Australia

Study tour 2009

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Study tour 2009

Each year the Resource Engineering Section of the Department of Applied Earth Sciences of Delft University of Technology in the Netherlands organises an excursion for their students and staff members.

The aim is to get a clear impression of the mining, extractive metallurgy and recycling industry in a particular country, its importance for Europe and the role it plays world-wide. The focus is always on the technological and economical aspects as well as on the cultural and geographical specialties of the country which is visited.

This year Australia was chosen as the excursion target. The following report summarizes the information which was collected during the visit.

Hans de Ruiter

Program

04/07	Sydney
05/07	Brisbane
06/07	University of Queensland
	CRC mining
07/07	Wilkie Creek Mine
08/07	Simtars
09/07	Gympie Gold
10/07	Curragh Mine
11/07	Airlie Beach
12/07	Whitsunday Islands
13/07	Bucyrus
14/07	Coppabella Mine
15/07	Goonyella Riverside Mine
16/07	Kestrel Mine
	Oaky Creek Coal Complex
	Gemfields
17/07	Brisbane
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Coppabella Mine

The mine

The Coppabella mine is one of the two operating mines of MacArthur Coal. The other mine, Moorvale, is located south of the Coppabella mine. The excavation of the coal resources is done with a truck and shovel operation. Besides the two operating mines MacArthur Coal is working on some projects in the Bowen Basin (for example Middlemouth).

The Coppabella mine started in 1998 by using draglines to strip the overburden. Nowadays the reserves will extend the mine life for at least ten years (2019). The mine consists of two pits, with a total length of 2 km. One of them, Johnson pit, has some major problems with mud and water inflow.

The Coppabella Mine is located 140 kilometres southwest of MacKay, near the townships of Nebo (25 km SW) and Moranbah (NE).

History

The mine lease was granted on June 1 1998. When this was granted the mine developed from a greenfields prospect to a coalproducing mine in just twelve months. At first the overburden removal was commenced in July 1998. After that the first coal was mined in October 1998. In April 2007 the mine reached a cumulative total of 40Mt of run of mine (ROM) coal mined.

Production

In 2003 the Coppabella Mine had a workforce of approximately 300 workers. These were working in mining, coal processing and additional works. The mine uses an open cut method. For the production of the coal a part of the overburden has to be blasted, because of the high water content in the mine, Coppabella uses emulsion explosives. The powder factor of 5-2.5 is used at the side. With a 10-meter saem and 110 meters of overburden the stripping ratio is around 9:1. Each month 1.8 million tonnes of rock will be blasted.

The Coppabella mine has an operating coal mine site and a coal washing plant. 15 to 20 trucks (Cat 92) are currently used for hauling the excavated material either to the waste dump or coal separation plant. Two rope shovels, a dragline and two excavators, with buckets up to 40 m3 are used to dig out the resources. Three water trucks are continually spraying water to prevent dust and to get rid of the water in the Creek Pit by evaporation. The mine is operation 7 days a week in and 24 hours a day. After an area is mined out, MacArthur Coal uses the overburden to backfill the mined out area.

Processing methods

Macathur Coal's subsidiary, Queensland Coke & Energy Pty Ltd, together with Stanwell Corporation Ltd is in progress of investigating the feasibility of establishing a new generation coke making plant at Stanwell in central Queensland.

Additional works

Currently civil workers are in the process of relocating the adjacent Peak Downs Highway and the Goonyella-Hay Point railway corridor to access an additional 20Mt of coal resource.

Product

After the coal has been washed, it is transported by train to the Dalrymple Bay Coal Terminal. The produced coal has its main markets in Asia (42%, Japan, Korea and Taiwan), Europe (40%) and Brazil (18%). A part of the customers are also shareholders of Macarthur Coal. The capital costs to mine the coal are less than 35$/t.

The mine produces a 9% ash, low volatile and low sulphur, high energy PCI coal. PCI coal is used for Pulverised Coal Injection. This is used for steel making. The mine also produces high energy thermal coal.

In 2002 4.2 Mtpa was produced this amount dropped down. And in 2003-2004 the mine produced 3.92 Mt saleable coal, and 2.17 Mt in 2008.

Geology

Queensland's coals range in age from Carboniferous, 350 million years (Ma) , to Tertiary (65 Ma). The commercially significant black coals are restricted to deposits within sedimentary basins of Permian (280 Ma), Triassic (250 Ma) and Jurassic (200 Ma) age, located mainly in the central and eastern portions of the Queensland state.

The coal deposits of Permian age are by far the most commercially important, of the State's black coal inventory totalling in excess of 30 billion (x109) tonnes (measured and indicated resources). The most important Permian coal basin is the Bowen Basin, which is exposed in a large, triangular-shaped area of central Queensland, 600km long and up to 250km wide. The basin extends south in the sub-surface beneath Mesozoic sediments of the Surat Basin, and connects with the Gunnedah and Sydney Basins in New South Wales.

Coal seams in the Bowen Basin exhibit major variations in rank and quality, reflecting both the depositional and tectonic history of the basin. A broad trend of increasing rank from west to east has long been recognised, and was used as a guide for coal exploration targets during the late 1950s and early 1960s.

Along the structurally disturbed north-eastern edge of the Bowen Basin, the coals range in rank from anthracite to low volatile bituminous, and deposits tend to exhibit a complex structure. Coals in the central part of the basin are medium to high volatile bituminous and include the best coking coals. Structural deformation in these deposits is generally relatively mild.

Coal-bearing horizons have been preserved at many stratigraphic levels throughout the Bowen Basin, but deposits of economic importance are restricted to four groups. The Coppabella mine mines Group IV coals, therefore only Group IV coals are mentioned in this part of the geology. This group includes the Rangal Coal Measures, Baralaba Coal Measures and the Bandanna Formation. The coals in this group are the most diverse in terms of quality, and also the most widely distributed within the basin. Group IV coals were deposited under fluviatile, lacustrine and paludal conditions.

Although the quality and rank of Group IV coals vary greatly, they are characterised by comparatively low reactives content and low sulphur. They are of major economic importance as a source of coking, PCI (Pulverised Coal Injection) and thermal coal and have been mined intensively over the past 30 years. Coppabella is one out of fourteen open-cut mines who is currently working the Group IV coal seam.

Local Geology

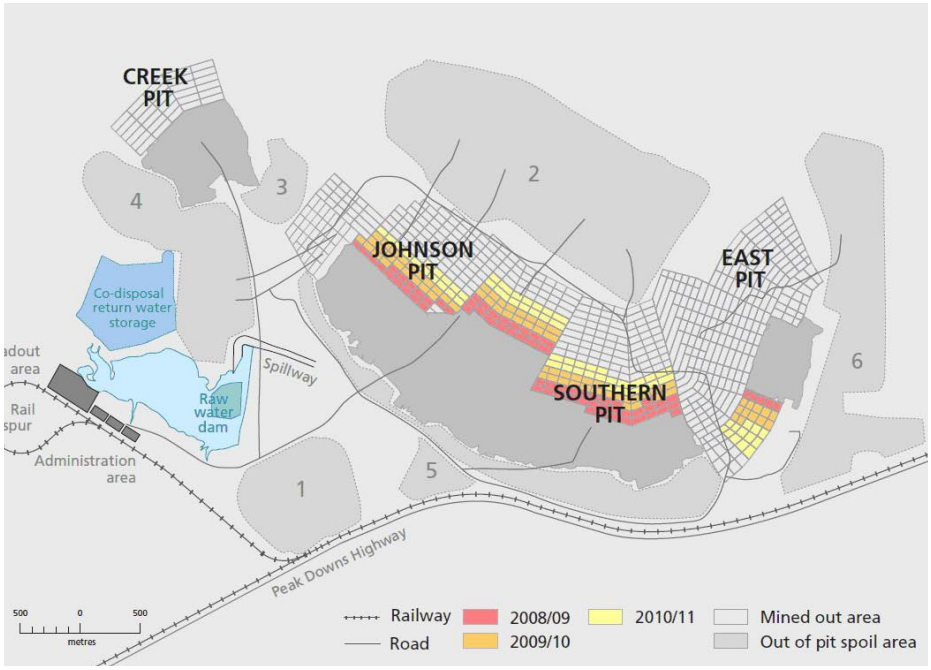
The coal seam has a thickness of 10 meters. The coal is PCI witch is a low-cost steelmaking coal (good enough for cokes). Now a part of this coal is converted to thermal coal due to decreased market for PCI. The saem lies in a geological syncline and the dips are 1:8 (70). The ash content of the coal is 12%. Due to the geological features the coal is difficult to mine (a lot of faults through the seam).

