

# **BRUNEI**

## **- EARTHQUAKES: A GENERAL FEELING OF COMPLACENCY AND NO URGENCY**

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### **1 INTRODUCTION**

Brunei Darussalam is situated on the northwestern coast of the island of Borneo, between longitudes 114°23'E and 115°23'E and between latitudes 4°N and 5°5'N. It is surrounded on three sides by the eastern Malaysian state of Sarawak and to the north by the South China Sea and divided into two parts by Sarawak (Figure 1).

Brunei Darussalam has a land area of 5,765 sq km with a coastline of 130 km. In the eastern part is Temburong District with a land area of 1,288 sq km. Three districts make up the western part. Belait District is the largest with a land area of 2,696 sq km; then Tutong, 1,152 sq km; and Brunei-Muara, 563 sq km, within which is the capital city, Bandar Seri Begawan.

Brunei Darussalam has a population of 256,500 (1990) and the main center of population is Bandar Seri Begawan. The next largest towns are Seria and Kuala Belait about 109 km from the capital, in which the oil and gas industry is centered.

### **2 GEOMORPHOLOGY**

The topography of Brunei Darussalam is, to a large degree, geologically controlled; both by virtue of a variety of lithologies of variable induration and by active tectonism which allows the preservation of a youthful landscape despite vigorous weathering and erosion (Figure 2).

Mountains of moderately to severely folded Eocene to Miocene sediments occupy most of the southern part of the Temburong District. The summit levels range from 700 to 900 meters. The summit ridge of Bukit Pagon at 1,850 meters contains the highest elevations in Brunei Darussalam. The most strongly folded sediments have given rise to strike ridges formed of sandstone, alternating with deep valley cuts along the less resistant interbedded shale.

The Upper Tertiary synclinal basins which underlie most of the Brunei-Muara District and the interior of the Belait and Tutong Districts, are marked topographically by lines of long arcuate strike ridges and cuestas. These surround the upper catchments of the Belait and Turong rivers, and form undulating coastal lowlands particularly in the Brunei-Muara District. The rims of the synclinal basins gradually rise from groups of low hills, surrounded by swamp, to distinctive cuestas 400-500 meters high.

