BASIC DESIGN STUDY
ON
THE QUATERNARY GEOLOGY LABORATORY PROJECT
IN
THE REPUBLIC OF INDONESIA

February 1982

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

In response to the request of the Government of the Republic of Indonesia, the Government of Japan decided to conduct a survey on the Basic Design for the Quaternary Geology Laboratory Project and entrusted the survey to the Japan International Cooperation Agency (JICA). The JICA sent to Indonesia a survey team headed by Mr. Yutaka Hosono from November 11th to December 1st, 1981.

The team had discussions on the project with the officials concerned of the Government of Indonesia and conducted a field survey. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

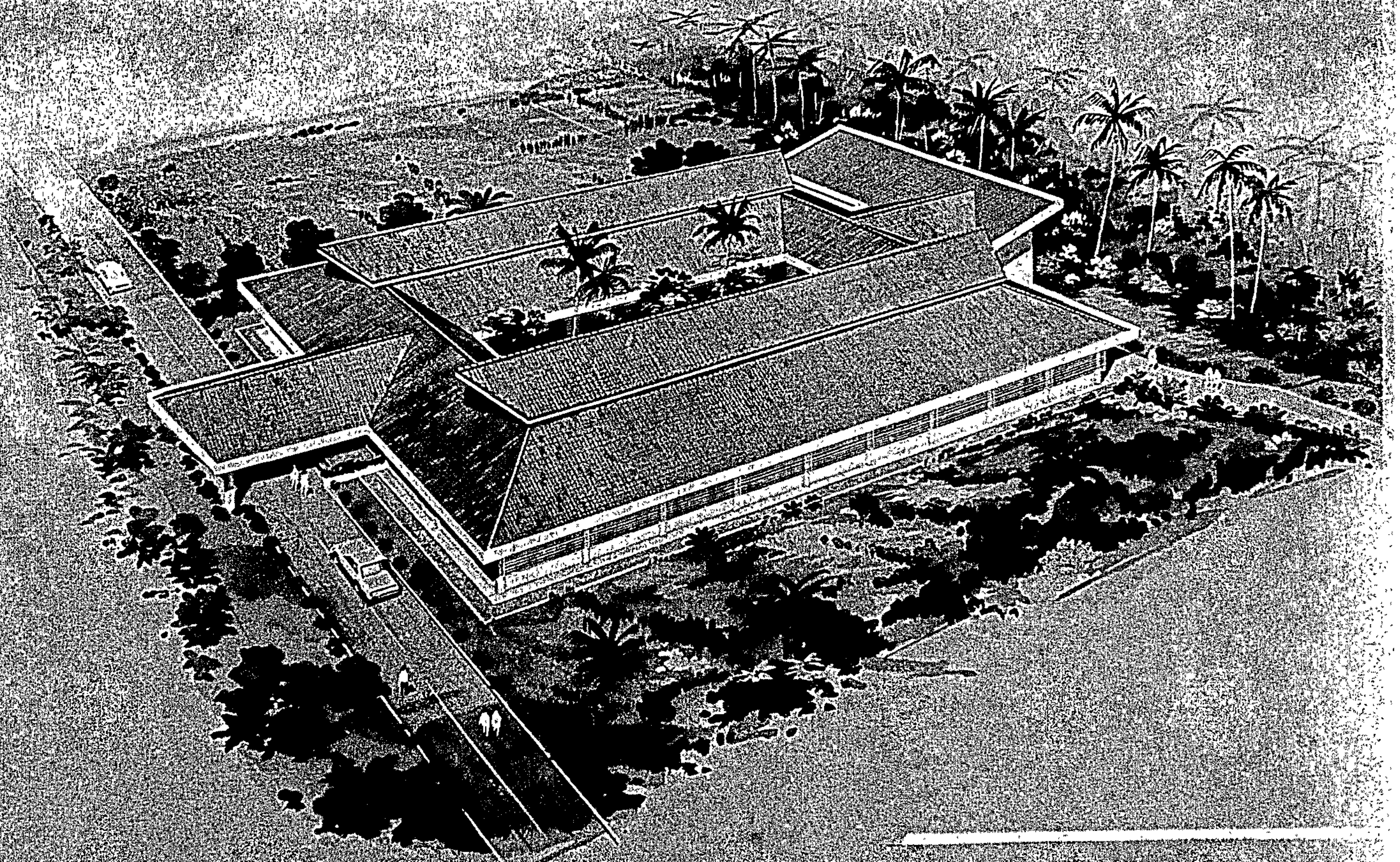
I wish to express my deep appreciation to the officials concerned of the Government of Indonesia for their close cooperation extended to the team.

February, 1982

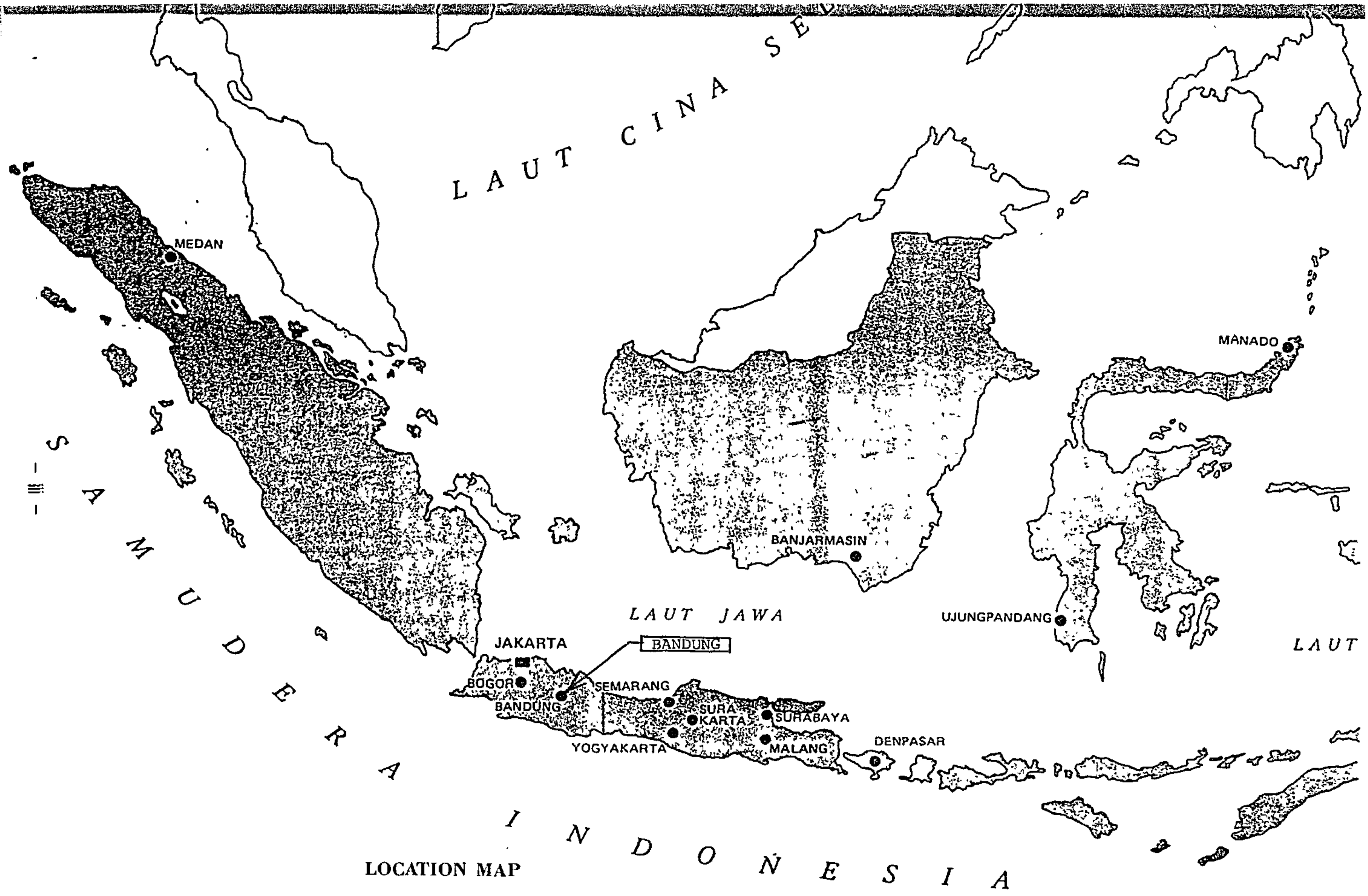
Keisuke Arita

President

Japan International Cooperation Agency



EXTERIOR PERSPECTIVE



LOCATION MAP

SUMMARY

The Quaternary is the geological era extending about two (2) million years up to the present in a total history of the earth which is said to be about five (5) billion years. The natural environment around us, such as the land surface, seas and climate, originated mostly in this era. The Quaternary is the richest in subjects for geological studies. In Indonesia, most of the land surfaces of Java, Sumatra, Kalimantan and other major islands of West Indonesia are covered with quaternary sediments. Therefore quaternary geology is especially meaningful to Indonesia. The Quaternary is the era that has proceeded parallel to the generation and development of man. It is called the "Era of Mankind", in which Indonesia occupies a significant place since the discovery of Pithecanthropus Erectus in 1891 in Central Java.

The Quaternary Geology Laboratory requested by Indonesia aims to integrate the scientists trained and equipment granted during the CTA-41 Project, to promote intensive and efficient study and seek further development. It also aims to satisfy widespread demand by governmental organizations and private industry as the special research and information center of quaternary geology, and to serve as a training center of Indonesian quaternary geology scientists.

The basic design study has studied the substance of the request from the government of Indonesia, and planned the most suitable basic design based on the appropriateness and the social and economic effect of the project for the establishment of the Quaternary Geology Laboratory.

The site is located in the west of Bandung, 112.5 kilometers from the capital city of Jakarta, and in the center of the inland area of West Java. The site consists of rice fields, grass and bush at present,

located on a slope going southward. The north edge of the site faces a 30 meter wide street which is under planning. The grounds, 18,000 square meters in area, have already been acquired by the Geological Research and Development Center (hereinafter called GRDC) under the Directorate General of Mines, Ministry of Mines and Energy. A comprehensive building arrangement plan of the grounds has been presented by GRDC, and the Quaternary Geology Laboratory is designed to be located according to this plan. The Laboratory is to belong to GRDC after completion of construction.

The major purposes of the Laboratory are to study mammalian, pollen, micro and nanno fossil contents in the samples collected from the quaternary sediments, to study paleomagnetism of rocks and minerals, to carry out geochronological study by fission track dating, fluo-analysis dating and ^{14}C analyzer dating, to determine the ages of the sediments by stratigraphic study and to elucidate the generation and characteristics of the sediments.

The Main Laboratory Building, which accommodates the administration and service division , is designed as a single-storey reinforced concrete structure to ensure minimal vibration transfer through the building for the protection of precision analysis equipment such as microscopes, balances and various kinds of analyzers. The Sample Preparation and Generator Rooms, where machinery and equipment which generate vibrations are placed, are in a different building in order to insulate against vibrations. The Astatic Magnetometer Room is designed to be in an isolated building to exclude exterior magnetic forces. The total floor area of the above three (3) buildings is to be 1,710 square meters.

Air-cooling of minimal capacity is to be provided for the laboratory equipment that needs temperature and humidity control for proper operation. For other areas natural ventilation and lighting are promoted by architectural design consideration to ensure comfortable environment. A generator system of minimal capacity is to be provided as an emergency power source for the laboratory equipment that must continue operation during power failure.

The new laboratory equipment planned to be installed consists of a ^{14}C analyzer for sample dating by measuring the breakdown of radiocarbon and a spinner magnetometer for rock dating by measuring residual magnetism in rocks. Their simplicity, utility and minimal maintenance cost have been the main considations in selecting them.

All the buildings are designed to be single-storey to lower the construction cost. Local products and construction methods are to be applied as far as possible to minimize the maintenance cost after completion of construction.

Quaternary studies involve the study of the background of man's life and production which took place in the Quaternary, the era of mankind. Quaternary studies are deeply related to man's life. There are such benefits in Japan as the construction of highways, bridges and multistorey buildings after the Kanto earthquake from the study of Kanto loam strata, the construction of the new Tokaido line by the study of alluvium, and so on. In Indonesia, basic study of quaternary geology will develop practical effects and enormous benefits are expected from the Quaternary Geology Laboratory such as the forecasting of volcanic activities, utilization of subterranean heat, countermeasures for landslides, construction of urban infrastructure, planting, agriculture, pedology, and exploitation of mineral resources in the quaternary sediments like casterite, magnetite, hematite and rutile, etc. The results from quaternary geology and the various methods of study fostered in it have the potential to expand and contribute to the entire range of geological study including tertiary geology.

As is stated above, the Quaternary Geology Laboratory Project is expected to have tremendous social and economic effects in Indonesia and is menaningful as an object of grant aid by the government of Japan.

