Member Country Report of MALAYSIA

Submitted by

Malaysia Delegation

(For Agenda Item 3)
ANNUAL MEMBER COUNTRY REPORT

| Country: | MALAYSIA | Period: | 1 July 2016 – 30 June 2017 |

1. OUTREACH

1.1. Summary

During the review period of 1 July 2016 to 30 June 2017, a series of earthquake-related and landslide-related public outreach programs were carried out by the Department of Mineral and Geoscience Malaysia (JMG) to create public awareness of the risks posed by earthquake and landslide.

1.2. Annual Review of Individual Technical Activities

1.2.1. Earthquake–Related Outreach Programmes

On 5 June 2015, an earthquake with a magnitude of 6.0 on the Richter scale struck Mt. Kinabalu, Sabah. The Mt. Kinabalu earthquake likely resulted from the rupture of the northwest-dipping Marakau fault or a closely associated fault beneath Mt. Kinabalu. As the epicenter of the earthquake was beneath Mt. Kinabalu, the tremors caused massive rock falls around the mountain, causing serious damage to the hostels and rest house near the summit of Mt. Kinabalu, which killed 18 hikers and injured at least 21 more along climbing trails on the steep mountain face. Following the Earthquake, a series of outreach programs, such as seminars, symposiums, capacity building, workshops and site visit, was carried out for the students, teachers and local communities residing in the earthquake prone areas in the west coast of Sabah i.e. Ranau, Tambunan, Tuaran and Kota Belud, as well as the earthquake and tsunami prone area in the east coast of Sabah, i.e., Lahad Datu (see also Section 3.2.3).

During the period under review, the outreach programs focused on drafting of guideline for seismic prone area, to establish earthquake peak ground acceleration value, and to identify and monitor active faults together with officers from Sabah Town and Regional Planning Department, Department of Survey and Mapping Malaysia (JUPEM), Sabah Syariah Court, The Ministry of Education Malaysia, the Economic Planning Unit of the Prime Minister's Department of Malaysia (EPU), The Kota Kinabalu City Hall, District councils, Public Works Department, Sabah Park, Employees at the Yayasan Sabah Tower, consulting engineers, geological consultants, and local universities.

1.2.2. Landslide-Related Outreach Programmes

Landslide is a growing global threat and has been destroying lives and property of humankind. Although the action of gravity is the primary driving force for a landslide to occur, there are other contributing factors affecting the original slope stability viz. hillside development at Cameron Highlands, which is a popular tourist destination and a hill station in Malaysia. Mapping of dangerous slopes carried out by the Department of Mineral and Geoscience Malaysia had identified 33 critical slopes in Cameron Highlands that are prone to landslide activities.
During the period under review, the Department of Mineral and Geoscience Malaysia carried out a series of landslide awareness programmes at Cameron Highlands and Ipoh for the Public Work Department, Royal Malaysia Police, Fire and Rescue Department, Department of Environment, State Planning Unit, Malaysia Civil Defense Force and State Financial Office, and local authorities.

1.3. Proposed Future Activities

Malaysia will continue to carry out outreach programs on:

(i) Earthquakes in earthquake prone areas in Sabah

(ii) Landslides in high landslide risk areas in Malaysia, particularly in Cameron Highlands

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

Assistance from CCOP is required in the mapping and monitoring of active faults, and zonation of seismic hazard using probabilistic and deterministic approaches.

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

Nothing to Report

1.6. Others Comments

Outreach programs conducted have successfully increased public awareness and preparedness of earthquake and landslide hazards.

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Director
Planning & Management Branch
2. COOPERATION AND PARTNERSHIP

2.1. Summary

The Department of Mineral and Geoscience Malaysia continues to cooperate with other national and international bodies in the fields of mineral and geoscience. During the period under review, the Department of Mineral and Geoscience Malaysia continued to maintain international bilateral technical cooperation in the Malaysia-Thailand Border Joint Geological Survey (MT-JGS) and the Malaysia-Indonesia Scientific and Technical Cooperation (MALINDO). In addition, the Department of Mineral and Geoscience Malaysia played an active part in international meetings and conferences, including the ASEAN Ministerial Meeting on Minerals (AMMin), the ASEAN Senior Officials Meeting on Minerals (ASOMM), the Asia-Pacific Economic Cooperation (APEC), Mining Task Force (MTC), the Coordinating Committee for Geoscience Programmes in East and South East Asia (CCOP), as well as the Malaysia-Korea Geoscience and Mineral Resources Cooperation (KIGAM).

