

**JABATAN MINERAL DAN GEOSAINS MALAYSIA**  
**MINERALS AND GEOSCIENCE DEPARTMENT MALAYSIA**



**2014**

**LAPORAN TAHUNAN**  
**ANNUAL REPORT**



**KEMENTERIAN SUMBER ASLI DAN ALAM SEKITAR MALAYSIA**  
**MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT MALAYSIA**

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# PERUTUSAN KETUA PENGARAH

## MESSAGE FROM THE DIRECTOR GENERAL

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**T**ahun 2014 menyaksikan JMG sekali lagi melaksanakan kesemua tanggungjawab yang diberikan dengan cemerlang. Kejayaan jabatan jelas seperti yang dicerminkan oleh pencapaian Petunjuk Prestasi Utama (KPI), terutamanya bagi sektor mineral dan geosains yang diterajui oleh jabatan. Saya ingin mengambil peluang ini untuk merakamkan terima kasih kepada Kementerian Sumber Asli dan Alam Sekitar (NRE) atas sokongan dan kepercayaan yang diberikan kepada JMG. Saya juga ingin menyampaikan setinggi-tinggi penghargaan kepada semua staf JMG di atas komitmen dan sumbangan mereka, serta agensi kerajaan yang lain, institusi pengajian tinggi awam, dan sektor swasta di atas kerjasama rapat dan sokongan yang telah diberikan.

**T**he year 2014 saw JMG once again discharging all its responsibilities commendably. The Department's successes are clearly reflected in the key performance indicators (KPIs) achieved, especially in the mineral and geoscience sectors that it spearheads. I would like to take this opportunity to express my gratitude to the Ministry of Natural Resources and Environment (NRE) for the support and trust accorded to JMG. I would also like to express my deep appreciation to the staff of JMG for their commitment and contributions, as well as to other government agencies, public higher educational institutions, and the private sector for their close co-operation and support.

Permintaan negara terhadap mineral mentah dan bahan binaan dijangka semakin meningkat dan berterusan pada tahun-tahun yang akan datang. Sebagai jabatan yang bertanggungjawab ke atas pengurusan sumber mineral negara, JMG memainkan peranan yang penting untuk terus mengenal pasti sumber mineral tempatan bagi membolehkan pembangunan negara yang sistematik. Kerja eksplorasi sumber mineral yang dijalankan oleh jabatan pada tahun 2014 telah membawa kepada penemuan sumber bijih besi, ilmenit, andalusit, agregat batuan, batu kapur, batuan silika, lempung marin, pasir binaan dan juga arang batu serta anomali geokimia emas dan timah.

Dalam usaha memantapkan pelaksanaan perkhidmatan geosains yang menyumbang kepada kesejahteraan hidup dan pemeliharaan alam sekitar, eksplorasi dan pembangunan sumber air tanah diteruskan pada tahun ini untuk membekalkan air bersih kepada penduduk di kawasan yang menghadapi masalah air dan juga bagi mengawal kebakaran kawasan tanah gambut yang sering berlaku pada musim kering. Projek ini sama ada diusahakan sendiri oleh JMG atau melalui kerjasama dengan pelbagai agensi kerajaan, seperti Kementerian Tenaga, Teknologi Hijau dan Air Malaysia (KeTTHA), Kementerian Kemajuan Luar Bandar dan Wilayah (KKLW) dan Jabatan Alam Sekitar (JAS). Di samping itu, kerja-kerja pemantauan telah dijalankan ke atas 585 buah telaga dari segi paras dan kualiti air tanah untuk memastikan sumber air bebas dari pencemaran dan digunakan secara mampan.

Pembangunan yang tidak terancang dan tidak terkawal akan meningkatkan pendedahan kepada risiko bencana geologi dan kemerosotan kualiti alam sekitar. Sehubungan itu, jabatan telah menjalankan pemetaan geologi terain dan pemetaan geologi kejuruteraan untuk menyediakan maklumat yang boleh digunapakai oleh perancang dan pihak berkuasa tempatan dalam melaksanakan pemantauan dan penilaian projek-projek pembangunan. Pada tahun 2014, pemetaan geologi terain telah dilaksanakan di 10 negeri meliputi kawasan seluas 669 kilometer persegi. Pemetaan geologi kejuruteraan telah dilaksanakan di cerun yang berisiko tinggi dan kawasan batuan kurang stabil di enam negeri, sementara pemetaan geologi kejuruteraan di kawasan gambut dan tanah lembut telah dilaksanakan di tiga negeri meliputi kawasan seluas 131 kilometer persegi. Di samping itu, jabatan juga telah membantu dalam siasatan geobencana seperti tanah runtuh, lubang benam serta aliran lumpur dan puing yang berlaku untuk mencari punca

The demand for raw minerals and construction materials is expected to increase in the coming years. As the department responsible for the management of mineral resources of the country, JMG plays an important role in identifying local mineral resources to facilitate systematic national development. Mineral resource explorations conducted by the Department in 2014 led to the discovery of iron ore, ilmenite, andalusite, rock aggregate, limestone, silica rock, marine clay, construction sand and coal, as well as anomalous concentrations of gold and tin.

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 is continued this year to provide clean water for the populace in areas of water constraint and to control peat fires which commonly occur during seasonal dry spells. These projects are undertaken either by JMG or through its collaboration with various government agencies, such as the Ministry of Energy, Green Technology and Water (KeTTHa), the Ministry of Rural Development (KKLW), and the Department of Environment (JAS). Besides this, monitoring of groundwater was carried out at 585 wells to determine groundwater level and quality to ascertain that the water resources were unpolluted and were being sustainably utilised.

Unplanned and uncontrolled development increases exposure to the risks of geological disasters and the deterioration of environmental quality. Accordingly, the department conducts geological terrain mapping and engineering geological mapping to provide information that can be used by planners and local authorities to monitor and evaluate development projects. In 2014, geological terrain mapping was carried out in 10 states in Malaysia with an overall coverage of 669 square kilometres. Engineering geological mapping was carried out on high-risk slopes and unstable rock areas in six states, while engineering geological mapping in peat and soft soil areas was conducted in three states, covering an area of 131 square kilometres. 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.



*Kerja eksplorasi sumber mineral yang dijalankan oleh Jabatan pada tahun 2014 telah membawa kepada penemuan sumber bijih besi, ilmenit, andalusit, agregat batuan, batu kapur, batuan silika, lempung marin, pasir binaan dan juga arang batu, serta anomali geokimia emas dan timah.*

*Mineral resource explorations conducted by the Department in 2014 led to the discovery of iron ore, ilmenite, andalusite, rock aggregate, limestone, silica rock, marine clay, construction sand and coal, as well as anomalous concentrations of gold and tin.*

dan faktor geologi pencetus kejadian. Dengan maklumat ini, jabatan akan berada dalam posisi untuk mencadangkan langkah-langkah mitigasi dan pencegahan kepada kerajaan negeri dan pihak berkuasa tempatan.

Malaysia komited menangani perubahan iklim dan pemanasan global akibat pengeluaran gas karbon dioksida dari penjanaan elektrik dengan menggunakan bahan api fosil. Pada tahun 2014, JMG telah menjalankan kajian ke atas potensi sumber geoterma di Ulu Slim, Perak dan di Kunak, Sabah selaras dengan polisi kerajaan untuk mempelbagaikan sumber penjanaan tenaga dan mengalakkan penggunaan tenaga yang boleh diperbaharui (renewable energy). Loji janakuasa geoterma pertama Malaysia, yang dibangunkan dengan input kajian daripada JMG terletak di Apas Kiri Tawau, Sabah, dijangka akan beroperasi pada tahun 2016.

'Ekspedisi Jura-Kapur 2014: Menjejak Dinosaur', yang telah dijalankan oleh jabatan bersama Kumpulan Warisan Geologi Malaysia (KWGM) di kawasan Gunung Gagau, Terengganu telah berjaya menemui fosil gigi dinosaur iguanodon dan kesan tapak kaki dinosaur theropod, iguanodon dan sauropod. Penemuan fosil dinosaur di Hulu Terengganu bukan saja membuka dimensi baru ilmu geologi di Malaysia, malah ia juga memberi nilai tambah kepada usaha menjadikan Wilayah Tasik Kenyir sebagai Geopark Kebangsaan dan seterusnya Geopark Global UNESCO.

Malaysia is committed to fighting climate change and global warming caused by carbon dioxide emissions from electricity generation using fossil fuels. In 2014, JMG carried out research on the potential of geothermal resources in Ulu Slim, Perak and in Kunak, Sabah in line with the government's policy to diversify energy generation and to encourage the use of renewable energy. The first geothermal power plant in Malaysia, established with research input from JMG, in Apas Kiri, Tawau, Sabah, would be operational in 2016.

'Jurassic-Cretaceous Expedition 2014: Tracking the Dinosaur', carried out by the Department together with the Malaysian Geological Heritage Group (KWGM) in Gunung Gagau area, Terengganu, led to the discovery of dinosaur's teeth, that of an iguanodon and footprints belonging to theropod, iguanodon and sauropod dinosaurs. The discovery of dinosaur fossils in Hulu Terengganu not only opens up a new dimension of geological sciences in Malaysia, but it also adds value to efforts to make Kenyir Lake Region a National Geopark / UNESCO Global Geopark.

JMG terus menjalankan projek-projek R&D berkaitan teknologi berasaskan lempung, silika, batuan dan bahan termaju selaras dengan kehendak kerajaan dalam menggalak dan mempelbagaikan penggunaan sumber mineral tempatan bagi menyumbang kepada pembangunan sektor perindustrian Negara. Di samping itu, jabatan juga telah menjalankan penyelidikan dan pembangunan teknik rawatan acid mine drainage (AMD) dan pemulihan tanah bekas lombong dan kuari. Jabatan juga telah memfailkan satu paten di bawah tajuk “A Method of Loading Filler in Pulp Fibre” yang merupakan hasil penyelidikan berkaitan teknik pemendakan *in situ* precipitated calcium carbonate (PCC) ke dalam lumen pulpa untuk pembuatan kertas dengan bantuan poliakrilamida (PAM). Setakat ini, hasil penyelidikan JMG telah berjaya memperolehi hak harta intelek untuk satu paten, satu utiliti inovasi dan satu hakcipta.

Dalam usaha untuk menjadikan Makmal JMG sebagai Pusat Kecemerlangan, kesemua empat Makmal Geokimia JMG telah berjaya mengekalkan sijil akreditasi MS ISO/IEC 17025:2005 sehingga ke tahun 2017/2018 oleh Jabatan Standard Malaysia. Pada masa yang sama, Pusat Penyelidikan Mineral (PPM) juga telah menambah skop pensijilan MS ISO 9001:2008 bagi perkhidmatan ujian pemrosesan bijih timah pada 12 Disember 2014. Di samping itu, Pusat Data JMG telah berjaya mengekalkan persijilan MS ISO/IEC 27001:2007 Information Security Management System (ISMS) dari SIRIM bagi tahun 2014 dengan mematuhi kesemua keperluan yang telah ditetapkan.

Dalam usaha untuk meningkatkan perhubungan dan kerjasama antarabangsa, JMG telah mengambil bahagian yang aktif dalam mesyuarat dan persidangan antarabangsa termasuk ASEAN Ministerial Meeting on Minerals (AMMin), ASEAN Senior Officials Meeting on Minerals (ASOMM), Asia-Pacific Economic Cooperation (APEC) Mining Task Force (MTC) dan Coordinating Committee for Geoscience Programme in East and South East Asia (CCOP). Di samping itu, JMG terus mengekalkan kerjasama teknikal dua hala antarabangsa, seperti Penyiasatan Geologi Bersama Sempadan Malaysia-Thailand (MT-JGS), Kerjasama Teknikal Malaysia-Indonesia (MALINDO), serta kerjasama Malaysia-Korea berkenaan Penyelidikan Geosains dan Sumber Mineral dengan Institut of Geoscience and Mineral Resources Republic of Korea (KIGAM) dan Kajian Perawatan Masalah Acid Mine Drainage (AMD) dengan pihak Mine Reclamation

JMG continues 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 Department also conducted research and developmental techniques for acid mine drainage (AMD) treatment and rehabilitation of former mines and quarries land. The Department also filed a patent under the title “A Method of Loading Filler in Pulp Fibre” that arose from the research on the deposition technique of precipitated calcium carbonate (PCC) into the lumen of pulp for paper making with the help of polyacrylamide (PAM). So far, intellectual property rights based on JMG research have been secured for a patent, a utility innovation, and a copyright.

In an effort to designate JMG Laboratory as a Centre of Excellence, all four JMG Geochemical Laboratories have successfully retained their MS ISO/IEC 17025 accreditation certifications by the Department of Standards, Malaysia until 2017/2018. At the same time, the Mineral Research Centre (PPM) also added a new scope for certification MS ISO 9001:2008 in testing services for the processing of tin ores on 12th December 2014. In addition, the JMG Data Centre successfully retained the ISO/IEC 27001:2007 Information Security Management System (ISMS) certification from SIRIM in 2014 after fulfilling all the set requirements.

To strengthen international relations and cooperation, JMG 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), and the Coordinating Committee for Geoscience Programmes in East and South East Asia (CCOP). In addition, JMG continued to maintain international bilateral technical cooperation in the Malaysia-Thailand Border Joint Geological Survey (MT-JGS), the Malaysia-Indonesia Technical Cooperation (MALINDO), as well as the Malaysia-Korea Geoscience and Mineral Resources Cooperation (KIGAM) and Mine Reclamation Corporation (MIRECO). The Department also participated in the 2014 China-ASEAN Mining Cooperation Forum and Promotion Exhibition organised by China-ASEAN Business and Investment Summit (CABIS) in Nanning, Guangxi, China.



Corporation (MIRECO) Republic of Korea. Jabatan juga telah menyertai 2014 China-ASEAN Mining Cooperation Forum and Promotion Exhibition anjuran China-ASEAN Business and Investment Summit (CABIS) di Nanning, Guangxi, China.

JMG telah mendapat manfaat melalui kerjasama dan hubungan strategik dalam bidang mineral dan geosains dengan pelbagai agensi dalam negara seperti Agensi Remote Sensing Negara (MACRES), Universiti Kebangsaan Malaysia (UKM), Universiti Malaysia Sabah (UMS), Universiti Malaysia Terengganu (UMT), Agensi Nuklear Malaysia (Nuclear Malaysia), Lembaga Pembangunan Tenaga Lestari (SEDA) Malaysia, Tenaga Nasional Berhad (TNB), Universiti Sains Malaysia (USM), Institut Kuari Malaysia (IQM), Menteri Besar Incorporated Perak (MB Inc.) dan Rahman Hydraulic Tin Sdn. Bhd.

Pada tahun 2014, Jabatan telah menerima kunjungan Delegasi yang diketuai oleh Mr. Wang Shouxiang, Timbalan Menteri di Ministry of Land and Resources China. JMG juga menjadi tuan rumah kepada lawatan oleh wakil-wakil dari Guangxi Bureau of Geology & Mineral Prospecting & Exploitation (the People's Republic of China) dan delegasi dari Ministry of Petroleum & Mineral Resources, the Federal Republic of Somalia.

JMG akan terus komited untuk melaksanakan tanggungjawab yang telah diamanahkan serta memberi perkhidmatan terbaik kepada rakyat Malaysia demi untuk kesejahteraan dan pembangunan negara disamping memastikan sumber asli dan alam sekitar diuruskan secara lestari dan mampan.



**DATO' YUNUS ABD RAZAK**

Ketua Pengarah / **Director General**  
Jabatan Mineral dan Geosains Malaysia

JMG has benefited from fostering cooperation and strategic relationships in the field of mineral and geoscience with various agencies in the country such as the National Remote Sensing Agency (MACRES), Universiti Kebangsaan Malaysia (UKM), Universiti Malaysia Sabah (UMS), Universiti Malaysia Terengganu (UMT), the Malaysian Nuclear Agency (Nuclear Malaysia), Sustainable Energy Development Authority (SEDA), Tenaga Nasional Berhad (TNB), Universiti Sains Malaysia (USM), Institute of Quarrying Malaysia (IQM), Menteri Besar Incorporated Perak (MB Inc.) and Rahman Hydraulic Tin Sdn Bhd.

In 2014, the Department received a delegation led by His Excellency Wang Shouxiang, Vice-Minister of the Ministry of Land and Resources of the People's Republic of China. JMG also hosted visits by representatives of the Guangxi Bureau of Geology & Mineral Prospecting & Exploitation (the People's Republic of China) and a delegation from the Ministry of Petroleum & Mineral Resources, the Federal Republic of Somalia.

JMG is committed to carry out the responsibilities entrusted and provide the best service to the people of Malaysia in order to achieve national development and prosperity while ensuring sustainable management of the country's natural resources and the environment.









# PROFIL KORPORAT CORPORATE PROFILE

Fotomikrograf suberinit di arang batu Balingian dari Sarawak (cahaya ultraungu pantulan di bawah rendaman minyak). Suberinit berasal dari dinding sel lapisan suberin yang telah mengalami proses korkifikasi yang menunjukkan kehadiran tumbuh-tumbuhan hutan di paya pembentuk gambut Lembangan Arang Batu Balingian.

Photomicrograph of suberinite in the Balingian coal of Sarawak (reflected ultraviolet light under oil immersion). Suberinite derives from suberin layers of corkified cell walls indicating the presence of forested plants in the peat-forming mires of Balingian Coalfield.

Photo: Sia Say Gee

# PROFIL KORPORAT

## Visi

Peneraju pembangunan mineral dan geosains menjelang 2020

## Misi

Menyumbang kepada peningkatan daya saing ekonomi negara dan kualiti hidup melalui penggunaan maklumat, perkhidmatan berkepakaran tinggi serta penyelidikan berkaitan mineral dan geosains yang efektif

## Objektif Strategik

1. Memperkasa pengurusan modal insan dan kapasiti organisasi ke arah meningkatkan kecekapan penyampaian perkhidmatan
2. Memperkukuh keupayaan aktiviti mineral dalam eksplorasi, pembangunan dan promosi untuk memacu ekonomi negara
3. Memantap pelaksanaan perkhidmatan geosains berkepakaran tinggi ke arah pembangunan mampan yang menyumbang kepada kesejahteraan hidup dan pemeliharaan alam sekitar
4. Memperkukuh penyelidikan dan pembangunan (R&D) mineral untuk memajukan industri mineral negara

## Objektif

- Menyediakan maklumat komoditi mineral bagi meningkatkan pertumbuhan industri berasaskan mineral
- Menggalakkan penggunaan optimum maklumat dan perkhidmatan geosains bagi pembangunan negara yang mampan

# CORPORATE PROFILE

## Vision

Leader in mineral and geoscience development by 2020

## Mission

To contribute towards enhancement of the nation's economic competitiveness and quality of life through effective usage of mineral and geoscience information, specialised expert services and related research

## Strategic Objectives

1. To strengthen the management of human capital and organisational capacity towards improving the efficiency of service delivery
2. To intensify the capability of mineral exploration, development and promotion activities to spearhead the national economy
3. To strengthen the implementation of specialised geoscience services towards sustainable development that contributes to the well-being of mankind and conservation of environment
4. To intensify research and development (R&D) on minerals for increased growth and advancement in the nation's mineral industry

## Objectives

- To provide mineral commodity information to enhance the growth of mineral-based industries
- To encourage the optimal use of geoscience information and services for the sustainable development of the country

- Memastikan perusahaan sumber mineral berkembang secara teratur, selamat, cekap dan mesra alam serta mendatangkan pulangan yang maksimum kepada negara
- Menggalak dan mempelbagai penggunaan sumber mineral tempatan bagi menyumbang kepada pembangunan sektor perindustrian negara melalui aktiviti-aktiviti penyelidikan dan pembangunan (R&D)
- Menyediakan perkhidmatan kepakaran dalam bidang mineral, geosains dan perlombongan di peringkat nasional dan antarabangsa bagi menggalakkan pelaburan dalam sektor mineral dan perancangan pembangunan negara

## Fungsi

- Mengendali eksplorasi mineral secara sistematik
- Mengendali penyiasatan pelbagai bidang geosains seperti pemetaan geologi, sumber air tanah, geologi kejuruteraan, bencana geologi, geologi alam sekitar, geologi marin, geofizik, dan bidang-bidang geosains lain secara sistematik
- Menyedia perkhidmatan analisis geokimia dan ujian fizikal bahan batuan dan mineral
- Bertindak sebagai bank data nasional bagi semua maklumat berkaitan dengan geosains dan sumber mineral negara
- Mengumpul, menganalisis dan menyebarkan data dan maklumat berkaitan eksplorasi mineral, perlombongan dan aktiviti yang berkaitan
- Menyedia perkhidmatan nasihat teknikal dan kepakaran dalam bidang mineral, geosains, perlombongan dan pengkuarian
- Membantu dan bekerjasama dengan pihak swasta dan industri dalam usaha pembangunan sektor mineral
- Menentukan supaya aktiviti perlombongan mineral serta aktiviti lain yang berkaitan dengannya dijalankan dengan cara yang selamat, cekap dan sistematik
- Melaksana dasar dan arahan Kerajaan berhubung dengan industri mineral dan geosains, disamping mentadbir dan menguatkuasakan undang-undang yang berkaitan
- Menjalankan penyelidikan dan pembangunan (R&D), pemindahan teknologi, pembangunan sumber mineral serta mempromosi hasil penyelidikan supaya digunakan oleh pihak industri

- To ensure that mineral resources are exploited in a systematic, safe, efficient and environmentally friendly manner as well as to secure their maximum returns to the country
- To encourage and diversify the use of local mineral resources so as to contribute towards the development of the country's industrialisation through research and development (R&D) activities
- To provide expert services in the fields of mineral, geoscience and mining at national and international levels so as to promote investments in the mineral sector and for national development planning

## Functions

- To undertake systematic mineral exploration
- To undertake systematic investigations in various geoscience disciplines such as geological mapping, groundwater resources, engineering geology, geological hazards, environmental geology, marine geology, geophysics, and others
- To provide geochemical analyses and physical tests on rock materials and minerals
- To act as the national depository for all information related to geoscience and mineral resources of the country
- To collect, analyse and disseminate data and information pertaining to mineral exploration, mining and related activities
- To provide technical advisory and expertise services in the fields of mineral, geoscience, mining and quarrying
- To assist and co-operate with the private sector and industry to develop further the mineral sector
- To ensure that mining of minerals and related activities are carried out safely, efficiently and systematically
- To implement government policies and directives with regards to the mineral industry and geoscience, besides administration and enforcement of regulations
- To carry out research and development (R&D), technology transfer, mineral resources development and promotion of research products so that they are acceptable to the industry

## Piagam Pelanggan

### Maklumat Mineral dan Geosains

- Membekalkan laporan geologi (termasuk peta), mineral dan bidang-bidang geosains lain yang telah diterbitkan dan sedia ada, dalam masa 1 hari selepas permohonan diterima
- Membekalkan laporan dan peta geologi, mineral dan bidang-bidang geosains lain yang belum diterbitkan dan sedia ada, dalam masa 1 minggu selepas permohonan diterima
- Membekalkan maklumat berdigit sedia ada dalam masa 3 hari selepas permohonan diterima

### Perkhidmatan Kepakaran

- Menyediakan perkhidmatan kepakaran apabila diminta dalam rangka masa yang ditetapkan atau dipersetujui bersama dengan pelanggan, terutamanya bagi bidang-bidang:
  - Pemetaan geologi
  - Siasatan mineral
  - Siasatan air tanah
  - Siasatan geofizik
  - Geologi marin
  - Siasatan geologi kejuruteraan
  - Siasatan geologi alam sekitar

### Perkhidmatan Makmal

- Menyediakan perkhidmatan makmal apabila diminta bagi bidang berikut:
  - Analisis mineralogi dan petrologi
  - Analisis geokimia sampel bijih, mineral, aloi, batuan, kelodak, konsentrat, tanah dan air
  - Ujian mineral perindustrian
  - Ujian sedimentologi
  - Ujian geologi kejuruteraan

dalam tempoh yang dipersetujui, sekiranya mandatori, atau jika rutin, dalam tempoh 2 minggu selepas sampel diterima

## Clients Charter

### Mineral and Geoscience Information

- To supply available and published geological (including maps), mineral and other geoscience reports within 1 day upon receipt of request
- To supply available but unpublished geological maps, mineral and other geoscience reports within 1 week upon receipt of request
- To supply available digital information within 3 days upon receipt of request

### Expert Services

- To provide expert services upon request, within the time frame stipulated or mutually agreed upon with the client, especially in the fields of:
  - Geological mapping
  - Mineral investigation
  - Groundwater investigation
  - Geophysical investigation
  - Marine geology
  - Engineering geology investigation
  - Environmental geology investigation

### Laboratory Services

- To provide laboratory services upon request for:
  - Mineralogical and petrological analyses
  - Geochemical analyses of ores, minerals, alloys, rocks, silts, concentrates, rocks and water samples
  - Industrial mineral tests
  - Sedimentological tests
  - Engineering geology tests

within the time frame stipulated or mutually agreed upon with the client if it is mandatory, or within 2 weeks if it is routine, upon receipt of samples



## Perkhidmatan Perlombongan dan Pengkuarian

- Mengeluarkan Lesen Melombong atau Lesen Kuari dalam tempoh 30 hari dari tarikh penerimaan permohonan yang lengkap
- Menyediakan laporan-laporan teknikal yang tepat dan lengkap berkaitan dengan kepentingan perlombongan, dalam tempoh 30 hari dari tarikh penerimaan permohonan yang disertakan dengan dokumen-dokumen yang lengkap

## Perkhidmatan Dagangan Mineral

- Memberi ulasan ke atas permohonan untuk mengeksport mineral dalam tempoh 5 hari dari tarikh penerimaan permohonan yang disertakan dengan dokumen-dokumen yang lengkap
- Mengeluarkan Lesen Bijih Mineral dalam tempoh 30 hari dari tarikh penerimaan permohonan yang lengkap
- Mengeluarkan dan membaharukan permit pengangkutan konsentrat timah dalam tempoh 1 jam

## Dasar Kualiti

Jabatan Mineral dan Geosains Malaysia komited untuk memastikan produk dan perkhidmatannya sentiasa memenuhi keperluan pelanggan. Untuk mencapai matlamat ini, pengurusan jabatan serta seluruh warga JMG adalah komited untuk:

- Melaksanakan sistem kualiti berdasarkan kepada keperluan MS ISO 9002;
- Memastikan bahawa produk dan perkhidmatan tepat pada masanya;
- Memastikan bahawa peningkatan kualiti dilaksanakan secara berterusan;
- Membina pasukan kerja yang kuat, responsif dan mempunyai etika kerja yang positif, dan
- Meningkatkan pengetahuan dan kemahiran melalui latihan.

## Mining and Quarrying Services

- To issue Mining Licences or Quarrying Licences within 30 days upon receipt of duly completed application forms
- To prepare comprehensive technical reports relating to mining interest within 30 days upon receipt of application supported by duly completed documents

## Mineral Commerce Services

- To provide comments on mineral export applications within 5 days upon receipt of applications accompanied by duly completed documents
- To issue Mineral Ore Licences within 30 days upon receipt of duly completed application forms
- To issue and renew permits for transportation of tin concentrates within 1 hour

## Quality Policy

The Minerals and Geoscience Department Malaysia is committed to ensuring customer satisfaction in its products and services. To achieve this goal, the JMG management as well as the constituents are committed to:

- Implementing a quality system based on MS ISO 9002 qualifications;
- Ensuring that datelines are met in both products and services;
- Continuance of quality improvement is implemented;
- Building of a strong and responsive work force with positive work ethics, and
- Development of knowledge and skills through training.

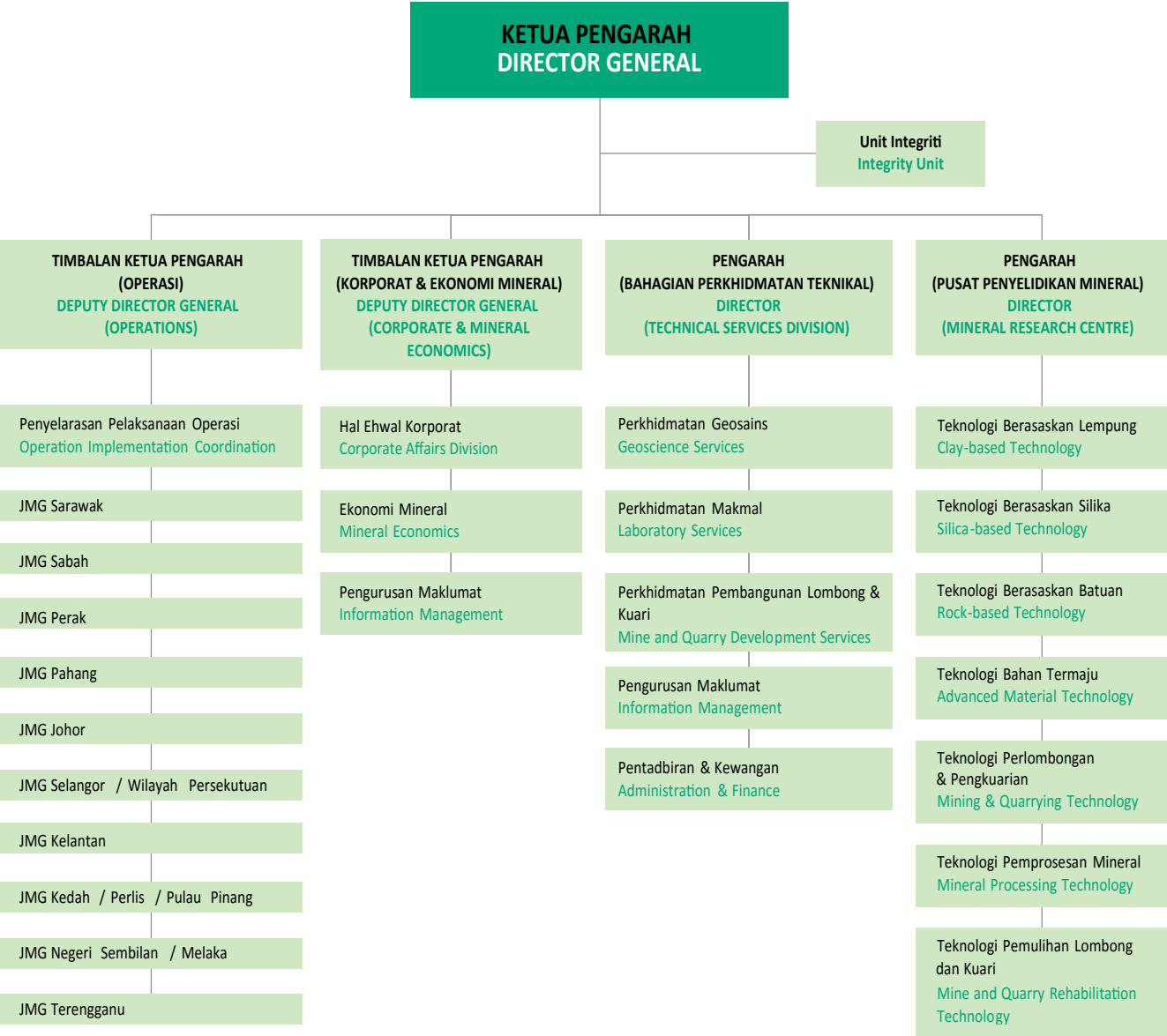
## Pengurusan Tertinggi Top Management



- 1. Dato' Yunus Abd Razak**  
(Ketua Pengarah)  
(Director General)
- 2. Mustapha Mohd Lip**  
(Timbalan Ketua Pengarah – Operasi)  
(Deputy Director General – Operations)
- 3. Mior Sallehuddin Mior Jadid**  
(Timbalan Ketua Pengarah – Korporat dan Ekonomi Mineral; dari 1 Disember 2014)  
(Deputy Director General – Corporate and Mineral Economics; from 1 December 2014)
- 4. Shahar Effendi Abdullah Azizi**  
(Pengarah – Pusat Penyelidikan Mineral)  
(Director – Mineral Research Centre)
- 5. Dr. Kamaludin Hassan**  
(Pengarah – Bahagian Perkhidmatan Teknikal; dari 1 Disember 2014)  
(Director – Technical Services Division; from 1 December 2014)

# Carta Organisasi

## Organisation Chart









# HAL EHWAL KORPORAT CORPORATE AFFAIRS

Fotomikrograf ulminit di arang batu Mukah dari Sarawak (cahaya putih pantulan di bawah rendaman minyak). Ia berasal dari tisu berkayu termasuk akar, batang, kulit kayu, dan daun. Kehadiran ulminite yang banyak di arang batu Mukah menunjukkan tahap pemeliharaan sel tisu yang tinggi di bawah keadaan basah, mungkin dengan pH yang rendah dalam kawasan gambut berhutan atau kawasan paya timbul berhutan yang basah.

Photomicrograph of ulminite in the Mukah coal of Sarawak (reflected white light under oil immersion). It derives from woody tissues including roots, stems, bark, and leaves. The presence of large amounts of ulminite in the Mukah coal indicate a high degree of cell-tissue preservation under wet, possibly low pH conditions within forested peatlands or forested wet raised bogs.

Photo: Sia Say Gee

## Kewangan Financial

### Perbandingan peruntukan dan perbelanjaan mengurus 2010-2014 Comparison of recurrent allocation and expenditure 2010-2014

Tahun Year	Peruntukan Allocation (RM)	Perbelanjaan Expenditure (RM)	%
2010	53,187,100.00	52,868,204.00	99.40
2011	58,743,900.00	58,570,135.00	99.70
2012	62,093,912.00	62,093,911.00	99.99
2013	63,390,568.00	63,387,855.00	99.99
2014	67,953,684.00	68,529,659.17	100.85

### Perbandingan peruntukan dan perbelanjaan pembangunan 2010-2014 Comparison of development allocation and expenditure for 2010-2014

Tahun Year	Peruntukan Allocation (RM)	Perbelanjaan Expenditure (RM)	%
2010	25,793,370.00	25,690,240.00	99.60
2011	5,544,010.00	5,251,252.00	94.72
2012	10,234,000.00	10,195,509.00	99.62
2013	8,765,700.00	8,761,881.00	99.95
2014	32,774,728.00	30,499,351.23	93.06



## Sumber Manusia Human Resource

### Status perjawatan tahun 2014 Staffing status 2014

Kumpulan perkhidmatan Group of service	Bil. jawatan diisi No. of filled posts	Bil. jawatan belum diisi No. of vacant posts	Jumlah Total
Pengurusan Tertinggi Top Management	5	1	6
Pengurusan & Profesional (Gred 41-54) Management & Professional (Grade 41-54)	290	32	322
Kumpulan Sokongan I (Gred 17- 40) Supporting Group I (Grade 17 - 40)	516	57	573
Kumpulan Sokongan II ( Gred 1-16) Supporting Group II (Grade1-16)	167	24	191
<b>Jumlah Keseluruhan Grand Total</b>	<b>978</b>	<b>114</b>	<b>1092</b>

## Pembangunan Sumber Manusia Human Resource Development

### Program Latihan Dalam Jabatan

Sebanyak 2657 program latihan dalam Jabatan melibatkan kursus, bengkel, taklimat, seminar, persidangan dan ceramah telah dilaksanakan oleh semua pejabat sepanjang 2014. Seramai 10,240 peserta telah menghadirinya. Sebahagian besar daripadanya merupakan program yang terdapat dalam takwim latihan yang dirancang.

### Program Latihan Luar Jabatan (Tempatan)

Sebanyak 838 kursus, bengkel dan seminar telah dihadiri oleh 2040 kakitangan Jabatan. Program ini melibatkan agensi penganjur seperti INSTUN, NRE, INTAN, INTIM, JPM, INSPIN, AKADEMI SAINS, MIMA, USM, UM, FRIM, JAKIM, JANM, JPA, SUK, NAHRIM, LPPKN, SIRIM, UNIMAS, LHDN, USM, UTP, IGM, IKM, MQA, RTM dan lain-lain.

### In-House Training Programme

A total of 2657 in-house programmes involving courses, workshops, briefings and seminars were conducted during 2014. A total of 10,240 participants were involved in these programmes. Most of these programmes were scheduled in the planned training calendar.

### External Training Programme (Local)

A total of 838 courses, workshops and seminars were attended by a total of 2040 participants. These programmes involved organising agencies such as INSTUN, NRE, INTAN, INTIM, JPM, INSPIN, AKADEMI SAINS, MIMA, USM, UM, FRIM, JAKIM, JANM, JPA, SUK, NAHRIM, LPPKN, SIRIM, UNIMAS, LHDN, USM, UTP, IGM, IKM, MQA, RTM and others.

## Program Latihan Luar Negara

Sebanyak 58 program latihan, mesyuarat dan lawatan di luar negara iaitu ke Singapura, Vietnam Indonesia, Thailand, Laos, Cambodia, Myanmar, Papua New Guinea, Hong Kong, China, Jepun, Taiwan, Korea Selatan, USA, UK, Switzerland, Afrika Selatan, dan Zimbabwe telah dianjurkan oleh CABIS, APEC, ASOMM, Perak MB Inc, KIGAM, AOTS, AMMIN, GAI, CCOP, JPA, GS of China dan pelbagai agensi luar negara. Seramai 95 anggota jabatan telah mengikuti program ini.

## Overseas Training Programme

A total of 58 training programmes, meetings and overseas visits to Singapore, Vietnam Indonesia, Thailand, Laos, Cambodia, Myanmar, Papua New Guinea, Hong Kong, China, Japan, Taiwan, South Korea, USA, UK, Switzerland, South Afrika, and Zimbabwe were organised by the CABIS, APEC, ASOMM, Perak MB Inc, KIGAM, AOTS, AMMIN, GAI, CCOP, JPA, GS of China and other overseas agencies. A total of 95 staff of the department attended these programmes.

### Program latihan dalam tahun 2014 Training programmes in 2014

Program latihan Training programme	Dalam jabatan In-house	Luar jabatan External	Luar negara Overseas	Jumlah Total
Sumber Mineral / Mineral Resources	63	3	6	72
Geosains / Geoscience	225	74	38	337
Lombong & Kuari / Mine & Quarry	28	11	7	46
Kimiabumi / Geochemistry	10	2	0	12
Penyelidikan / Research	57	13	1	71
Pengurusan Maklumat Information Management	92	60	2	154
Pengurusan Sumber Manusia Human Resource Management	1283	207	4	1494
Pengurusan Kewangan Financial Management	45	81	0	126
Pembangunan Kendiri / Self Development	122	90	0	212
Kualiti & Produktiviti Quality & Productivity	426	53	0	479
Kursus Wajib / Compulsory Course	0	1	0	1
Bahasa & Komunikasi Language & Communication	69	8	0	77
Lain - lain / Others	237	236	0	473
<b>Jumlah / Total:</b>	<b>2657</b>	<b>839</b>	<b>58</b>	<b>3554</b>

### Pengajian ijazah lanjutan sesi 2014/2015 Post-graduate for session 2014/2015

Bil. No.	Nama pegawai Name of officer	Universiti University	Bidang pengajian Field of study
1	Mohamed Fadzli Rahman	Dalam negara	Geologi (Geofizik)
2	Norinsafrina Mustaffa Kamal	Dalam negara	Teknologi hijau

## Pengurniaan dan Kepujian Awards and Accolades

### Penerima pingat darjah kebesaran Recipients of honorary titles and awards

Bil. No.	Nama pegawai Name of officer	Jawatan Position	Pejabat Office	Pingat darjah kebesaran Medal decoration
1	Dr. Kamaludin Hassan	Pengarah	JMG Perak	Darjah Paduka Cura Si Manja Kini (D.C.M)
2	Maznah Sulaiman	Pembantu Tadbir N17	JMG Kelantan	Pingat Taat
3	Sagnal Mat Shah	Pembantu Geosains C22	JMG Terengganu	Pingat Jasa Kebaktian (PJK)
4	Japili Samin	Pembantu Geosains C22	JMG Sabah	Bintang Kinabalu (BK)
5	Khazari Ahmad	Pembantu Geosains C22	JMG Kedah / Perlis / Pulau Pinang	Pingat Perkhidmatan Cemerlang (PCK) - Negeri Kedah
6	Johari Omar	Pembantu Geosains C22	JMG Kedah / Perlis / Pulau Pinang	Pingat Jasa Baik (PJB) - Negeri Perlis
7	Ismail Ghazali	Penolong Juru Ukur JA29	JMG Kedah / Perlis / Pulau Pinang	Pingat Jasa Kebaktian (PJK) - Negeri Pulau Pinang



14.10.2014

Tuan Haji Shahar Effendi Abdullah Azizi, Pengarah PPM, menerima Sijil *Award of Excellence* dari IQM  
Mr. Shahar Effendi Abdullah Azizi, Director of PPM, received Award of Excellence from  
the Institute of Quarrying Malaysia (IQM)

**Penerima Anugerah Perkhidmatan Cemerlang Tahun 2014 (Tahun Penilaian: 2013)**  
**Recipients of Excellent Service Award 2014 (Year of Assessment: 2013)**

<b>Ibu Pejabat / Headquarters</b>		
1	Hamadi bin Che Harun	Pegawai Geosains Gred C54
2	Shari bin Ismail	Pegawai Geosains Gred C44
3	Abd Razak bin Zainal Abidin	Pegawai Geosains Gred C41
4	Abd Razak bin Abd Aziz	Pembantu Geosains Gred C26
5	Nafiza binti Jomhari	Pen. Peg. Teknologi Maklumat Gred F29
6	Rukiah binti Ali Amat	Pembantu Tadbir Gred N22
7	Tumijah binti Bajure	Pembantu Tadbir Gred N17
<b>Bahagian Perkhidmatan Teknikal / Technical Services Division</b>		
8	Ismail bin C. Mohamad	Pegawai Geosains Gred C48
9	Mohd. Rais bin Ramli	Pegawai Geosains Gred C44
10	Mohd Fahami bin Abas	Pegawai Geosains Gred C41
11	Yusril A'mali bin Mohd Yusuf @ Hamid	Pegawai Geosains Gred C41
12	Zauyah binti Saidi	Pen. Pegawai Geosains Gred C27
13	Jamaluddin bin Rahin	Pembantu Geosains Gred C26
14	Petri Jamaliah binti Megat Dahalan	Pembantu Tadbir (Kew) Gred W22
15	Ramlah binti Satar	Pembantu Tadbir (P/O) Gred N22
16	Ng Sok Hoon	Pembantu Geosains Gred C22
17	Mohd Shafie bin Shaari	Pembantu Geosains Gred C17
18	Mariham binti Yaacob	Pembantu Geosains Gred C17
19	Mohamad Jo bin Ibrahim	Penolong Jurutera Gred JA29
20	Rashid bin Shapee	Pembantu Operasi Gred N11
21	Khalid bin Arshad	Pembantu Awam Gred H11
22	Mohd Fuad bin Shahrudin	Pemandu Kenderaan Gred H11
23	Zainuddin bin Bakar	Pembantu Awam Gred H11
<b>Pusat Penyelidikan Mineral / Mineral Research Centre</b>		
24	Khor Peng Seong	Pegawai Penyelidik Gred Q54
25	Aminudin bin Mahmud	Pegawai Penyelidik Gred Q54
26	Hasliza bin Ahmad	Pembantu Penyelidik Gred Q17
27	Zaidah binti Sulaiman	Pembantu Penyelidik Gred Q22
28	Asiah binti Mohd Yusof	Setiausaha Pejabat Gred N28
29	Amir Shariffddin bin Mohd Ramli	Penolong Jurutera Gred JA29
30	Zaiton binti Kamarudin	Pembantu Awam Gred H11
31	Zaiton binti Kelan	Pembantu Awam Gred H14
32	Syed Azmi bin Syed Kamar	Pembantu Am Pejabat Gred N1
33	Zamri bin Mohd Yusof	Pembantu Operasi Gred N11

<b>JMG Kedah / Perlis / Pulau Pinang</b>		
34	Juna Azleen bin Abdul Ghani	Pegawai Geosains Gred C44
35	Khalid bin Mat Hashim	Pembantu Geosains Gred C22
36	Muhammad Razif bin Osman	Pembantu Awam Gred H11
37	Mohd Gani bin Awang	Pembantu Geosains Gred C22
<b>JMG Perak</b>		
38	Ahmad Zukni bin Ahmad Khalil	Pegawai Geosains Gred C48
39	Burhanuddin bin Mohd Tahir	Pembantu Geosains Gred C22
40	Mohd Jasmi bin Ibrahim	Pembantu Geosains Gred C22
41	Norolhuda binti Mohd Hussin	Pembantu Tadbir (P/O) Gred N17
<b>JMG Selangor / Wilayah Persekutuan</b>		
42	Qalam A'zad bin Rosle	Pegawai Geosains Gred C41
43	Mohd Sayuthi bin Rashid	Pembantu Geosains Gred C17
44	Noor Hayati binti Ibrahim	Pembantu Tadbir Gred N22
45	Mohd Zaibri bin Zahhan	Pembantu Awam Gred H11
<b>JMG Negeri Sembilan / Melaka</b>		
46	Mustafar bin Hamzah	Pegawai Geosains Gred C52
47	Masrita binti Mohd Aras	Pegawai Geosains Gred C41
48	Saiful Azwan bin Kassim	Pembantu Geosains Gred C17
49	Maznah binti Md. Som	Pembantu Tadbir (P/O) Gred N17
<b>JMG Johor</b>		
50	Noorazhar bin Ngatimin	Pegawai Geosains Gred C44
51	Rozyah binti Johan	Pen. Pegawai Tadbir Gred N27
52	Norazman bin Isa	Pembantu Geosains Gred C22
53	Balqish Mazuien binti Bakiah	Setiausaha Pejabat Gred N27
<b>JMG Pahang</b>		
54	Mohd Asnizam bin Ayub	Pegawai Geosains Gred C41
55	Norasidah binti Abdul Rahman	Pelukis Pelan Gred J22
56	Ami bin Panjang	Pembantu Geosains Gred C22
57	Sepiah binti Awang	Pembantu Tadbir (Kew) Gred W22
<b>JMG Terengganu</b>		
58	Abdul Hadi bin Abdul Rahman	Pegawai Kajibumi Gred C44
59	Aliana binti Ali	Pembantu Tadbir Gred N17
60	Salehaton binti Sulaiman	Pembantu Geosains Gred C17
61	Idris bin Muhammad	Pembantu Geosains Gred C22

JMG Kelantan		
62	Amir Mizwan bin Mohd Akhir	Pegawai Geosains Gred C41
63	Nordin bin Safaai	Pembantu Geosains Gred C22
64	Ghaihan binti Abdul Aziz	Pembantu Tadbir Gred N17
65	Nurina binti Jusoh	Penolong Juruukur Gred JA29
JMG Sarawak		
66	Azzudin bin Shebli	Pegawai Geosains Gred C44
67	Joseph Jubin anak Aruh @Aro	Pegawai Geosains Gred C44
68	Lee Beng Huat	Pegawai Geosains Gred C41
69	Kennedy bin Mohd. Imran	Pegawai Geosains Gred C41
70	Pandi bin Kupli	Pembantu Geosains Gred C22
71	Unchu anak Meling	Pembantu Geosains Gred C22
72	Mengkau anak Ngumbang	Pembantu Geosains Gred C17
73	Emparan anak Bujang	Pembantu Geosains Gred C17
74	Soh Hee Yong	Penolong Juruukur Gred JA29
75	Vironica Serany anak Entalang	Pembantu Tadbir (PO) Gred N17
76	Mohd Zaidi bin Lias	Pemandu Kenderaan Gred H11
77	Amin bin Tana	Pembantu Awam Gred H11
JMG Sabah		
78	Kamaruddan bin Abdullah	Pegawai Geosains Gred C48
79	Jenneth @ Liliana Cyril	Pegawai Geosains Gred C44
80	Fredolin Javino	Pegawai Geosains Gred C44
81	Jeffery Paping	Pen. Pegawai Tadbir Gred N32
82	Abdul Arif bin Tahar	Pembantu Geosains Gred C17
83	Jasni bin Jaya	Pembantu Geosains Gred C17
84	Tharcus bin Kombuyuk	Pemandu Kenderaan Gred H11



## Pelawat Luar Negara Overseas Visitors

15.01.2014

Lawatan delegasi dari Guangxi Bureau of Geology & Mineral Prospecting & Exploitation, China  
Visit of delegation from Guangxi Bureau of Geology & Mineral Prospecting & Exploitation, China



Mr. Zhan Mingguo, Timbalan Ketua Pengarah Guangxi Bureau of Geology & Mineral Prospecting & Exploitation, menerima cenderahati dari Tuan Haji Mustapha Mohd Lip, Timbalan Ketua Pengarah (Operasi) JMG

Mr. Zhan Mingguo, Deputy Director-General of Guangxi Bureau of Geology & Mineral Prospecting & Exploitation, receiving a memento from Mr. Mustapha Mohd Lip, Deputy Director General (Operations) of JMG





**04.03.2014**

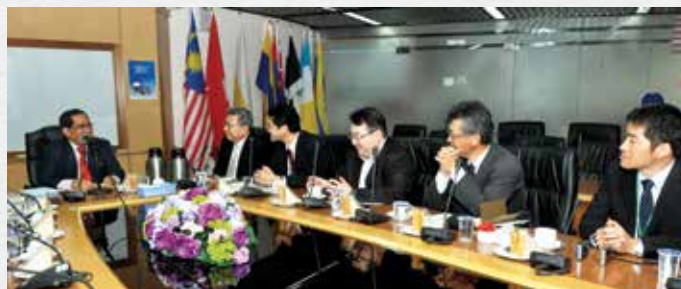
Delegasi OYO Corporation, Japan

Delegation of OYO Corporation, Japan



Mr. Masaru Narita (kedua dari kanan), presiden OYO, duduk bersama Tuan Haji Mohamemed Hatta Abd Karim (kedua dari kiri), Timbalan Ketua Pengarah (Korporat dan Ekonomi Mineral) JMG

Mr. Masaru Narita (second from right), OYO's president, seated with Mr. Mohamemed Hatta Abd Karim (second from left), Deputy Director General (Corporate and Mineral Economics) of JMG





**17.09.2014**

Lawatan delegasi dari Ministry of Petroleum & Mineral Resources, the Federal Republic of Somalia

Visit of delegation from the Ministry of Petroleum & Mineral Resources, the Federal Republic of Somalia



Delegasi dari Ministry of Petroleum & Mineral Resources, the Federal Republic of Somalia dan pegawai JMG Malaysia

Delegation from the Ministry of Petroleum & Mineral Resources, the Federal Republic of Somalia and JMG Malaysia officers





**04-07.12.2014**

Lawatan delegasi yang diketuai oleh Mr. Wang Shouxiang, Timbalan Menteri di Ministry of Land and Resources China  
Visit of delegation led by His Excellency Wang Shouxiang, Vice-Minister of the Ministry of Land and Resources of the People's Republic of China



Mr. Wang Shouxiang (kanan) sedang berbincang dengan Dato' Dr. Mohd Ali Mohamad Nor (tengah), Timbalan Ketua Setiausaha (Sumber Asli) NRE, dan Dato' Yunus Abd Razak (kiri), Ketua Pengarah JMG  
H.E. Wang Shouxiang (right) in discussion with Dato' Dr. Mohd Ali Mohamad Nor (center), Deputy Secretary General (Natural Resource) of NRE, and Dato' Yunus Abd Razak (left), Director General of JMG





## Kerjasama Antarabangsa International Cooperation

### Pemetaan Geologi Bersama Sempadan Malaysia-Thailand (MT-JGS) Malaysia-Thailand Border Joint Geological Survey (MT-JGS)

16-18.03.2014

Mesyuarat Kumpulan Kerja Bil. 1/2014, Kuala Terengganu  
Working Group Meeting No. 1/2014, Kuala Terengganu



Ahli Kumpulan Kerja Malaysia – Thailand  
Malaysia – Thailand Working Group members

Photo: Mat Niza Abdul Rahman

19-23.03.2014

Semakan geologi bersama Kumpulan Kerja Malaysia-Thailand di lapangan  
Malaysia-Thailand Working Group joint geological field check



Melakukan cerapan fosil tumbuhan kuno di Paya Peda, Terengganu  
Plant fossil observation at Paya Peda, Terengganu

Photo: Mat Niza Abdul Rahman



27.04.2014 – 01.05.2014

Bengkel Penyiasatan dan Pengurusan Dinosaur, Khon Kaen dan Kalasin, Thailand

Workshop on Dinosaur Investigation and Management, Khon Kaen and Kalasin, Thailand



Lawatan ke makmal dinosaur yang bertempat di Muzium Dinosaur, Kalasin, Thailand

Visit to dinosaur laboratory of the Dinosaur Museum, Kalasin, Thailand



Photo: Mat Niza Abdul Rahman

Lawatan ke Muzium Dinosaur, Kalasin, di mana fosil dinosaur yang lengkap terdedah