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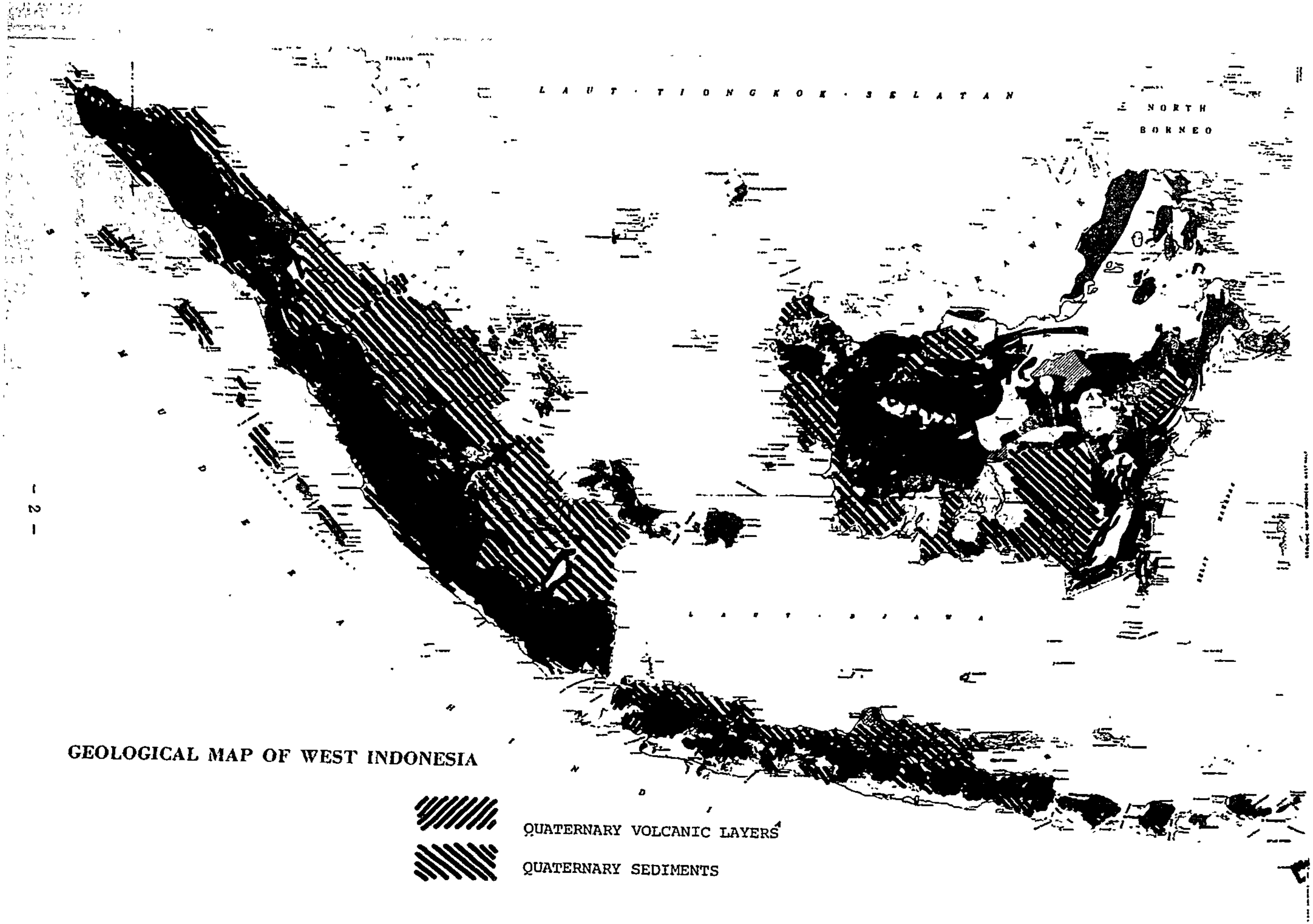
CHAPTER 1 OBJECTIVES OF THE PROJECT

CHAPTER 1 OBJECTIVES OF THE PROJECT

The Quaternary is the newest geological era extending two million years till today, which can be said to be only one or two days compared to the long history of the earth. Most of the land which man's life and productive activities have been based on was formed during the Quaternary. The surface of the earth including the sea, land, volcanos, lakes, glaciers and other natural environment such as the climate and distribution of animals and plants were originated in the Quaternary, changed over a long time, and continued to the modern era. The origin of the Indonesian islands is rather recent; most areas in Java, Sumatra and Kalimantan consist of quaternary layers as shown in the following page. Therefore, quaternary geology can be said to be one of the most important themes of geological study in Indonesia.

The Quaternary has proceeded parallel to the generation and development of man. In the environmental change during the Quaternary, man acquired the skill of using tools through the several glacial epochs, conquering nature and reaching today's prosperity. In this term, the Quaternary is also called as "Era of Mankind", in which Indonesia takes an important role as the place where Pithecanthropus Erectus was discovered in 1891 in Central Java. Also Homo Erectus Soloensis in 1931 and Meganthropus Palaeo-Javanicus in 1941 were discovered, which makes Indonesia a stage of major discoveries of hominid fossils of anthropoids and primitive men.

To elucidate the discovery of these hominid fossils, a technological cooperation project called "CTA-41" was carried out between Japan and Indonesia from August 1977 to 1979 as a part of an Indonesian national project. This project was a cooperative study including technological cooperation, through JICA, between Japan and Geological Survey of Indonesia(GSI) which was the original form of the present Geological Research and Development Center (GRDC), the authorities concerned in this Quaternary Geology



GEOLOGICAL MAP OF WEST INDONESIA

Laboratory. It was an integral research and study including geology, geophysics, paleontology, micropaleontology, anthropology, biology, and petrology, and covered mainly the area where the hominid fossils had been discovered. This project became the foundation of quaternary study in Indonesia. The result of this project was presented as a cooperative study report and the laboratory equipment granted by Japan during this period and new analytical methods using this equipment such as geochronological datings by paleomagnetics and fission-track dating were firmly established in Indonesia.

As mentioned hereabove, the quaternary study is partially an environmental scientific study of production and application which relates to man's life in terms that natural science deal with changes of natural environment, and the background of man's development during the Quaternary.

The request made by the government of Indonesia for assistance in the establishment of a Quaternary Geology laboratory aims to integrate the manpower and equipment trained or granted during the CTA-41 Project, which were scattered in different departments, for the purpose of intensive and efficient study. It is also intended that the Quaternary Geology Laboratory will serve as an information service center for the nation's scientists as the only research center of quaternary geology in Indonesia and training center for Indonesian scientists in the field of quaternary geology.

The government of Japan dispatched a basic design survey team through the Japan International Cooperation Agency (JICA) to Indonesia in November 1981 to confirm the request of Indonesia and to undertake an investigation of local conditions.*

The objective of the basic design study is to analyze the substance of the request and to plan the most suitable basic design based on appropriateness, the social and economic effect of the construction project of the

Quaternary Geology Laboratory.

* Yokogawa Architects & Engineers, Inc. was commissioned by JICA to perticipate in the basic design survey team.

CHAPTER 2 BACKGROUND OF THE PROJECT

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2-1 Present Situation of Geology in Indonesia

2-1-1 Education

One of the highest level educational organizations of natural science and engineering in Indonesia is the Institute of Technology of Bandung (ITB). ITB is located not far from GRDC, the authorities concerned in this project, whose faculty of geology is a four (4) storey building. The laboratory of quaternary geology isolated on the first floor of the adjacent building. The faculty of geology is led by five (5) professors who specialize in structural geology, quaternary geology, petrography and geophysics, and who are all well-known geologists. The dean of the faculty, Dr. J. A. Katili, serves concurrently as the head of the Directorate General of Mines, the supervisory department of the project. The department of quaternary geology covers a considerably large space furnished with various microscopes and specimens.

The study of geology in Indonesian universities was only started in 1956. It is a five-year course consisting of nine (9) semesters and one (1) six-month practical study period which the students have to take on the third year. The number of graduates is said to be only half of those who enter the school. Among those who passed the license exam for entering the universities, the applicants to the faculty of geology were 150, of whom only 54 students passed the examination, an indication that the course is rather a severe one. The number of students in the faculty of geology this year is 416.

About half of the graduates go to the governmental or private petroleum industries like PELTAMINA and the rest of them go to the mining industries or public geologic or mining organizations. This indicates what an important role petroleum plays in Indonesia. At present about 10 students are registered in the doctorate course in ITB. They are expected to go to the governmental research institution or remain in the university. Among the other universities and colleges in Bandung, only Pajajaran University has a faculty of geology and there are a few in Jakarta or Yogyakarta. The number of schools is not at all large.

The general courses in the faculty of geology are as follows:

General geology
Structural geology
Stratigraphy
Mineralogy
Petrology
Paleontology
Photogeology
Economic geology
Petroleum geology
Geomorphology
Cartography
Statistics

Other than geology programs in the universities,the Academy of Geology and Mining, founded in 1953 by the Ministry of Mining, has a three-year-course after graduating from high school for the training of assistant geologists.

2-1-2 The Geological Society of Indonesia

The Geological Society of Indonesia (IAGI) was founded in 1960 headed by Ir. Adjat Sudradjat M. Sc., with 650 members. The president is elected each year in the Annual Scientific Meeting. For application for new membership two recommendations from registered members are required.

Two publications, Berita IAGA (IAGA Letter) and Geologi Indonesia, are issued at present as well as the Stratigraphic Code of Indonesia now under study. Other publications of geological studies in Indonesia are as follows:

GRDC: Geological Maps, Bulletin

Directorate of Mineral Resources: Maps, Reports

Directorate of Environmental Geology: Maps, Reports

Volcanological Survey of Indonesia: Catalog of Indonesian Volcanos

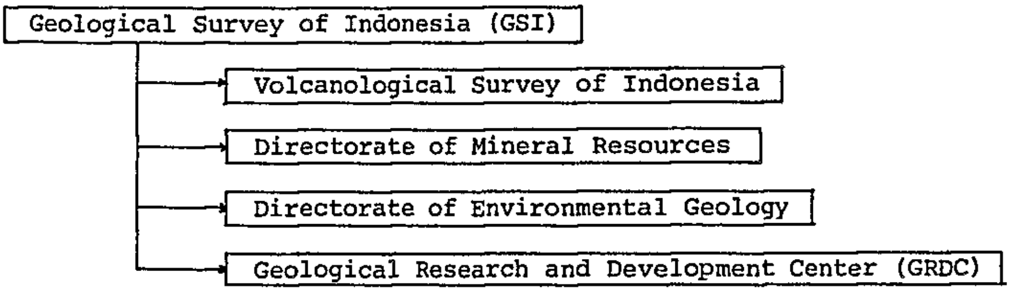
Indonesian Petroleum Association: Report of Annual Scientific Meeting

National Institute of Geology and Mining: Geological and Mining Research

Investigation of natural resources and the mapping of Indonesia were originated by the Prospecting Agency (de Opsporingsdienst) under the Bureau of Mines (Dionst van de Mynbouw) during the time of the Dutch colonial government. Quaternary geology also traces back to the time of the Dutch government, starting from quaternary stratigraphy based on the study of vertebrata in Java by Dutch geologists. Some of the present well-known research and studies include a study of the quaternary strata around the Sulawesi area by Prof. Sartono of ITB, a cooperative study by his group and the Institute of Archaeology on a study of hominid fossils in Java by Prof. T. Jacob of Gajah Mada University continuing more than ten (10) years. GRDC, established in 1979, is the only general research and study organization in Indonesia with a quaternary geology department and the above-mentioned CTA-41 Project contributed greatly to the establishment of the department of quaternary geology. It is not too much to say that many of the geologists and other scientists dealing with quaternary geology in GRDC were brought up and trained in that project.

2-2 Organization of the Directorate General of Mining

GSI was separated into GRDC and three other departments each of which was established as an independent organization in 1979. It is shown in the following chart.



(1) Volcanological Survey of Indonesia (VSI)

VSI is in charge of observing volcanic activity in Indonesia, forecasting eruptions and planning utilization of the volcanoes. It also deals with volcanological studies.

(2) Directorate of Mineral Resources (DMR)

DMR is in charge of investigation, development and conservation of mineral resources.

(3) Directorate of Environmental Geology (DEG)

DEG is in charge of geological investigation and control for the conservation of the ecological environment.

(4) Geological Reserach and Development Center (GRDC)

GRDC assumes the role of the general geological research and study organization for all the governmental organizations concerned with natural resources including the above and following six (6) departments. It also serves requests for analytical studies from mining companies and other industries dealing with natural resources.

Directorate General of Mines (DGM) consists of the four (4) departments above and the following three (3).

(5) Directorate of Mining Engineering (DME)

DME is mainly in charge of engineering in connection with mining and the selection of mineral ores.