2.2. Annual Review of Individual Technical Activities

2.2.1. International Cooperation

2.2.1.1. Malaysia-Thailand Border Joint Geological Survey (MT-JGS)

The Malaysia-Thailand Border Joint Geological Survey Project, implemented in 2000 under the umbrella of the Malaysia-Thailand Border Joint Geological Survey Committee, involves technical cooperation in the field of geoscience and minerals between the Department of Mineral and Geoscience Malaysia and the Department of Mineral Resources Thailand (DMR). It aims to harmonize the geological boundary and to correlate the rock units along the common border of both countries.

During the period under review, a detailed study on the stratigraphic correlation was jointly carried out with Thai counterpart in areas which were previously mapped. Compilation of report on the geology and mineral resources along the Malaysia-Thailand border was also continued during the period under review.

Three reports that were completed and published during the period under review were:

i. Detailed study on Carboniferous radiolaria in radiolarian-bearing rocks along the Malaysia-Thailand border

ii. Quantitative Rockfall Hazard Assessment for Bukit Lagi, Perlis, Malaysia using LiDAR Technology

iii. Geology of the Langkawi-Tarutao area along the Malaysia-Thailand border

Two projects that were initiated during 2016 and will be completed by the end of 2017 are:

i. Stratigraphic correlation between the Setul Formation and the Thung Song Group
ii. Detailed study on Permian-Triassic radiolaria in radiolarian-bearing rocks along the Malaysia-Thailand border.

2.2.1.2 Malaysia-Indonesia Scientific and Technical Cooperation (MALINDO)

The areas of cooperation include joint geological survey, geological resources and mineral investigation, exchange of scientific and technical information, exchange of scientists and technical personnel to work on collaborative research and development projects.

During the period under review, the four Technical Working Groups formed had carried out a series of activities including capacity building, working visits, geological mapping correlation, hydrological studies, and training courses in both countries.

2.2.1.3 Meetings and Workshops Attended

During the period under review, a total of 42 training programmes, workshops, meetings and overseas visits to USA, Taiwan, Cambodia, Vietnam, Japan, Myanmar, China, Thailand, Indonesia, Singapore, Switzerland and Korea Selatan were organised by ASOMM, CCOP, DMR, COTI, JPA, KIGAM, CGS, GEOSEA, IGF, AIST, IAEA, GAI, UNEP and other overseas agencies.

Among the meetings and workshops attended during the period under review were:

1) Groundwater survey and sustainable utilization for ASEAN member States Geo-environment and sustainable development for great Mekong Sub-region, 10-27 July 2016 (Beijing, China)

2) Thermal Processes and Geophysics, 24-28 July 2016 (Bangkok, Thailand)

3) ASEAN WEB-BASED Mineral Resources Database (J16-04075), 24 July – 26 August 2016, Tsukuba, Japan and Myanmar

4) The 5th Training Course of China-ASEAN Mining Personnel Exchange & Training Center, 16 August – 13 September 2016 (Guangxi, China)

5) China-ASEAN Mining Cooperation Forum (CAMCF), 7-9 September 2016 Nanning, Guangxi, China

6) 52nd CCOP Annual Session & 67th CCOP SC Meeting, 30 October - 6 November 2016 (Bangkok, Thailand)

During the period under review, Malaysia organized the following meetings and workshops:

1) The 13th ASOMM (ASEAN Senior Officials Meeting on Minerals) Working Group Meeting at Aseania Resort & SPA, Langkawi, Kedah, Malaysia, from 2-4 August, 2016

2) The 16th ASOMM (ASEAN Senior Officials Meeting on Minerals) and the 9th ASOMM+3 Consultations at Seri Pacific Hotel, Kuala Lumpur, Malaysia, from 8-10 November, 2016

3) 2016 Training Course on Digital Geological Mapping for Malaysia, Alor Setar and Sintok, Kedah, Malaysia, from 12-22 November 2016
During the period under review, the Department of Mineral and Geoscience Malaysia hosted visits of representatives from the Department of Mineral Resources Thailand (27-31 July 2016), China Geological Survey (11 November 2016 and 15 November 2016), and British Geological Survey (18 November 2016).

