

ORELOGYTM
MINE CONSULTING

CAPABILITY STATEMENT

March 2019

THE ORELOGY DIFFERENCE

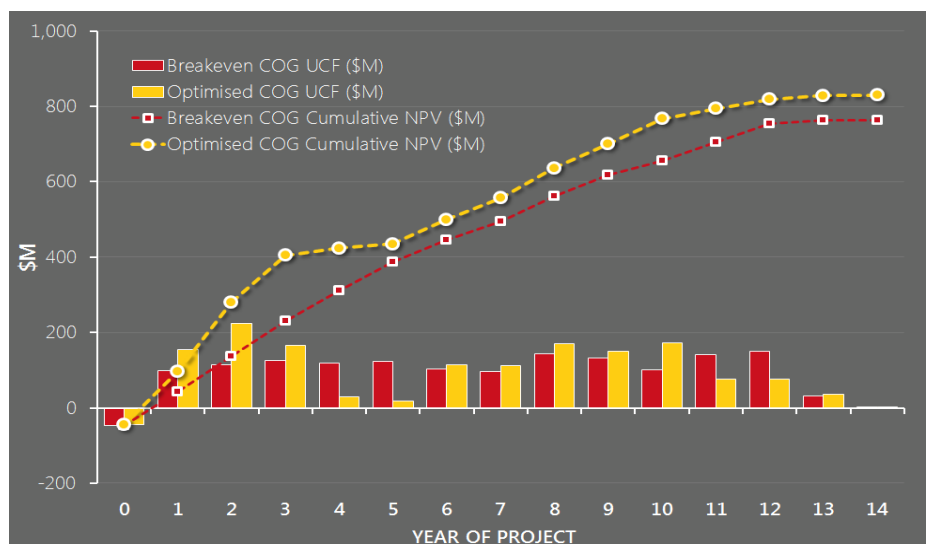
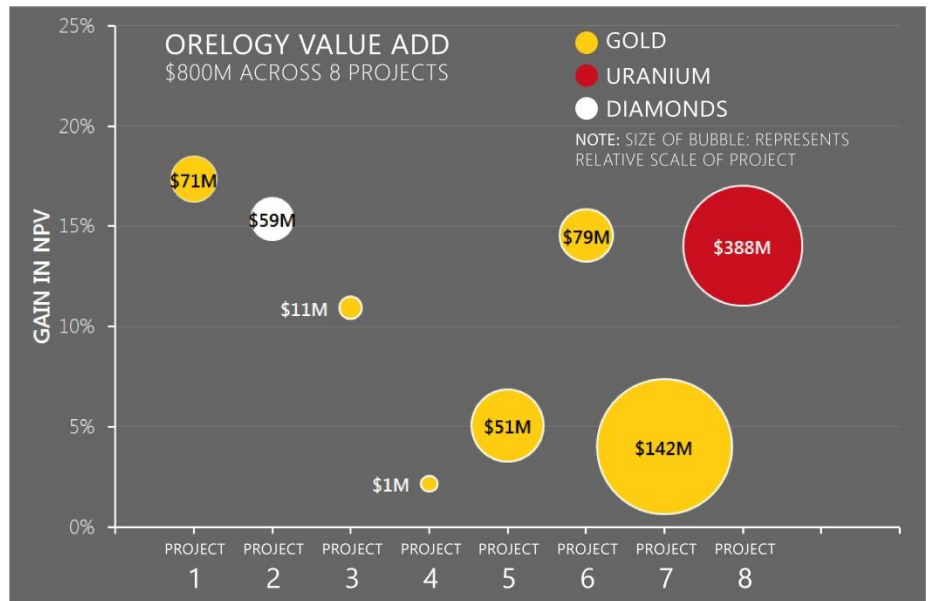
OUR NUMBER ONE GOAL IS TO UNLOCK THE TRUE VALUE OF YOUR PROJECT

Cut-off Grade optimisation is the single biggest value adding task that can be applied to a mining operation. ORELOGY, utilising Maptek's cutting edge and innovative Evolution™ solution, have generated significant added value to client projects in just a few months.

Whether your project is precious metal, base metal or energy commodity based, you will be guaranteed to add value and improve the early cash flow of your operation. ORELOGY ensure that the value is gained within a practical and achievable framework.