The mine uses 10-meter wide benches in the pit with a vertical height of 15 meters. The angle of 63 degrees is naturally formed by the soil in the mine. The benches are used to prevent dangers from geological failure.

Flooding and water problems

In 2008 the pit was flooded after heavy rain in Queensland, Australia. The creek pit hasn't been pumped dry jet. Currently the water is used for the coal washing plant. Pre split holes are drilled in the coal seam, because of the high water content in the coal. These holes are 10-15 meters drilled into the seem. The Coppabella mine has since spent 2008 2m$ to prevent another flooding.

The Galilee Basin, which is connected to the Bowen Basin across the Springsure Shelf, also contains large quantities of high volatile, low rank thermal coal.



Bucyrus

The Company

Bucyrus international Inc. is a manufacturing company of mining equipment. Until 2006 the company only produced high quality surface equipment. This equipment is used to extract a broad assortment of minerals from the earth, such as coal, iron ore, tar sands, diamonds etc. In 2007 the Bucyrus-brand started producing underground mining equipment as well.

The headquarters of the company are located in South Milwaukee, Wisconsin, USA.Bucyrus has established itself as an international leader in excavation equipment manufacturing. International subsidiaries are located within South Africa, Australia, Brazil, Canada, Chile, China, Europe, India and Peru. These offices support the sales and services needed by the customers.

During 2007 the production expansion increased all around the world (including Australia). This increased production meant an increased demand for new machines and after-market sales.

History

In 1880 the company which would later become Bucyrus was founded in Bucyrus, Ohio, USA by the founding father of the company: Daniel P. Eells. Two years after the founding the first steam shovel was built. This was the first machinery built by Bucyrus. In 1883, the first dipper dredge was shipped. In the years afterwards 77 shovels were shipped to build the Panama Canal. In 1910 Bucyrus entered the dragline market by purchasing manufacturing rights. In 1930 Bucyrus went international by merging with Ruston Hornsby in England. Three years after the merge the company entered the drill market through the acquisition of the manufacturing rights to the Armstrong Drill production line. In 1952 Bucyrus introduced its first rotary blast hole drill, and two years later its first bucket wheel excavator (BWE). In 1957, as a result of the declining market, Bucyrus produced its final dredge. The expansions overseas continued and in 1963 joint ventures were established in Japan, Brazil and Australia. In 1984 the drill production line (for water and oil) was sold to Buckeye Drill Co. In 1996 Bucyrus acquired its present name: Bucyrus International Inc.

A year later Bucyrus bought the Marion Power Shovel Company.

In 2007 the company merged with DBT GmbH, and entered the market for underground mining equipment. The equipment is suitable for room-and-pillar and longwall mining methods.

Financial

The two companies in Bucyrus International Inc. resulted in an installed base of mining machinery value at over $25 billion in 2007, which is believed to be the largest installed base of this type of machinery in the world.

Australian operations

The operations all over the world are increasing but the port facilities in Australia continue to be a bottleneck for the export of both thermal and metallurgical coal to the Asian markets. For instance, the increased demand of imported coal from India could not be met by Australia, their traditional supplier.

Bucyrus has two support and service centers, in Mackay , both for underground and surface mining equipment. These centers are located a short distance from each other.

Underground department

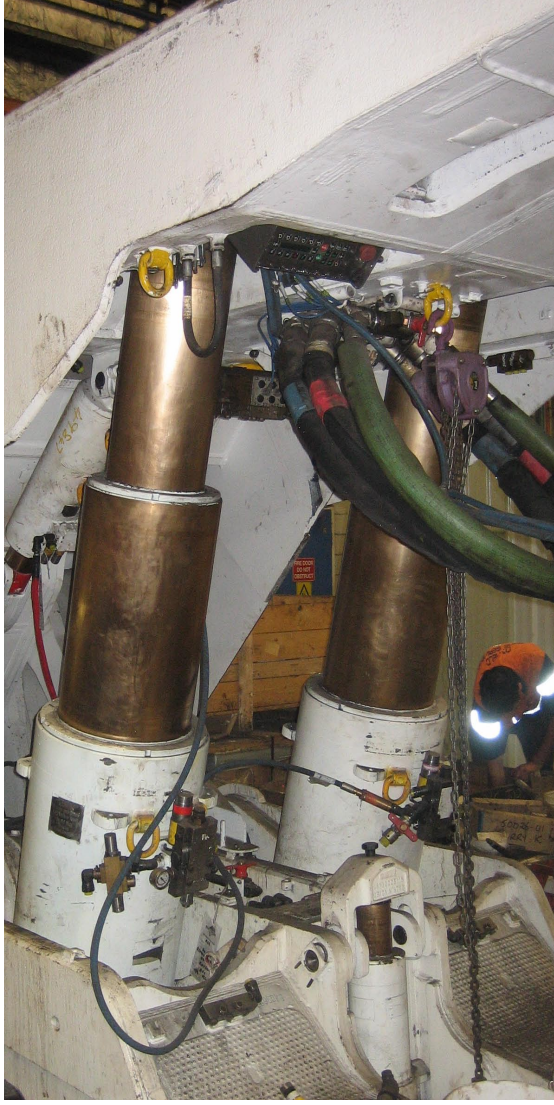
The underground center has the major tasks for the maintenance and customization of underground equipment. This equipment mainly consists of shields for longwall mining and other longwall equipment. Most of the customization is done on cursers at the longwall. The target areas are mainly the Bowen basin coalfields and the coalmines located in New South Wales. This location of the company employs 90 people working in the office and 200 people in the workshop. There are also 12 service engineers that can be sent to the mines to do repairs at location. The workshop is, just as the mines, operated 24 hours per day and is subdivided in different specialties. These are the valve department, the hydraulic department, the welding department and the electronic department.

The total maintenance of one longwall, consisting of 90 to 180 shields, one or two crushers, the scraper-arm and the chain conveyor takes 4 to 8 weeks. For this process the total longwall of one mine is transported to surface and the Bucyrus workspace in Mackay. Therefore most mines have two sets of equipment so they are continuously able of producing coal. Because of the regular maintenance frequency of the longwall equipment Bucyrus is able to plan their work over one year in advance.

Surface department

The surface department in Mackay only produces booms for draglines. These have a length around 100 meters and weight up to 300 tons. This is shipped out and assembled with the rest of the dragline at the mining site. It takes 6 months to build the boom and 18 months to complete a dragline. 28 Employees are currently working at the workshop in Mackay

The assembly repairs and maintaince of longwall machinery and surface equipment take place at this center. They also work on the repairs and the manufacturing of dragline buckets.



Quick Facts

Kestrel is a joint venture between Rio Tinto (80%) and Mitsui (20%).

Underground Coal Mine

Longwall mining

Annual production around 4 Mt saleable product

75/25 split Coking/thermal product

Average yield: approximately 80%

Estimated mine life: 2032

Kestrel

Overview

Kestrel Mine, located in Queensland's Bowen Basin 50 km northeast of Emerald and 300 km west of Rockhampton, is an underground longwall operation supplying world markets with premium quality high volatile coking coal as well as thermal coal. Kestrel Mine is jointly owned by Rio Tinto (80 per cent) and Mitsui Kestrel Coal Investment Pty Ltd (20 per cent) and employs 320 people. Their main markets are Japan China, Korea and Europe.

Geology

The coal is mined from a single seam, named German Creek seam. This seam has a height of 3.0 to 3.5 meters and dips gently. The seam depth is 110 to 450m and the ground conditions are average to weak (10-25 Mpa). The mined areas are bounded by main faults, within these mining areas minor faulting exists.

Mining Process

The mine operates at a depth of 250 metres below surface and is accessed by two inclined drifts. The majority of coal at the Kestrel Mine is extracted by longwall mining, with approximately ten per cent of total run of mine coal produced by continuous miners. Kestrel Mine has two longwall units that are operated alternately to minimise downtime and ensure seamless production and reliability. The ground support is done by roof bolting (8 x 2.1m bolts every meter) and rib bolting (6 x 2.1m bolts every meter) and the usage of tin cans in the tailgate of the longwall. The underground mine is ventilated by 3 main fans. These fans are situated at surface, 2 fans are normally operational and one on stand by. The capacity of these main fans is too low for further development of the mine, a new ventilation shaft is under construction.