Visit to Dinosaur Museum, Kalasin, where the complete dinosaur fossil was uncovered



**26.08.2014**

Mesyuarat Kumpulan Kerja Penyiasatan Geologi Bersama Sempadan Malaysia-Thailand Bil. 2/2014, Khao Lak, Phang-Nga Province, Thailand

Malaysia-Thailand Border Joint Geological Survey Working Group Meeting No. 2/2014, Khao Lak, Phang-Nga Province, Thailand



**27.08.2014**

Mesyuarat Jawatankuasa Penyiasatan Geologi Bersama Sempadan Malaysia-Thailand Ke-11 di Khao Lak, Phang-Nga Province, Thailand

11th Malaysia-Thailand Border Joint Geological Survey Committee Meeting, Khao Lak, Phang-Nga Province, Thailand



Photo: Mat Niza Abdul Rahman

Dato' Yunus Abd Razak, Ketua Pengarah JMG, menyampaikan ucapan

Dato' Yunus Abd Razak, Director General of JMG, delivering his speech



Photo: Mat Niza Abdul Rahman

Tn. Hj. Mior Sallehuddin dan Mr. Montri Luengingkasoot  
mempengerusikan mesyuarat

Mr. Mior Sallehuddin and Mr. Montri Luengingkasoot co-chaired  
the meeting



**28-29.08.2014**

Kerja lapangan pemetaan geologi di  
Wilayah Phang-Nga, Thailand  
Geological field mapping in the Phang-  
Nga Province, Thailand



Photo: Mat Niza Abdul Rahman

Perbincangan di lapangan  
Field discussion

**30.08.2014 - 02.09.2014**

Kerja lapangan di Guar Jentik, Perlis  
Fieldwork in Guar Jentik, Perlis



Photo: Mat Niza Abdul Rahman

## Kerjasama Teknikal dan Saintifik Malaysia – Indonesia dalam bidang geologi dan sumber mineral

### Malaysia – Indonesia Scientific and Technical Co-operation in the field of geology and mineral resources

**27.08.2014**

Mesyuarat dan kerja lapangan Kumpulan Kerja Teknikal 1 (TWG1) : Korelasi Geologi Kawasan Sintang-Silantek  
Meeting and fieldwork of the Technical Working Group 1 (TWG1) : Geological Correlation of the Sintang-Silantek Area



Photo: Hj. Mohd. Pauzi Abdullah

Kerja lapangan di Melacan Palm Plantation, Kalimantan Barat  
Fieldtrip in the Melacan Palm Plantation, West Kalimantan



Photo: Hj. Mohd. Pauzi Abdullah

Perbincangan di lapangan  
Field discussion



**22-26.09.2014**

Mesyuarat Kumpulan Kerja Teknikal (TWG) dan Mesyuarat ke-5 Jawatankuasa Pemandu di Melaka  
Technical Working Groups (TWG) and the 5th Steering Committee Meeting at Melaka



Pengesahan laporan Teknikal Kumpulan Kerja oleh Tuan Haji Mior Sallehuddin Mior Jadid (Ketua Delegasi Malaysia) dan Pak Calvin Karo Karo Gurusinga (Ketua Delegasi Indonesia)  
Endorsement of Technical Working Group report by Mr. Mior Sallehuddin Mior Jadid (Head of Malaysian Delegation) and Pak Calvin Karo Karo Gurusinga (Head of Indonesian Delegation)



Majlis menandatangani laporan Jawatankuasa Pemandu oleh Tuan Haji Mustapha Mohd Lip (Ketua Delegasi Malaysia) dan Dr. Surono (Ketua Delegasi Indonesia)  
Signing ceremony of the Steering Committee report by Mr. Mustapha Mohd Lip (Head of Malaysian Delegation) and Dr. Surono (Head of Indonesian Delegation)



Lawatan ke tempat bersejarah sempena Mesyuarat Kerjasama Saintifik dan Teknikal Malaysia-Indonesia di Melaka  
Visit to historical places in conjunction with the Malaysia-Indonesia Scientific and Technical Cooperation Meeting at Melaka



## Projek Kerjasama JMG - Mine Reclamation Corporation (MIRECO), Republik Korea untuk rawatan *acid mine drainage* (AMD)

### JMG and Mine Reclamation Cooperation (MIRECO), Republic of Korea cooperation project on acid mine drainage (AMD)

28.09.2014 – 03.10.2014

Rawatan *acid mine drainage* (AMD) di bekas lombong Mahmud, Sabah

Acid mine drainage treatment at former Mahmud Mine, Sabah



Penyediaan loji pandu rawatan pasif AMD  
Preparation of AMD passive treatment pilot plant



Tinjauan tapak  
Site inspection

## Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP)

4-6.03.2014

Mesyuarat Jawatankuasa Pemandu CCOP Ke-62, Chiang Mai, Thailand

62nd CCOP Steering Committee Meeting, Chiang Mai, Thailand





## ASEAN Senior Official Meeting on Minerals (ASOMM)

**26-28.08.2014**

Mesyyarat Ke-11 Kumpulan Kerja Teknikal ASOMM di Siem Reap, Cambodia

The 11th ASOMM Technical Working Group Meeting, Siem Reap, Cambodia

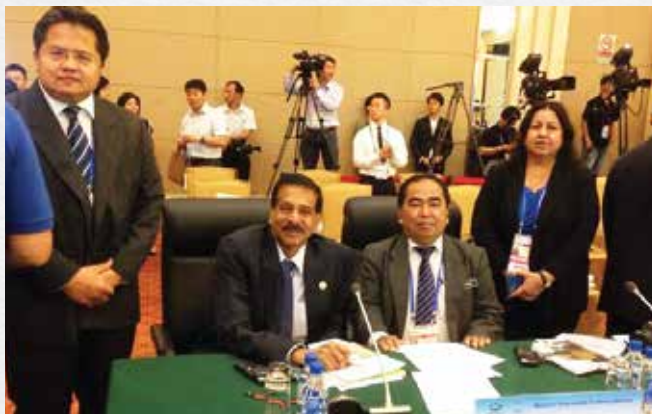


## APEC Ministers Responsible For Mining Meeting

**28.06.2014**

Delegasi Malaysia ke Mesyyarat APEC, Beijing, China

Malaysian delegation to the APEC Meeting, Beijing, China



Yang Berhormat Datuk Seri Palanivel (kedua dari kiri), Menteri di Kementerian Sumber Asli dan Alam Sekitar, bersama delegasi Malaysia

The Honourable Datuk Seri Palanivel (second from left), Minister of Natural Resources and Environment, with the Malaysian delegation





## Kerjasama Dalam Negara National Cooperation

### Universiti Malaysia Sabah (UMS)

12.02.2014

Majlis menandatangani memorandum persefahaman (MOU) antara JMG dan UMS di Universiti Malaysia Sabah, Sabah  
MOU signing ceremony between JMG and UMS at University Malaysia Sabah, Sabah



Naib Canselor UMS, Prof. Datuk Dr. Mohd Harun Abdullah, dan Ketua Pengarah JMG, Dato' Yunus Abd Razak, menandatangani MOU  
Vice chancellor of UMS, Prof. Datuk Dr. Mohd Harun Abdullah, and Director General of JMG, Dato' Yunus Abd Razak, signing the MOU



## Menteri Besar Incorporated (MB Inc.) Perak

15.09.2014

Yang Berhormat Datuk Seri Diraja Dr. Zambry Abdul Kadir, Menteri Besar Perak, melawat Pusat Penyelidikan Mineral, JMG  
The Honourable Datuk Seri Diraja Dr. Zambry Abdul Kadir, Chief Minister of Perak, visits the Mineral Research Centre, JMG





## Lembaga Pembangunan Langkawi Langkawi Development Authority

24–27.11.2014

Bengkel Pembangunan Geopark, Langkawi

Workshop on developing a Geopark, Langkawi



Ucapan aluan oleh Tuan Haji Mior Sallehhuddin Mior Jadid  
Welcoming speech by Mr. Mior Sallehhuddin Mior Jadid



Kertas ucaptama oleh Profesor Emeritus Dato' Dr. Ibrahim Komoo  
Keynote paper by Professor Emeritus Dato' Dr. Ibrahim Komoo



Yang Berhormat Tan Sri Khalid Ramli, Ketua Pegawai Eksekutif Lembaga Pembangunan Langkawi (LADA), merasmikan Bengkel  
The Honourable Tan Sri Khalid Ramli, Chief Executive Officer of the Langkawi Development Authority (LADA), officiating the Workshop



# JMG Dalam Berita

## JMG In The News

29.01.2014

Penemuan fosil tumbuhan di Paya Peda, Besut, Terengganu  
The discovery of plant fossils, Paya Peda, Besut, Terengganu

KOSMO



UTUSAN MALAYSIA



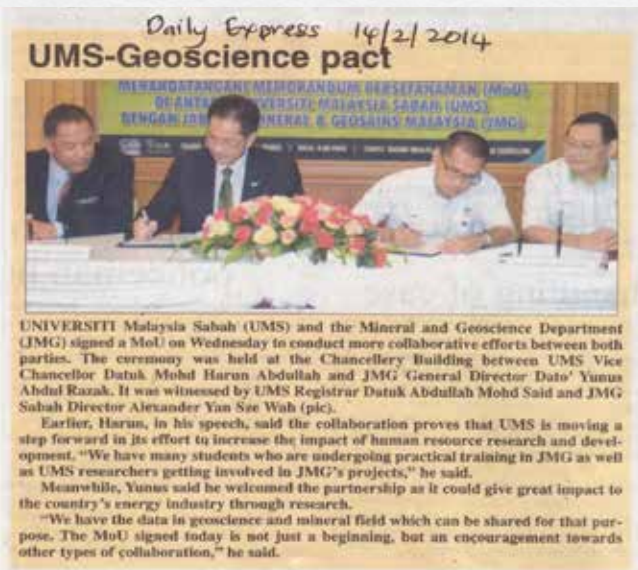
METRO



14.02.2014

Perjanjian UMS – Geosains  
UMS – Geoscience pact

Daily Express



22.10.2014

Tapak Geowarisan Bukit Larek, Kedah  
Bukit Larek Geoheritage Site, Kedah

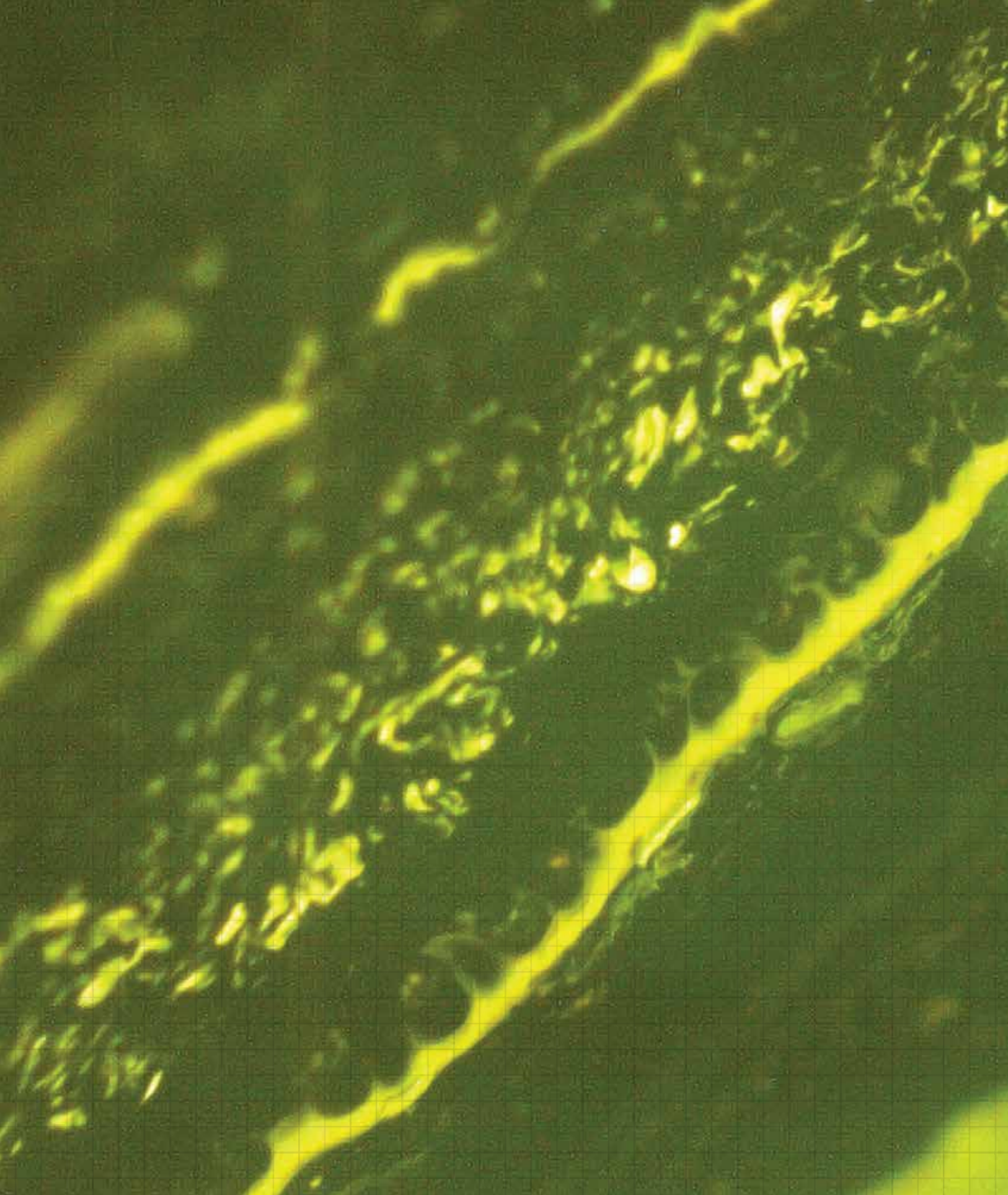
KOSMO



Oriental Daily News







A photomicrograph of coal macerals, showing long, serrated cutinite stringers sandwiching shorter fluorinite stringers. The image is in reflected ultraviolet light under oil immersion, showing a greenish-yellow color scheme.

# AKTIVITI MINERAL MINERAL ACTIVITIES

Fotomikrograf menunjukkan cutinit yang terpelihara dengan baik (rentetan panjang dengan tepi bergerigi) mengepit fluorinit (rentetan pendek) dalam arang batu Balingian dari Sarawak (cahaya ultraungu pantulan di bawah rendaman minyak). Cutinit adalah maseral liptinit yang berasal dari kutikula tumbuhan daratan, sementara fluorinit adalah maseral liptinit yang berasal dari minyak dan lemak tumbuhan. Kehadiran cutinit yang dipelihara dengan baik menunjukkan bahawa bahan organik di sampel ini telah dimendapkan di persekitaran penurun yang sederhana hingga kuat.

Photomicrograph of well-preserved cutinite (long stringers with serrated edges) sandwiching fluorinite (short stringers) in the Balingian coal of Sarawak (reflected ultraviolet light under oil immersion). Cutinite is a liptinite maceral derived from terrestrial plant cuticles, while fluorinite is a liptinite maceral derived from plant oils and fats. The presence of well-preserved cutinite indicates that organic matter in this sample was deposited in a mildly to strongly reducing environment.

Photo: Sia Say Gee



# AKTIVITI MINERAL

Jabatan Mineral dan Geosains Malaysia (JMG) bertanggungjawab untuk mengumpul dan menganalisis data berkaitan eksplorasi mineral, perlombongan, pengkuarian, pengeluaran mineral, pelaburan komersial dan status perkembangan industri berasaskan mineral.

Aktiviti mineral yang dijalankan oleh JMG melibatkan penilaian sumber mineral berlogam, mineral perindustrian, mineral tenaga, dan mineral strategik. JMG juga berperanan membekalkan maklumat komoditi mineral bagi membantu meningkatkan perkembangan industri mineral negara, serta memberi khidmat nasihat berkenaan guna tanah dan pembebasan mineral kepada pihak berkuasa negeri, dan swasta.

Penilaian sumber mineral berlogam melibatkan kajian peringkat tinjauan, susulan dan terperinci. Dari penilaian tersebut, beberapa kawasan yang kemungkinan berpotensi untuk perlombongan emas, bijih besi, bijih timah, dan ilmenit telah ditemui. Penilaian sumber mineral perindustrian di beberapa buah negeri juga telah berjaya mengenalpasti kawasan-kawasan yang mempunyai rizab andalusit, agregat batuan, batu kapur, batuan silika, lempung marin, dan pasir binaan. Penilaian sumber mineral tenaga yang dijalankan di Sabah dan Sarawak pula telah mengenalpasti beberapa kawasan arang batu yang berpotensi.

## Mineral Berlogam

### Penilaian Sumber Mineral Berlogam

Pada tahun 2014, kerja penilaian tinjauan sumber mineral berlogam telah dijalankan di tujuh buah negeri, iaitu Kedah, Kelantan, Negeri Sembilan, Pahang, Perak, Sarawak, dan Terengganu dengan jumlah kawasan liputan seluas 694 km<sup>2</sup>. Pada tahun yang sama, penilaian susulan / terperinci sumber mineral berlogam telah dilaksanakan di lapan buah negeri, iaitu Kedah, Kelantan, Pahang, Perak, Sabah, Sarawak, Selangor, dan Terengganu dengan jumlah kawasan liputan seluas 235.5 km<sup>2</sup>. Simpanan ilmenit (3060 tan metrik) telah dikenal pasti di Terengganu. Anomali geokimia emas telah dikesan di Kelantan, manakala anomali geokimia timah telah dikenal pasti di Selangor.

# MINERAL ACTIVITIES

The Minerals and Geoscience Department (JMG) is responsible for collecting, analysing data pertaining to mineral exploration, mining, quarrying, minerals production, commercial investment and the developmental status of mineral-based industries.

Mineral activities carried out by JMG involve resource evaluation for metallic, industrial, energy, and strategic minerals. JMG also plays a role in providing mineral commodity information to support the development of the nation's mineral industry, as well as provides advisory services pertaining to land use and mineral clearance to the state authorities, as well as the private sector.

Metallic mineral resource evaluation involves initial reconnaissance, follow-up and detailed surveys. From such evaluations, several localities with potential for the mining of gold, iron ore, tin ore, and ilmenite have been delineated. Resource evaluation for industrial minerals in several states have also identified areas with significant reserves of andalusite, rock aggregate, limestone, silica rock, marine clay, and construction sand. Energy mineral evaluation conducted in Sabah and Sarawak has located several areas with potential for coal.

## Metallic Minerals

### Metallic Mineral Resource Evaluation

In 2014, reconnaissance evaluation for metallic mineral resources was carried out in seven states, namely Kedah, Kelantan, Negeri Sembilan, Pahang, Perak, Sarawak, and Terengganu, covering a total area of 694 km<sup>2</sup>. In the same year, follow-up / detailed metallic mineral resource evaluation was carried out in eight states, namely Kedah, Kelantan, Pahang, Perak, Sabah, Sarawak, Selangor, and Terengganu, covering a total area of 235.5 km<sup>2</sup>. Reserves of ilmenite (3060 tonnes) have been identified in the state of Terengganu. Gold geochemical anomalies have been detected in the state of Kelantan, whereas tin geochemical anomalies have been detected in the state of Selangor.

**Penilaian sumber mineral berlogam (tinjauan)**  
**Metallic mineral resource evaluation (reconnaissance)**

Komoditi Commodity	Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Penemuan Findings
Timah / Tin	Kedah	Mahang, Kulim	18	Geologi dan corak pemineralan bijih timah telah dicirikan. The geology and tin ore mineralization patterns have been characterized.
		Ulu Muda	20	Konsentrat dari Sungai Bahoi, Ulu Muda mengandungi Sn setinggi 150,000 ppm. Concentrate from Sungai Bahoi, Ulu Muda contains Sn as high as 150,000 ppm.
Besi / Iron	Johor	Bukit Manisan, Segamat	6	Bijih besi terdiri daripada limonit dan hematit, dengan kandungan Fe antara 48.0% hingga 53.0%. Iron ores consisting of limonite and hematite, with Fe content ranging from 48.0% to 53.0%.
	Negeri Sembilan	Port Dickson	50	Bijih besi dengan kandungan Fe berjulat dari 37.0% hingga 55.2%. Iron ore with Fe content ranging from 37.0% to 55.2%.
Mineral berlogam / Metallic Minerals	Sarawak	Hose Mountains, Kapit	600	Beberapa sampel menunjukkan potensi emas. Several samples showed potential for gold.
Jumlah / Total:		5	694	

**Penilaian sumber mineral berlogam (susulan / terperinci)**  
**Metallic mineral resource evaluation (follow-up / detailed)**

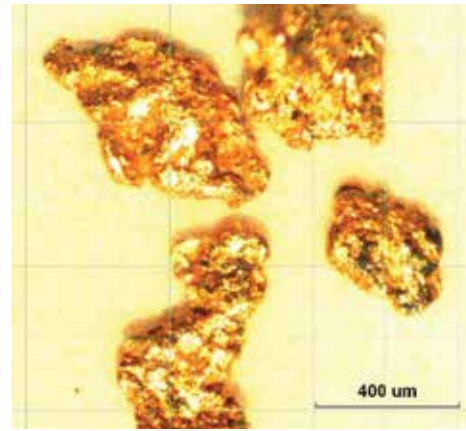
Komoditi Commodity	Negeri State	Lokasi Location	Liputan Coverage (km <sup>2</sup> )	Penemuan Findings
Emas / Gold	Kelantan	Kuala Betis, Gua Musang	37	Kawasan kajian terletak di dalam Zon Sutura Bentong yang mana batuan telah mengalami breksiasi dengan kehadiran blok kuarza. Keputusan analisis menunjukkan anomali emas yang baik di Sg. Peong dan Sg. Tereg yang mewajarkan kajian lebih terperinci. The study area is located in the Bentong Suture Zone, where the rocks have undergone brecciation with the presence of quartz blocks. Analytical results showed good gold anomalies at Sg. Peong and Sg. Tereg which warrant detailed studies.

Komoditi Commodity	Negeri State	Lokasi Location	Liputan Coverage (km <sup>2</sup> )	Penemuan Findings
Emas / Gold	Pahang	Sg. Kerak, Lipis, Pahang	8	Satu kawasan beranomali seluas 1.5 km <sup>2</sup> telah dikenal pasti. Projek kajian yang bermula dari tahun 2013 akan disambung pada tahun 2015. An anomalous area of 1.5 km <sup>2</sup> has been identified. The project that was started in 2013 will be continued in 2015.
	Sabah	Gunung Andrassy, Tawau	30	Kandungan emas dalam sampel tanah setinggi 0.469 ppm dan setinggi 1.243 ppm dalam sampel batuan. Walau bagaimanapun, kandungan emas adalah tidak signifikan dalam sampel sedimen sungai dan konsentrat dulang. The content of gold is up to 0.469 ppm in soil samples, and up to 1.243 ppm in rock samples. However, it is insignificant in stream sediment and panned concentrate samples.
		Balung, Tawau	1	Kandungan emas adalah di bawah nilai had pengesanan iaitu 0.003 ppm. The content of gold is below the detection limit of 0.003 ppm.
	Sarawak	Bukit Demam, Serian	1.5	Sampel dalam proses analisis. Samples are still being analyzed.
	Terengganu	Bukit Terendak, Merchang	15	Potensi rendah. Poor potential.
Ilmenit / Ilmenite	Terengganu	Sungai Cheniah, Dungun	2	Anggaran rizab adalah sebanyak 3060 tan metrik. Purata TiO <sub>2</sub> adalah 40.8%. Estimated reserve is 3060 tonnes. Average content of TiO <sub>2</sub> is 40.8%.
Timah / Tin	Kedah	Mahang, Kulim	2	Pemineralan bijih timah tertumpu di sekitar pending bumbung batuan metamorf. Tin mineralization is concentrated within the roof pendant of the metamorphic rocks.
	Perak	Temengor	89	Sampel dalam proses analisis. Samples are still being analyzed.
	Selangor	Sg. Lui, Hulu Langat	50	Beberapa lokasi anomali timah telah dikenal pasti. Several localities with tin anomalies have been identified.
Jumlah / Total:		10	235.5	

**Penilaian potensi sumber emas di Kuala Betis, Gua Musang, Kelantan**  
**Gold resource potential evaluation in Kuala Betis, Gua Musang, Kelantan**



Persampelan tanah  
Soil sampling



Butiran emas  
Gold flakes

**Penilaian potensi bijih timah di kawasan Temengor, Perak**  
**Tin ore potential evaluation in Temengor area, Perak**



Photo: Azizan Juhin

Pengeringan sampel kelodak sungai  
Drying of stream sediment samples



Photo: Azizan Juhin

Bijih timah kasar dalam konsentrat sungai di Sg. Jopai  
Coarse tin ores in stream concentrates at Sg. Jopai



**Penilaian sumber timah di Ulu Mahang, Sik, Kedah**  
**Evaluation of tin resource in Ulu Mahang, Sik, Kedah**



Telerang memotong jasad granit porfirit berfenokris  
 feldspar di hulu Sungai Sira  
 A vein cutting the feldspar phenocrysts containing  
 porphyritic granite body at the upstream of Sungai Sira



Pendulangan konsentrat mineral berat  
 Panning of heavy mineral concentrates

**Penilaian sumber ilmenit di Sungai Cheniah, Hulu Dungun, Terengganu**  
**Evaluation of ilmenite resource in Sungai Cheniah, Hulu Dungun, Terengganu**



Persampelan konsentrat mineral berat menggunakan pam selut  
 Sampling of heavy mineral concentrates using sludge pump

# Mineral Perindustrian

## Penilaian Sumber Mineral Perindustrian

Permintaan negara terhadap mineral mentah dan bahan binaan dijangka semakin meningkat, dan akan berterusan pada tahun-tahun yang akan datang. Pelan Induk Perindustrian menyatakan keperluan inventori sumber mineral perindustrian kebangsaan untuk membolehkan perancangan program perindustrian negara yang sistematik.

Dari sudut pandangan strategik, adalah mustahak bagi negara kita terus mengenalpasti sumber-sumber mineral perindustrian tempatan bagi memudahkan pembangunan negara. Pada masa yang sama, menggunakan sumber-sumber negara sendiri dan mengurangkan kebergantungan negara terhadap mineral-mineral import.

Sehubungan dengan itu, pada tahun 2014 penilaian telah dijalankan ke atas beberapa jenis mineral perindustrian iaitu andalusit, agregat batuan, batu kapur, batuan silika, debu vulkanik, dolomit, feldspar, lempung, dan juga pasir binaan dengan jumlah kawasan liputan 269 km<sup>2</sup>. Kajian yang dijalankan telah mengenalpasti 0.7 juta tan metrik andalusit, 978 juta tan metrik agregat batuan, 39 juta tan metrik batu kapur, 123.3 juta tan metrik batuan silika, 87.5 juta tan metrik lempung marin dan 25.6 juta tan metrik pasir binaan.

# Industrial Minerals

## Industrial Mineral Resource Evaluation

The demand for raw minerals and construction materials is expected to increase in years to come. The Industrial Master Plan requires an inventory of national industrial mineral resources to enable systematic planning of the country's industrialization program.

From the strategic point of view, it is important for the country to continue to identify local industrial mineral resources to facilitate national development. At the same time, securing the country's own resources also reduces dependence on imported minerals.

In connection with this, evaluations on several types of industrial minerals such as andalusite, rock aggregate, limestone, silica rock, volcanic ash, dolomite, feldspar, clay, and construction sand was carried out in 2014 with a total area coverage of 269 km<sup>2</sup>. The study has identified 0.7 million tonnes of andalusite, 978 million tonnes of rock aggregate, 39 million tonnes of limestone, 123.3 million tonnes of silica rock, 87.5 million tonnes of marine clay and 25.6 million tonnes of construction sand.

### Andalusit / Andalusite

Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Penemuan Findings
Terengganu	Sg. Parang, Kemaman	20	Penemuan mineral andalusit berbentuk 'knot' dalam batuan metapelit. Anggaran rizab adalah sebanyak 660,000 tan metrik. Kajian susulan ke atas kawasan ini telah dicadangkan. Discovery of knot-shaped andalusite mineral in metapelites. Estimated reserve is 660,000 tonnes. Follow-up study of this area is proposed.

### Agregat batuan / Rock aggregate

Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Penemuan Findings
Johor	Kulaijaya - Kota Tinggi	50	Anggaran rizab adalah sebanyak 318 juta tan metrik batuan granit. Estimated reserve is 318 million tonnes of granite.
Sarawak	Tunoh, Kapit	5	Anggaran rizab adalah sebanyak 660 juta tan metrik batuan vulkanik. Estimated reserve is 660 million tonnes of volcanic rock.

### Batu kapur / Limestone

Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Penemuan Findings
Pahang	Gua Panjang, Merapoh	2	Anggaran rizab adalah sebanyak 39 juta tan metrik. Estimated reserve is 39 million tonnes.

### Batuan silika / Silica rock

Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Penemuan Findings
Kelantan	Kuala Betis, Gua Musang	5	Purata SiO <sub>2</sub> dalam batuan kuarza adalah 98.5%. Anggaran rizab adalah sebanyak 14 juta tan metrik. Average content of SiO <sub>2</sub> in quartz rock is 98.5%. Estimated reserve is 14 million tonnes.
	Kg. Berdang, Jeli	5	Purata SiO <sub>2</sub> dalam batuan kuarza adalah 98.5%. Anggaran rizab adalah sebanyak 9.5 juta tan metrik. Average content of SiO <sub>2</sub> in quartz rock is 98.5%. Estimated reserve is 9.5 million tonnes.
Negeri Sembilan	Ulu, Rokan, Gemencheh	0.3	Purata SiO <sub>2</sub> dalam batuan kuarza adalah 97.6%. Anggaran rizab adalah sebanyak 97 juta tan metrik. Average content of SiO <sub>2</sub> in quartz rock is 97.6%. Estimated reserve is 97 million tonnes.
Perak	Ijok, Selama	2	Purata SiO <sub>2</sub> dalam batuan kuarza adalah 98.0%. Anggaran rizab adalah sebanyak 2.8 juta tan metrik. Average content of SiO <sub>2</sub> in quartz rock is 98.0%. Estimated reserve is 2.8 million tonnes.

Debu volkano / Volcanic ash

Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Penemuan Findings
Kedah	Padang Sanai, Kuala Nerang, Padang Terap	3	Penemuan enam longgokan debu volkano, dengan nisbah Al:Si 1:3, yang berpotensi sebagai sumber zeolit, telah dikenal pasti Six volcanic ash deposits, with Al:Si ratio between 1:3, with potential for zeolite resources, have been identified.

Dolomit / Dolomite

Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Penemuan Findings
Perlis	Bukit Mata Ayer - Bukit Ngolang, Padang Besar	8	Sempadan antara batu kapur berdolomit tinggi dan batu kapur berkalsium tinggi telah dikenal pasti. Delineated boundary between high magnesium and high calcium limestones.

Feldspar / Feldspar

Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Penemuan Findings
Sarawak	Gunung Pueh - Tanjung Batu, Lundu	82	Kandungan fluks agak rendah. Flux content slightly low.
Perak	Lawin, Hulu Perak	16	Kandungan fluks melebihi 6%. Flux content above 6%.

Lempung / Clay

Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Penemuan Findings
Negeri Sembilan	Kepis, Kuala Pilah	30	Analisis XRD menunjukkan kandungan utama lempung ini adalah muskovit dan kaolinit. Anggaran rizab lempung sebanyak 36 juta tan metrik telah dikenal pasti. XRD analyses showed that the major components of clay were muscovite and kaolinite. An estimated reserve of 36 million tonnes of clay has been identified.
Selangor	Sepang	12	Anggaran rizab lempung sebanyak 87.5 juta tan metrik telah dikenal pasti. An estimated reserve of 87.5 million tones of clay has been identified.



### Pasir binaan / Construction sand

Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Penemuan Findings
Pahang	Sungai Pahang	30	Anggaran rizab adalah sebanyak 25.2 juta tan metrik. Estimated reserve is 25.2 million tonnes.
Sabah	Sungai Pegalan, Keningau	33	Lima zon sesuai untuk pengambilan pasir dan batu kelikir telah dikenal pasti dengan anggaran rizab sebanyak 0.4 juta tan metrik. Five zones suitable for extraction of sand and aggregates have been identified, with estimated reserves of 0.4 million tonnes.

### Penilaian sumber andalusit di Ulu Cerul, Kemaman, Terengganu Evaluation of andalusite resource in Ulu Cerul, Kemaman, Terengganu



Photo: Muhammad Azfar Kamaruddin

Persampelan konsentrat andalusit  
Sampling of andalusite concentrates



Photo: Muhammad Azfar Kamaruddin

Hablur andalusit dalam batuan metapelit di Sungai Parang  
Andalusite crystals in metapelite rock at Sungai Parang

### Penilaian sumber batuan silika di Kuala Betis, Gua Musang, Kelantan Evaluation of silica rock resource in Kuala Betis, Gua Musang, Kelantan



Batuan silika berwarna putih susu dengan kekar yang rapat  
Milky white colour and highly jointed silica rock



Singkapan permatang kuarza  
Outcrop of silica ridge

**Penilaian sumber zeolit di Padang Sanai, Padang Terap, Kedah**  
**Evaluation of zeolite resource in Padang Sanai, Padang Terap, Kedah**



Persampelan debu vulkano menggunakan gerudi tangan di  
 Kampung Pok Ka  
 Sampling of volcanic ash using hand drill in Kampung Pok Ka



Persampelan debu vulkano di Kampung Gelanggang  
 Sampling of volcanic ash in Kampung Gelanggang

**Penilaian sumber feldspar di Lawin, Gerik, Perak**  
**Evaluation of feldspar resource in Lawin, Gerik, Perak**



Photo: Nor Azian Hamzah

Singkapan tuf berfeldspar  
 Outcrop of feldspar-bearing tuff



Photo: Nor Azian Hamzah

Persampelan menggunakan gerimit tangan  
 Sampling using hand auger



# Mineral Tenaga

## Penilaian Sumber Arang Batu

Arang batu di Malaysia terdapat dalam lembangan Tertier di ketiga-tiga wilayah geografi iaitu Sarawak, Sabah dan Semenanjung Malaysia. Walau bagaimanapun, kebanyakan daripada sumber arang batu terletak di negeri Sabah dan Sarawak. Pada akhir tahun 2014, jumlah sumber arang batu di Malaysia adalah sebanyak 1863 juta tan metrik, di mana 1502 juta tan metrik atau 80.6% terletak di Sarawak, 344 juta tan metrik atau 18.5% di Sabah, dan 0.9% yang selebihnya di Semenanjung Malaysia. Darjat arang batu berjelut dari subbitumen ke antrasit.

Pada masa ini, perlombongan dedah arang batu dijalankan secara aktif di lembangan arang batu Merit-Pila, Mukah dan Balingian, manakala perlombongan secara bawah tanah sedang dijalankan di lembangan arang batu Silantek, menghasilkan kira-kira 3 juta tan metrik arang batu setahun. Kebanyakan arang batu yang dihasilkan diguna oleh loji janakuasa selain industri pembuatan simen, serta besi dan keluli.

Pada masa ini, terdapat enam loji janakuasa arang batu yang beroperasi iaitu Loji Janakuasa Sultan Salahuddin Abd Aziz yang berkapasiti 1600 MW di Kapar, Selangor; Loji Janakuasa Sejingkat berkapasiti 210 MW di Kuching, dan Loji Janakuasa Mukah Power berkapasiti 270 MW di Mukah, Sarawak; Loji Janakuasa Manjong berkapasiti 2100 MW di Manjong, Perak; Loji Janakuasa Tanjong Bin berkapasiti 2100 MW di Johor; serta Loji Janakuasa Jimah berkapasiti 1400 MW di Port Dickson, Negeri Sembilan, dengan jumlah kapasiti penjanaan kuasa sebanyak 7680 MW.

Penggunaan arang batu di Malaysia telah meningkat daripada 0.08 juta tan metrik pada tahun 1980 ke 24.6 juta tan metrik pada tahun 2012. Jumlah penggunaan arang batu untuk penjanaan tenaga elektrik di Malaysia dijangka meningkat kepada 36 juta tan metrik pada tahun 2020.

# Energy Mineral

## Coal Resource Evaluation

Coals in Malaysia are present in the Tertiary basins in all three geographical provinces, viz. Sarawak, Sabah and Peninsular Malaysia. However, most of the coal resources are located in the states of Sabah and Sarawak. As at the end of 2014, total coal resources in Malaysia stood at 1863 million tonnes, of which 1502 million tonnes or 80.6% were located in Sarawak, 344 million tonnes or 18.5% in Sabah, and the remaining 0.9% in Peninsular Malaysia. The coals range from subbituminous to anthracite in rank.

Currently, opencast coal mining is actively being carried out in the Merit-Pila, Mukah and Balingian coalfields, while underground mining is being carried out in the Silantek coalfield, producing about 3 million tonnes of coal per year. Most of the coal produced is consumed by the power generation plants besides cement, as well as iron and steel manufacturing industries.

At present, there are six coal-fired power generation plants in operation namely the 1600 MW Sultan Salahuddin Abd Aziz Power Plant in Kapar, Selangor; the 210 MW Sejingkat Power Plant in Kuching, and the 270 MW Mukah Power Plant in Mukah, Sarawak; the 2100 MW Manjong Power Plant in Manjong, Perak; the 2100 MW Tanjong Bin Power Plant in Johor; as well as the 1400 MW Jimah Power Plant in Port Dickson, Negeri Sembilan, with a total power generation capacity of 7680 MW.

Coal consumption in Malaysia rose from 0.08 million tonnes in 1980 to 24.6 million tonnes in 2012. The total coal consumption for electricity generation in Malaysia is projected to increase to 36 million tonnes in year 2020.



Penilaian sumber arang batu telah dilaksanakan di Sabah dan Sarawak yang masing-masing meliputi jumlah keluasan 100 km<sup>2</sup> dan 80 km<sup>2</sup>. Eksplorasi arang batu di Sabah melibatkan penilaian sumber di blok Serudong di Tawau dan blok Lambunan di Sandakan. Kajian telah berjaya mengenalpasti dua lipit arang batu di blok Serudong dan tiga lipit arang batu di blok Lambunan dengan jumlah sumber sebanyak 9.58 juta tan metrik. Ujian makmal menunjukkan darjat arang batu di blok Serudong adalah *high volatile A bituminous*, manakala di blok Lambunan, berjulat dari *high volatile C bituminous* hingga *high volatile A bituminous*.

Di Sarawak, kajian arang batu telah dilaksanakan di blok Tunoh di kawasan Pergunungan Hose, Kapit dan blok Melikin, Serian. Sebanyak 33 singkapan arang batu dengan ketebalan berjulat dari 0.13 m hingga 2.30 m telah ditemui di blok Tunoh, sementara 8 singkapan arang batu dengan ketebalan berjulat dari 0.2 m hingga 1.6 m telah ditemui di blok Melikin. Satu lipit arang batu dengan anggaran sumber 34 juta tan metrik telah dikenal pasti di blok Tunoh. Ujian makmal menunjukkan darjat arang batu *high volatile C bituminous* di blok Tunoh, kawasan Pergunungan Hose di Kapit, manakala di blok Melikin, adalah berdarjat *low volatile bituminous*.

Coal evaluation was carried out in Sabah and Sarawak covering a total area of 100 km<sup>2</sup> and 80 km<sup>2</sup> respectively. Coal exploration in Sabah involved the assessment of coal resources in the Serudong block in Tawau and the Lambunan block in Sandakan. The study has successfully established two coal seams at the Serudong block and three coal seams at the Lambunan block with a total resource of 9.58 million tonnes. Laboratory analyses show that coal at the Serudong block is of high volatile A bituminous rank, while coal in the Lambunan block ranges from high volatile C bituminous to high volatile A bituminous in rank.

In Sarawak, coal exploration was conducted in the Tunoh block in the Hose Mountains area, Kapit and Melikin block, Serian. Thirty three coal outcrops ranging in thickness from 0.13 m to 2.30 m were found in the Tunoh block, while eight coal outcrops ranging in thickness from 0.2 m to 1.6 m were found in the Melikin block. One coal seam with an estimated resource of 34 million tonnes has been identified in the Tunoh block. Laboratory tests indicate that coal at the Tunoh block is of high volatile C bituminous in rank, whereas in the Melikin block, it is of low volatile bituminous rank.

#### Arang batu / Coal

Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Darjat Rank	Penemuan Findings
Sabah	Blok Serudong, Tawau	60	<i>High volatile A bituminous</i>  <i>High volatile A bituminous</i>	Dua lipit arang batu dengan anggaran sumber sebanyak 3.02 dan 0.50 juta tan metrik masing-masing telah dikenal pasti. <i>Two coal seams, with an estimated resource of 3.02 and 0.50 million tonnes respectively, have been identified.</i>
	Blok Lambunan, Sandakan	40	Berjulat dari <i>high volatile C bituminous</i> hingga <i>high volatile A bituminous</i>  <i>Ranging from high volatile C bituminous to high volatile A bituminous</i>	Tiga lipit arang batu dengan anggaran sumber sebanyak 1.42, 1.00 dan 3.64 juta tan metrik masing-masing telah dikenal pasti.  <i>Three coal seams, with an estimated resource of 1.42, 1.00 and 3.64 million tonnes respectively, have been identified.</i>

Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Darjat Rank	Penemuan Findings
Sarawak	Blok Tunoh, Pergunungan Hose, Kapit	60	High volatile C bituminous	33 singkapan arang batu dengan ketebalan berjulat dari 0.13 m - 2.30 m telah ditemui. Satu lipit arang batu dengan anggaran sumber sebanyak 34 juta tan metrik telah dikenal pasti.
			High volatile C bituminous	33 coal outcrops, ranging in thickness from 0.13 m - 2.30 m, were found. One coal seam with an estimated resource of 34 million tonnes has been identified.
	Melikin, Serian	20	Low volatile bituminous	Lapan singkapan arang batu berketebalan di antara 0.2 m - 1.6 m telah ditemui.
			Low volatile bituminous	Eight coal outcrops, ranging in thickness from 0.2 m - 1.6 m, were found.
Jumlah / Total:		4	180	

**Penilaian sumber arang batu di Tunoh, Kapit, Sarawak**  
**Evaluation of coal resources in Tunoh, Kapit, Sarawak**



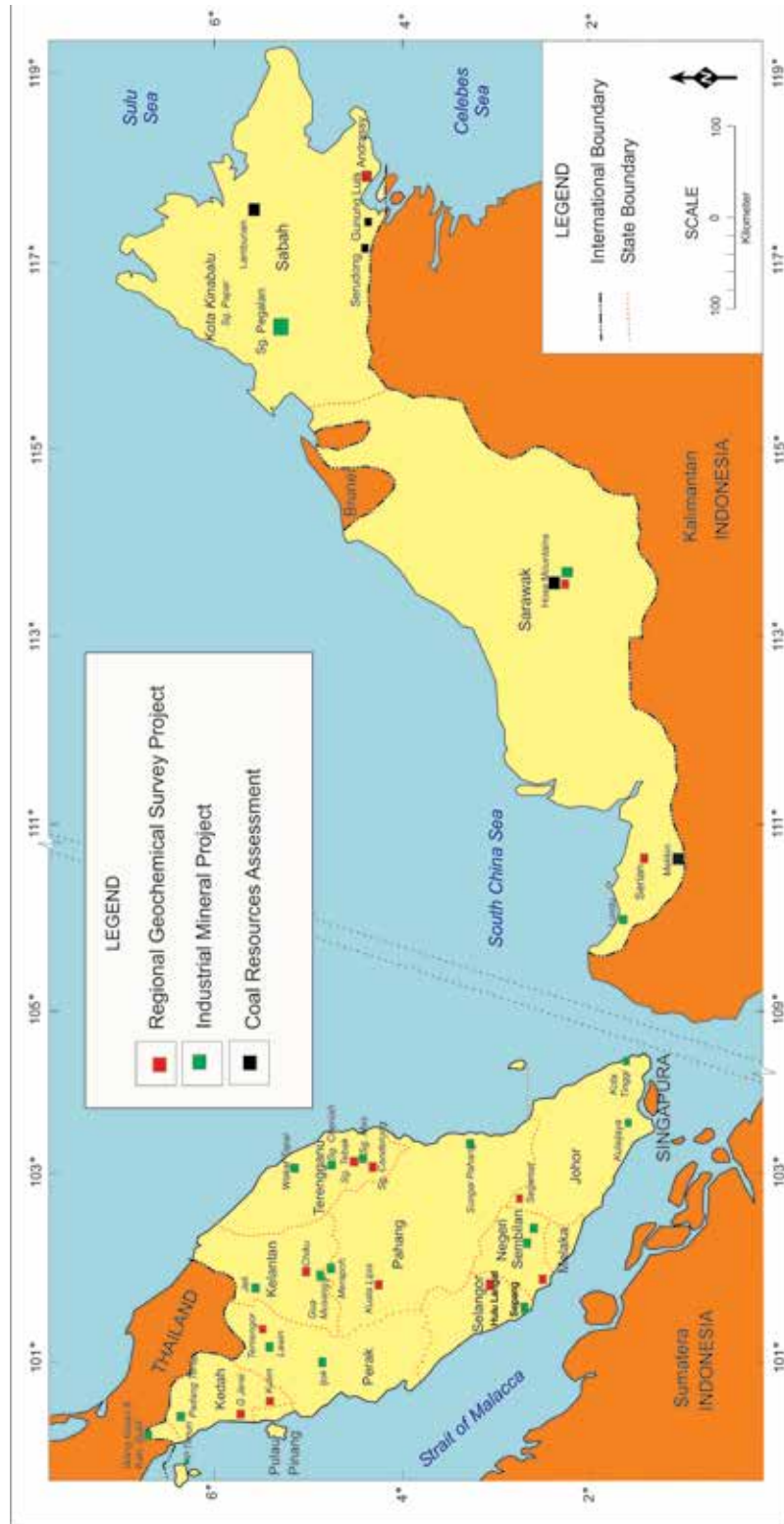
Photo: Julia Kaya

Lapisan arang batu berketebalan 1.10 m  
A 1.10 m thick coal bed



Photo: Julia Kaya

Lapisan arang batu berketebalan 70 cm  
A 70 cm thick coal bed



**Aktiviti Mineral 2014**  
**Mineral Activities 2014**



# Mineral Strategik

## Eksplorasi Unsur Nadir Bumi Berat

Sejak tahun 2014, projek eksplorasi mineral unsur nadir bumi berat (HREE) telah dilaksanakan di empat buah negeri, iaitu di Negeri Sembilan, Pahang, Perak dan Terengganu. Projek ini merupakan projek usaha sama antara Jabatan Mineral dan Geosains Malaysia dan Akademi Sains Malaysia. Projek ini bertujuan untuk mencari unsur nadir bumi berat yang terkandung dalam monazit ( $(\text{Ce},\text{La},\text{Y},\text{Th})\text{PO}_4$ ), alanit ( $(\text{Ca},\text{Ce},\text{Th})_2(\text{Al},\text{Fe},\text{Mg})_3\text{Si}_3\text{O}_{12}(\text{OH})$ ), basnesit ( $(\text{Ce},\text{Th},\text{La},\text{Y},\text{Ca})(\text{CO}_3)\text{F}$ ), euxenit ( $(\text{Y},\text{Ca},\text{Er},\text{La},\text{Ce},\text{U},\text{Th})(\text{Nb},\text{Ta},\text{Ti})_2\text{O}_6$ ), dan xenotim ( $\text{YPO}_4$ ).

# Strategic Minerals

## Heavy Rare Earth Elements Exploration

Started in 2014, heavy rare earth elements (HREE) exploration project has been conducted in four states, namely Negeri Sembilan, Pahang, Perak and Terengganu. The project is a collaborative effort between the Minerals and Geoscience Department Malaysia and the Academy of Sciences Malaysia. This project is aimed at finding heavy rare earth elements contained in monazite ( $(\text{Ce},\text{La},\text{Y},\text{Th})\text{PO}_4$ ), allanite ( $(\text{Ca},\text{Ce},\text{Th})_2(\text{Al},\text{Fe},\text{Mg})_3\text{Si}_3\text{O}_{12}(\text{OH})$ ), bastnaesite ( $(\text{Ce},\text{Th},\text{La},\text{Y},\text{Ca})(\text{CO}_3)\text{F}$ ), euxenite ( $(\text{Y},\text{Ca},\text{Er},\text{La},\text{Ce},\text{U},\text{Th})(\text{Nb},\text{Ta},\text{Ti})_2\text{O}_6$ ), and xenotime ( $\text{YPO}_4$ ).

### Unsur nadir bumi berat Heavy rare earth elements

Negeri State	Kawasan Area	Bil. tapak No. of site	Penemuan Findings
Negeri Sembilan	Titi, Kongkoi & Jelebu (Kuala Kelawang)	26	Survei tinjauan rantau. Sampel dalam proses analisis. Regional reconnaissance survey. Samples are still being analyzed.
Pahang	Kawasan Raub-Bentong-Karak Raub-Bentong-Karak area	45	
	Kawasan Bakapor Bakapor area		
	Kawasan Gambang-Sg. Lembing Gambang-Sg. Lembing area		
Perak	Daerah Kinta, Kampar, Kuala Kangsar, Larut Matang dan Selama, Manjung, dan Batang Padang Kinta, Kampar, Kuala Kangsar, Larut Matang and Selama, Manjung, and Batang Padang District	50	
Terengganu	Pluton granit di negeri Terengganu Granite pluton in the state of Terengganu	15	



Photo: Masrita Mohd. Aras

Persampelan tanah di Titi, Negeri Sembilan  
Soil sampling in Titi, Negeri Sembilan



Photo: Masrita Mohd. Aras

Persampelan tanah di Kampung Sg. Rotan, Trong, Perak  
Soil sampling in Kampung Sg. Rotan, Trong, Perak

## Ekonomi Mineral

Jabatan juga telah dipertanggungjawabkan untuk menyebarkan informasi mineral dalam negara. Seperti tahun-tahun sebelumnya, JMG menerbitkan lima laporan, iaitu *Malaysian Minerals Yearbook*, *Industrial Mineral Production Statistics and Directory of Producers in Malaysia*, *Malaysian Mining Industry*, *Malaysian Mineral Trade Statistics* dan *Review of Mineral-Based Industries in Malaysia*. JMG telah menyebarkan laporan tersebut kepada pemegang taruh, kedutaan luar, pengusaha industri, dan agensi-agensi lain yang berkaitan. Selain daripada tugas rutin ini, JMG juga menjalankan kajian komoditi mineral berkenaan kebergantungan terhadap mineral yang diimport di bawah Rancangan Malaysia Ke-10.

Tahun 2014 menyaksikan JMG terus memberi input berkala mengenai status sektor mineral kepada Kementerian Sumber Asli dan Alam Sekitar (NRE), dan agensi-agensi kerajaan yang lain. Di antara data yang dibekalkan adalah laporan industri perlombongan kepada Bank Negara, laporan data perusahaan perlombongan kepada Jabatan Perangkaan, laporan pengeluaran bijih timah kepada Lembaga Timah, laporan pelaburan swasta kepada MIDA, serta laporan data pengeluaran arang batu, batu kapur serta serbuk kapur kepada Malaysian Green Technology Corporation (dahulu dikenali sebagai Pusat Tenaga Negara). Antara lain, input ini bertujuan untuk pengiraan sumbangan sektor perlombongan kepada ekonomi negara oleh Bank Negara. Informasi ini juga digunakan untuk memformulasiimbangan tenaga negara, serta mengemaskinikan data inventori *greenhouse gas* (GHG) oleh Malaysian Green Technology Corporation. JMG telah mengedarkan sejumlah 720 naskah laporan berkala Statistik Bulanan Industri Perlombongan Malaysia kepada semua pejabat JMG negeri, dan agensi-agensi lain yang berkaitan.

JMG terus memainkan peranannya sebagai pusat rujukan bagi harga komoditi mineral. Tahun 2014 telah memberi cabaran kepada JMG dalam kompilasi harga komoditi mineral di mana harga komoditi mineral sentiasa berubah, terutamanya harga emas dan bijih besi. Selain menjawab pertanyaan dari pihak industri, JMG juga menyediakan laporan mingguan harga komoditi mineral yang didagangkan di Kuala Lumpur Tin Market (KLTM) dan London Metal Exchange (LME) kepada Mesyuarat Pasca-Kabinet di Kementerian Sumber Asli dan Alam Sekitar.

## Mineral Economics

The department is tasked with dissemination of mineral information in the country. As in previous years, JMG 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*. JMG distributed these reports to stakeholders, foreign embassies, industry players and other related agencies. Apart from these routine activities, JMG also conducted mineral commodity studies for mineral import reliance under the Tenth Malaysia Plan period.