Talk to ORELOGY today to unleash YOUR projects full potential by optimising your life-of-mine cut-off grade strategy.

ORELOGY CONSULTING
ADDED \$800M NPV ACROSS 8
PROJECTS



ABOUT ORELOGY

WE ARE A RARE COMBINATION OF BOTH OPERATIONAL EXPERTS AND TECHNOLOGISTS THAT HAVE DEMONSTRABLY IMPROVED THE PROFITABILITY OF MINING PROJECTS FOR OVER 10 YEARS



WHO WE ARE

ORELOGY was established in March 2005 and has organically grown to become a close-knit team of highly experienced professionals and specialist associates.

ORELOGY's clients range from junior explorers through mid-tier developers to a number of the world's largest miners in Australia, Africa and Asia. With many being longstanding clients. ORELOGY's personnel have extensive operational and consulting experience in a range of different commodities throughout the world. As a result, we bring a global understanding of the mining industry to develop practical solutions within a strategic framework.

ORELOGY offers a range of professional services that include Study & Project Management, Open Pit & Underground Mine Design, Scheduling, Technical Reporting, Ore Reserve Estimates, Due Diligence, Cost Modelling, Equipment Assessment and ongoing site support to mining operations.

The continued success of the company can be directly attributed to the professionalism, diligence and innovation of our team of ORELOGISTS.

EXPERIENCE AND EXPERTISE

ORELOGY has a track record consulting in a large range of differing commodities, locations and mining methodologies. As a company and individually we have particular experience and knowledge in the following:

COMMODITIES

- ▶ Gold
- ▶ Copper
- ▶ Lithium
- ▶ Graphite
- ▶ Uranium
- ▶ Lateritic Ni/Co/Sc
- ▶ Iron Ore
- ▶ Zinc & other base metals
- ▶ Mineral Sands

MINE PLANNING SPECIALITIES INCLUDING:

- ▶ Strategic Mine Optioneering
- ▶ Cut-off Grade Optimisation
- ▶ Open Pit Haulage Minimisation and waste landform optimisation
- ▶ Alternative materials handling such Trolley-Assist IPPC/Railveyor Assessment and Implementation
- ▶ Blend Vectored Modelling and Scheduling
- ▶ Underground mining method selection and access optimisation

OUR CAPABILITY

COMPANY ETHOS

Since 2005 ORELOGY's primary focus has been on providing our clients with value. ORELOGY achieve this by not only utilising smarter technical approaches, but also providing cost effective outcomes in a timely fashion. We call our approach to consulting "AGILE THINKING".

We "think" for our client, utilising our experience, leading-edge technology and common sense to solve problems. Our objective is to always deliver practical, high value outcomes, not just apply cookie-cutter solutions. ORELOGY have a proven track record in applying world class technical solutions to mining projects at both the feasibility and operational phase. Our team of dedicated of mine strategists are fully invested in the projects we undertake and seek to consistently provide the highest value deliverable.

And we are "agile". As a small group we can react quickly and efficiently to our clients' needs and the markets unpredictability, changing approach and deliverables when the goal posts change.



CLIENT SERVICES

ORELOGY's key to successful delivery is that we "think" for our clients, utilising our experience, leading-edge technology and common sense to solve problems and deliver practical, high value outcomes, not just apply cookie-cutter solutions. ORELOGY have a proven track record in applying world class technical solutions to mining projects at both the feasibility and operational phase. Our team of dedicated of mine strategists are fully invested in the projects we undertake and seek to consistently provide the highest value deliverable.

And we are quick on our feet. As a small group we can react quickly and efficiently to our clients' needs and the markets unpredictability, changing approach and deliverables when the goal posts change.

ORELOGY are constantly evaluating the opportunities and risks associated with your project. Our goal is to meet your key outcomes

with the greatest likelihood of success and lowest risk.