Raw coal is delivered to the surface via a series of conveyors. The coal is transferred to the raw coal stockpile before being fed to the coal handling and preparation plant to be processed into two premium products for export; low ash coking coal and high energy thermal coal.

Coal Transport

The coal is transported by rail to the Port of Gladstone for export. A contract with the port gives Kestrel the advantage to have a stockpile at the port of Gladstone. The great advantage of this stockpile is the opportunity to mix the different qualities in the port instead of on the mine site. An other advantage is that they need to transport a certain amount of coal by rail. Using the stockpile as a buffer gives a flexible use of rail transport. Its consistently high performance is due to inherent properties (high fluidity, low ash and low phosphorous contents) and the quality control standards maintained during production at Kestrel Mine.

Growth prospects

Kestrel is currently mining the '300 series', this will continue till 2014. Afterwards they will start mining the 400 and possibly 500 series. The 400-500 series lies at 250-400 m depth and will give a lifetime till 2032. The 2 main drifts for these new series are currently under construction. The used longwall for this new operation will be 375m.

Groundwater

Groundwater production is restriced by the Australian government. All the groundwater produced needs to be reused in the mine. Kestrel uses the washing plant and abandoned mine to reuse the groundwater. Then Kestrel mines the last parts of the 300 series. There might be a problem caused by fracturing the aquifer.

2008 Highlights:

In 2008, Kestrel Mine rehabilitated eight hectares more land than targeted and disturbed 17 hectares less land than targeted

- Construction on the Kestrel Mine extension, an expansion to the existing underground coal mine, started in August 2008, with the first coal from the extension planned for October 2012

- During the Queensland floods in early 2008, Kestrel Mine's Disaster Management team worked with local emergency services to protect property and help residents relocate to safer housing. This included door-knocking, evacuating residents, providing medical support, setting up and supporting evacuation centres and sandbagging to protect property and public infrastructure. As the waters receded, the Kestrel Mine team also assisted in the recovery and rebuilding process, while employees were directly involved in the Emerald Council Flood Recovery project.

- Kestrel Mine started using tomato and basil plants to help manage bacteria levels in its raw water dam in 2008, in an innovative project in collaboration with CQ University

- An increase in longwall productivity with the use of a support crew added $13.5 million in value at Kestrel Mine in 2008

- Projects related to the "Kestrel Blitz", a collaborative programme led by Coal Processing Improvement contributed approximately one third ($10.9 million) to Kestrel Mine's $32.1 million total of savings in 2008

- A new fire station opened at Kestrel Mine in 2008, which included a new fire truck

- Kestrel Mine hosted the first Rio Tinto Coal Australia Birdwatch event at Gordon Downs Property

- The mine finalised a draft cultural heritage management agreement with the Kangoulu people at Kestrel Mine, to be implemented in 2009

- $40,000 was provided through the Kestrel Mine Community Development Fund in 2008 to sponsor defensive driver training for all Emerald Year 12 students.

Curragh Mine

Quick facts	
Ownership	Wesfarmers Ltd
Employees	1000
Location	Blackwater, Queensland, Australia
Type of mining	Undercut dragline operation
Production rate	7,3 Mt per year
Production start	1984
Mine life	Until 2025
Process	Washing plant & size diminishing
Product	Thermal coal & hard coking coal

Location

The Curragh Mine is located 14 kilometres north-west of Blackwater and approximately 200 kilometres west of Rockhampton.

Ownership

Wesfarmers is one of Australia's largest public companies, with more than 200.000 employees across the country. It has investments in many different branches. Apart from coal mining (Wesfamers owns one other mine in Western Australia), the company invests, among other things, in liquor stores, retail, pubs, insurances and home improvement.

Geology

Mining at Curragh takes place on the Aries, Castor, Pollux and Pisces seams within the Rangal Coal Measures of Queensland's Bowen Basin. In North Curragh there are three main seams. From top to bottom: 1 meter seam, interburden, 3 meter seam, interburden, 10 meter seam. Part of the thickest seam is used as hard coking the coal, the rest leaves the mine as thermal coal. With exception of some big faults, there is not a lot of faulting in the region. The seams have a slight dip.

Mining

The Curragh mine is divided into two areas: Curragh and Curragh North. Curragh has about 6 to 7 strip mining operations which are run by three draglines each.

During our visit, we visited the Curragh North area, which consists of two strip mining operations. Although this area is smaller in the number of pits, the production volumes are much greater. A conveyor belt of 42 kilometers transports the coal from the site to the entrance where the washing plant is located. From the washing plant it goes up to a stockpile. A small bucket wheel excavator digs up the washed coal and loads it into wagons. Each wagon can carry 7,000 tonnes. These trains are so long that most of the times an extra locomotive has to be put in the middle.

The two draglines used in Curragh North are used to move the overburden. The weathered zone can be excavated right away while the unweathered zone and the coal have to be blasted. The removal

of one cubic meter of rock with a dragline costs $0,7, whereas removal of the same volume of rock with a shovel costs $3. This gives an indication of cost comparisons made by the management before they decide to buy a dragline. The topsoil and the coal seams are loaded into the haul trucks by shovels. The haul trucks used are CAT 793Ds; at the moment cycles are run with four trucks. All shovels and haul trucks are run by a contractor. Monitoring equipment is used on all equipment, including topography sensors on the shovels, weight detectors on the trucks and a GPS system to keep track of the cycles so they can be optimised.

The waste is directly dumped in the previously mined out strip. This results in a so called 'movement' of the active strip mine.

Most of the coal is sold to the power station in Rockhampton. The higher grade hard coking coal is transported to the port at Gladstone from where it is shipped mostly to China. Miners at Curragh work 4 days on, 4 days off. Water is continuously pumped away by 160 L/s pumps. This water is caused solely by precipitation.

Processing

The raw coal handling system consists of two main areas: the Curragh Run of Mine (ROM) system and the Curragh North ROM system.

The Curragh ROM system is a dual line design capable of crushing 1,200 tonnes per hour through each line (total 2,400 tonnes per hour). It also allows versatility by running coal to Preparation Plant feed stockpiles through one line and running bypass steam coal through another. Curragh ROM coal is dumped by 240 tonne haul trucks into 500 tonne capacity hoppers. Variable speed apron feeders discharge coal into hammer-mills reducing coal lump to less than 400 millimetres. Rotary breakers further reduce coal to a maximum size of 63 millimetres and from this point coal can either be sent directly as bypass coal to the secondary product coal line, or alternately, further crushed by double roll crushers to a maximum size of 32 millimetres and stacked as Preparation Plant feed. Plant feed is stacked in chevron piles to ensure consistent feed for the Preparation Plant.

The Curragh North ROM system is a single line system capable of crushing up to 2500 tonnes per hour. ROM coal is delivered by 190 tonne rear dump trucks or front end loaders to a 600t hopper. The coal is fed from the hopper via a chain feeder into a primary crusher. From the primary crusher, the coal is passed through a secondary crushing system to achieve a maximum lump size of 32mm. The coal is then transported via the 'World's Longest Single Flight Conventional Conveyor' at 20.02 kilometres in length and a top speed of 27km/hr to a 500 tonne bin at the Coal Handling and Preparation Plant feed stockpile area. From the 500 tonne bin, coal can be directly fed into the CHPP for processing, stockpiled to the Preparation Plant feed stockpiles or bypassed onto a secondary coal product pile. Reclamation of plant feed from the Preparation Plant feed stockpiles is via two bridge reclaimers. Surge capacity, to provide consistent feed rate to the plant, is provided by two 250 tonne surge bins fitted with electro-magnetic vibratory feeders providing precise feed rate control. The raw coal stackers and reclaimers are designed and utilised to ensure consistency in the quality and size distribution of the plant feed, prior to processing in the Preparation Plant.