The year 2014 saw JMG continuing 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 government agencies. Among the data that were supplied were mining industry reports to the Central Bank and the Statistics Department, tin ore production reports to the Tin Board, private investment reports to MIDA, as well as coal, limestone and lime production reports to the Malaysian Green Technology Corporation (formerly known as Pusat Tenaga Negara). The inputs were used, among other purposes, to calculate the contribution of the mineral sector to the country's economy by the Central Bank. The information was also used in the formulation of the national energy balance and in updating greenhouse gas (GHG) inventory data by the Malaysian Green Technology Corporation. JMG distributed 720 copies of the monthly statistics report on the Mining Industry in Malaysia to the state JMG offices, and other relevant agencies.

JMG continued to play its role as the reference centre for prices of mineral commodities. The year 2014 had been a challenging year for JMG in compiling mineral prices due to the fluctuations of mineral prices, especially for gold and iron ore. Besides answering enquiries from the industries, JMG also provided weekly reports on the prices of mineral commodities traded in the Kuala Lumpur Tin Market (KLTM) and the London Metal Exchange (LME) to the post-cabinet meetings in NRE.

Peranan JMG dalam menyalurkan input berkaitan industri mineral meliputi peringkat antarabangsa di mana informasi berkenaan industri mineral yang telah disediakan oleh JMG digunakan oleh kerajaan dalam misi pelaburan dan forum seperti Perjanjian Dagangan Bebas dan Pertubuhan Dagangan Dunia. Input JMG telah digunakan untuk formulasi perjanjian dalam mesyuarat dagangan dua hala dan kerjasama antarabangsa. Dalam hubungan ini sejumlah 9 nota ikhtisar negara telah disediakan dalam tahun 2014.

Di peringkat ASEAN, pegawai kanan JMG telah menghadiri mesyuarat dan bengkel seperti di bawah:

- i) *5th China-ASEAN Mining Cooperation Forum and Exhibition* (Nanning, China)
- ii) *11th ASOMM Working Group Meeting* (Siem Reap, Kemboja)
- iii) *7th ASOMM + 3 (ASEAN + China, Jepun & Korea)* (Siem Reap, Kemboja).
- iv) *Seminar on Mining Business and Investment Opportunities of the Rare Earth Minerals and Seminar on Reclamation, Mine Closure and Minerals Conservation* (Bali, Indonesia).
- v) *Workshop on ASEAN Mineral Database and Information System* (Tsukuba, Japan)
- vi) *Advanced Workshop on ASEAN Mineral Database and Information System* (Bali, Indonesia).

Dalam kerjasama dua hala di antara Malaysia-Indonesia, JMG bertindak sebagai urusetia dalam penganjuran mesyuarat di peringkat jawatankuasa pemandu untuk memastikan kelancaran pelaksanaan program-program teknikal yang telah dipersetujui oleh kedua-dua negara. Dalam hubungan ini, JMG telah berjaya menganjurkan mesyuarat berkenaan kerjasama saintifik dan teknikal dalam bidang geologi dan sumber mineral di antara Malaysia dan Indonesia, iaitu *Technical Working Groups (TWG)* dan *the 5th Steering Committee Meeting on Scientific and Technical Cooperation in the Field of Geology and Mineral Resources*, di Hotel Hatten, Bandar Hilir, Melaka pada 22-26 September 2014. JMG juga terlibat dalam pelaksanaan aktiviti-aktiviti di bawah TWG seperti kerja lapangan dan mesyuarat penyelarasan untuk aktiviti korelasi geologi, bencana geologi, air tanah, geologi alam sekitar, sumber mineral dan tenaga serta geo-warisan.

The role of JMG in supplying inputs on mineral industry extended to the global arena where information on the mineral industry prepared by JMG was used by the government in trade missions and in forums, such as the Free Trade Agreement and the World Trade Organisation. JMG's input was used in the formulation of agreements in meetings concerned with bilateral trade and international cooperation. In this context, a total of 9 country briefs were prepared in 2014.

At the ASEAN level, senior officers of JMG attended the following meetings and workshops:

- i) *5th China-ASEAN Mining Cooperation Forum and Exhibition* (Nanning, China)
- ii) *11th ASOMM Working Group Meeting* (Siem Reap, Cambodia)
- iii) *7th ASOMM + 3 (ASEAN + China, Japan & Korea)* (Siem Reap, Cambodia).
- iv) *Seminar on Mining Business and Investment Opportunities of the Rare Earth Minerals and Seminar on Reclamation, Mine Closure and Minerals Conservation* (Bali, Indonesia).
- v) *Workshop on ASEAN Mineral Database and Information System* (Tsukuba, Japan)
- vi) *Advanced Workshop on ASEAN Mineral Database and Information System* (Bali, Indonesia).

In bilateral cooperation between Malaysia-Indonesia, JMG acts as the secretariat in organising meetings at the steering committee level to oversee the smooth implementation of technical programmes agreed upon by both countries. In this regard, JMG successfully conducted the meeting on *Scientific and Technical Cooperation in the field of Geology and Mineral Resources between Malaysia & Indonesia*, namely the *Technical Working Groups (TWG)* and the *5th Steering Committee Meeting on Scientific and Technical Cooperation in the Field of Geology and Mineral Resources*, which was held in Hatten Hotel, Bandar Hilir, Melaka on 22-26 September 2014. JMG was also involved in the implementation of activities under TWG such as fieldwork and meeting coordination on geological correlation, geological hazard, groundwater, environmental geology, mineral and energy resources, as well as geoheritage.



JMG secara berterusan membantu dan bekerjasama dengan NRE dalam urusan berkaitan pembangunan mineral, terutamanya dalam kajian impak Dasar Mineral Negara 2 (DMN 2). Pegawai JMG juga terlibat dalam penyediaan kertas strategik sektor mineral dan geosains di bawah RM Ke-11. Jabatan ini adalah anggota tetap Jawatankuasa Persediaan Rundingan (Intergovernmental Negotiating Committee) Konvensyen Merkuri, *Task Force* Pasir Kebangsaan dan *Industry Standards Committee (ISC W) on Occupational Safety and Health* yang bermesyuarat di SIRIM sebanyak 2 kali setahun.

Untuk mengekalkan hubungan jabatan dengan pihak industri, pegawai JMG secara berterusan melakukan lawatan kerja ke lombong-lombong dan juga industri berasaskan mineral dalam negara untuk mengumpul maklumat berkaitan dengan pembangunan dan penggunaan bahan mineral serta produk-produk hiliran berasaskan mineral yang dihasilkan. Dalam tahun 2014, lawatan telah dilakukan ke 7 industri berasaskan mineral, 11 lombong dan satu kuari. Dalam tempoh yang sama JMG juga telah menerima sejumlah 38 pertanyaan berkenaan mineral dari dalam dan luar negara.

JMG continued to assist and cooperate with NRE in matters relating to the development of the minerals sector, especially the Impact Study on National Mineral Policy 2. JMG officers were also involved in the preparation of strategic paper on mineral and geoscience sectors under the Eleventh Malaysian Plan. The department is a permanent member of Intergovernmental Negotiating Committee for Mercury Convention, National Sand Task Force and Industry Standards Committee (ISC W) on Occupational Safety and Health which hold meetings in SIRIM twice a year.

To maintain good rapport with the industry, JMG officers continually made working visits to various mines and mineral-based industries in the country to collect information related to the development and utilization of minerals, as well as the production of value-added downstream mineral products. In 2014, JMG officers visited 7 mineral-based industries, 11 mines and one quarry. During the same period, JMG received 38 enquiries on minerals from within the country and abroad.



Lawatan ke pengeluar serbuk kalsium termendak  
Schaefer Kalk (M) Sdn. Bhd., Kuala Ketil, Kedah  
Visit to precipitated calcium carbonate producer Schaefer  
Kalk (M) Sdn. Bhd., Kuala Ketil, Kedah



Lawatan ke Malaysian Smelting Company Bhd.  
(MSC), Perai, Pulau Pinang  
Visit to Malaysian Smelting Company Bhd. (MSC),  
Perai, Pulau Pinang

## Penerbitan Berkaitan Mineral Mineral-Related Publications



Lima laporan yang diterbitkan oleh JMG setiap tahun  
The five reports published every year by JMG



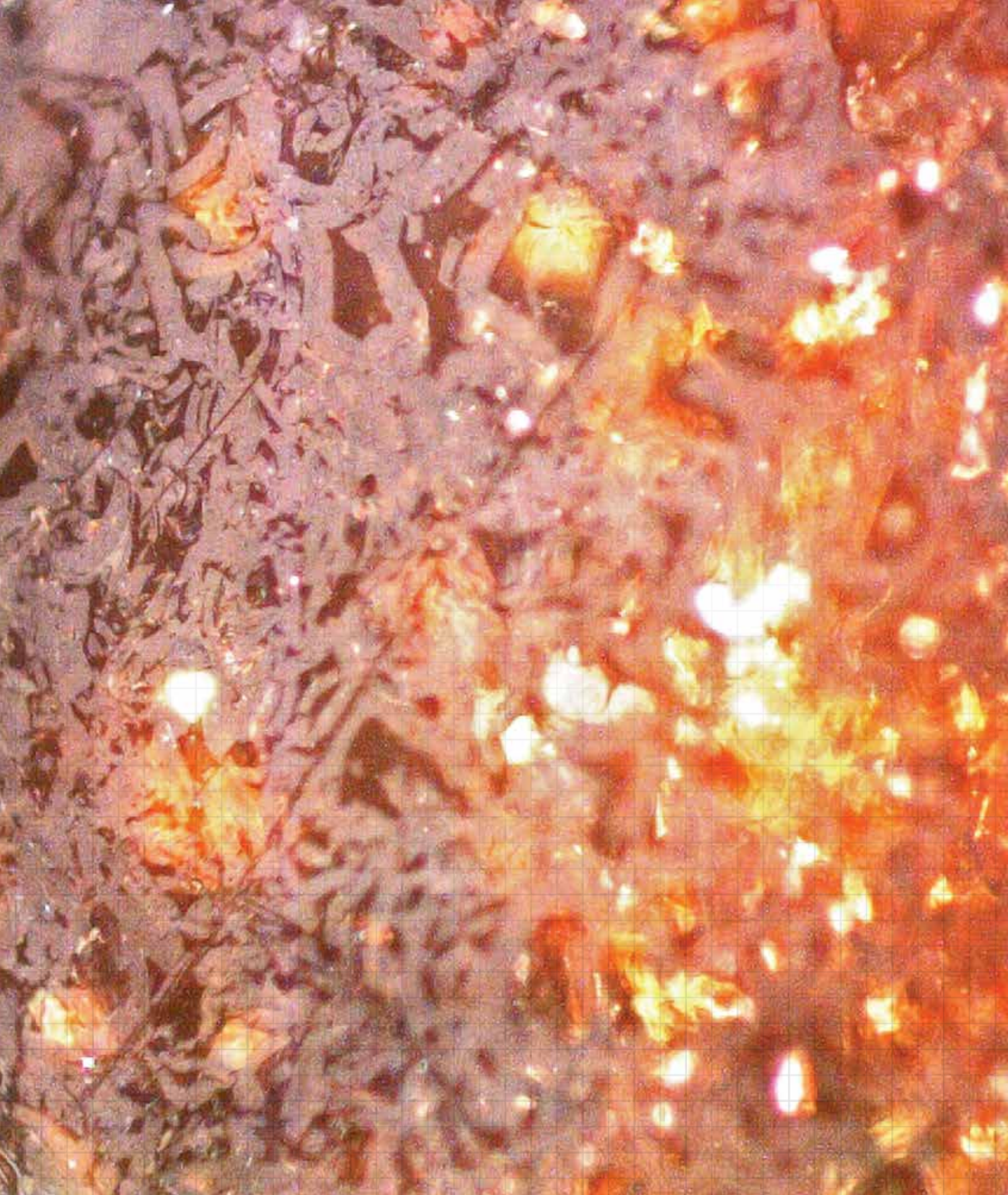
## Khidmat Nasihat Mineral

Berbagai khidmat nasihat telah diberikan kepada pihak berkuasa negeri dan swasta berkenaan dengan ulasan guna tanah dan pembebasan mineral. Pertanyaan daripada pelanggan berkaitan maklumat mineral juga telah dilayani sama ada secara lisan atau ulasan bertulis.

## Mineral Advisory Services

Various advisory services were rendered to the state authorities as well as the private sector concerning land use and mineral clearance reviews. Enquiries on mineral information from various interested sectors or individuals were attended to either verbally or in writing.

Negeri State	Jenis khidmat nasihat Type of advisory services		
	Ulasan guna tanah Land use review (bil. / no.)	Ulasan pembebasan mineral Mineral clearance review (bil. / no.)	Pertanyaan Enquiries (bil. / no.)
Ibu Pejabat / Headquarters	-	-	38
Johor	93	125	25
Negeri Sembilan	194	-	21
Melaka	-	-	-
Selangor	-	17	1
Wilayah Persekutuan	-	-	-
Perak	289	4	1
Kedah	31	-	14
Pulau Pinang	6	-	-
Perlis	18	1	-
Kelantan	3	39	5
Terengganu	42	-	33
Pahang	37	20	3
Sarawak	3	2	13
Sabah	153	-	-
Jumlah / Total:	869	208	154







# AKTIVITI GEOSAINS GEOSCIENCE ACTIVITIES

Fotomikrograf menunjukkan pengumpulan calitan minyak cerah dan berwarna-warni yang merupakan hidrokarbon janaan awal hasil penceraian suberinit di arang batu subbitumen C Balingian dari Sarawak (cahaya putih pantulan di bawah rendaman minyak).

Photomicrograph showing accumulation of bright and colourful oil smears of early generated hydrocarbons as a result of disintegration of suberinite from the subbituminous C Balingian coal of Sarawak (reflected white light under oil immersion).

Photo: Sia Say Gee

## AKTIVITI GEOSAINS

Aktiviti geosains yang merupakan bahagian bersepadu JMG telah dilaksanakan oleh jabatan untuk menyediakan maklumat geologi yang berguna dalam bidang seperti pemetaan geologi, warisan geologi, hidrogeologi, geologi kejuruteraan, geologi alam sekitar dan geologi marin. Maklumat geosains yang berkualiti serta memenuhi kehendak pemegang taruh dan pelanggan adalah input penting yang diperlukan dalam perancangan guna tanah bagi mencapai pembangunan mampan, mengurangkan risiko bencana dan memelihara alam sekitar.

Pemetaan geologi dijalankan bagi mengumpul maklumat asas geologi yang amat diperlukan dalam kerja-kerja carigali sumber mineral, perancangan guna tanah dan juga untuk menentukan kesesuaian tapak untuk pembangunan. Pemetaan warisan geologi pula dapat menilai dan memelihara tapak geologi yang berpotensi sebagai tapak warisan negara untuk dipromosikan sebagai kawasan geopelancongan serta kelestarian alam sekitar.

Maklumat hidrogeologi adalah penting dalam pengurusan sumber air tanah bagi memastikan ia dapat terus digunakan sebagai bekalan air negara, manakala maklumat pemetaan geobencana dan penilaian risiko bencana, terutamanya di kawasan perbandaran dan penempatan, amat berguna kepada pihak berkuasa tempatan dalam merancang pembangunan yang lebih sistematik.

## GEOSCIENCE ACTIVITIES

Geoscience activities, being an integrated part of JMG, are carried out to gather useful geological information in the field of geological mapping, geological heritage, hydrogeology, engineering geology, environmental geology and marine geology. Quality geosciences information, which meets the needs of stakeholders and clients, provides vital input needed in land use planning for sustainable development, reduces risks of disasters and protects the environment.

Geological mapping is carried out to collect basic geological information that is very much needed in the exploration of mineral resources and land use planning, as well as to determine suitability for site development. Geological heritage mapping is carried out to assess and conserve potential geological sites as national heritage while promoting geotourism and environmental sustainability.

Hydrogeological information is important in the management of groundwater resources to ensure groundwater resource remains available for the nation's water supplies, while information from geohazard mapping and disaster risk assessment, especially in the urban and settlement areas, helps the local authorities in systematic development planning.



## Pemetaan Geologi

Kerja pemetaan geologi yang dijalankan setakat ini telah meliputi 87.10% kawasan Semenanjung Malaysia, 28.51% kawasan Sabah dan 30.23% kawasan Sarawak. Di Semenanjung Malaysia, pemetaan geologi yang dilaksanakan di Johor, Kelantan, Negeri Sembilan, Pahang dan Terengganu pada tahun 2014 meliputi kawasan seluas 777 km<sup>2</sup>. Pemetaan geologi juga telah dilaksanakan di kawasan seluas 450 km<sup>2</sup> di Sabah dan 305 km<sup>2</sup> di Sarawak.

Pemetaan geologi sempadan Malaysia-Indonesia, dikenali sebagai Korelasi Geologi Kawasan Sintang-Silantek di antara Malaysia (Sarawak) dan Indonesia (Kalimantan), diteruskan. Kerja lapangan untuk pengumpulan data dan verifikasi telah diadakan di kawasan Batu Lintang dan Lubok Antu, Sarawak, Malaysia dan Badau, Kalimantan Barat, Indonesia. Mesyuarat Tahunan Kumpulan Kerja Teknikal (TWG) dan Mesyuarat Kali Kelima Jawatankuasa Pemandu Kerjasama Saintifik dan Teknikal dalam Bidang Geologi dan Sumber Mineral di antara JMG dan Agensi Geologi Indonesia (GAI) telah diadakan di Melaka.

Projek Penyiasatan Bersama Geologi Sempadan Malaysia-Thailand telah dilaksanakan pada tahun 2000 di bawah payung the Malaysia-Thailand Border Joint Geological Survey Committee (MT-JGSC), melibatkan kerjasama teknikal dalam bidang geosains dan mineral di antara Jabatan Mineral dan Geosains Malaysia dan Department of Mineral Resources Thailand. Ia bertujuan untuk menyelaraskan sempadan geologi serta korelasi unit-unit batuan di kawasan sempadan kedua-dua negara. Dua projek yang telah siap pada tahun 2014 ialah:

- i. Korelasi stratigrafi di antara Formasi Kubang Pasu / Yaha, dan
- ii. Pengumpulan data berkaitan bencana geologi di sepanjang sempadan Malaysia-Thailand.

Kajian korelasi stratigrafi di antara unit batuan Formasi Kubang Pasu di Malaysia dengan Formasi Yaha di Thailand telah mengesahkan bahawa kedua-dua formasi ini mempunyai jenis batuan dan usia geologi yang sama.

Kajian semula bencana geologi di sepanjang sempadan Malaysia - Thailand telah dijalankan untuk mengumpul data sedia ada mengenai kejadian bencana geologi yang pernah berlaku di kawasan sempadan kedua-dua negara.

## Geological Mapping

Geological mapping conducted has thus far covered 87.10% of Peninsular Malaysia, 28.51% of Sabah, and 30.23% of Sarawak. In Peninsular Malaysia, geological mapping that was carried out in 2014 covered a total area of 777 km<sup>2</sup> in Johor, Kelantan, Negeri Sembilan, Pahang and Terengganu. Geological mapping was also completed over an area of 450 km<sup>2</sup> in Sabah, and 305 km<sup>2</sup> in Sarawak.

The Malaysia-Indonesia border area geological mapping, known as the Geological Correlation of the Sintang-Silantek Area between Malaysia (Sarawak) and Indonesia (Kalimantan), continued. Fieldtrips for data collection and verification were carried out at the Batu Lintang and Lubok Antu, Sarawak, Malaysia and Badau, West Kalimantan, Indonesia. The Annual Technical Working Group (TWG) and the Fifth Steering Committee Meeting on Scientific and Technical Cooperation in Geology and Mineral Resources was held in Melaka between the Minerals and Geoscience Department Malaysia and the Geological Agency Indonesia.

The Malaysia-Thailand Border Joint Geological Survey Project, implemented in 2000 under the umbrella of the Malaysia-Thailand Border Joint Geological Survey Committee (MT-JGSC), involves technical cooperation in the field of geoscience and minerals between the Mineral and Geoscience Department Malaysia and the Department of Mineral Resources Thailand. It aims to harmonize the geological boundary and to correlate the rock units along the common border of both countries. The two projects completed in 2014 were:

- i. Stratigraphic correlation between the Kubang Pasu / Yaha Formation, and
- ii. Data compilation of geological hazards along the Malaysia-Thailand Border.

The study on the stratigraphic correlation of the Kubang Pasu Formation on the Malaysian side and Yaha Formation on the Thai side confirmed that the rock units are similar in terms of rock type and geological age.

A review of geological hazards along the Malaysia - Thailand border was conducted by compiling the existing data about geological disasters that had occurred along the border area of the two countries. The aim of this study was to understand the geological factors which caused the disasters. With such

Tujuan kajian ini adalah untuk memahami kejadian bencana yang telah berlaku disebabkan oleh faktor geologi. Dengan pemahaman ini, perancangan guna tanah akan dapat dilakukan dengan lebih berkesan dengan mengambil langkah-langkah yang sesuai untuk mengelakkan berulangnya insiden yang serupa.

Dua laporan yang telah disiapkan pada tahun 2012 dan diterbitkan pada tahun 2014, ialah:

- i. *Stratigraphic Correlation of the Singa-Khuan Klang Formation.*
- ii. *Litho- and Biostratigraphic Correlation of Chert Beds in Various Rock Units along the Malaysia-Thailand Border.*

an understanding, land use planning could be more effective through the adoption of appropriate measures to prevent recurrence of similar incidents.

Two reports that were completed in 2012 and published in 2014 were:

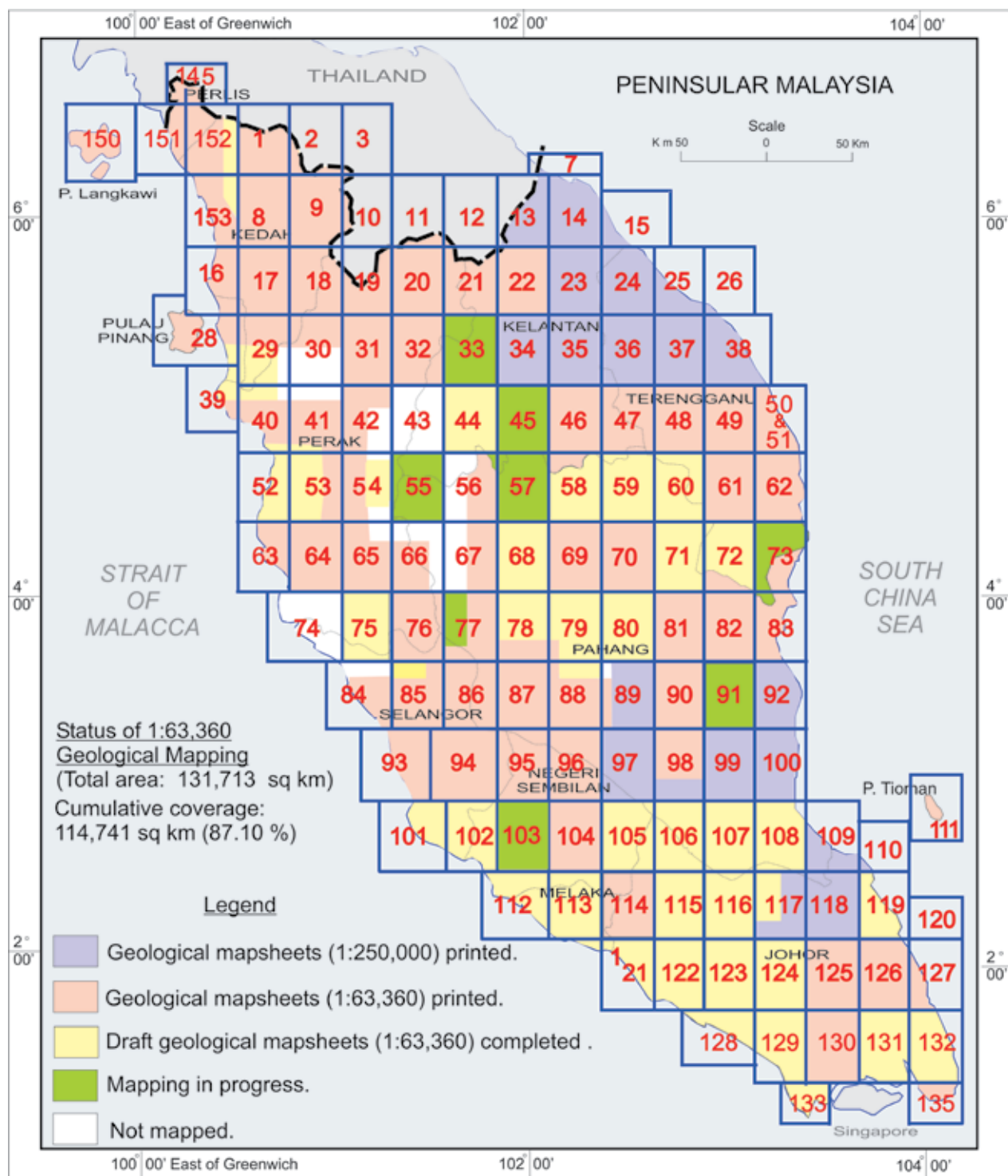
- i. *Stratigraphic Correlation of the Singa-Khuan Klang Formation.*
- ii. *Litho- and Biostratigraphic Correlation of Chert Beds in Various Rock Units along the Malaysia-Thailand Border.*

#### Pemetaan geologi Geological mapping

Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Penemuan / Catatan Findings / Remarks
Johor	Pulau Merambong	0.4	Terletak 300 m dari sempadan Malaysia-Singapura. Terdiri daripada selang lapis batuan syal, batu pasir halus dan batu lumpur (Formasi Semantan). Located 300 m from Malaysia-Singapore border. Consists of interbedded shale, fine sandstone and mudstone.
	Pulau Pisang, Pontian	1.3	Terdiri daripada batuan hornfels yang terlipat ketat dan bersentuhan dengan batuan diorit. Consists of tightly folded hornfels rocks in contact with diorites.
Kelantan	Gua Musang	100	Penentuan fasies dalam Formasi Gua Musang. Facies determination in the Gua Musang Formation.
Negeri Sembilan	Seremban - Lembar Peta 103	625	Lembar Peta 103 telah dibahagikan kepada 12 blok, dengan keluasan 125 km <sup>2</sup> setiap satu. Blok 1 hingga 5 telah siap dipetakan semula dan didapati terdapat perubahan di hampir kesemua sempadan litologi.
	Seremban - Map Sheet 103		Map Sheet 103 was divided into 12 smaller blocks of 125 km <sup>2</sup> each. Remapping of blocks 1 to 5 was completed with the results showing changes in almost all lithological boundaries.

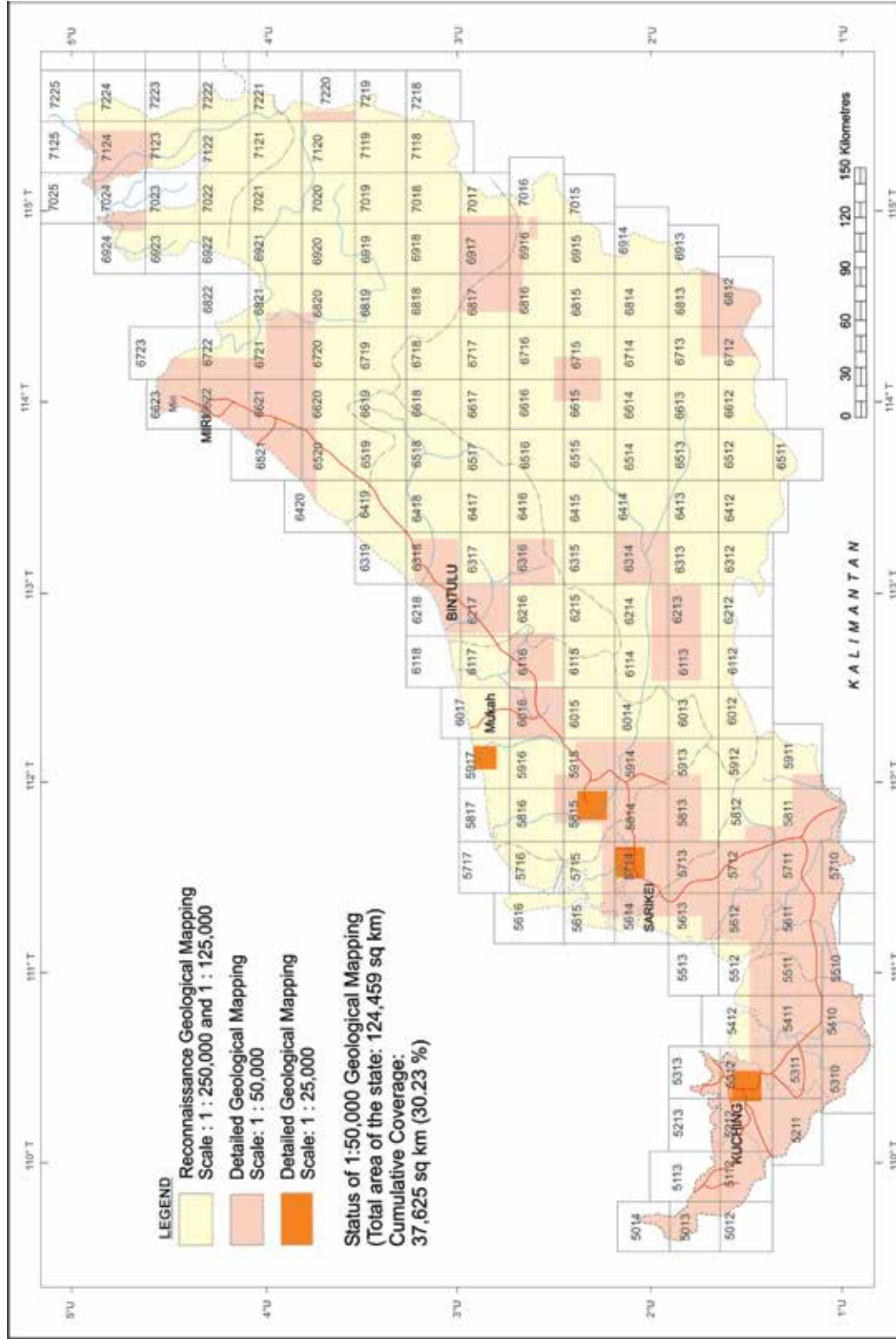


Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Penemuan / Catatan Findings / Remarks
Pahang	Pulau Manis – Lembar Peta 91  Pulau Manis – Map Sheet 91	30	Zon sesar ditemui berhampiran Institut Kemahiran Tinggi Belia Negara (IKBN) Paloh Hinai berkemungkinan unjuran zon Sesar Lepar di bahagian utara-barat laut kawasan kajian. Fault zone observed near IKBN Paloh Hinai is probably the extension of the Lepar Fault zone which is situated in the north-northwest of the study area.
Sabah	Tamparuli – Lembar Peta 7529 Tamparuli – Map Sheet 7529	450	Mengenal pasti litologi, stratigrafi, struktur dan sempadan formasi yang baru. Identification of new lithology, stratigraphy, structure and formation boundary.
Sarawak	Bario – Lembar Peta 7220 Bario – Map Sheet 7220	305	Pemetaan geologi pada skala 1:50,000. Tiga kerja lapangan meliputi 66% kawasan kajian telah dimulakan. Geological mapping of the Bario area on a scale of 1:50,000 has commenced, covering 66% of the study area.
Terengganu	Empangan Paya Peda, Hulu Besut		Fosil yang ditemui ialah bahagian daun dari genus Pecopteris sp, Tinggia sp, Lepidodendron sp, Sigillaria sp, Neurotepris sp, Lobatopteris sp dan Cordaites sp. Fosil tumbuhan yang dijumpai di Paya Peda merupakan himpunan yang hampir lengkap dan diklasifikasikan sebagai flora Cathaysia. Fossils discovered were the leafy part of Pecopteris sp, Tinggia sp, Lepidodendron sp, Sigillaria sp, Neurotepris sp, Lobatopteris sp and Cordaites sp. The plant fossil discovered at Paya Peda was almost complete and classified as Cathaysia flora.



**Status Pemetaan Geologi Semenanjung Malaysia 2014**  
**Status of Geological Mapping Peninsular Malaysia 2014**





Status Pemetaan Geologi Sarawak 2014  
Status of Geological Mapping Sarawak 2014







Fosil yang ditemui di kawasan Empangan Paya Peda, Besut, Terengganu. (A) *Sphenophyllum* sp., (B) *Lobatopteris* sp., (C) *Cordaites* sp., (D) *Archaeopteris* sp., (E) *Arteris Horizontalis* (*Cordaites* stem), (F) *Lepidostrobus* and (G) *Lepidodendron* sp. (Foto: Razaidi Shah)

Fossils found in the Paya Peda Dam area, Besut, Terengganu. (A) *Sphenophyllum* sp., (B) *Lobatopteris* sp., (C) *Cordaites* sp., (D) *Archaeopteris* sp., (E) *Arteris Horizontalis* (*Cordaites* stem), (F) *Lepidostrobus* and (G) *Lepidodendron* sp. (Photo: Razaidi Shah)

# Warisan Geologi

Kajian warisan geologi telah dijalankan bagi memastikan khazanah alam semulajadi yang sangat berharga dapat dipulihara bagi tatapan generasi akan datang. Menerusi kajian ini, konsep tapak terpelihara, monumen geologi, taman geologi dan lanskap berpemandangan indah dapat diperkenalkan kepada orang awam. Kajian kebolehlaksanaan bagi tapak warisan geologi telah dijalankan di tapak-tapak terpilih bagi cadangan penarafan sama ada sebagai geotapak, tapak warisan geologi kebangsaan atau geopark.

# Geological Heritage

Geological heritage studies were carried out to ensure that the wealth of nature would be conserved for future generations. Through these studies, the concept of preserved sites, geological monuments, geological parks and beautiful landscapes could be promoted and made known to the public. Feasibility studies for geological heritage sites were carried out at selected sites with the view to propose various locations as possible geosites, national geological heritage sites or geoparks.

## Pemetaan warisan geologi Geological heritage mapping

Negeri State	Kawasan Area	Status Status	Catatan / Remarks
Kedah	Bukit Larek, Pokok Sena	Tapak warisan geologi Geoheritage site	Tapak Terpelihara Geowarisan Bukit Larek: Rijang Beradiolaria.  Bukit Larek Geoheritage Conservation site of Radiolarian Chert.
	Padang Sanai	Tapak warisan geologi Geoheritage site	Tapak Terpelihara Geowarisan Padang Sanai: Debu Vulkanik.  Padang Sanai Geoheritage Conservation site of volcanic ash.
Pahang	Gua Batu Kapur Taman Negara Kuala Tahan, Jerantut.	Tapak warisan geologi  Geoheritage site	Lima gua batu kapur telah dikaji, iaitu Gua Kepayang Besar, Gua Kepayang Tengah, Gua Kepayang Kecil, Gua Daun Menari dan Gua Luas. Banyak speleotem seperti stalaktit, stalagmit, batu tirai dan tiang ditemui, terutamanya di Gua Kepayang Besar, Gua Kepayang Kecil dan Gua Kepayang Tengah.  Five limestone caves were studied, namely Gua Kepayang Besar, Gua Kepayang Tengah, Gua Kepayang Kecil, Gua Luas and Gua Daun Menari. Many speleothems such as stalactites, stalagmites, curtains and pillar stones were encountered, especially in Gua Kepayang Besar, Gua Kepayang Tengah and Gua Kepayang Kecil.



Negeri State	Kawasan Area	Status Status	Catatan / Remarks
	Sungai Tembeling, Taman Negara Kuala Tahan, Jerantut	Tapak warisan geologi  Geoheritage Site	Kajian tapak warisan geologi telah dilakukan di sepanjang Sg. Tembeling dari Kuala Tahan hingga ke Kuala Keniam. Terdapat banyak landskap geologi menarik dalam Formasi Mangkin berusia Jura-Kapur di sepanjang sungai seperti perlapisan hampir menegak batu pasir dan batu lodak, serta satah sesar dengan muka upam dalam batuan vulkanik.  Geoheritage study was conducted along Sg. Tembeling from Kuala Tahan to Kuala Keniam. There were a considerable number of notable geological landscapes in the Jurassic-Cretaceous Mangking Formation along the river, such as the subvertical bedding sandstone and siltstone, as well as the slickensided fault plane in the volcanic rocks.
Sarawak	Lembangan Sarawak, Kuching (Bako, Santubong, delta & pulau, Bau dan Pedawan) Sarawak Basin, Kuching	Cadangan Geopark Delta Sarawak  Proposed Sarawak Delta Geopark	Kertas cadangan bagi pengisytiharan Geopark telah dihantar ke Majlis Mesyuarat Kerajaan Negeri Sarawak pada bulan Ogos. JMG Sarawak telah terlibat dalam program Santubong Nature Festival pada bulan November sebagai salah satu program untuk memperkenalkan Geopark kepada orang ramai.  A proposal paper was submitted to the Sarawak State Cabinet in August. The department was also involved in the Santubong Nature Festival in November as one of the public awareness programmes. This would serve also as an initial approach to introducing the geopark to the public.
Terengganu	Ekspedisi Jura-Kapur 2014: Menjejak Dinosaur di kawasan Gunung Gagau Jurassic-Cretaceous Expedition 2014: Tracking the Dinosaur in the Gunung Gagau area	Tapak warisan geologi  Geoheritage Site	Fosil ditemui termasuk fosil gigi dan kesan tapak kaki dinosaur. Fosil gigi yang ditemui sebagai klasta dalam bongkah konglomerat menunjukkan ciri-ciri gigi dinosaur Iguanodon. Tiga jenis kesan tapak kaki dinosaur theropod, iguanodon dan sauropod juga ditemui.  Fossils discovered included tooth fossils and fossilised footprints of dinosaurs. Tooth fossils were found as clasts in conglomerate boulder and showed the characteristic of an Iguanodon dinosaur's teeth. Three types of footprints belonging to theropod, iguanodon and sauropod dinosaurs were also discovered.



Photo: Dony Adriansyah Nazaruddin (UMK)

Ekspedisi Jura-Kapur 2014: Menjejak Dinosaur di kawasan Gunung Gagau, Terengganu

Jurassic-Cretaceous Expedition 2014: Tracking the Dinosaur in the Gunung Gagau area, Terengganu



Photo: Mat Niza Abdul Rahman

Fosil gigi dinosaur iguanodontid ditemui dalam bungkah konglomerat

Tooth of the iguanodontid dinosaur found in a conglomerate boulder



Photo: Mat Niza Abdul Rahman

Tapak kaki dinosaur theropod ditemui di atas bungkah batu pasir

Theropod dinosaur footprints preserved on a sandstone boulder



Photo: Prof. Dr. Mohd Shafeea Leman (UKM)

Fosil kesan tapak kaki dinosaur iguanodontid ditemui di atas bungkah batu pasir

Fossilised footprint belongs to Iguanodontid dinosaur found on a sandstone boulder



Photo: Dony Adriansyah Nazaruddin (UMK)

Fosil kesan tapak kaki dinosaur iguanodontid ditemui di atas bungkah batu pasir

Fossil of iguanodontid dinosaur footprint found on a sandstone boulder



Photo: Prof. Madya Dr. Kamal Roslan Mohamed (UKM)

Fosil kesan tapak kaki dinosaur sauropod ditemui di atas bungkah batu pasir

Fossil of sauropod dinosaur footprints preserved on a sandstone boulder



## Hidrogeologi

Aktiviti hidrogeologi telah dijalankan oleh pejabat negeri bagi mendapatkan maklumat air tanah yang bertujuan untuk menilai potensi sumber air tanah dan untuk membekalkan air bersih kepada penduduk di kawasan yang sering menghadapi masalah bekalan air. Di samping itu, pihak jabatan juga menggalakkan penggunaan air tanah sebagai sumber air alternatif. Pada tahun 2014, sebanyak 55 telaga eksplorasi telah digerudi dan 23 telaga pengeluaran telah berjaya dibangunkan untuk sumber air.

Di bawah Projek Khas Bekalan Air, jabatan telah menyumbang kepakaran dalam bidang air tanah melalui kerjasama dengan pelbagai agensi kerajaan seperti Kementerian Tenaga, Teknologi Hijau dan Air Malaysia (KeTTHA), Kementerian Luar Bandar dan Wilayah (KKLW) serta beberapa agensi kerajaan negeri yang mengawalselia sumber air.

Jalinan kerjasama juga diadakan dengan pihak Jabatan Alam Sekitar bagi mengawal kebakaran kawasan tanah gambut yang sering berlaku pada musim kering. Penggerudian dan pembinaan telaga untuk tujuan memadam kebakaran di kawasan tanah gambut telah dijalankan oleh JMG di Johor, Kelantan, Pahang, Sarawak dan Selangor / Wilayah Persekutuan. Pihak JMG juga membantu pihak Kementerian Kesihatan dalam membuat perakuan terhadap permohonan pengeluaran air mineral di negeri-negeri.

Pemantauan air tanah telah dijalankan sepanjang tahun sebagai sebahagian daripada usaha Jabatan untuk memastikan sumber air bebas daripada pencemaran dan digunakan secara mampan. Program pemantauan yang dijalankan termasuk pengukuran paras air tanah, pengumpulan sampel untuk analisis makmal dan penyelenggaraan Sistem Penapisan Air Tanah Ringkas (SPATR). Data daripada kerja-kerja pemantauan yang dijalankan pada tahun 2014 ke atas 585 buah telaga tidak menunjukkan perubahan yang ketara berkaitan dengan paras air dan kualiti air.

Kerja pemodelan lembangan yang dijalankan di Lembangan Sungai Kelantan telah menghasilkan maklumat yang berguna dan penting berkaitan dengan kapasiti rizab air tawar dalam lembangan tersebut. Maklumat ini dapat membantu pihak berkuasa untuk perancangan masa hadapan dalam mengeksploitasi sumber air tanah.

## Hydrogeology

Hydrogeology activities were carried out by state offices to acquire data for the assessment of groundwater potential and to provide clean drinking water in water constraint areas. At the same time, the department also encourages the use of groundwater as an alternative water supply. A total of 55 exploration wells were drilled and 23 production wells were successfully developed for water resources in 2014.

Under the Water Supply Special Project, the department contributed its expertise through collaboration with various agencies, such as the Ministry of Energy, Green Technology and Water (KeTTHA), Ministry of Rural Development (KKLW) and various state agencies which manage water resources.

The department worked together with the Department of Environment to control peat fires which commonly occur during seasonal dry spells. Drilling and developing wells for fire-fighting in peat areas were carried out by JMG in Johor, Selangor / Wilayah Persekutuan, Kelantan, Pahang and Sarawak. JMG also assisted the Ministry of Health (KKM) in processing applications for the production of mineral water in the states.

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 2014 on 585 wells indicated that there were no significant changes pertaining to the water level and water quality.

The basin modelling project carried out in Kelantan River Basin yielded useful and important information pertaining to the capacity of freshwater reserves in that basin. This information would be crucial to the relevant authorities for future planning in the exploitation of groundwater resources.

## Pembangunan Air Tanah

### Groundwater Development

#### Penggerudian dan pembinaan telaga

#### Drilling and well construction

Negeri State	Lokasi Location	TE* EW*	TP* PW*	TM* MW*	Catatan Remarks
Johor	Kg. Tenglu, Mersing	-	1	-	Bagi membantu mengatasi masalah kekurangan bekalan air di kawasan Mersing. To overcome shortage of water supply in Mersing.
	Loji Rawatan Air Simpang Renggam	-	1	-	Bagi membantu mengatasi masalah pencemaran amonia dalam sumber bekalan air. To overcome ammonia contamination problems in the water supply.
Kedah	Madrasah Al-Quran, Pinang Jaya, Alor Setar	3	-	-	Ketiga-tiga lubang gerudi tidak menunjukkan potensi untuk air tanah. All three boreholes showed no potential for groundwater.
	Maahad Darul Hadis, Kg. Tok Keling, Alor Setar	1	-	-	Kapasiti telaga adalah 6.75 m <sup>3</sup> /j. Sepanjang kajian, air tanah adalah payau dari bahagian atas sehingga kedalaman 120 m, dan masin pada kedalaman 130 m hingga 150 m. Air telaga tidak berpotensi untuk kegunaan domestik. The well capacity was 6.75 m <sup>3</sup> /h. During the study, groundwater was observed to be brackish from the upper layer until 120 m and became saline from 130 m to 150 m. The tube well had no potential as a source of water for domestic consumption.
	Sekolah Menengah Agama As-Siddiqiah, Naka, Padang Terap	-	1	-	Kedalaman telaga adalah 104 m dengan luahan 51.6 m <sup>3</sup> /j. Telaga tiub adalah berpotensi dan akan dibangunkan untuk membekalkan air untuk kegunaan domestik. Depth of the well was 104 m and its yield was 51.6 m <sup>3</sup> /h. The tube well showed potential for development to supply water for domestic consumption.



Negeri State	Lokasi Location	TE* EW*	TP* PW*	TM* MW*	Catatan Remarks
Kelantan	Pasir Mas, Bachok, Pasir Puteh, Tumpat dan Kota Bharu	-	-	10	Telaga digunakan untuk pemantauan serta untuk kemaskini maklumat bagi model lembangan lapisan akuifer cetek. The wells were used for monitoring, and for updating information on the shallow basin aquifer model.
Melaka	Sungai Udang	-	1	-	Pembinaan telaga pengeluaran dengan kaedah pengejetan untuk membekal bekalan air alternatif kepada penduduk Sungai Udang semasa musim kering. Construction of a production well by jetting method to provide an alternative water supply to Sungai Udang residents during the dry season.
Negeri Sembilan	Ulu Chengkau, Rembau	-	1	-	Pembinaan telaga pengeluaran dengan kaedah pengejetan hingga kedalaman 10.8 m bagi membekalkan air sebanyak kira-kira 8 m <sup>3</sup> /j kepada Madrasah Az-Zaakiriin, Uu Chengkau, Rembau. Construction of production well with jetting method to a depth of 10.8 m for supplying water by about 8 m <sup>3</sup> /h to Madrasah Az-Zaakiriin, Ulu Chengkau, Rembau.
	Kuala Sawah, Seremban	-	1	-	Pembinaan telaga pengeluaran dengan kaedah pengejetan hingga kedalaman 5.7 m bagi membekalkan air sebanyak kira-kira 4.5 m <sup>3</sup> /j kepada Maahad Tahfiz Al-Quran Al-Falah, Kuala Sawah, Rantau. Construction of production well with jetting method to a depth of 5.7 meters for supplying water by about 4.5 m <sup>3</sup> /h to Maahad Tahfiz Al-Quran Al-Falah, Kuala Sawah, Rantau.
	Ampangan, Seremban	-	1	-	Pembinaan telaga pengeluaran dengan kaedah pengejetan hingga kedalaman 7.4 meter bagi membekalkan air sebanyak kira-kira 13.6 m <sup>3</sup> /j kepada Surau Jiboi Baru, Ampangan, Seremban. Construction of production well with jetting method to a depth of 7.4 meters for supplying water by about 13.6 m <sup>3</sup> /h to Surau Jiboi Baru, Ampangan, Seremban.

Negeri State	Lokasi Location	TE* EW*	TP* PW*	TM* MW*	Catatan Remarks
Negeri Sembilan	Terachi, Kuala Pilah	2	-	-	Membekalkan maklumat potensi air tanah bagi akuifer alluvium di kawasan Skim Pengairan Penanaman Padi, Terachi kepada Jabatan Pengairan dan Saliran Negeri Sembilan (JPSNS). Provides information on groundwater potential for alluvium aquifer in the area of Rice Cultivation Irrigation Scheme, Terachi to the Department of Irrigation and Drainage Negeri Sembilan (DIDNS).
	Gemencheh, Tampin	15	-	4	Kajian awal potensi air tanah bagi akuifer alluvium di kawasan bermasalah bekalan air. Preliminary study on groundwater potential for alluvium aquifer in water-stressed areas.
Pahang	Nenasi, Pekan	1	1	2	Pembinaan satu telaga pengeluaran berkedalaman 90 m dengan anggaran luahan (Q) 100 m <sup>3</sup> /j, dan dua telaga pemantauan masing-masing berkedalaman 36 dan 6 m. Construction of a production well with a depth of 90 m and with an estimated discharge rate (Q) of 100 m <sup>3</sup> /h, as well as two monitoring wells with depths of 36 and 6 m respectively.
	Ganchong, Pekan	1	1	1	Pembinaan satu telaga pengeluaran berkedalaman 59 m dan satu telaga pemantauan berkedalaman 41 m. Construction of a production well and a monitoring well with depths of 59 and 41 m respectively.
	Kg Tg. Medang, Pekan	1	1	1	Pembinaan satu telaga pengeluaran berkedalaman 54 m dan satu telaga pemantauan berkedalaman 41 m. Construction of a production well and a monitoring well with depths of 54 and 41 m respectively.
	Kg. Pahang Tua	-	-	1	Pembinaan satu telaga pengeluaran berkedalaman 39 m Construction of a production well with a depth of 39 m.
	RPS Runchang, Pekan	1	1	-	Pembinaan satu telaga pengeluaran berkedalaman 110 m. Paras air tanah pada kedalaman 44 m. Construction of a production well with a total depth of 110 m. Water level was detected at 44 m depth.



Negeri State	Lokasi Location	TE* EW*	TP* PW*	TM* MW*	Catatan Remarks
Perak	Daerah Kampar	-	-	5	Pembinaan lima telaga tiub pemantauan. Satu daripada telaga terpaksa ditimbus atas sebab-sebab teknikal. Five monitoring tube wells were constructed, but one of the wells was subsequently sealed due to technical reasons.
	Kampar District				
	Maahad Tahfiz Tarbiah Al Ummah, Batu Kurau, Taiping.	1	2	-	Pembinaan sebuah sistem rawatan ringkas air tanah yang telah memberi manfaat kepada 150 pelajar dan pengurusan Maahad. Construction of a groundwater treatment system which benefitted 150 students and the management of Maahad.
Sabah	Tenom	-	1	-	Telaga pengeluaran dibina di Sekolah Kebangsaan Chinta Mata, Tenom. A production well was built at Sekolah Kebangsaan Chinta Mata, Tenom.
	Kota Belud	-	-	8	Kajian potensi air tanah di kawasan penanaman padi. Study on groundwater potential in paddy cultivation areas.
Sarawak	SK Batu 36, Sibu	-	1	-	Telaga pengeluaran dengan kedalaman telaga 98.30 m, dan luahan 1.3 m <sup>3</sup> /j telah dibina. A production well was built with a depth of 98.30 m and yield of 1.3 m <sup>3</sup> /h.
Selangor	Bestari Jaya, Kuala Selangor	16	2	-	Kajian pembangunan air tanah melibatkan kaedah susupan tebing. Study on groundwater development by means of riverbank filtration method.
Terengganu	Kemaman dan Kuala Terengganu	13	6	-	Pembinaan 4 buah telaga pengeluaran di Kemaman dan 2 buah telaga pengeluaran di Kuala Terengganu. Construction of 4 production wells in Kemaman and 2 production wells in the Kuala Terengganu.

