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ANNUAL MEMBER COUNTRY REPORT


GEO-RESOURCES SECTOR

1. MINERAL PROGRAMME

1.1 Summary

In the report period from July 2009 to June 2010, the Department of Geology and Minerals of Vietnam (DGMV) and other agencies conducted many activities related to the Mineral Programme of the Geo-Resources Sector including geological mapping, mineral investigation and solid mineral potential assessment as detailed below.

1.2 Annual Review of Individual Technical Activities

1.2.1 Regional Geological Survey

DGMV continued geological mapping and mineral investigation at the scale of 1:50,000 in Cao Bang, Quang Nam, Yen Bai, Tuyen Quang, Bac Giang, Ninh Binh, Gia Lai, Kon Tum and Tay Ninh provinces.

Some notable results of geological mapping and mineral resources investigations at the scale of 1:50,000 were as follows:

- Geological mapping and mineral investigation in the Lang Son map sheet was carried out over 2,440km². As a result, several important geological and mineral findings were made. Findings of geological significance include: the first discovery of ammonites from the early-middle Devonian period; identification of three episodes of Mesozoic eruptions; detection of pillow basalts in late Permian formations. Regarding minerals, sixty-nine deposits and mineral prospects were discovered and registered. These comprised 4 newly discovered deposits, 28 prospects and 16 mineral occurrences, including 13 kinds of minerals: brown coal, iron ore, copper, lead-zinc, bauxite, gold, barite, crystalline quartz, cement limestone, building stone, facing stone, brick clay and sand and gravel for construction. Of these, economically promising minerals are construction materials, bauxite, gold and barite. Based on this, eight prospective mineral areas have been delineated to propose for further investigation.

- Geological mapping and mineral investigation at scale of 1:50,000 in Krong Pa sheet was carried out within an area of 2,250km². Geologically, several significant discoveries have been made such as detection of Pelecypoda fossils in Sinemurian stage (early Jurassic); additional detection of diatomite-trepe, kaolin in volcanic tuffs and early Neogene sediments. Regarding minerals, 68 deposits and mineral prospects have been recorded and registered, of which new discoveries included 23 deposits, 19 prospects and 11 occurrences, including 15 kinds of minerals: brown coal, lead-zinc, tin, gold, fluorite, barite, feldspar, kaolin, diatomite-trepe, quartz, facing stone, construction stone, sand and gravel, brick clay. Twelve promising mineral areas have been delineated to propose for the further investigation.
- The on-going projects of geological - mineral mapping at the scale of 1:50,000 have also initially resulted in some significant geological and minerals findings such as detection of iron ore in Cao Bang, Quang Nam, gold in Cao Bang, Yen Bai, Quang Nam and kaolin in Tay Ninh.

- As regards geophysical survey DGMV has completed one project with a final report and has 5 on-going projects. The report "Detailed examination of aeromagnetic anomalies in Thuong Giap area, Tuyen Quang province" has been prepared and submitted to the archives. As a result, one magnetite iron ore body and five lead-zinc sulphide ore bodies have been discovered and some promising areas have been delineated to propose for further investigation.

1.2.2 Solid mineral potential assessment

a) Completed Projects

DGMV has completed and approved 7 reports on investigation and assessment of mineral potential, including: lead - zinc: 2 reports; copper: 1 report; tin and rare metals: 1 report; magnesite: 1 report; facing stone: 2 reports. As a result, most of the minerals subjected to investigation and assessment have reached or exceeded the resource targets.

Lead – Zinc Ore:

In Dien Bien, 22 lead - zinc ore bodies have been delineated and assessed. The ores are of hydrothermal origin at low - medium temperature. The Pb + Zn grade is from 4.97 to 28.70%, the average Pb grade is 3.97% and average Zn grade is 6.16%. The discovery and assessment of these lead - zinc ores are very meaningful and open up a perspective for investigation and discovery of this type of mineral in the Northwest region.