2.2.2. National Cooperation

2.2.2.1. Cooperation with the Ministry of Natural Resources and Environment (NRE)

JMG continued to assist and cooperate with NRE on matters relating to the development of the minerals sector, especially the mineral potential development plan of the Economic Corridor of East Region (ECER). The ECER Development Council, at its meeting chaired by The Honorable Prime Minister on 9 April 2015, approved an allocation of RM15 million for the airborne geophysical survey of the ECER area. The survey was aimed at identifying potential metallic mineral deposits through the acquisition, processing, and interpretation of airborne geophysical radiometric and magnetic data. As of date, a total of 102 areas have been identified as being potential mineralized areas. The main focus of the project was to identify potential deposits in six mineral resources in the area which are important to the downstream industrial development of ECER, namely iron ore, limestone, silica sand, clay, feldspar, granite and other base metal.

The airborne geophysical survey flights were carried out between 27 August and 3 November 2016, traversing 62,937 km and covering a total area of 27,921 km². Maps under preparation from the data collected would provide information on % uranium (U), % thorium (Th), % potassium (K), ternary plots, regional magnetic plots, and structural geology and anomalies.

2.2.2.2. Collaborative with National University of Malaysia (UKM) on the Architecture and Modelling of Quarry System Based Integrated Data Object

The development of architecture and modelling for an environmental system of integrated data object is a solution aimed at expanding the management of the dynamic environmental data-sets to be more amenable to sharing. The research would be conducted in five phases covering: 1) conceptual design, 2) data object representation and formulation, 3) architecture and system design, 4) system development and implementation, and 5) system validation and confirmation. The main study seeks to establish how particulate environmental quarry components such as pollutants, vibrations and noise (PVN) and their relationships can be modelled into forms of digital objects (DO). The integrated objects are then incorporated into a primary repository system for easy manipulation of the DOs.

2.2.3. Partnership

During the period under review, several local and international oil companies visited PETRONAS data room to carry-out data reviews of Malaysian open exploration acreages which has led to 2 new exploration Production Sharing Contracts (PSCs) entered between PETRONAS and the contractors.
<table>
<thead>
<tr>
<th>Region</th>
<th>No. of PSC</th>
<th>Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peninsular Malaysia</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sarawak</td>
<td>2</td>
<td>SK410B and WL4-00</td>
</tr>
<tr>
<td>Sabah</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

2.3. Proposed Future Activities

Malaysia will continue to cooperate with other national and international bodies in various geoscience disciplines, particularly the two studies that have been embarked with CCOP (and PETRONAS), they are:

i. CO$_2$ storage and mapping
ii. Unconventional (shale hydrocarbon) studies

2.4. Assistance Required from CCOP in Support of Future Activities

Assistance from CCOP is required in:

i) Groundwater resource assessment and monitoring
ii) Technical assistance on project execution from CO$_2$ expert from Australia and KIGAM (Korea Institute of Geoscience and Mineral Resources)

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

Fundamental sequence stratigraphy and volumetric assessment and workshop.

2.6. Other Comments

Malaysia has benefited from fostering cooperation and strategic relationships in the field of mineral and geoscience with other national and international bodies.

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3. KNOWLEDGE ENHANCEMENT AND SHARING

3.1. Summary
The Department of Mineral and Geoscience Malaysia continued to provide consultative and advisory services to government agencies, the private sectors and individuals on aspects regarding land use planning reviews and geosciences information such as engineering geology. Hydrogeology advisory services included evaluating groundwater licence applications, providing reviews on groundwater as a natural mineral water resource, as well as assessing the potential of groundwater for agriculture, industrial and domestic usage. Engineering geology and land use advisory services provided by the Department included new township development planning, road alignment, and land use planning. In addition, the Department also assisted in investigations of geohazards such as landslides, sinkholes and debris/ mud flow occurrences in order to determine their possible causes and the contributing geological factors involved. With such information, the Department would be in a better position to propose mitigation and preventive measures to state governments and local authorities.

Currently, JMG is a member of more than 57 technical committees in the country, including the National Disaster Management Agency (NADMA), Special Committee for Dam Structure Safety Management, and One Stop Centre (OSC). JMG is also a permanent member of the State Water Consumption Committee, Natural Water Resource Packaging Approving Committee and Groundwater Resource Licensing Committee. The department is also involved at several state level committees related to geohazards, such as the State Planning Committee, State Disaster Management Committee, Environmentally Sensitive Area Committee, as well as the Highland and Foothill Development Committee.

During the year under review, geoscience information on a diverse range of geoscience activities including geological mapping, geological heritage, hydrogeology, engineering geology, environmental geology, marine geology, and geothermal resource assessment was collected by the Department in the course of providing geoscience services. In addition to this, the Department also continued to collect geoscience information through Slope Hazard and Risk Mapping, and also Active Fault and Earthquake Risk Area Mapping were also carried out.