TE\* / EW\* = Telaga Eksplorasi / Exploration Well

TP\* / PW\* = Telaga Pengeluaran / Production Well

TM\* / MW\* = Telaga Pemantauan / Monitoring Well

**Penggerudian dan pembinaan telaga di kawasan kebakaran tanah gambut**  
**Drilling and construction of wells in fire prone peat areas**

Negeri State	Lokasi Location	Luahan telaga (m <sup>3</sup> /j) Yield (m <sup>3</sup> /h)	Kedalaman Depth (m)	Catatan Remarks
<b>Johor</b>	Ladang Pertubuhan Peladang Negeri Johor (PPNJ), Air Hitam, Muar	16	100	Kesemua telaga tersedia untuk digunakan bagi mengawal kebakaran. All the wells were ready for use to control peat fire.
	Kg. Paya Kopi, Pagoh	37	106	
	Kg. Lepau II, Pengerang	8	118	
	Kg. Lepau III, Pengerang	6	103	
<b>Kelantan</b>	Kg. Batu Karang, Pasir Mas	25	84	
	Kg. Hujung Lidah, Bachok	50	60	
<b>Pahang</b>	Ladang Yayasan Pahang, Penor	50	60	
	Ladang Yayasan Pahang Bebar Utara	25	42	
<b>Sarawak</b>	Mukah	-	150	
	Lawas	-	62	
<b>Selangor</b>	Hutan Simpan Kuala Langat Utara Northern part of Kuala Langat Forest Reserve	16	20	
	Sungai Kelambu Hutan Simpan Kuala Langat Selatan Southern part of Kuala Langat Forest Reserve	200	60	
	Kg. Busut Baru Hutan Simpan Kuala Langat Utara Northern part of Kuala Langat Forest Reserve	16	21	



**Projek khas bekalan air**  
**Water supply special project**

<b>Negeri State</b>	<b>Projek Project</b>	<b>Sumber kewangan Fund source</b>	<b>Catatan Remarks</b>
<b>Sabah</b>	Projek penilaian potensi sumber air tanah, Kota Belud  Groundwater Resources Potential Assessment Project, Kota Belud	Kawasan Pembangunan Pertanian Bersepadu (KPPB)  Integrated Agricultural Development Area (IADA)	Potensi sumber air tanah di enam kawasan terpilih telah dinilai. Kawasan tersebut adalah Kg. Luadi, Kg. Bugaron, Kg. Suang Punggor, Kg. Kelawat, Kg. Kinasaraban-Pirasan & Kg. Bagahak.  Potential of groundwater resources in six selected areas was assessed. The areas were Kg. Luadi, Kg. Bugaron, Kg. Suang Punggor, Kg. Kelawat, Kg. Kinasaraban-Pirasan & Kg. Bagahak.
<b>Sarawak</b>	Projek NKRA – Infrastruktur Asas Luar Bandar  NKRA Project - Rural Basic Infrastructure	Kementerian Kemajuan Luar Bandar dan Wilayah  Ministry of Rural and Regional Development	Sebanyak 20 projek bekalan air luar bandar dengan peruntukan sebanyak RM4,445,000 telah dijalankan. Projek bekalan air sistem alternatif ini telah memberi manfaat kepada 579 keluarga (2900 penduduk).  A total of 20 rural water supply projects were carried out on a total allocation of RM4,445,000. The alternative water supply system project benefitted 579 households (2900 residents).
<b>Selangor</b>	Bekalan air tanah di Bukit Changgang dan Labohan Dagang  Groundwater supply at Bukit Changgang and Labohan Dagang	NRE	Telaga telah sediaada dengan kedalaman masing-masing 28 m dan 18 m, kadar luahan 0.08 dan 3 mld masing-masing. Bilangan pengguna 1000 orang dengan belanja RM24,960.00.  Two existing wells, with depths of 28 m and 18 m, discharge rate of 0.08 and 3 mld respectively for consumption of 1000 people with cost of RM24,960.00.

**Program pemantauan air tanah**  
**Groundwater monitoring programme**

<b>Negeri State</b>	<b>Bil. telaga dipantau No. of well monitored</b>	<b>Catatan Remarks</b>
<b>Johor</b>	34	Pemantauan dijalankan dua kali setahun di seluruh negeri. Tiada perubahan kualiti air tanah yang ketara. Monitoring was conducted twice a year throughout the state. No significant changes in groundwater quality were detected.
<b>Kedah</b>	27	Pemantauan dijalankan dua kali setahun di seluruh negeri. Tiada perubahan kualiti air tanah yang ketara. Monitoring was conducted twice a year throughout the state. No significant changes in groundwater quality were detected.
<b>Kelantan</b>	106	Pemantauan dijalankan sekali setahun di seluruh negeri untuk mendapatkan data asas kualiti dan paras air tanah. Monitoring was conducted once a year throughout the state to obtain baseline data on groundwater quality and groundwater level.
<b>Melaka</b>	12	Pemantauan dijalankan sekali setahun di seluruh negeri untuk mendapatkan data asas kualiti dan paras air tanah. Monitoring was conducted once a year throughout the state to obtain baseline data on groundwater quality and groundwater level.
<b>Negeri Sembilan</b>	30	Pemantauan dijalankan sekali setahun di seluruh negeri untuk mendapatkan data asas kualiti dan paras air tanah. Monitoring was conducted once a year throughout the state to obtain baseline data on groundwater quality and groundwater level.
<b>Pahang</b>	17	Tiada perubahan kualiti air tanah yang ketara. No significant changes in groundwater quality were detected.
<b>Perak</b>	36	Pemantauan dijalankan dua kali setahun di seluruh negeri; sekali semasa musim kemarau dan sekali semasa musim hujan. Monitoring was conducted twice a year throughout the state; once during the dry season and once during the wet season.
<b>Perlis</b>	20	Pemantauan dijalankan dua kali setahun di seluruh negeri. Tiada perubahan kualiti air tanah yang ketara. Monitoring was conducted twice a year throughout the state. No significant changes in groundwater quality.
<b>Pulau Pinang</b>	1	Pemantauan dijalankan dua kali setahun di seluruh negeri. Tiada perubahan kualiti air tanah yang ketara. Monitoring was conducted twice a year throughout the state. No significant changes in groundwater quality.

Negeri State	Bil. telaga dipantau No. of well monitored	Catatan Remarks
Sabah	163	<p>Sejumlah 163 telaga tiub di sekitar kawasan Pantai Barat Laut, Pantai Barat Daya, Pantai Timur dan sebahagian pedalaman Sabah dipantau pada tahun ini. Sebanyak 125 sampel air telah dianalisis bagi tujuan pemantauan kualiti air telaga tiub. Tiada sebarang pencemaran air tanah yang berlaku pada kesemua telaga yang dipantau.</p> <p>A total of 163 tube wells were monitored in the Northwest, Southwest, Eastern and some areas in the interior of Sabah. Analysis on water quality was carried out on 125 water samples. There was no groundwater contamination in any of the tube wells monitored.</p>
Sarawak	36	<p>Tiada perubahan kualiti dan paras air tanah yang ketara.</p> <p>There were no significant changes in groundwater level and quality.</p>
Selangor / Wilayah Persekutuan	40	<p>Pemantauan dijalankan tiga kali setahun di seluruh negeri.</p> <p>Monitoring was conducted thrice a year throughout the state.</p>
Terengganu	63	<p>Pemantauan dijalankan dua kali setahun di seluruh negeri, kecuali bagi pulau-pulau di mana ia hanya dijalankan sekali setahun.</p> <p>Monitoring was conducted twice a year throughout the state, except for the islands where monitoring was carried out once a year.</p>
<b>Jumlah / Total :</b>	<b>585</b>	

**Perkhidmatan pembangunan air tanah oleh Bahagian Perkhidmatan Teknikal**  
**Groundwater development service by Technical Services Division**

Negeri State	Lokasi / Location	Bil. Telaga No. of wells	Aktiviti / Activity	Catatan / Remarks
Melaka	Loji Asahan	2	<p>Pembinaan telaga tiub cetek dengan kaedah pengejetan.</p> <p>Construction of shallow tube wells.</p>	<p>Pembangunan telaga tiub dan perkhidmatan ujian pengepaman.</p> <p>Tube wells development and pumping tests services.</p>
Negeri Sembilan	Sungai Linggi	2	<p>Pembinaan telaga tiub cetek dengan kaedah pengejetan.</p> <p>Construction of shallow tube wells.</p>	<p>Pembangunan telaga tiub dan perkhidmatan ujian pengepaman.</p> <p>Tube wells development and pumping tests services.</p>
Pahang	Nenasi, Tanjung Medang dan Kampung Ganchong, Daerah Pekan, Pahang	8	<p>Pembinaan tiga buah telaga ujian dan lima telaga cerapan.</p> <p>Construction of three test wells and five monitoring wells.</p>	<p>Sebahagian daripada kajian hidrogeologi Lembangan Sungai Pahang.</p> <p>Part of Pahang River Basin hydrogeological study.</p>



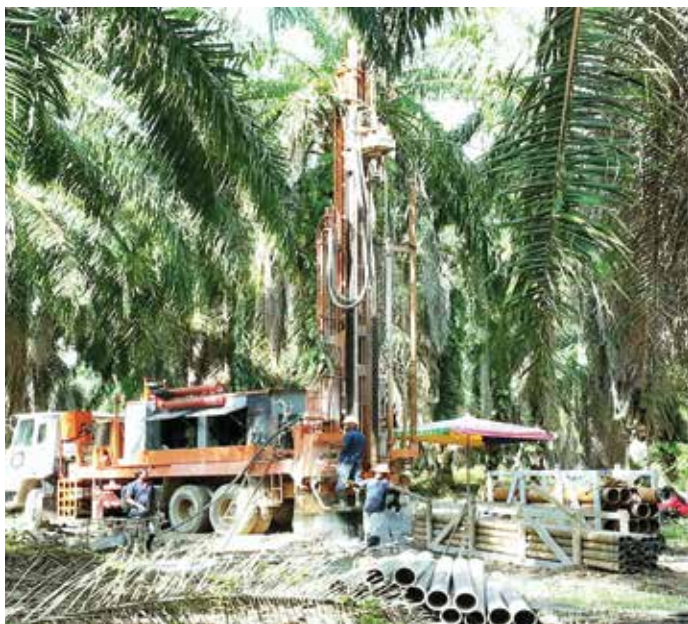


Photo: Norhazidi Masron

Penggerudian telaga tiub di Kg. Tenglu, Mersing, Johor  
 Tube well drilling at Kg. Tenglu, Mersing, Johor



Photo: Norhazidi Masron

Penggerudian telaga tiub di Loji Rawatan Air  
 Simpang Renggam, Johor  
 Tube well drilling at Water Treatment Plant  
 Simpang Renggam, Johor



Photo: Norzuhairil Bin Zubir

Pembinaan telaga dengan kaedah pengejetan di SK  
 Ayer Puteh, Kemaman, Terengganu  
 Well construction by jetting method at SK Ayer Puteh,  
 Kemaman, Terengganu



Photo: Mohamad Yusof Che Sulaiman

Persampelan air tanah di Bandar Baru Pasir Mas, Kelantan  
 Groundwater sampling at Bandar Baru Pasir Mas, Kelantan

# Geologi Kejuruteraan

Pembangunan negara yang pesat telah menyebabkan kawasan yang sesuai untuk pembangunan, terutamanya kawasan bandar dan pinggir bandar, semakin berkurangan sehingga memasuki kawasan yang dikelaskan sebagai kawasan sensitif alam sekitar termasuk lereng-lereng bukit. Sehubungan itu, jabatan telah mengambil langkah-langkah proaktif bagi mencegah atau mengurangkan berlakunya kejadian geobencana dengan menjalankan pemetaan geologi terain dan geologi kejuruteraan. Maklumat daripada aktiviti pemetaan tersebut digunakan secara meluas di dalam perancangan guna tanah oleh pihak berkuasa tempatan dan pelbagai agensi kerajaan lain untuk menghindar atau mengurangkan berlakunya geobencana seperti tanah runtuh, lubang benam dan lain-lain. Jabatan juga telah diminta untuk membantu dalam siasatan geobencana seperti tanah runtuh, lubang benam serta aliran lumpur dan puing untuk mencari punca kejadian dan faktor-faktor geologi pencetus kejadian, dan mencadangkan langkah-langkah kawalan dan pencegahan kepada kerajaan negeri dan pihak berkuasa tempatan.

# Engineering Geology

The rapid pace of development has resulted in the corresponding decrease of suitable areas for development, especially in urban and suburban areas, and at times the development has encroached into environmentally sensitive areas including hillsides. Accordingly, the department has taken proactive measures to prevent or reduce geohazard incidents by implementing geological terrain mapping and engineering geological mapping. Information from these mapping activities has been extensively referred to in land use planning by the local authorities and government agencies to prevent, or at least decrease the occurrence of geohazards such as landslides, sinkholes etc. The department has also been asked to assist in geohazard investigations such as landslide, sinkhole and debris / mud flow occurrences in order to determine the possible causes and contributing geological factors, and to propose mitigation and preventive measures to state governments and local authorities.

## Pemetaan geologi kejuruteraan Engineering geological mapping

Negeri State	Kawasan Area	Jenis pemetaan Type of mapping	Liputan Coverage	Catatan / Remarks
Kedah	Gunung Jerai- Yan	Pemetaan cerun kritikal batuan. Critical rock slope mapping.	12 km panjang 12 km in length	Kawasan batuan kurang stabil. Unstable rocky areas.
Negeri Sembilan	Tapak bekas Kuari Rasah Kemayan, Seremban Former Rasah Kemayan quarry site, Seremban	Pemetaan cerun kritikal batuan. Critical rock slope mapping.	65.8 m panjang 65.8 m in length	Kajian cerun yang berisiko tinggi. High risk slope study.
Perak	Ipoh	Pemetaan bahaya dan risiko cerun. Slope hazard and risk mapping.	200 km <sup>2</sup>	Projek dalam peringkat penawanan data LiDAR dan pemetaan geologi lapangan. The project was in the stage of LiDAR data acquisition and field geological mapping.

Negeri State	Kawasan Area	Jenis pemetaan Type of mapping	Liputan Coverage	Catatan / Remarks
Perlis	Bukit Chuping, Mata Ayer	Pemetaan cerun kritikal dan zon keselamatan batu kapur Limestone critical slope and safety zone mapping	1.3 km perimeter	Kawasan potensi runtuh batu kapur. Areas with potential for limestone collapse.
Sabah	Kundasang	Pemetaan kerentanan tanah runtuh Landslide susceptibility mapping	35 km <sup>2</sup>	Input geologi untuk perancangan guna tanah. Geological input for land-use planning.
Wilayah Persekutuan	Kuala Lumpur	Pemetaan geologi kejuruteraan dan geoteknikal Kuala Lumpur Engineering geological and geotechnical mapping of Kuala Lumpur	243 km <sup>2</sup>	Penghasilan peta geoteknikal dan geologi kejuruteraan kawasan Kuala Lumpur. Production of a geotechnical and engineering geological map of the Kuala Lumpur area.

**Pemetaan geologi kejuruteraan kawasan gambut dan tanah lembut**  
**Engineering geological mapping in peat and soft soil areas**

Negeri State	Kawasan Area	Jenis pemetaan Type of mapping	Liputan Coverage (km <sup>2</sup> )	Catatan / Remarks
Johor	Pekan Nanas – Ayer Baloi, Pontian	Pemetaan geologi kejuruteraan kawasan gambut dan tanah lembut  Engineering geological mapping in peat and soft soils areas	60	Membekalkan data geoteknikal dan input geologi berkenaan gambut dan tanah lembut untuk kesesuaian guna tanah dan pembangunan. Provided geotechnical data and geological input of peat and soft soils for land use suitability and development.
Sarawak	Mukah	Pemetaan geologi kejuruteraan kawasan gambut dan tanah lembut Engineering geological mapping in peat and soft soils areas	22	51 Lubang telah digerimit.  51 holes were augered.
	Lawas	Pemetaan geologi kejuruteraan kawasan gambut dan tanah lembut Engineering geological mapping in peat and soft soils areas	3.38	29 Lubang telah digerimit.  29 holes were augered.
Selangor	Meru, Klang	Pemetaan geologi tanah gambut  Geological mapping in peat areas	46	Pemetaan profil sub-permukaan tanah gambut telah dijalankan. Sub-surface peat profile mapping was carried out.
<b>Jumlah Liputan / Total Coverage:</b>			<b>131.38</b>	



**Pemetaan geologi terain**  
**Geological terrain mapping**

<b>Negeri State</b>	<b>Kawasan Area</b>	<b>Liputan Coverage (km<sup>2</sup>)</b>	<b>Catatan / Remarks</b>
<b>Johor</b>	Desaru	60	Memberi khidmat kepakaran kepada pihak Lembaga Kemajuan Johor Tenggara (KEJORA) dalam perancangan guna tanah dan pembangunan mapan di kawasan Desaru terutamanya projek pembangunan Desaru Coast yang menfokuskan produk pelancongan berimpak tinggi. Provided expert services to the South East Johor Development Authority (KEJORA) in land use planning and sustainable development in the Desaru area, especially with the development of Desaru Coast project which focused on high-impact tourism products.
<b>Kedah</b>	Gunung Jerai	32	Pemetaan geologi terain di kawasan Gunung Jerai, Yan bagi perancangan pembangunan masa depan. Geological terrain mapping in the Gunung Jerai, Yan, Kedah area for future development planning.
<b>Kelantan</b>	Blok 261 dan Blok 262	108	Pemetaan pada skala 1:10,000 untuk perancangan guna tanah dan pembangunan. Mapping at 1:10,000 scale for land use and development planning.
<b>Melaka</b>	Bukit Senggeh - Jus	50	Pemetaan geologi terain, geologi kejuruteraan permukaan, dan inventori cerun potongan meliputi kawasan seluas 50 km <sup>2</sup> di Blok 2248 dan Blok 2281, Kawasan Bukit Senggeh - Jus, Daerah Jasin. Geological terrain mapping, surface engineering geological mapping and cut slope inventories covering 50 km <sup>2</sup> in Block 2248 and Block 2281, Bukit Senggeh - Jus Area, Jasin District.
<b>Negeri Sembilan</b>	Hutan Simpan Setul – Seremban Utara	50	Pemetaan geologi terain, geologi kejuruteraan permukaan, dan inventori cerun potongan meliputi kawasan seluas 50 km <sup>2</sup> di Blok 2059, Hutan Simpan Setul – Seremban Utara, Daerah Seremban. Geological terrain mapping, surface engineering geological mapping, and cut slope inventories covering 50 square km <sup>2</sup> in Block 2059, Hutan Simpan Setul - North Seremban, Seremban District.
<b>Pahang</b>	Indera Mahkota, Kuantan	70	Perancangan guna tanah dan pembangunan. Land use planning and developement.

Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Catatan / Remarks
Perak	Lahat	30	Pemetaan geologi terain di Blok 1039, di sekitar Lahat. Geological terrain mapping at Block 1039, in the vicinity of Lahat.
	Batu Gajah	50	Pemetaan geologi terain dan inventori cerun di sekitar Batu Gajah. Geological terrain mapping and slope inventory in the vicinity of Batu Gajah.
Sarawak	Matang	57	Pemetaan pada skala 1:10,000 untuk perancangan guna tanah dan pembangunan. Mapping at 1:10,000 scale for land use and development planning.
Sabah	Sepanggar, Kota Kinabalu	110	Perancangan guna tanah and pembangunan. Land use planning and development.
Terengganu	Pulau Lang Tengah	2	Perancangan guna tanah untuk pembangunan pelancongan. Land use planning for tourism development.
	Hulu Telemung	50	
Jumlah / Total:		669	

**Siasatan geobencana**  
**Geohazard investigation**

Negeri State	Lokasi Area	Jenis bencana Type of hazard	Catatan Remarks
Johor	Hutan Lipur Sungai Bantang, Bekok, Labis	Kegagalan cerun	Siasatan kegagalan cerun di Hutan Lipur Sungai Bantang, Bekok.
	Sungai Bantang Recreational Forest, Bekok, Labis	Slope failure	Investigation on slope failure that occurred in the Sungai Bantang Recreational Forest, Bekok.
Kedah	Kampung Lahar, Bongor, Baling	Lubang benam Sinkhole	Siasatan kejadian lubang benam menggunakan kaedah geofizik (resistiviti) dan kajian tanah. Investigation on sinkhole occurrence using geophysical method (resistivity) and soil investigation.

Negeri State	Lokasi Area	Jenis bencana Type of hazard	Catatan Remarks
Melaka	Taman Bunga Raya, Bukit Beruang, Daerah Melaka Tengah	Tanah runtuh Landslide	Tanah runtuh berlaku dalam zon sesar; tanah runtuh ini dicetus oleh hujan lebat yang berterusan. Occurrence of landslide within a fault zone; the landslide was triggered by continuous heavy rain.
Negeri Sembilan	Kg. Panchor, Mukim Ampangan, Seremban	Tanah runtuh Landslide	Tanah runtuh dicetus oleh hujan lebat yang berterusan. Landslide triggered by continuous heavy rain.
Pahang	Gua Telinga, Taman Negara Kuala Tahan, Jerantut	Ketidakstabilan pintu masuk dan ruangan gua. Instability of the entrance and cavern.	Penilaian kestabilan menggunakan kaedah analisis kinematik dan kaedah penilaian penarafan jasad cerun. Assessment of stability was carried out using kinematic analysis and slope mass rating methods.
	Indera Mahkota, Kuantan	Mendapan dan keretakan tanah Land subsidence and cracking	Mendapan dan keretakan tanah di halaman istana. Land subsidence and cracking at palace courtyard.
	Ringlet, Cameron Highlands	Tanah runtuh Landslide	Tanah runtuh yang berlaku di Cameron Highlands pada 5 Disember 2014, telah mengakibatkan kematian di Ulu Merah, Sungai Kabok dan Sungai Tiang. Landslide occurred at Cameron Highlands on the 5 December 2014, causing casualties at Ulu Merah, Sungai Kabok and Sungai Tiang.
Perak	Ipoh	Lubang benam (skala kecil) Sinkhole (small scale)	Siasatan kejadian lubang benam yang berlaku di; Investigation of sinkhole occurrences at; i. Pengkalan Gate Tambahan 2, Lahat, Ipoh. ii. No. 21 Persiaran Halaman Ampang 4, Taman Ipoh Jaya Timur, Ipoh. iii. No. 90A, Laluan Buntong Jaya 8, RPT Buntong 3 Tambahan, Ipoh.
	Ipoh	Kegagalan cerun Slope failure	Siasatan kejadian kegagalan cerun yang berlaku di; Investigation of slope failure occurrence at; No. 1, Laluan Meru Indah 5A, Gerbang Meru Indah, Ipoh.
	Pengkalan Hulu	Kegagalan cerun Slope failure	Siasatan kejadian kegagalan cerun yang berlaku di; Investigation of slope failure occurrence at; Kem Batalion 18, Pasukan Gerakan Am (PGA), Jalan Iskandar, Pengkalan Hulu.



Negeri State	Lokasi Area	Jenis bencana Type of hazard	Catatan Remarks
Perak	Kuala Kangsar	Mendapan tanah Land subsidence	Siasatan kejadian mendapan tanah yang berlaku di; Investigation of land subsidence occurrence at; No. 80, Jalan Mayang 5, Taman Mayang Fasa 2, Kuala Kangsar.
	Taiping	Mendapan tanah Land subsidence	Siasatan kejadian mendapan tanah yang berlaku di; Investigation of land subsidence occurrence at; Kilang Lattex, Kamunting, Taiping.
Perlis	Sekolah Kebangsaan Chuping, Mata Ayer	Lubang benam Sinkhole	Siasatan kejadian lubang benam menggunakan kaedah geofizik (mikrograviti). Investigation on sinkhole occurrence using geophysical method (microgravity).
Sabah	Kg. Patau-Patau 2, W.P. Labuan	Tanah runtuh Landslide	Siasatan kejadian tanah runtuh yang berlaku pada bulan Januari 2014 yang telah mengakibatkan kerosakan kepada 4 buah rumah. Investigation on landslide which occurred in January 2014 that caused damage to four houses.
Sarawak	Miri	Tanah runtuh Landslide	Siasatan kejadian tanah runtuh yang berlaku di Kampung Padang Kerbau, Miri pada 22 Januari 2014. Investigation on landslide that occurred at Kampung Padang Kerbau, Miri on 22 January 2014.
	Santubong	Kajian cerun kritikal Critical slope study	Kajian cerun kritikal di tiga lokaliti, iaitu Kampung Budaya Sarawak, Nanga Damai Homestay dan Mount Santubong Trekking Checkpoint. Critical slope study at three locations, namely Sarawak Cultural Village, Nanga Damai Homestay and Mount Santubong Trekking Checkpoint.
	Santubong	Aliran debris Debris flow	Siasatan kejadian aliran debris yang berlaku di Tanjung Embang, Semenanjung Santubong. Investigation on debris flow incident that occurred at Tanjung Embang, Santubong Peninsula.

Negeri State	Lokasi Area	Jenis bencana Type of hazard	Catatan Remarks
Selangor	Apartmen Selasih Damansara Damai, Petaling Jaya	Aliran mata air Spring flow	Berlaku aliran mata air di kaki cerun Apartment Selasih, Damansara Damai. Occurrence of spring flow at the foot slope of Selasih Apartment, Damansara Damai.
	Kalumpang, Hulu Selangor	Aliran air tanah Groundwater flow	Berlaku resapan aliran air permukaan keluar dari lantai rumah di Taman Rajawali. Occurrence of surface water seeping out from the floor at Taman Rajawali.
	Taman Bukit Serdang, Seri Kembangan	Hakisan tanah Soil erosion	Siasatan kejadian hakisan tanah berikutan percikan tanah akibat air hujan. Investigation on soil erosion arising from to soil disintegration due to rain water.
Wilayah Persekutuan	Cheras	Tanah runtuh Landslide	Memantau kerja-kerja penambakan tanah dan bahan batuan di cerun pangsapuri atas permintaan penduduk, untuk meredakan kebimbangan kemungkinan berlakunya tanah runtuh. Monitored soil and rocks embankment works at the condominium slope to allay fears of possible landslides, on the request of condominium residents.
	Jalan Ampang, Kuala Lumpur	Tanah runtuh Landslide	Siasatan kejadian tanah runtuh, dengan 35 m lebar di bahagian kaki, 30 m lebar di bahagian puncak(crown) dan 25 m tinggi, di Jalan Ampang. Bahan gelinciran tanah terdiri daripada tanah terluluhawa bergred V-VI yang berasal dari bahan batuan setempat. Investigation on landslide, 35 m wide at the foothill, 30 m wide at the summit (crown) and 25 m high, at Jalan Ampang. Soil creep materials consisted of highly weathered soil; V-VI grade derived from the localised rock.
	Setapak, Wilayah Persekutuan Kuala Lumpur	Keretakan bangunan Cracking of building	Siasatan kejadian keretakan bangunan akibat penanaman cerucuk. Investigation on the cause of cracks due to piling works.



Photo: Mohd Farid Abdul Kadir

Kejadian tanah runtuh di Miri, Sarawak  
Landslide occurrence at Miri, Sarawak



Photo: Mohd Farid Abdul Kadir

Kerosakan rumah akibat tanah runtuh, Miri, Sarawak  
Damage of house due to landslides, Miri, Sarawak



Photo: Saiful Abdullah

Kejadian lubang benam di Kampung Pengkalan  
Gate Tambahan 2, Lahat, Perak  
Sinkhole incident at Kampung Pengkalan Gate  
Tambahan 2, Lahat, Perak



Photo: Khairul Naim bin Hussin

Kejadian retakan jalan di kawasan Pasukan  
Gerakan Am (PGA), Pengkalan Hulu, Perak  
Road cracks occurrences in the Pasukan Gerakan  
Am (PGA) area, Pengkalan Hulu, Perak



# Geologi Alam Sekitar

## Environmental Geology

### Ulasan Laporan Penilaian Kesan Alam Sekeliling

#### Review of Environmental Impact Assessment Reports

Ulasan laporan penilaian kesan alam sekeliling untuk projek pembangunan  
Review of environmental impact assessment reports for development projects

Negeri State	Bil. ulasan No. of review	Catatan Remarks
Johor	24	Memberi khidmat nasihat kepada kerajaan negeri berkenaan dengan cadangan pembangunan bercampur, perumahan, industri, tapak pelupusan, infrastruktur dan pertanian. Provided advisory services to state government pertaining to proposals for mixed development, housing, industry, landfill, infrastructure and agriculture.
Kedah	9	Memberi khidmat nasihat kepada kerajaan negeri berkenaan dengan cadangan pembangunan perumahan, hotel, resort, pembangunan kawasan perindustrian, pembangunan bercampur dan pembangunan tepi pantai. Provided advisory services to state government pertaining to proposals for housing development, hotels, resorts, industrial development, mixed development, and coastal development.
Kelantan	37	Menyediakan ulasan teknikal EIA bagi pelbagai projek. Provided technical review of EIA for various projects.
Melaka	1	Menyediakan ulasan teknikal bagi cadangan pengambilan sumber pasir laut di Melaka. Provided technical review for the proposed offshore sand extraction in Melaka.
Negeri Sembilan	1	Memberi khidmat nasihat berhubung cadangan penyaluran tranmisi 500 kV (Option 2) dari cadangan 2x1000 MV Supercritical Coal-Fired Power Plant di Mukim Jimah, Negeri Sembilan ke PMU Olak Lempit di negeri Selangor. Provided advisory services regarding the proposed 500 kV Transmission Line (Option 2) from the proposed 2x1000 MV Supercritical Coal-Fired Power Plant At Mukim Jimah, Negeri Sembilan to PMU Olak Lempit in Selangor.
Pahang	9	Menyediakan ulasan teknikal EIA bagi kawasan sensitif alam sekitar di daerah Kuantan, Bentong, Temerloh, Cameron Highlands dan Bera yang melibatkan kawasan pembalakan dan skim penanaman semula getah. Provided technical review of EIA for environmental sensitive areas in Kuantan, Bentong, Temerloh, Cameron Highlands and Bera districts, involving logging areas and rubber replanting schemes.
Perak	11	Menyediakan ulasan teknikal EIA bagi pelbagai projek. Provided technical review of EIA for various projects.

Negeri State	Bil. ulasan No. of review	Catatan Remarks
Pulau Pinang	10	Memberi khidmat nasihat untuk cadangan perumahan, pembangunan bercampur, pembangunan rekreasi awam, pembangunan hab pengangkutan dan stesen pemindahan sisa. Provided advisory services pertaining to proposed housing, mixed development, public recreational development, transportation hub development and waste transfer station.
Sabah	70	Menyediakan ulasan EIA berkaitan dengan projek pembangunan perumahan, resort, infrastruktur dan pengkuarian (pasir / agregat). Provided technical reviews of EIA for housing development projects, resorts, infrastructure, and quarrying (sand / aggregates).
Sarawak	35	Memberi khidmat nasihat kepada kerajaan negeri berhubung cadangan pembangunan di kawasan bandar, pembinaan jalanraya, jambatan, empangan, kawasan tadahan air, tapak pelupusan sampah, penimbunan tanah, kajian cerun, pertanian, siasatan seismik, kuari, pengorekan pasir dan tanah, lombong pasir silika, pembangunan projek gas, pelantar dan pepaipan telaga minyak dan loji bridge electrode. Provided advisory services to state government regarding the proposed development of urban areas, building of roads, bridges and dams; studies of agricultural activities, water catchment areas, slope stability, sanitary landfill, quarry, silica sand mining, sand extraction, soil extraction, seismic survey, exploration drillings, gas development projects, platform & pipeline and bridge electrode plant.
Selangor	65	Menyediakan ulasan teknikal EIA bagi pelbagai projek. Provided technical review of EIA for various projects.
Terengganu	6	Menyediakan ulasan teknikal EIA bagi pelbagai projek di Daerah Kemaman, Daerah Kuala Terengganu, Daerah Setiu dan Daerah Hulu Terengganu. Provided technical reviews of EIA for various development projects in the Kemaman District, Kuala Terengganu District, Setiau District, and Hulu Terengganu District.
<b>Jumlah / Total:</b>	<b>278</b>	

**Kajian geologi alam sekitar**  
**Environmental geology studies**

Negeri State	Lokasi Location	Catatan Remarks
Pahang	Cameron Highlands	Inventori dan siasatan kawasan tanah runtuh dan cerun di Cameron Highlands. Slope and landslide inventory and investigation, Cameron Highlands.

## Geologi Marin

Pada tahun 2014, aktiviti Unit Geologi Marin tertumpu kepada pelaksanaan dua projek di perairan Johor dan Pahang, iaitu Projek Sumber Pasir Laut Negara Fasa 3 dan kajian impak ke atas bekas aktiviti perlombongan pasir laut di kawasan perairan Beting Ramunia.

Projek Sumber Pasir Laut Negara Fasa 3, melibatkan pemetaan dan persampelan sedimen pantai, bermula dari Tambak (selatan Johor) hingga ke Chendor (utara Pahang). Persampelan cekau telah dilaksanakan di sepanjang perairan Johor dan Pahang meliputi kawasan sehingga 25 km dari pantai. Sebanyak 229 sampel cekau telah dikutip bersama dengan data batimetri dalam projek ini. Kesemua sampel sedimen yang dikutip telah dihantar ke Makmal Geologi Marin untuk tujuan analisis.

Kementerian Sumber Asli dan Alam Sekitar (NRE) juga memohon Unit Geologi Marin melaksanakan kajian impak ke atas bekas aktiviti perlombongan pasir laut di kawasan perairan Beting Ramunia. Kerja-kerja persampelan cekau telah dilaksanakan dengan menggunakan kapal Al-Tair milik Jabatan Laut. Sebanyak 173 sedimen cekau telah dikutip dan dihantar ke Makmal Geologi Marin untuk dianalisis. Data-data batimetri juga turut dicerap dalam kajian ini untuk tujuan permodelan hidraulik.

Pada 10 Disember 2014, satu majlis rasmi telah diadakan di Wisma Bapa Malaysia, Kuching, Sarawak untuk menyerahkan Laporan Akhir Projek Kajian Sumber Pasir Laut Negara Fasa 2: Sarawak. Laporan tersebut telah diserahkan oleh Ketua Pengarah Jabatan Mineral dan Geosains Malaysia kepada Datuk Mohd Naroden Majais, Menteri Muda Perancangan Sumber Sarawak.

Projek Pelantar Benua Malaysia - Fasa 2 bagi penyediaan submission ke Commission on the Limits of the Continental Shelf (CLCS), yang diterajui oleh Majlis Keselamatan Negara (MKN) diteruskan dalam tahun 2014. Dua pakar dari Australia telah dilantik oleh MKN untuk membantu pegawai JMG dalam penyediaan laporan untuk tujuan submission.

Permohonan ulasan ke atas permohonan lesen melombong pasir laut di bawah Seksyen 4 Akta Pelantar Benua 1966 (disemak 1972) telah diterima dari Jabatan Ketua Pengarah Tanah dan Galian (JKPTG). Pada tahun 2014, sebanyak 29 ulasan telah dikemukakan kepada JKPTG dan beberapa

## Marine Geology

In 2014, Marine Geology activities were focused on the implementation of two projects in the waters off the coast of Johor and Pahang, namely the National Offshore Sand Resources Study Phase 3 and impact study on former offshore sand mining activities in the area of Ramunia Shoal, Johor.

The National Offshore Sand Resources Study Phase 3, which involved coastal mapping and coastal sediment sampling, started from Tambak (southern Johor) till Chendor (northern Pahang). Grab sampling was implemented, covering an area as far as 25 km from the shores of coastal Johor and Pahang. A total of 229 grab samples were collected in this project together with bathymetry data. All sediment samples collected were sent to the Marine Geology Laboratory for analysis.

The Ministry of Natural Resources and Environment (NRE) also requested the Marine Geology Unit to undertake an impact study in the area of Ramunia Shoal, Johor, with regard to sand mining activities in the past. Grab sampling was conducted using the Marine Department vessel, MV Al-Tair. A total of 173 grab samples were collected and sent to the Marine Geology Laboratory for analysis. Detailed bathymetry data were also collected in this study for the purpose of hydraulic modeling.

On 10 December 2014, an official ceremony was held at Wisma Bapa Malaysia, Kuching Sarawak to hand over the final report of the National Offshore Sand Resources Study Phase 2: Sarawak. The report was presented by the Director General of Minerals and Geoscience Department Malaysia to Datuk Mohd Naroden Majais, Assistant Minister for Resource Planning of Sarawak.

The Malaysia Continental Shelf Project - Phase 2 for the preparation of submission to the Commission on the Limits of the Continental Shelf (CLCS), under the supervision of the National Security Council (NSC), was continued in 2014. Two experts from Australia were engaged by NSC to assist JMG officers in the preparation of the submission.

Applications for review by various companies to obtain offshore sand mining licences, under Section 4 of the Continental Shelf Act 1966 (revised 1972) were received from the Department of Director-General Land and Mines



mesyuarat One Stop Center juga telah dihadiri. Permohonan tersebut melibatkan perlombongan pasir laut di kawasan lepas pantai di Kedah, Johor, Labuan, Melaka, Negeri Sembilan, Pahang, Perak, Pulau Pinang dan Selangor.

Garis Panduan Kuantiti dan Kualiti Sumber Pasir Laut telah dimuktamadkan pada tahun 2014 setelah melalui beberapa siri bengkel dan mesyuarat. Garis panduan ini akan digunapakai oleh pihak yang memohon lesen melombong pasir laut di bawah Akta Pelantar Benua 1966 (disemak 1972).

(JKPTG). In 2014, a total of 29 applications were reviewed and submitted to the Department of Director-General, Land and Mines (JKPTG), and there were several One Stop Center meetings attended by officers from Marine Geology Unit. The applications involved sand mining in offshore waters of Kedah, Johor, Labuan, Melaka, Negeri Sembilan, Pahang, Perak, Pulau Pinang and Selangor.

The National Offshore Sand Resources Quality and Quantity Guidelines were finalised in 2014 through a series of workshops and meetings. These guidelines would be used in the future by companies applying for offshore sand mining licences under the Continental Shelf Act 1966 (revised 1972).



Photo: Abdullah Sulaiman

Kapal yang digunakan untuk Kajian Impak di Beting Ramunia, Johor  
Vessel used for Impact Study in the area of Ramunia Shoals, Johor



Photo: Abdullah Sulaiman

Persampelan cekau di perairan Johor dan Pahang  
Grab sampling in the waters of Johor and Pahang

## Khidmat Nasihat Geosains

JMG secara aktif memberi khidmat nasihat kepada agensi kerajaan, pihak swasta dan individu dalam aspek ulasan pembangunan guna tanah berserta maklumat geosains seperti hidrogeologi dan geologi kejuruteraan.

Khidmat nasihat hidrogeologi termasuk penyediaan ulasan dalam permohonan pelesenan air tanah dan air tanah sebagai sumber air mineral semulajadi serta potensi penggunaan air tanah untuk tujuan pertanian, industri dan domestik. JMG adalah ahli tetap di dalam Jawatankuasa Penggunaan Sumber Air Peringkat Negeri, Jawatankuasa Kelulusan Pembungkusan Sumber Air Semulajadi dan Jawatankuasa Pelesenan Sumber Air Bumi.

## Geoscience Advisory Services

JMG is active in providing advisory services to government agencies, the private sector and individuals on aspects of land use planning reviews and geoscience information such as hydrogeology and engineering geology.

Hydrogeology advisory services include providing reviews on groundwater licence applications and groundwater as natural mineral water resource and assessment of the potential of groundwater for agriculture, industrial and domestic usage. JMG is a permanent member of the State Water Consumption Committee, Natural Water Resource Packaging Approving Committee and Groundwater Resource Licensing Committee.

Khidmat nasihat geologi kejuruteraan dan pembangunan guna tanah pula merangkumi aspek perancangan pembangunan bandar baru, penjajaran jalan dan perancangan guna tanah. Jabatan ini terlibat di dalam beberapa jawatankuasa peringkat negeri berkaitan dengan geobencana, seperti Jawatankuasa Perancangan Negeri, Jawatankuasa Bencana Negeri, Jawatankuasa Kawasan Sensitif Alam Sekitar serta Jawatankuasa Pembangunan Tanah Tinggi dan Lereng Bukit.

JMG secara aktif memberi khidmat nasihat dan juga menawarkan input geologi untuk cadangan pembangunan kepada PBT menerusi Pusat Setempat (OSC). Ia juga menyediakan ulasan teknikal kepada pihak swasta dan pemaju. Pada tahun 2014, sebanyak 5762 ulasan OSC telah dikeluarkan.

Engineering geology and land use advisory services include new township development planning, road alignment and land use planning. The department is also involved in several state level committees related to geodisasters, such as the State Planning Committee, State Disaster Committee, Environmental Sensitive Area Committee, as well as Highland and Foothill Development Committee.

JMG is active in providing advisory services and offers geological input on proposed developments to local authorities through One Stop Centers (OSC). It also provides technical reviews to the private sector and property developers. In 2014, a total of 5762 OSC reviews were issued.

#### Ulasan pembangunan tanah dan maklumat geosains am Review of land development and general geosciences information

Negeri State	Jenis ulasan Type of review		
	Pusat Setempat One Stop Centre (OSC) (bil. / no.)	Pembangunan guna tanah Land use development (bil. / no.)	Maklumat geosains am General geoscience information (bil. / no.)
Kedah	298	5	2
Johor	752	-	74
Kelantan	112	-	-
Melaka	256	-	-
Negeri Sembilan	167	-	-
Pahang	740	2	97
Perlis	28	-	-
Perak	340	-	15
Pulau Pinang	97	33	6
Sabah	392	35	-
Sarawak	0	-	-
Selangor / Wilayah Persekutuan	2038	85	68
Terengganu	968	17	4
<b>Jumlah / Total:</b>	<b>6188</b>	<b>177</b>	<b>266</b>

**Khidmat nasihat hidrogeologi**  
**Hydrogeology advisory services**

<b>Negeri State</b>	<b>Bil. ulasan No. of review</b>	<b>Catatan Remarks</b>
<b>Kedah</b>	14	Menyediakan ulasan teknikal berkenaan potensi sumber air tanah untuk pertanian, kegunaan domestik, sektor industri dan air mineral yang dipohon oleh agensi kerajaan dan pihak swasta. Provided technical reviews on the potential of groundwater sources for agriculture, domestic use, industrial sector and commercial mineral water as requested by government agencies and the private sector.
<b>Kelantan</b>	12	Memberi khidmat nasihat kepada kerajaan negeri berhubung pelesenan air mineral dan lain-lain. Provided advisory services to the state government regarding the licensing of mineral water abstraction and others.
<b>Negeri Sembilan</b>	9	Menyediakan ulasan teknikal bagi tujuan permohonan baru dan pembaharuan lesen pengeluaran air tanah kepada Badan Kawal Selia Air (BKSA). Memberi khidmat nasihat berkaitan potensi air tanah serta cadangan pembangunan air mineral kepada agensi kerajaan, pihak swasta dan orang perseorangan. Provided technical reviews on new applications and renewal of the groundwater abstraction licence for Badan Kawal Selia Air (BKSA). Provided technical advice regarding groundwater potential and proposed development of mineral water to government agencies, the private sector, and individuals.
<b>Melaka</b>	16	
<b>Perak</b>	4	Memberi khidmat nasihat kepakaran kepada pelanggan berkaitan sumber air tanah, pembinaan telaga tiub dan perakuan punca air mineral semulajadi untuk pengeluaran secara komersial. Provided expert advisory services to clients on groundwater resources, tube well construction and source certification of natural mineral water for commercial production.
<b>Sabah</b>	5	Memberi khidmat nasihat berkaitan cadangan pembangunan telaga tiub bagi kawasan kritikal bekalan air. Provided advisory services on tube well development proposal in water-stressed areas.
<b>Sarawak</b>	5	Memberi khidmat nasihat kepakaran berkaitan sumber air tanah, pembinaan telaga tiub, sumber air graviti bukit dan sumber air sungai. Provided expert advisory services pertaining to groundwater resources, tube well construction, gravity feed water supply and river water resources.



Negeri State	Bil. ulasan No. of review	Catatan Remarks
Selangor	140	<p>Menyediakan ulasan permohonan pembaharuan dan permohonan baru penggunaan air tanah kepada Lembaga Urus Air Selangor (LUAS), serta khidmat nasihat kepada cadangan pembangunan air mineral kepada agensi kerajaan, pihak universiti, pihak swasta dan orang awam.</p> <p>Provided technical reviews for applications of renewal and new applications for the use of groundwater to Lembaga Urus Air Selangor (LUAS), as well as advisory services for mineral water development proposal to government agencies, universities, private sector and the public.</p>
Terengganu	16	<p>Khidmat nasihat telah diberikan kepada pertanyaan secara lisan dan bertulis. Pegawai JMG juga membuat lawatan tapak bersama pelanggan.</p> <p>Advisory services were provided in response to oral and written inquiries. JMG officers also made site visits together with clients.</p>
Bahagian Perkhidmatan Teknikal / Technical Services Division	5	<p>Permintaan untuk bantuan khidmat nasihat teknikal.</p> <p>Requested for technical advisory assistance.</p> <ol style="list-style-type: none"> <li>1. Cadangan pembangunan air tanah di Gemencheh, Semerbok dan Terachi, Negeri Sembilan kepada Jabatan Mineral dan Geosains Negeri Sembilan / Melaka. Proposed groundwater development in Gemecheh, Semerbok and Terachi, Negeri Sembilan for the Department of Mineral and Geosciences Negeri Sembilan / Melaka.</li> <li>2. Cadangan Projek Penapisan Tebing Sungai di Bentong, Pahang kepada Pengurusan Air Pahang Berhad (PAIP). Proposed Riverbank Filtration (RBF) Project at Bentong, Pahang for Pengurusan Air Pahang Berhad (PAIP).</li> <li>3. Cadangan projek pembangunan sumber air mineral di Felda Trolak kepada Koperasi Felda Trolak Timur. Proposed development of mineral water resources in Felda Trolak for Koperasi Felda Trolak Timur.</li> <li>4. Permintaan untuk kajian hidrogeologi bagi cadangan pembangunan air tanah untuk pertanian di Lojing, Kelantan kepada Jabatan Pertanian Negeri Kelantan. Requested for hydrogeological study on the proposed development of groundwater for agriculture in Lojing, Kelantan for the Department of Agriculture Kelantan.</li> <li>5. Permintaan untuk bantuan teknikal bagi kerja-kerja pembinaan lubang gerudi oleh Agensi Nuklear Malaysia, Bangi. Requested for technical assistance related to borehole construction works by Malaysian Nuclear Agency, Bangi.</li> </ol>
Jumlah / Total:	226	

**Khidmat nasihat geologi kejuruteraan**  
**Engineering geology advisory services**

<b>Negeri State</b>	<b>Bil. ulasan No. of review</b>	<b>Catatan Remarks</b>
<b>Johor</b>	15	Memberi khidmat nasihat untuk permohonan kebenaran merancang dan pelan kerja tanah projek pembangunan. Provided advisory services for applications on planning permission and earthwork plans of development projects.
<b>Kelantan</b>	9	Memberi khidmat nasihat berkaitan geologi kejuruteraan. Provided advisory services on engineering geology.
<b>Perak</b>	15	Memberi khidmat nasihat teknikal berkaitan cadangan pembangunan, terutamanya di sekitar bukit batu kapur, kawasan bekas lombong dan input geologi kejuruteraan kepada pelbagai agensi dan orang perseorangan yang berkepentingan. Provided technical advisory services related to proposed development, especially in the vicinity of limestone hills, ex-mining area and engineering geological input for various interested agencies and individuals.
<b>Sabah</b>	91	Memberi khidmat nasihat kepada Pihak Berkuasa Tempatan. Provided technical advisory services to local authorities.
<b>Selangor</b>	65	Memberi pelbagai khidmat nasihat berkenaan geologi kepada jurutera, perunding, orang awam, agensi kerajaan, pihak swasta dan pemaju. Provided various geological advisory services to engineers, consultants, the public, government agencies, the private sector and developers.
<b>Jumlah / Total:</b>	<b>195</b>	

## Penilaian Sumber Geoterma

Tenaga geoterma ialah tenaga yang wujud dalam bentuk haba di bawah permukaan bumi. Ia boleh digunakan untuk menjana kuasa elektrik dan juga rekreasi. Penggunaan tenaga geoterma sebagai sumber tenaga boleh baharui masih lagi baharu di negara kita. Janakuasa geoterma pertama Malaysia terletak di Apas Kiri Tawau, Sabah, dijangka akan beroperasi pada tahun 2016. Ia akan menjanakan sebanyak 30 MW tenaga elektrik untuk kegunaan kawasan sekitarnya.

JMG telah dilantik oleh Lembaga Pembangunan Tenaga Lestari (SEDA) Malaysia sebagai agensi pelaksana kajian untuk projek penilaian sumber geoterma di Ulu Slim, Perak. Projek yang bermula pada 1 September 2013 dijangka akan siap sepenuhnya pada 31 Disember 2015.

Pada tahun 2014, aktiviti penilaian sumber geoterma juga telah dijalankan di kawasan Sungai Segaria - Gunung Pock (Sg. Jipun), Kunak, Sabah meliputi kawasan seluas 100 km<sup>2</sup>.

## Geothermal Resource Assessment

Geothermal energy is the energy that exists in the form of heat beneath the earth's surface; it can be used for the generation of electrical power and also for recreation. At the time of writing, the use of geothermal energy as a renewable energy source is still new in our country. The first geothermal power plant in Malaysia, located in Apas Kiri Tawau, Sabah, would be operational in 2016. It would generate 30 MW of electricity for use in the surrounding areas.

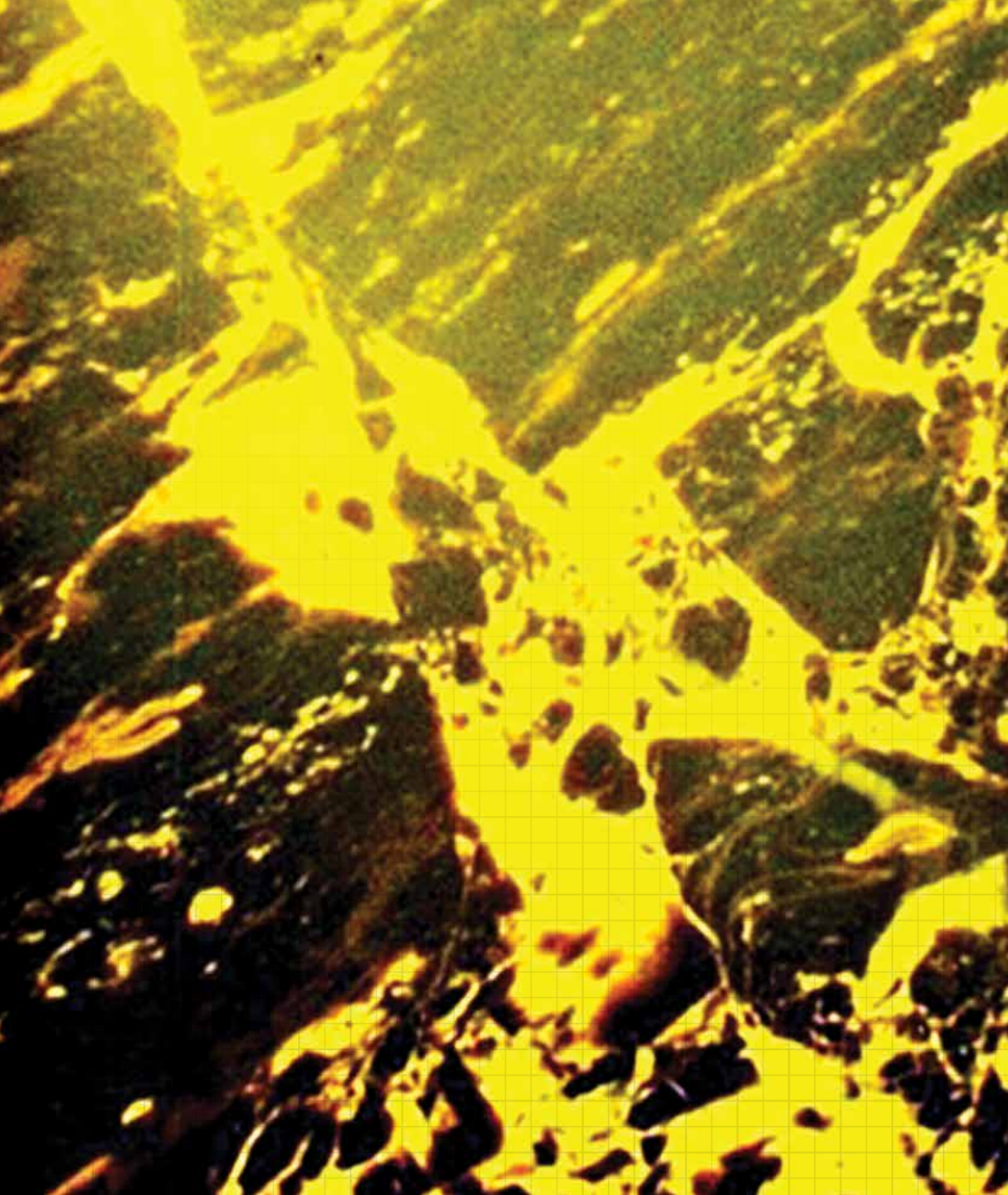
JMG was appointed by Sustainable Energy Development Authority (SEDA) Malaysia as the implementing agency for the geothermal resource assessment project at Ulu Slim, Perak. The project which began on 1 September 2013 was expected to be completed by 31 December, 2015.

In 2014, geothermal resource assessment activities were carried out in the area around Sungai Segaria - Gunung Pock (Sg. Jipun), Kunak, Sabah covering an area of 100 km<sup>2</sup>.

