



Geoscience education in the 21st Century: directions of higher education in Thailand

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INTRODUCTION

As the 20th century ends, new perspectives for entering the next century are being prepared. One of the most important perspectives is education. This article calls for contributions from the communities concerned with geoscience education in the 21st century, specifically, contributions on the perspectives, missions, and actions for the development of geoscience education in Southeast Asia.

Geoscience education has recently been emphasized mainly on classical geology which includes historical geology, sedimentology, structural geology, palaeontology, stratigraphy, mineralogy, petrology, and other related subjects. In Southeast Asian countries, the B.Sc. level provides students with training in geological mapping and mineral exploration. Applications and expertise have been obtained from actual work experience, for example, as survey geologists, petroleum geologists or as mining engineers. Further education in the M.Sc. and Ph.D. levels show more applications of classical geology and mineralogy. While the other scientific fields (e.g. applied chemistry, biotechnology, environmental sciences, and information technology/computer science) have been growing, the number of geoscience students has been, on average, declining. However, looking forward to the year 2000 and beyond, different ideas and experiences are needed for the future of geoscience education and its implementation. This article obviously will not be able to cover all of the major ideas. But the contributions from geoscientists and associates in Southeast Asia which are being consorted will guarantee the improvement of geoscience education

in the 21st century. New protocols on geoscience education have to be made from this GEOSEA '98 meeting.

STATUS AND VISIONS

The current economic crisis in Asia indicates problems with the education systems in our countries. All branches of the education systems, including geoscience, must be re-evaluated in an attempt to prevent a similar crisis in the future. Responsibility for our future must be achieved by ensuring today's students have the proper perspectives on our world. We must rapidly provide new and firm protocols to implement these changes in our education systems.

All Thai universities will become autonomous in the year 2002, which will encourage university personnel to be held accountable for the education of the students. This educational assurance, and links between the schools, industry, and government sectors with the universities, have to be planned in the next millennium in order to rapidly develop education by implementing network learning. Geoscience students will have to broaden their knowledge to function properly in this new education environment. The 21st century must use new materials and technologies that consume minimal resources and are friendly to the environment. The individuals concerned have to be accountable for their actions.

At least seven universities in Thailand have departments concerning geosciences: for example Geology (Chulalongkorn University, Chiangmai University), Mining Engineering (Chulalongkorn University, Prince of Songkhla University), Geotechnical Engineering (Asian Institute of

Table 1. Programs conducted at different universities in Thailand.

UNIVERSITY	GEOSCIENCE EDUCATION PROGRAMS	CURRICULA
Chulalongkorn	Petroleum geology, Ground water geology, Petrology, Mineralogy, Mineral deposits, GIS, Environmental geology, Geomorphology, Gemology, and research in these fields.	BSc (Geology) MSc (Geology) PhD (Geology)
Chiangmai	General geology, Gemology, Applied geophysics (inter-department program), and research in these fields depending on professor's expertise.	BS (Geology) BS (Gemology) MSc (Geology) MSc (Geophysics) PhD (Applied Geophysics, Geology)
Prince of Songkhla	Mining engineering, Materials engineering, Simulation geotechnical engineering, Mining and Environments, Environmental geology, Mineral exploration.	BEng (Mining) BEng (Materials) MEng (Mining)
Khon Kaen	Engineering geology, Ground water/Hydrology (Modeling) — Applications in environmental geology.	BSc (Geotechnology) MSc (Geotechnology)
Suranaree	Petroleum Technology, Engineering geology, Ground water technology.	BEng (Geotechnology) MEng (Geotechnology)
Kasetsart	Earth and Environmental Sciences, Interactions of Earth components, Future courses in integrated sciences, and research in: Environments, Applied geophysics, Geotechnology, Applied mineralogy.	BSc (Earth Sciences)

Technology, Khon Kaen University, Suranaree University) and Earth Sciences (Kasetsart University). Table 1 details the programs conducted at the mentioned universities.

Chulalongkorn University plans to emphasize petroleum geology and ground water geology as well as maintain economic geology. Chiangmai University will focus on mineral deposits and a new program in gemology, applied geophysics has been offered as an inter-department program (Physics and/or Geology). Gemology curricula have also been taught at Burapa University in eastern Thailand and at Srinakharinwirot University in Bangkok. Suranaree University is also preparing curricula for petroleum and ground water technologies, and is the only autonomous institution containing geosciences. One of the Earth Sciences curriculum being performed at Kasetsart University considers the earth as three major components — the atmosphere, the hydrosphere and the geosphere. The study of these components and their interactions will be emphasized, leading to the

development of a curriculum different from the classical one.

