ASX ANNOUNCEMENT

20 January 2017

BLACKGOLD ANNOUNCES INDEPENDENT QUALIFIED PERSON'S REPORT

Blackgold International Holdings Limited ("Blackgold") is pleased to announce that an Independent Geological Report ("Report") has been prepared by Al Maynard & Associates Pty Ltd ("AM&A"), an independent mining and geological consultant.

This Report has been conducted in accordance with the December 2012 Australasian Code for Reporting Exploration Results, Mineral Resources and Ore Reserves ("JORC Code 2012 Edition").

The Report covers Blackgold's four coal mining properties in the Chongqing Municipality in the People's Republic of China. As at the effective date (31 July 2016), the Coal Reserves and Resources of Blackgold are summarized as follows:

- Proved Reserves of 62.7 Mt and Probable Reserves of 36.3Mt for a total of 99.0 Mt

- Total Measured and Indicated Resources of 134.3 Mt and Inferred Resources of 39.0 Mt*

*Coal Resources reported are inclusive of the Coal Reserves.

Please refer to the accompanying Report for further details.

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Competent Person's Statement

The information in this report which relates to Exploration Targets, Exploration Results, Mineral Resources or Ore Reserves is based on information compiled by Mr Allen Maynard, who is a Member of the Australian Institute of Geosciences ("AIG"), a Corporate Member of the Australasian Institute of Mining & Metallurgy ("AusIMM") and independent consultant to the Company. Mr Maynard is the Director and principal geologist of Al Maynard & Associates Pty Ltd and has over 35 years of exploration and mining experience in a variety of mineral deposit styles. Mr Maynard has sufficient experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the "Australasian Code for reporting of Exploration Results, Exploration Targets, Mineral Resources and Ore Reserves" (JORC Code). Mr Maynard consents to inclusion in the report of the matters based on this information in the form and context in which it appears.

The information in this report which relates to Exploration Targets, Exploration Results, Mineral Resources or Ore Reserves is based on information compiled by Mr Brian Varndell, who is a Fellow of the Australasian Institute of Mining and Metallurgy and independent consultant to the Company. Mr Varndell is an associate of Al Maynard & Associate Pty Ltd and has over 40 years of exploration and mining experience in a variety of mineral deposit styles including iron ore mineralisation. Mr Varndell has sufficient experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the "Australasian Code for reporting of Exploration Results, Exploration Targets, Mineral Resources and Ore Reserves" (JORC Code). Mr Varndell consents to inclusion in the report of the matters based on this information in the form and context in which it appears.

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Disclaimer

Certain statements included in this announcement constitute forward-looking information. This information is based upon a number of estimates and assumptions made by the Company in light of its experience, current conditions and expectations of future developments, as well as other factors that the Company believes are appropriate in the circumstances. While these estimates and assumptions are considered reasonable, they are inherently subject to business, economic, competitive, political and social uncertainties and contingencies. Many factors could cause the Company's actual results to differ materially from those expressed or implied in any forward-looking information provided by the Company, or on behalf of, the Company. Such factors include, among other things, risks relating to additional funding requirements, commodity prices, exploration, acquisition, development and operating risks, competition, production risks, regulatory restrictions, including environmental regulation and liability and potential title disputes. Forward-looking information is no guarantee of future performance and, accordingly, investors are cautioned not to put undue reliance on forward-looking information due to the inherent uncertainty therein. Forward-looking information is made as at the date of this announcement and the Company disclaims any intent or obligation to update publicly such forward-looking information, whether as a result of new information, future events or results or otherwise, other than as required by law.

About Blackgold

Blackgold International Holdings Limited (ASX Code: BGG) is a Chongqing, China-based producer of high value thermal coal. Blackgold was listed on ASX on 22 February 2011.

Blackgold currently operates four existing underground thermal coal mines, the Caotang Mine and the Heiwan Mine in Fengjie County, Chongqing in the PRC, the Baolong Mine in Wushan County, Chongqing in the PRC and the Changhong Mine in the area bordering Xishui County of Guizhou and Qijiang County of Chongqing in the PRC.

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Australian & International Exploration & Evaluation of Mineral Properties

Independent Geological Report

for a

Resource and Reserve Update Reported in Accordance with the JORC Code (2012)

Prepared for

BLACKGOLD INTERNATIONAL HOLDINGS LIMITED

Authors: Brian J Varndell BSc BSc(Spec.Hons.), FAusIMM
Phil Jones BAppSc(AppGeol), MAIG, MAusIMM
Peer Review: Allen J Maynard, BAppSc(Geol), MAIG, MAusIMM
Company: Al Maynard & Associates Pty Ltd

Date: 18th January, 2017

EXECUTIVE SUMMARY

Blackgold International Holdings Limited ("Blackgold" or "BGG") has been a public listed company on the Australian Securities Exchange since February 2011. Its current organisation structure is shown in Figure 1. Through its subsidiaries, BGG owns a 100% interest in four coal mines located near Chongqing City, People's Republic of China. The BGG head office is located in downtown Chongqing City and the Company has subsidiary offices in Fengjie County and Qijiang District, all in Chongqing Special Economic Zone in the People's Republic of China (Figure 2 and Figure 3). BGG requested Al Maynard & Associates ("AM&A") to update the Resources and Reserves at its four coal mines reported in accordance with the JORC Code guidelines.

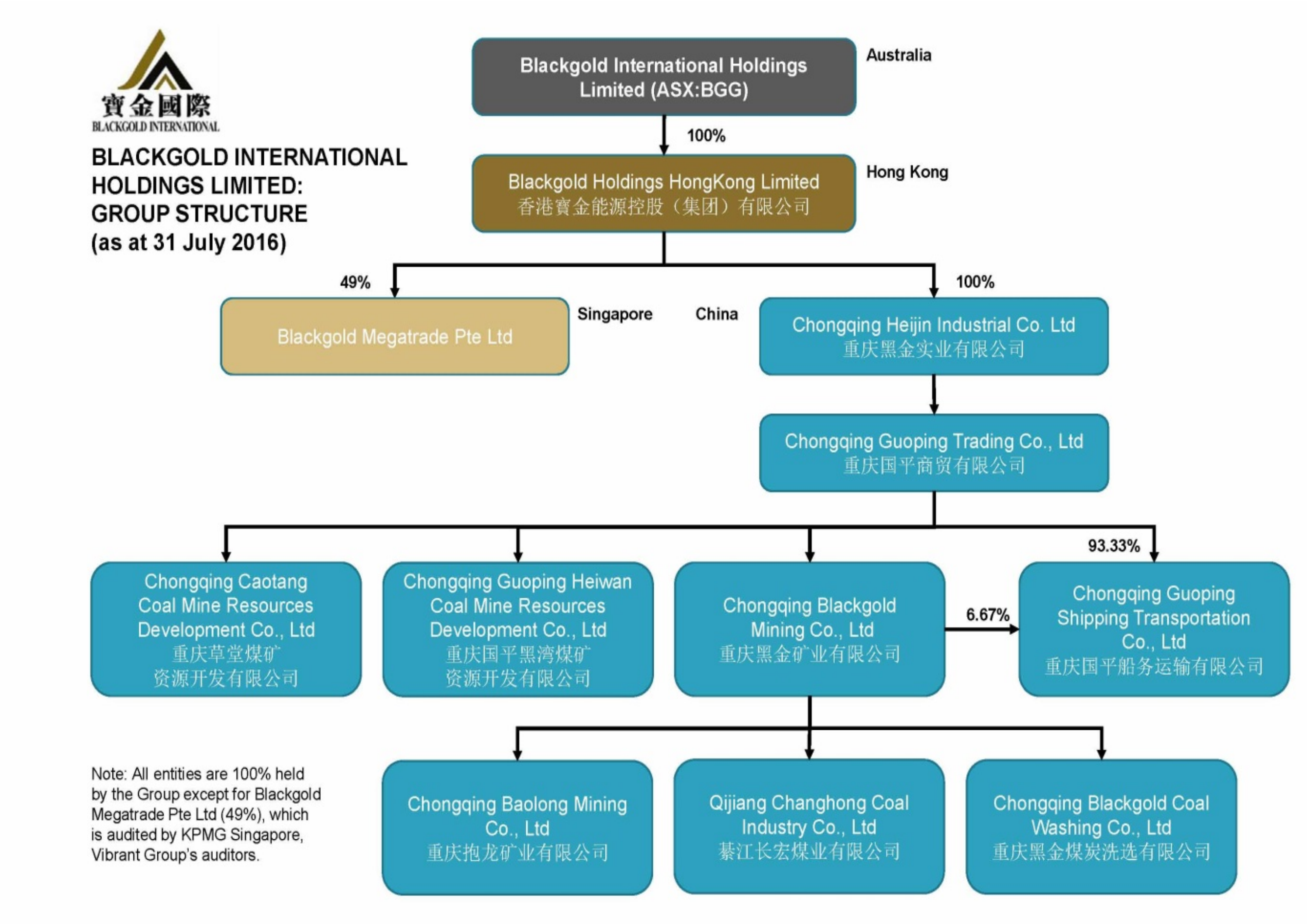

Figure 1: Blackgold Organisation structure.

BGG's primary assets are within the Chongqing Special Economic Zone, with the two operating underground coal mines in Fengjie County in the north-east and one other coal mine with production voluntarily suspended in Qijiang District to the south and one developing underground coal mine in Wushan County in the north-east (Figure 3). The four mines are:

- Caotang Coal Mine, in production, Fengjie County
- Heiwan Coal Mine, in production, Fengjie County
- Baolong Coal Mine, developing in Wushan County
- Changhong Coal Mine, in suspension, Qijiang District

Caotang and Heiwan mines are located within the Late Triassic coal measures while Baolong and Changhong mines occur within the Permian coal measures.

BGG produced approximately 1.78 Mt of raw coal since 1 May 2015, the date of the last reported Resource/Reserve update, to 31 July, 2016 from the Caotang and Heiwan mines.

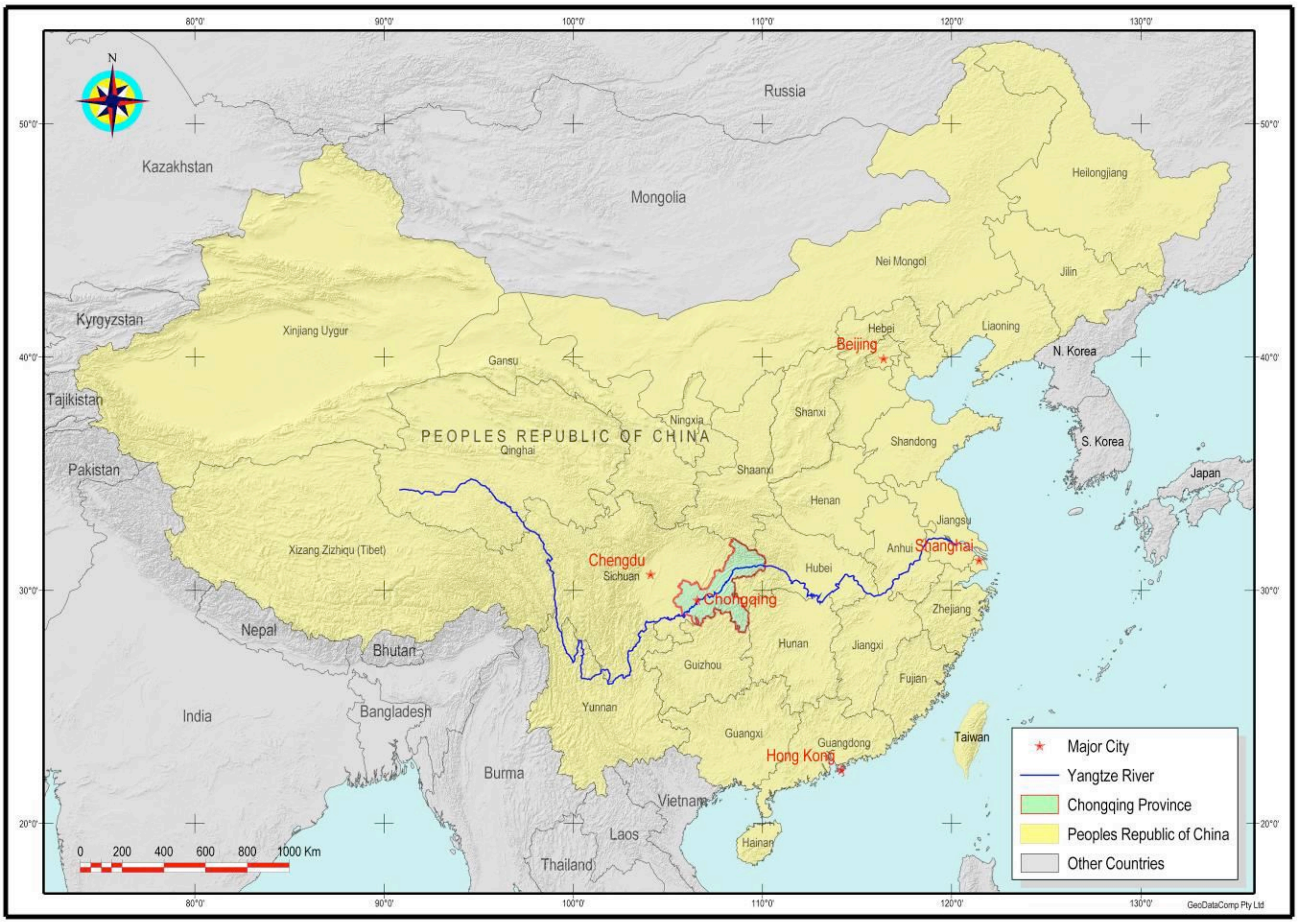

Figure 2: Blackgold Mines Location Plan.

AM&A estimated resources, as summarised in Table 1, for all the Company's projects using the latest mining and sampling data as at July, 31, 2016.

Mine	Reserves		Resources	Exploration Target*	
	Proved (Mt)	Probable (Mt)	Inferred (Mt)	(Mt) to	(Mt) from
Baolong	29.10	26.1	29.3	8.6	6.9
Caotang	18.62	3.1	0.0	6.6	5.3
Changhong	11.89	6.8	9.7	6.8	5.5
Heiwan	3.13	0.4	0.0	1.7	1.4
Total	62.74	36.3	39.0	23.7	19.0

Table 1: Summary of Blackgold Coal Reserves, Resources and Exploration Targets (31 July, 2016).

*Note that an Exploration Target estimate is only conceptual in nature as it is estimated without sufficient verifiable accurate data for a reliable resource estimate and so it cannot be assumed that any part of an Exploration Target estimate will eventually be converted to a resource after further exploration. Future early exploration devoted to conversion of these targets is not envisaged due to the current substantial life of mine available.

These anthracitic coal resources are Thermal Coals with a generally high ash content and at Changhong also a high sulphur content.

Mine	Moisture Mad (%)	Ash Content Ad (%)	Volatiles Vd (%)	Fixed Carbon Fcd (%)	Sulphur Std (%)	Calorific Value (Kcal/kg)	Thickness (m)
Baolong	0.5	28.3	6.8	63.3	0.6	5,515	1.8
Caotang	0.7	34.7	7.2	57.9	0.7	4,910	1.6
Changhong	0.5	18.6	9.0	68.5	2.6	6,863	8.9
Heiwan	0.8	26.3	6.9	65.8	0.7	5,660	0.7
Average	0.6	27.2	7.3	63.6	1.1	5,704	3.2

Table 2: Estimated Coal Qualities (Proximal Analyses) for the Resources.

Mine	Moisture Mad (%)		Ash Content Ad (%)		Volatiles Vd (%)		Fixed Carbon Fcd (%)		Sulphur Std (%)		Calorific Value (Kcal/kg)		Thickness m	
	From	To	From	To	From	To	From	To	From	To	From	To	From	To
Baolong	0.4	0.6	28.0	28.5	6.3	7.3	62.8	63.8	0.5	0.7	5,200	5,800	1.6	2.0
Caotang	0.6	0.8	34.2	35.2	6.7	7.7	57.4	58.4	0.6	0.8	4,600	5,200	1.4	1.8
Changhong	0.4	0.6	18.1	19.1	8.5	9.5	68.0	69.0	2.4	2.8	6,500	7,100	8.4	9.4
Heiwan	0.7	0.9	25.8	26.8	6.4	7.4	65.3	66.3	0.6	0.8	5,400	6,000	0.6	0.8
Total	**0.5**	**0.7**	**26.7**	**27.7**	**6.8**	**7.8**	**63.1**	**64.1**	**1.0**	**1.2**	**5,400**	**6,000**	**3.0**	**3.4**

Table 3: Blackgold Mines Exploration Targets Quality Parameters Ranges in Value.

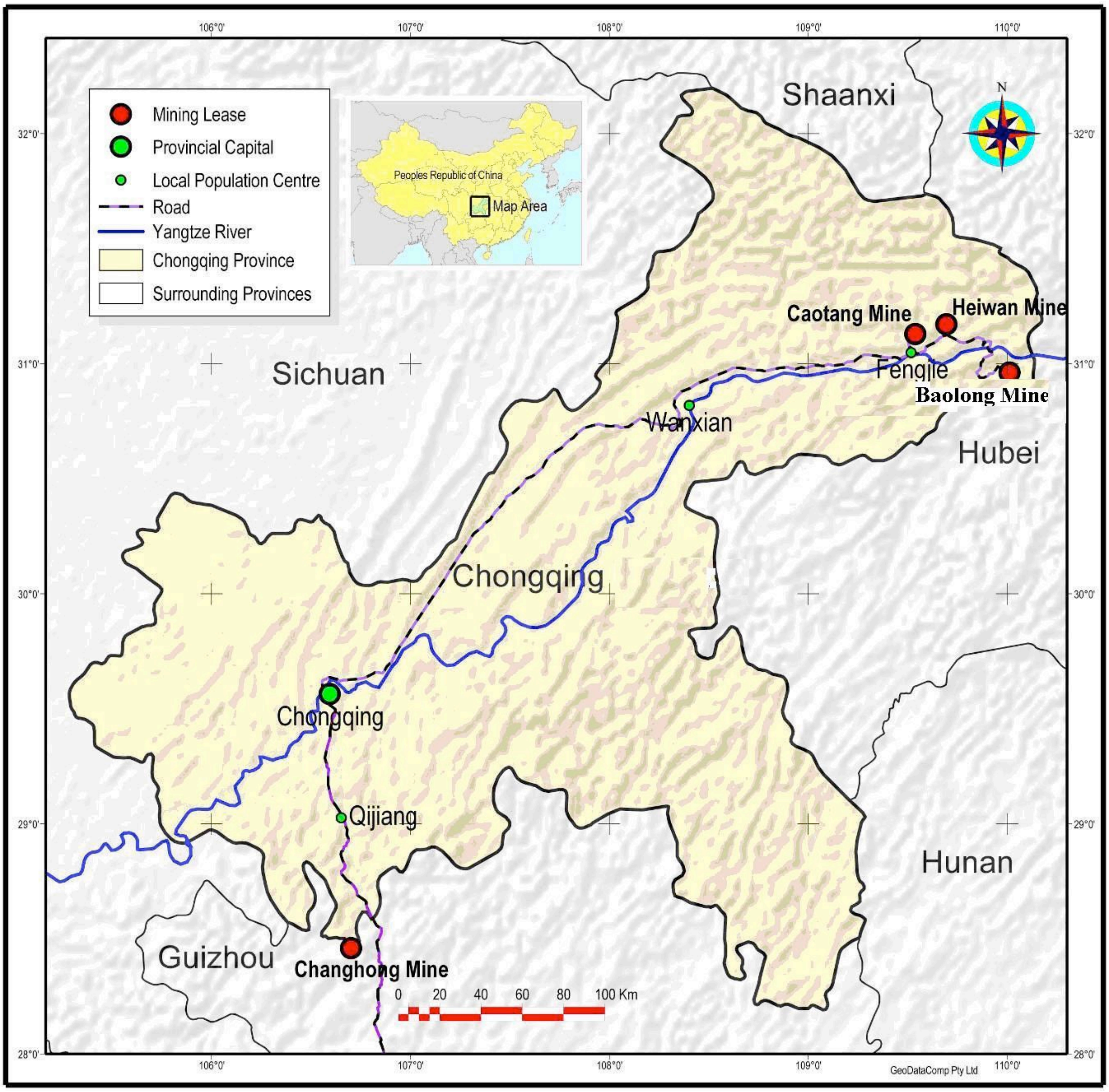

Figure 3: Blackgold Mines Location Map.

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The Directors, 18th January, 2017
Blackgold International Holdings Limited,
Level 12, No. 18 Mian Hua Street,
Yuzhong District,
Chongqing City, 400011
People's Republic of China.

Dear Sirs, **Resources and Reserves Update at 31st July, 2016**

Al Maynard and Associates ("AM&A") was engaged by Blackgold International Holdings Limited ("BGG") to prepare an updated Report on the Resources and Reserves reported in accordance with the JORC Code (2012) for their four coal mines located near Chongqing City, People's Republic of China (Figure 1). Opinions are presented in accordance with the JORC Code (2012) and other regulations and guidelines that govern the preparation of such reports.

This report is not a Valuation Report and does not express an opinion as to the value of the mineral assets or tenements involved, nor to the fairness and reasonableness of any transactions between BGG and any other party.

This report is to be used by BGG for ASX and other reporting requirements at their discretion.

The legal status of the tenure of the BGG Mineral Assets, is subject to a separate Solicitor's Report from Grandall Law Firm (Shanghai), titled "LEGAL DUE DILIGENCE OPINION" With respect to The Subsidiaries (within the PRC) of Blackgold International Holdings Limited. The present status of tenements listed in this report is based on information provided by BGG and the report has been prepared on the assumption that the tenements will have lawful access for evaluation and development.

In the course of the preparation of this report, access has been provided to all relevant data held by BGG and various other technical reports and information quoted in the bibliography. We have made all reasonable endeavours to verify the accuracy and relevance of the database. However, where discrepancies arise and no alternative comments are provided, data and interpretations provided by BGG have been used in this Report. The past exploration history for these tenements has been derived from previous exploration reports, as provided by BGG and Government records of exploration activities within the project areas.

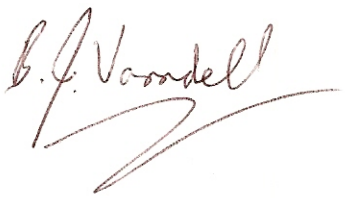
BGG has warranted to AM&A that full disclosure has been made of all material in its possession and that information provided, is to the best of its knowledge, accurate and true. None of the information provided by BGG has been specified as being confidential and not to be disclosed in our report. A recent site trip was undertaken by Brian Varndell from 18th September to 22nd September 2016 to update knowledge of all operations. As recommended by the Valmin Code, BGG has indemnified AM&A for any liability that may arise from AM&A's reliance on information provided by or not provided by BGG.

This report was prepared by geologist, Brian J. Varndell, BSc (SpecHonsGeol), FAusIMM (No 111022) with resource estimation by Phil Jones BAppSc (AppGeol), AusIMM (#1903) and MAIG (#105653) and subjected to peer review by Allen J. Maynard BAppSc(Geol), MAIG, MAusIMM. The writers are qualified to provide such reports for the purpose of inclusion in public company documents. This report has been prepared in accordance with the relevant requirements of the Listing Rules of the Australian Securities Exchange Limited, Australian Securities and Investment Commission ("ASIC") Regulatory Guidelines 111 & 112 and the Guidelines for Assessment and Valuation of Mineral Assets and Mineral Securities for Independent Expert reports (the Valmin Code) which is binding on Members of the Australasian Institute of Mining and Metallurgy ("AusIMM") and the Australian Institute of Geoscientists (AIG").

AM&A is an independent geological consultancy established 25 years ago and has operated continuously since then. Neither AM&A nor any of its directors, employees or associates have any material interest either direct, indirect or contingent in BGG nor in any of the mineral properties included in this report nor in any other asset of BGG nor has such interest existed in the past. This report has been prepared by AM&A strictly in the role of an independent expert. Professional fees payable for the preparation of this report constitutes our only commercial interest in BGG. Payment of fees is in no way contingent upon the conclusions of these documents.

AM&A has given, and has not withdrawn its written consent to being named author of this Report and to the inclusion of this Report in other documents to be issued by BGG.

Yours faithfully,



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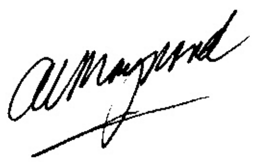
Phil Jones, BAppSc (AppGeol), MAIG, MAusIMM.



Allen J. Maynard BAppSc(Geol), MAIG, MAusIMM

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DISCLAIMER

The opinions expressed in this Report have been based on the information supplied to AM&A by BGG. The opinions in this Report are provided in response to a specific request from BGG to do so. AM&A has exercised all due care in reviewing the supplied information. Whereas AM&A has compared key-data supplied, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. AM&A does not accept responsibility for any errors or omissions in the supplied information and not accept any consequential liability arising from commercial decisions and actions resulting from them.

INTRODUCTION

Blackgold's primary assets are two operating underground coal mines in Fengjie County, one underground coal mine with production voluntarily suspended in Qijiang District and one developing underground coal mine in Wushan County, all in the Chongqing Special Economic Zone (Figure 3). The four mines are:

Caotang Coal Mine, in production, Fengjie County
Heiwan Coal Mine, in production, Fengjie County
Baolong Coal Mine, developing in Wushan County
Changhong Coal Mine, in suspension, Qijiang District

The physical and chemical characteristics of Blackgold's coals are categorized as anthracite coal with dry volatile matter contents ranging from 1% to 10%, as defined by the State Standard of China Coal Classification System (GB5751-86) and ASTM. The data indicates that the vast majority of the Company's coal is suitable for the thermal energy market and some of it is suitable for use in Pulverized Coal Injection (PCI) systems. The dry ash contents of most of the Company's coals indicate that beneficiation (coal washing) will be required prior to facilitate utilisation in some instances.

Tenure

The Company has 100% ownership of all the four mining licences. A summary of the tenure details is provided in Table 4.

Permits	Current Holder	Permit Number	Date Granted	Date Expires	Area (km2)
Mining	Caotang	C5000002009041130019437	27-Dec-13	27-Dec-16*	9.10
	Heiwan	C5000002009041130019439	05-Apr-16	30-Dec-17	3.34
	Baolong	C5000002009041130020052	23-Jul-14	21-Sep-17	2.87
	Changhong	C5000002009041130018279	29-Oct-15	31-Jan-18	0.77
Exploration	Baolong	T50120090301025873	22-Mar-15	22-Mar-17	23.12

Table 4: Summary of Blackgold's Mining Licences.

* Blackgold is in the process of renewing this license.

AM&A has not attempted to establish the legal status of the tenements within the Project area with respect to potential environmental and access restrictions. The mining licences all cover sufficient area to permit the mining of all the coal resources described in this Report and also provide sufficient area for the entire surface infrastructure including waste dumps necessary for the current and projected mining operations.
It has been noted that the following taxes and levies are applicable to the Mines (Table 5):

Items	Amount
ROM Coal Weighing Charges	16.3RMB/tonne
Road Construction Tax	5% of VAT
Education Tax	3% of VAT
Local Education Tax	2% of VAT
Resource Tax	3% of revenue from coal (exclude any re-charge on transportation costs)
Stamp duty	Annually 0.03% of sales contract
Value Added Tax	17.00% of gross revenue
Corporate Income Tax	For Caotang and Heiwan: 2.5% of gross revenue (valid for a year, to be approved on a yearly basis); For Baolong and Changhong: standard tax rate of 25% on profit before tax

Table 5: Summary of taxes and levies applicable to the Company mines

Environmental Liabilities

Information to date is that there are no identified existing material environmental liabilities on the mineral assets. Blackgold provides for restoration and environmental costs based on their past experiences and estimation of future expenditures, taking into account existing relevant China laws and regulations. As at the date of this report, the provisions have been adequately provided in the books of Blackgold. Accordingly, no adjustment was made during this Report for environmental implications.

Permits Required

To the extent known, the Company confirms the validity of the following Safety permits that must be acquired to conduct the work proposed for the properties (Table 6):

Permits	Current Holder	Permit Number	Date Granted	Date Expires
Safety Production	Caotang	(Yu)MK Safe Permit No. (2015)1501008	15-May-15	14-May-18
	Heiwan	(Yu)MK Safe Permit No. (2015)1501006	13-Mar-15	12-Mar-18
	Changhong	(Yu)MK Safe Permit No. (2014)1410018	24-Nov-14	23-Nov-17

Table 6: Safety permits required for Company's mines to maintain mining operations.

Other Relevant Information

To the extent known, the Company confirms the following relevant and material information for the operation of the projects:

- There are no records of public opposition to the operations of the mines. As such, the community presents no identified risk to the continuity of operations.
- There was no record of any non-governmental organisation impact on sustainability of mineral and/or exploration projects.

LOCATION AND ACCESS

Caotang Coal Mine is located 10 km north of the township of Fengjie County within the municipality of Chongqing City. The coal field covers a total area of 9.10 km^2. Coal mining is permitted between 300 m and 970 m elevation. The main portal is at an elevation of 435 m in the foothills of mountainous countryside. It is 14 km north-northeast of Fengjie County town, approximately 33 km by road from the town centre and approximately 25 km from the port on the Yangtze River. The corners of the mining permit area extend from longitude 109°31′00″ to 109°34′09″E and latitude 31°06′47″ to 31°09′45″N. The coordinates of the major adit portal are 109°31′27″E and 31°08′15″N at an elevation of 435.13 m.

The coal field infrastructure is reasonable with a total travelling distance by road of approximately 20 km between the coalfield to the coal loading wharf at Bei Di Town on the Yangtze River. The coal field is administered by Bei Di Town and Fen He Town.

The current mine layout consists of three production portals joined to form a single production system as was required per Government consolidation requirements.

Heiwan Coal Mine is located 26 km north of the new township of Feng Jie County within the municipality of Chongqing City. The coal field covers a total area of 3.25 km^2. Coal mining is permitted between 1,300 m to 1,050 m elevation.

The coal field infrastructure is reasonable with a total traveling distance of approximately 30 km between the coal field to the coal loading wharf at Feng Jie County on the Yangtze River. The coal field is administered by Bei Di Town and Fen He Town.

Baolong Coal Mine, is currently being developed with coal production planned to commence in Q2, 2017. The mine is located 17 km southeast of Wu Shan County township within the municipality of Chongqing City.

The coal field infrastructure is reasonable with 80 km of asphalt roads connecting to Wu Shan County, and 70 km of asphalt roads to Jian Shi County. The coal wharf is located at Pu Tao Dam on the Yangtze Jiang River from where the coal can be transported to Yichang, Wuhan, Shanghai, Wanzhou and Chongqing. The coal field is administered by Bao Long Town Wu Shan County.

Changhong Mine is located 108 km south of the provincial capital Chongqing, a distance that can be covered in 2 hours by vehicle, bordering Xishui County in Guizhou and Qijiang District in Chongqing. The Mine is approximately 62 km southeast of Qijiang town and 18 km from the nearest railway station. The mining permit allows mining between elevations between 800 m and 1,350 m and covers a total area of 0.7719 km^2.

The coal field is administered by Wanlong Village, Shihao Town. The main adit coordinates are 106°42′14″E and 28°27′47″N. There is a 3.0 km gravel access road to the secondary bitumen road that links to Shihao Town, Qijiang County 28 km to the north and Xianyuan Town in Guizhou to the south. Shihao County serves as a coal transportation hub with the cross provincial highway and railway passing through it.

Changhong Coal Mine has been established by integrating three existing coal mines, Changhong Coal Mine, Shanshuwan Coal Mine and Jixing Coal Mine. The mine is bordered by the Nanniwan Coal Mine to the west and Zhanghegou Coal Mine to the north-east. The mining tenement boundary was delineated by the Land Administration Bureau of Chongqing City which has confirmed that there is no disputed illegal encroachment of adjacent coal mines by the Changhong Coal Mine.

Access to the mine is currently through two adits with two other adits for ventilation. To increase the output capacity of the Changhong Coal Mine, another 600 m long adit was recently completed and is ready for operations although not currently in production.

Climate
Chongqing Province is located within a moist subtropical monsoon climate zone with four distinct seasons. The mean annual temperature is 18.4°C with a minimum of -7°C during December to January and maximum of 42°C during July to August.

The region has an average annual precipitation of 1050-1400 mm increasing in the higher elevations and mostly occurring during the monsoonal wet season from May to September. Landslides on steeper slopes occasionally cause problems during the monsoon season. The dry period extends between December and February.

Winds tend from the northeast to north with the windiest period between May and June.

Seismicity
Much of China lies within high seismic hazard zones however the Company's projects all lie within a low hazard zone, Figure 4. In eastern Chongqing the nearby Qi Yao Shan fault line is relatively inactive with only six, low intensity earthquakes recorded since 1327. The relevant seismic bureaus rate the rocks in the area as having a low velocity response and consequently there is only a low risk of property damage by earthquakes. The same rating has been applied to the Changhong Mine area.