Independently or simultaneously processing two different coal types, the plant handles up to a maximum of 1,750 tonnes of coal per hour through two modules. On entering the plant the raw coal is screened into two size fractions. Producing both coking and steam coal, the coarse coal (+0.5 mm) is processed in a two-stage dense medium cyclone circuit with the fine coal (-0.5 mm) processed in a single stage froth flotation circuit. Recent upgrades in 2002 and 2004 have seen the introduction of modern coal processing technology into the Curragh CHPP. This technology includes the installation of two Horizontal Belt Filters, Jameson Flotation Cells, 1000mm large diameter dense medium cyclones, VM1500 coarse coal centrifuges, banana screens and dry distributors.

Outlook

The current concession can be mined out in 16 years. At that time there is a possibility to go underground and extract the rest of the coal seam with longwall mining. There is also a lot of coal in the neighbouring area, but concessions and mining rights have yet to be gathered. The potential of this mine is quite large.

Gemfields

History

The Gemfields is a region in central-western queensland, near the town of Emerald. As the name suggest the main industry in the gemfields is sapphire mining supported by tourism. The first Gem find in the area occurred in 1875 when Archibald John Richardson found zircons at Retreat Creek. The following year a prospector found sapphires in the region and by 1881 commercial mining operations had commenced.

After 1935 the fields began to decline so that by 1953 there were only 21 full-time miners working in the area. However it was during this period that the Black Star of Queensland (see picture) was found. Weighing in at a remarkable 1165 carats it was the largest black-star sapphire in the world. In 1938 a twelve-year-old local named Roy Spencer found the huge sapphire near Reward Claim. He took it home and his father, not recognising its value, left it at the back door.

The fields experienced a new lease of life from tourism in the 1960s. However the big operators arrived in the early 1970s, with heavy machinery in tow. The frail romance of fossicking did not sit well with mass production.

Today the field is characterised by mainly individual hand miners supporting the local tourist market with larger mechanised operations being undertaken by mainly small family companies or joint venture partners and only one listed public company.

Occurrence

On the Anakie field sapphires occur in Tertiary and Quaternary alluvial deposits derived from the weathering and erosion of alkali-volcanic rocks, mainly basaltic lavas, pyroclastics and volcaniclastics of Tertiary age and underlying Palaeozoic basement rocks. The basement of the Anakie field consists of old metamorphic rocks and sediments of Late Proterozoic to Ordovician age (600 to 435 million years) known as the Anakie Metamorphics and Fork Lagoons beds, and granitoids of the Retreat Batholith which were intruded into them in Devonian times (350 to 380 million years). Although some younger sediments overlapped the area in subsequent times, little apart from erosion has occurred in this old basement block to the present day.

However, between 70 and 40 million years ago some volcanic activity erupted across the area spewing out basaltic ash and lavas. All that remains of these volcanoes now are plugs of lava that once filled their vents (eg Mount Hoy, Mount Leura); the rest having been eroded away. Referred to as the Hoy Basalt Province, it is one of many similar volcanic suites that are found throughout the highlands of eastern Australia.

It is believed that during the first phase of volcanic activity, abundant sapphires, spinels, garnets and zircons were blasted from the volcanoes as crystals in volcanic ash. Later less violent eruptions brought more normal basalt lava to the surface, carrying only a few sapphires as have been noted in the basalt at Mount Leura.

The sapphires have since been released from the volcanic material by weathering and erosion, transported by old streams, and concentrated in various layers of gravel (known as "wash") of Pliocene to Pleistocene age (2 million to 10 000 years ago). This "wash" has also been cut into by present drainage systems.

The old streams that drained the area and concentrated the sapphires in bed and bank deposits flowed towards the north and northeast, generally parallel to, and in some cases co-incident with modern streams. The sapphires and other heavy minerals tended to be concentrated in "runs" along particular channels in the old watercourses (palaeodrainage system). In some areas, the presence of several "wash" layers indicates the filling of channels with barren sediments and later deposition of sapphire-bearing material over the top.

The wash so formed is termed "high level wash", and occurs above present stream levels. It is variable in thickness and depth, reflecting original topographic features, and has undergone varying degrees of consolidation. Degradation of this wash by erosion, in places by gravity acting down-slope, and elsewhere by water, has formed areas of secondary "lower level wash". Modern streams have also reworked older wash deposits leading to sapphires in their drainages.

Goonyella Riverside Mine

General

Goonyella riverside mine is the biggest material moving operation of Australia, and one of the biggest in the world. The operation is 22 kms long and 8 kms wide. It is one of the nine BMA coal mines is Queensland and is located 190 km west of Mackay and is accessible by road and rail. The coal is mined by the surface stripping method and by the underground longwall method. Surface stripping produces 12.3 Mt per year and the longwall mining produces 4 Mt per year. So the total production of the mine per year is 16.3 Mt of raw coal. The produced coal is transported by rail to the coal terminals of Hay point and Dalrymple Bay at the shore.

The mine has 1000 eployees and 300 contractors working at the mine, in either a 7 day continuous 12 hour shift roster (for the stripping operations) or a 5 day continuous 12 hour shift roster (for the coal mining and processing operations). The mine operates 24 hours per day, 363 days per year.

The employees live in the town of Moranbah, 30 kms south of the mine, which has a total population of about 7000 people.

The equipment the mine uses for BMA stripping, contract stripping and underground mining consist of 58 trucks, 7 draglines, 9 excavators, 3 rope shovels and 3 loaders.

The mine prefers an underground operation when the overburden that has to be removed is exceeds 180 meters.

Coal resource

Three seams are mined. The Goonyella upper seam (GUS) is 6.0 to 9.5 meters thick and the yield is 63-70%, the Goonyella middle seam (GMS) is also 6.0 to 9.5 meters thick and has a yield of 77-85% and the Goonyella lower seam (GLS) is 3.0 to 4.0 meters thick and has a yield of 70-75%. Goonyella and Riverside are high quality, medium volatile coking coals, and are widely recognised for their superior coking characteristics. The seams dip 3-6 degrees to the East. The Riverside product will continue to be produced from the Goonyella lease, which has economic open cut reserves of 663 million tonnes and has "in situ" resources of about 1.6 billion tonnes. In 1971 BMA started mining the middle seam and dumped their waste above the lower seam. In 1983 the lower seam proved to be economically profitable and the mine started mining the coal under the old waste pile. This project is ongoing and splits the mine in two holes. This waste dump in the middle now causes severe problems with the water management.

Cycle of operations

To produce coal, the topsoil has to be removed. This is done by loaders and trucks. After that the upper half of the overburden is removed by excavators and trucks. What is left of the overburden gets drilled and blasted and will be removed by draglines. This process exposes the coals seams, which will be produced by excavators and trucks. For the underlying coals seams, the process is repeated.

Coal preparation

Raw coal from the mining faces is blended and processed by the coal preparation plants (CPP), then the coal is crushed to 50mm. Beneficiation involves dense medium separation of coarse (50 x 0.5mm) product from coarse reject, and the use of column flotation to separate fine (0.5 x 0mm) product from fine reject. The quality is monitored at all stages to ensure products are consistently "on spec".

Outlook

Goonyella Riverside has extensive reserves of GUS, GMS and GLS, which will enable production of Goonyella and Riverside products to continue well into the future (at least 60 years of mine life at current output)

Goonyella is addressing the major issue facing Goonyella Riverside - the increasing depth of the coal seams as they progress down dip:

– Equipment is being upgraded to increase efficiency

– Mine plans are continually optimised; including development of Airstrip Pit, and feasibility of double seam extension

– A program of continuous improvement (Operating Excellence) is in place to increase mine efficiencies and reduce costs

Oaky Creek Coal Complex

Quick Facts

Ownership: Xstrata Coal Queensland Pty Limited (55%), Sumisho Coal Australia Pty Limited (25%), Itochu Coal Resources Australia Pty Limited (15%) and ICRA OC Pty Limited (10%).

Product: Metallurgical coal (coking coal)

Location: Bowen basin, Central Queensland, Australia

Current production rate: 11Mt

Reserves: 63.1 Mt of proved marketable reserves

Start of production: 1983

Mining method: Longwall underground and open cut

Processing technology: Cyclones, spirals, flotation and filters/thickeners

Employees: 1230

Overview

This project is managed by Oaky Creek Coal Pty Ltd. It is a modern large-scale mining operation producing at a rate of approximately 11 million tonnes a year. The mine comprises two underground operations, Oaky No1 and Oaky North, and a preparation plant in Queensland's Bowen Basin a coal province internationally known for its high quality coking coals. All raw coal is washed to ensure consistent product quality. The coal is transported to ports of Dalrymple Bay and Gladstone, via the Queensland Government Railway lines.