### Penilaian sumber geoterma Geothermal resource assessment

Negeri State	Kawasan Area	Liputan Coverage (km <sup>2</sup> )	Penemuan / Catatan Findings / Remarks
Perak	Ulu Slim	40	Kerja-kerja yang telah dan sedang dilaksanakan ialah interpretasi fotoudara dan data IFSAR, kajian geologi, kajian geofizik dan kajian geokimia. Sebanyak 10 mata air panas telah dikenal pasti dengan julat suhu di antara 32 °C hingga 94 °C. Work that had been completed or was being implemented were air photo and IFSAR data interpretation, geological study, geophysics study, and geochemical study. 10 hot springs were identified that had temperatures ranging from 32 °C to 94 °C.
Sabah	Sungai Segaria - Gunung Pock (Sg. Jipun), Kunak	100	Survei geofizik keberintangan imej 2-D peringkat awal telah mengenal pasti keadaan outflow dan kedudukan / geometri berpotensi sumber ini. Survei keberintangan (magnetotellurik dan elektromagnetik) serta graviti susulan telah mengenal pasti dua sumber air geoterma sub-permukaan yang berasal dari air meteorik. Early stage 2-D resistivity imaging surveys identified an outflow condition and position / geometry of the potential resource. Resistivity (magnetotelluric and electromagnetic) and subsequent gravity surveys identified two sub-surface geothermal waters sources originating from meteoric waters.
Jumlah / Total:		140	





A vertical strip on the left side of the page shows a photomicrograph of a rock sample. It displays bright yellow, irregular, and somewhat rounded shapes (exsudatinite) against a dark, almost black background. The yellow areas have a slightly granular or crystalline texture.

# AKTIVITI LOMBONG DAN KUARI MINE AND QUARRY ACTIVITIES

Fotomikrograf menunjukkan pengusiran bahan 'seperti minyak' dalam bentuk exsudatinite (berwarna kuning; cahaya ultraungu pantulan di bawah rendaman minyak).

Photomicrograph showing expulsion of 'oil-like' materials in the form of exsudatinite (yellow colour; reflected ultraviolet light under oil immersion).

Photo: Prof. Dr. Wan Hasiah Abdullah (UM)



## AKTIVITI LOMBONG DAN KUARI

### Kawalseliaan & Penguatkuasaan

Adalah menjadi tanggungjawab jabatan untuk memastikan operasi perlombongan dan kuari, serta pemprosesan mineral dilaksanakan dengan cekap dan sistematik mengikut amalan terbaik. Jabatan juga memberi bantuan dan bekerjasama dengan lain-lain agensi kerajaan dan industri berasaskan mineral. Dengan itu, perkhidmatan nasihat teknikal dan kepakaran telah diberikan oleh jabatan kepada kedua-dua pihak kerajaan dan swasta.

Peranan jabatan berkembang pada tahun 2014 sejajar dengan permintaan dunia terhadap komoditi berasaskan mineral yang kukuh. Jabatan terus melaksanakan tugasnya dalam bidang penguatkuasaan, pengeluaran lesen dan permit, serta memantau operasi perlombongan dan pengkuarian.

### Pemeriksaan Teknikal Operasi Lombong dan Kuari

Pemeriksaan teknikal telah dijalankan dari masa ke semasa untuk memastikan pengusaha lombong dan kuari mematuhi peruntukan undang-undang dan peraturan-peraturan yang dikuatkuasakan oleh jabatan dipatuhi. Pemeriksaan ini juga adalah prasyarat penyediaan laporan untuk permohonan tenemen mineral, kerja peletupan, aduan, serta laporan kejadian kemalangan di lombong dan kuari.

Dalam tahun 2014, jabatan telah melakukan sebanyak 1198 pemeriksaan ke atas operasi perlombongan, 1595 pemeriksaan ke atas operasi kuari, 310 pemeriksaan ke atas kilang amang dan loji pemprosesan mineral, serta 292 pemeriksaan ke atas urusan kedai bijih mineral dan emas mentah.

Selain itu, sebanyak 332 penilaian teknikal dan pemeriksaan tapak peletupan untuk kerja pembangunan telah dijalankan. Di samping itu, 53 lawatan pemeriksaan teknikal tapak carigali telah dilakukan dalam tempoh yang sama.

## MINE AND QUARRY ACTIVITIES

### Monitoring & Enforcement

It is the department's responsibility to ensure that mining and quarrying operations, as well as mineral processing activities, are carried out efficiently and systematically in accordance with the best practices. The department also provides assistance and cooperation with other government agencies and the mineral-based industry. Advisory technical services and expertise are thus rendered to both government and the industry by the department.

The role of the department expanded in 2014 in tandem with strong global demand for mineral-based commodities. The department continued to discharge its duties in the areas of enforcement, issuance of licenses and permits, and also the monitoring of mining and quarrying operations.

### Technical Inspection of Mine and Quarry Operations

Technical inspections were carried out from time to time to ensure that miners and quarry operators' compliance with the relevant laws and regulations enforced by the department was met. The inspections were also a prerequisite for the preparation of reports pertaining to applications for mineral tenements, blasting works, complaints, as well as mine and quarry accident reports.

In 2014, the department carried out a total of 1198 inspections on mining operations, 1595 on quarries operations, 310 on amang and mineral processing plant operations and 292 on mineral ore and gold dealers.

Besides that, a total of 332 technical assessments and evaluations of blasting activities for development were carried out. In addition, 53 site inspections on prospecting work also took place during the same period.



## Pemantauan dan Kawalseliaan Aktiviti Perlombongan dan Pengkuarian

Tugas pemantauan dan kawalseliaan ke atas aktiviti perlombongan dan pengkuarian yang dijalankan oleh jabatan adalah bertujuan untuk memastikan ia dijalankan dengan teratur dan bersistematik mengikut amalan kejuruteraan sebenar dan mematuhi peruntukan perundangan.

Sebanyak 13 kerja ukur tanah sempadan dan cerun serta 697 kerja pengukuran gegaran dan pemantauan peletupan telah dijalankan dalam tahun 2014. Selain daripada itu, jabatan juga telah menjalankan sebanyak 334 persampelan efluen lombong sepanjang tahun.

Aspek keselamatan terus mendapat perhatian pada tahun 2014. Jabatan telah menyediakan sebanyak 7 laporan kemalangan lombong dan kuari, serta menerima aduan sama ada secara lisan atau bertulis daripada orang ramai dan suratkhobar. Sejumlah 102 siasatan aduan telah dilakukan oleh jabatan yang membawa kepada pengeluaran sebanyak 84 perintah dan arahan kepada pelombong dan pengusaha kuari yang berkenaan.

## Pelesenan

Pada tahun 2014, jabatan telah mengeluarkan 173 Skim Pengendalian Melombong di bawah Akta Pembangunan Mineral 1994 dan 167 Surat Kebenaran Pengkuarian di bawah Peraturan Kuari Negeri.

Jabatan masih terus menguatkuasakan Enakmen Bijih Mineral dan Enakmen Bijih Emas Negeri di mana sejumlah 232 Lesen Bijih Mineral, dua Lesen Pembeli Emas Mentah dan 234 Permit Mengangkut Bijih Padat Timah telah dikeluarkan.

Bagi pengeksportan mineral / bahan batuan, sebanyak 817 surat penilaian teknikal untuk eksport mineral dan 1537 laporan bahan batuan telah dikeluarkan. Pada tahun 2014, Jabatan telah melaksanakan sebanyak 3 sesi peperiksaan pembedil (teori) dengan sebanyak 168 orang calon telah menduduki peperiksaan ini.

## Monitoring and Supervision of Mining and Quarrying Activities

The task of monitoring and supervising mining and quarrying activities was to ensure that these operations were carried out in an orderly and systematic manner in accordance with the best engineering practices and that they complied with the relevant laws and regulations.

A total of 13 surveys on land boundaries and slopes, as well as 697 cases of monitoring vibrations and blasts were carried out in 2014. In addition, effluent sampling from 334 mines was also undertaken by the department throughout the year.

The aspect of safety continued to receive attention in 2014. The department prepared 7 accident reports and attended to written or verbal complaints from the public and mass media. A total of 102 complaint investigations were conducted by the department and, arising from this, 84 orders and instructions were issued to miners and quarry operators.

## Licensing

For the year 2014, the department issued 173 Operational Mining Schemes under the Mineral Development Act 1994 and 167 Letters of Authority to Quarry under State Quarry Rules.

The department continued to enforce the State Mineral Ores and Gold Enactments by which a total of 232 Mineral Ore Licences, two Raw Gold Buyer Licences and 234 Tin Ore Concentrate Transport Permits were issued.

As for the exportation of minerals / rock materials, a total of 817 technical assessment reports on mineral exports and 1537 reports on rock material were issued. In 2014, the Department conducted 3 sessions of short fire examination (Theory) with a total of 168 candidates sat for the examination.

## Khidmat Nasihat dan Kepakaran

Selain dari aspek penguatkuasaan undang-undang dan pemantauan, jabatan juga berperanan untuk memberi khidmat nasihat kepada pihak berkuasa negeri, industri dan juga orang ramai. Sebagai sebuah jabatan teknikal, pihak berkuasa negeri selalu merujuk permohonan berkaitan tanah lombong, tapak kuari dan lain-lain aspek undang-undang sebelum perakuan teknikal dibuat oleh pihak berkuasa negeri.

Pada tahun 2014, jabatan telah menyediakan sebanyak 474 laporan perakuan permohonan carigali dan pajakan lombong. Pada masa yang sama, sebanyak 65 laporan teknikal berkenaan permohonan tapak kuari telah disediakan dan dihantar kepada pihak berkuasa negeri.

Jabatan juga terlibat dengan laporan EIA, 42 laporan ulasan EIA yang berkaitan dengan aktiviti perlombongan dan pengkuarian telah dikomen. Selain dari itu, sebanyak 458 laporan pembebasan mineral dan 4 surat perakuan Laporan Magazim Letupan telah disediakan dalam tahun 2014.

## Aktiviti-aktiviti lain

Pihak jabatan juga menjalankan dialog, seminar dan pameran bagi meningkatkan kesedaran pihak awam terhadap industri mineral serta juga sebagai wadah untuk menyelesaikan masalah yang dihadapi penduduk berkaitan dengan aktiviti perlombongan dan pengkuarian. Sebanyak 59 seminar / dialog / pameran telah dibuat pada tahun 2014.



Membuat pemeriksaan peletupan mengikut spesifikasi SOP di kuari Plentong Granite  
Inspection on rock blasting in accordance with SOP specifications in the quarry of Plentong Granite

## Advisory and Expertise Services

Apart from enforcement and monitoring, the department's task is to render advisory technical services to state authorities, industry and to the public. Being a technical department, state authorities frequently refer to this Department for comments and assessment on applications for mining land, quarries and other legal aspects before any technical report is made to the state authority.

For 2014, the Department prepared a total of 474 reports on applications for prospecting and mining rights. At the same time, 65 technical reports were prepared and sent to state authorities with regard to application for quarries.

The department was involved in EIA reports, and 42 reports were commented on in relation to mining and quarrying proposals. In addition, 458 Mineral Clearance reports and 4 reports on Explosives Magazines were prepared in 2014.

## Other Activities

The department also conducted dialogues, seminars and exhibitions aimed at increasing public awareness on the mineral industry as well as resolving issues and problems faced by the public pertaining to mining and quarrying activities. A total of 59 seminars / dialogues / exhibitions were conducted in 2014.



Kerja pengukuran gegaran bumi dan ledakan udara dengan menggunakan alat vibrometer di sekitar kuari  
Ground vibration and air blast measurements using vibrometer equipment at the vicinity of quarry sites

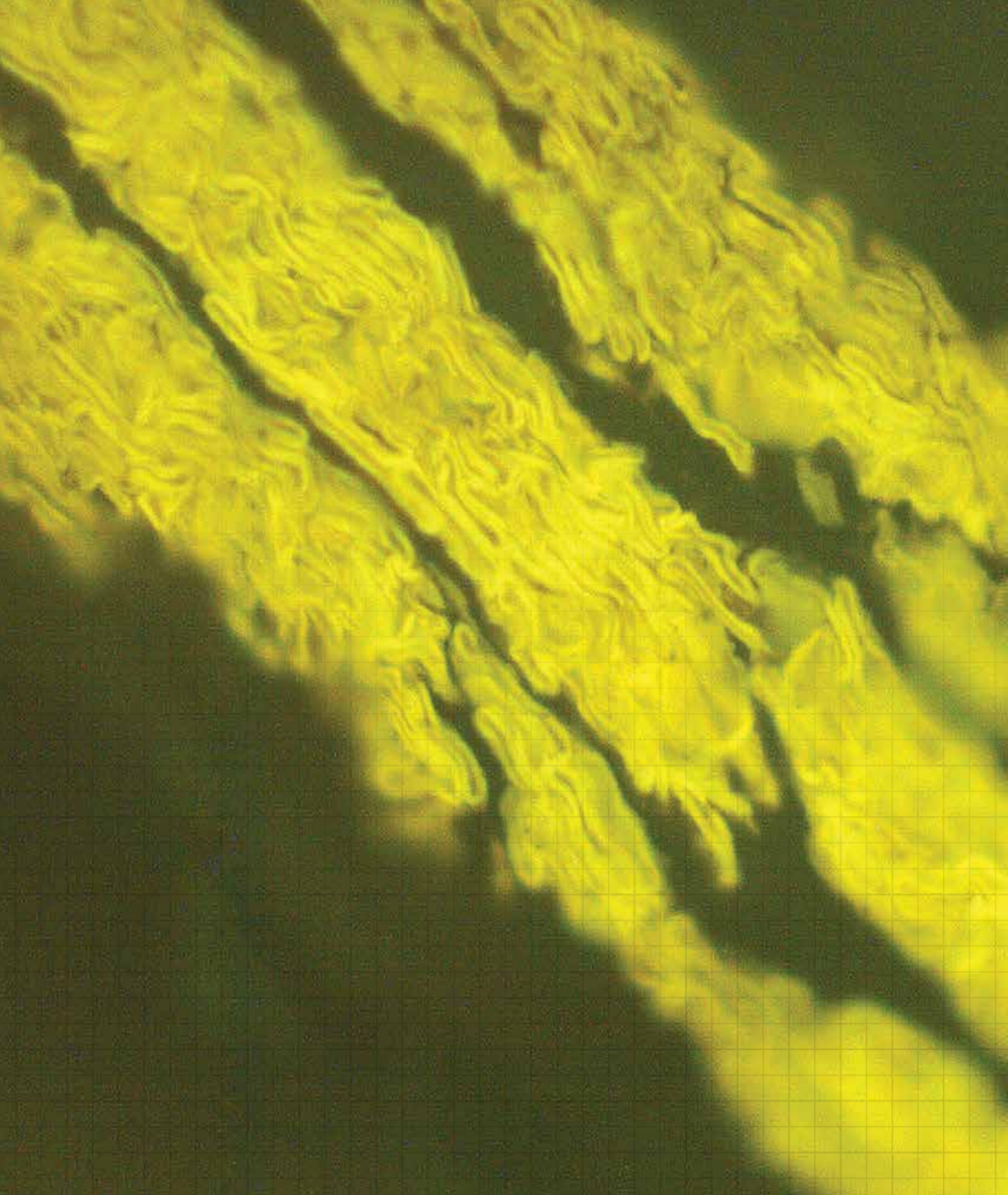
**Senarai Aktiviti Pembangunan Lombong & Kuari Dalam Tahun 2014**  
**List of Mine & Quarry Development Activities in 2014**

	Johor	Negeri Sembilan	Kelantan	Selangor	Perak	Kedah	Perlis	Pulau Pinang	Melaka	Terengganu	Pahang	Sarawak	Sabah	Jumlah
<b>Pemeriksaan Teknikal Operasi Lombong dan Kuari / Technical Inspection of Mine &amp; Quarry Operations</b>														
Pemeriksaan teknikal operasi lombong / Mining operation technical inspection	185	5	211	11	257	55	0	0	1	199	240	34	0	1198
Pemeriksaan teknikal operasi kuari / Quarrying operation technical inspection	197	72	53	139	608	34	11	203	8	63	152	15	40	1595
Pemeriksaan teknikal operasi kilang amang /loji pemrosesan mineral / Amang plant / mineral processing plant operations technical inspection	42	2	0	17	108	10	0	10	1	0	106	14	0	310
Pemeriksaan teknikal tapak peletupan (selain kuari) / Technical inspection of blasting sites (other than quarries)	4	0	0	150	14	10	3	136	0	0	3	0	12	332
Pemeriksaan teknikal kawasan carigali / Technical inspection of exploration areas	2	0	32	0	18	0	0	0	0	0	0	1	0	53
Pemeriksaan buku urusiaga mineral (termasuk kedai bijih / kedai emas ) / Account books inspection on mineral dealings (including tin ore dealer / gold dealer)	20	0	4	46	77	14	0	12	0	0	119	0	0	292
<b>Pemeriksaan Teknikal Operasi Lombong dan Kuari / Monitoring of Mining &amp; Quarrying Activities</b>														
Persampelan efluen lombong / Mine effluent sampling	0	0	0	0	191	0	0	0	0	0	133	3	7	334
Siasatan aduan / Complaint investigation	10	2	8	4	14	6	0	13	0	0	38	3	4	102
Perintah dan arahan / Orders and instructions	4	0	7	1	27	0	0	2	0	0	39	4	0	84
Kompaun / Compounds	0	0	0	0	0	0	0	0	0	0	0	0	0	0



	Johor	Negeri Sembilan	Kelantan	Selangor	Perak	Kedah	Perlis	Pulau Pinang	Melaka	Terengganu	Pahang	Sarawak	Sabah	Jumlah
Laporan kemalangan lombong dan kuari / Mining and quarrying accident reports	0	0	2	0	1	0	0	0	0	2	1	1	0	7
Kerja ukur tanah sempadan dan cerun / Survey works on land boundary and slope	0	0	0	0	0	0	0	0	0	0	13	0	0	13
Kerja ukur gegaran / habuk / kebisingan dan pemantauan peletupan / Vibration and blast monitoring	22	3	3	125	259	7	1	243	0	2	18	8	6	697
Pelesenan / Licensing														
Skim Pengendalian Melombong / Operational Mining Scheme	22	3	24	2	25	8	0	0	0	30	51	8	0	173
Surat Kebenaran Pengkuarian / Letter of Authority to Quarry	0	19	5	24	72	0	0	0	0	21	26	0	0	167
Lesen Bawah Tanah / Underground Licence	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Lesen Air Tahanan / Negeri / Permit Air / Annual / State Water Licence / Water Permit	0	0	2	0	0	0	0	0	0	0	10	0	0	12
Lesen Membeli Emas Mentah / Gold Buyers Licence	0	0	0	0	0	0	0	1	0	0	1	0	0	2
Lesen Bijih Mineral / Mineral Ores Licence	35	2	0	20	56	13	0	10	2	0	94	0	0	232
Permit Mengangkut Bijih Padat Timah / Tin Ore Concentrate Transport Permit	19	0	3	12	177	4	0	1	0	0	18	0	0	234
Laporan penilaian teknikal eksport mineral / Technical assessment report for mineral export	0	41	44	467	17	18	0	40	0	33	117	40	0	817
Laporan teknikal perakuan eksport bahan batuan / Technical assessment report for rock material export	722	3	13	0	404	284	0	13	0	9	3	42	44	1537
Permit Letupan / Blasting Permit	3	0	0	0	0	19	7	25	14	1	18	0	0	87

	Johor	Negeri Sembilan	Kelantan	Selangor	Perak	Kedah	Perlis	Pulau Pinang	Melaka	Terengganu	Pahang	Sarawak	Sabah	Jumlah
Laporan perakuan magazin letupan / Report for explosives magazine approval	3	0	0	0	0	0	0	0	0	0	1	0	0	4
Pengeluaran / pembaharuan Sijil Pembedi / Issuance / renewal of Shot Firer Certificate	4	5	4	15	23	7	3	10	0	4	8	4	9	96
Lencongan sungai / River diversion	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ujian pengurus lombong / kuari / Test for mine / quarry managers	0	0	6	0	0	1	0	0	0	0	0	0	0	7
Ujian amali pembedi / Shot firer practical test	0	0	1	7	7	0	3	0	0	1	2	9	0	30
Khidmat Nasihat dan Kepakaran / Advisory and Professional Services														
Ulusan laporan EIA / EIA report review	3	1	1	0	4	3	0	3	0	0	1	4	22	42
Laporan permohonan lesen carigali / pajakan / Prospecting and mining lease application report	19	3	94	0	21	9	0	0	0	51	273	4	0	474
Laporan permohonan tanah kuari / Quarry land application report	10	2	0	0	15	3	0	0	0	5	27	3	0	65
Laporan pembebasan mineral / Mineral clearance report	1	0	0	0	192	16	11	11	0	7	218	2	0	458
Lain-lain laporan teknikal untuk agensi lain / Miscellaneous technical report for other agencies	53	2	0	0	1	6	0	8	0	0	20	3	0	93
Pertanyaan mengenai maklumat lombong / kuari / Enquiries on mining / quarrying information	195	0	201	0	1	30	16	25	0	8	1536	48	34	2094
Lain-lain / Others														
Seminar / Dialog / Pameran / Seminar / Dialogue / Exhibition	18	13	0	4	2	0	0	0	0	1	6	15	0	59







# PENYELIDIKAN DAN PEMBANGUNAN RESEARCH AND DEVELOPMENT

Fotomikrograf menunjukkan tinggalan dinding luar spora / debunga yang telah diarangbatukan dan dinamakan sebagai sporinit (berwarna kuning) dalam arang batu Mukah di Sarawak (cahaya ultraungu pantulan di bawah rendaman minyak).

Photomicrograph showing the coalified remains of spore / pollen exines called sporinite (yellow colour) in the Mukah coal of Sarawak (reflected ultraviolet light under oil immersion).

Photo: Sia Say Gee

## PENYELIDIKAN DAN PEMBANGUNAN

Pusat Penyelidikan Mineral (PPM) merupakan bahagian penyelidikan dan pembangunan (R&D) kepada Jabatan Mineral dan Geosains (JMG) Malaysia.

Objektif PPM adalah:

- Untuk menggalak dan mempelbagai penggunaan sumber mineral tempatan bagi menyumbang kepada pembangunan sektor perindustrian negara melalui R&D
- Untuk menggalak pengusahahasilan sumber mineral secara mapan melalui R&D

Antara fungsi PPM ialah:

- Menjalankan R&D berasaskan mineral tempatan supaya dapat menghasilkan bahan mula dan bahan tambah nilai untuk digunakan oleh industri
- Membangun teknologi pemprosesan mineral dan kitar semula yang bersesuaian
- Menjalankan penyelidikan bersama Institusi Pengajian Tinggi, agensi R&D yang lain serta pihak industri dalam bidang mineral
- Mengkomersil hasil R&D yang signifikan melalui pemindahan teknologi kepada pihak yang berminat
- Berperanan sebagai penasihat dan pusat rujukan dalam perkara-perkara yang berkaitan dengan penyelidikan mineral tempatan
- Menjalankan R&D berkaitan pengusahahasilan mineral, impak alam sekitar dan pemulihan serta menyediakan perkhidmatan sokongan kepada jabatan dalam menangani masalah yang berkaitan

## RESEARCH AND DEVELOPMENT

The Mineral Research Centre (PPM) is the research and development (R&D) arm of the Minerals and Geoscience Department (JMG).

The objectives of PPM are:

- To encourage and diversify use of local mineral resources so as to contribute towards the development of the country's industrial sector through R&D
- To encourage the development of mineral resources in a sustainable manner through R&D

Among its functions are:

- To carry out R&D on local minerals in order to produce starting and value added materials for industrial use
- To develop suitable mineral processing and recycling technologies
- To carry out collaborative research with institutes of higher learning, other R&D agencies and industries in the field of minerals
- To commercialise significant R&D results through technology transfer to interested parties
- To assume advisory role and act as a reference centre in areas related to research in local minerals
- To undertake R&D in mineral extraction, environmental impact and rehabilitation as well as providing support services to the department in overcoming related problems

# Teknologi Berasaskan Lempung

## Clay-Based Technology

Bil. No.	Aktiviti / Projek R&D R&D Activity / Project	Hasil / Penemuan / Catatan Output / Findings / Remarks
1	<p>Teknologi penghasilan bebola seramik berasaskan lempung tempatan sebagai penyokong lapisan pemangkin dalam reaktor pemangkinan minyak, petrokimia, dan gas (Usahasama R&amp;D dengan rakan industri tempatan)</p> <p>Production technology for local clay-based ceramic ball as catalyst bed support in the oil, petrochemical and gas catalytic reactor. (R&amp;D collaboration with a local industrial partner)</p>	<p>Formulasi baru jasad seramik telah dibangunkan oleh JMG. Bebola seramik yang dihasilkan dari formulasi baru ini telah memenuhi spesifikasi produk komersil antarabangsa untuk media penyokong lapisan pemangkin. Pihak rakan industri telah bersetuju untuk mengkomersilkan dalam tempoh masa yang sesuai. Program pemindahan teknologi berkaitan pemilihan bahan jasad, kaedah pemprosesan serta penyediaan dan pencirian jasad baru telah dijalankan oleh JMG untuk rakan industri.</p> <p>A new ceramic ball was developed by JMG using a new formulation. The new ceramic ball had met the requirements of international commercial product specifications for catalyst bed support media, and the industrial partner agreed to commercialize it at an appropriate time. A technology transfer program on the selection of body materials, processing methodologies, characterization and body preparation was carried out by JMG for the industrial partner.</p>
2	<p>Teknologi penghasilan jasad seramik tembikar putih menggunakan bahan mentah lempung dari negeri Perak (Usahasama R&amp;D dengan Perbadanan Kemajuan Kraftangan Malaysia-Negeri Perak (PKKM-NP) sebagai rakan agensi)</p> <p>Production technology for ceramic whiteware body using raw clay material from Perak (R&amp;D collaboration with PKKM-NP as agency partner)</p>	<p>Dua jasad tembikar putih yang berpotensi untuk dibangunkan secara komersial telah berjaya dihasilkan, iaitu tembikar batu dan tembikar tanah. Kedua-dua formulasi jasad ini telahpun digunakan oleh pengusaha program inkubator di bawah seliaan PKKM-NP, dan juga oleh beberapa pengusaha seramik tempatan.</p> <p>Two ceramic whiteware bodies with commercialization potential were successfully developed, viz. stoneware and earthenware. The formulations of these two bodies were being used by entrepreneurs of the incubator program under PKKM-NP supervision, and also by several local ceramic entrepreneurs.</p>
3	<p>Teknologi penghasilan jasad seramik teknikal kalis nyala</p> <p>Production technology for flame-proof technical ceramic body</p>	<p>Lima jasad seramik teknikal kalis nyala jenis porselin telah berjaya direkabentuk serta dibangunkan oleh JMG. Kesemua jenis porselin ini memenuhi hampir keseluruhan keperluan spesifikasi seramik kalis nyala komersil, kecuali spesifikasi tahan pembakaran secara terus (produk retak atau pecah).</p> <p>Five flameproof technical ceramic body porcelain types were succesfully formulated and developed by JMG. These porcelain types fulfilled almost all the requirements stipulated for commercial flameproof technical ceramics, except for the specification on direct resistance heating (product broke or cracked).</p>

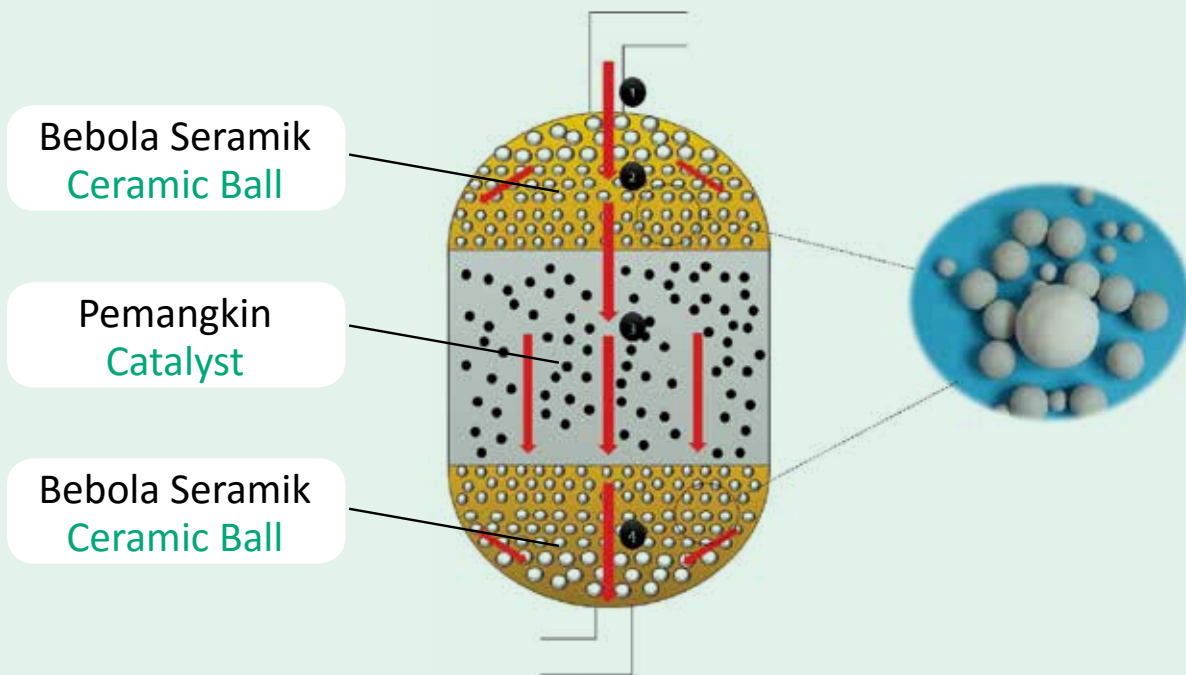


Teknologi penghasiian bebola seramik berasaskan lempung tempatan sebagai penyokong lapisan pemangkin dalam reaktor pemangkinan minyak, petrokimia, dan gas

Production technology for local clay-based ceramic ball as catalyst bed support in the oil, petrochemical and gas catalytic reactor

Kedudukan bebola seramik yang digunakan sebagai media penyokong lapisan pemangkin dalam reaktor pemangkinan

Arrangement of ceramic balls as catalyst bed support media in a catalytic reactor



1. Minyak / petrokimia / gas mentah mengalir dari bahagian atas ke bawah.
2. Minyak / petrokimia / gas mentah melalui ruang atas bola seramik sebelum ke ruang pemangkin.
3. Minyak / petrokimia / gas mentah bertindak balas secara kimia di ruang pemangkin dan menghasilkan produk minyak / petrokimia / gas sekunder.
4. Produk minyak / petrokimia / gas sekunder melalui ruang bawah bola seramik sebelum keluar untuk aliran proses yang seterusnya.

1. The raw oil / petrochemical / gas flows down from the upper part
2. The raw oil / petrochemical / gas materials goes through the upper ceramic ball zone before entering the catalyst zone
3. The raw oil / petrochemical / gas chemically reacts at the catalyst zone and get chemically engineered. It becomes the secondary oil / petrochemical / gas products.
4. The chemical engineered products then passes through the lower ceramic ball zone and flows out for the next process flow.

# Teknologi Berasaskan Silika

## Silica-Based Technology

Bil. No.	Aktiviti / Projek R&D R&D Activity / Project	Hasil / Penemuan / Catatan Output / Findings / Remarks
1	<p>Penghasilan jubin kaca di peringkat loji pandu menggunakan kaca kitar semula</p> <p>Glass tile production in pilot plant using recycled glass waste</p>	<p>Campuran sisa kaca soda-kapur, bahan pengikat lempung dan pigmen warna telah menghasilkan seramik kaca dengan melalui proses rawatan pensinteran yang mudah. Produk seramik kaca yang dihasilkan memenuhi spesifikasi standard ISO 13006 untuk jubin seramik dan setanding dengan jubin kaca seramik komersial (Neoparies dan jubin granit).</p> <p>A mixture of recycling soda-lime glass, clay binder and coloured pigment resulted in the formation of glass ceramics using a simple sintering treatment process. The resultant glass-ceramic materials complied with the standard specification of ISO 13006 requirements for ceramic tiles and were comparable to commercial tiles (Neoparies and granite tiles).</p>
2	<p>Penghasilan konkrit ringan menggunakan sisa kaca untuk industri pembinaan</p> <p>Lightweight concrete production using recycled glass for Construction Industry</p>	<p>Kajian telah dijalankan dengan menggunakan sisa bahan kaca sebagai pengganti simen dengan 5, 10 dan 15% kandungan kaca. Keputusan ujian menunjukkan bahawa walaupun 15% sisa bahan kaca digunakan sebagai pengganti simen kekuatan mampatan blok konkrit masih tinggi, iaitu 30 N/mm<sup>2</sup>.</p> <p>An investigation was carried out to study the possibility of using glass waste as a substitute for cement with 5, 10 and 15% glass content. The results showed that the compressive strength of the concrete block after replacement with 15% of glass waste was still high, exceeding 30 N/mm<sup>2</sup>.</p>

Penghasilan jubin kaca di peringkat loji pandu menggunakan kaca kitar semula  
Glass tile production in the pilot plant using recycled glass waste



Serbuk kaca  
Glass powder



Sampel jubin kaca sebelum proses pensinteran  
Glass tile samples before sintering



Sampel jubin kaca selepas proses pensinteran  
Glass tile samples after sintering

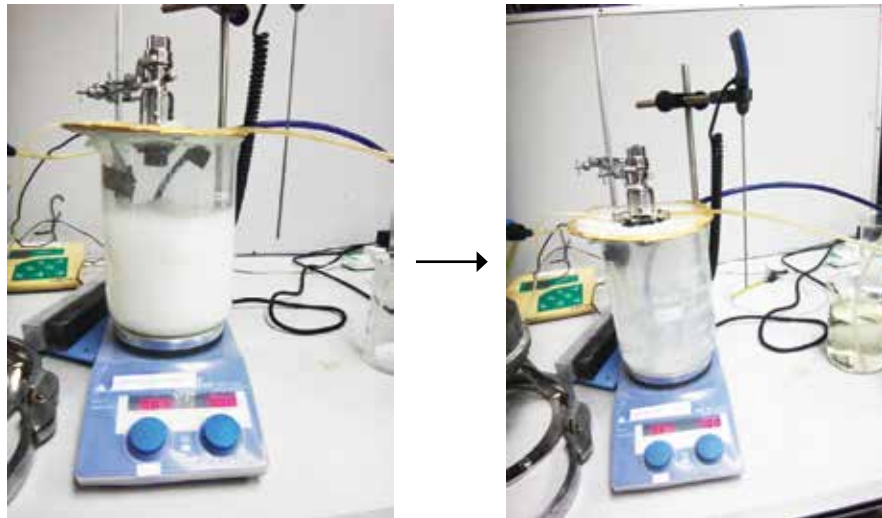
# Teknologi Berasaskan Batuan

## Rock-Based Technology

Bil. No.	Aktiviti / Projek R&D R&D Activity / Project	Hasil / Penemuan / Catatan Output / Findings / Remarks
1	<p>Penghasilan kalsium karbonat termendak (PCC) nano dengan kaedah penyemburan</p> <p>Production of nano precipitated calcium carbonate (PCC) using nozzle technique</p>	<p>Kajian menunjukkan bahawa teknik penyemburan menggunakan nozel mempunyai potensi untuk memperolehi PCC bersaiz nano.</p> <p>The study showed that the nozzle spraying method had the potential to produce nano PCC.</p>
2	<p>Pemendakan <i>in situ</i> PCC ke dalam lumen pulpa untuk pembuatan kertas dengan bantuan poliakrilamida (PAM)</p> <p><i>In situ</i> deposition of PCC in the lumen pulp for paper making with the aid of polyacrylamide (PAM)</p>	<p>Kajian menunjukkan kertas yang terawat dengan PAM mempunyai kekuatan koyakan, regangan dan pecahan yang lebih baik berbanding kertas yang dihasilkan tanpa bahan bantuan. Berkenaan sifat optik, kelegapan tercapai adalah lebih 95% untuk kesemua sampel kertas yang dihasilkan. Dari segi kandungan pengisi, kandungan PCC secara pemendakan <i>in situ</i> boleh mencapai 79% berbanding dengan pemendakan secara konvensional yang hanya mencapai 25% bagi kertas tanpa rawatan. Analisis morfologi mendapati pemendakan PCC tidak hanya berlaku di atas permukaan gentian, malah juga di ruang antara gentian dan lumen. Ujian kebolehcetakan ke atas sampel kertas yang dihasilkan menunjukkan kertas tersebut sesuai digunakan untuk percetakan.</p> <p>The study indicated that paper treated with PAM had stronger tear, tensile, and bursting indices compared to paper without additives. Regarding optical properties, the opacity attained was more than 95% for all the papers produced. As for the filler content, PCC content using the <i>in situ</i> deposition technique reached up to 79% compared to conventional method which recorded only 25% for paper without treatment. Morphological analyses indicated that PCC particles were not only deposited on the fibre surface but also in the fibre webs and in the lumen. Printability tests on the sample paper produced indicated that the paper was suitable for printing.</p>
3	<p>Perkhidmatan ujian batu dimensi</p> <p>Dimension stone testing services</p>	<p>Sejumlah 138 spesimen dari pihak swasta telah diuji.</p> <p>A total of 138 specimens from the private sector were tested.</p>



**Penghasilan kalsium karbonat termendak (PCC) nano menggunakan kaedah penyemburan**  
**Production of nano precipitated calcium carbonate (PCC) using nozzle technique**



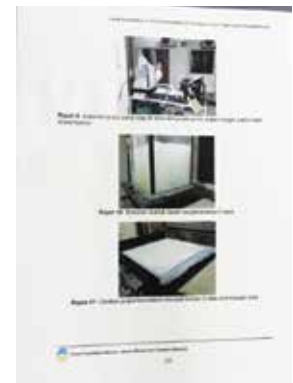
**Pemendakan *in situ* PCC ke dalam lumen pulpa untuk pembuatan kertas dengan bantuan poliakrilamida (PAM)**  
***In situ* deposition of PCC in the lumen pulp for paper making with the aid of polyacrylamide (PAM)**



Buburan pulpa dimasukkan ke dalam tangki  
pada hand sheet former  
Pulp slurry was filled into a tank at hand  
sheet former



Pemendakan *in situ* PCC ke dalam lumen  
pulpa untuk pembuatan kertas di atas  
permukaan kain  
*In situ* deposition of PCC in the lumen pulp for  
paper making on the surface of the cloth



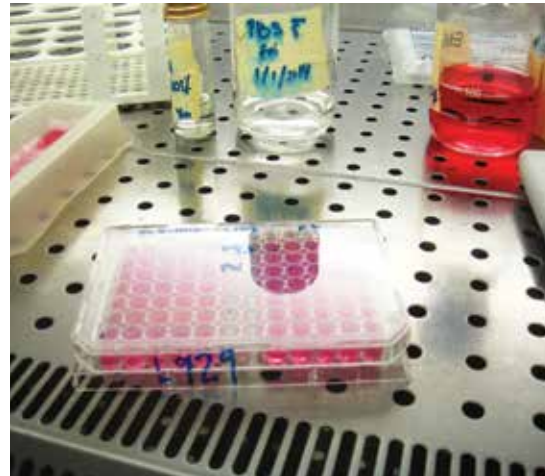
Kertas yang dihasilkan  
dengan teknik  
pemendakan *in situ*  
Papers produced by  
*in situ* precipitation  
technique

# Teknologi Bahan Termaju

## Advanced Material Technology

Bil. No.	Aktiviti / Projek R&D R&D Activity / Project	Hasil / Penemuan / Catatan Output / Findings / Remarks
1	Kebolehaucuan dan keserasian biologi ingot gigi leusit  Mouldability and biological compatibility of leucite dental ingot	Kajian ini memberi tumpuan kepada penilaian tahap bioserasi kaca-seramik leusit yang dihasilkan dari pasir silika tempatan bergred tinggi. Di bawah keadaan kajian, kesemua keputusan ujian menunjukkan bahawa tiada kesan sitotoksik, kemutagenan dan klastogen kaca-seramik leusit pada semua kepekatan kajian. Ujian ICP juga mengesahkan bahawa kaca seramik leusit tidak mengandungi sebarang bahan toksik seperti plumbum, arsenik, raksa dan kadmium.  This study focused on the biocompatibility evaluation of leucite glass-ceramics produced from local high grade silica sand. Under the conditions of the study, all the test results showed that the leucite glass-ceramics did not exhibit cytotoxic, mutagenic and clastogenic effect at all the tested concentrations. The ICP test also confirmed that the leucite glass-ceramics did not contain toxic materials such as lead, arsenic, mercury and cadmium.
2	Penghasilan komposit marmar menggunakan sisa dolomit dan andalusit tempatan  Production of marble composite using local dolomite waste and andalusite	Satu bahan komposit telah dihasilkan dari campuran resin polimer, sisa dolomit dan andalusit tempatan. Bahan komposit ini berpotensi tinggi untuk dijadikan produk <i>solid surface</i> kerana ia boleh dihasilkan dalam pelbagai bentuk untuk kegunaan sebagai kaunter dapur, sinki dan tab mandi. Kajian ini mendapati bahawa penambahan andalusit ke atas sisa dolomit telah meningkatkan kekuatan mekanikal komposit marmar.  A composite material was formed by combining polymer resin, local dolomite waste and andalusite. This composite material has high potential as a solid surface product as it can be fabricated to any shape for use as kitchen countertops, sinks and bath tubs. The study showed that the addition of andalusite to the mixture improved mechanical strength of the marble composite.
3	Penghasilan kalsium silikat ( $\text{Ca}_2\text{SiO}_4$ ) bersaiz nano  Production of nano-sized calcium silicate ( $\text{Ca}_2\text{SiO}_4$ )	Penyelidikan telah dijalankan terhadap pengisaran nanopartikel kalsium silikat ( $\text{Ca}_2\text{SiO}_4$ ) menggunakan pengisar bebola planetari tenaga tinggi. Kesan penggunaan bahan bantuan dalam pengisaran ke atas purata saiz partikel ( $d_{50}$ ) dan transformasi fasa telah dikaji. Keputusan ujian menunjukkan bahawa $d_{50}$ untuk nanopartikel boleh dikurangkan dari 1000 nm ke 90 nm dengan menambahkan bahan bantuan pengisaran, yang juga menghalang transformasi daripada fasa kristal kepada amorfus. Oleh itu, bahan bantuan pengisaran adalah sangat berkesan dalam proses pengisaran nanopartikel.  Research was carried out on nanoparticle grinding of calcium silicate ( $\text{Ca}_2\text{SiO}_4$ ) using a high energy planetary ball mill. The effect of grinding aids on the average particle size ( $d_{50}$ ) and the transformation of phases were investigated. It was demonstrated that the $d_{50}$ for nanoparticle could be reduced from 1000 nm to 90 nm by the addition of grinding aids, which also prevented transformation from the crystal to the amorphous phase. Thus, grinding aids were very effective in the nanometer range grinding process.

**Kebolehacuan dan keserasian biologi ingot gigi leusit**  
**Mouldability and biological compatibility of leucite dental ingot**



Ujian MTT ke atas kaca-seramik leusit  
 MTT assay of leucite glass-ceramics

**Penghasilan komposit marmar menggunakan sisa dolomit dan andalusit tempatan**  
**Production of marble composite using local dolomite waste and andalusite**



Sisa dolomit dari Perak  
 Dolomite waste from Perak



Komposit marmar yang dihasilkan dari sisa  
 dolomit dan andalusit tempatan  
 Marble composite produced from local  
 dolomite waste and andalusite



# Teknologi Pemprosesan Mineral

## Mineral Processing Technology

Bil. No.	Aktiviti / Projek R&D R&D Activity / Project	Hasil / Penemuan / Catatan Output / Findings / Remarks
1	Pembangunan teknik pemprosesan fiziko-kimia peringkat loji untuk sumber-sumber mineral tempatan Development of pilot plant scale physico-chemical processing techniques for local mineral resources	Kajian pengasingan mineral sulfida dari bijih kompleks dan peningkatan kandungan feldspar dengan teknik pengapungan. Aktiviti kajian dijalankan dengan menggunakan sel pengapungan bersaiz 30 liter yang dibangunkan oleh JMG sendiri. Study on separation of sulphide minerals from complex ores and upgrading of feldspar content by flotation technique. The research activities were performed using a 30 liter flotation cell developed by JMG.
2	Menilai parameter-parameter pengapungan bijih kompleks untuk digunakan dalam model simulasi proses pengapungan Evaluation of complex ore floatation parameters data for input into modelling and simulation flotation processes	Pengumpulan data bagi proses pengasingan mineral sulfida dari bijih kompleks dengan kaedah pengapungan. Perisian JKSimmet Versi 6.0 telah digunakan. Collection of data on the separation of sulphide minerals from complex ores by the flotation method. JKSimmet Software Version 6.0 was used.
3	Peningkatan perolehan kasiterit bersaiz halus dari bijih timah kompleks dengan menggunakan kaedah pengapungan Improving the recovery of fine-sized cassiterite from complex tin ores by flotation method	Kajian tertumpu kepada perolehan beberapa reagen yang bersesuaian dan parameter yang boleh digunakan untuk pemprosesan kasiterit bersaiz halus dengan kaedah pengapungan. Keputusan sehingga kini menunjukkan bahawa ianya berpotensi untuk diaplikasikan untuk bijih bersaiz halus pada julat saiz tertentu sahaja. Oleh itu, aktiviti kajian akan ditumpukan kepada kecekapan pengasingan untuk bijih halus dalam julat saiz tersebut dapat dioptimumkan. The study focused on the acquisition of appropriate reagents and parameters that could be used for the floatation of fine-sized cassiterite. The results thus far indicated that floatation could potentially be applied to a particular size range only. Therefore, more focus will be set on the optimization of fine-sized cassiterite separation within certain size ranges.
4	Pengsintesisan aerogel silika dan aplikasi produknya sebagai penyokong kepada bahan pemangkin titanium Silica aerogel synthesization and its application as supporting material for titanium catalyst	Satu kaedah pengsintesisan bahan berasaskan silika (aerogel) yang boleh digunakan sebagai media sokongan untuk bahan pemangkin titanium telah dapat dibangunkan. Produk yang diperolehi masih dalam proses penambahbaikan. A method for synthesizing silica based support material (aerogel) which could be used for hosting titanium catalyst, had been developed and was being improved.

Bil. No.	Aktiviti / Projek R&D R&D Activity / Project	Hasil / Penemuan / Catatan Output / Findings / Remarks
5	Penyelidikan kontrak berkaitan pemprosesan mineral untuk industri  Contract research related to mineral processing for industry	i. Kajian pemprosesan feldspar terluluhawa dari Syarikat Ceramic Materials Supply, Kapar, Selangor ii. Kajian pencirian dan <i>attrition scrubbing</i> untuk sampel pasir silika dari Syarikat Perusahaan Usahasama Membalak Sdn. Bhd., Johor i. Study on processing of weathered feldspar from Ceramic Material Supply (CMS) Sdn. Bhd., Kapar, Selangor ii. Study on characterisation and attrition scrubbing of silica sand sample from Perusahaan Usahasama Membalak Sdn. Bhd., Johor
6	Persijilan MS ISO 9001:2008  MS ISO 9001:2008 Certification	Pihak SIRIM mengekalkan Persijilan MS ISO 9001:2008 untuk Pusat Penyelidikan Mineral dengan penambahan skop Perkhidmatan Ujian Pemprosesan Bijih Timah di Makmal Cawangan Teknologi Pemprosesan Mineral, Pusat Penyelidikan Mineral. Persijilan ini, dengan penambahan skop, dikekalkan sehingga tahun 2015. SIRIM maintained the MS ISO 9001:2008 certification for Mineral Research Centre with additional scope of Testing Services for Tin Ore Processing at the Mineral Processing Technology Section laboratory, Mineral Research Centre. The certification, with additional scope, would be maintained until 2015.

## Teknologi Perlombongan dan Pengkuarian

### Mining and Quarrying Technology

Bil. No.	Aktiviti / Projek R&D Activity / R&D Project	Hasil / Penemuan / Catatan Output / Findings / Remarks
1	Pengkelasan efluen di kawasan lombong dan pembangunan teknik rawatan <i>acid mine drainage</i> (AMD)  Classification of effluent in mining areas and the development of AMD treatment techniques	Aktiviti projek ini tertumpu kepada kajian lapangan, persampelan dan penganalisaan efluen di kawasan lombong yang aktif seperti di lombong emas, bijih besi, pasir silika dan bauksit yang terdapat di Terengganu, Kelantan dan Johor. Ujian pencirian secara <i>in situ</i> bagi parameter kualiti seperti pH, oksigen terlarut, konduktiviti, jumlah pepejal terlarut, potensi penurunan-pengoksidaan dan kekeruhan telah dilakukan ke atas air. Analisis kandungan logam berat pula dilakukan di makmal Pusat Penyelidikan Mineral di Ipoh, Perak. Pengkelasan AMD akan dibuat berpandukan tahap keasidan, tahap kandungan besi dan mangan dalam air efluen dan sebagainya. The project activities were focused on field studies, sampling and analysis of effluent at active mines sites, such as gold, iron ore, silica and bauxite mines in Terengganu, Kelantan and Johor. <i>In situ</i> tests for water quality parameters such as pH, dissolved oxygen, conductivity, total dissolved solid, oxidation - reduction potential and turbidity were carried out on the water samples. Analyses of heavy metals were conducted at the Mineral Research Centre laboratory in Ipoh, Perak. AMD classification would be made based on the level of acidity, iron and manganese content in effluent water, etc.