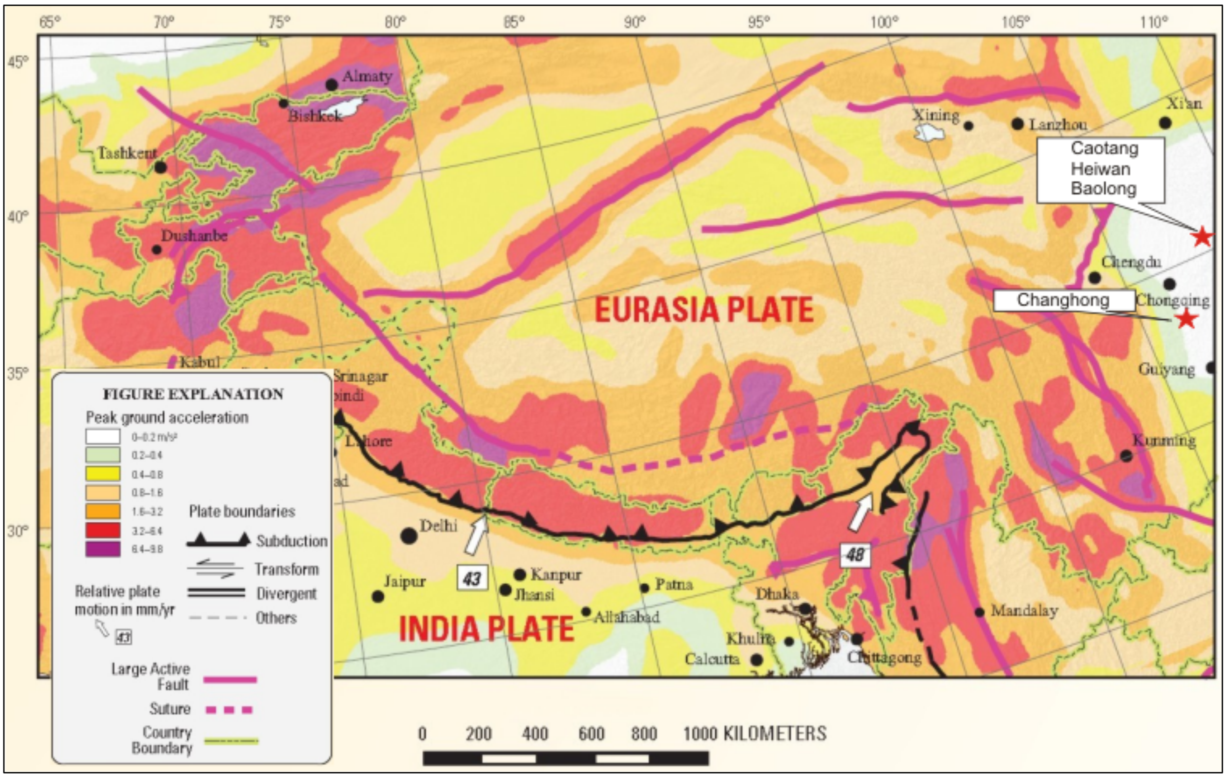


Figure 4: Seismic hazard map of Central Asia.
USGS, 2015

GEOLOGY
Coal Qualities and Characteristics

Coal originates from ancient accumulations of dead tropical and subtropical plants that have undergone physical and chemical alteration after settling in swampy areas, first forming peat which after becoming buried below further sediments, with increased heat and pressure, transforms into coal. In general, increasing burial pressure and heat increases the quality of the coal produced. This process takes several millions of years.

There are four general coal types of increasing quality; peat, lignite, bituminous and anthracite. Higher-ranking coal is denser, contains less moisture and volatile gases and has a higher heat value than lower-ranking coals.

The coal mined at the Company's mines is categorised as anthracite which is mostly sold into the low rank thermal market, Figure 5.

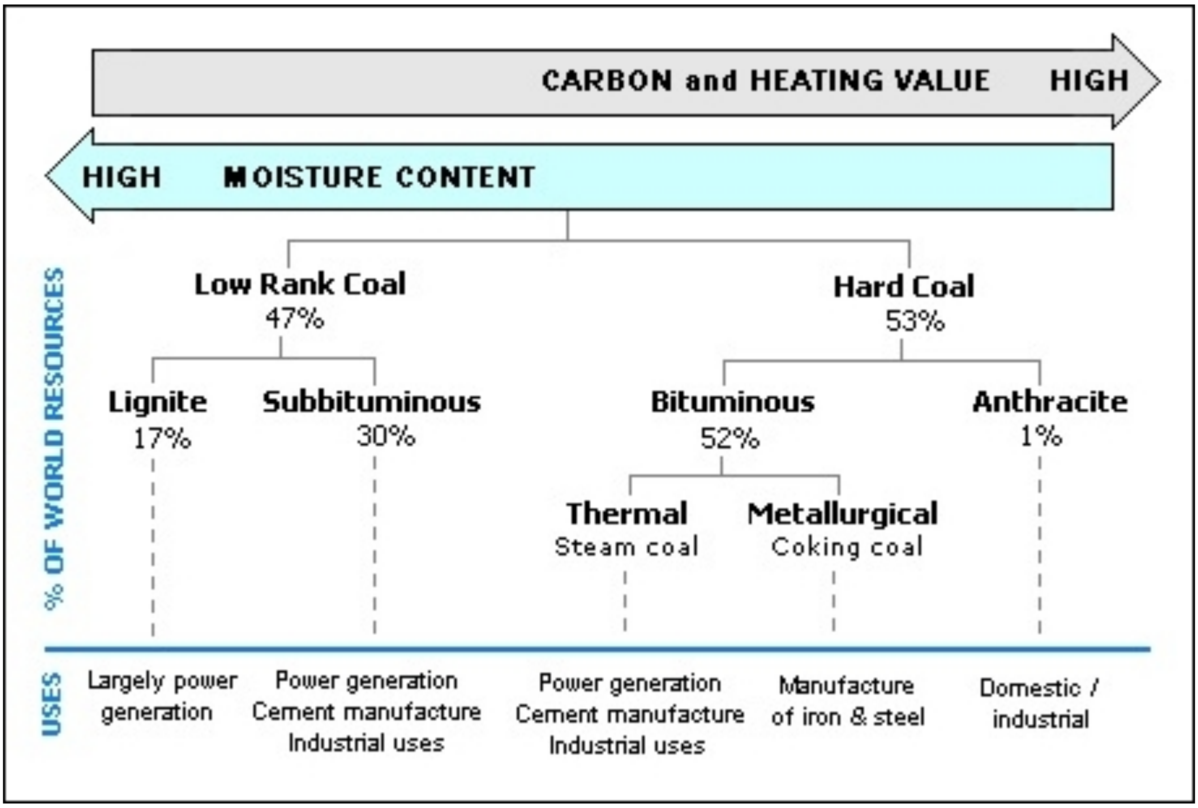


Figure 5: Typical uses and the estimated percentage of the world's coal reserves.
(Source: World Coal Institute)

Thermal Coals

Low rank thermal coals are mainly used to generate heat to produce steam in power plants with high ranking coals used domestically for heating and cooking. The best thermal coals have a low ash content and high calorific value with low contaminant levels, mainly sulphur. Normally in China the total sulphur content of thermal coals is below 2.5% since high sulphur coals, once burnt, produce noxious and highly corrosive gases.

The coal seams at Caotang, Heiwan and Baolong are low in sulphur however the Changhong coals, averaging 2.63% S are classified as high sulphur content coals. A summary of each coal seam characteristics is reported in Table 7.

Caotang Seam	Moisture %	Ash %	Volatile %	Fixed Carbon %	Sulphur %	Calorific Value %	Seam Thickness Metres
K1	0.7	36.5	7.2	55.7	0.8	4,696	2.0
K2	0.8	32.0	7.1	60.9	0.7	5,278	1.0
Total	0.7	34.8	7.2	57.6	0.8	4,911	1.6

Changhong Seam	Moisture %	Ash %	Volatile %	Fixed Carbon %	Sulphur %	Calorific Value %	Seam Thickness Metres
M5	0.5	19.4	9.2	70.8	2.5	7,101	3.8
M6	0.5	18.5	8.7	72.3	2.7	6,535	13.0
M7	0.5	17.9	9.0	56.0	2.5	6,945	6.6
M8	0.5	17.8	9.2	72.6	2.6	6,935	10.4
M12	0.6	20.0	9.3	70.5	2.6	7,098	6.3
Total	**0.5**	**18.6**	**9.0**	**68.5**	**2.6**	**6,863**	**8.9**

Heiwan Seam	Moisture %	Ash %	Volatile %	Fixed Carbon %	Sulphur %	Calorific Value %	Seam Thickness Metres
K1	0.7	25.5	6.7	66.6	1.0	5,702	0.9
K2	0.9	26.2	7.2	65.7	0.4	5,726	0.5
K3	0.7	31.0	7.0	61.4	0.6	5,210	0.5
Total	**0.8**	**26.2**	**6.9**	**65.8**	**0.8**	**5,667**	**0.7**

Baolong Seam	Moisture %	Ash %	Volatile %	Fixed Carbon %	Sulphur %	Calorific Value %	Seam Thickness Metres
K1	0.5	28.1	6.8	62.8	0.7	5,528	1.9
K2	0.5	28.5	6.9	64.0	0.5	5,495	1.6
Total	**0.5**	**28.3**	**6.8**	**63.3**	**0.6**	**5,515**	**1.8**

Table 7: Summary of BGG coal seam qualities.

According to the Chinese coal classification system all the coal seams are classified as Anthracite, Figure 6.

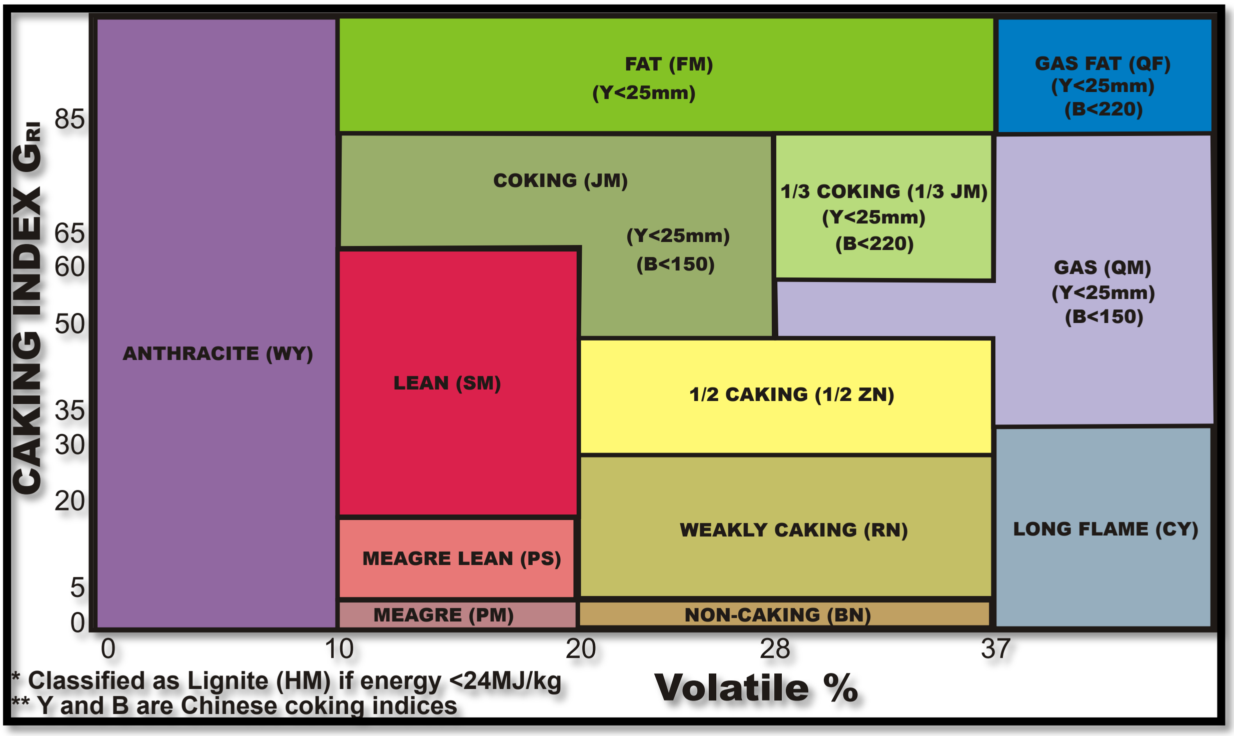


Figure 6: Chinese Coal Classifications.

All the Company's coal is sold as thermal coal for power generation. Where the Company's coal does not meet customer specifications, e.g. the high sulphur content of the Changhong coals, the Company's coal is blended with coal bought from other mines that exceeds the specifications until the blended coal just meets the customer's requirement specifications.

REGIONAL GEOLOGY

The four mines are located within the Yangtze Block (South China Block).

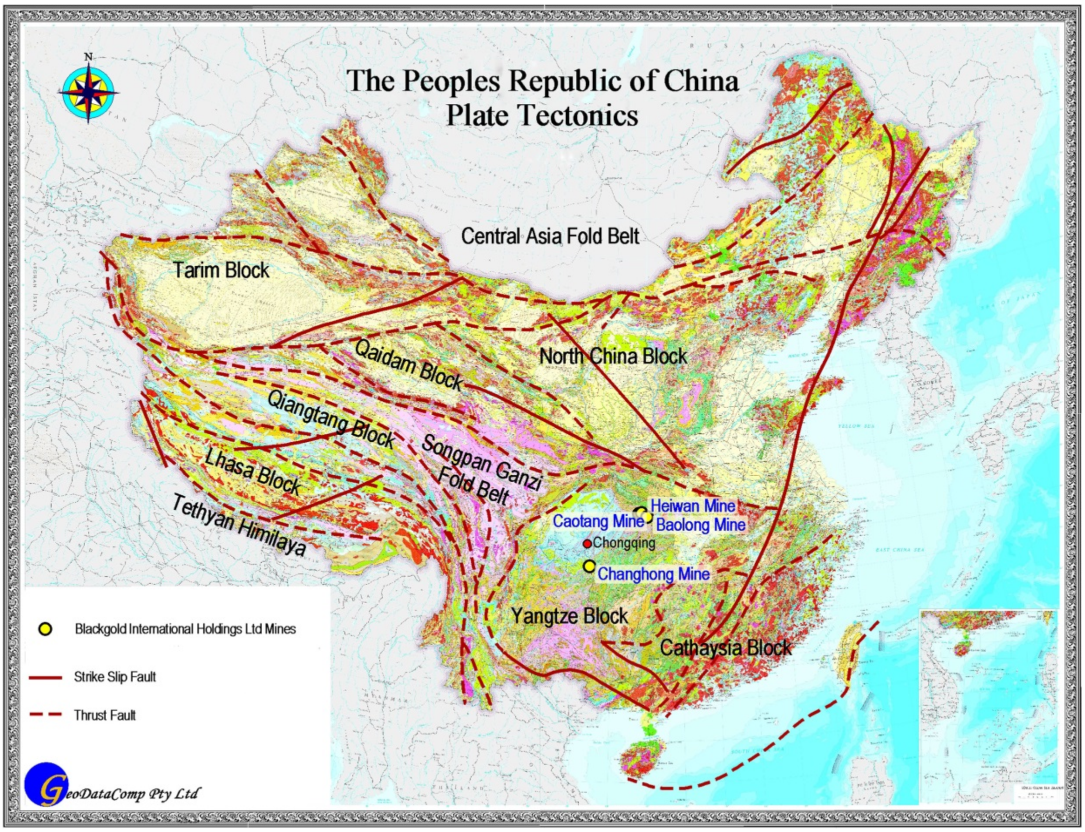


Figure 7: Regional Geological Map of China.

The Yangtze Block contains Archaean and Palaeo-proterozoic high grade crystalline metamorphic rocks, (mainly gneiss, amphibolites, marbles and banded iron formation) overlain by a Palaeozoic and Mesozoic to Cenozoic sedimentary succession (i.e. from greater than 2500 to less than 65 million years old), forming the Yangtze platform. These sediments are gently folded and the stratigraphic relationships between the stratigraphic units are well recorded (Table 8).

Era	Period	Lithology
Cenozoic	Quaternary	Widespread loess deposits
	Tertiary	Un-cemented sands with a 1 m thick gravel base layer
Mesozoic	Cretaceous	Sandy mudstone of continental inland basin and intermontane basin facies
	Jurassic	
	Triassic	
Paleozoic	Permian	Dominated by alluvial sandstones and shales Shanxi, Xiashangshihezi and Shiqianfeng Formation
	Carboniferous	Coal-bearing sandy shales. Benxi and Taiyuan Formations
	Silurian	Metamorphosed sandstone, skate, phyllite and tuff
	Ordovician	Carbonate rocks, limestone and dolomites with clastic rocks at base, total thickness approx. 600m well developed karst
	Cambrian	Mainly massive limestone, well developed karst
Proterozoic		Mainly schist, phyllite, gneiss and conglomerate
Archaean		Crystalline metamorphosed basement, gneiss and migmatite

Table **8**: Stratigraphic Column for the Yangtze Craton. In Guizhou and Guangxi, the Middle Palaeozoic marine clastic and calcareous facies are conformably overlain by Upper Palaeozoic marine calcareous and clastic sediments partly inter-bedded that laterally change to more siliceous facies in certain horizons. The boundary between the Permian and the Triassic in some sections is represented by the gradual change in lithology.

The marine sediments are a result of tectonic subsidence caused by collisions with neighbouring tectonic plates that dominated until the Late Triassic when the sedimentation regionally shifted to fluvial deposition as the basin began to rise from the ocean. The Triassic margin of the Yangtze platform extends in a sigmoidal SW/NE trend from Yunnan through Guizhou.

The post-Triassic gradual rise of the Yangtze platform resulted in erosion of the extensive Proterozoic marine sediments, particularly the limestones, resulting in the characteristic and spectacular karstic topography found throughout Guizhou and Guangxi.

Coal can be found in the Yangtze Platform within many of the terrestrial sediments from the Carboniferous to the Cretaceous. The coal deposits found at the Company's mines that are the subject of this Report are however restricted to flat dipping, 10° to 30°, freshwater continental sediments and sea water deposits in a coastal plain environment from between the Late Permian to Late Triassic.

The sedimentary strata exposed in the Company's four coal mining areas are mainly Permian, Triassic, and Jurassic, Table 9.

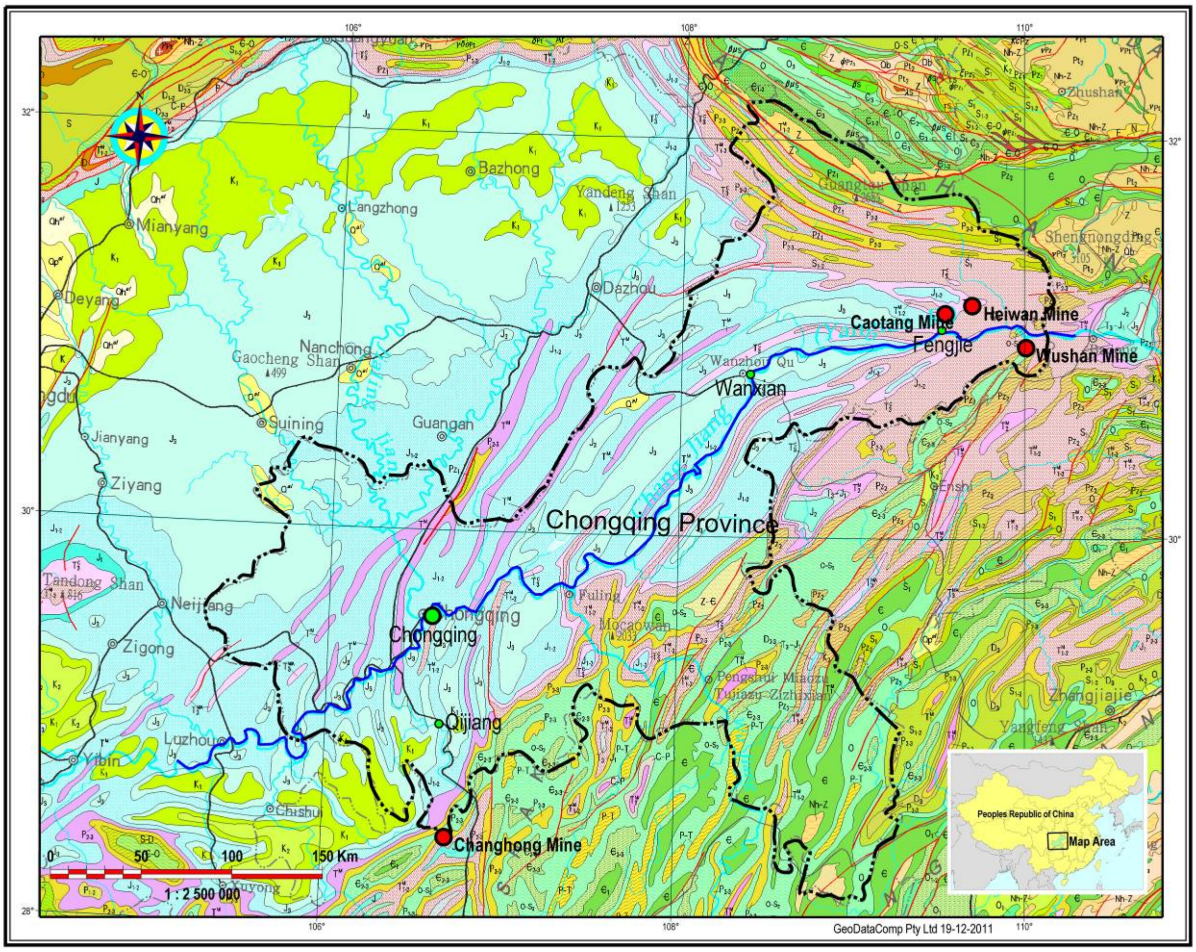
The main coal seams at the Baolong and Changhong Mines are located in the Late Permian Longtan (Wujiaping) Formation.

The Chongqing coal was deposited within a typical continental sedimentary environment during the Late Triassic along the eastern margin of the Sichuan inland lake basin. The sediments in this area include typical pediment alluvial plain, delta plain, and shallow lake deposits.

Jurassic		
		UNCONFORMITY

Triassic		
	Xujiahe Formation (Txj)	
	Badong Formation (T2b)	
	Jialingjiang Formation (T1j)	
	Daye Formation (T1d)	
		UNCONFORMITY
Permian		
	Dalong Formation (P2d)	
	Changxing Formation (P2c)	
	Longtan (Wujiaping) Formation (P2w)	Main Permian coal bearing Formation
	Gufeng Formation (P1g)	
	Maokou Formation (P1m)	
	Qixia Formation (P1q)	
	Liangshan Formation (P1l)	

Table 9: Stratigraphic column for sediments in Project areas.



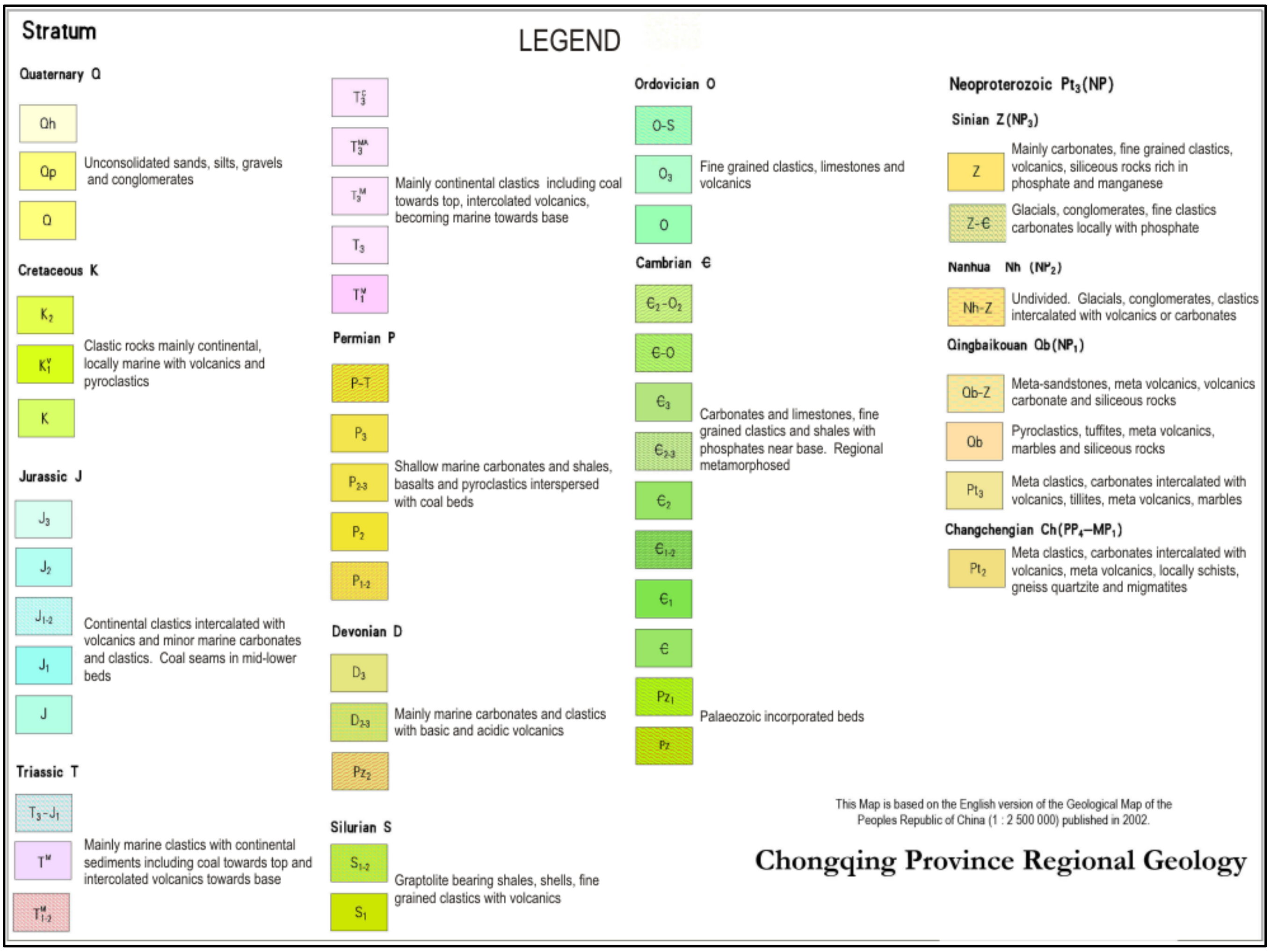


Figure 8: Geological map of Chongqin.

Faulting is common throughout the region and in the coalfields. Approximately 20 of these faults have been delineated in the Blackgold Mine workings showing minor displacements ranging from 0.2 m to 2 m. The sub-vertical dipping faults have two main strike directions: (a) north-south perpendicular to the axial plane of the Qumahe Syncline and (b) east-west parallel to the axial plane of the Qumahe Syncline.

LOCAL GEOLOGY

Caotang Coal Mine

Plate 1: Caotang Pit No1 Portal (L) and Pit No2 Portal (R).

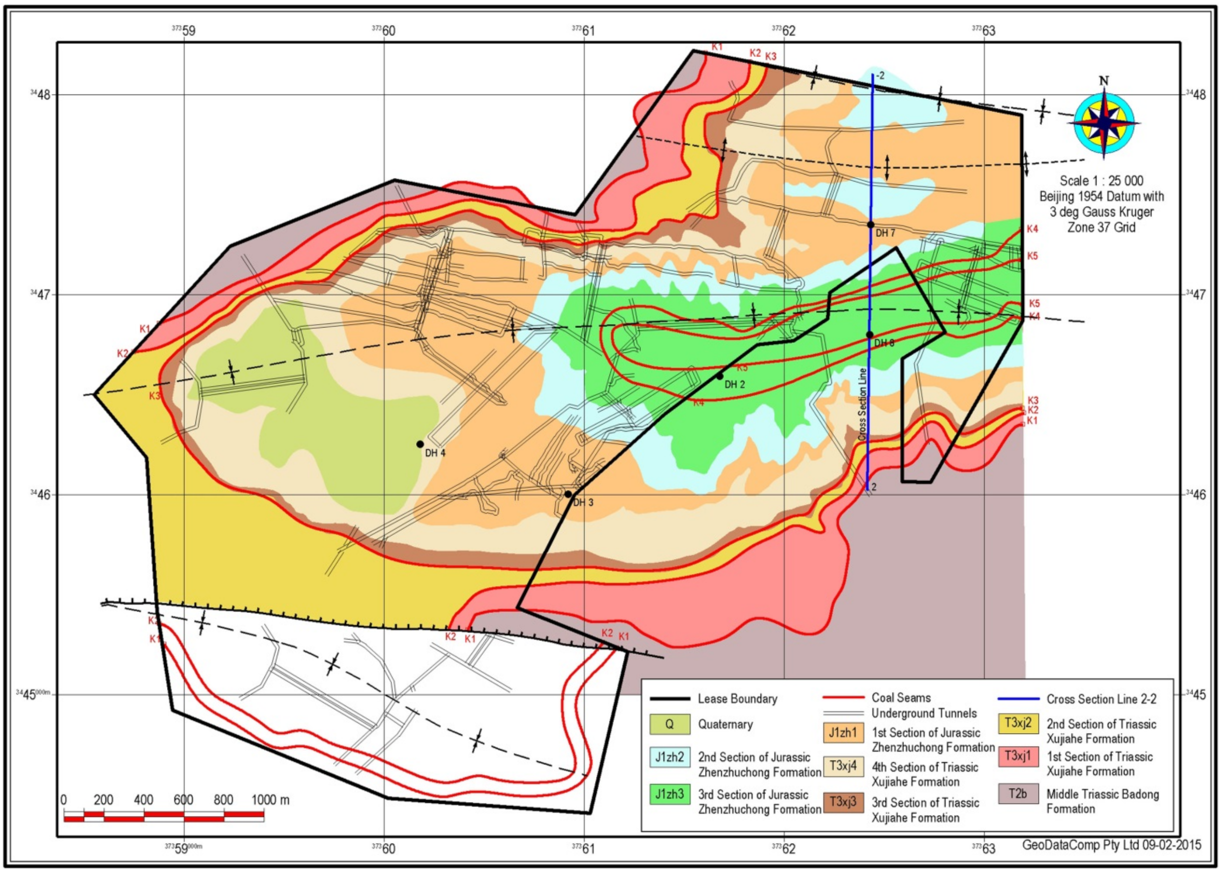


Figure 9: Caotang Mine local geology.

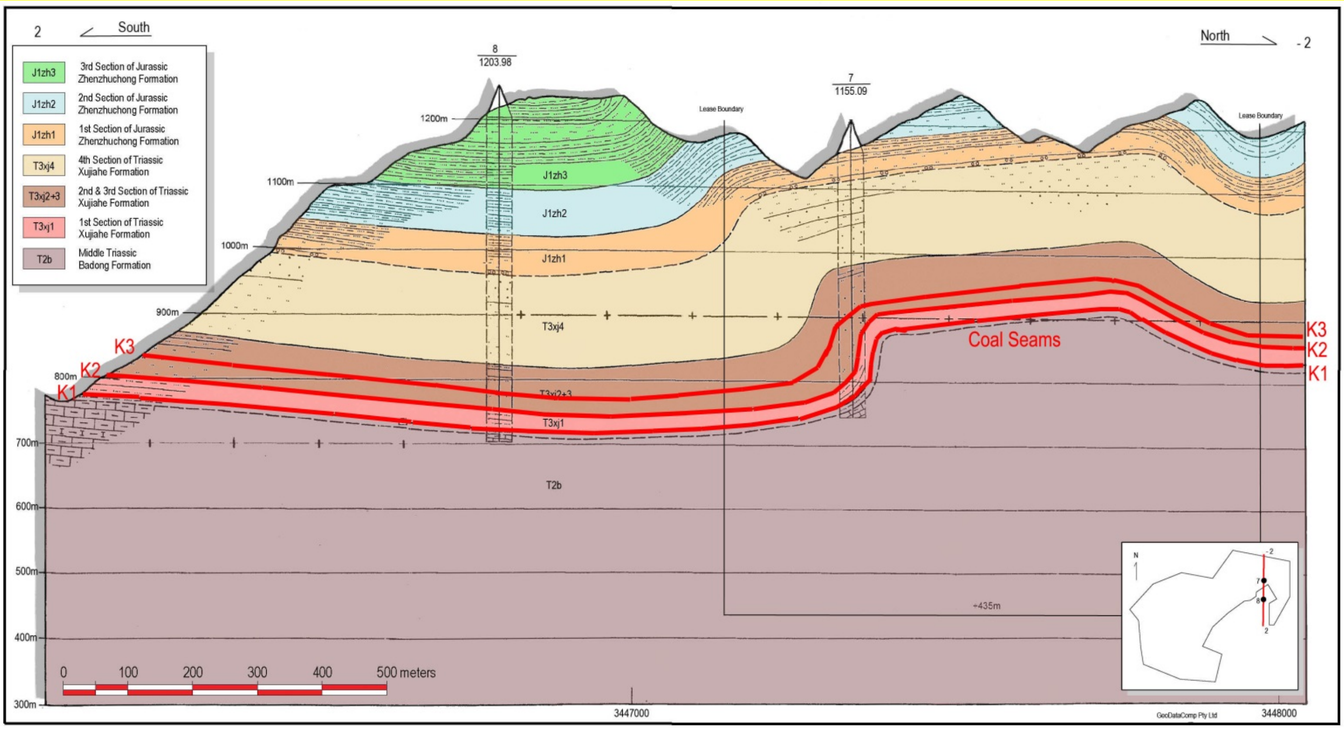


Figure 10: Caotang Mine Area Cross Section 2-2'.

