Country Report of MONGOLIA

Submitted by

Mongolian Delegation / MRPAM

(For Agenda Item 3)
1. OUTREACH

1.1. Summary

Mineral Resources and Petroleum Authority of Mongolia (MRPAM) is the main governmental organization applying its geological knowledge and information to recommend areas, policies and plans for preservation, conservation, rehabilitation of geological resources and administration of geological resources and activities. By providing recommendations for improvement, amendment or issuance of laws, regulations and measures concerning administration of geological resources and activities, as well as monitoring and enforcing the relevant laws, regulations and measures. In addition, MRPAM conducts geological and mineral surveying, inspecting, studying, researching, knowledge developing, distributing and servicing, and cooperating in geology and mineral resources with other countries and international organizations.

The MRPAM serves the country as a geological fact-finding agency that predominantly studies and researches minerals, fundamental and applied geology in order to provide geological understanding about natural resources condition.

1.2. Annual Review of Individual Technical Activities

1.2.1 Geology and exploration division

Activities:

To ensure implementation of geological mapping, thematic research, mineral exploration, unconventional and conventional explorations, coal prospecting and exploration within the framework of acting Laws, Regulations and Policy of Government of Mongolia on Minerals and Petroleum sectors.

Main functions:

- To implement geological and hydrogeological mapping, geophysical, geo-ecology, thematic researches according to the awarded contracts, monitoring, to conduct general evaluation on minerals based on effective researches on mineral distribution;

- To develop work program and identify geological targets for geological survey projects conducted under State Budget and monitoring its implementations, to review the submitted reports, to give conclusions and recommendations for guiding geological survey and to improve legal environment;
• To review the submitted exploration work plans, to conduct prompt field monitoring and verifying activities on minimum work expenses, to receive and give relevant conclusions and decisions on exploration work result reports and to provide information for government, non-governmental organizations and internally within the organization;

• To prepare materials on geological survey results in regards to carry out tenders to issue licenses for areas set by the State and to provide information to the relevant divisions;

• To intensify the unconventional and conventional prospecting, exploration operations and to organize activities for increasing potential oil reserves;

• To ensure the implementation of Production Sharing Contracts, conventional and unconventional oil and gas prospecting agreements, and to support and monitoring;

• To carry out monitoring activities with regards to the investments and cost recoveries of petroleum and unconventional oil and gas operations and give competent conclusions.

1.2.2. Mining production and technology division

To implement government action program in 2016-2020 within the framework of the Law on minerals and State policy on Minerals in 2014-2025, to deliver effective and efficient services to investors and support mining sector better policy by providing reliable researches and data.

Objectives:

• Provide crucial research, information and data for better mining sector policy making,

• To encourage, protect foreign direct investment, maintain investment attractiveness,

• To update main commodity market analysis by quarterly, forecast short term and long term forecast,

• To support extractive industry transparency initiative in Mongolia, to collaborate its national council,

• To conduct, evaluate social impact and environmental assessment from mining sector,

• To evaluate mining technology technical assessment, implement technical policy,

• To implement clause of the law of minerals in terms of supervising blasting safety, blasting material and equipment,

• To evaluate mineral processing technology, conduct mineral production statistics,

• To encourage mineral production export, receiving annual mine plan, report, to register samples through custom for abroad mineral testing laboratory,

• To register national mineral reserve data base,
• To conclude, propose legal environmental clauses in terms of artisanal miner’s action,

1.2.3. Cadaster division

According to Minerals law, Petroleum law and Nuclear energy law of Mongolia, Cadaster Division shall have the following duties:

• to issue exploration and mining licenses;
• to monitor activities related to exploration and mining licenses;
• to provide the public with access to the processes of issuing and reissuing exploration and mining licenses;
• to maintain license revocation, transfer, pledge and surrender of licenses for the entire or a part of the licensed area;
• to receive, register and make decisions with respect to applications for minerals exploration and mining licenses;
• to resolve boundary disputes among license-holders;
• to conduct geological mapping, prospecting and exploration of minerals through State budget funding

1.2.4 Coal Research division

The vision of the division is to provide necessary information and data for better coal sector policy making, to deliver efficient and operative service to investors, entities and individual person and improve the role of coal sector in national economic development by implementing regulations and policies.

Basic Functions:

• Provide information and support the higher level of organization for better coal sector policy making and ensure the implementation of policy and perspective, strategic plan.
• Receive and register the feasibility study, mining report and plan of coal mine, to register national coal reserve data base, ensure the implementation of occupational health and safety law and environment related laws and regulations.
• Evaluating and analyzing the coal sector impact on society and economy of state, researching of coal export, market, sales and supply and assess the investment environment.

1.2.5 Petroleum Exploitation Division

Main objective:

To ensure, monitor and support for the implementation of Production Sharing Contracts of petroleum development blocks in Mongolia in accordance with the State policy on Petroleum sector, Law on Petroleum and other applicable laws and regulations.
Functions:

- To ensure the implementation of Law on Petroleum, standards, rules, regulations, guidance and other relevant laws and regulations, decision of the Government and State administrative central body.

- To conduct inspection and monitoring of petroleum development and production operations, verify measurement, storage and transportation of Mongolian Government share oil.

- To provide professional assessment for verification of investment and recovery costs for petroleum development and production operations.

- To organize commencement of oilfield development.

- To implement the policy for intensifying oilfield development and increasing production.

- To make proposal and assessment by reviewing research and survey reports of petroleum development and production operations.

- To develop standards, rules and regulations for petroleum related operations and provide legal assistance for the implementation thereof;

1.2.6 Petroleum Product Division

The main vision of the division is adhering to policy of sustainable and multiple supply of petroleum product, introduces most recent technologies with low adverse impact to the human health and environment, implementing perform operation with construction and equipment are meets the related state code and standard

Main functions:

Supporting and implementing the Government Policy of petroleum products supply under the Petroleum Products Law and other relevant laws as well as the coordination of stable supply of petroleum products, increase alternative source of imports, build up the regular reserves, provide information on imported amount, reserves, remaining stocks, retail price, tax and border price of petroleum products to management and costumers, introduce most recent technologies with low adverse impact to the human health and environment, implementing perform operation with construction and equipment are meets the state codes and standards

1.2.7 Heavy Industry Technology Division

The main vision of the division is to provide necessary information and data for better policy making, implement regulations and policies, monitor and evaluate investment environment and carry out innovation development in the sector.