Ownership

The Oaky Creek Coal (OCC) complex is a joint venture between Xstrata Coal Queensland Pty Limited (55%), Sumisho Coal Australia Pty Limited (25%), Itochu Coal Resources Australia Pty Limited (15%) and ICRA OC Pty Limited (10%)

Location

The mine is located in Queensland's Bowen Basin 200 kilometres west northwest of Rockhampton. OCC workforce and their families mainly live in Tieri (approximately 2000 inhabitants), 14km west of the mine.

Mining

Exploration at Oaky Creek began in 1977 and in 1981 MIM acquired a major stake in the operation. In 1983 the mine was officially opened, initially as an open cut dragline operation. But underground operations commenced in 1989 to increase coal production as the open cut mine became deeper and stripping ratios increased. Longwall operations at Oaky No 1 began in 1990 and Oaky North development started in 1995. The Oaky Creek No 1 mine was developed from the highwall of a worked out open cut pit close to the preparation plant. The longwall extracts coal from a series of pre-developed blocks.

Oaky Creek North was developed as a major longwall mine and is generally a larger scale operation than the Oaky No 1 mine, thicker seams, wider longwall blocks and bigger more powerful equipment. In both mines continuous miners develop the blocks for longwall extraction, maintaining minimum developed longwall inventories of at least two blocks at all times. The underground mines at the OCC complex have optimum working conditions with a stable roof, floor and coalface and an above average seam thickness.

When production commenced in 1998, coal recovery became less economically profitable and therefore the open cut mine was closed in 1999. Changes in the exchange rates and coal prices saw the open cut operation become economical again, reopening in 2001 with two draglines in the high quality Aquila seam. Finally in December 2006 the open cut operation was closed again.

The OCC complex produces premium quality, medium volatile coking coal.

The coals contain moderately low ash, low sulphur and low alkalis and exert negligible pressure on coke oven walls. The Oaky Creek coals exhibit plastic properties such as high fluidity and high dilatation, which are exceptional for this rank of Australian coal.

Processing

Run of mine coal is transported from the underground mines directly to the surface raw coal stockpiles by high capacity conveyor belt systems. From these stockpiles the coal is fed through rotary coal breakers, which size the coal and make an initial segregation of waste rock material. It is then conveyed to stackers which place the raw coal on a series of stockpiles one for each of the qualities being mined.

Vibrating feeders reclaim coal from these stockpiles. It is then blended to ensure consistency of quality and fed to the preparation plant for washing. The preparation plant consists of four parallel modules. Each module has a heavy medium system for treating coarse coal of 50*1mm, a primary spirals unit treating the 1.0 *0.2mm size fraction and froth flotation for processing fines of less than 0.2mm. A secondary spirals unit processes misplaced material from the primary spirals circuit.

In 2000 horizontal belt filters where fitted to replace the original drum filters on the fines circuit. This has improved both the throughput capacity and the recovery of high quality fine coal. Fine reject material from the preparation plant goes to a thickener for concentration and is later transferred to a tailings storage facility. Clarified water from the thickener and tailings storage facility is pumped back to the plant for re use in the washing process.

A radial stacker places the washed product onto separate areas of the product stockpile depending on grade. As it leaves the preparation plant, the product coal is sampled and analysed continuously to ensure that quality meets contract specifications. All operations of the preparation plant are governed from a central control room, and monitored by modern sensing and control equipment.

Geology

Oaky Creek lies in the central Bowen Basin, next to Rio Tinto's Kestrel mine. The Bowen Basin contains the largest coal reserve in Australia. This major coal-producing region contains one of the world's largest deposits of bituminous coal. The Basin contains much of the known Permian coal resources in Queensland including virtually the entire known mineable prime coking coal. The Bowen Basin covers an area of over 60,000 square kilometres in Central Queensland running from Collinsville to Theodore.

The foreland, Early Permian to Middle Triassic Bowen Basin of eastern Queensland occupies about 160,000 km2, the southern half of which is covered by the Surat Basin. It has a maximum sediment thickness of about 10,000 metres concentrated in two N trending depocentres, the Taroom Trough to the east and the Denison Trough to the west. Deposition in the basin commenced during an Early Permian extensional phase, with fluvial and lacustrine sediments and volcanics being deposited in a series of half-graben in the east while in the west a thick succession of coals and nonmarine clastics.

Following rifting there was a thermal subsidence phase extending from the mid Early to Late Permian, during which a basin-wide transgression allowed deposition of deltaic and shallow marine, predominantly clastic sediments as well as extensive coal measures. Foreland loading of the basin spread from east to west during the Late Permian, resulting in accelerated subsidence, which allowed the deposition of a very thick succession of Late Permian marine and fluvial clastics, again with coal and Early to Middle Triassic fluvial and lacustrine clastics.

Sedimentation in the basin was terminated by a Middle to Late Triassic contractional event. Over 100 hydrocarbon accumulations have been discovered in the Bowen Basin, of which about one third are producing fields. Accumulations occur throughout the succession, but the most important reservoirs are in the Early Permian and Middle Triassic. Source rocks have been identified throughout the Permian and in the Middle Triassic and are mostly nonmarine. Proven plays comprise mostly anticlinal closures sometimes enhanced by a stratigraphic component, as well as fault rollovers. The Large volumes of methane gas are held at shallow depths within Permian coals in the north and has potential for coal seam methane developments.

The OCC complex mines from two seams the German Creek, which can be up to 4.5 metres thick, averaging 2.6 metres. The Aquila seam is thinner, averaging 1.4 metres, but is of complementary quality to the German Creek seam.

Growth Prospects

There are currently no plans to increase the production, this is all due to the financial crisis that hit at the end of 2008. In December 2008 Xstrata coal announced the suspension of longwall operations at Oaky No 1. due to the financial crisis. In August 2009 the operations were restarted at Oaky No 1. in response to increased spot market sales to China. The remaining mine life is 32 years for the operations at the OCC complex.

Outlook

At the end of 2008, in response to the global economic crisis, worldwide demand for coal imports fell precipitously, and the ensuing coal supply glut prompted many mines in coal exporting countries to lower their production levels. Although the break from intense global coal demand could provide an opportunity for coal trade infrastructure—including mine, rail, and port capacity—an opportunity to catch up with the previous years' fast-paced growth, many infrastructure projects in the early stages are likely to be deferred. Projects that are in progress, however, are assumed to continue. Despite the global economic crisis, the duration of which is uncertain, over the long run the volumes of total coal traded internationally increase steadily through 2030.

Wilkie Creek Mine

Overview

Wilkie Creek mine is located in the Surat Basin of south-east Queensland. Although mining originally started in 1994, Peabody didn't commence operations until 2005. Currently producing around 1.8 million tonnes (2 million tons) of low sulphur, low nitrogen, environmentally superior thermal coal, plans are underway to ramp up to 2.5 million tonnes (2.8 million tons) in 2008.

The open-cut operation utilises excavators, loaders and trucks for mining. Coal is railed 250 kilometres to the Port of Brisbane where it is exported to Japan, the Philippines, Chile and Korea for power generation. Coal is also sold to domestic customers. Wilkie Creek has an active mining lease of 128 hectares and has 201 million tonnes (221 million tons) of recoverable coal. Peabody Energy Australia's other thermal coal resource in the Surat, Horse Creek, also has significant reserves.

Mining and Production

Wilkie Creek was opened in 1995 and has been progressively developed as a modern, efficient mining operation that will continue to expand as new long-term coal sales contracts are secured. Wilkie Creek's coal is steadily winning acceptance in the export market as its superior combustion performance, favorable ash properties and low environmental impact become known. The mine has 50 million tonnes (55 million tons) of recoverable coal.

