

AUSROCKS
CONSULTING MINING ENGINEERS

**Newsletter
Winter 2020**

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Welcome!

by Carl Morandy, Managing Director

It seems like just last week we prepared the last Newsletter, but it's been nearly 12 months! Lucky 2020 has been an uneventful year... In all honesty the Bushfires and Covid 19 have put pressure on everyone in different ways but I am glad to report that when put under stress the Ausrocks team have dug deep. We have continued to do what we do best – work closely (at a distance of at least 1.5m) with our clients to achieve their goals. We were able to transition to the 'work from home' model seamlessly thanks to our robust IT setup courtesy of Nick but now have returned full time to office-based operations with extra hand sanitizer.

In our last Newsletter I indicated that 'All we need is another flood or cyclone and quarrying activity will skyrocket again'. This hasn't happened yet by the political response to the economic slowdown may have the same effect. A push to get key infrastructure projects fast-tracked can only be a good thing for the economy and our quarries. The QLD Election might stir things up a bit in that area.

In the first half of 2020 we have worked on a variety of projects including an industrial mineral resource assessment using new Micromine 2020 software, development

applications, flood risk management plans, quarry development plans and also various surveying tasks. Our team also completed a variety of online professional development courses so we can be prepared for the second half of 2020 and beyond.

On a personal note I completed professional development which has allowed me to obtain the following.

- AusIMM Chartered Professional (CP) credentials,
- Registered Professional Engineer QLD (RPEQ – 22981) in Mining, and
- Site Senior Executive (SSE) Notice with blasting endorsement (19/144)

I have a strong belief that we never stop learning and that if we want to be ahead of the game we need to keep striving to learn. Hopefully we can return to 'face to face' learning in the near future.

Enjoy the rest of the newsletter, until next time – Au Revoir.

What's been happening

An update on the latest from the Ausrocks crew including the latest training webinars, changes to Koala Habitat Mapping, Mines Inspectorate and potential relocation plans.

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What's been Happening

by Carl Morandy

Unfortunately, a number of event postponements have occurred due to Covid19 including all face-to-face IQA events such as the golf day, CMIC2020 conference and the Quarrying Safety & Health Conference. However if all goes to plan it looks like the first event to be held will be the IQA Annual General Meeting on 25/08.

In QLD there have been recent changes to koala habitat mapping which has increased the protected koala habitat by more than 421,000 hectares. Discussion with Ecologists and stakeholders indicate that these changes have the potential to significantly restrict future quarry resources. It is understood these newly defined restrictions essentially prohibit the clearing of 'koala habitat' for extractive industries unless within a Key Resource Area. Although we support any efforts to protect the Koala population the mapping produced appears to have inconsistencies and requires a better process for verification by a qualified ecologist.

As of 1 July 2020 the Mines inspectorate have moved to a new statutory body – the Resource Safety and Health Queensland (RSHQ). This is intended to provide the department more focus for the safety and health of QLD's resource workers. Ausrocks will continue its close liaison with the mines inspectors to work through the latest challenges facing our industry.

Ausrocks recently attended an IQA Webinar titled 'Brady Report: Review & Recommendations' and was presented by the author himself Dr Sean Brady. This important report provided the outcomes of the review recently undertaken on fatalities, serious accident, and high potential incidents in the mining and quarrying industries. The webinar focused on the key outcomes of the report, which were that the industry relies too much on administrative controls (paperwork) and does not place enough emphasis on quality supervision of workers.

Ausrocks has been on the search for a new abode for some time, we hope to be providing the next newsletter from a bigger and better location – stay tuned.

QLD Financial Provisioning Pains

by Nick Virisheff

In February 2018, the QLD government introduced the Mineral Resources and Energy (Financial Provisioning) Bill 2018 which creates a financial provisioning scheme and amends the EP Act to replace the financial assurance framework for resource activities. The new financial provisioning scheme is intended to improve the State's ability to manage the risk of an EA holder not meeting their obligations for a site.

The new scheme has significantly altered the way we are required to come to an agreement with the Department of Environment and Science (DES) on the value of the Financial Assurance (FA) for a site, now known as an ERC Decision. More information than ever before is required to be provided to DES, and whilst a Plan of Operations (PoO) is no longer required (outside of petroleum sites), most of the information that would normally be set out in a PoO is still required as supporting evidence.

