory assay certificates by assigned persons. The database validates every input and produces a report, detailed log and full quality control charts of duplicates and CRMs such that checks are completed during each batch import.

A full-time database administrator is employed at the Sukari site to manage the database.

12.2 Database Cut-Off Dates

Cut-off dates used to close the databases prior to undertaking the MRE are shown in Table 12.1.

Table 12.1: Database Cut-Off Dates by Area

Deposit	Cut-Off Date for Drillhole Samples
Open Pit	July 15, 2022
Underground	June 30, 2022

The drilling data received between the June 30, and July 15, 2022 is considered immaterial for the open pit MRE.

12.3 Data Verification by The Authors

12.3.1 Site Visit

A site visit to Sukari was undertaken by the authors on September 5 to 6, 2023 and included the following inspections:

- Extent of exploration work completed to date;
- Review of drill core logging, sampling, sample preparation, analysis and QA/QC procedures;
- Inspection of the core logging, sampling and storage facilities;
- Inspection of drilling sites and operations;
- Inspection of selected drill core to confirm the nature of the mineralisation and the geological descriptions; and
- Inspection of geology and mineralisation in the Sukari open pit and underground.

12.3.2 Database Review

A review of the Centamin drillhole databases was carried out by the authors and included the following checks:

- Verification that collar coordinates coincide with underground workings or topographical surfaces;
- Verification that downhole survey azimuth and inclination values display consistency;
- Evaluation of minimum and maximum grade values;
- Evaluation of minimum and maximum sample lengths;
- Assessing for inconsistencies in spelling or coding (typographic and case sensitive errors);
- Ensuring full data entry and that a specific data type (collar, survey, lithology and assay) is not missing and assessing for sample gaps or overlaps; and
- Review of QA/QC procedures and assay data (as detailed in Section 11).

Overall, no significant issues in terms of data collection, data entry or data storage were identified by the QPs in a review of the electronic databases.

12.3.3 Limitations

The authors have not undertaken any independent check analysis of samples nor conducted any twin hole drilling to confirm the assays contained in the electronic databases. The authors do not consider referee samples necessary given:

- The procedures used by Centamin for sampling, logging, sample preparation, analysis, sample security and data storage are considered to be robust;
- Routine monitoring of QA/QC data demonstrates an acceptable level of accuracy and precision; and
- Sukari is a mature operation with a significant production history. On-going reconciliation studies (detailed in Section 14) undertaken by Centamin show that the Mineral Resource models compare sufficiently with mine production data.

12.3.4 Adequacy of Data

The verification procedures carried out by the authors confirmed the integrity of the data contained in the electronic databases. The authors consider the databases to be suitable for the purposes of Mineral Resource estimation and for the purposes of this Technical Report.

13 MINERAL PROCESSING AND METALLURGICAL TESTING

13.1 Ausenco Testwork

Starting in 2000, several programmes of metallurgical and comminution testwork were performed on samples from the Amun Zone of the Sukari gold deposit. Ausenco planned and supervised two of the testwork programmes on behalf of PGM. These two testwork programmes were performed by:

- Independent Metallurgical Laboratories (IML) of Perth, Western Australia, in 2005 and early 2006.
- AMMTEC Limited (AMMTEC) of Perth, Western Australia, in 2006.

13.2 IML Testwork

13.2.1 Samples Used in the IML Testwork

Table 13.1 summarises the samples used for the IML testwork programme.

Table 13.1: IML Sample List

Description	Met Set	Head Grade Au g/t
Metallurgical Composite	A	1.73
Comminution Composite	B	n/a
Weathered Variability	C1	1.57
Highly Siliceous Variability	C2	1.63
Brecciated Variability	C3	0.09
Barren Porphyry Variability	D1&2	n/a
Red Sea Water	E1	1.72
Veined Mineralisation	E2	1.71
Stockwork Mineralisation	F1&2	0.37

13.2.2 Main Findings of the IML Testwork

Mineralogical investigation has shown that Sukari ore is a competent, siliceous rock consisting mainly of quartz, albite, and orthoclase, with minor sericite, kaolin, and hematite. Gold occurs in the ore as gold and argentian gold, as fine inclusions in pyrite or arsenopyrite, or enclosed in sulphides. Sulphide minerals are present in low proportion, with an average assay of 1% sulphur in the ore. Pyrite is the most common sulphide present.

Weathering of rock is predominant at and near the surface of the orebody. There is limited and localised weathering down surface fractures, and deeper along fractures associated with shear and brecciation. Sulphides have been oxidised to varying extent in the weathered zones, with formation of mainly iron oxides.

Comminution testwork was performed on a composite sample taken from the underground workings, as well as on variability drill-core samples. Comminution test results show that the ore is competent, abrasive, and hard to grind to its final product size. The results were highly consistent and indicate an orebody with unusually low variation in its hardness and abrasivity. Bond work and abrasion indices are depicted in Figure 13.1.

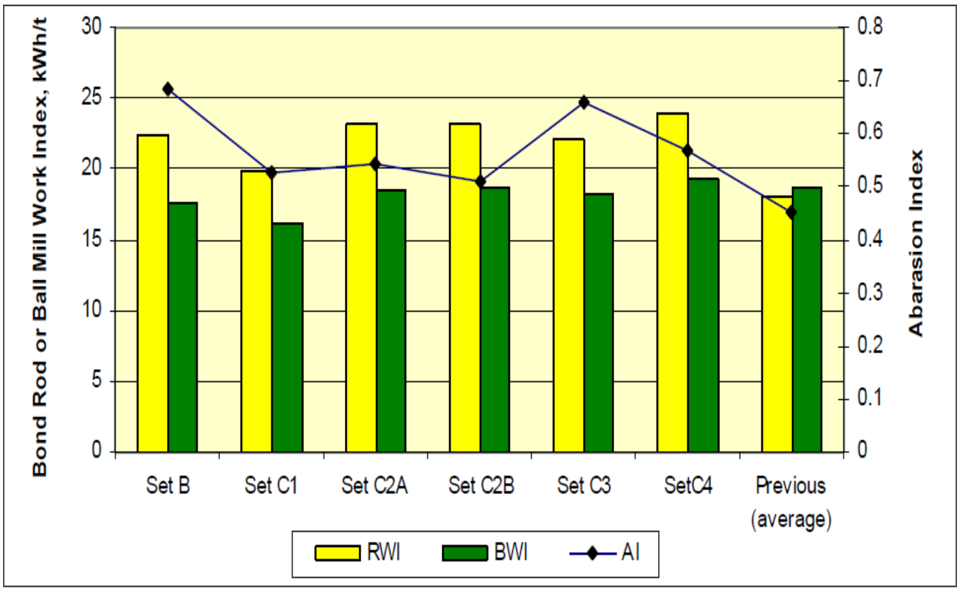


Figure 13.1: Comminution Results

IML performed cyanidation testwork on the metallurgical composite Set A. This testwork included leach optimisation, grind optimisation, and cyanide optimisation phases. Leach optimisation identified pre-aeration as a means of increasing the rate of gold extraction. Grind optimisation showed that a grind P_{80} of 63µm was the optimum for cyanidation of Set A material.

Flotation of Set A material using a xanthate collector provided a gold recovery exceeding 95% in most of the tests performed. Ausenco selected a grind of P_{80} of 175µm as the optimum for Set A flotation tests.

Fine regrinding of Set A flotation concentrate to a P_{80} of 10µm and subsequent cyanidation gave an average gold extraction of 91.9%. A mild form of "preg-robbing" was noted and it was therefore necessary to perform these cyanidation tests under CIL conditions.

Flotation of the weathered variability composite, Set C1 using a xanthate collector gave gold recovery from 25 to 30% less than Set A, with an average recovery of 69% in three tests. The low recovery is due to the oxidised state of much of the mineralisation in Set C1. Flotation results for Set A and Set C1 are shown in Figure 13.2.

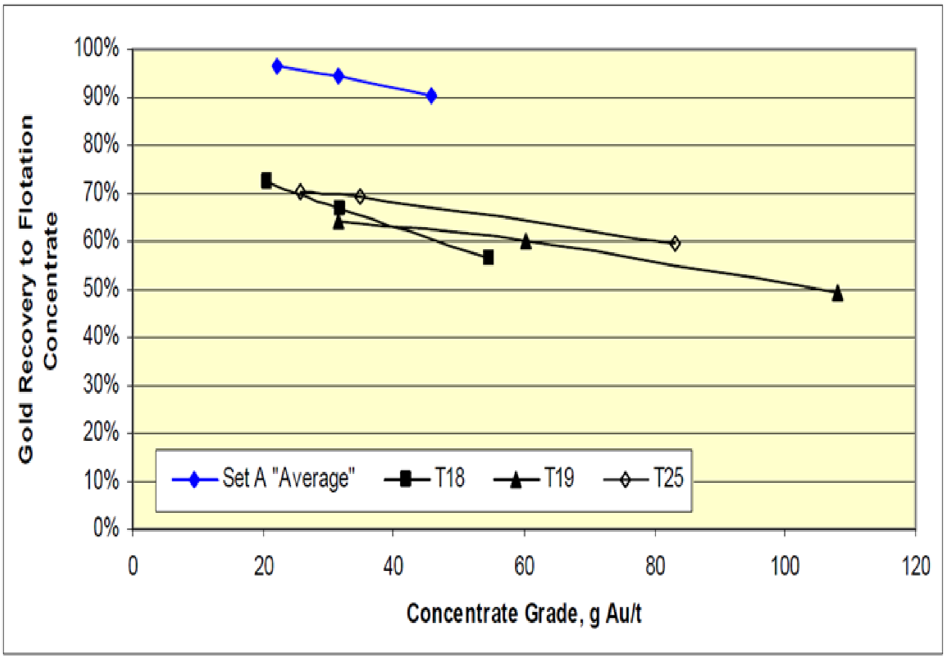


Figure 13.2: Variability Flotation Set A & C1

A rare phase search on Set C1 flotation concentrate identified gold occurring as fine inclusions in pyrite. A rare phase search on Set C1 flotation tailings did not find any gold occurrences.

Heap leach amenability cyanidation on Set C1, using a 7 day bottle roll at a crush size of 8mm, gave a gold extraction of 61.7%.

Flotation of Sets C2 and C3 material using a xanthate collector showed gold recovery very similar to Set A. Sets C2 and C3 are like Set A since they largely consist of fresh and slightly weathered rock, unlike Set C1 which is highly weathered.

An oxygen uptake test on flotation concentrate ground to a P_{80} of 10µm gave an average oxygen uptake rate of 0.039mg/L/min. Ausenco concluded that this oxygen demand will be satisfied by air sparging during concentrate cyanidation.

Rheology testing of flotation concentrate slurry with a P_{80} grind of 69µm showed low apparent viscosity at 40% and 50% solids, even at low shear rates of 1.01 and 2.96 s^{-1}.

Outokumpu performed settling and thickening tests on samples of flotation concentrate and flotation tailings. Sample grinds were measured with a P_{80} of 69µm and 198µm respectively. Magnafloc 342 provided the highest settling rate and was selected as the preferred flocculant. Outokumpu recommended flocculant dosage of 10g/t for both concentrate and tailings, to achieve solid loadings of 1t/(m²h) for tailings and 0.25t/(m²h) for concentrate.

Multi batch carbon contact tests on reground flotation concentrate provided carbon loading (Fleming) parameters of k = 190 and n = 0.60.

Fine grinding testwork on Set A flotation concentrate showed this material was suitable for grinding in an IsaMill to a product size P_{80} of 11.7µm, limited by the expected heat generation in the mill.

13.3 AMMTEC Testwork

13.3.1 Samples Used in the AMMTEC Testwork

Table 13.2 lists the samples used for the AMMTEC testwork programme.

Table 13.2: AMMTEC Sample Details

Sample Type	Description	No. of Samples	Head Grade Au g/t
Mineralisation Composite	M1	1	1.74
	M2	1	1.46
	M3	1	1.22
	M4	1	1.28
	M5	1	1.13
Mineralisation Variability	Sulphur Grade	4	1.77
	Low Grade Gold	5	0.99
	High Grade Gold	6	5.85
	Primary Hematite	1	1.87
	HW/Porphyry	1	1.67
	Kaolinite	2	3.36
	Mining Stage 1	11	1.39
	Mining Stage 2	7	1.60

The AMMTEC work also included tests on samples of Set A, Set C1, and Set C2 material, which were previously tested at IML. Ausenco defined the mineralisation types, M1 to M5 (as per the table above), as follows:

- M1 – Fresh rock, only sulphide mineralisation present;
- M2 – Mixed sulphide and oxide, >75% of mineralisation is sulphide;
- M3 – Mixed sulphide and oxide, >25% but <75% of mineralisation is sulphide;
- M4 – Mixed sulphide and oxide, <25% of mineralisation is sulphide; and
- M5 – Fully oxidised, only oxide mineralisation present.

Type M6 was defined as neither oxide nor sulphide (non-mineralised) and no testwork was performed on such material.

13.3.2 Main Findings of the AMMTEC Testwork

The gold and sulphur head grades of the mineralisation composites are shown in Figure 13.3.

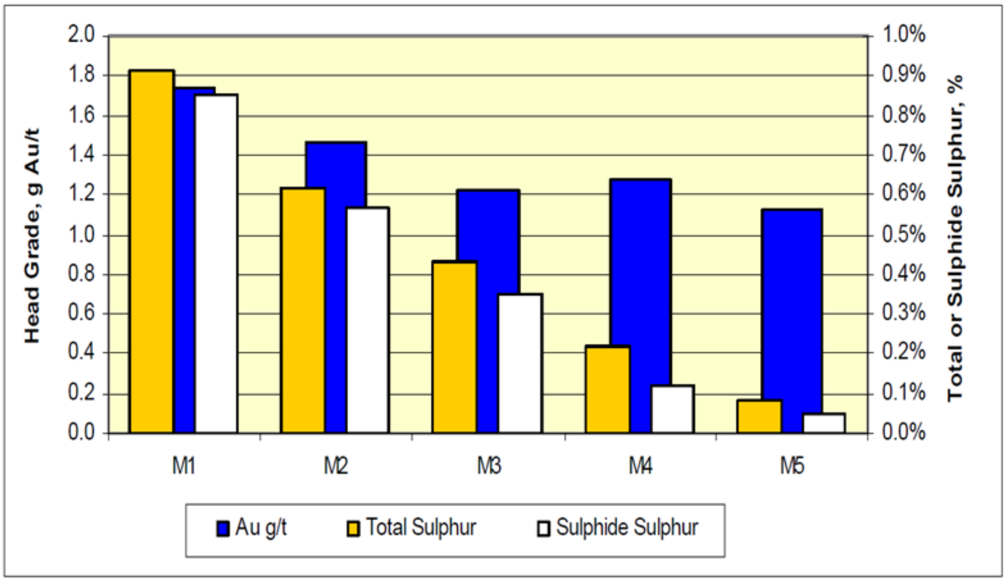


Figure 13.3: Mineralisation Composite Head Assays

The sulphur grade decreases from M1 to M5, consistent with the increasing proportion of oxide mineralisation. The gold grade also decreases from M1 to M5, which reflects the general trend of lower grade ore closer to surface.

Flotation tests on the mineralisation composites showed gold recovery ranging from 97.6% to 65.8%, with recovery decreasing from Type M1 to M5 proportional to the degree of oxidation of the sulphide mineralisation. Flotation recovery for the mineralisation composites is shown in Figure 13.4 together with the arithmetic average results for the mineralisation variability samples.

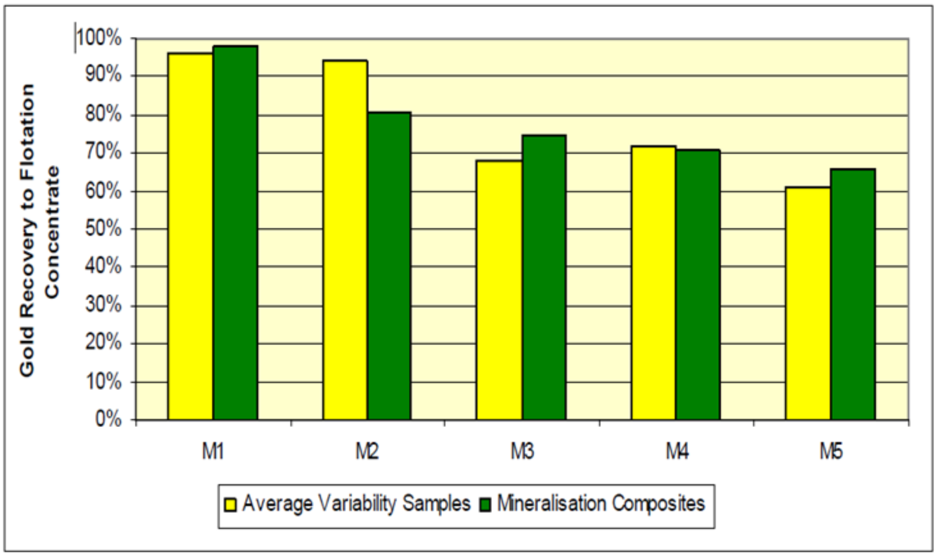


Figure 13.4: Flotation Gold Recovery

Flotation of a 1:1 blend of M1 and M5 material gave 83% gold recovery. This is slightly greater than the arithmetic mean of the individual M1 and M5 recoveries, which shows that flotation is not affected by a high proportion of oxide (M5) material in the sample.

Flotation of the Sulphur variability samples showed gold recovery of 88.8% for the low grade (0.53% sulphur) sample. A similar result of 91.7% was achieved on the low-grade gold (0.75g/t Au) sample. Flotation tests on the other sulphur and low-grade variability samples gave recoveries consistent with the results achieved on mineralisation composite M1.

Flotation tests on the high grade and mining variability samples gave recoveries ranging from 61.1% to 99.4%, consistent with the results achieved on the mineralisation composites.

Regrinding of the flotation concentrates to a nominal grind P_{80} of 10µm followed by cyanidation (CIL), gave gold extraction of 91.9% for type M1. Gold extraction increased for types M2 to M5 consistent with the degree of oxidation of the sulphide mineralisation. A maximum gold extraction of 98% was achieved on mineralisation composite M5. Subsequent checks of the actual grinds achieved on these samples showed the P_{80} size varied between 9 and 13µm, with an average of 11.2µm.

Flotation concentrate CIL gold extraction for the mineralisation composites is shown in Figure 13.5 together with the arithmetic average results for the mineralisation variability samples.

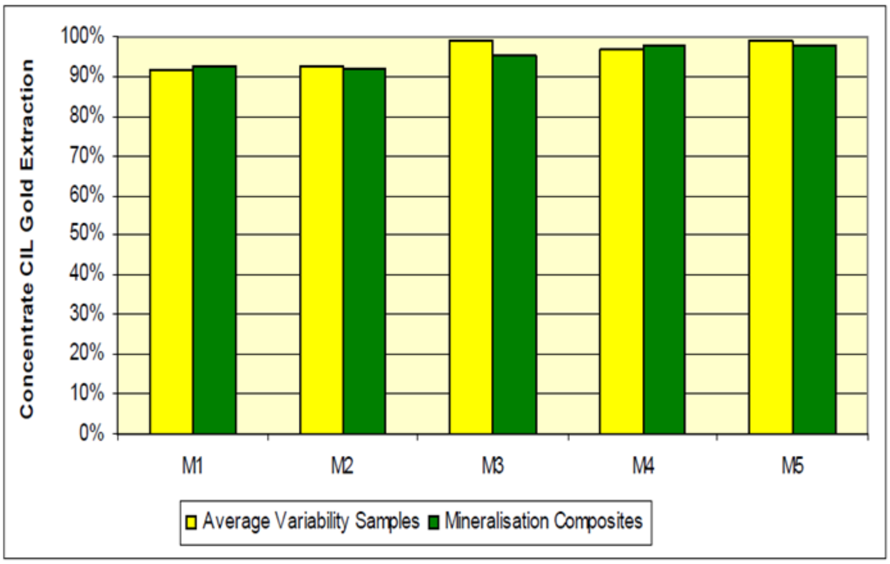


Figure 13.5: Flotation Concentrate CIL Gold Extraction

The agreement between mineralisation composite and average mineralisation variability sample results is good.

Cyanidation of the mineralisation composite flotation tailings gave gold extraction ranging from 67% to 72%. Cyanidation tests on the mineralisation variability sample flotation tailings gave gold extraction (by mineralisation type) ranging from 60.2% to 75.5%, which is consistent with the mineralisation composite results.

Figure 13.6 shows the Flotation tailings cyanidation results for the mineralisation composites and the arithmetic average result for the mineralisation variability samples

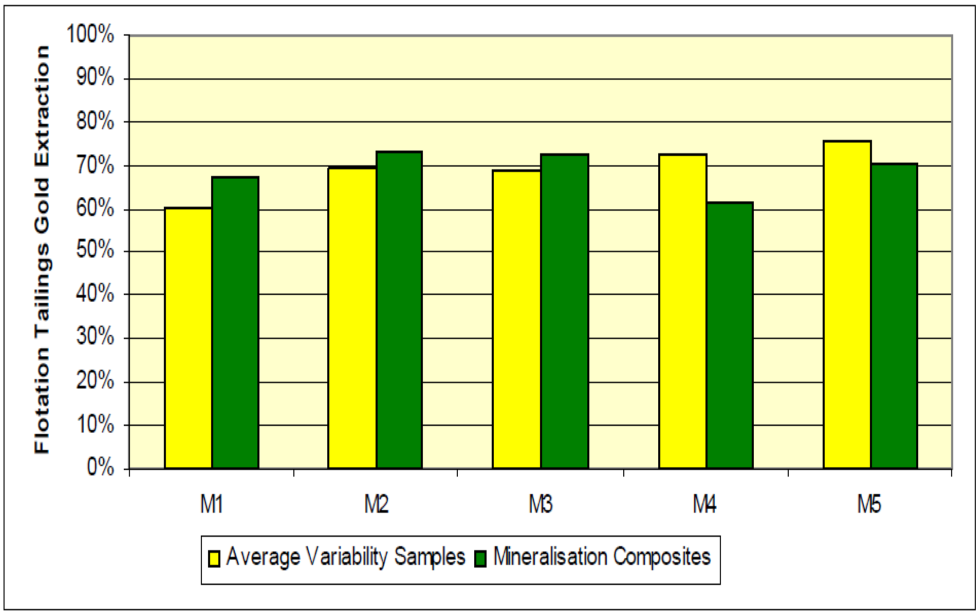


Figure 13.6: Flotation Tailings Cyanidation Gold Extraction

Heap leach amenability cyanidation on Set C1, using a 7 day bottle roll at a crush size of 3.35mm, gave a gold extraction of 88.6%. Tests on samples of M3 and M5, at the same conditions, gave gold extractions of 66.3% and 83.9% respectively

13.4 AMMTEC 2011 Testwork

13.4.1 Introduction

In 2011 a programme of laboratory testwork was undertaken on five samples by ALS AMMTEC in Australia. The samples were designated as follows:

- High S Open Pit – Main Zone
- High S Open Pit – Main Reef
- High Grade Underground

The two High S Open Pit samples were combined to produce a "Main Sulphide Ore" Composite. The high-grade Underground sample was re-designated as "Hapi Zone Ore".

A 25kg sub-sample of each composite was combined to produce an additional test composite, designated as "50/50 Blend Ore".

After head analysis of each composite, the gold grade of the Main Sulphide Ore composite was deemed by the Company to be too low, which prompted the dispatch of a replacement composite, designated as "New Main Sulphide Ore". Each of the test composites were treated individually throughout the test program.

13.4.2 Head Sample Analysis

The head grades of the samples are given in Table 13.3.

Table 13.3: ALS Head Sample Analysis

Analyte	Unit	Main Sulphide Ore Composite	Hapi Zone Ore Composite	50/50 Blend Ore Composite	New Main Sulphide Ore Composite
Au1	g/t	0.65	80.8	49	1.6
Au2	g/t	0.65	90.2	60.8	1.64
Ag	g/t	< 0.3	7.5	3.1	< 0.3
As	ppm	560	1030	830	1950
C_{TOT}	%	0.72	0.36	0.57	0.48
C_{ORG}	%	< 0.03	< 0.03	< 0.03	< 0.03
Cu	ppm	8	14	10	12
Fe	%	3.3	2.14	2.84	2.56
Ni	ppm	50	55	45	80
S_{TOT}	%	1	0.84	1.02	0.74
S_{SULPH}	%	0.8	0.76	0.94	0.7
Sb	ppm	1.6	1	1	1.1
SiO_2	%	67.4	80.8	66	68.4
Te	ppm	< 0.2	< 0.2	< 0.2	< 0.2
Zn	ppm	112	92	110	122

Variability in gold grades indicates the presence of coarse-grained gold in the ore. Arsenic levels are moderate, increasing the possibility of gold locked in ultra-refractory mode in solid solution with minerals such as arsenopyrite. Organic carbon levels are below detection, limiting the possibility of preg-robbing occurring during cyanidation leaching. Base metal levels are relatively low, reducing the possibility of excess cyanide consumption through complexation with these minerals.

The gold grade of the Main Sulphide Ore composite was deemed by the Client to be too low for the test program, prompting the dispatch to ALS AMMTEC of the "New Sulphide Ore Composite".

13.4.3 Flotation Testing

The use of froth flotation was investigated as a means of upgrading the ore to maximise gold extraction. A series of sighter tests were carried out followed by bulk separation. The bulk flotation products were utilised for subsequent extraction testwork. The results are summarised in Table 13.4.

Table 13.4: Flotation Test Results											
Grind	Concentrate Grades and Recoveries								Tails Grade		
Size mics	Wt. (%)	Au (ppm)	Au % Recovery	S (%)	S % Recovery	S^{2-} (%)	S2- % Recovery	Au (ppm)	S (%)	S2- (%)
New Main Sulphide Ore Composite											
150	3.13	73.3	98.75	25.78	95.42	24.28	98.74	0.03	0.04	0.01
200	3.38	59	98.57	23.86	97.66	22.4	98.74	0.03	0.02	0.01
Hapi Zone Composite											
150	3.77	1644	98.59	19.63	95.06	17.76	98.58	0.92	0.04	0.01
50/50 blend composite											
150	3.41	1170	98.83	24.53	93.52	23.18	97.6	0.49	0.06	0.02

Excellent results were achieved in all of the tests, with greater than 98% of the gold recovered in each case. Increasing the grind size from 80% passing 150 to 200 microns significantly reduced concentrate gold grade at a similar recovery.

A sub-sample of the bulk flotation tailing produced for the Hapi Zone and 50/50 Blend composites were utilised for CIL cyanidation time leach testwork. The results are summarised in Table 13.5.

Table 13.5: Flotation Tails CIL Test Results							
Composite Identity	Grind Size P80 (mics)	% Au Extraction @ Hours				Consumption (kg/t)	
		2	8	24	48	Lime	NaCN
Hapi Zone Flotation Tails	150	43.99	67.93	75.82	79.14	3.63	1.83
50/50 Blend Flotation Tails	150	25.32	41.39	59.60	78.57	3.99	1.04

For both composites, gold extraction was relatively high, suggesting that little gold would be lost to tailings in a full-scale operation. Relatively high lime consumption could most likely be attributed to the high level of dissolved salts in the sea water.

Sub-samples of the bulk flotation concentrate produced for each composite were utilised for CIL cyanidation time leach testwork at ultra-fine grind sizes to investigate the effect of grind size and oxygen on gold extraction levels. The results are summarised in Table 13.6.

Table 13.6: Flotation Concentrate Leach Test Results

Composite Identity	Grind Size P80 (mics)	Sparge	% Au Extraction @ Hours				Consumption (kg/t)	
			2	8	24	48	Lime	NaCN
New Main Sulphide Ore Flotation Con	20	Oxygen	74.6	78.33	80.79	81.75	8.16	10.18
	12	Oxygen	87.77	87.41	90.34	92.45	9.04	11.55
	12	Air	75.98	85.88	88.17	92.54	8.68	9.8
Hapi Zone Flotation conc	12	Oxygen	65.75	92.67	99.1	99.49	7.53	11.3
50/50 Blend Flotation conc	12	Oxygen	80.8	98.53	98.89	99.13	7.47	11.06

For the New Main Sulphide Ore Composite bulk flotation concentrate product, gold extraction was significantly improved at the finer grind size. The use of oxygen had no discernible effect on overall gold extraction, but it did appear to improve dissolution kinetics (however, note that the addition of oxygen for optimal gold recovery has been demonstrated and applied in practice). For the Hapi Zone and 50/50 Blend Ore composites, gold extraction levels were excellent, with greater than 99% of the gold recovered in each case. This indicates that the majority of refractory gold in these ore types had reported to the flotation tailing.

13.4.4 Knelson Gravity Process Route

13.4.4.1 Summary

The use of gravity separation via Knelson concentrator was investigated as a means of upgrading the ore to maximise gold extraction. A bulk separation was undertaken on each ore sample. The bulk gravity separation products were utilised for subsequent extraction testwork.

Gravity separation was conducted using a Knelson KC-MD3 gravity concentrator, with the following specifications:

- 0.12kW drive
- 1500rpm
- l/min fluidisation flow rate

The results are given in Table 13.7.

Table 13.7: Knelson Concentrator Gravity Results

Grind size (mics)	Concentrate Grades and Recoveries							Tails Grade		
	Wt. (%)	Au (ppm)	Au (%) Recovery	S (%)	S (%) Recovery	S^{2-} (%)	S2- (%) Recovery	Au (ppm)	S (%)	S2- (%)
Main Sulphide Ore Composite										
600	6.15	8.39 / 8.15	66.26 / 66.43	9.02	56.24	8.66	56.33	0.28/ 0.27	0.46	0.44
Hapi Zone Composite										
600	6.15	528 / 498	61.35 / 54.27	4.9	41.11	4.92	42.29	21.8/ 27.5	0.46	0.44
50/50 Blend Composite										
600	6.18	556 / 497	75.22 / 75.24	6.82	42.48	6.52	42.42	9.52/ 8.50	0.48	0.46
New Main Sulphide Ore Composite										
600	4.24	18.4 / 17.2	46.98 / 44.25	9.7	43.42	9.62	45.05	0.92/ 0.96	0.56	0.52

The results indicate the relative inefficiency of gravity separation in comparison to flotation separation. The results suggest a close association between the gold in the ore and the heavy sulphide minerals.

Subsequent gravity work has been undertaken with summary findings from the test work available in section 13.2.4.1 – Additional Gravity Testwork

A 4.0 kg sub-sample of each of the bulk gravity tailings products (excluding the original Main Sulphide Ore Composite) was utilised for rougher flotation testwork to further concentrate the gold in the ore prior to cyanidation. The results are given in Table 13.8.

Table 13.8: Gravity Tailings Flotation Test Results

Grind Size (mics)	Concentrate Grades and Recoveries							Tails Grade		
	Wt. (%)	Au (ppm)	Au % Recovery	S (%)	S % Recovery	S^{2-} (%)	S2- & Recovery	Au (ppm)	S (%)	S2- (%)
150	4.15	31.2	97.83	12.61	93.18	11.85	98.09	0.03	0.04	0.01
150	4.08	423	93.94	10.25	91.78	9.87	97.73	1.19	0.04	0.01
150	4.31	260	95.44	10.67	88.9	10.09	97.85	0.56	0.06	0.01

Excellent results were achieved in all of the tests, with greater than 98% of the gold recovered in each case. Results again suggest a close association between the gold in the ore and the sulphide minerals.

A sub-sample of the gravity tailing flotation tailing produced for the three test composites were utilised for CIL cyanidation time leach testwork. The results are given in Table 13.9.

Table 13.9: Leach Tests on Gravity Tailings Flotation Tailings Products							
Composite Identity	**Grind Size P80 (mics)**	**% Au Extraction @ Hours**				**Consumption (kg/t)**	
		2	8	24	48	Lime	NaCN
New Main Sulphide Gravity/Flotation Tails	150	19.19	37.55	45.03	45.03	4.74	2.12
Hapi Zone Gravity/Flotation Tails	150	14.35	18.42	22.47	22.47	4.24	2.6
50/50 Blend Gravity/Flotation Tails	150	14.29	26.24	26.24	26.24	4.2	2.27

Gold extraction was relatively poor for each of the composites, indicating that gravity separation followed by flotation was relatively successful at isolating the highly refractory gold component of the ore.

13.4.4.2 Additional Gravity Testwork

Consep Gravity Testwork and Modelling Report

Consep issued a report on gravity testwork and modelling in March 2019. Samples tested from Line 1 included SAG Mill Feed, Cyclone Overflow and Flotation Tailings. The test data from the SAG Mill Feed sample was used for gravity circuit modelling.

Overall, the ore is very high in GRG at 78.5-81.7%. Very high GRG values in the cyclone overflow and flotation tails samples are directly related to the lack of a gravity circuit. Consep recommended a gravity circuit consisting of four KC-QS48 Knelson Concentrators and a Consep CS4000 Acacia ILR. Modelling indicated that, at a flotation grind size P_{80} of 150 microns, gravity gold recovery was 37.6%.

The circuit, conceptually to be installed as a dedicated “Gravity Tower” due to lack of space, was based on treating a portion of the cyclone feed stream.

Maelgwyn South Africa (MSA) Pilot Plant Gravity Recovery Testwork

Maelgwyn issued a report in November 2022 summarising the results of pilot plant testwork. Following on from on-site laboratory testwork, which MSA also assisted with, a Knelson KC-CD10 unit was trialled over a period of two months, overseen by MSA who also assisted with the commissioning and training.

The unit was initially installed on Line 1 treating the Cyclone Feed and then Cyclone Underflow streams. Finally, the unit was moved to Line 2 treating the Cyclone Underflow stream. A 1mm screen was used to feed the unit. Each concentrate sample was also intensively leached. Varying unit cycle times were investigated, and multiple tests conducted for each cycle time. A sampling valve and flowmeter was installed on the tailings line. The tailings density was measured at set intervals. The grade of concentrate was determined from intensive leaching and the head grade was determined from the shift composite sample assay results for the Cyclone Underflow samples but actual sample grades for the Cyclone Feed samples.

For the Line 1 Cyclone Underflow stream, the best gravity gold recovery of 40.9% was achieved at the lowest cycle time of 20 minutes to a concentrate grading 1.5kg/t on average and from an average head grade of 10.1 g/t.

For the Line 1 Cyclone Feed stream, the best gravity gold recovery of 21.4% was achieved at the highest cycle time of 120 minutes to a concentrate grading 7.7kg/t on average and from an average head grade of 25.4 g/t.

For the Line 2 Cyclone Underflow stream, the best gravity gold recovery of 45.4% was achieved at the lowest cycle time of 20 minutes to a concentrate grading 1.8kg/t on average and from an average head grade of 10.7 g/t.

Intensive leaching recovered from 89-96.9% of the gold in the concentrates.

Throughout the testwork campaign, visible coarse gold particles could be seen.

It was concluded that the trials were successful and showed that the ore sources tested were highly amenable to gravity recovery, with the Line 1 and Line 2 Cyclone Underflow stream being most amenable to a gravity circuit.

Gekko Testwork 2023

The very latest gravity testwork was conducted and reported by Gekko in April 2023.

Laboratory gravity 3 stage GRG testwork was conducted by Centamin on two samples from CV-02 and CV-403, representing Line #1 and Line #2 respectively. The entirety of the Knelson test concentrates were sent to the Gekko Assay Laboratory (GAL) in Ballarat for sizing and assay.

The average head assay for CV-02 was 1.30 g/t Au (average of assayed and recalculated head grades). The average head grade for CV-403 was 0.78 g/t Au.

After the conventional third stage of GRG testing, a gold recovery of 59.1% was obtained for the CV-02 sample and 55.4% for the CV-403 sample.

Two additional reports (one each for Line (Plant) #1 and Line (Plant) #2) were then issued by Gekko, based on the 3 stage GRG results and using the AMIRA P420 BCC Gravity Model to simulate the change of gravity recovery with feed rate for three gravity circuit feed scenarios: mill discharge, cyclone underflow and cyclone feed.
For both plants, the mill discharge fed gravity circuit configuration resulted in the highest gold recoveries at all feed rates.

For Plant #1, based on mill discharge, the gravity recovery increased with increasing feed rate and no distinct plateau in the curve was observed. The steepest part of the curve was below 375 tph and a recommended minimum throughput of 425 tph was advised. The gravity recovery at this rate was approximately 27%, increasing to about 33% at 750 tph.

For Plant #2, based on mill discharge, the gravity recovery also increased with increasing feed rate and no distinct plateau in the curve was observed. The steepest part of the curve was below 425 tph and a recommended minimum throughput of 475 tph was advised. The gravity recovery at this rate was approximately 25%, increasing to about 27% at 750 tph, so a slightly flatter curve than for Plant #1.

For both plants, the installation of a gravity circuit fed from a split of the mill discharge stream was recommended. The limiting factor for the optimal throughput to maximise gold recovery is dependent on the overall water balance (including the screen spray and concentrator fluidisation water flows) and its effect on the mill density and grinding efficiency. This should be determined in a pre-feasibility study.

13.4.5 Summary

In summary and referring to the most recent AMMTEC testwork programme conducted in 2011, it is clear that, while the initial three samples provided were not representative in terms of gold grade, in response, the New Main Sulphide Ore Composite sample provided for testwork was more representative in terms of gold head grade, with an average of circa 1.62 g/t Au. For the flowsheet tested, based on flotation of a sulphide concentrate followed by ultra-fine grinding and cyanide leaching of the concentrate, gold flotation recovery to the sulphide concentrate was 98.75% to 3.13% of the mass. Ultra-fine grinding and leaching of the sulphide concentrate recovered 92.45% of the gold, for a total recovery of circa 91.3%. Leaching of the flotation tails, albeit from sulphide flotation of the two very high grade samples, recovered a further circa 79% of the gold (flotation tails grades circa 0.5-0.9 g/t Au).

Additionally, the ore is very clean in terms of base metals and other impurity elements, with no significant issues expected in terms of producing gold doré.

As described in Chapter 17 Recovery Methods, actual operational data over recent years shows very consistent performance and, for 2023 YTD, for a head grade of 1.23 g/t Au, the total gold recover is 88.54% (including a very small component from dump leaching). This compares favourably to the testwork data noted above, allowing for the normal decrease in recovery with lower head grades.

Comprehensive laboratory and pilot-scale gravity testwork strongly indicates the requirement for a dedicated gravity circuit, due to the presence of significant gravity-recoverable gold, and engineering studies are currently being conducted. This has the potential to further increase gold recovery and lower operating costs.

14 MINERAL RESOURCE ESTIMATES

14.1 Open Pit Mineral Resource

14.1.1 Overview

H&SC was retained by Centamin to update the Sukari open-pit Mineral Resource model based on additional drilling as at July 15, 2022. The estimate was prepared with reference to the CIM Definition Standards and CIM Best Practice Guidelines (2019) for preparing Mineral Resources and Mineral Reserves (CIM Guidelines).

Under NI 43-101 reporting requirements and CIM Definition Standards and CIM Guidelines, Arnold van der Heyden, a member of the AusIMM, with more than five years' experience in the use of geostatistics for estimation of Mineral Resources in gold deposits using the recoverable Multiple Indicator Kriging (MIK) method, is the QP for the purposes of this work. Mr van der Heyden has visited the mine on three occasions, most recently in July 2022.

The recoverable resource model was built using GS3©, MIK software developed by FSSI Consultants (Aust.) Pty Ltd and is suitable for use in open-pit optimisation studies.

14.1.2 Indicator Kriging for Recoverable Resource Estimation

The MIK method was developed in the early 1980s with a view toward addressing some of the problems associated with estimation of resources in mineral deposits. These problems arise where sample grades show the property of extreme variation and consequently where estimates of grade show extreme sensitivity to a small number of very high grades. These characteristics are typical of many gold deposits, where the coefficient of variation in samples normally exceeds 2.0. MIK is one of a number of methods which can be used to provide better estimates than the more traditional methods such as OK and inverse distance weighting.

It is fundamental to the estimation of Mineral Resources that the estimation error is inversely related to the size of the volume being estimated. To take the extreme case, the estimate of the average grade of a deposit generated from a weighted average grade of the entire sample dataset is much more reliable than the estimate of the average grade of a small block of material within the deposit generated from a local neighbourhood of data.

Another fundamental notion relevant to the optimisation of resources to develop an open-pit mine and schedule is that the optimisation algorithm does not require the resource be defined on extremely small blocks relative to data spacing. Small blocks cannot provide the basis for reliable estimates of recoverable resources.

The basic unit of an MIK block model is a panel that normally has the dimensions of the average drillhole spacing in the horizontal plane. At Sukari, the average drillhole spacing is 20m in the grid east direction and 25m in the grid north direction. The panel should be large enough to contain a reasonable number of blocks, or Selective Mining Units (SMUs; about 15). The SMU is the smallest volume of rock that can be mined separately as ore or waste and is usually defined by a minimum mining width. At Sukari, the dimensions of this block are assumed to be in the order of 5mE x 8mN x 10mRL.

The goal of MIK is to estimate the tonnage and grade of ore that would be recovered from each panel if the panel were mined using the SMU as the minimum selection criteria to distinguish between ore and waste. To achieve this goal, the following steps are performed:

1. Estimate the proportion of each domain within each panel. This estimation can be achieved by kriging of indicators of domain classifications of sample data points or by passing the model panels through wireframe interpretations of domains and calculating domain proportions directly from the wireframes. Wireframes have been used for the assigning of domain proportions into panels for the Sukari Mineral Resource model;
2. Estimate the histogram of grades of sample-sized units within each domain within each panel using MIK. The method actually estimates the probability of the grade within each panel being less than a series of indicator threshold grades. These probabilities are interpreted as panel proportions;
3. For each domain, and for each panel that receives an estimated grade greater than 0.0g/t Au, implement a block support correction (variance adjustment) on the estimated histogram of sample grades in order to achieve a histogram of grades for SMU-sized blocks. This step incorporates an explicit adjustment for Information Effect;
4. Calculate the proportion of each panel estimated to exceed a set of selected cut-off grades, and the grades of those proportions; and
5. Apply to each panel, or portion of a panel below surface, a bulk density to achieve estimates of recoverable tonnages and grades for each panel.

Apart from considerations of resource classification (Section 14.3.1), Step 5 completes construction of the Mineral Resource model. The estimates of recoverable resources for each panel may be combined to provide an estimate of global recoverable resources for the deposit.

14.1.3 Resource Dataset

Centamin provided an initial database consisting of 112,844 holes totalling 3,256,240 metres, which comprised all surface and underground holes, including resource and grade control holes, as well as underground face samples. The cut-off date for the database was July 15, 2022.

The Sukari database includes a number of different hole types, including:

- DD = Diamond Drill Core (mostly surface and underground resource holes);
- DDGC = DD Grade Control (underground);
- FS = Face Samples (underground);

- RC = Reverse Circulation, includes open-pit grade control, surface resource and geotechnical holes; and
- RCD = RC hole with DD tail (resource).

For the open-pit MRE, the open-pit grade control holes (most RC) and underground face samples (FS) were excluded, some of the underground grade control holes (DDGC) were removed but the advanced grade control (AGC) holes from surface were retained. The AGC holes are deeper surface RC holes drilled on a nominal 24x24m pattern, compatible with the nominal resource hole spacing of 25x25m. Table 14.1 summarises the open-pit MRE database and compares it to the total database provided by Centamin. Holes without assays were excluded from the MRE.

Table 14.1: Summary of Open Pit MRE Database

Hole Type	Total Database		Open-pit MRE		% in MRE	
	Holes	Metres	Holes	Metres	Holes	Metres
DD	2,848	808,179	2,386	755,697	84%	94%
DDGC	4,743	122,737	3,504	137,765	74%	112%
FS	40,597	201,734	1	5	0%	0%
RC	64,309	1,996,344	709	84,306	1%	4%
RCD	347	127,246	347	127,246	100%	100%
Total	**112,844**	**3,256,240**	**6,947**	**1,105,018**	**6%**	**34%**

In the open-pit MRE database, 362 DD holes were reallocated to DDGC on advice from Centamin, which explains the increase in meterage for that hole type. A trench sample was unintentionally integrated into the open-pit MRE database due to an incorrect hole type assignment, but this issue was subsequently rectified.

The main reasons for excluding some underground production holes and all face samples were the extreme clustering in high grade areas and the tendency for many to start or end in high grade mineralisation. Underground production holes were excluded if they were:

- Less than 10m in length;
- Less than 25m in length with high grade samples at both ends; and
- Greater than 25m in length and less than 10m from adjacent holes.

This procedure rejected ~31% of underground production holes, which is ~15% of their meterage and contains ~28% of their total metal.

Some additional data was added to the open-pit MRE database because it had been used in previous MRE’s, including:

- 42 RC sterilisation holes (total 5,303m)
- 5,087 surface rock chip samples (nominal 2m each)
- 2,234 trench channel samples (nominal 2m each)

The sterilisation holes are included in Table 14.1 but the rock chip and trench samples are not. The majority of the rock chip and trench samples are already mined out, but some remain on the lower slopes of Sukari Hill.

14.1.4 Mineralisation Modelling

Gold mineralisation is primarily hosted in the Sukari felsic porphyry (granodiorite) with minor mineralisation in the wall rocks. The geological interpretation and domaining of mineralisation were based on the current lithological and structural wireframe models for Sukari prepared by Centamin personnel. All wireframes were completely revised for this MRE (Figure 14.1). Structural measurements collected in the open pit and underground, were used to assist with modelling the mineralised zones.

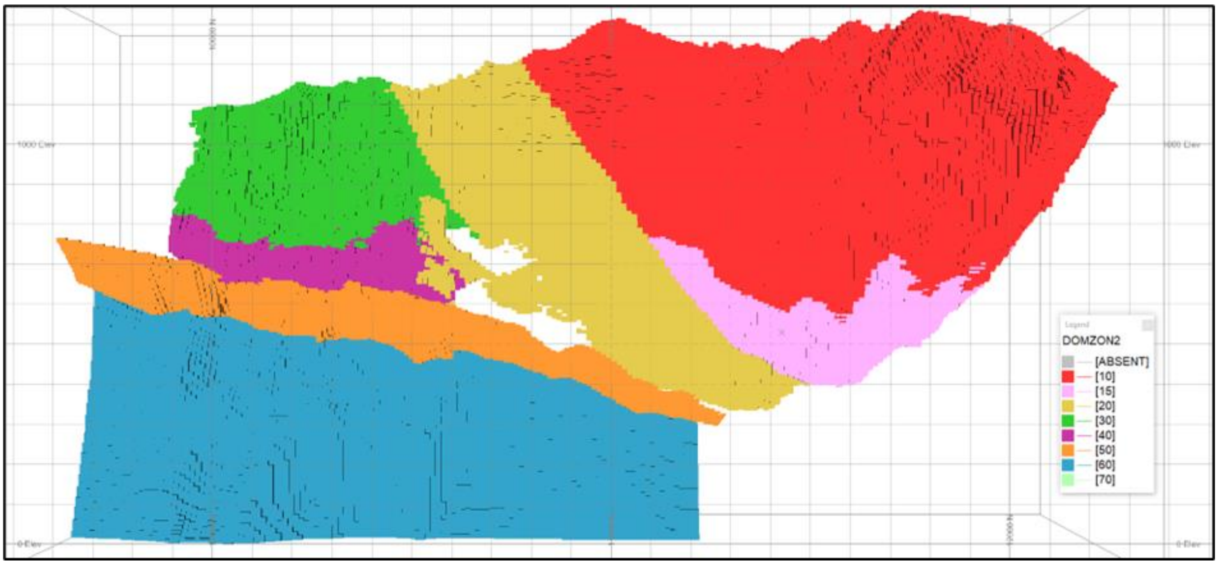


Figure 14.1: 3D Long Section of Major Mineralisation Domains (Looking West) (H&SC, 2022)

The Sukari porphyry is dismembered by faulting into three main blocks – the upper Main zone (Domains 10 – 40), the middle Amun zone (Domain 50) and the lower Horus zone (Domain 60) as shown in Figure 14.1. The Hapi fault separates the Main and Amun zones, while the Osiris Fault separates the Amun and Horus zones. There is also some sub-horizontal porphyry and gold mineralisation within the Osiris fault zone that constitutes the Osiris domain.

The upper Main zone has been sub-divided into three domains by the Buthinae and Kaolin 1 faults. The Main zone north of the Buthinae faults is generally weakly mineralised with a number of sub-parallel NW-dipping lodes (Cleopatra, Anthony, Julious). The bottom of the Main North zone is more strongly mineralised around the keel of the porphyry, so this material was divided by H&SC into a separate Keel domain.

The central Main zone between the Buthinae and Kaolin 1 faults is strongly mineralised and appears to plunge to the north. Part of the Main Reef mineralisation occurs in the Central Main domain.

The Main zone south of the Kaolin 1 faults is also strongly mineralised, has a horizontal plunge and includes the other half of the Main Reef.

A number of subsidiary porphyry bodies occur to the east of the Main zone to the south of the Buthinae faults and generally west of the Akbar Wahed fault. These hangingwall porphyries are sometimes mineralised, so this area was treated as another domain for estimation.

The footwall and hangingwall of the Upper Main zone are generally unmineralised, although there are occasional narrow high-grade veins.

The footwall and hangingwall of the Amun zone can be well mineralised in places, probably due to the strong deformation of the entire Amun zone between the Amun and Osiris faults.

H&SC converted the Centamin fault wireframe solids into surfaces by defining the central plane of each wireframe.

The fault and lithology wireframes were generated independently of each other by Centamin, so in some areas the geological relationships were not correctly honoured. This required H&SC to make some local changes to the wireframes or block model to maintain correct geological relationships.

H&SC modified part of the Osiris Fault because the Centamin interpretation did not account for all of the Osiris mineralisation and it incorrectly intersected the Horus zone, which occurs entirely below this fault.