3.2. Annual Review of Individual Technical Activities

3.2.1. Mineral Research and Development
During the review period, Mineral Research Centre (PPM), the research and development (R&D) arm of JMG, carried out research projects related to clay-based, silica-based, rock-based and advanced material technology, mineral processing, as well as mining and quarrying technology. Some of the research projects carried out were:

3.2.1.1. Production of anti-thermal shock porcelain body
Two anti-thermal shock hard porcelain bodies with high rupture strength (MOR) and low coefficient of thermal expansion (CTE) were produced using spodumene as the main flux and local raw ceramic materials such as ball clay from Kg. Coldstream, kaolin from Bidor, Perak and silica sand from Bintulu, Sarawak. One of the porcelain bodies won a gold medal at the iidex2016 competition.
3.2.1.2. Production of porous glass ceramics from the waste of soda-lime-silicate glass and fly ash

A study was undertaken to produce porous glass ceramic for the fabrication of heat insulation, sound insulation, and lightweight aggregate for water filters using a combination of soda-lime-silicate glass, fly ash and commercial silicon carbide (as a foaming agent) to form a porous structure. Porous glass ceramic produced by this method is low cost because it uses recycled materials as raw materials, and is carried out at a relatively low processing temperature (<1,000 °C). The results of this study showed that changes in the sintering temperature, soaking time, and heating rates had no impact on the nature of the crystalline phase formed including its intensity, but it affected bulk density, compressive strength, apparent porosity, and water absorption.

3.2.1.3. Preparation of nano-sized granite from quarry waste via the wet precipitation method

The study focused on the preparation of nano-sized granite from quarry waste to further improve the physical, mechanical and chemical properties of synthetic marble. Granite quarry waste from Keramat Pulai, Ipoh, was used as raw material to produce nano-sized granite by the wet precipitation method. The procedure involved reaction of the quarry waste with an alkaline solution of sodium hydroxide (NaOH) and potassium hydroxide (KOH). In this study, the effect of using ultrasonic equipment and reaction temperatures ranging from room temperature up to 100 °C was investigated. The results revealed that the use of NaOH at reaction temperatures between 80-100 °C accompanied by ultrasonic agitation produced a granite quarry waste preparation below 100 nm in size. This nano-sized granite will be used as a filler in the production of synthetic marble.

3.2.1.4. Development of Quarry Environmental Modelling Software (QEMs)

During the review period, the Mineral Research Centre conducted a study to develop a new software called Quarry Environmental Modelling Software (QEMs). This software is a new module that incorporates enhancements to the Quarry Particulate Index and Noise Software (QPIN) software developed the previous year.

This new software was designed by PPM to identify the cause of dust pollution and its control, and noise and blasting vibration in quarries. Copyright for the software was registered with the Intellectual Property Corporation of Malaysia (MyIPO) on 17 November 2016.

3.2.1.5. Phytoremediation study for the rehabilitation of ex-mining ponds

Phytoremediation refers to technologies that use living plants to clean up soil, air, and water contaminated with hazardous chemicals. Phytoremediation is a cost-effective plant-based approach of environmental de-toxification that takes advantage of the ability of plants to concentrate elements and compounds from the environment and to metabolize various hazardous compounds in their tissues. The method studied by PPM is a combination of a phytoremediation technique and the use of the "Floating Platform for Plantation (FPP)". Using this approach, plants grown on platforms floated in ex-mining ponds will
absorb heavy metals through their roots and accumulate in stems and leaves. A hardy species, vetiver grass, was used in this initial study. FPP was registered with the Intellectual Property Corporation of Malaysia (MyIpo) in the Industrial Design category on 15 July 2016.

3.2.1.6. Research activities for production and extraction of rare earth elements (REEs) from local sources

The objective of this project was to produce rare earth elements (REEs) from amang (a by-product of tin mining) using physical processing and chemical extraction. Samples from the amang plant in Perak were subjected to a physical separation process using a shaking table, magnetic separator, and a high voltage separator. Mineral products resulting from this process were monazite and xenotime which contained REEs. Based on a characterization analysis of the products, monazite content was increased from 9.17% to 62.96% while the xenotime content increased from 1.23% to 21.86%.

3.2.1.7. Production of synthetic marble using industrial quarry waste of limestone and granite

The aim of this study was to diversify and to increase the uses of industrial quarry waste by producing high quality synthetic marble that meets global product specifications. Limestone quarry waste and granite quarry waste from Keramat Pulai, Ipoh, Perak, were used as natural filler in the production of synthetic marble. The use of 60-70% limestone waste and 10% of granite quarry waste in the formulations increased the mechanical properties of the preparation that met the specifications of the commercial product. Synthetic marble produced has wide applications in solid surface products such as kitchen countertops, vanity sinks and bowls, bathtubs, shower walls, etc.