Perhaps the key piece of additional information that is to be provided with each ERC Decision lodgement is that of spatial data. DES now requires shapefiles to be provided of all indicated areas, points and lines within site that make up the assessable activity on site. The department have provided guidelines on how to provide this data, and due to formatting restrictions, adhering to the guidelines has been difficult and frustrating for many companies. These issues have been raised with the department and hopefully this will be resolved soon.

Like the previous FA calculator tool, there is a new calculator for the ERC Decision. There are many notable differences between the old and the new calculators, such as removing layers of cost transparencies, but ultimately the EA holder will want to know what the difference is in the final amount. Unfortunately, the unit rate for rehabilitation has increased in the order of 20-40% extra despite there being little difference in disturbance or activity levels.

Ausrocks have determined that the ERC calculator is geared towards the big mining projects as they provide the largest slice of the Financial Assurance pie. The smaller end of town is significantly disadvantaged as a result.

This may force a lot of junior miners to re-evaluate their participation in QLD and they may well go elsewhere as a result.

To complicate matters, prescribed activities (such as quarries) that have FA conditioned as part of their EA there is a hybrid process to follow. DES are still the assessment manager and an application for FA is still required but there are reduced requirements including no need for spatial data submission.

Hopefully, DES will make all the necessary changes to ensure that the new scheme has the flexibility needed to apply for sites of varying scale and intensity. That way, when DES eventually turn their attention away from the mines and towards the quarrying industry, a more equitable system will be ready to go.

QLD Rehab Reforms

by Nick Virisheff

The QLD government is busy readying the next phase of its Mined Land Rehabilitation Policy, coming in the form of a Progressive Rehabilitation and Closure Plan (PRCP) as per the Environmental Protection (Rehabilitation Reform) Amendment Regulation 2019.

The intention of the change is to force progressive rehabilitation to take place on resource activity sites, and therefore minimising the risks of environmental impacts and reducing cumulative areas of disturbed land.

When an EA is not specific about the rehabilitation outcomes of a site, they will need to be developed and clarified. Where an EA is specific about rehabilitation outcomes, the approved outcomes can easily be translated to the PRCP, unless changes are required which then begins a process which involves further steps such as public consultation.

Similar to the ERC Decision, a PRCP Schedule Decision will need to be lodged with DES and an approved timeline of milestones will need to be adhered to within the PRCP period of validity. The performance of the EA holder with respect to the outcomes of the PRCP will be made publicly available by DES including data on progressive rehabilitation activities and certification of rehabilitated areas.

Watch this space as we'll have more info as it comes to hand.

Micromine 2020

Ausrocks updates skillset to include Micromine 2020 capabilities.

by Dale Brown

Commencing in March 2020, Ausrocks entered into a lease agreement with Micromine to use their new Micromine 2020 software package. This was based on the needs of Ausrocks' clients to increase the geological confidence in some of their resource areas to a Measured Resource in accordance with the Joint Ore Reporting Committee (JORC) Code 2012.

A methodology was developed based on the updated project data and work previously completed by Ausrocks in conjunction with associate Senior Resource Geologist Brice Mutton. To meet the requirements for a Measured Resource in accordance with the JORC code, it was determined that additional data validation, geostatistics and block modelling would need to be completed.

Ausrocks personnel have a diverse background using various resource modelling/mine design software such as Datamine, Deswick Mine 2-4D, SURPAC, Maptek/Vulcan.

Based on the demand for geostatistics and block modelling, Ausrocks canvassed the market looking for a software that a straightforward workflow with flexible lease agreements to suit the cyclical demands of consulting work.

Following an initial meeting it was decided that Micromine 2020 was best placed to meet the project requirements whilst maintaining the flexibility to lease/hire the software on a daily, monthly, or annual basis.

Previously for the Inferred and Indicated Resource Estimates in accordance with the JORC Code 2012, SURPAC was used to complete all the resource modelling. The raw data was then seamlessly converted through Micromine and validated by cross-referencing assay, survey, and collar files.

With the validated files the top and bottom of the resource were defined, and a subsequent resource solid was formed. Influenced by the drillhole spacing an appropriate block spacing was chosen to allow for a blank block model.