In Yen Bai, 6 ore bodies have been delineated and assessed. The ore bodies are of pocket and lode form extending in sub-longitudinal and northeast - southwest direction with total lengths of 300 to 1,000 m, thickness of 1.2 to 2.5 m. Pb + Zn grade is from 7.19 to 14.98%.

Tin and Rare Metal ores:

In Quang Ngai province, 40 lithium - tin bearing ore bodies and pegmatoid mineral bodies have been discovered. Amongst these, 20 ore bodies of industrial grade have been identified. The ore bodies are often 300 to 500 m in length from and 0.7 to 3.0 m in thickness. The average Sn grade is from 0.1 to 1.4% and of Li₂O is from 0.18 to 0.67%.

Facing Stone:

In Nghe An province, 11 bodies of granite bedrock and 11 areas of boulders of industrial value have been delineated. The bedrock bodies have the length varying from 400 to 1,240 m, and width 100 - 440m. Most of the boulders have sizes ≥ 3 m³. This is the largest granite facing stone deposit investigated in the North Central region so far.

b) Ongoing Projects

As the initial result of the project "Investigation and assessment of titanium - zircon placer potential in the red sand formation in Binh Thuan and North Ba Ria - Vung Tau", 540 km² of red sand containing titanium and zircon have been delineated in North Phan Thiet area. The ore bodies have thickness from 8 to 166.5 m, with average from 49 to 88.5 m. The grade of heavy minerals in the ore bodies varies from 0.51% to 2.0%, with an average of 0.69%. The titanium - zircon ore concentrate resource in North Phan Thiet area alone is preliminarily prognosticated to reach over 300 million tons. The project is still ongoing.
1.3 Proposed Future Activities
- Continue investigation and assessment of titanium - zircon placer potential in the red sand formation in Binh Thuan and North Ba Ria - Vung Tau.
- Investigation and assessment of coal resources in the Red River Delta.
- Exploration of uranium deposits in accordance with energy program serving socioeconomic development.
- Overall investigation and assessment of bauxite resources in Southern Vietnam.

1.4 Assistance Required from CCOP/Other Member Countries in Support of Future Activities
- Strengthen the capacity in overall assessment of Vietnam’s mineral potential by advanced technology.
- Strengthen the capacity in geological mapping, mineral investigation at the scale of 1:50,000 based on digital technology.
- Upgrading the geological labs of the DGMV.

1.5 Assistance Offered to CCOP/Other Member Countries in Support of Future Activities
- Sharing experiences in geological and mineral mapping at the scale of 1:200,000 and 1:50,000.
- Sharing experiences on the investigation and assessment of solid mineral reserves.

1.6 Other Comments
- The Project "Support for a Mines Inspectorate" funded by the German Government has been successfully completed.
- The new draft Mineral Law has been submitted to the National Assembly for passing.

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2. ENERGY PROGRAMME

2.1 Summary
In the year of 2009, Vietnam produced total 24.31 million tons of oil equivalent, including 16.30 million tons of crude oil and 8.01 billion m$^3$ of gas.

From 1 January 2010 to 30 June 2010, 7.26 million tons of crude oil and 4.77 billion m$^3$ of gas were produced.

As for coal, in 2009 Vietnam produced 43.024 million tons of clean coal; from 1 January to June 2010 produced 22.782 million tons of clean coal.

2.2 Annual Review of Individual Technical Activities
2.2.1 Oil and Gas Exploration and Production Activities
2.2.1.1 Oil and gas Exploration Activities
A total of 22 Petroleum Contracts were signed during the reviewed period.
So far, 84 Petroleum Contracts have been signed in kinds of JV, PSC, BCC and JOC,
of which 59 are currently in operation.

During the reviewed period: a total of 46,332 km lines of 2D and 4,736 km² of 3D seismic were acquired; 62 exploration and appraisal wells were drilled; Ten new oil and gas discoveries have been identified; the total hydrocarbon reserves of Vietnam increased to 62 million tons of oil equivalent.