H&SC also smoothed out the interpretation of the Horus zone. The Centamin version was purely an interpretation of the porphyries, while the H&SC included mineralised material between the porphyries into a more continuous zone.

Table 14.2 shows the domain codes and dip/dip directions of mineralisation for each domain used in the updated MRE. The dip/dip directions were derived by visualising the data in 3D and examining variogram maps. Main North Wall (Domain 13) is a waste domain defined parallel to the north wall of the Main porphyry to minimise smearing of isolated high-grade samples in this area.

Table 14.2: Domain Codes and Orientations

Domain	Description	Dip>Dir	Domain	Description	Dip>Dir
10	Main North	45>315	41	Amun FW	70>090
11	Main FW	70>090	42	Amun HW	70>270
12	Main HW	70>270	50	Osiris	15>320
13	Main North Wall	50>180	60	Horus	90>090
15	Main Keel	10>000	61	Horus FW	90>090
20	Main Central	60>105	62	Horus HW	90>090
30	Main South	67>090	70	HW Porphyry	70>300
40	Amun	45>110			

Centamin also generated wireframe models for the major barren andesite dykes at Sukari, which dip moderately to steeply towards azimuths between 090° and 180° (East to South). Only major dykes were defined, and it was assumed the estimation process will adequately account for the numerous minor dykes. The major dykes were incorporated into the estimation process because they would not otherwise be adequately accounted for due to their oblique orientation to mineralisation and the relatively wide data spacing. The wireframes provided were assumed to be accurate, but this was not always necessarily the case. The interpretation of these dykes could be improved to ensure that high-grade samples are excluded, and all relevant low-grade intersections are captured. Currently, 4.4% of drillhole samples inside dyke wireframes have grades in excess of 0.2 g/t Au.

Some surface chip and trench samples were removed where they occur within the major barren dykes.

Oxidation surfaces (base of complete and base of partial oxidation) were provided by Centamin and used as supplied. Oxidation has little impact on gold grades so was not used in estimation domain definition.

14.1.5 Data Analysis

The Sukari database includes columns for three different gold assay methods, with one or other of these selected as the preferred assay in a separate column. Validation indicated that some gold assays were not in the same assay method column, when compared to the database for the previous MRE. The impact on these potential errors is not considered material to the MRE.

14.1.6 Sample Compositing

Figure 14.2 shows a histogram of sample length for the resource drill holes, excluding the surface rock chip and trench channel samples. The dominant sample length is 1.0m, with a number of shorter and longer samples due to core being cut to lithological boundaries. The peak at 2.4m represents the AGC holes with a sample length of 2.5m. There are a small number of samples with assays greater than 5m in length and a maximum value of 24.2m.

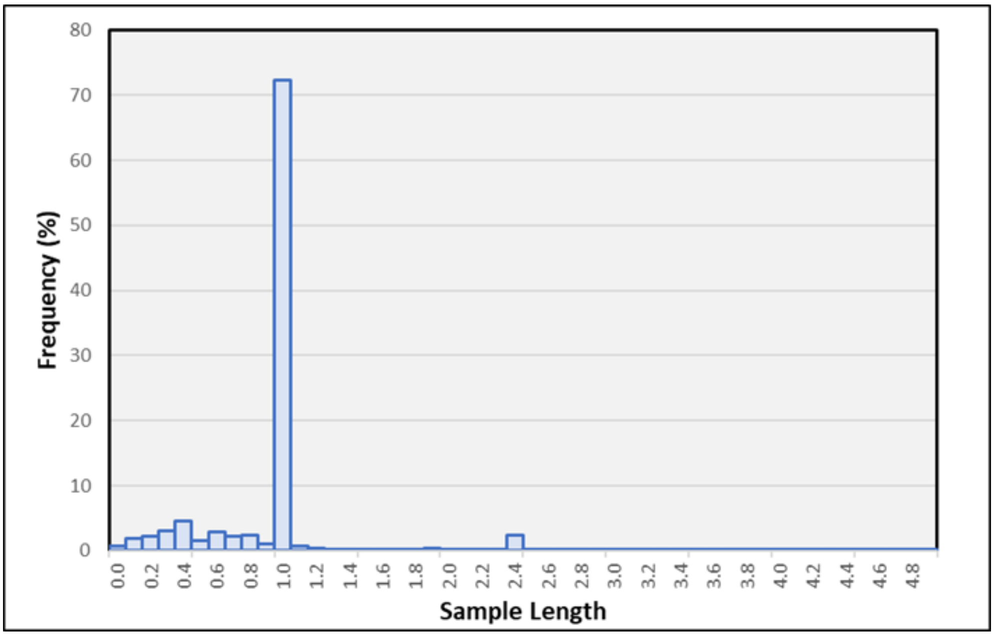


Figure 14.2: Histogram of Sample Length

Drill hole samples were composited to nominal 2.0m intervals, with composites less than 0.99m in length rejected. The surface chip samples were validated but not composited. Drill hole composites and surface chip samples were then combined into a single file, which was flagged by the domain and oxidation wireframes for analysis and estimation.

Barren dyke samples were removed from the composite file after flagging them with the dyke wireframes, because the dykes are estimated separately from the mineralisation. Only barren dyke samples with Au < 0.2 g/t were removed, to avoid excluding incorrectly flagged mineralised samples, while barren dyke samples outside the wireframes were retained.

Low default grades (0.005g/t) were assigned to unassayed intervals in a number of circumstances:

- All samples missing assays in waste domains;
- Samples >25m from existing assays in mineralised domains; and
- 2022 holes were not assigned default grades because some assay results had not yet been received from the laboratory; these records were left as absent data and ignored during analysis and estimation.

Defaults were not assigned to unassayed samples less than 25m from assays in the mineralised domains to avoid assigning default values to unassayed mineralised samples within tightly clustered fans of holes.

After trimming samples to the resource study area, the final resource dataset contained 553,776 composites (including surface rock chip and trench channel samples).

14.1.7 Summary Statistics

Summary statistics by domain for the resulting 2.0m drill hole composites and surface chip samples are shown in Table 14.3 below, excluding the barren dyke samples.

Table 14.3: Summary Statistics by Domain

Domain	Samples	Min	Max	Mean	SD	CV	Description
10	162,621	0.0005	228.6	0.274	1.17	4.28	Main North
11	25,701	0.001	4,505.4	0.865	30.36	35.09	Main FW
12	35,916	0.001	138.5	0.027	1.16	43.27	Main HW
13	4,368	0.001	120.4	0.046	1.86	39.96	Main North Wall
15	22,700	0.001	369.7	0.989	5.68	5.75	Main Keel
20	76,114	0.001	1,385.2	1.202	9.65	8.03	Main Central
30	30,392	0.001	643.1	1.751	9.08	5.19	Main South
40	23,339	0.001	556.5	2.053	9.70	4.72	Amun
41	20,261	0.001	359.1	0.401	6.87	17.12	Amun FW
42	4,907	0.001	206.3	0.660	6.28	9.52	Amun HW
50	25,777	0.001	2,727.3	0.874	18.37	21.02	Osiris
60	21,895	0.001	509.6	0.734	5.62	7.66	Horus
61	7,433	0.001	60.8	0.025	0.72	28.49	Horus FW
62	33,260	0.001	180.4	0.101	2.01	20.01	Horus HW
70	59,092	0.001	576.1	0.223	4.32	19.42	HW Porphyry
Total	**553,776**	**0.0005**	**4,505.4**	**0.631**	**9.34**	**14.81**	

Most domains have skewed grade distributions with relatively high coefficients of variation (CV=SD/mean), indicating that a non-linear estimation method such as recoverable Multiple Indicator Kriging (MIK) would be more appropriate than OK. The mineralised domains (shaded) tend to have lower CVs than the nominal waste domains (no shading), because the waste domains are dominated by low grades with only occasional high-grade samples.

14.1.8 Variography

Variogram maps were generated and examined to help determine the principal directions of gold grade continuity within each domain. In some cases, gold mineralisation is parallel to the porphyry boundaries, while in other cases the mineralisation crosscuts the porphyries. Figure 14.3 shows some examples for Domains 10 and 40.

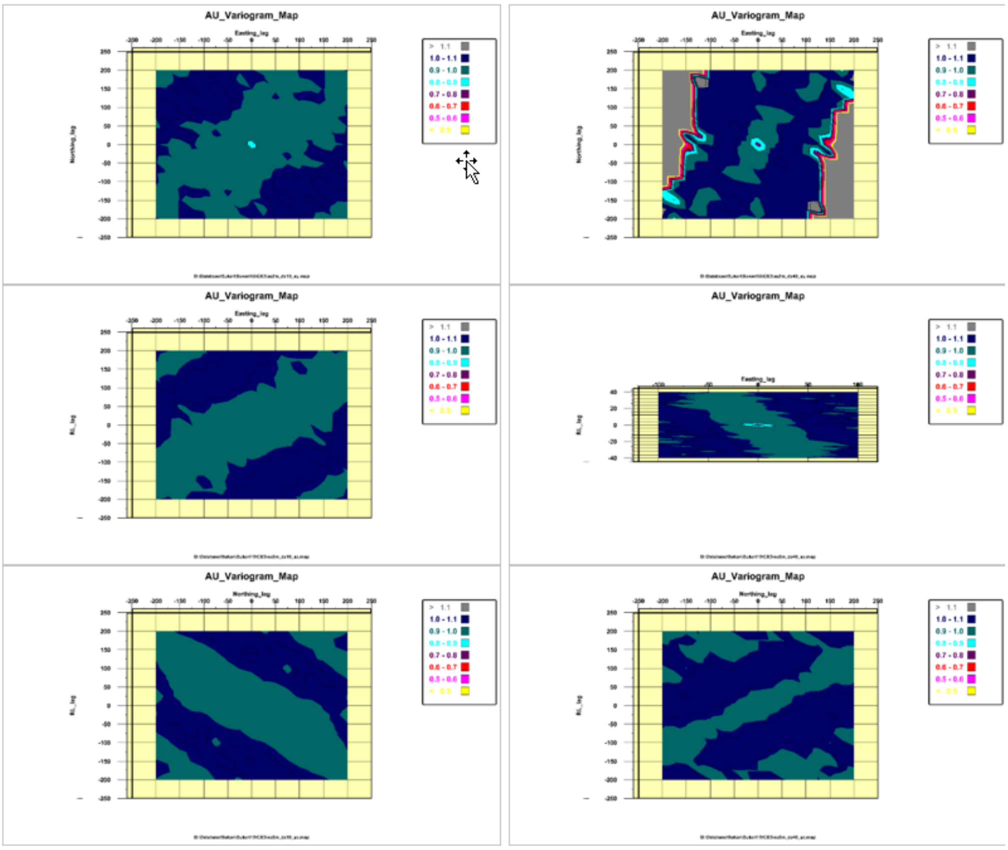


Figure 14.3: Variogram Maps for Domain 10 (Left) and Domain 40 (Right)

Variograms were generated for gold grade and a set of indicator variograms for each domain. An example of a gold grade variogram for Domain 10 is presented in Figure 14.4.

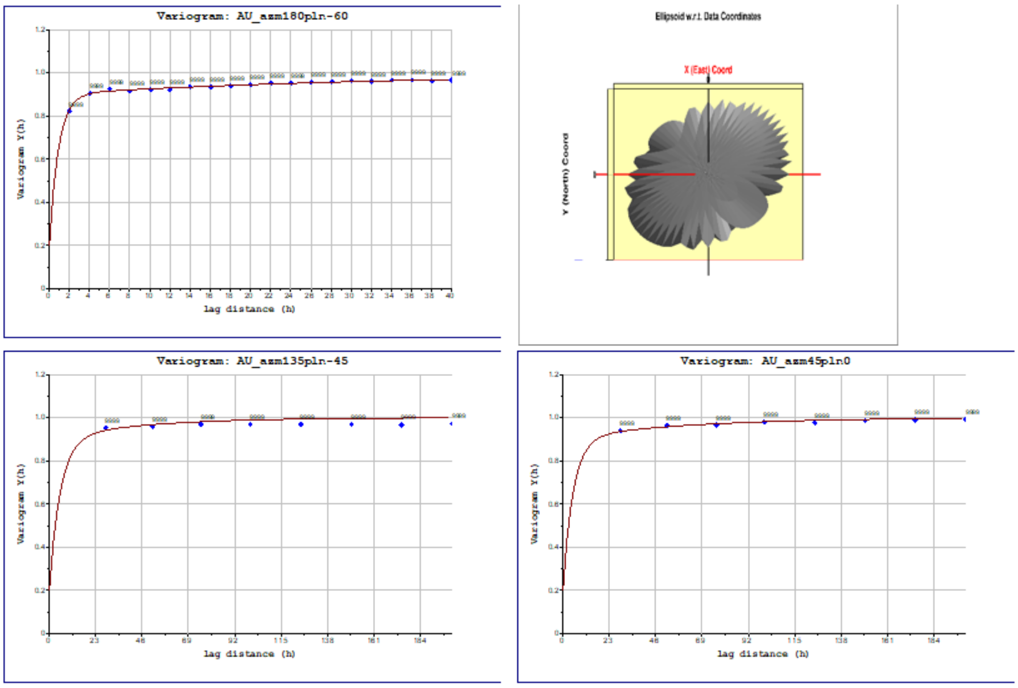


Figure 14.4: Gold Grade Variogram for Domain 10

An indicator variable is either zero or one, depending on whether the original sample variable, in this case gold grade, is above (1) or below (0) the indicator grade threshold.

Indicator thresholds were applied to each domain, based on a consistent set of grade percentiles (Cumulative Proportion) as shown in the example in Table 14.4 for Domain 10.

Table 14.4: Indicator Statistics for Domain 10

Grade Threshold	Cumulative Proportion	Class Mean	Class Median	No. Data
0.000	0.00	0.003	0.003	15,846
0.005	0.10	0.006	0.005	15,847
0.007	0.20	0.011	0.010	15,846
0.015	0.30	0.021	0.020	15,847
0.030	0.40	0.039	0.040	15,846
0.051	0.50	0.072	0.070	15,847
0.095	0.60	0.129	0.128	15,846
0.170	0.70	0.200	0.200	7,923
0.232	0.75	0.275	0.275	7,924
0.320	0.80	0.384	0.380	7,923
0.458	0.85	0.560	0.555	7,923
0.690	0.90	0.909	0.890	7,923
1.215	0.95	1.431	1.420	3,170
1.707	0.97	2.254	2.180	3,169
3.140	0.99	6.199	4.300	1,585

14.1.9 Dry Bulk Density

Centamin provided 13,945 dry bulk density (DBD) measurements performed on site using Archimedes method. Around 25% of measurements were collected between 1997 and 2013, while the remaining 75% were compiled between 2020 and 2022. These samples give good spatial coverage around the deposit and represent a range of rock types.

Summary statistics for measurements in fresh rock are presented by lithology in Table 14.5, which shows a range of values from 2.00 to 3.31 t/m^3.

Table 14.5: Summary of Density Statistics for Fresh Rock by Lithology							
Code	**Lithology Group**	**Samples**	**Min**	**Max**	**Mean**	**SD**	**CV**
0	Unassigned	41	2.57	2.93	2.791	0.079	0.028
100	Sediment	1,270	2.02	2.99	2.778	0.092	0.033
200	Volcanic Tuff	2,495	2.02	3.15	2.802	0.102	0.036
300	Carbonaceous Sediment	1,048	2.05	3.06	2.756	0.108	0.039
500	Granodiorite Porphyry	7,110	2.00	3.12	2.668	0.074	0.028
600	Andesitic Volcanics	23	2.50	2.98	2.737	0.103	0.038
700	Serpentine	550	2.15	3.00	2.801	0.112	0.040
750	Quartz Vein	207	2.35	2.93	2.668	0.061	0.023
800	Andesite Dyke	668	2.17	3.31	2.794	0.096	0.034
900	Gabbro	31	2.05	2.92	2.749	0.159	0.058
Total		13,443	2.00	3.31	2.722	0.106	0.039

Statistics by lithology and oxidation zone, are shown in Table 14.6. H&SC verified that the averages for fresh rock are correct.

Table 14.6: Average Density Values by Oxidation Zone				
Code	**Description**	**Fresh**	**Transition**	**Oxide**
100	Sediment	2.78	2.75	2.68
200	Volcanic Tuff	2.80	2.75	2.76
300	Carbonaceous Sediment	2.76	2.70	2.66
320	Schist	2.71	2.58	2.52
400	Talc Chlorite Schist	2.71	2.58	2.52
500	Granodiorite Porphyry	2.67	2.64	2.62
600	Andesitic Volcanics	2.74	2.72	2.68
700	Serpentine	2.80	2.68	2.58
750	Quartz Vein	2.67	2.66	2.63
800	Andesite Dyke	2.79	2.76	2.75
900	Gabbro	2.75	2.72	2.67

A geology block model was generated using Centamin lithology and oxidation wireframes. Density was then assigned to this model using the average values derived by Centamin, shown in Table 14.6. Finally, the combined geology and density model was added to the MIK grade model.

14.1.10 Estimation

Open pit Mineral Resources are estimates of recoverable tonnes and grade using Multiple Indicator Kriging (MIK) with direct lognormal change of support in the GS3 software package. Soft boundaries were applied between domains, whereby block estimation can be informed by composites from another domain, but variogram and search parameters change across the domain boundary. This estimation methodology is appropriate given:

- Around open pit cut-off grades the deposit has relatively diffuse grade architecture;
- Mixed distributions are present within domains which may not be effectively partitioned by further domaining;
- Domain statistics show extreme positive skew (Coefficient of Variation ~5 to 30); and
- It is useful to calculate the recoverable resource within a large block (panel), to better forecast grade control model/production results at SMU scale.

The MIK estimates were imported into Datamine Studio RM software for depletion with pit topography and underground voids as of end of June 2023. Blocks were then restricted to a US$2,000/oz reporting pit shell to produce the open-pit MRE.

The input parameters for MIK include:

- Indicator variogram models describing the spatial continuity of indicator variables within each domain at each indicator threshold.
- Variograms describing the spatial continuity of gold grades within each domain.
- Mean gold grades of each of the indicator classes within each domain.

Details of block model dimensions for the MIK estimates are provided in Table 14.7, and a selective mining unit (SMU) of 5x8x10m was used for the recoverable estimates. An expanded model with additional waste blocks was generated for pit optimisation, with dimensions of 2,020 x 3,200m in X and Y.

Table 14.7: Open Pit Resource Model Dimensions

Parameter	X	Y	Z
Origin	10,170.0	9,587.5	-100.0
Maximum	11,130.0	12,237.5	1,350.0
Block Size	20	25	10
Number of blocks	48	106	145
Length	960	2,650	1,450

The estimation search strategy is presented in Table 14.8. Pass 1 represents the minimum radii required to ensure that the block is entirely enclosed by the search ellipsoid regardless of the rotations. The ellipsoids for each domain were rotated so that the X axis had the dip and dip direction indicated in Table 14.2.

Table 14.8: MIK Estimation Search Strategy						
Estimation Pass	**Search Radii**			**Samples**		**Octants**
	X	**Y**	**Z**	**Min**	**Max**	**Min**
1	30	30	15	16	48	4
2	45	45	22.5	16	48	4
3	60	60	30	8	48	2

Discretisation was set at 5x5x5 points per block to generate block rather than point estimates. MIK was first used to estimate a panel cumulative distribution function (CDF), used to calculate a panel E-Type grade. Change of support was then implemented using the direct log-normal method, assuming a 5m by 8m by 10m SMU and a regular grade control pattern of 8m by 12m by 2.5m, to derive a CDF at SMU support used to report recoverable tonnes and grades. This resulted in the parameter shown in Table 14.9.

Table 14.9: Change of Support Parameters				
Domain	**Block/Data Variance Ratio**	**Block/Panel Variance Ratio**	**Information Effect**	**Total Correction**
10	0.106	0.039	0.524	0.056
11	0.079	0.064	0.050	0.004
12	0.054	0.044	0.050	0.003
13	0.040	0.030	0.050	0.002
15	0.114	0.047	0.402	0.046
20	0.132	0.098	0.332	0.044
30	0.153	0.112	0.313	0.048
40	0.123	0.086	0.359	0.044
41	0.126	0.102	0.133	0.017
42	0.147	0.121	0.139	0.020
50	0.043	0.029	0.050	0.002
60	0.085	0.065	0.066	0.006
61	0.096	0.079	0.050	0.005
62	0.087	0.069	0.067	0.006
70	0.081	0.066	0.050	0.004

With skewed grade distributions, such as gold at Sukari, estimates can be sensitive to the grade applied to the top indicator class. Based on the experience gained from the reconciliation of estimates against mine production, the following scheme has been developed. The preferred value in mineralised domains is the average of the mean and median grades for the top indicator class, while the more conservative median grade is used for the waste domains, in order to limit smearing of isolated high-grade samples in these nominally low-grade domains. Table 14.10 shows the top indicator statistics for all domains, with the values used for the preferred model indicated by shading.

Table 14.10: Top Indicator Class Statistics (Preferred Values Indicated by Shading)

Description	Domain	No Data	Threshold	Mean	Median	Mn+Md/2
Main North	10	1,585	3.14	6.20	4.30	5.25
Main FW	11	228	9.16	88.48	32.93	60.70
Main HW	12	331	0.23	2.18	0.43	1.31
Main North Wall	13	42	0.11	4.03	0.27	2.15
Main Keel	15	219	10.96	34.54	20.00	27.27
Main Central	20	744	9.98	39.40	17.33	28.36
Main South	30	304	19.75	58.42	38.72	48.57
Amun	40	234	23.72	66.32	44.47	55.39
Amun FW	41	200	3.55	37.03	15.61	26.32
Amun HW	42	50	11.33	44.10	27.40	35.75
Osiris	50	258	11.40	52.75	23.70	38.23
Horus	60	213	7.61	29.49	15.18	22.33
Horus FW	61	69	0.17	1.61	0.43	1.02
Horus HW	62	327	1.11	7.64	2.41	5.03
HW Porphyry	70	588	2.88	13.96	4.54	9.25

14.1.11 Validation

The 2022 resource model was validated in a number of ways, including visual comparison of block and drill hole grades, statistical analysis (summary statistics, swath plots, QKNA analysis), examination of grade-tonnage data, and comparison with grade control and the previous resource model.

Visual comparison of block and drill hole grades shows reasonable agreement in all areas examined and no obvious evidence of excessive smearing of high-grade assays.

A comparison of average sample composite and model block grades by domain is presented in Table 14.11. The composite statistics are not declustered and length weighted, while the block grades are volume weighted. The mineralised domains (shaded) generally performed better because their CVs are lower than the nominal waste domains. Average block grades are lower because samples tend to be clustered in higher grade areas, particularly the underground grade control holes.

Table 14.11: Comparison of Average Sample and Block Grades per Domain					
Domain	**Sample Composites**		**Model Blocks**		**Blk/Sam**
	Number	**Mean**	**Number**	**Mean**	**Mean**
10	162,621	0.274	63,697	0.199	73%
11	25,701	0.865	18,279	0.087	10%
12	35,916	0.027	24,543	0.016	59%
13	4,368	0.046	6,093	0.024	52%
15	22,700	0.989	5,192	0.694	70%
20	76,114	1.202	10,252	0.916	76%
30	30,392	1.751	5,636	1.206	69%
40	23,339	2.053	2,334	1.476	72%
41	20,261	0.401	7,990	0.099	25%
42	4,907	0.660	1,133	0.281	43%
50	25,777	0.874	4,290	0.388	44%
60	21,895	0.734	11,657	0.555	76%
61	7,433	0.025	7,420	0.023	92%
62	33,260	0.101	21,371	0.038	38%
70	59,092	0.223	22,408	0.121	55%
Total	553,776	0.631	212,295	0.240	38%
Mineral	362,838	0.822	103,058	0.428	52%
Waste	165,237	0.177	109,237	0.064	36%

Swath plots of gold grades in the Main Porphyry (Domains 10, 15, 20, 30 & 40 combined) are shown in Figure 14.5, and demonstrate that the composite and block grades show similar spatial trends and average values are comparable, allowing for smoothing in the model, clustering in the drill hole data and the generally larger volume represented by the model. Two sets of swath plots were generated, one using all holes and the other using only resource holes. The grade profiles for the resource holes only are closer to the block model grades than those using all holes, which is due to the underground grade control holes being clustered in high grade areas. The impact and location of the underground grade control holes is most apparent in the swath plots by elevation but affects all graphs.

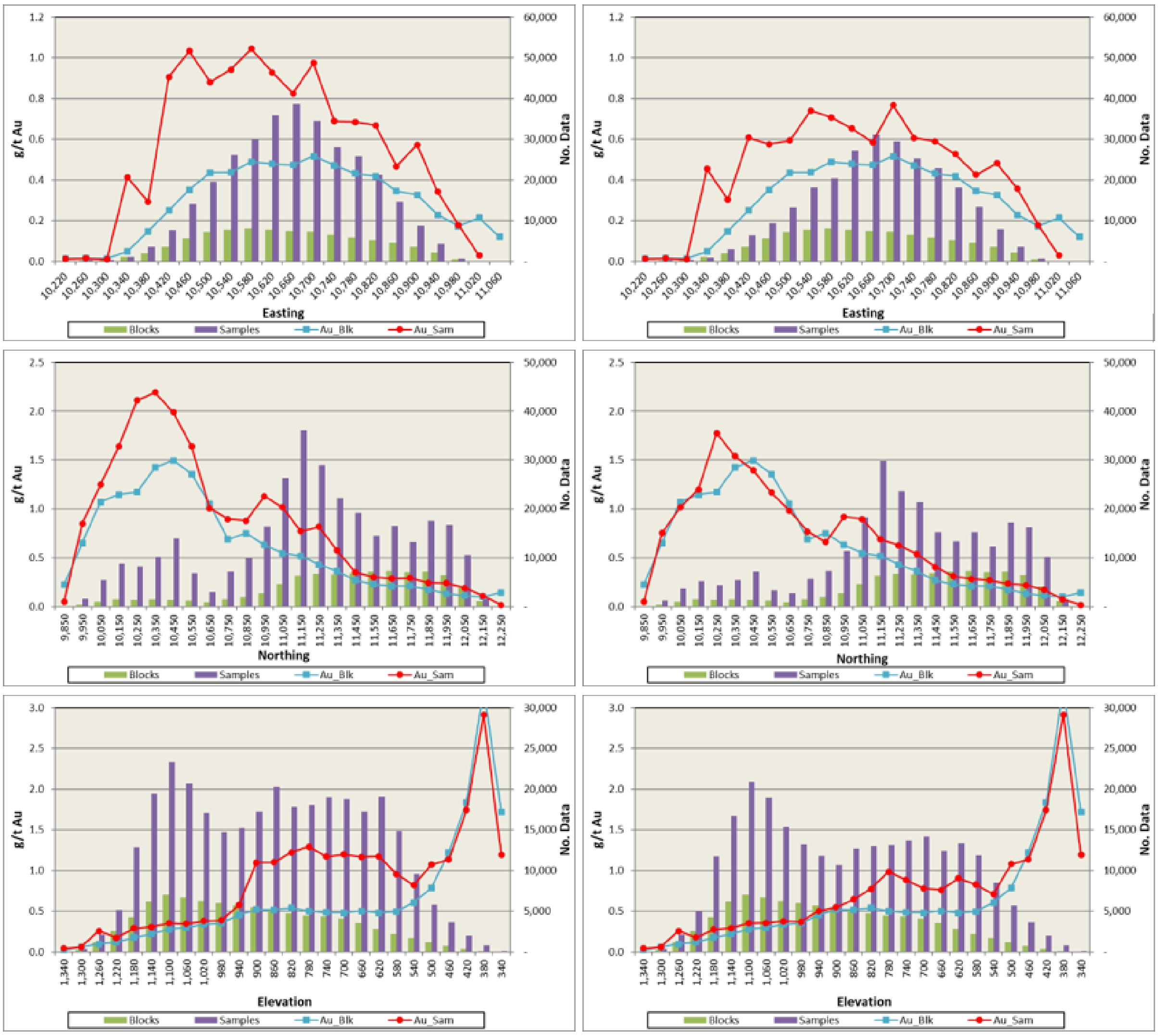


Figure 14.5: Swath Plots for Main Porphyry (Left = All Drillholes, Right = Resource Drillholes Only)

Limited quantitative kriging neighbourhood analysis (QKNA) was performed to give some indication of the quality of estimates. QKNA depends on variogram models and for MIK estimates, it is not obvious which variogram is most appropriate – one of the indicators or the metal grade variogram. H&SC initially examined QKNA for Domain 10, using both the metal grade variogram and the indicator variogram closest to the nominal cut-off grade. Figure 14.6 presents the results of this analysis, which shows that the slope of regression (Slope) and kriging efficiency (K_Eff) is substantially better for the indicator around 0.3 g/t Au (Ind 0.3 Au) than the metal grade variogram (Metal). As expected, QKNA parameters decrease as the estimation pass increases.

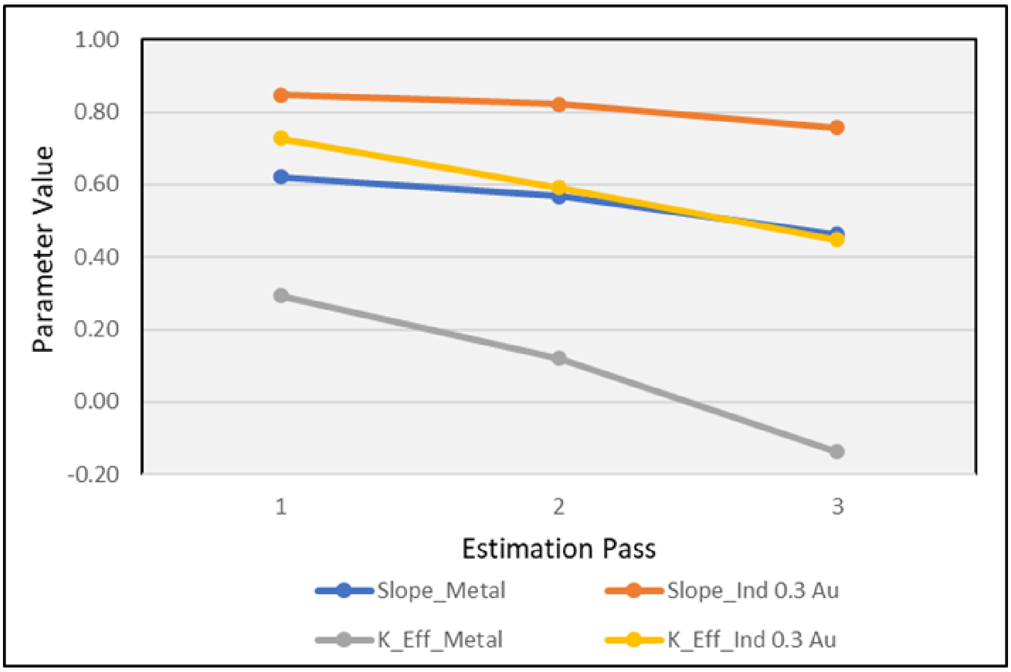


Figure 14.6: QKNA by Metal and Indicator Variogram

Analysis by metal variogram, is summarised in Figure 14.7 by Domain and estimation search Pass. In general, the mineralised domains performed better than the waste domains because their variograms have better structure due to the lower CVs.

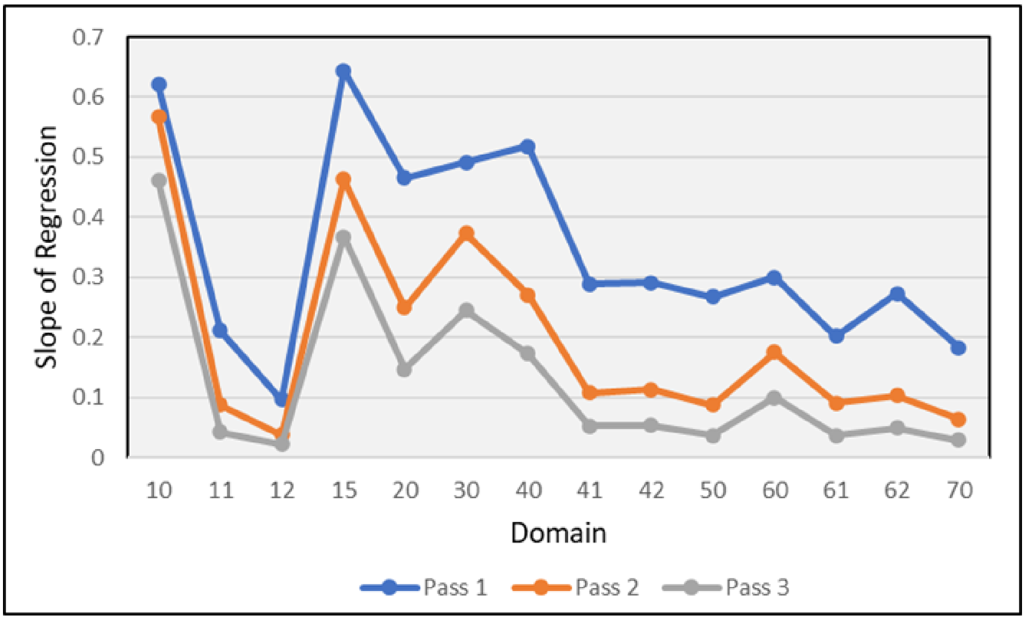


Figure 14.7: Slope of Regression by Domain and Pass

The grade-tonnage curve for the 2022 MRE, presented in Figure 14.8, shows a smooth gradation in both tonnage and grade over the range of cut-off grades examined, and no obvious kinks or bumps suggestive of estimation issues.

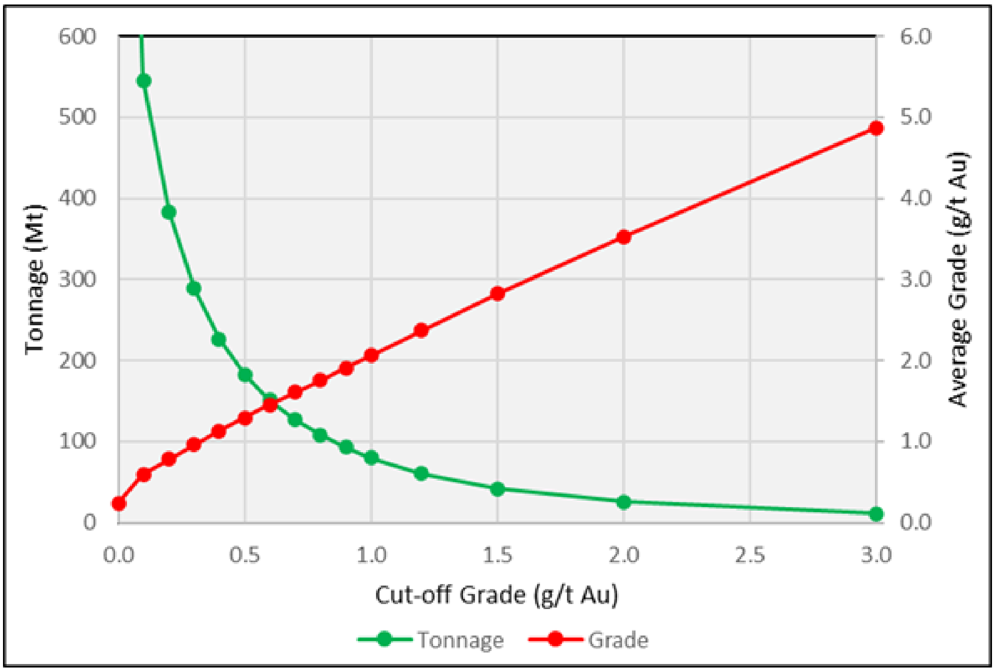


Figure 14.8: Grade-Tonnage Curve for MRE

H&SC generated a grade control model using recoverable MIK with the Sukari grade control database over an area of 720 x 1,375 x 250m. This area was chosen because it has reasonably consistent grade control hole coverage and sample length. Samples were composited to 2.5m and estimation used the same domains, methodology and block size as the resource model, except that the mean grade was used for the top indicator class because of the higher data density. The grade control model was not depleted for barren dykes because it was assumed that the higher data density would adequately account for these features. The comparisons between the resource and grade control models were made over the common volume (same blocks in both models).

A comparison of the MIK grade control model against the resource model at a 0.3g/t Au cut-off grade is presented in Figure 14.14, which shows that the resource model reconciles well with grade control in terms of contained ounces, although the tonnages and grades differ more.

Table 14.12: Comparison of MIK Grade Control and Resource Models (0.3g/t Au Cut-off Grade)

Model	Mt	g/t Au	Koz Au
Resource	141.8	1.014	4,625
Grade Control	148.1	0.952	4,533
% Difference	-4.2%	6.5%	2.0%

A comparison of metal content in the two models on a bench-by-bench basis, displayed in Figure 14.9, shows reasonable overall correlation, although there are significant differences on some benches. The largest differences appear to occur below around 940m elevation, where a substantial proportion of underground grade control holes begin to influence the resource model.

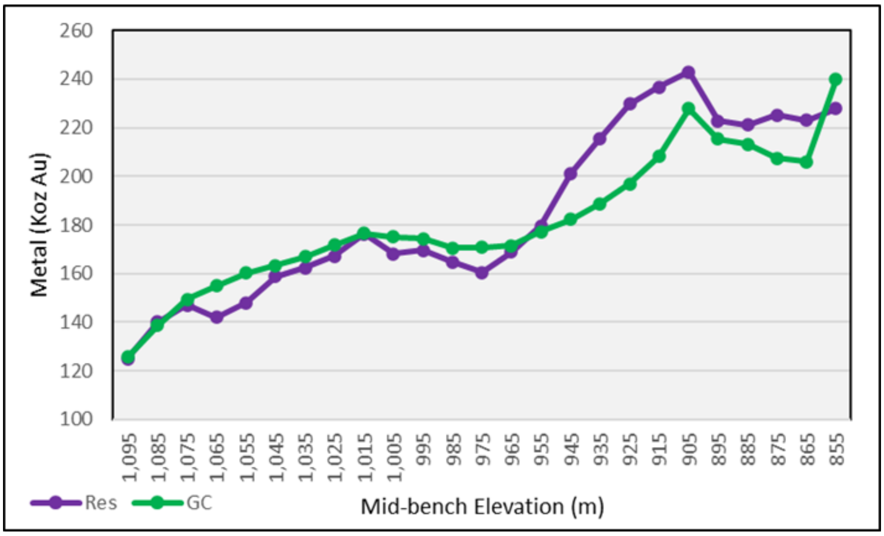


Figure 14.9: Metal Distribution by Bench: Resource vs Grade Control.

Site reconciliation between the 2021 resource model and the site grade control model for the period January to August 2022 shows similar results, as summarised in Table 14.13. The overall metal content is within 2% but there are significant differences in tonnage and grade, particularly for the different ore grade categories. To address these differences, additional infill AGC drilling on a 24m x 24m grid to the bottom of pit stages and extending the grade control drilling to a 12-month horizon is necessary. These steps are essential as previous attempts, which involved adjusting the SMU and variogram models, have proven unsuccessful in resolving the disparities.

Table 14.13: Comparison of Site Grade Control and 2021 Resource Model

Grade Class	GC Model			2021 Resource Model			GC vs Res Model		
	Kt	g/t Au	Koz Au	Kt	g/t Au	Koz Au	Kt	g/t Au	Koz Au
HG (>0.9)	3,750	1.48	178.6	3,522	1.77	200.0	6%	-16%	-11%
MG (0.6-0.9)	2,465	0.70	55.6	1,941	0.70	43.8	27%	0%	27%
LG (0.3-0.6)	1,434	0.47	21.9	1,049	0.48	16.2	37%	-2%	35%
Total	7,649	1.04	256.1	6,512	1.24	260.0	17%	-16%	-2%

Table 14.14 shows a global comparison of the 2021 and 2022 resource models below the end of June 2022 surface and inside the 2022 MRE reporting pit shell, with little difference at a 0.3 g/t Au cut-off grade despite substantially more drilling being available in 2022. However, a visual comparison of these models, presented in Figure 14.10, does show significant local differences that are not apparent in the global tabulation.

Table 14.14: Comparison of 2021 and 2022 Resource Models

Model	Mt	g/t Au	Moz Au
2021	285.4	0.974	8.940
2022	288.6	0.963	8.939
% Diff	1.12%	-1.13%	-0.02%

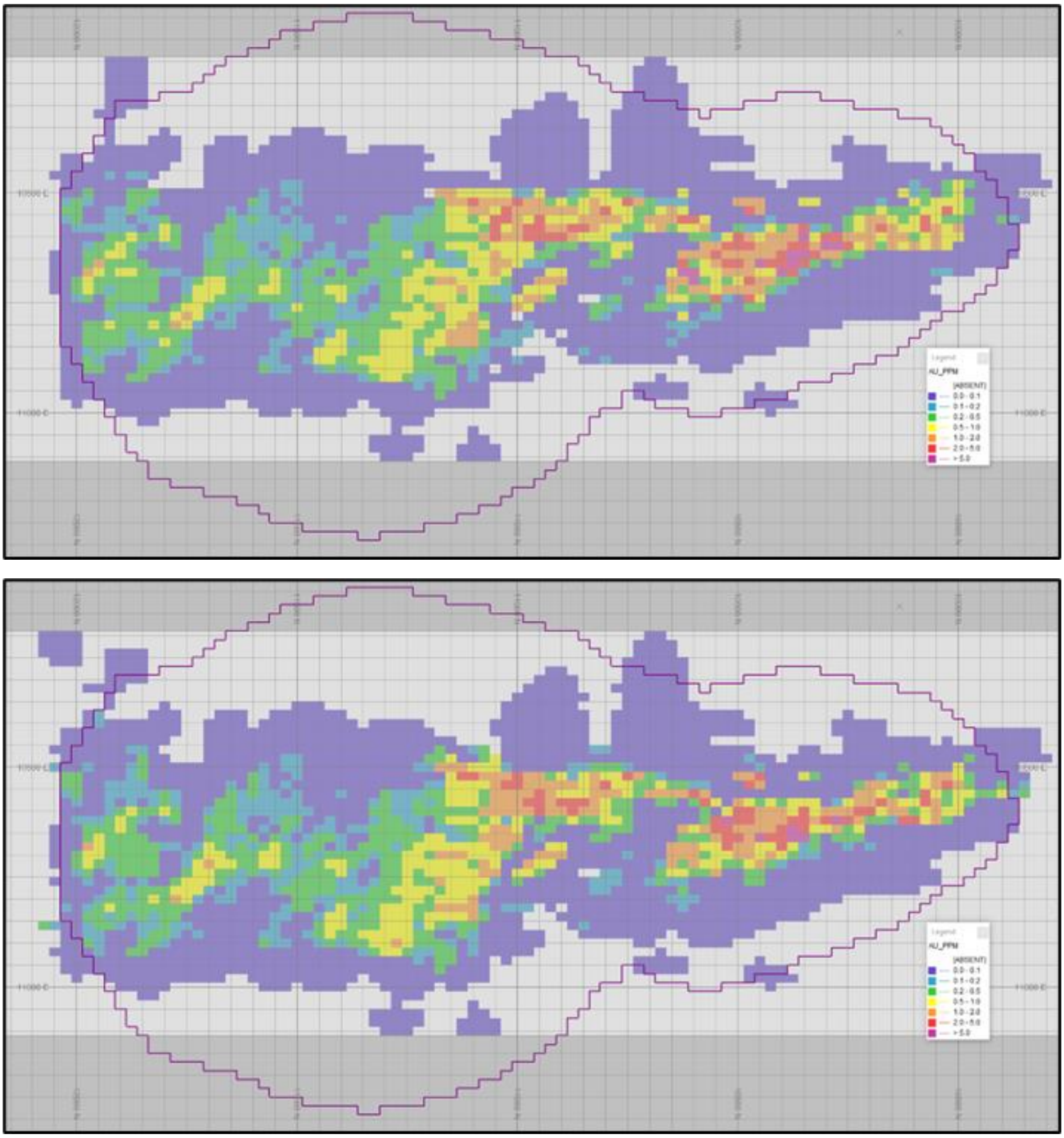


Figure 14.10: Visual Comparison of 2021 (Top) and 2022 (Bottom) Models. Level Plans at 805mRL Showing 2022 MRE Pit Shell in Purple (North to right, 100m grid) (H&SC, 2022)

Validation of the 2022 resource model shows that estimates are reasonable compared to resource drilling, grade control data and the previous model.

14.2 Underground Mineral Resource

14.2.1 Overview

The Sukari Underground MRE was informed by drilling up to June 30, 2022. Modelling and estimation was overseen by Centamin Group Mineral Resource Manager Mr Craig Barker (FAIG) and completed by Centamin Senior Resource Geologist Mr Rolly Wasonga (MAIG, MAusIMM). The estimate was prepared with reference to the CIM Definition Standards and CIM Guidelines for preparing Mineral Resources and Mineral Reserves.

Under NI 43-101 reporting requirements and CIM Definition Standards and CIM Guidelines, both Mr Wasonga and Mr Barker are QPs for the purpose of this work.

Cube Consulting conducted an independent technical review of the underground MRE resulting in the final estimation being classified as low risk (Saunders and Zammit, 2022).

14.2.2 Resource Dataset

The underground MRE mineralisation interpretation included all validated open-pit RC grade control holes 60 metres above the June 30, pit shell in Amun and 190 metres above in the Ptah Zone. All open-pit RC grade control holes below the pit shell and the AGC holes from surface were retained. The rest of the open-pit RC grade control holes were excluded. All DDGC and FS were used for the estimation with DDGC nominally drilled on a 25x25m spacing and face samples (FS) taken across each exposed development face, determined by lithology and structural orientation. Table 14.15 summarises the underground MRE database and compares it to the total Sukari database. Holes without assays were excluded from the MRE.

Table 14.15: Summary of Underground MRE Database

	Total Database		UG MRE		% in MRE	
Hole Type	**Holes**	**Metres**	**Holes**	**Metres**	**Holes**	**Metres**
DD	3,139	1,004,085	2,848	808,179	91%	80%
DDGC	5,036	146,403	4,743	122,736	94%	84%
FS	40,834	202,922	40,583	201,729	99%	99%
RC	74,121	2,346,863	64,309	1,996,343	87%	85%
RCD	393	151,276	347	127,246	88%	84%
Total	**123,523**	**3,851,549**	**112,830**	**3,256,233**	**91%**	**85%**

14.2.3 Geological Modelling

During 2021, an intensive relogging programme took place to review Sukari geology (lithologies, structure and alteration), produce a 3D geological model and improve the geological and structural understanding of the deposit.

Geological paper cross sections and level plans were generated by the Projects team, (Underground, Open Pit) on 25m intervals or on drill hole (oblique) section and georeferenced in Vulcan© and Leapfrog© software for 3D explicit modelling and implicit modelling, respectively. Lithological, weathering, and redox wireframes were modelled and subsequently flagged into the database and block model. The geological sections are updated daily while the geological models are updated quarterly, and interpretations are regularly cross checked with DD core, RC chips and underground mapping to ensure the model is representative.

14.2.4 Mineralisation Modelling

Underground mining at Sukari is focussed on discrete higher-grade zones, where gold mineralisation is concentrated in through-going quartz vein arrays, breccias, and shears. Mineralisation domains were built based on a combination of grade, lithology, alteration and structural data (from drill core, open-pit and underground mapping).

Statistical and visual analysis showed that a suitable geological related boundary cut-off grade was approximately 0.5g/t Au for Sukari underground. The resulting low-grade mineralised envelopes incorporate minor amounts of internal sub-grade material to preserve continuity. Where grades greater than 2g/t were observed with geological continuity, a high-grade domain was generated that capture internal rod-like ore shoots. Boundary analysis was completed to confirm there is a sharp change in grade profile across a domain boundary (e.g. Figure 14.11).

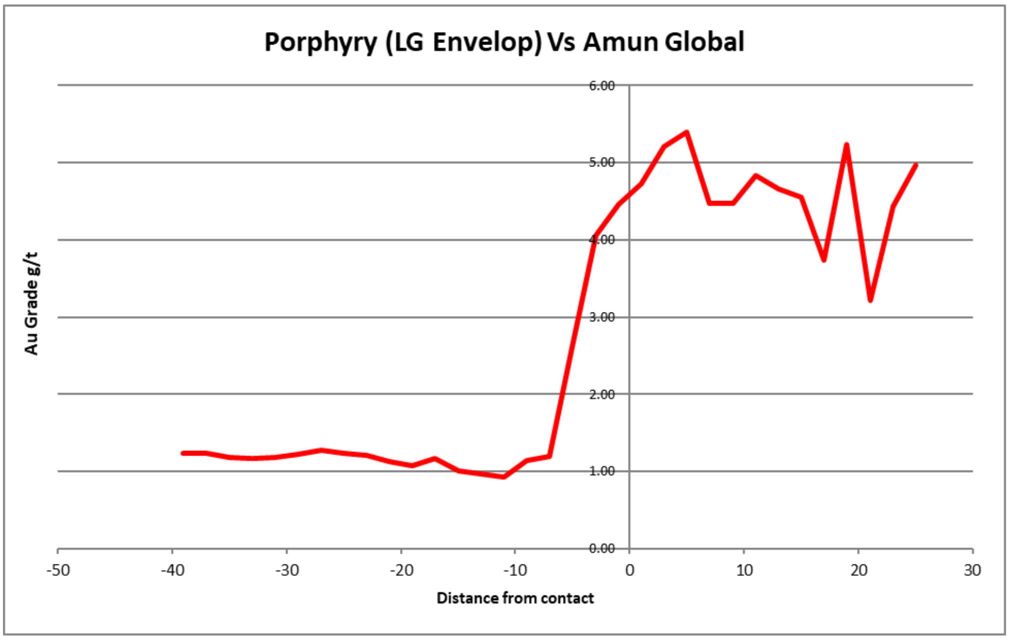


Figure 14.11: Example of Boundary Analysis for Sukari High and Low-Grade Domains

The mineralisation models were generated from geo-referenced paper cross-sections into Maptek Vulcan 3D software. Strings were generated on vertical sections in a North – South direction across the extent of the mineralisation.