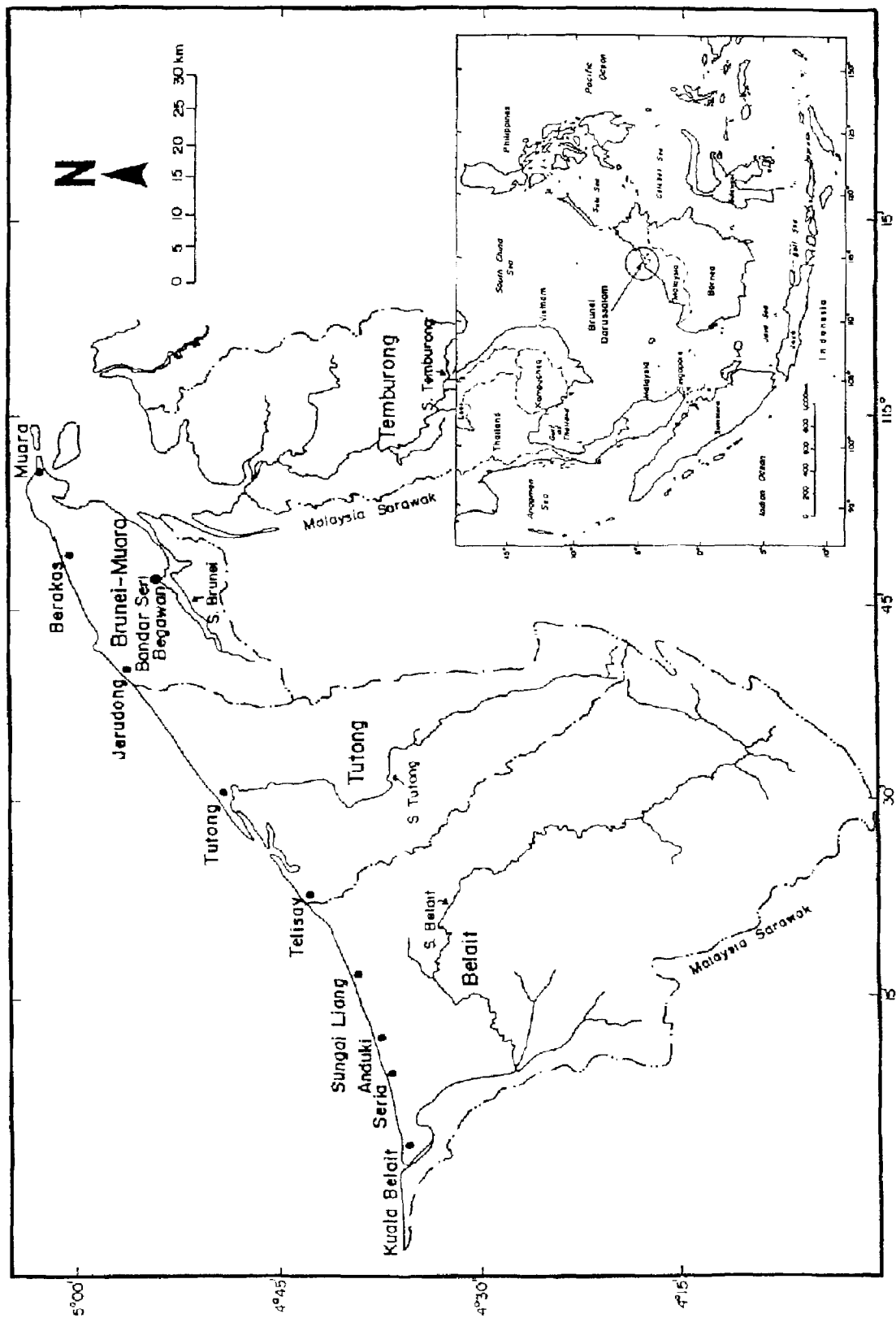