Functions

Establish investment friendly atmosphere in heavy duty industry through thorough research and development of product need and demand, effective processing of mineral resources and
oil with environmentally safe and clean technology that are in high economic return and low in environment harm, and efficiently implement the policies with support and guidance.

1.2.8 Mineral Resources Information Technology Center

The main vision of the center is to develop a mineral resources database, manage, maintain, processing and provide information to users.

Main functions

Develop a mineral resources database, update, data processing using modern and with international standards of information technology and software, provide interested individuals with all available geological and mining related satisfied, correct and updated information and cooperate with the same professional domestic and foreign organizations in mineral resources database.

1.2.9 Central Laboratory of Mining and Petroleum

Objective of division:

To provide with high quality and fast testing and analysis of petroleum products, minerals and their products according to the standards that applies in Mongolia, make summary, guidance and recommendation and assist in policy-making on the development of mineral sector.

Main functions of division:

- Determination of mineral and coals their chemical compositions and structure, physical and determination thermal characteristics;
- To make research and testing for environmental less mineral processing produce value-added products;
- Determination of quality level and monitoring export of coals and coal products;
- To analysis and testing the soil of the mining environment and water pollution;
- To improvement petroleum products of quality control system;

1.2.10 Legal Division

Mission of the legal division is to implement the ethical principles and rule of law connected to the mineral and petroleum prospecting, exploitation, processing within the territory of Mongolia.

Division principal functions:

Its function is to monitor the legal basis of the decisions by the Agency's Chairman, and its compliance with the relevant legislations and to control the legal basis of the enforcement of regulations of the agency's internal processes and procedures, labor contracts and other draft
resolutions, and to vote and approve draft decisions and monitor its implementation and be responsible for new issuance and re-issuance of the mineral exploration and mining license, establishment, cancellation, termination of the production sharing contracts, and to conform to the canceling operations in compliance with the law, for this purpose provide legal opinion, also shall be responsible to provide a professional and technical assistance to the relevant units to address pre-court procedures of application disputes and requests related to the mineral exploration and mining licenses.

1.2.11 Monitoring, evaluation and statistic division

Mission of the Division:

Mission of the Monitoring, Evaluation and Statistics Division: -In charge and ongoing programs, events and activities and their current performance and identify achievement and monitoring of policy implementation and outcome evaluation, to provide conclusions and recommendations, and to provide accurate information Timeliness time for internal auditing, management and support decision-making.

The basic functions of Division:

Monitoring, Evaluation and Statistics Division has the following operation functions:

- Provide for all internal units of programs of the Mineral Recourses and Petroleum Authority of Mongolia’s monitoring and evaluation of projects and activities carried out and implementation of internal monitoring and create a database of statistics and monitor their compliance its Authority to the law

- Government Action Program, the main direction of development of economic and social activities implementation within the scope of monitoring, evaluating, and management of Mineral Resources and Petroleum Authority obtains results in key areas to develop and implement each of the relevant measures, report to the Ministry of Mining and Heavy industry

- Internal monitoring of the decree governing organization, command, decision and implementation of the plan and its implementation, combined obtain performance management and reporting to the relevant authorities, and monitoring and evaluation,

- The organization is responsible for improving the use of staff time and the adoption of compiling labor discipline and a system to monitor the implementation of internal procedures organizational procedures and calculation, and to encourage responsible

- The improvement of the units of the Authority’s and personnel activity and professional level, and a mechanism to evaluate the performance and reporting, accountability and incentives

- Authority units and personnel activity and professional level, and a mechanism to evaluate the performance and reporting, accountability and incentives
- Provide Mineral Resources and Petroleum Authority’s regular monitoring of internal audit's financial statements

- Improve Mineral Resources and Petroleum Authority introducing a system of internal control

- Report Mineral Resources and Petroleum Authority unit’s data analysis

- A statistical report on a regular basis organization and submitted to the relevant authorities, report and provide necessary information.

### 1.2.12 Public Administration and Management Division

Division goal is to provide agency with public administration leadership, human resource management, optimal management and reporting of financial resources.

**Division duty:**

In scope of the first goal of mineral resources and petroleum actions strategy, main duty of the division is to provide leadership for administration and human resource management, be responsible for solving agency’s financial queries, intrude leading management method and experience into agency works, decide human resource management and development issues, qualify sectorial specialists, financial registration procedure, agency commissary, deliver everyone public services, confirmation for contractor’s investment- cost recoverable expenses, control state budget execution of the geological survey projects that are on the expense of the state budget, control projects budget codes, improve efficiency of agency’s activities and coordination between departments, report outcome, accountability, evaluation of results, improve reward system, and organize foreign relations, cooperation, and advertising.

### 1.3 Proposed Future Activities

The MRPAM is to ensure the responsible and sustainable use of our state's natural resources-water, land, minerals and energy-for the benefit of current and future generations of Mongolia. Partnerships with our investors and stakeholders are important to us, as we work to deliver policies, programs and services that support industry while improving the economic state of Mongolia.

### 1.4 Assistance Required from CCOP/Other Member Countries in Support of Future Activities

In collaboration with CCOP member countries, Mongolia organized the UnCon Project Phase II workshop successfully in September, 2019 year. In this project we will continue research Unconventional oil and gas in Mongolia’s area.

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2 COOPERATION AND PARTNERSHIP

2.1. Summary

2.1.1 Australia- Mongolia Extractive Program (AMEP) 2

The Government of Mongolia and the Government of Australia have commenced the three year Australia-Mongolia Extractives Program (AMEP) to assist Mongolia to sustainably manage its resource-led growth in 2021. Its Goal is to help to ensure that Mongolia’s citizens experience equitable and sustainable growth from their mineral resources. The Department of Foreign Affairs and Trade (DFAT) of Australian Government has contracted Adam Smith International as the Implementation Service Provider for AMEP.