Wireframes were snapped, where possible, to the drill hole sample intervals to create a precise boundary. The resulting interpretation produced consistent geometry and geological continuity for the plunging mineralised lodes (Figure 14.12).

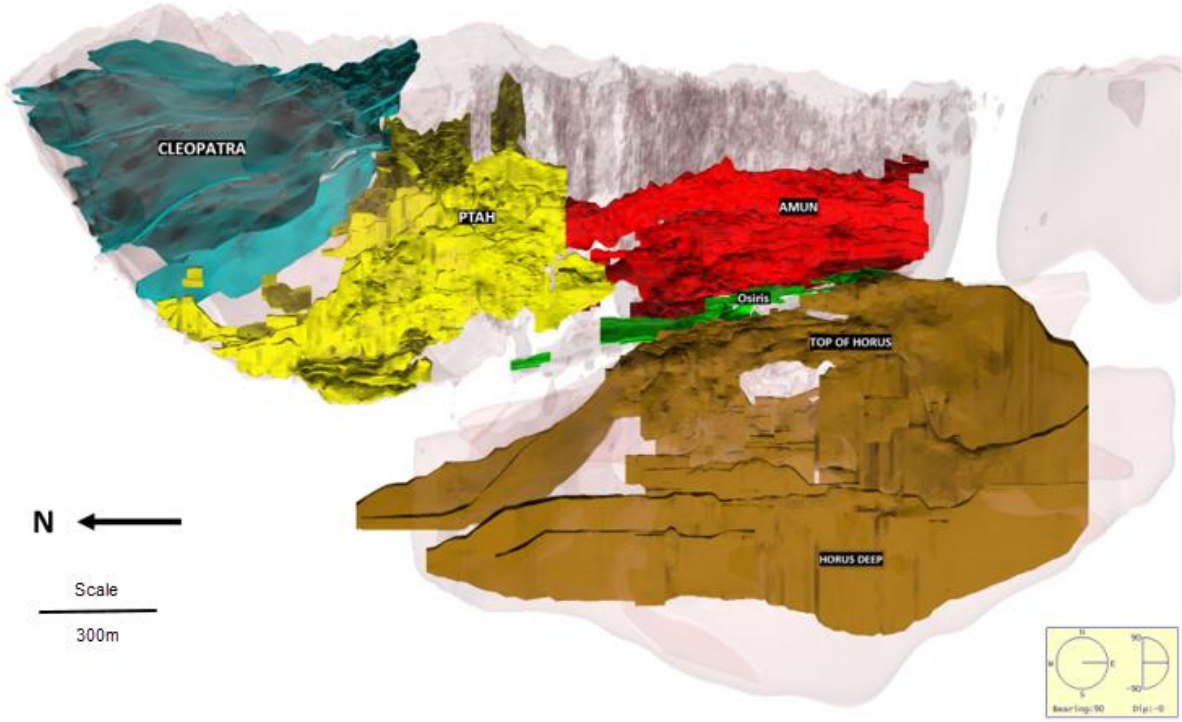


Figure 14.12: 3D View of Sukari Mineralisation Lodes (Centamin, 2022)

The mineralisation domains were categorized into six main groups of lodes, comprising a total of 142 individual domains (Table 14.16). The 1000 lode refers to the main porphyry intrusion, excluding mineralisation above 0.5g/t. The 2000 lodes comprise the Amun domains, situated in the southern portion of the deposit. The 3000 lodes represent the Osiris domains, located beneath Amun. The 4000 lodes represent the Top of Horus and Horus Deeps domains. The 5000 lodes represent the Ptah domains, found in the central portion of the deposit. Lastly, the 6000 lodes represent the Cleopatra domains, situated to the north of the deposit. Amun, Ptah, and Cleopatra are mined from both open pit and underground, whereas Horus is mined exclusively underground.

Table 14.16: Categorisation and Number of Mineralised Domains

Lode	Domains	LG Domains	MG Domains	HG Domains
Porphyry	1000	4	-	-
Amun	2000	25	13	4
Osiris	3000	9	6	5
Horus	4000	20	7	1
Ptah	5000	26	3	2
Cleopatra	6000	17	-	-

Thin continuous barren mafic dyke units are interspersed within the metasediment units in the footwall and within the main porphyry in the northern zone. These barren units were modelled independently and flagged as code 800 to both the composites and block model.

14.2.5 Sample Compositing

Prior to selecting the composite length for the underground Mineral Resource, the data was visually analysed using a histogram of sample length to identify the mode (see Figure 14.12). The coefficient of variation, standard deviation, and mean plots were produced with several composite lengths to ensure that they remained stable and did not increase with compositing.

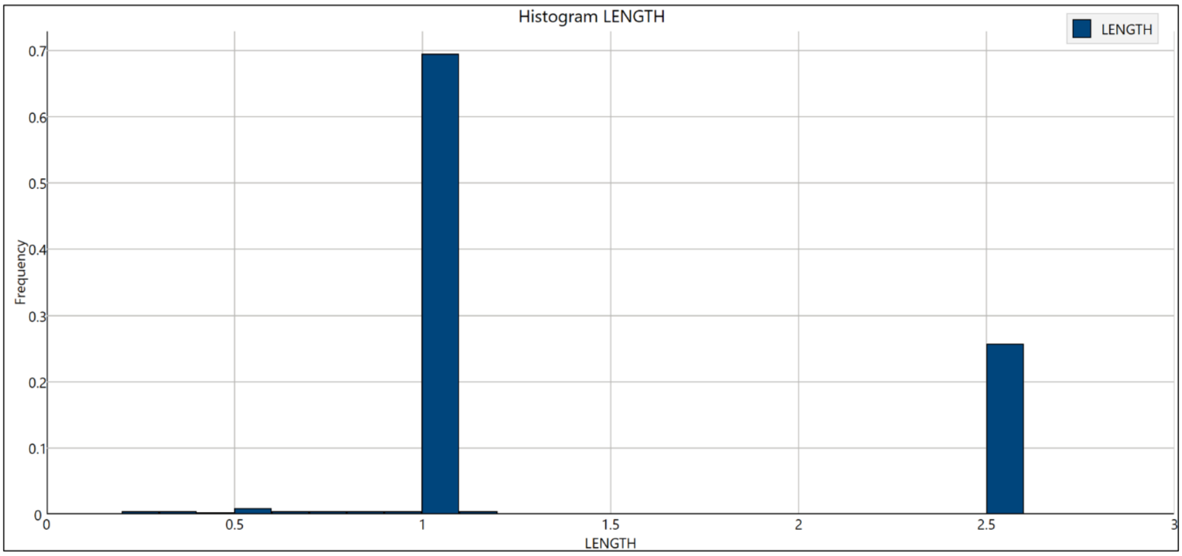


Figure 14.12: Histogram of Sample Lengths

Drill samples were composited down hole on a 1m length for underground samples. Minimum composite length was 0.3m. Small residual samples below 0.2m were merged with the previous interval. Compositing honoured the estimation domains by breaking on the domain code values.

14.2.6 Top Capping

Top capping was applied to reduce the effect of high-grade outliers during resource estimation. A multi-variate analysis method was used to select the top cap analysing a combination of histograms, probability plots, and disintegration. Generally, the top capping occurred within the top percentile ranges, between the 95th and 99.9th percentiles within the individual mineralised lodes. Mine to Mill reconciliation data in active areas of the mine was also used when assessing the final top cap.

Occasionally, where there were many other notable disintegration points in a grade population for a given domain, high yield limits were also utilised. This works by limiting the distance in which elevated values can be used during interpolation (limited range of influence), minimising the potential for grade smearing.

As an example, in the Ptah area 172,232 samples were reviewed for top capping analysis. In total, 283 samples were top capped between 21.9g/t Au and 430g/t Au. Top capping reduced the mean grade from 4.66g/t Au to 2.90g/t Au and resulted in a reduction of the coefficient of variation from 3.35 to 1.92. Detailed results for individual Ptah domains are shown in Table 14.17.

Table 14.17: Ptah Top Capping Analysis

Domain	Raw Data			Capped Data		
	No. Samples	Raw Mean	CV	Cap	Capped Mean	Capped CV
5001	25075	1.53	2.67	99.0	1.52	2.20
5002	52150	3.95	10.43	88.0	2.74	2.97
5003	7349	1.79	2.67	39.6	1.73	1.89
5004	644	0.82	3.12	34.0	0.79	2.67
5005	19146	10.16	13.73	72.0	3.50	2.88
5006	817	1.30	3.67	25.1	1.13	2.11
5007	6	0.72	0.23			
5008	3572	1.14	2.20	30.0	1.11	1.52
5009	2143	0.71	1.41		0.71	1.41
5010	11497	1.05	3.96	60.0	1.01	2.39
5011	11525	1.06	1.77			
5012	230	0.64	0.76			
5013	29	1.59	0.98			
5014	78	0.68	1.12			
5015	676	1.20	1.99			
5016	1541	1.22	1.49			
5017	281	1.55	2.00			
5019	129	1.12	1.14			
5021	1797	1.56	3.29	21.9	1.36	1.57
5024	12148	2.60	4.51	64.4	2.34	2.29
5032	456	1.10	1.78			
5033	544	0.89	1.27			
5034	980	1.06	5.31	32.5	0.91	2.23
5038	194	1.68	3.08	36.2	1.60	2.79
5041	24	0.91	1.39			
5101	830	67.22	5.85	430.0	31.13	2.86
5102	2218	4.24	6.52	51.2	2.52	2.96
4105	42	10.89	2.14	56.0	9.00	1.81
5103	4531	32.21	4.17	350.0	23.69	2.83
5104	4901	2.66	1.76			
5105	2745	1.42	1.52			
5106	3976	12.69	7.89	56.0	3.84	2.92

14.2.7 Variography

Variography was conducted using Snowden Supervisor v8.14. Variography is the study of the spatial variability of an attribute. Multiple lodes were grouped for variography based on ore zone and orientation. A normal scores transform was applied to declustered composites to help resolve spatial structure. Gaussian variogram models were back transformed to derive model inputs for estimation.

An example of variogram modelling for the AMUN 2103 domain is shown in Figure 14.13, which was populated by data from 42 sub-parallel lodes within the Amun ore zone.

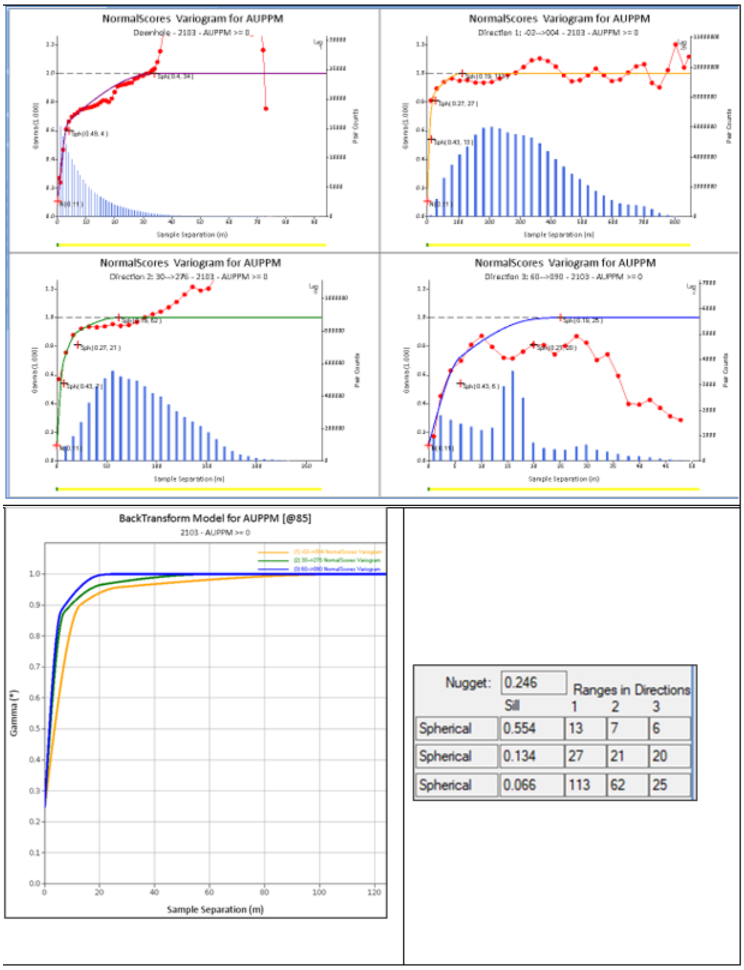


Figure 14.13: AMUN 2103 Normal Score and Back Transformed Variogram Model

Where an individual domain had insufficient samples to undertake variography, the variogram model parameters from a comparative domain with a similar trend were used and the orientation adjusted to match the domain with insufficient data.

14.2.8 Dry Bulk Density

Density was assigned in the block model using the approach described in Section 14.1.9.

14.2.9 Block Model Setup

Block model parent block size was tailored to the local data spacing. Maximum parent block size was 40m by 50m by 20m in waste areas and the minimum was 5m by 12.5m by 5m. Minimum sub cell size was 1.25m by 1.25m by 1.25m, which effectively resolves domain boundaries. The block model was not rotated. The block model was flagged by weathering, lithology and mineralisation domain. Table 14.20 summaries the block extents.

Table 14.18: Block Model Extents			
Block Extents	**Easting (X)**	**Northing (Y)**	**Elevation (Z)**
Origin	9,600	9,200	-500
Minimum Offset	0	0	0
Maximum Offset	2,000	3,300	1,900
Parent Block Size (m)	40	50	20
Sub Cell Size (m)	1.25	1.25	1.25
Rotation (Degrees)	90	0	0

14.2.10 Estimation

Underground Mineral Resources were estimated via OK using Vulcan software. All domains used hard boundaries to ensure that separate grade populations did not influence the estimate. Dynamic anisotropy was implemented to align variogram and search orientations to local domain orientation.

Each estimation domain was attributed its own estimation parameters defined via Quantitative Kriging Neighbourhood Analysis (QKNA). The QKNA was used to optimise the search ranges, sample numbers, and discretisation. Optimisations looked at kriging efficiency (KE), slope of regression (SR) and negative kriging weights. The QKNA was completed in each variogram domain with the first pass of estimation. Each estimation domain was also sub-domained by data density such that smaller blocks and more localised searches could be applied to the estimation of grade control drilled areas, relative to wider spaced exploration drilling.

In addition to gold, sulphur was also estimated for geometallurgical purposes.

14.2.11 Validation

Model validation used volume comparison (Table 14.19), swath plots (Figure 14.14), grade comparisons with nearest neighbour, and visual validation techniques (Figure 14.15) to ensure no significant errors occurred during the estimation process.

Table 14.19: Block Model Versus Wireframe Volume Comparison			
Deposit	**Wireframe Volume (m^3)**	**Block Model Volume (m^3)**	**Variance (%)**
AMUN	11,859,079	11,855,094	0%
OSIRIS	1,271,600	1,271,594	0%
HORUS	29,983,893	29,984,586	0%
PTAH	27,567,469	27,545,027	0%
CLEOPATRA	14,220,076	14,212,979	0%
PORPHYRY	639,635,440	638,636,518	0%

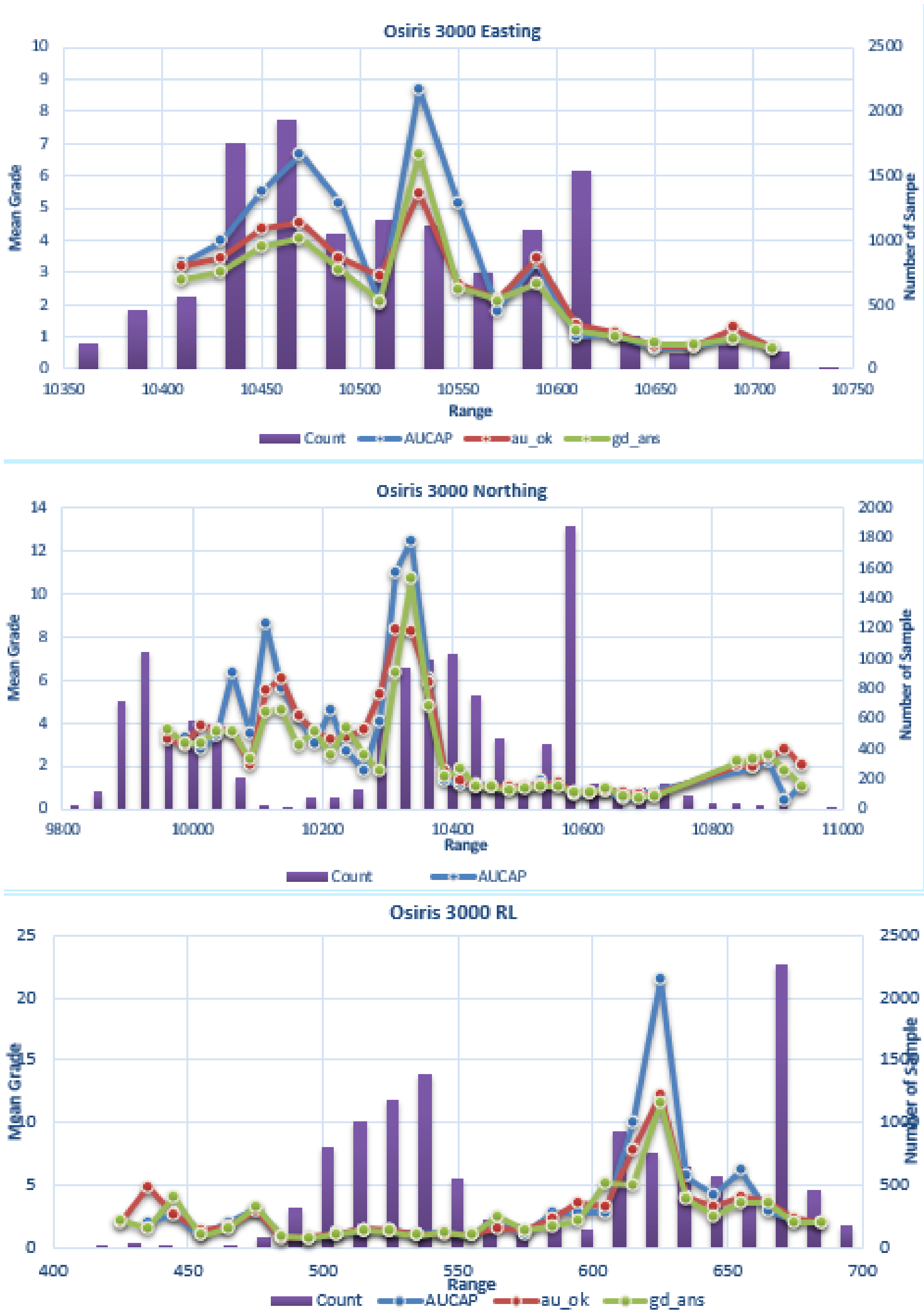


Figure 14.14: Example Swath Plots for the OSIRIS Ore Zone

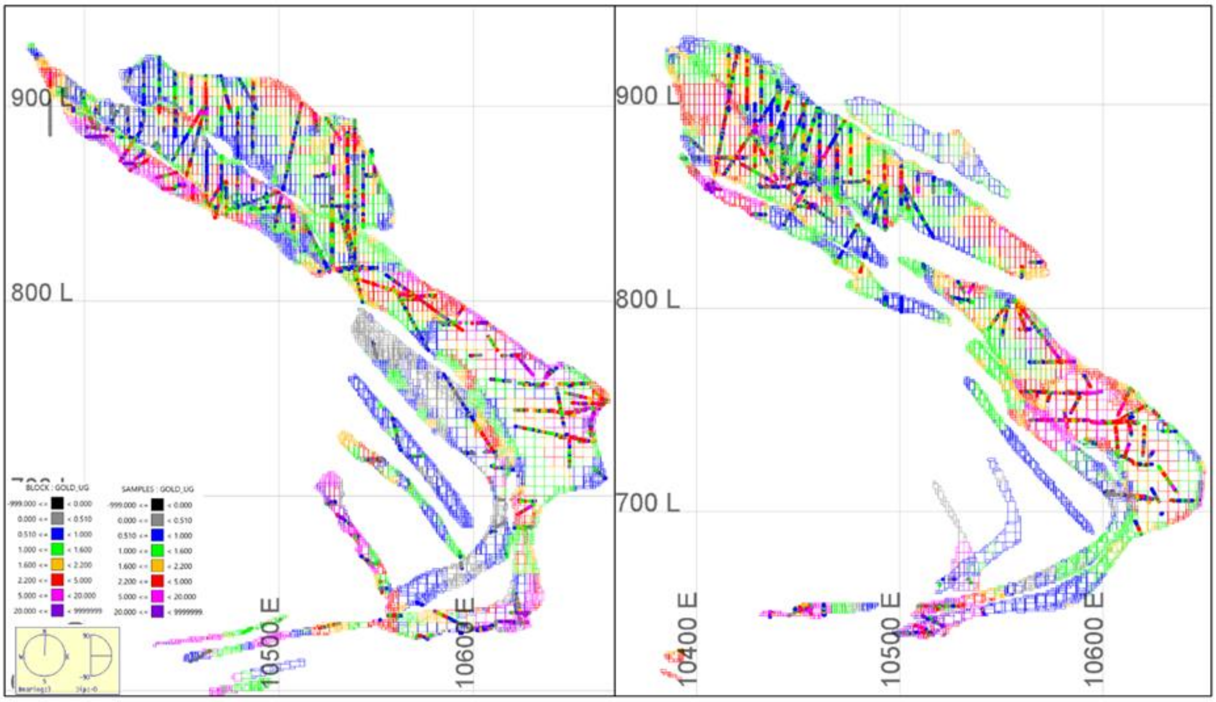


Figure 14.15: Sukari Visual Grade Check – Example Cross Section (Centamin, 2022)

Validation checks showed good agreement between drill hole composite values and model block values. The hard boundaries between wireframes constrained grades to their respective estimation domains. Top capping and high-grade restraining succeeded in minimising grade smearing in regions of sparse data.

14.3 Combined Mineral Resource

14.3.1 Classification

H&SC used Search Passes for Open Pit Mineral Resources. Pass 1 converts to Measured, Pass 2 to Indicated and Pass 3 to Inferred Open Pit Mineral Resources. The resource classification has not been smoothed because the use of octant constraints minimises the "spotted dog" problem and areas of Measured + Indicated are generally quite coherent. This classification includes consideration of deposit type, continuity of geology and grade, sampling and assaying methods, and analysis of QA/QC data.

Sukari Underground Mineral Resources were classified as Measured, Indicated, and Inferred based on data quality, drilling density, geological continuity, the variogram range, and the slope of regression. The main classification parameters applied to underground Mineral Resources are presented in Table 14.20.

Table 14.20: Sukari Mineral Resource Classification Parameters

Parameter		Measured	Indicated	Inferred
Minimum DH Samples		8	6	4
Minimum Consecutive Sections		4	Good Geological Continuity	-
Maximum Drilling Density	Underground	20m by 10m or 25m by 10m	50m by 25m	100m by 50m

For Indicated Mineral Resources, there were some allowances for areas where drilling density was lower, but successive drilling campaigns had shown grade and geological continuity. To ensure that the classification was continuous, classification wireframes were generated from the classification criteria and used to flag the block models.

14.3.2 Depletion and Sterilisation

Active mining areas are scanned using cavity monitoring laser scanners (CMS) monthly for underground and detailed drone photometry scans weekly for open pit. Depletion pit surveys and CMS stope scans at Sukari were updated in June 2023 and used to flag the block models in the mined-out field. The block models were not sub-celled on depletion boundaries and accurate reporting was achieved using a partial block depletion percentage.

For the open pit, grade estimates were generated with barren dyke samples excluded. Therefore, the resource model needed to be depleted for the barren dykes using the following process. Blocks were flagged with their proportion of barren dyke, which was treated as dilution if <10% but was assumed to be selectively mineable if >10%. Therefore, if the proportion of dyke was less than 10%, then the block proportions and grades above each cut-off were diluted by the proportion of dyke at a grade of 0.017g/t Au. However, if the proportion of dyke was greater than 10%, then the block proportions above each cut-off were reduced by the proportion of dyke but grades above cut-off were unchanged. In both cases, the average block grade was re-calculated. The 10% threshold between dilution and mineability was selected through discussions with mine personnel.

The open pit resource model was also depleted using existing (end of June 2023) underground development and stopes, as well as an additional set of voids, referred to as open-pit voids, which includes previously unsurveyed voids encountered during open-pit and underground mining. These were treated as stopes for the purpose of model depletion.

The stopes were depleted from the open pit resource model by preferentially removing the highest-grade material in each block, assuming that stopes targeted the highest available grades. Development was depleted at average grade, assuming that no specific material was targeted by this type of mining. While this approach is simplistic, it is considered to be more realistic than applying a single methodology to all underground voids.

For the underground model, regions considered sterilised by existing stoping or capital infrastructure were flagged and excluded from Mineral Resource reporting.

14.3.3 Block Model to Mill Reconciliation

The Company uses a number of metrics for reconciliation of both open pit and underground estimated tonnages and grade versus actual values on a weekly, monthly, quarterly and annual basis.

As an example of this, data from 2022 for the Mine Call Factor (MCF) shows that the Actual versus Grade Control (GC) Model reconciliation is strong (+/-2%) for the combined open pit and underground material when fed through the mill (Table 14.21).

Table 14.21: 2022 Sukari Mine Call Factor (MCF) Reconciliation

Dept	#	Recon Ore Mine, SP and Plant Feed	YTD 2022		
			Tonnes	Au g/t	Au oz
MRM	1	Mine (UG +OP)	12,410,873	1.24	496,730
MRM	2	Opening Stockpile	18,579,814	0.46	272,980
MRM	3	Closing Stockpile	18,853,779	0.46	278,592
MRM	4	Stockpile Change (3-2)	273,965	0.64	5,612
MRM	5	GC Theoretical Feed (1-4)	12,136,908	1.26	491,118
MRM	6	GC Actual Feed (UG+OP)	12,382,925	1.26	499,928
MRM	7	GC Actual Feed OP	11,553,901	0.96	358,273
MRM	8	GC Actual Feed UG	829,024	5.31	141,655
MRM	9	GC Adjustment (5-6)	-246,017	1.11	-8,810
Plant	10	Opening COS	227,395	0.84	6,162
Plant	11	Closing COS	178,095	0.90	5,182
Plant	12	COS Change (11-10)	-49,300	0.62	-980
Plant	13	Opening Scats	140,617	0.36	1,640
Plant	14	Closing Scats	213,234	0.39	2,707
Plant	15	Scats Change (14-13)	72,617	0.46	1,067
MRM	16	GC Call (6-12-15)	12,359,608	1.26	499,841
Plant	17	Plant total feed	12,113,591	1.26	491,141
GC vs Plant	18	MCF (17/16) *100	98%	100%	98%

However, when looking at the open pit reconciliation between the MIK resource model and the GC model, a different picture emerges where in 2022, the GC Model consistently exceeded the MIK model in tonnage by 15%, whilst grade was down 19%, with ounces being more consistent and within expectations at minus 6% (Figure 14.16).

In recent years, the reconciliation of the open pit has shown notable improvement, mainly attributed to the adoption of AGC drilling on a 24x24-metre grid. This implementation has effectively filled in the gaps in the Mineral Resource up to the bottom of the LOM pit, where discrepancies previously existed. AGC drilling will continue until the open pit Mineral Resource has been drilled out to 24x24 metres.

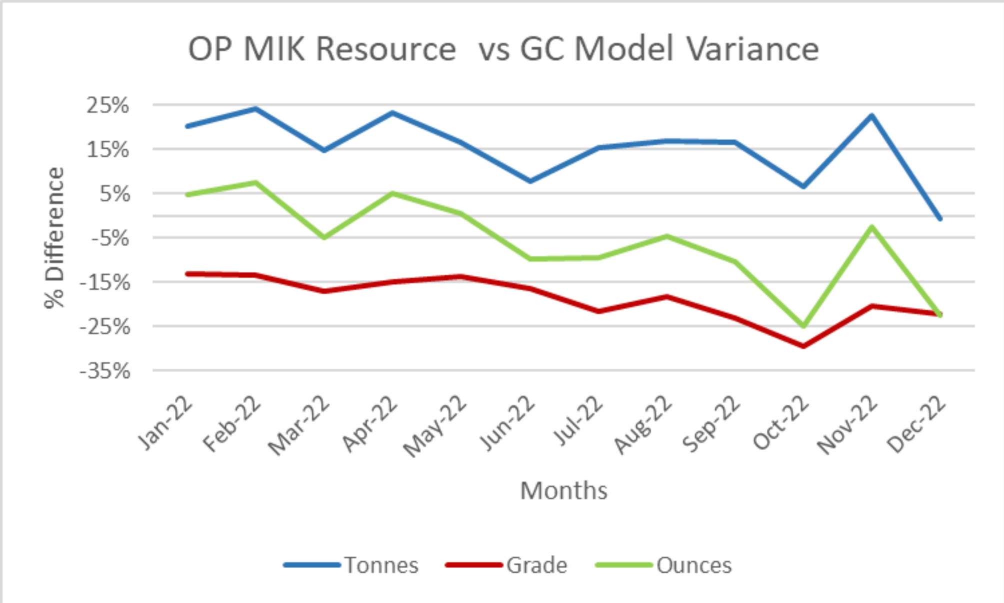


Figure 14.16: Open Pit MIK Resource Model to GC Model Comparison for 2022

Underground model reconciliation is challenging given the increased spatial complexity at higher UG cut-off grades, higher mining selectivity, more pronounced dilution and recovery issues, sample size and sample spacing.

The data in Figure 14.17 compares underground OK resource model versus GC model over monthly volumes in 2022. This shows that the monthly GC tonnes are consistent with the resource model at an average of +2%, while the grade and ounces are significantly higher in the GC model at an average of 45% and 47%, respectively. This may in part reflect the nuggety nature of Sukari gold mineralisation and that the grade control drilling is on a much tighter spacing than the resource drilling.

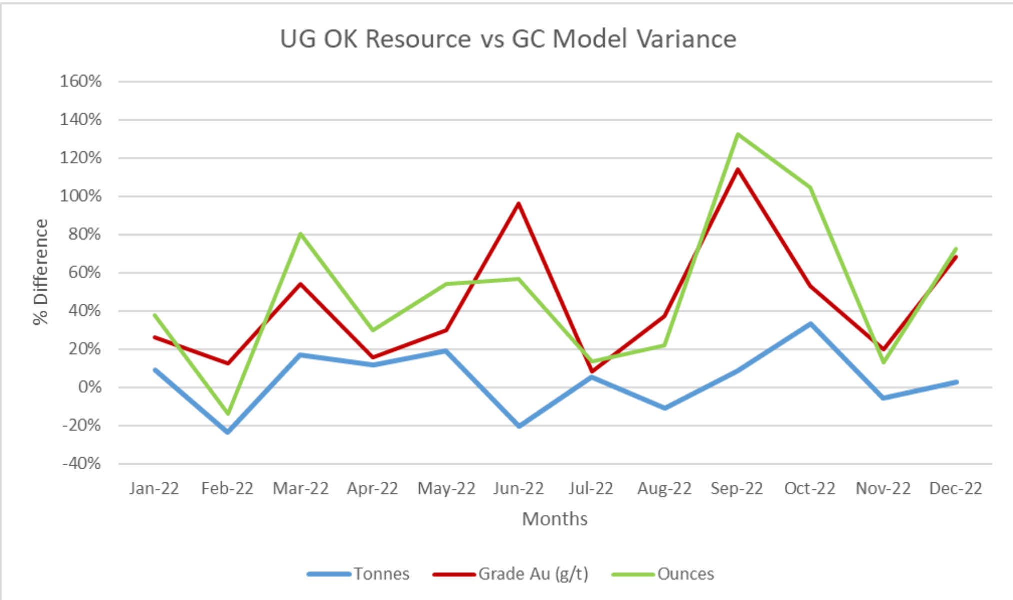


Figure 14.17: Underground OK Resource Model to GC Model Comparison for 2022

As a final look at reconciliation, the Company produces monthly data for Actual Mined versus Grade Control model versus Mineral Resource model for both the open pit and underground, as presented in Table 14.22.

The key points to come out of these data are that overall, the open pit and underground together show good reconciliation between Actual and GC Model for tonnes, grade and ounces, although these numbers hide the fact that underground Actual to GC Model reconciliation can be improved. In addition, the Actual versus Resource Model reconciliation is subpar, especially for the underground. Overall, the underground mine produces significantly more ounces than the resource model suggests.

To address the disparity between Actuals versus Resource Model in the underground mining operation, a plan is set to incorporate RC grade control drilling in 2025. This initiative aims to increase the sample size, boost productivity, and decrease drill spacing, ultimately leading to an improved reconciliation process for the underground operations. Additionally, domain top cuts are being adjusted once production data becomes available while ongoing geological interpretations and defining the true shape, orientation and grade continuity of the deposit. Furthermore, grade control drilling is scheduled to be 12 months ahead of the production timeline by mid-2024, which will further narrow the gap in terms of both grade and ounces. Currently, grade control drilling is ahead of production by 6 months.

Area	Actual Mined			GC Model			Res Model (MIK2019 & UG2020)			Actual vs GC Model Var			Actual vs Res Model Var			GC Model vs Res Model Var		
	Tones	Grade	Ounces	Tones	Grade	Ounces	Tones	Grade	Ounces	Tones	Grade	Ounces	Tones	Grade	Ounces	Tones	Grade	Ounces
OP	970,916	0.93	28,940	1,056,075	0.90	30,684	877,792	1.04	29,282	-8%	3%	-6%	11%	-11%	-1%	20%	-13%	5%
UG	39,170	4.06	5,107	30,511	4.23	4,153	32,225	3.14	3,253	28%	-4%	23%	22%	29%	57%	-5%	35%	28%
Jan-22	1,010,085	1.05	34,047	1,086,586	1.00	34,837	910,017	1.11	32,535	-7%	5%	-2%	11%	-6%	5%	19%	-10%	7%
OP	821,464	0.95	25,188	805,020	1.00	25,984	648,772	1.16	24,164	2%	-5%	-3%	27%	-18%	4%	24%	-13%	8%
UG	44,623	3.26	4,681	40,922	4.55	5,981	52,671	2.93	4,962	9%	-28%	-22%	-15%	11%	-6%	-22%	55%	21%
Feb-22	866,086	1.07	29,868	845,942	1.18	31,966	701,443	1.29	29,126	2%	-9%	-7%	23%	-17%	3%	21%	-9%	10%
OP	1,177,459	0.89	33,652	1,174,300	1.00	37,844	1,023,138	1.21	39,782	0%	-11%	-11%	15%	-26%	-15%	15%	-17%	-5%
UG	70,630	3.45	7,845	61,024	3.54	6,949	56,850	2.21	4,037	16%	-2%	13%	24%	56%	94%	7%	60%	72%
Mar-22	1,248,089	1.03	41,497	1,235,324	1.13	44,793	1,079,988	1.26	43,819	1%	-8%	-7%	16%	-18%	-5%	14%	-11%	2%
OP	1,109,056	1.09	38,954	1,143,949	1.11	40,861	926,824	1.31	38,925	-3%	-2%	-5%	20%	-16%	0%	23%	-15%	5%
UG	74,019	3.55	8,448	55,308	3.69	6,557	63,840	3.02	6,199	34%	-4%	29%	16%	18%	36%	-13%	22%	6%
Apr-22	1,183,075	1.25	47,402	1,199,257	1.23	47,418	990,664	1.42	45,123	-1%	1%	0%	19%	-12%	5%	21%	-13%	5%
OP	877,782	1.11	31,206	974,295	1.07	33,419	836,231	1.24	33,232	-10%	4%	-7%	5%	-11%	-6%	17%	-14%	1%
UG	69,903	4.08	9,170	63,140	4.20	8,536	56,789	3.00	5,477	11%	-3%	7%	23%	36%	67%	11%	40%	56%
May-22	947,685	1.33	40,375	1,037,435	1.26	41,955	893,020	1.35	38,710	-9%	5%	-4%	6%	-2%	4%	16%	-7%	8%
OP	779,766	1.01	25,322	769,714	1.06	26,168	713,466	1.26	28,991	1%	-4%	-3%	9%	-20%	-13%	8%	-16%	-10%
UG	86,941	6.28	17,550	95,975	5.56	17,142	103,735	3.27	10,898	-9%	13%	2%	-16%	92%	61%	-7%	70%	57%
Jun-22	866,706	1.54	42,872	865,689	1.56	43,311	817,201	1.52	39,888	0%	-1%	-1%	6%	1%	7%	6%	2%	9%
OP	910,771	1.10	32,298	758,180	1.13	27,571	657,470	1.44	30,460	20%	-2%	17%	39%	-23%	6%	15%	-22%	-9%
UG	74,309	4.58	10,944	63,347	4.72	9,607	68,980	4.15	9,204	17%	-3%	14%	8%	10%	19%	-8%	14%	4%
Jul-22	985,080	1.37	43,242	821,527	1.41	37,178	726,450	1.70	39,664	20%	-3%	16%	36%	-20%	9%	13%	-17%	-6%
OP	881,116	1.06	30,016	967,632	1.08	33,525	828,389	1.32	35,152	-9%	-2%	-10%	6%	-20%	-15%	17%	-18%	-5%
UG	72,378	6.92	16,107	47,722	6.78	10,409	76,507	4.97	12,225	52%	2%	55%	-5%	39%	32%	-38%	37%	-15%
Aug-22	953,494	1.50	46,123	1,015,354	1.35	43,934	904,896	1.63	47,377	-6%	12%	5%	5%	-8%	-3%	12%	-17%	-7%
OP	1,021,676	0.96	31,422	876,221	0.98	27,678	750,816	1.28	30,857	17%	-3%	14%	36%	-25%	2%	17%	-23%	-10%
UG	63,344	7.27	14,813	57,857	7.33	13,629	57,577	3.26	6,030	9%	-1%	9%	10%	123%	146%	0%	125%	126%
Sep-22	1,085,020	1.33	46,235	934,078	1.38	41,307	808,393	1.42	36,887	16%	-4%	12%	34%	-7%	25%	16%	-3%	12%
OP	1,012,897	0.95	31,082	956,102	0.89	27,232	897,119	1.26	36,272	6%	8%	14%	13%	-24%	-14%	7%	-30%	-25%
UG	71,276	5.56	12,750	56,348	4.15	7,510	53,336	3.27	5,612	26%	34%	70%	34%	70%	127%	6%	27%	34%
Oct-22	1,084,173	1.26	43,832	1,012,450	1.07	34,742	950,455	1.37	41,884	7%	18%	26%	14%	-8%	5%	7%	-22%	-17%
OP	1,031,867	0.94	31,209	1,000,924	0.91	29,435	816,197	1.15	30,178	3%	3%	6%	26%	-18%	3%	23%	-20%	-2%
UG	69,867	3.93	8,825	84,711	6.76	18,422	71,986	4.78	11,052	-18%	-42%	-52%	-3%	-18%	-20%	18%	42%	67%
Nov-22	1,101,734	1.13	40,034	1,085,635	1.37	47,857	888,183	1.44	41,229	1%	-18%	-16%	24%	-22%	-3%	22%	-5%	16%
OP	987,302	0.97	30,873	922,939	0.95	28,230	928,567	1.22	36,470	7%	2%	9%	6%	-20%	-15%	-1%	-22%	-23%
UG	92,343	3.48	10,319	105,691	7.47	25,391	89,883	4.73	13,661	-13%	-53%	-59%	3%	-26%	-24%	18%	58%	86%
Dec-22	1,079,645	1.19	41,192	1,028,630	1.62	53,621	1,018,450	1.53	50,130	5%	-27%	-23%	6%	-22%	-18%	1%	6%	7%
OP	11,582,071	0.99	370,161	11,405,351	1.01	368,632	9,904,781	1.24	393,764	2%	-1%	0%	17%	-20%	-6%	15%	-19%	-6%
UG	828,802	4.75	126,557	762,556	5.48	134,286	784,379	3.67	92,608	9%	-13%	-6%	6%	29%	37%	-3%	49%	45%
YTD 2022	12,410,873	1.24	496,719	12,167,907	1.29	502,918	10,689,160	1.42	486,372	2%	-3%	-1%	16%	-12%	2%	14%	-9%	3%

Table 14.22: 2022 Actual Mined vs Grade Control vs Resource Model Reconciliation

14.3.4 Mineral Resource Reporting

The Sukari open pit and underground MRE have been prepared according to the CIM Definition Standards, as incorporated with NI 43-101.

Open pit Mineral Resources were reported within a US$2,000/oz pit shell and above a 0.3g/t Au cut-off grade. The reporting pit shell was generated by Centamin personnel and audited by Quinton de Klerk of Cube Consulting Pty Ltd. Underground Mineral Resources were reported above 1g/t Au cut-off grade below the US$2,000/oz pit shell. Key pit optimisation assumptions are provided in.

Table 14.23: Pit Optimisation Input Parameters

Parameter	Unit	Value
Gold price	USD/oz	2,000
Sales costs – shipping	USD/oz	3.84
Sales costs – refining	USD/oz	0.20
Sub-total sales cost	USD/oz	4.04
Mineral royalty	%	3.0
Diesel price	USD/lt	0.60
Base Open Pit Mining Cost	$/t	1.84
Depth Cost	$/t	0.0177 (per 10m vertical uphill haul) 0.0139 (per 10m vertical downhill haul)
Mining Recovery Fraction	%	100
Mining Dilution Fraction	%	7
Rock Types Used	#	Measured, Indicated & Inferred
Processing Stream	#	CIL (Fresh / Transition @ 0.4 g/t cutoff grade) CIL (Oxide @ 0.9 g/t cutoff grade) DL (Oxide @ 0.2 g/t cutoff grade)
Process Recovery CIL Fixed	%	90
Process Recovery Dump Leach Fixed	%	60
Processing Cost CIL	$/t	14.47
Processing Cost Dump Leach	$/t	1.99
Optimisation Method	#	Lerchs-Grossman
Discount Rate	%	7

The Sukari MRE with an effective date of June 30, 2023, is listed in Table 14.24. The stated Mineral Resources are not materially affected by any known environmental, permitting, legal, title, taxation, socio-economic, marketing, political or other relevant issues, to the best knowledge of the authors. There are no known mining, metallurgical, infrastructure, or other factors that materially affect this MRE, at this time.

All Mineral Resources are tabulated inclusive of that material which is then modified to form Mineral Reserves. The Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.

Table 14.24: Sukari Gold Mine Mineral Resource Estimate as of June 30, 2023				
Type	**Classification**	**Tonnes (Mt)**	**Grade (g/t)**	**Gold Content (Moz)**
Open Pit	Measured	227.18	0.97	7.09
	Indicated	35.59	0.65	0.74
	Inferred	7.81	0.61	0.15
Underground	Measured	6.72	2.83	0.61
	Indicated	15.52	2.86	1.43
	Inferred	10.13	2.4	0.80
Stockpiles	Measured	18.01	0.47	0.27
Total	Measured	251.91	0.98	7.97
	Indicated	51.11	1.32	2.17
	Measured & Indicated	303.02	1.04	10.14
	Inferred	17.94	1.65	0.95

Notes:

1. All Mineral Resources are tabulated inclusive of that material which is then modified to form Mineral Reserves;
2. The open pit and underground Mineral Resource models are informed by drilling up to July 15, and June 30, 2022 respectively. Both models are depleted to June 30, 2023;
3. Open pit Mineral Resources are reported within a US$2,000/oz pit shell and above a 0.3g/t Au cut-off grade;
4. Underground Mineral Resources are reported above 1g/t Au cut-off grade below the US$2,000/oz pit shell;
5. Mr Rolly Wasonga, MAIG, MAusIMM, Centamin's Senior Resource Geologist, an officer of the company and QP, generated the Mineral Resources for Sukari;
6. Mr Craig Barker, FAIG, Centamin's Group Mineral Resource Manager, an officer of the company and QP, reviewed and signed off on the underground Mineral Resources;
7. Mr Arnold van der Heyden, Managing Director and Consulting Geologist for H&SC, a Member and Chartered Professional (Geology) of the AusIMM and QP generated and signed off on the Open Pit Resources; and
8. Numbers may not add due to rounding. In the AIF summary format, 2 significant figures are used for millions of tonnes (Mt) and million ounces (Moz). Two decimal places are used for Measured and Indicated grades, and one decimal place is used for Inferred grades.

A comparison of the open pit resource classification for the 2021 and 2022 models is presented in Table 14.25 at 0.3g/t Au cut-off grade; both models are reported below the end of June 2022 topography. The 2021 open pit model is based on grade estimates generated in 2019 and a substantial number of additional holes and assays have been added to the resource database since then. For the underground an additional 100km of drilling has been performed over the year. The 2022 data has resulted in a 10% increase in contained metal for the Measured Mineral Resources, at the expense of Indicated and Inferred Mineral Resources.

Table 14.25: Comparison of Classification for 2021 & 2022 Model (June 30, 2022 Depletion)									
Classification	**2021 Model**			**2022 Model**			**Difference (2022-2021)**		
	Mt	**g/t Au**	**Moz Au**	**Mt**	**g/t Au**	**Moz Au**	**Mt**	**g/t Au**	**Moz Au**
Measured	215.9	1.03	7.16	242.9	1.02	7.99	27.0	-0.01	0.83
Indicated	60.8	0.81	1.59	37.3	0.65	0.79	-23.4	-0.16	-0.80
Inferred	8.7	0.68	0.19	8.3	0.61	0.16	-0.4	-0.07	-0.03
Measured & Indicated	276.7	0.98	8.75	280.3	0.97	8.77	3.6	-0.01	0.02

15 MINERAL RESERVE ESTIMATES

15.1 Introduction

Sukari, which consists of both an open pit and underground operation, undertakes annual updates of its Mineral Resource and Mineral Reserve estimates which includes changes to various modifying factors such as gold price, process recoveries, geotechnical parameters, costs and estimates, dilution, ore loss, as well as additions and subtractions due to exploration and depletion. The various modifying factors and operational parameters developed by SGM for the June 30, 2023 Mineral Reserve estimate process are described below.

The SGM mine comprises an eight-stage open pit and four underground mining zones; Amun, Ptah, Horus & Bast, as shown in Figure 15.1 below.

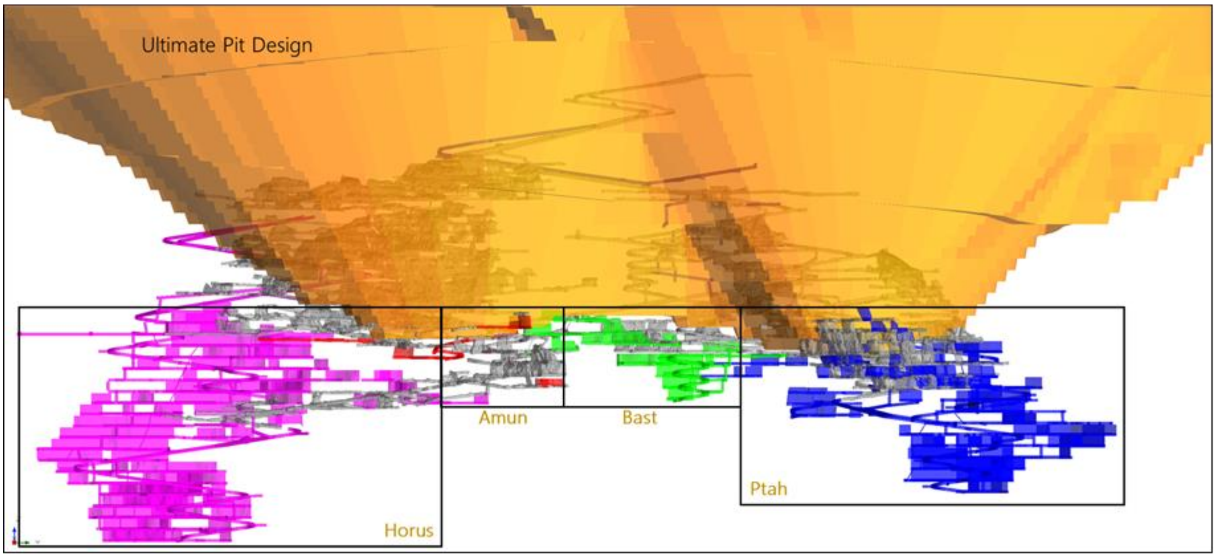


Figure 15.1: Sukari Mine Layout

Since 2020, Centamin management and SGM have undertaken an in depth review of the Sukari operation. The outcome has been numerous optimisation and improvement projects to improve understanding, confidence and productivity across the operation. Notably in terms of the resource modelling, geotechnical data, ventilation and introduction of paste fill; and WAI considers that SGM has made realistic assessments of the modifying factors based on these investigations with regards to the open pit slopes and base case assumptions.

15.2 Open Pit Mineral Reserves

15.2.1 Open Pit Optimisation

15.2.1.1 Input Parameters

General parameters and modifying factors, applicable to both the open pit and underground operations, includes the assumed gold price, sales costs, mineral royalty and diesel price. For the 2023 Mineral Reserve Estimation, the following general parameters are shown in Table 15.1 below. The pit optimisation parameters used as part of the production of the 2023 Mineral Reserve are given in Table 15.2 below. Values are based on 2023 actual annualised costs from the SGM model, and assumes a connection to grid power from 2025.