Bil. No.	Aktiviti / Projek R&D Activity / R&D Project	Hasil / Penemuan / Catatan Output / Findings / Remarks
2	<p>Penyisihan logam berat daripada air sisa lombong menggunakan penjerap yang murah</p> <p>Removal of heavy metals from mine waste water using low cost absorbent</p>	<p>Aktiviti projek difokuskan kepada penghasilan penjerap Zeolite P menggunakan sampel abu terbang arang batu dari stesen Janakuasa Manjung, Perak. Ujian pencirian seperti analisis saiz partikel, keupayaan penukaran kation (CEC), X-Ray Fluorescence (XRF), X-Ray Diffraction (XRD) dan unsur kaedah basah telah dijalankan ke atas sampel tersebut. Ujian penyisihan Fe daripada sampel mengguna Wet High Intensity Magnetic Separator (WHIMS) menunjukkan bahawa 20% dan 13 kGauss merupakan parameter ketumpatan buburan dan keamatan medan magnet yang optimum masing-masing. Siri ujian hidrotermal dan ujian CEC yang dilakukan mendapati parameter yang optimum adalah pada kepekatan NaOH 4M, dengan 0.1 nisbah cecair pepejal dan suhu tindakbalas 80 °C. Ujian XRD untuk digunakan untuk mengenal pasti penjerap yang dihasilkan bagi menguji keberkesanannya dalam ujian penyisihan logam berat daripada air sisa lombong.</p> <p>The project activities were focused on the production of an adsorbent, Zeolite P, using coal fly ash samples obtained from Manjung power plant station, Perak. Characterisation analyses such as particle size, cation exchange capacity (CEC), X-Ray Fluorescence (XRF), X-Ray Diffraction (XRD) and elemental wet method analysis were performed on the samples. An iron separation test using Wet High Intensity Magnetic Separator (WHIMS) indicated that 20% and 13 kGauss were the optimum pulp density and magnetic intensity respectively. A series of hydrothermal and CEC tests carried out showed that the optimum parameters were 4M NaOH concentration, with solid-liquid ratio of 0.1 and a reaction temperature of 80 °C. Subsequently, XRD test was conducted to identify the adsorbent that had been produced and to evaluate its effectiveness in removing heavy metal from mine waste water.</p>
3	<p>Penghasilan produk sampingan daripada sisa rawatan AMD</p> <p>Production of by-products from AMD treatment waste</p>	<p>Kajian ini memberi penekanan kepada penghasilan mendakan daripada rawatan AMD di dalam makmal menggunakan sampel air (daripada lombong bijih timah) bercampur dengan kapur terhidrat. Persampelan air telah dilakukan di tiga lokasi dalam kawasan lombong, iaitu Sg. Kijang, SP1 (sebelum campuran dengan kapur terhidrat) dan SP10 (sebelum air dilepaskan keluar). Mendakan berjaya dihasilkan melalui tindakbalas air sisa lombong dengan kapur terhidrat pada nisbah dan pH yang tertentu. Mendakan yang terhasil dituras dan dikeringkan untuk pencirian. Hasil analisis pencirian dengan kaedah XRF dan XRD mendapati produk yang dihasilkan sesuai digunakan sebagai bahan mentah untuk membuat simen portland biasa berdasarkan kandungan <math>\text{SiO}_2</math>, <math>\text{Al}_2\text{O}_3</math>, <math>\text{Fe}_2\text{O}_3</math> dan CaO yang tinggi.</p> <p>The focus of the study was the production of precipitate from AMD treatment in the laboratory using water samples (from a tin mine) mixed with hydrated lime. Water samples were collected from three locations in the mine area, namely Sungai Kijang, SP1 (a point before hydrated lime mixing) and SP10 (a point before water being discharged). The precipitate was successfully produced by mixing mine water with hydrated lime at a specific solid-liquid ratio and pH. The precipitate was filtered and dried for characterization. The results of characterization using XRF and XRD methods indicated that it was suitable for use as raw materials for making ordinary portland cement based on the high contents of <math>\text{SiO}_2</math>, <math>\text{Al}_2\text{O}_3</math>, <math>\text{Fe}_2\text{O}_3</math> and CaO.</p>



Bil. No.	Aktiviti / Projek R&D Activity / R&D Project	Hasil / Penemuan / Catatan Output / Findings / Remarks
4	<p>Pemodelan pencemaran bunyi trafik di kuari menggunakan keadah statistik</p> <p>Modeling of traffic noise in quarry using statistical methods</p>	<p>Sumber utama pencemaran bunyi di kuari terdiri dari aktiviti pemprosesan mineral dan juga pergerakan lori. Kajian telah dijalankan terhadap sumbangan faktor trafik ke atas pencemaran bunyi bising di kawasan kuari. Pembolehubah seperti kecerunan jalan, aliran trafik, bilangan dan kategori kenderaan pada setiap jam, kelajuan trafik dan muatan kenderaan telah dikaji. Projek ini berjaya menghasilkan satu modul berasaskan kaedah statistik penganggaran bunyi bising trafik di kawasan kuari. Modul baru ini telah diintegrasikan dalam Perisian Index Pencemaran Partikulat Kuari (Quarry Particulate Pollution Index Software)-QPPIs yang dihasilkan oleh jabatan pada tahun 2013</p> <p>The main sources of noise pollution in quarry operations are the noises emitted from the processing plant and traffic activities. A research was conducted on traffic factor that contributed to noise pollution in the quarry area. Parameters such as road gradient, traffic flow, the number and categories of vehicles at every hour, traffic speed and load of the vehicle were evaluated. This project successfully developed a module, based on statistical methods for estimating traffic noise in the quarry. This new module had been integrated into QPPI software that was developed by the department in 2013.</p>
5	<p>Rawatan AMD di tanah bekas lombong tembaga Mamut</p> <p>Treatment of AMD at the ex-Mamut copper mine land</p>	<p>Dalam projek usahasama antara JMG dan Mine Reclamation Corporation (MIRECO), Korea, pembinaan loji pandu tiga tangki untuk rawatan AMD secara pasif telah siap pada 23 September 2014. Kerja lapangan bersama pihak MIRECO telah dijalankan dari 28 September hingga 3 Oktober 2014. Penyediaan campuran bahan-bahan organik dan batu kapur untuk dimasukkan ke dalam tangki-tangki loji pandu telah dilakukan di lapangan. Pokok jenis <i>Typha Latifolia</i> ditanam di dalam tangki yang terakhir. Persampelan air loji pandu diambil setiap dua minggu sehingga April 2015. Keputusan awal menunjukkan keberkesanan loji pandu ini meningkatkan nilai pH dari 3 kepada 7.</p> <p>In this collaborative project between JMG and Mine Reclamation Corporation (MIRECO) of Korea, the construction of a three tank pilot plant for AMD passive treatment was completed on 23 September 2014. Joint fieldwork with MIRECO was conducted from 28 September till 3 October 2014. The preparation of mixing limestone and organic materials was done in the field, and the mixture was subsequently loaded into the tanks. <i>Typha latifolia</i> trees were planted in the final tank. Water sampling from the pilot plant was conducted at two-week intervals and would be continued until April 2015. Preliminary results indicated that the pilot plant was able to increase the pH value from 3 to 7.</p>

Bil. No.	Aktiviti / Projek R&D Activity / R&D Project	Hasil / Penemuan / Catatan Output / Findings / Remarks
6	Kajian kesan aktiviti perlombongan terhadap kualiti air Tasik Chini, Pahang  Impact of mining activities on water quality of Tasik Chini, Pahang	Projek ini bertujuan untuk menilai impak aktiviti perlombongan ke atas parameter kualiti air <i>in situ</i> dan kandungan logam berat di Tasik Chini dan kawasan sekitarnya. Ia merupakan projek kerjasama antara Pusat Penyelidikan Mineral dan JMG Pahang. Program persampelan telah diadakan dari September hingga November 2014 di kawasan sekitar Tasik Chini. Sebanyak 36 tempat persampelan telah dipilih untuk tujuan ini. Pengukuran parameter kualiti air <i>in situ</i> telah dijalankan untuk mengukur pH, kekonduksian elektrik dan jumlah pepejal terlarut di tempat persampelan. Analisis kandungan logam telah dijalankan di makmal untuk mengukur kandungan beberapa jenis unsur logam berat terpilih di dalam sampel air. Keputusan kajian ini telah dilaporkan dalam satu laporan bertajuk "Kesan Aktiviti Perlombongan terhadap Kualiti Air Tasik Chini, Pahang", yang diterbitkan oleh Pusat Penyelidikan Mineral.  The objective of this project was to evaluate the impact of mining activities on water quality by measuring <i>in situ</i> water quality parameters and metal contents in Tasik Chini and the surrounding areas. It was a collaborative project between the Mineral Research Centre and JMG Pahang. A sampling program was held from September to November 2014 in the vicinity of the Tasik Chini area. A total of 36 sampling points were selected for this purpose. <i>In situ</i> water quality parameters measurement were carried out to measure pH, electrical conductivity (EC), and total dissolved solid (TDS) at the sampling points. Metal content analyses were conducted in the laboratory to measure the content of selected metals in the water samples. The results of the study were presented in a report entitled "Impact of Mining Activities on Water Quality of Tasik Chini, Pahang", published by the Mineral Research Centre.
7	Kualiti air dan potensi penjanaan <i>acid mine drainage</i> (AMD) di sekitar Bukit Ibam, Pahang  Water quality and acid mine drainage (AMD) generation potential around Bukit Ibam, Pahang	Kajian ini bermula pada awal September 2014. Sampel air dan batuan telah dipungut dari beberapa kawasan terpilih di sekitar lombong di Bukit Ibam, Pahang. Sebanyak 9 sampel air dan 3 sampel batuan telah dianalisis. Keputusan analisis mendapati sampel air yang diperolehi adalah berasid dengan bacaan pH di antara 3 hingga 5. Sampel air juga mengandungi kandungan logam berat yang tinggi seperti aluminium (Al), kuprum (Cu), besi (Fe), mangan (Mn) dan zink (Zn). Analisis potensi AMD dijalankan melalui kaedah <i>Acid Base Accounting</i> (ABA). Keputusan mendapati sampel batuan tersebut berpotensi untuk menjana AMD.  This study was started in early September 2014. Water and rock samples were collected from selected areas around the mine at Bukit Ibam, Pahang. A total of 9 water samples and 3 rock samples were analysed. The results indicated that all water samples were acidic, with pH values around 3 to 5. The water samples also contained high concentrations of heavy metals such as aluminium (Al), copper (Cu), iron (Fe), manganese (Mn), and zinc (Zn). AMD generation potential was analysed based on the Acid Base Accounting (ABA) method. The results showed that the rock samples had the potential to generate AMD.



Mendakan dihasilkan melalui tindakbalas air sisa lombong dengan kapur terhidrat  
 Precipitate produced by mixing mine water with hydrated lime



Penyediaan peralatan pemantauan habuk dan bunyi bising di kuari  
 Preparation of dust and noise monitoring equipment at quarry



Kerja-kerja persampelan air di sekitar kawasan Tasik Chini dan Bukit Ibam  
 Water sampling in the vicinity of Tasik Chini and Bukit Ibam area



# Teknologi Pemulihan Lombong dan Kuari

## Mine and Quarry Rehabilitation Technology

Bil. No.	Aktiviti / Projek R&D Activity / R&D Project	Hasil / Penemuan / Catatan	Output / Findings / Remarks
1	<p>Kajian maklumat geospasial penggunaan tanah bekas lombong negara</p> <p>Geospasial information studies on the use of ex-mining land in Malaysia</p>	<p>a. Maklumat geospasial tanah bekas lombong negara telah disediakan dan diserahkan kepada Cawangan Pengurusan Maklumat di Ibu Pejabat. Aspek:</p> <ul style="list-style-type: none"> <li>i. Taburan guna tanah bekas lombong, analisis geospasial tanah bekas lombong, kolam bekas lombong dan tanah bekas lombong terbiar di Perak.</li> <li>ii. Kolam bekas lombong di Selangor</li> <li>iii. Guna tanah di tanah bekas lombong Malim Nawar-Ipoh 2010.</li> <li>iv. Pelan skim melombong Johor</li> <li>v. Kadar pembangunan tanah bekas lombong di Semenanjung Malaysia</li> <li>vi. Keperluan untuk mempraktikkan pengkuarian batu kapur subpermukaan bekas lombong terbiar di Perak</li> </ul> <p>b. Kajian maklumat geospasial tanah bekas lombong di Semenanjung Malaysia. Negeri:</p> <ul style="list-style-type: none"> <li>i. Johor</li> <li>ii. Melaka</li> <li>iii. Negeri Sembilan</li> <li>iv. Pahang</li> <li>v. Terengganu</li> <li>vi. Kelantan</li> </ul> <p>c. Koleksi data taburan tanah bekas lombong di Malaysia (1960 hingga 2008).</p> <ul style="list-style-type: none"> <li>i. Statistik luas kawasan tanah bekas lombong di Perak (mengikut daerah) dari tahun 1960 hingga tahun 1994.</li> <li>ii. Statistik luas kawasan tanah bekas lombong di Malaysia (mengikut negeri) dari tahun 1970 hingga tahun 1995.</li> <li>iii. Statistik taburan tanah bekas lombong di Semenanjung Malaysia (mengikut negeri) dari tahun 2000 hingga tahun 2008.</li> </ul> <p>d. Anggaran sumber batu kapur subpermukaan bekas lombong terbiar di Perak. Model Summation of Multiple Slices of Average Area-Volume (SMSAAV) meramalkan pengkuarian batu kapur mentah subpermukaan bekas lombong terbiar di Perak memberikan sumber sebanyak 21,905 tan metrik bernilai RM153 bilion. Anggaran ini adalah enam kali melebihi anggaran Jabatan Penyiasatan Kajibumi Malaysia iaitu sebanyak 3466 Mt (RM24 bilion) jika kesemua bukit batu kapur di Perak dikuarkan.</p>	<p>a. Geospasial information data of the country ex-mining land were prepared and submitted to the Information Management Division at Headquarters</p> <p>Aspects covered:</p> <ul style="list-style-type: none"> <li>i. Distribution of land-use in the ex-mining land, geospasial analysis of ex-mining land, ex-mining ponds and idle ex-mining land of Perak.</li> <li>ii. Ex-mining ponds of Selangor</li> <li>iii. Malim Nawar-Ipoh ex-mining land landuse 2010.</li> <li>iv. Johor mining scheme plan</li> <li>v. Development rate of the ex-mining land in Peninsular Malaysia</li> <li>vi. The need to practise sub-surface limestone quarrying in the idle ex-mining land in Perak</li> </ul> <p>b. Geospasial information study of the ex-mining land in Peninsular Malaysia. States covered:</p> <ul style="list-style-type: none"> <li>i. Johor</li> <li>ii. Melaka</li> <li>iii. Negeri Sembilan</li> <li>iv. Pahang</li> <li>v. Terengganu</li> <li>vi. Kelantan</li> </ul> <p>c. Data collection of ex-mining land distribution in Malaysia (1960 to 2008).</p> <ul style="list-style-type: none"> <li>i. Ex-mining land area statistics of Perak (according to districts) from 1960 to 1994.</li> <li>ii. Ex-mining land area statistics of Malaysia (according to states) from 1970 to 1995.</li> <li>iii. Ex-mining land area statistics of Peninsular Malaysia (according to states) from 2000 to 2008.</li> </ul> <p>d. Estimate of subsurface limestone resources under idle ex-mining land in Perak. Summation of Multiple Slices of Area-Average Volume (SMSAAV) model predicted the resource of subsurface raw limestone under idle ex-mining land in Perak is 21,905 Mt with a value of RM153 billion. This estimate is six times more than what was previously estimated by Geological Survey Department of Malaysia.</p>

Bil. No.	Aktiviti / Projek R&D Activity / R&D Project	Hasil / Penemuan / Catatan	Output / Findings / Remarks
2	Teknik penanaman mampan untuk pemulihan kawasan kuari  Sustainable Greening Technique for Rehabilitation of Quarries	Mereka bentuk satu sistem pengairan automatik (SPA) untuk pemulihan kawasan kuari. Komponen sistem tersebut adalah tangki air, saluran paip air, sensor kelembapan tanah, alat pencetus injab tangki air dan pengellog data kelembapan tanah.	Designing an automatic irrigation system (SPA) for the rehabilitation of quarries. The components of the system included a water tank, water pipelines, soil moisture sensor, water tank valve trigger device, and soil moisture data logger.

## Sistem Pengurusan Kualiti MS ISO 9001:2008 dan Harta Intelek

Pusat Penyelidikan Mineral (PPM) telah dianugerahkan dengan sijil MS ISO 9001:2008 pada 12 Disember 2012 dalam skop ujian batu dimensi di makmal Cawangan Teknologi Berasaskan Batuan. Sistem Pengurusan Kualiti di dalam makmal terus dipelihara, dan PPM boleh mengekalkan pensijilan tersebut sehingga tahun 2015. PPM juga telah menambah skop pensijilan bagi perkhidmatan ujian pemprosesan bijih timah di makmal Cawangan Teknologi Pemprosesan Mineral. Kedua-dua skop ini telah berjaya dipersijilkan pada 12 Disember 2014.

PPM telah memperolehi hak harta intelek untuk beberapa kajiannya. Satu paten, satu utiliti inovasi dan satu hak cipta telahpun diperolehi dan didaftarkan setakat ini seperti berikut:

- Paten: *Apparatus for Producing Precipitated Calcium Carbonate* (PI 2012004692)
- Utiliti Inovasi: *Lead and Barium Free Crystal Glass* (UI 2012004620)
- Hak Cipta: *Quarry Particulate Pollution Index Software Volume 1.3.2* (QPPIS V1.3.2)

Pada 10 Disember 2014, PPM telah memfailkan paten di bawah tajuk "A Method of Loading Filler in Pulp Fibre" dengan nombor pendaftaran PI 2014703714 yang merupakan hasil kajian berkaitan teknik pemendakan *in situ*.

## Management Quality System of MS ISO 9001:2008 and Intellectual Property

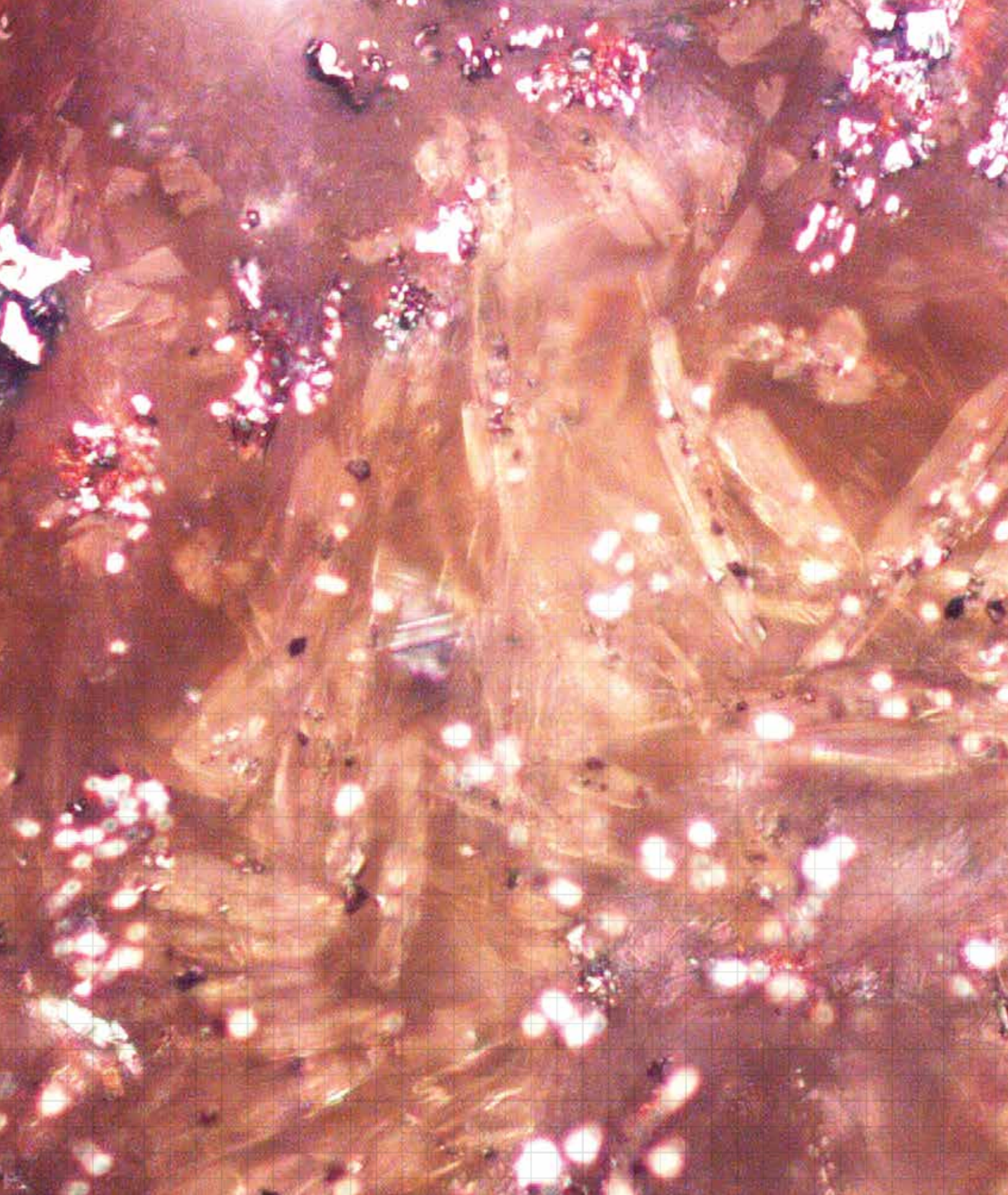
Mineral Research Centre (PPM) was awarded MS ISO 9001:2008 certification on 12 December 2012 in the scope of dimension stone tests of the Rock-based Technology Section laboratory. Quality management system in the laboratory had been continuously maintained, and PPM would be able to hold the certification until 2015. PPM had also added a new scope for certification in testing services for the processing of tin ores at the Mineral Processing Technology Section laboratory. Both scopes were successfully certified on 12 December 2014.

PPM had acquired intellectual property rights for several studies. A patent, a utility innovation, and a copyright had been granted and registered so far as follows:

- Patent: *Apparatus for Producing Precipitated Calcium Carbonate* (PI 2012004692)
- Utility Innovation: *Lead and Barium Free Crystal Glass* (UI 2012004620)
- Copyright: *Quarry Particulate Pollution Index Software Volume 1.3.2* (QPPIS V1.3.2)

On the 10 December 2014, PPM filed a patent under the title "A Method of Loading in Pulp Fibre Filler" with the registration number PI 2014703714 that arose from another study concerning the *in situ* deposition technique.









# PERKHIDMATAN SOKONGAN TEKNIKAL TECHNICAL SUPPORT SERVICES

Fotomikrograf hablur mulit di sampel abu terbang dari Loji Janakuasa Arang Batu Mukah yang membakar arang batu Balingian.

Photomicrograph of mullite crystals in the fly ash sample of the Mukah Coal-fired Power Plant that burning Balingian coal.

Photo: Sia Say Gee

# PERKHIDMATAN SOKONGAN TEKNIKAL

## Pengurusan Maklumat

### Infrastruktur, Keselamatan dan Aplikasi ICT

Infrastruktur Pusat Data JMG beroperasi dengan lancar sepanjang tahun 2014. Bandwidth rangkaian 1Gov\*Net di Kompleks JMG Ipoh kekal dengan kelajuan antara 6 sehingga 20 Mbps.

Pusat Data JMG berjaya mengekalkan persijilan MS ISO/IEC 27001:2007 Information Security Management System (ISMS) dari SIRIM bagi tahun 2014 dengan mematuhi keperluan-keperluan berikut:

- a) Audit dalam ISMS: 28-30 April 2014
- b) Audit SIRIM (Pemantauan Tahun Pertama): 21 Mei 2014.
- c) Kursus Pemantapan ISMS: 23-26 Jun 2014

Pada 27 Mei 2014, pasukan pelaksana ISMS telah menghadiri "Seminar Transition to Revised Information Security Management System Standard ISO/IEC 27001:2013" di Shah Alam Convention Centre, Selangor bagi mendapat pendedahan terhadap perubahan standard yang berkuatkuasa pada 30 September 2014.

Kontrak penyelenggaraan Pusat Data masih diteruskan bagi memastikan operasi dan fasiliti Pusat Data dapat beroperasi dengan lancar serta untuk meningkatkan tahap ketersediaan maklumat dalam MINGEOSIS (Sistem Maklumat Mineral dan Geosains).

Pusat Data JMG juga telah mengambil bahagian dalam projek Disaster Recovery Center (DRC) dan Government Data Center (GDC-2) di bawah pengelolaan pihak MAMPU. Laman web JMG telah berjaya dipindahkan sepenuhnya ke GDC-2 di Shah Alam pada bulan Januari 2014. Ujian Disaster Recovery (DR) Pusat Data bagi aplikasi MINGEOSIS, GIS, Active Directory dan laman web JMG telah berjaya dilaksanakan pada 1 Disember 2014 di Bangunan Strateg, Petaling Jaya, Selangor.

# TECHNICAL SUPPORT SERVICES

## Information Management

### ICT Infrastructure, Security and Application

JMG Data Center infrastructures operated smoothly throughout 2014. The 1Gov\*Net network bandwidth in JMG Ipoh Complex remained at speeds from 6 to 20 Mbps.

JMG Data Center successfully retained the ISO/IEC 27001:2007 Information Security Management System (ISMS) certification from SIRIM in 2014 by fulfilling the following requirements:

- a) ISMS Internal Audit: 28–30 April, 2014
- b) SIRIM Audit (First Year Surveillance): 21 May 2014
- c) ISMS Enhancement Course: 23-26 June 2014

On 27 May 2014, the JMG ISMS implementation team attended the "Seminar on Transition to Revised Information Security Management System Standard ISO/IEC 27001:2013" at the Shah Alam Convention Centre, Selangor to gain exposure to changes in the standard that would be effective from 30 September 2014.

Contracts on the maintenance of Data Center was continued to ensure the data center and facilities operates smoothly, and to enhance the availability of information in the MINGEOSIS (Minerals and Geoscience Information System).

JMG Data Center also participated in the Disaster Recovery Center (DRC) and Government Data Center (GDC-2) projects organized by MAMPU. The JMG Website was successfully transferred to GDC-2 in Shah Alam in January 2014. The Data Center Disaster Recovery (DR) test for MINGEOSIS applications, GIS, Active Directory and JMG websites were successfully executed on 1 December 2014 at Strateg building, Petaling Jaya, Selangor.

Pusat Data JMG juga terlibat dengan projek IPv6 (Protokol Internet Versi 6) dan MyGSOC (Perkhidmatan Komprehensif Keselamatan ICT Terurus Kerajaan Malaysia) di bawah pengelolaan pihak MAMPU. Pemasangan alat dan konfigurasi kedua-dua projek telah berjaya dijalankan pada bulan September 2014.

## Pengurusan Data Berkomputer

Aplikasi Statistik Atas Talian Lombong & Kuari atau ST@LK telah diperluaskan dan dilaksanakan di Negeri Sembilan, Melaka dan Pahang. Pegawai Geosains serta pengusaha lombong dan kuari di Negeri Sembilan dan Melaka menerima latihan secara *hands-on* pada 23-24 Januari 2014, manakala di Pahang pada 3-4 Jun 2014. Untuk memastikan maklumat yang dihantar ke aplikasi ST@LK dapat dimasukkan ke dalam sistem MINGEOSIS, beberapa perubahan perlu dilakukan terhadap sistem, khususnya yang melibatkan pangkalan data lombong dan kuari iaitu MINEdat (pangkalan data lombong) dan QUARRYdat (pangkalan data kuari).

Aplikasi HYDROdat (pangkalan data hidrogeologi) pula telah ditambahbaik dan telah dipertingkatkan kepada versi 2.0. Versi baru ini memaparkan struktur yang lebih teratur dengan antara muka yang baru dan mesra pengguna. Ia juga dilengkapi dengan laporan statistik serta carian yang menepati keperluan pengguna HYDROdat. Selain HYDROdat, METALdat (pangkalan data mineral berlogam) juga turut ditambahbaik. METALdat lama hanya mempunyai modul deposit tetapi dengan penambahbaikan ini ianya mempunyai modul tambahan seperti eksplorasi, makmal, query & report dan juga modul admin.

Masalah aplikasi ENGEODat (pangkalan data geologi kejuruteraan) telah berjaya diselesaikan melalui beberapa Problem Solving Meeting (PSM). Data-data sedang dimasukkan semula ke dalam pangkalan data ENGEODat secara pukal menggunakan utility batch upload.

Kerja penyelenggaraan sistem MINGEOSIS melibatkan modul administrator dan makmal, GEOCHEMdat (pangkalan data geokimia), dan juga Digital Library System. Ujian yang dijalankan di Ipoh pada 28 April menunjukkan pautan antara MINGEODat (pangkalan data mineral dan geosains) dengan MINGEOGIS berfungsi dengan betul.

Selain itu, latihan untuk semua penyelaras bagi modul administrator telah dijalankan di BPT, Ipoh pada 29-30 April 2014 manakala latihan modul makmal dan IMDat (pangkalan data mineral industri) untuk pegawai-pegawai baru daripada JMG Sabah dan JMG Sarawak telah diadakan pada bulan Mei dan Jun di Ibu Pejabat.

JMG Data Center was also involved in IPv6 (Internet Protocol version 6) and MyGSOC (Malaysia Government Security Operation) projects organized by MAMPU. Installation and configuration of devices for both projects were successfully carried out in September 2014.

## Computerized Data Management

Online Statistics for Mine & Quarry Application or ST@LK was implemented in Negeri Sembilan, Melaka and Pahang. Geoscience Officers and operators of mines and quarries in Negeri Sembilan and Melaka received hands-on training from 23-24 January, and in Pahang from 3-4 June 2014. Some changes were made to MINEdat (mine database) and QUARRYdat (quarry database) so that data from ST@LK could be transferred directly and stored into the respective databases.

HYDROdat (hydrogeology database) was improved and upgraded to version 2.0. The new version was structurally more organised with a new and a user-friendly interface. It is equipped with a summary statistics report and a customised search utility. Besides HYDROdat, METALdat (metallic minerals database) was also improved. Before the upgrade, METALdat only had a deposit module but with the upgrade, there were additional modules incorporated such as exploration, laboratory, query and report, as well as an administrator module.

Problems and issues related to ENGEODat (engineering geology database) were successfully resolved through a series of Problem Solving Meetings (PSM). After the revision, data were re-entered into the database via the batch upload utility.

Maintenance work carried out on MINGEOSIS on the administrator and laboratory module, GEOCHEMdat (geochemistry database), and Digital Library System. Tests carried out on 28 April showed the links between MINGEODat (minerals and geoscience database) and MINGEOGIS were working correctly.

Training for all database coordinators on the administrator module was conducted at BPT, Ipoh from 29-30 April 2014. Training on laboratory module and IMDat (industrial mineral database) was carried out at the Headquarters in May and June for newly appointed officers from JMG Sabah and Sarawak.



## Sistem Maklumat Geografi dan Kartografi Berdigit

Aktiviti penyediaan peta geologi digital, penghasilan peta tematik, pengumpulan dan perkongsian data spatial serta percetakan peta telah diteruskan. Di samping itu, kerja kartografi untuk penghasilan peta dan rajah dengan menggunakan perisian grafik masih diteruskan.

Bahagian Perkhidmatan Teknikal (BPT) telah melakukan suntingan bagi 16 unit peta digital termasuk lapan peta geologi dan lapan peta topo. Sebanyak 5235 unit gambarajah dan peta kecil pelbagai skala telah disediakan menggunakan perisian grafik; 599 peta pelbagai skala telah dimbas; 2 peta geologi telah dihasilkan semula dengan menggunakan perisian ArcGIS.

Di Ibu Pejabat, sebanyak lima peta geologi digital berdasarkan skala 1:63,360 telah disiapkan. Di JMG Kelantan, sebanyak sembilan buah peta topografi dan geologi, serta 12 unit peta kecil pelbagai skala juga telah disediakan. Di JMG Sabah, sebanyak sembilan peta tematik berbagai skala telah siap didigit dan dikemaskini. Di JMG Kedah / Perlis / Pulau Pinang, sebanyak 12 peta disamping 134 peta / rajah telah berjaya dihasilkan. Sebanyak 39 dan 40 peta serta rajah telah dihasilkan oleh JMG Johor dan JMG Negeri Sembilan/ Melaka masing-masing.

## Geographical Information System and Digital Cartography

The activities included the preparation of digital geological maps, thematic map production, spatial data collection and sharing, as well as printing of maps were continued. In addition, cartographic work for the production of diagrams and figures using graphics software was continued.

The Technical Services Division completed the editing of 16 digital maps that included eight geological maps and eight topographic maps. A total of 5235 diagrams and small maps of various scales were prepared using graphics software; 599 maps of various scales were scanned; 2 geological maps were reproduced using GIS software.

At Headquarters, a total of five digital geological maps of 1:63,360 scale were completed. At JMG Kelantan, nine topographic and geological maps, together with 12 thematic maps of various sizes were also prepared. At JMG Sabah, nine thematic maps of various sizes were digitised and updated. At JMG Kedah / Perlis / Pulau Pinang, a total of 12 maps together with 134 cartographic maps / diagrams were successfully produced. A total of 39 and 40 cartographic maps and diagrams were prepared by JMG Johor and JMG Negeri Sembilan/ Melaka respectively.

Pejabat JMG JMG offices	Kerja kartografi berdigit Digital cartography work
Ibu Pejabat / Headquarters	Lima peta geologi digital (skala 1:63,360) / Five digital geological maps
Bahagian Perkhidmatan Teknikal / Technical Services Division	16 peta digital (8 peta geologi dan 8 peta topo) / 16 digital maps (8 geological maps and 8 topographic maps) 5235 gambarajah dan peta kecil / 5235 diagrams and small maps 599 peta telah dimbas / 599 maps were scanned Dua peta geologi telah dihasilkan semula dengan menggunakan perisian ArcGIS / Two geological maps were reproduced using GIS software
Kelantan	Sembilan peta topografi dan geologi, serta 12 unit peta kecil / Nine topographic and geological maps, together with 12 thematic maps
Sabah	Sembilan peta tematik / Nine thematic maps
Negeri Sembilan / Melaka	12 peta, serta 134 peta dan rajah / 12 maps, as well as 134 cartographic maps and diagrams
Johor	39 peta dan rajah / 39 cartographic maps and diagrams
Kedah / Perlis / Pulau Pinang	40 peta dan rajah / 40 cartographic maps and diagrams

## Penerbitan dan Perpustakaan

Untuk mencapai salah satu fungsi JMG yang penting iaitu mengumpul, menganalisis dan menyebarkan data dan maklumat berkaitan mineral dan geosains, JMG telah menerbitkan hasil penemuan dan kajiannya dalam berbagai laporan teknikal dan peta. Penerbitan ini disebarkan melalui perpustakaan negeri di seluruh Malaysia.

Di samping enam terbitan berkala tahunan, JMG juga telah menerbitkan laporan peta iaitu “Geologi dan Sumber Mineral Kawasan Tanah Merah Kelantan” (Laporan Peta 25), Atlas Geokimia Kelantan dan “Laporan Teknikal Jilid 8”. Sebanyak dua garis panduan juga telah diterbitkan iaitu Garis Panduan Ekplorasi Mineral Andalusit (JMG.GP.17) dan Garis Panduan Ekplorasi Bauksit (JMG.GP.18).

Dua peta geologi telah diterbitkan, iaitu Peta Geologi Semenanjung Malaysia (Edisi Ke-9) dan Peta Geologi Kawasan Tanah Merah. Empat peta sumber mineral iaitu bagi negeri Kelantan, Kedah, Perlis dan Pulau Pinang juga telah diterbitkan.

JMG telah menerima seramai 2048 orang pelawat yang membuat rujukan, penyelidikan serta membeli laporan dan peta di perpustakaan. Jumlah kutipan hasil pada tahun 2014 adalah sebanyak RM103,105, sedikit penurunan berbanding tahun lepas.

## Publications and Library

One of the important functions of JMG is to collect, analyse and disseminate data and information pertaining to minerals and geoscience. In fulfilling this important role, JMG 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.

Apart from six annual publications, a map report titled “Geologi dan Sumber Mineral Kawasan Tanah Merah Kelantan” (Map Report No. 25), Atlas Geochemistry of Kelantan as well as a technical report titled “JMG Technical Papers Volume 8” were also published. Two guidelines, namely “Guidelines on Andalusite Mineral Exploration (JMG.GP.17)” and “Guidelines on Bauxite Exploration (JMG.GP.18)” were also published.

Two geological maps were published, namely Geological Map of the Peninsular Malaysia (Edition 9) and Geological Map of the Tanah Merah. Mineral resources maps for the states of Kelantan, Kedah, Perlis and Pulau Pinang were also published.

A total of 2048 visitors visited the libraries for reference, research, and the purchase of reports and maps. The total revenue collected for 2014 was RM103,105, a slight decrease compared to the previous year's.

Perpustakaan Library	Jumlah pelawat No. of visitor	Penjualan bahan terbitan jabatan Sales of departmental publication					Jumlah penjualan Total sales (RM)
		Laporan Report		Peta Map		Lain-lain Others	
		Bil. No. of item	Jumlah Amount (RM)	Bil. No. of item	Jumlah Amount (RM)	Jumlah Amount (RM)	
Ibu Pejabat / Headquarters	951	545	19,905	408	33,046	-	52,951
Bahagian Perkhidmatan Teknikal / Technical Services Division	187	105	5980	55	5290	1082	12,352
Sarawak	530	187	14,395	34	3200	-	17,595
Sabah	92	11	550	48	2650	3850	7050
Pusat Penyelidikan Mineral / Mineral Research Centre	18	1	70	-	-	-	70
Johor	19	5	310	22	1887	-	2197
Negeri Sembilan / Melaka	15	7	370	8	750	-	1120
Selangor / Wilayah Persekutuan	10	-	-	-	-	-	-
Kedah / Perlis / Pulau Pinang	95	22	770	10	1000	-	1770
Terengganu	71	26	1460	16	1550	-	3010
Pahang	10	22	2000	19	1390	-	3390
Kelantan	50	30	1650	26	2600	-	4250
<b>Jumlah / Total:</b>	<b>2048</b>	<b>961</b>	<b>47,460</b>	<b>646</b>	<b>53,363</b>	<b>4932</b>	<b>105,755</b>

## Muzium Geologi

Muzium geologi yang ditempatkan di BPT (Ipoh), JMG Sarawak (Kuching) dan JMG Sabah (Kota Kinabalu) memainkan peranan penting sebagai pusat pembelajaran dan pendidikan geosains di negara ini. Jumlah pelawat ke muzium geologi di Ipoh dan Kuching adalah masing-masing 7235 dan 132, sementara muzium geologi di JMG Sabah telah ditutup untuk ubahsuai.

## Geological Museum

Geological museums located at BPT (Ipoh), JMG Sarawak (Kuching), and JMG Sabah (Kota Kinabalu) play an important role as centres of learning and education of geoscience in the country. The number of visitors to geological museum at Ipoh and Kuching was 7235 and 132, respectively; the geological museum at JMG Sabah was closed for renovation.



## Perkhidmatan Geofizik

### Semenanjung Malaysia

Perkhidmatan geofizik yang telah diberikan adalah survei keberintangan imej 2-D, mikrograviti dan pengelogan geofizik.

Survei keberintangan imej 2-D telah dilaksanakan di 14 lokasi meliputi sejumlah 21,070 meter-garis untuk kajian air tanah dan siasatan tapak. Survei mikrograviti telah dijalankan di tiga lokasi meliputi sejumlah 690 stesen untuk kajian tapak dan penilaian sumber geoterma. Siasatan dengan menggunakan kaedah pengelogan geofizik telah dijalankan di satu lokasi.

## Geophysical Services

### Peninsular Malaysia

The geophysical services provided included 2-D resistivity imaging, microgravity, and geophysical logging activities.

2-D resistivity imaging surveys were carried out at 14 locations covering 21,070 line-meters for groundwater studies and site investigations. Microgravity surveys for site investigations were conducted at three locations covering 690 stations for site investigations and geothermal resource assessment. Investigations using the geophysical logging method were conducted at one location.

**Kaedah: Keberintangan imej 2-D**  
**Method: 2-D resistivity imaging**

Negeri State	Kawasan Area	Liputan (meter-garis) Coverage (line-metres)	Penemuan / Catatan Findings / Remark
Johor	Jementah	3950	Kajian air tanah / Groundwater study
	Muar	1600	Kajian air tanah / Groundwater study
	Pengerang	4800	Kajian air tanah / Groundwater study
	Mersing	1600	Kajian air tanah / Groundwater study
	Simpang Renggam	1400	Kajian air tanah / Groundwater study
	Segamat	400	Kajian air tanah / Groundwater study
Perak	Taiping	800	Kajian air tanah / Groundwater study
	Ipoh	140	Siasatan tapak / Site investigation
Selangor	Kuala Langat	1400	Kajian air tanah / Groundwater study
Pahang	Kuantan	800	Kajian air tanah / Groundwater study
	Pekan	1600	Kajian air tanah / Groundwater study
	Nenasi	800	Kajian air tanah / Groundwater study
	Jerantut	180	Siasatan tapak / Site investigation
Negeri Sembilan	Gemencheh	1600	Kajian air tanah / Groundwater study
<b>Jumlah / Total:</b>		<b>21,070</b>	

**Kaedah: Mikrograviti**  
**Method: Microgravity**

Negeri State	Kawasan Area	Liputan (bil. stesen) Coverage (no. of stations)	Penemuan / Catatan Findings / Remark
Perlis	Chuping	278	Siasatan tapak / Site investigation
Perak	Ipoh	139	Siasatan tapak / Site investigation
	Ulu Slim	273	Penilaian sumber geoterma Geothermal resource assessment
Jumlah / Total:		690	

**Kaedah: Pengelogan geofizik**  
**Method: Geophysical logging**

Negeri State	Kawasan Area	Liputan (bil. telaga) Coverage (no. of wells)	Penemuan / Catatan Findings / Remark
Kedah	Pendang	2	Perakuan air mineral Mineral water certification



Pengelogan geofizik untuk perakuan air mineral di kawasan Sik, Kedah  
 Geophysical logging for mineral water certification in Sik area, Kedah



Pengelogan geofizik di Tanjung Medang, Pekan, Pahang  
 Geophysical logging at Tanjung Medang, Pekan, Pahang

## Sabah

Survei keberintangan imej 2-D telah dilaksanakan di tiga lokasi meliputi sejumlah 24,400 meter-garis untuk membantu dalam kajian air tanah dan penilaian sumber geoterma.

Survei keberintangan magnetotellurik, keberintangan elektromagnetik dan graviti telah dijalankan di Kunak untuk membantu dalam penilaian sumber geoterma meliputi 32, 26 dan 110 stesen masing-masing.

## Sabah

2-D resistivity imaging surveys were carried out at three locations covering 24,400 line-meters to assist groundwater study and geothermal resource assessment.

Resistivity magnetotelluric, resistivity electromagnetic and gravity surveys to assist in geothermal resource assessment were conducted at Kunak covering 32, 26, and 110 stations respectively.

**Kaedah: Keberintangan imej 2-D**  
**Method: 2-D resistivity imaging**

Negeri State	Kawasan Area	Liputan (meter-garis) Coverage (line-meters)	Penemuan / Catatan Findings / Remark
Sabah	Sg. Jipun, Kunak	15,200	Penilaian sumber geoterma Geothermal resource assessment
	S.K. Chinta Mata, Tenom	800	Kajian air tanah / Groundwater study
	Kota Belud	8400	Kajian air tanah / Groundwater study
Jumlah / Total:		24,400	

**Kaedah: Keberintangan (Magnetotellurik)**  
**Method: Resistivity (Magnetotelluric)**

Negeri State	Kawasan Area	Liputan (bil. stesen) Coverage (no. of stations)	Penemuan / Catatan Findings / Remark
Sabah	Sg. Jipun, Kunak	32	Penilaian sumber geoterma Geothermal resource assessment

**Kaedah: Keberintangan (Elektromagnetik)**  
**Method: Resistivity (Electromagnetic)**

Negeri State	Kawasan Area	Liputan (bil. stesen) Coverage (no. of stations)	Penemuan / Catatan Findings / Remark
Sabah	Sg. Jipun, Kunak	26	Penilaian sumber geoterma Geothermal resource assessment



**Kaedah: Graviti (Ketumpatan)**  
**Method: Gravity (Density)**

Negeri State	Kawasan Area	Liputan (bil. stesen) Coverage (no. of stations)	Penemuan / Catatan Findings / Remark
Sabah	Sg. Jipun, Kunak	110	Penilaian sumber geoterma Geothermal resource assessment

## Sarawak

Siasatan geofizik dengan menggunakan kaedah keberintangan imej 2-D telah dijalankan di kawasan Mukah dan Lawas yang bertujuan untuk siasatan tapak dan kajian air tanah. Sebanyak 46 garisan profil merangkumi sejumlah 23,300 meter telah dijalankan.

## Sarawak

Geophysical investigations using 2-D imaging resistivity method were carried out in the Mukah and Lawas areas for site investigations and groundwater studies. Forty-six profile lines covering a total of 23,300 meters were carried out.

**Kaedah: Keberintangan 2-D**  
**Method: 2-D resistivity**

Negeri State	Kawasan Area	Liputan (meter-garis) Coverage (line-meter)	Penemuan / Catatan Findings / Remark
Sarawak	Mukah	18,500	Siasatan tapak / Site Investigation Kajian air tanah / Groundwater study
	Lawas	4800	Siasatan tapak / Site Investigation Kajian air tanah / Groundwater study
Jumlah / Total:		23,300	

# Mineralogi dan Petrologi

## Semenanjung Malaysia

Sebanyak 2201 unit kerja dengan nilai kerja RM54,400 telah dijalankan untuk jabatan, agensi kerajaan dan sektor swasta.

# Mineralogy and Petrology

## Peninsular Malaysia

A total of 2201 units of routine work valued at RM54,400 were completed for the department, other government agencies and the private sector.

### Senarai khidmat analisis yang dijalankan oleh Unit Mineralogi dan Petrologi, Bahagian Perkhidmatan Teknikal Details of analytical services carried out by the Mineralogy and Petrology Unit, Technical Services Division

	Untuk industri mineral For the mineral industry		Untuk agensi kerajaan For government agencies	
	Bil. unit kerja Number of work unit	Nilai kerja Value of work (RM)	Bil. unit kerja Number of work unit	Nilai kerja Value of work (RM)
Pengenalan sampel batuan dan mineral Identification of rock and mineral specimen	28	1960	29	2030
Pemeriksaan petrografi terperinci Detailed petrographic examination	130	3900	1	30
Anggaran mineral kuantitatif Quantitative mineral estimation	58	5220	13	1170
Pengasingan magnetik / Bromoform Magnetic separation / Bromoform	105	4690	234	7800
Penyediaan keratan mikro / gilap / sinar-x Micro / polished / x-ray section preparation	90	3600	249	9960
Ujian kimia Chemical test	59	1770	-	-
Koleksi batuan dan mineral Rock and mineral collection	3	210	-	-
Kerja fotografi Photographic work	-	-	1200	12,000
Ujian kekerasan Hardness test	2	60	-	-
Jumlah kecil / Sub -total	475	21,410	1726	32,990
<b>Jumlah unit kerja Total number of work units</b>	<b>2201</b>	<b>Jumlah nilai kerja Total value of work</b>		<b>54,400</b>

## Sarawak

JMG Sarawak telah melaksanakan 726 unit kerja rutin dengan nilai kerja sebanyak RM17,020. Kerja-kerja yang dilakukan merangkumi penyediaan keratan nipis batuan, pengenalan batuan dan penyediaan laporan petrografi. Kebanyakan kerja tersebut adalah atas permintaan pihak swasta.

## Sabah

Aktiviti Mineralogi dan Petrologi telah menjalankan pelbagai tugas, seperti menyedia keratan nipis batuan untuk kajian petrografi, mengenalpasti batuan dan mineral serta menyediakan gambar mikro. Sebanyak 241 kerja mineralogi dan petrografi dengan nilai kerja RM7945 telah dilaksanakan atas permintaan dalam dan luar jabatan.

## Sarawak

Routine work totalling 726 units with a work value of RM17,020 was carried out by JMG Sarawak. The work carried out included the preparation of rock thin-sections, petrographical examinations and the preparation of petrographic reports. Most of the work was carried out at the request of the private sector.

## Sabah

The Mineralogy and Petrology Activity performed various tasks such as the preparation and petrographical studies of rock thin sections, identification of rocks and minerals, as well as preparation of photomicrographs. A total of 241 mineralogy and petrography studies with a work value of RM7945 were carried out on internal and outside request.

### Kerja yang dijalankan oleh Unit Mineralogi dan Petrologi, JMG Sarawak dan Sabah Work carried out by the Mineralogy and Petrology Activity, JMG Sarawak and Sabah

Tugas / Task	Jumlah unit Number of units	
	Sarawak	Sabah
Penyediaan keratan nipis batuan / Rock thin-section preparation		
a. Permintaan dalaman (JMG) / Internal request	7	13
b. Permintaan luar (Luar Jabatan) / External request	187	62
Analisis petrografi / Petrographical analysis:		
a. Permintaan Dalaman (JMG) / Internal request	3	-
b. Permintaan Luaran (Luar Jabatan) / External request	529	56
Pemeriksaan kuantitatif mineral / Quantitative mineral examination	-	-
Gambarmikro keratan nipis / Photomicrographs of rock thin section	-	110
Bilangan pelanggan / Client		
a. Orang awam / General public	8	70
b. Pelajar / Student	5	5



# Fotogeologi dan Penderiaan Jauh

## Photogeology and Remote Sensing

### Fotogeologi dan penderiaan jauh Photogeology and remote sensing

Bil. No.	Kawasan Area	Luas Coverage (km <sup>2</sup> )	Tujuan Purpose	Catatan Remarks
<b>A Pemetaan fotogeologi / Photogeological mapping</b>				
1	Kawasan Ulu Lebir (Lembar 47), Gajah Terom (Lembar 48) dan Pulau Tinggi (Lembar 120), skala 1:63, 360 Ulu Lebir area (Sheet 47), Gajah Terom (Sheet 48) and Pulau Tinggi (Sheet 120), scale 1:63, 360	815	Menyiapkan Laporan Peta Geologi Semenanjung Malaysia. Completion of Peninsular Malaysia Geological Map Report.	Peta fotogeologi telah disediakan. Photogeological map has been prepared.
<b>B Perkhidmatan tafsiran foto / Photo-interpretation services</b>				
1	Tafsiran imej satelit IFSAR kawasan Ulu Slim, Perak Satellite images interpretation of IFSAR for Ulu Slim area, Perak	188	Permintaan untuk pemetaan geologi untuk prospek geoterma. Request for geological mapping in geothermal investigation.	Peta tafsiran lineamen telah disediakan. Lineament interpretation map has been prepared.
2	Tafsiran imej satelit IFSAR kawasan Bukit Tinggi, Pahang; Kundasang dan Lahad Datu, Sabah Satellite images interpretation of IFSAR for Bukit Tinggi area, Pahang; Kundasang and Lahad Datu, Sabah	611	Permintaan kerja penderiaan jauh dan analisis survei lapangan sesar aktif di Malaysia. Request for remote sensing and field survey analysis of active faults in Malaysia.	Peta tafsiran lineamen telah disediakan. Lineament interpretation map has been prepared.
3	Tafsiran imej satelit IFSAR kawasan Bukit Chuping, Mata Ayer, Perlis. Satellite images interpretation of IFSAR for Bukit Chuping area, Mata Ayer, Perlis	50	Permintaan untuk projek geobencana. Request for geohazard project.	Peta tafsiran lineamen telah disediakan. Lineament interpretation map has been prepared.
4	Pengekstrakan lineamen bagi seluruh negeri Selangor menggunakan Digital Elevation Model (DEM) Lineament extraction for Selangor state using digital elevation model (DEM)	6158	Permintaan untuk kajian potensi air tanah. Request for groundwater potential studies.	Peta tafsiran lineamen telah disediakan. Lineament interpretation map has been prepared.

## Makmal Geokimia

### Perkhidmatan Analisis Geokimia

Makmal Geokimia di Ipoh, Kuantan, Kuching dan Kota Kinabalu terus memberi perkhidmatan analisis kimia, ujian fizikal dan khidmat nasihat kepada pelanggan dalaman dan luaran Jabatan dari seluruh Malaysia. Aktiviti ini adalah untuk membantu pembangunan sektor mineral, industri berasaskan mineral, aktiviti kitar semula logam dan eksplorasi / pembangunan sumber air tanah dalam negara. Sebanyak 79,501 analisis telah disiapkan dengan nilai kerja keseluruhan RM2,169,400. Daripada jumlah ini, 3502 analisis telah diselesaikan untuk pelanggan swasta dengan kutipan hasil bernilai RM138,852.

### Sistem Pengurusan dan Akreditasi Makmal MS ISO/IEC 17025:2005

Keempat-empat Makmal Geokimia di Ipoh, Kuantan, Kuching dan Kota Kinabalu telah berjaya melaksana dan mengekalkan sijil akreditasi MS ISO/IEC 17025:2005 sehingga ke tahun 2017/2018 setelah audit dilaksanakan oleh Jabatan Standard Malaysia di makmal masing-masing.

## Geochemical Laboratory

### Geochemical Analytical Services

The Geochemical Laboratories in Ipoh, Kuantan, Kuching, and Kota Kinabalu continued to provide testing and consultancy services to internal and external clients of the Department throughout Malaysia. These activities are to assist the development of mineral and mineral-based industries, metal recycling activities, and ground water exploration / development in the country. A total of 79,501 analyses were completed with a total work value of RM2,169,400. Of these, 3502 analyses were completed for the private sector with a revenue collection of RM138,852.

### MS ISO/IEC 17025:2005 Laboratory Management System and Accreditation

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.

**Persijilan Akreditasi MS ISO/IEC 17025:2005**  
**MS ISO/IEC 17025:2005 Accreditation Certification**

<b>Makmal Laboratory</b>	<b>No. Sijil Certificate No.</b>	<b>Sah sehingga Valid until</b>	<b>Tempoh persijilan Certification duration</b>	<b>Skop akreditasi Scope of accreditation</b>	<b>Penandatanganan Sijil Ujian SAMM Approved signatory for SAMM test certificates</b>
<b>Ipoh</b>	SAMM 116	31 Ogos 2017	1997-2014 17 tahun / years	Pasir silika / <i>silica sand</i> : 11 Batu kapur / <i>limestone</i> : 14 Bullion emas / <i>gold bullion</i> : 1 Air tanah / <i>groundwater</i> : 15 Jumlah ujian / <i>test</i> : 41	14 Pegawai Geosains (Kimiabumi) / <i>Geoscience Officers (Geochemistry)</i>
<b>Kuching</b>	SAMM 173	12 Ogos 2017	1999-2014 15 tahun / years	16 ujian arang batu / <i>coal test</i>	4 Pegawai Geosains (Kimiabumi) / <i>Geoscience Officers (Geochemistry)</i>
<b>Kota Kinabalu</b>	SAMM 263	07 Jan 2018	2004-2014 10 tahun / years	3 ujian tanah / <i>soil test</i>	3 Pegawai Geosains (Kimiabumi) / <i>Geoscience Officers (Geochemistry)</i>
<b>Kuantan</b>	SAMM 508	04 Apr 2017	2011-2014 4 tahun / years	1 ujian sampel geokimia / <i>geochemical sample test</i>	4 Pegawai Geosains (Kimiabumi) / <i>Geoscience Officers (Geochemistry)</i>
<b>Jumlah / Total:</b>				<b>61 ujian / tests</b>	<b>25 Pegawai Geosains (Kimiabumi) / <i>Geoscience Officers (Geochemistry)</i></b>

Nota:- SAMM :- Skim Akreditasi Makmal Malaysia / *Malaysian Laboratory Accreditation Scheme*

Di samping itu, audit dalaman antara makmal serta mesyuarat kajian semula pengurusan berjadual terus diadakan mengikut jadual yang ditetapkan untuk memantau dan memastikan sistem pengurusan MS ISO/IEC 17025:2005 dilaksanakan dengan efektif.