2.2.1.2 Oil and Gas Production Activities

In 2009, Viet Nam produced total 24.31 million tons of oil equivalent, including 16.30 million tons of crude oil and 8.01 billion cubic meters of gas taken from 16 oil and gas fields including Bach Ho- Rong, Ruby, Rang Dong, Lan Tay- Lan Do, Su Tu Den, PM3- Cai Nuoc, Dai Hung, Ca Ngu Vang and Su Tu Vang.

From 1 January 2010 to 30 June 2010, 8.65 million tons of crude oil and 4.00 billion cubic meters of gas were produced.

2.2.1.3 Scientific Research Activities

Projects supported by Norwegian Government: PetroVietnam is continuing to implement the Phase III of Development of Management Systems on Health, Safety and Environment in the Vietnamese Petroleum Industry Project.

Projects supported by Danish Government: Viet Nam Petroleum Institute (VPI) and Department of Geophysics Geological Survey of Denmark and Greenland (GEUS) are planning to implement the ENRECA-Phase III Project.


2.2.2 Downstream activities

Viet Nam's first refinery has been operating commercially since February 2009 at Dzung Quat, in Quang Ngai province. The Nghi Son refinery and petrochemical complex in Thanh Hoa province and Long Son refinery in the South are preparing for construction. The Nam Con Son Gas pipeline system, the Cuu Long Basin Gas pipeline system, the Phu My- Nhon Trach gas pipeline and PM3-Ca Mau Gas pipeline system are operating smoothly. A gas pipeline is planned to be built from Block B to O Mon and Ca Mau, and this will be the core pipeline that can be used to link the East West network and the trans-South-East Asia pipeline.

2.2.3 Coal Activities/Operations

In the year of 2009, 44,332 million tons of run-of-mine coal was produced, of which clean coal comprised 43,024 million tons; 166,165 m of coal exploration boreholes was drilled; survey was carried out over 22,108 ha.

From 1 January 2010 to 30 June 2010, 24,897 million tons of run-of-mine coal was produced, of which 22.90 million tons was clean coal; 79,727 m of exploration boreholes were drilled, of which 600m were drilled underground; survey was carried out over 5,000 ha.

2.3 Proposed Future Activities

Continue to participate in the EPPM Project.

2.4 Assistance Required from CCOP in Support of Future Activities

Request for further Gas Hydrate and Oil and Gas E&P in deepwater areas workshops in Vietnam in 2011.
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3. GROUNDWATER PROGRAMME

3.1 Summary

From July 2009 to June 2010, the Centre for Water Resources Planning and Investigation (CWRPI) conducted projects on: groundwater investigation and assessment in many provinces of Vietnam; groundwater monitoring; hydrogeological and engineering geological mapping as detailed below.

3.2 Annual Review of Individual Technical Activities

a) Completed projects:
- As the result of the project “Groundwater investigation in Western area of Nghe An province”, groundwater resources were found and could be exploited in order to provide fresh water to local people.
- Hydrogeological mapping at the scale of 1:50,000 in Ninh Thuan and Binh Thuan provinces: Wells were drilled in mid 2009. Groundwater monitoring is being conducted in water-yielding wells and these wells will be used as production wells.
- Groundwater assessment in Duc Hoa area, Long An province and Vi Thanh – Long My area, Hau Giang province.

In the completed projects, boundaries, distribution areas, fresh water / saline water interfaces of aquifers have been determined, serving as the basis for further investigation or groundwater exploitation.

b) Ongoing projects:
- Investigation and assessment of groundwater resources was ongoing in Neogene sediments of the Hanoi area; in Meo Vac township area, Ha Giang province; in Western area of Nghe An province; in coastal and island areas; in the areas of special water-shortage of Ninh Thuan and Binh Thuan provinces; in Southern remote areas; in the Mekong river Delta; in Quang Ngai province; in Long An province.
- Hydrogeological mapping at the scale of 1:50,000 was continuing on in Ninh Thuan, Binh Thuan provinces and in Hau Giang province.
- Upgrading the national groundwater monitoring network in Northern Delta was also ongoing.

c) Groundwater monitoring:

Groundwater monitoring was going on in the Red river delta, Mekong river delta and Central Highlands: The average water level, and chemical composition of the groundwater in aquifers were determined:

Red River Delta:
- Water level: The average water level of Holocene (qh) aquifer declined in the last 6 months of 2009 relative to the first 6 months. In intensive groundwater extraction areas, the water level tended to decline most significantly.
- Water chemical composition: The samples collected were not contaminated with Cr, Se, Hg, NH4+ but 14 of 28 samples had Mn contents and 5 of 28 samples had As contents exceeding the standard limit.

