Current Status of Technical and Training offered for raw materials professionals in geology and mining engineering in East and Southeast Asia.

Dhiti TULYATID, Ph.D.
Regional Expert
Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP)
Email: dr.dhiti@ccop.or.th, dr.dhiti@gmail.com;
Website: www.ccop.or.th
The Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP) Intermin Madrid Meeting 2019

Outline

◆ CCOP – the Organization
◆ Current Status on Mineral Resources in E & SE ASIA region
◆ Summary of Geological and Mining School/University information in E-SE ASIA
◆ Training Courses Related to Geology & Mineral Exploration
◆ Summary & Way Forward
WHAT IS CCOP?

CCOP: Coordinating Committee for Geoscience Programmes in East & Southeast Asia

VISION
A Premier Intergovernmental Earth Science organization in E & SE Asia

MISSION
To contribute significantly to the economic development and sustainable management of the environment and improvement of the quality of life of its MCs by the application of Earth science knowledge.
1. Cambodia  
2. China  
3. Indonesia  
4. Japan  
5. Republic of Korea
6. Lao PDR  
7. Malaysia  
8. Mongolia  
9. Myanmar  
10. Papua New Guinea
11. The Philippines  
12. Singapore  
13. Thailand  
14. Timor-Leste  
15. Vietnam

1. Australia  
2. Belgium  
3. Canada  
4. Denmark  
5. France  
6. Germany  
7. The Netherlands  
8. Norway  
9. Poland  
10. Russian  
11. Sweden  
12. Switzerland  
13. United Kingdom  
14. U.S.A.

1. ASCOPE  
2. CIFEG  
3. CPC  
4. EUROGEOSURVEYS  
5. GETECH  
6. IOC  
7. IOMAC  
8. IUGS  
9. PETRAD  
10. UKM  
11. UN-ESCAP  
12. UNEP  
13. UNESCO  
14. THE WORLD BANK  
15. SOPAC
Current Status on Mineral Resources in East & Southeast Asia Region.
CCOP’s Book Project.

Nine countries share their experiences:
1. Indonesia
2. Japan
3. Republic of Korea
4. Lao PDR
5. Malaysia
6. Myanmar
7. Papua New Guinea
8. The Philippines
9. Thailand

(Note: Only selected cases are presented)

**Japan:**
There were 5,000 mines in Japan. Presently, there are 3 metallic & 1276 non-metallic mines (2016)
Production of major metals include Au, Cu, Pb & Zn.
There are three laws related to rehabilitation:
- Water Pollution Prevention Act (1971),
- Mine Pollution Prevention Act (1973)
- Basic Environment Law (1993)

Closed mines where the rehabilitation and drainage treatment are being carried out under the "METI's rehabilitation project in 2013-2022 (reproduced from JOGMEC (2013)). A pink dot indicates a mine that has a responsible owner (61 mines), while a cyan dot is a mine for which a responsible owner does not exist now (36 mines).
Japan:
- The Matsuo Mine (sulfur) is located on an eastern flank of Hachimantai Volcano, Iwate Prefecture, northern Japan.
- The mine started in 1914 & ended in 1971.
- Size 1500m x 1500m x 25-150m depth.
- Polluted by Acid Mine Drainage (AMD).

A. In 1974, Matsukawa River was badly polluted;
B. In 2010, significantly improved water quality in Matsukawa River
C. Kitakami River in Morioka City, 15 km downstream of A & B.
Republic of Korea:

- Important laws: Korea Coal Act (1950); Korea Mineral Resources Act (1967);
- Major mineral productions: Au, Ag, Pb, Zn, Fe, Ti, talc, pyrophyllite, feldspar, clays, limestone, silica (stone & sand), diatomite, serpentine, mica & zeolite.

South Korea’s Mining Activity by Provinces (Cited Source: KIGAM Korea Mineral Information 2016). (http://www.kigam.re.kr)

http://www.khoa.go.kr/kcom/cnt/selectContentsPage.do?cntId=51207220
Republic of Korea:

**Gangwon Province**, A successful cases for saving dead (coal) mining towns in Korea through five strategies:

1. Legal plans based on the Special Act on Balanced National Development;
2. Emphasize competitive regions that can respond to globalization;
3. Pursue specialized local development based on local features;
4. Pursue co-development through cooperation and win-win between regions;
5. Convert to local-initiated developmental systems through decentralization and self-government.