Wilkie Creek's 58 employees use a combination of dozers, scrapers, excavators, front-end loaders and trucks to uncover the coal and move the overburden. With a favorable stripping ratio, minimal blasting of overburden or coal is required. Four seams of coal ranging from 1 metre to more than 4.3 metres thick (3.3 feet to more than 14 feet thick) are mined individually. The coal from each seam is hauled by truck from the pit and stockpiled individually. If blending is required, this occurs when the coal is fed into the preparation plant at a rate of 350 tonnes (390 tons) per hour. The coal is crushed, sorted and washed with water obtained from recycled pit water, direct rainfall into the dam catchment area and ground water wells. From the preparation plant, the washed coal is hauled about 14 kms (8 miles) by truck to the rail load-facility on the Surat Moreton Rail Line. Trains with 1,940 tonnes (2,100 ton) capacity transport the coal by a direct rail link 250 kms (150 miles) to the Port of Brisbane coal export terminal.

A feasibility study is underway to increase production at Wilkie Creek that would involve upgrading the preparation plant and upgrading the transportation infrastructure, augmenting water and power facilities.

The Wilkie Creek Mine is a subsidiary of Peabody Energy. Acquired in 2002, it marked the return of Peabody to Australia, where the company has operated for much of the past decade. St. Louis-based Peabody Energy is the world's largest private-sector coal company, with 2004 sales of 227 million tons and $3.6 billion in revenues. Its coal products fuel more than 10 percent of all U.S. electricity and 3 percent of worldwide electricity. The company is serving global coal demand from electricity generators and steelmakers, and is growing to serve new global customers and emerging Btu Conversion markets.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Rio Tinto
SABRE

University of Queensland

Introduction

The University of Queensland, located in Brisbane, has a beautiful campus with a park and old monumental buildings. The UQ located. The number of students exceeds 30.000.

The mining department has a short history with an experimental mine Indooroopilly.

UQ itself consists of six research institutes where 350 researchers conduct their research.

Comparison with TU Delft

The Mining department works together with the mechanical engineering department. In order to learn more about the materialistic part of mining equipment. In the future the mines will be using more continuous processes and larger equipment.

Compared to the Netherlands, where the mining department is combined with civil engineering, this is quite a difference. The reason for this choice is that the TU Delft offers more than just the mining part. The faculty also offers courses in petroleum engineering and geo-engineering, so there is more overlap with civil engineering.

Another difference compared to the TU Delft is that students starting at UQ first have an engineering year and then, in their 2nd year, choose to what field of engineering they want to go. At the TU Delft you choose straight away what your field of engineering will be when students begin their study in Delft.

Department of mining

The mineral processing laboratory operates with Mr. Sante di Pasquale as head of the section. The laboratory facilities are divided into three subsections: physical, pyro- and hydrometallurgy.

In each subsection there were numerous processing machines available where bachelor students have to do an experiment every year. This way students here learn more about practical work than the way it's taught in the Netherlands where you learn it the theoretical way.

There is also research about spontaneous combustion of coal, the student conducting these experiments is Will Hitchcock, a PhD student. He works with coals of different ash content and moisture contents. He uses small furnaces with different pressures and air inside the furnaces. This way a lot can be learned about spontaneous combustion of coal.

The experimental mine

As part of the mining department there is an old mine which is used for teaching and conducting experiments on subjects like ventilation, electricity, and automatisation.

First a short history:

- 1918: Discovery of silver-lead by P J Madden & G Olsen. First mineral lease was granted and the first parcel of ore dispatched to Cockle Creek.

- 1919: Open cut mining commenced and the first underground shaft sunk.

- 1920: First recorded geophysical prospecting in Queensland carried out at Indooroopilly mines.
- 1921: Main shaft sunk.
- 1924: Small treatment plant erected.
- 1925: Open cut deepened. Plant expanded.
- 1926: Financial problems caused the mine to close, P J Madden purchased the property.
- 1928: Short lived revival of production.
- 1929: All operations ceased.
- 1951: Site acquired by the University of Queensland.

Quick facts:

- Previous know as: The Indooroopilly Silver mine
- Area: Approximate 8.6 acres
- Total production: 227.343 oz. of silver and 1.796 tons of lead

When UQ acquired the mine, the mine was flooded. The students redeveloped a part of the mine. The mine is now used for research on for example ventilation, geomechanics, electrics, etc.

Gympie Gold

Overview

Gympie is known as "Queensland's Golden City" following Queensland's first gold rush in 1867. Originally settled for grazing purposes, in 1867 the area became prominent when James Nash discovered gold. At the time Queensland was suffering from a severe economic depression and the discovery probably saved the colony from bankruptcy. This event is still celebrated today in the Gympie Gold Rush Festival, held annually from the 8-18th of October. Gold mining still plays a role in the area's fortunes, along with agriculture (predominantly dairy), timber and tourism.

The Museum houses a vast collection of documentation, artefacts and photographs from the discovery of gold in 1867 by James Nash to the current operations of the Gympie Eldorado Goldmine which is the 8th greatest gold producing mine in Australia today. Set by a picturesque lake, the museum houses memorabilia from the early gold mining era, as well as displays showcasing military, rural, transport, communications and steam development in Australia.

Ownership

Gympie Eldorado Gold Mines Pty Ltd (GEGM) owned the tenements over the Gympie Goldfield and surrounding exploration region. These permits covered an area of over 1300 square kilometers and surround our Monkland and Lewis Mines at the south end of the Goldfield. The Gympie Eldorado Goldmine Pty Ltd was sold in 2004 after the parent company Gympie Eldorado Goldmine Ltd went into receivership. The new Company Gympie Eldorado Mine Ltd wound down the operation and is currently in maintenance mode. It is presently owned by Buka Gold Limited which claims that Gympie is an operating mine with full infrastructure and services capable of rapid production scale up. Gold is mined at GEM's Monkland Mine using traditional underground mining methods. Mined ore is processed in a modern carbon-in-leach process plant to recover gold in the form of doré (a mixture of gold and silver in cast bars, as bullion). The current operations provide a basis for quickly bringing to account any future exploration success with many of the most advanced exploration prospects able to be accessed using existing mine infrastructure.

Location

The Gympie Goldfield is located 150km north of Brisbane. It has excellent infrastructure with easy access to highway and rail transport, power, water and workforce.

Discovery and development

James Nash discovered alluvial gold in October 1867 in gullies that were called Nashville and then later became Gympie. Though gold had been discovered earlier in several other regions of the colony, none had given prospects of such enormous wealth as Gympie which is ranked sixth in Australian hard rock gold producers behind Kalgoorlie, Bendigo, Ballarat, Mount Morgan and Charters Towers. The first modern exploration of the Gympie Goldfield occurred between 1980 and 1995, and was conducted by Freeport and BHP, under joint ventures with GEGM. The majority of that work concentrated on the ore reserve definition of the Inglewood Reef, on which the present Monkland Mine is based. Some first-pass, stratigraphic drilling was conducted elsewhere on the Goldfield, as well as some scout drilling on outlying historic workings.

Mining

The mine was worked continuously for 60 years until 1927. Hard rock production totaled 116 tonnes of gold (3.73 million oz) from 4.5 million tonnes of ore averaging 25.8 g/t recovered or about 29 g/t head grade. It was historically the 6th largest goldfield in Australia and the 3rd largest in Queensland after Charters Towers and Mount Morgan. Gympie was one of the highest grade and richest goldfields in the world, paying handsome dividends to its investors in Australia and especially Scotland for several decades. The Gympie Goldfield is famous for its coarse gold specimen stone that occurs where

gold-bearing reefs come into contact with a seam of black slate known as the 'Productive Horizon'. At today's gold price, Gympie gold production is worth over $1,500,000 (AU) which gives substance to the historian claims that Gympie was the town that saved the then Colony of Queensland from bankruptcy. The ore was mined by hand using hammer and tap drilling to insert black powder explosive that blasted the rock. Men loaded the handpicked ore into rail carts that were drawn along underground railways to the shafts by the men themselves. The heroic achievements of these early miners cannot be overstated. The earth was hot in deeper mines and ventilation limitations became the main engineering constraint on production at depth.

The modern era of the Gympie Goldfield commenced in the 1970's with the amalgamation of the fragmented mining tenements. Surface exploration commenced in 1980 with deep diamond drill holes that tested unmined portions of historically known ore zones. In 1988, the deepest shaft in the field, West of Scotland Shaft at the outskirts of Gympie was reopened after 84 years. In 1993, the reopening of the Scottish Gympie No. 2 Shaft commenced and came into production after the official opening in 1996. A modern powerful ventilation fan fitted to the top of the Scottish Gympie No. 3 Shaft upgraded ventilation throughout the interconnected workings. In 1996, the old Scottish Gympie No. 1 Shaft across the road from the Mining Museum was renamed after the famous geologist, Bas Lewis and it reopened in 1988 after being refurbished.