Based on the methodology that was set forth for the requirements, geostatistical analysis of the drilling data was necessary. Micromine 2020 completes this in a different manner by using a variogram map to show how much the

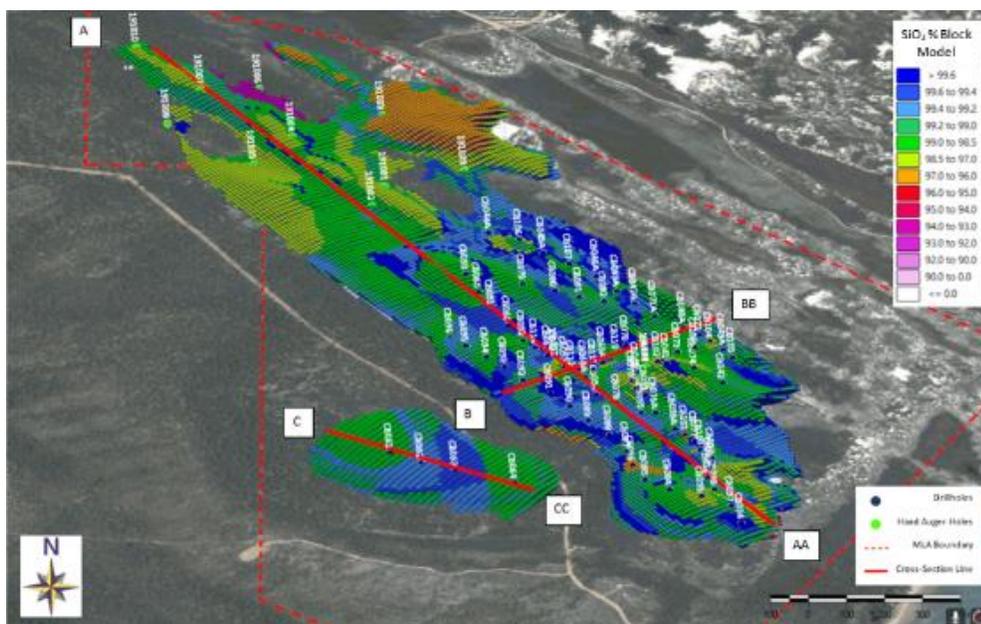


Figure 1: Block Model of Diatreme Resources Limited (ASX: DRX) Galalar Silica Sand Project, showing SiO₂ content throughout the resource. Released to market on 12th May 2020.

resource varies and how grades change in every direction (360°). These directions defined the strike, dip, and the pitch of the resource. This in turn was used to create a semi-variogram with the model fitted to allow for Kriging interpolation in the block model.

The resultant filled block model must then be validated, which involved looking at cross-sections of drillholes and comparing these to the interpolated blocks that were modelled, in addition to usual techniques such as Swath Plots and Quantitative Kriging Neighbourhood Analysis (QKNA). A filled block model with colour scale for Diatreme Resources Limited (DRX:ASX) is illustrated in Figure 1.

A block model simplifies the geological representation of an ore/waste body that assigns a grade value/material type/density to a small volume or block.

Completing block modelling allows for flexibility in mine planning and development down the track with the ability to target high grade areas to meet specifications or to blend to achieve optimum plant feed.

Often, depending on the commodity, completing geostatistics and subsequent block modelling (along with sufficient drilling information) allows for the resource to be reported at Inferred, Indicated and Measured

Resources reported in accordance with the JORC Code 2012 reduces the risk associated with the geological portion of project and identifies that the resource areas have economic potential.

Increasing the geological confidence in a resource (Inferred to Indicated to Measured) in accordance with the JORC Code 2012 allows for conversation to a Mineral Reserve (probable to proven) in accordance with a JORC Code 2012 with pre-feasibility/feasibility studies considering mining, processing, metallurgical, infrastructure, economic, marketing, legal, environment, social and government factors.

A Reserve in accordance with the JORC Code 2012 adds value to a project as it shows that a project is economically viable, with a pre-feasibility/feasibility study showing the projected revenues against the costs

In addition to the resource modeller bundle used for the recent project, Ausrocks is undertaking training to upgrade competencies in both Mine Designer and Mine Scheduler within the Micromine 2020 program. Should you have any further questions regarding Micromine 2020 or Ausrocks' resource capability and value adding using various software programs, do not hesitate to contact Senior Mining Engineer – Dale Brown at dale.brown@ausrocks.com.au.