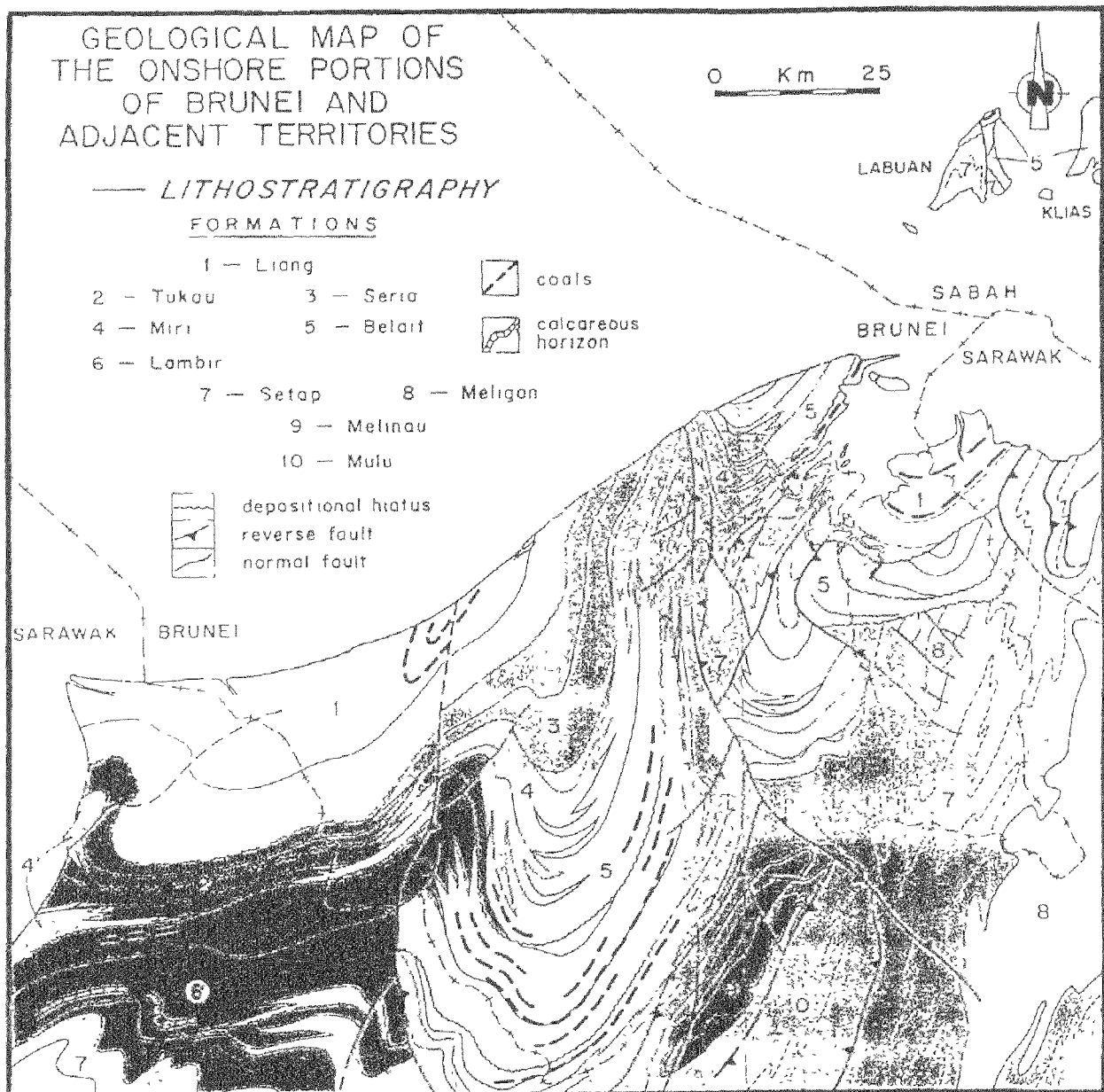