2.1.2. Mongolia Enhancing Resource Management Through Institutional Transformation (MERIT) project of Canada

The Mongolia: Enhancing Resource Management through Institutional Transformation project (MERIT) is funded by Global Affairs Canada to help to revive Mongolia’s economy and establish sustainable growth in 2016-2022 by building the capacity of the public sector and local community groups for effective management of the Mongolian extractive sector. The MERIT project aims to enhance public sector management of the Mongolian extractive sector so as to maximize its contribution to sustainable economic and social development.

2.1.3. Mongolia- Capacity Development in Mineral Resources Economics of the MRPAM project by BGR German

This project formally began with parties signing an agreement on the 17th of September, 2014. The Project duration is until 2020 year. The project is to support the MRPAM in increasing their capacity as a professional service provider for the Mongolian mineral resources sector and to comply with the mandate to regulate and promote the sector. There have been several important activities in phase 1 of the project, such as building MRPAM staff capacity, professional training, studies of minerals types, publication of an information bulletin and creation of databases.

2.1.4. Strengthening Extractive Sector Management in Mongolia (SESMIM) project of Canada

The Strengthening Extractive Sector Management in Mongolia (SESMIM) project, funded by the Canadian Government, aims to build Mongolian public sector capacity for transparent and effective policy implementation in supporting sustainable growth in the extractive sector in 2015-2020. The objective is to improve public sector governance in the extractive sector through three intermediate outcomes: improved implementation of extractive sector policies and regulations; improved coordination between ministries and key stakeholders in the extractive sector; and stronger evidence-based decision-making that supports extractive sector management in a gender-sensitive, socially and environmentally sustainable way. The project will be implemented by Agriteam Canada Consulting Ltd (Agriteam); counterparts in Mongolia include the Ministry of Mining and Heavy Industry; the Ministry of Environment and Tourism; the Ministry of Finance; and the Minerals Resources and Petroleum Authority of Mongolia. Other partners include the Government of Alberta, the University of Alberta and the University of Calgary.
2.1.5. Mongol Altai -50 project for 1:50 000 scale Geological Mapping and General Survey in Cooperation with Czech Republic

1:50 000 Scale Geological Mapping; General Survey for Studying Mineral Distribution Structure; And Assessing Perspectives in Khasagt Khairkhan Area, In Cooperation with Poland

The final results of the Mongol Altai-50 project for 1:50 000 scale geological mapping and general survey in cooperation with the Czech Republic, financed by the government and external partner agency, was discussed on the 11th and 12th of April, 2016, followed by formulation of all necessary documents such as inspection meeting notes, project introduction, staff-related data and other info. The final report was revised and sent on to the National Mineral Reserve Council, which discussed the report at its third meeting (22 September 2016).

Final reports for the Khasagt Khairkhan-50 project, jointly implemented by Mongolia and Poland, was received and sent on to the Central Geological Archive of MRPAM.

2.2. Annual Review of Individual Technical Activities

2.2.1. Australia- Mongolia Extractive Program (AMEP) 2

AMEP will support strengthened mining governance and stakeholder collaboration in the extractive sector of Mongolia. To that end, AMEP has provided technical assistance on the following areas in 2018-2021 for MRPAM.

- A revision of the existing safety regulation for mineral processing plants. This regulation will serve to improve the safety and operation of Mongolia’s mineral processing plants, contributing to a zero tolerance health and safety record, better quality product, and increased quantities. This task has been completed with the support of the School of Geology and Mining, Mongolian University of Science and Technology.

- Assessment of mineral valuation codes and introduction of appropriate mineral valuation system in Mongolia. A prescribed and standard approach in mineral valuation would ensure mining projects are valued according to an accepted and adopted methodology, in line with international good practice and minimize the chance of disputes and help Mongolia a planning of taxation to be collected from minerals. International and local mineral valuation experts developed the following reports:
  - Assessment of Valuation Codes for Mineral Deposits and Draft Mongolian Mineral Property Valuation Standards

- Supported Mineral Resources and Petroleum Authority of Mongolia in their communications strategy and implementation to disseminate comprehensive, relevant, utilizable information about entire value chain of extractive sector. This strategy will support effective implementation of the national mining legislation and policy. This task has been completed with the support of the Mongolian Mining Journal.
Supported the Mineral Resources and Petroleum Authority of Mongolia in their efforts to deliver an efficient service to the exploration companies. AMEP facilitated a training session to 500 staff of 300 exploration companies on how to submit geological exploration reports using a newly established e-reporting database of MRPAM. This task has been completed with the support of Smart Green Technology company.

2.2.2. Mongolia Enhancing Resource Management Through Institutional Transformation (MERIT) project of Canada

The MERIT project aims to enhance public sector management of the Mongolian extractive sector so as to maximize its contribution to sustainable economic and social development. Key activities include:

- Transfer of skills and best practice of international standards in the extractive sector,
- including environmental management, laboratory upgrades, risk management, responsible
- business practice, corporate social responsibility, EITI reporting etc.
- Project management, monitoring and evaluation.
- Human resource, organizational and financial management (including leadership training).
- Strategic planning.
- Information management (knowledge management, IT and GIS skills, software and technical support).
- Communications, improved public relations and multi-stakeholder consultations, increased awareness in the local community and civil society of impacts and opportunities from extractive sector activities.
- Support improved participation of women in the extractive sector.
2.3. Proposed Future Activities
MRPAM will attend CCOP’s work shop and technical support in the future.

2.4. Assistance Required from CCOP in Support of Future Activities
MRPAM will support and share the knowledge of the-CCOP member countries with sharing all the results and information obtained from the project.

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2 KNOWLEDGE ENHANCEMENT AND SHARING

3.1.1 Bayan Hundii Gold Deposit
The Bayan Khundii project is located on Erdene Mongol LLC’s 100% owned Khundii exploration license in Bayankhongor Aimag in south-western Mongolia, approximately 980 km southwest of Ulaanbaatar, Mongolia’s capital, and 300 km south of the aimag capital, Bayankhongor City. The project is also located 20 km southeast of Erdene’s Altan Nar gold-polymetallic project.

