



CCOP ANNUAL REPORT 2016



*CCOP Technical Secretariat
Bangkok*

CONTENTS

- Message from the Chairman
 - CCOP: Vision, Mission and Strategy
 - Management and Organization
 - Highlights for the Year 2016
 - Technical Programmes and Activities
 - Outreach
 - Cooperation and Partnership
 - Knowledge Enhancement and Sharing
 - Data and Information
 - Publications
 - Financial Highlights
 - List of Contacts
 - Abbreviations
-



Picture on cover page:
Logo of CCOP's 50th year anniversary celebration

CCOP Technical Secretariat
CCOP Building, 75/10 Rama VI Road
Phayathai, Ratchathewi
Bangkok, 10400, THAILAND
Tel. +66 (0) 2644 5468 ; Fax. +66 (0) 2644 5429
E-mail: ccopts@ccop.or.th
Website: <http://www.ccop.asia>

February, 2017

MESSAGE FROM THE CHAIRMAN



First and foremost, on behalf of the CCOP Member Countries, I would like to offer heartfelt condolences to the people of Thailand on the passing of His Majesty, King Bhumibol Adulyadej. Despite of the national tragedy in Thailand, the CCOP 50th anniversary, CCOP 52nd Annual Session and the 67th Steering Committee Meeting were successfully held in the city of Thailand, the heart of Bangkok. So, I would like to extend my sincere gratitude and congratulations to the government of Thailand and the CCOPTS for their utmost efforts and hospitality during this difficult period.

For refreshing the 50th anniversary of CCOP, the Special Discussion on Geoscience for the Society with the invited panelist and exhibitions from various member countries successfully took place during the event. Thanks to all organizers, I have no doubt that these unique activities made CCOP Golden Anniversary more fruitful and friendly both to the experts and to the general public.

CCOP was founded in 1966 with only four founding member countries; People's Republic of China, Japan, Republic of Korea and The Philippines. Five decades later, CCOP has now grown into one of the most prestigious international organizations of geoscience with fourteen member countries, fourteen cooperating countries, numerous cooperating organizations and advisory group from all around the globe. In this regard, my gratitude goes to all CCOP family members for their unwavering dedication in leaving immense impact on the field of Geoscience as well as CCOP's development.

Towards the next fifty years of history, CCOP is greatly looking forward to expanding both the scope of research cooperation and the range of membership. As we are facing with international geoscience challenges like global climate change which directly and indirectly affects the living standards, CCOP is required to set up the long term goal to minimize the negative impacts of it. Also, to make the progress of the Geopark which has influence over the national economy, frequent exchange of information and knowledge is required as it is beneficial to all of us. To do these, CCOP family has to make an ambitious contribution to the united global response. In this regards, the Pacific Community (SPC) who joined as the new cooperating organization, and Mongolia who attended the recent event as an Observer will surely allow us to strengthening our voice over the geoscience issues in the future.

Based on what we have achieved together, we will continue to courageously step up to the plate and will work together for the future. Without a doubt, your contribution will enable CCOP to maintain its broad reach, find innovative solutions, leverage strategic partnership and continue making a significant impact for the field of Geoscience. Therefore, I would like to ask CCOP family members for your continued support and interest. In celebration of the New Year, we hope that 2017 is nothing short of extraordinary for you and your loved ones. I am looking forward to seeing you at the 53rd CCOP Annual Session and 69th CCOP Steering Committee meeting in Cebu, Philippines in 2017.

Thank you very much.

Dr. Joong-Ho Synn
Chairman
CCOP Steering Committee

CCOP: VISION, MISSION AND STRATEGY

Vision: A premier intergovernmental Earth science organization in East and Southeast Asia.



Mission: To contribute significantly to the economic development and sustainable management of the environment and improvement of the quality of life of its Member Countries by the application of Earth science knowledge.

STRATEGIC FOCUS:

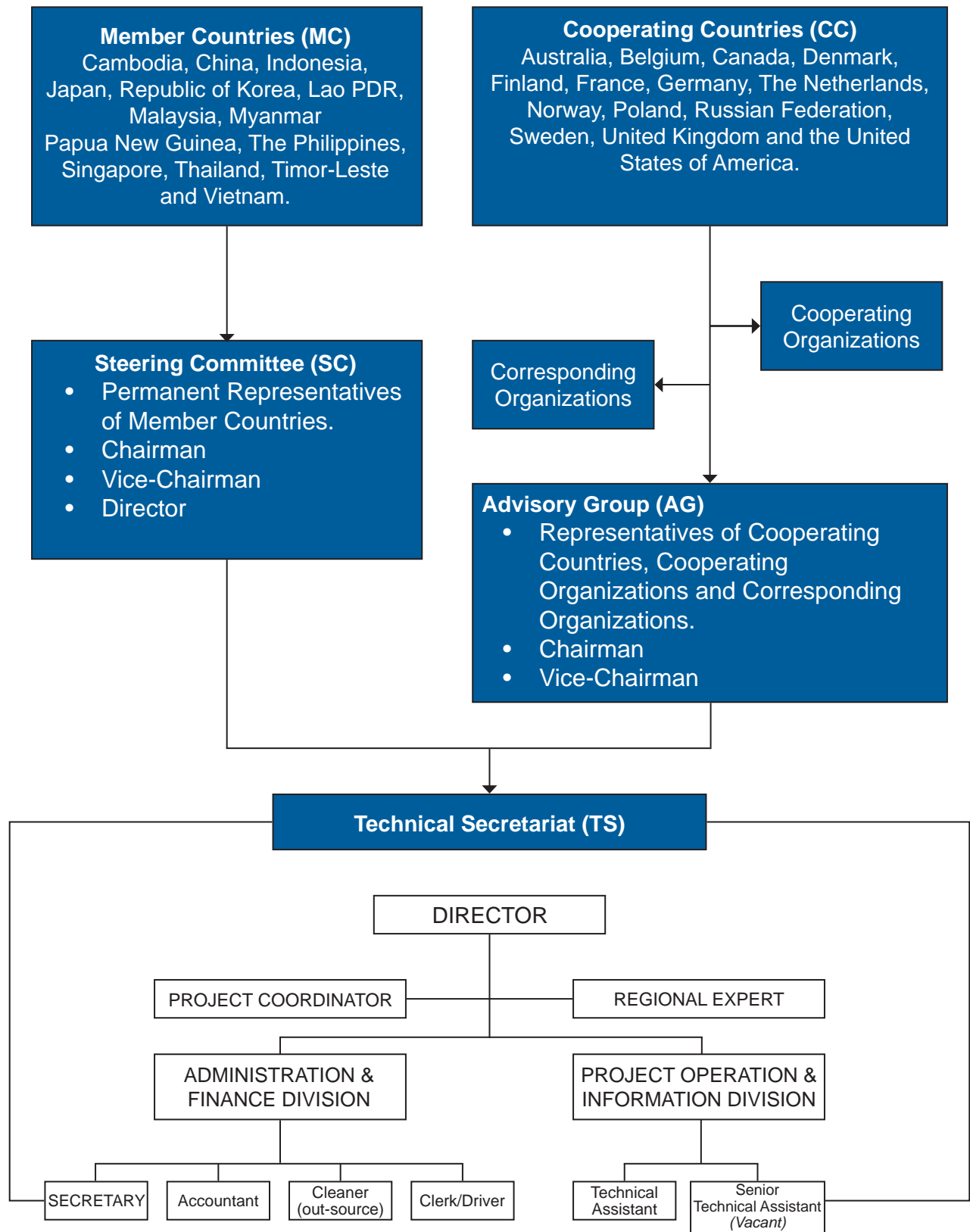
- **Outreach** – to enhance influence with decision makers, investors and the public through the provision of relevant Earth science information and to develop appropriate skills for communicating effectively with CCOP stakeholders.
- **Cooperation and Partnership** – to enhance the internal and external partnerships to improve the quality, reach application and impact of our Earth science information and knowledge.
- **Knowledge Enhancement and Sharing** – to manage, promote, share and exploit the region’s Earth science information and skills.
- **Data and Information** – to advance sharing of data and information and integrate Earth science data across national boundaries.

Member Countries: Cambodia, China, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Myanmar, Papua New Guinea, Philippines, Singapore, Thailand, Timor-Leste and Vietnam.

Cooperating Countries: Australia, Belgium, Canada, Denmark, Finland, France, Germany, The Netherlands, Norway, Poland, Russian Federation, Sweden, United Kingdom and United States of America.

Cooperating Organizations: ASCOPE, CIFEG, CPC, EuroGeoSurveys, GETECH, IOC, IOMAC, IUGS, PETRAD, SPC, UN-ESCAP, UNEP, UNESCO, UKM and THE WORLD BANK.

MANAGEMENT AND ORGANIZATION



As of 31 December 2016, the CCOPTS has 10 personnel, comprising four professionals, five supporting staffs and one outsourced staff.

In 2016, **Dr. Kyu Han Kim**, Permanent Representative of Republic of Korea to CCOP and **Mr. Mior Sallehuddin Mior Jadid**, Permanent Representative of Malaysia to CCOP, were respectively elected to serve as Chairman and Vice-Chairman of the CCOP Steering Committee (SC), for the 2016-2017 term. Nonetheless, **Dr. Joong-Ho Synn** succeeded **Dr. Kyu Han Kim** as the Permanent Representative of Republic of Korea to CCOP beginning 22 September 2016, and continues as the CCOP SC Chairman for the elected term, which ends on 31 December 2017. **Ms. Franca Schwarz**, Honorary Adviser to CCOP, continued her services as Chairperson of the CCOP Advisory Group, with **Mr. Ioannis Abatzis**, Representative of Denmark to CCOP and Senior Geophysical Adviser, Department of Geophysics, Geological Survey of Denmark and Greenland (GEUS), as Vice-Chairperson.

The 66th Steering Committee Meeting in Siem Reap, Cambodia, March 2016, approved the appointment of **Dr. Kamaludin Bin Hassan** from Malaysia as the CCOP Headquarter-based Regional Expert for the period 16 August 2016 to 15 August 2018, to replace **Dr. Nguyen Thi Minh Ngoc**.



The CCOPTS at the 52nd CCOP Annual Session in celebration of CCOP's Golden Jubilee, November 2016, together with **Mr. Mior Sallehuddin Mior Jadid**, acting Chairman of the 67th CCOP Steering Committee Meeting. Third from the right is **Dr. Kamaludin Bin Hassan**, the new CCOP Regional Expert.

Also in 2016, saw changes in the Permanent Representative (PR) of Member Countries to CCOP, **Dr. Joong-Ho Synn**, President, Korea Institute of Geoscience and Mineral Resources (KIGAM), Republic of Korea, succeeded **Dr. Kyu Han Kim** starting 22 September 2016. In the Cooperating Countries Representatives, **Dr. Arne Hoffmann-Rothe**, Head of Unit International Cooperation - Asia and Oceania, Federal Institute for Geosciences and Natural Resources, Germany (BGR) replaced **Ms. Franca Schwarz**, as the new Representative of Germany to CCOP, beginning 20 October 2016. In the 67th Steering Committee Meeting, **Ms. Franca Schwarz** is appointed the Honorary Adviser to CCOP.

The 66th Steering Committee Meeting

The 66th CCOP Steering Committee (SC) Meeting was held at the Sokha Angkor Resort, Siem Reap, Cambodia, on 9-11 March 2016. The Meeting was attended by delegates of the following Member Countries (MC): Cambodia, China, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, Timor-Leste and Vietnam. Also present was **Dato' Yunus Abdul Razak**, member of the Advisory Group (AG) and the Director and staff of the CCOPTS.

Welcoming remarks were made by **H.E. Ly Samreth**, Deputy Governor of Siem Reap Province and **H.E. Cheap Sour**, Permanent Representative of Cambodia to CCOP and Director-General, General Department of Petroleum, Ministry of Mines and Energy.

Dr. Eikichi Tsukuda, CCOP SC Chairman for year 2014 to 2015, officially handed over the chairmanship to **Dr. Kyu Han Kim**, Permanent Representative of the Republic of Korea to CCOP and President of Korea Institute of Geoscience and Mineral Resources (KIGAM). **Dr. Kyu Han Kim** delivered his acceptance speech as SC Chairman from 1 January 2016 to 31 December 2017.

H.E. Sok Khavan, Secretary of State, Ministry of Mines and Energy, Cambodia officially opened the 66th CCOP Steering Committee Meeting.

Aside from the endorsed Revised Workplan 2016 the following decisions were made by the Meeting.

On the recruitment of the CCOP Headquarter-based Regional Expert for the period 16 August 2016 to 15 August 2018, the Meeting agreed that **Dr. Kamaludin Bin Hassan** will be appointed the position to replace **Dr. Nguyen Thi Minh Ngoc**.

The Meeting accepted the proposal of the CCOPTS for the Pacific Community (SPC) in the Pacific Islands and Territories Region as CCOP Cooperating Organization.

The Meeting accepted the proposals of Indonesia for **Dr. Sukhyar**, former Permanent Representative of Indonesia to CCOP, and of Malaysia for **Dato' Yunus Abdul Razak**, former Permanent Representative of Malaysia to CCOP, as CCOP Honorary Advisers.

The Meeting endorsed the proposed future collaboration between CCOP and BGR in Risk-Sensitive Spatial Planning, and tasked the CCOPTS to work closely with BGR and the Member Countries on the contents of the training course.

See more at <http://www.ccop.asia/article/the-66th-ccop-steering-committee-meeting-9-11-march-2016-siem-reap-cambodia>.



The 67th Steering Committee Meeting

Following the 52nd CCOP Annual Session is the 67th CCOP Steering Committee Meeting held 4-5 November 2016 at the same venue. The Meeting was attended by 48 delegates from the following Member Countries (MC): Cambodia, China, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Myanmar, Thailand, Philippines and Vietnam. Also present were **Ms. Franca Schwarz**, Chairperson of the CCOP Advisory Group, **Dr. Yoshihiko Shimazaki**, CCOP Honorary Adviser, and the Director and staff of the CCOPTS. Representative of the Pacific Community in the Pacific Islands and Territories (SPC) attended as an Observer.

Signing Ceremony – SPC as CCOP Cooperating Organization

Signing Ceremony signifying official acceptance of the Pacific Community in the Pacific Islands and Territories (SPC) as CCOP Cooperating Organization was held. Representing SPC was **Prof. Michael G Petterson**, Director, Geosciences Division, SPC Secretariat and for CCOP **Mr. Mior Sallehuddin Mior Jadid**. Witnesses were **Dr. Tawsaporn Nuchanong**, Permanent Representative of Thailand to CCOP and **Dr. Adichat Surinkum**, Director of CCOPTS.



Left to Right:
Dr. Tawsaporn Nuchanong,
Prof Michael G. Petterson,
Mr. Mior Sallehuddin Mior Jadid and
Dr. Adichat Surinkum.

The Meeting endorsed the CCOP Workplan 2017 presented by **Dr. Adichat Surinkum**, Director of CCOPTS as well as the two initiatives proposed by Japan and Thailand respectively:

1. Compilation and Publication of a Revised “Magnetic Anomaly Map of East Asia 1:4,000,000” on CD-ROM;
2. Hydraulic Fracturing Guideline: Technical, Legal, Financial, and Environmental Aspects

The Myanmar Delegation informed the Meeting that Myanmar is pleased to host the 68th CCOP Steering Committee Meeting on 7-9 March 2017 in Naypyitaw, Myanmar. The Philippine Delegation reported that the 53rd CCOP Annual Session and the 69th CCOP Steering Committee Meeting will be held on 15-19 October and 20-21 October 2017, respectively in Cebu City, Philippines. On the occasion of KIGAM’s 100th year anniversary in 2018, Republic of Korea is pleased to host the 54th CCOP Annual Session and the 71st CCOP Steering Committee Meeting on 28 October to 3 November 2018 in Busan, Republic of Korea.

In September 2016, **Dr. Joong-Ho Synn** succeeded **Dr. Kyu Han Kim** as Permanent Representative of the Republic of Korea to CCOP. In this regard, the Meeting agreed that **Dr. Joong-Ho Synn**, being the current Permanent Representative of Republic of Korea to CCOP, succeeds **Dr. Kyu Han Kim** as Chairman of the CCOP Steering Committee with the term ending 31 December 2017.

The Meeting accepted in principle the concept of “World Happiness 2016 Ranking” in standardizing the member country’s annual cash contribution.

As proposed by Thailand Delegation, the Meeting accepted **Ms. Franca Schwarz**, former Representative of Germany to CCOP, as Honorary Adviser of CCOP.

See more at <http://www.ccop.asia/article/67th-ccop-steering-committee-meeting>.

