



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

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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

CCOP

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.

As of 2 Nov 2018
Mongolia's joined CCOP

- | | | |
|----------------------|----------------------|---------------------|
| 1. Cambodia | 6. Lao PDR | 11. The Philippines |
| 2. China | 7. Malaysia | 12. Singapore |
| 3. Indonesia | 8. Mongolia | 13. Thailand |
| 4. Japan | 9. Myanmar | 14. Timor-Leste |
| 5. Republic of Korea | 10. Papua New Guinea | 15. Vietnam |

ORGANIZATION

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.

Member Countries (MC)

Cooperating Countries (CC)

Cooperating Organizations (CO)

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.

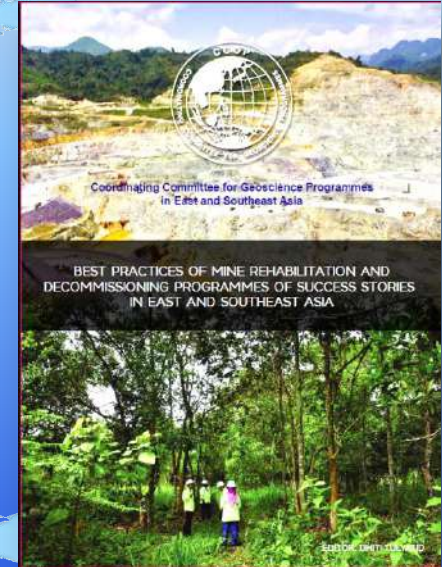
CCOP's Book Project.

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)

CCOP, 2018. Best practices of mine rehabilitation and decommissioning programmes of success stories in East and Southeast Asia. D. Tulyatid (ed.), October 2018. 188p.



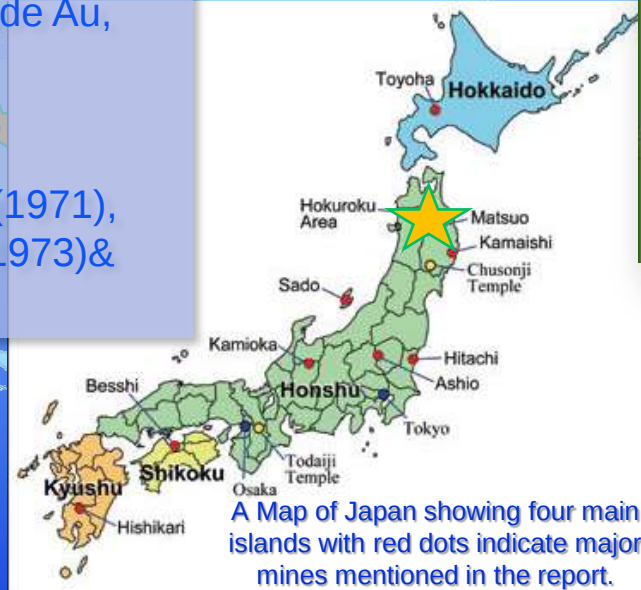
Japan:

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)



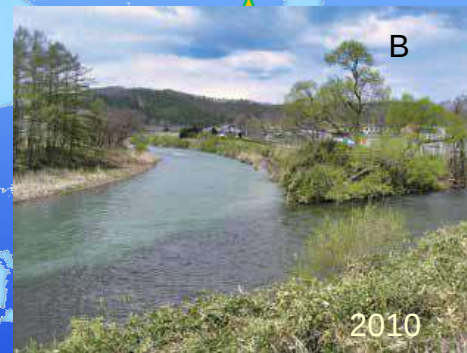
Closed mines where the rehabilitation and drainage treatment are being carried out under the *METI's rehabilitation project in 2013-2022 (reproduced from JOGMEC (2013)). A pink dot indicates a mine that has a responsible owner (61 mines), while a cyan dot is a mine for which a responsible owner does 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 of 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>)

Mining Activity by Region (Non-Fuel Minerals) 2016



<http://www.khoa.go.kr/kcom/cnt/selectContentsPage.do?cntId=51207220>

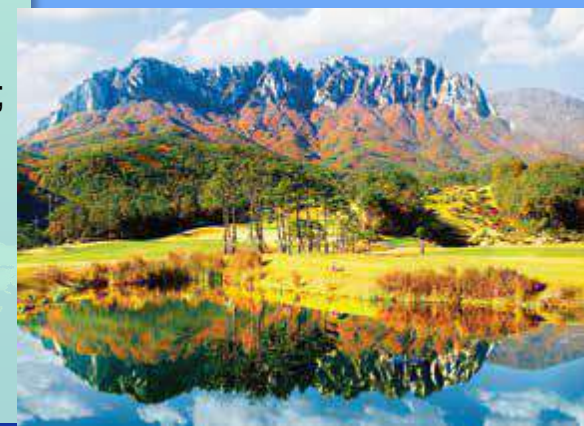
Republic of Korea:

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.