Bayan Khundii was discovered in Q2, 2015 when gold-bearing quartz veins were first sampled at what are now known as the Striker and Gold Hill zones. Initial assays returned very high grades, up to 4,380 g/t Au (141 oz./t) in chip samples from exposed veins and indicated that the majority of outcropping veins were highly auriferous.

Regional Geology and Tectonic Setting
The Khundii exploration license is located within the Edren island arc terrane, as described by Badarch et al. (2002), which is part of the larger composite Trans Altai Terrane (“TAT”) and is comprised by island arc terranes, back-arc and fore-arc basins, and ophiolite, accretionary wedge and metamorphic terranes.

The TAT forms part of the western end of the large, composite, arcuate-shaped Paleozoic New Kazakh-Mongol Arc terrane (“NKMA”) as described by Yakubchuk (2002). The NKMA is part of the Central Asian Orogenic Belt (CAOB; Windley et al., 2007) and extends along the southern margin of Mongolia, including the border region with China, and is host to the Oyu Tolgoi copper-gold porphyry mine to the east (Figs. 1) and the Tian Shan Gold Belt to the west.

The TAT is located immediately south of the Main Mongolian Lineament (Badarch et. al., 2002) that separates the dominantly Precambrian and Lower Paleozoic terranes to the north from the dominantly Upper Paleozoic terranes to the south.
The TAT consists mostly of Middle Paleozoic volcanic, sedimentary and meta-sedimentary rocks that were intruded by Middle Paleozoic calc-alkaline and alkaline plutons. The TAT in the region near Erdene’s license areas is comprised of three tectono-stratigraphic terranes (Fig. 1) as defined by Badarch.

**Figure 1** - Tectono-stratigraphic terrane map for Mongolia (Badarch et al 2002) with location of Trans Altai Terrane (in blue). The locations of the Bayan Khundii (BK) and Oyu Tolgoi (OT) are indicated with red stars

**Geology of Khundii Area**

Bayan Khundii epithermal gold deposit is located in the south eastern part of the Khundii license area. The bedrock geology of the Khundii license area is dominated by a sequence of Devonian and/or Carboniferous volcanic (andesite, andesite porphyry) and pyroclastic rocks (ash, lapilli, and block and ash tuffs) that were intruded by Carboniferous intrusions, with these rocks unconformable overlain by Jurassic volcanic and sedimentary units, with all rock units overlain by unconsolidated sediments of Quaternary or Recent age.

Geochronological constraints are based on the 1:200,000 scale regional mapping completed by the Mineral and Petroleum Authority of Mongolia (MPRAM). No detailed geochronological work has been undertaken to determine the ages of either host rocks or mineralized material at Bayan Khundii.
Carboniferous volcanic rocks are present throughout the license area and include several texturally-distinct units of intermediate composition including andesite, porphyritic andesite and basalt. A unit of block and ash tuff is the dominant lithology in the west-central part of the license area. Pyroclastic rocks, that are host to and restricted to the immediate area surrounding the Bayan Hundi mineralization, are interpreted to be Middle-Upper Devonian in age, possibly belonging to the Baruunhuurai Formation that is part of a large area of undifferentiated Devonian units to the South and West of the license area.

Pyroclastic rocks include lapilli and ash tuff, and welded tuff with very minor block and ash units. Fine grained Devonian andesite to the northeast of Bayan Khundii was intruded by a series of dacite porphyry plugs which are also interpreted as Devonian.

Carboniferous granitoid rocks intrude both the Devonian and Carboniferous volcanic and pyroclastic units and have a wide range in composition from least-evolved medium and coarse grained diorite, monzodiorite, monzonite and granodiorite, to the most evolved phases of fine grained granite, granite porphyry, syenite and quartz syenite.

Most Jurassic volcanic rocks are present in the southern part of the license area and consist mostly of basalt (commonly amygdaloidal) units. In addition, a Jurassic sedimentary unit, consisting of a basal conglomerate and overlying red to red and white mottled sandstone and siltstone, has been mapped in the southern part of the license area where it disconformably underlies the Jurassic volcanic rocks. Jurassic lithologies have been observed to unconformably overlie the older Devonian and Carboniferous lithologies.

Unconsolidated Quaternary to Recent sediments are present throughout the license area with a large area of colluvial-dominated sediments in the central part of the license north of the
Bayan Khundii project area. Alluvial sediment-filled stream channels are present throughout the license area and overlie all aforementioned Devonian, Carboniferous, Jurassic and Quaternary rocks and sediments. These ‘stream’ channels are mostly dry, however, flash flooding associated with episodic storm events have recently been observed to deposit additional alluvial sediments.

Several northeast-, northwest- and east-west trending faults were inferred in the license area and these cross-cut, or form contacts of, Carboniferous intrusive and volcanic map units. Faults do not appear to off-set Quaternary or Recent sediment deposits; however, some inferred faults form the contacts with older Devonian, Carboniferous or Jurassic lithologies. A detailed structural study at Bayan Khundii and surrounding areas puts these faults into a regional context and are interpreted to represent arc-parallel and arc-normal faults, including northeast-trending extensional faults interpreted as associated with the low sulphidation gold mineralization.

3.1.2. Petro Matad Oil

The geoscientific study carried out in 1892 in central Asia by Russian Scientist, V. A. Obruchev marked the beginning of Mongolian geology. A few decades later, oil exploration in Mongolia begun with the classification of Mesozoic and Tertiary sediments, and the discovery of oil shale outcrops in the Gobi region. Around 1940, the Zuunbayan oilfield was identified in the East Gobi by Mongolian and Soviet geologists.

At that time, the Zuunbayan and Tsagaan-Els oilfields reserves were estimated at 6.2 million tonnes. In 1950, construction of the country’s first ever refinery was completed and it started refining oil produced from the Zuunbayan field. Both fields yielded 586 thousand tonnes of oil until 1969, when the refinery and production ceased activities due to declined rates, a fire at the refinery and economic factors. Since then, Mongolian oil exploration and production activities were idle for over 20 years.