3.2.2. Slope Hazard and Risk Mapping Project

The Slope Hazard and Risk Mapping Project (PBRC) is among the initiatives under the National Slope Master Plan 2009-2023 Action Plan. The project aims to produce slope hazard and risk information in selected areas to be used by local authorities for better slope management. The information would also assist government agencies and local authorities in land-use planning for sustainable land management. Project implementation would involve participation in multidisciplinary fields including geology, engineering geology, Geographic Information System (GIS), geotechnical, LiDAR and surveying. During the period under review, slope hazard and risk mapping was carried out in Kota Kinabalu and Kundasang Sabah covering a total area of 225 km².

3.2.3. Active Fault and Earthquake Risk Area Mapping

Although Malaysia is located on the relatively stable Sundaland continental shelf, parts of the country are seismically active due to the movement of the Indian-Australian plate as it dips beneath the Sunda Plate at the junction better known as the Pacific Ring of Fire. At a meeting, held on 8 November 1993, with various agencies of the World Seismic Safety Initiative (WSSI), the Ministry of Science, Technology and Innovation (MOSTI) arrived at a consensus that seismic risks needed to be considered in planning national physical development. JMG has initiated a mapping project on the active faults in Sabah, Sarawak and a few states in Peninsular Malaysia to assess earthquake risks and their potential damaging effects.
The existence of active faults in several locations in the country shows a likelihood that Malaysia may encounter medium scale earthquakes in the future even though it is located outside the Pacific Ring of Fire. Studies conducted by Universiti Malaysia Sabah (UMS) reveal that Sabah faces a greater risk of earthquakes as compared to Sarawak and the Peninsula. Active fault zones in Sabah that are at greater risks earthquakes extend from Kundasang, Ranau, Pitas to Lahad Datu-Tawau-Kunak. During the period from 2009-2014, researchers at the Natural Disaster Research Unit of UMS encountered nine small tremors ranging from 2.6 to 4.7 on the Richter scale recorded in Ranau (see also Section 1.2.1). In Sarawak, the Malaysian Meteorological Department detected a number of tremors in the northern divisions of Bintulu, Batu Niah, Suai, Miri, Limbang and Lawas, all of which are along the major fault line. In the Peninsula, frequent earthquakes are experienced along the active fault zone from around Bukit Tinggi-Janda Baik to Kuala Lumpur.

During the review period, active fault and earthquake risk area mapping was carried out in six states covering an area of 11,468 km².

### 3.2.4. Hydrogeology

In order to strengthen the implementation of geoscience services that contribute to the well-being of mankind and conservation of the environment, exploration and development of groundwater resource was continued during the review period to provide clean water for the populace in areas of water constraint and to control peat fires which commonly occur during seasonal dry spells. Besides this, monitoring of groundwater was actively carried out in the country during the review period to determine groundwater level and quality to ensure that the water resources were free from pollution and that they were being sustainably utilised.

Hidrogeological activities were carried out by state offices to acquire data for the assessment of groundwater potential and to provide clean drinking water in water-constrained areas. At the same time, the department also encourages the use of groundwater as an alternative water source. A total of 112 exploration wells were drilled, 36 production wells and 10 monitoring well were successfully developed for water resources from 1 July 2016 to 30 June 2017.

The department also liaised with the Department of Environment to control peat fires which commonly occurs during the seasonal dry spells. Drilling and well development for fire-fighting in peat areas were carried out by JMG in Johor, Selangor / Wilayah Persekutuan, Kelantan, Terengganu, Pahang and Sarawak. JMG also assisted the Ministry of Health (KKM) in processing applications for the production of mineral water in the states. Construction of groundwater wells for peat fire fighting was successfully implemented in fire prone peat area in the states of Johor (1 location), Kelantan (2 locations), Pahang (1 location), Terengganu (2 locations) and Sarawak (2 locations).

Monitoring of groundwater was carried out throughout the year as part of the department’s effort to ensure that water resources were free from pollution and were sustainably utilised. Monitoring programmes included the measurement of groundwater levels, collection of samples for laboratory analyses and maintenance of Groundwater Filtration Systems (SPATR). Data from the monitoring works in 2016 on 563 wells indicated that there were no significant changes pertaining to the water level and water quality.
3.2.5 Energy Programme
During the period of 1 July 2016 to 30 June 2017, Malaysia’s average daily crude oil production was 558 kbd, condensate production was 106 kbd and gas production was 6,745 MMscfd.