**Gangwon Province uses TOURISM to save the dying town.**

1. Hosting the Winter Olympic Games
2. Developing an Attractive Tour Spots with the Casino Business; and
3. Re-modelling the Actual Mining Sites as Mining Museums.

([http://eng.gwd.go.kr/gw/eng](http://eng.gwd.go.kr/gw/eng), [http://eng.gwd.go.kr/gw/eng/sub04_04_02](http://eng.gwd.go.kr/gw/eng/sub04_04_02))
Republic of Korea:

Gangwon Province uses TOURISM to save the dying town.

(1) Hosting the Winter Olympic Games
(2) Developing an Attractive Tour Spots with the Casino Business;

Kangwonland, a versatile entertainment resort for skiing, golfing, casino, etc.
(http://kangwonland.high1.com/eng/aboutKangwonland/html.high1)
Republic of Korea:

Gangwon Province uses TOURISM to save the dying town.

(3) Re-modelling the Actual Mining Sites as Mining Museums.

“Educational Experience for the Juniors, Nostalgic Memories for the Seniors”

A Time Capsule to 1960s~1970s in Mining Town (Replica Set)

Mining Tunnel Open to Tourists.

Experiencing Mine workers in Tunnel

Replica of 1970s Mining Sites
Republic of Korea:
Gwangmyeong Cave Theme Park: A reborn from a polluted mining region to a cave theme park in Korea.
The Gwangmyeong Cave opened to the public in August 2011 was once Siheung Mine established in 1912.
One of the top 100 “must see” sites in Korea with two million tourists per year.
Lao PDR: (two cases: Phu Kham & Sepon)

- Phu Kham Copper-Gold operation, Phu Bia Mining (approximately 140 km N-NE of Vientiane). It is an open-pit mine feeding ore to a conventionally milling and flotation operation which produces a copper and precious metals concentrate.
- Mining operations commenced in 2008 with an estimated mine life of 14 years.
- PBM has a Mineral Exploration and Production Agreement (MEPA) with the Government of Laos.

Geological map of Lao PDR showing major geological units and fold belts of the country.
Lao PDR:

- The country still lacks of local regulations on mine rehabilitation and decommissioning.
- A lack of local regulations was not a significant hindrance to the development of leading practice mine closure planning.
- The identification and application of international mine closure guidelines and standards can provide a framework for advising existing mine closure planning and directing future planning, through a systematic understanding of knowledge gaps and closure risks.
Malaysia:

- Types of top minerals: gold, iron ore, copper-ores & concentration bauxite, manganese, tin-in-concentrates, aggregates, sand & gravel, limestone, earth materials & silica sand.

- **126 mines** throughout the country (JMG, 2016): tin mines (18), bauxite (3), iron (41), kaolin (19), gold (12), silica sand (8), coal (8), manganese (10), mica (2) and feldspar (5).

- The top three mineral commodities exported were **Iron ores** (USD 819.3 million), **Bauxite** (USD 151.7 million) and **Copper** ores & concentrates (USD 52.92 million)

- **5,029 workers**, of which, 1,405 people worked in tin mining, 1,357 people in gold mining & 776 people in iron mining

Two case studies:

- 1. Selinsing Gold Mine Manager Sdn Bhd. (SGMM)
- 2. J Resources Sdn Bhd
Myanmar: Myanmar produces: natural gas, petroleum, coal, copper, precious and semi-precious gemstones, tin, tungsten and zinc.
The Philippines:

Coral Bay Nickel Corp.
Rio Tuba Nickel Mining Corp.
Thailand:

Reclamation includes maintenance activities of the recreation areas to keep the place clean and attractive all the time.

Related laws:
- Environment Law
- Forestry Laws
- National Mineral Policy
Summary of Geological and Mining School/University information in E & SE ASIA

Criteria, approach & findings

In our study, we’ve considered the following criteria:

- QS RANKING, THE RANKING, Webometrics and URAP, The ranking websites are the first tool used in the selection of universities that provide geological and mining course.
- In our study, we’ve found that most of the geological courses of undergraduate programs cover mainly on the fundamental information.
- We’ve considered only the training programs that are related to mineral exploration.
- Samples: Countries within East and Southeast Asia Region (except PR China).
<table>
<thead>
<tr>
<th>Country</th>
<th>Area Sq.Km²</th>
<th>Population (Million)</th>
<th>Population Density (person/KM²)</th>
<th>No. of Universities that teach Geology</th>
<th>No. of Universities that teach Mining engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
<td>513,210</td>
<td>69.04</td>
<td>135</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Cambodia</td>
<td>181,035</td>
<td>16.01</td>
<td>89</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1,905,000</td>
<td>264.00</td>
<td>139</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Japan</td>
<td>377,972</td>
<td>126.80</td>
<td>336</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>Laos PDR</td>
<td>236,800</td>
<td>6.86</td>
<td>29</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Myanmar</td>
<td>676,575</td>
<td>53.37</td>
<td>79</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Malaysia</td>
<td>330,803</td>
<td>31.62</td>
<td>96</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>The Philippines</td>
<td>300,000</td>
<td>104.90</td>
<td>350</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Papua new guinea</td>
<td>462,840</td>
<td>8.25</td>
<td>18</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Singapore</td>
<td>722</td>
<td>5.61</td>
<td>7,770</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>100,210</td>
<td>51.47</td>
<td>514</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Chinese Taipei</td>
<td>36,193</td>
<td>23.58</td>
<td>652</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Timor-Leste</td>
<td>15,410</td>
<td>1.30</td>
<td>85</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Vietnam</td>
<td>331,210</td>
<td>95.54</td>
<td>289</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>
Charts display countries and number of universities that provide geology and mining engineering courses/programmes.
**Geology subjects list**

- **Calculus**
- **Chemistry**
- **L Biology**
- **Biology**
- **Physics**

**Computer and Programming**
- Statistic
- Drawing for Technologists
- Mechanics & Heat physics
- Wave & Optic Physics
- Numerical Analysis
- Electric and Electromagnetic Physics

**Principle of Geology**
- Physical Geology
- Earth Dynamic
- Earth Material
- Mineral and Rocks
- Geodynamics

**Additional Geological Subjects**
- Geology/Mineral Deposit of their own countries
- Geology of Southeast Asia.
- Introduction Geophysics
- Environmental Geology
- Marine Geology
- Geotectonics
- Microtectonics
- Subsurface Geology
- Ore Petrology/Optical Mineralogy
- Industrial Rock and Mineral
- Mineral Exploration
- Engineering Geology
- Coal Geology
- Quaternary Geology
- Well Loggings
- Petroleum Geology
- Hydrogeology
- Gemology
- Geotourism
- Geothermal Geology
- Volcanogeology

**Specific geological subjects**
- Soil Mechanics
- Rock Mechanics
- Engineering Geology I/II
- Groundwater Pollution Monitoring and Control
- Analytical Geochemistry
- Seismology
- Geo-electric and Electromagnetic Method
- Gravity and Magnetic Methods
- Geophysical Drill hole
- Geophysical Data Analysis
<table>
<thead>
<tr>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
</tr>
</thead>
</table>
| • Japan, Republic of Korea  
| • Most Universities that have geological and mining departments have long been established;  
| • Universities that teach Geology in Japan are more relate to Earth and planetary sciences than mineral exploration;  
| • Republic of Korea, geological school generally name as “Earth and Environmental Sciences”;  
| • Mining Engineering include Recycling engineering;  
| • The universities achieve high ranking QS RANKING, THE RANKING, Webometrics and URAP Website.  
| • These universities have high number of researchers. |
| • Thailand, Indonesia, Malaysia, The Philippines and Vietnam  
| • There are more than 5 universities have geology and mining departments;  
| • The Basic courses on geology are all similar, with some elective subjects in senior years depending on any specific purposes/needs such as engineering geology or exploration geophysics;  
| • There are majors in mining engineering and petroleum engineering.  
| • The universities are listed in QS RANKING, THE RANKING, Webometrics or URAP WEBSITE  
| • Undergraduate programmes are usually provided only to students in the country. |
| • Cambodia, Lao PDR, Myanmar, Papua New Guinea, Timor-Leste  
| • There are not many universities that provide geological course and the universities that provide the programme are relatively new.  
| • The information related to the geological and mining courses are difficult to find.  
| • No list in QS RANKING, THE RANKING, Webometrics and URAP WEBSITE. |

Remark: not include Singapore and Taiwan
Training courses related to geology and mineral exploration

- Regular Training Courses
- Special project
- CCOP projects / activities
“Exploration Development and Processing of Mineral Resources” organized and supported by the KOREA INSTITUTE OF GEOSCIENCE AND MINERAL RESOURCES (KIGAM) since 2013 to recent.