ORELOGY provides an extensive range of services to assist clients with the planning and management of their project, and the journey from resource to reserve to operation. These include:

- ▶ Project Management
- ▶ Independent Valuations, Due Diligence Studies and Independent Review
- ▶ Pre-feasibility & Feasibility Studies
- ▶ Scoping Studies
- ▶ NI43-101 & JORC 2012 technical reporting
- ▶ Site Specific Mine Planning Solutions
- ▶ Equipment Assessment, Selection and Costing
- ▶ Operational Implementation & Benchmarking
- ▶ Mine Operations Production, Planning & Support
- ▶ Training

PROJECT MANAGEMENT

ORELOGY undertake management of studies on behalf of clients, ensuring all relevant elements are incorporated, assessed to an acceptable level and completed in a timely fashion.

The management of study programs, particularly feasibility type studies, requires a fundamental understanding of all facets of the proposed mine development.

The development of a project's mine plan must effectively encapsulate all relevant aspects of an entire project, including not just mining but also geotechnical, hydrological, processing, environmental, marketing, tenure, closure, safety and more. This plan will determine the eventual economic viability and overall scale of the project. The requirement for mine planning to interface with all parties to determine project value gives ORELOGY an inherently comprehensive appreciation of all the key parameters of a project and their interaction with each other.

ORELOGY have a core group of highly experienced Principal Consultants and Project Managers who can bring a wealth of experience to any project, across a huge range of locations and commodities.

INDEPENDENT REVIEWS AND DUE DILIGENCE APPRAISALS

ORELOGY is able to provide demonstrably independent analysis and assessments for mining companies, banks and lenders, investors, insurance companies and the like. This form of study includes:

- ▶ Due diligence type assessments of both current operations and planned projects for the purposes of investment, acquisition and divestment
- ▶ Independent technical audits public reporting
- ▶ Technical reviews for internal company evaluation
- ▶ Fatal flaw reviews of completed studies

These appraisals cover a range of issues to varying levels of detail, dependent on time frame, budget and client requirements. They can include:

- ▶ Detailed assessment of the validity and robustness of the parameters used to develop a project (e.g. mining models, optimisation parameters, design parameters, optimise costs). This is particularly important in the case of verifying reported ore reserves conform to the required reporting codes.
- ▶ Examination of planning systems and assumptions to ensure they are practical while at the same time meeting corporate requirements and expectations.
- ▶ Rigorous review of proposed or actual operating systems and management strategies to determine their suitability, effectiveness and whether short or long-term targets are achievable.
- ▶ Assessment of the interface between mining and all other aspects of the project (e.g. geology, processing, environmental) to determine if any of the interacting systems or assumptions adopted are suitable or could be improved.
- ▶ Review the basis for operating and economic projections to determine whether they can be considered valid and realistic.

ORELOGY can produce reports complying with all relevant disclosure requirements and reporting codes and •brings a wealth of practical experience, both within Australia and internationally, to the formation of these reports

SCOPING STUDIES

ORELOGY can undertake all aspects of scoping studies or provide specific mining engineering contributions as part of a larger team.

This style of study involves initial assessment of the practical and economic viability of a project, with a view to confirming whether further, more detailed assessment is warranted.

This involves high-level first pass evaluation using generic or historical parameters to determine potential scale, extent and whether there is a potential break point for applying an underground mining approach. ORELOGY then builds on this by quickly conducting high level strategic scheduling while concurrently assessing the benefits of a cut-off grade and / or blending strategy to fully understand and realise the projects true value. The toolset Oreology uses also allows rapid assessment of different project development options, or "optioneering", which provides our clients with an improved forward view of what their project may realistically look like. In this way, an early indication of the scale of operations and the most appropriate development path can be determined, unlocking the project's true value while also identifying possible risks and opportunities.

The advantage ORELOGY has is our combination of experience and cutting edge toolsets enables us to turn around these initial assessments in a short time-frame. This agility saves our clients both time and money, and allows rapid decision-making on a sound technical basis.

PRE-FEASIBILITY, FEASIBILITY & IMPLEMENTATION STUDIES

ORELOGY undertake all mining engineering related aspects of pre-feasibility and feasibility assessments. This is usually defined as providing engineering and cost estimates to an accuracy of $\pm 25-30\%$ and $\pm 10-15\%$ respectively. Implementation studies are generally undertaken to budget level accuracy. The projects can be comprised of proposed "green-field" projects, expansions to existing operations, resumption of abandoned developments or combinations of all three. Components covered can include, but not limited to:

- ▶ Mining Method determination and production rate assessments
- ▶ Optimisation of excavation geometry, be it open pit bench height or underground stope

/ panel, in conjunction with appropriate modifying factors (ore loss, dilution, equipment selection, productivity estimation etc.)

