

## **Progress in Quaternary geological investigations in Southeast Asian countries since GEOSEA IV, Manila, 1981**

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**Abstract:** During GEOSEA IV, Manila, 1981, the importance of Quaternary geological investigations for the development of Southeast Asian countries was stressed. Since then, many mapping and research projects have been initiated. In this paper, the progress and developments in Quaternary geology in Indonesia, Malaysia, the Philippines and Thailand are reviewed.

### INTRODUCTION

Quaternary geological investigations of the alluvial and coastal plains in Southeast Asia started in the early seventies. In 1974 an offshore survey for tin off the Malay-Thai peninsula was implemented with assistance of the Committee for Co-ordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas (CCOP). During that survey and from discussions at CCOP meetings it became clear that most of the CCOP member countries had only an elementary knowledge of their Quaternary alluvial and coastal deposits.

The importance of these deposits for the purpose of evaluation of mineral resources, assessment of deposits containing construction materials and groundwater, geological support in solving subsidence and engineering problems, and rural and urban planning in Southeast Asian countries has been indicated and discussed in several publications (Heuwat, 1975; Van de Meene, 1977; and Suntharalingam, 1977).

The importance of Quaternary geology in the national development process was realized in those countries at the end of the seventies. As a result of this, sections for Quaternary have been attached to the Geological Survey organizations. Van de Meene at GEOSEA IV in Manila 1981 (1984) gave review of the activities of those sections for a number of countries in Southeast Asia.

This paper gives information on the further progress of Quaternary geological studies in four countries (Indonesia, Malaysia, the Philippines and Thailand) and some future developments are indicated.

### INDONESIA

Considerable progress has been made in the survey, mapping and study of Quaternary alluvial and coastal deposits in Indonesia in the past few years.

In 1978 a systematic mapping programme started in the coastal plain of Northern Java. From 1980 the survey and mapping of Quaternary deposits is undertaken by the Section for Quaternary Geology and Seismotectonics of the Geological Research and

Development Centre (GRDC). GRDC is a directorate of the Directorate General of Geology and Mineral Resources of the Ministry of Mines and Energy.

The systematic survey and mapping of Quaternary deposits at a scale 1:50,000 can be divided into two groups based on the methods used in obtaining data, and on the legend system:

- a) **Data on Holocene alluvial and coastal deposits.** They are mainly obtained by drilling (hand-auger equipment). For compiling mapsheets a profile-type legend, indicating the vertical sequence of deposits, is used.
- b) **Data on Pleistocene deposits.** They are obtained from exposures, outcrops, field observations and a limited number of drillings. For compiling mapsheets a litho-stratigraphical legend is used.

Up to now fieldwork for 9 mapsheets have been carried out or is ongoing in the alluvial and coastal areas of Java (figure 1). Three mapsheets, east of Jakarta, will be printed and published in 1984.

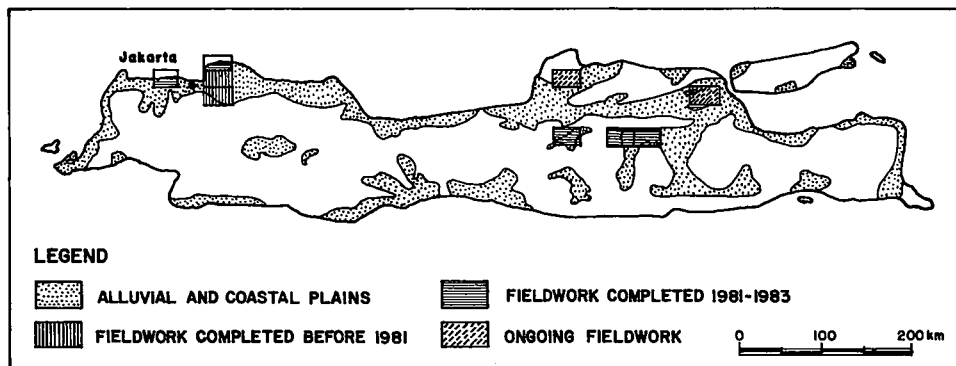


Fig. 1. Review of the systematic mapping, 1:50,000, of the alluvial and coastal plains of Java, Indonesia.