Processing

Only one piece of mining machinery remains on its original site on the Gympie Goldfield: a ten-head crushing stamper battery. The original battery building on this mine, No. 2 South Great Eastern, housed 80 head of stampers, or eight sets of ten-head stamper batteries, which were built by a Foundry at Bundaberg, Queensland, around about the 1900's. The gold-bearing ore was fed into the mortar box through an opening at the rear of the box. Water was added through two openings on top of the mortar box, and to the front lower part of the mortar box a heavy wire screen was fitted to an opening to which the ore was required to be crushed to release the particles of gold. Each stamper dropped at approximately 100 drops per minute, when the ore was crushed to sufficient fineness it was washed through the wire screen and washed down over the amalgamating plates where the gold was recovered. Periodically, each five-head of stampers were held up above the revolving cams, where clean water was allowed to pass through the box and wash all the crushed ore off the amalgamating plates. The water was then turned off and the gold amalgam was rubbed off the plates and collected in an amalgam bucket ready for further refining. Before restarting the crusher more mercury was added and spread over the amalgamating plates. As any coarse gold in the ore could not be crushed to pass through the wire screen on the mortar box, small amounts of mercury were regularly added to the mortar box to amalgamate the coarser gold which could then be collected from within the mortar box from time to time.

Geology

The Gympie Goldfield covers an area of 4km by 10km and consists of an extensive, mesothermal quartz vein system hosted within the Permo–Triassic mafic to intermediate island arc volcanics and sediments of the Gympie Group. The Gympie Group sits on a Devonian basement of deformed, deep marine, basalt, chert and sediments called the Amamoor Beds. These have been intruded by mid- to late-Triassic granite and diorite. The nearest intrusion to the Goldfield lies 10 km to the south east. The upper units of the Gympie Group comprise the South Curra Limestone and shale beds of the Tamaree Formation. These upper units appear to be unmineralised. Most of the high-grade mineralization occurs beneath the limestone where the quartz veins are in contact with carbon-rich sediments, historically referred to as "The Productive Beds". The Productive Beds lie above volcanic rock units and dip from 10 to 45 degrees to the east. The mineralization at Gympie occurs as low sulphide, quartz-carbonate veins that are often associated with carbonate-altered dolerite dykes. The gold occurs as free grains, which can be very coarse. Isotopic dating of the mineralization gives a Triassic age.

A large proportion of the gold produced from Gympie has come from reefs that do not outcrop at surface and are totally concealed beneath the barren limestone. The miners of 100 years ago understood this, and had such confidence that they would sink deep shafts through barren limestone to the Productive Beds to find rich reefs that had no surface indication. The mineralization continues past the old workings down the dip of the Productive Beds. Thin river gravels of the Mary River cover much of the field but the old timers would not risk sinking shafts anywhere near the river for fear of flooding.

The Goldfield is fragmented into a number of "Blocks" which have been shuffled up and down by later fault movement. In some cases this movement has exposed the veining in the Productive Beds at the surface whilst in other blocks the veins are concealed at shallow depth beneath the barren limestone.

Operating performance

The Gympie Goldfield produced 4,084,772 ounces of gold, recorded by the Gold Escorts in the 60 years between 1876 and 1926. Gympie has the distinction of having produced the largest nugget found in Queensland, the 30-kilogram (975 oz) Curtis Nugget unearthed in February 1868 as well as the Monkland `Big Cake' of 5972 ounces. Mining on the field ceased in 1927 due to diminishing returns and rising costs as mining chased the veins deeper at a time of high cost inflation and a pegged gold price. Other than the re-treatment of old mine tailings, the field lay effectively dormant from 1927 until the mid 1970's with over 200 small lease holdings across the field making it unattractive to invest significant exploration funds.

Environment

The Gympie Goldmine operates beneath a modern city and the Mill operates just outside the city limits. The operation has achieved a good environmental record due to the desire to be a respected long-term business in Gympie with guidance

and monitoring by the Government and local community. Discharge mine water is almost potable quality is supplied to the community during periods of extended low rainfall to keep the duck ponds in the nearby park fresh. The Mill discharges water and tailings into a sealed and fenced dam with the Mill waters and tailings neutralized prior to discharge to stock-quality standards. Wildlife uses this dam for water during drought.

The Museum

- Relics of later Mining and Gold recovery including gem displays.
- Military History such as The 5th Light Horse Regimental Military Museum which houses an Award Winning Collection. It includes Military equipment and memorabilia of sons and daughters from the Gympie area that went to war.
- The Andrew Fisher House, named after Australians" second Labour Prime Minister between 1908 - 1915. Andrew Fisher lived here with his Family.
- An original old Jail House from the Gympie area.

Outlook

As stated previously, the mine is currently owned by Buka Minerals Ltd, which was at the time of purchase, 2004, chaired by mining magnate Robert Champion de Crespigny. In 2002, Champion de Crespigny was awarded the Companion of the Order of Australia for his service to the mining industry, to business and to the community in the areas of cultural preservation and education. He was also in the same year awarded the South Australian Director of the Year by the Australian Institute of Company Directors and South Australian of the Year for 2002 by SA Great.[8] In 1993 he was awarded Australian Businessman of the Year. Nowadays, David Hillier is executive chairman of the company. Gympie's current gold rush could be over for now. Operations at the Gympie Eldorado gold mine have been scaled back with staff retrenchments taking place recently and the Monkland site believed to be for sale. David Hillier told The Gympie Times that the closure was "an inevitable winding down of a 100-year-old mine".

In Buka Gold's Report to Shareholders for the 2008 September quarter, it stated that the core focus of the company's activities would now be the Mt Scotchy and Maryborough Basin exploration projects. The report read: "Given that the (Monkland) mine is no longer the company's principal focus and that mining operations have, for some time been making only modest contributions to exploration costs, the Board has decided to close the Monkland operations while it continues to seek buyers for the Gympie assets. "Mining will remove all available broken stocks, complete stoping of 13-47 and 124-49ELC and then remove all equipment for sale that can be retrieved economically."

The Gympie Goldfield was the first profitable redevelopment of an eastern Australian historical goldfield. In its modern heyday, the Monkland Mine greatly benefited Gympie in many ways, employing professional and skilled trades people with the natural flow on to the community at large.

Mineral resources

In 1991, Gympie Eldorado Gold Mines acquired the mine at Gympie and initiated an active regional exploration program performed by "Terranean mapping technologies". Initially, there was an enormous quantity of uncatalogued exploration data, some dating back to the beginning of the 20th century. These data included field survey notes, drill logs, geological maps, interpretations in various scales and projections, airborne and ground geophysics in different formats, media and levels of processing. The challenge was to process and integrate these valuable, but unusable, data resources into an integrated information base, which could be interrogated and used to support multi-million dollar investment decisions.

CRC Mining

CRC mining started in July 2003 as a research centre for the mining industry. The centre which is a non-profit organisation was established by the commonwealth government under the cooperative research centres programme. The centre is located near Brisbane and is currently supported by 14 companies and 5 universities of which 4 in Australia and 1 in USA. Some major supporting companies are Anglo Coal, Rio Tinto, BHP, Caterpillar, Xstrata and more.

Current research projects:

Shovels:

CRC mining now uses the fourth generation of a shovel testing machine. The test machine which has been designed and improved over a time span of 10 years is based on a 1:25 scale imitating the true situation. The high precision and reliability has been made possible by the development of a unique algorithm which links the values acquired with the testing machine to full scale values. Beside using a miniature shovel the muck pile is designed to imitate the true situation as best as possible. To achieve this site, analysis of the muck pile is required. Rock samples are taken and used in combination with different gravel sizes to build the miniature muck pile.

By testing the shovel design in realistic conditions CRC mining is able to advise mining company on their choices of shovels. This includes advice concerning shape and size of shovel, number and shape of used teeth, to achieve maximum production.