- ▶ Open pit optimisation and / or underground layout optimisation and assessment of any interaction / trade-off between the two
- ▶ Strategic project development assessment including cut-off grade and / or blending strategies
- ▶ Detailed, practical open pit and / or underground designs
- ▶ Calculation of mineable Ore Reserves in compliance with the appropriate reporting standard (JORC, NI-43101, AIM, SAMREC)
- ▶ Life of Mine (LoM) mine scheduling including cut-off grade, stockpiling and blending strategies
- ▶ Design of mine layouts including mine infrastructure, road networks, surface water management etc.
- ▶ Mine closure and rehabilitation plans
- ▶ Generation of LoM cash-flows and analysis of key project parameters
- ▶ Risk and opportunity assessment

ORELOGY can also cater for the mineral resource estimate, geotechnical appraisal and infrastructure requirements of these studies by utilising our network of recognised and trusted service providers.

ORELOGY have the background and expertise to take mining operations from study level through implementation and execution, with a history of involvement in projects from feasibility through execution to on-going support. We can provide the next level of practical detail to ensure feasibility studies translate into a viable and sustainable operation with the greatest likelihood of success.

EQUIPMENT ASSESSMENT, SELECTION & COST MODELLING

Orelogy has undertaken many studies involving both optimisation of mining methods and assessment of mining equipment selection options.

This includes assessment of:

- ▶ Continuous Surface Miners
- ▶ In-Pit Crushing and Conveying (IPCC)
- ▶ Railveyor Material Handling
- ▶ Trolley-Assist Truck Haulage

It has the knowledge and experience to provide detailed cost estimation and provide recommendations for mining applications and purchases of associated capital items.

TAILORED MINE PLANNING SUPPORT AND MENTORING

ORELOGY personnel collectively have considerable mine planning experience and high level competency in most recognised mine planning packages, including MineSight, Vulcan, Whittle 4X, Surpac and Datamine. They are regarded as the pre-eminent experts in Maptek Evolution globally.

ORELOGY also has expert scripting and programming skills to help projects where a customised solution is necessary. As a result ORELOGY can develop comprehensive mine planning systems and procedures tailor-made to the specific requirements of our client. This can vary from strategic life-of-mine planning for multiple working areas to short term planning for individual open pits.

ORELOGY can provide a bespoke planning support service to operations at either the implementation, pre-production or production phases of operation. This includes every level from Life of Mine (LOM) schedules, annual budgets to monthly production schedules, including development plans and blast layouts.

ORELOGY personnel have considerable practical site experience and this background can be of considerable benefit to clients. ORELOGY personnel have often been embedded with our clients team to offer on-going mine planning expertise, training and mentoring to site based personnel. Their role can include review and optimisation of all aspects of site mining operations, from the mine face right through the mine operations and planning chain to the end customer.

ORELOGY are also agile enough to quickly react to a client's requirements and provide support as and when needed.

SCHEDULING EXPERTS

As mine planning engineers, our primary goal is to improve the value of a mining project. This goal is best served through development of robust and practical high value mine plans using smart scheduling techniques.

ORELOGY has always sought ways to deliver improved solutions to our clients, and as part of that process ORELOGY developed EVOLUTION, a best-of-breed open-pit mine scheduling solution that harnesses a variety of optimisation techniques.