Participants from Cambodia, Cameroon, Chile, Columbia, Dominican Republic, DR Congo, Ecuador, Indonesia, Kazakhstan, Lao PDR, Malaysia, Mongolia, Myanmar, Papua New Guinea, Peru, Philippines, Republic of Turkey, Sri Lanka, Tanzania, Thailand, Timor-Leste, Turkey, Uzbekistan, Vietnam, Yemen and Zambia.

Special project

WORLD BANK-FUNDED PILOT GEOLOGICAL MAPPING PROJECT IN NORTHERN LAO PDR: GEOLOGICAL SURVEY METHODOLOGY AND FIELD PRACTICES IN THE NAMBAK-NGOY STUDY AREA

This project aims:

• to produce new airborne geophysical data, geological field mapping;
• to produce new geological maps and
• to define new ore potential areas/zones/criteria and
• to train (On-the-job) six geologists from DGM on geological survey and mineral exploration.
CCOP projects / activities


Note that CCOP, working together with Member Countries, will promote the resource classification through the use of UNFC Resource Classification System.
Mining activities are still active in E and SE Asia region.
Each country has unique geological settings with different commodity.
In general, most universities keep providing the same or similar basic geology courses. Some may add new subjects to the programmes as elective subjects in response to the need of the students/communities.
Graduates will never know what they will have to work on when they get into the work market, i.e., mining companies, government offices, etc. These works require different skills and knowledge.
Way Forward

- Basic geological courses are still needed because there are still needs in the mining sector.
- Students of different countries may have the same basic geological knowledge but still need different focuses on applied geological knowledge depending on their geological setting and mineral commodity.
- New subjects or special programmes will be important to the need of the industry.
- Focused programmes may be needed to produce students to work on specific tasks or industry.
Gracias
THANK YOU FOR YOUR ATTENTION
ขอบคุณครับ
Appendix

Summary on countries, number of universities that provide programmes on Geology and Mining Engineering, and the year of establishment.
Japan

18

Geoscience School
4 years

- Kyushu University (KU)
- Akita University (AU)
- Kyoto University
- Etc. (15 Universities)

Geology
Earth and planetary Sciences

2

Mining Engineering School
4 years

- Kyushu University (KU)
- Akita University (AU)

Mining Engineer
Petroleum engineer

1939 (KU)
1897 (Kyoto)
1949 (AU)

Recent
The Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP) Intermin Madrid Meeting 2019

Republic of Korea

7
Geoscience School
4 years
- Seoul National University (SNU)
- Korea University (KU)
- Pusan National University (PNU)
- Chonbuk National University (CBNU)
- Chonnam National University (JNU)
- Chungnam National University (CNU)
- Yonsei University (YU)

2
Mining Engineering School
4 years
- Inha University
- Dong-A University

Geology
- Applied Geology
- Earth Science

Mining Engineer
Petroleum engineer

1946 (SNU) 1951 (CBNU) 1952 (CNU) 1963 (KU) 1968 (YU) 1979 (JNU)

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

Intermin Madrid Meeting 2019

Singapore

1. Geoscience School
   - 4 years
   - Nanyang Technological University, Singapore

Geology
Applied Geology

Mining Engineering School
   - 4 years

Present

1955
Chinese Taipei

- Geoscience School: 4 years
- National Taiwan University (NTU)
- National Cheng Kung University (NCKU)
- National Taiwan Normal University (NTNU)
- National Central University (NCU)
- National Taiwan Ocean University (NTOU)
- National Chung Cheng University (CCU)
- National Dong Hwa University (NDHU)

- Geology Engineering Geology
- 1952 (NTUI) 1974 (NCKU) 1968 (NCU)

- Mining Engineering School: 4 years
- National Taiwan University (NTU)
- National Cheng Kung University (NCKU)
- National Taipei University of Technology (NTUI)

- Mining Engineer Petroleum engineer
The Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP) Intermin Madrid Meeting 2019

Indonesia

- Bandung Institute of Technology (ITB)
- University of Indonesia (UI)
- Padjadjaran University (UNPAD)
- University pembangunan nasional veteran Yogyakarta (UPNVY)
- Trisakti University (Usakti)
- Medan Institute Of Technology (ITM)