Resumption

The collapse of the Soviet Union in 1989 had far-reaching impacts for Mongolia, politically, economically and socially. A parliamentary democracy was put in place, the development of upstream petroleum operation recommenced, and the Petroleum Law of Mongolia and related regulations were put into effect in 1991. The government initiated the “Petroleum Program” classifying prospective petroleum areas into contract blocks and releasing them for international bidding.

In 1993, the first Production Sharing Contract (PSC) was signed with SOCO from the USA and the first exploration well of 3,000 meters’ depth was drilled a year later.

In 1997, well 19-3 on Block XIX was recorded as the country’s first free flowing oil well. Soon after, oil was exported from Mongolia by trucks to China to be refined.
Figure 3. Petro Matad Mongolia – Proven petroleum systems.

Figure 4. Block Proximity to Producing Basins.
Geological Overview

Lacustrine depositional environment
Half-graben and sag basins with up to 4000m Mesozoic – Tertiary fill
Proven Late Jurassic – Early Cretaceous Petroleum System, additional older potential
Alluvial, fluvial and lake turbidite reservoir fairways predominant
Proven source rocks in East and now Central Mongolia – present day maturity
Complex structural history but multiple trap styles proven effective.

Figure 5. Geological Overview.

3.1.3. Ukhaa Hudag Coal

Ukhaa khudag coking coal mine located within the Tavantolgoi coal basin in Tsogtsetsii soum, Umnugobi aimag. Mining at Ukhaa khudag started in 2009. The proximity to the Mongolian-Chinese border and the main market region provides access for Mongolian coal products to the largest steel producing provinces in China. The designed annual production capacity of the Ukhaa khudag mine is 15 million tons.

Using advanced mining technology, exploration modalities and inventive operational techniques, Ukhaa khudag is the most advanced coking coal mine in the country. The company also aims to maintain the highest health, safety and environmental standards in each level of its operations. Its’ LTIFR and other safety metrics are favorable compared with industry benchmarks internationally.

The mine has a complete on-site coal analysis laboratory with a capacity to conduct testing and analysis on around 60-70,000 samples annually. The laboratory was twice accredited by Mongolian National Accreditation Authority and conducts coal testing in compliance with domestic and international mining standards such as MNS, ISO and GB.

Supporting services at the mine-site include heavy equipment workshop facilities, a mine office complete
with 24-hour emergency center, and the state-of-the-art simulator training equipment specifically designed to train local employees. The mine utilizes the most efficient and advanced mining equipment from world renowned brands such as Liebherr and Caterpillar.

The mining operations are conducted through two 12-hour shifts, 7 days a week, 365 days a year, adaptable to inclement weather conditions in the Gobi region. Ukhaa khudag mine is considered an exemplary project across all aspects of its integrated operations and serves as an operating hub for processing raw coal from Baruun naran mine as well.

Ukhaa khudag mine is considered an exemplary project across all aspects of its integrated operations and serves as an operating hub for processing raw coal from Baruun naran mine as well.

3.2. Annual Review of Individual Technical Activities

3.2.1 Bayan Hundi Project Geology

The oldest rocks at Bayan Khundii, and the host rocks for gold mineralization, include a sequence of intensely silicified and illite-altered pyroclastic rocks. Pyroclastic lithologies include fine- and coarse-grained lapilli tuffs (i.e. containing lithic fragments <2m and >2cm respectively), ash tuffs (fragments < 2mm; some finely laminated), welded tuffs (with fiamme) and rare block and ash tuffs (with blocks >6 cm). These rocks are exposed over limited areas within the Southwest and Northeast prospect areas, however, geophysical data and drilling in 2016 and 2017 indicates these altered rocks extend beneath adjacent Jurassic cover over an approximately 1.5 by 0.4 kilometer area (Fig. 2).

The 1:200K scale government geological map that covers the Khundii license (MPRAM map L-47-XXXIII) outlines a large area of undifferentiated Middle-Upper Devonian units to the south and west of the Khundii license that includes slate, pyroclastic sandstone and conglomerate, and granitoid intrusions. Erdene geologists interpreted the tuffaceous rocks at Bayan Khundii to be part of the Devonian Baruunhuurai Formation.

Intense quartz-illite hydrothermal alteration has replaced most primary minerals in these tuffaceous rocks, giving the lithologies a pervasive medium grey colour in outcrop, and making identification of the protoliths difficult, even in fresh drill core. Observations from outcrop and surface trenches in the Southwest Prospect area, coupled with mapping of weakly altered tuffaceous units to the north and west of the Northeast Prospect area, indicate these rocks have a dominant northeast-southwest strike trend and dip at approximately 40 to 45 degrees to the northwest.
Recent structural analysis of oriented drill core from parts of the Midfield Zone, coupled with field observation in the Northeast Prospect area, indicate that lithologies may also have northwest and east-west strikes with variable dips. A small intrusion of medium grained equigranular hornblende monzonite (≤100 m diameter) outcrops in the center of the Southwest Prospect area, to the west of Gold Hill (Fig. 8). This monzonite was intersected in the top of several drill holes including BKD-12, -34, -46 and -55 where sharp intrusive contacts were observed with lapilli tuff.

Several fine grained aplite and porphyritic granite dykes were intersected throughout the Bayan Khundii area including two granite porphyry dykes (0.8 and 17m wide) and an 8-meter interval at the bottom of drillhole BKD-41 in the Northeast Zone and several dykes in the Midfield Zone, ranging in thickness from 1 to 12 metres wide.

Some of the aplite, quartz syenite and granite porphyries may be late differentiating from the underlying syenite intrusion at depth. The syenite intrusion that underlies the mineralized tuffs is interpreted as post-mineral and possibly of Carboniferous age, whereas the age of the altered dykes is unclear although the presence of gold mineralization the dyke in in BKD-60 suggests a Devonian age.

Numerous andesite porphyry dikes have been logged throughout the Bayan Khundii prospect. These are thought to be Devonian in age, and have formed along with the deposition of the tuffaceous units.