Table 15.1: General Modifying Factors (2023 Mineral Reserves)

Parameter	Unit	2023 Reserves	Notes
Gold Price	US$/oz	1,450	Consistent with 2022 reserves
Refining & Selling Costs	US$/oz	2.20	
Mineral Royalty	%	3.00	Apply to sales revenue
Diesel Price	US$/litre	0.75	

Table 15.2: Pit Optimisation Parameters (2023 Mineral Reserves)

Parameter	Units	Value	Notes
Final Bench Height	m	10	
Overall Slope Angle	North wall ° North-east wall° East wall° South-east wall° South-west wall° West wall°	45 43 42 42 34 32	
Base Mining Cost	US$/t mined	1.83	±US$0.02/10m (datum at 1090m RL) Including sustaining capex
CIL Processing Cost	US$/t processed	12.68	Including sustaining capex
Dump Leaching Cost	US$/t processed	2.41	
G&A Cost	US$/t mined	3.08	
CIL Process Recovery	%	90	
Dump Leach Recovery	%	60 25	Dump Leach Oxide Dump Leach Sub-Grade
Mining Dilution	%	7	Accounted for via model reblocking to 20m x 25m x 10m (XYZ)
Ore Losses	%	Nil	

15.2.1.2 Geotechnical Parameters

A Geotechnical review for the Stage 8 pit design “stg8_v8_230610” developed for the Sukari Mine Reserve 2023 update, for the purposes of confirming the feasibility of the updated design for reserve estimation purposes.

The latest Stage 8 pit design "(Stg8_v8_230610)" developed for the 2023 Reserve calculations is an updated version of the Stage 8 pit design used for the 2022 Reserve estimation (Stage 8_v4_221007), modified in line with results of slope stability analyses conducted.

Revised pit design walls have typical inter-ramp angles (IRA) and overall slope angles (OSA) as per Table 15.3

Table 15.3: Pit Slope Angles				
Wall	**Inter-Ramp**		**Overall Slope**	
	IRSA (°)	**Slope Height (m)**	**OSA (°)**	**Slope Height (m)**
East	46°	190	42°	550
West	36°	450	32°	500
North	49°	295	42°	570
South	44°	180	38.5°	520

15.2.1.3 Process Recoveries

The process recoveries for optimisation have been provided based upon production actuals defined by the SGM metallurgical and processing department. SGM is currently undertaking metallurgical test work of samples to better understand the differences in recovery from the various ore sources.

The process plant production data from 2020 to-date is shown in Table 15.4.

Table 15.4: Sukari Plant Production Data				
	2020	**2021**	**2022**	**H1-2023**
Ore processed (t)	11.91	11.92	12.11	6.08
Feed grade g/t	1.35	1.18	1.26	1.23
Overall Recovery	87.9	88.6	88.20	88.54
Recovered gold (oz)	452,320	415,370	440,974	220,561

In 2023, 6.08Mt was processed to June YTD (H1), equating to a projected annual throughput of 12.16Mt. The 2023 YTD head grade at 1.23, with gold recoveries stable, ranging from 87.9% to 88.6%, with 88.54% for YTD 2023.

The recovery value used for optimisation and cut-off grade calculation of 90% is in line with the production actuals described.

15.2.1.4 Dilution & Losses

An understanding of ore dilution and mining losses is required to ensure accurate modifying factors are applied to Ore Reserve Estimation works.

Calculations of dilution at Sukari have been based upon the regularisation of an original sub-celled MRE block model to a Standard Mining Unit (SMU) of 20m x 25m x 10m (XYZ).

The regularisation process groups material into specified universal block sizes, and can then be interrogated to calculate the volumes, grade and classification of the block as a whole assuming that any material selectivity within that block is not unreasonable. The re-blocking process also accounts for any mineralisation below cut-off grade in the evaluation process.

15.2.1.5 Operating Costs

WAI understands that the operating cost assumptions are the result of recent detailed estimation and modelling by SGM, based upon mine actuals combined with production estimates for the various stages and taking into account improvements to the haulage fleet in addition to various other maintenance methodology innovations.

The average elevation of the base mining cost of US$1.83/t is 1090mRL, with an assumption of incremental depth variation of ±US$0.02/t per 10m bench (with increased cost as depth increases).

15.2.2 Open Pit Cut-off Grades

The assumptions used in the calculation of cut-off grade to be applied to the material contained within the optimised pit and final designed pits to define ore and waste are presented in Table 15.5 below.

Table 15.5: Open Pit Cut-off Grade Parameters and Costs

Description	Unit	CIL Process	Dump Leach OX	Dump Leach SG
Parameters				
Gold Price	US$/oz US$/g	1450 46.62	1450 46.62	1450 46.62
Revenue & Selling Cost	US$/g	0.07	0.07	0.07
Mineral Royalty	%	3.00	3.00	3.00
Mining Dilution/Loss	%	-	-	-
Process Recovery	%	88.1	50.0	25.0
Costs				
Total Mining Cost	US$/t ore	2.20	2.20	-
Heap Leach Adjustment	US$/t ore	-	0.08	0.08
Total Processing	US$/t ore	12.68	2.41	2.41
Power	US$/t ore	2.87	0.20	0.20
G&A	US$/t ore	3.08	-	-

Table 15.6: Summary of Calculated COGs

Cut-Off Grade	Unit	CIL Process	Dump Leach OX	Dump Leach SG
Calculated COG	g/t	0.45	0.20	0.21
Marginal COG	g/t	0.32	0.11	0.23
In-situ COG	g/t	0.48	0.22	0.23
In-situ Marginal COG	g/t	0.35	0.12	0.25

The parameters quoted result in a theoretical (calculated) ore cut-off grade for material sent to the CIL process plant of **0.45g/t Au**. Operationally, SGM uses a mill cut-off of 0.50g/t Au and an ore cut-off grade of 0.40g/t Au; with material in the 0.40-0.50g/t Au range stockpiled as low grade, and material of greater than 0.50g/t Au sent to the ROM stockpile. Operationally, material grade bins can be summarised as follows:

- **HG:** Trans & Fresh Ore ≥0.90g/t Au to ROM Pad
- **MG:** Trans & Fresh Ore 0.50 – 0.90g/t Au to ROM Pad
- **LG:** Trans & Fresh 0.40 – 0.50g/t Au to Low Grade Stockpile
- **HGOX:** Oxide ≥0.90 to ROM Pad
- **DLOX:** Oxide 0.20 – 0.90g/t Au to Dump Leach
- **SG:** Trans & Fresh Material 0.2 – 0.3g/t Au to Sub Grade stockpile
- **Waste:** <0.20g/t Au

15.2.3 Pit Design

15.2.3.1 Overview

The latest Stage 8 pit design "(Stg8_v8_230610)" developed for the 2023 Reserve calculations is an updated version of the Stage 8 pit design used for the 2022 Reserve estimation (Stage 8_v4_221007), modified in line with results of slope stability analyses conducted.

The process of pit design is carried out by the technical services team at the mine and includes the generation of a Whittle Optimisation based on the most recent geotechnical constraints which give overall slope angles for each wall domain. The shell selected was equivalent to the US$1,450/oz reference gold price.

A new Final Pit (Stg8_v8_230610) was designed based on this shell by SGM to inform the LOM schedule and generate the annual Open Pit Mineral Reserve.

Figure 15.2 presents the current configuration of the open pit, whilst Figure 15.3 presents the final "*Stg8_v8_230610" design.*

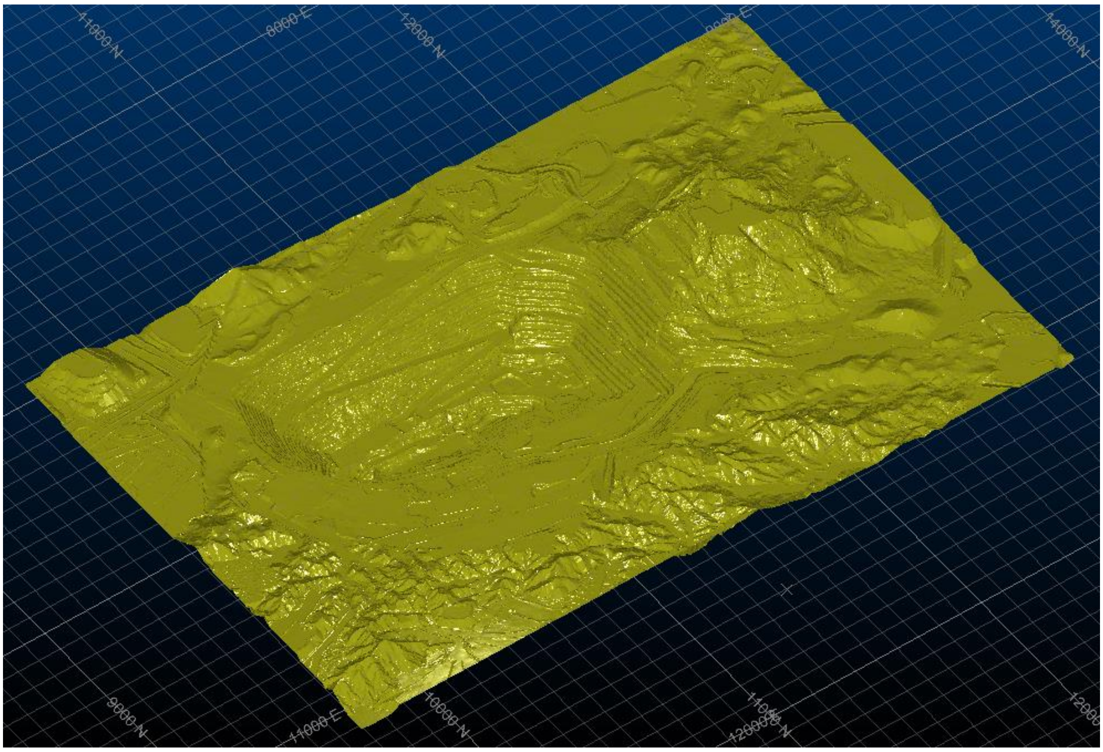


Figure 15.2: Current Pit (June 2023)

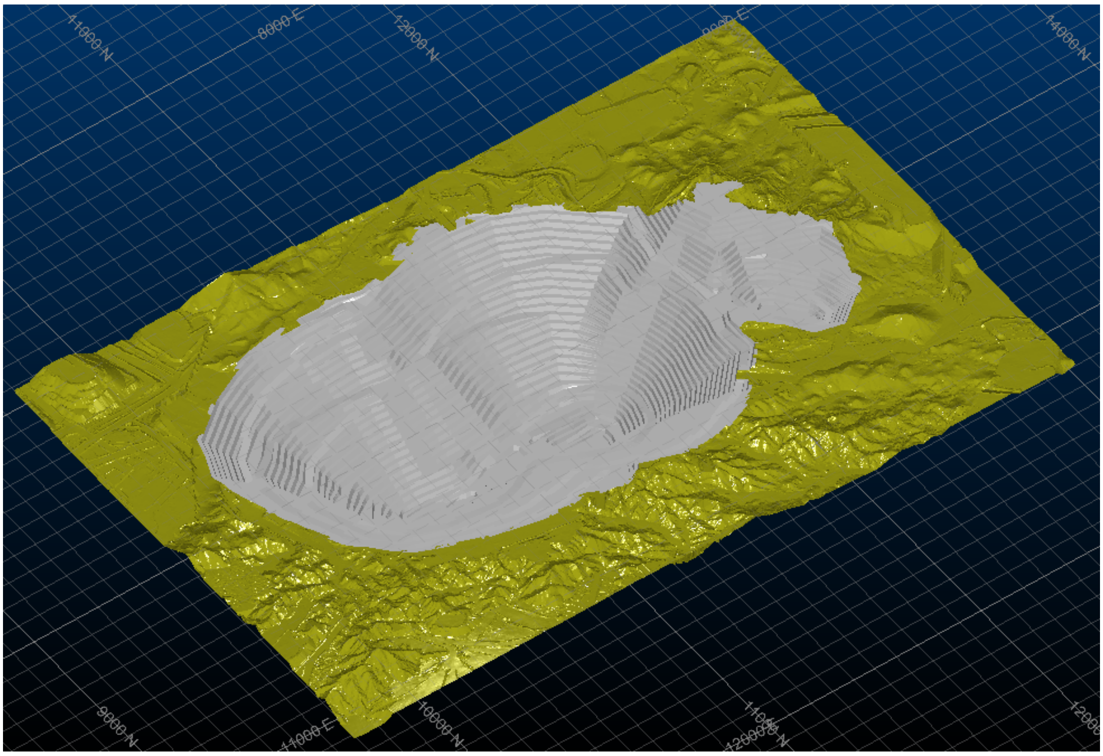


Figure 15.3: Life of Mine Design

15.2.3.2 Pit Design Parameters

The June 2023 update of the open pit design for Sukari (Stg8_V8_230610) is based upon the open pit design parameters outlined below. This pit design has then been utilised to determine the mining schedule and subsequently define the Mineral Reserve.

15.2.3.3 Operational Parameters

Operational design parameters for the open pit include:

- Dual-lane haul ramp of 32m width at a gradient of 1 in 10.
- Minimum operating width 32m, including safety windrows.
- UG void intersections in final pit walls have been considered by adopting void fill parameters within the numerical modelling.
- Mining capacity:
  - Initial 110Mtpa total material to be mined by the mine operator (94Mtpa in 2021) this increase to 110Mtpa is supported by the addition of five new trucks
  - Up to40Mtpa total material to be mined by contractor until completion of the contracted 120Mt (42.3Mtpa in 2022)
- Geotechnical observations:
  - Current North wall performance acceptable with minor and localised bench scale failures as expected.
  - East wall prior to east void interaction performed as expected and void intersections included in the analysis.
  - Current South wall acceptable except in areas of over mining and void interaction.
  - West wall showing acceptable factor of safety (1.5) with current design criteria after wall moved behind Sukari Thrust 1.
  - Potential caving mitigation by backfilling all newly created and legacy voids, using the paste fill plant commissioned in 2023, and CRF/Waste fill.
  - Kinematic feasibility due to structural data considered in the intermediate pits.
  - Monitoring instrumentation plan in place to include TDRs and borehole inclinometers.
  - Geotechnical drilling programme for geotechnical domains and void pillar definition planned to improve geotechnical assessments.
- Mine Scheduling:
  - 10m benches for scheduling purposes.
  - Maximum vertical rate advance of 100m per year per stage.

15.3 Underground Mineral Reserves

15.3.1 Optimisation Input Parameters

General parameters and modifying factors, applicable to both the open pit and underground operations, includes the assumed gold price, sales costs, mineral royalty and diesel price. For the 2023 Mineral Reserve estimation, the following general parameters and assumptions are shown in Table 15.1 above.

15.3.2 Underground Cut-off Grade

The assumptions used in the calculation of cut-off grade to define the underground mine design and Mineral Reserve are presented in Table 15.7 below. Assumptions for the non-mining elements are the same as for the open pit.

Table 15.7: Underground Cut-off Grade Parameters and Costs

Description	Unit	CY2022	CY2023
Gold price	US$/oz	1,450	1,450
Gold price	US$/g	46.62	46.62
Process recovery	%	88.1%	88.1%
Modifying factors			
Unplanned average stope dilution	%	10%	20%
Unplanned average dev dilution	%	7%	20%
Stope unplanned ore loss	%	8%	10%
Development unplanned ore loss	%	2%	2%
Costs			
Ore development	US$/t	12.5	9.0
Stoping	US$/t	49.2	39.6
UG mining (ore + waste)[1]	US$/t	61.8	45.2
Processing	US$/t	14.5	12.7
Haulage	US$/t	1.2	2.3
Power	US$/t	3.2	3.2
G&A	US$/t	4.6	3.1
Total cost[2]	US$/t	85.3	66.5
Calculated COGs			
Full economic COG	g/t	2.57	2.23
Stope COG[3]	g/t	2.19	2.04
Development COG	g/t	0.99	0.93
Processing COG	g/t	0.60	0.57
UG Operational Stope COG	**g/t**	**2.20**	**2.20**
UG Operational Development COG	**g/t**	**0.99**	**0.99**

Notes:
1 Includes operating and sustaining capital development costs
2 All costs, inclusive of development and sustaining capital
3 Stope or incremental COG considers that the development cost is already sunk

Mining costs are based on an average of the last 12 months of actual underground mining costs as incurred by SGM. The underground stope cut-off grade is calculated as 2.2 g/t whilst the cut-off value for treating development material as ore is 0.99 g/t. The stope cut-off is used for Deswik.SO stope optimisation and reserves reporting.

15.3.3 Underground Mine Design

15.3.3.1 Design Basis

Reserve Estimation has been carried out based on Block Model *Revision 7*. This model is the block model depleted from the current open pit design described above (*Stg8_v8_230610*), generating Stope Shapes through Deswik stope optimizer.

Stope designs are limited to a maximum hydraulic radius of 5m (Area/Perimeter) in the effective unsupported spans for backs, hangingwall, footwall and side walls. Cable bolting at a maximum spacing of 2.0m (and up to 2.5m on strike) using 6.0m cables in the backs and 8.0m cables in the walls is used to reduce the effective unsupported spans.

15.3.3.2 Development

The LOM Development design was completed using the design criteria set out in Table 15.8 with the purpose of optimising layouts for the mining methods employed per section. Within Horus, development has been laid out in such a way that either longitudinal or transverse mining methods can be employed should the mineralised zone lend itself to bulk mining.

Table 15.8: Development Design Standards

Item	Guideline
Decline Minimum Radius	≥ 25m
Vertical height between decline, accesses, and drives	3:1 (3 x width of decline)
Pillar between vertical and horizontal development	3:1 (3 x width of horizontal development)
Vertical development	Not to be placed through the centre of the decline
Pillar between horizontal development and open pit	Major infrastructure location minimum of 50m from Stage 8 pit and 30m from the current planned stopes. Sublevels and ore drive minimum of 30m from the pit pickup.
Ore pillars and horizontal development	2:1 (Pillar twice width of the height)
Decline standoff from shear or thrust	≥ 20m
Decline standoff from orebody	≥ 50m in 3D
Return air raise (RAR) standoff from orebody	≥ 30m in 3D
Footwall drive or hangingwall drive standoff from orebody.	≥ 25m in 3D

Inter level spacing is governed by the geotechnical requirement that the middling (pillar) between vertical and horizontal development be at least three times the width of the controlling drive. In case of ore drives, the standard width of 5m therefore dictates a "Floor to Floor" spacing minimum of 20m with the exception of sill pillars where access to the top is required for filling purposes. These drives are monitored closely by the Geotechnical team who determine any local amendments to the standard support patterns.

15.3.3.3 Stoping

Stope dimensions are limited to 20m height as a result of interlevel spacing. For transverse stopes, the "T-Drive" required for establishing the slot raise and opening up a void suitable to blast the remainder of the stope, is also limited to 20m (Table 15.9).

Table 15.9: Standard Stope Sizes

Item	**Guideline**
Longitudinal and Transverse Stope Height	20m floor to floor
Longitudinal Stope Width	≤ 7m
Longitudinal Stope Strike Length	Variable not exceeding 20m
Transverse Stope Strike Length	20m
Transverse Stope Width	Variable not exceeding 20m

With changing ground conditions, the only way to control overall stope stability is by limiting the stope width in transverse stopes, and stope length in longitudinal stopes. Geotechnical Stope Stability assessments are completed for every stope and guidelines as to stope detailing are communicated before stope drilling commences.

It should be noted that planned Reserve Stope dimensions are in line with the geotechnical guidelines in comparison to historic stope dimensions. Footwalls and hangingwalls are limited within the Stope Optimizer settings to create near-vertical walls where filling of stopes are to be done.

15.3.4 Underground Dilution and Recovery

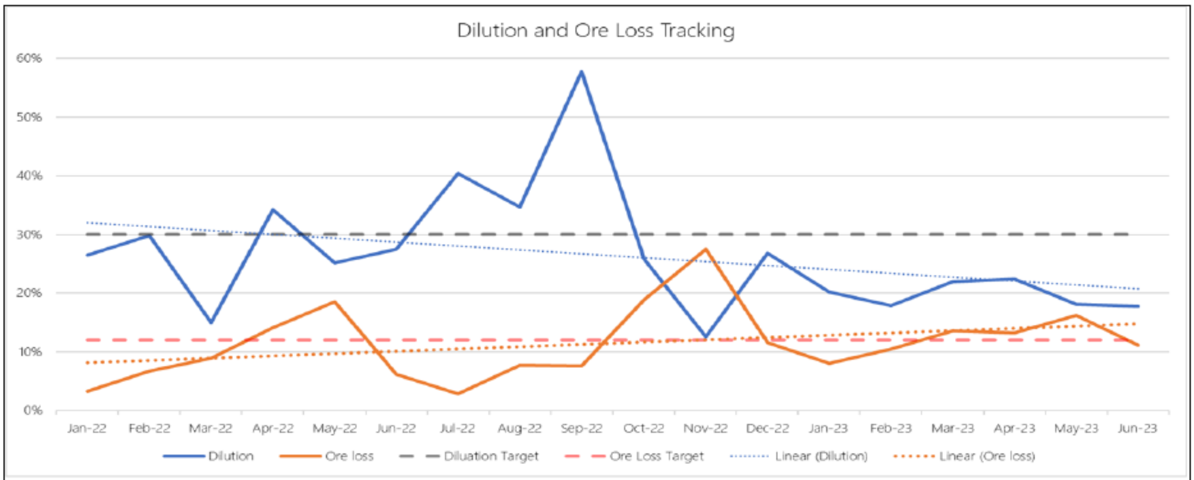
15.3.4.1 Overview

Sukari has undertaken rigorous analysis of dilution and ore loss within the underground operation as summarised below.

For the 2023 Reserve Estimate, calculation of Dilution and Ore loss factors used two methods:

- Summarising Stope Reconciliation Data; and
- Calculating Dilution percentages and grades using dilution shells within the Deswik Stope Optimiser.

Dilution and recovery/ore loss are tracked and reported on a monthly basis (Figure 15.4).



	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23
Dilution	26%	30%	15%	34%	25%	27%	40%	35%	58%	26%	13%	27%	20%	18%	22%	22%	18%	18%
Ore loss	3%	7%	9%	14%	19%	6%	3%	8%	8%	19%	28%	12%	8%	10%	14%	13%	16%	11%

Figure 15.4: Monthly Reporting of Dilution and Ore Loss Against Target.

This performance is considered in the LOM planning, with the values used in developing the ore reserves estimate stated by SGM to be as shown in Table 15.10.

Table 15.10: Dilution and Recovery (Ore Loss) Assumptions Used in Ore Reserve Estimates

Modifying Factors Verification			Dilution		Ore Loss	
			Tonnes (%)	g/t	Tonnes (%)	Grade (%)
Development			20	0	2	100
Stopes	Bulk	Primary	20	0.75	7	100
		Secondary	20	0	7	100
Stopes	Narrow		20	0	16	100

15.3.4.2 Stope Reconciliation Data

The mine planning teams consider stope reconciliation by orebody and stope type, compiling data into “narrow” and “bulk stopes” from reconciliation data. All design shapes are also interrogated against the Geological RQD block model in an attempt to identify possible relationships between RQD and fracture frequency, with dilution and ore loss data.

For 2023, the result of reconciliation indicated that excessive dilution and ore loss percentages were apparent, notably in bulk stopes which returned a diluted grade of 62% of original design shape grade (versus 46% in narrow stopes). Ore loss percentages were 6% and 16% for bulk and narrow stopes respectively. For bulk stoping the ore loss value of 6% represents a notable improvement since 2021 when the figure typicaly approached 15%, the move to owner mining in Q1 2022 has given site greater autonomy and control of the underground operations. Table 15.11 summarises the 2023 reconciliation data.

Table 15.11: Stope Reconciliation Data (Jan 2019-Sep 2020)					
Excavation Type	**Dilution %**	**Dilution Grade (g/t)**	**Dilution Grade (as % of planned grade)**	**Ore Loss %**	**Metal Loss %**
Bulk Stopes	16	3.11	62	6	6
Narrow Vein	28	1.94	27	16	12

15.3.4.3 Reserve Estimate: Planned Dilution

Planned dilution skins of 0.5m have been coded into stope optimiser parameters. The final drill and blast design shapes are then reconciled against the original optimised shapes and comparisons noted during the next Mineral Reserve Estimate for possible changes to the current 0.5m and 1.0m dilution parameters for narrow and bulk stopes respectively.

15.3.4.4 Reserve Estimate: Unplanned Dilution

As planned dilution has been added within the optimised shapes during creation, the unplanned dilution (added manually from within the long-term schedule) is reduced, the parameters presented in Table 15.10 are used for Mineral Reserve estimation.

15.4 Mining Schedule

SGM has developed a detailed production schedule driven by ROM tonnages from the open pit and underground operations, and augmented by stockpile feed where required in order to provide for a plant feed of 12.5Mtpa.

The mining schedule utilised to produce the Mineral Reserve Estimate considers only Measured and Indicated Mineral Resources as ore (which are converted to Proven and Probable Reserves). A secondary LOM plan which considered Inferred and unclassified material is also produced by the mine for internal purposes and to guide long-term planning and exploration. Table 15.12 presents the LOM schedule.

Table 15.12: Open Pit & Underground Mining Schedule for Mineral Reserve Estimation

Production Schedule	Units	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Open Pit													
Total Ex-Pit Rock	kt	119,331	110,000	110,000	110,000	100,200	94,750	82,546	56,000	31,000	10,189	-	824,016
Total Waste	kt	103,189	100,013	101,145	99,955	91,927	83,667	70,333	41,133	18,685	4,350	-	714,395
Total Ore	kt	16,142	9,987	8,855	10,045	8,273	11,083	12,213	14,867	12,315	5,839	-	109,621
Mined Ore Grade	g/t	0.87	1.14	1.18	1.15	1.30	1.16	1.01	0.91	1.01	1.04	-	1.05
Total Mined Metal	koz	454	366	336	372	346	413	396	433	402	195	-	3,713
Strip Ratio	tw:to	6.39	10.01	11.42	9.95	11.11	7.55	5.76	2.77	1.52	0.74	-	6.5
Underground Mine													
Total Rock Mined	kt	2,043	2,137	2,036	1,881	1,236	956	902	-	-	-	-	11,192
Total Waste	kt	918	887	691	619	-	-	-	-	-	-	-	3,116
Total Ore	kt	1,125	1,250	1,345	1,262	1,236	956	902	-	-	-	-	8,076
Mined Ore Grade	g/t	4.15	4.13	4.04	3.99	4.10	3.62	3.30	-	-	-	-	3.94
Total Mined Metal	koz	150	166	175	162	163	111	96	-	-	-	-	1,023
Process Plant & Dump Leach Feed													
Total Milling Feed	kt	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	4,403	129,403
Mill Feed Head Grade	g/t	1.37	1.37	1.36	1.37	1.38	1.32	1.21	1.00	1.01	0.71	0.49	1.19
Total Mill Feed Metal	koz	549	552	546	553	554	531	487	402	404	284	69	4,931
Total Milling Recovery	%	88.5	89.7	89.7	89.7	89.7	89.4	89.4	89.0	89.0	89.0	92.3	89.4
Dump Leach Feed	kt	2,000	2,000	1,900	622	-	-	-	-	-	-	-	6,522
Dump Leach Grade	g/t	0.38	0.38	0.38	0.38	-	-	-	-	-	-	-	0.38
Dump Leach Metal	koz	25	25	23	8	-	-	-	-	-	-	-	81

Note: The QPs have verified that the LOM schedule presented herein, and the data utilised to develop this schedule, supports the October 12, 2023 news release

15.5 Summary of Mineral Reserve Estimate

The Sukari open pit and underground Mineral Reserve estimates have been prepared according to the CIM Definition Standards, as incorporated with NI 43-101.

The Sukari Mineral Reserve Estimate with an effective date of June 30, 2023 is listed in Table 15.13 below. The stated Mineral Reserves are not materially affected by any known environmental, permitting, legal, title, taxation, socio-economic, marketing, political or other relevant issues, to the best knowledge of the authors. There are no known mining, metallurgical, infrastructure, or other factors that materially affect this Mineral Reserve estimate, at this time.

Table 15.13: Sukari Gold Mine Mineral Reserve Estimate (June 30, 2023)

Location	Cut-off Grade	Proven			Probable			Total		
		Tonnes	Grade	Metal	Tonnes	Grade	Metal	Tonnes	Grade	Metal
	g/t Au	Mt	g/t Au	Moz Au	Mt	g/t Au	Moz Au	Mt	g/t Au	Moz Au
Open Pit	0.4	88.5	1.13	3.22	21.1	1.16	0.79	109.6	1.13	3.99
Underground	2.2	3.6	3.75	0.43	4.4	4.10	0.56	8.1	3.94	1.02
Stockpiles	-	17.8	0.47	0.27	-	-	-	17.8	0.47	0.27
Total Mineral Reserves		**109.9**	**1.11**	**3.92**	**25.6**	**1.67**	**1.37**	**135.5**	**1.21**	**5.28**

16 MINING METHODS

16.1 Open Pit Operations

16.1.1 Overview

The Sukari open pit mine is operated as a conventional truck and shovel mine using face shovels and backhoe excavators to load ore and waste to CAT 785 haul trucks. All ore and waste material requires drilling and blasting. Ore is transported to a ROM pad adjacent to the processing plant and either stockpiled for blending purposes or direct tipped to the crusher. Waste is transported to waste rock dumps (WRDs) which are located around the perimeter of the pit. Working benches are of 10m height, whilst final benches are 10 to 20m in height, depending on geotechnical factors. Figure 16.1 shows the Sukari pit as of September 2023.

Figure 16.1: Sukari Open Pit view from Stage 7 North (Looking South)

The mine is currently operating at rate of 130Mtpa total rock movement. Grade control is undertaken using RC drilling and is used to define ore and waste. Mining is Owner-Operated although a Contractor was engaged by SGM to undertake an open pit waste mining services contract for the East wall (the "Capital Waste Contract"). The Capital Waste Contract has a fixed volume component, starting January 2021, to complete a 120Mt open pit waste stripping programme at Sukari, providing load & haul and ancillary services. As of the June 30, 2023, the Capital Waste Contract was 70% complete, with scheduled completion by mid-2024

16.1.2 Load and Haul

All ore and waste from the pit is mined using conventional open-pit methods. The mine currently operates a fleet of six loaders (four CAT 6040 face-shovels, two CAT 6040 backhoe excavators) and forty-eight CAT785C haul trucks with lightweight trays to carry out the bulk of the ore and waste movement. The lightweight trays increase the capacity of the CAT785 trucks by some 15t per load from the original capacity. Generally, four loaders operate in waste and one in ore, with one on planned maintenance. In addition, the contract fleet provides an additional two 6040 and one 6020 backhoe excavator with seventeen CAT785C haul trucks.

The operation is selective in terms of separating ore and waste, and the degree of selectivity is appropriate for the scale of mining equipment and the nature of the mineralisation. A SMU of 5m x 8m x 10m (XYZ) has been adopted.

The mining fleet includes the requisite ancillary equipment (track and wheel dozers, motor graders, front-end wheel loaders, service trucks, and water trucks) to maintain the pit haul roads, loading and tipping areas, for ROM pad operations, and a projects fleet for pioneering work and TSF construction.

Two units of the existing open pit shovels are both reaching the end-of-life phase, and replacement units are expected to be required by 2026.

The updated LOM plan accounts for increasing the truck fleet size from 48 to 54 CAT785 (lightweight tray) trucks, and an additional CAT 6030 loader (the current loader is undergoing refurbishment to be operational by Q2 2024) to maintain production targets of up to 110Mtpa rock.

Main ore for plant feed is hauled to the ROM pad adjacent to the primary crusher. The majority of ore is direct tipped into the crusher, with provision for ore to be stockpiled for reclaim by a front-end-loader operated as part of the crushing and processing operation. Oxide ore with grade between 0.2-0.9g/t is transported to the dump leach facilities adjacent to stage 7 in the north.

Whilst ore and waste are visually distinct in certain areas of the pit, this is not always the case and ore and waste segregation is generally based upon RC drilling, sampling, and assays for definition of ore blocks.

Waste is used for construction or is hauled to the mine waste dumps, located to the north, east and south of the pit.

16.1.3 Drill and Blast

All in situ ore and waste requires blasting with no free dig material. Production drilling is conducted at 10m benches while pre-split drilling is over 20m bench heights, hole diameters are 165mm holes and 140mm respectively. There are variations to pattern size, hole diameter, and powder factor, depending on rock type, oxidation state, and structure, to ensure optimal fragmentation of the rock mass for mining operations.

Blasting typically takes place once-daily at the end of the day-shift. Explosive and explosive accessories are supplied by an explosive contractor, they have their own facilities on-site to produce the required explosives as well as storing and issuing explosive accessories.

16.1.4 Auxiliary Information

All production mining activities at Sukari operate across two, 12-hour shifts, commencing 5am and 5pm.

Haul roads are maintained by SGM personnel. Waste dump slopes will be progressively battered down to their final profiles during construction.

Portable lighting towers, and trailer-mounted diesel generator sets with banks of halogen floodlights mounted on an easily erected towers are used to illuminate the working areas in the open-pit at night. Typically, lighting towers are used at the excavating face, dumping face and other locations around the pit perimeter to give overall illumination of working areas, and ramp intersections. Lighting towers are also required for night shift drilling crews. Permanent lighting for night time operation is installed at fixed locations close to mains power, such as the ROM pad.

16.1.5 Waste Dumps

A total of some 831Mt of waste is to be mined from the final pit. Waste rock will be hauled to and placed in the south, east or north waste dumps, as well as being used to construct the TSF stages (lifts). The dump design capacities are sufficient to contain the planned mining waste volume.

A ring road has been constructed on the east side of the pit that links the east dump to the northeast and southeast pit ramps, providing SGM with haul-route options to optimise the waste haulage cycles.

In addition to the waste dumps adjacent to the open-pit, a series of ore stockpiles (sub-grade, low-grade, and ROM feed grade) are designed as close as practicable to the plant site.

16.1.6 Risks & Opportunities

SGM has undertaken a robust analysis of potential risks/challenges and opportunities for the operation, the findings of which are summarised below:

Risks:

- Grade Control Reconciliation
    - The historical MIK model performance shows negative reconciliation to the grade control model. The open pit plan accounts for -7% global grade dilution compared to the original model. An updated 2023 MIK model which deals with the historical grade differences is under development for use in future reserve updates.
- Voids Impact
    - Voids and void propagation through main pit structures.
    - These are proactively managed on site with the implementation of the open-pit Ground Control Management Plan and Void Management Plan. With planned filling of any unfilled underground excavations and stopes proximal to the pit walls underway alongside radar monitoring for any potential areas of concern. For planning purposes, equipment productivity has been derated around known void areas to account for this.
- Productivity Targets
    - The updated LOM uses productivity targets of circa 2,750tph from the main digging units (a 10% increase compared to historic 6040 front shovels performance and 20% increase compared to historic 6040 backhoe performance).
    - Rates of up to 3000tph are now being achieved in the open pit and the targeted rates will be sustained with the following. Changes to the blasting strategy to reduce the amount of tramming time for loaders between blasts as well as existing improvements to fragmentation. Additional trucks will reduce the amount of hang time for the loading fleet. Finally, the implementation of a fleet management system and the move away from manual dispatch is expected to further improve productivity.
- Operational Risks
    - Mine interaction between working stages (Stage 5 & 6). This risk is mitigated as 3-4 fleets were utilised at Stage 5 in 2022 and are planned to continue until December 2023. Starting in January 2024, only one fleet will be utilised, with limited time and double access from both the east and west.
    - OP-UG Interaction.
    - Blasting close to UG main decline.

Opportunities:

- Dump Leach Expansion
    - There are upside opportunities for additional ounces production by utilizing subgrade transition material, and rehandling current EMRA stockpiles and subgrade stockpiles at the south waste dump.
- OASA Optimisation

  - SGM have identified upside potential through reduced stripping optimization could allow additional ore to be extracted from bottom of the pit with steeper walls in the north and east.
- Underground portals within the open pit
  - There is upside potential for improved productivity for the underground fleet by developing and maintaining portals from the underground direct into the open pit and using the open pit fleet to rehandle the ore to the crushers through Stage 6 at the 920mRL western switch back followed by Stage 6 at the 860mRL south switchback.
- Dumping Optimisation Improvements
  - Reduce waste haulage to the south waste dump by rehandling EMRA and subgrade material to south dump leach extension.
  - Potential for in-pit dumping following stage 6 mining activities.

16.2 Underground Operations

16.2.1 Overview

Underground operations at SGM utilise a fully mechanised mining method for both development and stoping with access from surface via the Amun twin decline. The Ptah decline has been developed from the 710mRL to access the Ptah orebody to the north and Amun and Horus orebodies to the south.

Historically underground mining targeted high-grade zones which were followed by the open pit, but future underground operations are now planned to be deeper and below the final open pit shell. A minimum crown pillar of 40m is maintained between the pit and active underground workings.

Underground mining utilises a fleet of conventional underground trucks and loaders for material movement. Ore is sourced from jumbo drill development headings and production stoping areas that utilise a number of different stoping methods. Ore is hauled to the surface ROM pad and used for blending with ore from the open-pit operation. Ventilation and a second means of egress is provided by a second decline system which parallels the access declines. The mine also has the opportunity to use portals from the underground into the open pit as operations continue to progress at depth, these not only provide an additional means of egress but have the potential to be used to shorten haulage profiles.

Sukari uses Cemented Paste Fill (CPF), commissioned in 2023, with the Long Hole Open Stoping (LHOS) mining method.

The Sukari underground mine utilises two mining methods for ore production:

- Transverse long hole open stoping; and
- Longitudinal long hole open stoping.

16.2.2 Transverse Long Hole Stoping

The transverse mining method is utilised for bulk stoping areas, allowing for multiple stopes to be in production along strike simultaneously on any given sublevel. Stopes along strike are split into primary and secondary stopes, allowing a pillar to be maintained between the primaries during excavation to improve overall stability.

Once primary stopes have been excavated, backfilled and cured, the secondary stope between pairs of primaries is excavated and subsequently filled with either lower-strength fill, waste rock or a combination of the two. Mining then progresses bottom-up.

The transverse methodology is predominantly employed in the Ptah East, West and Keel zones. Figure 16.2 below presents the progression of the transverse stoping method within the Ptah Keel Zone.

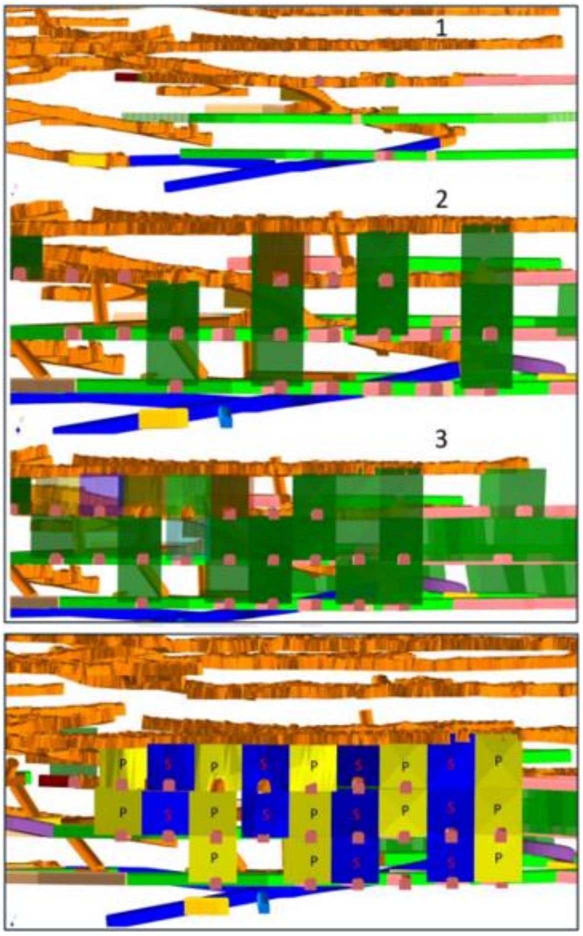


Figure 16.2: Transverse Long-Hole Stoping Progression

16.2.3 Longitudinal Long Hole Stoping

A longitudinal long-hole method is utilised for narrower vein stoping. This method consists of driving horizontal drifts along the strike of the vein and then blasting the ore vertically between the upper and lower drifts.

The current methodology mines a block of three, 20m high levels in an overhand lift sequence using CRF to fill the completed stopes and later be used as a platform for the next sub-level. Development waste is currently used for fill purposes either on its own or as the primary component of CRF. The use of CRF has now been predominantly replaced by cemented paste backfill following the commissioning of the paste fill plant in 2023.

The transverse methodology is predominantly employed in the Amun, Bast & Horus (Horus & Deep) zones. Figure 16.3 below presents the progression of the longitudinal stoping method, whilst Photo 16.1 shows drilling operations in a longitudinal long hole stope as of September 2022.

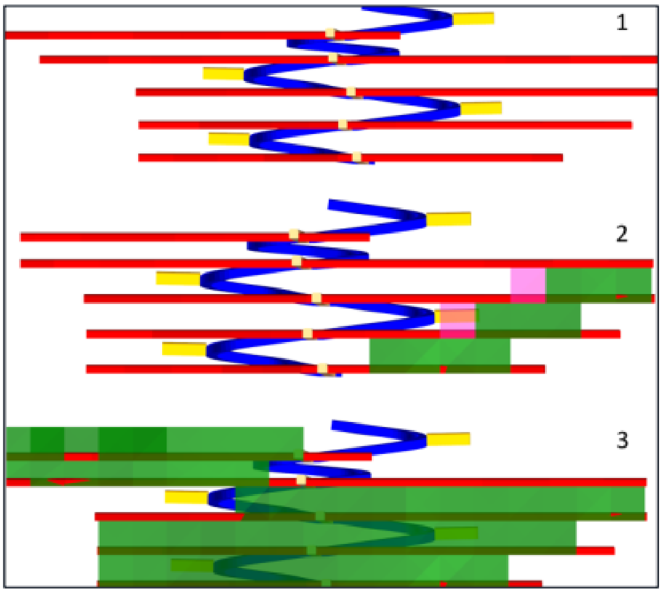


Figure 16.3: Longitudinal Long-Hole Stoping Progression

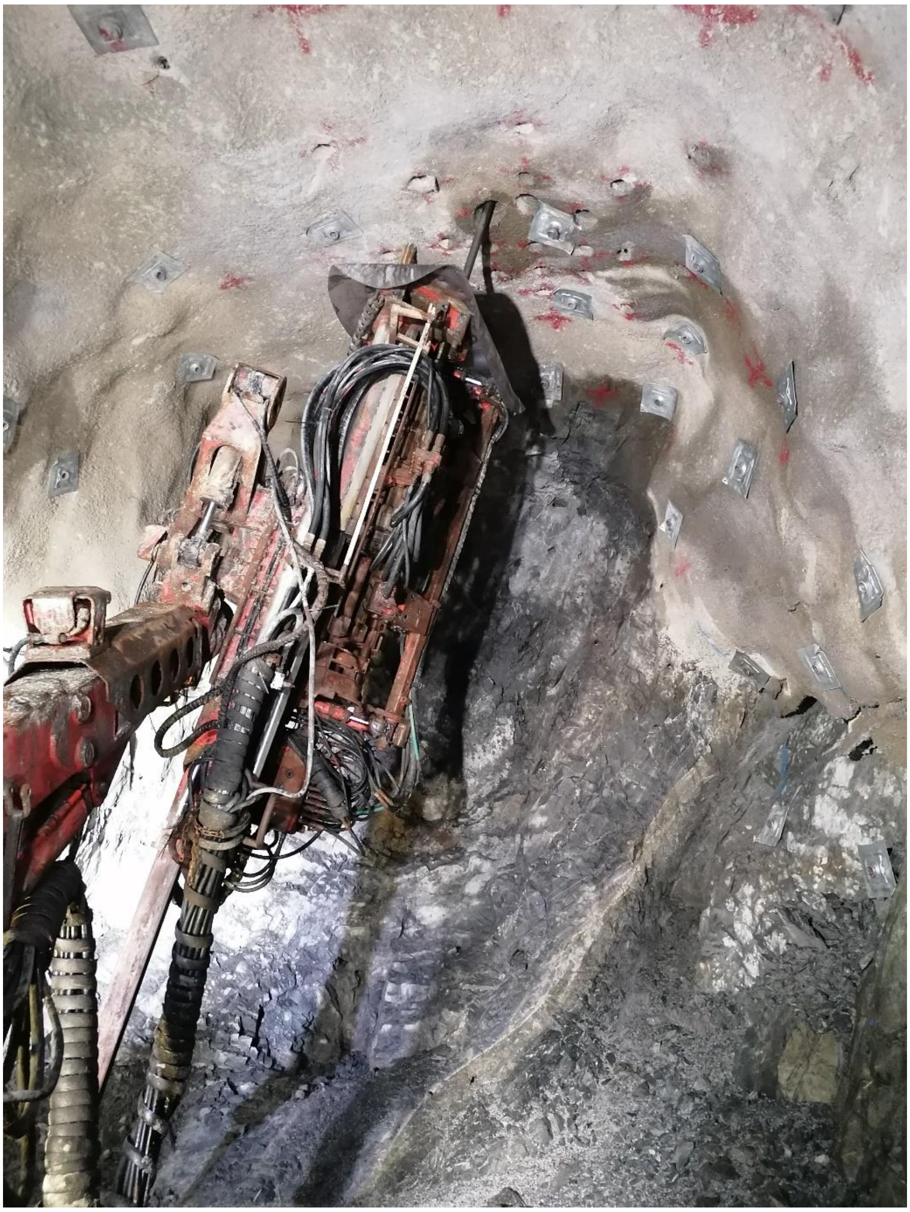


Photo 16.1: Longitudinal Long-Hole Stoping Operations

16.2.4 Equipment

The underground operation at Sukari maintains a conventional fleet of underground trucks and loaders for material movement, in addition to jumbo drill rigs and auxiliary equipment.

Table 16.1 below presents the current fleet below.

Table 16.1: Sukari Underground Equipment Fleet		
Plant Description	**Make & Model**	**Number**
Cable Bolter Rig	Sandvik DS421	1
Fork Lift CAT DP30NT	UG Workshop	1
Jumbo Development Drill	Sandvik DD421	4
Long Hole Drill	Sandvik DL431	1
	Sandvik Solo 7	1
Surface Top Hammer Drill	Commando DC300Ri T3	1
Tele Handler MANITOU MHT 860L	UG Maintenance	1
UG Agitator	ULTIMEC LF600	3
UG Concrete Spraying	Spraymec SF050D	2
UG Explosives Charging Equipment	CHARMEC 1614B	2
UG Integrated Tool Carrier	Volvo L120F	6
UG Maintenance Graders	CAT 12M	1
UG Truck	CAT AD45	2
	CAT AD63	2
	Sandvik TH663	3
UG Water Truck	CAT AD30	1
UG Wheel Loader	CAT R1700	2
	CAT R2900G	3
	Sandvik LH621	2

SGM is proactively mitigating current long lead times for new equipment purchases. The strategy to mitigate production disruptions is as follows:

- Purchase new equipment where available;
- Rebuild existing equipment where sufficient value can be extracted; and
- Purchase of newly or fully ground-up rebuilt equipment.

16.2.5 Cemented Paste Fill System

Following commissioning of a paste plant in Q1 2023, Sukari uses Cemented Paste Fill (CPF) for stability with the Long Hole Open Stoping (LHOS) mining method.

Tailings from the process plant are sent to the CPF Plant and stored in a buffer tank. If needed, a cyclone cluster installed on the buffer tank allows for the de-sliming of the tailings feed. The buffer tank feeds a horizontal belt filter that discharges to a transfer conveyor that feeds into the paste mixer.

Binder and trim slurry are added to the paste mixer to achieve the desired backfill concentrations. A hopper feeds the CPF to the Positive Displacement Piston Pump (PD pump). The PD pump will pump to the Underground Distribution System (UDS). The paste will be transferred from the paste hopper via the paste pipeline to the underground mine stopes using the duty paste pump.

Paste is then delivered to the designated stope by the UDS and will discharge from the top drive to fill the stope. A barricade will retain the initial plug pour that will cure before filling the bulk of the stope.

The yield stress operating range for the various discharge locations is shown below. The graph below compares the operating ranges achieved when pumping at 5,500kPa and nominal flow versus 7,000kPa at minimum flow.

Allowing the system to operate up to 7,000kPa provides operating flexibility and gives the paste plant operator the time to take corrective actions if the CPF yield stress increases.

16.2.6 Ventilation

The total ventilation air movement at Sukari is some 270m_3/s with intake via the main decline portal, the Amun portal and via leakage through stoping which has caved to surface.

Air is exhausted via two circuits, specifically the main fan exhaust through the Ptah orebody and to the open pit via the Horus exhaust.

The Sukari UG ventilation system has approximately 8% leakage from the intake straight to the exhaust. Around 26% of the Ptah intake air is used air coming from the Horus area. Following the commissioning of the paste plant the underground has a two-year project to use paste fill in unfilled legacy workings to help reduce leakage and short-circuiting.

In order to maintain production and extend ventilation at depth, two main fans are scheduled for purchase and installation underground in Q4 2023. One fan will be installed on the Ptah side and one on the Horus side. This will take the total underground airflow to greater than 450m^3/s, split between the two sides.

Table 16.2 and Table 16.3 present the intake and exhaust systems, whilst the current primary ventilation main system is presented in Figure 16.4.