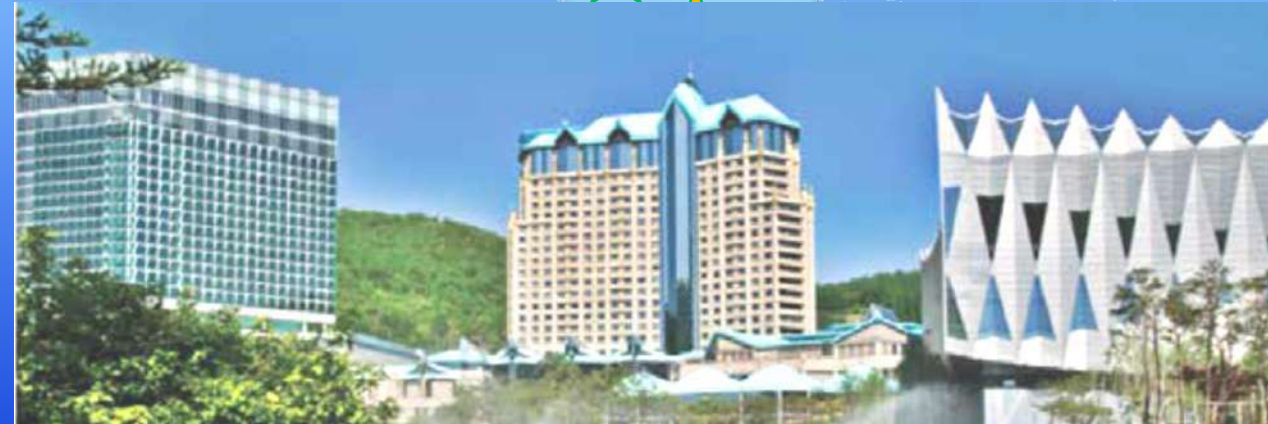
- (1) Hosting the Winter Olympic Games
- (2) Developing an Attractive Tour Spots with the Casino Business; and
- (3) Re-modelling the Actual Mining Sites as Mining Museums.



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”



Experiencing Mine workers in Tunnel



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



Mining Tunnel Open to Tourists.



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.

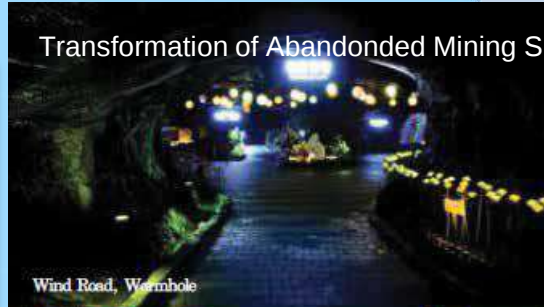
One of the top 100 “must see) sites in Korea with two million tourists per year.

Modern History Museum

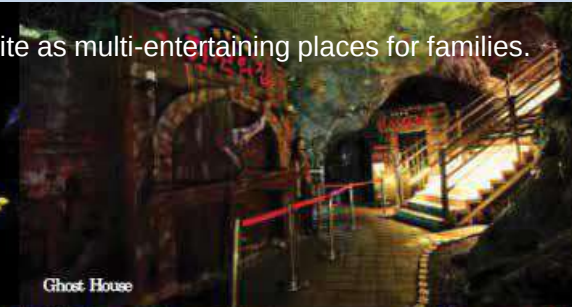


Transformation of Abandoned Mining Site as multi-entertaining places for families.