Age	Name	Thickness	Description
Quaternary	Q_4	0-35 m	Mainly in valleys and flatter slopes. Boulders, pebbles, silty clay and coal gangue.
			Unconformity

Lower Jurassic	Zhenzhuchong Formation (J_1zh)	150-400 m averaging 275 m	Light grey to dark grey fine grained lithic quartz sandstone, with minor muddy sandstone, sandy mudstone, and siltstone, and intermittent coal seams.
			Unconformity
Upper Triassic	Xujiahe Formation ($T_s$xj)		
	T_3xj4	126-138 m averaging 132 m	Light grey to grey medium to coarse grained lithic sandstone with minor hematite near the top capped by gravel. Central contains feldspathic lithic cross bedded sandstone with thin sandy mudstones containing siderite, muddy inclusions and some coaly inclusions.
	T_3xj3	6-14 m averaging 9.0 m	Grey medium grained sandy mudstone, muddy siltstone containing clavatus sp fossils and intermittent K3 coal seam.
	T_3xj2	59-63 m averaging 61 m	Grey to light-grey medium grained lithic feldspathic quartz-wacke with a middle section coarse grained lithic quartz-wacke with horizontal fine grained siltstones containing siderite and discontinuous 'coaly' lines
	T_3xj1	31-49 m averaging 37.0 m	Upper predominantly dark grey sandy mudstone with minor siltstone and muddy siltstone that hosts the 0.99 m K2 coal seam. Central is dark-grey to grey medium grained sandy mudstone, and muddy siltstone with minor pyrite nodules, medium grained sandstone, fine grained sandstone and muddy limestone. Lower dark grey sandy siltstone, mudstone and muddy siltstone with the 1.96 m thick K1 coal seam situated at the top.
			Unconformity
Middle Triassic	Badong Formation (T_2b)	780-1014 m	Siltstones, mudstones, calcareous shales, dolomites, shales and quartzites

Figure 11: Stratigraphic column at Caotang.

The mining area is situated in the eastern part of the arcuate Xinhuaxia Qiyueshan Fold Belt. The mine area covers the north of Qumahe compound syncline with the subsidiary east-west Xujiaping Anticline and Shitaowan Syncline in the north of mine where limbs dip to 15^0. Locally however the south limb of the Xujiaping Anticline is steeper, with a maximum dip of 68^0, and an average of 32^0 between 750-850 m.

The oldest exposed strata at Caotang is the Middle Triassic Badong Formation (T_2b) that passes unconformably upwards into the Upper Triassic Xujiahe Formation (T_3xj) that is in turn unconformably capped by the Lower Jurassic Zhenzhuchong Formation (J_1zh). Quaternary sediments occur along the water courses. The Xujiahe and Zhenzhuchong Formations both host coal seams, Figure 11.

The Caotang Mine exploits the Triassic K1 and K2 coal seams located near the base of the Upper Triassic Xujiahe Formation which provides a relatively stable mining environment. The thickness of the K1 coal seam ranges between 0-2.4 m averaging 2.0 m within the mine while K2 coal seam ranges between 0-1.00 m with an average of 1.0 m in the mine. The hanging wall to the K1 seam and footwall to the K2 seam is clayey sandstone.

Caotang Coal Mine produces thermal coal for local, regional, and national power plants or furnace operators. The coal is classified as high ash, medium to high sulphur, medium to high phosphorous and medium calorific value coal suitable for thermal energy market.

Heiwan Coal Mine

The Heiwan mining permit covers some extremely rugged, mountainous country.

Plate 2: Heiwan Mine Pit No. 1 (L) and View South Over Pit No1 Main Portal towards Main Road and New Office (R).

The mining area lies on the eastern limb of the Chuandong Fold Belt which includes a number of parasitic folds and faults. From north to south, these folds are the Hongyan Syncline, Longchi Anticline, Qumahe Syncline, Tongcun Anticline, Gulingzhen Syncline, Wenyaoshan Anticline, Wushan Syncline, Hengshixi Anticline and the Maocaoba Anticline.

Generally the anticlines are tight and the synclines open with the folds tightening to the east. Strata within the mine area are mainly Triassic and Lower Jurassic sediments. Regionally the folding and faults affect the coal seam thickness, in some instances to total destruction.

In the local mine area the stratigraphy includes the basal Triassic Badong Formation (T_2b) progressing up through the Upper Triassic Xujiahe Formation (T_3xj) and Lower Jurassic Zhenzhuchong Formation (J_1z), Figure 12 to Figure 14.

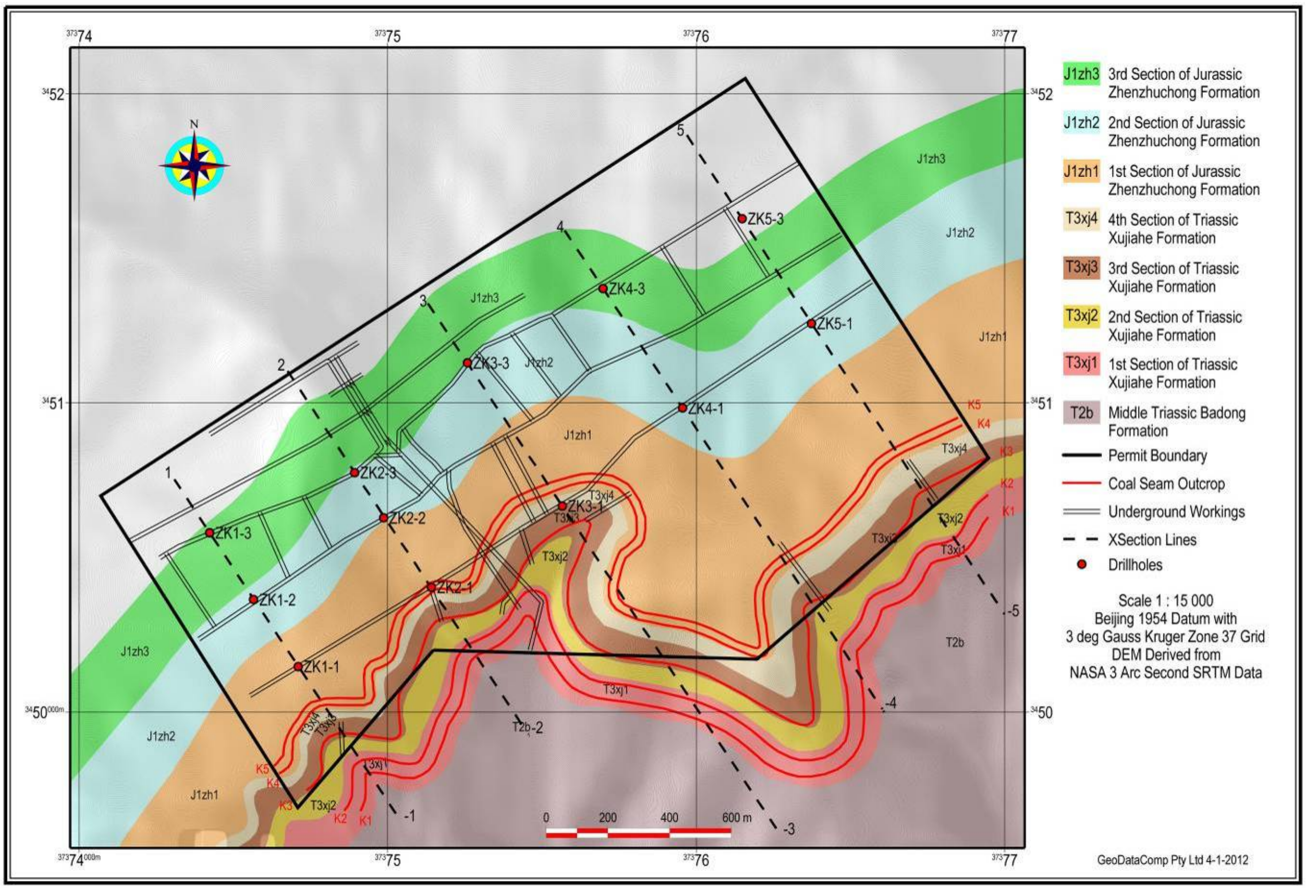


Figure 12: Heiwan Local Geological Map and Underground Drillhole Sites within Mining Permit.

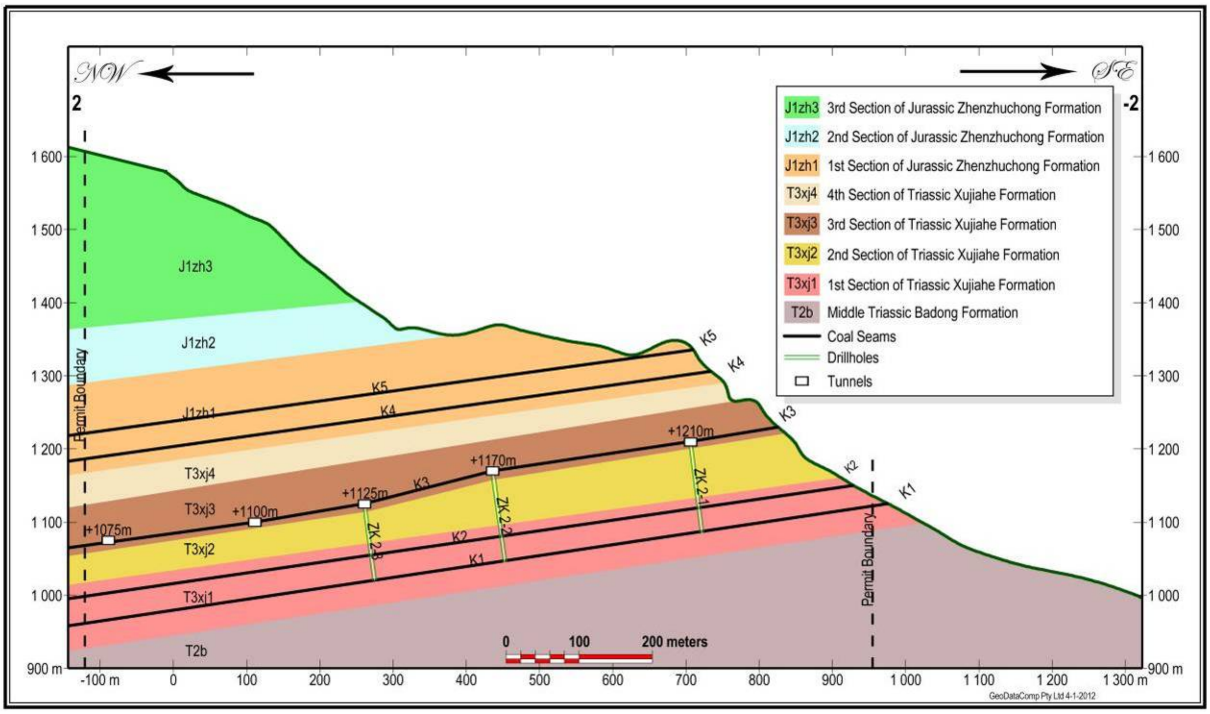


Figure 13: Section 2-2' Through Heiwan Mine.

Age	Name	Thickness	Description
Lower Jurassic	Zhenzhuchong Formation (J_1z)	230 m	Yellow grey to brownish grey to grey fine grained sandstone, siltstone and sandy mudstones and shale. Basal zone is dark grey siltstone, mudstone and shale, containing 2 to 4 coal seams including K6 and K7 that are locally

			economic. These two seams are approximately 30-50 m apart. Upper 200 m brownish grey to grey fine grained mudstone, siltstone and quartz sandstones deposited in a drying braided stream environment.
			Unconformity
Upper Triassic	Xujiahe Formation (T3xj)		
	T_3xj6 "Iron Top"	70-130 m	Light grey to grey, medium to coarse grained quartz sandstone, siltstone and mudstone with some locally developed coal seams
	T_3xj5	21-38 m averaging 55 m	Grey to dark grey, fine to medium grained siltstone, quartz sandstone, calcareous shale and mudstone, including 2-3 coal seams with 0.3 m K4 and 0.25 m K5 with variable widths of clay partings representing locally economic seams.
	T_3xj4 "Iron floor"	120 m-150 m	Grey to white coarse grained quartz sandstone, fine grained siltstone with large-scale cross bedding. Some 20-30 m above coal seam K3 and 30-50 m below seam K4 is a marker horizon composed of 20-60 mm granules 60% flinty sandstone, 25% grey to white quartz and remainder very fine grained sandy cement with basal 0.2 m of marker horizon sideritic coal seam with a reniform texture.
	T_3xj3	40 m-51 m	Dark grey fine to medium grained sandstone, siltstone, and calcareous shale with coal seams near the top and bottom that locally attain economic thickness. Main economic seam central K3 seam averaging 0.5 m.
	T3xj2	75 m	Light grey to yellow grey coarse feldspathic quartz sandstone with bedding that weathers into distinctive shell-like fragments. Siderite nodules scattered near base.
	T_3xj1	27 m to 41 m	Light to dark grey, fine to medium grained siltstone, quartz sandstone, sandy mudstone and shale. Base 0.5 m white to grey clay with minor pyrite. Two to three coal seams but only 0.9 m K1 and 0.5 m K2 seams are economic.
			Unconformity
Middle Triassic	Badong Formation (T2b)		Mainly thin mudstones and sandy mudstone. Top is medium grained sandy mudstone.

Figure 14: Stratigraphic column at Heiwan.

The strata generally strikes 330^0 dipping 13^0 north with numerous small, generally dry, east-west micro-scale faults. There are five mineable coal seams at the Heiwan Coal Mine namely K1, K2, K3, K4 and K5 of which K3 is the primary coal seam with an average thickness of 0.5 m.

Heiwan produces thermal coal for local, regional and national power plants or furnace operators. The raw coal is vitreous black, clearly defined bedding and with planar and conchoidal fractures. The coal is hard with a calorific value generally around 5,500 kcal/kg. The coal is classified as a high to medium ash, low sulphur anthracite.

Baolong (Wushan) Coal Mine

The Baolong district has a rugged, mountainous terrane with steeply incised valleys with limited flat lowlands. The topographic range is 160 m in the Baolong River with the highest point at Liyinyang with an elevation of 1717 m.

Plate 3: Baolong Maojiawan No 1 East Mine Production Adit (L) and Ventilation Adit (R).

The Baolong Mine area is located on the northeast of the Yudong Fold Belt which is part of the Neocathaysian Tectonic System with northeast-southwest striking fold axes. The folds are asymmetrical having open synclines and tight anticlines. The nearby fold structures appear in an en-echelon array. The area covered by the mine is over the central portion of the northwest limb of the Changliangzi Anticline. Local compression and tension has caused normal and thrust faulting with secondary parasitic folds, Figure 16.

In the local mine area the stratigraphy includes the basal Lower to Mid Silurian Middle Shamao Formation (S2s) unconformably overlain by Devonian Yuntaiguan (D3y), unconformably overlain by Huangjiacheng and Xiejingsi (D3h+x) formations, Carboniferous Huanglong Formation (C2h), Permian Liangshan (P1l), Xixia (P1q), Maokou (P1m), Gufeng (P1g), Wujiaping (P2w), Changxing (P2c), Dalong (P2d) formations, unconformably overlain by Triassic Daye (T1d), Jialingjiang (T1j) and Badong (T2b) formations progressing up unconformably through Quaternary alluvials along the rivers (Figure 15 to 17).

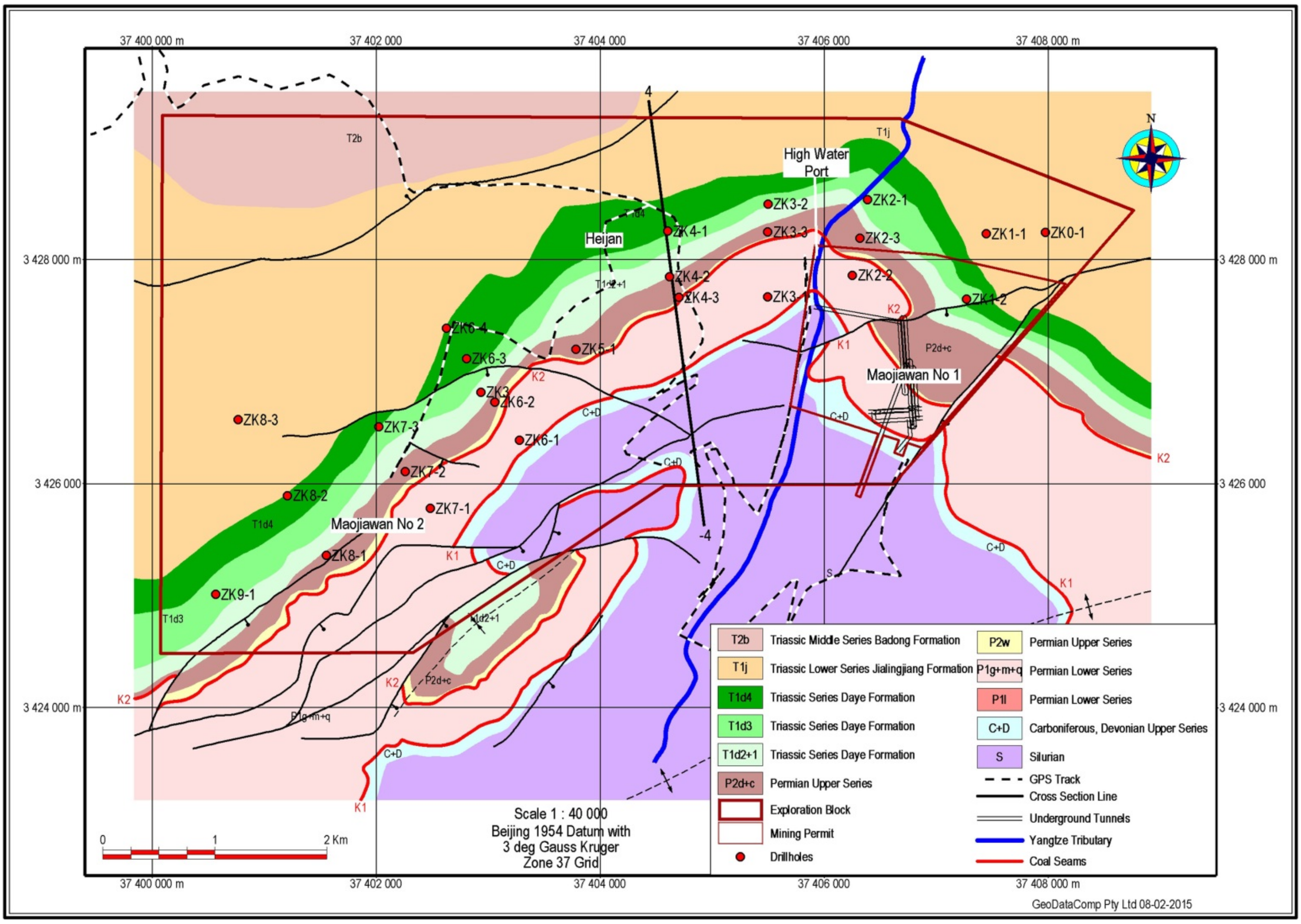


Figure 15: Baolong Mine Local Geology.

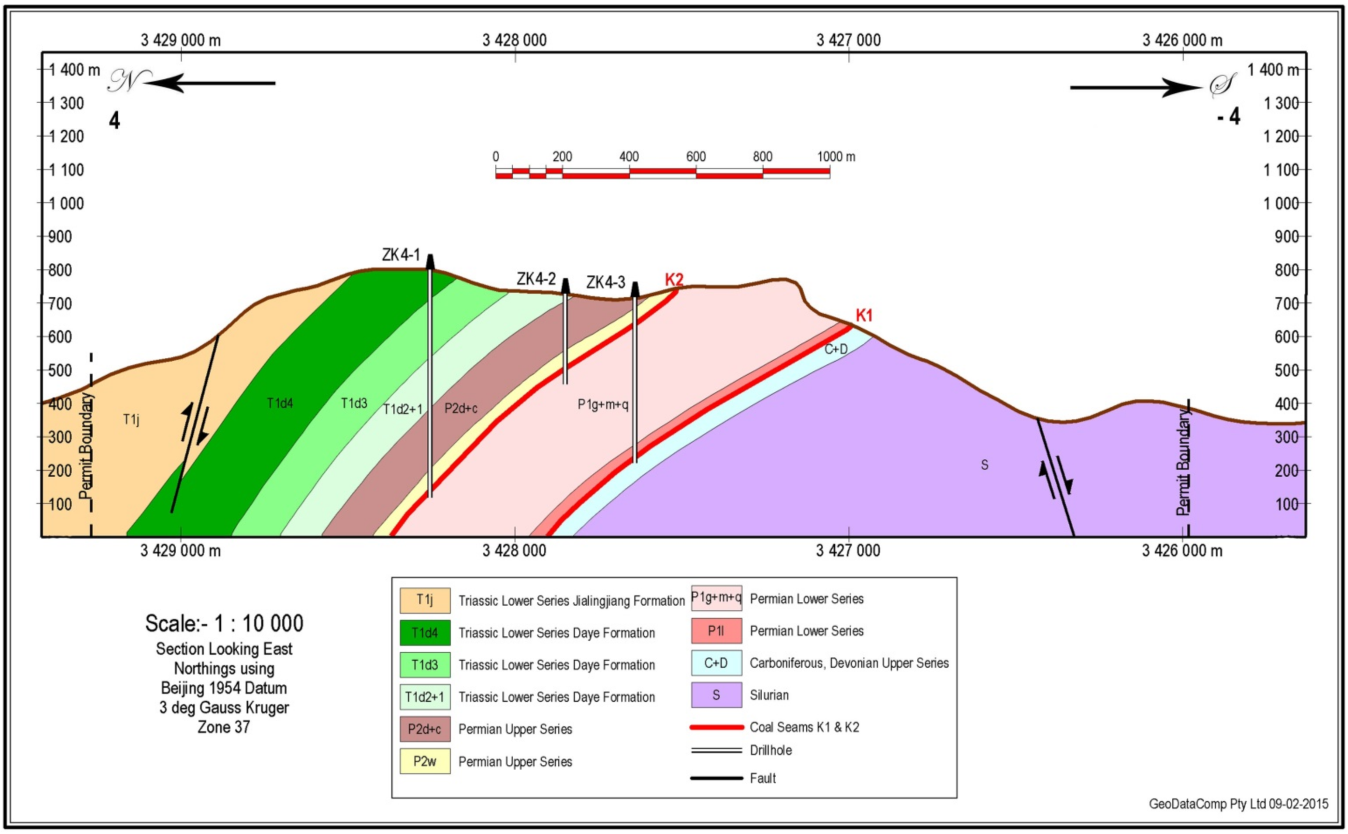


Figure 16: Baolong cross-section 4-4.

Age	Name	Thickness	Description
Quaternary	Quaternary (Q)	0 – 5 m	Mainly yellow and yellow-brown clays, silty clay, and cobbles along gullies and scree slopes off mountains.
			Unconformity
Middle Triassic	Badong Formation (T_2b)		Brown red and purple red mudstones with yellow grey calcareous shales and marl
Lower Triassic	Jialingjiang Formation (T_1j)	800-1400 m	The first and third units are thin to medium bedded grey limestone and bio-detritus limestone mixed with lesser dolomitic limestone. The second and fourth units are grey to light grey medium bedded dolomite, dolomitic limestone mixed with evaporites and minor fossils.
	Daye Formation (T_1d)		
	T_1d4	211 m	Light grey thin muddy limestone and dolomitic limestone with wavy structural development. Upper part purplish red muddy limestone, muddy limestone and dolomitic limestone.
	T_1d3	110-159 m averaging 130 m	Grey, light grey medium to coarse limestone, locally oolitic with minor shale layers
	T_1d2	25-35 averaging 35 m	Light grey thin muddy limestone and dolomitic limestone, limestone and minor shales with a wavy structure.
	T_1d1	50-80 averaging 70 m	Dark grey and black mudstone, muddy limestone and limestone.
			Unconformity
Upper Permian	Dalong Formation (P_2d)	25-35 m	Grey black silty limestone mixed with grey black to grey and yellow grey muddy limestone with fossils.
	Changxing Formation (P_2c)	90-120 averaging 105 m	Grey black medium to coarse bedded limestone. Upper mixed with flinty limestone where flint appears cloddy or stripped slowly decreasing downwards. Lower grey black medium bedded fine grained limestone mixed with carbonaceous shale.
	Wujiaping Formation (P_2w)		
	P_2w2	30 m	Grey to dark grey fine to medium grained bedded mudstone, flinty limestone and siliceous limestone, mixed with siliceous lenses of nodular flint with dark grey muddy layers. Contains coral and brachiopod fossils. The bottom 5m is a marker horizon of bio-detritus limestone or silty limestone with lenses of pyrite that usually occurs some 5.3 m above the K2 coal seam.
	P_2w1	9 m	Minor pyrite with upper sandy mudstone mixed with very fine sandstone and K2 coal seam, lower sandstone and clayey mudstone.
Lower Permian	Gufeng Formation (P_1g)	28 m	Dark grey to black muddy limestone or siliceous limestone mixed with calcareous shale. The upper part is mixed with siliceous dolomite in spots or as lenses. The central and lower part is mixed with coal lenses over 20~35 m.

	Maokou Formation (P_1m)	184 m	Light grey, grey thickly bedded fine grained limestone. Upper mixed flint veinlets or siliceous beds, lower grey thick bedded bio-detritus, fine grained limestone mixed with thin bedded bio-detritus muddy limestone.
	Xixia Formation (P_1q)	100 m	Grey medium grained bedded to blocky limestone, muddy limestone, asphalt bearing with flint veinlets.
	Liangshan Formation (P_1l)	2-15 m averaging 5 m	Mixed coal, sandstone and mudstone. Upper grey to black carbonaceous mudstone and claystone with 0.4-4.0 m K1 coal seam, generally with two claystone partings between 0.23~0.50 m, for an average width 1.72m. Footwall bauxitic mudstone and grey white to dark grey with light red fine to coarse grained quartz sandstone.
			Unconformity
Carboniferous	Huanglong Formation (C_2h)	40 m	Upper light grey compact limestone, sometimes mixed with siliceous beds. Central light grey to grey fine grained limestone and dolomitic limestone with local calcite zones. Lower grey to grey green muddy limestone and dolomitic limestone, sometimes mixed with thin shales with rare pyrite crystals, main 1st marker horizon for K1 coal seam occurring within 2.5 m below seam.
			Unconformity
Upper Devonian	Huangjiacheng and Xiejingsi Formation (D_3h+x)	7-54 m averaging 20 m	Light grey to grey green claystone and sandy mudstone. Lower light grey to grey green dolomitic clay
	Yuntaiguan Formation (D_3y)	26-61 m averaging 40 m	Grey white to light grey coarse bedded fine quartz sandstone, with light yellow to light red medium to coarse grained quartz sandstone and thin sandy mudstone.
			Unconformity
Silurian	Middle Shamao Formation (S_2s)		Yellow green to yellow grey sandstone, quartz sandstone, sandy mudstone and shales.

Figure 17: Stratigraphic column at Baolong.

There are 13 faults, mostly normal but F8, F11and F12 are reverse faults, within the Baolong mine area. Details on the faults are summarised in Table 10.

Fault	Length (km)	Strike ^{0}	Dip ^{0}	Throw (m)
F1	24	120-165	50-75	550
F4	0.675	137	65	40
F7	3	150	73	120
F8	3.4	130	67	70
F9	2.0	143-170	67	80
F10	4.0	190	70	50
F11	0.700	190	50	50
F12	5	330-340	76	>200
F13		160	65	50

Table 10: Summary of major faults in Baolong Area.

There are two mineable coal seams at the Baolong Coal Mine, namely K1 and K2 are separated by an average 350 m of Permian sediments. Both coal seams have clay partings of variable thicknesses.

The thickness of the K1 coal seam varies 0.5-2.4 m and has 1-2 clay partings. The clay partings are grey mudstone with variable thickness from 0.05-0.5 m. The central to upper K1 seam is mainly bright coal with minor dull coal, soft, grey black to black with an oily sheen. The lower part is mainly dull coal mixed with bedded bright coal with a steel grey appearance. The national standard classifies the K1 seam as high ash, high sulphur, special low phosphorus, low chlorine, low calorific value blind coal.

The thickness of K2 seam ranges from 0.72-1.2 m averaging 1.5 m and is dull grey black with black striations and minor half bright coal with an adamantine and oily sheen. It has many fracture planes breaking irregularly into mostly powder with minor blocks. The national standard classifies the K2 seam as medium ash, medium-high sulphur, medium calorific value blind coal.

The K1 coal can be used for general industrial or domestic uses while K2 coal can be used for thermal power generation, motive power or domestic uses. The high arsenic content of the K2 coal prohibits its use for steam generation in the food processing industry and the high fluorine content requires it can only be used in special combustion stoves when used domestically.

Changhong Coal Mine

Plate 4: Changhong Mine 1023m New Production Adit Portal (L) and 1093 m Production Adit Portal (R).

The Changhong Mine site is located on the northwest limb of the Guandian Syncline in the northwest of the Loushan Mountain Fold Belt. The bedding at the mine strikes 142-147° and dips 29-32°SE.

The district is structurally stable with limited risk of landslides. There are no faults or folds that affect mining.

In the local mine area the stratigraphy includes the basal Permian Maokou (P_1m), Longtan (P_2 l) and Changxing (P_2c) formations, unconformably overlain by Triassic Yulongshan (T1y) and Feixianguan (T_1f) formations progressing up unconformably through to Quaternary alluvials scattered along the rivers (Figure 18 to 20)

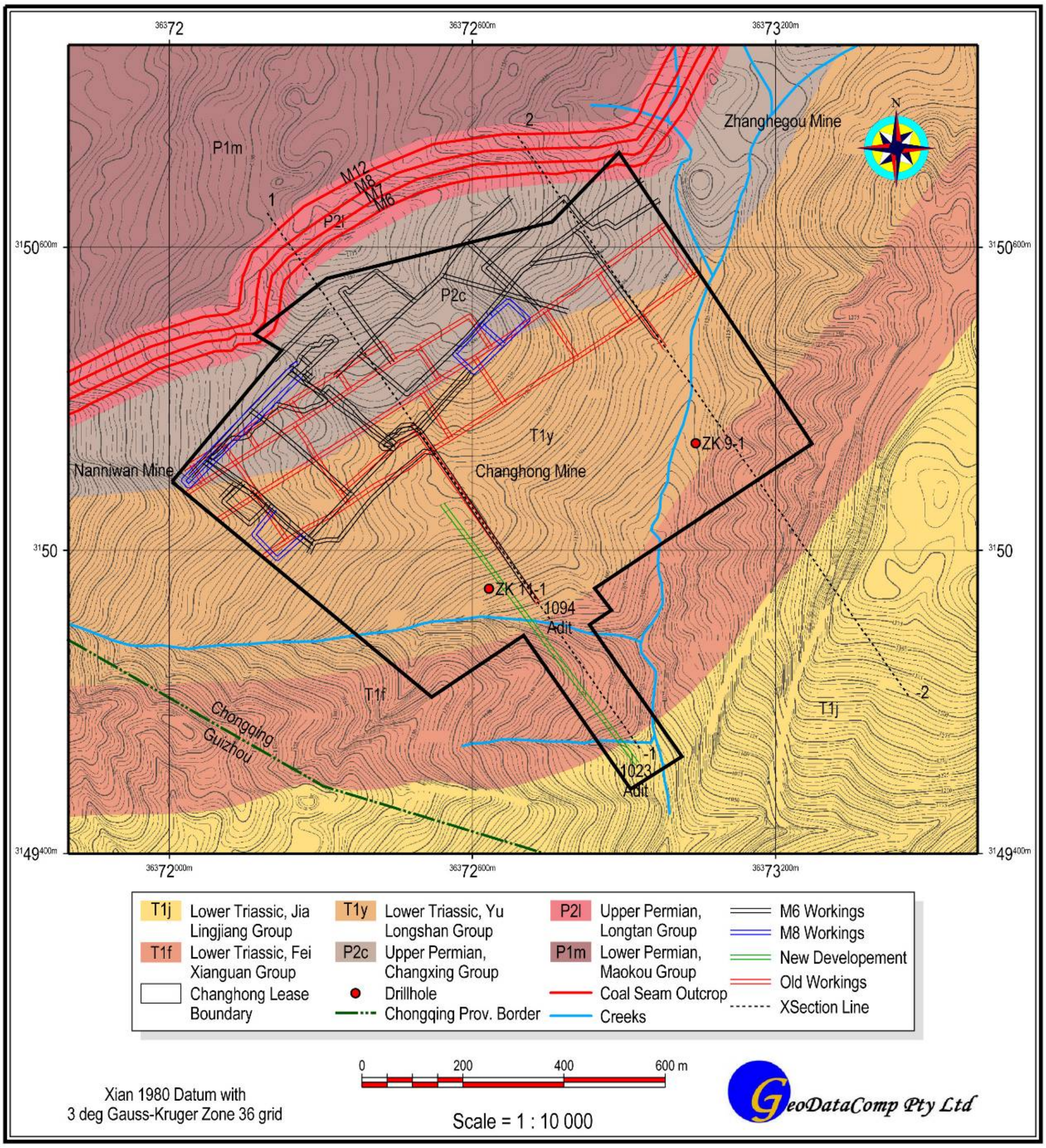


Figure 18: Changhong Mine regional geology.