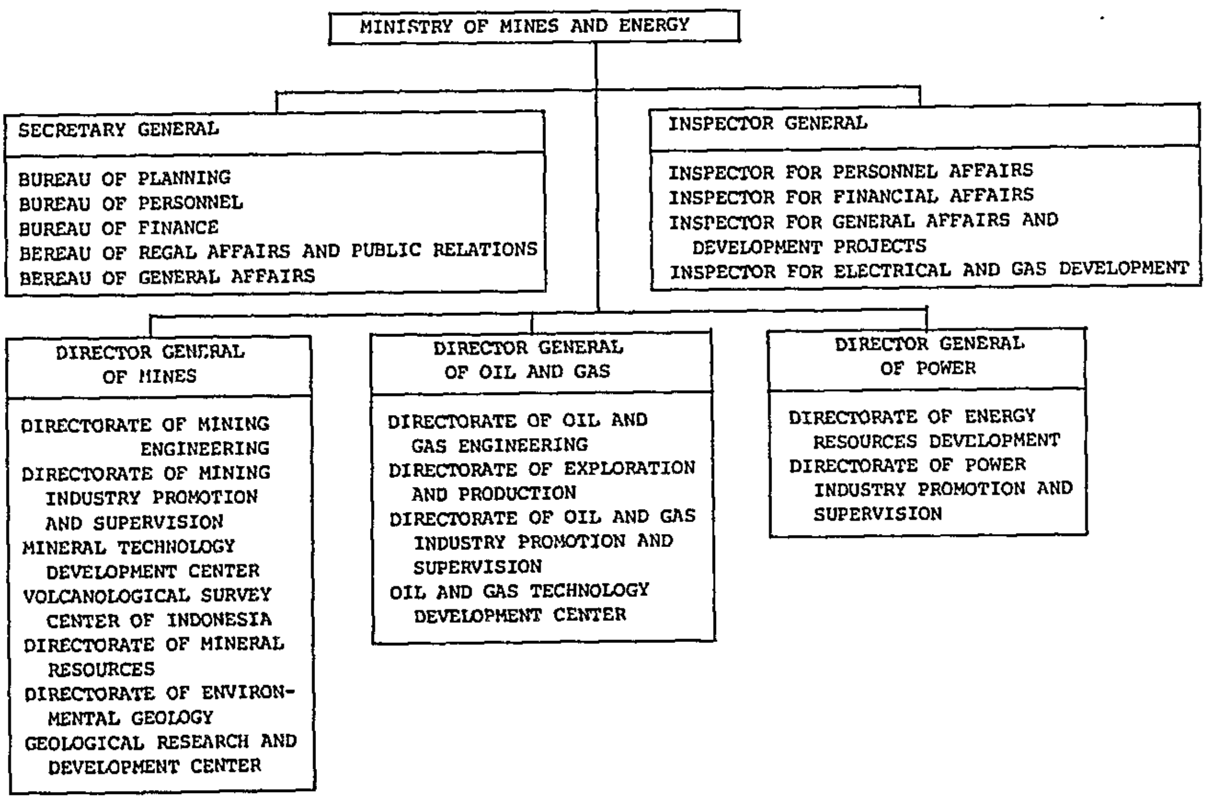
(6) Directorate of Mining Industry Promotion and Supervision (DMPS)

DMPS is in charge of supervising and promoting the mines.

(7) Mineral Technology Development Center (MTDC)

MTDC mainly serves in the role of a laboratory for the above two (2) departments.

The following chart shows the organization of the Ministry of Mines and Energy including the Directorate General of Mines.



ORGANIZATION OF MINISTRY OF MINES AND ENERGY

2-3 Aims and Organization of GRDC

(1) Aims

The Letter of Decision from the Minister of Mines, No. 734 in 1978 states the duty and function of GRDC as follows. GRDC is a technical executive unit for geological research and development and is responsible for carrying out research on various aspects of geology covering the supply of basic geological data and their handling as well as the development of various concepts and methods of geological research. To carry out this duty, GRDC has the following functions:

1) to supply basic geologic data needed for local, regional and national development programs,
2) to map and compile geologic maps of various scales,
3) to compile regional geologic maps, tectonic maps, and other thematic geologic maps,
4) to carry out research and to develop research methods in geology and other disciplines related to geology,
5) to supply facilities and laboratories to support geologic research and development,
6) to carry out geophysical research and mapping,
7) to assist other institutions in carrying out geologic research,
8) to administer an information system based on reports of various geologic activities and publish the results, and
9) to undertake planning and programming, financial, personnel and internal matters of GRDC.

For the above aims, it seems that GRDC, as its name implies, carries out geological research and development as a research center in Indonesia as well as assisting other geologic institutions, and funcitons as a training center of geologists. It is the other departments that carry out investigation of mineral resources, utilization of volcanic heat and control natural disasters. GRDC has the duty to provide basic geologic data for planning those policies which makes theoretical geologic study indispensable. The project of establishing the Quaternary Geology Laboratory is a part of the project for improving the laboratory facilities.

(2) Organization

GRDC is composed of the General Services Division and five (5) other divisions as shown in the next chart, with a staff of 432.

1) General Services Division

The duty of the General Services Division is to provide technical and administrative services to all elements and divisions of GRDC.

2) Regional Geology Division

The duty of the Regional Geology Division is to carry out research on geology of certain regions to obtain detailed geologic data.

3) Specialized Geology Division

The duty of the Specialized Geology Division is to carry out surveys in the field of applied geology, marine geology, quaternary geology and seismotectonics as well as to compile thematic geological maps.

4) Laboratory Analysis Division

The duty of the Laboratory Analysis Division is to undertake research and laboratory analysis on photogeology, remote sensing, petrology, mineralogy, geochronology, paleontology and rock chemistry.

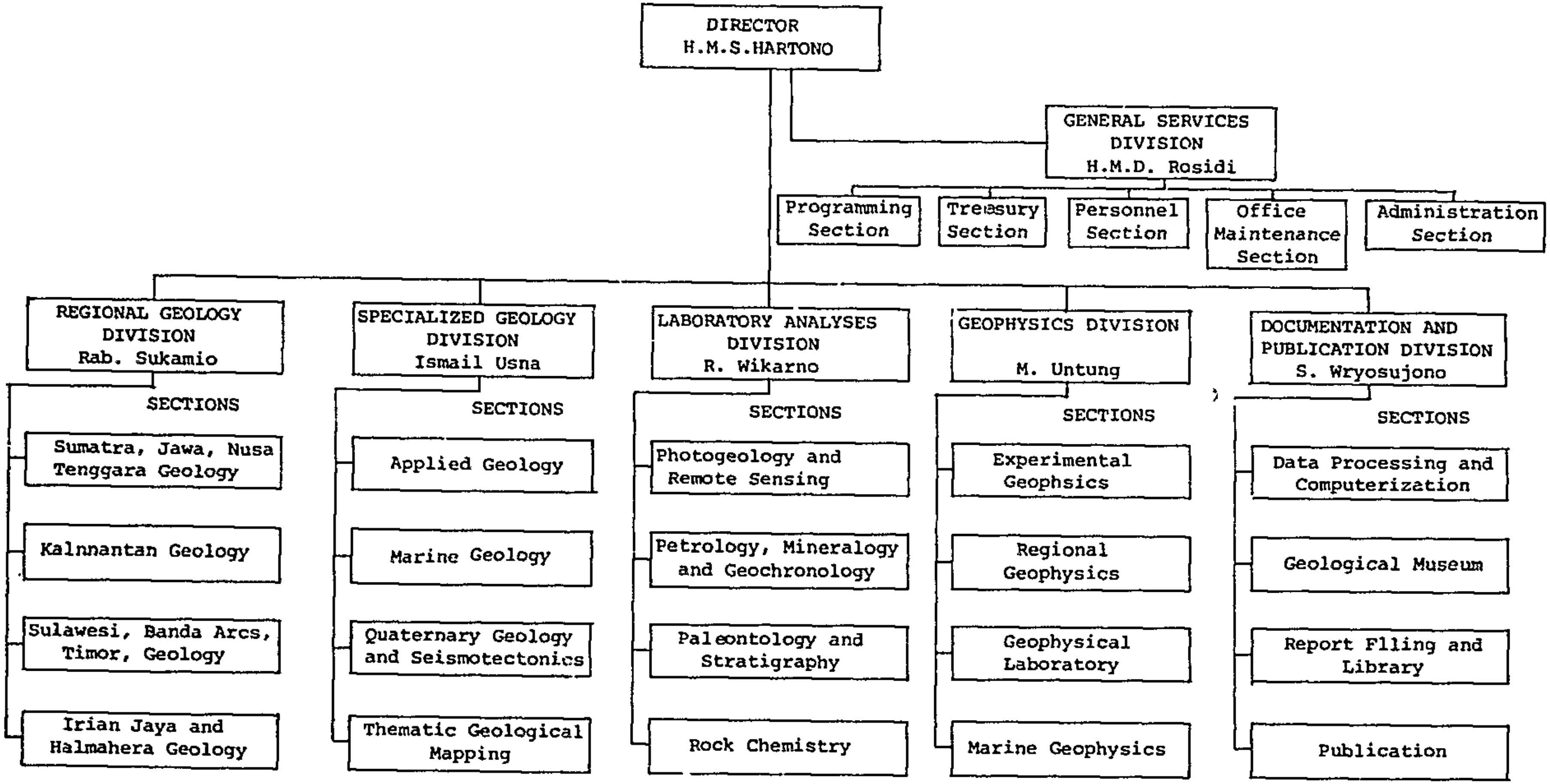
5) Geophysics Division

The duty of the Geophysics Division is to undertake geophysical research on land, in the sea as well as in the air.

6) Documentation and Publication Division

The duty of the Documentation and Publication Division is to document the results of geological surveys and research and to publish those which are essential to the geological community. It is also responsible for

GEOLOGICAL RESEARCH AND DEVELOPMENT CENTRE
DIRECTORATE GENERAL OF MINES
DEPARTMENT OF MINES AND ENERGY
JALAN DIPONEGORO 57, BANDUNG, INDONESIA



GEOLOGICAL RESEARCH AND DEVELOPMENT CENTER managing a library and geological museum. The geological museum preserves various rock samples, mineral samples and fossils. It has a display of huge fossils and is crowded with visitors of all ages.

The Quaternary Geology Laboratory is expected to be organized based on the quaternary geology laboratory under the Special Geology Division along with geochronology, stratigraphy and paleontology laboratories to fill out the laboratory staff. The established Quaternary Geology Laboratory is to belong the Laboratory Analysis Division. The new organization including this new laboratory is expected to be as follows:

GEOLOGICAL RESEARCH AND DEVELOPMENT CENTRE
DIRECTORATE GENERAL OF MINES
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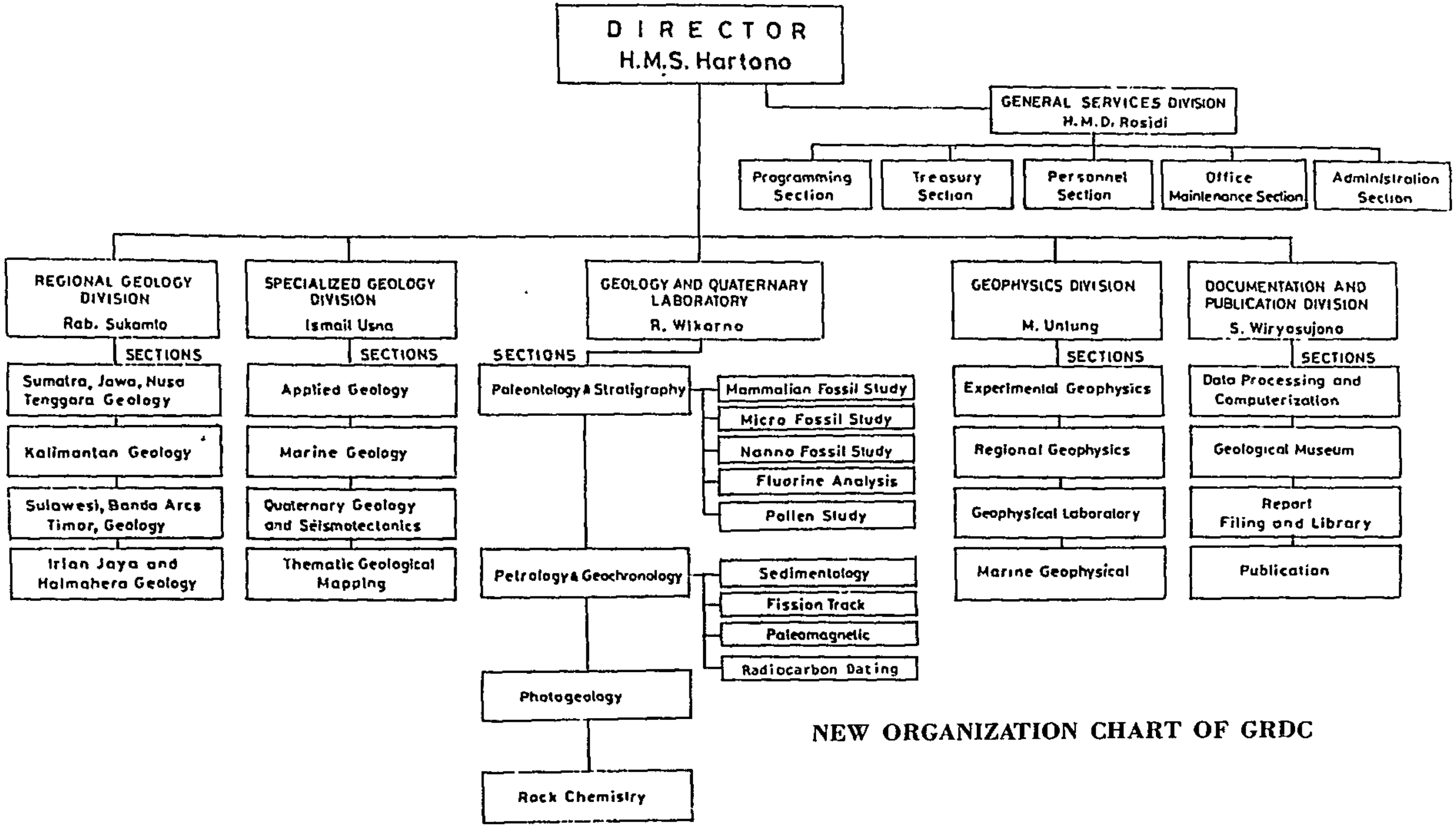

NEW ORGANIZATION CHART OF GRDC

2-4 Five Years Development Plan of GRDC

Upon the seperation of GRDC from GSI in 1979, GRDC established a five-year development plan from 1979 to 1984, which had the following six (6) program activities.