Bagi memenuhi keperluan mandatori standard pengurusan MS ISO/IEC 17025:2005 dan usaha berterusan untuk meningkatkan lagi kualiti perkhidmatan analisis kepada pelanggan Jabatan, makmal di Ipoh, Kuching dan Kota Kinabalu telah berjaya mengelolakan dan mengambil bahagian dalam program ujian kecekapan / perbandingan antara makmal. Makmal Jabatan telah menunjukkan prestasi baik dan kecekapan teknikal melaksanakan ujian-ujian dalam kesemua program ujian kecekapan / perbandingan antara makmal yang disertai.

In addition, interlaboratory internal audits and management review meetings were conducted regularly as scheduled to monitor and ensure the effective implementation of the MS ISO/IEC 17025:2005 management system.

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 laboratories in Ipoh, Kuching and Kota Kinabalu successfully organised and participated in several proficiency testing (PT) / Interlaboratory Cross-check programmes. The Department's laboratories demonstrated good performance and competency in all the Proficiency Testing / Interlaboratory Cross-check programmes.



**Penyertaan dalam Program Ujian Kecekapan / Perbandingan antara makmal**  
**Participation in Proficiency Testing and Interlaboratory Cross-check Programmes**

Bil. No.	Nama Program Ujian Kecekapan / Perbandingan di antara makmal Name of Proficiency Testing (PT) / Interlaboratory X-check Programme	Penganjur / Pengelola program Organiser / Programme Provider	Penyertaan Participation
1	8 PT programme on water testing:- ENVITEST 2 (Round 1) – Trace metals Al, Cd, Cr & Cu ENVITEST 2 (Round 2) – Trace metals Fe, Mn, Pb, Ni & Zn ENVITEST 4 – Total Solids, Suspended Solids & Total Dissolved solids ENVIEST 5 – Turbidity & Alkalinity ENVITEST 6 – Hg & As WAPAS 1 – Anions - Cl, SO <sub>4</sub> , NO <sub>3</sub> & F WAPAS 5 – Na & K WAPAS 6 – Hardness, Ca & Mg	Jabatan Kimia Malaysia Chemistry Department Malaysia	Makmal Ipoh Ipoh Laboratory
2	Determination of iron in iron ore by potassium dichromate titration	Makmal Ipoh Ipoh Laboratory	Makmal Ipoh, Kuantan, Kuching dan Kota Kinabalu Ipoh, Kuantan, Kuching and Kota Kinabalu Laboratories
3	Determination of CaO, MgO, SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , Fe <sub>2</sub> O <sub>3</sub> , MnO, P <sub>2</sub> O <sub>5</sub> , K <sub>2</sub> O, TiO <sub>2</sub> and Acid Insoluble Residue in limestone by a) Wet classical method b) XRF determination	Makmal Ipoh Ipoh Laboratory	Makmal Ipoh, Kuantan, Kuching dan Kota Kinabalu Ipoh, Kuantan, Kuching and Kota Kinabalu Laboratories
4	Coal Proficiency Testing Programme (Round 31)	Proficiency Testing Australia (PTA)	Makmal Kuching Kuching Laboratory
5	Determination of chloride, sulphate and pH tests in soil sample	Makmal Kota Kinabalu Kota Kinabalu Laboratory	Makmal Ipoh, Kuantan, Kuching dan Kota Kinabalu Ipoh, Kuantan, Kuching and Kota Kinabalu Laboratories

## Penyertaan dalam Pembangunan Standard Malaysia

Pegawai Geosains (Kimiabumi) Makmal Geokimia Ipoh terus mewakili Jabatan dalam beberapa Jawatankuasa Teknikal / Kumpulan Kerja Pembangunan Standard dan telah menyumbang secara aktif dalam pembangunan Standard Malaysia (MS) yang baru dan yang dikaji semula selepas melebihi usia lima tahun.

## Participation in the development of Malaysian Standards

Geoscience Officers (Geochemistry) of the Ipoh Geochemical Laboratory continued to represent the Department in several Technical Committees / Working Groups. They contributed actively to the development of new Malaysian Standards as well as the revision of Malaysian Standards which were more than five years old.

Bil. No.	Jawatankuasa / Kumpulan Kerja Teknikal Technical Committee / Working Group
1	Industrial Standard Committee B for Chemicals and Materials (ISC B)
2	Working Group for Lime and Lime Products
3	Working Group for Clay and Clay Products
4	Technical Committee on Soil Quality
5	Technical Committee on Raw materials for Iron and Steel and Intermediary products
6	Technical Committee on "Non-Ferrous Metals and Ores"
7	Working Group on Precious Metals

**Penghasilan kerja perkhidmatan makmal geokimia tahun 2014**  
**Geochemical laboratory services work output for 2014**

Jenis sampel Type of sample	Penghasilan Output	Perkhidmatan makmal (Semenanjung)			Perkhidmatan makmal (Sarawak)			Perkhidmatan makmal (Sabah)		
		Laboratory services (Peninsular)			Laboratory services (Sarawak)			Laboratory services (Sabah)		
		Sampel dalam jabatan Internal sample	Agensi kerajaan Government agencies	Sektor swasta Private sector	Sampel dalam jabatan Internal sample	Agensi kerajaan Government agencies	Sektor swasta Private sector	Sampel dalam jabatan Internal sample	Agensi kerajaan Government agencies	Sektor swasta Private sector
Sampel geokimia (Sedimen, tanih, konsentrat & batuan)	Bilangan analisis Number of analysis	26,462	4	99	7793	-	-	5723	34	96
Geochemical (Sediment, soil, concentrate & rock)	Nilai Kerja Work value (RM)	373,680	40	6150	99,140	-	-	375,940	2720	5385
Air (Air tanah, air permukaaan, effluen)	Bilangan analisis Number of analysis	17,903	-	391	766	-	-	6511	-	75
Water (Groundwater, surface water, effluents)	Nilai Kerja Work value (RM)	430,115	-	8550	17,990	-	-	128,420	-	1295
Arang Batu Coal	Bilangan analisis Number of analysis	-	-	-	1068	-	560	-	-	-
	Nilai Kerja Work value (RM)	-	-	-	47,723	-	17,200	-	-	-
Silikat (batuan silikat, agregat & debu arang batu)	Bilangan analisis Number of analysis	2096	-	179	-	-	-	-	-	-
Silicates (silicate rock, aggregate & coal ash)	Nilai Kerja Work value (RM)	135,850	-	6705	-	-	-	-	-	-
Mineral perindustrian (pasir silika, batu kapur, lempung, feldspar)	Bilangan analisis Number of analysis	2868	1898	1553	525	-	1	412	2	39
Industrial minerals (silica sand, limestone, clay, feldspar)	Nilai Kerja Work value (RM)	160,420	92,670	70,272	35,090	-	70	23,630	80	2085
Bijih berlogam (ilmenit, bijih besi, struverit, zircon)	Bilangan analisis Number of analysis	1518	6	493	-	-	-	-	-	-
Metalliferous ores (ilmenite, iron ore, struverite, zircon)	Nilai Kerja Work value (RM)	85,360	240	20,810	-	-	-	-	-	-



Jenis sampel Type of sample	Penghasilan Output	Perkhidmatan makmal (Semenanjung)			Perkhidmatan makmal (Sarawak)			Perkhidmatan makmal (Sabah)		
		Laboratory services (Peninsular)			Laboratory services (Sarawak)			Laboratory services (Sabah)		
		Sampel dalam jabatan Internal sample	Agensi kerajaan Government agencies	Sektor swasta Private sector	Sampel dalam jabatan Internal sample	Agensi kerajaan Government agencies	Sektor swasta Private sector	Sampel dalam jabatan Internal sample	Agensi kerajaan Government agencies	Sektor swasta Private sector
Logam & aloi (Emas, ingot logam & pelbagai aloi) Metals & Alloy (gold, metal ingot & miscellaneous alloy)	Bilangan analisis Number of analysis	2	30	6	-	-	-	-	-	-
	Nilai Kerja Work value (RM)	100	2440	180	-	-	-	-	-	-
Pelbagai sampel (Sludge, sisa industri) Miscellaneous (sludges, industrial waste etc.)	Bilangan analisis Number of analysis	-	378	10	-	-	-	-	-	-
	Nilai Kerja Work value (RM)	-	18,900	150	-	-	-	-	-	-
Jumlah Total	Bilangan analisis Number of analysis	50,849	2316	2731	10,152	0	561	12,646	36	210
	Nilai Kerja Work value (RM)	1,185,525	114,290	112,817	199,943	0	17,270	527,990	2800	8765
Jumlah keseluruhan Overall total	Bilangan analisis Number of analysis		55,896			10,713			12,892	
	Nilai Kerja Work value (RM)		1,412,632			217,213			539,555	
Jumlah besar Grand total	Bilangan analisis / Number of analysis				Nilai kerja (RM) Work value (RM)			Nilai kerja termasuk bayaran (RM) Work value including payment (RM)		
	Kutipan Hasil (RM) Revenue collection (RM)									
	Sampel dalam jabatan Internal sample	Agensi kerajaan Government agencies	Sektor swasta Private sector	Jumlah Total	Sampel dalam jabatan Internal sample	Agensi kerajaan Government agencies	Sektor swasta Private sector			
								2,169,400		138,852
	73,647	2352	3502	79,501	1,913,458	117,090	138,852			

## Makmal Geologi Kejuruteraan

Makmal Geologi Kejuruteraan di Bahagian Perkhidmatan Teknikal, Ipoh telah menjalankan perkhidmatan ujian penentuan ciri-ciri mekanikal, fizikal dan kekuatan agregat batuan dan tanah. Ia memberi perkhidmatan sokongan geoteknik kepada aktiviti geologi kejuruteraan, perlombongan, pengkuarian dan aktiviti lain jabatan. Makmal ini juga menawarkan perkhidmatan geoteknik kepada agensi kerajaan dan pihak industri.

Sebanyak 223 sampel batuan dan 98 sampel tanah telah diterima, 441 dan 438 ujian masing-masing telah dijalankan ke atas sampel batuan dan sampel tanah dengan jumlah nilai kerja sebanyak RM32,705.

## Engineering Geology Laboratory

The Engineering Geology Laboratory of the Technical services Division, Ipoh provides tests to determine mechanical and physical properties and strength of rock aggregates and soil. It provides geotechnical support services to the engineering geology, mining, quarrying and other activities of the department. This laboratory also offers geotechnical test services to other government agencies and the private sector.

A total of 223 rock and 98 soil samples were received while 441 and 438 tests were carried out on the rock and soil samples respectively with the total work value of RM32,705.

### Senarai terperinci kerja yang dijalankan oleh Makmal Geologi Kejuruteraan Details of work carried out by the Engineering Geology Laboratory

Ujian agregat / tanah Aggregate / soil test	Untuk industri For the industry		Untuk agensi kerajaan For government agencies	
	Bilangan unit Number of unit	Nilai kerja Work value (RM)	Bilangan unit Number of unit	Nilai kerja Work value (RM)
Specific gravity	90	1800	5	100
Water absorption	20	500	5	100
Moisture content	1	15	-	-
Sound value	17	1360	2	160
Flakiness index	10	300	4	120
Elongation index	4	120	-	-
Impact value	17	680	4	160
Crushing value	15	750	4	200
Ten % fines value	11	550	2	100
Los angeles abrasion	19	1140	4	240
Sieve analysis	132	6600	-	-
Cube test	22	418	13	247
Plasticity index	1	30	-	-

Ujian agregat / tanah Aggregate / soil test	Untuk industri For the industry		Untuk agensi kerajaan For government agencies	
	Bilangan unit Number of unit	Nilai kerja Work value (RM)	Bilangan unit Number of unit	Nilai kerja Work value (RM)
Mechanical sieving	13	364	2	56
Crush to size	11	550	-	-
Fractured Face (flakiness)*	-	-	-	-
Bulk density (SG)*	5	100	-	-
Clay silt dust content (SA)*	3	150	-	-
Hardness number test	-	-	-	-
Crushing strength	-	-	-	-
Porosity	-	-	-	-
Shell content	1	30	-	-
Rebound hammer	4	120	-	-
Gradation (hydrometer)	4	120	94	2820
Sieve analysis (soil)	4	200	94	4700
Atterberg limits	-	-	74	4810
Moisture content	4	60	69	1035
Specific gravity	4	80	91	1820
Linear limit	-	-	-	-
Shrinkage limit	-	-	-	-
Jumlah kecil / Sub-total	412	16,037	467	16,668
			Jumlah bilangan unit / Total no. of unit	Jumlah Nilai kerja / Total work value (RM)
			879	32,705



## Makmal Geologi Marin

Sebanyak 402 sampel telah dianalisis untuk saiz butiran (ayak mekanikal dan Laser Particle Size Analyzer), karbonat dan bahan organik. Makmal Geologi Marin juga turut melaksanakan kerja penyelenggaraan peralatan makmal.

## Marine Geology Laboratory

A total of 402 samples were analysed for grain size (mechanical sieves and Laser Particle Size Analyzer), carbonates and organic matter. The Marine Geology Laboratory also performed routine maintenance of laboratory equipment.

## Woksyop & Penggerudian Workshop & Drilling

Perkhidmatan yang diberikan oleh Unit Woksyop & Penggerudian, Bahagian Perkhidmatan Teknikal pada 2014  
Services provided by Unit of Workshop & Drilling, Technical Services Division in 2014

Bil. No.	Aktiviti / Projek Activity / Project	Catatan Remarks
1	Kerja penggerudian persampelan teras batuan Rock Core Drilling and Sampling	<p><u>USM</u></p> <ul style="list-style-type: none"> <li>Satu lubang gerudi di kawasan Batu Berdinding, Lenggong dengan kedalaman 20 m</li> <li>One drill hole at Batu Berdinding area, Lenggong with a depth of 20 m.</li> </ul>
2	Penyelenggaraan kenderaan, jentera / mesin dan bangunan Bahagian Perkhidmatan Teknikal. Maintenance of Technical Services Division's vehicles, machineries and buildings	<ul style="list-style-type: none"> <li>Kenderaan / Vehicles – 21 unit</li> <li>Mesin gerudi / Drilling machines – 6 unit</li> <li>Set generator / Generator sets – 2 unit</li> <li>Pam air / Water pumps – 5 unit</li> <li>Kompleks JMG Ipoh / Ipoh JMG's Complex (penyelenggaraan am / general maintenance)</li> <li>Kuarters JMG Ipoh / Ipoh JMG's quarters (penyelenggaraan am / general maintenance)</li> <li>Alat Penghawa Dingin / Air conditioners</li> <li>Sistem pencegah kebakaran / Fire extinguisher system</li> <li>Peralatan &amp; pemasangan elektrik / Electrical devices and installation</li> </ul>



Mesin gerudi Gemco  
Gemco drilling machine

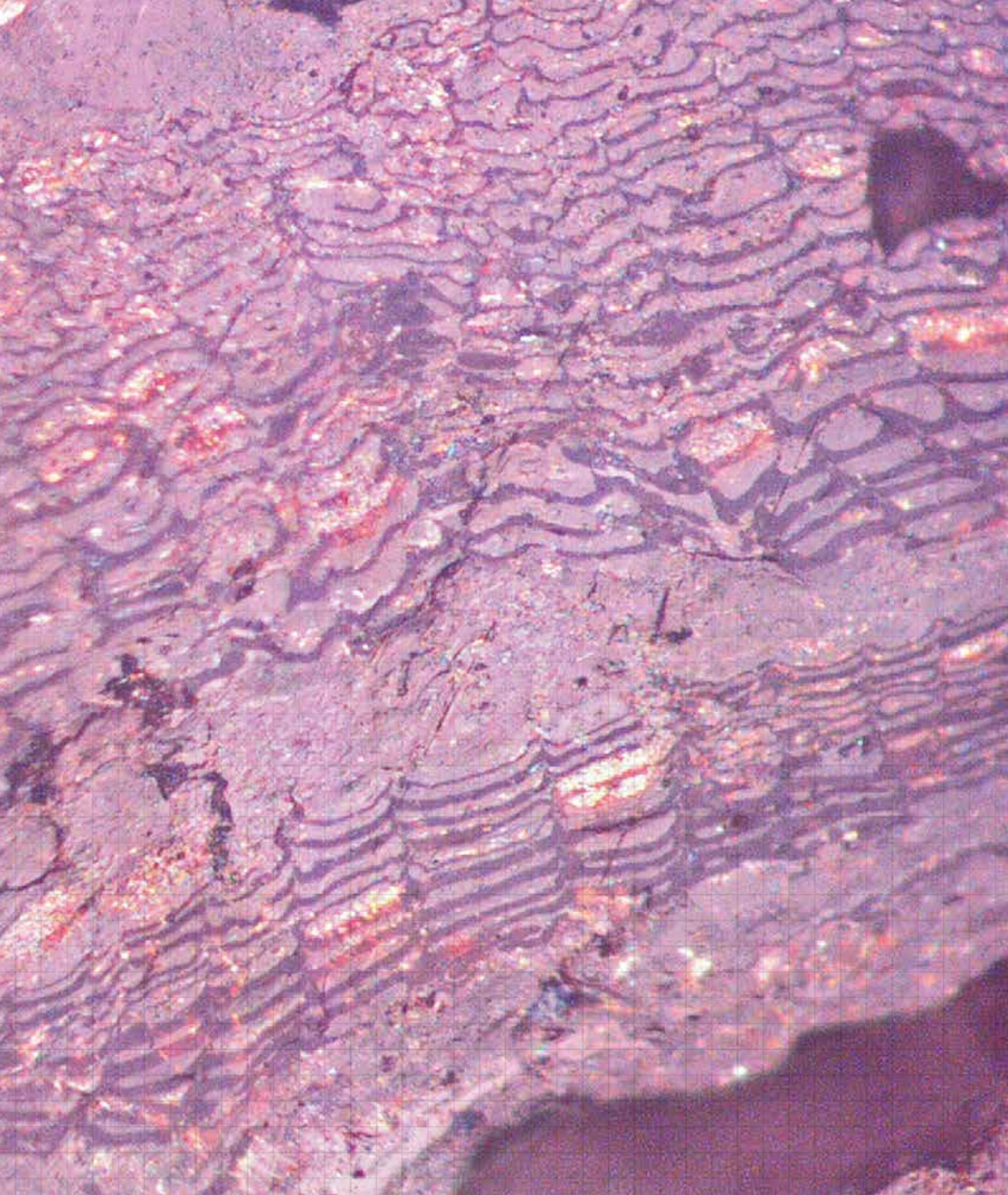


Mesin gerudi Bournedrill THD 35VPH  
Bournedrill THD 35VPH drilling machine



Generator Set Kohler (60 KVA) untuk ujian pengepaman  
Kohler (60 KVA) Generator Set for pumping test









# PENERBITAN PUBLICATIONS

Fotomikrograf phlobaphinit (berbentuk bujur) yang mengisi sel suberinit di arang batu Mukah dari Sarawak (cahaya putih pantulan di bawah rendaman minyak).

Photomicrograph of cell-filling phlobaphinite (oval-shaped) in suberinite in the Mukah coal of Sarawak (reflected white light under oil immersion).

Photo: Sia Say Gee

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3. Ismail, I., Md Muzayin, A., Hashim, H. & Khairun Azizi, M.A., 2014. Adsorption of coco amine with diesel in muscovite and quartz. International Conference on Material and Metallurgy 2014, Pulau Pinang, 17-18 September 2014.
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2. Mohamad Shukri Ramlan, Zakaria Mohamad, Qalam Azad Rosle, Siti Saidatul Hanim Saharuddin & Rozeta Yusof. Pelan kekangan geologi dalam penghasilan pelan impak pembangunan sebagai kawalan pembangunan guna tanah Majlis Perbandaran Sepang.



3. Richard Mani Banda, Mohd Yusop Ramli, Thomson Galin, Wahyu Gunawan & Idik Pribadi. Geological correlation and stratigraphic nomenclature of Sintang-Silantek area, Central West Borneo.
4. Thomson Galin. The provenance of the Belaga Formation using heavy mineral studies.
5. Abdullah Sulaiman, Noran Alwakhir Shaarani & Vijayan V.R. Heavy metals distribution and trend in the surface seabed sediments of the Malaysia offshore.
6. Traeth Gwylit, Menai Strait, Wales, Noran Alwakhir Shaarani & J.D. Bennell. Monitoring subaqueous sand dune evolution in response to tidal motions.
7. Abdullah Sulaiman & Hamid Ariffin. Methane hydrate potential in the Northeast of Sabah.
8. Mohd Shafreen Mad Isa. The use of electronic detonation close-proximity quarry blasting – a case study on hilltop blasting at Kukusan Quarry, Tawau.
9. Ahmad Zukni Mohd. Khalil & Zaiton Abdullah. Bad blasting practices in quarry site.
10. Abdul Hadi Bin Abdul Rahman, Muhammad Azfar Bin Kamaruddin & Rashita Abd. Rashid. Kajian andalusit di Sungai Parang, Kemaman, Terengganu: cirian, penilaian dan taburan sumber.
11. Masrita Mohd Aras & Haniza Zakri. Bijih timah di Linggi dan Titi, Negeri Sembilan.
12. Khairul Nazri Yaakub, Joanes Muda & Enggong Aji. Eklorasi geokimia di kawasan Gunung Nyendeng, Serian, Sarawak.
13. Shamsul Kamal Sulaiman & Md Muzayin Alimon. Mercury free, small scale gold mining in Malaysia.
14. Ismail Ibrahim, Md Muzayin Alimon, Salmah Baharuddin & Roshaida Bt Arbain. Separation of weathered sodium feldspar by physical and physico-chemical process.
15. Mohammed Hatta Abd Karim. Groundwater quality of monitoring wells in Malaysia-findings from multivariate statistical analysis.
16. Roslan Rajali. Groundwater investigation and development at Tudan-Kuala Baram-Permyjaya, Miri, Sarawak.
17. Amir Mizwan Mohd Akhir, Ab Rashid Ahmad & Ismail Yusoff. Groundwater modelling for North Kelantan River Basin (shallow aquifer).
18. Joseph Jubin Aro & Asep Suryana. Coal resources in Silantek (Sarawak) – Sintang (Kalimantan) border area.
19. Khairul Zaman Ibrahim, Fadzirul Hafith Margono & Abdullah Sani Hj. Hashim. Mineralogi, fizikokimia dan asal mula longgokan kaolin Lenggor, Johor.
20. Hanizah Zakri & Azimah Hussin. The potential of Kg. Padang Biawas quartz rock for solar industry.
21. Noor Akhmar Kamarudin & Mohd Zaidi Mohd Hasan. Characterization of tin concentrate using combine XRF and XRD analysis.
22. Hamdan, Abdul Rois, Kori & Aspaniza. Development of flameproof ceramics.
23. Mohd Idham Mustaffar & Mohamad Haniza Mahmud. Converting recycled soda lime glass into glass-ceramic for tiles.
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2. Mohd Anuar Razali, 2014. Survei keberintangan 2D di kawasan-kawasan Segamat dan Jementah, Negeri Johor Darul Takzim dan kawasan-kawasan Gemas dan Gemencheh, Negeri Sembilan Darul Khusus. No. Laporan: JMG.BPT(GF) 1/2014.
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3. Ismail Ibrahim, Salamah Baharuddin, Md Muzayin Alimon & Roshaida Arbain: Laporan kajian pengapungan mineral sulfida menggunakan sel pengapungan berkapasiti 30 liter. No. Laporan: R015/2014.
4. Khor Peng Seong, Shamsul Kamal Sulaiman, Norinsafrina Mustaffa Kamal & Mohd Syahrir Mohd Rozi: Report on water sampling of iron mines and rivers in Kerambit, Lipis and Jerantut, Pahang. No. Laporan: PPM R001/2014.
5. Nazwin Ahmad: Characterisation and attrition scrubbing of silica sand sample from Perusahaan Usahasama Membalak Sdn. Bhd. No. Laporan: R009/2014.
6. Nazwin Ahmad: Synthesis of silica aerogel from waterglass at ambient pressure and its application as  $\text{SiO}_2$  /  $\text{TiO}_2$  catalyst. No. Laporan: R016/2014.
7. Norinsafrina Mustaffa Kamal & Shamsul Kamal Sulaiman: AMD treatment of Ex-Mamut Copper Mine Sabah. No. Laporan: PPM R004/2014.
8. Rohaya Othman, Nasharuddin Isa & Anuar Othman: Kajian teknik pemendakan *in situ* bagi pemasukan PCC ke dalam lumen pulpa untuk pembuatan kertas. No. Laporan: R018/2014.
9. Rashita Abd Rashid: Penghasilan wolastonit sintetik menggunakan batu kapur dan pasir silika tempatan serta aplikasinya sebagai bahan pengisi dalam bahan komposit gigi. No. Laporan: R003/2014.
10. Ramli Mohd Osman: Laporan koleksi data taburan tanah bekas lombong di Malaysia (1960 hingga 2008). No. Laporan: PPM R005/2014.



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3. Mohamad Yusof Che Sulaiman: Pembinaan telaga air tanah di Kampung Batu Karang, Pasir Mas, Kelantan di bawah Program Pengurusan Tanah Gambut Yang Sering Terbakar. No. Laporan: JMG.KLT(SAT) 01/2014.
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5. Mohamad Yusof Che Sulaiman: Laporan penyiasatan geologi dengan penggerudian lubang siasatan tanah di Kampung Seberang, Pasir Mas, Salor dan Kampung Kok Seraya, Tumpat, Kelantan. No. Laporan: JMG.KLT(SAT) 03/2014.
6. Mohamad Yusof Che Sulaiman: Groundwater modelling of Lower Kelantan River Basin. No. Laporan: JMG. KLT(SAT) 04/2014.
7. Amir Mizwan Mohd Akhir: Laporan Lapangan pemetaan stratigrafi dan paleontologi Gua Musang. No. Laporan: JMG.KLT(PGN) 01/2014.

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### • Sumber Mineral / Mineral Resources

1. Mohd Yuzlan Yusof: Penilaian sumber batuan silika Negeri Kelantan. No. Laporan: JMG.KLT(MPI)1/2014.
2. Mohd Yuzlan Yusof: Laporan bersepadu projek. No. Laporan: JMG.KLT(MPI)2/2014.
3. Mohd Yuzlan Yusof: Statistik pengeluaran mineral perindustrian dan direktori pengeluar bagi Negeri Kelantan 2014. No. Laporan: JMG.KLT(MPI)3/2014.

### • Geosains / Geosciences

1. Ahmad Rosli Othman: Pemetaan geologi terain Blok 261, Jajahan Machang, Kelantan Darul Naim. No. Laporan: JMG.KLT(GBN) 01/2014.
2. Ahmad Rosli Othman: Pemetaan geologi terain Blok 262, Jajahan Machang, Kelantan Darul Naim. No. Laporan: JMG.KLT(GBN) 02/2014.

### • Pembangunan Lombong dan Kuari Mine and Quarry Development

1. Aidil Amolous Rema: Laporan sektor perlombongan tahun 2014 Negeri Kelantan. No. Laporan: JMG.KLT(LK) 1/2014.
2. Aidil Amolous Rema: Laporan aktiviti carigali & perlombongan tahun 2014. No. Laporan: JMG.KLT(LK) 2/2014.

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1. Rosni Lokmanul Hakim & Zamri Abu Samah: Statistik hasil pengeluaran dan panduan syarikat pembuatan berasaskan mineral perindustrian Negeri Melaka tahun 2013. No. Laporan: JMG.NSM(SM) 1/2014.
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1. Muhammad Fawwaz Zainal Abedin & Dorsihah Mohamad Jais: Kajian keberkesanan penyusupan tebing sungai untuk kelestarian bekalan air negeri di Lembangan Sungai Linggi. No. Laporan: JMG.NSM(SAT) 01/2014.
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- **Unit Perkhidmatan Makmal**  
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# PROFIL PEJABAT OFFICE PROFILES

Fotomikrograf menunjukkan penyingkiran exsudatinit dari suberinit di arang batu Merit-Pila dari Sarawak (cahaya ultraungu pantulan di bawah rendaman minyak).

Photomicrograph showing suberinite expelling exsudatinit in Merit-Pila coal of Sarawak (reflected ultraviolet light under oil immersion).

Photo: Prof. Dr. Wan Hasiah Abdullah (UM)



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## Cawangan Hal Ehwal Korporat Corporate Affairs Section

Cawangan Hal Ehwal Korporat,  
Jabatan Mineral Dan Geosains Malaysia  
Lantai 20 & 21, Bangunan Tabung Haji,  
Jalan Tun Razak, 50658 KUALA LUMPUR  
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Faks: (6) 03-21611036  
E-mail: jmgkll@jmg.gov.my

**Pengarah / Director:** Dr. Richard Mani Banda  
E-mail: dr.richardm@jmg.gov.my



Dari kiri / **From left:** Mohd Badzran Mat Taib (Timbalan Pengarah, Unit Perancangan & Pemantauan Pembangunan), Dr. Richard Mani Banda (Pengarah), Kamuradin Md Slar (KPP, Unit Pembangunan Sumber Manusia), Habibah Tahir (KPP, Unit Perhubungan Awam & Perundingan)

---

## Cawangan Penyelarasan Pelaksanaan Operasi Operation Implementation Coordination Section

Cawangan Penyelarasan Pelaksanaan Operasi,  
Jabatan Mineral Dan Geosains Malaysia  
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**Pengarah / Director:** Ab Halim bin Hamzah  
E-mail: abhalim@jmg.gov.my



Dari kiri / **From left:** Hisamuddin Termidi (Timbalan Pengarah, Unit lombong & Kuari), Ab Halim Hamzah (Pengarah), Siti Aminah Abdul Sarif (KPP, Unit Geosains)



# Bahagian Perkhidmatan Teknikal

## Technical Services Division

Bahagian Perkhidmatan Teknikal,  
Jabatan Mineral Dan Geosains Malaysia  
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**Pengarah / Director:**  
**Mior Sallehuddin Bin Mior Jadid**  
(sehingga / until 30 November 2014)

**Dr. Kamaludin Bin Hassan**  
(dari 1 Disember 2014 / from 1 December 2014)  
E-mail: kamaludin@jmg.gov.my



Dari kiri / From left: Abdul Rahman Mohd Yusoff (KPPPM), Ismail Iman (TPGS), Mior Sallehuddin Mior Jadid (Pengarah), Chin Siew Yee (TPMK) (bersara pada / retired as of 6 September 2014), Nor Asyikin Yusoff (KPT)

1	Sumber Manusia / Human Resource (bil. / no.)	
	· Pegawai Profesional / Professional officers	45
	· Kakitangan Sokongan / Supporting staff	158
2	Peruntukan / Allocation (RM)	
	· Mengurus / Operation	12,889,000
	· Pembangunan / Development	2,223,000
3	Perkhidmatan Makmal Geokimia / Geochemical Laboratory Services (bil. / no.)	
	· Analisis kimia / Chemical analyses	80,589
4	Perkhidmatan Geosains / Geoscience Services	
	a. Penggerudian untuk kajian saintifik / Drilling for scientific study (bil. / no.)	1
	b. Geologi Marin / Marine Geology	
	· Permohonan lesen melombong pasir laut / Applications for offshore sand mining license (bil. / no.)	26
	· Analisis sampel sedimen marin / Marine sediment samples analysis (bil. / no.)	402
	c. Perkhidmatan geofizik / Geophysical services	
	· Elektromagnet Transient / Transient Electromagnet (Stesen / Station)	417
	· Survei keberintangan 2D / 2D Resistivity survey (m)	21,070
	· Survei Seismos / Seismic Survey (m)	-
	· Pengelogan Geofizik / Geophysical logging (bil. / no.)	2
	d. Perkhidmatan fotogeologi & penderiaan jauh / Photogeology & remote sensing services	
	· Pemetaan fotogeologi / Photogeological mapping (km <sup>2</sup> )	815
	· Perkhidmatan tafsiran foto / Photo-interpretation service (km <sup>2</sup> )	7007
	e. Perkhidmatan kajian mineralogi dan petrologi	
	· Kajian mineralogi dan petrologi / Mineralogical and petrological examinations (bil. / no.)	2201
5	Perkhidmatan Pembangunan Lombong dan Kuari / Mine and Quarry Development Services (bil. / no.)	
	· Pengukuran kualiti udara / Air quality measurements	74
	· Ujian kompetensi pembedil / Shot-firer competency tests	168
	· Ujian geoteknik / Geotechnical tests	879
6	Pengurusan Maklumat / Information Management (bil. / no.)	
	· Peta didigitkan / Maps digitized	16
	· Gambar rajah disediakan / Diagrams prepared	1220
	· Penerbitan Jabatan dijual / Departmental publications sold	205
	· Peta dijual / Maps sold	84



# Pusat Penyelidikan Mineral

## Mineral Research Centre

Pusat Penyelidikan Mineral,  
Jabatan Mineral Dan Geosains Malaysia  
Jalan Sultan Azlan Shah,  
31400 Ipoh,  
Perak Darul Ridzuan  
Tel: (6) 05-547 7053  
Faks: (6) 05-547 7185  
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**Pengarah / Director:**  
**Shahar Effendi Abdullah Azizi**  
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Berdiri dari kiri / **Standing from left:** Hasnita Mat Isa, Md. Muzayin Alimon, Kori Mohammad, Ramli Mohd Osman, Nasharuddin Isa, Mahadi Abu Hassan, Dr. Shamsul Kamal Sulaiman, Aminudin Mahmud, Dr. Rashita Abd Rashid  
Duduk / **Sitting:** Shahar Effendi Abdullah Azizi

1	Sumber Manusia / <a href="#">Human Resources</a> (bil. / no.)	
	Pegawai profesional / <a href="#">Professional officers</a>	30
	Kakitangan sokongan / <a href="#">Supporting staff</a>	89
2	Peruntukan / <a href="#">Allocation</a> (RM)	
	Mengurus / <a href="#">Operation</a>	6,251,700
	Pembangunan / <a href="#">Development</a>	2,800,000
3	Aktiviti Pembangunan & Penyelidikan Mineral / <a href="#">Mineral Research &amp; Development Activities</a> (bil. / no.)	
	Kajian kebolehaan dan kerosakan biologi ingot gigi leusit / <a href="#">Study on mouldability and biological compatibility of leucite dental ingot</a>	11
	Penghasilan komposit marmar menggunakan sisa dolomit dan andalusit tempatan / <a href="#">Production of marble composite using local dolomite waste and andalusite</a>	8
	Penghasilan kalsium silikat (Ca <sub>2</sub> SiO <sub>5</sub> ) bersaiz nano / <a href="#">Production of nano-sized calcium silicate (Ca<sub>2</sub>SiO<sub>5</sub>)</a>	5
	Penghasilan kalsium karbonat termendak (PCC) nano menggunakan kaedah penyemburan / <a href="#">The production of nano precipitated calcium carbonate (PCC) using nozzle technique</a>	2
	Kajian teknik pemendakan <i>in situ</i> bagi pemasukan PCC ke dalam lumen pulpa untuk pembuatan kertas dengan bantuan poliakrilamida (PAM) / <a href="#">Study on the in situ deposition technique of PCC in the lumen pulp for paper making with the aid of polyacrylamide (PAM)</a>	24
	Teknologi penghasilan bebola seramik berasaskan lempung tempatan sebagai penyokong lapisan pemangkin dalam reaktor pemangkin minyak, petrokimia, dan gas. (Usahasama R&D dengan rakan industri tempatan) / <a href="#">Production technology of local clay-based ceramic ball as catalyst bed support in the oil, petrochemical and gas catalytic reactor. (R&amp;D collaboration with a local industrial partner)</a>	3
	Teknologi penghasilan jasad seramik tembikar putih menggunakan bahan mentah lempung dari negeri Perak. (Usahasama R&D dengan Perbadanan Kemajuan Kraftangan Malaysia-Negeri Perak (PKKM-NP) sebagai rakan agensi) / <a href="#">Production technology of ceramic whiteware body using clay raw material from Perak. (R&amp;D collaboration with PKKM-NP as agency partner)</a>	4
	Teknologi penghasilan jasad seramik teknikal kalis nyala. / <a href="#">Production technology of flame-proof technical ceramic body</a>	2
	R&D penghasilan jubin kaca di peringkat loji pandu menggunakan kaca kitar semula / <a href="#">R&amp;D glass tile production in pilot plant using recycled glass waste</a>	44
	R&D penghasilan konkrit ringan menggunakan sisa kaca untuk industri pembinaan / <a href="#">R&amp;D lightweight concrete production using recycled glass for construction industry</a>	27
4	Pembangunan teknik Pemprosesan fiziko-kimia peringkat loji untuk sumber-sumber mineral tempatan / <a href="#">Development of pilot plant scale physico-chemical processing techniques for local mineral resources</a>	2
	Mengkaji parameter-parameter pengapungan bijih kompleks untuk digunakan dalam model simulasi proses pengapungan. / <a href="#">Evaluation on complex ores flotation parameters data for input in modelling and simulation flotation process</a>	1
	Kajian untuk meningkatkan perolehan kasiterit bersaiz halus dari bijih timah kompleks dengan menggunakan kaedah pengapungan / <a href="#">Study to improve the recovery of fine-sized cassiterite from complex tin ores by flotation method</a>	1
	Penghasilan aerogel silika dan aplikasi produknya sebagai penyokong kepada bahan pemangkin / <a href="#">Silica aerogel synthesis and its application as supporting material for catalyst</a>	1
	Penyelidikan kontrak berkaitan pemprosesan mineral untuk industri / <a href="#">Contract research related to mineral processing for industry</a>	3
	Kajian maklumat geospasial penggunaan tanah bekas lombong negara / <a href="#">Geospatial information studies on the use of ex-mining in malaysia</a>	3
	Kajian teknik penanaman mampan untuk pemulihan kawasan kuari / <a href="#">Study of sustainable greening technique for rehabilitation of quarries</a>	16
	Pengkelasan efluen di kawasan lombong dan pembangunan teknik rawatan acid mine drainage (AMD) / <a href="#">Classification of effluent in mining areas and the development of AMD treatment techniques</a>	5
	Kajian penyisihan logam berat daripada air sisa lombong menggunakan penyerap yang murah / <a href="#">Study on heavy metals removals from mine waste water using low cost absorbent</a>	1
	Kajian penghasilan produk sampingan daripada sisa rawatan AMD / <a href="#">Study on production of by-products from AMD treatment waste</a>	1
	Pemodelan pencemaran bunyi trafik menggunakan keadahan statistik di kuari / <a href="#">Traffic noise modeling using statistical methods in quarry</a>	1
	Rawatan AMD di tanah bekas lombong tembaga Mamut / <a href="#">Treatment of AMD ex-Mamut copper mine land</a>	2
	Kajian kesan aktiviti perlombongan terhadap kualiti air Tasik Chini, Pahang / <a href="#">Study on impact of mining activities on water quality of Tasik Chini, Pahang</a>	1
	Kajian kualiti air dan potensi penjejakan acid mine drainage (AMD) di sekitar Bukit Ibam Pahang / <a href="#">Study on water quality and generation potential for acid mine drainage (AMD) Bukit Ibam, Pahang</a>	1



## Pejabat JMG Negeri State JMG Offices

### JOHOR

Jabatan Mineral Dan Geosains Malaysia, Johor  
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**Pengarah / Director:**  
**Tuan Haji Zakaria Bin Hussain**  
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Berdiri dari kiri / **Standing from left:** Noramzihali Hj Ramli (Menanggung PPT), Abdullah Sani H. Hashim (TPSM), Nizarulikram Abdul Rahim (TPGS), Nurul Huda Romli (TPLK), Nor Asmah Abdul Aziz (KUPM)  
Duduk / **Sitting:** Zakaria Hussain (Pengarah)

### NEGERI SEMBILAN / MELAKA

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**Pengarah / Director:**  
**Zulkipli Bin Che Kasim**  
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Dari kiri / **From left:** Dorsihah Mohamad Jais (TPGS), Haniza Zakri (TPSM), Zulkipli Che Kasim (Pengarah), Ir. Muhamad Suhaimi Nordin (TPLK), Siti Haslinda Abdul Wahid (PPT), Norhayati Md. Rawi (KUPM).



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## PEJABAT SELANGOR / WILAYAH PERSEKUTUAN SELANGOR / FEDERAL TERRITORIES

Jabatan Mineral Dan Geosains Malaysia,  
Selangor / Wilayah Persekutuan  
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**Pengarah / Director:**  
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Dari kiri / **From left**: Tony Chew (TPLK), Mohd. Sidi Daud (TPGS), Dato' Zakaria Mohamad (Pengarah), Marina Mansor (PPT), Mahisham Ibrahim (KUPM), Che Ibrahim Mat Saman (TPSM)

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## PERAK

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**Pengarah / Director:**  
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Dari kiri / **From left**: Suzannah Akmal (KUPM), Tuan Rusli Tuan Mohamed (TPGS), Dr. Kamaludin Hassan (Pengarah), Ahmad Zukni Ahmad Khalil (TPLK), Mohamad Sari Hasan (TPSM), Zaiton Mohamed Latif (PPT)



## KEDAH / PERLIS / PULAU PINANG

Jabatan Mineral Dan Geosains Malaysia,  
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**Pengarah / Director:**

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Berdiri dari kiri / **Standing from left**: Juna Azleen Abd Ghani (TPLK),  
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Duduk dari kiri / **Sitting from left**: Hamdan Ariffin (TPSM), Zainol  
Husin (Pengarah), Badrol Muhammad (TPGS)

## KELANTAN

Jabatan Mineral Dan Geosains Malaysia,  
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**Pengarah / Director:**

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Dari kiri / **From left**: John Joseph Jinap (TPSM), Hizam Abdul Kadir  
(TPLK), Hj Che Abdul Rahman Jaafar (Pengarah), Ab Rashid Ahmad  
(TPGS), Azliyah Che Long (PPT).



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## TERENGGANU

Jabatan Mineral Dan Geosains Malaysia,  
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**Pengarah / Director:**  
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Dari kiri / **From left**: Hamlee Ismail (TPGS), Tan Hai Hong (TPLK), Nailah @ Nazirah Abdullah (PPT), Abdul Hadi Abdul Rahman (TPSM), Suhaimizi Yusoff (KUPM).  
Duduk / **Sitting**: Mohd. Zukeri Ab. Ghani (Pengarah)

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## PAHANG

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**Pengarah / Director:**  
**Mohd Za'im Bin Abdul Wahab**  
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Dari kiri / **From left**: Afandi Muda (KUPM), Asminah Rajuli (TPGS), Dato' Zainal Abidin Md. Nor (TPLK sehingga Julai 2014 / until July 2014), Mohd Za'im Abdul Wahab (Pengarah), Wan Saifulbahri Wan Mohamed (TPSM), Nurmaiziera Abd Rahim (PPT)



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## SARAWAK

Jabatan Mineral Dan Geosains Malaysia, Sarawak  
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93658 KUCHING,  
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**Pengarah / Director:**

**Alex Unya Ambun**

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Berdiri dari kiri / **Standing from left:** Manggon Abot (KUPM), Henry Litong Among (TPGS), Enggong Aji (TPSM), Ismail Bin Hanuar (TPMK)  
Duduk dari kiri / **Sitting from left:** Affriza Mohd. Affandi (PPT), Alex Unya Ambun (Pengarah)

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## SABAH

Jabatan Mineral Dan Geosains Malaysia, Sabah  
Jalan Penampang,  
Beg Berkunci 2042,  
88999 KOTA KINABALU,  
Sabah

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**Pengarah / Director:**

**Mustafar Bin Hamzah**

(dari 1 Julai 2014 / **from 1 July 2014**)

E-mail : [mbh57@jmg.gov.my](mailto:mbh57@jmg.gov.my)

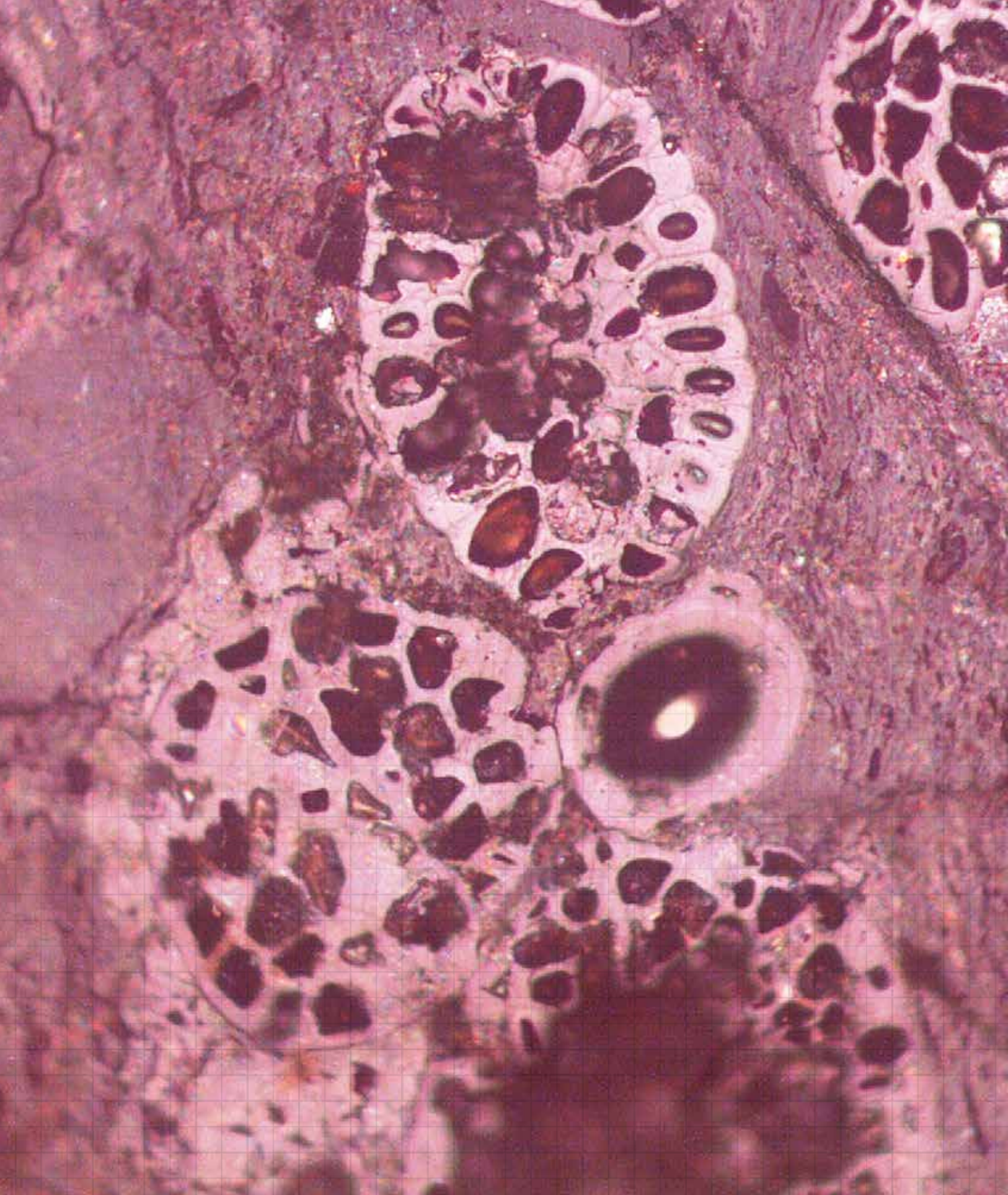


Dari kiri / **From left:** Jenneth @ Liliana Cyril (KUPM), Kamaruddin Abdulah (TPLK), Mohd Yusop Ramli (TPGS), Mustafar Hamzah (Pengarah), Jontih Enggihon (TPSM), Rokiah Abdullah (Memangku TPMK), Jeffery Paping (PPT)



Profil Pejabat JMG Negeri State JMG Office Profile										Jumlah Total	
	Johor	Negeri Sembilan / Melaka	Selangor / Wilayah Persekutuan	Perak	Kedah / Perlis / P. Pinang	Kelantan	Terengganu	Pahang	Sarawak	Sabah	
1 Sumber Manusia / Human Resource											
Pegawai profesional (bil.) / Professional officer (no.)	15	11	22	19	12	11	11	16	54	44	215
Kakitangan sokongan (bil.) / Supporting staff (no.)	35	33	38	39	34	37	32	35	98	59	440
2 Peruntukan Tahunan / Yearly Allocation											
Mengurus / Operation (RM)	2,911,400	2,198,400	4,212,900	2,886,700	2,483,300	1,580,000	2,251,500	2,911,080	8,933,100	6,140,620	36,509,000
Pembangunan / Development (RM)	798,500	625,000	13,874,000	565,000	722,000	669,000	480,000	830,000	2,710,000	4,911,000	26,184,500
3 Menjalankan Eklorasi dan Menyediakan Maklumat Sumber Mineral / Carry Out Exploration and Provide Mineral Resource Information											
Sumber mineral berlogam dikenal pasti (juta tan metrik) Metallic mineral resource identified (million tonnes)	19,100	-	100	6400	-	7250	8114	24,561	1500	2771	69,796
Sumber mineral perindustrian dikenal pasti (juta tan metrik) Industrial mineral resource identified (million tonnes)	425,794	3,179,827	2,481,820	3,104,601	2,137,779	8,221,497	835,344	3,874,579	16,267,687	70,041,914	110,570,842
Sumber mineral tenaga dikenal pasti (juta tan metrik) Energy mineral resource identified (million tonnes)	-	-	-	-	-	-	-	-	599,056	360,955	960,011
4 Menyediakan Maklumat dan Khidmat Geosains / Provide Geoscience Information and Services											
Liputan pemetaan geologi (km <sup>2</sup> ) Geological mapping coverage (%)	18,987 (100%)	8404 (100%)	5401 (100%)	17,175 (82%)	11,253 (100%)	12,117 (80%)	12,980 (100%)	27,980 (78%)	37,470 (30%)	20,986 (28%)	172,753 (52%)
Liputan pemetaan geologi terrain (km <sup>2</sup> ) Terrain geological mapping coverage	460	864	1558	400	899	762	707	453	400	460	6963
Liputan pemetaan geologi tanah gambut dan tanah lembut (km <sup>2</sup> ) Peat and soft soil geological mapping coverage	260	850	46	-	-	-	-	450	60	-	1666
Telaga Eklorasi dan pembangunan air tanah (bil.) Groundwater exploration and development well (no.)	118	326	269	131	71	91	269	409	321	192	2197
Telaga pemantauan air tanah (bil.) Groundwater monitoring well (no.)	41	38	38	40	38	105	58	17	80	108	563
Telaga air tanah di kawasan kebakaran gambut (bil.) Groundwater well in fire prone peat area (no.)	10	-	7	-	-	7	-	12	10	5	51
Liputan Penilaian sumber geoterma (km <sup>2</sup> ) Geothermal resource assessment coverage	-	-	-	-	-	50	-	-	-	250	300
Penarafan Geotapak (bil.) / Geosite characterisation (no.)	31	2	4	18	15	12	23	14	53	15	187
5 Penguatuasaan dan Kawalselaian Aktiviti Lombong dan Kuari / Enforcement and Supervision of Mining and Quarrying Activities											
Lombong beroperasi (bil.) / Operating mines (no.)	18	3	0	25	8	34	16	74	11	0	189
Kuari beroperasi (bil.) / Operating quarries (no.)	42	30	20	59	38	13	16	31	43	28	320
Skim Pengendalian Melombong dikeluarkan (bil.) Mining Operation Schemes issued (no.)	22	3	2	25	8	24	30	51	8	0	173
Surat Kebenaran Pengkuarian dikeluarkan (bil.) Letters of Authorisation to Quarrying issued (no.)	0	19	24	72	0	5	21	26	0	0	167
6 Perkhidmatan Makmal Geokimia / Geochemical Laboratory Services											
Analisis (bil.) / Analyses (no.)	-	-	-	-	-	-	-	-	10,713	12,892	23,605
Nilai kerja / Work value (RM)	-	-	-	-	-	-	-	-	217,213	539,555	756,768







A vertical strip on the left side of the page shows a photomicrograph of coal. It features dark, irregular, and somewhat circular or oval shapes (funginite) embedded within a lighter, more textured matrix (densinite). The overall color is a mix of dark brown and reddish-brown.

# SOROTAN PERISTIWA EVENT HIGHLIGHTS

Fotomikrograf funginit (maseral inertinit tinggalan kulat yang berpantulan tinggi) dalam matrik densinit (gel tisu berkayu) di arang batu Mukah dari Sarawak (cahaya putih pantulan di bawah rendaman minyak). Ia mencadangkan iklim yang panas-lembap dan keadaan pembentukan gambut yang basah atau rendaman air.

Photomicrograph of funginite (highly reflecting inertinite maceral derived from fungal remains) in the matrix of densinite (gelified woody tissues) in the Mukah coal of Sarawak (reflected white light under oil immersion). This suggests a warm-humid climate and a continuously wet or subaqueous peat formation condition.