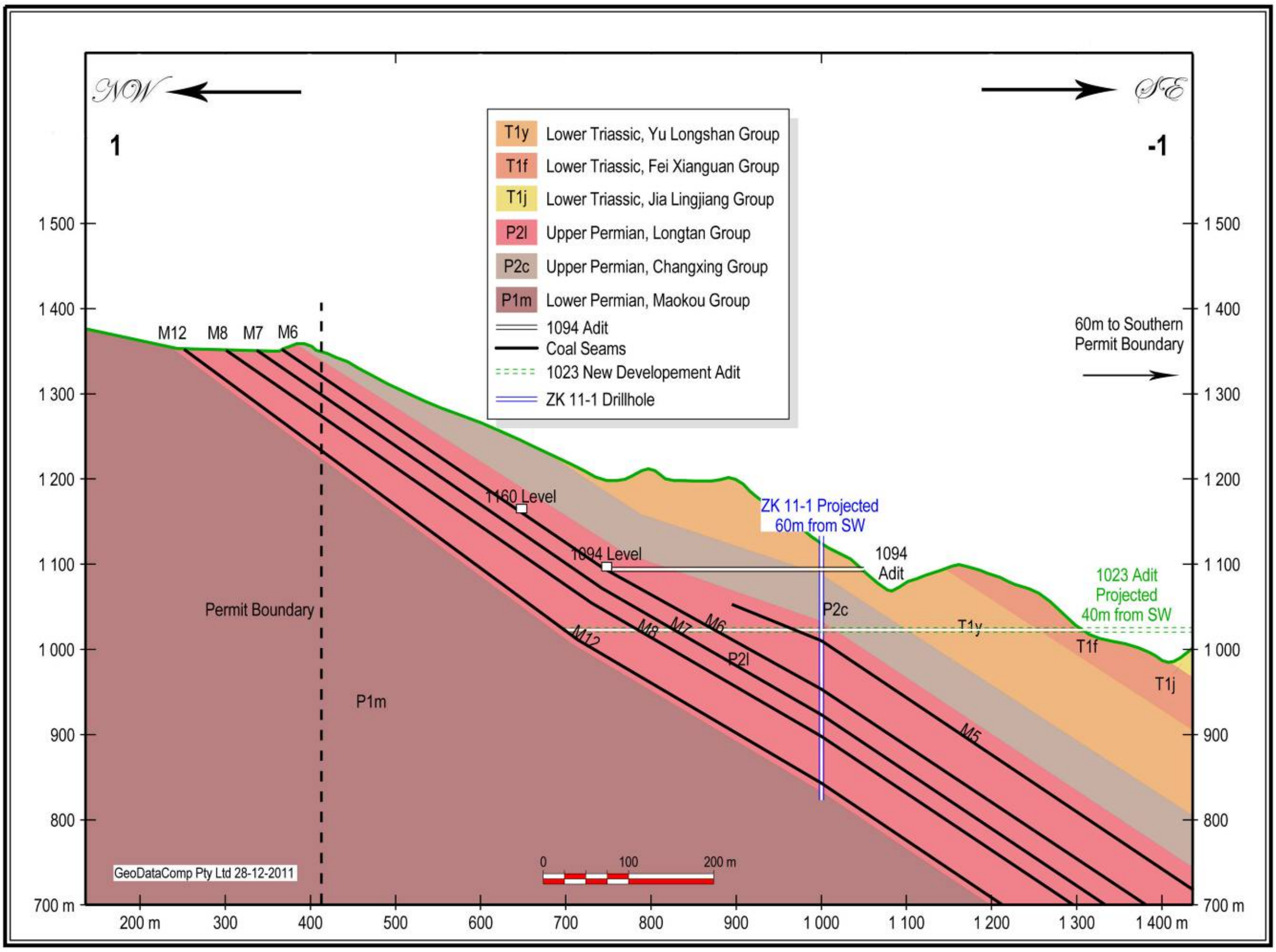


Figure 19: Changhong Mine cross section 1-1'.

Age	Name	Thickness	Description
Quaternary	Quaternary (Q)	0 -1.2 m	Mainly yellow and yellow-brown clays, silty clay, and cobbles along gullies and scree slopes off mountains.
			Unconformity
Lower Triassic	Feixianguan Formation (T_1f)	191 m	Thin-medium bedded red purple and dark red purple calcareous mudstones. Central several thin-bedded grey and dark grey limestone layer and two layers of medium-bedded grey limestone. Basal layer of thin-bedded slate-grey argillaceous limestone or grey micaceous claystone.
	Yulongshan Formation (T1y)	133 m	Thin-medium bedded light grey and grey limestone and argillaceous limestone with central and lower thin-bedded mudstone. Lower 0.3-1.5 m grey-green calcareous mudstone with “claw-like” calcite veins.
Upper Permian	Changxing Formation (P_2c)	49 m	Thick-medium bedded massive grey to dark grey to blackish limestone with thin-bedded dolomitic limestone in middle. Chert nodules exuding an asphalt odour when broken. Lower beds medium-bedded grey limestone with calcareous mudstone, asphaltene mudstone and characteristic brachiopod fossils.
	Longtan Formation (P_2l)	72 m	Upper 24 m grey to dark grey mudstone, marlstone or sandy mudstone with minor fine sandstone, siltstone and coal lines. Central 30m thick grey and dark grey sandy mudstone,

			mudstone, claystone, fine sandstone and coal seams with partial argillaceous limestone. Lower part approximately 18 m of grey argillaceous limestone, sandy mudstone, mudstone, siltstone and thin coal seams. The lowest zone is fireclay with pyrite. Includes 5-8 coal seams of which two are workable, M6 and M8, while M7 has been worked sporadically.
			Unconformity
Lower Permian	Maokou Formation (P_1m)	120 m	Dark grey, light grey and brown grey thick-bedded limestone. Base black compact limestone; lower central spotted dolomitic limestone; upper central black limestone with chert and multiple stylolitic structures; upper compact off-white limestone.

Figure 20: Stratigraphic column at Changhong.

The coal seams at Changhong are gas producing so the mine has been classified as having potential for gas explosions. The absolute gas emission rate is 4.72 m^3/min and the relative gas emission rate is 54.8 m^3/t. The average temperature of the mine at 800 m is a safe 22.8^{0}C. Since the mine is located in a karstic area where most of the limestones are aquifers regularly recharged by rainfall, safety precautions are required.

The two current commercial coal seams at the Changhong Coal Mine, namely M6 and M8, are part of the Upper Permian Longtan Formation dipping approximately 30°.

According to Chinese standards the M6 coal seam is high-ash, high sulphur anthracite with a medium calorific value while the M8 coal seam is medium ash, medium sulphur anthracite with high calorific value. Both coals are suitable for power generation, domestic consumption or steaming coal.

MINING AND EXPLORATION HISTORY OF THE PROJECTS

The initial regional exploration of the concessions in the early 1970s was mainly being conducted by the state owned geology brigades in China when the commercial potential of the coal resources were first identified.

Blackgold has followed up the regional exploration with underground drilling and channel sampling programs in its three operating coal mines. Within the areas targeted for mining, the drill hole and sampling channel spacing was generally 500 m × 500 m and in some areas 1,000 m × 1,000 m.

Mining Method

The main factors affecting choice of mining method are the dip and thickness of the coal seams and the stability of surrounding rock. The Company’s Projects at Caotang, Heiwan and Changhong have long histories of coal mining however no legal mining has occurred to date at Baolong.

Room and pillar mines are developed on a grid basis except where geological features such as faults require the regular pattern to be modified. The size of the pillars is determined by the load-bearing capacity of the material above (“hangingwall”) and below (“footwall”) the coal seam being mined and the load bearing capacity of the coal itself in the pillars will determine the pillar size.

To prevent pillar and back failure the mine is divided up into areas or panels. Pillars known as barrier pillars separate the panels. The barrier pillars are significantly larger than the "panel" pillars and are sized to allow them to support a significant part of the panel and prevent progressive collapse of the mine in the event of failure of the panel pillars.

Retreat mining is the final stage of room and pillar mining in the Company’s mines. Once the coal between the pillars has been exhausted, the pillars that were left behind initially are removed, retreating back towards the panel's entrance. After the pillars are removed, the roof (or back) is allowed to collapse a safe distance behind the mining area into the mined out void. Pillar removal must occur in a very precise order to reduce the risks to workers, owing to the high stresses placed on the remaining pillars by the abutment stresses of the caving ground.

For the thick seams at Changhong the seams are mined using the same basic room and pillar method with up to three slices approximately 2 m high.

Since the ground stability can be considered generally good as the coal seams are situated within competent hanging and foot walls, AM&A considers the conventional retreat mining room and pillar mining method is well suited for all the Company's mines.

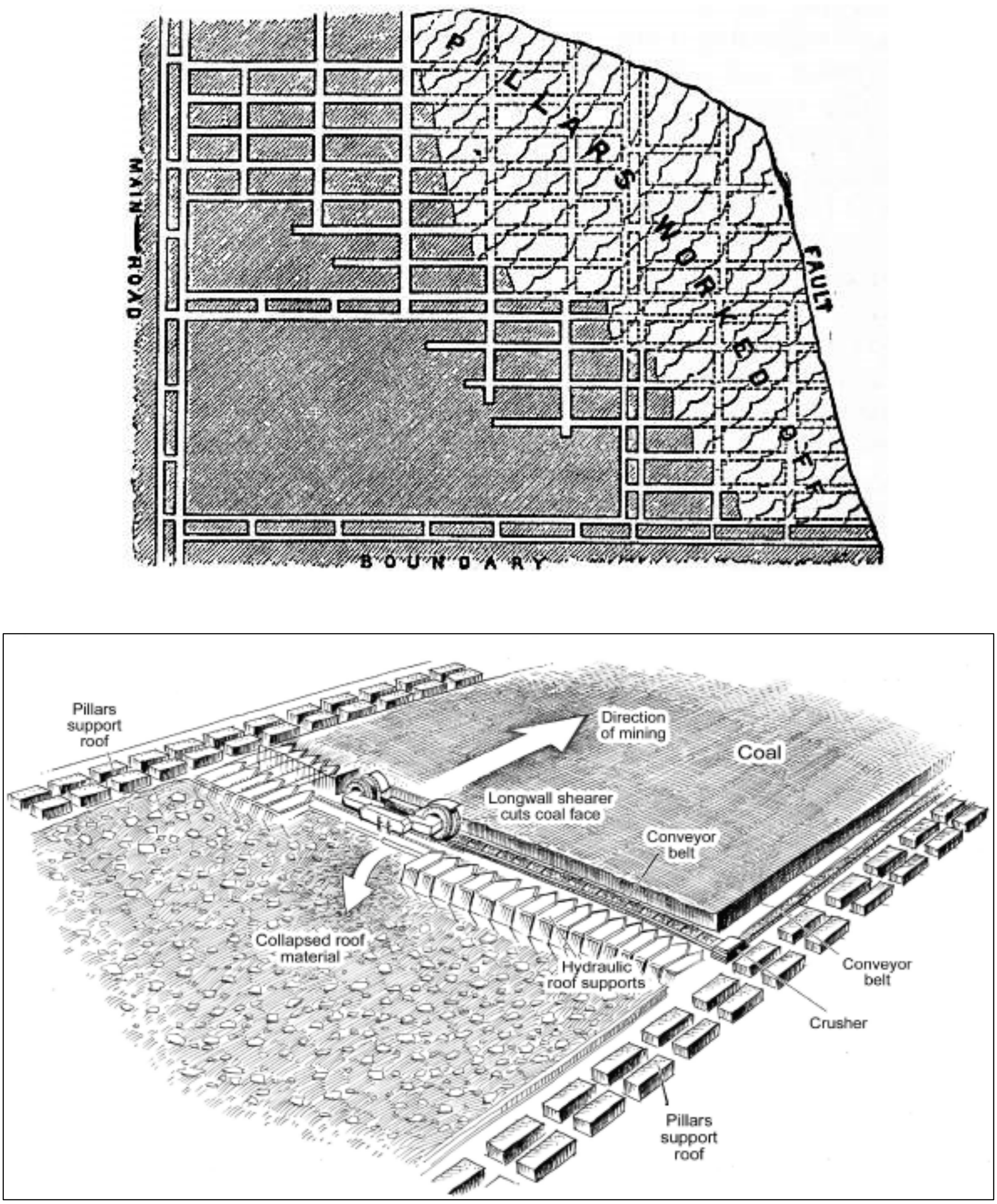


Figure 21: View of conventional retreat mining method, top Plan View, lower 3D View.

Mining Factors

Normally not all of a resource is eventually mined. Some coal is lost as spillage and left behind on floors and roofs as well as coal left behind un-mined as safety pillars for various reasons. Pillar dimensions at the three projects vary according to ground condition, seam thickness and pillar purpose.

The amount of coal lost during mining as spillage and left behind on roofs and floors is usually estimated based on experience in similar seams. The percentage lost is generally greatest in narrow seams and where the country rock is soft and unstable. The amount lost in pillars depends on the configuration of the mine development, the mining method used and the stability of the country rock.

The recovery factors assumed by AM&A for converting the resources to reserves are the same used by Behre Dolbear (BD) in the Company's last resource/reserve update in 2015 which were in turn based on the life-of-mine designs created by China Coal International Engineering Chongqing Coalmine Design Institute, Table 11.

These mining recovery rates were determined by AM&A to be reasonable and consistent with actual mine production records.

As coal is mined it is usually expected that waste rock will be mined and mixed with the coal as dilution. The amount of dilution is variable and is usually greatest where the seams are thin and the country rock is soft and unstable (Table 11). This dilution effectively increases the ash content of the coal and lowers its calorific value. It is expected that much of the excessive waste rock included as dilution will be removed underground and at the surface by hand picking and by selective mining practices.

Mine	Reserves
Baolong	75%
Caotang	76%
Changhong	72%
Heiwan	54%
Total	**74%**

Table 11: Recovery factors (after BD) for converting Resources to Reserves.

Mine Safety

Underground mining of coal is a risky occupation and over the years many miners have died throughout the world mining coal underground. All mines in China must comply with increasingly strict Chinese government laws and regulations that require high standards of mine safety are followed. These laws and regulations affect training of staff, mine design, operating practices, equipment and management. All operating mines are monitored by the government authorities and regular safety audits carried out. All the Company's mines will need to meet at least the minimum requirements of these laws and regulations or else they will be closed down and, in some cases where accidents have occurred, penalties may apply ranging from fines to imprisonment of the responsible management.

The most important safety measures that the Company are proper training of all mine staff and creating a culture that puts personal safety ahead of all else. Careful planning and mine production scheduling with strong capable management is critical if mine accidents are eliminated or kept to an absolute minimum.

During the site visits, different risk mitigation measures are observed. These include:

- Only approved materials and clothing are allowed within the mine to prevent possible explosion caused by sparks.
- Use of blast doors to control ventilation and possible explosions
- Use of water and airflow direction to control dust
- Faulted zones are cemented, preventing water ingress

In additional, AM&A notes that the mines have:

- Statutory reporting of accidents as per Chinese law

- Annual regular safety audits by the government

Ground Stability

The sediments that make up the rock formations exposed during the mining of the coal in all of the mines are considered to be moderately stable. If proper care is taken and appropriate safety measures are taken, all the mines in the Report can be mined safely. It is pointed out that with the retreat mining method used to mine the Company's coal, controlled roof collapsing in mined out areas is normal and should not be a risk to the safety of the miners.

The stability of the formations exposed by mining is well known and mining methods have evolved to compensate for any structural weaknesses at the coal mines covered in this report that are currently being mined. There are also numerous other operating coal mines in the mining districts near all the Company's mining operations that are successfully and safely mining identical seams included in this Report.

It is imperative that all active mining areas are monitored and structural features such as shears and weak wall rocks are mapped by experienced geologists and appropriate actions taken, including increased ground support measures and where necessary abandoning dangerous areas, to avoid roof collapses and side wall failures in areas where miners are at risk.

Ventilation and Gas

Typically high volume flow-through ventilation is used to maintain fresh air for the miners and to safely flush out any potentially combustible gases and dust. Fresh air enters the mine from the surface via the mine portal and is distributed through the mine via internal ventilation drives.
Air flow is controlled by regulators, dampeners and ventilation fans. Stale air is normally exhausted via large fans located on separate shafts or adits.

Coal mines generate methane and other combustible and poisonous gasses such as carbon dioxide and carbon monoxide as the coal seams are exposed during mining along with potentially explosive coal dust. If these gas and dust levels in the mine workings exceed acceptable limits fires, explosions or asphyxiation of the miners may occur. Continual monitoring of the gas concentrations in the mine workings in tandem with alarm systems are required and have been installed in all of the coal mines. The Chinese authorities are well aware of the dangers of such events and have enacted a number of laws and regulations to ensure mine workings are safe. All the Company's mines are fully compliant with the current laws and regulations.

AM&A is of the opinion that the ventilation systems and monitoring procedures currently in use or described in the feasibility study reports, if properly followed, meet current Chinese standards and should be sufficient to satisfy the requirements of the various coal mines. AM&A notes however that there have been no fatalities or serious incidents caused by gases in the active mines owned by the Company.

Drainage and Pumping

If uncontrolled large quantities of groundwater water enter operating mines the miners are at risk of drowning and the stability of the workings can be compromised.

The geology of all the mines, in particular the lack of deep shear zones and proximal rivers, and experience gained from current mining operations within the Company's licenses and in nearby mines indicate that they are not likely to experience major water ingress problems.

The geology and groundwater flows in all mine workings will need to be carefully and continually monitored and where there is any likelihood of excessive water flows appropriate action taken. There should also be sufficient pump capacity installed to cope with all the normal as well as any foreseeable excessive water flows that may occur.

All waste water generated by the mining operations must be properly managed and recycled wherever possible. Any water released into the environment must be properly cleaned to remove any sediment and any dissolved dangerous chemicals such as sulphur and arsenic must be removed or neutralized before it is released.

AM&A is of the opinion that the water management systems and monitoring procedures currently in use or described in the feasibility study reports, if properly followed, meets current Chinese standards and should be sufficient to satisfy the requirements of the various coal mines.

Dust

Dust generated by mining in coal mines especially, besides being a nuisance, can cause severe health problems to the miners and cause dust explosions. Much of the coal included in the quoted resource estimates has potential to produce problem dust. Similar measures will need to be taken as for gases including continual monitoring and installation of alarms. It is also important that dust levels are kept low by copious spraying of water in areas where dust can be generated and being careful that excessive dust is not generated by traffic or mining equipment.

Spontaneous Combustion

All coal has the potential for spontaneous combustion once coal is exposed to the air by mining; especially lower quality thermal coals with a high sulphur content as found at Changhong. If spontaneous combustion occurs in any coal mine the consequences can be disastrous leading to fatalities and mine closure.

The risk of spontaneous combustion can be minimised by keeping the period that active coal faces are exposed to the air to a minimum, properly sealing off mined out areas and keeping the time that broken coal stocks are left underground to an absolute minimum. This entails high standards of mine planning and production scheduling along with strict management.

Subsidence

Where mine workings are close to the land surface and the middlings, i.e. interstitial waste country rock between coal seams, is thin, the potential for problematic subsidence of the rocks above mined out stopes is a real possibility.

Where surface rocks collapse into a shallow mined out stope, structures and occupied land may be affected or destroyed and people and animals endangered. Collapsing stopes also could allow dangerous water in-flows into the mine below and provide air to remnant coal in mined out areas that could lead to spontaneous combustion.

As with all potentially dangerous situations, prevention is far more important than remediation so sufficiently thick crown pillars should be left un-mined above mined out areas and constant monitoring of all pillars is essential. If movement or cracks are detected the appropriate measures should be taken including abandoning dangerous areas and backfilling may be required. All cracks to the surface should be sealed if there is a risk of collapse or water in-flow.

Where seams are to be mined in areas with thin middlings, proper production scheduling of stopes is required so the mining on the different levels advance systematically in a proper sequence to eliminate the risk of pillar collapse between stopes while mining is in progress.

Mine Closure

The Chinese mining regulations require that all mines, upon closure, are left in a safe condition and all superfluous infrastructure removed and the mine site returned to a condition as close as possible to the state it was prior to the commencement of mining. All rubbish must be removed and mining waste left so it is safe and has minimal impact on the environment. The risk of collapse and dangerous chemicals leaching from waste dumps and abandoned mine workings into the environment has to be eliminated.

Approved mine closure plans are in place for all the active mines as required by the government authorities.

Caotang Mine

The Caotang Mine commenced producing coal in 1982. The property was purchased by the Guoping Group in 2003 and subsequently transferred to BGG in March 2010. Raw coal produced from the mine is transported by trucks approximately 25 km to the Company's Yangtze River port loading facility for shipping to customers.

The Caotang Mine produced 1.55 Mt of raw coal from combined K1 and K2 coal seams from 30 April 2015, the date of the last resource update, to 31 July 2016.

Heiwan Mine

Coal production at the Heiwan Mine commenced in 1996. The property was purchased by Guoping Group in 2001 and then transferred to Blackgold in March 2010. The Heiwan Mine is currently BGG's second largest producing mine. Raw coal produced from the mine is transported by trucks a distance of 35 km to the Fengjie Jinpen coal dock along a tributary of Yantze River.

The Heiwan Mine produced 0.26 Mt of raw coal from coal seam K3 between 30 April 2015, the date of the last resource update, to 31 July 2016.

Changhong Mine

Coal mining commenced at Changhong in the early 1990s and the property was purchased by BGG in August, 2011. Most of the coal produced is transported 18 km by truck to the nearby rail station for sale. The remainder is transported approximately 20 km to the river port loading facility on a tributary of the Yangtze River.

No coal has been produced from the Changhong Mine since the last resource/reserve update during refurbishment and expansion work on the mine infrastructure.

Baolong Mine

The Baolong Mine is a developing underground mine that was purchased by BGG in April 2011. The planned raw coal production capacity for the current mining permit is 60,000 tonnes per annum (tpa), which will be expanded to 1.5 Mt after the Company completes current development works. The trucking distance from the Maojiawan No. 1 adit to the local Baolong dock site on the Yangtze River at Putaoba Town is 25 km. No coal has been produced from the Baolong Mine since the last resource/reserve update as expansion work had been suspended due to weak coal prices.

Production Statistics

The Company's financial year is from 1 November to 31 October. The Company's records show that from 1 May 2015, the date of the last resource/reserve update, to 31 July 2016 a total of 1.78 Mt of coal was produced from the two operating coal mines. Table 12 summarises the production over this period.

Mine	Seam	2015 Report Total Reserve (Mt)	2016 Report Total Reserve (Mt)	Mined (Mt)	Difference (Mt)
Caotang	K1 & K2	22.2	21.7	1.55	-0.5
Heiwan	K3	3.6	3.6	0.23	0.0
Totals		25.8	25.3	1.78	

Table 12: Mine production 1 May 2015 to 31 July 2016.

Although 1.55 Mt of coal was mined at Caotang over the reporting period, the difference between the 2015 and 2016 resource estimates is only 0.5 Mt. This smaller difference is because coal seam thickness measurements in areas newly exposed by mining indicated that the coal seam in these areas were slightly thicker than previously modelled, and once the resources were remodelled using the new data, slightly more than 1 Mt tonnes of additional coal resources were modelled. The estimated coal resources at Heiwan were not reduced as much as the tonnes mined for the same reason.

DRILLING AND UNDERGROUND SAMPLING

The sampling data used for the resource modelling is summarised in Table 13.

Mine	Seam	Drill Holes	UG Samples	Total Samples	Ave Seam Thickness (m)	Min Seam Thickness (m)	Max Seam Thickness (m)
Changhong	M5	2	0	2	3.8	3.1	4.5
Changhong	M6	2	59	61	12.9	9.1	15.7
Changhong	M7	2	2	4	6.6	5.7	7.3
Changhong	M8	2	13	15	9.2	8.7	12.1
Changhong	M10	1	0	1	4.0		
Changhong	M12	2	0	2	5.4	3.0	7.9
Caotang	K1	0	417	417	2.04	1.35	2.53
Caotang	K2	0	223	223	1.08	0.35	1.2
Caotang	K3	0	0	0	0.9*		
Heiwan	K1	12	0	12	0.8	0.7	0.9
Heiwan	K2	12	0	12	0.5	0.4	0.7
Heiwan	K3	0	213	213	0.48	0.40	0.63
Heiwan	K4	0	0	0	0.3*		
Heiwan	K5	0	0	0	0.3*		
Baolong	K1	12	0	12	1.8	0.9	3.2
Baolong	K2	21	0	21	1.5	0.5	2.5
Totals		68	927	995			

Table 13: Summary of sampling used in resource modelling.
**Based on surface mapping*

The drilling and underground sampling was carried out following prescribed Chinese standards for diamond drilling and underground sampling of coal seams. A copy of the Chinese Standards for Sampling Coal Seams, GB/T 482-2008, is attached as Appendix 1. These standards, if followed correctly, meet the requirements of the JORC Code (2012) for sampling coal seams.

The drilling was carried out using conventional NQ wire-line diamond drilling equipment and logged by qualified geologists with the lithologies and core recoveries recorded. All core within the coal seams is recorded as exceeding 95% recovery. The whole core within the coal seam was collected for analysis, after logging by the supervising geologist, and stored in sealed plastic bags labelled with unique codes before being transported to the laboratory. The drill collars are accurately surveyed by qualified surveyors. All the drill holes are vertical and, where the seams are dipping, the true seam thickness is calculated by correcting for the dip of the seam.

The coal seams are mapped, measured and sampled at approximately 50 m intervals along the underground development drives as they progress in the coal seams under the supervision of qualified geologists. All sample locations are surveyed by the mine surveyor. All the samples and seam measurements are taken perpendicular to the seam boundaries as true widths.

All the samples are transported to the laboratory in sealed bags that are themselves stored in strong, sealed polyweave bags

AM&A believes that the drilling and underground sampling and measurement methods and quality control protocols used by the Company are of a high standard that meets the requirements of the JORC Code (2012) for resource modelling.

SAMPLE PREPARATION, ANALYSES AND SECURITY

All the coal samples are analysed at independent certified laboratories (Intertek Testing Services Co., Ltd. Shanghai) following sample preparation and analytical methods and protocols described in Chinese Standard for Proximate Analysis of Coal GB/T 212-2008. An English translation of this standard is included at the end of this report as Appendix 2.

All the samples are analysed as follows:

- Total moisture content (Mt) is the amount of moisture in the sample as it is collected prior to being air dried. (Can only be done with drill core samples)

- Moisture Content air dried (Mad) is the amount of moisture in the sample after the sample has been fully dried by being left open to the air at room temperature.
- Ash content air dried (Ad) is a measure of ash left after combustion.
- Volatile content air dried (Vd) is a measure of the volatile gases liberated after air drying at a standard temperature.
- Sulphur content air dried (Std) is a measure of the sulphur content after air drying.
- Fixed Carbon content air dried (Fcd) is the carbon content of the sample after air drying.
- Calorific value (CV) is the amount of heat energy generated by combusting the coal, expressed as kcal/kg.

AM&A believes that the sample preparation and analytical methods and quality control protocols used by the laboratories are of a high standard that meets the requirements of the JORC Code (2012) for resource modelling and estimation.

DATA VERIFICATION

AM&A has visited all the Company's mines annually since 2011-2014 and again in 2016 to monitor the progress of the mines, discuss the mining and sampling procedures and verify the coal quality and seam thicknesses in the operating stopes.

A suite of channel and production dump samples were collected by AM&A in 2011 from the Caotang, Table 14, and Heiwan, Table 15, mines to compare assays between the local laboratory at Fengjie, where the exploration and mine samples were analysed, and SGS, an ISO accredited laboratory in Tianjin.
Four channel samples were collected from K1 and one from K2 along with five "product" samples from stockpiles using a spear sampler at both mines.

	H_2O % ar	H_2O % ad	CV kcal/kg ar	CV kcal/kg ad	Ash % ad	Vol % ad	FC % ad	S % ad	P % ad
Fengjie K1	3.02	0.84	5,335	5,467	28.93	8.28	61.95	1.58	---
SGS K1	2.25	1.11	5,641	5,821	27.80	8.18	62.93	1.88	0.05
Difference	-0.77	0.27	306	354	-1.13	-0.10	0.98	0.30	---
Fengjie K2	2.54	0.62	5,714	5,838	25.74	10.0	63.61	2.03	---
SGS K2	2.11	1.10	6,111	6,293	22.64	8.04	68.22	1.39	0.15
Difference	-0.43	0.48	397	455	-3.10	-1.99	4.61	-0.64	---
Fengjie Product	3.37	0.69	5,410	5,577	28.24	9.40	61.67	1.78	---
SGS Product	2.32	1.00	5,648	5,835	27.20	8.83	62.95	2.10	0.06
Difference	-1.05	0.31	238	258	-1.04	-0.57	1.28	0.32	---

Table 14: Caotang Mine Inter Laboratory Assay Comparison.

	H_2O % ar	H_2O % ad	CV kcal/kg ar	CV kcal/kg ad	Ash % ad	Vol % ad	FC % ad	S % ad	P % ad
Fengjie K1	3.11	0.63	5,626	5,785	25.62	6.40	67.35	0.35	---
SGS K1	2.18	1.30	6,165	6,334	23.60	5.80	69.35	0.47	0.01
Difference	-0.93	0.67	539	549	-2.02	-0.60	2.00	0.12	---
Fengjie K2	2.54	0.49	5,780	5,914	24.42	8.22	66.87	1.65	---
SGS K2	1.90	0.73	6,073	6,262	22.50	9.07	67.70	1.35	0.14
Difference	-0.64	0.24	293	348	-1.92	0.85	0.83	-0.30	---
Fengjie Product	3.04	0.75	5,506	5,651	26.57	6.69	65.99	0.77	---
SGS Product	2.44	1.10	5,977	6,155	24.80	6.98	67.13	0.87	0.02
Difference	-0.60	0.35	471	504	-1.77	0.29	1.14	0.10	---

Table 15: Heiwan Mine Inter Laboratory Assay Comparison.

3.4.4 JORC Code Compliant Ore Reserves, Mineral Resources and Target Mineralisation

A statistical analysis of all the assay results from both mines, Table 16, indicates that generally the ISO accredited lab results produced better qualities than the Fengjie laboratory, i.e. lower Ash and higher calorific values. This could be due to slightly different operating standards and temperatures being used at the Fengjie lab than those used by the ISO accredited lab. These results therefore indicate an element of conservatism to the Fengjie assay results.

	H_2O % ar	H_2O % ad	CV kcal/kg ar	CV kcal/kg ad	Ash % ad	Vol % ad	FC % ad	S % ad	P % ad
Fengjie	3.08	0.71	5,496	5,645	27.12	7.87	64.30	1.21	---
SGS	2.20	1.11	5,877	6,056	25.52	7.61	65.77	1.35	0.05
Difference	-0.88	0.40	381	411	-1.60	-0.26	1.47	0.14	---

Table 16: Inter Laboratory All Assay Comparison for Caotang and Heiwan Mines.

It is AM&A's opinion that the quality and reliability of the coal quality and seam thickness data meets the standards expected for resource modelling and estimation to be reported in accordance with the JORC Code (2012), although with the potential of being slightly conservative.

MINERAL PROCESSING AND METALLURGICAL TESTING

To date all the coal has been sold unprocessed to customers as thermal coal for power generation and furnaces. When the coal does not meet customer specifications, e.g. the sulphur content of the Changhong coal or the ash content of the Baolong coal is too high, cleaner coal from other mines has been bought by the Company and this cleaner coal blended with the Company's coal to produce a product within the customer's specifications.

The Company's coal from all the mines has the potential for significant upgrading by washing to produce a significantly higher value product with a larger customer base.

Coal washing

Coal washing is a process where crushed coal is separated from waste material and possibly other contaminants such as sulphide minerals, usually by using a liquid (heavy media) with a density between the specific gravity of the waste and the coal. Finely ground minerals such as magnetite are used to form a slurry for the heavy media. If the washing is successful, the ash content and sulphur content of the coals can be significantly reduced and the calorific value increased.

The finely ground magnetite (media) and coal to be washed is pumped as a slurry(pulp) tangentially into a cyclone where the separation takes place. The higher specific gravity fractions, the magnetic media and contaminants, being subject to greater centrifugal forces pull away from the central core and descend downwards towards the apex along the wall of cyclone body and pass out as rejects/middlings. The lighter coal particles are caught in an upward stream and pass out as clean coal through the cyclone overflow outlet via the vortex finder.

The Heavy Media Cyclone may be lined with very high quality ceramic tiles or manufactured from Ni-hard (a very hard alloy of cast iron containing nickel) with a specially designed helical profile to reduce corrosion and wear. The pressure at the inlet of the cyclone is a very important factor as the pressure at which the pulp (mixture of coal and magnetite) is introduced in the cyclone is the principal means of controlling the forces within the cyclone. A decrease in the pressure will mean that more coal will report to the discard/middlings, thus impairing the efficiency of separation. This process may be repeated to produce a progressively cleaner product.

The Company has recently initiated washing tests but no meaningful results are available for this report.

MARKET STUDIES AND CONTRACTS

All the coal mined at the Company's mines is sold on the spot market as thermal coal to local electric power generating companies. Where the Company's coal does not meet minimum specifications for these customers, higher quality coal is bought from other mines and this better coal blended with the Company's coal to produce a marketable product just meeting the customer's requirements. All the coal produced in the high sulphur seams has to be blended with low sulphur coal to meet government air pollution regulations for thermal coal.

COAL RESOURCE ESTIMATES

JORC Code (2012) Definitions

A 'Measured Coal Resource' represents the part of a coal resource for which tonnage, densities, shape, physical characteristics, quality and mineral content can be estimated with a high level of confidence. It is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes. The locations are spaced closely enough to confirm geological and quality continuity.

An 'Indicated Coal Resource' represents the part of the coal resource for which tonnage, densities, shape, physical characteristics, quality and mineral content can be estimated with a reasonable level or confidence. It is based on exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes. The locations are too widely or inappropriately spaced to confirm geological and/or quality continuity, but are spaced closely enough for continuity to be assumed.