(1) To carry out a systematic geologic mapping of the Indonesian region, scale 1:100,000 in Java, 1:250,000 outside Java, and compilation of a regional geologic maps;

(2) To carry out research on applied geology, marine geology, quaternary geology, and seismotectonics, as well as to produce thematic geologic maps;

(3) To carry out research in petrology, paleontology, stratigraphy, and geochemistry, and the establishment and development of a geochronology laboratory;

(4) To prepare and provide data in geology and geophysics, as basic information for further development;

(5) Management and development of office, survey and laboratory equipment, in order to support geological research activities; and

(6) To carry out systematic geophysical mapping in the Indonesian region and interpretation of possible mineral potential, to undertake marine and experimental geophysical activities.

The project of establishing the Quaternary Geology Laboratory is to realize item (3) above. It may be interesting to indicate what programs are incorporated in the five-year development plan relating to quaternary geology, in order to get acquainted with the activities of the Quaternary Geology Laboratory. Those are:

1) Observations of geologic disaster areas caused by tectonic earthquakes, at Marapi (West Sumatra), G. Lawu (Central Java), Lombok, Yapen isl., Garut-Taskimalays, Curup (Bengkulu), and Karangasem (Bali).

2) Stratigraphic investigation of hominid and mammlian fossil discoveries in the Sangrian area, Central Java.

3) Palinologic investigation of Lake Bandung sediment,

4) Paleontology laboratory services,

5) Radiometric dating by the fission-track dating method,

6) Gravity, magnetic and paleomagnetic investigation in Flores,

7) Compilation of seismotectonic camps,

8) Applied geologic and quaternary geologic mapping in Java and outside Java,

9) Quaternary palinologic survey of the Bekasi and Tanggerang areas,

10) Micropaleontology study of the West Indonesian Islands,

11) Development of paleontology and biostratigraphy laboratory facilities,

12) Seismotectonic study in Bali,

13) Geothermal study of Mt. Ijen, East Java,

14) Geologic hazard mitigation studies,

15) Study on the quaternary pollen distribution and its sedimentation environment,

16) Observation and supervision of hominid and mammalian fossil discoveries in Central and East Java,

17) Paleomagnetic study,

18) Cainozonic biostratigraphy and magnetostratigraphy investigation in Central and East Java,

19) Development of paleontology and biostratigraphy laboratory facilities, and

20) Paleontologic and biostratigraphic study of Cainozonic formation, base on foraminiferal and diatom fossils content.

2-5 CTA-41 Project

As mentioned in CHAPTER 1, technological cooperation from Japan to GSI between 1977 and 1979 was called the CTA-41 Project which provided an important contribution to the development of quaternary geology in Indonesia, including paleontology, paleomagnetics, stratigraphy and geochronology. This project was a systematic, integral research and study covering paleontology, stratigraphy, biology, geology, petrology, and geochemistry as well as geochronology, by paleomagnetics and the fission-track method in the River Solo basin, Sangiran Dome, Pucangan Formation, Kabuh Formation, etc. in Central Java, where hominid fossils like Pithecanthropus or Meganthropus were excavated in the past. This project was indeed the beginning of general quaternary study in Indonesia.

Of the Indonesian scientists who participated in this project seven (7) were specialists in paleontology, four (4) in geophysics, one (1) in geology, five (5) in petrology and mineralogy. They joined GRDC in 1979 and have been continuing their studies of the quaternary. In particular, a sufficient number of scientists are continuing active studies in paleontology, and stratigraphy. Two scientists are continuing radiometric dating by the fission-track dating method which was introduced in the CTA-41 Project and have made considerable achievements. However, the fluo-analysis dating method was suspended. New scientists must be trained for practical use of this method.

The laboratory equipment granted by Japan at the time of the CTA-41 Project was carefully treated. All of it except that for fluo-analysis dating are more or less functioning properly. The scanning electron microscope is installed in a seperate room where air-conditioning is provided and a special engineer is posted for operation.

The principal purpose of the project of establishing the Quaternary Geology Laboratory is to concentrate the scientists trained in and the equipment granted under the CTA-41 Project which are now scattered in different departments in order to establish a close cooperationship between each department to assume more effective and efficient studies. That is, it is intended to ensure the general quaternary study system centering around geology as well as to function as the training center for quaternary study scientists in Indonesia.

2-6 Manpower Training Program by GRDC

The total number of staff in GRDC amounts to 432 as of the end of 1981; 244 in professional posts, 75 in administrative posts and 113 in non-professional posts. The 244 professionals are subdivided further:

Geologists	71
Assistant Geologists	68
Chemists	2
Biologist	1
Geophysicist	1
Zoologist	1
Surveyors	33
Analysts & Technicians	39
Cartographic & Graphic Technicians	28

GRDC is considered a peculiar scientific organization in which the above professionals occupy 56 percent of the total staff.

Since the establishment of the Center in 1979, 15 scientists have been sent to foreign universities and training centers using various international funds or aids from the foreign countries. The first six (6) scientists are in quaternary geology, one (1) in quaternary geology, one (1) in paleomagnetics, three (3) in paleontology and one (1) in geochronology. They are all scheduled to finish their overseas studies to work in the Quaternary Geology Laboratory by the time of the completion of the Laboratory. The fact that six (6) of the total 15 scientists majored in quaternary geology indicates the emphasis GRDC gives to this study.

Though receiving foreign aid, GRDC does not provide its own or overseas scholarship system. Therefore it is necessary to establish a professional training system in the Center to train young scientists as well as to establish a long-term manpower training program centering around the overseas study program. Thus it is believed the Quaternary Geology Laboratory will make a great contribution to GRDC's manpower training program by aiming to be the training center of all Indonesia in quaternary geology and related subjects.

GEOLOGICAL RESEARCH AND DEVELOPMENT CENTRE PERSONNEL
STUDYING/TRAINING ABROAD

	SUBJECT STUDIED	DONOR COUNTRY	UNIVERSITY	LENGTH OF STUDY	DEPARTURE
No.1	Training on Palaeomagnetic	Australia	The Flinders Univ.	1 Year	- 1-1981
2	Paleontology (Training)	Australia	Univ. of Westhern Australia	1 Year	16- 3-1981
3	Quaternary Geology (M. Sc. Program)	Belgium	Vrije Universiteit	2 Years	6- 2-1980
4	Palaeontology (M. Sc Program)	N. Zaeland	Auckland Univ.	2 Years	9- 2-1981
5	Geochronology (Training)	British	Institute of Geological Sciences	1 Year	27- 3-1981
6	Training on Palaeontology (PH. D. Program)	Japan	Yamagata Univ.	1 Year	28- 8-1981
7	PH. D. Program on Geophysics	Australia	Univ. of New England	3 Years	14-11-1978
8	M. Sc. Program on Structural Geology	Australia	Univ. of New South Wales	38 Months	13- 1-1980
9	M. Sc. Program on Marine Geology	Australia	The Flinder Univ.	51 Months	6- 1-1981
10	M. Sc. Program on Exploration Geophysics	Australia	Univ. of New England	3 Years	2- 1-1981
11	Museumology (Dipl Program)	Australia	Univ. of Sydney	1 Year	2- 2-1981
12	Marine Geology (PH. D. Program)	West Germany	Christian Albert Univ.	3 Years	7- 4-1980
13	Seismotectonics (M. Sc. Program)	N. Zaeland	Auckland Univ.	30 Months	22- 6-1980
14	Marine Geophysics	U. S. A.	Smith Sonian Institute of Oceanology (S.I.O)	1 Year	22- 7-1981
15	Training on Seismology	Japan	Yamagata Univ.	1 Year	3- 9-1981

CHAPTER 3 SITE CONDITIONS

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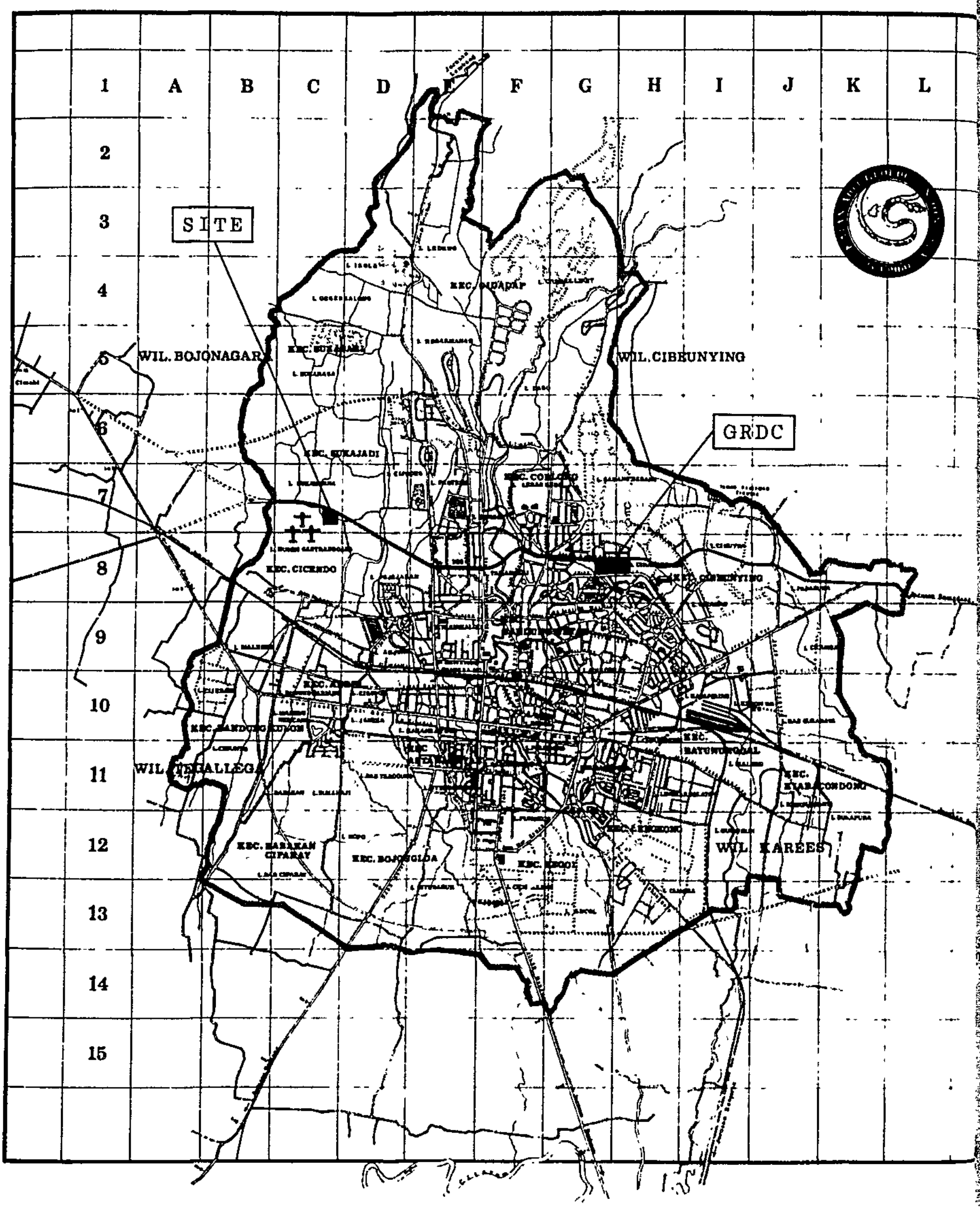
3-1 Location of the Site

Bandung is located about 180 kilometers by road southeast of the capital city, Jakarta, in the center of the Bandung basin, which lies the center of the inland area of West Java. Though Bandung is located at 6°55' S. latitude and 107°36' E. longitude, in the equatorial area, the climate is relatively comfortable with an average temperature of 24° C because the city is built on a plateau 760 meters above sea level. Owing to this, there are ten (10) universities and colleges as well as laboratories and other vocational schools in Bandung, which give the city an academic atmosphere along with antique rows of houses and old roadside trees since the days of the Dutch colonial govenment. The population of Bandung is 1.4 million.

The site is in the west of Bandung, on a sloping surface commanding a view of the Bandung airport to the south. The north side of the site faces Terusan Pasteur Street. The other three (3) sides face the adjacent grounds.

3-2 Surrounding Area at the Site

Terusan Pasteur St., on the north side of the site is now undergoing expansion construction as the by-pass of the national highway crossing the center of the city from east to west. The width of the street is planned to be 30 meters including sidewalks with the roadside trees. The work has proceeded westward from the center of the city to front of the grounds and has been suspended at the next village, west of the site. Proceeding on Terusan Pasteur St. eastward, it connects with Surapati St. though they only partially connect in the center of the city; on the south side of Surapati St. is located the GRDC headquaters, which accomodates a geology museum. At the time the road construction is completed, GRDC and the Quaternary Geology Laboratory will be connected by one street at a little less than five (5) kilometers distance.



LOCATION MAP OF GRDC AND SITE

At present the area surrounding the site borders urban and village areas, a quiet area where fields and rice fields mingle. After the completion of the front road construction, the surrounding area may show great change considering the favorable circumstance that it will face the by-pass of the national highway through Jakarta - Bandung - Yogyakarta, and its proximity to Bandung airport.