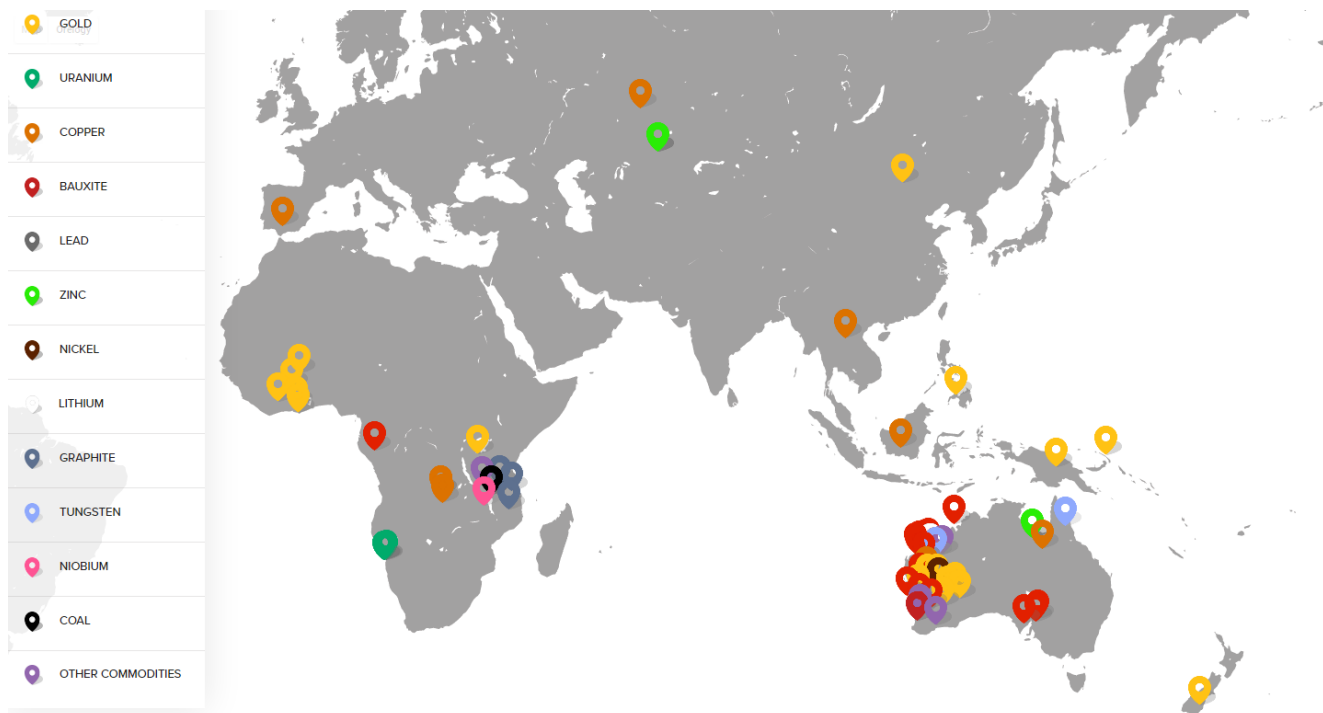
In October 2014 Maptek™, providers of the Vulcan general mining software, acquired the EVOLUTION suite of products from ORELOGY. Its acquisition by Maptek is a validation of the unique and proven product ORELOGY developed.

ORELOGY remain the pre-eminent power users of the EVOLUTION product globally and bring an unrivalled capability in the application of this product to provide real world mining solutions.

ORELOGY personnel have often been “embedded” with clients to offer ongoing mine planning expertise, training and mentoring to site based personnel. Their role can include review and optimisation of all aspects of site mining operations, from the mine face right through the mine operations and planning chain to the “end client”.

ORELOGY pride ourselves on our ability to quickly respond to a client’s requirements and provide support as and when required.

PROJECTS BY LOCATION & COMMODITY



THE ORELOGISTS

STEVE CRAIG

MANAGING DIRECTOR

BEng(Mining- Hons), FAusIMM

Steve has been professionally employed in the mining industry since 1988 in a variety of operational, management and mine planning roles. Since January 1995, he worked as an independent consultant specialising in mine planning, software implementation and training. This has afforded Steve an extensive range of experience in both mining location (Australia, UK, USA, Europe, South America, Africa, South East Asia and the CIS) and commodity (gold and PGM's, base metals, iron ore, industrial minerals and diamonds).

In early 2005, Steve co-founded a new consulting practice in Perth, Australia called ORELOGY, with the key objective of supplying specialised mine planning services to the mining industry worldwide. During this period Steve was pivotal in both growing the ORELOGY's consulting business and also the in-house development of the EVOLUTION mine scheduling solution. When the software and IP was acquired by Maptek in 2014, Steve was seconded to Maptek for 3 years as the person responsible for the continued development of Evolution under the Maptek banner.

In November 2017 he returned to ORELOGY and once again assumed the position of Managing Director. He brings a wealth of new experience back to this fundamental role and is ideally placed to guide ORELOGY forward into the future.