Mekong River Delta:
- Water level: In 2009, the average water level in the upper Pleistocene aquifer (qp3) and lower Pleistocene aquifer (qp1) tended to rise, however, in particular, the water level in Middle-Upper Pleistocene (qp2-3) and Middle Pliocene aquifer (n2) tended to decline. In intensive groundwater extraction areas, the water level tended to decline.

- Water chemical composition: The As, Cr, Cu, Pb, Hg, Ni, NH4+ contents in samples are within the permissible limit; most of samples are contaminated with Mn.

  Central Highlands:

- Water level: tended to rise in the last months of the year relative to the first months, but varied little relative to the long term average (0.9m). However, in some areas such as Kon Tum town, the water level declined continuously in 2009 reaching a minimum of -10.67m in July 2009.

- Water chemical composition: TDS, As, Pb, NH4+, Phenol, CN contents in samples were within the standard limit, only one sample contained Hg in the dry season and 2 samples contained Mn in the rainy season exceeding the standard limit.

3.3 Proposed Future Activities

- Continue investigation and assessment of groundwater in: Neogene sediments in the Hanoi area; in Meo Vac town area, Ha Giang province; in Ninh Thuan, Binh Thuan, Quang Ngai; Long An province; Hau Giang province.

- Continue upgrading of national groundwater monitoring network in the Red river Delta.

- Continue national groundwater monitoring.

- Together with other CCOP member countries participate in the formulation and implementation of the CCOP Deep groundwater exploration and development project funded by the Norwegian Government.

3.4 Assistance Required from CCOP in Support of Future Activities

  Technical assistance for groundwater monitoring and pollution assessment.

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

  Sharing experiences on hydrogeological mapping, groundwater resources assessment and groundwater monitoring.

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GEO-ENVIRONMENT SECTOR

4. COASTAL ZONE, GEOHAZARDS AND ENVIRONMENTAL GEOLOGY PROGRAMMES

4.1 Summary

In the period from July 2009 to June 2010, many activities related with the coastal zone, geohazards and environmental geology programmes were carried out by units of DGMV, Vietnamese Academy of Science and Technology (VAST) and Vietnam Administration for Sea and Islands (VASI) as described below.

4.2 Annual Review of Individual Technical Activities

4.2.1 Activities carried out by DGMV

In the past year, DGMV conducted some geohazard and environmental geology investigations. The results include identification of contaminated areas due to mining in Nghe An and Ha Tinh provinces, delineation of areas containing toxic minerals in Quang Nam province, and monitoring of radioactive environments in some mines.

4.2.2 Activities carried out by VAST

a) Coastal Programme

VAST participated in the implementation of following projects:

- Natural resources and environment in the coastal zone of ASEAN countries, which was completed in June 2009. A monograph on natural resources and environment in the coastal zones of ASEAN countries including Vietnam has been published.

- Determination of the outer limits of the continental shelf of Vietnam. The report was submitted to the UN Commission on the Limits of the Continental Shelf (CLCS) in May 2009.

- IOC-WESTPAC (Intergovernmental Oceanographic Sub-Commission for West Pacific) project on East Sea sediments supply: organized a joint field survey in the Red river delta, Mekong delta, and South Central coastal area, with participation of experts from China, Japan, Korea, France, Germany in May 2009.

- Joint integrated marine resources survey expedition in May, June 2010 with the institutes of the Far East Centre of the Russian Academy of Sciences along the coastline and around islands of Vietnam, and hosted a Vietnamese - Russian review workshop of the expedition.

b) Geohazard Programme

- The project for construction of a modern network of seismic stations for forecasting earthquakes and tsunamis in Vietnam has been approved. Thirty seismic stations are to be built and equipped to be connected with stations in the region and worldwide, ensuring prompt and exact notification of earthquakes occurring in Vietnam and neighbouring countries with magnitude 3.5 or more on the Richter scale and the risk of tsunamis from the East Sea.