3-3 Present Situation of the Site

The site is about 70 meters wide east to west and about 240 meters in length from north to south. It is a long narrow ground oriented in a north-south direction, facing Terusan Pasteur St. on the north. The site is a part of a hill having a slope from north to south with a difference in level of about 10 meters from north to south. The north one-third of the site area is flat and to seems to have been fields while the middle one-third area seems to have been rice fields, which are now covered with grass and bushes. The south one-third of the area is rice fields with rice planted at present. This area is said to have been purchased later. The west side of the site is partially bordered by barbed wires. The rest of the border is clearly indicated by the temporary posts driven at necessary places. The total site area is about 18,000 square meters. At present, the site remains as it was when it was purchased, without grading. No site preparatory work like drainage, water supply or electric supply has been carried out.

3-4 Existing Infrastructure

3-4-1 Electric Power

Electric power in Bandung is controlled and supplied from RERATURAN UMUM INSTALASI LISTRIK (P.U.I.L.). The present power supply capacity is not sufficient, however, and it is expected to be improved after an electric distribution center is constructed in the north of Bandung in January 1982. Still since power failures are frequent, a generator system of minimum capacity shall be provided as an emergency power source.

The main cable of 20KV is to run along the street on the north side of the site (JALAN TERUSAN PASTEUR) from which GRDC plans to lead the incoming feeder for this entire complex.

3-4-2 Water Supply

The water supply system is rather poor in Bandung. Most households use water from deep or shallow wells.

A 2-1/2" dia. (65/m) pipe is installed under the street on the north side (JALAN TERUSAN PASTEUR) for fire water only, which is not allowed to be used for water supply. Future installation plans are not under consideration yet.

GRDC plans to dig two deep wells in the complex (including a sistern and pump) from which water is to be distributed and supplied to each building by a gravity distribution system. It will be completed prior to the commencement of the construction of the project buildings.

3-4-3 Drainage

The drainage system is also poor in Bandung; even drainage from the public roads is not complete. GRDC has a plant for only storm water drainage for the complex, and a seepage pit is to be used instead of the sewage system.

3-4-4 Telephone and Telecommunications

PERUM TELEKOMUNIKASI provides management and control of the telephone and telecommunication system in Bandung. Its capacity is sufficient for use. However, application for the installation of new lines is difficult; sometimes the applicant has to wait for several years. GRDC has already applied for the circuits of which one (1) circuit is determined to lead into the project building.

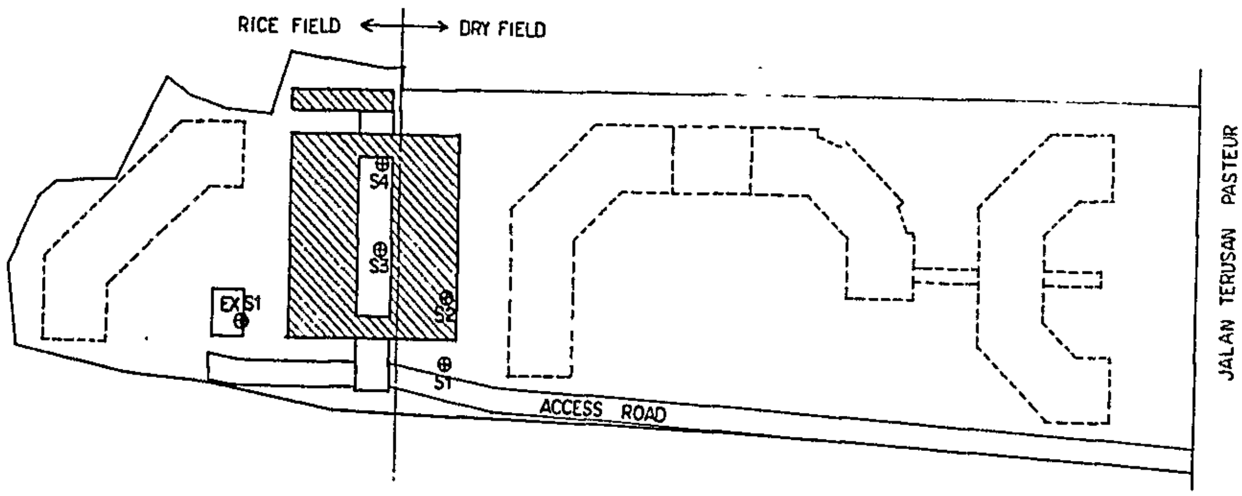
3-4-5 Gas Supply

There is no public gas service and propane gas is used commonly, which has sufficient supply capacity.

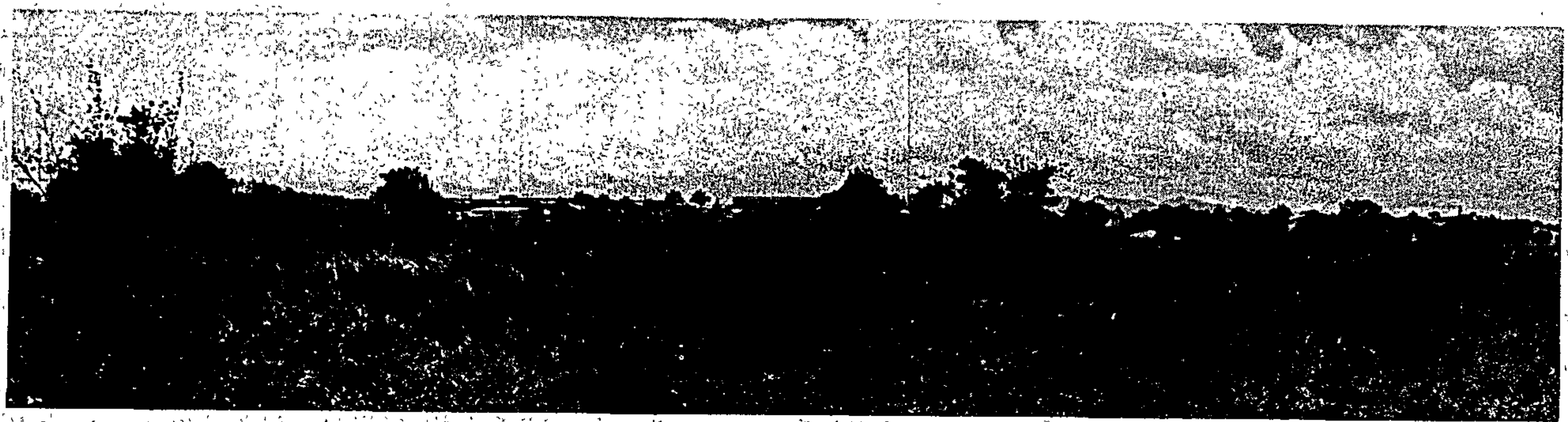
3-5 Soil Conditions

According to the field survey, it was expected that the southern one-third of the site, the area with the rice fields, would have undesirable soil bearing capacity. As the site for the Quaternary Geology Laboratory was allocated in the area extending from the rice field and the north grass fields based on the entire grounds arrangement plan by GRDC, the surevey team designated two (2) points in the rice field and two (2) in the grass field for boring and requested soil investigation. The soil investigation report was received by the team on November 26 (attached to Annex). If the foundation bed of the Quaternary Geology Laboratory is located on the 594 meters level in the topographic plan (1 or 1.5 meters below the ground surface), the allowable soil bearing capcity is around 10 t/sq.m at S_1 and S_2 points, north of the rice field; and 2 t/sq. m at S_3 and S_4 points in the rice field. That is, the allowable soil bearing capacity of the present rice field area is only one-fifth compared to that of the northern area.

The boring tests, however, indicated that firm rock bed of 150 to 200 t/sq.m allowable soil bearing capcity lies 7 meters below the ground surface. Boring points are indicated in the following sketch.

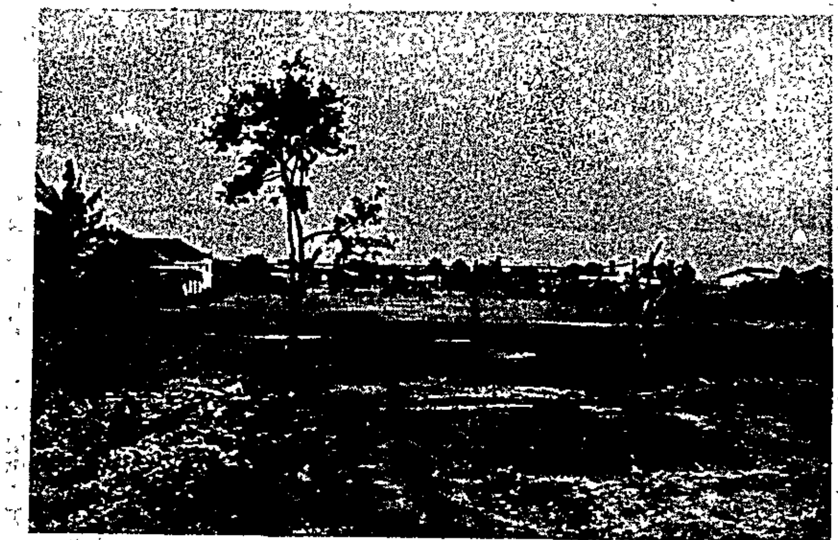


BORING POINTS IN THE SITE



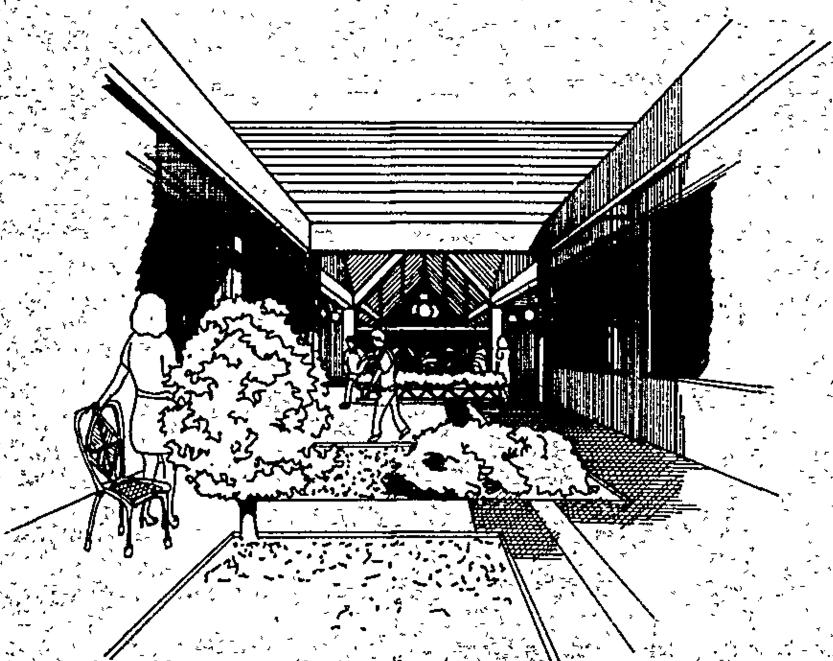
SITE AREA (North to South)

TERUSAN PASTEUR ST. UNDER CONSTRUCTION (East to West)



NORTHERN ONE-THIRD OF SITE

CHAPTER 4 BASIC PLANNING



CHAPTER 4 BASIC PLANNING

4-1 Basic Principles

The Quaternary Geology Laboratory will consist of the Main Laboratory Building attached to the Unloading Building and the Astatic Magnetometer Building. The basic policies in designing the project are--

(1) to respect the desire of the Indonesian authorities concerned in the selection of laboratory equipment to be granted and to consider the simplest system for their easy operation and maintenance,

(2) to design the laboratory utilizing domestic Indonesian products and materials and respecting local construction methods as far as practicable,

(3) to ensure a comfortable environment in conformance with local hot humid weather conditions,

(4) to harmonize with the environment of surrounding area,

(5) to consider the simplest system to minimize trouble and damage of building facilities as well as to attain easy repairs,

(6) to limit the air-cooling unit only to the laboratory equipment that functionally requires cooling. Generator system is also limited to minimal capacity that is necessary, and

(7) to minimize the operation and maintenance cost after completion of construction.

4-2 Functional Components

The Quaternary Geology Laboratory is composed of the following functional components as specified in the basic drawings in the following chapter (numbers are matched with the room numbers shown in the plans):

(1) Administration and Service Division

This division consists of the administrative, and building service rooms.

04 Guard Room, 05 Office, 07 Conference Room, 09, 10, 13, 14 Lavatories, 11 Entrance Hall, 12 Service Entrance Hall, 15 Drawing Room, 16 Dark Room, 17 Cafeteria, 18 Storage, 19 Drilled Core Storage (Samples collected from underground by driving pipes into the strata are called drilled core), 20 Electric Power Distribution Room, 26, 27 Passages, 28 Generator Room

(2) Research and Analysis Division

01 Pollen Analysis

Pollens and spores grown in the geological age scattered out of anthers and remain in the sediments as fossil pollen and spores. Their firm exines are well preserved resisting soil pressure and geothermy. There are various methods for extracting pollen and spores from sediments depending on the kind of pollen and spores. Common methods are removing soluble substances by acid and alkali to extract fossils from the remnants. Pollen analysis is useful to elucidate the history of forestry, paleoclimate and paleovegitaion, and is also applicable to petroleum resources development and submarine geology.

02 Micro-Fossil Study

Fossils of micro-scopic size are called micro-fossils including micro-animals (radiolaria, amoebas, foraminifera, silicotlagellates etc.) micro-plants (diatoms), and some larger creatures (sponges, spicules, crinoids). Micro-fossils are found more frequently than large fossils. As they are found even in small samples like bored cores; they can be studied statistically and are often utilized in applied geology. Micro-fossils are also used for sedimentation and comparison of strata, which is called micro-fossil stratigraphy. Minute fossils that is smaller than micro-fossils and cannot be observed even by the microscopes are called nanno-fossils.

