

3D Geological Modelling & Resource Estimation for Exploration & Mining Projects

Life-of-Mine Value Chain From Exploration to Closure

With a footprint of mining services complementary across geographies, clientele, and capabilities, CSA Global is unrivalled in the provision of reliable resource estimation for exploration and mining projects. With respect to Africa, from their regional office in Johannesburg, South Africa, the firm provides relevant local knowledge and skills.



Osino Resources' Twin Hills Gold Project.

For clientele involved in contemporary exploration and mining projects, the financial viability of a project is still at the forefront, with sustainability (Environmental, Social and Governance) taking on a strong focus in recent years. Just over two years ago, CSA Global was acquired by sustainability consultancy ERM Group, headed out of London and is perfectly placed and well-resourced to add value in these areas for prospective clientele in Africa. CSA Global excels in providing technical and management consulting services and independent corporate advice to mining and exploration companies and financial and legal groups worldwide.

In good stead

Galen White, Partner (EMEA) based in the United Kingdom, Graham Jeffress, Partner (APAC) based in Australia and Anton



Graham Jeffress, Partner – Asia Pacific.

Geldenhuys, Principal Resource Consultant based in South Africa foresee CSA Global playing a more prominent role in Africa as project prospects are positive following a lull that greeted the news of the COVID-19 pandemic.

The three resource specialists are confident that, well-resourced, thoroughly compliant with industry best practice, and constantly innovative, the company is in good stead to solve complex challenges for clients. There are vast opportunities in mining and exploration on the continent, and there is a lack of credible geological data.

One of the areas where they look to consult is in resource estimation and work with clientele on delivering value through 3D geological modelling, orebody characterisation and improving orebody knowledge through their geometallurgy service offering, which has seen growth over recent years.



CSA Global is currently working on an early-stage gold exploration project in the Eastern Desert, Egypt.

Well-resourced

• Skills

Undoubtedly, CSA Global's most valuable assets are the vast diversity of skills complemented by a host of relevant and current industry-specific software. This gives the company the flexibility to handle different project needs for clients. CSA Global's human capital pool constitutes the cream of skills in mining, geoscience, exploration, data, and water management. The company's employees and associates globally include a team of geologists, engineers, mining consultants, hydrologists, hydrogeologists, and data specialists who are some of the most experienced and sought-after professionals across the mining industry backed by many years of various levels of commodity expertise.

CSA Global's consultants have worked on a vast array of projects in most African countries, across all mineral commodities and covering all stages of the exploration and mining cycle. Since 2006, CSA Global has worked in 40 African countries and issued more than 700 technical reports on projects in Africa. West African projects account for 40% of our work in the region, followed by Southern Africa (25%), North and East Africa (13% and 12% respectively) and 10% in the Democratic Republic of Congo.

Leveraging ERM's global infrastructure, CSA Global provides expertise in environmental, health, safety, risk, social consulting across the life cycle of a mining business. ERM has more than 5,500 people in over 40 countries and territories operating from more than 160



Galen White, Partner – EMEA

offices around the world. "We guarantee proper estimation, proper Environmental Social Governance (ESG) and Health and Safety (HS) of the project," Jeffress comments, adding that sustainability services help companies operate more safely, efficiently and as stewards of society and the environment.

Software

CSA Global Resources team uses a host of software relevant to industry needs. "Using relevant software, we are able to provide block models in the client's required format. We can prepare resource estimates for almost every style of mineralisation, under all international reporting codes, using relevant software. This sets us apart from competitors. Having a background that is strong in mining geology, best practice alignment with reconciliation, short- and long-term models and nonlinear estimation techniques to routing offerings also sets us apart," Geldenhuys states.

The common software packages that CSA Global uses are Datamine, Surpac, Micromine, Isatis, Leapfrog, Vulcan, and Supervisor. However, the software does not work in isolation; it needs to be in the hands of a proficient team with a strong geological background, Geldenhuys clarifies. "Powerful tools become easy when you are confident with geological modelling."

Compliance with Best practice

One of the cornerstones of CSA Global's success is compliance with best practice.



Anton Geldenhuys, Principal Resource Geologist



Panoramic view of the Eastern Desert showing small scale mine workings in Egypt

Mainly, this is founded on two critical factors: the competence of the consultants engaged and robust QA&QC (Quality Assurance and Quality Control).

Competence of CSA Global specialists

The competence of CSA Global specialists involved in the process gives confidence in the integrity of data. As old hands and members of various recognised bodies, consultants are well-versed. For instance, a team of data geologists involved in resource work is responsible for packaging data and reviewing, checking, validating, and then handing over the robust database on satisfaction. CSA Global's team of competent geologists and resource practitioners handle software, comprising a wealth of geological experience to underpin geological modelling, complimented by geostatistical skills to deliver the clients mineral resource estimation. As a standard practice, the importance of securing data and having competent specialists in software (as mentioned earlier) is constantly stressed and based on the client's requirement.

Robust QA&QC

Worth mentioning, CSA Global's approach is informed by the notion that "Quality output is dependent on the data you have." For this reason, the resources team goes all-out in testing the quality and precision of the input data. "We do not compromise on the need to critically assess the robustness of QA and QC on drill data, survey information, as well as the way the samples are prepared to be sent to the labs," White emphasises.