Photo: Sia Say Gee

## SOROTAN PERISTIWA

## EVENT HIGHLIGHTS

06.05.2014

Majlis Penyampaian Surat Arahan Pemangkuan Secara Khas Untuk Penyandang oleh YBhg. Tan Sri Dr. Ali Hamsa, Ketua Setiausaha Negara

Presentation ceremony of Letter of Acting for Special to Holder Post by YBhg. Tan Sri Dr. Ali Hamsa, Chief Secretary to the Government





17.09.2014

Majlis Pelancaran Projek Peta Bahaya Dan Risiko Cerun di Kementerian Sumber Asli dan Alam Sekitar, Putrajaya  
Launching Ceremony for Slope Hazard and Risk Mapping Project at Ministry of Natural Resources and Environment, Putrajaya





06.11.2014

Majlis Perasmian Tapak Geowarisan Bukit Larek, Kedah  
*Inauguration Ceremony of the Bukit Larek Geoheritage Site, Kedah*



22.11.2014

Majlis Pelancaran Geopark Lembah Kinta oleh YB Dato' Nolee Ashilin Dato' Mohammed Radzi di Jelapang, Ipoh  
*Launching Ceremony of Kinta Valley Geopark by the Honourable Dato' Nolee Ashilin Dato' Mohammed Radzi at Jelapang, Ipoh*



10.12.2014

Penyerahan laporan akhir Projek Kajian Sumber Pasir Laut Negara – Fasa II, Perairan Sarawak oleh Dato' Yunus Abd Razak, Ketua Pengarah JMG kepada YB Datuk Hj. Mohd Noroden bin Hj. Majais, Menteri Muda di Pejabat Ketua Menteri (Pembangunan Usahawan) dan Menteri Muda Perancangan Sumber Sarawak, mewakili Kerajaan Negeri Sarawak  
*Handing over Final Report of National Marine Sand Studies Project – Phase II, Sarawak Coastal Area by Dato' Yunus Abd Razak, Director General of JMG Malaysia to the Honourable Datuk Hj. Mohd Noroden Hj. Majais, Assistant Minister in Chief Minister Office (Entrepreneur Development) and Assistant Minister of Resource Planning Sarawak, on behalf of Sarawak Government*



Photo: Khalid Kasdi



Photo: Khalid Kasdi



## PERSIDANGAN CONFERENCE

13-14.06.2014

Persidangan Geosains Kebangsaan 2014 di Hotel Grand Continental, Kuala Terengganu dianjurkan bersama oleh JMG, Universiti Malaysia Terengganu dan Persatuan Geologi Malaysia  
National Geoscience Conference 2014 at Grand Continental Hotel, Kuala Terengganu jointly organised by JMG, University of Malaysia Terengganu and Geological Society of Malaysia



18-19.06.2014

Persidangan JMG 2014 di Hotel Aseania Resort SPA, Langkawi  
2014 JMG Conference at Aseania Resort SPA Hotel, Langkawi





## MEDIA / PUBLISITI

## MEDIA / PUBLICITY

27.01.2014

Taklimat media berkenaan penemuan fosil tumbuhan di Paya Peda, Besut  
Media briefing on the discovery of plant fossils at Paya Peda, Besut



Photo: Sia Say Gee



Photo: Sia Say Gee

05.03.2014

Program Kembara Bersama Media NRE – Muzium Geologi  
NRE Media Adventure Programme – Geological Museum





**14-15.10.2014**

Pameran sempena Conference and Exhibition 2014 anjuran Institut Kuari Malaysia, Palm Garden Hotel, IOI Resort, Putrajaya

Exhibition in conjunction with Conference and Exhibition 2014 organised by Institute of Quarrying Malaysia, Palm Garden Hotel, IOI Resort, Putrajaya





18-19.10.2014

Pameran Hari UNESCO Malaysia 2014 di Dataran Merdeka, Kuala Lumpur  
Malaysia UNESCO Day Exhibition 2014 at Dataran Merdeka, Kuala Lumpur





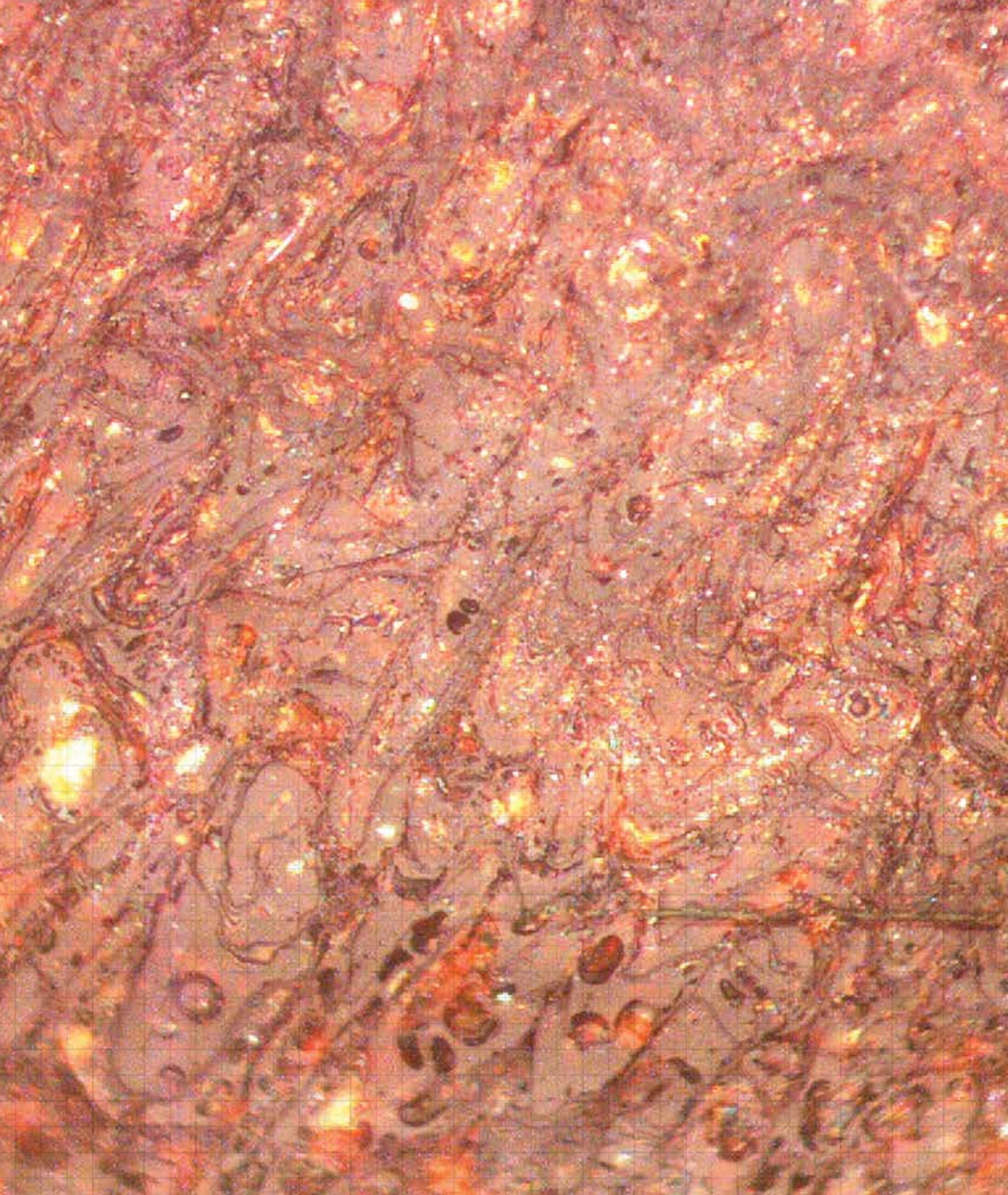
16.11.2014

Sidang media oleh YAB Menteri Besar Terengganu tentang penemuan fosil Dinasour

Press conference by the Honourable Chief Minister of Terengganu on the discovery of dinosaur fossils











# SENARAI PEGAWAI PROFESIONAL LIST OF PROFESSIONAL OFFICERS

Fotomikrograf menunjukkan kehadiran calitan minyak berwarna-warni yang merupakan hidrokarbon yang tersingkir dari suberinit di arang batu subbitumen B Mukah dari Sarawak (cahaya putih pantulan di bawah rendaman minyak).

Photomicrograph showing occurrence of colourful oil smears as a result of hydrocarbon expulsion from the suberinite from the subbituminous B Mukah coal of Sarawak (reflected white light under oil immersion).

Photo: Sia Say Gee



# SENARAI PEGAWAI PROFESIONAL

## LIST OF PROFESSIONAL OFFICERS

Ibu Pejabat / Headquarters		
Ketua Pengarah, JUSA A Director General	Dato' Yunus bin Abd Razak	BSc(Hons)(Geology)(UKM) MSc(Eng. Geology)(London), DIC
Timbalan Ketua Pengarah (Operasi) JUSA B Deputy Director General	Mustapha bin Mohd Lip	BEng(Hons)(Mining)(NSW Australia) MSc(Environment Resources)(Saltford)
Timbalan Ketua Pengarah (Korporat dan Ekonomi Mineral) JUSA C Deputy Director General	Mohammed Hatta bin Abd. Karim (retired as of 24 September 2014)	BSc(Hons)(Geology)(UM) MSc(Eng. Geology)(Leeds)
	Mior Sallehuddin bin Mior Jadid (from 01.12.2014)	BSc(Hons) (Geology)(UKM) MSc(Environmental and Ecological Science) (Lancaster)
Pengarah, C54 Director	Hamadi bin Che Harun (retired as of 31.07.2014)	BSc(Hons)(Applied Geology)(UM)
	Zakaria bin Hussain (until 31.03.2014)	BSc(Hons)(Geology)(UKM) MSc(Mineral Exploration)(UKM)
	Dr. Richard Mani Banda (from 01.04.2014)	BSc(Hons) (Geology) (UM) PhD(Advanced Industrial Technology) (Tsukaba)
	Mohamad Pauzi bin Abdullah	BSc(Hons)(Geology)(UKM)
	Ab Halim bin Hamzah	BSc(Hons)(Geology)(UKM) MSc(Mineral Resources Eng.)(USM)
Timbalan Pengarah, C52 Deputy Director	Kamal bin Daril	BSc(Hons)(Geology)(UKM) MS(Mineral Economics)(Michigan)
	Mohd Badzran bin Mat Taib	BSc(Hons)(Geology)(UKM)
Ketua Penolong Pengarah Kanan, C52 Senior Principal Assistant Director	Kamuradin bin Md Slar	BSc(Hons)(Geology)(UKM)
	Zulkipli bin Che Kasim (until 30.06.2014)	BSc(Hons)(Geology)(UM) MSc(Mineral Exploration & Mining) (Leicester)
Ketua Pegawai Geosains Kanan, C52 Senior Principal Geoscience Officer	Ir. Azman bin Abdul Majid	BSc(Hons)(Mining Eng.) (Leeds), PE
	Mohd Nazan bin Awang	BSc(Hons)(Geology)(UKM)
	Hisamuddin bin Termidi	BEng(Hons)(Mining) (Laurentian)
Ketua Penolong Pengarah, C48 Principal Assistant Director	Ling Nan Ley @ Ling Nan Leh (until 31.03.2014)	BSc(Hons)(Earth Science)(UKM) MSc(Engineering Geology)(Durham)
	Siti Aminah binti Abdul Sarif	BSc(Hons)(Applied Geology)(UM)
	Mohd. Zulkiflee bin Che Soh	BSc(Hons)(Geology)(UKM)
	Habibah binti Tahir	BSc(Hons)(Geology)(UKM) MSc (Environment) (UPM)
	Yusari bin Basiran	BSc(Hons)(Applied Geology)(UM) MSc(Mineral Industry)(UKM)
	Ahmad Zulkifli bin Kamaruzaman	BAppSc(Hons)(Geophysics)(USM)
	Azizan bin Ali (from 01.04.2014)	BSc(Hons)(Applied Geology)(UM) MSc(Engineering Geology)(UKM)
Ketua Pegawai Teknologi Maklumat, F48 Principal IT Officer	Tan Teong Ming	BSc(Information Technology)(UKM)
Ketua Pegawai Tadbir, 48 Principal Administration Officer	Marlia binti Mamat (until 06.05.2014)	BSc(Information Technology)(UKM) MA(International Relations) (Monash)
	Kalaichelvan a/l Balakrishnan (from 28.04.2014)	BSc(Computer) (UPM)

Ibu Pejabat / Headquarters		
Ketua Pegawai Geosains, C48 Principal Geoscience Officer	Dr. Sia Say Gee	BSc(Hons)(Applied Geology)(UM) PhD (Coal Geology) (UM)
	Norsham binti Samsudin	BSc(Hons)(Geology)(UKM)
	Dorsihah binti Mohamad Jais (until 02.03.2014)	BSc(Hons)(Geology)(UM)
	Nurzaidi bin Abdullah	BSc(Hons)(Geology)(UKM) MSc(Remote Sensing)(UPM)
	Dr. Ferdaus bin Ahmad (from 02.04.2014)	BSc(Hons)(Geology)(UM) MSc (Engineering Geology) (Leeds) PhD (Earth & Environment) (Leeds)
	Shari bin Ismail	BSc(Hons)(Applied Geology)(UM)
	Abd Rahim bin Harun	BSc(Hons)(Geology)(UKM)
	Basharuddin bin Ismail	BSc(Hons)(Geology)(UKM)
Pegawai Geosains Kanan, C44 Senior Geoscience Officer	Ummi Daeimah binti Hussin	BSc(Hons)(Applied Geology)(UM) MSc (Environment) (UPM)
	Brendawati binti Ismail	BSc(Hons)(Geology)(UM)
	Hisam bin Haji Ahmad (study leave)	BSc(Hons)(Geology)(UM)
	Ahmad Zamani bin Samat (from 03.03.2014)	BSc(Hons)(Geology)(UM)
	Mohamad Tarmizi bin Mohamad Zulkifly (from 16.01.2014)	BSc(Hons)(Geology)(UM) MSc (Engineering Geology) (UM)
	Safura binti Alias (from 17.02.2014)	BEng(Hons)(Mineral Resources Eng.)(USM)
Pegawai Geosains C41 Geoscience Officer	Mohd Anuar bin Ishak	BSc(Hons)(Geology)(UM)
	Abdul Razak bin Zainal Abidin	BSc(Hons)( Applied Geology)(UM)
	Nightingale Lian Marto (from 03.03.2014)	BSc(Hons)(Geology)(UKM) MSc(Environmental Management)(UMS)
	Maziadi bin Mamat (until 16.02.2014)	BEng(Hons)(Mineral Resources Eng.)(USM)
	Mat Wadi bin Ab Satar	BEng(Hons)(Mineral Resources Eng.)(USM)
	Mohd Shafiq Farhan bin Mohd Zainudin	BSc(Hons)( Geology)(UM)
	Zahari bin Mohamed (unpaid leave)	BEng(Hons)(Mineral Resources Eng.)(USM)
Bahagian Perkhidmatan Teknikal / Technical Services Division		
Pengarah, JUSA C Director	Mior Sallehuddin bin Mior Jadid (until 30 November 2014)	BSc(Hons)(Geology)(UKM) MSc(Env. & Ecological Sciences)(Lancaster)
Pengarah, JUSA C Director	Dr. Kamaludin bin Hassan (from 01.12.2014)	BSc(Hons)(Geology)(UM) MSc(Palynology)(Sheffield) PhD(Quaternary Envi. Change)(Durham)
Ketua Pegawai Geosains, JUSA C Principal Geoscience Officer	Dr. Vijayan a/I V.V. Rajan	BSc(Hons)(Applied Geology)(UM) MSc(Geophysics)(UM) MSc(Marine Geophysics)(Mississippi) PhD(Marine Geology)(Mississippi)
Timbalan Pengarah, C54 Deputy Director	Ismail bin Iman	BSc(Hons)(Geology)(UM) MSc(Quaternary Geology)(VUB Brussels)
	Chin Siew Yee (retired as of 6 September 2014)	BSc(Hons)(Chemistry)(USM) MSc(Environmental Analysis and Assessment)(London), AMIC

Bahagian Perkhidmatan Teknikal / Technical Services Division		
Ketua Pegawai Geosains, C52 Principal Geoscience Officer	Mohd Ariff bin Omar	BSc(Hons)(Chemistry)(Nottingham), AMIC
	Abdul Kadir bin Ahmad	BSc(Hons)(Chemistry)(UKM), AMIC
	Chan Fook Onn	BSc(Hons)(Chemistry)(UM) MSc(Analytical Chemistry and Instrumentation) (Loughborough), AMIC
	Baharuddin bin Wanik	BSc(Hons)(Chemistry)(USM)
	Mohd Zaidi bin Mohd Hasan	BSc(Hons)(Geology)(UKM)
	Azahari bin Ahmad	BSc(Hons)(Geophysics)(USM)
	Abdul Rahman bin Mohd Yusoff	BSc(Hons)(Earth Science)(UKM)
	Dato' Zainal Abidin bin Md. Nor	BSc(Hons)(Mining Eng.)(London) MSc(Mining Eng.) Pennsylvania
Ketua Pegawai Geosains, C48 Principal Geoscience Officer	Dzazali bin Ayub	BSc(Hons)(Geophysics) (USM)
	Ismail bin C. Mohamad	BSc(Hons)(Geology)(UKM) MSc(Geology)(UKM)
	Mohamad Hussein bin Jamaluddin	BSc(Hons)(Geology)(UKM)
	Abdullah bin Sulaiman	BSc(Hons)(Applied Geology)(UM) MSc(Oceanography) (Southampton)
	Wan Zulasmin bin Wan Ibrahim (retired as of 1 Jun 2014)	BEng(Hons)(Mining Eng.)(Newcastle-Upon-Tyne)
	Hazan Maheran binti Mohd	BSc(Hons)(Chemistry)(UKM), AMIC
	Thangavelu a/l Ramen	BSc(Hons)(Chemistry/Mathematic)(USM) MSc(IT)(Nottingham), AMIC
	Mohd Rais bin Ramli	BAppSc(Hons)(Geophysics)(USM)
	Mohamad bin Kasim	BSc(Hons)(Chemistry)(USM), AMIC
	Dr. Pauline Dushyanthi a/p Paul Nesaraja	BSc(Hons)(Chemistry)(UM) MSc(Hydrogeology)(Birmingham), AMIC PhD(Environmental Chemistry) University of Buffalo, State University of New York
	Mohd. Saad bin Samsudin	BSc(Hons)(Chemistry)(UKM), AMIC
	Hairani Sham binti Manas	BAppSc(Hons)(Geophysics)(USM)
	Mat Niza bin Abdul Rahman	BSc(Hons)(Geology)(UKM)
	Dr. Mohamad bin Abd Manap	BSc (Hons)(Earth Science)(UKM) MSc (Remote Sensing)(UPM) PhD (Environmental Hydrology and Hydrogeology) (UPM)
Ketua Pegawai Tadbir, M48 Principal Administrative Officer	Nor 'Asyikin binti Yusoff (until 16.10.2014)	LL.B (Hons)/UIAM
Pegawai Geosains Kanan, C44 Senior Geoscience Officer	Hamid bin Ariffin	BSc(Hons)(Applied Geology)(UM)
	Mohd Anuar bin Md Razali	BAppSc(Hons)(Geophysics)(USM)
	Halim bin Darahim	BAppSc(Hons)(Geophysics)(USM)
	Mohd Fauzi bin Muhammad Said	BSc(Hons)(Chemistry)(UKM), AMIC
	Wan Ibrahim bin Wan A Rahman	BSc(Hons)(Chemistry)(UKM), AMIC
	Amin Noorasid bin Abd Jalil	BSc(Hons)(Geology) (UMS)
Pegawai Teknologi Maklumat Kanan, F44 Senior IT Officer	Syamillah binti Samsudin @ Murad	BSc(Hons)(Information Technology)(UUM)
Pegawai Geosains, C41 Geoscience Officer	Noran Alwakhir bin Shaarani	BSc(Hons)(Geology)(UM) MSc (Applied Marine Geoscience)(Bangor University, UK)
	Hairul bin Mohamed Shaharudin	BEng(Hons)(Mineral Resources Eng.)(USM)
	Yusril A'mali bin Mohd Yusuf @ Hamid	BSc(Hons)(Chemistry)(UPM), AMIC
	Sharizan bin Ibrahim	BAppSc(Hons) Applied Chemistry UiTM MSc(Mechanical Eng.)(UNIMAP)
	Mohd Fahami bin Abas	BAppSc(Hons)(Analytical Chemistry)(USM) MSc (Management)(UUM)
	Mohd Fuzi bin Hashim	BSc(Hons)(Chemistry)(UM)
	Noor Akhmar bin Kamarudin	BSc(Hons)(Chemistry)(UPM)
	Halime bin Azahari @ Adnan	BSc(Hons)(Applied Chemistry)(UiTM)



Bahagian Perkhidmatan Teknikal / Technical Services Division		
Pegawai Geosains, C41 Geoscience Officer	Mohd Zahar bin Ibrahim	BSc(Hons)(Chemistry)(USM)
	S. Pasupathi a/l Subramaniam	BSc(Hons)(Chemistry)(USM)
	Azrul bin Arifin	BSc(Hons)(Applied Chemistry) (UiTM)
	Nurul Husna binti Ismayatim	BSc(Hons)(Chemistry)(UKM)
	Intan Shazwani binti Abdul Ghani	BSc(Hons)(Chemistry)(UM)
Pusat Penyelidikan Meneral / Mineral Research Centre		
Pengarah, JUSA C Director	Shahar Effendi bin Abdullah Azizi	BSc(Hons)(Mining Eng.) (Leeds) DESS (Econ. Evaluation of Mining Projects) (Paris School of Mines)
Pegawai Penyelidik Kanan, Q54 Senior Research Officer	Ir. Khor Peng Seong (retired as of 10 Disember 2014)	BSc(Hons)(Physics)(UM) MSc(Mining)(Leeds) EC(Mining)
	Md Muzayin bin Alimon	BSc(Hons)(Chemistry)(UKM) MSc(Mineral Processing) (Pennsylvania State)
	Nasharuddin bin Isa	BAppSc(Hons) (Minerals Science and Technology) (USM) MSc(Minerals Engineering) (Exeter), MCSM
	Mahadi bin Abu Hassan	BSc(Hons)(Geology)(UKM)
	Kori bin Mohammad	BSc(Hons)(Geology)(UKM) MSc(Engineering Geology) (Leeds)
	Aminudin bin Mahmud	BSc(Hons)(Geology)(UKM) MSc(Engineering Geology)(Leeds)
	Abd Rahman bin Abd Aziz (retired as of 2 July 2014)	BSc(Hons)(Geology)(UKM) MSc(Mineral Resources)(Cardiff)
	Abdul Rois bin Abdul Mois	BAppSc(Hons) (Minerals Science and Technology) (USM) MSc(Ceramic Engineering)(Sheffield)
	Ramli bin Mohd Osman	BSc(Hons)(Applied Geology)(UM) MSc(Environmental Science & Engineering) (Colorado)
	Mohamad Haniza bin Mahmud	BEng(Hons)(Mineral Resources Eng.) (USM) Adv. Diploma(Environmental Engineering) (Manchester) MSc(Materials Engineering) (USM)
	Dr. Shamsul Kamal bin Sulaiman	BSc(Hons)(Mining Engineering)(Alabama) MSc(Mineral Resources Eng.)(USM) PhD(Advanced Material)(Leeds)
	Dr. Nazwin binti Ahmad	BEng(Hons)(Mining Engineering)(Nova Scotia) PhD(Advanced Material)(Leeds)
	Dr. Ismail bin Ibrahim	BEng(Hons)(Mineral Resources Eng.) (USM) MSc(Mineral Resources Engineering)(USM) PhD(Mineral Processing)(USM)
	Dr. Izhar Abadi bin Ibrahim Rais	BEng(Hons)(Mineral Resources Eng.) (USM) MSc(Mineral Resources Eng.)(USM) PhD(Mineral Resources Processing)(USM)
	Dr. Rashita binti Abd Rashid	Diploma(Chemical Engineering)(UTM) BEng(Hons)(Chemical Engineering)(UTM) MSc(Mineral Resources Eng.)(USM) PhD(Materials Science)(UKM)
Pegawai Penyelidik Kanan, Q48 Senior Research Officer	Malek bin Selamat	BEng(Hons)(Mineral Resources Engineering)(USM) MPhil(Advanced Material)(Leeds)
	Salmah binti Baharuddin	BSc(Computer Science)(Hons)(USM) MSc(Image Processing)(USM)
	Abdullah bin Hussin	Adv. Diploma(Land Survey)(ITM) BSc(Land Survey)(ITM)

Pusat Penyelidikan Meneral / Mineral Research Centre		
Pegawai Penyelidik, Q44 Research Officer	Marlinda binti Daud	BEng(Hons)(Materials Engineering)(USM)
	Siti Mazatul Azwa binti Saiyed Mohd Nurddin	Diploma(Science)(ITM) BAppSc(Hons)(Industrial Chemistry)(USM) MSc(Advanced Materials Engineering)(UPM)
	Dr. Rohaya binti Othman	Diploma(Textile Technology)(ITM) BSc(Hons)(Textile Technology)(UiTM) PhD(Materials Science)(UKM)
	Hamdan bin Yahya (study leave)	BSc(Hons)(Materials Science)(UKM)
	Mohd Syahrir bin Mohd Rozi	BEng(Hons)(Chemical Engineering)(UTM)
	Mohd Idham bin Mustaffar	BEng(Hons)(Chemical Engineering)(UTM) MEng(Bioprocess Engineering)(UTM)
Pegawai Penyelidik, Q41 Research Officer	Norinsafrina binti Mustaffa Kamal	BEng(Hons)(Environmental Engineering) (Melbourne)
	Anuar bin Othman	BSc(Hons)(Industrial Chemistry)(UTM)
	Roshaida binti Arbain	BEng(Hons)(Mineral Resources Engineering) (USM) MSc(Mineral Resources Engineering)(USM)
	Aspaniza binti Ahmad (from 17.2.2014)	BEng(Hons)(Materials Engineering)(USM) MSc(Materials Engineering)(USM)
	Fatihah binti Azmi (from 24.3.2014)	BEng(Hons)( Civil Engineering)(UMP) MSc(Enviromental Engineering)(USM)
	Hamizah binti Abdul Samad (from 14.4.2014)	BEng(Hons)(Materials Engineering)(USM) MSc(Materials Engineering)(USM)
Sarawak		
Pengarah, JUSA C Director	Alex Unya ak Ambun (retired as of 30 December 2014)	BSc(Hons)(Geology)(UM) Dip. (Mineral Exploration) (ITC) MSc (Applied Structural Geology and Rocks Mechanics) (London), DIC
Timbalan Pengarah, C54 Deputy Director	Dr. Richard Mani ak Banda (until 1.4.2014)	BSc(Hons)(Geology)(UM) PhD (Adv. Industrial Tech.)(Tsukuba)
Timbalan Pengarah, C52 (KUP) Deputy Director	Rushtom bin Rushdi	BSc(Hons)(Mining Eng)(Newcastle-Upon-Tyne)
	Enggong ak Aji	BSc(Hons)(Earth Science)(UKM) MSc(Exploration Mineral)(UKM)
	Henry Litong Among (from 2.4.2014)	BSc(Hons)(Geology)(UKM)
	Ismail bin Hanuar (from 1.7.2014)	BSc (Chemistry) (USM)
Ketua Pegawai Geosains Kanan, C52 Senior Principal Geoscience Officer	Tungah bin Surat (retired as of 1.6.2014)	BSc(Hons)(Geology)(UM) MSc(Economic Geology)(UMS)
	Tennent ak Ahai	BSc(Hons)(Earth Science)(UKM)
	Sulong ak Enjop	BSc(Hons)(Earth Science)(UKM) MSc(Hydrogeology)(London), DUCL
	Joanes Muda	BSc(Hons)(Earth Science)(UKM) MSc(Geology)(UMS)
	Ling Nan Ley @ Ling Nan Leh (from 1.4.2014)	BSc(Hons)(Earth Science)(UKM) MSc (Engineering Geology), Durham Uni, UK
	Azemi bin Hj Eki	BSc(Hons)(Geology)(UKM) MSc(Material Eng.)(USM)
	Paulius Godwin	BSc(Hons)(Geology)(UKM)
Timbalan Pengarah, C48 Deputy Director	Sabtuyah binti Hj. Su'ut (retired as of 2.3.2014)	BSc(Hons) Chemistry, UKM, AMIC

Sarawak		
Ketua Pegawai Geosains, C48 Principal Geoscience Officer	Yusuf bin Bujang	BSc(Hons)(Geology)(UKM) MSc(Hydrogeology)(London)
	Richard Batoi @ Lipai ak Jantau	BSc(Hons)(Geology)(UM)
	Siti Faridah binti Yusuf	BSc(Hons)(Geology)(UM)
	Ajon Winnie	BSc(Hons)(Earth Science)(UKM)
	Hussein bin Mohd Juni	BSc(Hons)(Geology)(Texas, USA)
	Setebin @ Roslan bin Rajali	BSc(Hons)(Applied Geology)(UM) MSc(Env. Hydrogeology)(Cardiff, U.K)
	Jaithish John	BSc(Hons)(Applied Geology)(UM) MSc(Applied Geology)(Univ. of Pennsylvania, USA)
	Edward ak Muol	BSc(Hons)(Applied Geology)(UM)
Pegawai Geosains Kanan, C44 Senior Geoscience Officer	Segar a/l Velayutham	BSc(Hons)(Chemistry)(USM), AMIC
	Zamzuri bin Ghazalee	BSc(Hons)(Geology)(UM)
	Japri bin Bujang	BSc(Hons)(Geology)(UKM)
	Azzudin bin Shebli	Adv. Dip(Applied Chemistry)(UiTM), AMIC BSc(Hons) (Chemistry) (UNIMAS) MSc (Chemistry) (UNIMAS)
	Rengga ak Gendang	BSc(Hons)(Geology)(UM)
	Manggon ak Abot	BSc(Hons)(Geology)(UKM) Dip. Ed. (IPGBL) MSc(Geology, Mineralogy & Petrology)(Oregon State, USA)
	Mohd Aswandi bin Ariff	BSc(Hons)(Industrial Chemistry)(UPM)
	Dr. Joseph Jubin ak Aruh @ Aro	BSc(Hons)(Geology)(UM) MSc (Pengurusan Sumber Lestari)(UPM) PhD (Env. Hydrology and Hydrogeology ) (UPM)
	Freddy ak Heward Chinta	BSc(Hons)(Earth Science)(UKM)
	Julia ak Kaya	BSc(Hons)(Geology)(UKM)
	Luqman bin Hj. Kaluni	BSc(Hons)(Geology)(UKM)
	Hermawati binti Tambeng	BSc(Hons)(Applied Chemistry)(UiTM)
	Salehuddin bin Mohamad	BEng.(Hons) (Mineral Resources Engineering) (USM)
	Thomson ak Galin	BSc(Hons)(Geological Science)(Leeds) MSc(Geology)(London)
	Balachandar a/l Subramaniam	BSc(Hons) Applied Chemistry (UM) MSc(Analytical Chemistry and Instrumental Analysis)(UM)
	Lee Beng Huat	BSc(Hons)(Geology)(UKM) MSc(Geology)(UKM)
Pegawai Geosains, C41 Geoscience Officer	Mohamad Zahir bin Che Amad	BSc(Hons)( Applied Geology)(UM)
	Shahrul Ridzuan bin Zainal Rashid	BAppSc(Hons)(Geophysics)(USM)
	Nik Mohd Nishamuddin bin Nik Rahimi	BSc(Hons)(Geology)(UKM)
	Clarence Anyau ak Tibu	BSc(Hons)(Geology)(UKM)
	Nazirrahmat bin Suleiman	BSc(Hons)(Geology)(UKM)
	Ledyhernando Taniou	BSc(Hons)(Geology)(UMS)
	Zaidulkhair bin Jasmi	BSc(Hons)(Geology)(UKM)
	Mohd Farid bin Abdul Kadir	BSc(Hons)(Geology)(UKM)
	Mohd Afiq bin Mohd Atan	BSc(Hons)(Geology)(UMS)
	Angela Ee	BSc(Hons)(Geology)(UMS)
Pegawai Teknologi Maklumat, F41 IT Officer	Silvia Joseph	BSc(Hons)(Computer Science) (UPM)



Sabah		
Pengarah, C54 Director	Alexander Yan Sze Wah <i>(retired as of 31.05.2014)</i>	BSc(Hons)(Applied Geology)(UM) MSc(Structural Geology and Rock Mechanics) (London), DIC
	Mustafar bin Hamzah <i>(from 01.07.2014)</i>	BSc(Hons)(Geology)(UKM) MSc(Geographical Information System) (University of Leicester)(UK)
Timbalan Pengarah, C52 Deputy Director	Mohd Yusop bin Ramli	BSc(Hons)(Geology)(UKM)
	Ismail bin Hanuar <i>(until 30.06.2014)</i>	BSc(Hons)(Chemistry)(USM), AMIC
	Jontih Inggihon@Enggihon	BSc(Hons)(Geology)(UKM) Adv. Diploma(Computer Science)(UKM)
	Kamaruddin bin Abdullah	BEng.(Hons)(Mineral Resources Eng.)(USM) MSc(Occupational Safety & Health)(Murray State of University, USA)
Timbalan Pengarah, C48 Deputy Director	Rokiah binti Abdullah	BSc(Hons)(Chemistry)(UKM), AMIC
Ketua Pegawai Geosains, C48 Principal Geoscience Officer	Zamri bin Ramli	BSc(Hons)(Applied Geology)(UM) MSc(Environment)(UPM)
	Hilary Muyan Nicholas Thomas	BSc(Hons)(Geology)(UM)
	Che Aziz bin Che Soh	BSc(Hons)(Earth Science)(UKM)
	Wong Vui Chung @ Webster	BSc(Hons)(Applied Geology)(UM) MSc(Environmental Management)(UMS)
	Frederick Francis Tating	BSc(Hons)(Earth Science)(UKM) MSc(Environment)(Kumamoto University)
	Jenneth Cyril @ Liliana	BSc(Hons)(Geology)(UKM)
Pegawai Geosains Kanan, C44 Senior Geoscience Officer	Dr. Ferdaus bin Ahmad <i>(until 01.04.2014)</i>	BSc(Hons)(Geology)(UM) MSc(Eng. Geology)(Leeds) PhD(Earth & Environment) (Leeds)
	Morius Bantas	BSc(Hons)(Chemistry)(UKM) MSc(IT Management)(UTM)
	Fredolin Javino	BSc(Hons)(Applied Geology)(UM)
	Dana ak Badang <i>(study leave)</i>	BSc(Hons)(Geology)(UKM) MSc(Environment)(UKM)
	Daulip @ Dee Dee Langkait	BSc(Hons)(Earth Science)(UKM)
	Norul Ashikin binti Hj. Ab Karim <i>(until 31.03.2014)</i>	BSc(Hons)(Geology)(UM)
	Jaineh Lingi <i>(study leave)</i>	BSc(Hons)(Applied Geology)(UM)
	Bailon Golutin	BSc(Hons)(Geology)(UMS)
	Cleafos Totu	BSc(Hons)(Earth Science)(UKM)
	Khairun Nasir bin Mokhtar	BSc(Hons)(Chemistry)(UM)
	Jayawati Fanilla Sahih binti Montoi <i>(study leave)</i>	BSc(Hons)(Geology)(UM)
	Faye Donna Edmund	BSc(Hons)(Geology)(UKM) MSc(Applied Geosciences) (Univ. of Pennsylvania, USA)
	Arthur Clement Makulim	BSc(Hons)(Geology)(UMS)
	Eddie Affandy bin Mohd Yuslee	BSc(Hons)(Geology)(UMS)
	Farid bin Zainudin	BSc(Hons)(Geology)(UMS)
	Alvyn Clancey Mickey	BSc(Hons)(Geology)(UMS) MSc(Geology)(UMS)

Sabah		
Pegawai Geosains, C41 Geoscience Officer	Chung Pit Soon bin Chung Chung Loi (resigned 02.02.2014)	BSc(Hons)(Geology)(UMS)
	Norzuhairil bin Zubir (until 02.03.2014)	BSc(Hons)(Geology)(UM)
	Nightingale Lian Marto (until 17.03.2014)	BSc(Hons)(Geology)(UKM) MSc(Environmental Management)(UMS)
	Mazrali bin Alway	BSc(Hons)(Applied Geology)(UM)
	Muhammad Umar bin Sarimal	BSc(Hons)(Geology)(UMS)
	Mahadi bin Santa	BSc(Hons)(Geology)(UMS)
	Akrimi Masua binti Mohamad	BAppSc(Hons)(Analytical Chemistry)(USM)
	Mison bin Ajum (from 03.03.2014)	BSc(Hons)(Geology)(UMS)
	Kennedy bin Mohd Imran (from 17.03.2014)	BSc(Hons)(Applied Geology)(UM) MSc(Eng. Geology)(University of Newcastle Upon-Tyne)(England) M.D.(Zamboanga Medical School Foundation)
	Mohd Shafreen bin Mad Isa	BEng(Hons)(Mineral Resources Eng.)(USM)
	Lim Li Chein (from 17.02.2014)	BSc(Hons)(Geology)(UMS)
	Goh Khean Siong (from 15.05.2014)	BSc(Hons)(Geology)(UKM) MSc(Geology)(UKM)
Pegawai Teknologi Maklumat, F41 IT Officer	Azlan bin Ahmad	BSc(Hons)(Computer Science)(UKM)
Pahang		
Pengarah, C54 Director	Mohd Zaim bin Abdul Wahab	BSc (Hons)(Mining Eng)(Newcastle-Upon-Tyne) DESS (Econ. Evaluation of Mining Project) (Paris School of Mines)
Timbalan Pengarah, C52 Deputy Director	Wan Saifulbahri bin Wan Mohamad	BSc(Hons)(Geology)(UKM)
Timbalan Pengarah, C48 Deputy Director	Ahmad Zukni bin Ahmad Khalil (from 01.08.2014)	BEng.(Hons)(Mineral Resources Eng)(USM)
	Asminah binti Rajuli	BSc(Hons)(Geology)(UKM) MSc (Environment) (UPM)
Pegawai Geosains Kanan, C44 Senior Geoscience Officer	Mohammad Aznawi bin Mat Awan	BSc(Hons)(Geology)(UKM)
	Afandi bin Muda	BSc(Hons)(Applied Geology)(UM)
	Mazlan bin Mohamad Zain	BSc(Hons)(Applied Geology)(UM) MSc(Eng. Geology)(UKM)
Pegawai Geosains, C41 Geoscience Officer	Yusuf bin Imbun	BSc(Hons)(Geology)(UKM)
	Zainal Abidin bin Jamaluddin	BSc(Hons)(Geology)(UKM) MSc(Applied Geology)(UKM)
	Salmiah binti Nawi@Muhammad (study leave)	BEng(Hons)(Mineral Resources Eng)(USM)
	Adha Syuraini bin Abd. Ghani	BEng(Hons)(Mineral Resources Eng)(USM)
	Zaki bin Alias	BSc(Hons)(Applied Geology)(UM)
	Mohd Asnizam bin Ayub (study leave)	BSc(Hons)(Geology)(UKM)

Perak		
Pengarah, C54 Director	Dr. Kamaludin bin Hassan (until 30.11.2014)	BSc(Hons)(Geology)(UM) MSc(Palynology)(Sheffield) PhD(Quaternary Envi. Change)(Durham)
Timbalan Pengarah, C48 Deputy Director	Ahmad Zukni bin Ahmad Khalil (until 31.7.2014)	BEng(Hons)(Mineral Resources Engineering)(USM)
	Tuan Rusli bin Tuan Mohamed	BSc(Hons)(Geology)(UKM) MSc(Engineering Geology)(UKM)
	Mohamad Sari bin Hasan	BSc(Hons)(Geology)(UKM)
Pegawai Geosains Kanan, C44 Senior Geoscience Officer	Faizal bin Arshad	BEng(Hons)(Mineral Resources Eng)(USM)
	Othman bin Kangsar	BAppSc(Hons)(Geophysics)(USM) MSc(Engineering & Environment Geophysic)(UKM)
	Nor Azian bin Hamzah	BSc(Hons)(Geology)(UKM)
Pegawai Geosains, C41 Geoscience Officer	Suzannah binti Akmal	BSc(Hons)(Geology)(UM)
	Mohd Irwan bin Ariff (study leave)	BSc(Hons)(Geology)(UKM)
	Azmi bin Abu Bakar (study leave)	BSc(Hons)(Applied Geology)(UM)
	Mohd. Shahrizal bin Mohamed Sharifodin	BSc(Hons)(Geology)(UKM)
	Zaiton binti Abdullah (study leave)	BEng(Hons)(Mineral Resources Eng)(USM)
	Azizan anak Juhin	BSc(Hons)(Geology)(UMS)
	Saiful bin Abdullah	BSc(Hons)(Geology)(UKM)
	Hanizam Shah bin Saidin	BEng(Hons)(Mineral Resources Engineering)(USM) MSc(Mineral Resources Engineering)(USM)
	Nurul Amalina binti Md. Nor (from 17.02.2014)	BSc(Hons)(Geology)(UM)
	Asman bin Alias (from 16.6.2014)	BSc(Hons)(Geology)(UMS)
Johor		
Pengarah, C54 Director	Zakaria bin Hussain (from 01.04.2014)	BSc(Hons)(Geology)(UKM) MSc(Mineral Exploration)(UKM)
Timbalan Pengarah, C52 Deputy Director	Abdullah Sani bin H. Hashim	BSc(Hons)(Geology)(UKM)
Timbalan Pengarah, C48 Deputy Director	Nizarulikram bin Abdul Rahim	BSc(Hons)(Geology)(UM)
	Nurul Huda bin Romli	B.Eng(Hons) (USM ) M.Sc(OSH) UNSW
Ketua Pegawai Geosains C48 Principal Geoscience Officer	Noorazhar bin Ngatimin	BSc(Hons)(Geology)(UM)
Pegawai Geosains Kanan, C44 Senior Geoscience Officer	Nor Asmah binti Abd Aziz	BSc(Hons)(Geology)(UKM)
	Mohd Fauzi bin Rajimin @ Jeman	BSc(Hons)(Geology)(UKM)
	Khairul Zaman bin Ibrahim	BSc(Hons)(Geology)(UKM), MSc (Industrial Mineral)(UKM)
	Hasnida binti Zabidi @ Zainudi	BSc(Hons)(Earth Science)(UKM)
	Muhammad Hazli bin Mohamed Hanapi	BSc(Hons)(Applied Geology)(UM)
	Mohammed Syahrizal bin Zakaria	BSc(Hons)(Geology)(UKM)
	Noraini binti Basiri	BSc(Hons)(Geology)(UKM)
	Norhazidi bin Masrom	BSc(Hons)(Geology)(UKM)
	Mohd Hisham bin Md Nawi	BEng(Hons)(Mineral Resources Eng)(USM)
Pegawai Geosains, C41 Geoscience Officer	Arda Anasha binti Jamil	BSc(Hons)(Geology)(UM)



Selangor / Wilayah Persekutuan		
Pengarah, C54 <i>Director</i>	Dato' Hj. Zakaria bin Mohamad	BSc(Hons)(Geology) (UKM) MSc(Applied Quaternary Geology) (Free University of Brussel)
TimbalanPengarah, C52 <i>Deputy Director</i>	Mohd. Sidi bin Daud	BSc(Hons)(Geology)(UKM)
Timbalan Pengarah, C44 <i>Deputy Director</i>	Ir. Tony Chew	BEng(Hons)(Mineral Resources Eng.) (USM) MBA (UMS)
Timbalan Pengarah, C48 <i>Deputy Director</i>	Che Ibrahim bin Mat Saman	BSc(Hons)(Geology)(UKM)
Ketua Pegawai Geosains Kanan, C52 <i>Senior Principal Geoscience Officer</i>	Mahisham bin Ibrahim	BSc(Hons)(Geology)(UKM)
Pegawai Geosains Kanan, C44 <i>Senior Geoscience Officer</i>	Mahat bin Sibon	BSc(Hons)(Geology)(UM)
	Qalam A'zad bin Rosle	BSc(Hons)(Geology)(UM) MSc(Structural Geology With Geophysics) (Leeds)
	Iszaynuddin bin Abd. Hamid	BSc(Hons)(Geology)(UKM)
	Mazatul Akmar binti Aros	BSc(Hons)(Geology)(UM)
Pegawai Geosains, C41 <i>Geoscience Officer</i>	Muhamad Ezwan bin Dahlan	BSc(Hons)(Geology)(UKM)
	Mohd. Shukri bin Ramlan <i>(until 1/12/2014)</i>	BSc(Hons)(Geology)(UMS)
	Mustaza bin Mustafa	BEng(Hons)(Mineral Resources Eng)(USM)
	Safura binti Alias <i>(until 30/3/2014)</i>	BEng(Hons)(Mineral Resources Eng)(USM)
	Maziadi bin Mamat <i>(from 30/3/2014)</i>	BEng(Hons)(Mineral Resources Eng)(USM)

Kelantan		
Pengarah, C52 <i>Director</i>	Che Abdul Rahman bin Jaafar	BSc(Hons)(Earth Science)(UKM)
TimbalanPengarah, C48 <i>Deputy Director</i>	Ab. Rashid bin Ahmad	BSc(Hons)(Geology)(UKM)
TimbalanPengarah, C44 <i>Deputy Director</i>	Mohamed Hizam bin Abdul Kadir	BEng(Hons)(Mineral Resources Eng.)(USM)
	John ak Joseph Jinap	BSc(Hons)(Applied Geology)(UM)
Pegawai Geosains Kanan, C44 <i>Senior Geoscience Officer</i>	Mohamad Yusof bin Che Sulaiman	BSc(Hons)(Geology)(UM)
	Ropidah binti Mat Zin	BSc(Hons)(Applied Geology)(UM) MSc.(GIS) (UiTM)
	Mohd Yuzlan bin Yusoff	BSc(Hons)(Applied Geology)(UM)
	Ahmad Rosli bin Othman	BSc(Hons)(Applied Geology)(UM) MSc (Alam Sekitar & Pembangunan) ( UKM)
	Mohamed Asri bin Omar	BSc(Hons)(Geology)(UM)
	Amir Mizwan bin Mohd Akhir	BSc(Hons)(Geology)(UKM)
Pegawai Geosains, C41 <i>Geoscience Officer</i>	Aidil bin Arnolous Rema	BEng(Hons)(Mineral Resources Eng.)(USM)
	Nur Asikin binti Rashidi <i>(from 15.5.2014)</i>	BSc(Hons)(Geology)(UKM) MA(Archaeology)(USM)

Negeri Sembilan / Melaka		
Pengarah, C52 Director	Zulkipli bin Che Kasim	BSc(Hons)(Geology)UM MSc (Mineral Exploration and Mining Geology) England
Timbalan Pengarah, C48 Deputy Director	Dorsihah binti Mohamad Jais (from 03.03.2014)	BSc(Hons)(Geology)UM
	Haniza binti Zakri	BSc(Hons)(Geology)UKM MSc(Geology)UKM
Timbalan Pengarah, C41 Deputy Director	Ir. Muhamad Suhaimi bin Nordin	BSc(Hons)(Mining Eng.) Newcastle-Upon-Tyne MSc(Rock Mechanics & Excavation Eng.) Newcastle-Upon-Tyne
Pegawai Geosains Kanan, C44 Senior Geoscience Officer	Azhar bin Ahmad Nazri	BSc(Hons)(Earth Sciences)UKM
	Norul Ashikin binti Ab. Karim (from 02.04.2014)	BSc(Hons)(Applied Geology)UM
	Rosni binti Lokmannul Hakim	BSc(Hons)(Geology)UM
	Norhayati binti Mohd. Rawi	BSc(Hons)(Geology)UKM
	Masrita binti Mohd. Aras	BSc(Hons)(Geology)UKM
Pegawai Geosains, C41 Geoscience Officer	Mohd. Nizam bin Mohd. Noordin	BSc(Hons)(Geology)UKM
	Muhammad Fawwaz bin Zainal Abedin	BSc(Hons)(Geology)UMS
Terengganu		
Pengarah, C54 Director	Mohd. Zukeri bin Ab. Ghani	BSc(Hons)(Geology)(UKM)
Timbalan Pengarah, C48 Deputy Director	Hamlee bin Ismail	BSc(Hons)(Geology)(UKM) MSc (Industrial Mineral)(UKM)
Timbalan Pengarah, C44 Deputy Director	Tang @ Tan Hai Hong	BEng(Hons)(Mineral Resources Eng.)(USM)
	Abdul Hadi bin Abdul Rahman	BSc(Hons)(Geology)(UM) MSc (Industrial Mineral)(UKM)
Pegawai Geosains Kanan, C44 Senior Geoscience Officer	Suhaimizi bin Yusoff	BSc(Hons)(Earth Science)(UKM)
	Muhammad Fadzli bin Deraman	BSc(Hons)(Geology)(UM) BEng(Hons)(Civil)(UiTM)
Pegawai Geosains, C41 Geoscience Officer	Hamzah bin Zakaria (until 1.7.2014)	BSc(Hons)(Geology)(UKM)
	Norzuhairil bin. Zubir (from 1.3.2014)	BSc(Hons)(Geology)(UM)
	Muhamad Safid bin Saad	BAppSc(Hons)(Geophysics)(USM)
	Razaidi Shah bin A Kadir	BSc(Hons)(Geology)(UMS)
	Khairul Nazri bin Yaakub (from 3.3.2014)	BSc(Hons)(Geology)(UM)
	Muhammad Azfar bin Kamaruddin	BSc(Hons)(Geology)(UMS)

Kedah / Perlis / Pulau Pinang		
Pengarah, C54 Director	Zainol bin Hj. Husin	BSc(Hons)(Geology)(UKM)
Timbalan Pengarah, C48 Deputy Director	Hamdan bin Ariffin	BSc(Hons)(Applied Geology)(UM) MSc (Mineral Resources Engineering)(USM)
Timbalan Pengarah, C44 Deputy Director	Juna Azleen bin Abdul Ghani	BEng(Hons)(Mineral Resources Engineering) (USM) MSc (Mineral Resources Engineering)(USM)
	Badrol bin Muhammad	BSc(Hons)(Earth Science)(UKM)
Pegawai Geosains Kanan, C44 Senior Geoscience Officer	Fathullah bin Abu Naim	BSc(Hons)(Geology)(UM)
	Nur Susila binti Md Saaid	BSc(Hons)(Applied Geology)(UM)
	Zamila binti Abd Rahman	BSc(Hons)(Geology)(UKM)
	Ahmad Zamani bin Samat (until 02.03.2014)	BSc(Hons)(Applied Geology)(UM)
Pegawai Geosains, C41 Geoscience Officer	Wan Salmi bin Wan Harun (study leave)	BSc(Hons)(Applied Geology)(UM)
	Muhammad Mustadza bin Mazni	BSc(Hons)(Geology)(UMS)
	Fakhruddin Afif bin Fauzi	BSc(Hons)(Geology & Geophysics) (University of Adelaide)
	Anis Nasuha binti Mustapha @ Rosli (from 1.6.2014)	B.Sc(Hons) (Applied Science Geophysics)(USM)
Pegawai Geoscience, C41 Geoscience Officer	Azihan bin Mat Arshad	BEng(Hons)(Mineral Resources Engineering)(USM)

### Jawatan Kader di Agensi luar Cader Posts in other Agencies

Jabatan Kerja Raya Public Works Department		
Cawangan Kejuruteraan Cerun Slope Engineering Branch		
Ketua Pegawai Geosains Kanan, C52 Senior Principal Geoscience Officer	Mohd Anuar bin Mohd Yusof	BSc(Hons)(Geology)(UKM) MSc (Industrial Mineralogy)(Leicester)
	Abdul Rashid bin Bachik	BSc(Hons)(Geology)(UKM)
Ketua Pegawai Geosains , C48 Principal Geoscience Officer	Nicholas Jacob a/I T. Jacob	BSc(Hons)(Geology)(UKM), MSc (Environment)(UPM)
	Zaidi bin Daud	BSc(Hons)(Geology)(UM)
Cawangan Kejuruteraan Jalan & Geoteknik Road & Geotechnique Engineering Branch		
Pegawai Geosains Kanan, C44 Senior Geoscience Officer	Syed bin Omar	BSc(Hons)(Applied Geology)(UM) MSc (Eng. Geology)(Newcastle-Upon-Tyne)

Kementerian Tenaga, Teknologi Hijau & Air Ministry of Energy, Green Technology & Water		
Pasukan Projek Penyaluran Air Mentah Pahang-Selangor		
Pegawai Geosains Kanan, C44 Senior Geoscience Officer	Kamarulbahrin bin Hashim	BSc(Hons)(Applied Geology)(UM)
Jabatan Bekalan Air		
Pegawai Geosains, C41 Geoscience Officer	Mohamed Fadzli bin Rahman	BSc(Hons)(Geology)(UM)