As Thai universities become autonomous, the new curricula in education must also become clearly defined and standardized. The process of approving the new curricula in geoscience education will involve the collection of ideas, visions, and questions from the public by the appropriate committees, which will then form the policies for implementing the integrated sciences approach.

Problems seen for geoscience education are the lack of human resources and facilities for advanced instrumentations. For example, electron microprobes have not been installed in Thai universities and isotopic age determination facilities do not exist. This leads to the effect of sending students abroad to learn skills that cannot be obtained in Thailand. A further problem is that most of the Ph.D. geoscientists do not show progress after returning to Thailand. They cannot contribute and develop their new skills since the universities do not have the proper facilities.

On the positive side, the number of female students enrolled in higher education has increased for Thailand and is now comparative to other countries for geology. In fact one curriculum exceeds the expected enrollment rate which is the gemology curriculum in Chiang Mai University, where approximately 90% of the students are female. Also, geology in Thailand has not been promoted as vigorously as the biological sciences and the other physical sciences fields. However, it has still been ranked 46th in the world out of 50, while the other physical sciences are the 50th or lower.

Today, the vision of geoscience education must be clearly seen by geoscientists and representatives of organizations. This vision is 'Geoscience Education in the 21st Century'. It has to contain perspectives and missions which should be worthy, practical, and challenging. Once the strategies for our missions have been developed they should be acted upon immediately, thus defining new practices in geoscience education. For example, if one of the missions is defined as 'Everybody should be aware of geoscience', then the strategies could include such steps as starting to teach geoscience at schools, and increasing the number of geoscience teachers. These steps would promote the understanding of geoscience concepts at the school level and new practices would be developed to implement these strategies. However, a major factor for the success of the missions is the quality of the national education policies of each country.

PERSPECTIVES AND STRATEGIES

In order to improve geoscience education, perspectives for new theories and research in geoscience need to be defined and researchers need to cover a wide range of themes. The geoscience communities should carefully consider changes in technologies and follow their development and evolution. Several examples of improvements to geoscience education that could be made are as follows:

- Instrumental technology should be taught and practiced since beam techniques such as SHRIMP, PIXE, Laser, IR, UV, electrons, synchrotrons, etc. are playing important roles in geoscience and will be widely used in the 21st century.
- Information technology such as GIS, mathematics, and statistics programs have to be incorporated into the curriculum.
- More integrated sciences approaches need to be taught.
- Measuring instruments for structural geology have changed, for example, the role of GPS

verses a compass has to be clearly distinguished by using both in mapping courses and indicating the evolution of GPS as the new navigational system.

- Previously, principles of Geophysics have been mainly used on a theoretical basis, but by emphasizing the meanings of the mathematical equations involved, Geophysics will become easier and more practical, for example, more information of the earth's interior (at least maps of the mantle) can be obtained by modern geophysical methods.
- Since all pollutants enter the air, water, and ground systems, an understanding of geochemistry is important to prevent and cope with environmental problems.
- New ideas, hypotheses, and theories should be considered as being interesting and stimulating, for example James Lovelock's GAIA theory.
- More elective courses in senior years should be offered, such as geohazards, natural disasters, forensic geosciences etc.
- Geoscience students should be more familiar with spectroscopy techniques and should be able to adapt themselves to new technologies.

The geoscientists in the 21st century must have a strong basic science background, know classical geology and mineralogy, and be able to consult society in matters concerning geological resources planning and investigations. They must also cope with problems concerning natural disasters and hazards, environmental problems, etc. and be able to explain and predict the natural phenomena with scientific support more so than in the past. Finally, they have to create and prove new theories in geoscience, as well as teach students to be good hearted, open minded, inventors, challengers, or even the best politician!

MISSIONS AND PROTOCOLS

The discussion above are some of our missions that are being devoted to the geoscience education for the 21st century, however, are there any other missions? Have you thought of any new missions and how they could be implemented? And what should be our next actions? How can geoscientists be moved toward greater liberation, equity, and social justice?

New protocols of geoscience education for Southeast Asian countries will be defined at this Geosea '98 meeting. Topics that should be considered include:

- addressing critical approaches to research at higher education levels.

- pooling the facilities for regional research cooperation.
- increasing numbers of international conferences to establish close contacts and cooperation as well as information exchange among the geoscientists in the region.

Geoscience education in the 21st century will have the perspectives, strategies and practices of working together as community partners. These include school children, teachers, researchers, NGO's, and politicians to identify and solve our

social, economic, environmental, and ecological problems.

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