Jurassic red-bed sedimentary rocks unconformably overlie the altered Devonian tuffaceous rocks at Bayan Khundii. Lithologies include coarse-grained, poorly sorted hematitic sandstone and mudstone with a very coarse-grained basal conglomerate commonly developed at the unconformity with the Devonian tuffs.

The Jurassic sedimentary sequence is unconformably overlain by unaltered massive and amygdaloidal basalt.

The primary S₀ orientation in the basalt flows differs from the underlying red-beds, having an average NE-SW strike (051°) and an average dip of 14° to the SE. Accordingly, the contact between this basalt and the underlying red-beds is interpreted as an angular unconformity.

Topographic low areas at Bayan Khundii are underlain by unconsolidated Quaternary and Recent sediments. The pattern and distribution of various facies of Quaternary deposits reflects modern and paleo-drainage systems.

There is a prominent southeast orientation to many of the small Quaternary sediment-filled valleys at Bayan Khundii that are sub-parallel to the main auriferous quartz vein orientation. Larger NW-SE, N-S and E-W trending linear valleys may reflect contact zones or structures, possibly faults.
Figure 6. – Photographs of lithologies including: 1) weakly altered (chloritized) coarse-grained lapilli tuff from an outcrop 500 m north of the Northeast Zone; 2) strongly altered (illite-quartz) coarse-grained lapilli tuff from the Striker Zone; 3) Finely laminated and variably altered ash tuff interbedded with welded tuff to the northwest of Striker Zone in drillhole BKD-40; 4) Welded tuff with angular quartz fragments and coarse lithic and chalcedony fragments from an outcrop approximately 400 metres north of the Northeast Zone.

Mineralization

Mineralization at Bayan Khundii consists of gold (Au) ± silver (Ag) in massive-saccharoidal, laminar and comb-textured quartz± hematite veins, multi-stage quartz-adularia-chalcedony± hematite veins, quartz-hematite breccias, along late fractures (±hematite/ specularite), and as disseminations within intensely illite-quartz altered pyroclastic rocks, where it is commonly associated with hematite that partially or completely replaced pyrite grains.

No Au± Ag mineralized veins or breccias have been noted in the unconformably overlying Jurassic sedimentary rocks or basalt, indicating these rocks represent an unmineralized cover sequence.

Some Au± Ag enrichment has been noted in basal conglomerate containing angular, altered, and possibly mineralized Devonian tuff clasts, near the unconformity. This mineralization may represent the incorporation of mineralized material from nearby Devonian tuffs, although it is possible that it may represent paleo-placer Au in the conglomerate matrix. A strongly mineralized 1-metre interval (51.2 g/t gold) of basal conglomerate was intersected directly above altered and mineralized tuff in the Midfield Zone (BKD-95).
Petrographic analysis by New Zealand-based petrographic consultants, APSAR, identified several gold grains associated with acicular tourmaline within Iron-Magnesian-calcium carbonate facies that have replaced the matrix of the basal conglomerate.

The origin of this gold mineralization is unclear, however, the petrographic evidence suggests the gold mineralization is ‘paragenetically associated with tectonic and hydrothermal overprinting of the thermally metamorphosed and metasomatized sedimentary rock’ (APSAR, 2017).

The gold mineralization and associated carbonate-tourmaline alteration is restricted to the Devonian-Jurassic contact zone and may reflect post Jurassic hydrothermal activity along the contact.

**Figure 7.** – Photographs of gold-bearing veins and breccias, including: 1) Comb-textured quartz-hematite/specularite vein from BKD-02; 2) Composite multi-stage quartz-chalcedony-adularia vein from BKD-01; 3) Composite quartz-adularia-chalcedony vein from outcrop with bladed calcite (i.e. ‘boiling’) textures, now pseudomorphed by quartz; and 4) Hematite-specularite-quartz breccia from BKD-60.

Perhaps one of the most striking features of Bayan Khundii is the intense alteration that overprints all Devonian tuffaceous rocks at Bayan Khundii, including the outcropping Southwest and Northeast Prospects that is evident on high resolution satellite images (e.g. GeoEye).

This alteration is in sharp contrast to the relatively unaltered unconformably overlying Jurassic sedimentary rocks and basalt. In many locations at Bayan Khundii it is difficult to identify the protolith, as virtually all primary minerals have been variably replaced by quartz and illite.
Figure 8 - Map of the Southwest Prospect area showing the distribution of alteration zones, as defined by Short-Wave Infrared (SWIR) Analysis

Deposit Type

Several features support a low sulphidation model for the Bayan Khundii mineralization, including: the presence of quartz-adularia-sericite (illite) veins and adularia alteration zones in gold mineralized zones; the low Ag : Au values (0.1-5, avg. ~1) local colloform bands of chalcedony (often with finely disseminated gold), bladed calcite (now pseudomorphed by quartz) textures that indicate boiling; the generally low concentrations of base metals, widespread intense illite-quartz alteration zones; the ubiquitous presence of hypogene hematite as fractures, veins and breccias; and the presence of comb-textured quartz veins and chalcedony, albeit minor in abundance.

The general absence of smectite at Bayan Khundii suggests erosion to at least 150 m depth below the paleo-groundwater table.

Based on the features and discussion above, Bayan Khundii gold±silver mineralization is considered to be a low sulphidation epithermal type gold deposit.
**Resource Estimate**

Bayan Khundii deposit Resource Estimate was carried out and updated by Tetra Tech Inc. in Oct 2019.