ROSS CHEYNE

DIRECTOR / PRINCIPAL CONSULTANT

BEng (Mining- Hons), FAusIMM

Ross has been employed professionally since 1990. And has extensive operational and planning experience. This includes working in Australia, Ghana, Malaysia, Myanmar and Ireland. He began his consulting career in 2001 with CSA in Dublin, then with Snowden Consultants in Perth before co-founding ORELOGY with Steve Craig in 2005.

As a Director and Principal Consultant with ORELOGY, Ross has managed work on numerous projects in a range of commodities, scales and locations across the globe. He has undertaken all aspects of the mine planning cycle with an emphasis on costing and financial modelling. Ross has always been primarily focused on the consulting aspects of the ORELOGY business. So when Steve Craig was seconded to Maptek in 2014 as part of the Evolution software acquisition, it was a natural decision that Ross would remain at ORELOGY and take the reins as MD. He managed ORELOGY through 2014 to late 2017, successfully keeping the team of Orelogists together through a difficult period in the mining industry. when

In late 2017 Steve returned to ORELOGY after completing his tenure with Maptek and resumed his role as MD, with Ross supporting him as Technical Director. This "dynamic duo", along with a stable core team of Orelogists, had been extremely successful in the past, and was now well positioned to continue this success moving into the future.

JAKE FITZSIMONS

**PRINCIPAL CONSULTANT/
GENERAL MANAGER OPEN PIT**

BEng (Geological Eng), FAusIMM

Jake commenced work in the mining industry in 1986 and has a depth of experience in site-based operations. His experience included 10 years at Cawse Nickel Laterite Operations rising to the level of Mining Manager.

Jake moved to a technical role in 2008 and joined a mid-tier company as Study Manager working on a large world class magnetite project before joining ORELOGY in 2012.

As GM Consulting, in addition to managing the consulting team and engaging with clients, Jake has worked on a wide range of projects and commodities as project manager.

CAREL MOORMANN

PRINCIPAL CONSULTANT

MSc (Mining), FAusIMM

Carel has been employed as a professional mining engineer since 1982 in variety of underground and open pit mines, with extensive experience in operational, management & planning roles. In 2005, Carel started work in the mine planning environment with BHP Billiton.

Carel joined ORELOGY in October 2007 and has worked as project manager on numerous projects.

BEN WILSON

**PRINCIPAL CONSULTANT/
GENERAL MANAGER UNDERGROUND**

BEng (Mining), WASMA, MAusIMM

Ben has over 20 years industry experience with 15 being in underground operations. Through his professional career Ben has built a strong operational and technical background and has led mining projects from scoping through to PSF operations.

Prior to joining Orelogy Consulting; through his own company Unicorn Consulting, Ben has been providing his technical expertise on a range of projects to several mining companies.

Ben joined Orelogy in April 2018 as GM Underground and has quickly established himself as a key member of the Orelogy team. His range of operational experience across multiple commodities (Gold, Nickel, Zinc/Lead and Copper) and locations (Australia, Philippines, Mali, Peru).

RYAN LOCKE

PRINCIPAL CONSULTANT

DipEng, MAusIMM

Ryan has worked in the mining industry since 1999, predominantly in nickel & gold operations, in both OC & UG.

Since commencing with ORELOGY in 2009, Ryan has undertaken the lead technical role for numerous commodities both inside and outside Australia, including cost estimates, mine design, mining schedules, project evaluations, dilution & recovery analysis from scoping studies through to BFS.

Ryan is considered one of the pre-eminent users of Maptek's Evolution software worldwide.