Table 16.2: Sukari Underground Air Intake

Location	**Quantity (m^3/s)**
Portal Intake	90
Avoca Stopes	10
Amun 950 Intake	28
A635-Dec Intake	90
A-605	52
Total Intake	**270**

Table 16.3: Sukari Underground Air Exhaust		
Zone	**Location**	**Quantity (m^3/s)**
Ptah	P610-VD_ P630-VD	40
	P-590	28
	P570-VD	22
	P-550-VD	30
	P-530-VD	35
	Fuel Bay	12
	System Leakage	22
	Ptah Sub-Total	189
Horus	P-875-Exhaust	81
	Horus Sub-Total	81
Ptah + Horus	**Total Exhaust**	**270**

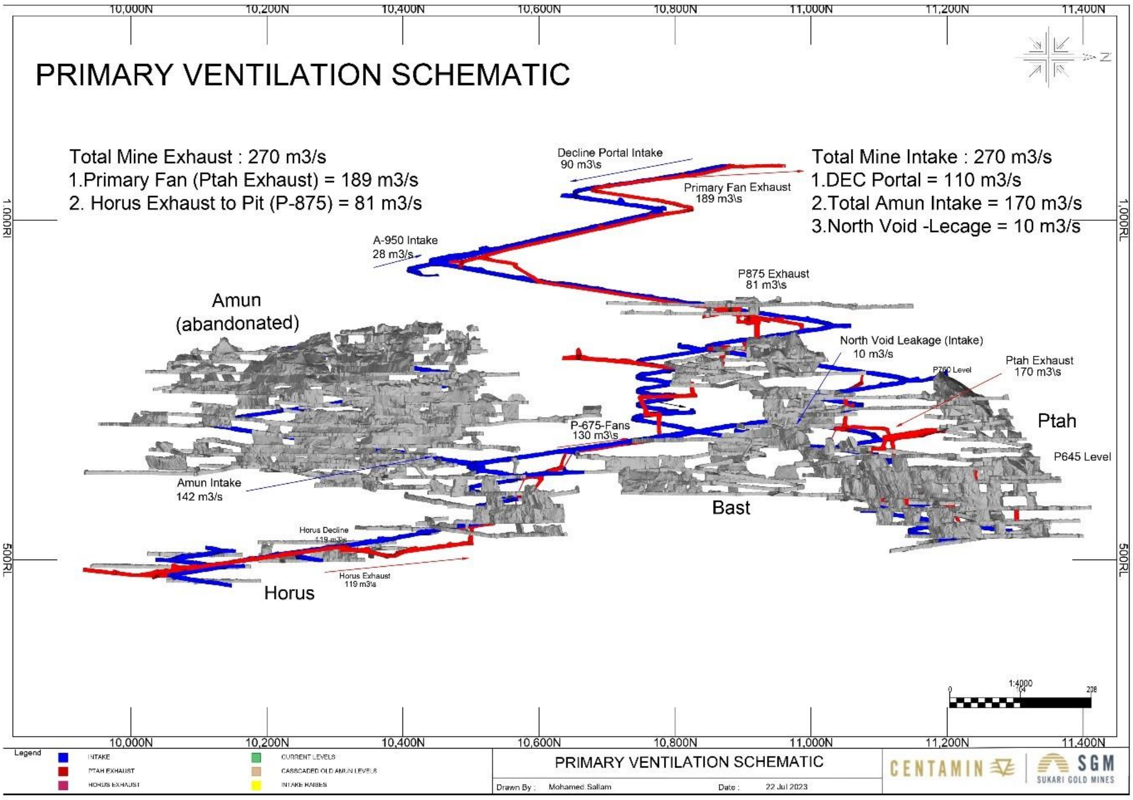


Figure 16.4: Sukari Ventilation Schematic

16.2.7 Refuge and Emergency Egress

The mine has a number of mobile refuge chambers for between four and twenty persons. Fixed permanent fresh air bases are also in place or planned. An emergency set of services runs through the exhaust system, providing an independent source of compressed air and fire-fighting water. Radio communications are available throughout the mine, and a backup conventional telephone system is also in place.

The underground escape way plan is presented in Figure 16.5 below.

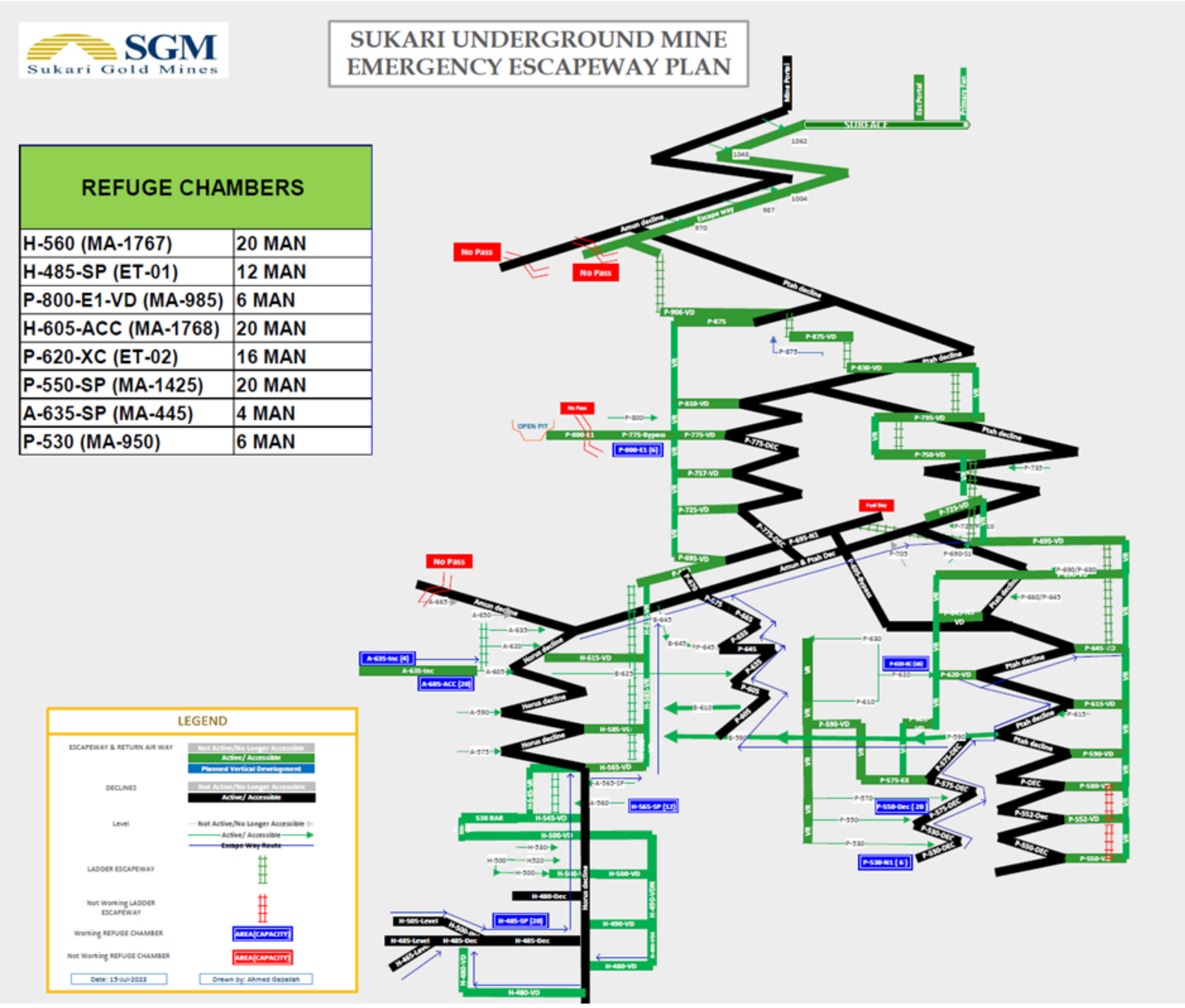


Figure 16.5: Sukari Emergency Access Schematic

16.3 Geotechnical Considerations

16.3.1 Introduction

SGM engaged AMC Consultants (UK) Limited (AMC) to provide this written geotechnical section, as required by NI 43-101.

AMC conducted a site visit on 4 June to 8 June 2023 to conduct a review of the geotechnical conditions in the underground and open-pit mines, review geotechnical core logging procedures and discuss short-term and LOM planning with site-based engineers. Mike Sandy, Principal Geotechnical Engineer, conducted the site visit, reviewed the underground geotechnical and backfill information, and authored the underground geotechnical section below (specifically, sections 13.3.4 and all included sub-sections). Asoka Herath, AMC Principal Geotechnical Engineer, reviewed the open-pit geotechnical information, and authored the open-pit geotechnical section for the report. Ruth

Stephenson, AMC Principal Geotechnical Engineer, provided Peer Review of the written sections (specifically, section 16.3.3 and all included sub-sections).

16.3.2 Supplied Data

The following information was reviewed to prepare this section of the report:

- Underground Ground Control Management Plan (SGM-TSUG-PLN-0001 dated October 1, 2022);
- Geotechnical review of underground mine design for reserve estimation (SGM memorandum, July 5, 2023);
- Ground Support Standards (updated June 2023);
- Paste fill process presentation;
- Mine planning sign-offs;
- Geotechnical weekly reports;
- Updated lithology and structure models (2022);
- Review of hydrogeology and water management (SRK Consulting UK (SRK), October 2022);
- Analysis of paste fill exposure stability and bulkhead strength (Geotechnica, August 2022);
- Current as-built open pit and underground mine excavations; and
- Stage 8 Pit design (stg8_v8_230610).

16.3.3 Open Pit

16.3.3.1 Open-Pit Mine Geology and Structure

The Sukari deposit is hosted within Neoproterozoic rocks of the Nubian shield. The gold mineralisation is located largely within a felsic porphyry intruded into a district-scale ophiolite shear zone. The porphyry strikes northeast to south-west and dips towards the south-east. Country rocks forming the footwall and hangingwall comprise overturned, easterly-dipping, sequences of andesite, serpentinite, and volcaniclastic sediments and includes graphitic (black) shales, serpentinite, coarse and fine-grained meta-sediments, tuffs, and minor basalt and porphyry intrusions.

The deposit has a complex structural environment and is intersected by several structural zones with mine-scale persistence, including thrust faults, normal faults, and shear zones. Both the porphyry and sedimentary units have been cut into blocks and then displaced by the main fault structures.

Commonly, both the porphyry/country rock hangingwall and footwall contacts are sheared. Older structures have been cut and displaced by younger structures.

The intact rock strength varies from 32MPa (graphite schist) to 85MPa (porphyry).

The geology and structure pertaining to the LOM pit is described below.

North Wall: Mainly porphyry, with hangingwall metasediments exposed in the toe; multiple pit-scale faults daylight in the wall including the Puggy Shear, and the Crossfault and Buthinae fault sets.

South Wall: Mainly hangingwall metasediments, with the lower sections in black shales; multiple pit scale structures daylight in the wall including the Osiris Fault underneath the slope and daylighting at the toe, and the Puggy Shear, Sukari Thrust, and the Akbar-Wahed Faults.

West Wall: Footwall metasediments in the upper sections; granodiorite, black shales and serpentinite in the lower sections; east-dipping Puggy Shear exposed in lower sections, the KF Fault in the central section with the Osiris Fault daylighting in the southern section toe.

East Wall: Mainly hangingwall metasediments in the upper sections, with black shales and serpentinite in the lower sections; multiple shear zones exposed along the wall, with the Osiris Fault daylighting in southern section toe.

16.3.3.2 Open-Pit Geotechnical Model

The geotechnical model for the Sukari deposit has been developed using a series of geotechnical domains based on the principal lithological and structural units hosting the deposit and forming the country rocks. All geotechnical logging data was spatially sorted using the wireframe solid models developed by SGM, then processed using interval length-weighting methods to determine statistical distributions of the key parameters.

There were 14 geotechnical holes assessed for the open pit, to a total of 3,100m, OTV structure logging, and geotechnical mapping conducted in 2022. Several major structures that could influence the wall stability (especially the west wall) have been identified in the past and were investigated by the recent drilling. The geotechnical logging has improved the understanding of the characteristics of such structures. The knowledge gained has been used to improve the geotechnical domain models and LOM pit designs.

The Stage 4 west wall has experienced a multi-batter instability caused by Sukari Thrust 1 daylighting on the wall. Sukari Thrust 1 will be excavated in the cutbacks but a parallel structure, Sukari Thrust 2, exists proximal to and potentially daylights in the upper slope towards north.

Geotechnical logging has indicated that conditions of Sukari Thrust 2 are better than Thrust 1. Figure 16.6 shows some major structures relative to the LOM design. It shows that the Sukari Thrust 2, Puggy Shear, and Osiris Fault can potentially influence west wall stability.

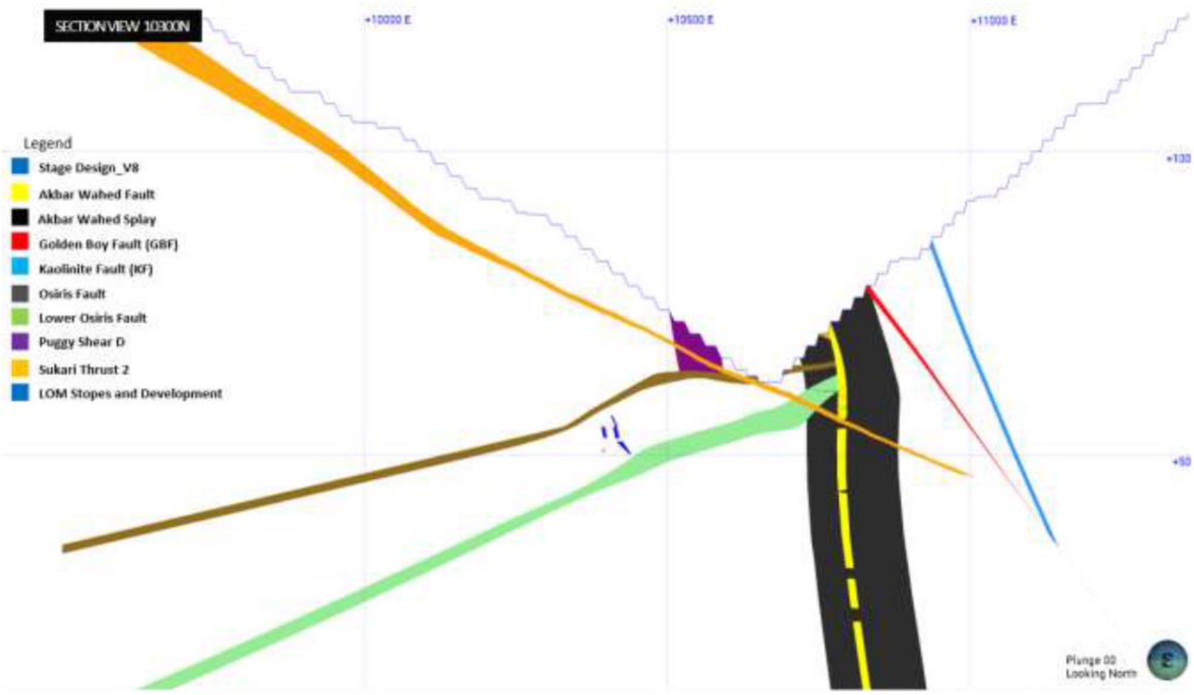


Figure 16.6: 10,300mN Section Showing Major Structures Relative to the LOM Pit Design.

The information from the pit investigations has been used for:

- Rock mass classification and improving the geotechnical domain models;
- Updating structural information for kinematic stability analysis;
- Updating large- and mine-scale structural models and characteristics of the structures;
- Characterizing shear strength properties of structures, especially the major structures that can influence pit wall stability; and
- Improving geotechnical design parameters.

Sukari Thrust 1 and Sukari Thrust 2 are two regional thrust faults that have an adverse influence on pit wall stability. Sukari 1 has caused a multi-batter failure in the Stage 4 south-west wall. Only Sukari Thrust 2 will be present in Stage 8 (LOM) west wall, which will daylight on the upper slope towards north and be situated at close proximity to the wall in the southern section as shown in Figure 16.6.

These thrusts, although regional structures, do not appear to be completely altered and sheared zones with fault gouge with very low shear strength, but more like fractured zones as shown in Figure 16.7.

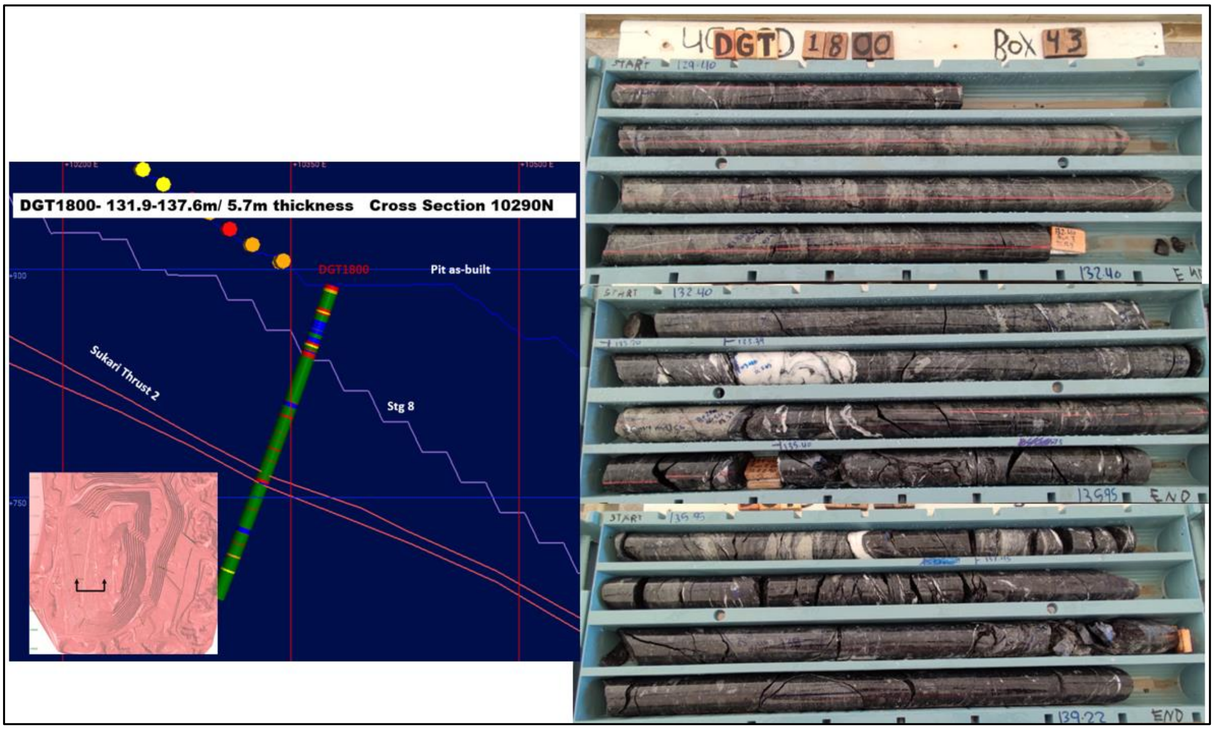


Figure 16.7: Sukari Thrust 2 Conditions as Intersected in Drillhole DGT1800.

Using the generalized Hoek-Brown criterion in the limit equilibrium stability assessments, Sukari Thrust 2 has been modelled with a GSI value of 35, a uniaxial compressive strength (UCS) of 15MPa, and a mi value of 5. Other fault zones are modelled with a GSI value of 40, UCS of 15MPa, and mi of 5.

A significant amount of rock strength test data was obtained since 2006 (155 UCS tests, 252 tensile strength tests, 89 modulus tests, and 35 triaxial tests). They have been used to confidently define shear strengths of different rock units and major structures.

Tests are yet to be conducted to obtain shear strength parameters for the small structures, including the foliation. This deficiency has been addressed by obtaining shear strength parameters through back-analysis of many small-scale failures.

16.3.3.3 Open-Pit Geotechnical Design Parameters

The lithological units and influencing structures have been characterized using industry-accepted classification methods Q and GSI systems. Based on the GSI and laboratory strength parameters, geotechnical design parameters applicable to different lithological units and major structures have been derived using the generalized Hoek-Brown Method (Table 16.4).

The geotechnical design parameters have been derived from factual data using the industry-accepted methodologies applicable for pit wall stability assessment and design.

Depressurized conditions have been used in the stability assessments.

Table 16.4: Geotechnical Design Parameters Used in the Stability Assessments.								
Material Name	**Unit Weight (kN/m3)**	**Strength Type**	**Cohesion (kPa)**	**Phi (°)**	**UCs (MPa)**	**GSI**	**mi**	**D**
Fault	27.50	Generalized Hoek-Brown			15	40	5	0.7
Fault-Sukari Thrust 2	27.50	Generalized Hoek-Brown			15	35	5	0.7
Void backfill	20.00	Mohr-Coulomb	10	35				
Porphyry GSI >40	26.50	Generalized Hoek-Brown			85	56	20	0.7
Porphyry GSI <40	26.50	Generalized Hoek-Brown			65	45	20	0.7
Tuff GSI >40	27.86	Generalized Hoek-Brown			60	50	15	0.7
Tuff GSI <40	27.86	Generalized Hoek-Brown			48	40	15	0.7
Carbonate schist GSI >40	27.40	Generalized Hoek-Brown			50	44	13	0.7
Carbonate schist GSI <40	27.40	Generalized Hoek-Brown			40	35	13	0.7
Graphite schist GSI >40	27.27	Generalized Hoek-Brown			41	40	10	0.7
Graphite schist GSI <40	27.27	Generalized Hoek-Brown			32	32	10	0.7
Any joint	27.00	Mohr-Coulomb	40	35				

16.3.3.4 Mine Hydrogeology

The hydrogeological studies imply that the wall rocks consist of low permeability rocks. Several regional structures influence the hydrogeological character with compartmentalisation of groundwater within the wall rocks.

Recharge to bedrock occurs during sporadic rainfall events, mostly through the Wadi sediments. The Wadi is dry in the local area for most of the year but would become saturated and flow during episodic rainfall events.

Minor seepage from the walls have been recorded as associated with some faults and thrusts and the areas in between. Similarly, minor seepage from the Puggy Shear has been observed in the underground. Minor water seepages occur along some geological contacts and fracture zones.

Although there are significant underground developments under the pit area, they have not influenced groundwater drawdown in the pit walls. Due to the low permeability of the wall rocks, dewatering of the pit walls from out-pit bores is not possible.

An advanced depressurisation programme (extending the current programme) is planned using horizontal drillholes (HDH) in targeted areas. The HDH will extend up to 150m behind the pit walls. Piezometers will be installed to monitor the performance of the HDH programme.

16.3.3.5 Open-Pit Geotechnical Risk

SGM has identified four significant potential geotechnical risk factors pertaining to the Stage 8 (LOM) designs as follows:

1. Uncertainties in orebody knowledge (i.e. geological/structural/hydrogeological knowledge) that can influence wall stability
2. Existing and planned underground workings will be exposed or exist close to the final North, East, and West wall toes and pit floor in several locations which can lead to localized wall instability.
3. The Stage 8 wall stability analyses assumed full depressurisation of the slopes and structures will be achieved by the planned HDH drilling programme.
4. The Osiris Fault (a shallow westerly dipping fault with variable dip) daylights at the toes of the southern sections of both the East and West walls which interacts with other pit-scale shears and faults that can adversely influence stability.

The following programmes are planned for implementation:

- Uncertainties in orebody knowledge, including:
    - Continuous update of the geological and structural knowledge. As the pit is developed in a series of cutbacks there is opportunity to improve on the geology and structural models.
    - Monitoring of the performance of horizontal drainage drilling to evaluate hydrogeological assumptions.
- Influence from underground voids, including:
    - Implementation of the open-pit Ground Control Management Plan and Void Management Plan.
    - Undertake filling of any unfilled underground excavations and stopes proximal to the pit walls.
    - Implement radar monitoring for areas of concern.
- Assumption of fully depressurized slopes, including a comprehensive evaluation of depressurisation performance.
- Adversely oriented structures, including:
    - Further evaluation of the presence of major structures.
    - Geology model updates.
    - Influence of groundwater if full depressurisation cannot be achieved.

16.3.3.6 Open-Pit Stability Modelling

For slope designs, SGM has adopted the design acceptance criteria recommended in Read and Stacey (2009) as presented in Table 16.5. Under these criteria, a factor of safety (FOS) target of 1.2 has been deemed acceptable for most slopes except where a FOS of 1.3 is required due to the presence of permanent haulage ramps or other infrastructure.

Table 16.5: Typical Slope Design Acceptance Criteria (Read and Stacey, 2009)

Slope Scale	Consequences of Failure[1]	Acceptance Criteria[2]		
		FOS (min) – Static	FOS (min) – Dynamic (pseudo static analysis)	POF (max) P[FOS≤1] (%)
Bench	Low to high	1.1	N/A	25 to 50
Inter-ramp	Low	1.15 to 1.2	1.0	25
	Moderate	1.2	1.0	20
	High	1.2 to 1.3	1.1	10
Overall	Low	1.2 to 1.3	1.0	15 to 20
	Moderate	1.3	1.05	10
	High	1.3 to 1.5	1.1	5

[1] Semi-quantitatively evaluated.
[2] Needs to meet all acceptance criteria.

The design acceptance criteria specify a FOS ≥1.0 to 1.1 for pseudo-static stability assessments.

The kinematic stability assessments have been conducted using the Mohr-Coulomb strength model and the inter-ramp and overall slope stability analysis of fresh rock domains using the generalized Hoek-Brown strength criterion.

SGM conducted two-dimensional and three-dimensional limit equilibrium analyses using Rocscience™ software Slide2 and Slide3, and finite element analysis using RS2™, which uses the strength reduction method. The anisotropic analysis was carried out using RS2™. These are industry-accepted methodologies.

16.3.4 Underground Mine

16.3.4.1 Underground Geotechnical Conditions

The Sukari underground deposits are hosted within a complex lithological, structural, and geotechnical environment, and are commonly associated with structural features such as shear zones and altered contact zones between the main granodiorite (porphyry) bodies and sequences of sedimentary and igneous country rocks.

The Sukari granodiorite units typically comprise relatively high-strength rock with multiple joint sets, and frequent kaolinitic alteration zones with moderate rock strength. The sedimentary country rocks comprise moderate strength, fine- and coarse-grained sediments with steeply dipping bedding/foliation, with altered, sheared, and graphitic shale and serpentinite zones adjacent to the porphyry.

The pit-scale fault and shear zones typically comprise low to very low strength rock with deformed bedding/foliation and high-fracture frequency, and include persistent, thin zones of highly sheared, brecciated material (gouge), which is typically damp to wet.

Geotechnical domains have been developed for each of the principal ore zones, based on a combination of lithological and structural models. Geotechnical conditions have been assessed using industry-standard rock mass classification systems. Details of the geotechnical characteristics and models are summarized in the Sukari Underground Ground Control Management Plan (UGCMP). The Sukari UGCMP is based on industry-standard methods and documentation for geotechnical risk mitigation controls, design methods and operational QA/QC procedures.

Geotechnical investigations were conducted during 2022 for the underground resources which included logging of 31 resource holes totalling 4,228 m and completing 6,856 m (23 holes) of the planned 11,000 m LOM drilling programme. All geotechnical core logging and mapping is conducted using industry-standard methodologies for the calculation of the Norwegian Geotechnical Institute's (NGI) Q, Bieniawski's rock mass rating (RMR), and Hoek's geological strength index (GSI) parameters. Typical rock mass quality for the planned stoping blocks ranges from ”poor” to ”fair” in the granodiorite units, to ”extremely poor” to ”very poor” in shear zones specifically in the Bast mining zone.

SGM has continued the development and updating of the lithological and mine-scale structure models of the deposit and country rocks. The work in the underground sections has included ground-truthing the shear and fault models, in particular the Puggy Shears and the Buthinae Fault, and updating the geotechnical model domains. Detailed geotechnical mapping of drives is also routinely undertaken to confirm local conditions for stope design assessments.

Laboratory testing for rock material properties has been conducted at a commercial laboratory in Italy and at the University of Cairo with reasonable agreement in the results for the main rock types at the project.

An assessment of the in-situ stress conditions has been undertaken based on borehole breakout data and structural considerations. Mining One Consultants provided two alternate interpretations, both indicating “thrust” stress environments. Numerical modelling has been conducted using the more conservatively interpreted stress field.

The current mining depth is less than 500m below surface. Underground observations suggest that the current stress environment is low to moderate stress. Recognizing that mining is planned to extend to depths exceeding 1,000m, preparations are in hand to conduct overcoring stress measurements during 2023.

16.3.4.2 Underground Mine Design

The mine has underground resources grouped into four zones:

- Ptah;
- Bast;
- Amun; and
- Horus/Deep Horus.

Most of the ore lodes have steep dip of approximately 70° and extensive strike lengths in the upper levels. In the lower levels in Horus, the ore lodes are flatter dipping, typically approximately 62°.

Figure 16.8 shows the relationship between the planned Stage 8 Pit and the underground resources.

Potentially mineable resources extend to a depth of approximately 1,100m below surface in the Horus/Horus Deeps lenses. The updated reserve stoping model extends to a depth of approximately 950m. Current underground operations extend to a maximum depth of approximately 550m below surface and are taking place at least 15m below the current pit floor.

The Stage 8 Pit will progress after the Stage 5 Pit has been in operation for approximately four years. Most of the interaction between underground and open-pit mining will occur during the mining of Stage 5.

Stope design parameters were based initially on the industry-standard stability graph method as described in Hutchinson and Diederichs (1996). Significant experience has since been gained of stope performance in the site's conditions and the current stope designs reflect this.

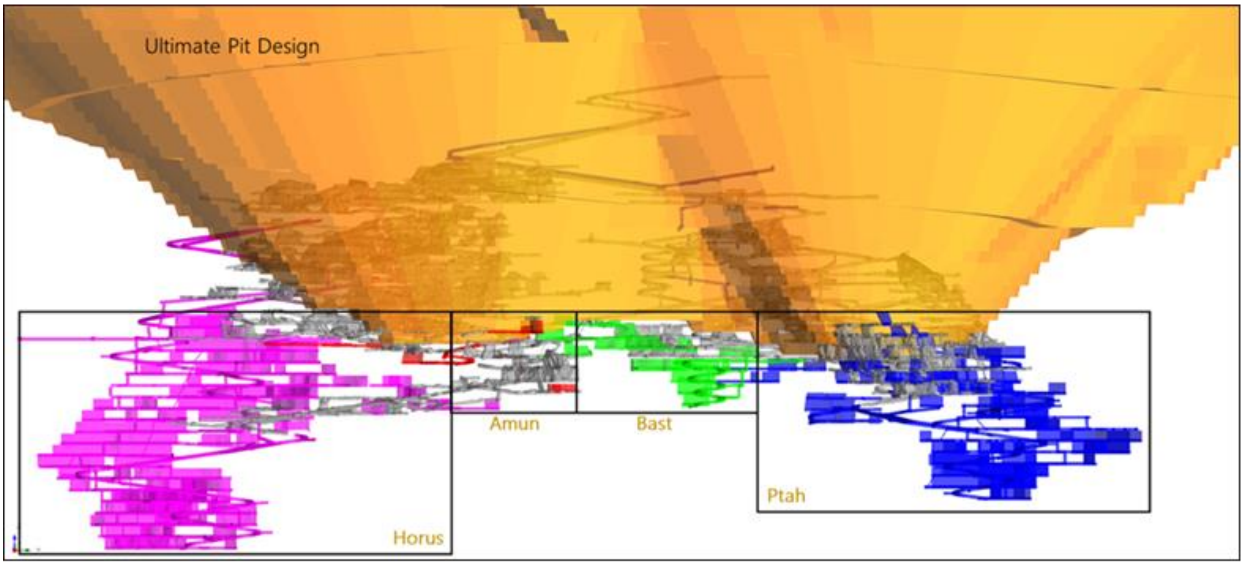


Figure 16.8: Sukari Stage 8 Pit and underground stope shapes, looking west.
pit: brown, existing stoping: grey, proposed stoping: purple/blue/red/green

16.3.4.3 Underground Development

Development is undertaken with a fleet of modern electrohydraulic jumbos.

Standard ground support designs have been developed to cover drive function, profile, dimensions, and prevailing ground conditions using the Q system and local experience. The designs typically comprise a combination of frictionbolts, mechanical point anchor dynamic bolts, with either mesh or fibrecrete for surface control. Osro straps are used for strapping pillars and fibrecreted to minimize equipment damage.

Spiling and short development rounds are used for development in “extremely poor” to “very poor” ground categories associated with the shear zones. In addition, shotcrete arch ribs are installed to mitigate potentially converging/squeezing ground conditions. Intersections are routinely supported with patterns of cablebolts.

16.3.4.4 Underground Mining Methods

Mining is conducted using a combination of methods as follows:

Wide ore sections: Transverse long-hole open-stopes in an over-hand, primary/secondary sequence with backfill. Currently the fill comprises CRF in primaries, and rockfill in secondaries. Conversion to a paste fill system is in progress following paste plant commissioning in 2023.

Narrow ore sections: Longitudinal long-hole open-stopes in an over-hand sequence retreating from the lode extremities to a central access pillar, with lifts currently filled with waste rock or CRF. Again, paste filling is being considered in some areas to allow recovery of sill pillars. Depending on numerical modelling and the results of the planned overcoring stress measurement, some areas might be mined using a centre-out sequence to mitigate closure pillar stress issues after geotechnical advice.

Stoping blocks typically comprise 5 x 15m lifts with nominal 15m sill pillars between blocks. Where cemented fill has been placed in the lowermost stopes in each block, sill pillar recovery is planned using blind up-hole retreat.

16.3.4.5 Cemented Paste Backfill

The paste fill plant and reticulation system have been commissioned. Strength requirements for paste fill exposures were assessed by Geotechnica (2022) using 3D numerical modelling analysis. Geotechnica’s report provides results of strength tests on test mixes of the Sukari paste material at various moisture and binder contents. The results show the high sensitivity of fill strength to moisture content/pulp density as well as binder content (Figure 16.9).

The site geotechnical laboratory undertakes routine sample casting and testing as part of paste QA/QC.

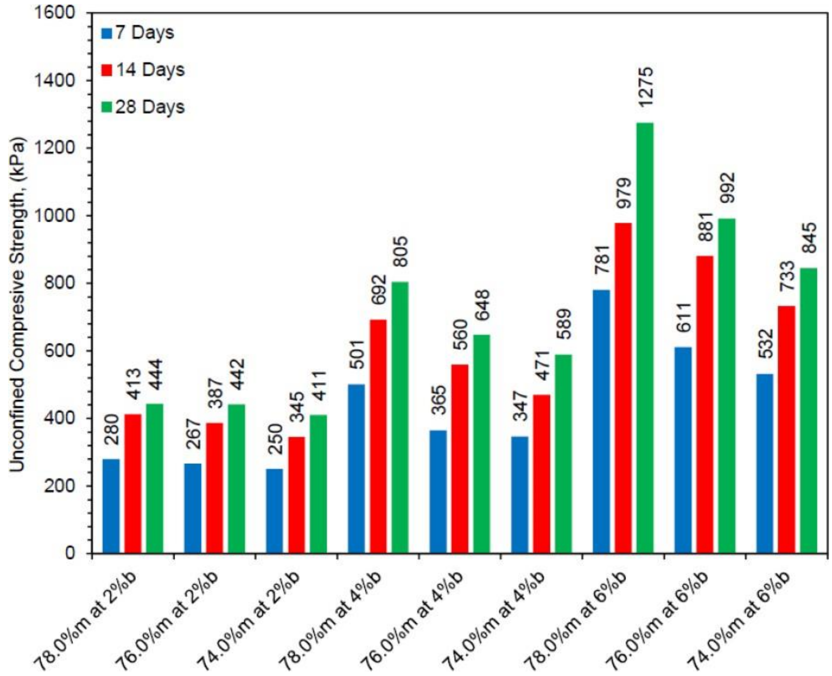


Figure 16.9: Paste Fill Strength Testing Results (Patterson and Cooke, 2022).

16.3.4.6 Void Management

Interactions between previously mined stopes and other excavations including the Sukari open pit are managed with a formal Void Management Plan. This is based on a review of global void management practices and includes probe drilling from underground and open-pit platforms, inspection of breakthroughs into voids using borehole cameras, a cavity auto-scanning laser system (C-ALS), and barricading to prevent access into hazardous locations.

16.3.4.7 Underground Monitoring

SGM uses a range of best-practice procedures, tools, and equipment to monitor the rock mass response to excavation and to provide assurance of the effectiveness of ground support in accessible development. This includes a Maptek scanner for development mapping and convergence monitoring, laser-based stope surveys, extensometers, and an Institute of Mine Seismology (IMS) seismic system which was commissioned in November 2022. Geotechnical instruments from Yield Point Inc. are used including (but not limited) to multi-point borehole extensometers and Smart Cables, for which data is uploaded and processed through cloud-based Vantage Point software.

Data is collected, analysed, and reported monthly or at shorter intervals when required.

16.4 Hydrogeological Considerations

16.4.1 Introduction

The primary focus of this section is to review hydrogeological aspects of the Sukari open pit and underground mining operations. As outlined in Section 4, the open pit of Sukari has been operational since early 2009 and the underground mine became operational in late 2010. There are at least 12 years of production planned with 9.8 million ounces in gold resources to mine at Sukari, as well as other prospects within the 160km^2 concession area.

CIL processing has been used since the open pit mine opened in 2009, initially at a processing rate of oxide ore at 4Mtpa. This has increased by multiple plant expansions to enable processing of a blend of oxide and sulphide ores at a rate of 12.6Mtpa currently.

This section has been undertaken by review of existing reports and information provided by Centamin. As the primary hydrogeological consultants for Centamin, SRK have provided direct input to support this section in August 2023. In addition to the direct input for SRK (August 2023), the hydrogeological related information in the section is from the following documents:

- Groundwater Resource Management, Site Visit Summary Report, 2012.
- Lycopodium, Sukari Gold Mine Site Visit and Process Plant Review, 2095-FREP-001, 2019.
- Knight Piésold, Groundwater Management Plan DRAFT, KP Report No. PE401-00015/31, May 2020.
- Knight Piésold, NI 43-101 Hydrogeology and Surface Water Update, PE401-00015/16-A KR L20004, May 2020.
- Centamin, Sukari Gold Mines, Memorandum: OP Geotechnical Consideration of Pit Design for 2022 Reserves, 2021a.
- Centamin, Sukari Gold Mines, Geotechnical update during 2021 PowerPoint presentation, 2021b.
- Snowdon, Memorandum: Geotechnical Review of 2022 Stage 8 Open Pit Design, 2021.
- Centamin, Sukari Gold Mines, OP/UG Geotechnical Update 2022 presentation, September 2022.
- Centamin, Sukari Gold Mines, HSE department, Environmental team, Groundwater monitoring weekly reports dated August 29, 2022, September 5, 2022.
- Email communication from Centamin, Sukari Gold Mine Environmental Superintendent, Sara Mohamed, September 15, 2022.
- Centamin, Sukari Gold Mines, site water balance model (GoldSim), September 2022.
- Digby Wells Environmental, Sukari Gold Mine - Groundwater Monitoring Programme Review, October 2022
- SRK, Review Of Hydrogeology And Water Management At Sukari Open Pit And Underground Gold Mine, Egypt, October 2022.
- Piteau Associates, Sukari Mine, Goldsim Water Balance: 2023 Update, Report: 4145R3v0, June 2023.

Documents that have been referred to, but not directly provided to WAI for review as part of this section of the report include:

- Knight Piésold groundwater model

16.4.2 Meteorology

Located within the Eastern desert of Egypt, Sukari has an arid desert climate with a temperature range of 17-27°C during winter (October to March) and from 26-36°C during the summer months (April to September) with maximum temperatures exceeding 40°C. Precipitation is extremely low, usually less than 10mm/year. Historical rainfall data were limited.

From the SGM station on site, the annual average rainfall on site was 16.9 mm/year, based on 5 years dataset (SRK, 2022). Rainfall events are typically high intensity, short duration for one to two days every 6 or 7 years on average. Evaporation is extremely high, estimated to be approximately 5000mm/year (GRM, 2012). Average evapotranspiration varies between 8.7 mm/day in winter and 28 mm/day in summer. There is a significant negative water balance at the Site, reflecting the desert environment.

16.4.3 Surface Water

The site covers a catchment area of c. 60 km^2 and has a design rainfall for the operational period of 70 mm/year (KP, 2020). The relief of the gold mineralised area is a relatively steep ridge with average slopes of 50°-60°, reaching over 400m. The surrounding hills are also relatively steep (30°-40°). The wadi below is relatively flat. There is no natural surface water within the project area. There is very little rainfall, although conceptually, when infrequent precipitation events occur, surface water runoff flows from the ridge to the wadi and forms the intermittent surface water channel features in the wadi.

Knight Piésold developed a surface water management plan for Sukari using a record of a high-intensity rainfall event in November 2001. Due to the wide, flat topography of the wadi valleys, accurate flow path mapping for high intensity events was not possible with a high degree of certainty. Knight Piésold produced an updated surface water management plan for Sukari in 2020 including the updated project infrastructure, pit designs, TSFs and downstream dam break mitigation bund. The management plan outlines critical flash flood locations and areas where significant ponding is expected during short lived, high intensity rainfall events which the area is subject to on a relatively infrequent basis (every 6-7 years typically).

The 'passive' surface water management approach includes ponding or diversion of upstream catchments or the installation of baffles to reduce storm flow velocities. Surface water quality, levels and observations of erosion are included in event-based surface water monitoring. Surface water monitoring is event based only as there is no permanent surface water on site. To enable active flood risk management, an early warning system, such as an automated rain gauge that could trigger an alarm system was recommended (KP, 2020).

Knight Piesold (2020) outlined critical operational management requirements for surface water at the following locations:

<u>TSF No. 2</u>

- Run-off from the catchment to the south of the process and mine areas will be captured, contained and recirculated to the plant as process water.
- Localised ponding of surface water upstream of TSF No. 2 from various catchments will be implemented by embankments. Upstream ponding reduces flow to TSF No. 2 due to evaporation and induces more recharge to the underlying wadi sediments.
- A risk of erosion of the southern waste rock dump downstream of TSF No. 2 by flooding events needs monitoring.

<u>Open Pit</u>

- Occasional surface water dewatering may be required from the the open pit which will collect surface water runoff from the pit catchment and benches and interception of the runoff from the waste rock dump will need to be removed by pumps to the process plant/ TSF.

<u>TSF No. 1</u>

- Upstream embankments are required to pond, attenuate and flatten the flood peak amplitude of flows during storm events.
- A Dam-Break mitigation bund is to be built subject to appropriate risk assessment and design.
- This has been constructed to contain the majority of site runoff during a storm event to reduce flood risk downstream of the site by slowing flows and enabling losses by evaporation and recharge to the wadi sediments.

Knight Piesold (2020) highlighted the areas at risk of flash flooding are:

- Accommodation village: situated on a flat wadi area and therefore at risk. There have been several small diversion bunds installed to manage surface water, however, Knight Piesold (2020) also recommended baffles are installed upstream on the large wadi channel that passes to the north of the accommodation to slow the storm flows.
- Emulsion Plant: situated on a flat wadi area and therefore at risk. Local drains and diversions are installed, however, Knight Piesold also recommended baffles are installed in the upstream to delay flow.
- Explosives Magazine: situated on a flat wadi area and therefore at risk. Local baffles and drains installed, however, Knight Piesold (2020) also recommend a minor diversion system to divert ‘a significant catchment’

- Main site access road: noted as high risk of flooding. The recommendation was that the road is closed during rain events to mitigate risk to staff and damage to the road.

16.4.4 Hydrostratigraphy and Structures

The project area comprises two key hydrogeological domains; an upper unit Wadi sediments overlying a deeper fractured bedrock which hosts the orebody.

The Wadi sediments represent an unconfined, unconsolidated sands and gravels aquifer. The sediments range in thickness from 10-50m in the centre of the Wadi and thin to only a metre or two thickness across the wider floodplain towards the edges of the Wadi. The depth of the unconsolidated wadi gravels across the process plant site varies between 1 and 9.3 m as observed in the test pits and drill holes (KP, 2020). The Wadi sediments receive direct recharge from infrequent rainfall events which percolates and is either held in storage at the base of the wadi sediments where there is a permeability contrast with the underlying bedrock. Over time water held in storage in this manner recharges the deeper fractured bedrock.

The host rock of the gold mineralisation comprises a NNE striking mélange of 1) calc-alkaline igneous rocks and 2) metasediments which have undergone regional metamorphism to mid-upper greenschist facies.

The outcrop of the Sukari felsic granodiorite ridge is 2.3km long, ranging from 100-600m thickness and dipping relatively steeply easterly (50°- 75°). The open pit is dominated by the porphyry, with contacts along the hanging wall (to the east) and footwall (to the west) with the meta-sediments. The upper hangingwall is dominantly Tuffs and Carbonate Schists, the upper footwall is dominantly Carbonate Schists. The geological structures control groundwater within the fractured bedrock, acting as a barrier and creating preferential flow paths for groundwater. The bedrock has relatively low permeability in the vast majority of the mining areas, but in localised fault and structal zones pemeability is enhanced. The main source of recharge to the fractured deeper bedrock is through the overlying wadi sediments.

The understanding of the complex structural geology in the vicinity of the open pit and underground mine was updated in 2021 and it is understood another review is now underway (September, 2023). A 3D structural geology model (Leapfrog Geo) was created by SRK (2021) with the primary purpose to inform a geotechnical model for planning. The 3D geological model included 19 faults; 9 major faults and 10 intermediate faults. This integrated the open pit and underground datasets which have been maintained largely independent of each other.

SRK reported that "The Sukari Thrust, Puggy Shear, Golden Boy and Akbar Wahed particularly play a key role in controlling seepages to the pit and underground mine. The Sukari Thrust is particularly significant in terms of groundwater flow to the western wall and groundwater inflows in the south-western corner of the pit is associated with the intersection between the Puggy Shear and the Sukari Thrust."

16.4.5 Hydrogeological Properties

SRK are going to prepare an updated 2D model but are waiting additional data from newly installed piezometers. They are also waiting to review the vibrating wire piezometer data in the West wall and incorporate this data into the report.

Air-lifting of 15 boreholes in the vicinity of the open pit indicated a range of yields from 0.1 to 1.3L/sec. Tests were undertaken for 1-2 hours and in the vast majority of boreholes the air lifting rate decreased during the test (GRM, 2012) No more recent hydraulic testing has been presented within the existing hydrogeological conceptualisation.

16.4.6 Groundwater Levels

A network of around 80 standpipe piezometers exists (SRK, August 2023), although a number of the monitoring points are obsolete and are no longer monitored as they are installed in zones that have become dry. Groundwater levels are understood to be monitored within 48 boreholes to inform the temporal and spatial variation in the vicinity of the open pit, underground mine and TSFs. Ambient groundwater levels were reported as between 1084 and 1064 mRL in 2012. Recent water levels provided (2022) have been stable. Open pit and underground mines have advanced below the original ambient groundwater levels, although there has not been significant dewatering or required significant management (GRM, 2012). The notion of a water table is perhaps simplistic in this setting as groundwater levels are relatively variable indicating the compartmentalisation of groundwater by regional structures within the bedrock. This was confirmed during the WAI site visit in 2022.

The location of the groundwater monitoring boreholes is presented in Figure 16.10. Many of the boreholes are reported as inactive in (red dots). In the vicinity of the open pit, it is understood a number of boreholes (as shown in red) have been decommissioned as the pit extents have advanced (now at Stage 5 and 6).

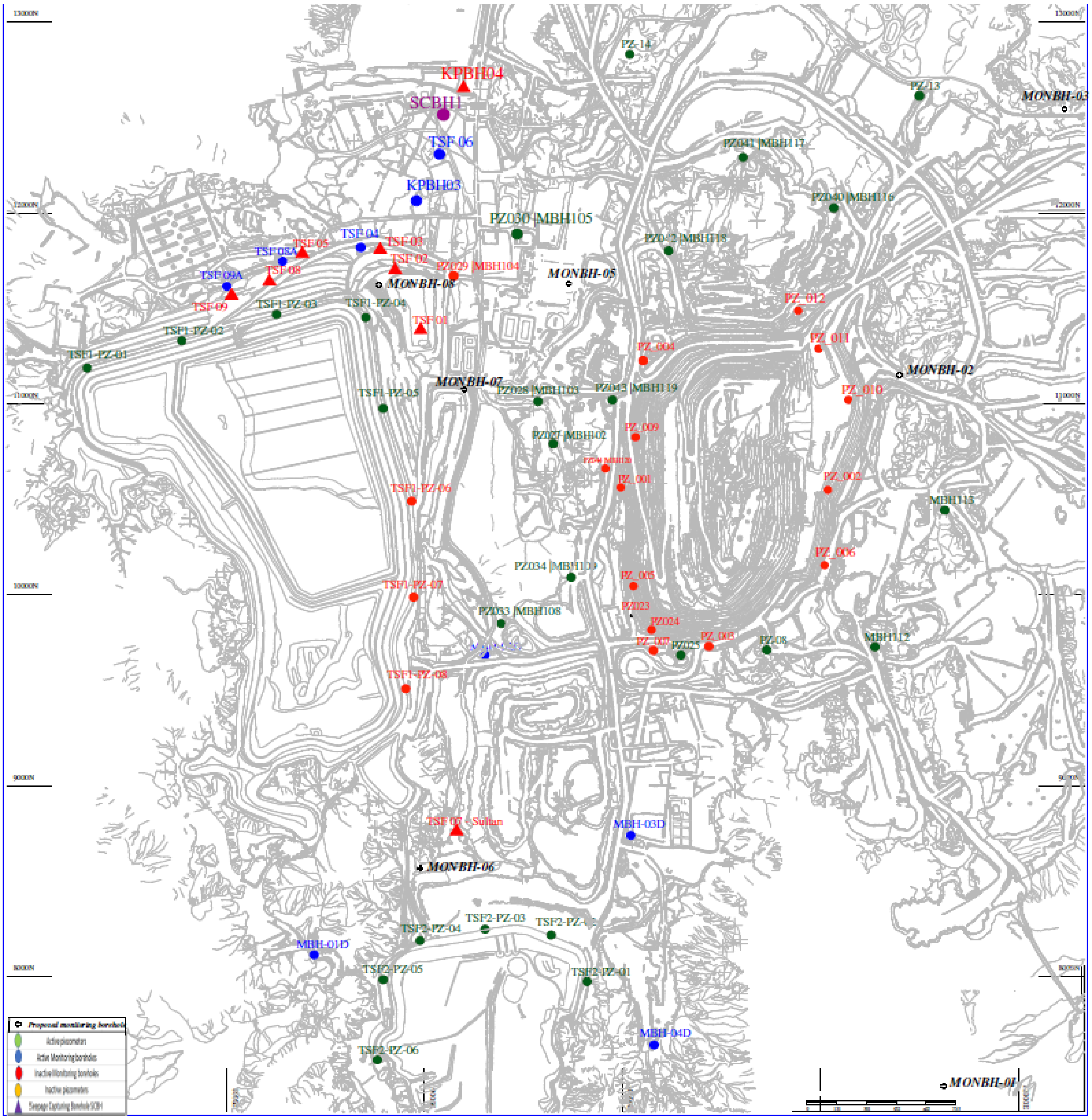


Figure 16.10 Groundwater Monitoring Locations

Note: Green= Active piezometers, Blue= Active monitoring boreholes, Red= Inactive monitoring boreholes, Orange= Inactive piezometers.