Micromine provided training packages online & via the help desk through the COVID-19 pandemic as face to face meetings were not possible. Ausrocks was also invited onto the Micromine Podcast "Dig into Tech" to talk through our experience using the software and value adding outcomes to our clients, which can be found:

<https://open.spotify.com/episode/4FMA5cyrtRt0SJGoqc7PxR?si=Tb-rOPZUSD21yNftBoWbAg>

Diorite - A Versatile Aggregate

Its chemical, physical and material properties are highly suitable for most aggregate applications.

by Brice Mutton

“Diorite-type rocks” are intrusive rocks and are the mineralogical equivalent to the better-known volcanic basalt and andesite rocks. Diorite rocks are not commonly quarried in south-eastern Queensland, with aggregate sources dominated by large resources and quarries of greywacke (metamorphic rock) and basalt. However, in the longer-term, supplies will need to come from further afield and diorite is a potential candidate. Current examples of this diorite potential include operating quarries at **Harlin, Antigua/Mungar and South Scotchy Pocket**, plus potential quarries at **North Scotchy Pocket and Mt Eaton**.

Diorites are generally suitable for all aggregate applications including concrete, riprap, armour rock and also for rail ballast. Like basalt, diorite-type rock provide long-term performance and high strength material for the construction and engineering infrastructure industries.

The Rock

Diorite-type rocks include mineralogical variations named **monzo-diorite, quartz monzo-diorite, quartz diorite, diorite and gabbro**. These five rocks types are mineralogically equivalent to the volcanic-derived andesite and basalt, the names diorite porphyry (intrusive) and andesite porphyry (volcanic) are sometimes interchanged due to their similar mineralogical composition.

Diorite is a medium to coarse grained textured rock composed of primary minerals of sodium rich plagioclase with lesser amounts of hornblende and biotite. It usually contains little if any quartz. Quartz when present is mostly free silica (not strained). Due to the contrasting mix of black and white coloured mineral grains, the rock is often referred to as having a “salt and pepper” appearance – see image below. Cut and polished diorite has appeal and has been used also as dimension stone. Plagioclase accounts for approx. 60% of the rock, its crystal and textural dominance sometimes having petrographics describe these rocks as **diorite porphyry or andesite porphyry**.

Diorites also contain approx. 20% up to 50% secondary minerals, including weak minerals like micas, which may be a factor in some aggregate applications. Secondary minerals may include sericite/illite, epidote, chlorite, calcite/siderite. A high percentage of weak secondary minerals may present problems but this is uncommon.

The physical and mechanical measures of diorite-type rocks are high and near-comparable to basalt. Some important measures include:

- Moh’s Hardness – 6,
- Compressive Strength - 100 to 300Mpa, average 220Mpa,
- Modulus of rupture – 14 to 50Mpa,
- Specific Gravity – average 2.8 t/m³.

In all, diorite-type rocks are is categorised as “strong to very strong”.



Image: Hand specimen of fresh Diorite Porphyry showing black xenoliths.

Its Occurrence

Diorites are crustal high-level intrusive igneous rocks, associated with deeper parent granitic bodies, but have formed nearer to just below surface. The term “intermediate” or “hyperbyssal” is often used to denote their particular mode of occurrence. They therefore have the potential to form very large resources of predictable and consistent rock fabric.

The present-day exposure of these originally near-surface intrusives indicates that several hundred to kilometres of overburden has been eroded from above to expose them. Weathering of the rock mass can sometimes be a delimiting factor to the depth of fresh rock, although weathered material is eminently suitable for secondary grade applications.

Intermediate intrusive diorite-type rocks of Jurassic age (approx. 230Ma) occur sporadically throughout the wider southeast Queensland region. They principally include unnamed formations referred to as “Jki”.

As Aggregates

Diorite’s high strength/durability, high abrasion resistance, and high bearing ratio are key physical and mechanical properties. The processed crushed, sieved and graded rock is clean of inferior fines and chemically inert.