In the coastal area, east of Jakarta (mapsheets Bekasi, Batujaya and Galian; see Situmorang *et al.*, 1982 and Situmorang, 1983), four important types of deposits, overlying the Pleistocene surface, are distinguished. They are: channel deposits, floodplain deposits, mangrove swamp and nearshore deposits, and beach and beachridge deposits. Nine primary profile types can be composed with these four main components. They are given in figure 2. Figure 3 shows how these nine primary profile-types characterize the schematic profile through the coastal area. Each profile-type has its own colour. In the marine deposits underlying the channel, floodplain, beach and beachridge deposits or combinations of two of them, details are indicated by black signatures. Thus the primary profile-types can be refined into subtypes. Primary profile type J (mangrove swamp and nearshore deposits) is also refined into subtypes.

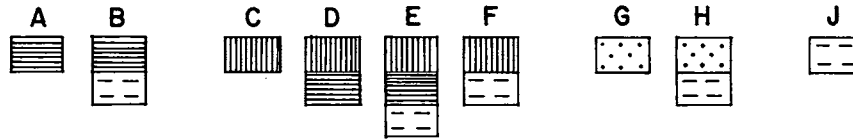


Fig. 2. Primary profile types.

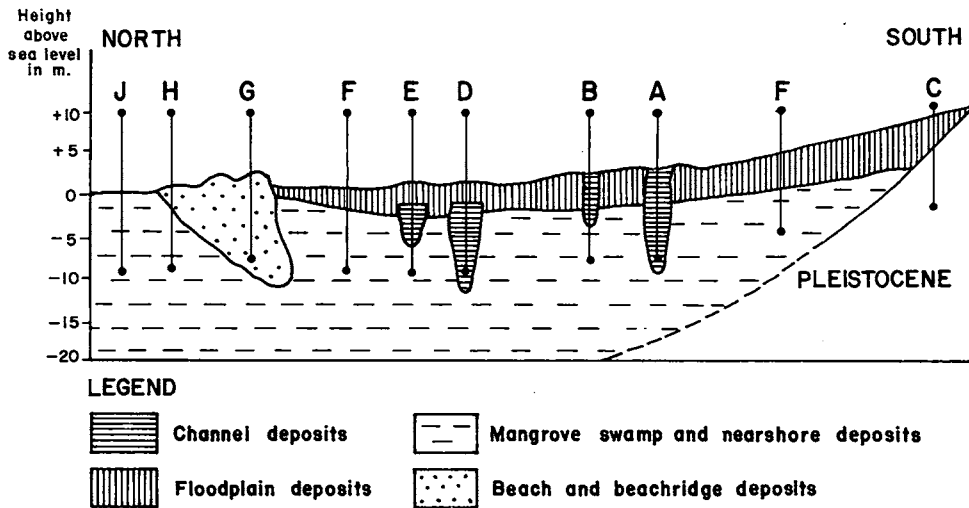


Fig. 3. Schematic profile of the coastal area of Northern Java.

Besides the systematic mapping programme special studies are undertaken for coastal research, heavy detrital minerals, and other applied aspects of Quaternary geology. Recently also geomorphological mapping started in addition to the Quaternary geological maps.

Studies and surveys are supported by palaeontological research (palynology, forams, mammalia), grainsize and heavy mineral analyses, and geotechnical tests. A new Quaternary geological laboratory was inaugurated in March 1984. Besides laboratory work as indicated above, this magnificent laboratory offers possibilities to carry out C14 dating (not yet operational), fission track and K : Ar dating, and palaeomagnetic research. Prof. Watanabe of the University of Tokyo, Japan is assigned in Bandung for 2 years to train geologists in palaeomagnetic research.

A Seminar on "Peat for Energy Use" was held in Bandung, 1982. Several experts from Finland, Indonesia, Ireland and the Netherlands participated in the Seminar. At the moment three institutions within the Ministry of Mines and Energy are involved in various aspects of peat investigations such as systematic mapping, exploration and inventory, and laboratory analysis of peat.