Wind Road, Wormhole



Ghost House



Cave Aqua World



Hanging a Golden Plaque



The Cave of the Light



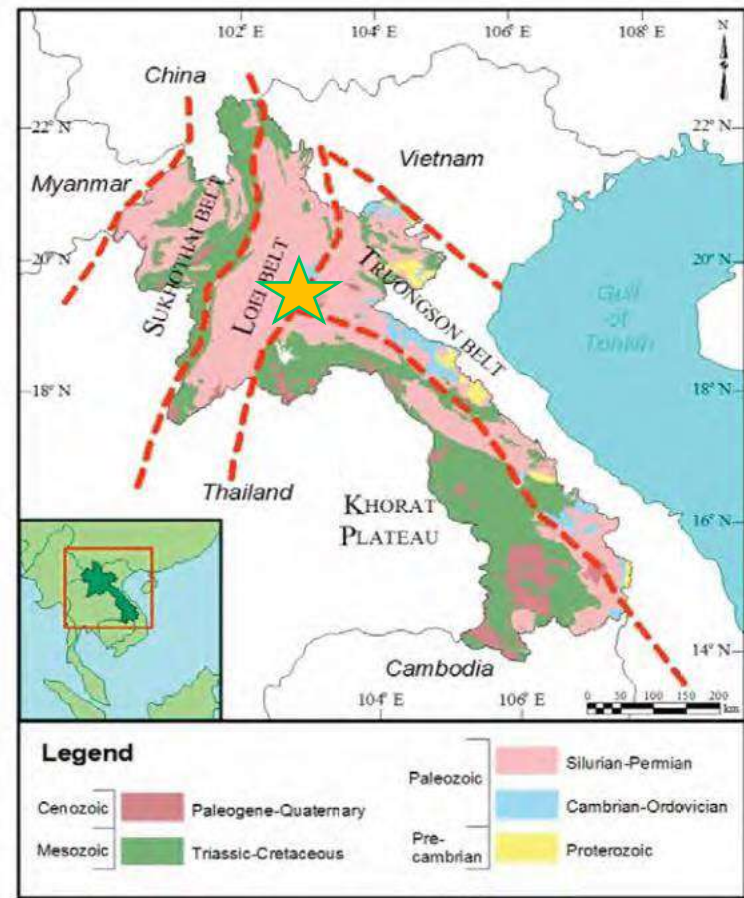
Gold Panning



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

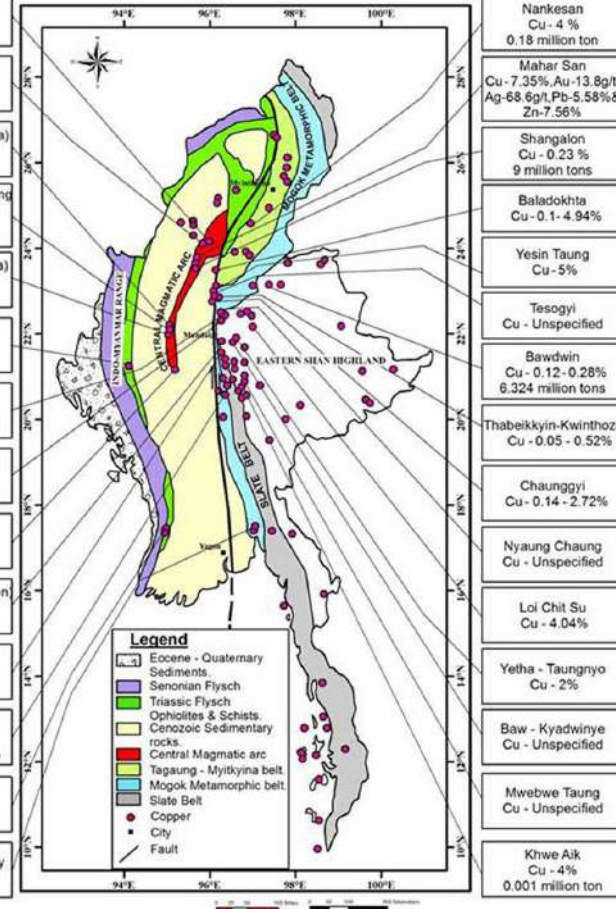


Two case studies:

- ✓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.



Photograph shows Sabetaung Open-pit, Monywa Copper Mine, Sagaing Region



The Philippines:

OPERATING MINES IN THE PHILIPPINES

50

Metallic mines

62

Non-metallic mines

Coral Bay Nickel Corp.
Rio Tuba Nickel Mining Corp.