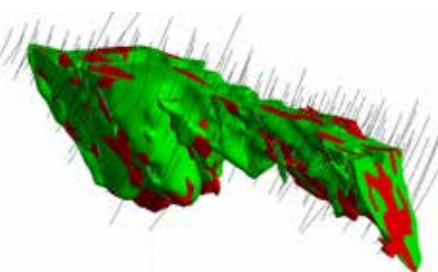
"There is more rigour, more discipline in the company's approach, every process is peer-reviewed, under all international reporting codes."

Continuous innovation

CSA Global is at the cutting edge of innovation. When necessary, the company adopts technologies that can enable it to add value to clientele's project expectations. This is evident mainly in In-situ recovery and opportunities opening in machine learning, amongst others.

In-situ Recovery

CSA Global's adaptation of In-situ leaching, commonly known as In-Situ Recovery (ISR), has been revolutionary. While traditionally a primary extraction method used to obtain uranium from the ground, CSA Global has initiated its deployment to the extraction process of other metals such as nickel, gold, and copper successfully. "It has proved to be an alternative in terms of low operational costs and a lower environmental footprint. It is a very desirable recovery method," Jeffress explains, predicting increased usage as the electric vehicle market continues to gain traction. Thus far, ISR has been successfully used in Russia, Turkey, and Kazakhstan.



Machine learning

Another area where CSA Global sees opportunities emerging is the application of machine learning techniques. Currently, a lot of buzz in the academic world and select institutions is yet to be echoed in mainstream mining. The resource team is constantly exploring how machine learning can unlock complex geological problems, like how to use models using the entire database and in other mining processes.

What gives CSA Global the edge

CSA Global has an edge over competitors in handling client's project needs mainly in the following areas:

A global footprint of complementary services

Firstly, with a footprint of mining services complementary across geographies, clientele, and capabilities, CSA Global is unrivalled. With respect to Africa, from the regional office based in Johannesburg, South Africa, the firm provides local knowledge and skills to mining companies. CSA Global's resource consultants are involved in projects from the get-go to enable them to understand the data of the deposit geology better. They do the groundwork properly first, relying on client insight, using drill holes and sample data to determine the quality of input data with respect to density, grade, and recovery characteristics. The discussion revolves on where, when, and how to collect input data. Eventually, this gives confidence in 3D geological modelling to support resource estimation, resulting in a clear understanding of the project to determine whether it makes geological sense.

"Our estimates of resources are informed by geological understanding, practical mine-site experience, and current industry best practice," Geldenhuys points out.

Substantiating the point, Jeffress says, once resource work is concluded, the team compares the resource with the estimate.

"Others may not have the required skills set to do data interrogation and draw a conclusion to accuracy. We use experience and expertise in generating resource models and grade control models and help optimise what they are mining fundamentally. At the end of the day, a company can be confident to bring a project into production."

Managing client expectations

Another area where CSA Global Resource consultants are adept at is managing clients' expectations when working on a project, which is always a big challenge. Sometimes clients can have very optimistic figures in their head about an ore bodies viability. Unfortunately, there is no 'Hollywood ending' in resource estimation, as the quality of input data always determines the

output. For this reason, at all costs, Geldenhuys underlines CSA Global balances optimism with realism.

Relishing the challenge

Overall, CSA Global's consultants have always thrived where challenges abound, and they are relishing the current mining environment where sustainability is a critical business imperative as an immense opportunity. They declare that they will go all-out to enable clients to realise real value from their assets.

CSA Global's resource estimation solutions, which include sampling and data reviews, cover 3D geological modelling; statistical and geostatistical studies; grade estimation and conditional simulation; mineral resource reporting; mineral geology; and due diligence and training. The company's diverse clientele comprises junior, mid-tier and major mining companies, the financial and legal services industry, development agencies and governments.

CSA Global is headquartered in Perth, Western Australia, and serves clients across Australia, Asia, Africa, Europe, and the Americas.

Project Milestones in Africa

CSA Global views Africa as a big growth avenue and continues to register milestones for clients in diverse mineral commodities in different countries. The following are some of their recent projects:

Mali

Operational support to the mine geology function of a mid-tier gold producer, to minimise dilution and increase gold recovered.

Burkina Faso

Mineral Resource Estimation, including periodic updates, for a mid-tier gold producer.

Liberia

Mineral Resource Estimation, Prefeasibility Study and Definitive Feasibility Study for a gold mine expansion project.

DR Congo

Prefeasibility studies for the client for the world's largest lithium ore reserve.

Mozambique

Involvement in a graphite project in Mozambique. Graphite is in manufacturing vehicle batteries.

Ghana

Exploration and database management services, and Mineral Resource estimation. Operational support to a mid-tier underground gold producer to further optimise mine geology and reconciliation practises, and improve gold recovered.

Namibia

Technical Report for Twin Hills Gold Project, Namibia.

*Half of the projects in Africa are in West Africa, where a lot of work relates to resource estimates, mainly Ghana, Burkina Faso, and Mali.



CSA Global
Mining Industry Consultants
an ERM Group company



BUILDING A SUSTAINABLE MINING FUTURE

CSA Global is a world-leading geological and mining consulting company providing strategic advisory services and high-quality solutions to help clients manage the entire Life of Mine of a mineral asset.

We focus on helping clients take their mine from concept through to discovery, optimization, development and operation. Our world class experts advise in all practice areas from exploration through to mining, development and closure.

With an extensive network of international experts, let CSA Global help you to solve your critical challenges, create high results and make a significant contribution to your next project.

For more information email: info@csaglobal.com

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CSA Global is part of the ERM Group, a leading global provider of environmental, health, safety, risk, social consulting services and sustainability-related services.