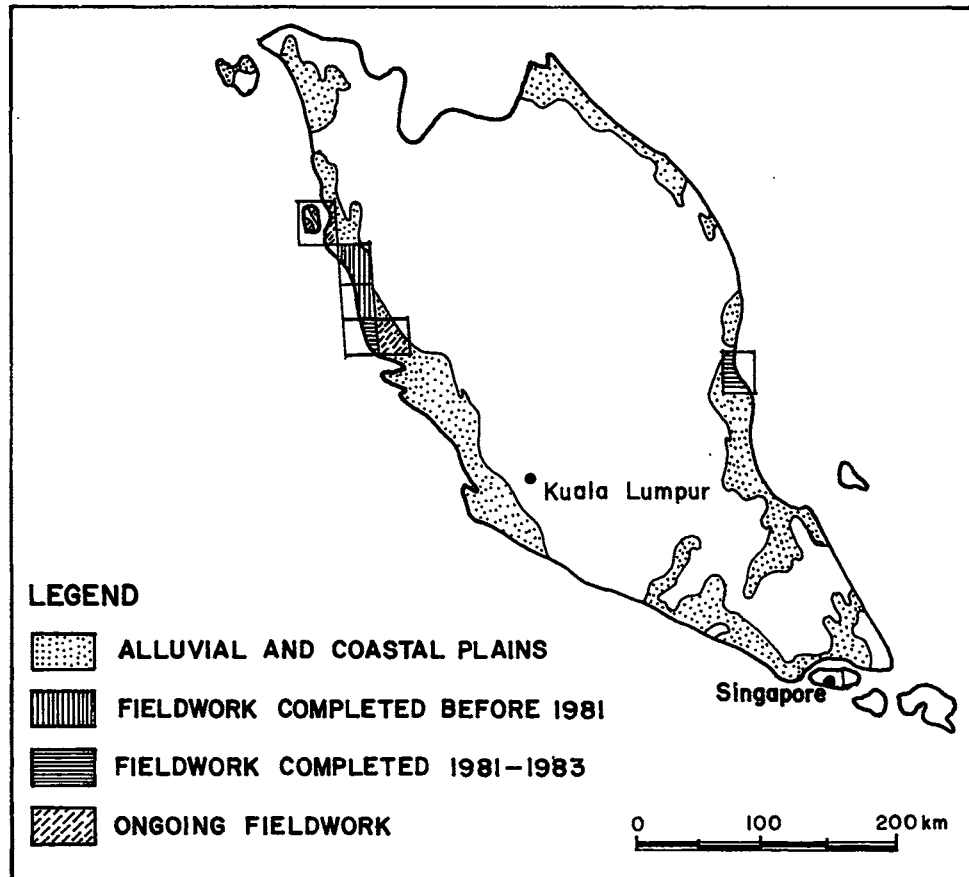


Fig. 4. Review of the systematic mapping, 1:63,360, of the alluvial and coastal plains of Peninsular Malaysia.

#### MALAYSIA

The Geological Survey of Malaysia (GSM) started a Section for Quaternary geology in 1976 which was later upgraded to a Division. About 15% of the alluvial and coastal area of Peninsular Malaysia has been mapped (Fig. 4). The first map, on a scale 1:63360 or 1 inch to 1 mile, with a report to be published, is the Taiping sheet.

The Division is also carrying out special studies comprising amongst others a) 1:500000 Quaternary geological reconnaissance map of Peninsular Malaysia which will probably be published in 1984, b) studies of sedimentary environments of Holocene age in the Lower Perak and Kota Bharu areas to gain knowledge about sediment properties and c) an experimental geophysical survey over a deep alluvial deposit at Kuala Langat.

Through the systematic mapping and special studies it was possible to establish a

Quaternary litho-stratigraphy for Peninsular Malaysia (Suntharalingam, 1983). Correlation of onshore and offshore unconsolidated sequences in northwestern Peninsular Malaysia are carried out jointly by the GSM and CCOP Project Office.

The Division has its own laboratory facilities, where several tests are now done on a routine basis: grainsize analysis, heavy minerals and preparation of pollen slides. Other laboratories of the GSM provide chemical tests, firing tests, X-ray diffraction analysis, and geotechnical tests.

In 1984 a pilot project "Systematic mapping of Sibu town and surroundings, scale 1:10000" will start in Sarawak, East Malaysia. The aim of the project is to obtain Quaternary data for planning activities. The area is underlain by strongly waterlogged peat which gives problems in maintenance of roads, construction of new roads, housing estates, industrial settlements, etc. This project will also serve as a pilot area for a long term plan on peat studies.

Other developments related to Quaternary geology are, among others, the studies on soils and weathering by the Universiti Pertanian Malaysia; the studies on sea-level changes (e.g. Tjia, *et al.* 1983); and geomorphological studies in several areas of Peninsular Malaysia (e.g. Dapper, 1981 and 1983).

#### PHILIPPINES

The Geological Survey Division of the Bureau of Mines and Geosciences (BMG) through its Hydrogeology and Engineering Geology Section started systematic investigations of Quaternary deposits in the Sab-a basin on Leyte in 1980.