16.4.7 Groundwater Flow Direction and Behaviour

The groundwater flow direction in the Wadi sediments is generally east and north-eastwards towards the Red Sea. There are two known wells within the Wadi sediments installed by Bedouins, nomadic pastoralists, for water supply (KP, 2020). The current status of these well is unknown. There are no known Bedouin wells in the wadi downstream of the mine and TSF No. 1 (KP, 2020).

16.4.8 Groundwater Chemistry

Routine weekly monitoring of groundwater chemistry is undertaken for contaminants of concern. Parameters routinely monitored include; total dissolved solids (TDS), pH, Cyanide (CN), Weak Acid Dissociable Cyanide (WADCN), Sulfate, Chloride, Copper and Arsenic. Results are presented in a weekly monitoring report as time series graphs and with spatial 'hot spot' graphs to assess the evolution of trends or anomalous results. This is completed by the HSE department of the Environmental Team. Anomalous results are understood to be followed up.

The status of groundwater monitoring boreholes is presented in Table 16.1 (Source: SGM, September 2023)

Borehole ID	Coordinates			Status	Borehole ID	Coordinates			Status
	Northing	Easting	Elevation			Northing	Easting	Elevation	
TSF 1	11376.54	8989.62	1060.83	Inactive	PZ033 |MBH108	9845.55	9385.45	1088.34	Active
TSF 2	11711.7	8829.13	1054.17	Inactive	PZ034 |MBH109	10090.83	9740.62	1114.39	Active
TSF 3	11782.85	8758.83	1054.4	Inactive	PZ036 |MBH112	9722.58	11282.67	1176.77	Active
TSF 4	11819.64	8676.9	1054.92	Active	PZ037 |MBH113	10440.32	11630.67	1175.57	Active
TSF 5	11788.55	8379.15	1065.49	Inactive	PZ040 |MBH116	12026.41	11069.72	1069.82	Active
TSF 6	12308.47	9074.49	1044.52	Active	PZ041 |MBH117	12292.73	10611.49	1107.28	Active
TSF 7 Sultan	8752.86	9178.77	1100	Inactive	PZ042 |MBH118	11802.95	10229.05	1124.99	Active
TSF 8	11652.4	8248.3	1067.62	Inactive	PZ043 |MBH119	11022.4	9948.37	1087.57	Active
TSF 9	11574.2	8010.82	1074.38	Inactive	PZ044 |MBH120	10658.23	9914.76	1086.68	Inactive
TSF 08A	11747.05	8283.31	1068.33	Active	TSF1-PZ-01	11187.94	7295.13	1122.38	Active
TSF 09A	11614.8	8001.32	1076.4	Active	TSF1-PZ-02	11330.99	7774.23	1121.87	Active
KPBH03	12062.89	8958.32	1049.68	Active	TSF1-PZ-03	11467.97	8251.22	1122.11	Active
KPBH04	12635.06	9194.48	1040.51	Inactive	TSF1-PZ-04	11466.25	8703.39	N.A.	Proposed
KPBH05	13269.64	9331.61	1031.42	Active	TSF1-PZ-05	10973.19	8788.21	1122.02	Active
MBH-01D	8125.33	8444.9	1148.69	Active	TSF1-PZ-06	10490.81	8934.1	N.A.	Proposed
MBH-02D	9682.94	9304.8	1090.04	Active	TSF1-PZ-07	9994.76	8948.15	N.A.	Proposed
MBH-03D	8739.72	10042.3	1144.79	Active	TSF1-PZ-08	9507.54	8902.53	1125.42	Active
MBH-04D	7641.82	10160.39	1169.48	Active	TSF2-PZ-01	7972.73	9821.23	1152.94	Inactive
MBH-05D	5604.17	9862.36	1169.41	Active	TSF2-PZ-02	8217.37	9639.51	1152.84	Inactive
KPBH06	13990.55	9474.29	1020.04	Active	TSF2-PZ-03	8248.07	9305.14	1152.87	Inactive
KPBH07	14941.26	10329.48	1002.04	Active	TSF2-PZ-04	8188.68	8976.68	1152.75	Inactive
PZ-08	9710.01	10729.77	1124.61	Active	TSF2-PZ-05	7982.43	8789.82	1152.78	Inactive
PZ-13	12613.24	11503.62	1038.24	Active	TSF2-PZ-06	7562.81	8760.53	1152.67	Inactive
PZ-14	12828.08	10039.22	1046.91	Active	TSF2-VWP-01	8081.82	9843.51	1150.48	Active
PZ-25	9386.98	10294.95	1106.57	Active	TSF2-VWP-02	8235.15	9623.47	1151.95	Active
PZ027|MBH102	10790.87	9654.57	1075.99	Active	TSF2-VWP-03	8262.64	9313.36	1151.51	Active
PZ028|MBH103	11004.91	9565.96	1072.06	Active	TSF2-VWP-04	8214.43	9046.23	1151.89	Active
PZ029|MBH104	11674.47	9144.29	1055.32	Active	TSF2-VWP-05	8049.53	8774.39	1151.53	Active
PZ030|MBH105	11889.8	9467.38	1051.93	Active	TSF2-VWP-06	7644.77	8676.24	1155.98	Active
PZ031|MBH106	13427.89	11341.16	1018.9	Active	SCBH1	12514.848	9095.2231	N.A.	Seepage Capturing
PZ032|MBH107	10671.76	15134.09	997.5	Active	SCBH2	13806.956	9432.3541	N.A.	Seepage Capturing
TSF Sultan 02	9798.906	9276.134	1089.473	Active	MONBH03	12747.423	11772.616	1037.869	Active
MONBH04	14426.525	11229.761	1004.77	Active	KPBH03_Replace	11994.6	9071.212	1050.382	Active
TSFMON1	11976.65	8704.517	1052.014	Active	TSFMON2	11835.33	8343.751	1067.347	Active

Table 16.6 : Status of Groundwater Monitoring boreholes

16.4.9 Groundwater Management

16.4.9.1 Dewatering / Depressuring

Open Pit

The anticipated total depth of the open pit is 560mRL, c. 500m below the initial water strike recordings. Although a degree of connection between the wadi groundwater and bedrock groundwater is likely (promoting bedrock recharge), it not clear whet the degree of hydraulic continuum is between units. The relative elevations of the water strike / water table recorded and the pit base means there is potential for a hydraulic gradient between surrounding saturated bedrock and discharge points in the pit faces and pit base.

SRK (2023) has reported that regional structural features, namely the Sukari Thrust, Puggy Shear, Golden Boy and Akbar Wahed zone play a key role in controlling seepages to the pit and underground mine. The Sukari Thrust dominates the groundwater flow to the western wall and the intersection between the Puggy Shear and the Sukari Thrust dominates the groundwater inflow observed in the south-western corner of the pit.

Despite the potentially high hydraulic gradient, SRK report that there are low inflows to both the underground and open pit mine which are typically less than <5 L/s. Given the aridity and scale of the pits with significant capacity for sump storage, these inflows rarely require pumping out.

Unsurprisingly, given the high head differentials and low outflows, there is potential for significantly elevated 'pore-water pressure' in the pit faces. Fracture connectivity in many of the massive blocks of the pit walls will be limited and corresponding pore-water pressures may be low to moderate because the blocks are essentially isolated. In structural zones such as the thrust and puggy shear units, the material may have more porous, or equivalent porous properties and be hydraulically connected over larger vertical distances. Therefore, it is possible for higher heads to develop and create higher pore-water pressures. In regards to open pit mine water management, SRK commented:

> *"The open pit at SGM appears to be sensitive to pore water pressures, especially in the southern and western sectors, although the degree of sensitivity is still under investigation. It is thought that pore water pressures played a role in instability in the western wall, which was subject to movement in 2020. In response, as well as being buttressed, a number of horizontal drain holes of between 110 and 150 m length were drilled into the western and southern walls with the aim of depressurizing the area behind the key zones of instability via geological structures. After these remedial measures were implemented, movement reduced significantly, although it is not clear what role that horizontal drain holes played compared to the buttressing as few monitoring wells (and no VWPs) were operational in the area at the time. A second program of horizontal drain hole drilling was undertaken in later 2021, with drains of up to 200 m drilled into the southern, northwestern and northeastern corners of the pit. SGM plans to continue drainhole drilling as the mine progresses, with the immediate focus being an area around the recently installed*

> *VWP monitoring such that the effectiveness of the drainholes can more accurately be assessed. Seepage from horizontal drain holes is collected in a lined trench from where it mostly evaporates, requiring only occasional pumping out to a water truck."*

In the north and north-eastern corners of the open pit, minor groundwater seepage associated with kaolinitic structures of the East Puggy Shear were observed in May 2021. The north-eastern corner is also reported to intersect a historical area of Wadi sediments, possible representing a recharge zone to the fractured bedrock (SRK).

From the WAI site visit in September 2022, it is understood that dewatering of the open pit and underground mine are now independent of each other. Inflows from seepages are collected in a sump within the open pit and each zone of the underground mine and dewatered from there.

It is reported that "generally water [is] not an issue with stability, but only in contact with Puggy Shear and Sukari Thrust," (Centamin, Sukari Gold Mines, OP/UG Geotechnical Update 2022 presentation, September 2022). During the WAI site visit, seepages were observed in the south west of the open pit (within the Western design domain) attributed to the intersection of the open pit with the Sukari Thrust Fault.

Separate to the horizontal drain holes reported by SRK above, a depressurisation programme commenced in September 2020 with drilling 26 vertical holes, each 200m depth to target seepage areas within the open pit. The majority of the holes focused on the south-west corner of the open pit, targeting the Sukari Thrust Fault.

No depressurisation boreholes were observed during WAI site visit, although it was reported to WAI during the visit that water was flowing from one of the depressurisation boreholes in the south-west of the open pit.

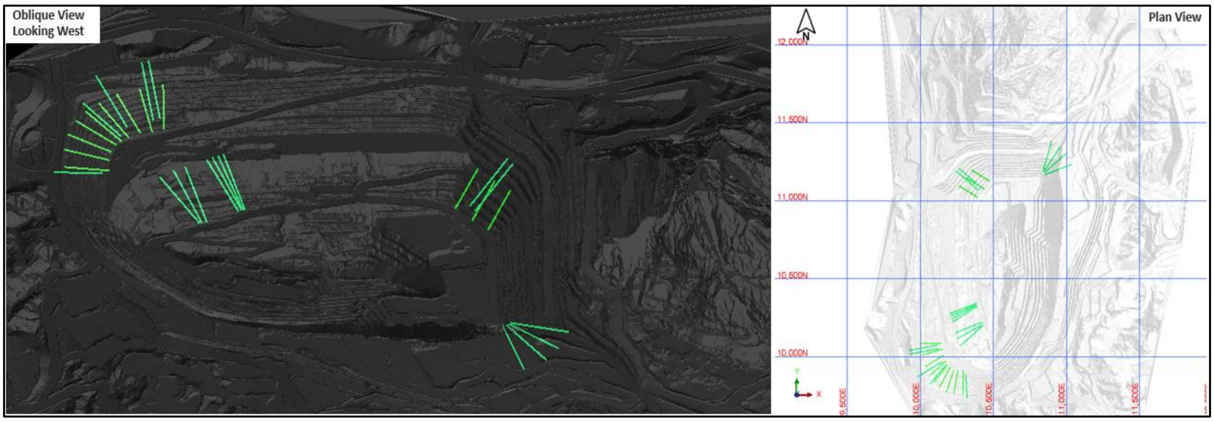


Figure 16.11: Location of Depressurisation Holes at Stage 5

To address a recent instability of a sliding block in the Stage 5 West, it is understood that six additional depressurisation holes (totalling 900m) are to be drilled from the 910mRL. These are to replace the historical drainage holes which have been destroyed due to blasting.

Eighteen (18) depressurisation boreholes are monitored daily and reported on a weekly basis. Twelve (12) of these boreholes do not have any recordable flow in them, although water may have ponded at the base. Of the remainder that were reported to have flows (5 in July 2023 and 3 in August 2023). the flows were relatively consistent and low not exceeding 1m^3/day with the exception of DP_STG04_46 that yielded just over 1m^3/day.

Underground Mining

Groundwater inflows are anecdotally reported as 'near zero" in the underground mine (GRM, 2012). No routine flow monitoring was being undertaken at this time. Minor inflows comprise seeps to flowing water. The flows are reported as dominantly due to intersection with exploration drill holes and are not sustained over time (GRM, 2012). Conceptually, as the vast majority of the transmissivity is attributed to fractured fault zones and the primary permeability of the volcanics and metasediments is relatively low, once the localised groundwater held in fractures is drained, over a short time period, the groundwater inflow rate is significantly reduced therefore the sustained groundwater inflows to the open pit and underground mine are low.

Groundwater has not been a limiting factor for Sukari operations therefore it has remained of little concern relative to other geotechnical challenges. Following the 2020 open pit western wall instability event, and its possible attribution to high pore-water pressure in conjunction with weak structural and enhanced porous zones, it's now an area of more focused attention.

In 2012, the northernmost and north-western parts of the underground mine had greater groundwater inflow rates than elsewhere. The north-western flow was characterised by 'dripping'. It was interpreted that the northernmost zone of the underground mine (at this time) observed increased inflows due to intersection of an E-W trending fault.

In regard to underground mine water management, SRK commented:

> *"Inflows to the underground mine are generally less than 2 L/s and short-lived, typically dropping to less than 1 L/s after a few days. Inflows are typically associated with the same geological structures which are also associated with seepages in the open pit, for example the Puggy Shear, Golden Boy and Sukari Thrust. Groundwater inflows to the underground mine cannot be discerned from service water, the latter of which constitutes the majority of dewatering requirements. The largest service water inflow is due to daily flushing of the backfill line and efforts are made to divert the majority of this flushing water away from stopes to the larger sumps, wherever possible. The dewatering system comprises a daisy chain of single unit Challenge WearTuff helical rotor pumps, fed using submersible centrifugal trash pumps from operational sumps."*

During the WAI site visit in 2022, underground seepage was observed, attributed to the intersection of the Puggy Shear Fault in the Bast Zone of the underground mine. This was noted to be drilling water and was significantly less than the water accumulating and being dewatered from the underground mine due to operational drilling activities.

16.4.9.2 Modelling

Groundwater modelling has been undertaken to improve understanding of open pit depressurisation/dewatering programmes (SGM, 2021a). This has been used to inform the geotechnical assessment.

16.4.9.3 Management Planning

In 2020, Knight Piésold developed a Groundwater Management Plan and a set of Standard Operating Procedures (SOP) aiming to comply with Egyptian mining and groundwater legislation, or alternatively, IFC Performance Standards and IFC Environmental, Health and Safety Guidelines.

SRK have since undertaken a review of hydrogeology and water management on behalf of SGM in October 2022. This involved a site visit by two hydrogeologists, a review of all available hydrogeological data, development of a preliminary hydrogeological conceptual model and recommendations on future works in regard to hydrogeological site investigation and informing SGM's dewatering programme. The recommendations in the 2020 groundwater management plan have been superseded by the SRK recommendations. An illustrative overview of the preliminary conceptual understanding (pre-VWP installation) is presented in Figure 16.6.

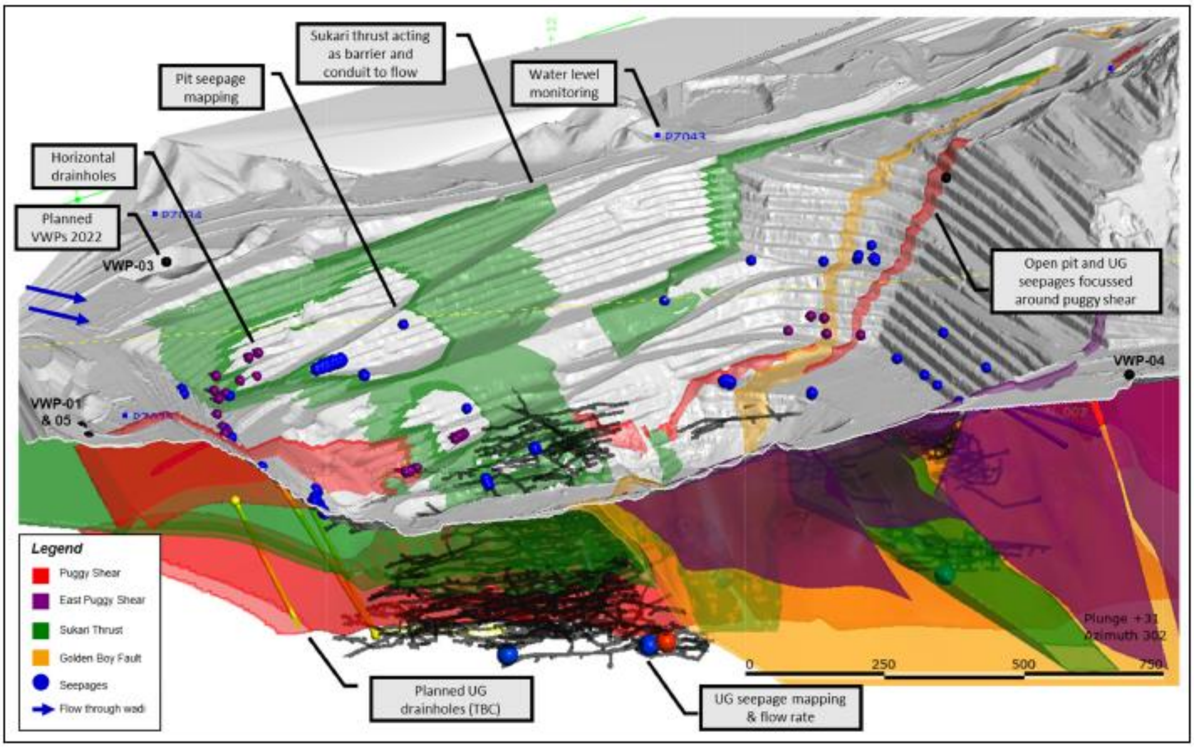


Figure 16.6 Preliminary conceptual understanding (SRK, 2022)

17 RECOVERY METHODS

17.1 Introduction

The Sukari processing plant (Photo 17.1) was commissioned in 2009 and has since undergone several expansions. The initial crushing, milling and CIL circuits (purchased second-hand) were designed to process oxide ore at a rate of 4Mtpa. The circuit was expanded to process a 5Mtpa blend of oxide and sulphide ores with the addition of secondary crushers, a flotation circuit, flotation concentrate regrind circuit, flotation concentrate CIL circuit and expansion of the essential support services. The processing plant was further expanded to process 10Mtpa in 2012 by the addition of a second crushing, milling and flotation circuit. Several other smaller circuit modifications to debottleneck the process plant were made including the addition of a second Zadra elution circuit and a second carbon regeneration kiln which allows the circuit to operate at a nominal throughput rate of 12.6Mtpa.

Photo 17.1: Sukari Process Plant

In addition, there are two dump leach operations, one of which has effectively been operating since the start of operations, but this contributes only a small amount of the total gold production, its primary focus being to cover the costs of mine waste transportation.

A small amount of gold is produced from processing the CIL carbon fines and tailings dam return solution through a carbon-in-column plant.

The current LOM is 12 years with an average plant feed grade of 1.19/t Au, sourced from both the open pit and underground mining operations. The underground ore has a higher average head grade of circa 3.9 g/t Au and will primarily be processed through the Line 1 processing circuit, with appropriate blending from open pit ore. The underground ore will supply on average about 10% of the tonnes and 25% of the gold production.

The average LOM plan requires a process plant throughput of 12.5Mtpa and a gold recovery of 89.4%.

Power generation is from both a dedicated solar power station and from diesel-fuelled generators in two power stations. With a total site power demand of approximately 50MW, approximately 30MW_{DC} is currently produced from the solar power station (installed capacity is 36MW_{AC}), saving 22 million litres of diesel fuel a year. However, the power is not consistently applied over 24 hours and is mainly generated during the day shift, at approximately 30MW. The balance of power is provided by the 80MW diesel-fuelled power station, with the required number of generators running on diesel fuel rather than heavy fuel oil. SGM plans to expand the solar farm by a further 15-20MW and following a Grid Power study in 2022, SGM is in negotiation with an approved Egyptian contractor for a direct national grid connection to fully displace the need for on-site diesel generated power and further reduce operating costs and GHG emissions.

Raw water supply for the process is pumped from the Red Sea and supplemented by Tailings Dam Return Water.

There are currently two RO (Reverse Osmosis) plants, with a third one planned to double capacity, which supply fresh and potable water, for reagent preparation and other required areas of the plant.

The process plant has 300 employees (excluding maintenance which reports directly to the General Manager) and operates on a 12-hour shift basis (three shift crews), currently from 5am – 5pm.

17.2 Process Description

17.2.1 Crushing and Ore Storage

Two crushing circuits are operating at Sukari. The first (Line 1) consists of a 54” x 74” primary gyratory and an open circuit CH870 Sandvik secondary cone crusher. The circuit receives a higher-grade blend of underground and open-pit ROM material. The crushed product is fed onto Stockpile 1 with a live capacity of 15,000t. The second circuit (Line 2) consists of a 55” x 83” primary gyratory crusher, two vibrating scalping screens on the primary crusher product and three Sandvik CH870 secondary cone crushers to crush the screen oversize. This circuit receives mainly lower-grade open-pit ROM material and feeds crushed product onto Stockpile 2 with a live capacity of 15,000t. A portion of the product may also supplement the feed to Stockpile 1 if required.

The flowsheet is shown as Figure 17.1.

Crushed ore is reclaimed from the two stockpiles via apron feeders and discharged onto conveyors that feed the two separate milling circuits. Each stockpile is fitted with three apron feeders. The design capacity of the feeders is such that only two feeders are required to operate at any time with the third being a standby. However, due to the conical shape of the stockpile and natural segregation occurring when crushed ore is discharged onto the stockpile, all three feeders are operated per stockpile.

The crushing circuits are designed to crush a total of 15Mtpa of ROM material to a product P_{80} size of 40mm. The crushing circuits have a combined availability of approximately 87% per annum. The capacities of the installed equipment are significantly more than the required design throughput, resulting in an estimated crusher circuit operating utilisation of 68% per annum. Trials were conducted to see if it was possible to operate only the larger crushing circuit and shut down the smaller one as a cost-saving exercise, but throughput was adversely affected and so both crushing circuits remain in operation.

17.2.2 Milling

Two SABC milling circuits are operating at Sukari for the two process lines. The first circuit, Line 1, consists of a SAG mill (8.32m diameter by 3.81m EGL, 5,593kW fixed speed drive) and two ball mills (4.85m diameter by 9.14m EGL, 4,100kW fixed speed drive each).

Pebbles from the SAG mill product are removed using a combination of a trommel screen and a vibrating screen. The pebbles are crushed using a single Metso HP500 short head cone crusher. Crushed pebbles are returned to the SAG mill feed conveyor. Trommel and pebble screen undersize material is pumped to the combined ball mill discharge pump box.

The combined SAG mill and ball mill products are pumped to a cyclone cluster where the cyclone underflow is returned equally to the two ball mills, and the cyclone overflow is discharged onto one new and larger (originally three smaller) vibrating trash screen. Trash screen underflow is pumped to the Line 1 flotation conditioning tank. Trash screen overflow is currently dumped to the milling area floor and pumped back into the SAG or ball mill discharge hoppers via the spillage pumps.

The second milling circuit, Line 2, consists of a SAG mill (8.54m diameter by 4.65m EGL, 7,000kW variable speed drive) and a ball mill (6.10m diameter by 9.62m EGL, 7,000kW fixed speed drive). Pebbles from the SAG mill discharge are removed using a trommel screen. The pebbles are crushed using two FLSmidth Raptor XL300 short head cone crushers. Crushed pebbles are returned to the SAG mill feed conveyor. Trommel screen undersize material discharges into a combined mill discharge pump box.

The combined SAG mill and ball mill products are pumped to a cyclone cluster where the cyclone underflow is returned to the ball mill, and the cyclone overflow is discharged onto three linear vibrating trash screens. Trash screen underflow gravitates into the Line 2 flotation conditioning tank. Trash screen overflow is currently dumped to the milling area floor and pumped back into the combined mill discharge hopper via the spillage pumps.

The milling circuits are currently producing a combined flotation feed of approximately 12Mtpa at a P_{80} grind size of 150 microns for Line 1 and 200 microns for Line 2 compared to the original design of 10Mtpa at a grind P_{80} size of 150 microns. Line 1 typically receives a blend of higher-grade underground ore and lower grade open-pit ore. Line 2 receives mainly lower grade open-pit ore.

The grinding media make-up sizes are 80mm and 60mm for the ball mills and 125mm for the SAG mills.

While the higher-than-design throughput has historically exerted some stress on the classification and trash screening circuits (roping cyclones, overflowing trash screens), no significant problems are currently reported, particularly with the replacement of the three smaller trash screens on Line 1 with one larger more efficient trash screen. The trash screen aperture size has also now reverted back to design, namely 0.8mm.

SAG mill relining operations (steel liners) are contracted to a New Zealand company, while all Ball Mill relining operations (rubber liners) are contracted to a local contractor. There is on-going work to optimise liner design with the vendors.

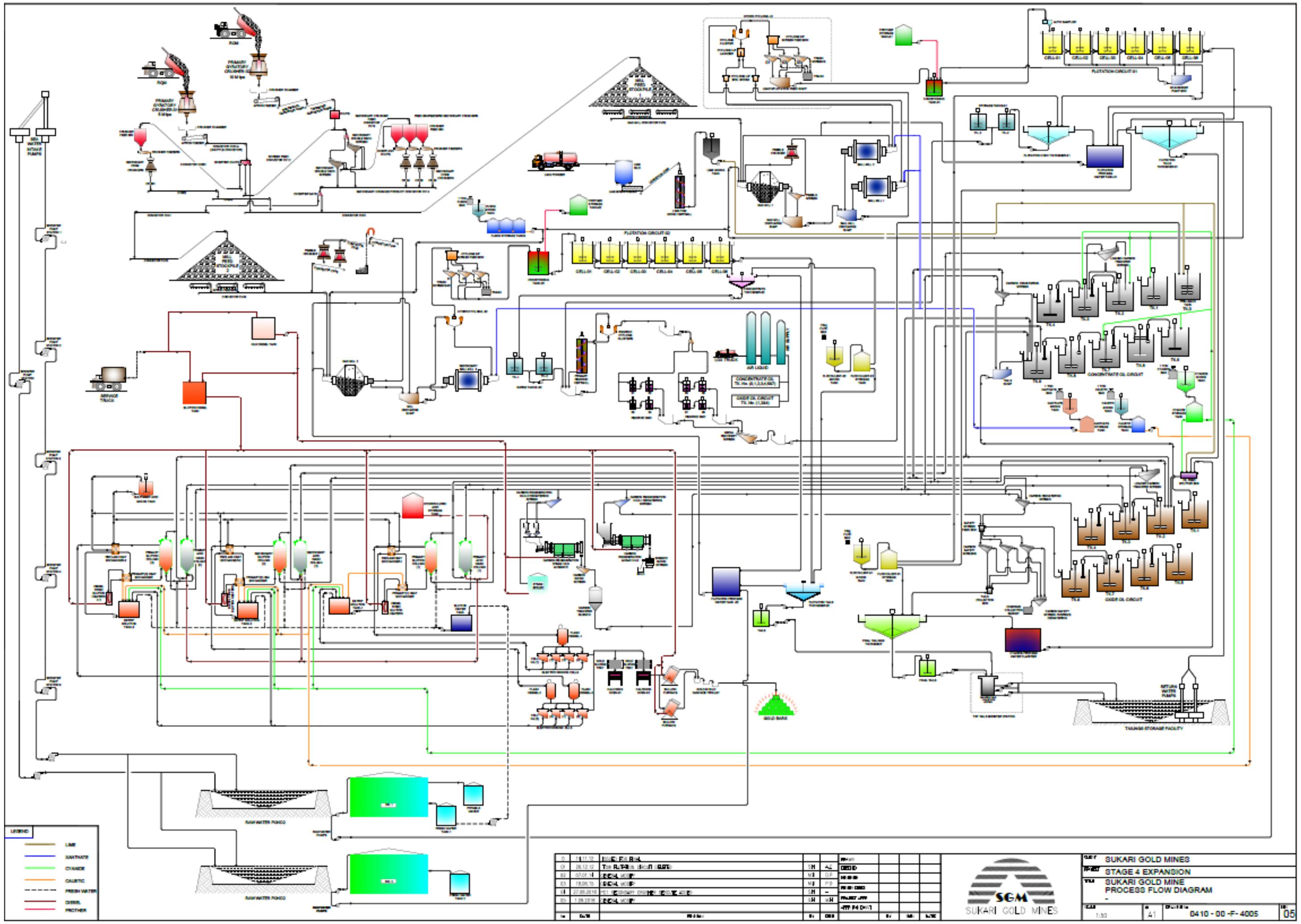


Figure 17.1: Sukari Process Plant Flowsheet

17.2.3 Flotation

Two rougher flotation circuits (Lines 1 & 2) receive the underflow from the corresponding circuit's trash screens. The Line 1 flotation circuit consists of four 100m^3 rougher flotation cells and two 100m^3 rougher scavenger flotation cells. The concentrate from the rougher flotation cells is pumped to the Line 1 concentrate thickener, and the concentrate from the rougher scavenger cells is recycled back to the rougher feed conditioning tank.

The Line 2 flotation circuit consists of six 130m^3 rougher flotation cells. There are no scavenger flotation cells in Line 2. The combined concentrate from the six cells is pumped to the Line 2 concentrate thickener. The tailings from the two flotation circuits are pumped to their respective tailings thickeners. The thickened underflow from Line 1 tailings thickener reports to the float tail CIL circuit to recover additional non-floatable gold particles from the higher-grade input from underground ore (up to 5 g/t Au). Line 2 flotation produces a low-grade tailings stream that is pumped directly to the TSF.

Both circuits produce a high-grade gold-enriched sulphide (pyrite) concentrate. Various quantities and types of gangue minerals in the ore, e.g., talc, kaolinite clays, carbonaceous material and shales cause flotation difficulties. The carbonaceous/graphitic ore present in the pit can potentially preg-rob some of the gold in the leach circuit if included in the plant feed, although this is generally waste material.

Although some arsenic sulphides are present, it is reported not to a significant issue.

The pyrite flotation circuits are the core processes for gold recovery to the downstream circuits. Automatic control systems developed by Metso: Outotec are employed and include sulphide measurements of the flotation head and tails streams, froth depth and air flowrates. Flotation is conducted at the natural pH of circa 8.0. Potassium Amyl Xanthate (PAX) is used as the collector with copper sulphate as the activator. A project is underway investigating the use of a secondary collector.

The sulphide recovery is generally circa 88-89% but can vary, although there is not always a direct correlation between sulphide and gold recovery. For example, sulphide recovery can fall to about 80% without impacting the gold recovery.

Fully automatic samplers have now been installed, incorporating primary and secondary sampling systems.

17.2.4 Thickeners

There are five thickeners installed at Sukari. Two float concentrate thickeners (14m and 15m diameter), dewatering the flotation concentrate from the two Lines, and two flotation tailings thickeners (23m and 25m diameter) dewatering the flotation tails from the two Lines respectively. The overflow from the concentrate and tails thickeners reports to the respective process water tanks in each Line.

The fifth thickener (23m diameter) originally dewatered the Line 1 float tail CIL tailings stream but was taken out of service as the thickener was continuously sliming, so this stream reports directly to the TSF, albeit at a slightly lower slurry density.

While historically there were issues with the thickeners sliming with the increased throughput, they are reported to be operating satisfactorily and work has been done to improve performance and the flocculant dosing with new dosing systems installed.

17.2.5 Regrind

The underflow from the concentrate thickeners is pumped to surge tanks ahead of the regrind circuit to ensure that a stable and constant feed is provided to the regrind mills. Particle size analysis of the regrind circuit feed indicates that the average feed size to the circuit is 25 microns. The regrind circuit originally consisted of a single Metso VTM1250 Vertimill operating as the primary mill with four secondary Metso SMD355 Stirred Media Detritors (SMD) and four tertiary Metso SMD355 Stirred Media Detritors (SMD), the SMD mills operating in series in four pairs.

The Vertimill is no longer in operation but is retained on standby for emergency use only. Historically, it was noted that the Vertimill was not performing well in terms of grind size reduction but added considerably to the operating costs. The final grind P_{80} size from the SMDs averages 10 microns, with a P_{50} of circa 5 microns.

The concentrate (thickened underflow) reports to a pump box and is pumped to the (now) first-stage SMD regrind mill splitter box where the slurry is split equally between the number of operating first-stage regrind mills (four). The product then reports to the second-stage SMD mills (four) operating in series and in pairs. The final product is pumped to an SMD media recovery screen where misplaced ceramic media is removed and recovered before it is pumped to the float concentrate CIL circuit.

The regrind circuit was initially designed to produce a float concentrate CIL circuit feed with a grind P_{80} size of 12 microns. However, site and laboratory testwork indicated that additional gold could be recovered by reducing the CIL circuit feed P_{80} size to 7 microns, but this target size has subsequently been increased to 10 microns.

All eight of the SMDs are in operation.

Grinding costs have been reduced by utilising old grinding media with new grinding media in a 50:50 blend. Additionally, there is an on-going project to investigate installing a cyclone classification stage ahead of the SMDs to potentially remove a fines fraction that may not require regrinding.

17.2.6 Leach and Carbon in Leach Circuits

17.2.6.1 Introduction

The Sukari process plant contains two leach and CIL circuits, namely the pyrite flotation concentrate leach and CIL circuit and the Line 1 flotation tails leach and CIL circuit.

17.2.6.2 Float Concentrate Leach and CIL Circuit

The combined flotation concentrate from the two flotation circuits (Lines 1 & 2) reports to the float concentrate leach and CIL circuit, after it has been reground to the P_{80} size of 10 microns. Slaked lime is added to increase the pulp pH to 10.2. Oxygen is also added to increase the dissolved oxygen concentration in the solution to circa 15-20 ppm. Ten tanks of 288m^3 volume and two tanks of 3,000m^3 volume are used of which the first five small tanks are used for pre-oxidation only. Cyanide is added to the sixth small tank (CIL) with the remaining CIL tanks containing activated carbon and the associated inter-stage screens. All the tanks are agitated and oxygen is sparged into each tank (3 spargers per tank). The oxygen pressure and flowrate is regulated to each tank. The overflow pulp from each tank gravitates through the tanks via launders from the inter-stage screens. Carbon is pumped through the carbon adsorption tanks counter-currently to the flow of pulp.

Oxygen is supplied on site from two sources: the first is from a dedicated cryogenic oxygen plant, the second is through the supply of liquid oxygen which is trucked to site.

Note that the two larger tanks are located in the float tail CIL circuit (converted for use in the float concentrate CIL circuit to increase residence time, circa 36 hours, for increased gold recovery).

Carbon recovered from the float tail CIL circuit is pumped to the last CIL tank and then pumped counter-current to the slurry stream, using vertical slurry pumps, to adsorb the gold in solution. Gold loaded carbon is recovered in batches from the first CIL tank via the carbon recovery pump and a vibrating screen.

The loaded carbon overflows the loaded carbon screen and discharges into a three-tonne carbon transfer column. The carbon recovery pump is stopped when the transfer column is full. The transfer column is pressurised using freshwater, and the carbon is transferred to either one of the acid wash columns.

The pulp pH is monitored, and slaked lime and cyanide can be stage-added as required to the pre-oxidation and CIL tanks. The slurry temperature in the float concentrate leach circuit is too high for dissolved oxygen probes to function correctly. Therefore, oxygen is continuously metered into all the tanks based on pre-determined flow set points. For the first two tanks, oxygen is added via a multimixer oxygen sparging system with hyper spargers for the other tanks.

There is a project being considered to replace the five small tanks used for pre-oxidation with one large tank from the float tail CIL circuit, to provide better efficiency and control of reagent additions. A solid to liquid system (SLS) is also being considered for cyanide solution preparation, which reduces handling and removes the need to dispose of cyanide briquette boxes and bags, as reusable packaging is employed instead.

17.2.6.3 Float Tail Leach and CIL Circuit

The Line 1 flotation tailings is thickened and then pumped to the float tail leach and CIL circuit, which consists of six 3,000m^3 volume CIL tanks (originally the old oxide CIL circuit containing eight tanks, but the second and fourth tanks are now used for the flotation concentrate leach and CIL circuit).

Slaked lime is added to the first tank to maintain a pH of 9.9. Cyanide is also added to start the gold leach process. Oxygen is metered into all the tanks via side sparging. The tailings slurry from the last pyrite float concentrate CIL tank is also added to the third tank. The slurry gravitates through the six tanks via the intertank screens and launders. The tailings from the last CIL tank gravitates over three carbon safety screens before being pumped to the TSF without thickening.

Regenerated carbon, fresh carbon and loaded carbon from the north and south heap leach dumps are added to the last CIL tank via the carbon safety screen. Carbon is pumped counter-current to the slurry from the last and through to the first tank using an airlift pumping system. Loaded carbon is recovered from the first tank using the carbon recovery pump and a DSM screen. Recovered carbon discharges into the last pyrite float concentrate CIL tank, and the slurry returns back to the first float tail CIL tank.

The carbon recovered using the DSM screen and carbon recovery pump is not sufficient to maintain a constant carbon concentration throughout the float tail CIL tanks and the pyrite float concentrate CIL tanks. Therefore, carbon is also recovered from the first float tail CIL tank using the carbon recovery pump and the old, loaded vibrating carbon recovery screen. Carbon recovered from this screen discharges into either of the two acid wash columns and is then transferred to the penultimate float concentrate CIL tank using pressurised freshwater.

17.2.7 Elution, Carbon Regeneration and Goldroom

17.2.7.1 Introduction

Gold is recovered from the loaded carbon utilising two parallel 9 tonne Zadra elution circuits, each processing two batches of carbon per day. This requires a daily carbon movement of 36 tonnes. The majority of the valves in both the acid wash and elution circuits are manually operated rather than via automatic sequencing. The average loaded carbon value is circa 1 kg/t Au. Two regeneration kilns are operating with a smaller 3t column which is used, when required, to reduce gold in circuit.

17.2.7.2 Carbon Transfer

Loaded carbon is recovered from the first pyrite float concentrate CIL tank via the loaded carbon recovery screen and discharged into a 3-tonne transfer column. The transfer column is pressurised when full using freshwater and the carbon is then transferred in batches to one of the two 9 tonne acid wash columns. Three batches of carbon are required to fill one acid wash column.

17.2.7.3 Acid Wash

The two 9 tonne acid wash columns operate independently from the elution circuit, i.e., any one of the acid wash columns can feed any one of the elution columns. During acid washing, concentrated hydrochloric acid is metered into the bottom of the column where it is diluted with freshwater to achieve a 2.6% w/w concentration. The acid solution in the column is circulated through the acid wash column by the acid circulation pump for 60 minutes at a flow rate of 0.9 bed volumes (BV) per hour. The acid wash circulation pump is shared between the two acid wash columns. Therefore, only one acid wash column can conduct the soaking cycle at any one time.

The loaded carbon is then rinsed with 6.8 BV of freshwater. The rinse water displaces any residual acid from the loaded carbon. Dilute acid and rinse water is discharged into the float tail CIL tail pump box. Once the rinse is complete, the water is drained into the bund. The carbon is then hydraulically transferred using freshwater to either of the two elution columns which are ready to receive the next batch of loaded carbon.

17.2.7.4 Elution

Two Zadra elution circuits consisting of an elution column, associated strip solution heaters, heat exchangers and four electrowinning cells containing 12 cathodes each operate at Sukari.

A stripping solution containing 2.5% w/v cyanide and 2.8 % w/v caustic is prepared before the elution sequence commences in the strip solution tank. Before the second elution, additional strip solution is added to make-up for solution losses from the first strip. The complete strip solution is dumped after every second strip and a new solution made up to prevent a build-up of any contaminants that may negatively affect the elution.

The strip solution is then continuously pumped through the elution column and heat exchangers while the elution heaters are heating the solution. Upon completion of the preheat stage where the solution temperature has reached 85°C for 10 minutes, the electrowinning feed valve is opened, and the solution is pumped through the flash vessel into the electrowinning cells. The solution temperature is also further increased to 124°C. The pressure of the strip solution is reduced to atmospheric in the flash vessel allowing the steam to flash off before the solution enters the electrowinning cells. Direct current is passed through stainless-steel anodes and the stainless-steel mesh cathodes within the electrowinning cells, causing the gold in solution to plate out onto the stainless-steel cathodes by

electrolysis. Barren eluate leaving the electrowinning cells gravitates back to the strip solution tank and is recirculated through the column and electrowinning cells for 9 BV.
On completion of the 9 BV recycle, the strip solution heaters are switched off, and the solution continues to be circulated until the temperature falls below 95°C. A single BV of cold freshwater is pumped into the elution column to displace the residual eluate to the carbon safety screen feed box, and to cool the carbon.

17.2.7.5 Carbon Regeneration

After the carbon in the elution column is cooled down, the barren carbon is hydraulically transferred using freshwater to the carbon dewatering screen ahead of the carbon regeneration kiln. Two kilns are available, one of which is new to replace one of the older kilns that was previously used for drying the carbon only due to low temperatures.

Carbon entering the regeneration kiln is heated to 850°C and held at this temperature for 20 minutes to allow effective regeneration to occur. Carbon exiting the regeneration kiln enters a fluidised bed cooler in which superheated steam is discharged. The superheated steam flows from the fluidised bed cooler counter current to the carbon through the kiln. The carbon discharges from the cooler onto the discharge screen for fines removal with the oversize from the screen discharging into a quench tank.

A new Holman shaking table has been installed to separate grit from the fine carbon, with the latter recovered for ashing and gold recovery via cyanidation.

The sized regenerated carbon is then pumped back to the flotation tails CIL carbon sizing screen.

17.2.7.6 Goldroom

The cathodes are washed inside the electrowinning cells with a high-pressure hose after elution and electrowinning are complete. The water is drained from the cells through a pressure filter to collect any particles that were swept with the water. The majority of the gold sludge settles to the bottom of the cells and is collected from the cells by the goldroom operator using a small shovel and a bucket.

The buckets with the gold sludge are emptied into the oven pans and dried at 400°C for 24 hours. The dried sludge is hand-mixed with fluxes and added into one of two diesel-fired smelting furnaces. The gold doré is poured into ingots. Crystallised slag is crushed and passed through a mineral cone. Heavy particles from the cone are mixed with the gold sludge for smelting, and the lighter slag particles are dumped into the ball mill.

17.2.8 Reagents

17.2.8.1 Lime

Quicklime is delivered by bulk tanker and offloaded into a 240-tonne storage silo. Quicklime is metered into a Vertimill for slaking via a rotary valve, screw feeder and conveyor. The Vertimill product overflows into a settling cone. The underflow of the settling cone returns to the Vertimill for further grinding and slaking and the overflow discharges into the storage tank. Slaked lime is then reticulated through the process plant using a ring main system. Lime is metered using a timer-based solenoid-controlled valve into the regrind product pump box, float concentrate leach and CIL tanks and the float tail leach and CIL tanks.

17.2.8.2 Sodium Cyanide

Cyanide is delivered to site in one tonne bulk bags inside a wooden box for additional protection. The cyanide briquettes are then dissolved in a batch mixing facility by dissolving nine bulk bags into a 34 m^3 tank fitted with an agitator using freshwater. The cyanide solution is then transferred to the storage tank (120m^3) and reticulated through the process plant using a ring main system. Cyanide is dosed into the float concentrate leach and CIL tanks and the float tail leach and CIL tanks using automated flow control valves on the main dosing points and manual valves on secondary dosing points. Cyanide required in the elution circuit is metered into the circuit using progressive cavity dosing pumps.

Cyanide is also pumped via the ring main to the South heap leach cyanide storage tank. A stand-alone cyanide mixing, storage and reticulation system is used at the North heap leach area.

17.2.8.3 Caustic

Caustic is delivered to site in 1 tonne bulk bags. A caustic solution is made by dissolving five bags of caustic pearls into a 13.8m^3 agitated tank using freshwater and then transferred to the caustic storage tank. The caustic solution is metered to the two strip solution tanks using progressive cavity dosing pumps.

17.2.8.4 Hydrochloric Acid

Hydrochloric acid is delivered to site in 1,000 litre intermedia bulk containers (IBC) and pumped into the storage tank using a peristaltic pump. Concentrated hydrochloric acid is metered into the acid wash columns using a dedicated peristaltic dosing pump per column.

17.2.8.5 Flocculant

Flocculant is delivered to site in 25kg bags and mixed in one of two continuous mixing and dosing systems. The mixed flocculant is metered into the thickeners using variable speed controlled progressive cavity dosing pumps.

17.2.8.6 Collector

Potassium amyl xanthate (PAX) is used as the sulphide mineral collector in the flotation circuit. PAX is delivered in 900kg bulk bags to site. Twelve bags are mixed with freshwater in the agitated mixing tank to a concentration of 10% w/v and then pumped to the storage tank. PAX is dosed into the three ball mill feed chutes using variable speed controlled peristaltic pumps.

17.2.8.7 Frother

Frother is delivered to site in 1,000 litre IBCs and dosed neat into the flotation circuit. Frother is dosed using variable speed peristaltic pumps into the conditioning tanks of the two flotation circuits.

17.2.8.8 Copper Sulphate and Ferrous Sulphate

Copper sulphate pentahydrate and ferrous sulphate heptahydrate are delivered in one tonne bulk bags to site. Four bags of each reagent are mixed with freshwater in a continuous mixing and dosing system. The mixture of copper and ferrous sulphate is dosed using variable speed peristaltic pumps into the SAG Mill 1 and 2 feed dilution water pipelines and the feed boxes of the two flotation tail thickeners.

Both reagents are also added to the tailings dam return water pumped back to the process water tanks, to detoxify the solution prior to recycling as process water, as any cyanide in solution would adversely affect the sulphide flotation process.

17.2.8.9 CMC Dispersant

A dispersant (CMC) is added to the flotation circuit to assist with depressing kaolinite when it occurs in the ore. The dispersant is delivered to site in 1,000 litre IBCs and dosed neat into the flotation circuit. The dispersant is dosed using variable speed peristaltic pumps into the feed chutes of the two SAG mills.

17.2.8.10 Oxygen

Cryogenic liquid oxygen is delivered to site in bulk tankers and stored in three cryogenic storage tanks complete with vaporizers and a pressure control system. The vaporizer converts the liquid oxygen into a gaseous state, and the pressure control manifold then controls the gas pressure that is fed to the CIL tanks. Oxygen addition to the CIL tanks is controlled using gas flowmeters and automated flow control valves at each tank.

Note that a new reagent preparation area has recently been installed for the CMC, copper sulphate, ferrous sulphate and flocculant reagents. An additional area is planned for sodium sulphite pending a potential detoxification circuit project.

17.2.9 Water Services

17.2.9.1 Process Water

Process water is stored and reticulated through the process plant from three storage tanks. Two of the process water tanks, one in each flotation circuit, receive the overflow from the flotation concentrate and tailings thickeners of each circuit and decant return water from the TSF. Raw water is used as make-up water to maintain the tank level if required. The process water is then reticulated to the respective milling and flotation circuits for dilution and spray water. The process water tank in Line 1 also provides process water to the float concentrate CIL and the float tail CIL circuits. Process water to the concentrate regrind circuit is provided from the Line 2 process water tank.

17.2.9.2 Raw Water

Raw water from the Red Sea is supplied from two seawater harvesting systems containing intake pumps, buffer tanks and booster pumps. Harvested seawater is discharged into a concrete tank located at the process plant that feeds the freshwater supply system. The concrete tank overflows into two raw water storage ponds. Raw water pumps reticulate raw water through the process plant from the storage ponds.

17.2.9.3 Gland Water

Raw water is used as gland water for the slurry pumps. Gland water is stored in several surge tanks throughout the process plant and reticulated to the slurry pumps via ring main systems. Dedicated gland water and gland water booster pumps provide gland water to the two-stage tailings pumps.

17.2.9.4 Freshwater

Freshwater to the process plant, offices and camp is supplied by two reverse osmosis (RO) plants with a combined capacity of 2,000m^3 per day and stored in two freshwater tanks. Freshwater in the process plant is used for reagent make-up, carbon transfer and strip solution in the elution process. Freshwater is also reticulated to the camp, offices and the mining areas.

17.2.9.5 Potable Water

Potable water is delivered to site in a bulk tanker from Marsa Alam and stored in the potable water tank. Potable water is reticulated to the safety showers in the process plant and for domestic use in the camp and office buildings.