Economic Contributions of Mining in the Philippines*

Gross Production Value

PhP176.3 B



Gross Domestic Production Contribution

PhP176.3 B (0.6%)



Export Share

\$2.137 B



Employment

219,000 (0.5%)



Taxes, Fees & Royalties from Mining

PhP 33.43 B



*As of 2017



Thailand:



Related laws:

- Minerals Act B.E. 2560 (A.D.2017)
- 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:

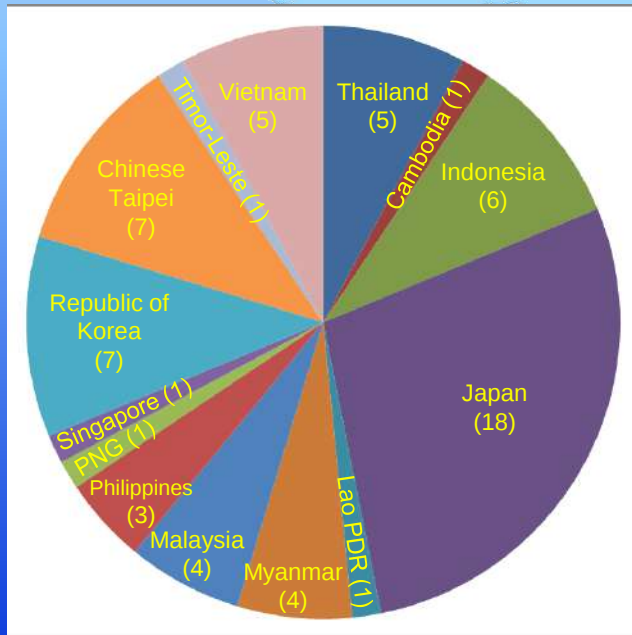
- ☐ QS RANKING, THE RANKING, Webometrics and URAP, The ranking websites are the first tool used in the selection of universities that provide geological and mining course.
- ☐ In our study, we've found that most of the geological courses of undergraduate programs cover mainly on the fundamental information.
- ☐ We've considered only the training programs that are related to mineral exploration.
- ☐ Samples: Countries within East and Southeast Asia Region (except PR China).

Countries' basic information and number of universities that provide geology and mining engineering courses/programmes.

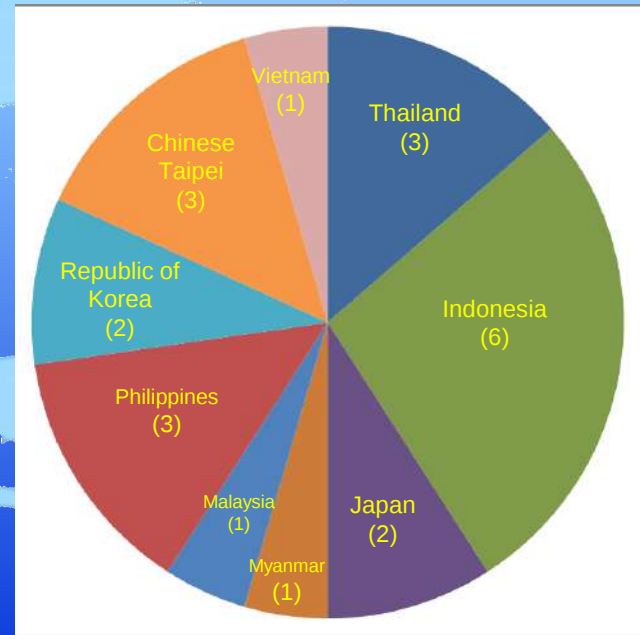
Country	Area Sq.Km²	Population (Million)	Population Density (person/KM²)	No. of Universities that teach Geology	No. of Universities that teach Mining engineering
Thailand	513,210	69.04	135	5	3
Cambodia	181,035	16.01	89	1	0
Indonesia	1,905,000	264.00	139	6	6
Japan	377,972	126.80	336	18	2
Laos PDR	236,800	6.86	29	1	0
Myanmar	676,575	53.37	79	4	1
Malaysia	330,803	31.62	96	4	1
The Philippines	300,000	104.90	350	3	3
Papua new guinea	462,840	8.25	18	1	0
Singapore	722	5.61	7,770	1	0
Republic of Korea	100,210	51.47	514	7	2
Chinese Taipei	36,193	23.58	652	7	3
Timor-Leste	15,410	1.30	85	1	0
Vietnam	331,210	95.54	289	5	1

Charts display countries and number of universities that provide geology and mining engineering courses/programmes

Geology



Mining Engineering





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

Mineralogy
Petrology (All type of Rock)
Sedimentology
Igneous and Metamorphic rocks
Paleontology (Invertebrate)
Stratigraphy
Structure Geology
Geochemistry
Geomorphology
Remote Sensing
Mineral Deposits
Geostatistics
GIS for geologist

Field work/Mapping Experience
Field Trip
Field Mapping (less than 15 days)
Field Mapping (More than 15 days)

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

Group A

- 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.