Up to now fieldwork of 8 mapsheets has been completed and at present fieldwork is carried out in two areas (Fig. 5). The significance of BMG's Quaternary mapping programme lies in the field of optimum landuse, detrital mineral prospecting; engineering geology and hydrogeology. In addition to the Quaternary geological maps a start has been made to compile geomorphological maps at the same scale.

The "Petrolab", the general laboratory of BMG, inaugurated in February 1983, carries out grainsize analyses and research of detrital minerals. Besides these analyses equipment is available, although not yet all operational, to carry out e.g. determination of clay minerals, C14 and K/Ar dating, palaeomagnetic analysis and dating, and determination of chemical composition of rocks. Furthermore BMG has good facilities and know-how for foraminifera studies.

In May 1984 a course "Introduction to Quaternary Geology" for undergraduate students in geology will be organized at the University of the Philippines Systems in Metropolis Manila. This Course also aims to establish at the University a permanent undergraduate elective course in Quaternary geology in future.

#### THAILAND

The Thai Department of Mineral Resources (DMR) started in 1980 the systematic mapping of its alluvial and coastal deposits. In the ambitious five year plan (1982-1986) the Geological Survey Division of DMR completed fieldwork of 8

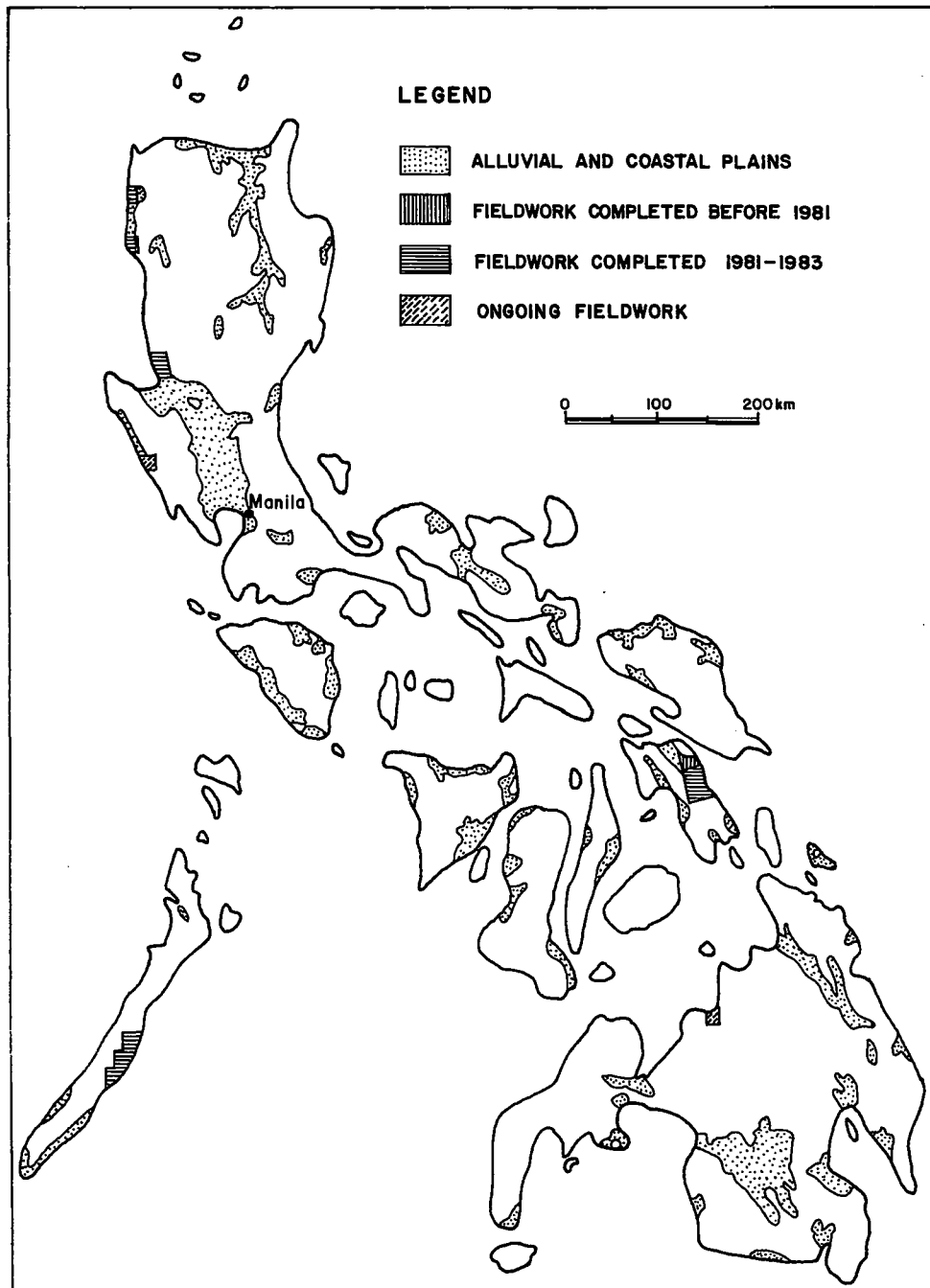


Fig. 5. Review of the systematic mapping, 1:50,000, of the alluvial and coastal plains of the Philippines.

mapsheets and fieldwork on 3 more mapsheets in Phang-Nga and Songkhla area in Southern Thailand is underway (Fig. 6). The surveys and mapping are mainly carried out for alluvial tin, other economic deposits as silica sands, and rural and urban planning.

Laboratory facilities of the Geological Survey Division are very limited. In the planned new building of DMR for 1985 space will be made available for a Quaternary geological laboratory. Limited support is given by the paleontological section in which a palynological unit will be set up in 1984. Samples for C14 dating can be sent to the Office of Energy for Peace in Bangkok.