HIGHLIGHTS FOR THE YEAR 2016

CCOP'S 50th YEAR ANNIVERSARY CELEBRATION

CCOP Golden Jubilee Book

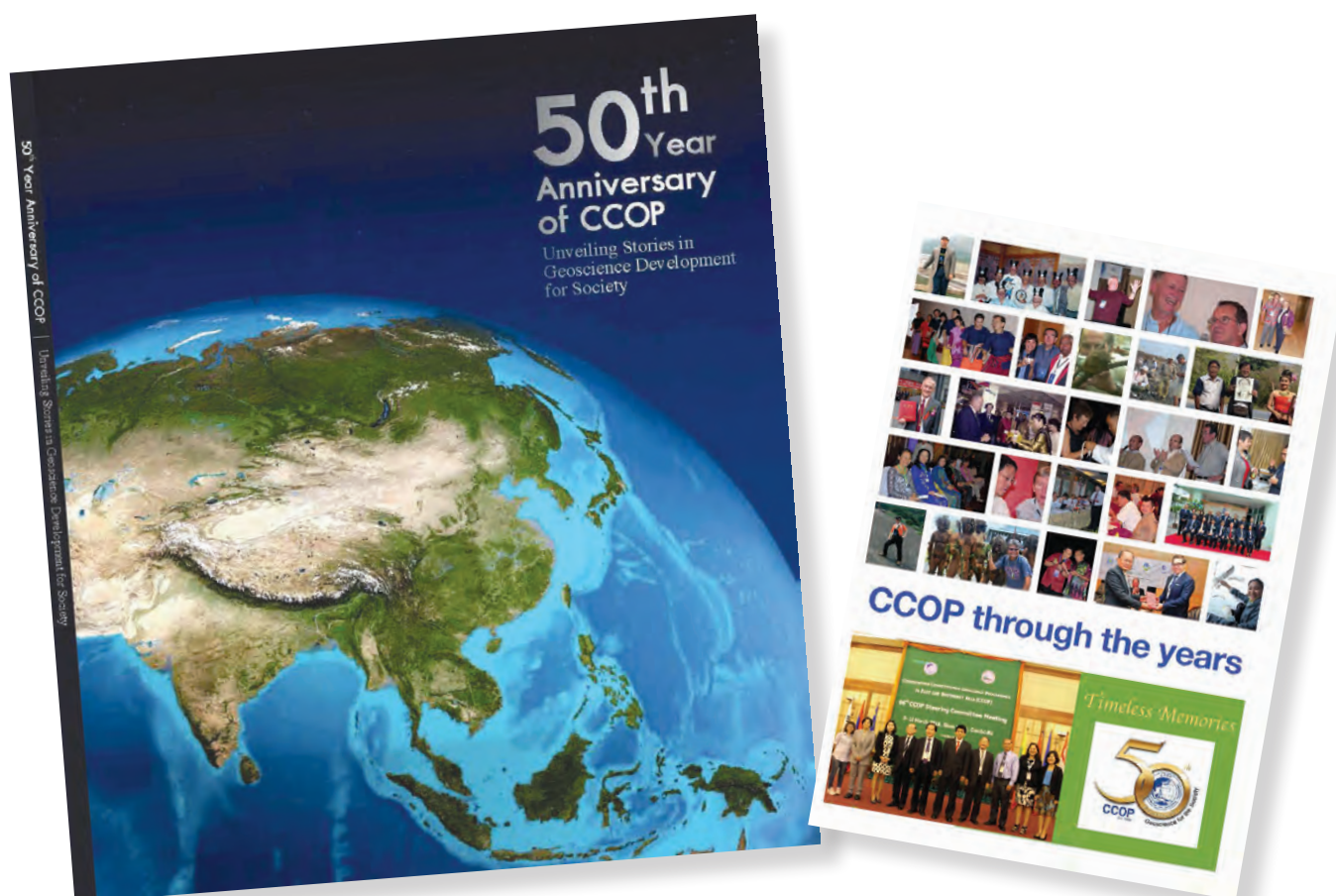
The 64th Steering Committee Meeting held on March 2015 in Krabi, Thailand decided the theme of the 50th year anniversary celebration of the founding of CCOP as “CCOP’s 50th: Geoscience for the Society”, and produce a jubilee book. This book is in form of a pictorial history of 50 years of CCOP (meetings, programmes, personalities, events from the CCOP archive, from Member Countries, Cooperating Countries and personal archives). There are 3 main parts: Part 1 describes the beginning and growing of CCOP during the first 20 years (written by **Dr. Anthony Reedman**); Part 2 summarized major changes of CCOP until 2004 (written by **Dr. Anthony Reedman**); and Part 3 highlighted challenges and solutions raised by CCOP member countries. All member countries have contributed one or more pages in the book. CCOPTS Regional Expert, **Dr. Nguyen Thi Minh Ngoc** was the coordinator for the book project. **Dr. Anthony Reedman** and **Dr. Dhiti Tulyatid** are key editors, in coordination with the CCOPTS. This Jubilee Book was distributed during the 52nd CCOP Annual Session, 30 October to 3 November 2016, in Bangkok, Thailand.

The printed book is hard-bound, and with 110 colored pages. The 11MB pdf file of the book can be downloaded from the link, <http://ccop.asia/pdf/publication/CCOP50thJubileeBook.pdf>.

CCOP Through The Years

CCOP Through the Years, a compendium of 50 years of memories of former and current CCOP SC Chairmen, Advisory Group Chairmen, CCOPTS Director, CCOPTS Experts, etc, can be downloaded from this link, <http://ccop.asia/pdf/publication/MemoriesBook2016.pdf>

This was distributed together with the Jubilee Book at the 52nd CCOP Annual Session.



THE 52nd CCOP ANNUAL SESSION

The 52nd Annual Session of the Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP) was held at the Berkeley Hotel Pratunam, Bangkok, Thailand on 31 October – 3 November 2016. It was organized by the Department of Mineral Resources, Ministry of Natural Resources and Environment, Thailand and co-organized by the Department of Groundwater Resources, Department of Marine and Coastal Resources, Department of Primary Industries and Mines, and Department of Mineral Fuels with the CCOPTS. The Session was attended by 332 delegates from the following Member Countries: Cambodia, China, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Myanmar, Philippines, Thailand and Vietnam. Mongolia attended as an observer. From the Cooperating Countries, Canada, Denmark, Finland, Germany, the Netherlands, Norway and United Kingdom were in attendance. From the Cooperating Organizations, EuroGeoSurveys (EGS) and Universiti Kebangsaan Malaysia (UKM) attended the session. Secretariat of the Pacific Community (SPC) Geoscience Division (formerly SOPAC) attended as an observer organization. Also present at the Meeting were the Honorary Advisers of CCOP and staffs of the CCOPTS.



Head of Member Countries' Delegations at the 52nd CCOP Annual Session

Opening Ceremony

The welcome addresses were delivered by **Police General Asawin Kwanmuang**, Governor of Bangkok and **Dr. Tawsaporn Nuchanong**, Permanent Representative of Thailand to CCOP, and Director-General, Department of Mineral Resources, Thailand. **Mr. Mior Sallehuddin Mior Jadid**, Acting Chairperson of the CCOP Steering Committee, Permanent Representative of Malaysia to CCOP and Director-General of Malaysia's Minerals and Geoscience Department delivered a special message. **H.E. General Surasak Karnjanarat**, Minister of Natural Resources and Environment, Thailand officially opened the 52nd CCOP Annual Session and the Exhibition with the theme "Geoscience for the Society". H.E. Ambassadors of Cambodia, Timor-Leste and Germany in Thailand, as well as Minister Counsellor of Indonesia Embassy in Thailand graced the Opening.



L-R: H.E. Ambassador of Timor-Leste; Minister Counsellor of Indonesia Embassy in Thailand; **Dr. Adichat Surinkum**, CCOPTS Director; **Ms Franca Schwarz**, Chairman CCOP Advisory Group; **Mr. Mior Sallehuddin Mior Jadid**; **H.E. General Surasak Karnjanarat**; Police General **Asawin Kwanmuang**; **Dr. Tawsaporn Nuchanong**; H.E. Ambassador of Cambodia ; and H.E. Ambassador of Germany in Thailand.



H.E. General **Surasak Karnjanarat** visiting booths at the 52nd CCOP Annual Session exhibition.

Special Discussion on Geoscience for the Society

In celebration of the 50th year anniversary of the founding of CCOP, a special discussion on how CCOP has contributed to the society, in particular to East and Southeast Asia region and what are the opportunities and challenges in the future, was convened. The Discussion was from the perspective of Cooperating Countries, Member Countries and Technical Secretariat. The panelists were **Dr. Michael Patterson**, Representative of the United Kingdom to CCOP, Chief Operating Officer of the British Geological Survey (BGS) and CCOP Honorary Advisers **Mr. Chen Shick Pei**, former CCOPTS Director and **Dato' Yunus Abdul Razak**, former Chairman of the Steering Committee. The discussion was moderated by **Dr. Dhiti Tulyatid**, Lecturer, Mahidol University, Thailand.



L-R: **Dr. Dhiti Tulyatid**, **Dato' Yunus Abdul Razak**, **Mr. Chen Shick Pei** and **Dr. Michael Patterson**.



52nd CCOP ANN
— 31 OCTOBER - 3 N
BANGKOK, T



กรมเชื้อเพลิงธรรมชาติ
กระทรวงพลังงาน



ANNUAL SESSION

NOVEMBER 2016 —
BANGKOK, THAILAND

Special Recognition of Honorary Advisers

CCOP Honorary Advisers, **Dr. Yoshihiko Shimazaki** (Japan), **Dr. Anthony Reedman** (United Kingdom) and **Dr. Oystein Berg** (Norway) were specially acknowledged for their long involvement and dedicated service to CCOP.



CCOP Advisory Group (Representatives of Cooperating Countries and Organizations, and Honorary Advisers) at the 52nd CCOP Annual Session.

Thematic Session – “Geoscience for the Society”

A thematic session with poster session on the topic “Geoscience for the Society” was held on 1st November 2016 at the same venue. The conference aims to address the current global issues of population growth and the increasing demand for geological resources and the increasing risks of natural disasters to society.

Keynote speech on “Sharing Resources: ASEAN Perspective” was delivered by **Ms. Phasporn Sangasubana**, Acting Director-General of the Department of ASEAN Affairs, Ministry of Foreign Affairs, Thailand. **Mr. Somsak Potisat**, CCOP Honorary Adviser, former Director General, DMR and former Chairman of the CCOP Steering Committee gave a keynote presentation on “The Role of Geoscience in Thai Society”.



Left: Ms. Phasporn Sangasubana; Right: Mr. Somsak Potisat

There were 3 sub-sessions in the thematic session; geo-resources, geo-environment and geo-education, and attended by 400 participants. Due to overwhelming response, three parallel sessions were conducted for the oral presentations. A total of 99 contributions were received, out of which 57 are selected for oral presentations and 42 in the poster session.

See more at <http://www.ccop.asia/article/52nd-ccop-annual-session>.





Delegates of the 52nd CCOP Annual Session at the Mangrove Forest Learning and Development Center 2 (Samut Sakhon Mangrove Forest Research Centre) during the field trip.



Delegates of the 67th CCOP Steering Committee Meeting

TECHNICAL PROGRAMMES AND ACTIVITIES

In 2016, a total of 31 training/workshop activities were carried out and attended by 984 participants from the CCOP Member Countries. With strategic focus on capacity building, knowledge sharing and technology transfer; the workshops, training courses, symposiums, working group meetings and expert visits were conducted during the reporting period and Member Countries participation were highly appreciated.

Summary of CCOP Member Countries' Participation in Technical Activities

SECTOR	NO. OF ACTIVITIES	NO. OF PARTICIPANTS
Geo-resources	17	497
Geo-environment	11	400
Geo-information	3	87
TOTAL	31	984

In August 2015, the Action Planning Meeting for the CCOP Strategic Plan 2016-2020 was held at the Asia Hotel, Bangkok, Thailand. The CCOP Action Plan 2016-2020 was presented at the 65th SC Meeting and endorsed with amendments. Following the CCOP Strategic Plan, the activities carried out by CCOP are herein reported in the new format under subheadings Outreach, Cooperation and Partnership, Knowledge Enhancement and Sharing, and Data and Information.



CCOP Strategic Action Plan Meeting 2016-2020 at the Asia Hotel, Bangkok, Thailand



The 65th SC Meeting, Xian, China



OUTREACH

In 2016, the outreach initiatives carried out include attending technical meetings, giving lectures, discussions and telephone conferences. The activities are reported here as in accordance to the 2016 CCOP Workplan.

The 3rd CCOP-Cheongsong-KIGAM-UNESCO Symposium on Developing Geoparks within East & Southeast Asia Region

As a collaboration between International School for Geoscience Resources (ISGeo) of Korea Institute of Geoscience and Mineral Resources (KIGAM), UNESCO, Cheongsong Governors and the CCOPTS, the 3rd CCOP-KIGAM/ISGeo Symposium on Developing Geoparks within East & Southeast Asia region in conjunction with ISGeo Regular Training Course on Aspiring Geoparks - Development and Preparation have been successfully co-organized during 19-28 May 2016 in Cheongsong, Republic of Korea. 70 participants attended the training course, including 18 participants from 10 CCOP member countries, together with international resource persons and local participants in Cheongsong. The training course and symposium were also attended by knowledgeable lecturers and resource persons from UNESCO France, UNESCO Bangkok, Brazil and National Geoparks Secretariat of Republic of Korea, provincial governor and geopark guiders from Cheongsong. This symposium was a good base for future cooperation among CCOP member countries and KIGAM/ISGeo. The network of geopark researchers and managers established is maintained and developed for further collaborative activities within the region.



Participants of the 3rd CCOP-Cheongsong-KIGAM-UNESCO Symposium on Developing Geoparks within East & Southeast Asia region.

Karst Conservation

Discussion on the cooperation in the fields of karst geology as well as hydrogeology and environmental geology between CCOP led by **Dr. Adichat Surinkum**, Director of CCOPTS with Chinese delegation led by **Prof. Zhang Fawang**, the Executive Deputy Director of the Institute of Karst Geology (IKG) under China Geological Survey, was made during the “Training Course on Capacity Building on Hydrogeology and Environmental Geological Survey and Sustainable Development of Great Mekong Subregion Countries”, held in Bangkok, 22-28 August 2016.

The Chinese delegations are represented by members from the IKG and Institute of Hydrogeology and Environmental Geology (IHEG) of the China Geological Survey.



Exchanging Minutes of Meeting between representatives of the Institute of Karst Geology (IKG) / Institute of Hydrogeology and Environmental Geology (IHEG), Chinese Academy of Geological Sciences, China Geological Survey, and Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP)

WEB-GIS

Geoinformation Sharing Infrastructure for East and Southeast Asia (GSI) Project

The Japanese-funded CCOP Geoinformation Sharing Infrastructure for East and Southeast Asia (GSI) Project scheduled for 2015 – 2019, aims to develop new geoinformation integration and sharing system using international standards and free and open-source software among CCOP countries. Scope of the project includes:

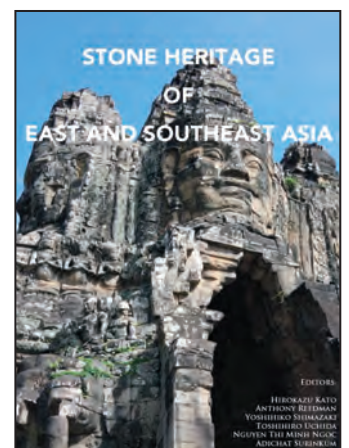
- Compile various geoscientific information in CCOP countries, and construct a database on an open Web, using the world standard formats and GIS,
- Each member country is responsible for updating the database and maintaining the data quality,
- Upload already-published geoscience data and maps with the GIS format,
- Establish a basic geoinformation infrastructure in Asia and for the world.

The first-version official database is targeted to be opened in 2019. During the reporting period, there have been 2 meetings held with attendance by CCOP member countries.

PUBLICATIONS

Stone Heritage of East and Southeast Asia

This book covers some of the representative examples of stone heritage in East and Southeast Asia (the CCOP region) regardless of their size, scale and age; miniature or gigantic; from ancient to modern. This book is of 246 pages, and available both in printed and digital forms. The 22MB PDF file of the book can be downloaded from http://www.ccop.or.th/download/pub/ccop_stone_book_low_res.pdf.



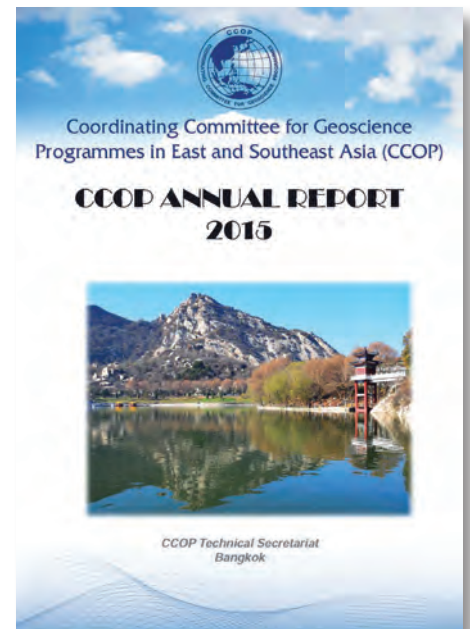
GW-6: Report of the CCOP-GSJ-NAWAPI Groundwater Phase III Project Meeting, 16-18 March 2016, Hanoi, Vietnam

This is the publication of the country reports presented at the CCOP-GSJ-NAWAPI Groundwater Phase III Meeting held on 16-18 March 2016, in Hanoi, Vietnam. Its pdf file is of about 4MB filesize, and can be downloaded from this link, <http://ccop.asia/pdf/publication/GW-6.pdf>.



CCOP Annual Report 2015

The CCOP Annual Report 2015 has been published in February 2016, and distributed at the 66th SC Meeting in Siem Reap, Cambodia, March 2016. It is available for download from the link: <http://www.ccop.or.th/download/CCOP-AR2015.pdf>.