03 Mammalian Study

Mammalian study is the study of mammalian fossils.

04 Fluorine Study

Though bones of living creatures hardly contain any fluoride, hydroxyapatite, which is a subtance in bones, gradually changes to fluoropatite, as the OH ion of hydroxyapatite is replaced by the fluoride ion in underground water while the bones are preserved underground for a long period. As a result, fluoride ions increase in fossil bones. Fluorine study is fossil dating study by measuring the amount of fluorides in fossil bones.

22 Fission Track Study

Fission track study is a dating study of minerals by measuring tracks left on mineral glass which was made when uranium 235 (^{235}U) atoms broke down on reaction with thermoneutrons into two (2) nuclei and scattered. It is said that fission track study is applicable within the range of 10^3 to 10^9 years. The size of the tracks is measured only in millimicrons, however, they are easily observed by chemical etching treatment.

23 Pedological Study

Pedological study is the study of soils as natural substance. As it is widely applicable in agriculture and forestry; pedology is incorporated into agricultural chemistry or forestry in universities or under academic adminstration. However, pedological studies are chronological and consist of pedogenesis, physical pedology, chemical pedology, biological pedology, mineralogical pedology, etc.

24 Paleomagnetic Study

Paleomagnetic study is rock dating by measuring residual geomagnetism based on human records over 400 years which are obtained by using residual rock magnetism as a magnetic fossil. British geophysists concluded in 1957 that four (4) assumptions were needed to clarify natural residual magnetism data they had collected. It is not mentioned here what these assumptions were, however, since then, paleomagnetic study has been firmly established in relation to the theory of geomagnetic cause of geoevolution theory such as polar wandering and continental displacement.

24 Radiocarbon Dating Study

Radiocarbon dating study will also be located in No. 24 room by dividing the room into two (2) spaces.

Radioactive carbon ^{14}C shows β^--distruction in a 5,730-year half-life. The ^{14}C contents of living creatures is almost the same throughout the ages, but the ^{14}C content of a body that died t years ago has decreased on account of β^--distruction in t years. Radiocarbon dating study involves the calculation of this t years by measuring the decreased amout of ^{14}C. Creatures to which radiocarbon dating study is applicable are wood, carbon, shells, peat, bones, etc.

29 Unloading & Sample Preparation Room

Samples such as rocks, mineral ores and fossils collected by field surveys are delivered to the Unloading and Sample Preparation Room and unloaded, washed, sorted and stored. Then they are prepared into appropriate shapes and sizes for research and analysis by shattering and grinding.

30 Astatic Magnetometer Building

The magnetic susceptibility of rocks and others will be measured by the astatic magnetometer in this building. Two (2) vertical magnets are fixed in parallel at a little distance and are hanged by crystal strings. When these magnets are reversed, force from the geomagnetic field will affect them in the opposite direction negating each other. If a sample is placed close to one of the magnets, magnetism in the sample causes a reaction in each of the magnets and they turn round to the angle equivalent to the strain on the crystal string. From the distance of the sample to magnets and the radian, the magnetic susceptibility of the sample can be measured.

Astatic magnetometer seldom causes problems as it is a very simple system. The problem is that the radian of the magnets can be influenced by subtle external magnetic forces. The equipment requires an isolated environment. Reinforcing bars or structural steel can not be used in the building.

4-3 Arrangement of Buildings

GRDC is purpose in the entire building arrangement plan, as shown in the following page, is to move its research and analysis division as well as administration and service division into the project site from the present location in Bandung. The arrangement plan is to locate the administration building in the north area facing Terusan Pasteur St., the building of the research and analysis division next to it to surround the tennis court and the workshop in the south end of the grounds. The project site of the Quaternary Geology Laboratory lies between the research building and the workshop. The administration and the research buildings are designed to be of four-(4) storey reinforced concrete structure complying to the Bandung city planning ordinance that all the buildings facing major streets have to be four-(4) storey. The part with oblique lines is now under preparation for construction as the first construction stage of the entire schedule.

The administration and research buildings are to serve as the protective screen for the Quaternary Geology Laboratory against the noise and vibrations of Terusan Pasteur St.

From the south side of the ground Bandung Airport can be seen below; however, since there is about one (1) kilometer distance to the airport and as take-offs and landings are infrequent , their noise and vibrations are not considered to be a problem. The reason why noise and vibrations have to be taken into consideration is explained below. As of the commencement of the construction work of the project building, the above building of the first construction stage will be under construcion by GRDC, and completion of the installation of temporary electric power and water supply is promised. It is also promised that a temporary road for site transportation from Terusan Pasteur St. to the designated location of the laboratory is to be constructed by GRDC.

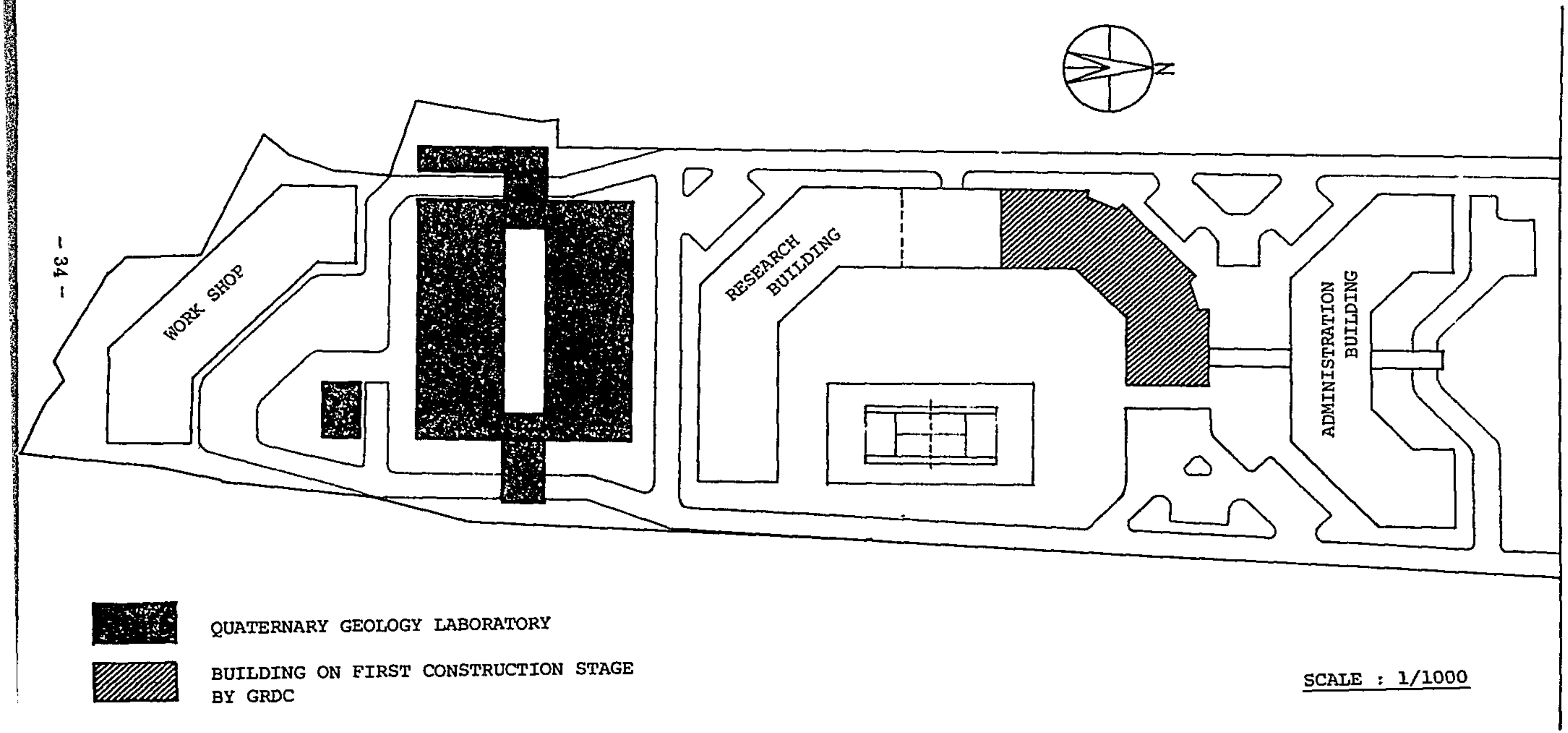
The main laboratory is to accommodate various rooms including laboratories in which geology laboratory equipment for precision analysis and measurement is to be arranged. The equipment granted in the CTA-41 Project and to be transferred to the Main Laboratory Building in the future, and that requested in this Project is extremely precise equipment which absolutely requires no vibrations, noise and dust. Vibrations especially must be definitely excluded because they may cause counting errors. It is because of these characteristics of the laboratory equipment that the Generator Room and the Sample Preparation Room are designed in different building to isolate vibrations from the Main Building and that the Main Building is designed to be single storey reinforced concrete structure so as not to transfer vibrations through the building. Two (2) wards are to be arranged north and south in parallel, which will be connected at east and west ends where the main and the service entrances are to be located. The whole building is to be designed to surround the courtyard. A patio type building style surrounding a courtyard is commonly seen in Indonesia.

The Unloading Building attached to the Main Building is to be for transportation, unloading and sorting of rocks and other laboratory study materials, and for preparation of those sample which may generate noise, vibrations and dust. It will accommodate machinery and equipment for the operations and a generator room, which may also generate noise and vibrations, as an emergency power source for the laboratory equipment in case of power failure. The building is to be a single storey reinforced brick structure with asbestos slate roofing. It is to be arranged with a space from the Main Building for car unloading in between, and a roof will be provided over the space for convenience in rainy weather.

The Astatic Magnetometer Building is to be a building of special structure located in the farthest place from all the other facilities in the grounds because the astatic magnetometer is sensitively affected by external minimal magnetic force. The Quaternary Geology Laboratory is to consist of these three (3) buildings.

The Main Laboratory Building, that will accommocate the major common rooms, is designed to have its main axis east to west, to insure a comfortable environment in terms of lighting and ventilation, and to ensure an effectively lower thermal load for the air-conditioning provided to those rooms as functionally required.

The main entrance is to be designed on the east side of the main axis while on the west side the service entrance and unloading space for the Unloading Building is to be located. Two (2) access roads will be constructed along the east and west sides of the building connecting Terusan Pasteur St., north of the grounds, to the main and the service entrances respectively.



ENTIRE BUILDING ARRAGEMENT PLAN

4-4 Planning

The Main Laboratory Building will be single storey reinforced concrete structure, 16 meters north-south and 45 meters east to west. Two (2) buildings will be parallel at 8 meters distance. This interval will be closed at the east and west ends where the main entrance and the service entrance are located. The inner space will be left as a courtyard with plants. It will serve as the rest area for the laboratory staff, and the open space will provide natural lighting and ventilation. Both entrances will be open to the courtyard; visitors outside the main entrance can see the bright courtyard through transparent glass and from the entrance hall they can reach the courtyard beyond a deep canopy. The back hall will serve as the lounge for the laboratory staff.

Two (2) laboratory wards wil be of 8 meters x 2 spans with a uniform rigid frame structure haivng a middle corridor 2.5 meters wide (wagons carrying samples will pass through the corridor). The outer rooms will be 8 meters long and the inner rooms facing the courtyard will be 5.5 meters long. Various laboratory rooms requiring a large area will be arranged in the outer rooms while small rooms mainly for administrative service will be arranged in the inner rooms. Lavatories will be diagonally located to have equal access distance. Those close to the main entrance will also be available to visitors. Next to the entrance hall, the guard room and information desk will be located adjacent to the office. The whole layout is designed to be symmetrical as far as practicable. Symmetric arrangement presents the beautiful good balance, and it is the simplicity of form which leads to low construction cost.

4-5 Finish Grading

As is stated in Chapter 3-5, Soil Conditions, the project site lies in both a grass field with relatively good soil bearing capacity and a rice field with poor bearing capacity. Prior to the finish grading work, the soft topsoil of the grass field and mud of the rice field have to be romoved. Considering this point, the finised grade level is planned on the flattest part with the widest contour distance so that the amount of cut soil will be much more than that of fills and the total amount of soil used for the grading work will not be great. As the area has a slope of six (6) percent gradient on the average to the south according to the topographic plan and section, a huge amount of soil would have to be graded to obtain a uniform-level finished grade. Therefore it is planned that the floor levels of the north and south wards will have a difference within a tolerance that will not affect practical use, for the purpose of decreasing the amount of soil to be graded. The designed levels of the finished grade are 594.00 meters for the north ward and 593.40 meters for the south ward. The planned finish grading drawings with the net amount of soil to be graded are indicated in Chapter 5-9 and 5-10.

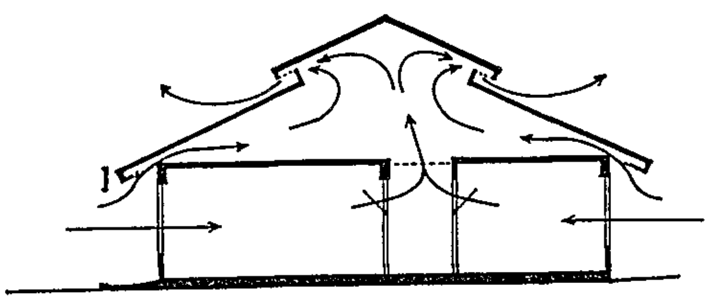
The finish grading work incicated in the above drawings will be Indonesia's responsibility. The cutting down of trees and bushes, and the excavation and removal of soft, muddy topsoil have to be carried out prior to the finish grading. Part of the cut soil and soils collected from outside the grounds with suitable quality are to be used for fills.