Diorite is highly suitable for road and highway bases and subbases. For road and highway aggregates pavements, whether it is concrete or asphalt, diorite can achieve important durable and sustainable wear surfaces. Diorite is resistant and doesn’t deteriorate or disintegrate under the action of weathering via freezing, thawing, variations in moisture and temperature changes, especially extreme high temperature as occurs throughout most of the Australian landscape. A wide range of physical and chemical tests confirms diorites superior qualities.

For major engineering infrastructure ie high rise buildings, bridges etc. requiring high strength concretes, diorites high compressive strength provides is a highly suitable aggregate. The lack of fine or highly strained silica, a problem with many rock types (other than basalt), eliminates critical concrete alkali-silica reactivity (ASR) issues, a primary cause of concrete deterioration and integrity.

Summary

Some of the key benefits and virtues diorite;-

- High physical and material properties,
- High strength, durability and abrasion resistance,
- Available in large volumes with consistent quality,
- Provides for high strength concrete, minimal internal impurities and minimal silica (ASR),
- Environmentally favourable with no respirable silica issues, and,
- Overall is economically cost-effective.

Accordingly, diorite type deposits are a legitimate target for all aggregate types. Diorite-type rocks possess all-round high qualities and engineering performance make it – “a highly suitable aggregate”.

Ausrocks has built a large database and expertise on diorite occurrences throughout eastern Australia. Ausrocks believes that potential exists for additional deposits to be delineated and exploited, within an environment of increasing urbanisation, community expectations and constraints.

For further information or interest, contact Ausrocks.

Big Trucks Underground 1980-2020

by Alan Robertson

Alan Robertson has experience in underground and surface trucking of ore, waste and fill from the early 1980's to well into the twenty first Century, a period of forty years. While at Mount Isa in the 1970's he experienced the exhilaration of the ABB Kiruna 50t (500E) electrics which, fully loaded, could beat a Toyota FJ40 utility up a 1 in 9 gradient decline. Power was supplied from a 1000V overhead electric trolley wire. There was 1 electric motor for each axle, making the truck 4WD.

While Alan worked at Renison in Tasmania most underground trucks were Wagners, ranging from 20t to 40t. The DJB550 50t truck was used successfully at Mt Lyell and development of the 769B (originally used in King Island) and 769C was being carried out at that time by Dale B Elphinstone (DBE) with truck capacity up to 40t as a 769 tipper tray or ejector tray in a 5mx5m decline. Some larger 6mx6m declines in Western Australia used modified Caterpillar 773B and 773C 50t trucks.

The benchmark for truck performance in the 1980's was the DBE769 truck which was compact and relatively fast. In the 1990's the benchmark was the DBE50t truck and then the Atlas Copco (now Epirock) 50t trucks, and then Toro 40t and 50t trucks. Underground road trains, developed by Gulf Transport, had a capacity of close to 55t with a 20t payload for the prime mover and 35t for the trailer. Some trucks had two trailers with a capacity of 90t. At present, only three remain operational in Australia. Road trains could easily fit in a 4.5m x 4.5m underground opening but required good road conditions and wide, sweeping bends for optimum manoeuvrability and preferred chute loading.

Currently the available large underground trucks include the Sandvik Toro 551 and 663 trucks, the Caterpillar CAT AD63 and the Epiroc Minetruck MT65. The Sandvik 663 truck currently appears to be the "benchmark" for large underground haulage trucks, low operating cost being a major feature. Development of automated and battery powered trucks is part of the long-term strategy of the three major producers

A 60t Queensland truck developed by long-term truck designer and builder Ron Schliebs

and his experienced team at Loadpro is currently being trialled by Karreman's Quarry, Brisbane. The X60 6x4 truck incorporates state of the art technology in all aspects of diesel trucking including hi-tech braking, on board monitoring, fuel burn efficiency and operator comfort. Initial trucks have been developed as service trucks, water trucks and tippers for long hauls at open cut coal and metalliferous mines and quarries but future applications will, in the opinion of the author, include low cost high performance competitively priced underground trucking units. Features include an inter-axle differential to assist in traction, a 480kW 16L Mercedes engine 12 speed auto transmission, tare weight of 32 t and gross weight up to 98t.



Image: Loadpro Truck at Karreman's Quarry



If you come across any weird or wacky signs, feel free to email them through to info@ausrocks.com.au

Interesting Signs & Safety Procedures



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