CCOP Golden Jubilee Book

This book is in form of a pictorial history of 50 years of CCOP (meetings, programmes, personalities, events from the CCOP archive, from Member Countries, Cooperating Countries and personal archives). The 11MB pdf file of the book can be downloaded from the link, <http://ccop.asia/pdf/publication/CCOP50thJubileeBook.pdf>

Others

Paper on "CCOP at 50: Half a Century of Regional Geoscience Cooperation" got published in IUGS Journal - Episodes, Vol 39, Issue 3, September 2016, <http://www.episodes.org>.

COOPERATION AND PARTNERSHIP

In the year 2016, CCOP continued to collaborate with its MCs, CCs and COs to implement the planned activities and adopt activities in new areas of concern. Outreach activities have continuously been developed, thanks to generous support by funding agencies and in-kind contribution by member countries, to optimize the benefits of the partly sponsored programmes. The Table below summarizes the cooperation and activities of the Member Countries, Cooperating Countries and Cooperating Organizations.

Summary of CCOP Technical Activities with Member Countries, and Cooperating Countries & Organizations in 2016

COUNTRY/ ORGANIZATION	CCOP TECHNICAL ACTIVITIES
1) Member Countries	
Cambodia	<p>Cambodia hosted the following CCOP activities:</p> <ul style="list-style-type: none"> • CCOP–KIGAM Unconventional Oil and Gas Project: National Coordinators Meeting & Workshop 4 (UCM4), Siem Reap, 7-8 March; • CCOP-ASEAN Seamless Geology Project Meeting, Siem Reap, 8 March; • 66th CCOP Steering Committee Meeting, Siem Reap, 9-11 March; • CCOP-VIETADAPT-GDMR Workshop on Geoscience supporting risk management, water and food security, Siem Reap, 12 March; • CCS-M Training Course on Sequence Stratigraphy (T6), Phnom Penh, 25-29 April; and • CCOP-KIGAM-UNESCO-MME Workshop on Climate Change and Groundwater Resources in the Mekong River Basin, Sihanoukville, 1-2 June.
China	<p>China hosted the following activities:</p> <ul style="list-style-type: none"> • Energy China Forum 2016: 6th Asia-Pacific Shale Gas Summit, Asia-Pacific Unconventional Resources Technology & Equipment EXPO, 17-19 October 2016, Shanghai, China; and • China Geological Survey (CGS) sponsored the Workshop on Capacity Building on Marine Geoscience and Geohazards Reduction & Prevention for ASEAN Member States, 26-30 September 2016, Guangzhou, China, organized by Guangzhou Marine Geological Survey (GMGS) and Qingdao Institute of Marine Geology (QIMG).
Indonesia	<p>Geological Agency of Indonesia (GA) hosted and co-funded the GSi Project's First International Workshop held in Solo, 20-22 Sept 2016.</p> <p>Indonesia continues to provide own-cost resource persons to participate in CCOP technical activities.</p>
Japan	<p>GSJ continues to financially and technically support the following activities:</p> <ul style="list-style-type: none"> • CCOP-GSJ Groundwater Project and installation of GSHP systems in Thailand and Vietnam; • CCOP-ASEAN Harmonized Geology Project, including a series of Web-GIS training courses and meetings in CCOP member countries; • GSi Project; • High Education Support Network in CCOP region • CCOP Book Project on "Stone Heritage of East and South East Asia"; and • Publication of CCOP Golden Jubilee Book (CCOP 50th Anniversary Book).

COUNTRY/ ORGANIZATION	CCOP TECHNICAL ACTIVITIES
<p>Republic of Korea</p>	<p>KIGAM continues to financially and technically support the following projects:</p> <ul style="list-style-type: none"> • Unconventional Oil & Gas Project (UC): Mapping of Black Shale Formations for the Prediction of Shale Resources; • 2nd Asia-Pacific Business Forum: Korean CCUS Technology for Climate Change, 7-8 March 2016, Bangkok; and • Solution for Groundwater problems in CCOP region. <p>New project supported and initiated by KIGAM from 2016 is the Volcano Monitoring Project in the East & Southeast Asia region. Under this project, the Training Course on GPS Data Processing and Analysis with GAMIT/GLOBK/TRACK software was organized on 23-27 May 2016 in Daejeon.</p> <ul style="list-style-type: none"> • KIGAM and ISGeo continued to support and organize 5 training courses: <ul style="list-style-type: none"> i. Petroleum Exploration, Development and Production; ii. Exploration and Evaluation of Mineral Resources; iii. Aspiring Geoparks–Development and Preparation combined with the 3rd CCOP- UNESCO Symposium on Developing Geoparks within East & Southeast Asia region - Opportunities and Challenges; iv. Groundwater and Environmental Geochemistry; and v. Landslide and Slope Stability. <p>KIGAM continues to provide own-cost resource persons to participate in CCOP technical activities.</p>
<p>Lao PDR</p>	<p>Lao PDR hosted:</p> <ul style="list-style-type: none"> • CCOP-KIGAM Unconventional Oil & Gas Project (UCM5): National Coordinators Meeting and Workshop 5, 10-12 May 2016, Vientiane. • Lao PDR continues to provide resource persons to participate in CCOP technical activities.
<p>Malaysia</p>	<p>Malaysia continues to provide resource persons to participate in CCOP technical activities. PETRONAS of Malaysia provided experts at the CCS-M T6: Training Course on Sequence Stratigraphy, 25-29 April 2016, Phnom Penh.</p>
<p>Myanmar</p>	<p>Myanmar joined CCOP in 2015. Myanmar provides resource persons to participate in CCOP technical activities</p>
<p>Papua New Guinea</p>	<p>PNG cooperated with CCOP to publish the proceedings of thematic papers presented at the 50th CCOP Annual Session in Kokopo, PNG.</p>
<p>Philippines</p>	<p>Philippines continues to provide resource persons to participate in CCOP technical activities.</p>
<p>Singapore</p>	<p>Singapore continues to be updated with CCOP activities from CCOPTS.</p>

COUNTRY/ ORGANIZATION	CCOP TECHNICAL ACTIVITIES
Thailand	<p>Thailand hosted the following activities:</p> <ul style="list-style-type: none"> • 7th International Conference on Applied Geophysics-Geophysics towards Sustainable Development of Thailand and AEC (GEOPHYSICS 2016), 14-15 January 2016, Bangkok • Workshop on Promoting Earth Science and Climate Change towards Sustainable Development, 17- 19 February 2016, Kanchanaburi • The 2nd Asia-Pacific Business Forum: Korean CCUS Technology for Climate Change, 7-8 March 2016, Bangkok, Thailand. • AAPG Geosciences Technology Workshop 2016 “Characterization of Asian Hydrocarbon Reservoirs”, 31 March - 1 April 2016, Bangkok • The 5th International Conference on Earth Science and Climate Change, 25-27 July 2016, Bangkok. • The 23rd Electromagnetic Induction Workshop (EMIW2016), 14-20 August 2016, Chiang Mai • ASEAN-CCOP Harmonized Geology Project Meeting, 2 November 2016, Bangkok • CMU Workshop on Tectonics of Northwestern Indochina (TNI-2016), 14 - 15 November 2016, Chiang Mai, Thailand • 52nd CCOP Annual Session and 67th CCOP Steering Committee Meetings, 31 October - 5 November, Bangkok <p>DMR cooperated with CCOP to publish the proceedings of thematic papers presented at the 52nd CCOP Annual Session in Bangkok, Thailand. DMR continues to support for the Permanent Office Building for CCOPTS in DMR Complex, Bangkok, Thailand.</p>
Timor-Leste	<p>Timor-Leste provides resource persons to participate in CCOP technical activities.</p>
Vietnam	<p>Vietnam hosted the following activities:</p> <ul style="list-style-type: none"> • BGR - CCOP Workshop on “Integrated water resource management in coastal zones with a focus on groundwater – experiences in East and Southeast Asia countries”, 19-21 January 2016, Can Tho; • VIETADAPT (Vietnam) co-organized with CCOP, GTK (Finland) and GDMR (Cambodia) the Workshop on "Geoscience supporting risk management, water and food security", 12 March 2016, Siem Reap, Cambodia; • CCOP-GSJ-NAWAPI Groundwater Project Meeting, 16-18 March 2016, Hanoi; • HUNRE – KKU – UQAT – CCOP Workshop on “Sustainable Groundwater Development”, 5 – 7 July 2016, Hanoi, Vietnam; • CCS-M S6: Workshop on CO₂ Geological Storage and CO₂ for EOR Technologies, 7-9 June 2016, Hanoi; • CCOP-KIGAM Unconventional Oil and Gas Project: National Coordinators Meeting and Workshop 6 (UCM6), 16-18 August 2016, Danang; • 5th Int. Symposium & Exhibition-VACI2016 Vietnam Water Cooperation Initiative for Managing Transboundary Waters: from Policy to Practice, 2-4 October 2016, Hanoi; • Workshop on Capacity Building on Geophysical Technology in Mineral Exploration and Assessment on Land, Sea and Islands in Hanoi on 15-16 October 2016. • Workshop on Geoscience Supporting Risk Management, Water and Food Security, 30 October 2016, Bangkok, in conjunction with the 52nd CCOP Annual Session.

COUNTRY/ ORGANIZATION	CCOP TECHNICAL ACTIVITIES
--------------------------	---------------------------

2) Cooperating Countries

Australia	Australia supported the establishment of Global CCS Institute (GCCSI). The GCCSI supported the First Phase of CCS-M amounting to USD 0.5 Million. Australia also provides resource persons to the CCOP activities in the energy sector.
Belgium	Belgium continues to be updated with CCOP activities from CCOPTS.
Canada	Geological Survey of Canada (GSC) supported the publication of the CCOP Memories Book in celebration of CCOP's 50th year anniversary.
Denmark	Denmark continues to assist CCOP in seeking funding support for CCOP activities.
Finland	<p>GTK (Finland) and VIETADAPT project team (Vietnam) co-organized with CCOP, and GDMR (Cambodia) the Workshop on "Geoscience supporting risk management, water and food security", 12 March 2016, Siem Reap, Cambodia, and the CCOP-GTK-VIETADAPT-SEADPRI (Malaysia) Workshop on "Geoscience supporting risk management, water and food security", 30 October 2016, Bangkok, in conjunction with the 52nd CCOP Annual Session.</p>
France	<p>UNESCO in France sent resource persons to facilitate the 3rd CCOP- UNESCO Symposium on Developing Geoparks within East & Southeast Asia region - Opportunities and Challenges, 25-28 May 2016, Chongseong, Republic of Korea</p>
Germany	<p>France continues to be updated with CCOP activities from CCOPTS.</p> <p>BGR continues to assist CCOP MCs in Geoscience programs, especially focusing on requests from MCs.</p> <p>BGR financially supported the Workshop on "Integrated water resource management in coastal zones with a focus on groundwater" – experiences in East and Southeast Asia countries", 19-21 January 2016, Can Tho, Vietnam.</p> <p>BGR will financially and technically support 3-4 training courses on "Risk-Sensitive Spatial Planning in CCOP Member Countries" during 2017-2018. BGR representatives, represented by Dr. Dirk Kuhn and Dr. Dirk Balzer had visited CCOP office in Bangkok on September 13-16, and discussed relevant issues and plan to execute the training course.</p>
The Netherlands	Deltares continues to assist CCOP in seeking funding support for CCOP activities. A proposal on groundwater development has been submitted to Adaptation Fund in 2016.
Norway	The Norwegian Government through the Royal Norwegian Embassy (RNE) – Jakarta is also providing funds to support some of the activities of the CCS-M Program. Norway, thru the Norwegian Petroleum Directorate also provided resource persons in the CCS-M Program.
Poland	Poland continues to be updated with CCOP activities from CCOPTS.
Russian Federation	Russia continues to be updated with CCOP activities from CCOPTS.
Sweden	Sweden continues to be updated with CCOP activities from CCOPTS.

COUNTRY/ ORGANIZATION	CCOP TECHNICAL ACTIVITIES
United Kingdom	BGS continues to support bilateral projects with MCs.
United States of America	Annual EAGER Research Grant by the Geological Society of America for CCOP Annual Session host country. USGS provided resource persons to the CCS-M Program in the area of national assessment of geological CO ₂ storage sites and UC Project.

3) Cooperating Organizations

ASCOPE	ASCOPE maintained close cooperation with CCOP through jointly organized seminars and information exchange for the benefit of the Member Countries. ASCOPE published the ADG (ASCOPE Decommissioning Guideline) Book that was developed in cooperation with CCOP and PETRAD. CCOPTS participated in ASCOPE Joint Committee meetings to discuss current trends and issues in the energy program.
ESCAP	Information exchange and discussion, cooperation on technical activities as well as organizing workshops and conferences. CCOP reports to the UN-ESCAP Commission Session and participates in the subcommittee meetings. CCOP participated in the 72 nd UN-ESCAP Session (Phase II) on 15 - 19 May 2016 in Bangkok, Thailand.
EGS	CCOP and EuroGeoSurveys (EGS) continue to exchange information on Geosciences. EuroGeoSurveys invited CCOPTS to join the Annual Session meetings.
GETECH	Supported in the production and sale of aeromagnetic and gravity maps.
IUGS	CCOP is an Associate Member of IUGS and annually submits an activity report.
PETRAD	All reports from previous PETRAD seminars in East and Southeast Asia are available through the CCOPTS in Bangkok.
SPC	Pacific Community in the Pacific Islands and Territories (SPC) is accepted as CCOP Cooperating Organization in 2016
UKM	SEADPRI of UKM co-organized with VIETADAPT Project Team, GTK and CCOP the Workshop on "Geoscience supporting risk management, water and food security" on 30 October 2016 in Bangkok, in conjunction with the 52 nd CCOP Annual Session.
UNEP	CCOPTS continued to submit report to UNEP annually and has attended the 72 nd UN-ESCAP Session (Phase II) on 15 - 19 May 2016 in Bangkok, Thailand.

COUNTRY/ ORGANIZATION	CCOP TECHNICAL ACTIVITIES
UNESCO	<p>UNESCO cooperated with CCOP and KIGAM in organizing the 3rd CCOP-KIGAM-UNESCO Symposium on Developing Geoparks within East & Southeast Asia Region, 25-28 May 2016, Cheongsong, Republic of Korea and the CCOP-KIGAM-UNESCO-MME Workshop on Climate Change and Groundwater Resources in the Mekong River Basin, 1-2 June 2016, Sihanoukville Cambodia.</p> <p>UNESCO, ADB in Lao PDR and CCOPTS formulated the proposal on groundwater to apply for the Adaptation Fund in September 2015.</p>
World Bank	CCOPTS plan to use the remaining World Bank budget from CASM Workshop for Water Simulation Workshop scheduled in 2017.

Other Cooperating Countries generally continued their technical support to a number of multilateral and bilateral technical cooperation (TC) activities in CCOP Member Countries by providing valuable advice and guidance as well as resource persons and technical assistance.

Thanks are due to all the Cooperating Countries and Organizations for their provision of representatives to CCOP who have contributed in large measure to the review, assessment and formulation of CCOP work programmes and for the contribution of technical information.

KNOWLEDGE ENHANCEMENT AND SHARING (KES)

The 7th International Conference on Applied Geophysics towards Sustainable Development of Thailand and AEC (GEOPHYSICS 2016)

CCOP and Kasetsart University, Thailand, co-organized the 7th International Conference on Applied Geophysics-Geophysics towards Sustainable Development of Thailand and AEC (GEOPHYSICS 2016) on 14-15 January 2016 at the Miracle Grand Convention Hotel, Bangkok, Thailand, in collaboration with Asian Institute of Technology, Chiang Mai University, Prince of Songkla University, Mahidol University, Department of Mineral Resources, Department of Groundwater Resources, Department of Mineral Fuels, Department of Royal Irrigation and Geological Society of Thailand. The program began after the Opening Ceremony session, and comprised about 4 special talks from guest speakers including several oral presentations in two conference rooms during the day, and poster presentations in each evening. More than 50 research presentations were presented at the conference, which were divided into 6 sessions: Environment and Natural Hazards; Petroleum Geophysics; Geothermal and Hydrological Geophysics; Petroleum Geophysics; Shallow Geophysics; Solid Earth Geophysics.

The conference was attended by geophysical professionals, researchers from both governmental and private sectors as well as the academia, and with 6 attendants from the CCOP member countries and CCOPTS. It addressed topics related to geophysics, geology, environment, natural hazard and natural resources exploration.

BGR - CCOP Workshop “Integrated water resource management in coastal zones with a focus on groundwater” – experiences in East and Southeast Asia countries”

The CCOPTS, in cooperation with the BGR-NAWAPI Project (IGPVN) has successfully organized the BGR - CCOP Workshop “Integrated water resource management in coastal zones with a focus on groundwater” – experiences in East and Southeast Asia countries” on 19 – 21 January 2016, in Can Tho, Vietnam. The conference was financially and technically supported by the Federal Institute for Geosciences and Natural Resources of Germany (BGR), with attendance by 56 participants and resource persons from 11 CCOP member countries (Cambodia, China, Indonesia, Republic of Korea, Lao PDR, Myanmar, Papua New Guinea, Philippines, Thailand, Timor-Leste and Vietnam), BGR, IGPVN Project, National Center for Water Resources Planning and Investigation (NAWAPI), Mekong River Committee (MRC), GIZ, Viten Evides International B.V., Rise & Fall Project, Netherlands, Departments of Natural Resource and Environment of southern provinces of Vietnam, Provincial People's Committee (PPC) of Can Tho and Climate Change Coordination Office (CCCO) of Can Tho, and CCOPTS staff.