17.2.9.6 Firewater

A firewater reserve of approximately 1,800m^3 is maintained in the two freshwater tanks. Firewater is reticulated through the plant using an electrical and diesel motor driven pump. Pressure in the firewater system is maintained with an electrical jockey pump.

17.2.10 Laboratory

The on-site laboratory is owner-operated and can treat up to 1,200 samples per day from the plant, exploration and grade control departments. The laboratory operates continuously over 2 shifts, each of 12 hours, each shift consisting of 22 employees.

It consists of the normal ventilated areas and equipment for sample preparation, splitting, drying and pulverising. There are two sample preparation stations, each containing 5 pulverisers. In addition, there are 3 jaw crushers and 2 Rocklab crushers available.

Fire assay is used for gold determinations, there being 4 fire assay furnaces and 5 cupellation furnaces, with an aqua regia finish (except for bullion samples).

Plant samples consisting of solids and solutions are assayed and the results returned after 24 hours and 2 hours respectively.

There are three sulphur analysis and three Atomic Absorption (AA) machines plus a carbon ash furnace for carbon assay determinations.

The QA/QC procedure is essentially an internal one at this stage, but there are plans progressing to achieve ISO/IEC accreditation in the next few years. The new Laboratory Information Management System (LIMS) is in progress and is awaiting the required hardware and software (CCLAS, which is Datamine's Windows-based LIMS system). This will be followed by training and it is hoped to have the system operational by the end of the year.

Random samples are given to the laboratory for analysis by the Geology department and samples are also sent to ALS for check assay. The results are fully reported via internal QA/QC reporting. The laboratory has been audited by Geostats in Australia and is part of a laboratory Round Robin survey.

The laboratory also includes an extensive metallurgical test laboratory, enabling all areas of the process plant to be tested at a laboratory scale.

17.2.11 Dump Leaching

Dump leaching of low grade mineralised waste has essentially been operating since the mine commenced and is an effective way of paying for the mine waste transportation costs, with any additional gold recovery a bonus.

There are two dump leach areas, old and North, with the old dump leach largely completed with no new stacking of material, although leaching continues. This contains approximately 80Mt of material. There is also an ongoing project to extend the North dump leach operation and the first stage of this extension is completed, with irrigation started on the interval ramp between the existing pad and the new extension.

The dump leach operations treat ore with grades of typically 0.25-0.50 g/t Au. The North dump leach is currently irrigated with 15-30ppm cyanide. The current LOM plan indicates an average grade of 0.38 g/t Au and is based on leaching the mined oxide reserves only. However, it is currently planned to also leach sub-grade transitional material and also rehandled stockpiles. Testwork is also underway to investigate the leaching of fresh material.

Gold recovery is reported to be low at typically 30-50% for oxide material and 20-30% for both the sub-grade transitional and potential fresh material. Gold production in 2022 for the dump leach operation was 6,650oz and 6,100oz for YTD 2023, with the philosophy of only needing to pay for the mine transportation costs. However, recoveries may be improved with higher cyanide concentrations and this is also being investigated.

In addition, a carbon-in-column plant has been installed to recover gold from the dam return water prior to being pumped to the process water tanks.

17.2.12 Metal Accounting and Sampling

Weightometers on the primary crusher product conveyors and stockpile feed conveyors are used to create a mass balance of crushed ore. Weightometers on the SAG mill feed conveyors and pebble discharge conveyors are used to calculate plant feed tonnages.

Metal accounting samplers, i.e., a pressure pipe and Vezin samplers on Line 1 and cross-cut and Vezin samplers on Line 2 are used to provide representative samples of the flotation feed and tailings streams. Flow meters are installed on some slurry and water pipelines. No online density meters are installed in the process plant. Slurry densities are measured using hand samples and a Marcy scale.

17.3 Production Data

The process plant production data from 2020 to-date is shown in Table 15.4. The bullion poured numbers include the gold produced from dump leaching (DL).

Table 17.1: Sukari Plant Production Data

	2020	2021	2022	2023 H1
Ore processed (t)	11.91	11.92	12.11	6.08
Feed grade g/t	1.35	1.18	1.26	1.23
Overall Recovery	87.9	88.6	88.20	88.54
Bullion poured (oz) incl. DL	452,320	415,370	440,974	220,561

Ore processed was 11.91Mt in 2020, 11.92Mt in 2021 and 12.11Mt in 2022. In 2023, 6.08Mt was processed to June YTD (H1), equating to a projected annual throughput of 12.16Mt. The 2023 YTD head grade is 1.23 g/t, with a range of 1.18-1.35 g/t Au over the last few years.

Gold recoveries have remained very stable, ranging from 87.9% to 88.6%, with 88.54% for YTD 2023.

High plant availabilities are achieved with 2023 YTD numbers of 82% for the crushing circuit and 95% for the plant.

17.4 Process Operating Cost

The Sukari process operating costs for YTD June 2023 are given in Table 17.2.

Table 17.2: Process Operating Cost

Area	$/t Milled	%
Administration	0.41	2.9
Crushing	0.93	6.7
Grinding	4.30	30.9
Concentrate	0.13	0.9
Flotation Circuit	0.25	1.8
Regrind Circuit	0.48	3.4
Tailings/Oxide Circuit	0.33	2.4
Lime & Reagents Cost	4.98	35.8
Gold Room	0.23	1.7
Support Activities	0.18	1.3
Other Costs	1.70	12.2
Total	**13.92**	**100.0**

The total process operating cost YTD 2023 is **$13.92/t**. This represents a significant reduction compared to the 2022 YTD cost of $16.76/t, with key reductions in crushing, grinding and reagents costs, as well as lower generated power costs.

The key unit cost drivers above are **reagents** at $4.98/t (35.8%) and **grinding** at $4.30/t (30.9%).

The reduction in reagent and consumables costs is due to a number of key drivers: the implementation of optimised reagent flow and dosing strategies, commissioning of the upgraded copper sulphate dosing system, upgrading of the oxygen sparging and dosing system, minimal operation of the Vertimill with consequent savings in grinding media, installation of a new carbon regeneration kiln to reduce new carbon consumption, improved delivered lime activity reducing lime consumption and the use of recycled old SMD media blended 50:50 with new media.

Details of the individual reagents and consumables unit consumptions for YTD June 2023 are shown in Table 17.3.

Table 17.3: Reagents & Consumables		
Item	**Unit**	**Value**
Lime	KG/t	50.33
Antiscalant	M3/t	0.24
Carbon	KG/t	0.52
Caustic	M3/t	3.98
Collector PAX	KG/t	2.49
Copper Sulphate	KG/t	2.52
Sodium Cyanide	KG/t	16.11
Ferrous Sulphate	KG/t	4.38
Flocculant	KG/t	0.30
Frother	KG/t	0.19
Grinding Media – Ball Mills	KG/t	10.57
Grinding Media – SAG Mills	$/t	17.07
Hydrochloric Acid	M3/t	5.94
Oxygen	M3/t	31,884
SMD Media	KG/t	0.48
Vertimill Media	KG/t	0.03

In terms of the operating cost in $/t milled (total $13.92/t), cyanide represents by far the single highest cost contributor at $2.32/t milled, followed by SAG and Ball Mill grinding media totalling $1.21/t. Lime/PAX/Oxygen and Copper Sulphate are the next significant contributors, all at similar levels ranging from $0.20/t to $0.27/t.

The high cyanide cost is directly related to the requirement to fine grind the gold-pyrite flotation concentrates to 10 microns prior to leaching. The high grinding media costs are directly related to the hard and abrasive ROM ore for the fine grind required.

The power generated from the solar power station is effectively free, with limited operating costs for panel maintenance and cleaning, with the power costs principally from the generated power station (diesel gensets). For June 2023 YTD, 201,970MWh was generated at a cost of $158.2/MWh. This compares with 412,980MWh and a cost of $210.7/MWh for 2022.

Hence, there has been a significant reduction in power costs in 2023 compared to 2022, reflecting a lower diesel fuel price and also full commissioning of the solar power plant. This accounts for $1.93/t of the $2.84/t reduction in 2023 YTD process operating costs compared with 2022.

17.5 Process Plant Improvements

Lycopodium conducted a site review in September 2019 and issued a number of recommendations and actions to improve plant performance. These have substantially been completed, with a particular focus on reagent preparation, optimal dosage rates and dosing points, and new projects are now on-going.

The most important project at the moment is the testwork and engineering studies for a potential gravity circuit. It is known that visible (coarse) gold is present and testwork completed to-date with the associated modelling and simulation studies has clearly indicated the benefits of installing a gravity circuit (see Chapter 13) with a high GRG component indicating higher overall gold recovery is achievable. Currently the engineering studies required are nearing completion to enable a decision to be made shortly. Due to lack of space for retrofitting a gravity circuit, a new area has been demarcated.

A second potential project is the requirement for a detoxification circuit on the CIL tailings slurry stream.

At present, Sukari is not a signatory to the International Cyanide Management Code but aims to follow the guidelines. This indicates that the WAD cyanide entering the TSF should not exceed 50ppm, otherwise a detoxification circuit is required. At present, the WAD cyanide level is circa 150ppm, with approximately 80ppm in the TSF return water pumped back to the process plant. In the plant, ferrous sulphate is added to partially detoxify the solution to achieve circa 40ppm WAD cyanide. The cyanide in solution is a problem for the flotation process (acts as a depressant).

In some operations, the flotation and CIL tailings are stored in separate TSFs, so cyanide-bearing solution would not be returned to the flotation circuit, but this is not the case at Sukari.

Therefore, the two motivations for a potential detoxification circuit would be to follow the Code and to improve performance of pyrite flotation, which is the core process.

Sukari is currently developing a simpler, cheaper and novel process for detoxification (similar to the INCO process) but based on using sodium sulphite, ferrous sulphate and air (instead of oxygen). Lime addition is also not required. Plant trials are planned and on-going.

At present, Sukari reports no issues with birdlife due to the high WAD cyanide levels, although this is being carefully managed.

18 PROJECT INFRASTRUCTURE

18.1 On-site Infrastructure

Power supply for processing stages 1-3 and infrastructure is generated using five MAK and six Cummins generators capable of supplying 6.5MW (de-rated) and 1.2MW (de-rated) respectively. Processing stage 4 receives power generated from five Wartsila generator sets capable of supplying 7.8MW (de-rated). A diesel fuel storage facility is present on site with a combined capacity of 5,207m^3.

A 36MW$_{DC}$ solar farm has been commissioned which produces a significant proportion of the mine's power, whilst the Company is also continuing to work towards a full national grid connection. This, combined with the solar farm, would displace the diesel generator sets which will then be retained in case of a loss of supply from the grid.

Several on-site buildings, serving a multitude of purposes are present which support the operations of the mine, including a housing village which has a maximum capacity of 800. Maintenance and workshop buildings are provided for the process plant and for both SGM heavy mobile equipment and light vehicle maintenance. Workshops are provided with facilities for offices, ablutions, parts storage, training, tooling and equipment, welding/fabrication, machining, and rubber works.

A communications network utilising satellite and fibre-optic cable has been established on the site. The fibre-optic cabling extends into the underground following the main decline. A "trunked" repeater system enables the system of hand-held and mobile radio sets to communicate around the site.

A 125m^3/hour paste fill plant has also been recently constructed and was commissioned in early 2023. The tailings from the process plant are sent to a buffer tank at the backfill plant. A cyclone cluster installed on the buffer tank allows for de-sliming of the tailings feed if needed. The buffer tank feeds a horizontal belt filter that discharges to a transfer conveyor that feeds into the paste mixer. At the paste mixer the filter cake and binder slurry are mixed and the cemented paste discharges to a paste hopper that feed a PD pump. The PD pump discharges to a surface pipeline, this runs to the primary borehole collar and into an underground reticulation system that ends at the discharge into the stopes.

18.2 Tailings Storage Facilities

18.2.1 Introduction

Sukari has two TSFs, TSF No. 1 and TSF No. 2, located to the west and south of the main mine area, respectively, as shown in Figure 18.1. TSF No.1 was commissioned in 2009 and has been in continuous operation since but is now near full capacity and provides emergency contingency storage only.

The starter embankment (Stage 1) of TSF No.2 was constructed in 2020 and commissioned in January 2021 under the supervision of Knight Piésold. The next raise construction (Stage 3) has recently been constructed providing 36Mt of capacity for a production rate of 12Mtpa at a 50% solids by weight slurry. Stage 4 construction was started in 2023 under the supervision of engineer of record ("EOR") Epoch, to take the capacity to 48Mt, with commissioning expected in mid 2024.

The TSFs meet host country legislative requirements and are managed through a robust framework of principles, standards and guidelines to ensure structural stability, human safety and environment protection, whilst maintaining efficient and responsible production. The facilities are designed in accordance with the Australian National Committee on Large Dams ("ANCOLD") guidelines. The embankments have been constructed using the downstream method and facilities comprise an high-density polyethylene [HDPE] geomembrane lines to provide additional seepage reduction. Both facilities have a hazard consequence classification of 'High A' under the ANCOLD guidelines.

Each TSF has an Operating Manual covering the operation, monitoring, maintenance, construction, closure and rehabilitation guidelines for the facility; clear definition of responsibility for key personnel; and a Trigger Action Response Plan to effectively assess deviations from standard operating practice and required actions, including what to do in the event of an incident or emergency.

The TSFs are monitored through a layered assurance system by a team of internal specialists, an external Engineer of Record (EOR), and Independent Technical Reviewer and with oversight maintain by the Centamin Accountable Executive and Board of Directors. The EOR conducts dam safety inspections on a quarterly basis.

As a responsible mining company, Centamin is committed to the Global Industry Standard on Tailings Management ("GISTM"). In 2023, Centamin assessed its conformance against the GISTM and has in place a roadmap to address corrective actions. In additiona, a Failure Modes and Effects Analysis ("FEMA") was completed for each TSF in 2023, including the identification of measures to reduce the risk of failure to As Low As Reasonably Practicable ("ALARP").

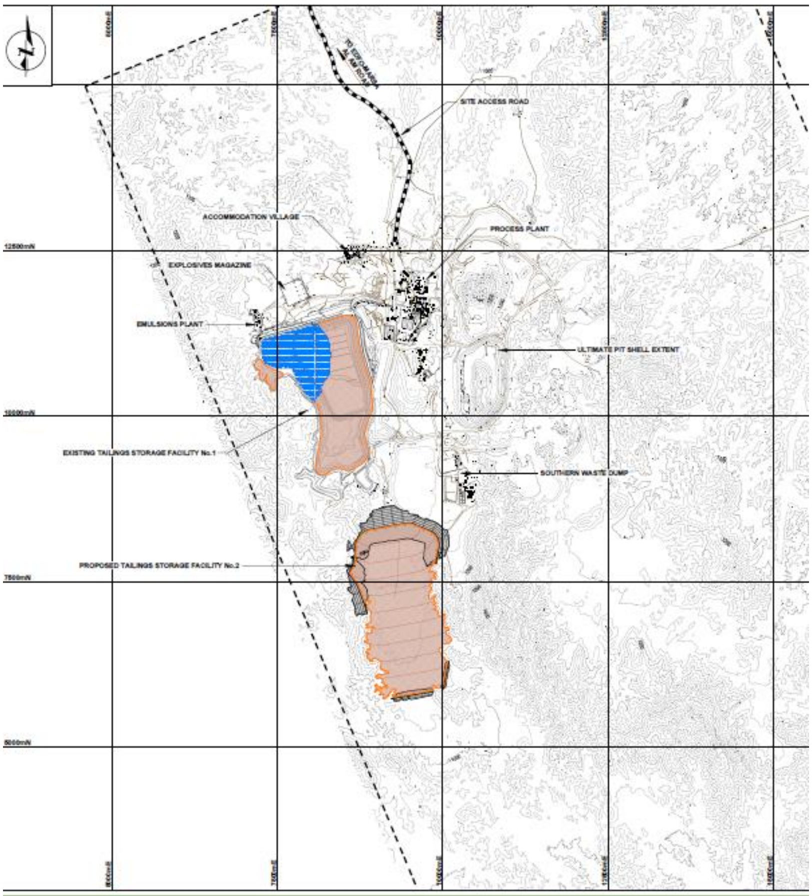


Figure 18.1: TSF Site Layout Plan of Existing TSF No1 and Proposed TSF No2

18.2.2 TSF No. 1

TSF No. 1 is a single cell paddock storage facility containing approximately 70Mm^3 of tailings with containment provided by downstream engineered earthfill embankments and the natural strata and is fully lined with 1.5mm HDPE liner. The embankments are formed from waste rock fill, wadi gravels and a sand and gypsum blended soil liner, with a maximum embankment height of 60m. The HDPE liner is bedded on a sand and gypsum blended soil layer.

The tailings were deposited by sub-aerial spigots and the supernatant water decanted via a floating barge. The initial design and CQA of construction were undertaken by Knight Piésold. Following this, TSF No. 1 raise design was undertaken by various consultancies with construction undertaken by SGM. The general layout and a typical cross section layout are shown in Figure 18.2 and Figure 18.3.

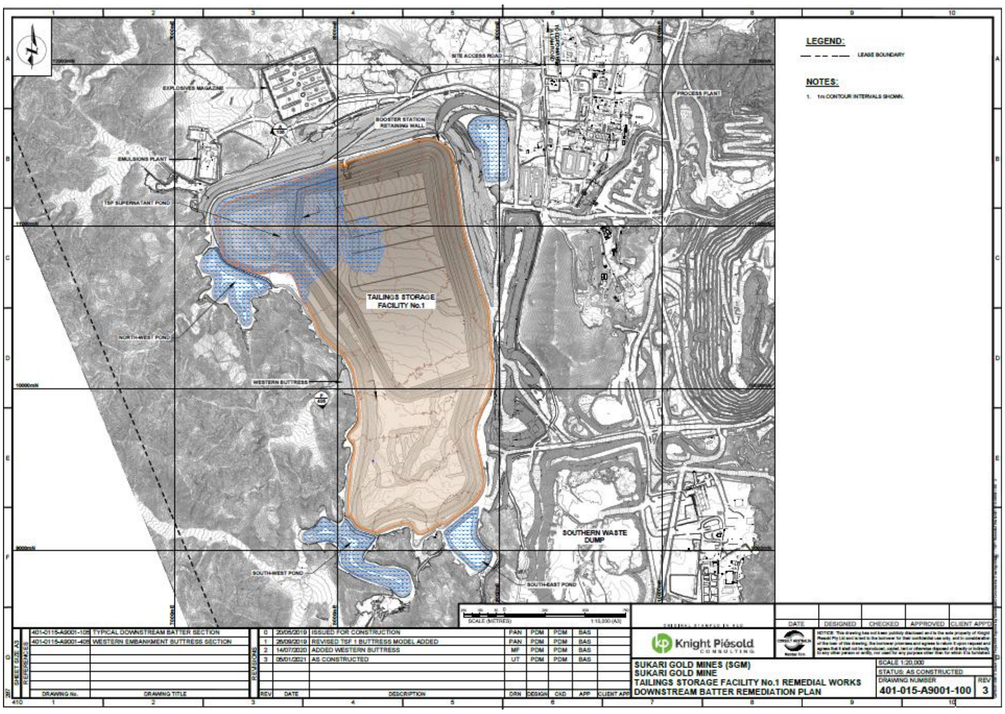


Figure 18.2: TSF No. 1 layout

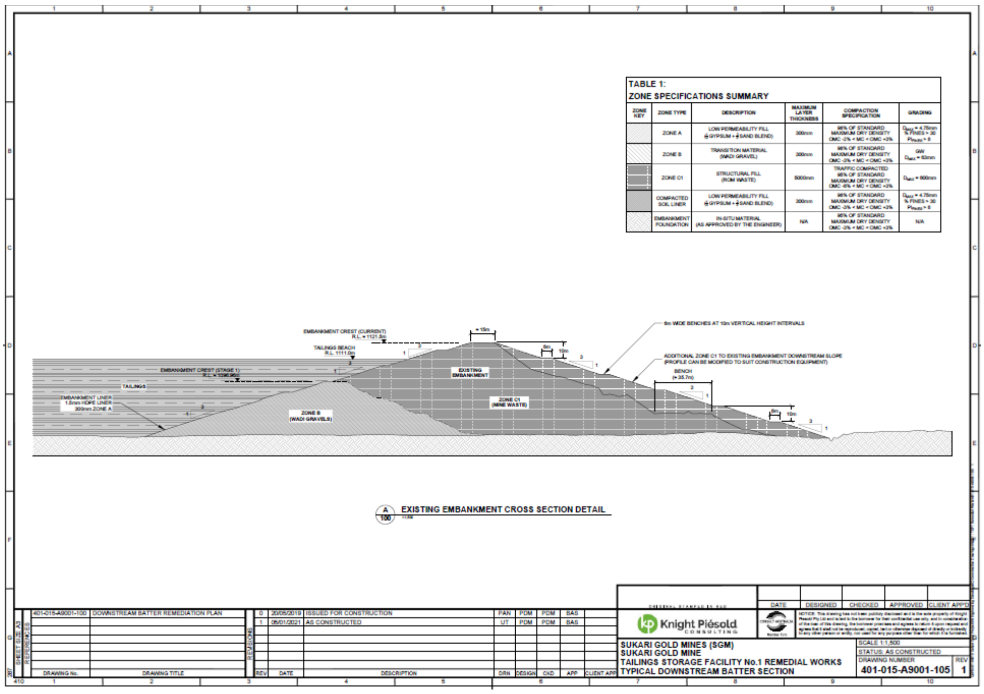


Figure 18.3: TSF No. 1 Typical Cross Section Showing Embankment Construction

An independent inspection was undertaken in 2018 by Knights Piésold ("KP") with remediation measures implemented in 2019 and a preliminary closure plan developed in 2020.

The preliminary closure design includes developing a closure beach profile, removal of the tailings delivery pipelines, minimisation of the supernatant pond by decant and evaporation, commission the underdrainage system which is currently not operational, limited reshaping of the final embankments, installation of a closure spillway, cover of the tailings body once all water is removed with 2m of waste rock and installation of monitoring points around the TSF embankments. The project programme for completion is 1 to 2 years post final deposition of tailings, with detailed closure design and assessment being prepared by the EOR.

Tailings deposition has ceased at TSF No. 1 and the supernatant pond continues to be reduced with the tailings beach area desiccating. The facility currently has 2m – 3m freeboard available for use as emergency storage.

18.2.3 TSF No. 2

TSF No. 2 is a single cell and containment provided by zoned earth and rock fill embankment and the natural strata. The main embankment is to the north side of the facility, but extending to the west and eastern sides, a smaller embankment forms the southern end of Stage 1. The natural strata forms the remainder of the containment on the western and eastern sides. TSF No. 2 layout is shown in Figure 18.4 and Photo 18.1.

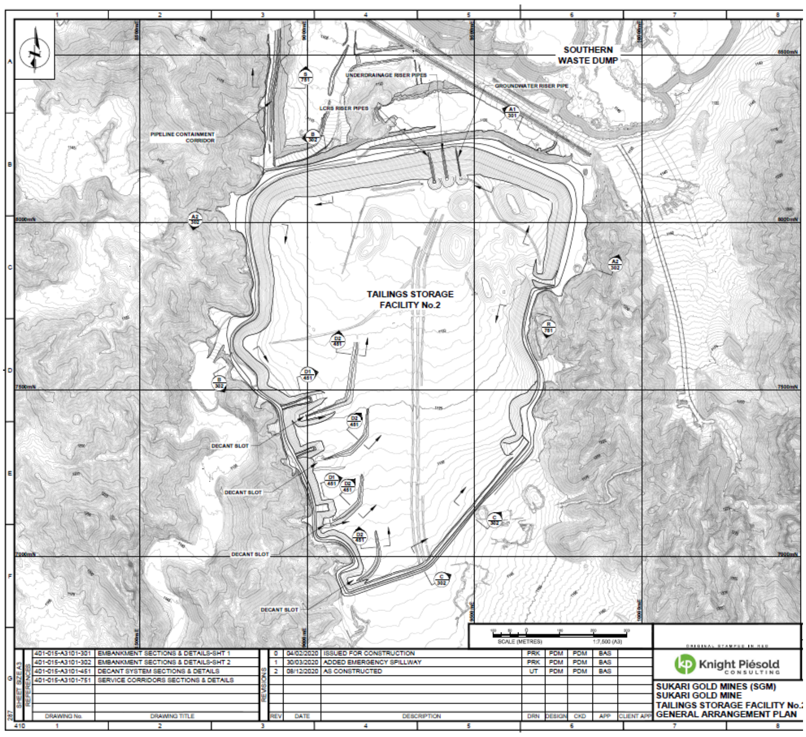


Figure 18.4: TSF No. 2 Stage 1 Layout

Photo 18.1: TSF No. 2, Viewed from the North

The impoundment is lined with 1.5mm HDPE liner underlain by a hypernet drainage layer, another 1.5mm HDPE liner which is founded on reworked in situ soils. The hypernet drainage layer is a leachate collection and recovery system. Overlying the liner system is an underdrainage system which is operated sporadically to reduce the phreatic surface build up within the tailings. An emergency spillway is located on the western side of the facility. The facility has been designed to contain a probable maximum flood (PMF) event and as such the spillway has been designed for a nominal capacity in the event that the facility is operated outside of the design criteria. The TSF water balance is net negative, i.e., the return water from the tailings facility does not meet all the process water requirements.

The tailings are deposited subaerially from spigots located on the main embankment with the supernatant pond located at the southern end of the facility. Stage 1 has not had a decant system installed, although a floating barge decant system has now been installed for Stage 3 operations.

The tailings are pumped to TSF No. 2 via two 500mm diameter HDPE (PN16) pipelines from TSF No. 1 east wall to the northwest corner of TSF No. 2. A booster station is located at TSF No. 1, and has recently been upgraded in order to enable pumping of tailings to TSF No. 2.TSF No. 2. Stage 1 contains approximately 3Mm^3.

Stage 3 construction begin in 2021 and was completed under the CQA supervision and management of KP, and subsequently Epoch. The raise comprises a downstream raise of the main embankment and provides an additional 36Mt of storage, which based on a 12Mtpa production equates to 3 years of storage.

Stage 4 construction was started in 2023 under the supervision of the EOR, taking the capacity to 48Mt, with commissioning expected in mid 2024. Stage 5 and 6 will start in 2025 with commissioning planned for 2026, as shown in Figure 18.5.

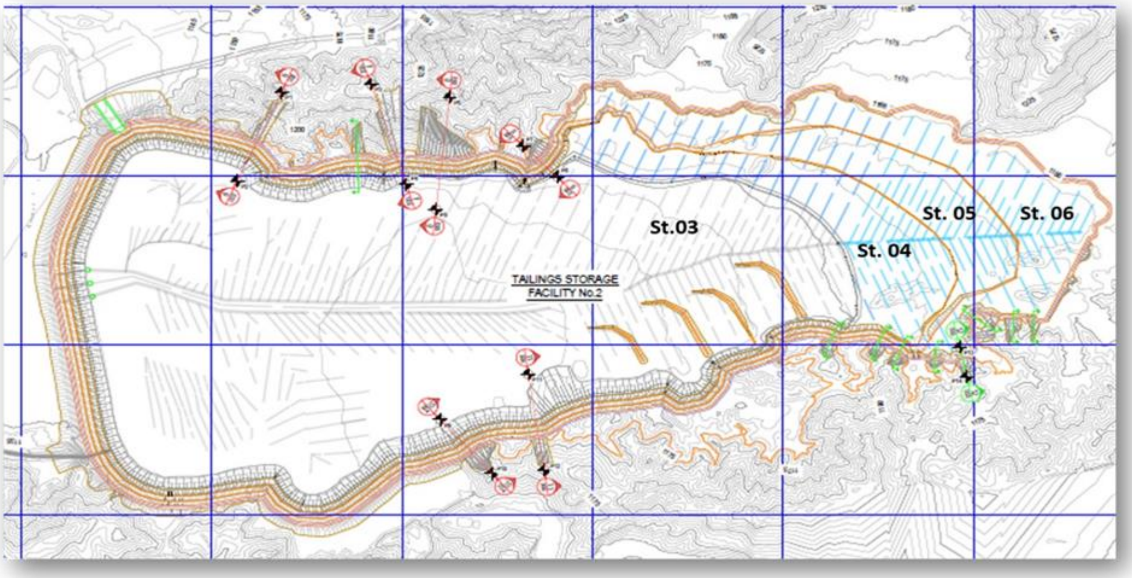


Figure 18.5: TSF Stages 4-6 Layout

The overall design of TSF No. 2 has a capacity for 150Mt of tailings with room for further expansion if required. The facility will be developed by a total of 13 downstream raises with the majority of the embankment material sourced from mine waste rock. After the initial Stage 1 embankment height of approximately 27m, the facility will be raised in progressively smaller lifts ranging from 8m to 1.3m lift heights with an overall embankment height of 80m (northern embankment) and 25m (southern embankment) as shown in Figure 18.6.

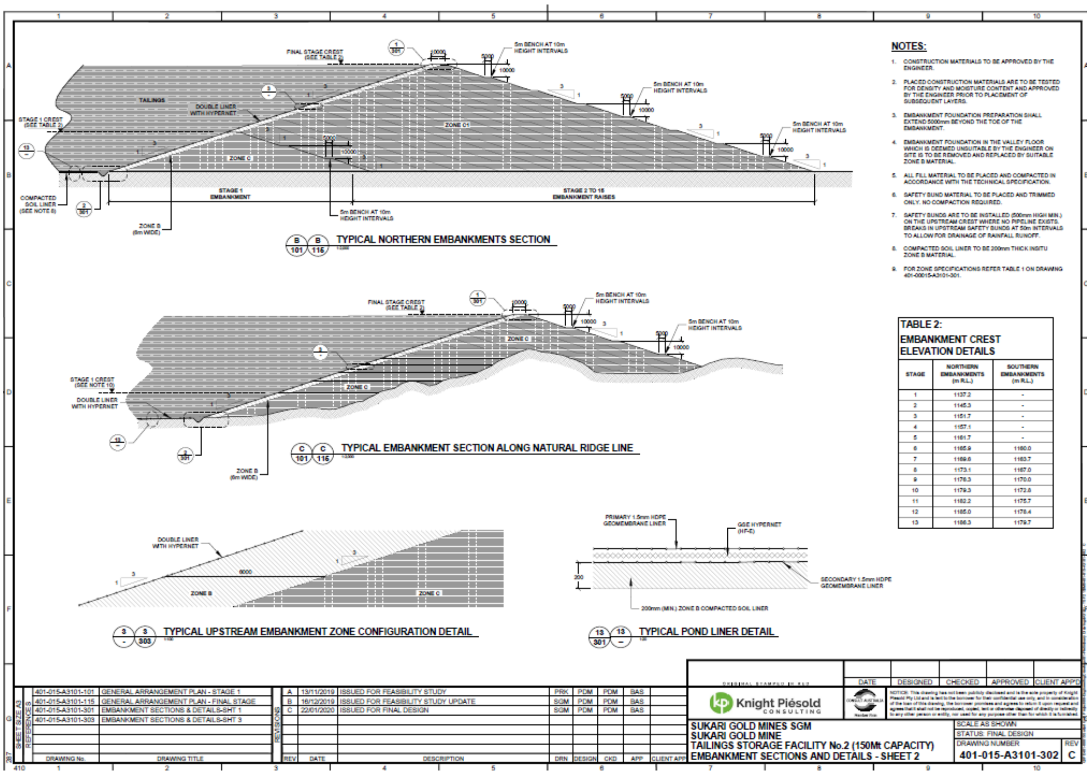


Figure 18.6: Typical Cross Sections of TSF No. 2 Northern and Southern Embankments

The tailings are classified as Non-Acid Forming (NAF), although the solids and supernatant water contain elevated concentrations of cyanide and a number of environmentally significant elements (metals and metalloids) as well as being hypersaline. Monitoring of the groundwater in and around the facility as well as the leachate collection system will be undertaken throughout the life of the facility. Return water amounts range between 27% to 50% with an average of 34%. The average monthly sea water usage is reported as 635,912m^3 per month. Improved decant and underdrainage management should improve the return water quantities enabling the sea water usage to be minimised as much as practicable.

The stability of TSF No. 2 has been assessed for short term undrained (with and without containment release), long term drained and post seismic conditions. In accordance with ANCOLD design guidelines, the Factors of Safety applied to the design are:

Short-term drained (no loss of containment)	1.3
Short-term drained (potential loss of containment)	1.5
Long-term drained	1.5
Post-Seismic	1.0 – 1.2

18.3 Solar Farm

Centamin is dedicated to moving towards decarbonisation of power generation, and as a first step, the Company has built a 36MW_{DC} solar farm, covering some 85 hectares, immediately to the north of the mining operations (Photo 18.2). Combined with this is a 7.5Mw battery storage system, the battery storage system is used for frequency and power compensation for short durations whenever there is fluctuation in frequency and solar power output. At the time of the site visit, the facility is fully operational and supplying a nominal 30MW_{AC} of power to the operation during daylight hours.

Photo 18.2: Solar Farm Viewed From Sukari Mountain

The farm provides around 22% of Sukari's annual power generation requirements which has the major advantages of saving up to 22 million litres of diesel per year and therefore reducing exposure to price volatility as well as cutting down on the transport requirements to and from Sukari. This project represents a saving of some 60,000t CO_2-e per year.

The Company is also considering further expanding this facility by some 15MW.

18.4 Off-site Infrastructure

The Sukari mine is serviced by an access road linking the mine to the coastal highway through the town of Marsa Alam. The access road comprises 25.9km of paved road between Marsa Alam and the entrance to the mine site.

The mine receives a supply of seawater via three pipelines, which comprises two sets of intake pumps and coastal wells, and booster pumping stations. The pipeline has been constructed at a depth of 1m below ground level.

18.5 Future Infrastructure Plans

Since 2014, Egypt has constructed more than 3,500km of high voltage powerlines and is increasing its renewable energy in its generation capacity. Accordingly, the Company conducted a Grid Power study in 2022 and, given a new grid extension lies some 25km from Sukari on the western side of Marsa Alam, the Company is in negotiation with an approved Egyptian power service provider for a direct national grid connection to fully displace the need for on-site diesel generated power and further reduce operating costs and GHG emissions.

19 MARKET STUDIES AND CONTRACTS

19.1 Markets

WAI has not seen evidence to suggest that a formal market study has been carried out by Centamin.

SGM are not dependent upon any one customer for the sale of gold. Since commencement of production, gold has been sold to various gold bullion dealers and smelters. Gold doré bars are transported from the mine site to the chosen accredited gold refiner for smelting and refining into and LME grade gold bar on a regular basis. The refiner is selected on a periodic and competitive basis.

For the economic analysis used to determine the Mineral Reserves, a gold price of US$1,450/oz and a diesel price of US$0.75/litre was used.

19.2 Contracts

SGM is engaged in numerous contracts with local and international companies relating to the operation of the mining and processing operations. Material contracts that are in place, the terms, rates or charges of which are within industry norms, include:

- Capital Drilling (Egypt) LLC for Open pit drilling;
- Capital Drilling (Egypt) LLC for an open pit waste mining services contract for the East wall;
- Geodrill Group for underground resource drilling;
- Mantrac Egypt for Caterpillar support and parts supply;
- MaxamCorp International for supply of explosives and explosive accessories;
- Misr Petroleum for diesel fuel supply; and
- MKS PAMP SA for the current Refining Agreement.

Below are the key changes in contractual arrangements since the 2015 NI 43-101 report.

After observing the expansion of underground reserves, and approaching the conclusion of the current contracts, an evaluation of the underground mining operations was undertaken with external support from an international expert. The purpose was to assess the viability of a contractor versus adopting an owner-operator approach for ongoing underground mining operations on the project. The decision was undertaken during the first quarter of 2022 to transition to owner mining, with the contractor fully demobilising from site, servicing of all purchased equipment and the transition of selected staff from contractor to owner.

Capital Drilling (Egypt) LLC is engaged by SGM to undertake an open pit waste mining services contract for the East wall (the "Capital Waste Contract"). The Capital Waste Contract has a fixed volume component, starting January 2021, to complete a 120Mt open pit waste stripping programme at Sukari, providing load & haul and ancillary services and also expanding and extending its existing drilling contract at Sukari. As of the June 30, 2023, the Capital Waste Contract was 70% complete, with scheduled completion by mid-2024.

The estimated bullion transport costs, liability charges and refining costs used for the financial analysis were based on contract prices agreed with third party contracts. Under the current Refining Agreement between SGM and MKS PAMP SA (‘‘Refiner’’), SGM must deliver all of the production of gold/silver doré from the Sukari mine to the Refiner’s appointed secure carrier at the Sukari mine for refining at its refinery in Switzerland. The risk of loss and damage to the gold/silver doré passes from SGM to the Refiner upon stowage of the material into the carrier’s vehicle at the gold room at the Sukari mine. The agreement commenced on July 1, 2023 for an initial two-year term.

20 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

20.1 Scope of study

WAI has reviewed the potential environmental and social impacts of the Sukari gold project ("the Project"), assessing existing environmental, social and health and safety practices and comparing them with recognised international standards, codes, and good management practices where appropriate. Typical standards considered include the World Bank's IFC Performance Standards and EBRD's Performance Requirements.

This section of the report considers environmental and social documentation and data held by Centamin and will highlight any potential gaps in information when measured against international and Egyptian requirements.

In the time available it was only possible to have an overview of the Project and the way that the company manages its health, safety, environmental and social obligations. Whilst WAI believes it has gained some insight into the key issues and performance, there may be additional information that was not seen, or variations in interpretation of the available data that could not be explored further.

20.2 Method of Study and Information Sources

The review of the environmental and social performance of the Project is based on information provided by the Company as well as publicly available data and information collected during the site visit held by WAI from September 4, to September 8, 2023.

The main documents inspected are listed as appropriate in this section and include:

- ESIA for Sukari Project, Environics, 2007;
- Scoped EIA for North Tailings Storage Facility (TSF No. 2) at Sukari Gold Mine, Environics, 2016;
- Scoped EIA for PV Plant at Sukari Gold Mine, Doaa Abou Elailah, 2020;
- ESIA and EIAs approvals by Egyptian Ministry of Environment;
- Organisational chart of the HSES department;
- Waste Rock and Low-Grade Ore Geochemical Assessment, Knight Piésold Pty Limited, 2006;
- Hazardous Materials Management Plans;
- Annual and Monthly Sustainability Reports;
- Ambient Air and Water Quality Monitoring Plans and Results;
- Emergency Response Plans;
- Stakeholder Engagement Plan;
- Grievance Mechanism and Grievance Register;
- Community Development Plan;
- Environmental Management Plan;

- Occupational Health and Safety Management Plan;
- HSE Training Compliance Management Plan; and
- Sukari Asset Retirement Obligation, 2022
- Centamin Sustainability Report, 2022
- Sukari Permits Register, 2023.

20.3 Environmental & Social Setting and Context

20.3.1 Landscape and Topography

Sukari is located in the central part of the Eastern Desert of Egypt on the western slope of Sukari Hill with elevation of 630m above sea level. The mine area is located within a mountainous terrain characterised by the sharply incised Red Sea Hills and numerous wadis which drain towards the Red Sea which coast lies at the distance of 25km. Elevations range between approximately 300m and 585m. No seismic activity has been recorded in the region.

20.3.2 Climate

The climate at the Sukari Site is harsh and arid, with maximum temperatures often exceeding 40^{o}C and precipitation rarely exceeding 10mm per annum. Average temperatures range from 17-27^{o}C in the Winter (October to March) and 26-36^{o}C during Summer (April to September). Humidity is generally very low, but may exceed 80% near the coast, particularly during winter.

20.3.3 Land Use and Land Cover

The Sukari license area covers arid and mountainous landscape in which there are no community settlements or known indigenous areas. The landscape is almost devoid of vegetation due to the lack of water, except for sporadic trees in the main wadi drainage lines comprising *Acacia raddiana, Zilla spinosa, Aerva javanica, Zygophyllum simplex*. Environmental baseline studies (PGM, 2007) identified 13 reptile species and 13 species of mammals in the landscape. Of these species, three are identified as threatened: Striped Hyaena, Dorcas Gazelle and Nubian Ibex. The Wadi El Gamal national protected area, declared in 2002, is located approximately 16km to the south of the Mine and comprises terrestrial and marine components.

There are few forms of active land use surrounding Sukari due to the rugged terrain, remoteness, and low flora coverage. The area is not considered a livestock grazing location. Artisanal and small-scale mining is low intensity, but widespread in the Eastern Desert, involving the exploitation of both hard-rock and alluvial deposits.

The Eastern Desert is notable for its geological history, with a variety of ancient Egyptian and Romanic mining settlements of varying archaeological value. At Sukari, one site of archaeological value comprising the rock ruins of mine worker houses was identified during the ESIA and was protected from mine disturbance at the recommendation of the Supreme Council of Antiquities (SCA) (PGM, 2007). At the request of Sukari in 2022, the SCA commenced an operation to salvage and relocate the ruins to allow for the progressive expansion of the mine. Excavations of the ruins have revealed features typical of the Ptolemaic (305 BC) and Roman empires (30 BC), including artefacts dating back to the Modern Pharonic State (1600 BC). These findings are of surprising richness in the context of ancient gold mining and investigations are ongoing including academic research led by the SCA. A small museum has been established at Sukari to display these findings.

The development of the Project has not resulted in any physical resettlement or economic displacement and there are no grievances or disputes between the Client and communities related to land use rights. In general, there is limited land use history in the Project Area, other than its mining history and low-level nomadic livestock herding.

20.3.4 Communities and Livelihoods

There are no human settlements in the Sukari Concession Area. The nearest Bedouin camp is 9km away which is occupied intermittently by one family. The nearest town is Marsa Alam, located approximately 25km to the east of Sukari located on the Red Sea coast. Following the opening of an international airport in 2003, Marsa Alam was subject to a rapid increase in popularity as a tourist destination. Following the Egyptian revolution in 2011 and more recently the coronavirus pandemic, the level of tourism and growth along the Red Sea has fallen. The population of Marsa Alam is approximately 10,000.

20.3.5 Infrastructure and Communications

Sukari is 25km west of Marsa Alam which has hospital facilities, a police presence, and other municipal facilities associated with a tourist destination including an international airport. A 25km water pipeline runs to Sukari from the Red Sea, and the Sukari project site is accessed by tarmac roads and has its own off grid power comprising thermal and solar power generation. Communications within the site utilise satellite and fibre optic technologies.

The key infrastructure facilities of Sukari include:

- Open Pit: open pit excavation, haul roads and adjacent areas on the crest of the open pit;
- Waste rock dumps: North, East and South dumps;
- Low grade ore stockpile;
- Run of Mine (ROM) pads;
- Tailings Storage Facility 1 (TSF No. 1): Tailings surface, Process Pond, evaporation ponds, TSF embankment,
- Perimeter access road and adjacent areas;
- Tailings Storage Facility 2 (TSF No. 2): Tailings surface, TSF embankment, perimeter access road and adjacent areas
- Process Plant Area: Process plant, reagent and supply chain warehouses, power stations, offices, fuel station and storage, laydown area, workshops, roads and adjacent areas;

- Camp Site Area: accommodation camp including mosque, sports fields, recreation building, mess and kitchen, administration office, sewage treatment plant, driver training area, site entrance and security;
- Salvage/Scrap Yard;
- Water Supply Infrastructure: Red Sea water intake, water pipeline, booster pump stations, and back-up groundwater borefield
- Underground Mine Area: underground portal, ventilation shafts and facilities, offices and workshop, waste rock dump, roads and parking area
- Dump Leach Facilities: dump leach, ponds and process area;
- Emulsion Plants;
- Explosive Magazines;
- Main Access Road;
- North Dyke;
- Solar PV Farm;
- Helipad; and
- New Site Entrance and Security.

20.4 Project Status, Activities, Effects, Releases and Controls

20.4.1 Energy Consumption and Source

Sukari provides all the power services to support its operations. There are two power stations (MAK and Wärtsilä) generating energy for the mine site and containing several generator sets. The generators are operated using diesel fuel. It is reported that in 2022 stationary fuel combustion at the Project was approximately 94M litres whilst mobile fuel combustion in the same year is reported to be around 90M litres. Mobile fuel combustion increased compared to 2021 by 14M litres due to accelerated waste-stripping programme.

Centamin is committed to reducing its carbon footprint and increasing energy efficiency at its sites through corporate-level efficiency initiatives. In Q4 2022, Sukari successfully commissioned the $36MW_{DC}$ ($30MW_{AC}$) solar plant and 7MW battery energy storage system, providing a secondary energy source to Sukari and increasing the renewable make-up of site power generation to 20%. This solar plant will save up to 70,000 litres of diesel per day; equivalent to an annual reduction of $59,000tCO_2$.

Other energy efficiency initiatives underway at Sukari leading to further carbon abatement include roll-out of the remaining 30 high-production trays to the haul fleet, resulting in an 8% reduction in fuel consumption per tonne of material moved; LED light bulb conversion; modified operational controls in the ultrafine grinding circuit allowing intermittent shutdown of the vertical mill to reduce power load; replacement of older underground trucks and loaders with more efficient units. Revisions of the life-of-mine plan envisaging optimisation of open pit slope angle will reduce waste stripping that along with haulage and waste dump optimisation will reduce mining fleet emissions.

Centamin has developed a Decarbonisation Roadmap for Sukari with an interim target of a 30% reduction in operational Scope 1 and 2 GHG emissions by 2030. The carbon abatement projects that underpin this interim target are a 15-20MW_{AC} extension to the existing solar plant, a 50MW_{AC} connection to the national electricity grid, including increased levels of renewable energy sourced through the national electricity grid compared to 2021 base-year.

20.4.2 Water Management and Effluents

There are no surface water resources in the mine area. Groundwater resources originate from occasional rainfall, that partially infiltrate through the more permeable wadi deposits and accumulate in basement depressions or is trapped by faults and buried dykes. Based on the numerous faults and shear zones intersecting the Sukari open pit and underground mine, it is reasonable to deduce that seepage is minimal and structurally controlled. Groundwater is characterised as brackish with high TDS levels and not suitable for drinking.

Water is drawn directly from the Red Sea for the mine operation. Three pipelines are installed with two sets of sea water intake pumps and booster stations to transport the water from the Red Sea to the Sukari mine site, a distance of approximately 25km. The combined capacity of 1700m^3/h is sufficient to meet the process plant and mining water requirements at Sukari. The seawater pipelines report to the raw water ponds located within the process plant area. Reverse osmosis water treatment plants draw a portion of the seawater for potable and fresh water supplies. Brine solution produced at the desalination plant is recycled to the raw water ponds.

A back-up bore field is installed, but has not been required to support operations, close to the coastline were seawater freely infiltrates into the groundwater, using submersible pumps.

Total water consumption of the Project in 2022 was 9,083Ml including seawater 8,424Ml, freshwater from Marsa Alam 349Ml, precipitation 51Ml, pit water 1Ml, and entrained water 259Ml. The mine reports zero discharges and 37% of water is reused. Pit water collected as the result of the West wall depressurisation is used for dust suppression.

The water balance for the TSF is strongly negative due to the low rainfall and high evaporation that characterises the region’s climate, thus 60-70% of total process water requirements needs to be extracted from the Red Sea.

20.4.3 Emissions to Air

Air pollutant emissions of the Sukari project are associated with such processes as drilling, blasting, haulage, crushing, power generation and transportation along the supply chain. Associated air emissions include particulate matter and gases.

Sukari is located 25 kilometres from Marsa Alam, to which it is connected by a bitumen road, and 13 kilometres from the northern extent of the Wadi El Gamal National Park. The operation has negligible impact on the airshed of these sensitive receptors and no community complaints or grievances related to air quality were reported in 2022.

The Project pays particular attention to improving the underground air quality through upgrading the underground ventilation system and investigating the opportunities of replacing the underground equipment with more environmentally friendly options. Plans for 2023 include introduction of new primary fans underground to further increase ventilation capacity to 450m3/s from 270m3/s in 2021 (160m3/s in 2019). The mine also sources low sulphur diesel for use by an underground mobile plant, subject to availability.

The principal dust suppression and control measures deployed at Sukari include road maintenance and watering, strict control on vehicle speed limits, waste dump/ROM pads management, enclosures and screens within the rock crushing circuit, and environmentally controlled operator booths.

20.4.4 Waste Management

20.4.4.1 Mineral Wastes – Rock

A total of 1,350Mt of waste rock will be mined across the overall life of Sukari. Waste rock is stored in waste rock dumps to the south, east and north of the pit or used for construction of tailings storage facility stages and hauls roads from the pit to run-of-mine pad.

Geochemical testwork (Knight Piésold , 2006) on waste rock and low-grade ore samples were all found to be non-acid forming with low sulphide contents and variable acid neutralising capacities. The acid neutralising capacity was predominately from contained carbonate minerals. The waste rock samples were found to be enriched in a small number of environmentally significant elements, of moderate solubility, which could have adverse environmental impact if not managed correctly. However, owing to extremely low rainfall, the risk of mobilisation of environmentally significant elements is considered low. Further geochemical testwork to verify these results were completed by Digby Wells in 2023.

20.4.4.2 Mineral Wastes – Tailings

Centamin is committed to the GISTM (Global Industry Standard on Tailings Management) with the objective to cause no harm to people or the environment through tailings facility design, operation and closure. Sukari operates two downstream TSFs lined with 1.5mm tick HDPE to reduce seepage and risks of groundwater contamination. Tailings are deposited via sub-aerial techniques, and decant water is pumped back to the process plant water tank for reuse.

Mineral waste facilities are engineered to meet the following requirements:

- Physical stability under all conditions;
- Chemical stability so as not to cause environmental harm; and
- Limited impacts on the landscape and environment after mine closure.