<table>
<thead>
<tr>
<th>Period</th>
<th>Crude Oil (kbd)</th>
<th>Condensate (kbd)</th>
<th>Gas (MMscfd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 2016 – June 2017</td>
<td>558</td>
<td>106</td>
<td>6,745</td>
</tr>
</tbody>
</table>

During the period under review, a total of 2,635 line-km of new 2D seismic and 12,682 km$^2$ of new 3D seismic were acquired, and seven exploration wells were drilled resulting in 5 oil and gas minor discoveries (non-commercial).

<table>
<thead>
<tr>
<th>Item</th>
<th>Peninsular</th>
<th>Sabah</th>
<th>Sarawak</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2D Seismic (line km)</td>
<td>-</td>
<td>2,635</td>
<td>-</td>
<td>2,635</td>
</tr>
<tr>
<td>3D Seismic (km$^2$)</td>
<td>654</td>
<td>12,028</td>
<td>-</td>
<td>12,682</td>
</tr>
</tbody>
</table>

The first phase for shale gas unconventional project (UCM) will deliver the preliminary resource estimation for shale basin in Malaysia prior the Steering Committee meeting planned in October 2017. Altogether there were eight UCM sessions conducted up till July 2017. UCM 8 key objectives was to apply the CCOP Guideline Methodology for shale oil and shale gas resources of the participating countries. Both EIA and BGS method were tested and its uncertainties were discussed during this workshop.

As for Malaysia, Sarawak Basin was selected as the area of interest for the study. Shale samples were submitted for analysis to KIGAM during this period. All required report and basin summary was also completed. The deliverables will be accessible via QGIS software and report completion estimated by October 2017.

3.3. Proposed Future Activities
Malaysia will continue to carry out research projects related to clay-based, silica-based, rock-based and advanced material technologies in line with the government’s aspiration to encourage and diversify the use of local mineral resources to contribute towards development of the country’s industrial sector. In addition, the study on CO$_2$ storage and unconventional energy resources studies between PETRONAS and CCOP will also continue.

3.4. Assistance Required from CCOP in Support of Future Activities
Assistance from CCOP is required in:

(i) Expertise in R&D with specific reference to industrial minerals.
(ii) Expertise in peat study particularly in overcoming the engineering problems associated with the development on peat land.
(iii) Expertise in groundwater resource assessment and monitoring.
(iv) Technical assistance from Australia and KIGAM (Korea) on CO$_2$ storage and mapping.
3.5. Assistance Offered to CCOP/Other Member Countries in Support of Future Activities

3.5.1 Geochemical Laboratories

Information on the chemical composition and physical properties of rock materials and minerals is often of fundamental importance to many branches of geoscience. Such information is especially relevant to search and recovery methods for ore and mineral deposits, and also to environmental pollution studies. These activities assist the development of mineral and mineral-based industries, metal recycling activities, and groundwater exploration and management in the country.

The Department commits to provide a comprehensive range of accredited geochemical analyses and physical tests on rock materials and minerals to internal and external customers of the Department throughout Malaysia. With accurate testing of the chemical composition and physical properties of rock materials and minerals being a vital service that the Department provides, all the four Geochemical Laboratories of the Department have been accredited to the MS ISO/IEC 17025:2005 standard.

During the period under review, all four Geochemical Laboratories in Ipoh, Kuantan, Kuching and Kota Kinabalu successfully implemented and retained their MS ISO/IEC 17025:2005 accreditation certificates until 2017/2018 after assessment audits were conducted by the Department of Standards, Malaysia in the respective laboratories. Coal Quality Laboratory JMG Sarawak has an additional scope of testing (Moisture, Ash, and Volatile Matter) using Thermogravimetry Analyzer (TGA). As part of the mandatory requirements for compliance with the MS ISO/IEC 17025:2005 management standard and as a continuous effort to further improve the quality of testing services provided to the Department’s clients, the geochemical laboratories in Ipoh, Kuching, and Kota Kinabalu successfully conducted several Proficiency Testing / Interlaboratory Cross-check programmes. The Department’s laboratories have demonstrated good performance and consistency in all the Proficiency Testing / Interlaboratory Cross-check Programmes.