Participants of the BGR - CCOP Workshop “Integrated water resource management in coastal zones with a focus on groundwater”

The workshop was targeted at senior level officials who are involved in or overseeing groundwater management activities from state/country mandated water agencies. It was held as a technical seminar for two days in Muong Thanh Hotel in Can Tho, Vietnam and one full-day field trip to visit sea salinity intrusion monitoring points on Hau river, water work on Con Son Island, and Water supply plant at An-Nghiệp industry in SocTrang city.

The event aimed to exchange information among the concerned state institutions and other relevant stakeholders with regard to their tasks, problems, challenges and solutions on the topic of groundwater protection in coastal zones, focusing on integrated water resource management (IWRM) and sharing of know-how among the CCOP countries.



At the Water supply plant at An-Nghiệp Industry in SocTrang City

KIGAM/ISGeo Training Courses Related to Energy and Mineral Resources Sustainable Development

Training Course on Petroleum Exploration, Development and Production

KIGAM/ISGeo training course on “Petroleum Exploration, Development and Production” was conducted from 15 February – 11 March 2016 in Daejeon, Republic of Korea, in collaboration with CCOP for its member countries. 23 trainees from CCOP Member Countries (China, Cambodia, Indonesia, Lao PDR, Malaysia, Papua New Guinea, Thailand, Timor-Leste and Vietnam) attended the course, together with other international and Korean students.



Participants of the Petroleum Exploration, Development and Production Training Course

The 30-days training course provided participants with an introduction to key aspects of energy resources related to the petroleum industry. The contents of the course comprised a general overview on petroleum economics, petroleum geology, reservoir & sequence stratigraphy, reservoir geophysics & petrophysics, petroleum engineering & unconventional resources. A total of 16 instructors were involved in the course. Various other activities were also included in the 4 weeks training course. This include a half-day seminar with GECC (Global Energy Cooperation Center) and MOFA (Ministry of Foreign Affairs), KIGAM Lab tour, visit to KIER (Korea Institute of Energy Research), country report briefing and Korean language & cultural class. Participants visited several KIGAM labs including Gas Hydrate Dept., Underground Space Dept., Pilot Plant for mineral processing, Geological Museum, and energy related governmental institute.

Overall, the training course has been successfully organized. It reached the targets and had benefited all the participants. The petroleum and energy network established should be maintained and developed further for future collaborative activities.



KIGAM Lab tour



Workshop on Promoting Earth Science and Climate Change towards Sustainable Development

The CCOPTS, in collaboration with the Mahidol University at Kanchanaburi Campus, Thailand (MUKA), successfully co-organized the Workshop on Promoting Earth Science and Climate Change towards Sustainable Development on 17 – 19 February 2016 in Kanchanaburi, Thailand. The workshop was organized as a pre-conference event prior to the 5th International Conference on Earth Science and Climate Change to be held in July 2016, also in Bangkok, Thailand.



Workshop participants comprising the Member Countries delegation and the Mahidol University students

With support from CCOP and Mahidol University, this workshop aims to strengthen the research group on earth science and climate change, extending their work towards sustainable management for the local communities, and to establish a framework for the above mentioned upcoming International Conference.

The meeting was attended by 55 participants from CCOP Member Countries, including 7 Indonesian participants, 2 Timor-Leste participants, 1 Vietnam participant, 3 resource persons, 11 local participants in Thailand, 5 lecturers and 23 students from Mahidol University and 3 CCOPTS staff.

There were 6 technical sessions on the topics natural/ environmental changes and geohazards (landslides & earthquake) in view of geology and geophysics; geological resources: mineral resources, groundwater for local communities; speleothem / cave deposits / karst geology; geoconservation and geotourism for sustainable development of local communities; outreach and earth science education for general public; and packaging and delivering Research and Development (R&D) results for sustainable development.



Participants engaging in lively discussions at the Workshop



Fieldwork in Mueang Sing Historical Park

The 2nd Asia-Pacific Business Forum: Korean CCUS Technology for Climate Change

The 2nd Asia-Pacific Business Forum: Korean Carbon Capture, Utilisation and Storage (CCUS) Technology for Climate Change were held on 7 - 8 March 2016 in Bangkok, Thailand, as a collaborative effort among the Korean Institute of Geoscience and Mineral Resources (**Dr. Kyu Han Kim**, President), Green Technology Center (**Mr. Changmo Sung**, President) and the Korean-Thai Chamber of Commerce (**Mr. Jae Lee**, CEO), supported by UNESCO, CCOP and other institutions. The forum was attended by 67 participants from CCOP member countries, together with Korean invited guests and resource persons. Among the participants are KIGAM President, **Dr. Kyu Han Kim**; UNESCO-BGK Programme Specialist & Chief of Natural Sciences, **Dr. Ramasamy Jayakumar**; CCOPTS Director, **Dr. Adichat Surinkum**; Director-General of Green Technology Center, **Dr. Hyun Woo Shin**; and other international institutions and business representatives.



As a follow-up action to the agreement on CO₂ mitigation in the 2015 United Nations Climate Change Conference (COP 21), the Korean climate change CCUS technology (i.e. Low carbon high-functional green cement by utilization coal power plant ash and CO₂; Waste paper pulp In-situ Precipitated Calcium Carbonate (PCC) technology by utilization of CO₂) has been researched and developed by KIGAM. In an effort toward sustainable global cooperation for mitigation of CO₂ for climate change, this Asia-Pacific Business Forum was established, aiming not only to transfer this Korean climate change CCUS technology to Asia-Pacific countries but also to develop the cooperation network between industries, universities, institutes and business network between companies in Republic of Korea and Asia-Pacific countries.

The opening ceremony proceeded with the main event of the forum, the "carbon utilization technology business" launching ceremony. A project team has been created for the expansion of climate change countermeasure technology to developing countries that KIGAM is conducting with UNESCO, the Korean-Thai Chamber of Commerce, CCOP and advanced research institutions. The team is undertaking the following for the international application of the Korean climate change carbon mineralization technology such as the green cement technology and CO₂ paper recycling technology:

1) KIGAM acquired a world-class technology that facilitates the recycling of low concentration CO₂ produced from power plants, cement and paper industries;

2) Technology for the production of low carbon-high quality cement through industrial byproducts was successfully demonstrated by KIGAM in 2012 and it is receiving spotlight from developing world countries that are still heavily reliant on coal-fired power generation;

3) Technology that allows usage of CO₂ produced from paper industries for paper recycling. KIGAM succeeded in demonstrating this in 2014.



Additionally, KIGAM, GTC-K and the KTCC signed an MOU agreement for the establishment of an international industry-academia network for the climate change countermeasure technology. The three institutions will enhance their cooperation regarding the transfer of Korean climate change countermeasure technology to developing countries.

See more at <http://www.ccop.asia/article/the-2nd-asia-pacific-business-forum-korean-ccus-technology-for-climate-change>.

Regional project “Groundwater resources in the Greater Mekong Subregion; collaborative resource management to increase resilience”

The pre-concept for the regional project “Groundwater resources in the Greater Mekong Subregion; collaborative resource management to increase resilience”, prepared by UNESCO, IWMI, IGRAC and CCOP has been submitted to the Adaptation Fund. The project amount of USD 4 million is targeted. The overall Goal/Objective is to share an expanding knowledge and expertise base on sustainable use of groundwater resources for increased climate change resilience in the Greater Mekong Subregion.

During the submission for approval, the pre-concept was fully supported by Governments of Cambodia, Lao PDR, Myanmar, Thailand and Vietnam. The project/programme will be implemented by UNESCO and executed by CCOP in collaboration with member country agencies, International Water Management Institute (IWMI) and International Groundwater Resources Assessment Centre (UNESCO-IGRAC).

CCOP-GSJ Project on Groundwater Assessment and Control in the CCOP Region

Supported by GSJ of Japan, phase I and phase II of the CCOP-GSJ Groundwater Project had been implemented since 2005 to March 2014. Phase I had focused on evaluating the groundwater resources and environments, and monitoring programs. Phase II, had started in 2008 and focused more on evaluation of groundwater resources by means of database, to facilitate all CCOP member countries to share information in the standard format. Phase III of the project, entitled “Development of Geoinformation Sharing Infrastructure for East and Southeast Asia”, was started in March 2014. Scopes of Phase III include compilation of geoscientific information from CCOP countries, and to construct a web based database using the OGC standard formats. Under this program, each member country will be responsible for maintaining the data quality and updating the database. Final objective is to establish a basic geoinformation infrastructure in Asia and for the world.

CCOP-GSJ Groundwater Project Phase III Meeting

The CCOP-GSJ-NAWAPI Groundwater Project Phase III Meeting was held on 16-18 March 2016, in Hanoi, Vietnam. It was attended by 19 participants from Cambodia, China, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Myanmar, Papua New Guinea, Philippines, Thailand, and Vietnam and the CCOPTS.



Participants of the CCOP-GSJ Groundwater Phase III Meeting

Dr. Youhei Uchida presented the progress of the Project from 10 February 2015 to 11 March 2016. During the period, the report of the CCOP-GSJ-DGR Groundwater Phase III Project Kick-Off Meeting held on 10-12 February 2015 in Bangkok, Thailand has been published, circulated to all the participants of the meeting, and uploaded to the CCOP website, <http://www.ccop.or.th/download/GW5.pdf>. The CCOP Geoinformation Sharing Infrastructure for East and Southeast Asia (GSi Project) portal is under development and is accessible by the project members from <http://ccop-gsi.org>. The compiled groundwater data of Japan, Thailand and Vietnam from the Project Phase II is temporarily available from http://jcbwebgis.com/ccop_water, and will soon be made accessible from GSi Portal.

Group discussions were held and in accordance to the 2015 and 2016 Workplan. The meeting agreed that CCOP issues letter to all the permanent representatives of CCOP member countries requesting nomination of groundwater data coordinators for the GSi project, with attachment of participants list of the CCOP-GSJ-DGR Groundwater Project.

Report of the meeting can be downloaded from <http://ccop.asia/publication-details/84>.



CCOP-GSJ Groundwater Project Phase III Meeting field trip

AAPG Geosciences Technology Workshop 2016 “Characterization of Asian Hydrocarbon Reservoirs”

The AAPG Geosciences Technology Workshop “Characterization of Asian Hydrocarbon Reservoirs” was organized on 31 March - 1 April 2016 in Swissotel Le Concorde, Bangkok, Thailand, as collaboration between AAPG Asia Pacific Geosciences Technology Workshop and CCOP with attendance by about 80 participants including the participation of Thailand, China, Malaysia, Indonesia and CCOPTS. The workshop brought together experts from around the Asia region and the world to discuss timely topics of interest related to characterization of Asian reservoirs including: Low Permeability Reservoirs, Clastic Reservoirs, Non-Clastic Reservoirs, and Enhanced Recovery technologies. It also provided the opportunity to learn and discuss the latest ideas and technologies applied to Asian petroleum reservoirs which can be utilized to explore for and develop these reservoirs. The workshop also provided a setting for networking and sharing of experiences with fellow petroleum scientists interested in developing and producing the hydrocarbon resources of Asia. The participants are mostly coming from the oil and gas companies & service companies operating in Thailand.

Training Course on “Exploration and Development of Mineral Resources”

KIGAM/ISGeo training course on “Exploration and Development of Mineral Resources” was conducted from 18 April to 13 May, 2016 in Daejeon, Republic of Korea, in collaboration with CCOP for its member countries. Fifteen trainees from CCOP Member Countries (Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, Vietnam) attended the course, together with other international and Korean students.

The 25-days training course provided participants with an introduction to key aspects of Exploration Methods for Mineral Resources, Mineral deposit systems: principles and genetic concepts, Mining Engineering, Mineral Processing and Metallurgy. The course was divided into two parts, “exploration geology” and “exploration management and evaluation”. The course provided introduction to ore and mineral deposits genesis, metallic and non-metallic mineral deposits, marine and continental depositional environments, to different techniques from geology, geophysics through geochemistry. Participants are taught the various exploration methods, how to design spatial database for mineral potential analysis and analysis of relationship between deposit and related factors which involves database using GIS/RS, exposure to the fields of resources/reserves estimation and financial valuation of mining projects, and deep ocean deposits as well as field trip to Korean mining site. A total of 12 instructors were involved in the course. Various other activities were also included in the training course. This include field excursion at Chaesok-gang Cretaceous sedimentary basin, Culture Trip to Jeonju and KIGAM Lab Tour, country report briefing, and Korean language & cultural class.



Demonstration of equipment used in mineral investigation

Overall, the training course has been successfully organized. It reached the targets and had benefited all the participants.



Culture Trip - Course participants adorned traditional Korean dresses

Training Course on “Aspiring Geoparks - Development and Preparation”

The KIGAM/ISGeo training course on “Aspiring Geoparks - Development and Preparation” was conducted from 19 -24 May, 2016 in Daejeon and followed by the 3rd CCOP-KIGAM/ISGeo Symposium on Developing Geoparks within East & Southeast Asia region on 25-28 May 2016 in Cheongsong, Republic of Korea. Seventeen trainees attended, including from the CCOP Member Countries (Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, Vietnam), one staff of CCOPTS and other international and Korean students.

The course is basically designed for Geopark, Geo-heritage, or National Park-related personnel who want or need to develop Geoparks especially in non-Geopark Southeast Asian countries. It is also meant for geologists and Geopark, Geo-heritage, or National Park-related officers who would like to share their experience and knowledge on Geopark. The module include “How to develop Geoparks” and touches on 4 topics: 1) Science, 2) Education, 3) Geotourism, and 4) Sustainable Development.

The instructors are **Prof. Arthur Abreu Sá** (University of Trá-os-Montes e Alto Douro) and **Dr. Soo Jae Lee** (Korea Environment Institute).

The course also provided introduction to Strategy for Global Geoparks planning and promotion (Science, Geotourism & Education, Management systems/models, Sustainable development).

Overall, the training course has been successfully organized. It reached the targets and had benefited all the participants. Advanced courses are recommended for future consideration.

See more at <http://www.ccop.asia/article/the-3rd-ccop-cheongsong-kigam-unesco-symposium-on-developing-geoparks-within-east-southeast-asia-region>.



KIGAM/ISGeo geopark course participants

CCOP-KIGAM Project “Solution for Groundwater Problems in the CCOP Region”

The Project was proposed by KIGAM and adopted as new initiative at the 48th CCOP Annual Session in November 2012 with updates at the 60th CCOP Steering Committee in March 2013. This 5 year (2013-2017) project is sponsored by KIGAM, Republic of Korea and participated by all CCOP Member Countries. The first phase – Step I, aiming to contribute to the understanding of groundwater problems in the CCOP regions with focus on:

1. Identifying groundwater problems in each country, and,
2. Building trust and enhancing reliability to cope with groundwater problems in each country, and had been completed with 1 training course in Republic of Korea and 1 workshop in Thailand.

Step II (year 2014) focuses on finding cooperative measures to solve the groundwater problems with two main tasks:

1. Establishment of the international network and
2. Priority decision making for solving the groundwater problems in the CCOP region, and,

Step III (year 2015) focuses on Cooperative actions to solve the groundwater problems.

CCOP-KIGAM-UNESCO-MME Workshop “Climate Change and Groundwater Resources in the Mekong River Basin”

In collaboration with KIGAM, UNESCO in Bangkok and General Department of Mineral Resources (GDMR) of Ministry of Mines and Energy (MME) of Cambodia, the CCOPTS successfully co-organized the Workshop on Climate Change and Groundwater Resources in the Mekong River Basin on 1-2 June 2016 in Sihanoukville, Cambodia. The objectives of the workshop were to promote sharing of information and best practices among Mekong countries in assessing availability of groundwater resources under climate change scenario and to support member countries to prepare for sustainable groundwater management plan. The workshop was attended by 28 participants from 6 Mekong countries & resource persons from Republic of Korea (KIGAM, C&H, Gwangju Institute of Science and Technology - GIST, EcoEnergySolution), UNESCO, USGS and CCOPTS.



CCOP-KIGAM-UNESCO-MME Workshop participants

Keynote presentations given by UNESCO, KIGAM, CCOP, USGS, C&H and EcoEnergySolutions provided introduction on the project, overview of the groundwater potential and climate change issues in the whole CCOP region, implemented and on-going activities, monitoring system and also technological application for solving groundwater problems. The country reports by 6 Mekong countries addressed major issues and status of groundwater management with changing environment. Issues on strategy to enhance collaboration between neighboring countries to manage wisely the groundwater resource and adapt future climate change were discussed. On the second day, a field trip was arranged for all participants to visit water treatment plants and groundwater wells/reservoirs on Koh Rong island.



At the CCOP-KIGAM-UNESCO-MME Workshop on “Climate Change and Groundwater Resources in the Mekong River Basin” field trip

The workshop provided opportunity towards understanding of dynamic relationship between climate change and groundwater, and to look into strategies for sustainable groundwater resource management over the Mekong River Basin. The country reports are expected to be published in a special volume of Journal of Groundwater Science and Engineering.

See more at <http://www.ccop.asia/article/ccop-kigam-unesco-mme-workshop-on-climate-change-and-groundwater-resources-in-the-mekong-river-basin>.

KIGAM/ISGeo Regular Training Course on “Groundwater and Environmental Geochemistry”

Within a series of regular training courses provided by KIGAM/ISGeo in collaboration with CCOP for member countries, the KIGAM/ISGeo training course on Groundwater and Environmental Geochemistry was conducted from 20 June-8 July, 2016 in the International School for Geoscience Resources of KIGAM, Daejeon, Republic of Korea, with total 25 participants including 14 participants from CCOP Member Countries.