Figure 1: Negara Brunei Darussalam and its districts  
(adopted from MOD-DOTCP No. 13, 1986i)



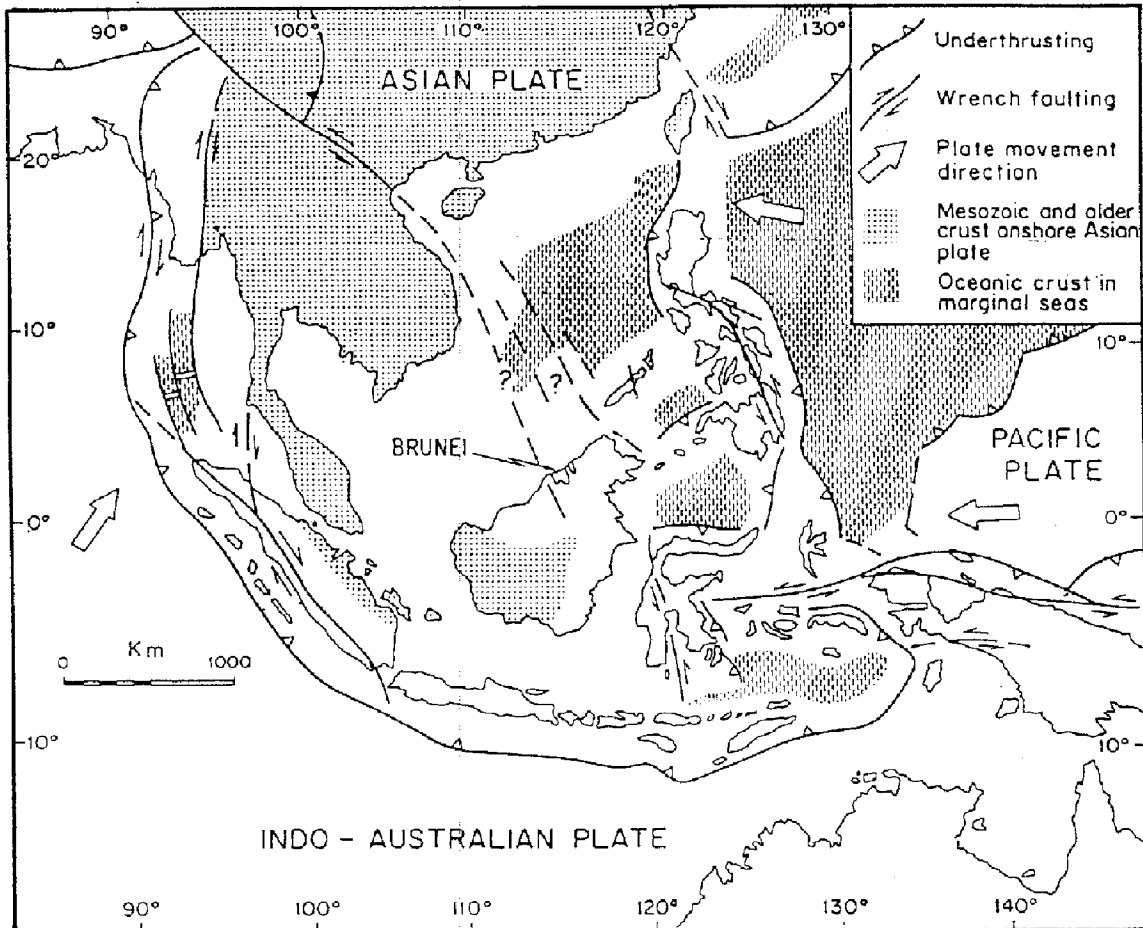
*Figure 2: Geological map of the onshore portions of Brunei and adjacent territories*