<table>
<thead>
<tr>
<th>Laboratory</th>
<th>MS ISO/IEC 17025:2005 Accreditation Certification</th>
<th>Scope of accreditation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Certificate No.</td>
<td>Valid until</td>
</tr>
<tr>
<td>Kuching</td>
<td>SAMM 173</td>
<td>12 August 2017</td>
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<tr>
<td>Kota Kinabalu</td>
<td>SAMM 263</td>
<td>07 January 2018</td>
</tr>
<tr>
<td>Kuantan</td>
<td>SAMM 508</td>
<td>04 April 2017</td>
</tr>
</tbody>
</table>

Jumlah / Total: 62 tests

Nota:- SAMM :- Malaysian Laboratory Accreditation Scheme
3.5.1.1. Coal Laboratory Development and Coal Quality Testing

The Coal Laboratory of the Department of Mineral and Geoscience Malaysia has acquired more than 20 years of experience and technical expertise in coal testing and is well-recognised as a competent testing laboratory in the country for coal quality evaluation. The laboratory currently has in its equipment inventory, a comprehensive range of modern instrumentation to perform ultimate and proximate analysis as well as technological tests for coal samples. The laboratory adopts internationally recognised ASTM (American Society of Testing and Materials) Standard Methods for the testing of coal and the entire scope of 17 coal quality tests conducted by the coal laboratory is currently MS ISO/IEC 17025:2005 accredited.

Malaysia through the auspices of the Department of Mineral and Geoscience Malaysia is in a favourable position to offer technical assistance (advice and training) to fellow CCOP member countries intending to set up a laboratory for coal testing, as well as the implementation/conduct of coal quality testing activities in the laboratory.

3.5.1.2. Assay of gold by fire-assay and cupellation

The laboratory in Ipoh operates a gold testing facility to assay gold purity (fineness of gold) in gold bullion samples by cupellation, while the laboratories in Kuantan and Sarawak are fully equipped to conduct analysis of trace gold in geochemical exploration samples by fire-assay pre-concentration, cupellation and flame atomic absorption analysis. All the three laboratories are technically competent to perform gold analysis by the fire assay/cupellation technique and the government of Malaysia through the auspices of the Department of Mineral and Geoscience Malaysia can also offer technical expertise to fellow CCOP member countries seeking assistance to set up a fire-assay laboratory for gold testing.

3.5.1.3. Instrumental Techniques of Water Analysis

All three laboratories in Ipoh, Kuching and Kota Kinabalu are well-equipped, have vast experience and are technically competent to perform trace elemental (inorganic) analysis for groundwater, surface water and mine effluent samples by various instrumental techniques in support of the department’s groundwater exploration and development programmes, as well as environmental monitoring and conservation. Instrumental techniques used by the laboratories include: -

(i) Flame Atomic Absorption Spectrometry (FAAS)
(ii) Hydride Generation-Atomic Absorption Spectrometry (HGAAS)
(iii) Mercury Cold Vapour-Atomic Absorption Spectrometry (HG/CVAAS)
(iv) Mercury-Gold Amalgamation
(v) Inductively-coupled Plasma Optical Emission Spectrometry (ICP-OES)
(vi) UV-Visible Spectrophotometry
(vii) Ion Selective Electrode (ISE) technique
The government of Malaysia through the auspices of the Department of Mineral and Geoscience Malaysia can offer technical expertise to fellow CCOP member countries seeking assistance to set up a water laboratory and conduct inorganic water testing.

3.5.2. Geological Terrain Mapping

Malaysia has acquired expertise on geological terrain mapping and is in a position to advise or transfer the knowledge to whichever neighbouring countries interested in developing the mapping technique.

3.6. Other Comments

The research findings of Mineral Research Center had won several international and local awards during the period under review. At the 27th International Invention and Innovation Exhibition (ITEX'16) the invention entitled Eco Green Paper: Carbide Lime Filler Paper Waste as Paper Filler won the gold medal, while the invention entitled Quarry Particulate Pollution Index Volume and Noise Software 1.0.0 (V1.0.0 QPINs) was awarded a silver medal. At the Invention, Innovation & Design Exposition 2016 (iidex2016) held on 20 – 23 September 2016 in Shah Alam, Selangor, the invention entitled Malaysian Low Cost Ingots Leucite for Restorative Dental Applications and the invention entitled Anti Thermal Shock Porcelain Tableware won gold medals.

During the period of 1 July 2016 to 30 June 2017, a patent was filed for one research finding, namely Floating Platform for Plantation, an industrial design was registered namely a Method of Producing Precipitated Calcium Carbonate, while two software were filed for copyright, namely Quarry Dust Deposition Rate Modelling Software (QDDRMs V3.1) and Quarry Environmental Modelling Software (QEMs V1.0).