**Table 1 - Bayan Khundii deposit resource estimate**

<table>
<thead>
<tr>
<th>Cut-off Grade</th>
<th>Resource Classification</th>
<th>Quantity (Mt)</th>
<th>Grade Au g/t</th>
<th>Gold Koz</th>
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</thead>
<tbody>
<tr>
<td>0.4</td>
<td>Measured Indicated</td>
<td>1.7</td>
<td>3.15</td>
<td>176</td>
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<tr>
<td></td>
<td></td>
<td>4.6</td>
<td>2.45</td>
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<tr>
<td></td>
<td>Measured &amp; Indicated</td>
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<td>2.64</td>
<td>540</td>
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<td></td>
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<td>3.10</td>
<td>106</td>
</tr>
<tr>
<td>0.55</td>
<td>Measured Indicated</td>
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<tr>
<td></td>
<td></td>
<td>3.7</td>
<td>2.93</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td>Measured &amp; Indicated</td>
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<td>3.16</td>
<td>521</td>
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<tr>
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</tr>
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<td></td>
<td>Inferred</td>
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</table>

**Notes:**

1. The Statement of Estimates of Mineral Resources has been compiled under the supervision of Mr. Cameron Norton who is a full-time employee of Tetra Tech and a P. Geo. Mr. Norton has sufficient experience that is relevant to the style of mineralisation and type of deposit under consideration and to the activity that he has undertaken to qualify as a Qualified Person as defined in the CIM Standards of Disclosure.
2. All Mineral Resources figures reported in the table above represent estimates based on drilling completed up to April 22, 2019. Mineral Resource estimates are not precise calculations, being dependent on the interpretation of limited information on the location, shape and continuity of the occurrence and on the available sampling results. The totals contained in the above table have been rounded to reflect the relative uncertainty of the estimate. Rounding may cause some computational discrepancies.
3. Mineral Resources are reported on a dry in-situ basis.
4. The Mineral Resources is reported at a 0.55 g/t Au cut-off. Cut-off parameters were selected based on Tetra Tech’s internal cut-off calculator, which indicated that a break-even cut-off grade of 0.55 g/t Au, assuming an open cut mining method, a gold price of USD $1,350 per ounce, an open mining cost of USD $2 per tonne, a processing cost of USD $16 per tonne milled, a G&A cost of $5 per tonne, and a gold recovery of 0.95%.
5. The mineral resource estimate has been constrained to a preliminary optimized pit shell which assumed a gold price of USD $2,000 and the economic potential tested using the above parameters.
6. The mineral resource estimate assumes an average density of 2.66 t/m³ for the mineralized domains.
7. Mineral Resources referred to above, have not been subject to detailed economic analysis and therefore, have not been demonstrated to have actual economic viability.
8. Measured and Indicated mineral resources do not have demonstrated economic viability. Inferred mineral resources have a greater amount of uncertainty as to their existence and potential economic and legal feasibility, do not have demonstrated economic viability, and are exclusive of mineral reserves.
Table 2 - Bayan Khundii deposit resource estimate (reserve)

<table>
<thead>
<tr>
<th></th>
<th>Tonnage (Mt)</th>
<th>Grade Au g/t</th>
<th>Contained Au Koz</th>
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</thead>
<tbody>
<tr>
<td>Proven Mineral Reserves</td>
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<td>165</td>
</tr>
<tr>
<td>Probable Mineral Reserves</td>
<td>2.4</td>
<td>3.4</td>
<td>256</td>
</tr>
<tr>
<td><strong>Total Mineral Reserve</strong></td>
<td><strong>3.5</strong></td>
<td><strong>3.7</strong></td>
<td><strong>422</strong></td>
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</tbody>
</table>

Notes:
1. The effective date of the Mineral Reserve estimate is October 15th, 2019. The QP for the estimate is Ms. Maurie Phifer, P.Eng. of Tetra Tech
2. The Mineral Reserve estimates were prepared with reference to the 2014 Canadian Institute of Mining, Metallurgy and Petroleum (CIM) Definition Standards (2014 CIM Definition Standards) and the 2003 CIM Best Practice Guidelines
3. Reserves estimated assuming open pit mining methods
4. Reserves are reported on a dry in-situ basis
5. Waste to ore cut-offs were determined using a Net Smelter Return (“NSR”) for each block in the model. NSR is calculated using prices and process recoveries for each metal accounting for all off-site losses, transportation, smelting and refining charges. NSR cut-off was calculated to be $22.93, and includes 5% royalty deduction
6. Reserves are based on a gold price of $1267/oz, mining cost of $2.5/tonne, milling costs of $16.46/tonne feed, G&A costs of $6.58/tonne
7. Mineral Reserves include dilution of 9% and losses of 5%.

3.2.2. Petro Matad Oil

- Exploration Term up to 12 years (8+2+2)
- Exploitation Term up to 35 years (25+5+5)
- E&A/P&D costs are low
  - Exploration wells in the $3MM to $8MM range
  - Development wells to 2000m costing $2MM or less
- Royalty 5-10%

- Contractor Production Share 45-60% depending on production rate
- Production share not affected by rate of return or reserve size, therefore Contractor shares fully in upside
- Cost Recovery of all costs, capped at 40% of Gross Revenue
  - Unlimited carry-forward of unrecovered costs
- No corporate taxes on oil/gas sales
- Contractor can freely dispose of its production share
- No sales of oil at reduced prices for domestic market are required
- Oil price linked to internationally traded marker crude
Figure 9.

Heron Prospect and Well Prognosis

Figure 10.
Red Deer Prospect - Block XX Southwest

- New basin opening well in Asag Sag, 100km southwest of existing Petro China operated production
- Targeting Early Cretaceous Petroleum System proven in surrounding basins
- Outcrop and shallow borehole data confirm presence of oil prone source rocks
- Basin centre 3-way dip fault bounded closure
- Attractive resource size with significant follow up potential

Figure 11.

Red Deer Prospect and Well Prognosis

Top Lower Tsagaantsav Fm Equivalent Depth Map

- Primary target reservoirs are fluvial sandstones of the Lower Tsagaantsav Formation interpreted to be at Marker A
- Secondary targets at Marker C (Lower Zuunbayan)

Figure 12.
Figure 13.

Figure 14.
3.2.3. Ukhaa Hudag Coal activation

With its Coal handling and preparation plant (CHPP) at Ukhaa khudag, MMC is the first washed coal producer and exporter in Mongolia. The plant is comprised of three processing modules with a collective capacity to process 15 million tons of raw coal annually. While the 1st and 2nd modules of the plant are operational from 2011 and 2012 respectively, the 3rd module was put into operation in 2013.