TSF No. 1 was commissioned during 2010 and has undergone a number of lifts over its operating life to its final eight in 2020. TSF No. 1 has a dam crest height of 60m and is near full capacity at $70Mm^3$. It provides intermittent emergency contingency storage only.

TSF No. 2 was commissioned in 2021 and currently serves as the primary operational facility for tailings containment. The construction of Stage 2 and 3 lifts on TSF No. 2 were completed in early 2022. The facility is designed to be raised through 13 stages downstream lifts and will provide 150 million tonne of dry tailings storage over the life of the mine. Height of TSF No. 2 embankment as of June 2023 is 41m, and volume of stored tailings is $15.9Mm^3$.

The Sukari operation has a contingency plan to prevent overtopping of the tailings impoundment, as well as early warning systems for slope and foundation failures. Operation of the TSFs is managed by a dedicated team of people who conduct daily performance monitoring including visual inspections to confirm the operational and structural integrity of the facility. This is supplemented by routine occupational safety and environmental monitoring and inspections by the HSE department. The monitoring results are routinely reviewed by Engineer of Record, including formal quarterly facility inspections.

Sukari generated 12.1Mt of tailings in 2022. In 2023, Sukari commenced the reuse of tailings paste for structural backfill of the underground operation.

20.4.4.3 Non-Mineral Wastes

A waste management system is in place at Sukari, outlining the waste handling, storage, and disposal requirements. Understanding the types and quantities of waste generated is critical to determine these requirements, as well as potential for reuse or recycling of wastes where possible. The waste management system covers:

- Waste minimisation – avoiding expired chemicals by maintaining an average stock;
- Maximising recycling and reuse of waste on-site;
- Recovery of valuable material;
- Reuse of wastewater; and
- Recycling and treatment of waste off-site.

Detailed waste management plans available at Sukari ensure all hazardous and non-hazardous waste generated is managed in a manner that minimises environmental risks and promotes and reduces closure and reclamation liabilities.

The primary hazardous non-mineral waste produced at Sukari includes sewerage effluent, hydrocarbon waste, packaging for cyanide and other hazardous reagents, solvents, paints, and batteries. Non-hazardous waste includes scrap metal, wood waste, tyres, cardboard, plastic, rubber, and food waste. Under the Sukari Concession Agreement, non-hazardous waste materials of beneficial value for reuse or recycling – principally scrap metal, wood, plastic, rubber, and tyres – are the responsibility of the Egyptian Mineral Resources Authority ("EMRA"). These materials are segregated and stockpiled for periodic collection and transfer off site by licensed third-party waste contractors appointed by EMRA. Food waste is donated as animal feed to local herders.

20.4.5 Hazardous Materials Storage and Handling

Hazardous materials that are used on the Sukari mine site include diesel fuel for power plants and vehicles, stored in the onsite fuel depot, chemicals for mining and processing operations including cyanide, oxygen, flotation reagents, nitric acid, emulsions, and boosters for blasting.

Produced hazardous waste include tailings, packaging for cyanide and hazardous reagents, solvents, waste oil, batteries, hydrocarbon contaminated items, effluents, and some medical waste.

The Mine has a Hazardous Material Standard to manage storage and handling of the hazardous materials in a manner that minimises environmental and health risks.

20.5 Security

Plant infrastructure is surrounded by 2.4m-high mesh fencing, and all persons entering controlled areas must pass through security gatehouses which are manned 24hours a day.

20.6 Permitting

The Project is subject to laws, regulations, guidelines, and standards of the Arab Republic of Egypt. Issues of environmental protection in Egypt are governed by Environmental Law 4/1994 (amended in 2009 and 2015) that outlines regulations pertaining to land, air, and water pollution and creates the Environmental Affairs Agency (EEAA), endowing it with the powers to enforce these requirements. As per the requirements of Law 4/1994 and its executive regulations, new projects are to prepare and submit an environmental impact assessment (EIA) study according to the EIA guidelines as part of the project approval process.

An Environmental and Social Impact Assessment (ESIA) was carried out in 2007 by Environics and approved by the Egyptian Environmental Affairs Agency. Of note, various elements of mine infrastructure have been the subject of EIA addenda subsequent to the original ESIA, namely: extension of the power plant (2008); water intake from the Red Sea and borefield (2009); oily sludge incinerator (2009); the second tailings storage facility (2016); and the solar PV project (2021). These EIA addenda were the subject of approvals by the EEAA. These outline the framework for environmental management currently adopted by SGM at the Sukari site, in order to evaluate and mitigate Project impacts and meet legal requirements and compliance with the Equator Principles IV (EP4).

Apart from EIA approval, the Project holds other permits, including permit for establishing the direct water intake, permits to establish beach wells, army permits to establish project components, permits related to use, import and purchase of explosives, clearance for the utilisation of the concession area from the archaeological point of view, etc.

SGM has a permit tracking system to ensure timely renewal and/or extension of permits. According to the provided Sukari Permits Register, as of October 2023 the mine is expecting a new permit for the process plant from the Ministry of Industry, and the following permits are under renewal:

- Industrial register;
- Annual clearance for cyanide importing;
- Sodium cyanide store; and
- Reagents store.

20.7 Environmental Management

20.7.1 Environmental Policy and Company Approach

Centamin has a group-level environmental policy which aims to ensure environmental protection and sustainable development. This includes evaluating risks of environmental impact and designating systems to prioritise the environment throughout exploration, construction, and operation of Projects such as Sukari. The Policy is supported at the operational level by Management System's Standards and tailored Environmental Management Plan that considers the regulatory context of the country and unique environmental risks specific to each site.

Centamin is committed to meeting international standards of good practice in the areas of environmental protection, social development, and health, safety, and security. To support this commitment, Centamin has developed a Sustainability Performance Framework which governs the Company's operations with respect to these key issues comprising policy, operational management standards and assurance processes.

20.7.2 Environmental Management and Staff Resources

Environmental and occupational health and safety aspects of the Sukari Project operation are managed by HSES Department headed by HSES Manager and supported by Chief Medical Officer, ER Superintendent, Safety Superintendent, Training Compliance Coordinator, Environmental Superintendent, Social Superintendent, HSES Systems Supervisor and numerous subordinated personnel.

The Project has onsite laboratory for environmental analyses and external accredited laboratories such as Air Pollution Laboratory of Alexandra University and Inspection Services of Acerta Middle East Certification Body are regularly involved for inspections and audits.

20.7.3 Environmental Monitoring, Compliance and Reporting

SGM has an Environmental Management System (EMS) which covers waste management, material, water and energy management, management of hazardous substances and chemicals and biodiversity management, among other factors.

The EMS aims to monitor Project performance through methods such as visual inspection, auditing, data collection and inventories, measurements and as well as systematic observations. Environmental monitoring will encompass the following aspects:

- Water quality, tailing storage facility water quality, groundwater quality and sewage;
- Air quality, air emissions and dust;
- Work environment parameters including dust, noise, illumination;
- Waste management practices;
- Potential impacts on biodiversity; and
- Potential impacts on cultural heritage.

The Mine has a groundwater monitoring network with boreholes distributed upstream and downstream of the TSFs, around the pit, water ponds and other facilities. Groundwater quality is monitored for the set of parameters, including TDS, pH, CN^-, WAD CN^-, sulphate, chloride, Cu, As.

In 2022, Digby Wells Environmental Ltd. was commissioned by Centamin to conduct a review of the groundwater monitoring network at Sukari, and certain recommendations were made to improve the network efficiency including drilling of additional boreholes for baseline and compliance monitoring.

Water quality results are evaluated in a weekly monitoring report and are routinely reported on a monthly basis to the regulator. WAI reviewed a summary spreadsheet with the results of groundwater analyses for TDS, pH, CN^-, and WAD CN for last 12 months and notices general compliance of the majority of monitored components concentration/value with permissible limits.

In 2022, boreholes of the TSF No. 1 West Wall demonstrated higher sulphate levels. WAI was informed that the concentration of sulphate had decreased after cessation of tailings discharge to TSF 1 and downstream groundwater recovery bores had been installed for the collection and return of groundwater to water containment facilities.

Stack emissions from thermal electricity generators are sampled monthly for SO_2, CO and NO_X. The Mine workers have personal dust monitors to measure their occupational exposure to dust during their workday. Twice a year, the air quality monitoring programme is externally audited including independent sampling and analysis.

WAI was provided with stack emissions summary for 2022 and External Air Quality Monitoring Report prepared by Air Pollution Laboratory of Alexandra University in January 2023. The reports indicate occasional exceedance of NO/Nox levels in stack emissions, other parameters were in compliance with the permissible limits, established by Egyptian Environmental Law 4/1994.

Commissioning of the 30MWAC solar plant has reduced diesel plant utilisation (and associated emissions); and future grid connection is expected to fully displace onsite thermal power generation.

20.7.4 Emergency Preparedness and Response

Centamin has developed a comprehensive site-specific Crisis Management Plan for the Sukari Project. The plan, which is regularly updated, includes site description and risk assessment, guidance for its activation and application in a step-by-step manner, and sections featuring contact details of key staff member, crisis communications information, duties, and responsibilities, etc.

It is supported by a series of Standard Operating Procedures (ER SOPs), Open Pit and Surface Operations Emergency Management Plan and Underground Mining Emergency Duty Cards. The SOPs outline the requirements for everyone who might be involved in a specific emergency. Duty Cards provide detailed instructions to people involved in emergency response activities. Emergency and Crisis Management Plan as well as its all supporting documentation are reviewed on a regular basis.

Sukari has an emergency response team on site, which is trained and equipped to manage emergency situations, including potential incidents related to tailings management or hazardous chemical spills.

20.7.5 Social and Community Management

20.7.5.1 Stakeholder Dialogue and Grievance Mechanisms

Centamin has a stakeholder engagement system, aiming to maintain communications and involvement with local communities and wider stakeholders. Stakeholder engagement, based in Marsa Alam, has been maintained since the design phase of Sukari with a commitment to prior and informed consultation, including monthly meeting with a formal Consultation Committee and annual community impressions surveys.

SGM works with the community, local NGOs and community support organisations, and government authorities to improve infrastructure and services in the region, and has supported projects to improve livelihoods, education, and health.

At the Project level, stakeholder engagement process is guided by the appropriate SE Framework that identifies the Project stakeholders, their interests and influence on the Project, describes engagement activities held on the ESIA, construction, and operation phases, suggests SE methods and tools, and includes plan of activities and list of responsibilities.

Community perception surveys undertaken in 2021 and 2022, indicated that the majority of respondents support the Sukari operation, including recent efforts of the Company to improve gender diversity.

To ensure the Project is following good practice and meeting international standards in grievance management, Sukari implements a grievance mechanism with all received grievances logged in the Grievance Register. SGM maintains separate registers for HR (internal) and community (external). WAI has reviewed the provided Registers. In 2023, three appeals from community members were registered including two related to potential impact of the Mine's residential option initiative on rental and property prices in Marsa Alam and one request of financial support. All appeals were reviewed and satisfied within two weeks according to the Register records. Internal grievances concerned mainly impolite behaviour of supervising personnel and transportation options. All successfully resolved.

20.7.5.2 Social Initiatives and Community Development

Centamin pays considerable attention to maintaining good relationships with local community and invests in various community development projects that might range from social infrastructure development, educational programs to environmental projects. According to the provided Community Investments Register, the following initiatives were completed or in progress by Centamin in 2022 and 2023 YTD:

Community Projects Undertaken in 2022:

- Established a Karate court to support the youth centre at Marsa Alam;
- Established a volley ball – handball and basketball court to support the youth centre at Marsa Alam;
- Established a workshop with full equipment and materials to train women in sewing and handicrafts;
- Established an eye diagnostic and surgery clinic;
- Established a classroom for literacy training for Marsa Alam women;
- Speech therapy for Marsa Alam rehabilitation centre; and
- Financial support to Marsa Alam schools and nursery.

Community Projects Undertaken and Ongoing in 2023:

- Establishment of an applied technical school for mining technology;
- Development of EIA guidelines for the metal mining sector;
- Establishment of a museum to protect cultural and archaeological artefacts found within the Sukari site in cooperation with the Supreme Council of Antiquities;
- Training program of women on sewing and handicrafts; and
- Support to infrastructure in two schools, and religious institutions in Marsa Alam.

20.8 Health and Safety

Centamin is pursuing ISO 45001:2018 Occupational Health and Safety management system certification at Sukari by 2023/2024. Sukari has an Occupational Health and Safety Management Plan that outlines policy and a structured approach to the identification, review and management of occupational health and safety related issues. It is applicable to all of Sukari personnel, including employees, contractors, and visitors.

Training for personnel is formalised under the HSE Training Compliance Management Plan. The Plan aims to ensure that the workforce is hazard aware, trained, and competent to safely and effectively carry out assigned work in accordance with applicable internal HSE requirements and requirements of Egyptian Labour Law.

At group-level, Centamin tracks and reports on fatality, lost time injuries, total recordable injury, and all injuries frequency rates. Sukari issues monthly sustainability reports with various incident frequency rates, including Total Recordable Injury (TRIFR), All Injury (AIFR), Lost Time Injury (LTI), Restricted Work Incident (RWI), Medically Treated Injury (MTI), First Aid Injury (FAI) and High Potential Incident (HPIFR).

In 2022, a notable improvement in safety performance was reported. Lost Time Injury Frequency rate at Sukari reduced to 0.09 from 0.49 reported in 2021 and 0.65 reported in 2020. Fatality frequency rate per 1,000,000 hours worked is reported to be 0.00 for the last three years.

20.9 Mine Closure and Rehabilitation

Centamin has a conceptual rehabilitation and restoration plan for the Sukari site developed during construction. The main activities of the rehabilitation process were planned to range from dismantling infrastructure, winning-hauling-dumping-spreading of waste rock, ripping compacted surfaces and grading the area to topographically blend with the surroundings. Since the Sukari mine site is located within an arid desert, no topsoil conservation or revegetation is required as part of mine closure. Generic and specific mine closure measures are planned in a way to ensure stable environmental, geochemical, geotechnical, and social conditions and reduce any hazards to health and safety of humans, livestock, and wildlife to levels equal to or below those naturally existing within the surrounding environment.

Centamin maintains an Asset Retirement Obligations document that is routinely reviewed and updated on and annual basis. The latest update was provided to WAI for review. It represents the estimated cost liability as of December 31, 2022 to close, decommission and rehabilitate affected areas, based on the present state of the mining operation.

The estimated cost liability as of December 31, 2022 to close, decommission and rehabilitate areas affected by Sukari, based on the present state of the mining operation is US$42.1M.

SGM is continuing to develop a comprehensive LOM Closure Plan for the full physical, bio-physical and socio-economic scope of the Sukari operation. This LOM Closure Plan will elaborate the closure vision, principles and objectives underpinned by consideration of potential post-closure land use and a formal identification and assessment of risks and opportunities.

21 CAPITAL AND OPERATING COSTS

21.1 Introduction

Centamin has, on the October 12, 2023, published a LOM production and cost forecast from 2024 onwards. The cost forecast includes operating costs, selling costs (royalties and refining costs) and sustaining and non-sustaining capital. A gold price of US$1,450/oz and a diesel price of US$0.75/litre was used.

21.2 Capital Costs

Total capital expenditure for the 2023 LOM Mineral Reserve-only case has been estimated by SGM to total US$706M, with US$572M of the total estimated as the sustaining CAPEX. A summary of the Sustaining and Non-sustaining CAPEX estimates for the areas for 2023 LOM Mineral Reserve-only case is presented in Table 21.1 below.

Table 21.1: Summary of CAPEX (2024 – LOM)

Area	US$M
HME Rebuilds	229
Open Pit Fleet Replacements	79
WMC Stripping	34
Underground Fleet Replacements	35
UG Rebuilds	18
UG Waste Capitalisation	208
Gravity Recovery Circuit	20
Tailings Dam Lifts	40
Grid	34
Plant Maintenance	2
Other Misc	8
Sustaining Capex	**572**
Non-Sustaining Capex	**134**
Total Capex	**706**

All capital expenditure funded by Centamin is recovered over a three-year period. Centamin is entitled to recover all exploration costs from the Government of Egypt with the timeframe depending on its classification.

21.3 Operating Costs

Open pit and underground mining operating costs have been based on the results of recent detailed estimation and modelling carried out by SGM. Mineral processing operating costs have been estimated for each tonne of ore, based on metallurgical test work and data and the current cost of operating the processing plant, an allowance has been made for the transition to grid power from on-site thermal power generation

Table 21.2 presents a summary of the Cash operating costs for the project for the 2023 LOM Mineral Reserve-only case.

Table 21.2: Summary of OPEX (2024 – LOM)		
Area		**US$M**
Gross Costs		
Open Pit Mining		1,526
Underground Mining		251
Processing		1,503
G&A		356
Total Site Costs		**3,636**
Selling Costs (3% NSR Royalty and Refining Costs)		203
Unit Costs		
Area	**Units**	**Value**
Open Pit Mining	US$/t mined	1.9
Underground	US$/t mined	40.9
Processing	US$/t Proc	11.6
G&A	US$/t Proc	2.8
Cash Operating Costs	**US$/oz Prod**	**818**

21.4 Taxes

Due to the licensing agreement with the Government of Egypt, SGM operations are exempt from paying taxes for 15 years from first commercial production. PGM and EMRA also agree that the operating company will in due course file an application to extend the tax-free period for a further 15 years.

As with most mining operations around the world, Sukari has experienced operating cost increases from consumables and in particular fuel costs. However, the Company has partially mitigated its exposure to fuel pricing through the construction of a 36MW solar farm and related battery storage facility which will allow a major saving in diesel fuel whilst helping to de-carbonise the operation. The recent move to owner-operated status in the underground alongside an ongoing cost reduction programme have also had significant cost savings. Looking forward, the Company is also planning to develop a grid connection to further improve costs as well as a possible future expansion of the solar plant.

22 ECONOMIC ANALYSIS

Centamin is a producing issuer and Sukari is in production. This technical report does not include a material expansion of production. As such, this section is excluded.

23 ADJACENT PROPERTIES

There is no information regarding adjacent properties applicable to the Sukari Gold Mine for disclosure in this Technical Report.

24 OTHER RELEVANT DATA AND INFORMATION

There is no other relevant data or information to report in this Technical Report about Sukari.

25 INTERPRETATION AND CONCLUSIONS

25.1 Introduction

Centamin plc (Centamin) is a gold mining and exploration company that owns 50% of SGM through its wholly owned subsidiary PGM. The remaining 50% of SGM is owned by the EMRA. In addition, Centamin owns the Doropo and ABC Gold Projects in Côte d'Ivoire. Centamin is a public company, whose ordinary shares are listed on the LSE under the symbol "CEY" and on the TSX under the symbol "CEE".

Sukari is Egypt's first large-scale modern mine and includes a low grade, bulk tonnage open pit and a high-grade underground operation, using CIL processing.

25.2 Geology & Mineralisation

The Sukari gold deposit comprises a broadly mineralised granodiorite porphyry dislocated by major shear/vein hosted higher grade mineralised zones. Gold mineralisation is hosted mainly by granodiorite, with some mineralisation extending into the surrounding metasediments.

The granodiorite has a strike length of approximately 2.3km, and ranges in thickness from 100m in the south to approximately 600m in the north. Gold mineralisation within is not homogenous and its deposition has been influenced by major long-lived structures that experienced continuous reactivation.

Gold mineralisation at Sukari is intimately related to sulphides; pyrite is the most abundant sulphide, followed by arsenopyrite. Sericite and silica are the most prevalent alteration products within the Sukari granodiorite, closely associated with mineralised zones.

Since 2021, an intensive relogging programme has been undertaken to review Sukari geology (lithologies, structure and alteration), produce a 3D geological model and improve the geological and structural understanding of the deposit. The resulting geological history, structural interpretation and 3D model have been developed in collaboration with industry experts and are now continually refined on-site via drillhole logging, section interpretation and underground mapping. The resulting model provides a robust tool for exploration targeting and resource modelling.

25.3 Exploration

Exploration at Sukari is currently focussed on defining targets close to existing infrastructure (within 10km) which can be quickly and cost effectively brought into the mine planning process, while also continuing to test the depth and strike extensions that underpin the longer-term potential of the underground mine and the mine expansion plan.

The Horus zone sits at depth beneath the Amun zone and represents the long-term future of the underground operations. Horus Deeps remains open to the north, south and down dip.

In addition, Sukari surface exploration has identified multiple shallow open pit gold satellite targets within the Sukari Mining Concession which have the potential to supplement Sukari mill feed, in the medium to long term, improving operational flexibility.

The authors consider the sample collection at Sukari is undertaken by competent personnel using procedures that are consistent with industry best practices. The authors conclude that the samples are representative of the mineralisation and there is no evidence that the sample collection process has resulted in a bias that could materially impact the accuracy and reliability of the results.

25.4 Drilling, Sampling and Analysis

All drilling has been conducted by SGM using contractor operated reverse circulation, diamond and multi-purpose drill rigs, from surface and underground drill sites. Both sample recovery and location accuracy are considered acceptable, and no factors have been applied to the Sukari drillhole data.

Current drilling at Sukari extends to approximately 1500m below surface. Drilling is orientated to ensure that drill intersections are as close to perpendicular with mineralisation as technically possible.

All samples are analysed by the SGM site laboratory. Centamin employs a comprehensive QA/QC programme as part of the assaying procedure, involving regular insertion of Certified Reference Materials (CRMs), duplicates and blanks. 5% of all samples are sent to ALS Loughrea on a quarterly basis for check analysis.

Based on a desktop review and site visit, the authors consider that appropriate systems are in place to ensure that the Sukari drillhole database is sufficiently accurate and precise for Mineral Resource and Mineral Reserve estimation.

25.5 Mineral Resource Estimation

The Sukari open pit and underground MREs were prepared according to the CIM Definition Standards, as incorporated with NI 43-101.

Open pit mining exploits the Sukari felsic porphyry over a broad extent, whereas underground mining targets discrete higher-grade zones, where gold mineralisation is concentrated in through-going quartz vein arrays, breccias, and shears. Modelling and estimation techniques have been appropriately tailored to these distinct mining scenarios, resulting in two separate Mineral Resource models. Open-pit Mineral Resources are estimates of recoverable tonnes and grade using Multiple Indicator Kriging (MIK) with direct lognormal change of support, whilst Underground Mineral Resources were estimated using OK.

All open pit Mineral Resources were reported within a US$2,000/oz pit shell and above a 0.3g/t Au cut-off grade. Underground Mineral Resources were reported above 1g/t Au cut-off grade below the US$$2,000/oz pit shell.

Actual mined versus Resource model reconciliation appears to be improving but remains a challenge, particularly for the underground mine. Active initiatives to improve reconciliation include on-site ownership of all modelling and estimation activities to shorten feedback loops between operational performance and model updates, closer alignment of resource and grade control model architecture, and the introduction of underground RC drilling from 2025 to increase sample size, drilling rates and drillhole density. Planned expansion of the grade control inventory to 1 year ahead of underground production and 2 years ahead of open pit production should also enhance reconciliation performance.

25.6 Mineral Processing and Metallurgical Testing

Significant metallurgical testwork has been conducted on samples of Sukari ore since 2000, with the latest testwork programmes conducted by AMMTEC in 2011 and Gekko in 2023.

The AMMTEC testwork focussed on a New Main Sulphide Ore Composite sample and a very high grade Hapi Zone Ore sample. In general, the results confirmed the flowsheet currently in use, namely grinding, flotation, fine grinding and CIL of the flotation concentrate and further CIL processing of the high grade flotation tailings. This is reflected in the current operation consisting of two plants or lines, with one line treating higher grade ore with additional leaching of the flotation tailings. The flotation concentrates from both plants are combined for ultra fine grinding, oxygen injection and subsequent cyanide leaching and carbon adsorption.

The flotation circuit is the core circuit and greater than 98% gold recovery to concentrate was achieved in testwork, with reasonable and acceptable gold recoveries from leaching the flotation concentrate and the high grade flotation tails stream.

The ore is generally siliceous rock with the gold contained in sulphides, principally pyrite. Arsenic levels are moderate. The ore is generally very hard and abrasive. Coarse gold is present and it is unusual that a gravity circuit was not included in the original plant design.

Significant gravity testwork has now been conducted, with the latest testwork conducted by Gekko in April 2023. These results clearly indicate the need for a gravity circuit. Further studies are required to determine the maximum throughput, as a split of the mill discharge stream, to maximise gold recovery while maintaining the required solids and water balance for efficient milling.

25.7 Mineral Reserve Estimate & Mining Methods

Sukari, which consists of both an open pit and underground operation, undertakes annual updates of its Mineral Resource and Mineral Reserve estimates which includes changes to various modifying factors such as gold price, process recoveries, geotechnical parameters, costs and estimates, dilution, ore loss, as well as additions and subtractions due to exploration and depletion.

Since 2020, Centamin management and SGM have undertaken a in depth review of the Sukari operation. The outcome has been numerous optimisation and improvement projects to improve understanding, confidence and productivity across the operation. Notably in terms of the resource modelling, geotechnical data, ventilation and introduction of paste fill; and WAI considers that SGM has made realistic assessments of the modifying factors based on these investigations with regards to the open pit slopes and base case assumptions.

All ore and waste from the pit is mined using conventional open-pit methods. The operation is selective in terms of separating ore and waste, and the degree of selectivity is appropriate for the scale of mining equipment and the nature of the mineralisation. A SMU of 5m x 8m x 10m (XYZ) has been adopted.

Calculations of dilution at Sukari have been based upon the regularisation of an original sub-celled MRE block. The regularisation process groups material into specified universal block sizes, and can then be interrogated to calculate the volumes, grade and classification of the block as a whole assuming that any material selectivity within that block is not unreasonable. The re-blocking process also accounts for any mineralisation below cut-off grade in the evaluation process.

WAI considers the process undertaken to delineate dilution and ore losses to be appropriate, taking due cognisance of operational factors and understanding of the ore body when measured against production actuals.

WAI believes that the operation and the parameters utilised for the calculation of cut-off-grades have been defined based upon robust initial data, augmented by operational knowledge from an active mining operation, and are of an appropriate confidence level to define a Mineral Reserve to international standards. Furthermore, the use of operational CoGs utilised at the mine site, which corelate well with the calculated CoGs, coupled with the stockpiling of marginal ore represents good operational practice.

Table 25.1 below presents the June 30, 2023 Mineral Reserve Estimate for Sukari

Table 25.1: Sukari Gold Mine Mineral Reserve Estimate (June 30, 2023)

Location	Cut-off Grade	Proven			Probable			Total		
		Tonnes	Grade	Metal	Tonnes	Grade	Metal	Tonnes	Grade	Metal
	g/t Au	Mt	g/t Au	Moz Au	Mt	g/t Au	Moz Au	Mt	g/t Au	Moz Au
Open Pit	0.4	88.5	1.13	3.22	21.1	1.16	0.79	109.6	1.13	3.99
Underground	2.2	3.6	3.75	0.43	4.4	4.10	0.56	8.1	3.94	1.02
Stockpiles	-	17.8	0.47	0.27	-	-	-	17.8	0.47	0.27
Total Mineral Reserves		**109.9**	**1.11**	**3.92**	**25.6**	**1.67**	**1.37**	**135.5**	**1.21**	**5.28**

Based on both the desktop review and site visit, WAI is of the opinion that appropriate systems are in place in terms of mine optimisation, design, scheduling and modifying factors to allow a Mineral Reserve Estimate to be declared for Sukari.

25.8 Recovery Methods

The Sukari operation is a well-established and well-run operation with a high plant throughput of circa 12Mtpa, one of the largest in Africa. The national workforce is very well educated and skilled. The process team has been working together for many years and are very pro-active in metallurgical testwork and projects to improve throughput, increase recovery and lower operating costs. There is the benefit of a very well equipped metallurgical laboratory. The use of two process Lines allows for plant trials on the lower-grade Line 2 with minimal risk to plant operations.

The flowsheet is relatively straightforward and is based on crushing, milling, sulphide (pyrite) flotation, fine grinding of the flotation concentrate and leaching/CIL for gold recovery. There are essentially two similar process lines developed from previous plant expansions and the flotation tails from Line 1 treating the higher-grade ore are processed through the old oxide leach/CIL circuit for additional gold recovery, together with the flotation concentrate CIL tails. One CIL circuit treats the combined and finely reground flotation concentrates from both lines. The total plant tailings (flotation tails from Line 2 plus total CIL tails) are pumped to a conventional TSF (TSF 2 is in operation with TSF 1 decommissioned) with a booster station installed for the plant tailings due to the additional distance of TSF 2.

Metallurgical and production performance over the last few years has been very consistent, with throughput circa 12Mtpa and gold recovery circa 88-89% for a head grade range of 1.18-1.35g/t Au.

The LOM plan is based on a throughput of 12.5Mtpa, gold recovery of 89.4% and an average head grade of 1.19 g/t Au. Although 12.5Mtpa has not yet been achieved (12.11Mtpa in 2022), this should be achievable with the on-going optimisation projects.

In effect, the process philosophy is similar to the Albion process for refractory ores, with a pyrite/gold flotation concentrate being ultra-finely ground and then cyanide leached with the addition of oxygen sparging.

For the high plant throughput, unit operating costs were relatively high in 2022 at $16.76/t (and allowing for inflationary effects) but have significantly reduced in YTD 2023 to $13.92/t, mostly due to significantly lower power costs with full commissioning of the solar power station and a lower cost of diesel for the generated power (genset power station), but also with significant optimisation of the reagent preparation systems, dosage rates and optimum dosage addition points. Reduction of operating costs will continue to be a major focus. However, the hardness and abrasivity of the ore inherently results in high grinding media consumption and the high reagent consumptions (cyanide in particular) are derived directly from the requirement for ultra-fine grinding to 10 microns and subsequent leaching. Grinding media and cyanide consumptions are by far the two major cost contributors.

A further expansion of the solar power plant is planned with an additional 15-20MW to be installed.

Historical problems have occurred with roping cyclones/overflowing trash screens due to pushing throughput significantly above design, but these issues have largely been overcome from testwork to optimise the flocculant addition to the thickeners and from installing a single larger trash screen on Line 1. However, the old/oxide CIL tail thickener remains off-line and the resulting lower slurry density will likely impact on the LOM tonnage accommodated by TSF 2. However, this would be mitigated if a new cyanide detoxification circuit was to be installed based on thickened tailings.

The dump leach operation is working satisfactorily although, with a reported low gold recovery of circa 30-50% for oxide material, it is only being operated to cover the mining waste transportation costs, with a relatively low cyanide addition. Higher recoveries could potentially be obtained from higher cyanide concentrations in the irrigation solutions and this is being investigated. The gold contribution from dump leaching is minor but a valuable benefit in reducing operating costs by paying for the mine waste transportation costs. It is also planned to leach sub-grade transitional material and associated rehandled stockpiles and also potentially fresh material. Recoveries for both ore types are expected to be in the range of 20-30% with testwork continuing.

Gold is also recovered from treating the tailings dam return water through a new carbon-in-solution circuit, but again the gold contribution is minor.

On-going design and auditing of the TSF passed from Knight Piésold to Epoch Resources (South Africa).

25.9 Environmental Studies, Permitting and Social or Community Impact

Generally, WAI concludes that no fatal flaws pertaining to the environmental, socioeconomic, and Health & Safety aspects that might affect the viability of the Project have been revealed during the study.

From review of the documentation provided, the Project is in compliance with in-country requirements and environmental legislation, namely Environment Law 4/1994 and WAI's review shows a commitment to international requirements and good industry practice. Overall, WAI perceive that the environmental and social aspects of the Sukari Project are well understood and managed. All required permits are in place and renewed when required, management plans are reviewed and updated on a regular basis, and any cases of non-conformance and incidents are subject to root cause analysis. The effective communication and engagement with local stakeholders are successful in ensuring a mutually beneficial project.

The ESIA studies, management plans and reports provided to WAI for review, indicate the Company's commitment to reduction of Environmental and Social risk. From the H&SC standpoint, WAI has not identified any risks or liabilities that may arise from the operations should the existing level of H&SC standards and practices is maintained.

25.10 Market Studies and Contracts

The NI 43-101 report published by Centamin in 2015 suggests that SGM are not dependent upon any one customer for the sale of gold and as such gold is sold to various gold bullion dealers and smelters on a competitive basis. The report also indicates that gold doré bars are transported from the mine site to the chosen accredited gold refiner for smelting and refining into and LME grade gold bar on a regular basis.

For the economic analysis, a gold price of US$1,450/oz and a diesel price of US$0.75/litre was used.

SGM is engaged in numerous contracts with local and international companies relating to the operation of the mining and processing operations.

25.11 Capital & Operating Costs

Centamin has, on the October 12, 2023, published a LOM production and cost forecast from 2024 onwards. The cost forecast includes operating costs, selling costs (royalties and refining costs) and sustaining and non-sustaining capital. A gold price of US$1,450/oz and a diesel price of US$0.75/litre was used.

Total capital expenditure for the 2023 LOM Mineral Reserve-only case has been estimated by SGM to total US$706M, with US$572M of the total estimated as the sustaining CAPEX.

Overall cash operating costs for the operation are US$818/oz of gold metal produced.

26 RECOMMENDATIONS

26.1 Exploration

WAI endorses continued exploration at Sukari to extend the LOM and increase optionality. This includes testing strike and depth extensions to the underground mine, alongside development of potential satellite deposits. Subject to Board sign-off, the 2024 budget for exploration is estimated to be approximately US$8-12M for Eastern Desert Exploration (EDX) and US$6-10M for Sukari underground operations.

26.2 Drilling, Sampling and Analysis

The fractured nature of Sukari host rocks makes collection of oriented drill core difficult. Televiewer or other downhole tools should be considered to acquire oriented planar structural data during exploration DD.

26.3 Mineral Resource Estimation

Although the Mineral Resource work has been undertaken to a high standard and is compliant with international reporting codes, the following actions are recommended as part of continuous improvement.

In the open pit model, interpretation and modelling of andesite dykes could be improved to ensure that high-grade samples are excluded, and all relevant low-grade intersections are captured. Panel size could be adjusted such that panel dimensions are divisible into SMU blocks. Statistical checks by domain would benefit from comparison of block model and declustered composite grades. WAI recommends that the open pit resource classification method is aligned with the approach used in the underground model.

In the underground model, Centamin should consider adopting a mineable stope optimiser (MSO) tool to better constrain blocks with reasonable prospects of eventual economic extraction.

Due to high nugget and spatial complexity, reconciliation is often challenging in orogenic gold deposits, particularly when cut-off grade and selectivity is increased for underground mining. WAI supports ongoing initiatives to improve model reconciliation, including on-site model ownership, alignment of resource and grade control model domain architecture, introduction of underground RC drilling, alongside expansion of the grade control inventory to 1 year ahead of underground production and 2 years ahead of open pit production.

Further work to improve underground resource model reconciliation could include calibration of top-caps and high yield limits, based on domain grade-tonnage curve comparisons with the grade control model. WAI also advises that underground reconciliation results would be more representative of model performance, if calculated over a common volume that encompasses both LOM stope and design stope extents.

26.4 Mineral Processing and Metallurgical Testing

Significant metallurgical testwork has been conducted on samples of Sukari ore since 2000, with the latest testwork programmes conducted by AMMTEC in 2011 and Gekko in 2023.

Significant gravity testwork has now been conducted, with the latest testwork conducted by Gekko in April 2023. These results clearly indicate the need for a gravity circuit. Further studies are required to determine the maximum throughput, as a split of the mill discharge stream, to maximise gold recovery while maintaining the required solids and water balance for efficient milling.

26.5 Mineral Reserve Estimate & Mining Methods

WAI understands there is a meteorological monitoring station on site from the reported data. The occurrence of low frequency and possibly high-intensity rainfall makes conventional rainfall-runoff modelling estimates problematic. Nonetheless, it is recommended that the site-specific data collected is periodically (yearly) reviewed to enable the generation/update of site-specific Intensity-Duration-Frequency (IDF) curves to use as tools to support decision making on future surface water management.

CGM have a relatively up-to date surface water management plan which considers mine closure. This included a review of the topography and infrastructure and made clear recommendations on flood risk mitigation methods. From the site visit it is understood that there are no permanent surface water features in the vicinity of Sukari, therefore routine surface water monitoring is not relevant.. The mitigation measures in place for the areas vulnerable to flash flooding should be maintained. It is not known if the additional flood risk mitigation measures recommended by Knight Piesold have been employed. It is not considered a significant need to update the surface water management plan however WAI recommend SGM follow up on previous recommendations to review their resultant actions and ongoing surface water management systems.

Given the mine size, an upper recharging storage body (wadi aquifer) and localised seepage and groundwater zones in structural domains that may also be prone to geotechnical weaknesses, it is expected that the mine will have undertaken a programme of groundwater investigation to identify hydrogeological parameters, pore-water pressure distributions and modelling to evalaute the effectiveness of control measures. The general recommendations made by SRK in October 2022 for data collection including installation of five VWPs seems justified. At present, it is understood this program is ongoing in the north east. SRK have completed installation of piezometers in the south, north and west walls and are undertaking a groundwater modelling. The West wall is also awaiting the installation of data loggers. SRK will complete data review Q4 2023. It is expected that results from this will be incorporated into slope stability modelling which, to-date has not included groundwater.

Mining has advanced below the ambient groundwater level and this has been the case for over 12 years. Despite which relatively few, if any reliable hydraulic conductivity or permeability estimates are available that adequately characterise the water bearing zones. It is recommended that annual oversight and if necessary re-purposing of the groundwater programme is maintained so that the work is kept aligned with the necessary objectives. As data becomes available the initial conceptualisation of the groundwater system will need to be refined based on the quantitative work and analysis currently being performed.

Given so many of the depressurisation boreholes are not providing any flow, it is recommended that the effectiveness of this program is reviewed. Some of the modelling and VWP work that is currently in progress should be used to refine understanding of overall mine pore-water pressure control and where interventions may have positive effect on slope stability and geotechnical management. This is covered by the SRK scope of work, reviewing the data for VWPS.

Although inflows and inrush risk to the underground mine is considered to be low based on the net negative water balance, it is recommended that the following hydrogeological aspects are addressed to move forward with mining with appropriate precautionary measures:

1. Estimation of inflows associated with the Sukari 2 Thrust
2. Evaluation of the effectiveness of the depressurisation scheme, and
3. Potential seepage to groundwater from TSF No. 1.

26.6 Recovery Methods

Metallurgical and production performance over the last few years has been very consistent, with throughput circa 12Mtpa and gold recovery circa 88-89% for a head grade range of 1.18-1.35g/t Au.

The LOM plan is based on a throughput of 12.5Mtpa, gold recovery of 89.4% and an average head grade of 1.19 g/t Au. Although 12.5Mtpa has not yet been achieved (12.11Mtpa in 2022), this should be achievable with the on-going optimisation projects.

One issue to consider is when the dump leach operations finally close and the potential requirement to treat run-off solutions if acid-rock drainage (ARD) is a problem due to the sulphide content. This will have to be determined through testwork.

In terms of the future potential for operating cost reduction, de-commissioning the old/oxide CIL circuit would be beneficial, but this is dependent on the current project to install a gravity circuit. Testwork and simulation studies completed to-date clearly indicate the metallurgical benefits of installing a gravity circuit, with a high GRG content. This would improve overall gold recovery. Engineering studies are nearing completion to allow a decision to be made shortly.

While the potential gravity circuit is the most important project currently underway for the process plant, a second project is the potential for a detoxification circuit, using a novel process being developed by Sukari, similar to the INCO process, but more economical. This is currently being fully investigated through plant trials and testwork. The motivation for this project would be to follow the International Cyanide Management Code guidelines (WAD cyanide limit of 50ppm entering the TSF compared to 150ppm currently) and to improve the pyrite flotation process – although detoxification of the TSF return water is undertaken using ferrous sulphate, there still remains approximately 40ppm which can adversely affect pyrite flotation performance (cyanide acts as a depressant).

26.7 Project Infrastructure

Power supply for processing stages 1-3 and infrastructure is generated using five MAK and six Cummins generators capable of supplying 6.5MW (de-rated) and 1.2MW (de-rated) respectively. Processing stage 4 receives power generated from five Wartsila generator sets capable of supplying 7.8MW (de-rated). A diesel fuel storage facility is present on site with a combined capacity of 5,207m^3.

A 36MW_{DC} solar farm has been commissioned which produces a significant proportion of the mine's power, whilst the Company is also continuing to work towards a full national grid connection. This, combined with the solar farm, would displace the diesel generator sets which will then be retained in case of a loss of supply from the grid.

Sukari has two TSFs, TSF No. 1 and TSF No. 2 located to the west and south of the main mine area respectively. TSF No.1 was commissioned in 2009 and has been in continuous operation since, but is now near full capacity and provides emergency contingency storage only. The starter embankment (Stage 1) of TSF No.2 was constructed in 2020 and commissioned in January 2021 under the supervision of Knight Piésold. The next raise construction (Stage 3) has recently been constructed providing 36Mt of capacity for a production rate of 12Mtpa at a 50% solids by weight slurry. Stage 4 construction was started in 2023 under the supervision of engineer of record ("EOR") Epoch, to take the capacity to 48Mt, with commissioning expected in mid 2024.

26.8 Environmental Studies, Permitting and Social or Community Impact

The following recommendations can be made to ensure continuous improvement of environmental and social management of the Project:

- Continuous update of operational management systems and plans to ensure they are relevant and proportionate to risks, including alignment with ISO standards ;
- Ongoing collaboration with contractors and suppliers to strengthen conformance to good practice environmental and social standards;
- Achievement of full conformance of the Sukari tailings management system to the requirements of the GISTM;
- Ongoing reduction of GHG emissions through the execution of projects identified under the 2030 decarbonisation roadmap, including the investigation of additional opportunities; and
- Develop a standalone Mine Closure Plan to reflect the current Project Description and ongoing activities.

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CERTIFICATE OF QUALIFIED PERSON

I, Stuart Andrew Richardson, BEng, MSc, CEng, MIMMM, as an author of this report titled "NI 43-101 Technical Report on the Sukari Gold Mine, Egypt" dated November 27, 2023, and with an effective date of June 30, 2023, do hereby certify that:

- I am a Technical Director with Wardell Armstrong International, with a business address at Baldhu House, Wheal Jane Earth Science Park, Baldhu, Truro, Cornwall, United Kingdom, TR3 6EH.
- I am a graduate of the University of Exeter in the United Kingdom (BEng Mining Geology, 2006; MSc Mining Engineering 2016). I have practiced my profession continuously since 2007 and have estimated and audited Mineral Reserves for a variety of commodities, including gold related to disseminated sulphides deposits.
- I have read the definition of "Qualified Person" set out in NI 43-101 and certify that by reason of my education, affiliation with a professional association and past relevant work experience, I fulfil the requirements of a "Qualified Person" for the purposes of NI 43-101.
- I am a registered member in good standing of the Institute of Mining, Metallurgy and Materials and Chartered Engineer (#496923).
- I last personally inspected the Sukari Mine on September 5 to September 7, 2023.
- I am the co-author of this report and responsible for Sections: 1.1, 1.2, 1.3, 1.4, 1.11, 1.12, 1.14, 1.16 (mining), 1.17, 1.18.2, 2, 3, 4, 5, 6, 15, 16, 19, 21 (mining), 22, 23, 24, 25.1, 25.7, 25.10, 25.11 (mining), and 26.5.
- I am independent of the issuer, Centamin plc, as defined by Section 1.5 of NI 43-101.
- I have had prior involvement with the Sukari Gold Mine that is the subject of the Technical Report, including a Competent Persons Report for Centamin plc dated September 30, 2022.
- I have read NI 43-101, and the Technical Report has been prepared in compliance with NI 43-101 and Form 43-101F1.
- At the effective date of the Technical Report, to the best of my knowledge, information and belief, the sections of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 27th day of November 2023.

(Signed & sealed) Stuart A. Richardson

Stuart Richardson BEng, MSc, CEng, MIMMM

CERTIFICATE OF QUALIFIED PERSON

I, Alison Brianna Allen, BSc, MSc, CEnv, FIMMM, MIEMA, MIEEM, as an author of this report titled "NI 43-101 Technical Report on the Sukari Gold Mine, Egypt" dated November 27, 2023, and with an effective date of June 30, 2023, do hereby certify that:

- I am Deputy Managing Director with Wardell Armstrong International, with a business address at Baldhu House, Wheal Jane Earth Science Park, Baldhu, Truro, Cornwall, United Kingdom, TR3 6EH.
- I am a graduate of the University of East Anglia in the United Kingdom (BSc (Hons) Natural Sciences, 2001) and Camborne School of Mines (University of Exeter) in the United Kingdom (MSc Mining Environmental Management, 2008). I have practiced my profession continuously since 2001 in a variety of countries and commodities, and including preparing Environmental and Social Chapters and Impact assessments for gold and base metals;
- I have read the definition of "Qualified Person" set out in NI 43-101 and certify that by reason of my education, affiliation with a professional association and past relevant work experience, I fulfil the requirements of a "Qualified Person" for the purposes of NI 43-101.
- I am a Fellow of the Institute of Mining, Metallurgy and Materials (# 474370), and a Chartered Environmentalist of the Institute of Environmental Management and Assessment (# 0013685).
- I did not visit the Sukari Gold Mine.
- I am the co-author of this report and responsible for Sections: 1.15, 20, 25.9, and 26.8
- I am independent of the issuer, Centamin plc, as defined by Section 1.5 of NI 43-101.
- I have had prior involvement with the Sukari Gold Mine that is the subject of the Technical Report, including a Competent Persons Report for Centamin plc dated September 30, 2022.
- I have read NI 43-101, and the Technical Report has been prepared in compliance with NI 43-101 and Form 43-101F1.
- At the effective date of the Technical Report, to the best of my knowledge, information and belief, the sections of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 27th day of November 2023.

(Signed & sealed) Alison B. Allen

Alison Allen BSc, MSc, CEnv, FIMMM, MIEMA, MIEEM

CERTIFICATE OF QUALIFIED PERSON

I, Frank Browning, MSci, MSc, MCSM, PGCert, FGS, CGeol, as an author of this report titled "NI 43-101 Technical Report on the Sukari Gold Mine, Egypt" dated November 27, 2023, and with an effective date of June 30, 2023, do hereby certify that:

- I am a Principal Resource Geologist with Wardell Armstrong International, with a business address at Baldhu House, Wheal Jane Earth Science Park, Baldhu, Truro, Cornwall, United Kingdom, TR3 6EH.
- I am a graduate of the University College London in the United Kingdom (MSci Earth Sciences, 2011), Camborne School of Mines (University of Exeter) in the United Kingdom (MSc Mining Geology, 2016) and Edith Cowan University in Australia (PGCert Geostatistics, 2019). I have practiced my profession continuously since 2011 and have estimated and audited Mineral Resources for a variety of commodities and deposit types, including orogenic gold deposits.
- I have read the definition of "Qualified Person" set out in NI 43-101 and certify that by reason of my education, affiliation with a professional association and past relevant work experience, I fulfil the requirements of a "Qualified Person" for the purposes of NI 43-101.
- I am a registered member in good standing of the Geological Society of London as a Fellow and Chartered Geologist (# 1031973).
- I last personally inspected the Sukari Mine on September 5 to September 7, 2023.
- I am the co-author of this report and responsible for Sections: 1.5, 1.6, 1.7, 1.8, 1.10, 1.18.1, 7, 8, 9, 10, 11, 12, 14, 25.2, 25.3, 25.4, 25.5, 26.1, 26.2, 26.3, and 27.
- I am independent of the issuer, Centamin plc, as defined by Section 1.5 of NI 43-101.
- I have had prior involvement with the Sukari Gold Mine that is the subject of the Technical Report, including a Competent Persons Report for Centamin plc dated September 30, 2022.
- I have read NI 43-101, and the Technical Report has been prepared in compliance with NI 43-101 and Form 43-101F1.
- At the effective date of the Technical Report, to the best of my knowledge, information and belief, the sections of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 27th day of November 2023.

(Signed & Sealed) Frank Browning

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CERTIFICATE OF QUALIFIED PERSON

I, James William Grenville Turner, BSc (Hons), MSc, CEng, MIMMM, as an author of this report titled "NI 43-101 Technical Report on the Sukari Gold Mine, Egypt" dated November 27, 2023, and with an effective date of June 30, 2023, do hereby certify that:

- I am a Technical Director with Wardell Armstrong International, with a business address at Baldhu House, Wheal Jane Earth Science Park, Baldhu, Truro, Cornwall, United Kingdom, TR3 6EH.
- I am a graduate of the Camborne School of Mines in the United Kingdom (BSc (Hons) Mineral Processing Technology, 1984; MSc Minerals Engineering, 1993). I have practiced my profession continuously since 1984, on site-based operations and consultancy, including gold related to disseminated sulphide deposits.
- I have read the definition of "Qualified Person" set out in NI 43-101 and certify that by reason of my education, affiliation with a professional association and past relevant work experience, I fulfil the requirements of a "Qualified Person" for the purposes of NI 43-101.
- I am a registered member in good standing of the Institute of Mining, Metallurgy and Materials and Chartered Engineer (#0046967).
- I last personally inspected the Sukari Mine on September 5 to September 7, 2023.
- I am the co-author of this report and responsible for Sections: 1.9, 1.13, 1.16 (process), 13, 17, 18, 21 (process), 25.6, 25.8, 25.11 (process),26.4, 26.6, and 26.7.
- I am independent of the issuer, Centamin plc, as defined by Section 1.5 of NI 43-101.
- I have had prior involvement with the Sukari Gold Mine that is the subject of the Technical Report, including a Competent Persons Report for Centamin plc dated September 30, 2022.
- I have read NI 43-101, and the Technical Report has been prepared in compliance with NI 43-101 and Form 43-101F1.
- At the effective date of the Technical Report, to the best of my knowledge, information and belief, the sections of the Technical Report that I am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated this 27th day of November 2023.

(Signed & sealed) James W.G. Turner

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