4-6 Sectional Planning

As mentioned above, there is a 0.6 meter level difference between the north and south ward floors. When the level of the entrances is designed in the middle, 593.70 meters, the entrances will be connected to the south ward corridor by a slope of 0.3 meter downwards and to the north ward corridor by a slope of 0.3 meter upwards. The roof level of the two (2) wards should have a 0.6 meter level difference in parallel with the floor levels; however, the roof is designed to be of equal level considering that it will cause rain water leakage if the roof is designed with a level difference.

The main problem of designing the Laboratory for weather conditions in Indonesia is that of designing the building to withstand the strong rays of the sun in the dry season and the high temperatures and humidity and showers in the rainy season. Bandung is located at 6°55' S latitude with a southing solar height of 73°25' at the summer solstice, northing solar height of 59°35' at the winter solstice and 83°05' at the vernal and autumnal equinoxes. Also the sun passes directly above twice a year. Therefore windows will not be placed on the east and west sides as far as practicable in order to receive the minimum solar heat in the morning and evening, but placed on the north and south sides with wide canopies to eliminate the sun's rays and leaking in heavy rains. Based on this principle, the design of the building has an east to west axis and rooms facing north and south.

The roof is of a steep pitch, common in this area in order to prevent leaking in rain showers as well as to utilize the spacious attic as a heat insulating zone. The hot air will be naturally ventilated by a monitor roof which is to be designed on the ridge. Fresh air will be taken through the north and south exterior windows, flow to the corridor through the transom windows above the room doors, to the attic through the opening in the corridor ceiling and leave through the monitor roof. This air flow is shown in the following figure.



NATURAL VENTILATION

4-7 Module

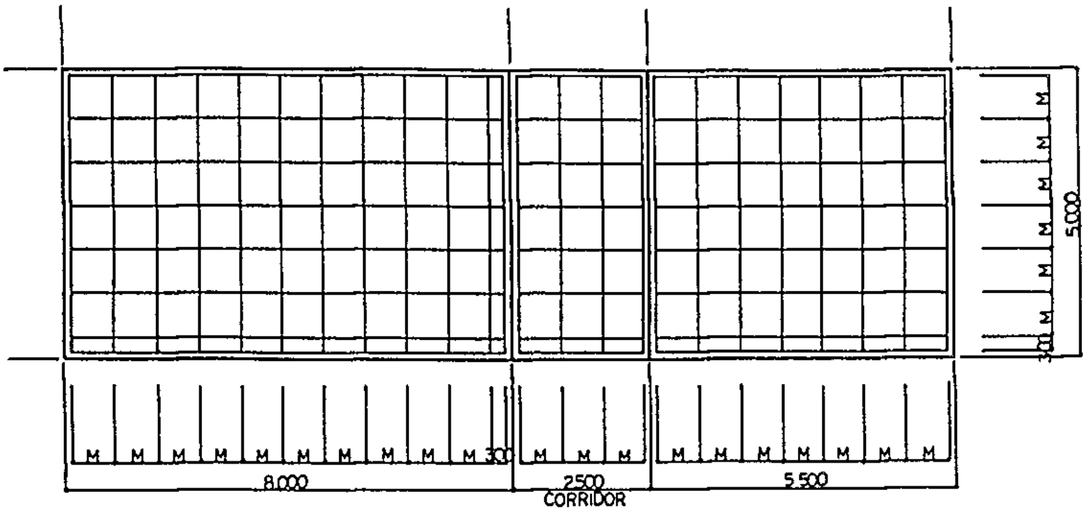
Architecture is called the "science of dimension", which means that architecture interprets every tool and device in human life into dimensions to form a comfortable ecological environment. The basic module value of the basic laboratory plan is to be 750 mm, which is the greatest common measure of the laboratory equipment, facilities, furniture and human activities as is shown in the following figure. Based on the dimension of 750 mm, a module table has been estimated as follows. This table covers the dimensions of ready made construction materials or their combination. Each room's dimensions will be principally based on this table.

MODULE TABLE

25	5	1	2	4	8	16	32	64
75	15	3	6	12	24	48	96	
	45	9	18	36	72			
		27	54					

75 stands for the basic module, 5 and 8 mean the spans of the Main Laboratory Building. From the basic module, double numbers or half numbers are listed to the right and left, and triple or one-third numbers downward or upward.

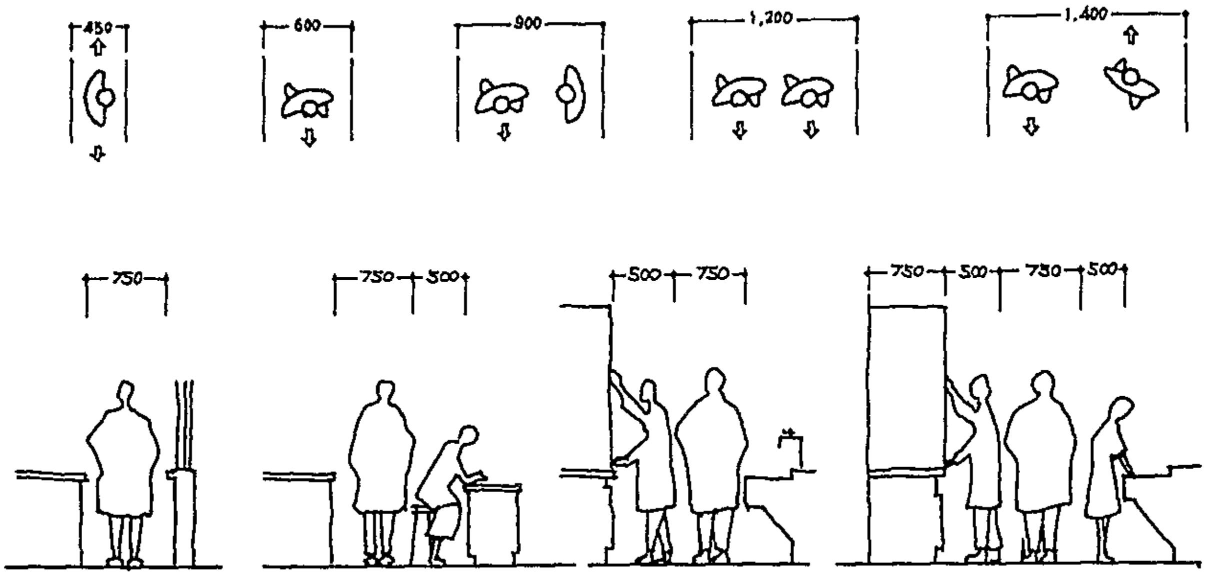
The following figure indicates modular grids in the main laboratory standard spans. This method is useful for working designs in that it creates no useless space while keeping enough space for human activities when working tables, shelves, tables, passages and the like are designed based on this grid as well as creating a neat interior appearance.



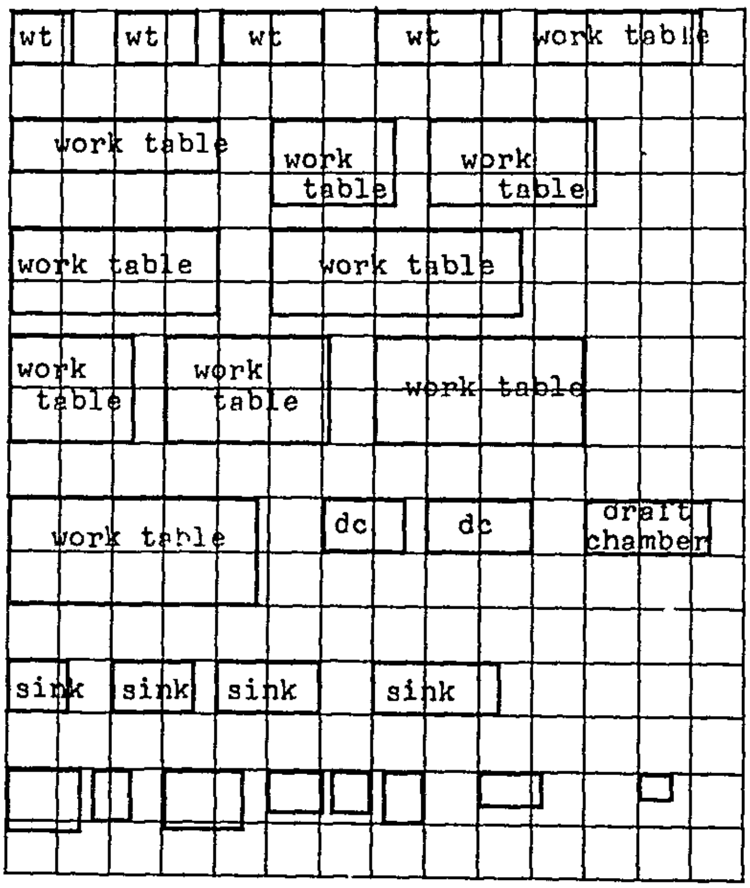
M stands for the standard dimension of 750 mm.

The 300 mm width is for shelf spaces.

MODULAR GRID



WIDTH OF PASSAGE



LABORATORY EQUIPMENT IN MODULAR GRID
(750mm x 750mm)

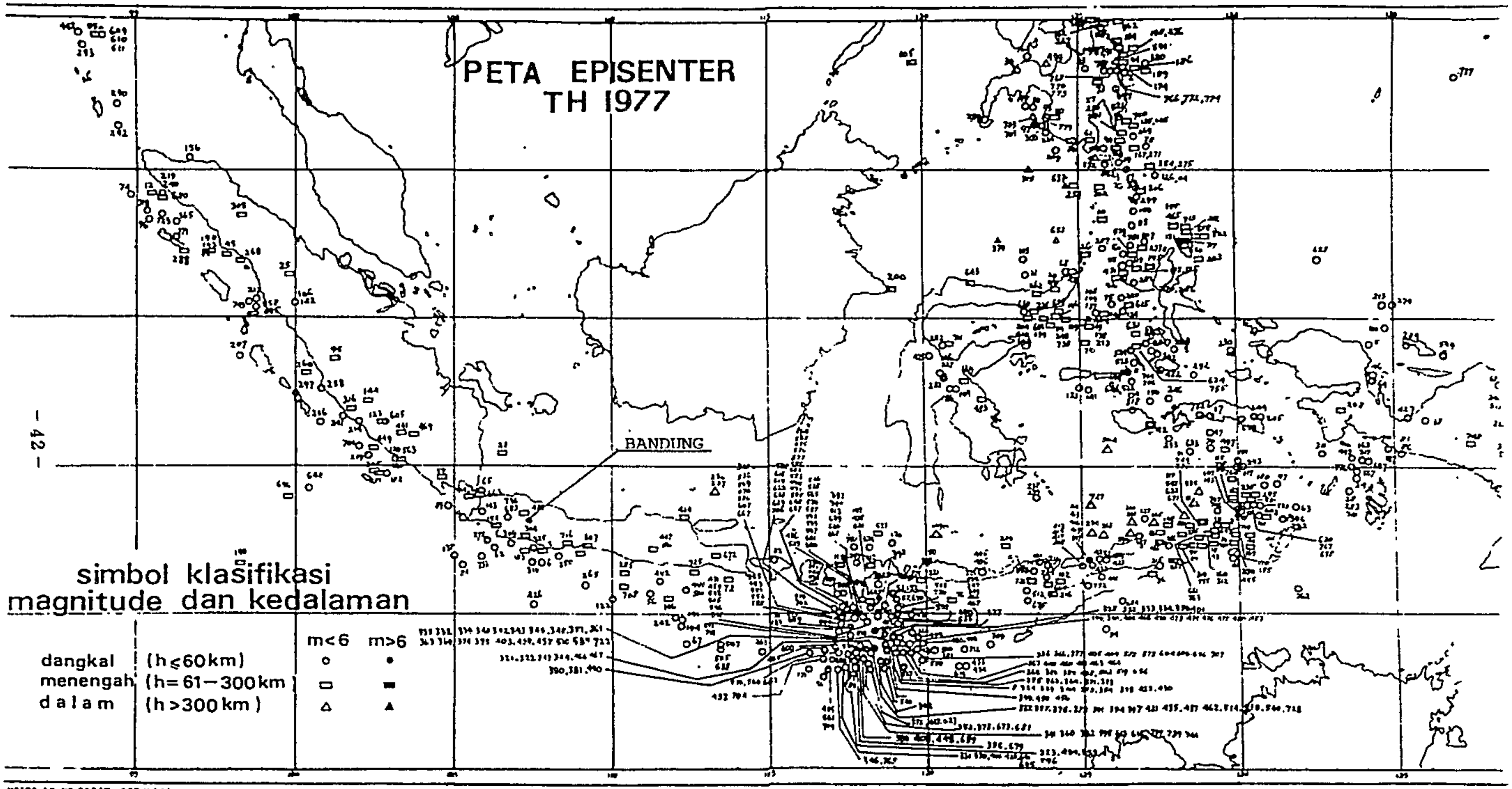
4-8 Structural Planning

The Indonesian archipelago belongs in the seismic area in the world where earthquakes occur frequently. A figure in the following page shows the past records of earthquakes which occurred in Indonesia according to the depths of the seismic centers. A map in the page after next specifies factors to determine seismic load for building design by area categories. According to this figure, Bandung is located at the boundary of the areas of local seismic factors 0.5 and 1.0. The earthquakes recorded by the weather station in Bandung for the ten (10) years from 1965 to 1975 are not very big, magnitude III-IV in November 1969, magnitude II in August and September 1971, magnitude II in June and July 1972, and magnitude II in April and September 1974; however, the local seismic factor is desirably to be 1.0 for safety's sake. Modified Marcalli Intensity is applied to represent the scale of earthquakes in Indonesia, and magnitude III-IV in November 1969 is equivalent to magnitude II (a small-strong one) by the Japan Meteorological Agency, one which most people can notice and causes doors or screens to shake a little.