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4. DATA AND INFORMATION

4.1. Summary

Along with the advancement of the geospatial information and datasets, GIS is used to integrate previous geological and recent topographical datasets in the re-production of higher quality geological maps. GIS provides a better data capturing, storing, visualisation, archiving, updating, analysis, sharing and re-production from the manipulation of the geodatabase system. During the period under review, quite a substantial progress has been achieved in the geo-information sector. The geospatial technology has been broadly used in both routines and long-term initiatives such as geological maps reconciliation, geospatial data sharing and also data entry and updating in our integrated database applications.

One of the important functions of the Department of Mineral and Geoscience Malaysia is to collect, analyse and disseminate data and information pertaining to minerals and geoscience. In fulfilling this important role, the Department of Mineral and Geoscience Malaysia publishes its findings and research results in various technical reports and maps, and also disseminates these publications through its libraries in various states in the country.

4.2. Annual Review of Individual Technical Activities

4.2.1. Dissemination of Geospatial Data

In cooperation with other governmental organizations, the Department of Mineral and Geoscience Malaysia plays its role as the Custodian for mineral and geoscience geospatial datasets (including the metadata) for the National Spatial Data Infrastructure (NSDI) hosted by Malaysian Centre for Geospatial Data Infrastructure (MaCGDI). The Department of Mineral and Geoscience Malaysia is constantly maintaining and sharing the geospatial data in the Malaysia Geospatial Data Infrastructure (MyGDI) through the application of web services and the application of MyGDI Explorer.

To date, geospatial data including geology, mineral resources (industrial minerals, metallic minerals) and geotechnical (hydrogeology, mine and quarry) data are available in MyGDI. During the period under review, a number of maps, data sets, metadata and services were prepared through the website for the use of interested users.

4.2.2. Development of Database and Data Centre

During the period under review, a new application known as “National Geospatial Terrain and Slope Information System (NaTSIS)” involving 15 modules was developed and assigned to the Technical Services Division of the Department of Mineral and Geoscience Malaysia. NaTSIS is a component in the Slope Hazard and Risk Mapping Project, the initiatives under the National Slope Master Plan 2009-2023 Action Plan. The objective of this system, which required the procurement of both hardware and software, was to develop the database infrastructure for national geospatial terrain and slopes.

4.2.3. Publications

4.2.3.1 Mineral Information

The Department of Mineral and Geoscience Malaysia is tasked with dissemination of mineral information in the country. As in previous years, during the period under review the Department of Mineral and Geoscience
Malaysia continued to publish the Malaysian Minerals Yearbook, Industrial Mineral Production Statistics and Directory of Producers in Malaysia, Malaysian Mining Industry, Malaysian Mineral Trade Statistics and Review of Mineral-Based Industries in Malaysia. The Department of Mineral and Geoscience Malaysia distributed these reports to stakeholders, industry players and other related agencies.

Besides the publication of the five main reports, JMG continued to provide periodical inputs on the status of the minerals sector to the Ministry of Natural Resources and Environment (NRE), as well as to other related government agencies. Among the data supplied were:

1. Mining industry reports to Central Bank and Statistics Department,
2. Tin ore production reports to the Tin Board,
3. Private investment reports to MIDA, and
4. Coal, limestone and lime production reports to the Malaysian Green Technology Corporation (formerly known as Pusat Tenaga Malaysia).

These inputs were necessary for the calculation of the contribution of the mineral sector to the country’s economy by the Central Bank. The information was also needed in the formulation of the national energy balance and in the updating of greenhouse gas (GHG) inventory data by Malaysian Green Technology Corporation.

JMG’s input on minerals was also necessary in the formulation of bilateral trade agreements and in international cooperation. In this context, a total of five country briefs namely on Jordan, China, Japan, South Korea and South Africa were prepared in the year.

4.2.3.2 Geological Report

During the period under review, a geological report titled *Geology of the Langkawi-Tarutao Transect area along the Malaysia-Thailand Border* and Technical Papers Vol. 9 were also published.

4.3. Proposed Future Activities

Malaysia would continue to apply GIS technology in the geo-database system for geological mapping purposes. Malaysia would also continue to develop other databases for the MINGEOSIS system as well as other GIS web-based applications.

4.4. Assistance Required from CCOP in Support of Future Activities

Malaysia welcomes technical assistance in the following areas:

(i) Hands-on training using information and data archived in the Department of Mineral and Geoscience Malaysia Data Centre

(ii) On-the-job-training on various aspects of database development and management

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