At the Asian Institute of Technology (AIT), an autonomous international institution, studies in the field of engineering geology and hydrogeology of unconsolidated sediments are undertaken in which Quaternary geology plays an important role. Geomorphological mapping is mainly undertaken by the Soil Survey Division of the Department of Land Development to support their soil surveys.

Chiang Mai University will start an elective course "Geology of Surficial Deposits" in its Geology Department of the Faculty of Science. A description of the course will be given in the 1984 Catalogue.

A course "Introduction to Quaternary Geology" for undergraduate students was organized at the Geology Department of the Chulalongkorn University in Bangkok, January 1984. The aim of the course was, like that in Chiang Mai and Manila, to establish a permanent undergraduate elective course in Quaternary geology in future.

During the past years, several symposia and workshops on Quaternary geology and/or geomorphology were organized in Thailand:

- a. Landplan I, an International Symposium on Soil, Geology and Landforms: Impact on Landuse Planning in Developing countries (Natalaya, *et al.*, eds., 1982).
- b. First Symposium on Geomorphology and Quaternary Geology of Thailand (Thiramongkol and Pisutha-Arnond, eds., 1983).
- c. Workshops on stratigraphic correlation of Thailand and Malaysia (Natalaya, ed., 1983).
- d. Meeting of the International Working Group on Geomorphology of River and Coastal Plains, held in 1983 (Thiramongkol and Ten Cate, eds., 1984).

#### FUTURE DEVELOPMENTS

At GEOSEA IV in Manila, 1981, Van de Meene (1984) indicated that the Division for Quaternary Geology of the Geological Survey of Malaysia was ahead of other Southeast Asian countries in terms of experience in Quaternary geological studies of alluvial and coastal plains. External support for training and implementation of programmes resulted in considerable progress of such studies in Indonesia, the