Coil tube drilling:

Although coil tube drilling is not a new technique, CRC mining now wants to apply this technique underground. The main objective is to drain methane from coal seams. The main challenge is formed restricted working space available for the machine. Due to the restricted working space a small diameter spool has to be used to wind up the coil tube. However one of the issues is to wind up the coil tube on a small diameter spool without damaging the tube itself. Another challenge is to get the coil tube out in one piece, because when it breaks and a part of it stays stuck in the hole, the long wall can't be placed on that specific spot, and that equals lots of money lost.

Chain strain gauges:

Chains used in the longwall machinery are subjected to extensive wear and tear. To get more production the mining-companies ask for longer longwalls, but when they get longer and longer, the strain on the chain is increasing. CRC mining is now developing strain gauges to measure these strains to predict and avoid chain failure. Although this technology would indicate accurate strain on the chain, no company is truly interested in it. Installation of the strain gauge takes up to 12 hours. This means a loss of production of 12 hours which according the mining companies is not worth it.

Conclusion

Through its relatively short existence CRC mining has developed some innovation technologies to improve effectiveness in the mining industry. Although these new technologies are likely to improve the production process and safety of mines, companies remain quiet. The fact that different parties are rewarded by delivered ton of coal means that installation of new technology results in loss of money for each party on the short term. Unless this does not change, it will remain a challenge for CRC mining to sell their technology.

Northparks

Introduction:

Northparks is a copper and gold mine located 27 kilometres north-west of Parkes in the Central West of New South Wales, Australia. Its a joint venture between Rio Tinto (80%) and the Sumitomo Group (20%).

Operations include both underground block cave mines and open-cut mines. Northparkes was the first in the country to use a variation of the cost-effective block cave mining technique in its underground operations. Underground block cave operations include the E26 Lift 2 and Lift 2 North block caves as well as the E48 block cave project. Open-cut mining campaigns have been undertaken in the E22 and E27 pits.

Northparkes Mines owns 6,000 hectares of land around the mine, of which the mining lease covers 1,630 hectares. The remaining land is actively farmed using best practice farming methods developed and adopted to maximise productivity and quality while conserving water and soils.

Different operations:

The open-cut operation:

The Northparkes Open Cut operation comprises two Open Cut mines that have been in production on and off since November 1993. The Open Cut ore bodies are E22 and E27. Ore body E27 is mined out and is now being used as a tailing site. E22 is at the moment 120m deep with a copper grade of 1%. they are planning to go up to 250m depth.

Mining of the Open Cuts involves conventional practises of drilling and blasting with a 160 ton hydraulic excavator and haul trucks of approximately 90 ton capacity loading and hauling the material.

Mining is carried out on a 5 m bench height and an overall waste: ore ratio for Open Pit is approximately 1.5:1.

Ore processing takes large quantities of low grade ore from the mines and converts it into a much smaller quantity of high quality concentrate suitable for selling to copper smelters.

The underground operation:

The Endeavour 26 (E26) ore body is the largest and highest grade of the ore bodies at Northparkes. The mine, which is currently in full production, had pre-mining reserves of approximately 50 Mt at grade 1.4% copper and 0.4 g/t gold. Original ore body dimensions were approximately 200m in diameter and over 800m in depth extending from just below the surface. Access to the Underground operations is by a decline from the surface for personnel and materials access, with ore being transported to surface by conveyor belts to a hoisting shaft.

The mining method used is block caving with the mine being developed in two lifts, initially to 480m below surface accessing the first lift of approximately 25 Mt. The second lift extending to the full depth of 830m below the surface accessing 25 Mt.

Block caving is possible at Northparkes due to the nature of the rock and the size of the ore body. Caving occurs when a sufficient area of rock is undercut to the point where the rock mass fails and breaks up. This occurs without the requirement for drilling and blasting and the rock

continues to fail and break up whilst the broken rock beneath is removed.

Broken rock is removed from the column at the extraction level through a grid of draw points. Feeding from these draw points are Load Haul Dump (LHD) machines (between three to five operating) each of 6m3 carrying capacity, transporting the rock to a crusher located on the western side of the ore body. The rock is gyratory crushed to 150mm and is then conveyed and hoisted, through the hoisting shaft to the surface for overland conveying to the crushed ore stockpiles.

The E48 block cave project where development is finished for 96% has been put on hold by Rio Tinto due to the economic recession. This was a great opportunity for us to see every bit of development of a block caving method. E48 has pre-mining reserves of approximately 63,4 Mt at grade 0.85% copper and 0.34 g/t gold. The company also applied some new technologies in the development of E48; post undercut and preconditioning. Also little improvements are made, for example the blocks in the corner of the dump.

Crushed Ore Handling:

There are two coarse ore stockpiles receiving coarse material from the surface and underground crushers. The total capacity of each stockpile is 100,000t. Crushed ore is reclaimed by four vibrating feeders from each stockpile.

Grinding:

The grinding circuit is comprised of two separate modules, each incorporating Semi Autogenous Grinding (SAG), two stages of ball milling and flash flotation.

Flotation:

Flotation takes place in two distinct modules, each linked to its own grinding circuit. The flotation process aims to float a sulphide concentrate to recover the major copper and gold bearing minerals.

The final concentrate produced for each module assays 36-40 per cent copper and is pumped to a concentrate thickener. Final tailing from each module is pumped to a common tails thickener for dewatering.

Concentrate Thickening and Filtration:

Final concentrate from the flotation circuits is pumped to thickeners where it is thickened to an average underflow density of 60 per cent solids. Thickened concentrate is then pumped to concentrate storage tanks prior to treatment through the filtration circuit, using ceramic disc filters.

The filtered concentrate is discharged onto slow moving conveyor belts, each equipped with a weightometer to determine final production of concentrate.

Concentrate Handling:

Concentrate is removed from the storage bays using a Caterpillar front-end loader, which loads concentrate into shipping containers carried on a semi-trailer. The containers are sealed and trucked to the Goonumbla rail siding 12km from the concentrator. The full containers are loaded onto trains with the carrying capacity of each train being 60 containers of concentrate. Concentrate is currently railed to the Port Kembla for shipping to overseas customers.

Tailings Disposal:

Three sets of slurry pumps pump the thickened underflow tailings to either of the two tailings dams. Two pipelines are used to transport the tailings to the dam, 2 km away from the plant. Tailings Dam 1 has an area of 141 ha and Tailings Dam 2 at 137 ha. Wall construction is via rock and clay upstream method.

Water is recovered from the tailings dam back to the plant.

Simtars

Simtars was founded in 1975 after a mine disaster in Queensland where thirteen miners were killed. Simtars stands for Safety in Mines Testing and Research Station. It is a company which looks after safety in mines. The company has different research subjects, such as spontaneous combustion and environmental monitoring. Simtars also provides On-Site -and Personal monitoring. The company has an eighty-five percent market share in Queensland and has clients in over twenty countries.

Simtars is a non-profit organization, which is partly supported by the Australian Government (Department of Mines and Energy); seventy percent of the income is through companies. Offices are in McKay and in Redbank, with a workforce of ten and eighty respectively.

The company has four different centres all related to the company's research in different areas:

- Occupational Hygiene, Environment and Chemistry Centre (OHECC)

this centre provides services in health, hygiene, safety and environmental management. Mine-gas monitoring and laboratory analysis are also provided.

- Engineering, Testing and Certification Centre (ETCC)

This division is allowed to certifi other laboratories. It does specialized testing and calibration services for electrical and mechanical equipment as well.

- Mining Research and Development Centre (MRDC)

Mine safety research is part of this centre; it also applies new safety technologies in the industry.

- Safety Training Centre (STC)

This centre focuses mainly focused on giving courses and seminars and safety trainings to other companies on site or at their own training facilities.

The OHECC is specifically involved in the sampling and analysis of contaminants associated with mining operations such as air quality, dust, chemicals and noise.

In the ETCC the company provides electrical and mechanical testing. As well as combustible dust testing for dust clouds and dust layers. With those tests the explosion indices can be determined as well as the lower explosible limit and the minimum ignition energy and minimum ignition temperature can be obtained.

The MRDC is investigating the propagation of explosives; the company has a thirty meter tube for testing with the explosive gases. Simtars' MRDC is also doing a lot of research in dust control and spontaneous combustion.

In the STC the company provides training courses on all levels (i.e. operators, inspectors, workers, managers). Additionally the STC provides confined space entry tests in order to improve the safety.

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SME-TMS 2009; Hans de Ruiter, Evert Dolman, Pieter Sturm and Peter Berkhout