Aiming to foster professionals from all over the world in the fields of groundwater and geochemistry related research as well as to enhance the capabilities of the cooperating countries/organizations with Republic of Korea/KIGAM, this 3-weeks training course was planned to provide participants with an introduction to key aspects of groundwater resources and environmental geochemistry. The contents of this course comprise a general overview on evaluation and exploitation of groundwater resources that covered introduction to groundwater resources and practical geochemistry and groundwater contamination and remediation. Also there was a course about numerical groundwater modeling/calibration/uncertainty analysis including case studies and from this year, environmental geochemistry course was inserted as Module 3. A total of 16 instructors were involved in the course.



Participants of the KIGAM/ISGeo training course on Groundwater and Environmental Geochemistry

As usual, the activities include country report session, lab tour, field investigation, and visits were arranged. Hydrogeological field investigation activities let the participants experience both practical and theoretical aspects such as head measurement, borehole camera, hydraulic test, groundwater sample collection (non-pumping well), filtering, water chemistry measurements (bypass from pumping well) and software usage (AQTESOLV). Visit to the AMD treatment facilities in Mungyeong city let the participants to look around Korean Gapjeong Abandoned Coal Mine and learned passive treatment system consisting of oxidation pond, SAPS, and aerobic wetland. Tour in Mungyeong city to Mungyeong-saejae open set studio and Mungyeong Coal Museum was also arranged.



Hydrogeological field investigation

Overall, the training course was successfully organized, reached the targets and benefited all the participants. It is a good base for future cooperation and networking between the groundwater and environmental geochemistry participants in the CCOP member countries and KIGAM/ISGeo.

See more at <http://www.ccop.asia/article/regular-training-course-on-groundwater-and-environmental-geochemistry-2016>.

The 5th International Conference on Earth Science and Climate Change

The 5th International Conference on Earth Science and Climate Change was held at Hotel AVANI Atrium, Bangkok, Thailand during 25-27 July, 2016, in collaboration with CCOP. The conference is based on the theme “Stimulating and Analysing the changes of Earth & Climate”, comprised of scientific sessions containing topics on Earth and Geosciences, Marine Sciences, Atmospheric and Space Sciences, Meteorology and Geophysics, Remote Sensing and GIS, Global Warming, Climate Change, its causes, effects and associated hazards among other critically important scientific issues.

CCOP have partly sponsored and facilitated attendance of 7 participants from CCOP member countries, including 2 from Indonesia, 1 from Malaysia, 2 from Thailand and 2 from CCOPTS. CCOPTS Regional Expert, **Dr. Nguyen Thi Minh Ngoc** contributed one presentation titled “Trans-boundary geosciences and climate change adaptation in East and Southeast Asia – Role of CCOP”, to share information and make CCOP more visible in the region.

See more at <http://www.ccop.asia/article/the-5th-international-conference-on-earth-science-and-climate-change>.

The 23rd Electromagnetic Induction Workshop (EMIW2016)

CCOP and Mahidol University co-organized the 23rd Electromagnetic Induction Workshop (EMIW2016) on 14 - 20 August 2016 at the Empress Convention Center in Chiang Mai, Thailand. This workshop addressed electromagnetic topics related to EM Instrumentation, Source Fields, Data Processing, Rock Resistivity, EM Theory, Tectonic Applications, Marine EM geophysics, Modelling and Inversion (including 3D and joint inversion), Resource Applications (geothermal energy, petroleum, minerals, groundwater, environment and hazards), Global and Planetary EM, with 21 attendants from CCOP member countries and CCOPTS.

Collaboration Project between CCOP Member Countries & BGR: ‘International Training Course on Risk-Sensitive Spatial Planning in CCOP Member Countries’

A new collaborative Project between CCOP Member Countries & Federal Institute for Geosciences and Natural Resources, Germany (BGR): ‘International Training Course on Risk-Sensitive Spatial Planning in CCOP Member Countries’ was proposed to CCOP and presented for approval at the 66th CCOP Steering Committee meeting in Siem Reap, Cambodia in March 2016. The Federal Ministry for Economic Cooperation and Development Germany (BMZ) approved the project proposal “Risk-Sensitive Spatial Planning in CCOP Member Countries” on 14 July, 2016. BGR representatives, **Dr. Dirk Kuhn** and **Dr. Dirk Balzer** visited CCOP office in Bangkok on 13-16 September, and discussed relevant issues and plan to execute the training course. The quotation draft “BGR - CCOP International Training Courses on Risk-Sensitive Spatial Planning” was prepared and tentatively agreed.

The “BGR - CCOP International Training Courses on Risk-Sensitive Spatial Planning” will hold three training courses in 2017-2018, each 13 days duration. The first training course will be held 20 Feb – 2 March 2017 in Bangkok, Thailand, with successive trainings in the Philippines and Vietnam.



Dr. Dirk Balzer (in the middle) and **Dr. Dirk Kuhn**, the lecturers of the Germany-funded International Training Courses on Risk-Sensitive Planning, with CCOPTS staffs

Workshop on Marine Geoscience and Geohazards Reduction and Prevention for ASEAN Member States

The Workshop on Marine Geoscience and Geohazards Reduction and Prevention for ASEAN Member States was held at Guangzhou, People’s Republic of China, 26-30 September 2016. The workshop was sponsored by the China Geological Survey (CGS), Ministry of Land and Resources (MLR), P.R. China, and organized by Guangzhou Marine Geological Survey and Qingdao Institute of Marine Geology, both entities of the CGS. A total of 88 participants; 35 from CCOP member countries, 2 from CCOPTS and 51 China participants attended the workshop. The CCOP ASEAN member countries that were represented include Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand and Vietnam.

Many presentations were delivered during the workshop that include countries presentations, China marine geological works, technology and methods of investigating the ocean crusts, introduction to geophysical data processing and compilation, geological-geophysical map series compilation, and capacity building and outlook on marine geosciences cooperation. A presentation to highlight CCOP activities, titled “Marine Geoscience Capacity Building and Geohazards Reduction and Prevention for ASEAN Member States: Role of CCOP” was presented. The workshop was wrapped-up with a discussion cum suggestion session, whereby, the respective country representative’s leaders voiced out their expectations for capacity building, cooperation with CGS on marine geological survey and scientific research, and geo-information sharing. More information can be found in this link, <http://www.ccop.or.th/article/workshop-on-marine-geoscience-and-geohazards-reduction-and-prevention-for-asean-member-states>.



Workshop participants visiting the Guangzhou National Supercomputer Centre

5th International Symposium & Exhibition – VACI2016 Vietnam Water Cooperation Initiative for Managing Transboundary Waters: From Policy to Practice

The symposium was held under the auspice of the Ministry of Natural Resources and Environment of Vietnam (MONRE) and hosted by the National Center for Water Resources, Planning and investigation (NAWAPI), 2-4 October 2016, at Hanoi, Vietnam. CCOP was among one of the many sponsors of the meeting. VACI2016 was reported (http://vaci.org.vn/index.php?option=com_content&view=frontpage&Itemid=109), as among the best held since its inception.



The event had attracted some 1,500 participants from 25 countries spanning the governmental, international organizations, universities, research institutes and companies for discussion, exchange and networking. Many groundwater topics were delivered in the symposium. **Dr. Adichat Surinkum** and **Dr. Kamaludin bin Hassan**, Director CCOPTS and CCOPTS Regional Expert respectively, were invited as resource persons. The former deliberated as one of the panelists discussing the Symposium theme, while the latter presented “Coordination of groundwater management activities in East and Southeast Asia: Role of CCOP”.

Energy China Forum 2016: 6th Asia-Pacific Shale Gas Summit and Unconventional Resources Technology & Equipment EXPO

Energy China Forum (ECF) 2016: 6th Asia-Pacific Shale Gas Summit and Unconventional Resources Technology & Equipment EXPO, was held 17-19 October 2016, in Jianguo Hotel, Shanghai, People's Republic of China, and claimed as the largest unconventional energy event in the Asia-Pacific region. Five ECF unconventional oil & gas summit had been successfully held since 2011. The aim of the 6th ECF Summit was to gather professionals and experts from all around the world to explore policy trends, discuss latest shale development, classify and study



industry chain, and to build the annual Asia-Pacific region's biggest and most influential platform for the energy industry. ECF 2016 was organized by the Shanghai United Institute for Unconventional Resources, and received support from the Shanghai Energy Economy Committee, China Petroleum Pipeline Bureau, SZ Energy Intelligence Co. Ltd., China Petroleum Enterprise, leading China national agencies and cooperation of CCOPTS.

The event had attracted a total of 154 participations (39 speakers, 102 delegates and 13 from the media) representing governmental and international organizations, universities, research institutes and companies for discussion, exchange of information and networking. Only one delegation from Indonesia was represented from the CCOP Member countries, apart also a participation from the CCOPTS. A total of 26 presentations were delivered in the 2½ days symposium. A presentation to highlight CCOP activities, titled "Development of Shale Gas in East and Southeast Asia: Role of CCOP" was presented by the Regional Expert, **Dr. Kamaludin Hassan**, who was also invited to hand out the ECF2016 Shale Gas Summit Award to three representative companies. A visit to SOLVAY Novecare Oil & Gas Company was made in the afternoon of the last day.

More information of the award is reported at: <http://www.ccop.or.th/article/quality-183-efficiency-183-technology-ecf2016-oil-gas-tech-innovation-award>.

KIGAM/ISGeo Regular Training Course on Landslide and Slope Stability 2016

Under the series of regular training courses provided by KIGAM/ISGeo in collaboration with CCOP for member countries, the KIGAM/ISGeo training course on Landslide and Slope Stability was conducted from 31 October - 18 November, 2016 in the International School for Geoscience Resources of KIGAM, Daejeon, Republic of Korea, with total 25 participants including 13 participants from CCOP Member Countries. Various activities were conducted during the 3 weeks of the training course. A total of 7 instructors were involved in the course.

The 3-weeks training course provided participants with an introduction to key aspects of landslide and slope stability. The course contents comprised a general overview on mechanics of landslide, monitoring and early warning of landslide and analysis of rock slope stability. Also the course was held in conjunction with The Korean Society of Engineering Geology (KSEG) 2016 Fall Conference at Byunsan Daemyung Resort which was held 3 – 4 November. All participants attended the KSEG fall conference, the special session on landslide prediction and early warning and the field excursion at Chaesok-gang. **Dr. Byung Joo Lee** lectured on the Geology and Geological Structure of the Cretaceous sedimentary basin.



Participants of the training course with their Certificate of Completion

Overall, the training course has been successfully organized. It reached the targets and had benefited all participants. It would be a good base for future cooperation among CCOP member countries and KIGAM/ISGeo. The landslide and slope stability network established should be maintained and developed further for future collaborative activities. Advanced courses, activities such as field survey and case study & discussion are also recommended for future consideration. More information on the course can be found from this link, <http://www.ccop.asia/article/kigam-isgeo-regular-training-course-on-landslide-and-slope-stability-2016>.

CCOP-VIETADAPT Workshop on "Geoscience supporting risk management, water and food security"

The workshop on "Geoscience supporting risk management, water and food security" aims to identify possibilities of geosciences to support East and Southeast Asian societies in safeguarding water and food resources. In 2016, two such workshops were held.

The first workshop was organized by CCOPTS in cooperation with the Geological Survey of Finland (GTK), VIETADAPT Project and the Ministry of Mines and Energy of Cambodia (MME), on 12 March 2016, at Siem Reap, Cambodia. It gathered 27 experts from Cambodia, Indonesia, Myanmar, Vietnam, Japan, Thailand, Philippines, China and Finland.



The full-day workshop had focused on exchange of methodologies and technologies to further water management and sustainable development in the CCOP area.

Eight presentations under three topics: 1) Geoscience and food security – examples and further ideas; 2) Vulnerability analyses for water supply; 3) Climate change adaptation for water resource management, were made. It presented an overview on how to enhance the geoscientific applications in food security matters. Several applications on sustainable water resource management from Cambodia, Vietnam, Indonesia and Thailand were introduced. Methodologies and tools for assessing water resources vulnerability in changing climatic and socio-economic conditions were shown. The presentations triggered constructive, fruitful and extremely active discussions that were acknowledged by the workshop participants. The overall feedback for the workshop was very positive and sharing experience from real case studies was received.



CCOP-VIETADAPT-SEADPRI Workshop participants

The second workshop was held on 30 October 2016, in conjunction with the 52nd CCOP Annual Session, in Bangkok, Thailand. The CCOP-VIETADAPT-SEADPRI workshop was jointly organized by the Geological Survey of Finland (GTK), the Southeast Asia Disaster Prevention Initiative of Universiti Kebangsaan Malaysia (SEADPRI-UKM), the Vietnamese Sub-Institute of Hydro-Meteorology and Climate Change (SIHYMECC), the Vietnamese Centre for Water Resources Warning and Forecasting (CEWAFO), Asian Network on Climate Science and Technology (ANCST) and the CCOPTS. A total of 26 participants representing CCOP member countries of China, Indonesia, Philippines, Thailand, CCOP cooperating country of the Netherlands and CCOPTS attended the workshop. The half-day afternoon workshop presented the results of some ongoing projects that have assessed such risks as the anthropogenic impact on natural resources (i.e. water) and agriculture (i.e. soils) from that of climate change. The applied modelling and assessments and methodologies are explained in the presentations – with the aim to trigger constructive discussions. The workshop successfully highlighted issues that land and socio-economic development plus population increase and climate change pose emerging challenges to secure food production and safeguarding of water resources. The workshop concludes to publish the workshop material in a listed journal.

See more at <http://www.ccop.asia/article/workshop-on-geoscience-supporting-risk-management-water-and-food-security-30-oct-2016>.

Workshop on “Opportunities and Benefits of Geothermal Use”

The workshop was co-organized by the National Institute of Industrial Science and Technology (AIST) of Japan, Department of Groundwater Resources (DGR) of Thailand and Korea Institute of Geoscience and Mineral Resources (KIGAM) on 17 November 2016, in Chiang Mai, Thailand. The workshop on “Opportunities and Benefits of Geothermal Use” discussed best practices of direct use by experts from around the world. **Dr. Adichat Surinkum**, CCOPTS Director was invited to present on “Ground Source Heat Pump, Geothermal Direct Use, Development in CCOP Member Countries”. This is the output of the 3rd Phase of CCOP-GSJ Groundwater Project led by **Dr. Youhei Uchida**. The GSHP are now installed and being tested in Thailand, Indonesia and Vietnam in order to find the best practices on different groundwater models.

Resources and Environment Effects of Global Karst Dynamic System



The launching of the scientific plan on “Resources and Environment Effects of Global Karst Dynamic System” in Guilin, China

On 14-16 November 2016, China Geological Survey and other geoscience organizations launched the scientific plan on “Resources and Environment Effects of Global Karst Dynamic System” in Guilin, China. This ceremony was attended by participants from UNESCO, IUGS, CCOPTS (represented by **Dr. Adichat Surinkum**), representative from ASEAN member states and hydrogeologists from around the world. This event was followed by the training course organized by International Research Center on Karst. During 16-26 November, trainees had an opportunity to learn not only on the subject related to karst but also how to set up the monitoring for Karst dynamic system as well.

11th ASIAN Geothermal Symposium

The Symposium was co-organized by the National Institute of Industrial Science and Technology (AIST) of Japan, Department of Groundwater Resources (DGR) of Thailand and Korea Institute of Geoscience and Mineral Resources (KIGAM) on 18-20 November 2016, in Chiang Mai, Thailand. In the symposium, experts presented updated status, new innovation on exploration and exploitation and collaboration program. They also shared ideas on opportunities and barriers in each topic at the end of the symposium. It was also a very good opportunity for those who involved in the development of the First Geothermal Power Plant in Thailand to share their memories during the site visit on Saturday, 19 November. Both the above workshop and symposium is reported in <http://www.ccop.asia/article/asian-geothermal>.

CCOP-KIGAM Volcano Monitoring Project in the East & Southeast Asia region

The CCOP-KIGAM Volcano Monitoring Project in the East & Southeast Asia region was proposed by the Korean delegation, Korea Institute of Geoscience and Mineral Resources (KIGAM) at the CCOP Annual Session meeting in Xi'an, China, on 22-26 November 2015 and approved by the meeting for implementation, with participation by CCOP member countries. The project aims to develop a volcano observatory using Global Navigation Satellite System (GNSS) technique and near real-time continuous monitoring of surface deformation of active volcanoes in participating member countries, in order to mitigate volcanic hazards and timely alert for the community. In February 2016, a network of national focal point of this project had been established via CCOP facilitation, with involvement of 6 CCOP member countries (Indonesia, Japan, Republic of Korea, Myanmar, Papua New Guinea, Vietnam).

Within framework of the KIGAM-CCOP Volcano Project, during the 23-27 May, 2016, KIGAM organized a one-week long training course entitled "GPS Data Processing and Analysis with GAMIT/GLOBK/TRACK" at the International School for Geoscience Resources of KIGAM, Daejeon, Republic of Korea. **Prof. Thomas Herring** and **Dr. Michael Floyd** from Massachusetts Institute of Technology (MIT, USA) were the instructors in the course. The course covered introduction to GPS processing for high-quality geodetic applications, processing GPS phase observations using GAMIT, post-processing using GLOBK to generate final time series and velocities, advanced analysis techniques and utility programs and kinematic processing of GPS phase observations using TRACK. The course participants totaled 46 including 3 CCOP member countries participants, one from Myanmar and two from Indonesia. Through this course, it is expected to develop a volcano monitoring project using GNSS technology for the member countries of CCOP. The purpose of the project is to mitigate volcanic hazards in CCOP countries and to timely alert impending eruptions to the community. These developments will contribute directly to the key objectives of CCOP activities such as protecting citizens from natural disasters, enhancing knowledge of natural hazards, developing mitigation strategies and improving methodologies for accessing risk.