Geology

- 1948 (ITB)
- 1958 (UPNVY)
- 1960 (UNSRI)
- 1965 (UNP)
- 1979 (UNISBA)

Applied Geology

- 1950 (ITB)
- 1958 (UNPAD, UPNVY)
- 1960 (UI)
- 1980 (UI)

Mining Engineering School

- 1960 (UI)
- 1979 (UNISBA)

- Bandung Institute of Technology
- Bandung Islamic University (UNISBA)
- University pembangunan nasional veteran Yogyakarta (UPNVY)
- University of Sriwijaya (UNSRI)
- Medan Institute Of Technology (ITM)
- Padang State University (UNP)

Mining Engineer

Petroleum engineer

Present
The Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP) - Interim Madrid Meeting 2019

Thailand

5 Geoscience School
4 years

- Chulalongkorn University (CU)
- Chiang Mai University (CMU)
- Khon Kaen University (KKU)
- Kasetsart University (KU)
- Mahidol University (MU)

Geology
- Applied Geology
- Earth Science

3 Mining Engineering School
4 years

- Chulalongkorn University (CU)
- Prince of Songkla University (PSU)
- Chiang Mai University (CMU)

Mining Engineer
Petroleum Engineer

- 1958 (CU)
- 1964 (CMU)
- 1984 (KKU)
- 2002 (KU)
- 2004 (MU)

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

Intermin Madrid Meeting 2019

Vietnam

5
Geoscience School
4 years

- Hanoi University of Mining and Geology (HUMG)
- Hue University of Sciences (HUE)
- Vietnam National University, Hanoi (VNU)
- Vietnam National University, Ho Chi Minh City
- Ho Chi Minh City University of Technology (HCMUT)

Geology
Applied Geology

1
Mining Engineering School
4 years

- Hanoi University of Mining and Geology (UMG)

Mining Engineer
Petroleum Engineer

1966 (UMG)
1957 (HCMUT) 1966 (HUMG) 1976 (HUE)

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

Intermin Madrid Meeting 2019

Malaysia

- Geoscience School (4 years)
  - University of Malaysia (UM)
  - Universiti Kebangsaan Malaysia (UKM)
  - Universiti Malaysia Sabah (UMS)
  - University Teknologi Petronas (UTP)

- Geology
  - Applied Geology

- Mining Engineering School (4 years)
  - Universiti Sains Malaysia (USM)

- Mining Engineer
  - Petroleum engineer

Timeline:
- 1960 (UM)
- 1975 (UKM)
- 1984 (USM)
- Present
- 1997 (UTP)
The Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP) Intermin Madrid Meeting 2019

The Philippines

3

Geoscience School
4 years

- University of the Philippines Diliman (UP)
- University of Southeastern Philippines (USEP)
- Mapúa University

1968 (AU)

Geology
Applied Geology

3

Mining Engineering School
4 years

- Adamson University (AU)
- University of the Philippines Diliman (UP)
- Mapúa University

1983 (UP)

Mining Engineer
Petroleum engineer

1983 (UP)

Present

1979 (USEP)
The Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP) Intermin Madrid Meeting 2019

Myanmar

4

- University of Yangon (UY)
- Yangon Technological University (YIT)
- East Yangon University (EYU)
- Dagon University (DU)

Geoscience School
4 years

1920 (UY) 1978 (YIT) 1993 (DU) 2000 (EYU)

Geology

Applied Geology

1

Mining Engineering School
4 years

Yangon Technological University (YIT)

Mining Engineering

Present
Cambodia

1. Geoscience School
   - 4 years
   - Institute of Technology of Cambodia

Geology
- Applied Geology

Mining Engineering School
- 4 years

Present

2011
Papua New Guinea

1. Geoscience School
   - 4 years
   - University of Papua New Guinea (UNPG)

Geology
- Applied Geology

Mining Engineering School
- 4 years

Present

1973 (UNPG)
The Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP)

The Coordinating Committee for Geoscience Programmes in East and Southeast Asia (CCOP) Intermin Madrid Meeting 2019

Timor-Leste

1 National University of East Timor

Geoscience School 4 years

Geology

Petroleum Geology

Mining Engineering School 4 years

Present

2012

National University of East Timor

Geoscience School 4 years

Geology

Petroleum Geology

Mining Engineering School 4 years

Present

2012
There is no University that provides Geological course in Lao PDR