By processing raw coking coal, the CHPP produces washed hard coking coal for exports with 8-10% ash content as well as thermal coal for the on-site power plant use. The plant is enabling the company to sell washed hard coking coal products with consistent quality directly to end-customers while having a significant contribution in raising the market recognition and competitiveness of Mongolian coking coal in the world market. The CHPP is designed to operate year round in Mongolia’s extreme weather conditions and is a customized solution to maximize the Ukhaa khudag coking coal product yield. It utilizes modern equipment of well-known brands from Australia, USA, Europe, South Africa and China.

The CHPP was built and designed by Sedgman company of Australia, one of the world leaders in coal processing and material handling technology.

The plant’s highly-automated, cutting edge technology allows up to 95% water-recycling making it an optimal environmental solution. A Belt Filter Press facility which was put into operation at the CHPP in 2013 allows the Company to further increase the rate of water recovery.

Site Infrastructure.

3x6 megawatt power plant is operational at Ukhaa khudag since 2011. Introducing the latest technological advances most efficient for the arid Gobi climate including circulated fluidized bed technology, air cooling system with “0” water consumption and emission control system, the power plant not only supports electricity needs of the CHPP and the mine project operations but also provides electricity to Tsogttsetsii and neighboring soums of Umnugobi aimag.

The power plant is the first venture of reputable Mongolian engineers with extensive experience in the domestic energy sector. Based on carefully studied design best suited to the Gobi climate, the power plant technology complies with applicable environmental regulations of the World Bank and other international institutions. As a result, it uses approximately 4-5 times less water compared to regular water-cooling systems commonly used in Mongolia.

![Figure 15. Site Infrastructure](image-url)
Transportation and logistics

MMC’s coal transport operations are currently based on a truck-and-road model. The company has its own fleet of around 450 double-trailer trucks and a truck maintenance and repair workshop with a capacity to handle 5 heavy-duty trucks at the same time, essential for maintaining the safety and efficiency of its coal transport operations.

The 245-km paved road between Ukhaa khudag mine and Gashuun Sukhait border checkpoint in Mongolia serves as the company’s primary infrastructure for the transport and delivery of coal products. The road was built by MMC in 2011 under the BOT agreement between the Company and the Government of Mongolia and was transferred to the Government in 2014.

In addition to the main coal delivery operations to China, the company is continuing with its efforts to conduct trial shipments to various seaborne market destinations including Japan, Taiwan, Germany and India.

Figure 16. Ukhaa Hudag Coal transportation.

Water Supply.

To support the operations of its CHPP and production capacity expansion, MMC carried out water supply system project in stages since 2011 and successfully expanded the overall capacity to around 200 liters per second. The water supply system ensures reliable water supply of the entire mining complex as well as the local residents of Tsogttsetii soum, Umnugobi aimag.

The water supply facility at Ukhaa khudag applies the latest technologies with high efficiency ratio and is considered to be the most economically efficient solution suitable in the Gobi region. It incorporates components such as potable water tank, booster pump station, twelve boreholes, water collecting pipeline with total length of 21 km and two process water reservoirs with storage volumes of 56,000 m3.
The processing scheme at the company’s CHPP is designed to ensure optimum water use efficiency with approximately 95% of the used water being recycled. In addition to that, a Belt Press dewatering plant built at the CHPP handles the tailings stream of the plant. It allows up to 60-70% more water for re-use thus bringing vital environmental and economic benefits to the company operations.

Figure 17. Water Supply.
The water supply system ensures reliable water supply of the entire mining complex as well as the local residents of Tsogttsetii soum, Umnugobi aimag.

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4. Methane (CH₄) gas

4.1. Summary

The methane is a product of geological process from the one aspect and of biological process from the other aspect. The coal layer or strata is saturated with water and the water holds the methane gas with the power of hydrostatic pressure. Therefore, an ordinary method to separate the methane from coal is to reduce the pressure by sucking the water.

In order to extract, there is no need to excavate the tens of meters of soil; just drill holes and suck them. The coal’s methane gas exploration projects have been more intensified at the international level, the technical and technological methods and solutions to extract and utilize the methane become more developed and the range of its usage has been expanding.

4.2. Annual Review of Individual Technical Activities

Although the geological surveys on gases such as natural gas, shale gas, and crude oil gas are not so well developed in Mongolia, Mongolia has huge amount of coal deposits and resources. In this sense, the coal layer’s methane can become the most important source of energy. As of today, assuming the installed capacity of the energy at the level of whole country, 83.3% of the energy demands are supplied based on the coal, 0.2% is supplied by the diesel power plants and 16.5% is generated by the renewable energy sources such as solar, wind and water power plants.

The geological forecasted coal reserves of Mongolia are 173.1 billion tons, of it, the estimated reserves are 32.8 billion tons, of which, the 17.38 billion tons are brown coal, 15.3 billion tons are coal and 0.118 billion tons are the coal anthracite.

This amount has been steadily increasing year by year and the position occupied at the world level is increasing. The coal is classified as brown coal, coal, and anthracite, and the brown coal is dominated in the eastern region, mid layer that becomes the coal from the brown coal deposit in the central region, and the coal and the coking coal are dominated in the western and southern Gobi regions.

The largest accumulation of methane of the coal layers with the economic importance occurs in the coal and the probability to be accumulated in the anthracite and brown coal is very low.

The methane is fuel of the era. The huge amount of methane is segregated from the mine while extracting the coal and lost in the air. Using the methane instead of raw coal is a very efficient way to reduce the air pollution.
4.3 Proposed Future Activities

The methane and medical geology is a newly emerging sector in Mongolia and we will study it furthermore.

4.4 Assistance Required from CCOP in Support of Future Activities

We are seeking for the possibilities to develop the surveys on the medical geology and methane furthermore in cooperation with the CCOP.

4.5 Assistance Offered to CCOP/Other Member Countries in Support of Future Activities

We would like to learn from the experiences of other member countries that have already surveyed about methane.

Figure 18. Methane (CH₄) gas

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