SNAPSHOT OF RECENT PROJECTS

COMPANY	PROJECT	COUNTRY	COMMODITY – WORK
Superior Lake Resources	Superior Lake	Canada	Zn – DFS (current)
Randgold Resources	Various	Africa	Au – Long term planning support (current)
Australian Mines	Sconi	Australia	Sc/Co/Ni – Mining Study (current)
Australian Vanadium	Gabanintha	Australia	V – Project Optimisation Study (current)
Sovereign Metals	Malingunde	Malawi	Graphite - PFS (current)
Kalbar Resources	Fingerboards	Australia	Heavy Mineral Sands – PFS (current)
Globe Mining & Metals	Kanyika	Malawi	Nb – PFS (current)
Volt Resources	Bunyu	Tanzania	Graphite – PFS (current)
Barrick Gold	Lumwana	Zambia	Cu – Site Support / Growth Plan (current)
GMA Garnet Australia	Port Gregory	Australia	Garnet – Planning review (current)
Dacian Gold	Mt Morgans	Australia	Au – DFS / ongoing support (current)
BBI Group	Balla Balla	Australia	Fe – LOMP (current)
Nzuri Copper	Kalongwe	DRC	Cu – PFS / DFS (current)
Ibaera Capital	Gold	Ghana	Au – Options Study (current)
First Quantum Minerals	Various	Various	Var – Corporate Planning Support (current)
Fortescue Metals Group	Multiple	Australia	Fe – Mine planning support (current)
FYI Resources	Cadoux	Australia	Al - Mining Study Manager (current)
Tungsten Mining	Mt Mulgine	Australia	W – LOMP(current)
AMC Bauxite	Koumbia	Guinea	Bauxite – Plateau 7 Schedule Optimisation (current)
La Sino-Congalaise des Mines	Sicomines	DRC	Cu – Mine planning study
Gruyere JV	Gruyere	Australia	Au – post DFS optimisation
Tawana Resources	Bald Hill	Australia	Li – Mine Planning
Peak Resources	Ngualla Project	Tanzania	REE – PFS & DFS
Anglo-Gold Ashanti	Tropicana	Australia	Au – On-going Site Support
Black Rock Mining	Mahenge	Tanzania	Graphite – PFS
Asiamet Resources	BKM	Indonesia	Cu – PEA
Swakop Uranium	Husab	Namibia	U – PFS / DFS / Site Support
Altura Mining	Pilgangoora	Australia	Li – PFS & DFS
Magnis Resources	Nachu	Tanzania	Graphite – PFS
RTG Mining	Mabilo	Philippines	Cu/Au/Fe – Scoping / PFS
Independence Group	Various	Africa	Au – DD / Valuation / Scale of Ops
Endeavour Mining	Houndé	Burkina Faso	Au – DFS and Implementation
Altona Mining	Cloncurry	Australia	Cu – Project optimisation
Vital Metals	Watershed	Australia	W – DFS
PMI Gold	Obotan	Ghana	Au – DFS
Ampella Mining	Konkera	Burkina Faso	Au – DFS / Site assistance
RNI	Various	Australia	Cu/Au – Site assistance
Crosslands Resources	Jack Hills Project	Australia	Fe – Scheduling
APIJV	West Pilbara Iron Ore	Australia	Fe – Feasibility Study
Atlas Iron	Pilbara Projects	Australia	Fe – Scheduling
Flinders Mines	Pilbara Project	Australia	Fe – Feasibility Study / Mine Planning

PROJECTS BY METHOD & COMMODITY

		Primary Commodity																											
		Coal	Bauxite	Iron Ore	Manganese	Garnet	Mineral Sands	Limestone	Kaolin	Poly Metallic	Copper	Zinc	Lead	Tin	Nickel Laterite	Sulphide Nickel	Graphite	Vanadium	Molybdenum	Niobium	Lithium	Tungsten	Uranium	REE	Gold	PGE	Diamond	Other	
Surface Mining	Strip Mining	✓					✓																✓					✓	
	Quarrying		✓			✓	✓	✓																					
	Open Pit (Large/Bulk)			✓	✓				✓	✓	✓			✓	✓	✓	✓			✓	✓		✓	✓	✓		✓		
	Open Pit (Selective)			✓	✓		✓		✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Mineral Sands					✓	✓																						
	IPCC			✓																									
	Surface Miners		✓	✓																			✓						
Underground Mining	Block Caving									✓																			
	Sub-level Caving														✓														
	Stoping with fill									✓	✓	✓			✓										✓				
	Open Stoping								✓						✓														
	Cut and Fill Stoping									✓	✓				✓										✓				
	Room & Pillar									✓	✓	✓													✓	✓			
	Narrow Vein Stoping									✓	✓														✓			✓	
	Airleg Stoping													✓		✓									✓				✓
	Civil Tunnelling																												✓

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