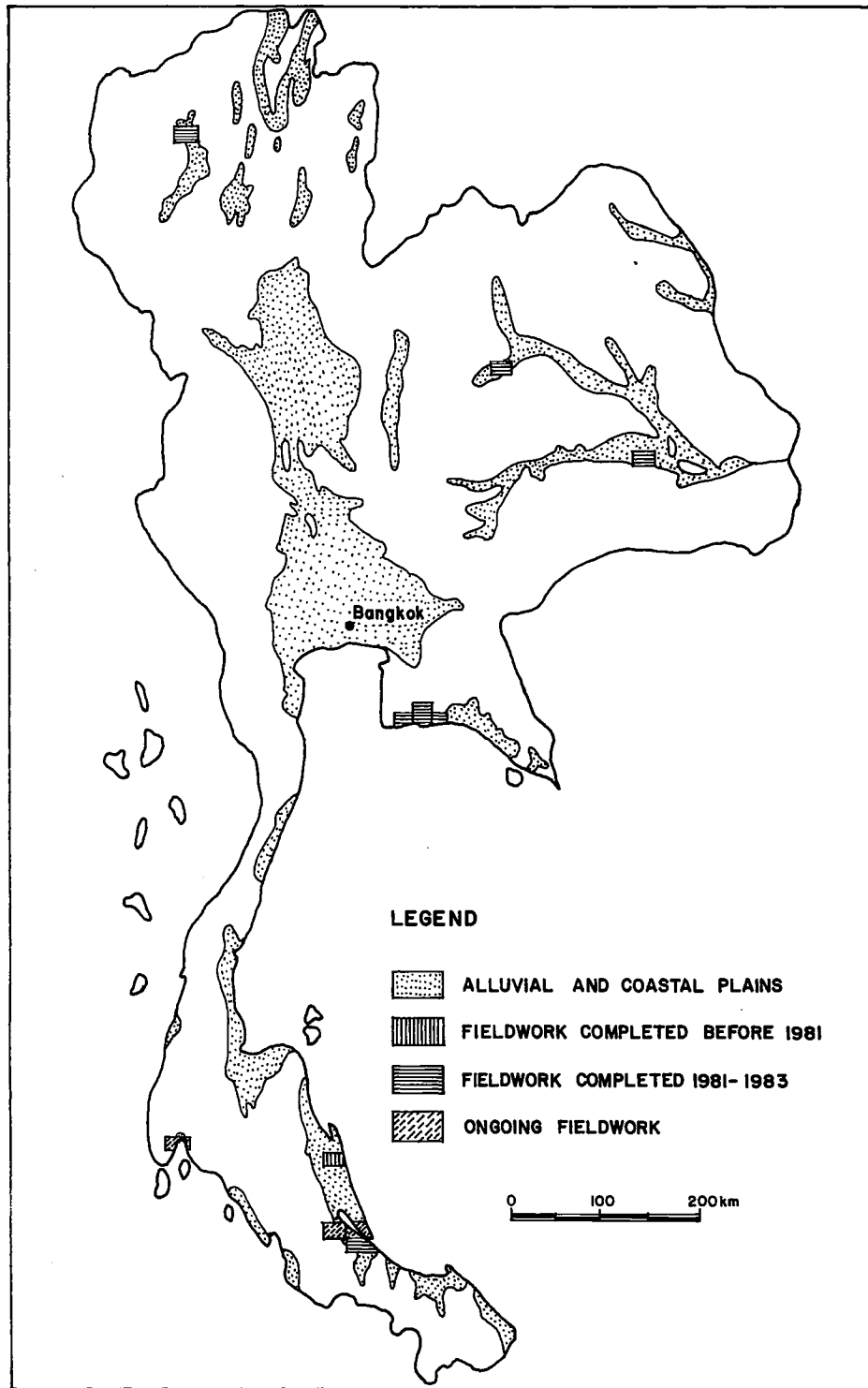


Fig. 6. Review of the systematic mapping, 1:50,000, of the alluvial and coastal plains of Thailand.



Philippines and Thailand. It is expected that these countries through their ambitious programme and new laboratory facilities will soon arrive on the same level in Quaternary geological studies as Malaysia.

Quite a number of geologists follow Master degree courses in Quaternary geology at universities in other countries, e.g. New Zealand, Belgium (IFAQ), and the Netherlands (ITC). Many geologists participated in courses on various aspects of Quaternary geology organized in co-operation with CCOP. Some obtained fellowships for short term courses overseas. Those activities have to be continued as it looks that there will be an increasing demand for geologists specialized in Quaternary geology.

A new development is the start of elective courses for undergraduate students in Quaternary geology at universities in Thailand and the Philippines. CCOP is willing to support universities in other countries in the setting up of similar courses.

CCOP at its nineteenth session in Tokyo, 1982, accepted the offer of China to provide host facilities for a Regional Centre in Quaternary Geology (RCQ) in Qingdao. No progress, however, has been made in setting up this Centre. Other countries expressed their concern about the location of the Centre in Qingdao. It is still hoped and may be a must that a RCQ will come into being for the continuity in the study of Quaternary geology. The tasks of such a Centre would be a) to provide training to Quaternary geologists and other professionals, b) to provide expert services to participating countries, c) to undertake scientific studies in tropical areas, and d) to act as a documentation and information centre.

This paper only intends to outline the achievements and developments of Quaternary geological studies in Southeast Asia which might be even more relevant now the organizing committee of the GEOSEA V Congress decided to hold a special session on Quaternary geology and related subjects. The fact that this session takes place is a milestone for Quaternary geology in this part of the world and is to be considered an encouraging development.

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