Flat, mainly swampy, alluvium occupies most of the coastal area, particularly in Temburong, and extends as broad belts up the valleys of the Belait and Tutong rivers. The alluvium in the lowest parts of these valleys has mostly accumulated during and since the post-glacial rise of the sea level some 5400 years ago.

Older Quaternary sediments form terraces, usually of unconsolidated sand and gravel, in the main river valleys and along the coasts between Tutong and Muara. Almost all the alluvial plains are covered by peat, except near the riverbanks and in the vicinity of hills, where thin clay or sandy alluvium deposits are usually located.

### 3 SEISMIC HAZARD

Southeast Asia is reputedly a region of high seismic activity. Although Brunei Darussalam is one of the countries within this region, it is very fortunate not to be located in an earthquake-prone area and thus is considered to be of low seismic risk (Figure 3).

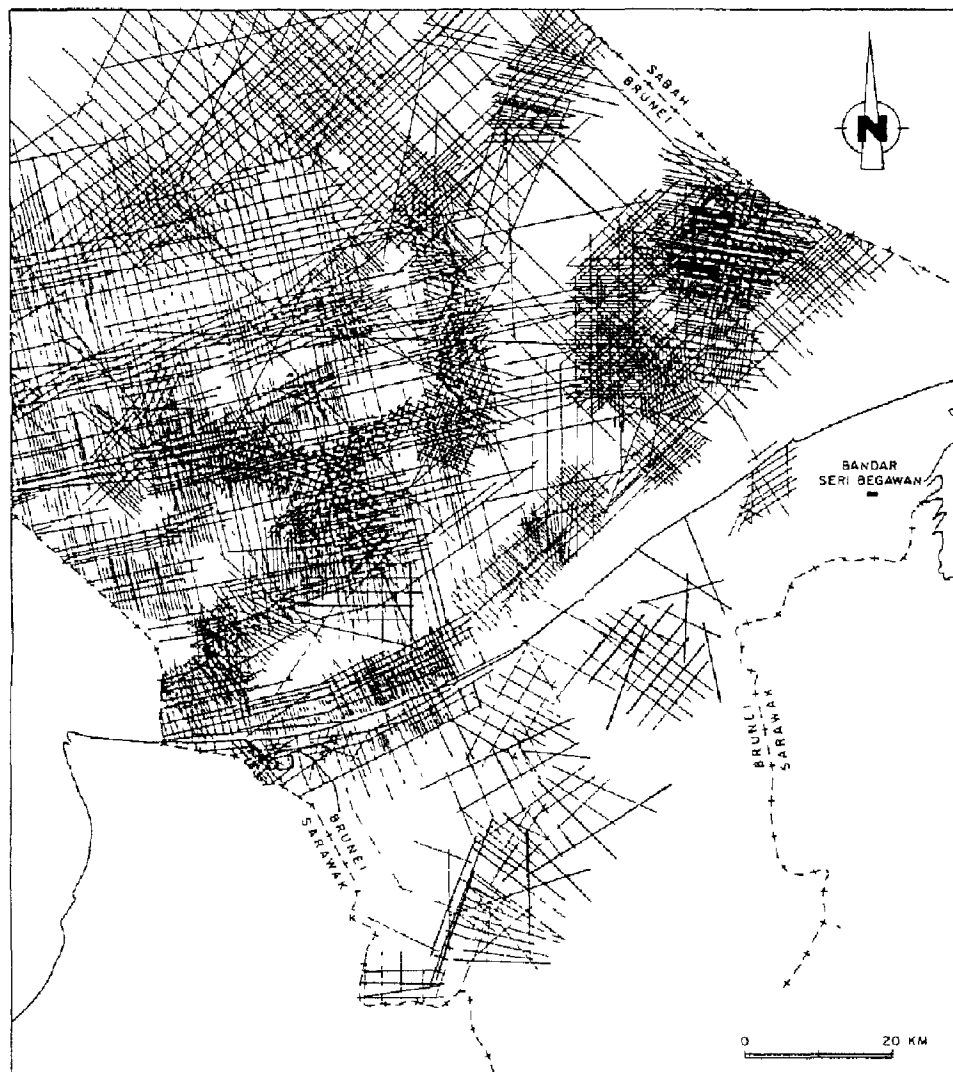


*Figure 3: Plate tectonic elements of SE Asia. Based largely on Hamilton (1979) and Holloway (1982)*

Brunei Darussalam has not experienced any earthquake of local origin in the recent past. Its capital city, however, did experience slight tremors which caused swaying of some high-rise buildings (5-6 stories) at approximately 8:40 a.m. on February 22, 1992. An official request to the Malaysian Meteorological Services for information on the earthquake identified its epicenter to be at around 5°N and 114.5°E with a magnitude of 4.5 to 5.0 on the Richter scale, which placed it in the offshore area.

Toward end-1983, Brunei Shell Petroleum Company has shot over 51,000 kilometers of seismic lines (Figure 4 indicates the end-1982 coverage.) and drilled 102 exploration wells, including 66 offshore. The company, therefore, has a large quantity of seismic data from its oil and gas exploration activities. These data, however, are highly confidential and not easily made available.

To date, hazard mapping has not been carried out within the country to establish geographically where natural and man-made hazards may occur.



*Figure 4. Seismic coverage: 1970-82*

## **4 ORGANIZATION**

Due to the low seismicity and the rarity of earthquake occurrence in the past, an organization specifically responsible for earthquake disaster mitigation has not been established in Brunei Darussalam.

Unlike some neighboring countries, the task of monitoring seismic activities does not fall under the responsibilities of the Brunei Meteorological Section, Civil Aviation Department. The Meteorological Section is not equipped with any seismograph or data processing facilities to localize earthquake sources.

In fact, at present, there is no department/agency in the Government to conduct activities in the field of geophysics, i.e., to collect, to process, to analyze and to disseminate the various geophysical data and information to support seismic hazard mitigation.

## **5 TYPES OF STRATEGIES**

Due to the low seismicity of the country and the absence of any incidence of human casualty or serious damage to properties in the past, low priority is attached to earthquake hazard mitigation.

There is a lack of awareness not only among the public but also among the decision-makers about the threat posed by earthquake hazard in neighboring countries within the region.

Most of the local engineers are British-trained and the curricula of their undergraduate civil engineering courses do not include topics related to earthquake engineering.

The Standard on Material and Construction currently in use is based on British Standard. The Construction Planning and Research Unit under the Ministry of Development is responsible for the preparation of a Brunei Standard with assistance from British consultants.