- The State level research project on evaluation of seismic and tsunami risks in coastal and island areas of Vietnam has been completed with publication of an earthquake and tsunami source map of the East Sea and a detailed seismic and tsunami risk map of the coastal area of Vietnam. The results of the project serve as the basis for forecasting and controlling earthquakes and tsunamis in Vietnam.
- The construction and installation of 2 modern seismic stations has been completed in Son La and Da Lat, belonging to the Information Connection and Early Warning Program for natural hazards in SE Asia and Indian Ocean. This program was funded by the UN, connecting 70 modern seismic and tsunami monitoring stations in the region.

c) Environmental Geology Programme

In the basic investigation project on positional resources, ecological and geologic conditions of the coastal areas of Vietnam (2008-2010), several field investigation trips were carried out in the coastal and island areas, many new and valuable data were collected and processed, the tourist potential and ecological landscape were evaluated and data were supplemented for the Cat Ba biosphere conservation area and other national marine conservation areas.

4.2.3 Activities carried out by the Geology and Mineral Resources Centre, Vietnam Administration for Sea and Islands

- The project “Investigation and assessment of mineral resources potential in the coastal offshore area of Soc Trang province at 1/100,000 scale” was ongoing. The main components include: geological survey, geophysical survey and exploratory drilling in the tidal flat and estuarine areas.

The results include: determination of the age and genesis of Quaternary sediments; tectonic structures, faults; mineral prospects; environmental geological conditions of the study area. As regards ages, 6 main stratigraphic units have been differentiated with the ages: \( Q^1_1, Q^1_2, Q^1_3a, Q^1_3b, Q^2_{1-2} \) and \( Q^2_3 \). As regards geneses, the following geneses of Quaternary sediments have been differentiated: alluvial (\( a \)), alluvial-marine (\( am \)), marine (\( m \)), marine-alluvial (\( ma \)), marine - boggy (\( mb \)) and marine-alluvial-boggy (\( mab \)). As regards minerals, the coastal offshore area of Soc Trang province is not prospective for placer minerals but is of high potential for construction materials.

- The project "Investigation of geological, geodynamic characteristics, mineral resources, geoenvironment and prediction of geohazards in offshore areas of Vietnam” has been completed.

The field survey in the Project component 1: “Investigation of geological, geodynamic characteristics, mineral resources, geoenvironment and prediction of geohazards in the area of 30 to 100m water depth of Vietnam at 1/500,000 scale” has been completed. Stratigraphic units, geomorphologic units, depositional fields; construction material and placer mineral prospective areas have been delineated; recommendations have been proposed for rational use of coastal zones for sustainable marine economic development.

The report of Project component 3: “Investigation of geological, geodynamic characteristics, mineral resources, geoenvironment and prediction of geohazards in the area of 30 to 100m water depth of Hai Phong – Quang Ninh at 1/100,000 scale and the key area of Bach Long Vi island at 1/50,000 scale” has been submitted to the Archives. The results include: clarification of geological, geo-environmental characteristics, geohazards, geophysical fields in the study area; evaluation of geochemical characteristics; zoning of mineral potentials, vulnerability of the natural and social conditions in the study area. These results will serve as the basis for proposing planning solutions for sustainable development of the Hai Phong – Quang Ninh and Bach Long Vi areas.

The report of Project component 4: “Investigation of geological, geodynamic characteristics, mineral resources, geoenvironment and prediction of geohazards in the area of 30 to 100m water depth of Phu Quoc – Ha Tien at 1/100,000 scale has been submitted to the Archive”.

4.3 Proposed Future Activities
- Compilation of radioactivity background map of Vietnam at 1: 1,000,000 scale.
- Studying the history of climate change and sea level rise in late Pleistocene – Holocene period and long-term prediction of their future impacts in Vietnam.