An 'Inferred Coal Resource' is that part of a Coal Resource for which quantity and quality are estimated on the basis of limited geological evidence and sampling. Geological evidence is sufficient to imply but not verify geological and quality continuity. It is based on exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes.

An Inferred Coal Resource has a lower level of confidence than that applying to an Indicated Coal Resource and must not be converted to a Reserve. It is reasonably expected that the majority of Inferred Mineral Resources could be upgraded to Indicated Coal Resources with continued exploration.

Data

The diamond drill hole and underground sampling data used for these resource estimates were received as several Excel spreadsheets while the maps were received as dxf format files and/or scanned pdf files. The main data used in this resource estimate are summarised below in Table 17.

Data	Description
Hole/sample coordinates	Excel spreadsheets received from client.
Sample qualities	Excel spreadsheets received from client.
Bulk Density	1.5 used for calculations based on information received from client.
Tenement boundaries	Digitised from maps received from client.
Coal limits	Outcrops digitised from maps received from client.
Mined out limits	Digitised from maps received from client.

Table 17: Data used in estimating the Black Gold coal resources.

Samples

The number of drill hole and underground samples used for each seam estimate are summarised in Table 18. The drill holes at Heiwan were drilled down from underground development on the K3 level while the remaining drill holes were drilled from the surface.

Mine	Seam	Drill Holes	UG Samples	Total Samples	Ave Seam Thickness	Min Seam Thickness	Max Seam Thickness
Changhong	M5	2	0	2	3.8	3.1	4.5
Changhong	M6	2	59	61	12.9	9.1	15.7
Changhong	M7	2	2	4	6.6	5.7	7.3
Changhong	M8	2	13	15	9.2	8.7	12.1

Changhong	M10	1	0	1	4.0		
Changhong	M12	2	0	2	5.4	3.0	7.9
Caotang	K1	0	417	417	2.04	1.35	2.53
Caotang	K2	0	223	223	1.08	0.35	1.2
Caotang	K3	0	0	0	0.9*		
Heiwan	K1	12	0	12	0.8	0.7	0.9
Heiwan	K2	12	0	12	0.5	0.4	0.7
Heiwan	K3	0	213	213	0.48	0.40	0.63
Heiwan	K4	0	0	0	0.3*		
Heiwan	K5	0	0	0	0.3*		
Baolong	K1	12	0	12	1.8	0.9	3.2
Baolong	K2	21	0	21	1.5	0.5	2.5
Totals		68	927	995			

Table 18: Summary of sampling used in these resource estimates.

These resource estimates used the assays from both the diamond drill holes and the underground channel samples.

Bulk Density

Bulk densities between 1.5 and 1.45 were used in all calculations to convert volumes of coal to tonnes. These values are based on measurements on 20 samples analysed by Chongqing Wanzhou Measure and Quality Inspection Centre. These values are typical for the coal qualities mined at these mines.

Mining Lease, Coal Limits and Mined Out Areas

The mining lease boundaries, coal limits and mined out areas were digitised from maps supplied by the Company.

Estimation Method

The coal volumes were estimated by gridding the coal limits, i.e. within the tenement boundary and the mapped outcrop, using 20 m x 20 m cells in MineMap© software. The coal qualities and thickness were interpolated into the cells using an inverse distance squared (ID^2) algorithm. Two interpolation passes were done, the first with a 4,000 m search radius then the second with a 1,000 m search radius. The first pass allowed all the model cells to be filled (for Target Mineralisation) while the second pass was used for resource estimation.

The coal seams that have been sampled or drilled with at least six points and within 500 m of a sample point were considered to be Measured, between 500 m and 1,000 m Indicated, between 1,000 m and 2,000 m Inferred and beyond 2,000 m Exploration Target. If the seam was sampled at two to six points, the coal within 500 m of a sample point was considered as Indicated and 500 m to 1,000 m as Inferred and beyond 1,000 m Exploration Target.

The volume was calculated by multiplying the area of the coal modelled by the average modelled coal seam thickness. This volume was then multiplied by the bulk density to calculate the tonnes.

One parameter in the model was reserved for marking if the cell was within the mined out area as digitised from the maps supplied.

Maps showing the resource models and sample points for the seams mined during 2016, Figure 22 to Figure 25.

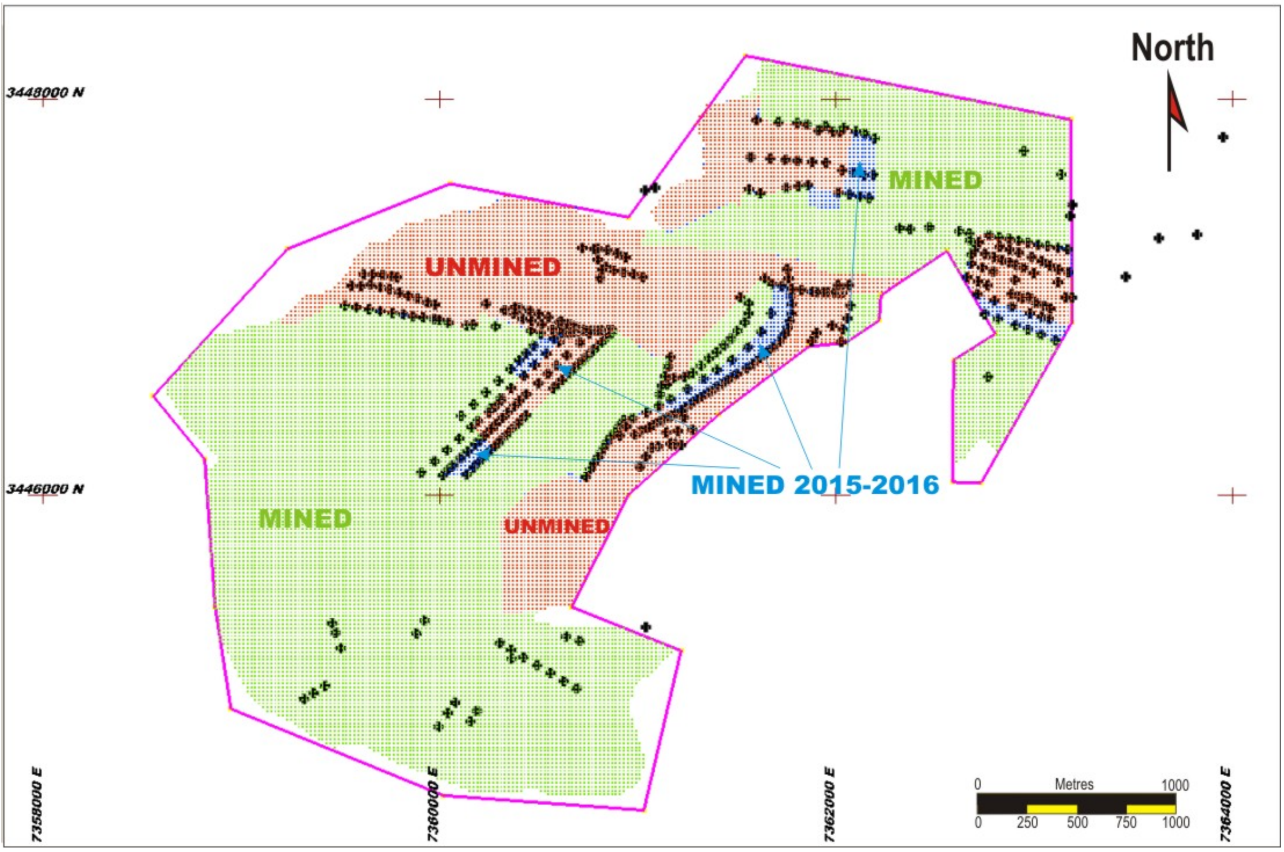


Figure 22: Caotang K1.

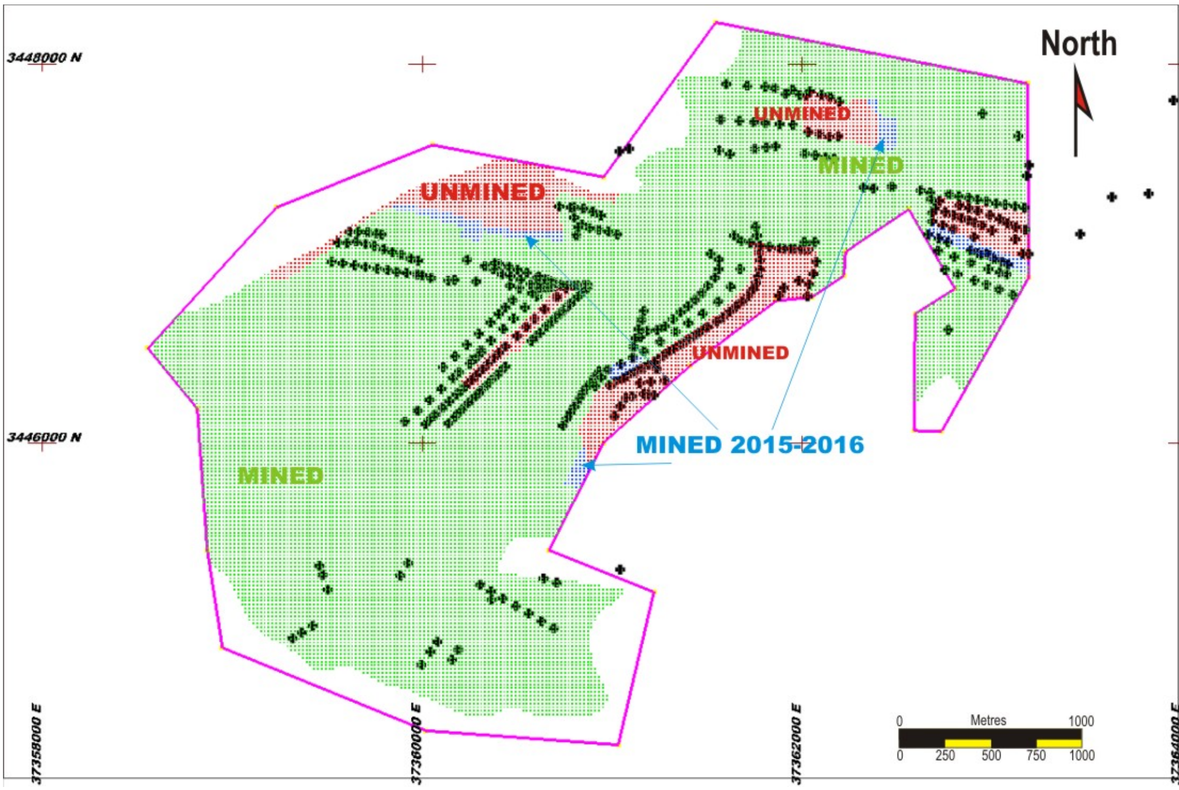


Figure 23: Caotang K2.

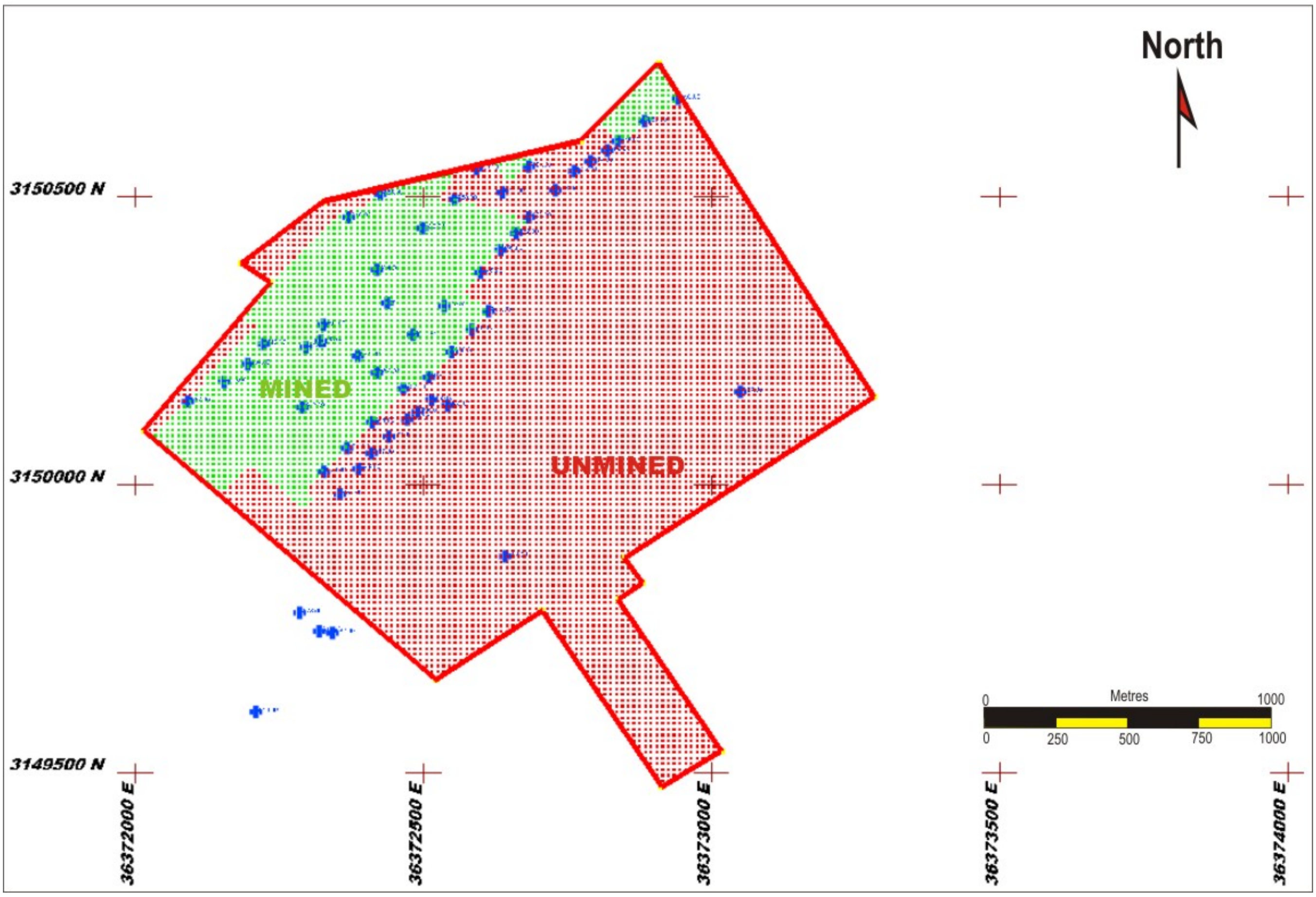


Figure 24: Changhong K6.

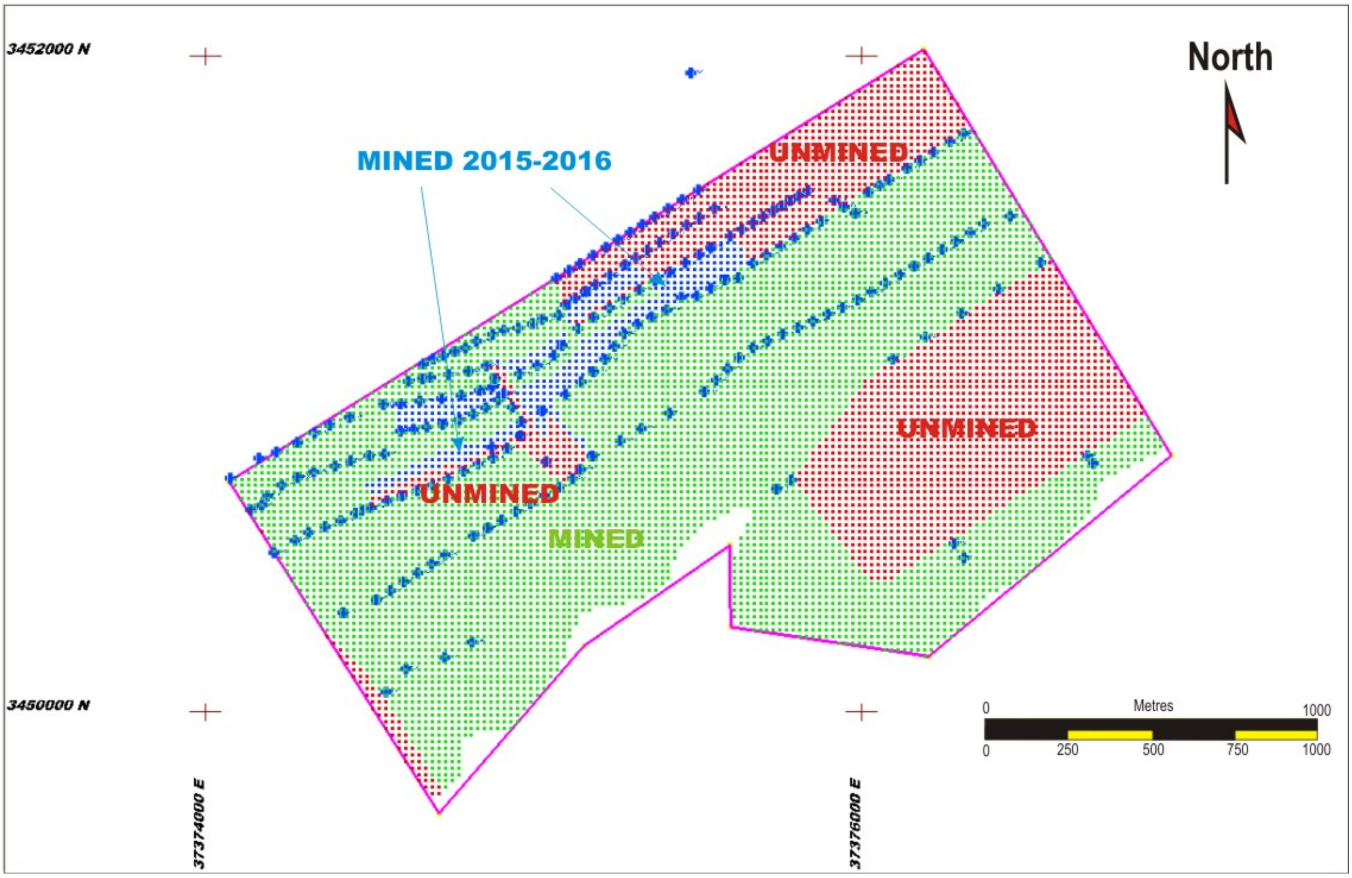


Figure 25: Heiwan K3.

2016 Production Reconciliation

Between 1 May 2015, the date of the last resource/reserve update, and 31 July, 2016 the Company has reported that a total of 1.78 million tonnes was mined and sold from the Company's two operating mines,

Table 19. The differences in reported mine production and the reserve modelling for Caotong is mainly due to extra coal seam thickness measurements in new mine development areas being slightly more than previously modelled adding extra resources to inventory.

Mine	Seam	2015 Report	2016 Report	Mined	Reserve Difference
		Total Reserve (Mt)	Total Reserve (Mt)	(Mt)	(Mt)
Caotong	K1 & K2	22.2	21.7	1.55	-0.5
Heiwan	K3	3.6	3.6	0.23	0.0
Total		25.8	25.3	1.78	-0.5

Table 19: Summary of BGG's mine production for Financial Year 2016.
(Production statistics supplied by the Company)

Resource Estimates

The Coal Resource and Exploration Target estimates are summarised below in Table **20**.

Caotang

Seam	Resources			Total Moisture (%)	Ash Content (%)	Volatiles (%)	Fixed Carbon (%)	Sulphur (%)	Calorific Value	Thickness (m)	Exploration Target*	
	Measured (Mt)	Indicated (Mt)	Inferred (Mt)								(Mt) to	(Mt)
K1	15.8	2.1	0.0	0.7	36.5	7.2	55.7	0.8	4,696	2.0	0.0	0.0
K2	9.9	0.6	0.0	0.8	32.0	7.1	60.9	0.7	5,278	1.0	0.0	0.0
K3											6.6	5.3
Total	25.7	2.7	0.0	0.7	34.8	7.2	57.6	0.8	4,911	1.6	6.6	5.3

Changhong

Seam	Resources			Total Moisture (%)	Ash Content (%)	Volatiles (%)	Fixed Carbon (%)	Sulphur (%)	Calorific Value	Thickness (m)	Exploration Target*	
	Measured (Mt)	Indicated (Mt)	Inferred (Mt)								(Mt) to	(Mt)
M5	0.0	0.0	3.6	0.5	19.4	9.2	70.8	2.5	7,101	3.8	1.4	1.1
M6	11.4	0.1	0.0	0.5	18.5	8.7	72.3	2.7	6,535	13.0	4.7	3.7
M7	0.0	7.6	0.1	0.5	17.9	9.0	56.0	2.5	6,945	6.6	0.0	0.0
M8	6.7	0.1	0.0	0.5	17.8	9.2	72.6	2.6	6,935	10.4	0.0	0.0
M10	0.0	0.0	0.0								0.0	0.0
M12	0.0	0.0	6.0	0.6	20.0	9.3	70.5	2.6	7,098	6.3	0.8	0.6
Total	18.1	7.8	9.7	0.5	18.6	9.0	68.4	2.6	6,852	9.1	6.8	5.5

Heiwan												
	Resources										Exploration Target*	
Seam	Measured (Mt)	Indicated (Mt)	Inferred (Mt)	Total Moisture (%)	Ash Content (%)	Volatiles (%)	Fixed Carbon (%)	Sulphur (%)	Calorific Value	Thickness (m)	(Mt) to	(Mt)
K1	3.4	0.4	0.0	0.7	25.5	6.7	66.6	1.0	5,702	0.9	0.0	0.0
K2	2.1	0.2	0.0	0.9	26.2	7.2	65.7	0.4	5,726	0.5	0.0	0.0
K3	0.6	0.0	0.0	0.7	31.0	7.0	61.4	0.6	5,210	0.5	0.0	0.0
K4	0.0	0.0	0.0	0.0							0.9	0.8
K5	0.0	0.0	0.0	0.0							0.8	0.6
Total	6.1	0.6	0.0	0.8	26.2	6.9	65.8	0.8	5,667	0.7	1.7	1.4

Baolong												
	Resources										Exploration Target*	
Seam	Measured (Mt)	Indicated (Mt)	Inferred (Mt)	Total Moisture (%)	Ash Content (%)	Volatiles (%)	Fixed Carbon (%)	Sulphur (%)	Calorific Value	Thickness (m)	(Mt) to	(Mt)
K1	19.5	22.4	19.2	0.5	28.1	6.8	62.7	0.7	5,527	1.9	6.2	4.9
K2	19.4	12.1	10.1	0.5	28.5	6.9	64.0	0.5	5,496	1.6	2.4	1.9
Total	38.9	34.5	29.3	0.5	28.3	6.8	63.3	0.6	5,515	1.8	8.6	6.9

Total	88.7	45.6	39.0	0.6	27.2	7.3	63.6	1.1	5,704	3.2	23.7	19.0

Table 20: Summary of Coal Resources and Exploration Target estimates as at October 31, 2016.

Note that an Exploration Target is NOT a Resource and is only conceptual in nature and may not necessarily be converted to a resource after further exploration.

JORC Compliance

All the samples were collected, from drill core and underground channels, following procedures that ensured accurate unbiased samples were collected. The coal qualities of the samples were measured at a Chinese government accredited laboratory. AM&A therefore believes that the resource and reserve estimates quoted in this report satisfy the requirements for reporting coal resources according to the JORC Code (2012) and that the reliability of the estimates is properly implied by the resource classifications used for the estimates.

Coal Reserve Estimates

Mining coal underground will result in coal losses such as pillars, particularly supporting access and conveyor drives, left for underground support; areas left unmined where faulting or other geo-structural features make the ground unstable and unsafe to mine; pillars left to support infrastructure, buildings and rivers at the surface; and coal left on the backs and floors of stopes to prevent mining dilution with waste.

Taking these factors into consideration, the Measured and Indicated resources were converted to Proved and Probable reserves by multiplying the resource tonnes by recovery factors determined by BD who in turn considered the life-of-mine designs developed by the China Coal International Engineering Chongqing Coalmine Design.

The estimated Reserves and Resources for the Company's deposits are summarised in the Table 21.

AM&A Resources 2017 Update – BGG

Caotang

	Reserves		Resources								Target	
Seam	Proved (Mt)	Probable (Mt)	Inferred (Mt)	Total Moisture (%)	Ash Content (%)	Volatiles (%)	Fixed Carbon (%)	Sulphur (%)	Calorific Value	Thickness (m)	(Mt) to	(Mt)
K1	11.5	2.4	0.0	0.7	36.5	7.2	55.7	0.8	4,695.9	2.0	0.0	0.0
K2	7.2	0.7	0.0	0.8	32.0	7.1	60.9	0.7	5,278.1	1.0	0.0	0.0
K3											6.6	5.3
Total	18.6	3.1	0.0	0.7	34.9	7.2	57.6	0.8	4,907	1.6	6.6	5.3

Changhong

	Reserves		Resources								Target	
Seam	Proved (Mt)	Probable (Mt)	Inferred (Mt)	Total Moisture (%)	Ash Content (%)	Volatiles (%)	Fixed Carbon (%)	Sulphur (%)	Calorific Value	Thickness (m)	(Mt) to	(Mt)
M5	0.0	0.0	3.6	0.5	19.4	9.2	70.8	2.5	7,101	3.8	1.4	1.1
M6	7.5	0.1	0.0	0.5	18.5	8.7	72.3	2.7	6,535	13.0	4.7	3.7
M7	0.0	6.6	0.1	0.5	17.9	9.0	56.0	2.5	6,945	6.6	0.0	0.0
M8	4.4	0.1	0.0	0.5	17.8	9.2	72.6	2.6	6,935	10.4	0.0	0.0
M10	0.0	0.0	0.0								0.0	0.0
M12	0.0	0.0	6.0	0.6	20.0	9.3	70.5	2.6	7,098	6.3	0.8	0.6
Total	11.9	6.7	9.7	0.5	18.7	9.0	67.9	2.6	6,886	8.5	6.8	5.5

Heiwan

	Reserves		Resources								Target	
Seam	Proved (Mt)	Probable (Mt)	Inferred (Mt)	Total Moisture (%)	Ash Content (%)	Volatiles (%)	Fixed Carbon (%)	Sulphur (%)	Calorific Value	Thickness (m)	(Mt) to	(Mt)
K1	1.8	0.3	0.0	0.7	25.5	6.7	66.6	1.0	5,702	0.9	0.0	0.0
K2	1.1	0.2	0.0	0.9	26.2	7.2	65.7	0.4	5,726	0.5	0.0	0.0

Baolong												
	Reserves		Resources								Target	
Seam	Proved (Mt)	Probable (Mt)	Inferred (Mt)	Total Moisture (%)	Ash Content (%)	Volatiles (%)	Fixed Carbon (%)	Sulphur (%)	Calorific Value	Thickness (m)	(Mt) to	(Mt)
K1	14.6	16.9	19.2	0.5	28.1	6.8	62.8	0.7	5,528	1.9	6.2	4.9
K2	14.5	9.1	10.1	0.5	28.5	6.9	64.0	0.5	5,495	1.6	2.4	1.9
Total	29.1	26.0	29.3	0.5	28.3	6.8	63.3	0.6	5,515	1.8	8.6	6.9
Total	62.7	36.3	39.0	0.6	27.3	7.3	63.4	1.0	5,704	3.1	23.7	19.0

Table 21: Reserve and Resource estimates for BGG's deposits as at 31 July, 2016.

ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

At the date of the Report, the mining operations at three mines were ongoing. Points under continual review include:

- Rock Collapses:

After freshly mined rock is exposed to the air, oxidation of some of the rock minerals may produce unstable rock conditions. All previously mined areas that are need to be accessed to gain entry to new mining areas are carefully checked and any unstable areas remedied before mining continues.

- Contamination of groundwater:

Since coal seams at the Projects are quite shallow, cracks and land subsidence may occur in mined-out areas. Groundwater may pass through these openings, react with the rock minerals, especially sulphides, and contaminate aquifers. In addition, lowering of groundwater aquifers during mining could affect the soil fertility and have an effect on the local agricultural industry.

- Soil Erosion:

Clearing the mine area of vegetation for infrastructure and laying impermeable roads and working areas may increase local erosion increasing the risk of landslides and mud debris flows, especially in the wet seasons.

- Environmental Pollution

Disposal of industrial, domestic waste and mining waste from the Project is monitored to ensure environmental pollution is minimised and meets government standards. Also, mine transportation and mining produces dust, steam, noise and other chemical air pollutants, like sulphur dioxide that may pollute the air so these pollutants are monitored to ensure that all air pollution is minimised and meets government standards.

- Gas Explosions

Gas levels are relatively high in Seam, 8 at Changhong. All the necessary measures to minimise, disperse and monitor coal gases are in place before mining commences to eliminate the possibility of gas explosions.

To mitigate the above issues, the following remedies are used by the Company.

- Construction of sufficient safety pillars under industrial areas and residential areas in the mining area
- Frequent monitoring of any cracks that develop on mountains near the Projects to prevent any uncontrolled landslides and land subsidence
- Vegetation is monitored in the mining area to reduce soil erosion, noise and dust emissions
- Stabilisation measures, like building retaining walls to slopes which have potential landslide risks are used
- Advanced sewage and drainage treatment technology is used to reduce toxic chemicals leaking to the environment
- Mine waste is used as much as possible for road construction and maintenance and for building construction

OPERATING COSTS ("Opex")

The current Opex for the Company's projects are summarised in Table 22.

	Caotang		Heiwan	
	RMB	A$	RMB	A$
Raw material consumed	452,559	94,087	119,374	24,818
Salaries	4,630,601	962,702	7,834,064	1,628,702
Depreciation of property, plant and equipment	9,771,015	2,031,394	4,058,880	843,841
Amortisation of land use rights	2,888	600	-	-
Amortisation of IA	92,248	19,178	46,230	9,611
Amortisation of mine development	5,763,878	1,198,310	2,509,875	521,803
Amortisation of restoration cost	43,847	9,116	17,811	3,703
Electricity and water	317,258	65,958	128,303	26,674
Maintenance	29,853	6,206	2,760	574
Labour protection fee	1,168	243	-	-
Labour insurance	441,925	91,876	9,192	1,911
Rent	-	-	40,426	8,405
Misc expenses	2,956	614	320	67
Total	21,550,196	4,480,284	14,767,235	3,070,109

Average rate for 9 months to 31 July 2016		0.2079

Table 22: Summary of Opex estimates for Company's projects.
(Costs provided by Company)

Overall, AM&A considers that the estimated Opex for the Projects are reasonable and within the range typical for this style of operation in the districts. However, actual OPEX costs for Baolong may vary significantly from estimates due to unplanned geological and operating conditions encountered over the project life. Thus, AM&A recommends that upon commencement of production; the Opex cost estimates should be monitored by competent auditors and if required adjusted for future budgets in order to reflect the actual operating costs.

ECONOMIC ANALYSIS

China Thermal Coal Prices

The Chinese coal price for standard thermal coal has risen from a trough at the beginning of 2016 of Rmb325/t ($AU69/t) to about Rmb650/t ($AU126/t) at the end of September. Figure 26.

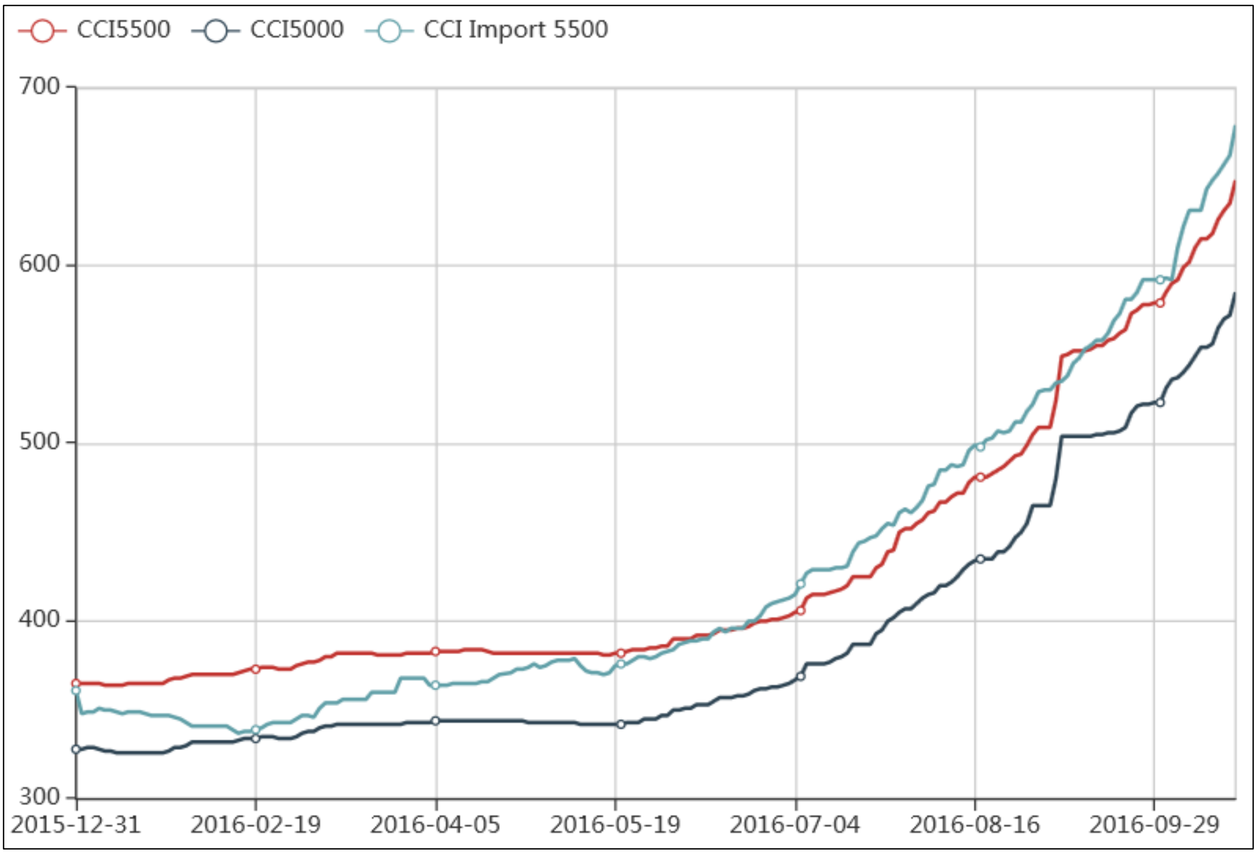


Figure 26: Thermal Coal price (Rmb/t) for 2016 to date.
(http://www.sxcoal.com/site/index?lang=en)

Thermal Coal in China

Being one of the major fuels used to produce energy, coal demand has experienced a rapid continuous growth in China since the 1980s. The most significant uses are in electricity generation, steel production and cement manufacture with coal fuelling about 40% of the world's electricity generation.