CCOP CO₂ Storage Mapping Program (CCS-M)

CCS is essential. Even with concerted action by the global community to limit temperature increases to under 2°C, fossil fuels would still provide 60% the world's primary energy by 2040. Fossil fuels currently provide around 80% primary energy demand. Demand for fossil fuels has begun to decline in the developed world; however, demand in developing countries has been rising and will continue to rise. Investments in technologies that use fossil fuels are still being made around the world. Investments made today will lock in emissions sources for the next 30 years or more.

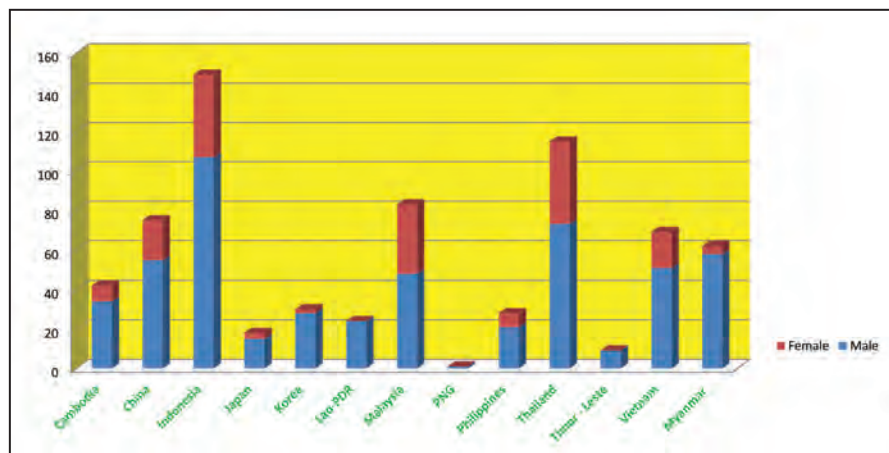
CCS is the only technology which can reduce emissions on a significant scale from fossil fuel power plants and these industrial processes. To achieve the global goal to limit temperature increases to no more than 2°C, the scale of change and the level of low-carbon technology deployment is enormous. The IPCC's Fifth Assessment Synthesis Report states that the deployment of CCS, including bio-CCS, will significantly reduce the risk of not meeting climate goals, and is also the most important technology in minimizing the costs of achieving required emission reductions out to 2100. CCS is a GHG emission reduction technology, whose deployment is dependent on an enabling policy framework. Given the substantial contribution CCS can potentially make in mitigating the risk of climate change, the quality of the policy matters.

The CCOP implemented the CCS-M Program in 2013 in response to the aspirations of the member countries to enhance its understanding on the climate change issues, particularly its impact to society, economy and environment, and the role of the geoscience community in the implementation of mitigation and adaptation technologies as well as the needed policy.

The Goal of CCS-M is to enable government organizations in the CCOP member countries responsible in mapping for the geological storage of CO₂ to:

- a. Provide a high level overview of the potential for large-scale CO₂ storage,
- b. Enhance their capacity and capabilities in the assessment of geological sites for the safe and long-term storage of CO₂, and
- c. Increase their understanding of the potential of CO₂ for enhanced oil/gas recovery.

As of December 2016, a total of 765 participants attended in the technical activities of CCS-M since its Project Launching in 2013. Majority of the participants are management representatives from regulatory and research organizations in upstream oil and gas agencies and national oil & gas companies. Representatives from environmental, legal, finance, and academic organizations, also participated in the technical activities. The female participation is at ~30% of the total, comparably higher than other technical activities in CCOP. Below is the participants distribution, also indicating the male/female participation.



Member Countries participation to CCS-M activities, 2013-2016

In 2016, three (3) technical CCS-M activities were conducted.

1. **CCS-M M2: National Coordinators Meeting/Workshop** - was conducted at the CCOPTS office in Bangkok on 15-16 February 2016 with 14 participants. The Meeting discussed about the progress of CCS-M, presentation of the Country Report of the participating countries that includes their pledges or "Intended Nationally Determined Contributions" (INDC) at the COP21 - Paris last December 2015, and work plan discussions on future capacity building activities.



2. **CCS-M T6: Training Course on Sequence Stratigraphy** - was conducted in Phnom Penh, Cambodia on 25-29 April, 2016 with 36 participants. CCS-M T6 was specifically for geoscientists from Cambodia, Lao PDR, Myanmar, Philippines, Thailand, Timor-Leste, and Vietnam, and covered the concepts and practical applications of sequence stratigraphy for petroleum exploration and mapping of geological CO₂ storage sites. A team of experts from PETRONAS were the resource persons at the training course.



CCS-M T6, Field visit at a road-cut section

3. **CCS-M S6: Workshop on CO₂ geological storage and CO₂ for EOR** was conducted in Hanoi, Vietnam on 7-9 June 2016 with 30 participants.

At the CCS-M S6, the National Coordinators provided an update of their CCS activities, with focus on activities related to mapping the CO₂ geological storage and their national commitment at the 2015 Paris Climate Conference 21 (COP21). Added information are from the Global CCS Institute Storage Portfolio Report (March 2016).

Presently, CCOPTS is seeking for additional funding for the remaining activities of CCS-M. These activities includes training courses specific to some member countries, publication of the CO₂ geological storage atlas and dissemination seminars. For more information about CCS-M, visit <http://www.ccop.asia/ccsm/>.



CCS-M S6, Visit to Red River Basin first gas field

CCOP - KIGAM Unconventional Oil and Gas Resources Project: Mapping of black shale formation for the prediction of shale resources (UC Project)

The Memorandum of Agreement (MOA) between CCOP and KIGAM for the UC Project was signed during the 64th CCOP Steering Committee Meeting on 24 March 2015 in Krabi, Thailand.

The Goal of the UC Project is to create the highest possible value for society from oil and gas resources in order to improve the quality of life of the people in the CCOP member countries. The Project is designed to sustain the experience, technology transfer and institutional capacity building projects in CCOP. This is also consistent with the aspiration of the member countries for a sustainable development of the energy resources and energy security.

The implementation of the UC Project in CCOP is very timely and provides a new opportunity (and new challenges) in the CCOP region. Shale exploration and development leverages on the advancements in directional drilling, micro-seismic monitoring and fracturing technologies. The Project will also create a better learning and collaborative environment for the CCOP countries as these technologies are developing at a very fast pace. The CCOP countries will learn new geochemical models of how rocks reacts to well optimization, surface management technology and to answer the question: Can it be done safely?

During the reporting period, the UC Project conducted three (3) meetings (coded UCM4, UCM5 and UCM6) with technical sessions and field work integrated in the Meeting's agenda.

1. **UCM4:** Siem Reap, Cambodia on 7-8 March 2016 with 20 participants;
2. **UCM5:** Vientiane, Lao PDR on 10-12 May 2016, also with 20 participants; and
3. **UCM6:** Danang, Vietnam on 16-18 August 2016, with 32 participants. The participants are mostly national coordinators (main contact persons) and members of local UC Project teams from Cambodia, China, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Philippines, Papua New Guinea, Thailand and Vietnam. Representatives from the ASEAN Council on Petroleum (ASCOPE) also participated in the mentioned activities.

At the **UCM4**, KIGAM presented the results of the analysis from the shale samples that were submitted by the participating member countries. The samples were analyse for their total organic content (TOC), Maximum Temperature (Tmax), Kerogen type, and mineral contents. The information on mineral quantification were also plotted into a Ternary Diagram and for comparison purposes, the mineral composition of major US shales were also plotted in the same diagram. Also in the same meeting, it was agreed to continue the shale resources assessment of the basins using the **US Energy Information Agency (EIA) / Advance Resources, Inc (ARI) Methodology for World Shale Gas and Shale Oil Resource Assessment (June 2013)**, the **Guideline Methodology** adapted by CCOP.

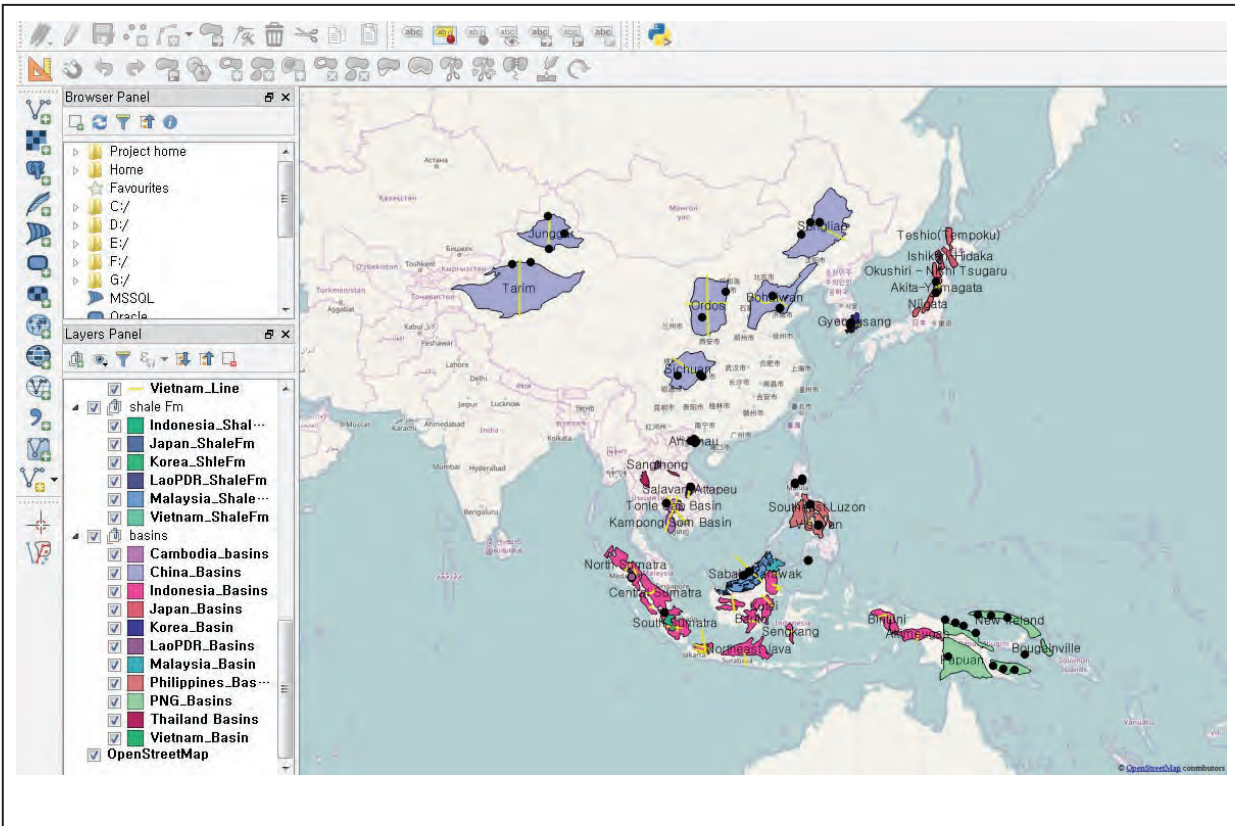


UCM4 Field visit to Battambang Quarry

During **UCM5**, the national coordinators provided an updates via the Country Report, on the assessment of the national shale oil and gas resources, including the challenges encountered in using the Guideline Methodology. The report also mentioned their training needs and recommended topics of future workshops. Furthermore, the national coordinators agreed to complete the mapping of their shale basins, indicating 1) basin boundary, 2) shale formation boundary, 3) sample locations within the shale formation map, and 4) cross section. As for the shale analysis, KIGAM will still accept shale samples. The submitted samples should indicate the information of basin, location (coordinates), well name (if log sample), formation name and age (if available). The integration of the Asian Shale Basins Map commenced right after UCM5. As of end August 2016, the draft Asian Shale Basins Map is shown below:



UCM 5 Shale outcrop visit



Asian shale basins map on QGIS

UCM6 was conducted in close cooperation with Vietnam Petroleum Institute, the host organization. The venue was Danang Petro Hotel, Da Nang City and focused on the integration of the shale basin maps and training course/workshop on mineral quantification analysis with X-ray diffraction using the Siroquant software. The workshop was led by **Mr. Tim Black** of Sietronics PTY Ltd that is based in Canberra, Australia.



Participants of UCM6

During the CCOP 52nd Annual Session, an update of the UC Project was presented by the Project Coordinator **Mr. Simplicio Caluyong** as part of the CCOPTS progress report. The Project was also presented by **Dr. Young Joo Lee**, Executive Director, Petroleum and Marine Research Division, KIGAM as one of the Keynote paper at the Thematic Session, celebrating the 50th Year Anniversary of CCOP with the theme “Geoscience for the Society”.

The Way Forward

At the UCM6, the National Coordinators agreed to complete the mapping of their country’s shale basin, indicating:

1. Basin boundary (vector file);
2. Shale formation boundary (vector file);
3. Sample locations within the shale formation map (vector file)
4. Cross section (raster file);
5. Sample location (delimited text, CSV) and other information about the sample (formation name, age, etc); and
6. Brief description of the basin for Publication - to include location, geological setting, stratigraphy and shale formation - these can be obtained from publications and reports.

Once complete data are submitted (by 31 March 2017) the UC Project will proceed with the Resource Assessment workshop following the agreed Guideline Methodology. A shale sedimentary basin in the member countries will be used as case study area for the resource assessment exercise.

UCM Workplan 2017

- 28-30 March 2017, UCM7: Shale maps review, case study and resource assessment workshop, Bangkok, Thailand
- 31 March 2017, Completion of shale maps and basin descriptions - following the agreed Guideline Methodology
- July 2017, UCM8: Shale Resource Assessment & Drafting of Asia Shale Basin Book report, Indonesia
- 5-19 October 2017, UCM9: Publication of the Asia Shale Basin book at the CCOP 53rd Annual Session, Cebu, Philippines

For more information on the UC Project, visit <http://www.ccop.asia/uc/>.

Others

East Asia Geoscience and Environmental Research (EAGER) Project

The EAGER Project is a trust fund set up in the Geological Society of America with personal contribution of **Dr. Maurice “Ric” Terman**, CCOP Honorary Advisor, to be used for funding research in geoscience in the region. Under the programme, a grant will be made available for research on Geoscience and Environment in East and Southeast Asia to candidates from the Member Country hosting the CCOP Annual Session since 2003.

The 65th CCOP Steering Committee Meeting in Xi'an, China held on November 2015 agreed on the proposed revision of utilizing an alphabetical listing of the countries to receive the annual EAGER Award, with amendments for the first cycle as follows: 2016 - Timor-Leste, 2017 - Myanmar, 2018 - Cambodia and 2019 - Lao PDR. The CCOPTS communicated this to the EAGER Grant sponsor in January 2016, but received no reply.

The CCOPTS emailed letter to the Permanent Representative of Timor-Leste to CCOP, calling for EAGER Grant applications in February 2016, and received no applications.

DATA AND INFORMATION

CCOP-ASEAN Seamless Geology Project Meeting

The CCOP- ASEAN Seamless Geology Project was initiated in 2013 with the goals of standardization of the geological legend, compilation of 1:1 million seamless geology maps and to be operated by the web-GIS system. In 2016, two meetings were held, both in conjunction with the CCOP Annual Session and Steering Committee meetings.

In 8 March 2016 a day before the 66th CCOP Steering Committee Meeting, the CCOPTS in cooperation with Cambodia's Ministry of Mines and Energy and the Geological Survey of Japan, AIST, held the CCOP-ASEAN



Seamless Geology Project Meeting at Sokha Angkor Resort, Siem Reap, Cambodia. The main objectives of this meeting were to update the participating countries on the progress made in 2015, share the understanding so far, and discuss the future plan. There were 16 participants from CCOP member countries attending the meeting. The progress of the project and field trip in Cambodia were reported by **Dr. Yasukuni Okubo** and **Dr. Yutaka Takahashi** (Geological Survey of Japan), respectively. And the progress of harmonization over cross-border areas were reported by **Mr. Sompob Wongsomsak** (DMR, Thailand). The Member Countries also discussed on the workplan, in connection with the upcoming training courses in Myanmar and Japan in August-September 2016.

The 2nd CCOP- ASEAN Seamless Geology Project Meeting of 2016 was held simultaneously with the 52nd CCOP Annual Session, on the 2 November 2016 (9am-12.15pm), in Bangkok, Thailand. The meeting was chaired by **Dr. Yasukuni Okubo** from the Geological Survey of Japan AIST. The meeting was attended by 19 delegates representing Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Thailand, Vietnam & the CCOPTS. Additional information on the meeting could be sourced at; <http://www.ccop.asia/article/the-ccop-asean-seamless-geology-project-meeting>.