Group B

- 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.

Group C

- 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



Regular Training Course



- ❑ “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, 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.
- ❑ This course covers topics of Ore and Mineral Deposits, Exploration Models and Techniques for Sediment-hosted Mineral Deposits, Structural Geology, Fluid and Melt Inclusion in Ore-forming System, Exploration Methods for Mineral Resources, Exploration Management and Targeting, Economic Evaluation of Mineral Projects, Mining Engineering, Mineral processing and Extractive metallurgy.

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

1. CCOP-KIGAM-UNECE-PETRAD Workshop on “Application of the United Nations Framework Classification for Resources (UNFC)”, Tue 30 October 2018, Busan, Republic of Korea.

Up Coming

CCOP-DGM-ASOMM Workshop for ASEAN Mineral Resource Evaluation, 11-14 March 2019 Vientiane, Lao PDR.

Note that CCOP, working together with Member Countries, will promote the resource classification through the use of UNFC Resource Classification System.

Summary

- ☐ 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

1949 (AU)

Recent

1897 (Kyoto)

1939 (KU)

1949 (AU)

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)

Geology
Applied
Geology
Earth Science

2

Mining Engineering
School
4 years

- ☐ Inha University
- ☐ Dong-A University

Mining
Engineer

Petroleum
engineer

1958 (inha)

Recent

1946 (SNU)

1951 (CBNU)

1952 (CNU)

1963 (KU)

1968 (YU)

1979 (JNU)

Singapore

1

Geoscience School
4 years

□ Nanyang Technological
University, Singapore

Geology

Applied
Geology

Mining Engineering
School
4 years

Present

1955

Chinese Taipei

7

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

3

Mining Engineering
School
4 years

- ☐ National Taiwan University (NTU)
- ☐ National Cheng Kung University (NCKU)
- ☐ National Taipei University of Technology (NTUT)

Mining
Engineer

Petroleum
engineer

1952 (NTUI)

1974 (NCKU)

1968 (NCU)

Present

1956 (NTU)

1968 NCKU, NCU)

1990 (CCU)

1994 (NTOU)

2005 (NDHU)

Indonesia

6

Geoscience School
4 years

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

Geology
Applied
Geology

6

Mining Engineering
School
4 years

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

Mining
Engineer

Petroleum
engineer

1948 (ITB)

1958 (UPN VY)

1960 (UNSRI)

1965 (UNP)

1979 (UNISBA)

1950 (ITB)

1958 (UNPAD, UPN VY)

1960 (UI)

1980 (UI)

Present

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

1939 (CU)

1975 (PSU)

1983 (CMU)

1958 (CU)

1964 (CMU)

1984 (KKU)

2002 (KU)

2004 (MU)

Present

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

Malaysia

4

Geoscience School
4 years

- ☐ University of Malaysia (UM)
- ☐ Universiti Kebangsaan Malaysia (UKM)
- ☐ Universiti Malaysia Sabah (UMS)
- ☐ University Teknologi Petronas (UTP)

Geology

Applied
Geology

1

Mining Engineering
School
4 years

- ☐ Universiti Sains Malaysia (USM)

Mining
Engineer

Petroleum
engineer

1984(USM)

Present

1960 (UM)

1975 (UKM)

1997 (UTP)

The Philippines

3

Geoscience School
4 years

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

Geology

Applied
Geology

3

Mining Engineering
School
4 years

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

Mining
Engineer

Petroleum
engineer

1968 (AU)

1983 (UP)

1979 (USEP)

1983 (UP)

Present

Myanmar

4

Geoscience School
4 years

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

Geology

Applied
Geology

1

Mining Engineering
School
4 years

- ☐ Yangon Technological University (YIT)

Mining
Engineering

1972 (YIT)

1920 (UY)

1978 (YIT)

1993 (DU)

2000 (EYU)

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)

Timor-Leste

1

Geoscience School
4 years

□ National University of East
Timor

Geology

Petroleum
Geology

Mining Engineering
School
4 years

Present

2012

Lao PDR

1

Geoscience School
4 years

□ National University of Laos

Mining Engineering
School
4 years

There is no University that provides Geological course in Lao PDR

Present