China is both the largest consumer and producer of coal in the world. China has abundant coal reserves placed with the third-largest in the world with about 13% of the world's total reserves.

There are 27 provinces in China that produce coal. Northern China, especially Shanxi and the Inner Mongolia Provinces contain most of China's easily accessible coal deposits. China's coal industry has traditionally been fragmented among large state-owned coal mines, local state-owned collieries, and thousands of town and village coal mines. The top three state-owned coal companies produce less than 15% of China's domestic coal.

China is becoming increasingly open to foreign investment in the coal sector, particularly in an effort to modernise existing large-scale mines and introduce new technologies into China's coal industry. These include coal liquefaction, coal bed methane production, and slurry pipeline transportation projects.

Supply and Demand Chongqing

Chongqing serves as the economic centre of the upstream Yangtze basin and is a major manufacturing centre and transportation hub becoming one of China's "13 emerging megacities".

Historically, the difficulties of transporting coal over the mountains from the north have forced Chongqing to rely primarily on its own coal production, despite the limited size, complex geology, high recovery costs, and mediocre quality of the municipality's high sulphur anthracite deposits. Starting from 2008, Chongqing became a progressively larger net coal importer as its own production plateaued. Chongqing serves as the economic centre of the upstream Yangtze basin and is a major manufacturing centre and transportation hub becoming one of China's "13 emerging megacities".

Most incoming coal originated in Shaanxi Province to the north, with the remainder coming from Guizhou to the south.

Economic growth in Chongqing, as in most of China, has decelerated since 2012.

The most explosive phase of Chongqing's urbanization is over, and the city will likely grow close to the nationally projected average of 7 – 8.5 percent. If, as the central government projects, the focus of economic growth shifts towards consumption, the demand for coal will grow at a somewhat slower rate due to increased energy efficiencies.

Given the limited volume and poor quality of Chongqing's reserves, the central government has planned that high quality coal from the north will gradually displace coal mined in Chongqing. This will be a gradual process taking place over some years.

Perhaps 50-75 percent of the thermal coal consumed in Chongqing's large power plants and steel mills comes from Chongqing Energy Investment Company (owned by the municipal government) coal mines, the remainder of which is met by spot purchase from smaller local mines including BGC or from mines outside the province.

Chongqing municipality recently shifted its focus to production capacity reduction, aiming to reduce overcapacity of the steel and coal industries. Chongqing government has stated that it will close around 340 local coal mines with combined capacity of 23 Mtpa by 2018, thus reducing the number of coal mines to below 70 and cutting capacity to 20 Mtpa.

Last year, the city closed 210 coal mines with an outdated capacity of 12.63 Mt, coupled with eliminating 1.26 Mt of outdated capacity through upgrading of 18 mines.

Chongqing aims to maintain a stable annual steel production of 8 million tonnes by the end of 2017.

Conclusions

Regional work by geologists from a China Geology Brigade has provided an understanding of the geology and coal deposits of Blackgold's projects. Blackgold and AM&A have sampled and mapped multiple coal seams of Permian to Triassic age on the Company's properties.

Blackgold has provided AM&A with historical data, current technical information, and business plans. AM&A's review focused on exploration data, coal resources and reserves, mining operations and planning, costs, business forecasts, environmental management, and permitting. The primary objective was to update the Company's Resource/Reserve statements compliant with the JORC Code (2012).

AM&A has concluded that the coal resource estimate database, data density, procedures, and parameters applied to the Blackgold Mines are reasonable and acceptable and the geologic and mining factors applied by Behre Dolbear (BD) in 2015 were adequate.

AM&A has concluded that, as of 31 July 2016, the in situ coal tonnages for Blackgold Mines comprise approximately 88.7 Mt of Measured, 45.6 Mt of Indicated, and 39.0 Mt of Inferred coal resources, conforming to the definitions in the JORC Code 2012 Edition.

AM&A has also concluded that, as of 31 July 2016, the Blackgold Mines, inclusive of the coal resources, held approximately 62.7 Mt of Proved and 36.3 Mt of Probable coal reserve, conforming to the definitions in the JORC Code 2012 Edition.

Recommendations

The exploration targets on Blackgold's four coal properties have potential to contain additional resource tonnages of similar quality coal to that currently being mined, i.e. high ash and sulphur anthracite. There are also 39.0 Mt of Inferred coal resources from Baolong and Changhong Mines. Further exploration in the target areas might define more Inferred Resource tonnages. It might also allow conversion of some Inferred Resource tonnages into the Measured and/or Indicated Resource categories.

An ongoing thorough review of mining methods and practices as well as the structural and geotechnical geology is highly recommended to identify ways of cutting costs and reducing safety risks to be more competitive with coal imported from neighbouring provinces. The Chongqing and Central Beijing governments have stated that they will progressively close all mines producing poor quality coal, especially high sulphur coals that impact adversely on the local environment. To overcome this threat of mine closure, AM&A strongly recommends that a feasibility study is initiated on coal washing to upgrade the coal produced in the BGC mines to remove impurities and deleterious minerals like pyrite containing sulphur that significantly devalue the Company's coal.

Project Risks

This Section identifies the areas that AM&A regards as the major risks associated with the Company's coal projects.

The main risks pertaining to the projects are as follows:

- Resource risk due to changes in geological interpretation, assumed mining and processing parameters and new geological information and or sampling data;
- Commodity prices and exchange rates are constantly changing;
- Risks inherent in exploration and mining include, among other things, successful exploration and identification of ore reserves, satisfactory performance of mining operations if a mineable deposit is discovered and competent management;
- Risks associated with obtaining renewal of tenements upon expiry of their current term, including the grant of subsequent titles where applied for over the same ground. The grant or refusal of tenements is subject to ministerial discretion and there is no certainty that the renewal of tenements will be granted.
- The risk of material adverse changes in the government policies or legislation of China that may affect the level and practicality of mining activities;
- Environmental management issues with which the Company may be required to comply from time to time. There are very substantive legislative and regulatory regimes with which the Company needs to comply for land access and mining which can lead to significant delays.
- Poor weather conditions over a prolonged period, earthquakes or other natural events which might adversely affect mining and exploration activities and the timing of earning revenues;
- Unforeseen major failures, breakdowns or repairs required to key items of mining and processing equipment, mining plant and equipment or mine structure resulting in significant delays, notwithstanding regular programs of repair, maintenance and upkeep;

This is not an exhaustive list. Further clarification of the major risks follow:

Resource Risk (Low to Medium)

All resource and reserve estimates are based on limited sampling to represent a much larger quantity of coal contained within a deposit. Therefore all resource and reserve estimates carry a level of unreliability due to geological variability and limited sampling. The JORC (2012) Code ranks resource and reserve estimates according to reliability of the estimates. Only Measured Resources carry relatively small geological risks. Only 51% of the estimated total resources for the Company's projects are classified as Measured with the remainder Probable (26%) and Inferred (23%).

Coal mining using the conventional retreat mining method works most efficiently in seams that have stable walls and are not displaced by faulting or folding. The mapping and drilling carried out on the properties to date has not identified significant faults or folding that displaces the coal seams. If it is found that a significant number of faults or folds were missed by these investigations and the coal seams are found to be more fragmented than indicated by current geological interpretations the economics of mining these seams may be adversely impacted.

Geotechnical Risk (Low to Medium)

During the wet season water from the surface and groundwater from other areas including accumulated water in abandoned previously mined stopes and open cuts could flow into the operating underground workings through faults and cracks risking flooding of the workings and also over time affect the stability of the wall rocks. Based on experience gained while mining to date, these risks are not considered to be exceptional for the Company's Projects compared to most other underground coal mines although mining near old mining stopes and below any surface streams still need to monitored carefully.

Coal Price Risk (Low to Medium)

The world economy is currently unstable resulting in widely fluctuating prices for all types of coal. Current prices for coals are generally high, although off recent peaks, but no-one can confidently predict future coal prices and how these changes will impact the project. It is noted however that the project is within China which is a major consumer of the type of coals mined at the projects and it is government policy to become self-sufficient in coal. The market for the coal types mined at the Company's mines is in very high demand with continual construction of electric power plants fuelled by coal so it is expected that all the thermal coal produced by Company's mines will be readily sold.

If pollution control laws are strengthened and the high ash and sulphur content coal produced in the Company's larger mines become un-saleable the coal may require washing to reduce the ash and sulphur content of the coals below acceptable limits.

Sovereign Risk (Low to Medium)

The Chinese mining regulations and laws have changed considerably over recent years and are expected to continue to evolve. Most of the changes have made mining regulations more transparent and assist foreign investment. The extent and direction of further changes to the mining regulations and laws and their impact on these projects cannot be estimated, however it is not expected that any changes in the government regulations will pose exceptional risk to the project.

Contamination of Local Water System Risk (Low to Medium)

The Projects produces significant water as in-flow and groundwater into the underground mine workings that exits to the surface and water is also used extensively around the site for domestic purposes, at the workshops and for dust suppression. The quantity and quality of water produced at the Projects could cause problems in the local environment leading to possible litigation by local residents and the government if the Project's water management does not meet the conditions set out in the government approved Environmental Impact Statement that forms part of the mining licence conditions. The likelihood of contamination problems would increase should the Company be required to wash their coal prior to marketing.

Contamination of the local water system is possible from other mine activities such as leaching of contaminants from mine waste dumps, industrial waste from workshops and domestic waste.

AM&A considers that due to the isolated location of the projects, the risk of serious water contamination that could adversely affect local residents or contravene government regulations is low to medium.

Underestimation of the Operation Costs Risk (Low to Medium)

The operating cost estimates used in the report that are the basis of AM&A's reserve estimates are based on a number of assumptions. AM&A considers that there is a low to medium risk that operating costs may exceed the assumed estimates due to unforeseen increases of operating costs including fuel, labour and general inflation that could adversely affect the profitability of the projects.

Spontaneous Combustion and Gas Explosion Risk (Moderate to High)

The coal seams in the Company's projects have low to moderate tendency of spontaneous combustion due to their volatility and friability with the coal at Changhong being of most concern. The Company makes every effort to eliminate this risk by minimising the time that broken coal underground is exposed to the air after blasting and all possible sources of ignition such as electrical arcing are eliminated or protected.

To prevent volatile gases such as methane and dust generated by the coal from igniting, the atmosphere in the mine workings are strictly monitored and ventilation maximised.

Natural Disasters (Low)

Since the Company's projects are located in a low seismic region, infrastructure damage and disruption to mine production due to a large earthquake is unlikely.

The Project area is within a relatively dry mild climatic region however rare storms and floods are possible.

AM&A considers that the possibility of a major natural disaster is low.

Summary of Risks

A summary of the main Project risks are included, summarised and ranked by their importance as follows in Table 23:

Risk Issue Likelihood Consequence	Likelihood	Consequence Rating	Risk
Geological			
Resource/Reserve tonnes and grades significantly not achieved beyond the limits implied by the JORC classifications	Unlikely	Major	Medium
Mine workings collapse	Unlikely	Major	Medium
Significant unexpected faulting or folding	Unlikely	Minor	Low
Unexpected groundwater ingress	Possible	Moderate	Medium
Adverse Economic Conditions			
Coal price	Possible	Moderate	Medium
Inflation increases	Possible	Minor	Low
Change in Interest Rates	Possible	Minor	Low
Loss of demand	Unlikely	Major	Medium
Industrial disruption	Possible	Minor	Low
Sovereign risk	Possible	Moderate	Medium
Environmental Damage or Event			
Significant Unpredicted Surface Subsidence	Possible	Moderate	Medium
Ecological Damage	Unlikely	Minor	Low
Extra costs for environment restoration	Possible	Minor	Low
Contamination of local water system	Possible	Moderate	Medium
Flooding	Possible	Moderate	Medium
Significant seismic event	Possible	Moderate	Medium
Capital and Operating Costs			
Project timing delays	Possible	Minor	Low
Capital cost increase	Possible	Moderate	Medium
Operating costs underestimated significantly	Unlikely	Major	Medium
Licensing and permitting	Possible	Moderate	Medium
Operational Risk			
Underperformance of plant and machinery	Possible	Moderate	Medium
Adverse weather condition	Unlikely	Moderate	Low
Other natural hazards	Unlikely	Moderate	Low
Lack of working force	Unlikely	Moderate	Low
Spontaneous combustion	Possible	Major	High
Gas Explosion	Possible	Major	High

Table 23: Project risk assessment.

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Abbreviations

g	gram	m^3	cubic metre
kg	kilogram	mm	millimetre
km	kilometre	M	million
km^2	square kilometre	t	tonne
m	metre		
m^2	square metre		

JORC Code, 2012 Edition – Table 1

Section 1 Sampling Techniques and Data

(Criteria in this section apply to all succeeding sections.)

Criteria	JORC Code explanation	Commentary
Sampling techniques	• Nature and quality of sampling (eg cut channels, random chips, or specific specialised industry standard measurement tools appropriate to the minerals under investigation, such as down hole gamma sondes, or handheld XRF instruments, etc). These examples should not be taken as limiting the broad meaning of sampling. • Include reference to measures taken to ensure sample representivity and the appropriate calibration of any measurement tools or systems used. • Aspects of the determination of mineralisation that are Material to the Public Report. • In cases where 'industry standard' work has been done this would be relatively simple (eg 'reverse circulation drilling was used to obtain 1 m samples from which 3 kg was pulverised to produce a 30 g charge for fire assay'). In other cases more explanation may be required, such as where there is coarse gold that has inherent sampling problems. Unusual commodities or mineralisation types (eg submarine nodules) may warrant disclosure of detailed information.	• Most samples used for resource estimation are channel samples collected from underground workings by trained personnel following Chinese Sampling Standard GB/T 482-2008 "National Standards of the People's Republic of China Sampling of coal seams". The quality of this sampling has been confirmed by the CP during site visits as being reliable and unbiased and suitable for resource modelling reported in accordance with the JORC Code. • Seam thicknesses were measured perpendicular from the mapped hangingwall to the footwall of the seams exposed at regular intervals in working mine development drives. • Samples were collected from cleaned faces in channels 10 cm wide and 5 cm deep. • Where drill sampling used, these samples were collected from diamond drill holes where the core recovery in the seams exceeded 85%.
Drilling techniques	• Drill type (eg core, reverse circulation, open-hole hammer, rotary air blast, auger, Bangka, sonic, etc) and details (eg core diameter, triple or standard tube, depth of diamond tails, face-sampling bit or other type, whether core is oriented and if so, by what method, etc).	• Where drill sampling used, these samples were collected from diamond drill holes. • All core is NQ recovered with standard conventional tube equipment.
Drill sample recovery	• Method of recording and assessing core and chip sample recoveries and results assessed. • Measures taken to maximise sample recovery and ensure representative nature of the samples. • Whether a relationship exists between sample recovery and grade and whether sample bias may have occurred due to preferential loss/gain of fine/coarse material.	• Drill core sample recoveries in the seams sampled exceeded 85% in all holes. • All samples collected following Chinese standard procedures. • Since all core samples exceeded 85% recovery and proper channel sampling procedures were followed no sample bias is expected. More likely coal rather than partings is lost so any bias is likely to have a slightly negative impact on assays.
Logging	• Whether core and chip samples have been geologically and geotechnically logged to a level of detail to support appropriate Mineral Resource estimation, mining studies and metallurgical studies.	• All diamond drill core was logged by a qualified geologist with the seam limits accurately marked prior to sampling. • All underground samples were collected by trained personnel with the

Criteria	JORC Code explanation	Commentary
	• Whether logging is qualitative or quantitative in nature. Core (or costean, channel, etc) photography. • The total length and percentage of the relevant intersections logged.	seam limits determined by a qualified geologist prior to sampling. • All the samples collected for analysis were taken between qualitative logged coal seam boundaries.
Sub-sampling techniques and sample preparation	• If core, whether cut or sawn and whether quarter, half or all core taken. • If non-core, whether riffled, tube sampled, rotary split, etc and whether sampled wet or dry. • For all sample types, the nature, quality and appropriateness of the sample preparation technique. • Quality control procedures adopted for all sub-sampling stages to maximise representivity of samples. • Measures taken to ensure that the sampling is representative of the in situ material collected, including for instance results for field duplicate/second-half sampling. • Whether sample sizes are appropriate to the grain size of the material being sampled.	• All drill core and underground samples were taken of the entire seam, including any partings where they occur, from the logged/mapped hangingwall to the logged/mapped footwall. • All the drill core, i.e. no core splitting or sub-sampling was done, was dispatched for laboratory analysis. • All the samples collected from underground were sent for laboratory analysis without sub-sampling or splitting. • All sample splitting done at the laboratory was after fine crushing. • The sample collection and sample preparation techniques meet international standards for coal sampling. • Since the drilling and underground sample locations are determined by regular sample spacing the sampling is considered to be representative of the seams where sampled and not biased by selective sampling. • The sample sizes are appropriate for the grainsize/coal bedding thicknesses of the coal being sampled.
Quality of assay data and laboratory tests	• The nature, quality and appropriateness of the assaying and laboratory procedures used and whether the technique is considered partial or total. • Nature of quality control procedures adopted (eg standards, blanks, duplicates, external laboratory checks) and whether acceptable levels of accuracy (ie lack of bias) and precision have been established.	• All the laboratory analyses were performed by nationally accredited laboratories using standard techniques and properly calibrated equipment.
Verification of sampling and assaying	• The verification of significant intersections by either independent or alternative company personnel. • The use of twinned holes. • Documentation of primary data, data entry procedures, data verification, data storage (physical and electronic) protocols. • Discuss any adjustment to assay data.	• No verification samples were collected by the CP. However the sample analysis results from operating mines used in the resource modeling match the referee quality samples analyses taken at the ROM by the purchaser. • All the sampling data has been properly recorded on Excel spreadsheets by the geological staff at each mine. • No adjustments to the quality data or seam thicknesses were required.
Location of data points	• Accuracy and quality of surveys used to locate drill holes (collar and down-hole surveys), trenches, mine workings and other locations used in Mineral Resource estimation. • Specification of the grid system used. • Quality and adequacy of topographic control.	• All the drill collars were surveyed by licensed surveyors. • All underground samples were accurately located using surveyed station points on the mine development backs. • All surveys use the GAUSS-KRUGER Xi'an 1980 grid datum. • All the mine sites have been covered by adequate topographic surveys and the underground workings surveyed to a standard suitable for the resource modeling.

Criteria	JORC Code explanation	Commentary
Data spacing and distribution	• Data spacing for reporting of Exploration Results. • Whether the data spacing and distribution is sufficient to establish the degree of geological and grade continuity appropriate for the Mineral Resource and Ore Reserve estimation procedure(s) and classifications applied. • Whether sample compositing has been applied.	• Almost all the drilling used for resource modeling is spaced on a nominal 500 m spaced grid. • Most of the underground samples were collected at nominal 50 m intervals along the mine development. • The spacing of the drilling and underground sampling, after considering the geology of the seams and any structural complexities, is appropriate for the resource categories reported. • Sample compositing was not required as all the samples were collected across the entire seam being sampled.
Orientation of data in relation to geological structure	• Whether the orientation of sampling achieves unbiased sampling of possible structures and the extent to which this is known, considering the deposit type. • If the relationship between the drilling orientation and the orientation of key mineralised structures is considered to have introduced a sampling bias, this should be assessed and reported if material.	• Since the seams are horizontal or only very shallowly dipping and the drilling and underground samples were taken vertically, the sampled seam thicknesses are essentially true seam widths. • There is no sample bias due to the orientation of the samples.
Sample security	• The measures taken to ensure sample security.	• All samples dispatched for laboratory analysis were sent in sealed, secure plastic bags to prevent drying and oxidation of the samples and spillages. • All the samples were all transported to the laboratories for analysis in secure transport.
Audits or reviews	• The results of any audits or reviews of sampling techniques and data.	• The CP has thoroughly reviewed the entire sampling stream and found that all the sampling properly followed the Chinese standards which in turn meet international and JORC Code (2012) standards. • The data used in the resource estimates has been checked for accuracy against primary sources where available. All sample locations were checked against mine development plans to confirm that they are recorded as being located in the development where they were taken. All errors found were corrected.

Section 2 Reporting of Exploration Results

(Criteria listed in the preceding section also apply to this section.)

Criteria	JORC Code explanation	Commentary
Mineral tenement and land tenure status	• Type, reference name/number, location and ownership including agreements or material issues with third parties such as joint ventures, partnerships, overriding royalties, native title interests, historical sites, wilderness or national park and environmental settings. • The security of the tenure held at the time of reporting along with any known impediments to obtaining a licence to operate in the area.	• All tenements included in this report are owned 100% by the Company or its 100% owned subsidiaries. • All tenements are in good standing with the relevant authorities. • There are no extraordinary impediments to maintaining current operating licences at all the mines reported. All the important standard conditions for operating each of the mines according to Chinese Mining Law are

Criteria	JORC Code explanation	Commentary
		described in the text of the report.
Exploration done by other parties	• Acknowledgment and appraisal of exploration by other parties.	• All data used in this report was provided by the Company or obtained from publicly available sources and, where appropriate, listed in the References section of this report.
Geology	• Deposit type, geological setting and style of mineralisation.	• The genesis and style of coal described in this report is typical of Triassic age coal seams throughout the world where they occur.
Drill hole Information	• A summary of all information material to the understanding of the exploration results including a tabulation of the following information for all Material drill holes: ○ easting and northing of the drill hole collar ○ elevation or RL (Reduced Level – elevation above sea level in metres) of the drill hole collar ○ dip and azimuth of the hole ○ down hole length and interception depth ○ hole length. • If the exclusion of this information is justified on the basis that the information is not Material and this exclusion does not detract from the understanding of the report, the AM&A should clearly explain why this is the case.	• Maps showing the locations of all the drill holes and underground samples used in the reported resource estimates are included in the main body of this report. • No data supplied to the CP was excluded because it was considered not Material from the resource modelling.
Data aggregation methods	• In reporting Exploration Results, weighting averaging techniques, maximum and/or minimum grade truncations (eg cutting of high grades) and cut-off grades are usually Material and should be stated. • Where aggregate intercepts incorporate short lengths of high grade results and longer lengths of low grade results, the procedure used for such aggregation should be stated and some typical examples of such aggregations should be shown in detail.	• Data aggregation was not required in the resource modelling. All the sampling measurements and qualities used in the resource modelling were of whole seams.
Relationship between mineralisation widths and intercept lengths	• These relationships are particularly important in the reporting of Exploration Results. • If the geometry of the mineralisation with respect to the drill hole angle is known, its nature should be reported. • If it is not known and only the down hole lengths are reported, there should be a clear statement to this effect (eg 'down hole length, true width not known').	• Since the seams are horizontal or only very shallowly dipping and the drilling and underground samples were taken vertically, the sampled seam thicknesses are essentially true seam widths.
Diagrams	• Appropriate maps and sections (with scales) and tabulations of intercepts should be included for any significant discovery being reported These should include, but not be limited to a plan view of drill hole collar locations	• Maps showing the local geology, mine workings and typical cross sections for each of the deposits are included in the main body of this report.

Criteria	JORC Code explanation	Commentary
	and appropriate sectional views.	
Balanced reporting	• Where comprehensive reporting of all Exploration Results is not practicable, representative reporting of both low and high grades and/or widths should be practiced to avoid misleading reporting of Exploration Results.	• All the sampling data collected by the Company was included in the modelling of the coal seams and reported in the resource estimates.
Other substantive exploration data	• Other exploration data, if meaningful and material, should be reported including (but not limited to): geological observations; geophysical survey results; geochemical survey results; bulk samples – size and method of treatment; metallurgical test results; bulk density, groundwater, geotechnical and rock characteristics; potential deleterious or contaminating substances.	• No substantive exploration work, that has not been included in this report, has been carried out.
Further work	• The nature and scale of planned further work (eg tests for lateral extensions or depth extensions or large-scale step-out drilling). • Diagrams clearly highlighting the areas of possible extensions, including the main geological interpretations and future drilling areas, provided this information is not commercially sensitive.	• Since the deposits are operating mines, no further surface drilling is planned. Sampling and measurements of the coal seams will continue at regular intervals along the mine development drives as they advance.

Section 3 Estimation and Reporting of Mineral Resources

(Criteria listed in section 1, and where relevant in section 2, also apply to this section.)

Criteria	JORC Code explanation	Commentary
Database integrity	• Measures taken to ensure that data has not been corrupted by, for example, transcription or keying errors, between its initial collection and its use for Mineral Resource estimation purposes. • Data validation procedures used.	• The data used in the resource estimates has been checked for accuracy against primary sources where available. All sample locations were checked against mine development plans to confirm that they are located in the development where they were taken. All errors found were corrected.
Site visits	• Comment on any site visits undertaken by the AM&A and the outcome of those visits. • If no site visits have been undertaken indicate why this is the case.	• The CP has made four site visits, most recently in December 2014, and sampling, mining and beneficiation processes were verified along with data compilation, input methods and data integrity checked.
Geological interpretation	• Confidence in (or conversely, the uncertainty of) the geological interpretation of the mineral deposit. • Nature of the data used and of any assumptions made. • The effect, if any, of alternative interpretations on Mineral Resource estimation. • The use of geology in guiding and controlling Mineral Resource estimation. • The factors affecting continuity both of grade and geology.	• The coal seams, at all the mines reported, have very simple geology and predictable continuity of seam qualities and widths, with very little folding and faulting offsetting the seams. The density of the coal seam thickness and coal quality data available for each of the seams modelled provides a sound understanding of the geology for the resource categories reported. • No special assumptions were required to model the seam geology and continuity. • The resource models are all constrained in all three dimensions by the

Criteria	JORC Code explanation	Commentary
		geology.
Dimensions	• The extent and variability of the Mineral Resource expressed as length (along strike or otherwise), plan width, and depth below surface to the upper and lower limits of the Mineral Resource.	• The flat dipping coal seams all extend well beyond the limits of the tenements and resource models described in this report.
Estimation and modelling techniques	• The nature and appropriateness of the estimation technique(s) applied and key assumptions, including treatment of extreme grade values, domaining, interpolation parameters and maximum distance of extrapolation from data points. If a computer assisted estimation method was chosen include a description of computer software and parameters used. • The availability of check estimates, previous estimates and/or mine production records and whether the Mineral Resource estimate takes appropriate account of such data. • The assumptions made regarding recovery of by-products. • Estimation of deleterious elements or other non-grade variables of economic significance (eg sulphur for acid mine drainage characterisation). • In the case of block model interpolation, the block size in relation to the average sample spacing and the search employed. • Any assumptions behind modelling of selective mining units. • Any assumptions about correlation between variables. • Description of how the geological interpretation was used to control the resource estimates. • Discussion of basis for using or not using grade cutting or capping. • The process of validation, the checking process used, the comparison of model data to drill hole data, and use of reconciliation data if available.	• All the seams were modelled by extrapolating the coal seam data, including the coal seam thicknesses and coal qualities, using an Inverse Distance Squared (ID^2) algorithm into gridded cells. • Since the seams vary little in thickness and qualities within the modelled areas this modelling method is appropriate for resource estimation. • No check resource models/estimates were considered but actual mine production figures, where available, tally well with the resource models and estimates. • No by-products are considered as part of the resource estimates. • The coal produced from the mines, sometimes blended with coal purchased from other sources, is readily sold under long term contracts with no penalties paid for deleterious elements such as sulphur. • The cells in the block models are considered by the CP as being appropriate for the sample spacing and dimensions of the resources. Full details of model parameters for each model are included in the report. • The resource model is confined by the mapped outcrop of the coal seams where appropriate and by the tenement boundaries. All the mapped shear zones were also considered in the modelling and appropriate pillars of unmined coal left for mine workings stability. • Grade cutting is not considered appropriate for the coal seams modelled since variations in the qualities and thicknesses within the individual seams was small with no significant outliers. • All resource models were colour coded and checked visually with the sample points.
Moisture	• Whether the tonnages are estimated on a dry basis or with natural moisture, and the method of determination of the moisture content.	• All tonnages are based on air dried bulk densities. • Moisture contents were measured in samples using Chinese standard equipment and techniques that also conform to JORC Code (2012) standards.
Cut-off parameters	• The basis of the adopted cut-off grade(s) or quality parameters applied.	• Cut-off grades/qualities are not considered in the resource estimates.
Mining factors or	• Assumptions made regarding possible mining methods, minimum mining dimensions and internal (or, if applicable, external) mining dilution. It is	• All mining parameters used for estimating reserves from resources, including mining dilution and recoveries, are based on actual mining

Criteria	JORC Code explanation	Commentary
assumptions	always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential mining methods, but the assumptions made regarding mining methods and parameters when estimating Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the mining assumptions made.	experience in the relevant deposits.
Metallurgical factors or assumptions	• The basis for assumptions or predictions regarding metallurgical amenability. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider potential metallurgical methods, but the assumptions regarding metallurgical treatment processes and parameters made when reporting Mineral Resources may not always be rigorous. Where this is the case, this should be reported with an explanation of the basis of the metallurgical assumptions made.	• All the coals included in the resource estimates could be beneficiated by washing however the CP is unaware of any washing tests carried out on the coals. To date all the mined coal has been sold without beneficiation with the customer either washing the coal or blending it to produce an acceptable product for the intended end use.
Environmental factors or assumptions	• Assumptions made regarding possible waste and process residue disposal options. It is always necessary as part of the process of determining reasonable prospects for eventual economic extraction to consider the potential environmental impacts of the mining and processing operation. While at this stage the determination of potential environmental impacts, particularly for a greenfields project, may not always be well advanced, the status of early consideration of these potential environmental impacts should be reported. Where these aspects have not been considered this should be reported with an explanation of the environmental assumptions made.	• All the operating mines are operating within the current environmental guidelines determined by the relevant government authorities. • All waste is being stockpiled in a manner consistent with the government regulations. No contamination of the environment by mine waste or deleterious minerals exceeding government guidelines has been reported.
Bulk density	• Whether assumed or determined. If assumed, the basis for the assumptions. If determined, the method used, whether wet or dry, the frequency of the measurements, the nature, size and representativeness of the samples. • The bulk density for bulk material must have been measured by methods that adequately account for void spaces (vugs, porosity, etc), moisture and differences between rock and alteration zones within the deposit. • Discuss assumptions for bulk density estimates used in the evaluation process of the different materials.	• The bulk densities used in the resource estimates for Baolong are based on measurements taken of representative samples. The bulk densities for all the other seams are based on historical mine measurements and sales data..
Classification	• The basis for the classification of the Mineral Resources into varying confidence categories. • Whether appropriate account has been taken of all relevant factors (ie	• The coal resource estimates are classified according to the minimum search distance between the resource model blocks and the nearest sample point. The resources that have been sampled or drilled at least six

Criteria	JORC Code explanation	Commentary
	relative confidence in tonnage/grade estimations, reliability of input data, confidence in continuity of geology and metal values, quality, quantity and distribution of the data). • Whether the result appropriately reflects the AM&A's view of the deposit.	points and within 500 m of a sample point were considered to be Measured, between 500 m and 1000 m Indicated, between 1000 m and 2000 m Inferred and beyond 2000 m Exploration Target. If the seam was sampled at two to six points, the coal within 500 m of a sample point was considered as Indicated and 500 m to 1000 m as Inferred and beyond 1000 m Exploration Target. Exploration Target estimates are NOT included in the resource inventory. • The confidence in the geological interpretations and quality of the sampling were all considered when deciding on these search distances. • The resource modelling appropriately reflects the CP's view of the deposit.
Audits or reviews	• The results of any audits or reviews of Mineral Resource estimates.	• No independent audits or reviews of the resource estimates have been undertaken although the reconciliation between actual mine production and resource and reserve estimates in the seams currently being mined are good.
Discussion of relative accuracy/ confidence	• Where appropriate a statement of the relative accuracy and confidence level in the Mineral Resource estimate using an approach or procedure deemed appropriate by the AM&A. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the resource within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors that could affect the relative accuracy and confidence of the estimate. • The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used. • These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	• The CP believes that the relative accuracy of the resource estimates are properly indicated by the implied accuracy of the JORC Code (2012) categories used. Only small changes to the tonnages and qualities of future resource estimates, after allowances for mined out tonnages are made, are expected as more sampling is carried out from the underground workings as mining progresses. • All resource estimates in this report are of the entire area covered by coal seams within the tenements with allowances for any coal already extracted by mining. • Reconciliation between actual mine production and resource and reserve estimates in the seams currently being mined are considered by the CP to be good.