A study of the land within Brunei Darussalam for the Master Plan was carried out in 1985. The two main objectives of the study were to identify present land use and to indicate potential future land use with particular reference to land suitability for agricultural development. The results of the study are supplemented by three maps (1:100,000) showing respectively present land use, land suitability and agricultural development areas.

In case of emergency, the National Emergency Committee comprising various concerned government agencies supports first-aid and public facilities. The emphasis is on preparedness for relief, not on mitigation.

## **6 FUTURE ACTIONS REQUIRED**

- (a) Hazard mapping of the whole country to identify hazard areas and to produce hazard maps;
- (b) Vulnerability analysis to provide an understanding of the level of exposure of persons and property to the various natural hazards identified;
- (c) Zoning of risk areas;
- (d) Evaluation of the resources required for mitigating the risks;
- (e) Formulation of a disaster plan, especially the measures within such a plan which deal with preparedness, response and recovery;
- (f) Definition and application of measures which can reduce vulnerability in specific cases/areas;
- (g) Formulation and utilization of long-term programs of mitigation and prevention.

## **7 SUGGESTIONS**

The low seismicity and rarity of earthquake occurrence within Brunei Darussalam have caused problems for economies of countermeasures and public awareness. There is a general feeling of complacency and no urgency.

The service of international experts is needed to promote awareness primarily among the decision-makers in the Government about the threat posed by seismic hazard within the Southeast Asian Region, and to assist in the preparation of hazard maps, assessment of vulnerability, and evaluation of risk.

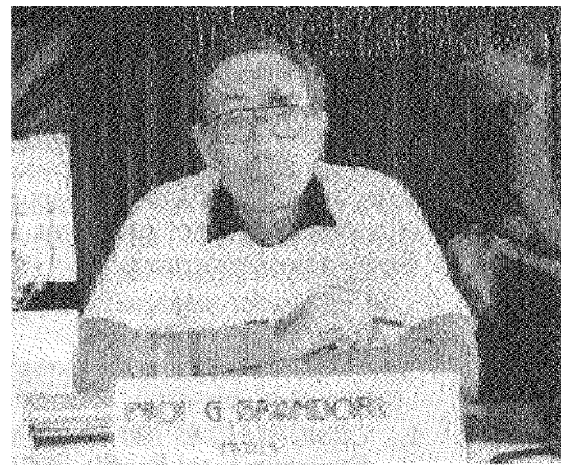
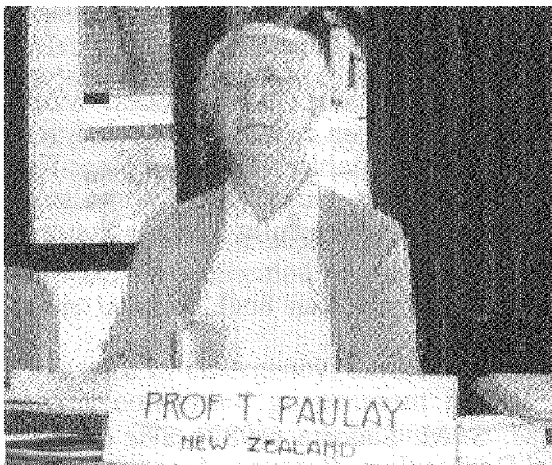
Only after having reached the stage in the assessment process where information on hazards and vulnerability has been collected and analyzed, in terms of potential losses and resources available to address identified risks, can the decision-makers in the Government decide on the formulation of national disaster programs and so integrate them fully into the national development programs.

## **REFERENCES**

1. Chua, T.E., L. M. Chou and M. S. M. Sadorra (1987), *The Coastal Environmental Profile of Brunei Darussalam: Resource Assessment and Management Issues*, p.5, Figure 1.1.
2. James, D.M.D. (1984), *The Geology and Hydrocarbon Resources of Negara Brunei Darussalam*, p.11, p.103, Fig. 11, Fig. 39 and Fig. 75.
3. *Negara Brunei Darussalam Master Plan, Background Paper, 1 - Land Use and Land Suitability*, p.1.



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***Wealth of Expertise*** Profs. Paulay and Grandori (current and former President of IAEE)  
*listen and share their insights*