Participants of the 2nd CCOP- ASEAN Seamless Geology Project Meeting

First International CCOP GSi Workshop

Co-funded by the Geological Survey of Japan, AIST and the Geological Agency of Indonesia, the First International Workshop of the CCOP Geoinformation Sharing Infrastructure for East and Southeast Asia (GSi) Project was held on 20-22 September 2016 at Hotel Kusuma Sahid Prince, Solo, Indonesia. Forty-seven participants from the member countries (Cambodia, Indonesia, Japan, Republic of Korea, Lao PDR, Malaysia, Myanmar, Philippines, and Thailand) including the staff of the CCOPTS attended the workshop.

All the CCOP member countries represented in the workshop gave a report on their preliminary 5-years data upload plan, name of national and data coordinators, progress of data upload and portal site, requests and suggestions on GSi project and country's current status of Spatial Data Information System and extent of Geographic Information System usage. **Mr. Simplicio Caluyong** of the CCOPTS presented the CCS-M and KIGAM Unconventional Oil and Gas Resources Project's plan of publishing data through the GSi System. Hands-on training on the usage of the GSi System with real data, and on mobile web-GIS development, including discussion of naming conventions was conducted by **Dr. Joel Bandibas** on the first and second day of the workshop.



Hands-on exercises on the usage of GSi Web System

Discussion on the GSi system development, data policy, five years working plan, server preparation plan, system development team, collaboration among CCOP Member Countries, useful applications, data analysis, collaborations with other major projects was made.

See more at <http://www.ccop.asia/article/geoinformation-sharing-infrastructure-for-east-and-southeast-asia-international-workshop>.



The participants visited the Sangiran Museum of Ancient Man during the field trip.

FINANCIAL HIGHLIGHTS

From January 1 to December 31, 2016, Member Countries' total cash contributions amounted to **USD 394,710.47**, that consists of China (USD 50,000), Indonesia (USD 40,000), Japan (USD 50,000), Republic of Korea (USD 60,000), Lao PDR (USD 10,000), Malaysia (USD 50,000), Myanmar (USD 5,000), Philippines (USD 40,000), Thailand (USD 40,000), and Timor-Leste (USD 10,000). Thailand cash contribution for 2017 was received in advance since 2016 (USD 39,710.47) (**Table 1**).

*Table 1: Cash Contributions of Member Countries for 2015-2016
(Ending 31 December 2016)*

Member Countries	2014 Contribution Received in 2015	2015 Contribution Received in 2015	2016 Contribution Received in 2016	2017 Contribution Received in 2016
Cambodia	-	5,000.00	-	-
China	-	50,000.00	50,000.00	-
Indonesia	-	40,000.00	40,000.00	-
Japan	-	50,000.00	50,000.00	-
Republic of Korea	-	60,000.00	60,000.00	-
Lao PDR	-	10,000.00	10,000.00	-
Malaysia	-	50,000.00	50,000.00	-
Myanmar	-	5,000.00	5,000.00	-
Papua New Guinea	-	25,000.00	-	-
Philippines	40,000.00	40,000.00	40,000.00	-
Singapore	-	-	-	-
Thailand	-	40,000.00	40,000.00	39,710.47*
Timor-Leste	-	10,000.00	10,000.00	-
Vietnam	-	25,000.00	-	-
Total	40,000.00	410,000.00	355,000.00	39,710.47

*Thailand cash contribution for 2017 was received in advance since 2016 (Amount received is less than the expected because of loss of exchange rate from Thai Baht to US Dollar)

In addition to Member Countries' contributions, the amount of **USD 32,067.82** were earned from the management of projects during January - December 2016 period, from "BGR-CCOP Workshop Integrated Water Resource Management in Coastal Zones with a focus on Groundwater-Experiences in East and Southeast Asia Countries" (USD 7,738.00), "CCOP-KIGAM Unconventional Oil and Gas Project: Mapping of Black Shale Formations for the Prediction of Shale Resources" 1st Installment (1/2) (USD 3,756.48) and 2nd Installment (2/2) (USD 3,968.25), "CCOP-GSJ-NAWAPI Groundwater Project Phase III Meeting" (USD 3,271.00), and "CCOP-KIGAM Collaborative Workshop on Climate Change and Groundwater Resources in the Mekong River Basin" (USD 4,947.00), "Geo-information Sharing Infrastructure for East and Southeast Asia (GSi) International Workshop" (USD 4,266.00) and "Fund supported for a special event at the celebration of 50th Year of CCOP Anniversary" (USD 4,121.09) details are shown in **Table 2**.

Other incomes during the period amounted to **USD 33,704.54** were from interest earned (USD 1,468.05), from Sale of Publications (USD 13.92), Loss on Conversion Currencies and Exchange rate (USD – 5,014.75), and miscellaneous incomes (USD 37,237.32). The total income during the period was **USD 460,482.83**. The expenditure of **USD 490,308.67** was incurred from operation and administrative support. The cash balance as of ending December 2016 amounted to **USD 908,971.90**.

Other Fund (outstanding balanced) (USD 115,655.52) that consists of “Bundesanstalt für Geowissenschaften und Rohstoffe” (BGR), Germany (USD 28,475.15), “CCOP-KIGAM Unconventional Oil & Gas Project: Mapping of Black Shale Formations for the Prediction of Shale Resources” (USD 86,440.23), “CCOP-KIGAM Groundwater Meeting” (USD 5,089.26) and “International Environmental Partnership Grant Award (Taiwan-US IEP Grant)”, Taiwan R.O.C. (USD – 4,349.12).

The Technical Secretariat office premise is being provided by the Royal Thai Government, through the kind arrangements of the Department of Mineral Resources (DMR), Ministry of Environment and Natural Resources, at the CCOPTS Building, DMR Complex, Rama VI Road, Bangkok, Thailand.

Table 2: Management Income from Execution of Project and Activity (January 1 - December 31, 2016)

Funding Source	Activities	Country	Period	Amount (USD)
BGR	BGR-CCOP Workshop Integrated Water Resource management in Coastal Zones with a focus on Groundwater - Experiences in East and Southeast Asia Countries	Can Tho, Vietnam	January 19-21, 2016	7,738.00
KIGAM	CCOP-KIGAM Unconventional Oil and Gas Project: Mapping of Black Shale Formations for the Prediction of Shale Resources	Bangkok, Thailand 2016 (1/2) & 2016 (2/2)	March 2016	3,756.48 3,968.25
GSJ	CCOP-GSJ-NAWAPI Groundwater Project Phase III Meeting	Hanoi, Vietnam	March 16-18, 2016	3,271.00
KIGAM	CCOP-KIGAM Collaborative Workshop on Climate Change and Groundwater Resources in the Mekong River Basin	Sihanoukville, Cambodia	June 1-2, 2016	4,947.00
GSJ	Geo-information Sharing Infrastructure for East and Southeast Asia (GSi) International Workshop	Solo, Indonesia	September 20-22, 2016	4,266.00
GSJ KIGAM C&H, Inc. PTTGC CH. Karnchang Siriphira Co., Ltd. Survey Engineer Intertech Co., Ltd. Pre Development Consultant Co., Ltd.	Fund supported for a special event at the celebration of 50 th Year of CCOP Anniversary	Bangkok, Thailand	October 30-31 and November 1-3, 2016	4,121.09
Total Project Management Income				32,067.82
Net Total Project Management Income for Budget Year 2016				32,067.82

Target Project Management Income for year 2016, USD 67,000.00

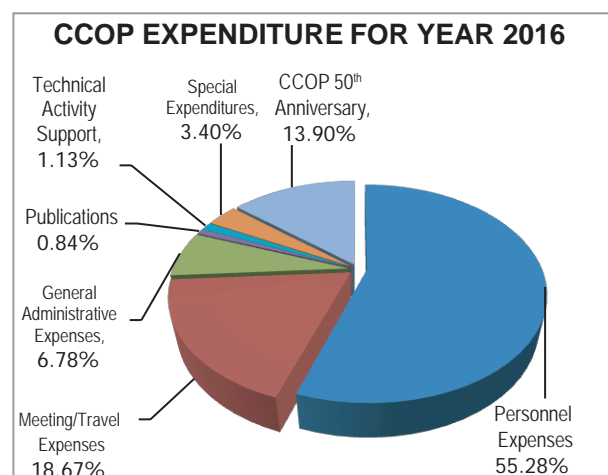
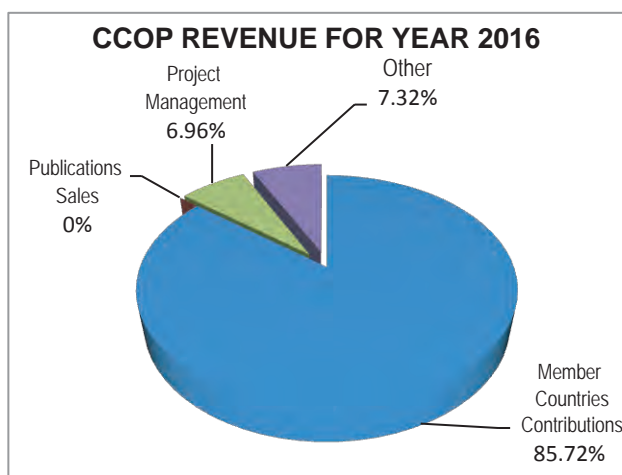


Table 3: CCOP Financial Statement for year ended 31 December 2016 (amount in US Dollars)

DESCRIPTION	2015		2016	
	USD	USD %	USD	USD %
Fund Balance	778,320.37		835,492.30	
Income:				
<i>Member Countries' Contributions</i>	450,000.00	93.03	394,710.47	85.72
<i>Publications sales</i>	-	-	13.92	0.00
<i>Project management</i>	37,820.47	7.82	32,067.82	6.96
<i>Others</i>	(4,120.83)	(0.85)	33,690.62	7.32
Total Income	483,699.64	100.00	460,482.83	100.00
Expenditures :				
<i>Personnel expenses</i>	294,243.25	69.29	271,026.65	55.28
<i>Meeting / travel expenses</i>	79,494.25	18.72	91,538.01	18.67
<i>General administrative expenses</i>	27,608.68	6.50	33,233.16	6.78
<i>Publications</i>	3,633.88	0.86	4,114.27	0.84
<i>Technical activity support</i>	2,408.91	0.57	5,519.60	1.13
<i>Special expenditures</i>	17,262.36	4.07	16,718.98	3.40
<i>Fund supported for a special event at the celebration of 50th Year of CCOP Anniversary</i>	-	-	68,158.00	13.90
Total Expenditure	424,651.33	100.00	490,308.67	100.00
<i>Income over/(under) expenses</i>	59,048.31		(29,825.84)	
<i>Total Fund Balance before adjustment.</i>	837,368.68		805,666.46	
<i>Adjusting entries</i>				
<i>Unrealized gain/(loss) on exchange rate for Retained Earning</i>	(1,876.38)		4,798.83	
<i>Tax payable</i>	-		-	
Year-end Balance	835,492.30		810,465.29	
<i>Adjustment to reflect actual cash inflow/outflow):</i>				
<i>Account payable</i>	240.75		-	
<i>Other Fund (outstanding balanced)</i> <small>BGR (USD 28,475.15) KIGAM Unconventional Oil & Gas Project (USD 86,440.23) KIGAM Groundwater Meeting (USD 5,089.26) Taiwan-US IEP Grant/ Taiwan R.O.C (USD -4,349.12)</small>	131,377.88		115,655.52	
<i>Office equipment (net)</i>	(31,468.88)		(18,495.86)	
<i>Advance</i>	(864.75)		(33.41)	
<i>Account Receivable</i>	-		(17.38)	
<i>Tax deductible</i>	1,269.49		1,397.74	
Year-end Cash Balance	936,046.79		908,971.90	

Table 4: Project Financial Statement: CCOP-CCS-M Fund for year ended 30 September 2016 (amount in US Dollars)

DESCRIPTION	CCS-M FUND 2013 (USD)	CCS-M FUND 2014 (USD)	CCS-M FUND 2015 (USD)	CCS-M FUND 2016 (USD)
Fund Balance	-	860,078.07	481,894.92	177,490.55
Income :				
<i>Received from Fund</i>	287,523.00	165,209.16	-	-
<i>Received from RNE-Jakarta</i>	868,391.40	-	-	-
<i>Others</i>	(3,023.10)	(439.77)	(2,896.78)	126.68
Total Income	1,152,891.30	164,769.39	(2,896.78)	126.68
Expenditures :				
<i>Technical Activities Expenses</i>	294,857.71	543,586.28	301,044.54	151,150.72
Total Expenditure	294,857.71	543,586.28	301,044.54	151,150.72
<i>Income over/(under) expenses</i>	858,033.59	(378,816.89)	(303,941.32)	(151,024.04)
<i>Adjusting entries :</i>	-	-	-	-
<i>Unrealized gain/(loss) on exchange rate for Retained Earning</i>	2,044.48	633.74	(463.05)	641.85
Year-end Balance	860,078.07	481,894.92	177,490.55	27,108.36
<i>Adjustment to reflect actual cash inflow/ (outflow):</i>	-	-	-	-
<i>Tax deductible</i>	-	22.57	-	-
<i>Advance</i>	(5,261.56)	(10,002.19)	-	-
Year-end Cash Balance	854,816.51	471,915.30	177,490.55	27,108.36

Fund Balance as of September 30, 2016, the remaining amount of USD 27,108.36 was transferred to the Royal Norwegian Embassy in Jakarta on November 22, 2016.

LIST OF CONTACTS

CCOP STEERING COMMITTEE

MEMBER COUNTRIES PERMANENT REPRESENTATIVES (14)

The Steering Committee is a policy making body of CCOP, which shall establish policies and principles for CCOP activities, approve work plan, budget, accounts for each year, new programme proposals, establish subsidiary bodies, appoint the Director, receive and consider the reports of Director on the functions delegated to him.

CAMBODIA:

H.E. Mr. Cheap Sour

Permanent Representative of Cambodia to CCOP
Director-General
General Department of Petroleum
Ministry of Mines and Energy
#13-14 Russian Confederation Blvd.
Khan Dangkor, P.O. Box 1442
Phnom Penh, Cambodia

CHINA:

Dr. Li Jinfa

Permanent Representative of China to CCOP
Vice-President
China Geological Survey (CGS)
45 Fuwai Street, Xicheng District
Beijing 100037
People's Republic of China

INDONESIA:

Dr. Ego Syahril

Permanent Representative of Indonesia to CCOP
Head, Geological Agency
Ministry of Energy and Mineral Resources (MEMR)
Jl. Diponegoro No. 57, Bandung
40122 West Java, Indonesia

JAPAN:

Dr. Eikichi Tsukuda

Permanent Representative of Japan to CCOP
Director-General
Geological Survey of Japan
National Institute of Advanced Industrial Science and Technology
Higashi 1-1-1, AIST Central 7
Tsukuba Ibaraki 305-8567, Japan

KOREA:

Dr. Joong-Ho Synn

Permanent Representative of Republic of Korea to CCOP
President, Korea Institute of Geoscience and Mineral Resources (KIGAM)
124, Gwahak-ro Yuseong-gu,
Daejeon, 34132, Republic of Korea

LAO PDR:

Mr. Boualay Saatsy

Permanent Representative of Lao PDR to CCOP
Acting Director-General
Department of Geology and Minerals
Ministry of Energy and Mines
Khounboulom Road, Vientiane
Lao PDR

MALAYSIA:

Mr. Mior Sallehuddin Mior Jadid

Permanent Representative of Malaysia to CCOP
Director General
Mineral and Geoscience Department
20th Floor, Bangunan Tabung Haji
Jalan Tun Razak
50658 Kuala Lumpur, Malaysia

MYANMAR:

Dr. Ye Myint Swe

Director General
Department of Geological Survey and Mineral Exploration
Ministry of Natural Resources and Environmental Conservation
Nay Pyi Taw
Republic of the Union of Myanmar

PAPUA NEW GUINEA:

Mr. Shadrach Himata

Permanent Representative of Papua New Guinea to CCOP
Secretary
Department of Mineral Policy and Geohazards Management
Private Mail Bag, Port Moresby Post Office, National Capital District
Papua New Guinea

THE PHILIPPINES:

Engr. Mario Luis J. Jacinto

Permanent Representative of The Philippines to CCOP
Director, Mines & Geosciences Bureau (MGB)
Undersecretary, Department of Environment and Natural Resources (DENR)
North Avenue, Diliman, Quezon City
1600 Republic of the Philippines

SINGAPORE:

Prof. Charles Martin Rubin

Permanent Representative of Singapore to CCOP
Chair, Asian School of the Environment Earth Observatory of Singapore (EOS)
Nanyang Technological University
50 Nanyang Avenue, Block N2-01a-15, Singapore 639798

THAILAND:

Dr. Tawsaporn Nuchanong

Permanent Representative of Thailand to CCOP
Director-General, Department of Mineral Resources (DMR)
75/10, Rama VI Road, Ratchathewee
Bangkok 10400, Thailand

TIMOR-LESTE:

Mr. Helio Casimiro Guttereres

Permanent Representative of Timor-Leste to CCOP
President
Institute of Petroleum and Geology – Public Institute (IPG-IP)
Ministry of Petroleum and Mineral Resources
Rua Jacinto Candido Bairo Central

VIETNAM:

Mr. Do Nam Thang

Permanent Representative of Vietnam to CCOP
Vice-Director, International Cooperation Department
Ministry of Mineral Resources and Environment (MONRE)
No. 10, Ton That Thuyet Street, Cau Giay District, Hanoi, Vietnam

CCOP COOPERATING COUNTRIES AND REPRESENTATIVES (14)

AUSTRALIA:

Dr. Stuart Minchin

Representative of Australia to CCOP
Chief, Environmental Geoscience
Division
Geoscience Australia
G.P.O. Box 378, Canberra 2601
Australia

BELGIUM:

Prof. Dr. Ir. Léon Dejonghe

Representative of Belgium to CCOP
Geologist Director
International Cooperation
Geological Survey of Belgium
Royal Belgian Institute of Natural
Sciences
13 Jenner Street, B-1000 Brussels
Belgium

CANADA:

Dr. Philip R. Hill

Representative of Canada to CCOP
Director, Geological Survey of
Canada - Pacific
Natural Resources Canada
9860 West Saanich Road, P.O. Box
6000 Sidney, B.C., V8L 4B2, Canada

DENMARK:

Mr. Ioannis Abatzis

Representative of Denmark to
CCOP
Vice-Chairperson, CCOP Advisory
Group
Senior Geophysical Adviser
Department of Geophysics
Geological Survey of Denmark and
Greenland (GEUS)
Øster Voldgade 10, DK-1350
Copenhagen K, Denmark

FINLAND:

Dr. Philipp Schmidt-Thomé

Representative of Finland to CCOP
Head of International Cooperation.
Geological Survey of Finland (GTK)
P.O. Box 96, FI-02151 Espoo
FINLAND

FRANCE:

Mr. Jean Claude Guillaneau

Representative of France to CCOP
Director, Georesources Division
Bureau de Recherches Géologiques
et Minière (BRGM)
3 avenue C. Guillemin - BP 36009
45060 Orléans Cedex 2
France

GERMANY:

Dr. Arne Hoffmann-Rothe

Representative of Germany to CCOP
International Cooperation
Bundesanstalt für
Geowissenschaften und Rohstoffe
(BGR)
Federal Institute for Geosciences and
Natural Resources
Germany

THE NETHERLANDS:

Mr. Cornelis A. Bons

Representative of The Netherlands
to CCOP
Specialist Advisor, Southeast Asia
Deltares
Boussinesqweg 1, 2623 HV Delft;
P.O. Box 177, 2600 MH Delft
The Netherlands

NORWAY:

Mr. Gunnar V. Soiland

Representative of Norway to
CCOP
Project Director
Norwegian Petroleum Directorate
(NPD)
Prof. Olav Hanssensvei 10, P.O. Box
600, N-4003 Stavanger, Norway

POLAND:

Dr. Witold Szczucinski

Representative of Poland to CCOP
Professor, UAM
Institute of Geology
Adam Mickiewicz University in
Poznan
Makow Polnych 16
61-606 Poznan, Poland

RUSSIAN FEDERATION:

Dr. Elena A. Konstantinovskaia

Representative of Russian
Federation to CCOP
Senior Researcher
Geological Institute
Russian Academy of Sciences
7, Pyzhevsky per., 119017 Moscow
Russian Federation

SWEDEN:

Dr. Las Persson

Representative of Sweden to CCOP
Director
Geological Survey of Sweden (SGU)
P.O. Box 670, SE-75128
Uppsala, Sweden

UNITED KINGDOM:

Dr. Mike Patterson

Representative of the U.K. to CCOP
Chief Operating Officer
British Geological Survey (BGS)
Keyworth, Nottingham, NG12 5GG
United Kingdom

UNITED STATES OF AMERICA:

Dr. Jack H. Medlin

Representative of U.S.A. to CCOP
Chief, Asian and Pacific Programs
Office of International Geology
U.S. Geological Survey (USGS)
MS-954 National Center
12201 Sunrise Valley Drive
Reston, Virginia, 20192
U.S.A.

CCOP COOPERATING ORGANIZATIONS AND REPRESENTATIVES (15)

ASCOPE:

Mr. Nopporn Chuchinda
Secretary-in-Charge, ASCOPE
ASEAN Council on Petroleum
PTT Public Company Limited (Head
office)
20th floor, Building 1
555 Vibhavadi Rangsit Road,
Chatuchak
Bangkok 10900 Thailand

CIFEG:

Mr. Max Vidal
President
International Center for Training
and Exchanges in the Geosciences
(CIFEG)
3, Avenue Claude Guillemin, B.P.
6517, 45065 Orléans Cedex 2,
France

CPC:

Mr. Gary Greene
President, Circum Pacific Council
Center for Habitat Studies
Moss Landing Marine Labs
8272 Moss Landing Road, Moss
Landing, CA 95039
USA

EURO-GEOSURVEYS:

Mr. Luca Demicheli
Secretary-General, EuroGeoSurveys
The Geological Surveys of Europe
36-38, Rue Joseph II
1000 Brussels, Belgium

GETECH:

Dr. J. Derek Fairhead
President & Founder of GETECH
Prof. of Applied Geophysics
Geophysical Exploration
Technology (GETECH)
Kitson House, Elmete Hall
Elmete Lane, Roundhay
Leeds, LS8 2LJ, United Kingdom

IOC:

Dr. Vladimir Ryabinin
Executive Secretary
Intergovernmental Oceanographic
Commission (IOC) of UNESCO
1, rue Miollis, 75732 Paris CEDEX
15, France

IOMAC:

Dr. Hiran W. Jayawardene
Secretary-General
Indian Ocean Marine Affairs
Cooperation (IOMAC)
Suite 4-212, Bandaranaike Memorial
International Conference Hall
(B.M.I.C.H.), Baudhaloka Mawatha
Colombo 7, Sri Lanka

IUGS:

Prof. Dong Shuwen
IUGS Secretariat
International Union of Geological
Sciences (IUGS)
Chinese Academy of Geological
Sciences
No. 26, Baiwanzhuang Road
Xicheng District
Beijing 100037
CHINA

PETRAD:

Mr. Bengt Hope
Managing Director
PETRAD - International Programme
for Petroleum Management and
Administration
Prof. Olav Hanssens vei 10
P.O. Box 598, NO-4003 Stavanger
Norway

SPC:

Prof. Michael G Petterson
Director
Geosciences Division
Secretariat of the Pacific Community
Private Mail Bag, 241 Mead Road
Nabua, Suva, Fiji Islands

UN-ESCAP:

Dr. Shamsad Akhtar
Executive Secretary
UN-ESCAP, United Nations Building
Rajdamnern Nok Avenue
Bangkok 10200, Thailand

UNEP:

Dr. Isabelle Louis
Acting Regional Director and
Representative
Regional Office for Asia and the
Pacific
United Nations Environment
Programme (UNEP)
2nd Fl., Block A
United Nations Building
Rajdamnern Nok Avenue
Bangkok 10200, Thailand

UNESCO:

Dr. Giuseppe Arduino
Programme Specialist
Division of Water Sciences
International Hydrological
Programme (HP)
UNESCO, Paris, France

UKM

Dr. Ibrahim Komoo
Chair, SEADPRI
Southeast Asia Disaster Prevention
Research Institute (SEADPRI)
Universiti Kebangsaan Malaysia
(UKM)
Selangor, Malaysia

THE WORLD BANK:

Mr. Gotthard Walser
Senior Mining Specialist
Industry and Mining Division
Finance and Private Sector
Development
The World Bank Group
1818 H. Street, N.W., Washington
DC 20433, U.S.A.

CCOP HONORARY ADVISERS

CHINA:

Prof. He Qixiang

Honorary Adviser to CCOP
Qingdao Institute of Marine Geology
62 Fuzhou Road, Qingdao, 266071
People's Republic of China

Mr. Wang Daxiong

Honorary Adviser to CCOP

Mr. Wang Xionglin

Honorary Adviser to CCOP

Prof. Dr. HE Qingcheng

Honorary Adviser to CCOP
Deputy Director-General
Center for Deep Earth Exploration of
CGS
Director, IUGS Secretariat
Chinese Academy of Geological
Sciences
26 Baiwanzhuang Road, Xicheng
District
Beijing 100037, China

GERMANY:

Ms. Franca Schwarz

Chairperson, Advisory Group
Head of Sub-Department
International Cooperation
Bundesanstalt für
Geowissenschaften und Rohstoffe
(BGR)
Federal Institute for Geosciences and
Natural Resources
Stilleweg 2, Post Box 510153,
D-30655 Hannover, Germany

INDONESIA:

Prof. Dr. Adjat Sudradijat

Honorary Advisor to CCOP
Professor Emeritus
Padjadjaran University, Bandung
Director, Galeripadi Scientific Book
Publishing House
Bandung, INDONESIA

Dr. Sukyar

Honorary Adviser to CCOP
President Director,
Mining Private Companies
Republic of Indonesia

JAPAN:

Dr. Yoshihiko Shimazaki

Honorary Adviser to CCOP
3-2-36 Nishiazabu, Minato-ku Tokyo
106-0031, Japan

Dr. Hirokazu Kato

Honorary Adviser to CCOP
Emeritus Researcher
National Institute of Advanced
Industrial Science and Technology
Higashi 1-1-1, AIST Central 7,
Tsukuba, Ibaraki 305-8567, Japan

KOREA:

Dr. Hee Young Chun

Honorary Adviser to CCOP
Emeritus Researcher, KIGAM
914-1602 Treefull City
Sangdae-Dong, Youseong-Gu
Daejeon, Republic of Korea

MALAYSIA:

Mr. Fateh Chand

Honorary Adviser to CCOP
Academy of Sciences Malaysia
902-4, Jalan Tun Ismail
50480 Kuala Lumpur, Malaysia

Mr. Chen Shick Pei

Honorary Adviser to CCOP
Sarawak Energy Berhad Group of
Companies (SEB)
Kuching Sarawak, Malaysia

Dato Yunus Abdul Razak

Honorary Adviser to CCOP
Associate Fellow, SEADPRI-UKM,
Universiti Kebangsaan Malaysia
(UKM)
Chairman, Board of Geologists
Malaysia
D'Villa 10, Jalan Sunway 5/7,
Bandar Sunway, 43500
Semenyih, Malaysia

NORWAY:

Dr. Øystein Berg

Honorary Adviser to CCOP
Vaganesveien 16,
4052 Royneberg, Norway

THE PHILIPPINES:

Dr. Guillermo R. Balce

Honorary Adviser to CCOP
Consultant for Energy and Mining,
San Miguel Corporation
153 EDSA, Mandaluyong City
Metro Manila, Philippines

THE NETHERLANDS:

Dr. E. Oele

Honorary Adviser to CCOP
Kagerdreef 188
2172 HR Sassenheim
The Netherlands

Dr. Henk J.W.G. Schalke

Honorary Adviser to CCOP
Lijtweg 13
2341 HA Oegstgeest.
The Netherlands

Dr. Jos de Sonnevile

Honorary Adviser to CCOP
Director, Waterwys
Deltares/TNO
Sijzenlaan 44, The Hague,
The Netherland 2566WJ

THAILAND:

Mr. Sermsakdi Kulvanich

Honorary Adviser to CCOP
Sermsakdi K. Co., Ltd.
76 Petkasem Road, Tambon
Noppring
Moo 4, Amphoe Muang
Phang-Nga 82000, Thailand

Mr. Somsak Potisat

Honorary Adviser to CCOP
125 /350 Magmai
Soi 3/2, Ramintra 103/3 Rd.
Kannayao District
Bangkok 10230, Thailand

Dr. Prinya Nutalaya

Technical Adviser to CCOP
473, Soi Utane 12, Sri Nakorn
Pattana
Navamintr Road, Bung Khum
Bangkok 10240, Thailand

UNITED KINGDOM:

Dr. Anthony Reedman

Honorary Adviser to CCOP
15 Malvern Road, Mapperley
Nottingham NG3 5GZ
United Kingdom

U.S.A.:

Dr. Maurice J. Terman

Honorary Adviser to CCOP
Scientist Emeritus
U.S. Geological Survey
917 National Center, Reston
VA 20192, U.S.A.

Dr. David B. Prior

Honorary Adviser to CCOP
Executive Vice President and Provost
Emeritus
Dean of Geosciences Emeritus
Texas A&M University
18310 Cantle Court
College Station
Texas, 77845

ABBREVIATIONS

Below are the meaning of the abbreviations used in the context of this report.

AAPG – American Association of Petroleum Geologists
ADB – Asian Development Bank
ADG – ASCOPE Decommissioning Guideline
AEC – Asean Economics Community
AIST – National Institute of Advanced Industrial Science and Technology, Japan
AMD – Acid Mine Drainage
ANCST – Asian Network on Climate Science and Technology
ARI – Advance Resources, Inc. USA
ASCOPE – ASEAN Council on Petroleum
ASEAN – Association of Southeast Asian Nations
BGR – Federal Institute for Geosciences and Natural Resources, Germany
BGS – British Geological Survey
BMZ – Federal Ministry for Economic Cooperation and Development, Germany
CC – Cooperating Country
CCCO – Climate Change Coordination Office
CCOPTS – CCOP Technical Secretariat
CCS – Carbon Capture and Storage
CCS-M – Carbon Capture and Storage-Mapping
CCS-M M – Carbon Capture and Storage-Mapping Meeting
CCS-M S – Carbon Capture and Storage-Mapping Workshop
CCS-M T – Carbon Capture and Storage-Mapping Training
CCUS – Carbon Capture, Utilisation and Storage
CEWAFO – Centre for Water Resources Warning and Forecasting, Vietnam
CGS – China Geological Survey
CIFEG – International Center for Training and Exchanges in the Geosciences
CMU – Chiang Mai University, Thailand
CO – Cooperating Organisation
CO₂ – Carbon Dioxide
COP – Conference of Parties
CPC – Circum Pacific Council
DGOF – Depleted Gas and Oil Field
DGR – Department of Groundwater Resources, Thailand
DMR – Department of Mineral Resources, Thailand
EAGER – East Asia Geoscience and Environmental Research
ECF – Energy China Forum, China
EGS – EuroGeoSurveys
EIA – Energy Information Agency, USA
EMIW – Electromagnetic Induction Workshop
EOR – Enhanced oil recovery
ESCAP – Economic and Social Commission for Asia and the Pacific
GA – Geological Agency of Indonesia
GCCSI – Global CCS Institute
GDMR – General Department of Mineral Resources, Cambodia
GECC – Global Energy Cooperation Center, Republic of Korea
GETECH – Geophysical Exploration Technology
GEUS – Geological Survey of Denmark and Greenland
GHG – Greenhouse Gas
GIS – Geographic Information System
GIST- Gwangju Institute of Science and Technology, China
GIZ – German Development Agency (Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH)
GMGS – Guangzhou Marine Geological Survey, China
GNSS – Global Navigation Satellite System
GSC – Geological Survey of Canada
GSHP – Ground Source Heat Pump
GSi – Geoinformation Sharing Infrastructure
GSJ – Geological Survey of Japan
GTC-K – Green Technology Center, Republic of Korea

GTK – Geological Survey of Finland
HUNRE – Hanoi University of Natural Resources and Environment, Vietnam
IGPVN – Improvement of Groundwater Protection, Vietnam
IGRAC – International Groundwater Resources Assessment Centre
IHEG – Institute of Hydrogeology and Environmental Geology, China
IKG – Institute of Karst Geology, China
INDC – Intended Nationally Determined Contributions
IOC – Intergovernmental Oceanographic Commission
IOMAC – Indian Ocean Marine Affairs Cooperation
IPCC – Intergovernmental Panel on Climate Change
ISGeo – International School for Geoscience Resources, Republic of Korea
IUGS – International Union of Geological Sciences
IWMI – International Water Management Institute
KIER – Korea Institute of Energy Research
KIGAM – Korea Institute of Geoscience and Mineral Resources
KKU – Khon Kaen University, Thailand
KSEG – Korean Society of Engineering Geology
KTCC – Korean-Thai Chamber of Commerce
MC – Member Country
MIT – Massachusetts Institute of Technology, USA
MLR – Ministry of Land and Resources, China
MME – Ministry of Mines and Energy, Cambodia
MOA – Memorandum of Agreement
MOFA – Ministry of Foreign Affairs, Republic of Korea
MOM – Minutes of Meeting
MONRE – Ministry of Natural Resources and Environment of Vietnam
MOU – Memorandum of Understanding
MRC – Mekong River Committee
MUKA – Mahidol University at Kanchanaburi, Thailand
NAWAPI – National Center for Water Resources Planning and Investigation, Vietnam
PCC – Precipitated Calcium Carbonate
PETRAD – Petroleum Management and Administration, Norway
PETRONAS – Petroliaam Nasional Berhad (Malaysian National Oil Company Inc.)
PNG – Papua New Guinea
PPC – Provincial People's Committee, Vietnam
QIMG – Qingdao Institute of Marine Geology, China
RNE – Royal Norwegian Embassy
RS – Remote Sensing
SEADPRI – Southeast Asia Disaster Prevention Research Initiative, Malaysia
SIHYMECC – Sub-Institute of Hydro-Meteorology and Climate Change, Vietnam
SPC – Pacific Community in the Pacific Islands and Territories
TNI – Tectonics of Northwestern Indochina
TOC – Total Organic Content
UC – Unconventional Oil & Gas Project
UC-M – Unconventional Oil & Gas Project-Mapping
UCM – Unconventional Oil & Gas Project Meeting
UKM – Universiti Kebangsaan Malaysia
UN – United Nations
UNEP – United Nations Environment Programme
UNESCO – United Nations Educational, Scientific and Cultural Organization
UNESCO-BGK – UNESCO Bangkok
UQAT – Université du Québec en Abitibi-Témiscamingue, Canada
USGS – United States Geological Survey
VACI – Vietnam Water Cooperation Initiative



CCOP Annual Report 2016