Section 4 Estimation and Reporting of Ore Reserves

(Criteria listed in section 1, and where relevant in sections 2 and 3, also apply to this section.)

Criteria	JORC Code explanation	Commentary
Mineral Resource estimate for conversion to Ore Reserves	• Description of the Mineral Resource estimate used as a basis for the conversion to an Ore Reserve. • Clear statement as to whether the Mineral Resources are reported additional to, or inclusive of, the Ore Reserves.	• The resource estimates quoted in this report have, after appropriate modifying factors such as mining dilution and mining losses have been applied, been converted to reserve estimates and so are inclusive of the reserve estimates quoted in this report.
Site visits	• Comment on any site visits undertaken by the AM&A and the outcome of	• The CP has made four site visits, most recently in September 2016, and

Criteria	JORC Code explanation	Commentary
	those visits. • If no site visits have been undertaken indicate why this is the case.	sampling, mining and beneficiation processes were verified along with data compilation along with checking input methods and data integrity.
Study status	• The type and level of study undertaken to enable Mineral Resources to be converted to Ore Reserves. • The Code requires that a study to at least Pre-Feasibility Study level has been undertaken to convert Mineral Resources to Ore Reserves. Such studies will have been carried out and will have determined a mine plan that is technically achievable and economically viable, and that material Modifying Factors have been considered.	• The modifying factors such as mining dilution and mining losses that have been applied to convert the resource estimates to reserve estimates are based on actual mining experience at the relevant mining operations and standard Chinese mining recovery rates.
Cut-off parameters	• The basis of the cut-off grade(s) or quality parameters applied.	• Since the mining method is labour intensive allowing careful selective mining, no minimum cut-off grades/qualities were applied.
Mining factors or assumptions	• The method and assumptions used as reported in the Pre-Feasibility or Feasibility Study to convert the Mineral Resource to an Ore Reserve (i.e. either by application of appropriate factors by optimisation or by preliminary or detailed design). • The choice, nature and appropriateness of the selected mining method(s) and other mining parameters including associated design issues such as pre-strip, access, etc. • The assumptions made regarding geotechnical parameters (eg pit slopes, stope sizes, etc), grade control and pre-production drilling. • The major assumptions made and Mineral Resource model used for pit and stope optimisation (if appropriate). • The mining dilution factors used. • The mining recovery factors used. • Any minimum mining widths used. • The manner in which Inferred Mineral Resources are utilised in mining studies and the sensitivity of the outcome to their inclusion. • The infrastructure requirements of the selected mining methods.	• Since all the modelledmodelled coal seams included in this report are at operating mines, no Feasibility Study is required to determine the Modifying Factors required to convert the Resources to Reserves. • The modifying factors such as mining dilution and mining losses that have been applied to convert the resource estimates to reserve estimates are based on Chinese regulatory standards and confirmed by actual mining experience at the relevant mining operations. • The current underground mine workings at all the mines are not affected by geotechnical factors such as folding and faulting that could influence mining recoveries and dilution. • The underground mining method used to extract the coal at all the mines is called conventional retreat mining which is a typical mining method for similar coal seams over the world. • Since the mining method is labour intensive allowing careful selective mining, no mining dilution factors were applied. • Chinese mining regulations require that all mine operators recover no less than 85% of the estimated coal resources, allowing 15% for losses as pillars for underground support and any other mining losses, or else they will be penalized so this recovery factor was generally used for conversion of resources to reserves. • Only Measured and Indicated resources were converted to Reserves. • All the coal seams modelled exceed the minimum mining width. • No major additional infrastructure will be required to mine the reported reserves than has already considered in current Company budget projections.

Criteria	JORC Code explanation	Commentary
Metallurgical factors or assumptions	• The metallurgical process proposed and the appropriateness of that process to the style of mineralisation. • Whether the metallurgical process is well-tested technology or novel in nature. • The nature, amount and representativeness of metallurgical test work undertaken, the nature of the metallurgical domaining applied and the corresponding metallurgical recovery factors applied. • Any assumptions or allowances made for deleterious elements. • The existence of any bulk sample or pilot scale test work and the degree to which such samples are considered representative of the orebody as a whole. • For minerals that are defined by a specification, has the ore reserve estimation been based on the appropriate mineralogy to meet the specifications?	• All the coals would produce higher quality products, with lower ash and sulphur contents and higher calorific values, if they were beneficiated by washing, however no metallurgical test work results have been provided to the CP to be assessed. • No metallurgical recovery factors have been applied to the resource and reserve estimates since all the coal is currently sold without beneficiation or washing. • None of the modelled coals have deleterious elements that have to date caused problems with the sale of the mined coal or waste disposal. Where the mined coal does not meet customer specifications it is blended with “above spec” coals purchased from other operators to produce a blended product that meets customer specifications.
Environmen-tal	• The status of studies of potential environmental impacts of the mining and processing operation. Details of waste rock characterisation and the consideration of potential sites, status of design options considered and, where applicable, the status of approvals for process residue storage and waste dumps should be reported.	• All the operating mines are operating within the current environmental guidelines determined by the relevant government authorities. • All waste is being stockpiled in a manner consistent with the government regulations. No contamination of the environment by mine waste or deleterious minerals exceeding government guidelines has been reported. • The current tenements include sufficient sites with capacity for future safe disposal of all planned mine waste.
Infrastructure	• The existence of appropriate infrastructure: availability of land for plant development, power, water, transportation (particularly for bulk commodities), labour, accommodation; or the ease with which the infrastructure can be provided, or accessed.	• All the mines and exploration projects are well serviced by existing infrastructure such as roads, railways, river ports, electric power, water and access to labour, sufficient for any current or planned future mining. • The current tenements include sufficient sites to meet any future requirements for mining infrastructure including offices, workshops, accommodation for staff, processing plants and for waste disposal.
Costs	• The derivation of, or assumptions made, regarding projected capital costs in the study. • The methodology used to estimate operating costs. • Allowances made for the content of deleterious elements. • The derivation of assumptions made of metal or commodity price(s), for the principal minerals and co- products. • The source of exchange rates used in the study. • Derivation of transportation charges. • The basis for forecasting or source of treatment and refining charges, penalties for failure to meet specification, etc.	• All assumptions on operating, transportation and capital costs are based on the current mining operations that are currently profitable. • Where the mined coal does not meet customer specifications it is blended with “above spec” coals purchased from other operators to produce a blended product that meets customer specifications so no allowance for these deleterious elements is necessary. • Current contract prices for the coal being produced were supplied by the client. • All assumed current and forecasted operating and capital costs as well as sales are in Chinese Renminbi (RB).

Criteria	JORC Code explanation	Commentary
	• The allowances made for royalties payable, both Government and private.	• Assumed operating costs include all the relevant government royalties.
Revenue factors	• The derivation of, or assumptions made regarding revenue factors including head grade, metal or commodity price(s) exchange rates, transportation and treatment charges, penalties, net smelter returns, etc. • The derivation of assumptions made of metal or commodity price(s), for the principal metals, minerals and co-products.	• All assumptions on revenues are based on current mined coal sale contracts.
Market assessment	• The demand, supply and stock situation for the particular commodity, consumption trends and factors likely to affect supply and demand into the future. • A customer and competitor analysis along with the identification of likely market windows for the product. • Price and volume forecasts and the basis for these forecasts. • For industrial minerals the customer specification, testing and acceptance requirements prior to a supply contract.	• The coal currently being mined is in high demand as thermal coal and no sale problems are expected for the mine products into the future. • If stricter government air pollution regulations are enacted the high sulphur coal at Changhong may become unsaleable without further blending with other low sulphur coals or will require washing. • Price and volume forecasts are based on the Company's local market experience. • All coal sales require "umpire" analyses of representative samples collected from each shipment to ensure customer specifications are met. Penalties apply for "out of spec" shipments.
Economic	• The inputs to the economic analysis to produce the net present value (NPV) in the study, the source and confidence of these economic inputs including estimated inflation, discount rate, etc. • NPV ranges and sensitivity to variations in the significant assumptions and inputs.	• There are no economic analyses provided in this report although it is noted that the operating mines at Heiwan, Changhong and Caotang are currently profitable.
Social	• The status of agreements with key stakeholders and matters leading to social licence to operate.	• No social problems with the local communities have been experienced to date at the operating mines. • No social problems are expected at the other projects where mining is yet to commence since all the projects are located in existing mining districts with a long history of coal mining and the local communities rely heavily on coal mining for employment and business revenues.
Other	• To the extent relevant, the impact of the following on the project and/or on the estimation and classification of the Ore Reserves: • Any identified material naturally occurring risks. • The status of material legal agreements and marketing arrangements. • The status of governmental agreements and approvals critical to the viability of the project, such as mineral tenement status, and government and statutory approvals. There must be reasonable grounds to expect that all necessary Government approvals will be received within the timeframes	• The operating mines maintain good safety records with no serious injuries or fatalities occurring since the Company took over the mining operations. The coal seams are subject to the risk of dust explosions, spontaneous combustion and roof collapse like all coal mines however they are not considered especially a reason for concern. • If stricter government air pollution regulations are enacted the high sulphur coal at Changhong may become unsaleable without further blending with other low sulphur coals or will require washing.

Criteria	JORC Code explanation	Commentary
	anticipated in the Pre-Feasibility or Feasibility study. Highlight and discuss the materiality of any unresolved matter that is dependent on a third party on which extraction of the reserve is contingent.	• All the required governmental agreements and approvals are in place for the continued operation of the active mines and no impediments can be foreseen why these approvals should not continue for the remaining life of these mines or should not be granted for any new mines. • Modern monitoring equipment and trained safety personnel are monitoring all the risks and appropriate remedial action is taken to ensure accidents will be kept to a minimum. • All operating mines exceed the minimum safety and environmental requirements set by the relevant government authorities.
Classification	• The basis for the classification of the Ore Reserves into varying confidence categories. • Whether the result appropriately reflects the AM&A's view of the deposit. • The proportion of Probable Ore Reserves that have been derived from Measured Mineral Resources (if any).	• The coal reserve estimates are classified according to the minimum search distance between the resource model blocks and the nearest sample point. If the resources have been sampled or drilled by at least six points and within 500 m of a sample point were considered to be Proved and between 500 m and 1000 m or if the seam was sampled at two to six points, the coal within 500 m of a sample, is categorised as Probable after modifying factors applied Measured resource > Proved reserve and Indicated resource > Probable reserve. • No Measured resources were converted to Probable reserves. • The confidence in the geological interpretations and quality of the sampling were all considered when deciding on these search distances. • The reported reserve categories appropriately reflects the CP's view of the deposit.
Audits or reviews	• The results of any audits or reviews of Ore Reserve estimates.	• No independent audits or reviews of the reserve estimates have been undertaken although the reconciliation between actual mine production and reserve estimates in the seams currently being mined are good.
Discussion of relative accuracy/ confidence	• Where appropriate a statement of the relative accuracy and confidence level in the Ore Reserve estimate using an approach or procedure deemed appropriate by the AM&A. For example, the application of statistical or geostatistical procedures to quantify the relative accuracy of the reserve within stated confidence limits, or, if such an approach is not deemed appropriate, a qualitative discussion of the factors which could affect the relative accuracy and confidence of the estimate. • The statement should specify whether it relates to global or local estimates, and, if local, state the relevant tonnages, which should be relevant to technical and economic evaluation. Documentation should include assumptions made and the procedures used. • Accuracy and confidence discussions should extend to specific	• The CP believes that the relative accuracy of the resource estimates are properly indicated by the implied accuracy of the JORC Code (2012) categories used. Only small changes to the tonnages and qualities of future reserve estimates, after allowances for mined out tonnages are made, are expected as more sampling is carried out from the underground workings as mining progresses. • All the modifying factors used to convert the resource estimates to reserve estimates are based on current mining experience. At Caotang, Heiwan and Changhong there is currently mining in the main seams modelled. • The quoted reserve estimates in this report are of the entire area covered by coal seams within the tenements, within the stated ranges of sample points, with allowances for any coal already extracted by mining.

Criteria	JORC Code explanation	Commentary
	discussions of any applied Modifying Factors that may have a material impact on Ore Reserve viability, or for which there are remaining areas of uncertainty at the current study stage. • It is recognised that this may not be possible or appropriate in all circumstances. These statements of relative accuracy and confidence of the estimate should be compared with production data, where available.	• The quoted reserve estimates are inclusive of the resource estimates. • Reconciliation between actual mine production and resource and reserve estimates in the seams currently being mined are good.

Table 24: JORC Code Table 1.

Appendix 1.

ICS 73.040
D 21

National Standards of the People's Republic of China
GB/T 482-2008
Replacing GB 482-1995

Sampling of coal seams

Published on July 29 2008 Implemented on May 1 2009
Published by

General Administration of Quality Supervision, Inspection and Quarantine of the Pe
China

Standardization Administration of the People's Republic of Chin
GB/T 482-2008

Introduction

This standard replaces GB 482-1995 *Sampling of Coal Seams.*

Compared with GB 482-1995, the major changes in this standard include the following:

- "Items" added;
- "Introduction" added;
- "Terms and definitions" added (Chapter 3 in this version);
- Revision of the structure in chapter 3 of the previous standard (chapter 3 in the previous version being chapter 4 in the current one);
- Correction of the errors in ruler and tape sizes (see 5.5);
- Splitting chapter 6 in the previous standard (chapter 6 in the previous version split into chapters 7, 8 and 9 in the current one);
- Correction of the errors in 6.6 of the previous version (6.6 in the previous version being 8.2 in this version).

Appendix C in this standard is regulatory while appendices A and B are informative.

This standard is proposed by the China Coal Industry Association.

Administration of this standard is the responsibility of the National Coal Standardization and Technical Committee.

This standard is drafted by the following entities: Coal Analysis Laboratory Of Coal Science Institute, Jixi Coal Industry (Group) Company, Hebi Coal Industry (Group) Company and Huaibei Coaling (Group) Company.

This standard is drafted by the following persons: Sun Gang, Wu Yinghua, Wu Hongkuan, Gong Xinglu, Tian Xinhua and Pan Minguang.

The publication history of the previous standard replaced by this one is as follows:

GB 482-1964, GB 482-1979, GB 482-1995.

GB/T 482-2008

Sampling of coal seams in Mines

1. Scope

This standard provides the method for sampling coal seams.

This standard is applicable to sampling brown coal, bituminite, and anthracite coal seams.

2. Referenced regulatory documents

The clauses in the documents listed below are incorporated into this standard by reference. All the revision lists (excluding the corrections) or amendments subsequent to any dated reference document are not applicable to this standard; however, the parties who reach an agreement based on this standard are encouraged to study if the latest updates of these documents can be used. The latest updates of any undated reference document are applicable to this standard.

GB/T 212 Industrial Coal Analysis Method (GB/T 212-2008, ISO 11722:1999, ISO 1171:1997, ISO 562: 1998, NEQ)

GB/T 217 Method for determining the true relative density of coal

GB 474 Method for preparing coal samples (GB 474-1996, eqv ISO 1988: 1975)

Coalmining Safety Rules 2006 version by National Coalmining Safety Inspection Bureau

3. Terms and Definitions

The following terms and definitions apply to this standard.

3.1 Coal seam sample

Samples collected from one seam when digging working faces, exploratory development or adits in accordance with regulations.

3.2 Stratified seam sample

Samples collected from each natural stratum in coal seams and waste partings in accordance with regulations.

3.3 Workable seam sample

All the samples of the regulation thicknesses should be collected (including samples from coal strata and waste partings).

3.4 Coal part of all stratified seam samples

Stratified seam samples collected of coal only in accordance with regulations and their overall qualities are obtained by qualitative weighted averages of the relevant stratified seam strata.

3.5 Workable part of all stratified seam samples

Stratified seam samples collected of coal strata and waste partings corresponding to the workable seam thickness in accordance with regulations and their overall qualities are obtained by qualitative weighted averages of the relevant stratified seam strata.

4 General rules

4.1 Composition of coal seam samples

Coal seam samples include stratified samples and workable samples.

4.2 Stratified samples

4.2.1 Stratified samples are collected to analyse the nature of each coal stratum and waste partings and verify the representativeness of workable samples.

GB/T 482-2008

4.2.2 Stratified samples are collected from each natural stratum in coal and waste parting. When the waste parting thickness is greater than 3 cm, it should be treated as a separate stratum for sampling.

4.3 Workable samples

4.3.1 Workable seam samples are collected to determine all the coal strata that should be exploited and the average qualities includes the waste partings.

4.3.2 The sampling range in the workable samples includes all the strata that should be exploited including the waste partings less than 30 cm thick. For the thick coal seams which are exploited in strata, samples of the mined stratum thickness should be collected.

Samples of waste partings greater than 30 cm in thickness should be collected separately; if the waste partings cannot be mined separately, bulk workable samples may be collected provided that this is clarified in the report.

4.3.3 For open cast mines, this standard applies to the coal seams with a working bench which is less than 3.00 m in height and if it is indeed difficult to apply the method provided herein for a working bench higher than 3.00 m, coal cores may be extracted by rotary drilling rig as workable samples.

4.4 Sampling requirements
4.4.1 Coal seam samples should be collected from access development and the stope faces.

4.4.2 Representative coal seam samples should be collected at locations with normal geological structures; however, other samples should also be taken at locations where geological structures cause extensive damage to the coal seam to represent these anomalous areas.

4.4.3 Stratified and workable samples should be taken simultaneously.

4.4.4 The oxidised layer on the surface of the coal seam should be removed before taking samples.

4.4.5 Taking coal seam samples is the responsibility of the coal quality management department and the exact locations where samples are taken should be specified per this standard; under special circumstances, such locations can be determined together with the geological department.

4.4.6 Coal mining safety regulations should be strictly followed during sampling operations so that safety of personnel can be guaranteed.

4.5 Sampling intervals
At least one coal seam sample should be taken after advancing 100 to 500 m from working faces along main roadways. Stoping faces should be sampled at least once every quarter and the number of samples taken should be determined on the basis of the length of the stoping face; one to be taken if shorter than 100 m, two for 100-200 m and three for a stoping face longer than 200 m. More coal seam samples should be taken at locations where coal seam structure is complicated and coal nature varies extensively.

5. Sampling tools

5.1 Pickaxes with flattened heads and tips or applicable sampling machinery.

5.2 Hammers.

5.3 Spades.

5.4 Goggles.

5.5 Measuring tapes: steel tapes no shorter than 2 m and rulers no shorter than 1.5m with the minimum division unit being one millimetre.

5.6 Blanket: compact, solid and waterproof with an area of at least 2.5 m².

5.7 Bags for holding seam samples: strong and waterproof with a tie at the top.

5.8 Notes and necessary stationery.

5.9 Tool kit.

5.10 Labels.
Labels of the following format should be printed:
a) Sampling location:
b) Number of working face:

c) Seam sample number:
d) Samples taken by:
e) Samples taken on MM DD YY.
The properly filled-in labels should be put into plastic bags.

6. Sampling procedures

6.1 Preparation

The oxidized layer on the surface of coal seams should first be removed, the surface of the coal seam should be flattened carefully and perpendicular to the top and bottom bedding planes; then on the flattened seam surface, draw four straight lines from top to bottom which are perpendicular to the top and bottom bedding planes where the distance between the lines is 0.10 m when the seam thickness is >1.30 m, and 0.15 m when the thickness is <1.30 m. If the seam is soft and friable, the distance between the second and third lines can be widened if necessary. The stratified samples are taken between the first and second lines and workable seam samples are taken between the third and fourth lines with the sampling channel depth being 5 cm.

6.2 Collection of stratified samples

Mark each natural stratum of coal and waste parting between the first and second lines, measure the thickness of each stratum and their total depth and record the rock characteristics, thickness of each stratum and other matters related to seams.

Put a blanket below the sampling point so the samples drop onto the blanket and can be collected cleanly for each natural strata; all the samples from each sampled natural stratum are to be securely bagged and correctly labeled; the blanket must be cleaned before collecting the next natural stratum. Samples collected from waste partings less than 3 cm thick should be included with a neighbouring coal sample. Samples from the coal and waste partings should be collected only within the marked lines.

Numbered labels, as prescribed herein, should be attached to each sample bag.

Numbering each stratum sample: x – stratum-x.

Example: 2-stratum-4 indicates samples from the fourth stratum in the second seam.

6.3 Collection of the workable seam samples

Put a blanket below the sampling point so that the chiseled samples cleanly drop onto the blanket; samples from the stratification and waste parting should be taken together; all the collected materials should be bagged with correctly filled in labels as prescribed herein attached. Samples from the coal and waste partings should only come from within the marked lines.

Numbering each stratum sample: x – workable-1, 2, 3…

Example: 2-workable-1, 2, 3… indicates workable samples from the second seam which includes 1,2,3…strata.

7 Preparation of samples and verification of workable seam samples

7.1 Preparation of samples

When the sampling is completed, seam samples should be sent to the sample preparation room for preparation per standard GB 474. Stratified samples are prepared for general analysis according to the requirements of the analyses being carried out, usually separate splits are taken and prepared for total moisture and general analysis. Preparation of seam samples at the sampling location is prohibited.

7.2 Weighted average ash content of the stratified samples

Moisture, ash content and true relative density of each stratified seam sample are determined per standards GB/T 212 and GB/T 217. Based on the results from the determinations, the weighted average ash content of all the stratified samples, seam stratification samples and exploitable seam samples is calculated respectively per equation (1):

$$\overline{A}_d = \frac{A_{d1} \cdot t_1 \cdot \mathrm{TRD}_1 + A_{d2} \cdot t_2 \cdot \mathrm{TRD}_2 + \cdots + A_{dn} \cdot t_n \cdot \mathrm{TRD}_n}{t_1 \cdot \mathrm{TRD}_1 + t_2 \cdot \mathrm{TRD}_2 + \cdots + t_n \cdot \mathrm{TRD}_n} \quad \cdots\cdots\cdots\cdots (1)$$

In the equation:

$\overline{A}_d$ - mass fraction of the weighted average ash content in the dried samples, %;

$A_{d1}, A_{d2}, \cdots, A_{dn}$ - mass fraction of the dried samples in 1,2,…n strata or waste partings, %;

$t_1, t_2, \cdots, t_n$ - thickness of 1,2,…n strata or waste partings in metres (m) ;

$TRD_1, TRD_2, \cdots, TRD_n$ true relative density of 1,2,…n strata or waste partings

7.3 Verification of the representativeness of workable samples
Moisture and ash content of the workable seam samples are determined per standard GB/T212. If the relative difference, ⊿, of the weighted average ash content of the exploitable stratified samples and workable samples is less than 10%, the workable samples meets the requirements for representativeness. If the relative distance is greater than 10% they should be discarded and the seams resampled due to the lack of representativeness.

The relative difference ⊿(%) is calculated per equation (2):

$$\Delta = \frac{\overline{A}_{d,开} - A_{d,可}}{\frac{\overline{A}_{d,开} + A_{d,可}}{2}} \times 100 \qquad \cdots\cdots\cdots\cdots(2)$$

In the equation:

$\overline{A}_{d,开}$ = mass fraction of the weighted average ash content of the dried samples in the sampled strata, %

$A_{d,可}$ = mass fraction of the ash content in the dried workable samples, %.

Calculation examples are given in appendix A.

8. Chemical analysis of the seam samples

8.1 The moisture, ash content and true relative density (TRD) of the stratified samples should be determined.

8.2 Workable seam samples, when they are verified as meeting representativeness requirements, are then subject to industrial analysis, and such determinations as total moisture, total sulfur, calorific value and TRD etc. are made.

8.3 At least two representative seam samples are to be collected from each worked seam annually and then prepared into raw coal and floating coal specimens per standard GB 474 based on actual needs and subject to relevant analyses.

8.4 The reported results from the measurement of thickness and the determination of ash content and TRD are rounded up to two decimal places.

9 Reporting results
Coal seam reports should be prepared with reference to appendix B and should include:

a) Report number;
b) Sampling date and the date the report is compiled;
c) Names of personnel who took samples, completed, verified and approved the report;
d) Description of the seam;
e) Location where samples were taken;
f) Location of the work face;
g) Thicknesses and ash contents of all the individual strata, the exploitable strata and the whole seam;
h) Numbers of the workable seam samples and their analytical results;
i) Graphic log of the seam samples with analytical results and stratigraphic logs.

The graphic log in the coal seam report should be prepared using the legend provided in appendix C.

Appendix A

(Informative)
Calculation examples

A.1 Experimental data
In table A.1, assuming the total thickness of the seam is 1.62 m, it comprises three coal beds and two waste partings, and Table A.1 indicates the thickness, ash content and TRD of each stratum and waste parting in the seam; the ash content of the dried sample in the workable seam samples is 19.37%.
Table A.1 Experimental data

Coal seam structure	Thickness/m	Ash content A_d/%	True relative density TRD_d
First bed (coal)	0.30	10.00	1.31
Second bed (waste parting collected separately)	0.30	80.00	2.15
Third bed (coal)	0.40	8.00	1.30
Fourth bed (waste parting)	0.12	85.00	2.20
Fifth bed (coal)	0.50	12.00	1.32

A.2 Weighted average ash content of the all the stratified coal samples
[(10.00X0.30X1.31)+(80.00X0.30X2.15)+(8.00X0.40X1.30)+(85.00X0.12X2.20)+(12.00X0.50X1.32)]÷[(0.30X1.31)+(0.30X2.15)+(0.40X1.30)+(0.12X2.20)+(0.50X1.32)] = 36.28%

A.3 Weighted average ash content of exploitable stratified samples
[(10.00X0.30X1.31)+(8.00X0.40X1.30)+(85.00X0.12X2.20)+(12.00X0.50X1.32)]÷[(0.30X1.31)+(0.40X1.30)+(0.12X2.20)+(0.50X1.32)] = 20.93%

A.4 Weighted average ash content of stratified coal seams
[(10.00X0.30X1.31)+(8.00X0.40X1.30)+(12.00X0.50X1.32)]÷[(0.30X1.31)+(0.40X1.30)+(0.50X1.32)] = 10.18%

A.5 Verification of representativeness of the workable seam samples
The relative difference⊿ between the weighted average ash content of the exploitable stratified coal seams and workable coal seams:

$$\Delta=\frac{20.93-19.37}{\frac{20.93+19.37}{2}}\times 100\%=7.74\%$$

⊿ value is less than 10%, which indicates the sample meets the requirements for representativeness.

Appendix B

(Informative)
Coal seam sample report

Number Sampling date: MM DD YY
Filling date: MM DD YY

1. Mining authority: Mine Shaft Seam
2. Sampling location:
3. Situation on the work face (top, bottom and middle):
4. Seam thickness and ash content:

(1) Total seam thickness__m, ash content $\bar{A}_d$:__ %

(2) Thickness of the exploitable seam__m, ash content $\bar{A}_d$:__ %

(3) Coal thickness __m, ash content $\bar{A}_d$: __%

5. Number of the workable seam samples: workable
6. Results from the analytical experiments on the workable samples (see table B.1)

Table B.1 Results from the analytical experiments on the workable samples

Items	M_t/ %	M_{ad}/ %	A_d/ %	V_{daf}/ %	Char residue characteristics	FC_d/ %	$S_{t,d}$/ %	$Q_{gr,d}$/(MJ/ kg)				……
Raw coal												
Float coal												

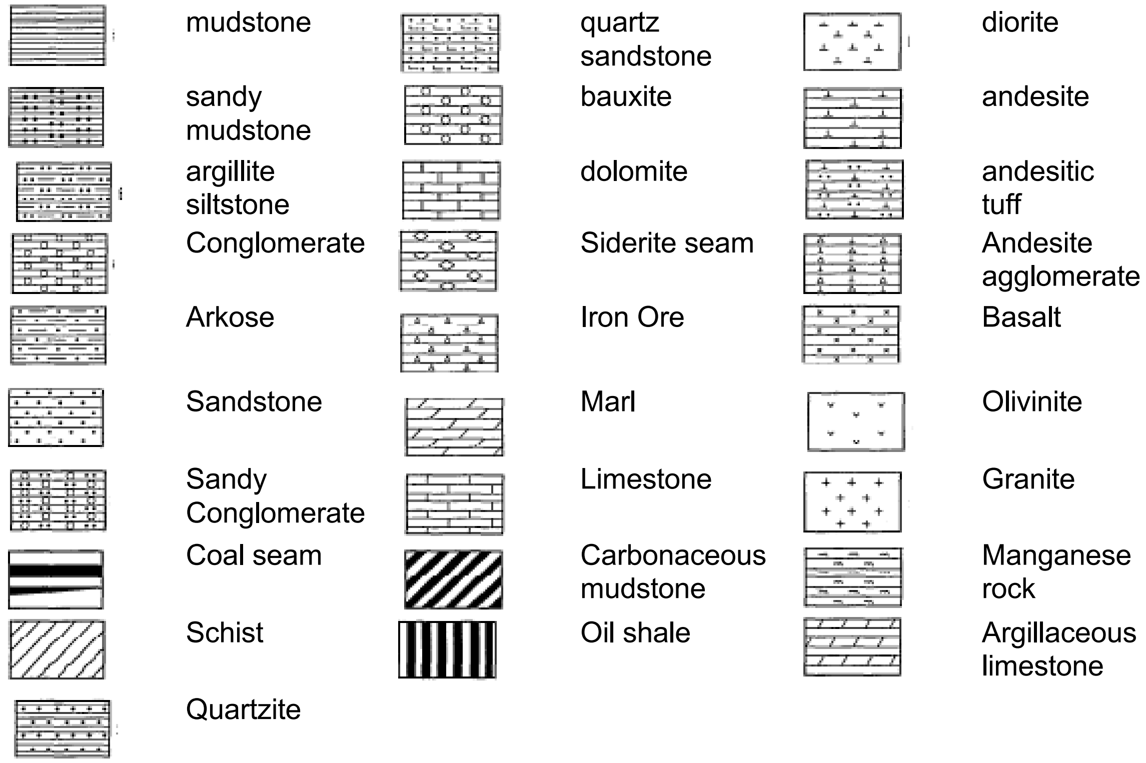
7. Seam graphic log and analytical results with the stratified samples (see table B.2)

Table B.2 Seam graphic log and analytical results with the stratified samples

Order	Graphic log and percentage			Seam name and characteristics	Stratum thickness t/m	True relative density TRD_d	Ash content A_d/%	4 x 5 columns	6x 7 columns	Notes
1	2			3	4	5	6	7	8	9
Top plate										
1										
2										
……										
n-1										
n										
Bottom plate										
Total strata										
Exploitable strata										
Coal strata										

Sampled by: ____Compiled by:
Checked by: _____Approved by:

Appendix C
(Regulatory)
Bar graph legends



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GB/T 482-2008
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Appendix 2

ICS 73.040
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National Standard of the People's Republic of China
GB/T 212-2008
To replace and supercede GB/T 212-2001, GB/T 15334-1994 and GB/T 18856.7-2002
Proximate Analysis of Coal
(ISO 11772: 1999, Solid mineral matter fuels – Hard coal – Determination of moisture in the general analysis test sample by drying in nitrogen;
ISO 1171: 1997, Solid mineral matter fuels – Determination of ash;
ISO 562: 1998, Hard coal and coke – Determination of volatile matter, NEQ)

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General Administration of Quality Supervision, Inspection & Quarantine of the PRC
Standardization Administration of the PRC

Preface

This Standard corresponds to the following international standards: ISO 11772: 1999, Solid mineral matter fuels – Hard coal – Determination of moisture in the general analysis test sample by drying in nitrogen; ISO 1171: 1997, Solid mineral matter fuels – Determination of ash; and ISO 562: 1998, Hard coal and coke – Determination of volatile matter, NEQ, is different in that:

- \- a proximate analysis method for inherent moisture in coal is included;
- \- an air drying method for determining moisture content is incorporated;
- \- a quick ashing method is incorporated;
- \- the standard temperature and time for determining volatile matter is specified as 900±10℃ and 3min; and
- \- a standard microwave drying method for moisture is incorporated as an annex.

This Standard shall replace and supersede

- GB/T 212-1001 Proximate analysis of Coal,
- GB/T 15334-1994 Determination of moisture in coal – Microwave drying method, and
- GB/T 18856.7-2002 Test method for inherent moisture in coal, Part 7.

This Standard is different from GB/T 212-2001 in that:

- proximate analysis of coal water mixture is incorporated; and
- "Determination of moisture in coal – Microwave drying method" is incorporated (as annex A hereto).

Annex A and Annex B hereto are normative annexes.
This Standard is proposed by China National Coal Association.
This Standard falls under the jurisdiction of National Technical Committee on Coal Standardization Administration of China.
This Standard is drafted by Coal Analysis Laboratory of China Coal Research Institute and No 143 Brigade of Yunnan Coalfield Geological Survey Co., Ltd.
This Standard is drafted by Han Liting, Lin Yujia and Chen Kequan.

Revisions of the standards to be replaced and superseded by this Standard include:

- \- GB 212-1963, GB 212-1977, GB/T 212-1991 and GB/T 212-2001;
- \- GB/T 15334-1994;
- \- GB/T 18856.7-2002.

Proximate Analysis of Coal

1. Scope

This Standard covers the determination of total and inherent moisture, ash and volatile matter and fixed carbon in coal samples.

This Standard shall apply to brown coal, bituminous coal, anthracite and coal seams.

2. Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this Standard. For dated references, all subsequent modifications (excluding corrigenda) or revisions thereto shall not apply to this Standard. Parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent edition of the normative references indicated below. For dated references, the latest edition shall apply.

- GB/T 218 Determination of carbon dioxide content in the mineral carbonates associated with coal (GB/T 218-1996, eqv ISO 925: 1980)
- GB/T 7560 Determination of mineral matter in coal (GB/T 7560-2001, eqv ISO 602: 1983)
- GB/T 18510 Guideline for the validation of alternative methods of analysis for coal and coke
- GB/T 18856.1 Test methods for quality of inherent water in coal – Part 1: Sampling
-

3. Determination of moisture

This Section covers the three methods for determining moisture in coal. Method A applies to all coals; Method B applies to lignite and anthracite; microwave drying method (as described in Annex A) applies to the quick determination of moisture in brown coal and lignite.

Where the coal sample to be tested is used for a referee analysis or basis conversion, Method A is used to determine the moisture content of the test sample.

3.1 Method A (drying in nitrogen)

3.1.1 Outline

Weigh the coal sample to be tested, place it in a drying oven at 105~110℃ and dry it in dry nitrogen flow until its mass remains constant. Calculate the moisture content of the sample using to the mass lost by the dried coal sample.

3.1.2 Reagents

3.1.2.1 Nitrogen: 99.9% purity; oxygen content less than 0.01%.

3.1.2.2 Anhydrous calcium chloride (HGB 3208): chemically pure; granular.

3.1.2.3 Allochroic silica gel: industrial product.

3.1.3 Instrumentation

3.1.3.1 Small volume dryer: airtight box with limited free space, furnished with a gas inlet and outlet as well as automatic thermostat that maintains the temperature within (105~110)℃.

3.1.3.2 Glass weighing flask: 40 mm in diameter, 25 mm tall, with an airtight ground cap (as illustrated in Fig 1).

In mm

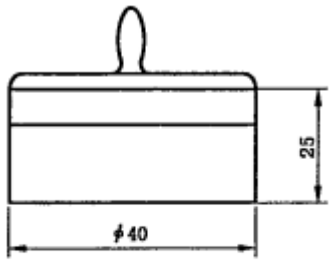

Fig 1 Glass weighing flask

3.1.3.3 Dryer: contains allochroic gel or granular anhydrous calcium chloride.

3.1.3.4 Drying tower: 250 ml capacity, with drying agent inside.

3.1.3.5 Flowmeter: ranges (100~1,000) mL/min.

3.1.3.6 Analysis balance: 0.1mg sensitivity.

3.1.4 Testing procedure

3.1.4.1 Add 1g±0.1 g of general-analysis coal sample, ground to <0.2 mm, to a pre-dried and weighed weighing flask and weigh the sample to the accuracy of ±0.0002 g after spreading the sample evenly over the base of the weighing flask.

3.1.4.2 Place the uncapped weighing flask into the drying oven that has been flooded with nitrogen and pre-heated to 105~110℃. The sample should be dried for 1.5 hour for lignite or for 2 hours for anthracite. Commence flooding the oven with nitrogen 10 minutes before placing the weighing flask into the oven at least at the rate of 15 volume changes per hour.

3.1.4.3 Cap the weighing flask immediately after removing it from the oven, place it in the dryer, and weigh the flask and contents after it has cooled down to room temperature (after approximately 20 minutes).

3.1.4.4 Continue drying for 30 min periods until the dried sample mass varies by no more than 0.0010 g for two consecutive dries or when the mass of the dried sample increases, in which case the mass weighed at the time before the mass increase shall be used for the calculations. However, no inspective drying will be needed when the moisture content is <2.00%.

3.2 Method B (air drying method)

3.2.1 Outline

Weigh the general-analysis coal sample to be tested, place it in a 105~110℃ forced-air drying oven and dry it until the mass of the dried sample remains constant. Calculate the moisture content of the sample using to the mass lost by the dried coal sample.

3.2.2 Instrumentation

3.2.2.1 Forced-air drying oven: furnished with a thermostat that maintains the oven temperature within the temperature range 105~110℃.

3.2.2.2 Glass weighing flask: as described in Subsection 3.1.3.2.

3.2.2.3 Dryer: as described in Subsection 3.1.3.3.

3.2.2.4 Analysis balance: as described in Subsection 3.1.3.6.

3.2.3 Testing procedure

3.2.3.1 Add 1g±0.1 g of general-analysis coal sample, ground to <0.2 mm, to a pre-dried and weighed weighing flask and weigh the sample to the accuracy of ±0.0002 g after spreading the sample evenly over the base of the weighing flask.

3.2.3.2 Place the uncapped weighing flask into the drying oven that has been flooded with nitrogen and pre-heated to 105~110℃ (3.2.2.1) and, ensuring that aeration is present all the time, dry it for 1.0 hour for lignite or for 1.5 hours for anthracite..

A uniform temperature is required in the oven so the fan should be turned on 2~5 minutes before the weighing flask containing the coal sample is placed in the drying oven.

3.2.3.3 Cap the weighing flask immediately after removing it from the oven, place it in the dryer, and weigh the flask and contents after it has cooled down to room temperature (after approximately 20 minutes).

3.2.3.4 Continue drying for 30 min periods until the dried sample mass varies by no more than 0.0010 g for two consecutive dries or when the mass of the dried sample increases, in which case the mass weighed at the time before the mass increase shall be used for the calculations. However, no inspective drying will be needed when the moisture content is <2.00%.

3.3 Calculation of results

Moisture in the general-analysis coal sample tested is calculated using equation (1):

$$M_{ad} = \frac{m_1}{m} \times 100 \quad \cdots\cdots\cdots (1)$$

Where:

M_{ad} – Moisture content of coal sample, expressed as a mass fraction, %;

m – mass of the coal sample tested, expressed in grams;

m_1 – mass lost when the coal sample is dried, expressed in grams.

3.4 Precision of moisture Determination

The precision to which moisture shall be determined is provided in Table 1.

Table 1 Repeatability limits for moisture determination

Moisture content (M_{ad}), %	Repeatability limit, %
＜5.00	0.20
5.00~10.00	0.30
＞10.00	0.40

4. Determination of ash

This Section covers two methods for determining ash in coal – quick ashing method and slow ashing method. The former is used for referee samples.

4.1 Slow ashing method

4.1.1 Outline

Weigh the sample of coal to be tested, heat it in a Muffle furnace set at 815±10℃ and continue to combust until the mass of ash remains constant. The residual ash mass divided by the original sample mass shall be taken as the ash content of the sample.

4.1.2 Instrumentation

4.1.2.1 Muffle furnace: the furnace chamber large enough for the sample to be maintained at a constant 815±10℃, a chimney diameter of 25~30 mm through the upper part of the furnace wall, a small hole in the lower part of the furnace wall 20~30 mm above the oven floor for inserting a thermocouple, and an air vent 20 mm in diameter in the furnace door.

The constant temperature zone of the Muffle furnace shall be tested with the door closed at least annually. The pyrometer (including the milivoltmeter and the thermocouple) shall be calibrated at least annually.

4.1.2.2 Ash tray: ceramic, rectangular, with base 45 mm x 22 mm and height 14 mm (as illustrated in Fig 2).

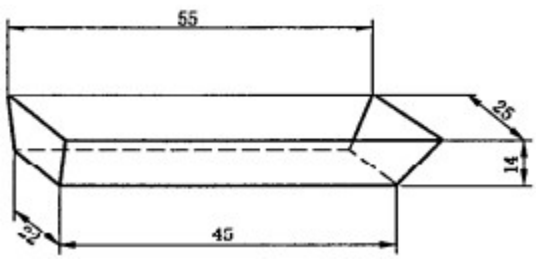

Fig 2 Ash tray, dimensions shown in millimetres

4.1.2.3 Dryer: as described in Subsection 3.1.3.3.

4.1.2.4 Analytical balance: as described in Subsection 3.1.3.6.

4.1.2.5 Heat-resistant ceramic plate or asbestos board.

4.1.3 Testing procedure

4.1.3.1 Weigh 1.0g±0.1 g of coal to be tested, ground to <0.2 mm, on a pre-weighed heat resistant tray to ±0.0002 g and spread the coal over the ash tray so that the mass per square centimeter is <0.15 g.

4.1.3.2 Place the tray and sample in the constant temperature zone of the Muffle furnace where the temperature is 100 max, close the door maintaining an approximate 15 mm gap, gradually raise the temperature of the furnace to 500 within 30 minutes and maintain for a minimum 30 minutes at this temperature. Continue to heat the furnace to 815±10 and allow the burning to continue for 1 hour at this temperature.

4.1.3.3 Take the tray out of the furnace, place it on a heat-resistant ceramic plate or asbestos board and let it air cool for approximately 5 minutes. Place the tray in the dryer, and weigh the tray and contents after it has cooled down to room temperature (after approximately 20 minutes).

4.1.3.4 Continue the ashing at 815±10℃ for 20 min cycles until the mass variation is <0.0010 g for two consecutive burns. The mass after the last burn shall be used for the calculation of ash content. No continuing burning would be required if the ash content is less than 15.00%.

4.2 Quick ashing

This Section covers two quick ashing methods: Method A and Method B.

4.2.1 Method A

4.2.1.1 Outline

Place the tray containing the coal sample on the belt conveyor of the quick ash content tester pre-heated to 815±10℃. The sample is automatically passes through the instrument. The residual mass shall be taken as the ash content of the sample.

4.2.1.2 Special instrument: quick ash content tester (as illustrated in Fig b.1 of Annex B).

4.2.1.3 Testing procedure

Preheat the quick ash content tester to 815±10℃.

Start the belt conveyor and adjust its speed to around 17mm/minute or other speed as appropriate.

Note: For a new quick ash content tester, it is necessary to conduct comparison tests on different coals against the manual ashing method and the speed of the belt adjusted according to the test results.

Weigh 0.5g±0.01 g of coal to be tested, ground to <0.2 mm, on a pre-weighed heat resistant tray to ±0.0002 g and spread the coal over the ash tray so that the mass per square centimeter is <0.08 g.

Place the tray containing the coal sample on the belt conveyor of the quick ash content tester and the tray with sample will be automatically delivered into the furnace.

When the ash tray is delivered out of the furnace, place it on a heat-resistant ceramic plate or asbestos board and let it air cool for around 5 minutes. Place the tray in the dryer, and weigh the tray and contents after it has cooled down to room temperature (after approximately 20 minutes).

4.2.2 Method B

4.2.2.1 Outline

Insert the tray containing the coal sample to be tested gradually into a Muffle furnace, preheated to 815±10 , creating ash, but without combustion, until the mass of the ash remains constant.

4.2.2.2 Instrumentation: as described in Subsection 4.1.2.

4.2.2.3 Testing procedure

Weigh 1.0g±0.1 g of coal to be tested, ground to <0.2 mm, on a pre-weighed heat resistant tray to ±0.0002 g and spread the coal over the ash tray so that the mass per square centimeter is <0.08 g. Place the trays containing the coal samples to be tested in discrete rows on a heat-resistant ceramic plate or asbestos board.

Pre-heat the Muffle furnace to 850, open the door, progressively push the heat-resistant ceramic plate or asbestos board carrying the coal samples slowly into the Muffle furnace to ash the coal sample in the each row separately for 5~10 minutes or when the coal does not smoke any longer, then progressively push the remaining rows of ash trays in sequence into the burning portion of the furnace. Note that this test will be invalid if the coal sample catches fire and combusts.

Close the door but leaving an approximately 15 mm gap, and burn the sample for 40 min at 815±10.

Take the trays holding the ash samples out of the furnace, place them on a heat-resistant ceramic plate or asbestos board and let them air cool for approximately 5 minutes. Then place the trays in the dryer, and individually weigh the trays and contents after they have cooled down to room temperature (after approximately 20 minutes).

Continue the ashing at 815±10 for 20 min cycles until the mass variation is <0.0010 g for two consecutive burns. The mass after the last burn shall be used for the calculation of ash content. Where the mass measurements of the repeated ashing cycles are unstable, the sample must be retested by the slow ashing method. No continuing burning would be required if the ash content is less than 15.00%.

4.3 Calculation of the result

The air dry basis ash content is calculated using equation (2):

$$A_{ad} = \frac{m_1}{m} \times 100 \quad \cdots\cdots (2)$$

Where:

A_{ad} – the air dried basis ash content, expressed as a mass fraction, %;

m – mass of the air dried coal sample tested, expressed in grams;

m_1 – mass of the residual ash after burning, expressed in grams.

4.4 Precision of ash determination

The precision to which ash content shall be determined is provided in Table 2.

Table 2 Precision of ash determination

Ash content, %	Repeatability limit, A_{ad}, %	Reproducibility critical difference, A_d, %
＜15.00	0.20	0.30
15.00~30.00	0.30	0.50
＞30.00	0.50	0.70

5. Determination of volatile matter

5.1 Outline

Weigh the sample of coal to be tested, place it in an sealed airtight ceramic crucible and heat for 7 minutes at 900±10℃, and the volatile matter of the coal sample shall be the reduced mass of the original total sample, less the moisture content of the sample.

5.2 Instrumentation

5.2.1 Volatile matter crucible: a heat resistant crucible with an airtight cover and dimensions as illustrated in Fig 3. The total mass of the crucible is 15~20 g.

In mm

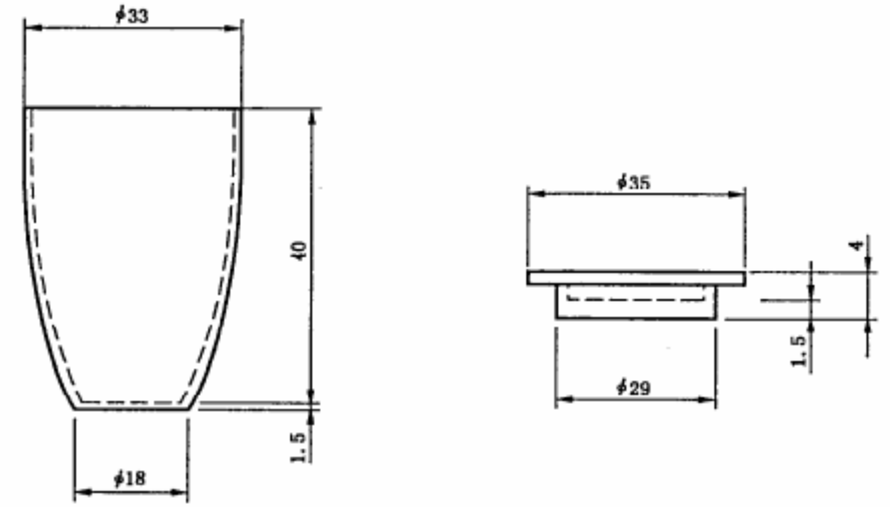

Fig 3 Volatile matter crucible, dimensions shown in millimetres

5.2.2 Muffle furnace: a furnace of sufficient volume to hold the crucibles and equipped with a pyrometer and thermostat to maintain the temperature at a constant 900±10. The thermal capacity of the furnace shall be sufficient to restore the temperature to 900±10 within 3 minutes after the door is closed when a crucible holder and several crucibles at room temperature are placed in the furnace. An air vent and a suitable sized hole for inserting a thermocouple are required in the furnace wall and located so that the thermal contact of the thermocouple is between the crucible bottom and the furnace bottom.

The constant temperature zone of the Muffle furnace and the pyrometer (including the milivoltmeter and the thermocouple) shall be calibrated at least annually.

5.2.3 Crucible holder: fabricated of nickel-chrome wire or other heat-resistant metal wire of sufficient size to hold all the crucibles in the constant temperature zone of the Muffle furnace and the crucible bottom is close to the upper part of the thermal contact of the thermocouple (as illustrated in Fig 4).

In mm

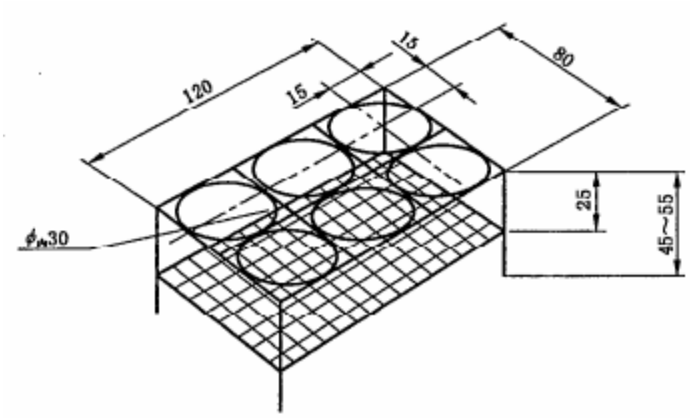

Fig 4 Crucible holder

5.2.4 Crucible holder tongs (as illustrated in Fig 5).

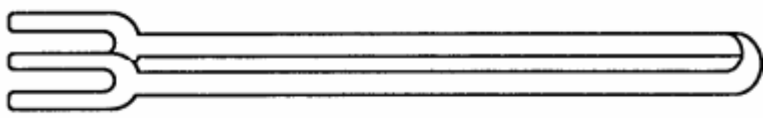

Fig 5 Crucible holder tongs

5.2.5 Dryer: As described in Subsection 3.1.3.3.

5.2.6 Analytical balance: As described in Subsection 3.1.3.6.

5.2.7 Cake press: A spiral or lever cake press that presses coal cakes approximately 10mm in diameter.

5.2.8 Stopwatch.

5.3 Testing procedure

5.3.1 Weigh 1.0 g±0.1 g of coal to be tested, ground to <0.2mm, in a pre-weighed heat resistant crucible to ±0.0002 g and then vibrate the crucible gently until the sample is flat. Cover the crucible and place it in the crucible holder.

Lignite or anthracite shall be caked and cut into small pieces approximately 3 mm in advance.

5.3.2 Preheat the Muffle furnace to around 920. Open the door, place the crucible holder carrying the crucibles into the constant temperature zone, close the door and record the time to ensure it is heated for exactly 7 minutes. The test will be invalid unless the furnace returns to 900±10 within 3 minutes after the crucible and the crucible holder are put into the furnace and remains at 900±10 thereafter. The heating time shall include temperature recovery.

Note: The preheating temperature for the Muffle furnace may be adjusted specific to the furnace used so that it will return to 900±10℃ within 3 minutes after the crucible and the crucible holder are placed in the furnace.

5.3.3 Take the crucibles out of the furnace, let them air cool for approximately 5 minutes before moving onto the cooling racks. The crucibles can be weighed once they have cooled to room temperature (after approximately 20 minutes).

5.4 Classification of coke button

Classify the features of the coke button obtained after the determination of volatile matter under the following principles:

1. Powdered (type 1): Consists fully of powder without particles adhering to each other;
2. Adhered (type 2): Becomes mostly powder after slight finger touch;
3. Weakly bonded (type 3): Becomes small pieces after slight finger touch;
4. No-fusion bonded (type 4): Becomes small pieces only after heavy finger touch; the coke button is dull on the upper surface with light silvery white luster on the lower surface;
5. Non-expansive fusion bonded (Type 5): The coke button comprises a flat cake with indistinguishable coal particles, noticeable silvery white metal luster on the upper surface and more noticeable silvery white luster on the lower surface;
6. Slightly expansive fusion bonded (type 6): Does not break under finger pressure, with silvery white metallic luster on both the upper and lower surfaces of the coke button, and minimal or small expansion bubbles on the surface;
7. Expansive fusion bonded (type 7): The coke button exhibits a silvery white metallic luster on both the upper and lower surfaces and has noticeably expanded but is not more than 15mm high;

8. Highly expansive fusion bonded (type 8): The coke button exhibits a silvery white metallic luster on the upper and lower surfaces and is more than 15 mm high.

To make it easier, the sequence numbers above are used as the code to classify the individual features of the coke button.

5.5 Calculation of the result

The air dry basis volatile matter of the coal sample in calculated using equation (3):

$$V_{ad} = \frac{m_1}{m} \times 100 - M_{ad} \qquad \cdots\cdots (3)$$

Where:

V_{ad} – volatile matter air dry basis, expressed as a mass fraction, %;
m – mass of the air dried coal sample tested, expressed in g;
m_1 – reduction in mass of the coal sample tested after heating, expressed in grams;
M_{ad} – moisture content of the coal sample tested, expressed as a mass fraction, %.

5.6 Precision of volatile matter determination

The precision to which volatile matter shall be determined is provided in Table 3.

Table 3 Precision of volatile matter determination

Ash content, %	Repeatability limit, V_{ad}, %	Reproducibility critical difference, V_d, %
＜20.00	0.30	0.50
20.00~40.00	0.50	1.00
＞30.00	0.80	1.50

6. Calculation of fixed carbon

The air dry basis fixed carbon content is calculated using equation (4):

$$FC_{ad} = 100 - (M_{ad} + A_{ad} + V_{ad}) \qquad \cdots\cdots (4)$$

Where:

FC_{ad} – air dry basis fixed carbon content, %;
M_{ad} – air dry basis moisture content of coal sample tested, expressed as a mass fraction, %;
A_{ad} – air dry basis ash content, expressed as a mass fraction, %;
V_{ad} – air dry basis volatile matter, expressed as a mass fraction, %.

7. Conversion of air dry basis volatile matter into dry ash-free basis volatile matter and dry mineral matter-free basis volatile matter

7.1 Dry ash-free basis volatile matter is converted in equation (5) ~ equation (7):

The dried ash-free volatile matter is converted in equation (5) ~ equation (7):

$$V_{daf} = \frac{V_{ad}}{100 - M_{ad} - A_{ad}} \times 100 \qquad \cdots\cdots (5)$$

When the carbon dioxide content as carbonate in the coal sample tested is (2~12%), then:

$$V_{daf} = \frac{V_{ad} - (CO_2)_{ad}}{100 - M_{ad} - A_{ad}} \times 100 \qquad \cdots\cdots (6)$$

When the carbon dioxide content as carbonate in the coal sample tested is more than 12%, then:

$$V_{daf} = \frac{V_{ad} - [(CO_2)_{ad} - (CO_2)_{ad(\text{焦渣})}]}{100 - M_{ad} - A_{ad}} \times 100 \qquad \cdots\cdots (7)$$

Where:

V_{ad} – air dried basis volatile matter content, %;
$(CO_2)_{ad}$ – air dried basis carbon dioxide content as carbonate in the coal sample tested (per GB 218) , expressed as a mass fraction, %
$(CO_2)_{ad\ (coke\ button)}$ – air dried basis carbon dioxide content expressed as a mass fraction in the coke button in relation to the quantity of the coal sample.

7.2 Dry mineral matter-free basis volatile matter is converted in equation (8) ~ equation (10):

$$V_{dmmf} = \frac{V_{ad}}{100 - (M_{ad} + MM_{ad})} \times 100 \qquad \cdots\cdots (8)$$

When the air dried basis carbon dioxide content as carbonate in the coal sample tested is 2~12%, then:

$$V_{dmmf} = \frac{V_{ad} - (CO_2)_{ad}}{100 - (M_{ad} + MM_{ad})} \times 100 \quad \cdots\cdots (9)$$

When the air dried basis carbon dioxide content as carbonate in the coal sample tested is >12%, then:

$$V_{dmmf} = \frac{V_{ad} - [(CO_2)_{ad} - (CO_2)_{ad(焦渣)}]}{100 - (M_{ad} + MM_{ad})} \times 100 \quad \cdots\cdots (10)$$

Where:

V_{dmmf} – dry mineral matter-free basis volatile matter content, expressed as a mass fraction, %

MM_{ad} – air dry basis mineral matter content of the coal sample tested (per GB/T 7560) , expressed as a mass fraction, %.

8. Proximate analysis of coal water slurry

8.1 Preparation of analysis sample

8.1.1 Preparation of coal water mixture sample

Stir the water coal slurry sample before the test so that it is uniform without hardness differences.

8.1.2 Preparation of dry coal water mixture sample

Prepare a dry sample of water coal slurry as provided in GB/T 18856.1.

8.2 Determination of moisture in coal water slurry

8.2.1 Outline

Weigh the uniformly mixed coal water slurry sample, place it in a 105~110 drying oven and dry it until its dried mass remains constant. Then calculate the moisture content of the coal water slurry according to the mass lost.

8.2.2 Instrumentation

As described in Subsection 3.2.2.

8.2.3 Testing procedure

8.2.3.1 Add 1.2~1.5 g of well mixed test sample of coal water slurry into a dry weighing flask whose weight is already known, spreading it evenly over the bottom of the flask, cap it quickly and weigh it to within 0.0004 g.

8.2.3.2 Uncap the weighing flask containing the coal water slurry described above in a drying oven pre-heated to 105~110 and dry it under aeration for 1 hour.

8.2.3.3 Take the weighing bottle out of the drying oven, cap it immediately and place it on a cooling rack. Weigh it when it has cooled to room temperature after approximately 20 minutes.

8.2.4 Calculation of the result

Calculate the moisture in the coal water mixture using equation (11):

$$M_{cwm} = \frac{m - m_1}{m} \times 100 \quad \cdots\cdots (11)$$

Where:

M_{cwm} – Moisture content of the water coal slurry, expressed as a mass fraction, %;

m – mass of the coal water slurry sample, expressed in grams;

m_1 – mass of the dried coal slurry, expressed in grams.

8.2.5 Precision of moisture determination

The repeatability limit to which the moisture in the coal water mixture shall be determined is provided in Table 4.

Table 4 Precision of moisture determination in coal water slurries

Moisture in coal water slurry	Repeatability limit, %
M_{cwm}	0.40

8.3 Determination of moisture in dry coal water mixture sample

The moisture in the coal water slurry shall be determined as provided in Section 3 of this Standard.

8.4 Determination of ash in coal water mixture sample

8.4.1 Determination of ash in dry coal water mixture sample

The air dry basis ash content in the dried coal water slurry sample shall be determined as provided in Section 4 of this Standard.

8.4.2 Calculation of ash in coal water mixture

The ash content in the coal water slurry is calculated using equation (12):

$$A_{cwm} = A_{ad} \times \frac{100 - M_{cwm}}{100 - M_{ad}} \quad \cdots\cdots (12)$$

Where:

A_{cwm} – ash content of the coal water mixture, expressed as a mass fraction, %;

A_{ad} – air dry basis ash content in the dried coal water slurry sample, expressed as the mass fraction, %;

M_{ad} –moisture content of the dried coal water slurry sample, expressed as a mass fraction, %;

M_{cwm} –moisture content in the coal water slurry, expressed as a mass fraction, %.

8.5 Determination of volatile matter in coal water slurries

8.5.1 Determination of volatile matter in dry coal water mixture sample

The volatile matter in the coal water slurries is calculated as provided in Section 5 of this Standard.

8.5.2 Calculation of volatile matter in coal water mixture

The volatile matter in the coal water mixture is calculated using equation (13):

$$V_{cwm} = V_{ad} \times \frac{100 - M_{cwm}}{100 - M_{ad}} \quad \cdots\cdots (13)$$

Where:

V_{cwm} – volatile matter in the coal water slurry, expressed as a mass fraction, %;

V_{ad} – air dry basis volatile matter in the dried coal water slurry sample, expressed as a mass fraction, %

M_{ad} – moisture content of the air dried coal water slurry sample, expressed as a mass fraction, %;

M_{cwm} – moisture content of the coal water slurry sample, expressed as a mass fraction, %.

8.6 Calculation of fixed carbon in coal water mixture

The fixed carbon content of the coal water slurry is calculated using equation (14):

$$FC_{cwm} = 100 - (M_{cwm} + A_{cwm} + V_{cwm}) \quad \cdots\cdots (14)$$

Where:

FC_{cwm} – fixed carbon content of the coal water slurry, expressed as a mass fraction, %;

M_{cwm} – moisture content of the coal water slurry sample, expressed as a mass fraction, %.

A_{cwm} – ash content of the coal water mixture, expressed as a mass fraction, %;

V_{cwm} – volatile matter in the coal water slurry, expressed as a mass fraction, %;

Annex A

(Normative annex)

Determination of moisture in coal – Microwave drying method

A.1 Scope

This Annex covers the quick determination of moisture content in coal samples using a microwave drying method.

This method applies to the quick determination of moisture in lignite and anthracite.

A.2 Outline

Weigh the coal sample to be tested and place it in a microwave moisture tester, where the magnetron inside the oven transmits non-ionizing microwaves that cause the water molecules to vibrate at ultra-high speed producing friction heat causing the moisture in the coal to be quickly evaporated. The mass lost by the coal sample is the moisture content.

A.3 Instrumentation

A.3.1 Microwave moisture tester ("moisture tester"): has a programmable controller, with input power of approximately 1,000W. The instrument is furnished with a rotary mini-crystal glass plate inside onto which is placed an asbestos mat approximately 2 mm thick with a marking ring.

A.3.2 Glass weighing flask: as described in Subsection 3.1.3.2.

A.3.3 Dryer: as described in Subsection 3.1.3.3.

A.3.4 Analytical balance: as described in Subsection 3.1.3.6.

A.3.5 Beaker: approximately 250mL capacity.

A.4 Testing procedure

A.4.1 Add 1±0.1 g of the coal sample to be tested, ground to <0.2 mm, into a dry flask of known weight ensuring it is evenly spread in the flask and weigh the sample to ±0.0002 g accuracy.

A.4.2 Place a 250 mL capacity beaker containing approximately 80 mL distilled water on the rotary plate of the moisture tester, heat it for 10 minutes under the preheating program and take out the breaker. If more than one measurement is expected on continuous basis, preheat the breaker only before the first measurement.

A.4.3 Uncap the weighing flask containing the coal sample, place the flask on the rotary plate of the moisture tester within and touching the marked ring on the asbestos mat. After a complete rotation of the plate, surplus weighing flasks may be closely packed within the weighing flasks with samples. Place a covered 250 mL breaker containing distilled water in the middle of the rotary plate (the water volume shall be as recommended by the moisture tester manufacturer) and close the door of the moisture tester.

Note 1: The evaporation of moisture relates to the distribution of the microwave electAM&Agnetic field, so it is important that the weighing flasks are within the uniform field intensity zone.

Note 2: The heating of the water contained in the beaker is related to the power of the microwave magnetron, so only sufficient water should be added the the beaker so that there is a little water left in the beaker after it has been heated.

Note 3: The microwave moisture tester manufacturer is expected to make sure that the distribution of the microwave electAM&Agnetic field agrees with the zone for moisture measurement and mark this zone (i.e. provide a marking ring), and determine the appropriate amount of water.

A.4.4 Heat the coal sample following the procedure recommended by the manufacturer.

A.4.5 After the weighing flask is heated for the recommended period, take it out of the moisture tester, cap it immediately and place it in the dryer. Weigh it when it has cooled to room temperature after approximately 20 minutes.

Note: Other types of microwave moisture testers are also acceptable provided that they have been tested and meet the precision and accuracy standards detailed in GB/T 18510.

A.5 Calculation of the result

The air dry basis moisture in the coal sample is calculated using equation (A.1):

$$M_{ad} = \frac{m_1}{m} \times 100 \qquad \cdots\cdots (A.1)$$

Where:

M_{ad} – air dry basis moisture content of the coal sample tested, expressed as a mass fraction, %;

m – mass of the coal sample tested, expressed in grams;

m_1 – mass lost from the coal sample tested after it has been dried, expressed in grams.

A.6 Precision

As described in Subsection 3.4.

Annex B

(Normative annex)

Quick ashing apparatus

B.1 Figure B.1 is a schematic example of a quick ash tester comprised of a U-shaped electric tube furnace, a belt conveyor and a controller as described below:

a) U-shaped electric tube furnace: the chamber is about 700 mm long, 75 mm tall, open at both ends, axially inclined around 5^o, with constant temperature zones approximately 140mm long at 815±10 and approximately 270 mm long at 750 ~825, with the temperature at the outlet not more than 100.

b) Automatic chain-type conveyor (“belt conveyor”): fabricated from high temperature resistant metal with adjustable conveying speed; does not deform or peel at temperatures <1,000.

c) Controller: temperature and a conveyor belt speed controller. The temperature controller automatically maintains the furnace temperature at 815±10; the conveyor belt controller manages the conveyor speed at15~50 mm/min.

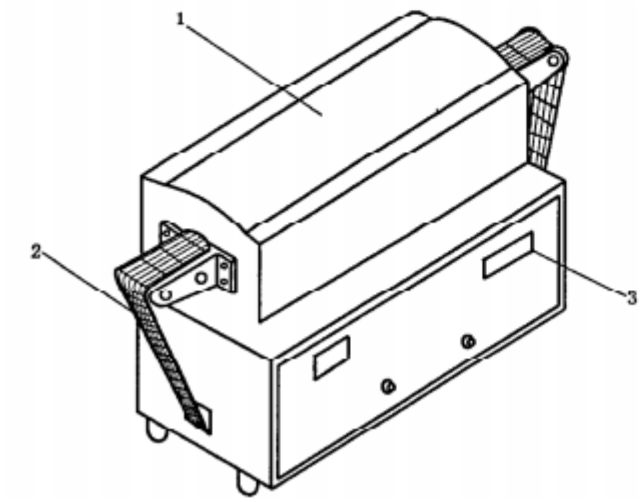

Fig B.1 Quick ash tester

1 – electric tube furnace;

2 – belt conveyor;

3 – controller.

B.2 Any other form of quick ash tester will be acceptable provided that:

a) The high temperature furnace can be heated to 815±10

b) The furnace provides enough air inside it for complete burning the coal sample;

c) The coal sample has long enough residence time inside the furnace to complete the ashing process; and

d) The tester is designed to prevent or limit the oxidation of sulphur and carbonate decomposition.