4.4 Assistance Required from CCOP in Support of Future Activities
- Investigation of geohazards in Vietnam.
- Application of new technologies for investigation of marine resources and environment.

4.5 Assistance Offered to CCOP/Other Member Countries in Support of Future Activities
- Assist Cambodia in investigations on geology, mineral resources, environmental geology and geohazards in coastal and shallow offshore areas.
- Assist Cambodia in investigations on geology, mineral resources, environmental geology and geohazards in Tonle Sap area.

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GEO-INFORMATION SECTOR

5. GEO-DATA AND INFORMATION MANAGEMENT PROGRAMME

5.1 Summary
In the period from July 2009 to June 2010, DGMV and VAST carried out many activities related with the application of IT in the management of geological data and information, in the State administrative reform, in publishing documents on geology and mineral resources, training and international cooperation in the field of geo-information. Details are given below.

5.2 Annual Review of Technical Programmes/Activities
a) Activities carried out by DGMV
- In the period July 2009 to June 2010, in the project "Computerization of geological reports in the Geological Archive", DGMV computerized 64 geological reports, bringing the number of computerized geological reports up to 1,269. (The reports submitted to the Geological Archives from 2003 to date have been computerized according to a unified technical procedure).
- Geoscience bibliography: 600 new bibliographic items were converted to the SANGIS format developed by CCOP and CIFEG and so far almost 25,500 items have been converted.
- The geology and minerals component of the project “E-library of natural resources and environment” was completed in December 2009.
- The project "Establishment of a national database for geology and mineral resources" as a component in the project "Establishment of a national database for natural resources and environment" of the Ministry of Natural Resources and Environment has been formulated.
- Phase 1 of the project “Editing for publication of the 1/1,000,000 scale Geological and Mineral Resources map of Vietnam for integration with the International OneGeology program” (2010 - 2011) was implemented.
- Phase 1 (2010) of the project “Compilation of the Geological and mineral investigation status map" (2010-2011).was implemented.
- Training in geo-information for geological staff of DGMV.
- Publication of the Journal of Geology series A (in Vietnamese) and series B (in English).
- Publication of the 2009 Annual Report of DGMV.

b) Activities carried out by VAST
- At the beginning of 2010, the Science and Technology Publishing House of VAST published the Atlas of Natural Resources and Environment of sea areas of Vietnam consisting of over 60 maps showing physical, geological, geophysical, meteorological, environmental, ecological characteristics of the sea areas of Vietnam.
- In 2010, Science and Technology Publishing House of VAST also supplemented and re-published the monograph "The East Sea" consisting of 4 volumes as a result of the marine research programs led by VAST from 1976 to date. With over 2,000 pages, the Monograph consists of 4 volumes:
  - East Sea I – Overview of natural conditions.

5.3 Proposed Future Activities
- Implement the 4th year of the project "Computerization of geological reports in the Geological Archive" (5 years)
- Complete the project “Editing for publication of the 1/1,000,000 scale Geological and Mineral Resources map of Vietnam for integration with the International OneGeology program”
- Complete the project “Compilation of the Geological and mineral investigation status map" (2010-2011).
- Implement phase 1 of project "Establishment of a national database for geology and mineral resources as a component in the project "Establishment of a national database for natural resources and environment", to be implemented in 2010-2015.
- Participate in the implementation of the project “Development of the Natural Resources and Environment Information Network" led by the Department of Information Technology.
- Participate in the implementation of the project “Construction of the electronic information portal of the Ministry of Natural Resources and Environment ” led by the Department of Information Technology.
- Intensify the training and technology transfer to subordinate units of DGMV.

5.4 Assistance Required from CCOP in Support of Future Activities
CCOP is requested to continue exchanging information, IT and software, to provide technical assistance in compilation and publication of geological and mineral resources maps at 1/ 1,000.000 to conform with the International OneGeology programme.
5.5 Assistance Offered to CCOP in Support of Future Activities

Sharing experience in processing and synthesizing data to serve geological investigation and mineral assessment projects.

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