4-8-1 Framing

The Main Laboratory Building is to be a single storey reinforced concrete structure with rigid framing and the roof is to be steel framed to lessen the building weight. Since the north and south wards are seperated with the entrance halls in between, expansion joints have to be provided. The ground floor is designed as a flat floor slab to eliminate settlement.

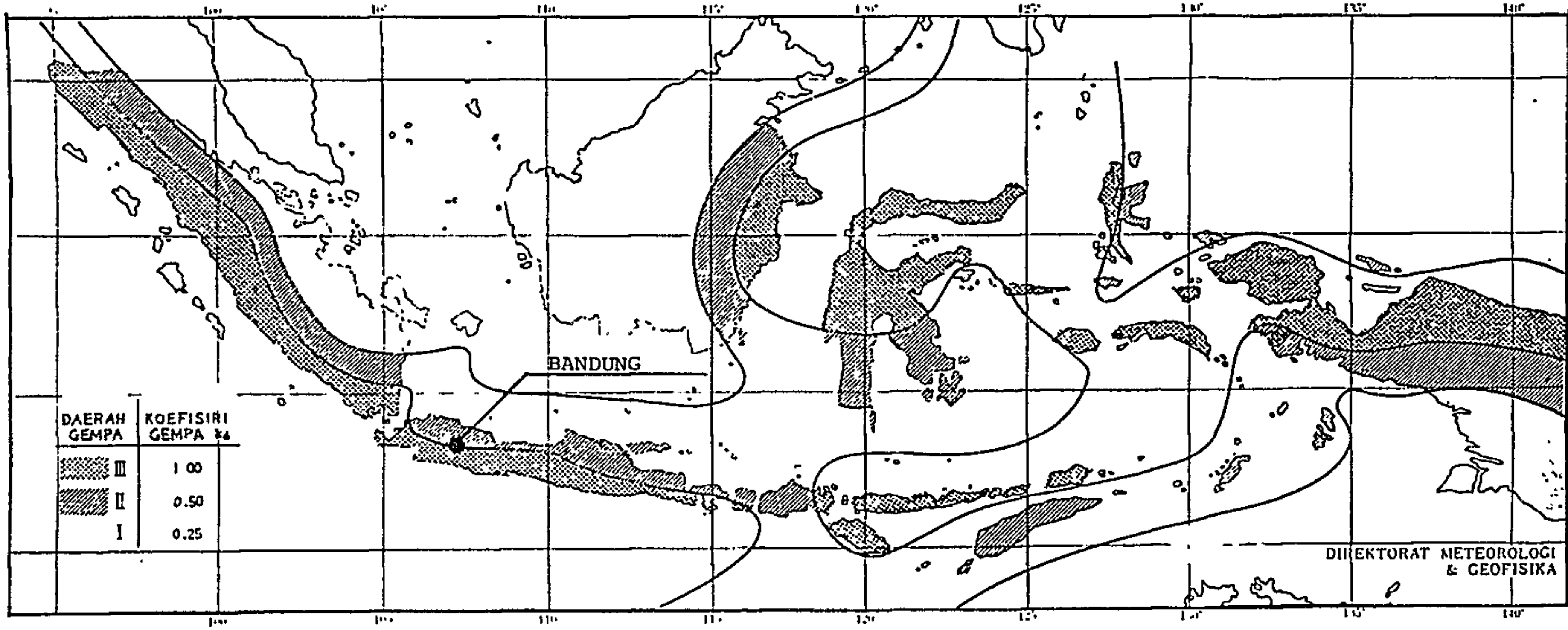
The Unloading Building is to be a similar structure to the Main Building, with the exposed surface reinforced concrete floor on the ground floor. The Astatic Magnetometer Building is to be a brick structure with wooden framed slate roofing and a plain concrete floor on the ground floor because of the need to prevent magnetic force.



RECORDS OF EARTHQUAKES IN INDONESIA

SEISMIC MAP OF INDONESIA

PETA DAERAH GEMPA INDONESIA



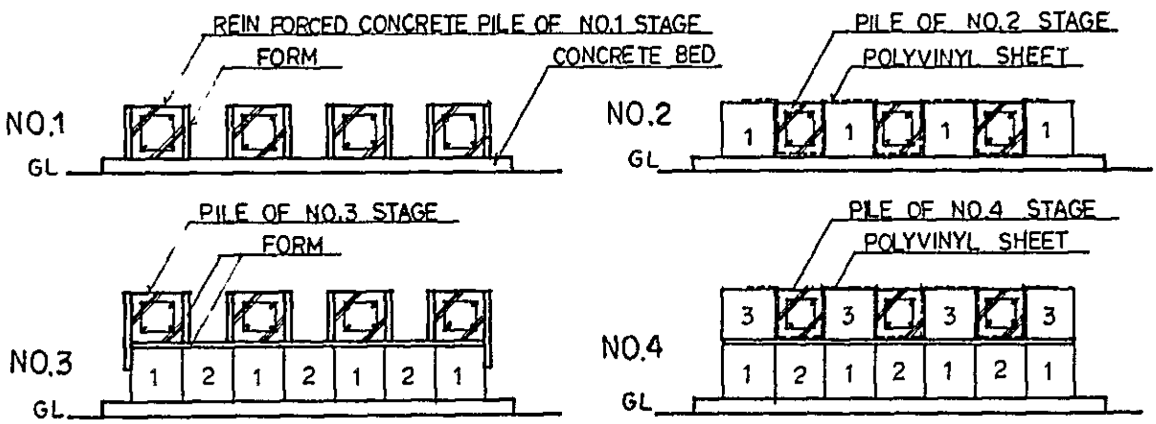
4-8-2 Foundations

According to the boring data and the soil investigation report by GRDC, attached in Annex, soil condition is becoming worse southward along the contour lines. As is stated in the report, soil bearing capacity of 594 m level is 10 t/m^2 in the north grass field and 2 t/m^2 in the south rice field, which indicates that the soil bearing capacity in the rice field is very bad. Data from five (5) borings indicate there lies a firm sandy gravel layer under six (6) to seven (7) meters deep, but composite layers and their soil bearing capacities to that depth are not the same. That is, no other layers except the sandy gravel layer of the bed rock are dependable as the foundation bed so that all the foundations are constructed on a uniform level.

Based on these soil conditions, following foundation construction methods are to be applicable.

(1) Concrete Pile Foundation

A method to drive concrete piles to the sandy gravel layer, which supports the foundations. This is the ideal method as it would not cause the building settlement in the future, however, some construction period is required for the manufacturing and driving of piles. Generally concrete piles are cast in place in the following way.



CONCRETE PILE CASTING PROCESS AT THE SITE

(2) Raft Foundation

A method to arrange foundations to support the whole building floor and to construct foundations on the graded ground. Raft foundation is effective to prevent the building from differential settlement, however, not perfectly effective against the settlement of the whole building.

(3) Strip Foundation

A method to connect the footings under the columns of logitudinal direction (ridge direction) of the building to prevent differential settlement of this direction. Foundations are set on the graded ground. This method is not perfectly effective against the differential settlement of the transverse direction.

It is undesirable to use all the above three (3) construction methods concurrently. At present, concrete pile foundation method is considered the most dependable.

4-8-3 Design Standards

The structural design of this Project is to be based on the present construction regulations in Indonesia. The following standards and regulations are to be applied:

- National Building Standards (1978)
  Peraturan Bauguan Nasional
- Indonesia Loading Standards (1970)
  Peraturan Muatan Indonesia
- Indonesia Reinforced Concrete Standards (1971)
  Peraturan Beton Bertulang Indonesia
- Indonesia Wooden Structure Standards (1973)
  Peraturan Konstruksi Kayu Indonesia
- AIJ Standards

4-8-4 External Forces and Loads

Design external forces and loads are to be as follows in compliance with Indonesian Loading Standards.

1) Dead load

Dead load will include the weights of all the structural members, partitions, and finishing materials.

2) Live load

	Room	Live load (kg/m^2)	
a)	Office	300	
b)	Laboratory	300	This figure may be increased if necessary to accomodate heavy machinery and equipment.
c)	Library, storage room	500	
d)	Conference room	400	
e)	Lavatory	250	
f)	Corridor	300	

3) Earthquake force

Earthquake magnitude $K = k_i \cdot k_d \cdot k_t$

where

k_i : factor by height (height $H \leq 10$ m, $k_i = 0.1$)

k_d : coefficient depend upon the zone (See the Seismic Map of Indonesia)

$k_d = 1.0$ in Bandung

k_t : coefficient for site-structure resonance

$k_t = 1.0$

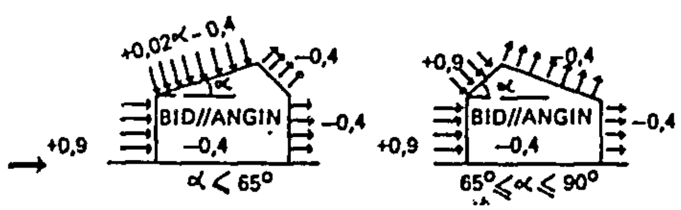
Design earthquake magnitude

$K = 0.1 \times 1.0 \times 1.0 = 0.1$

4) Wind force

Design wind force $p = 25\ kg/m^2$

The wind force factor is according to the following figure.



WIND FORCE FACTOR

4-9 Building Facilities

According to the field survey in Jakarta and Bandung, most of the plumbing equipment and machinery are found to be Japanese made, or Japanese brands manufactured in Indonesia. Repair of damaged parts, procurement of spare parts, reliability and durability of the machinery after completion of the building shall be considered in the selection of plumbing equipment and machinery. In addition, safety and accessibility for maintenance are of importance in the management and control of equipment and machinery after completion.

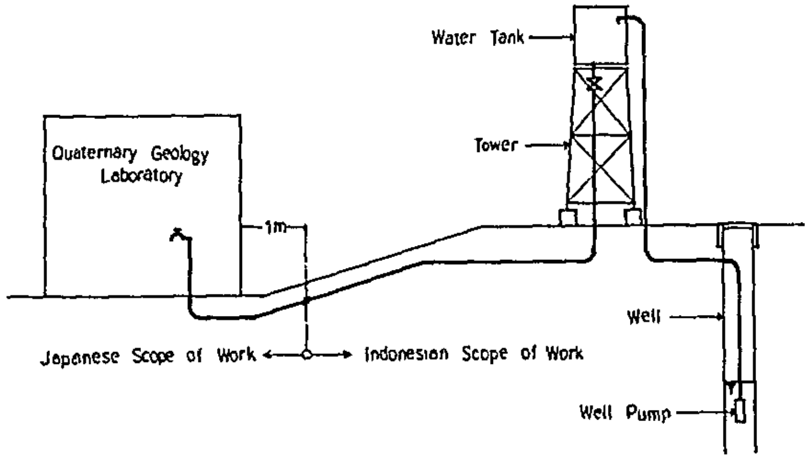
Design standards for electric, water supply and drainage, air-conditioning and ventilation systems comply with the U. S. Code requirements in Indonesia. Generally, plumbing equipment and machinery are available locally except for the special cases.

4-9-1 Water Supply and Drainage System

(1) Water Supply System

Since water main placement along the Terusan Pasteur St. is not expected awhile as stated in Chap. 3, Sec. 4-2 Water Supply, GRDC is planning to dig two (2) deep wells in the grounds for the entire complex. Water is to be pumped to a high tank from which water will be supplied to each project building by a gravity type supply system. Digging of wells, installation of pump, high tank and a main pipe to the point one (1) meter out of the exterior walls of the Quaternary Geology Laboratory belong to GRDC's scope of work. If water treatment facilities are required because of the quality of water found not suitable for drinking by the quality test, these facilities will also belong to Indonesian scope of work.

Piping systems are partially concealed or embedded with concrete and the rest part is basically exposed to facilitate maintenance. Valves are to be located at the appropriate points for the control and maintenance of each zone.



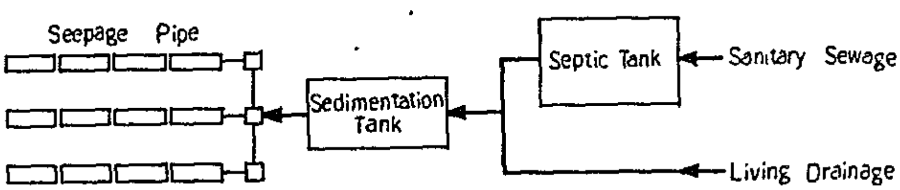
WATER SUPPLY SYSTEM

(2) Warm Water Supply System

A propane gas water heater shall be installed to supply warm water to necessary places. Forced ventilation shall be provided for the large-size water heaters.

(3) Drainage System

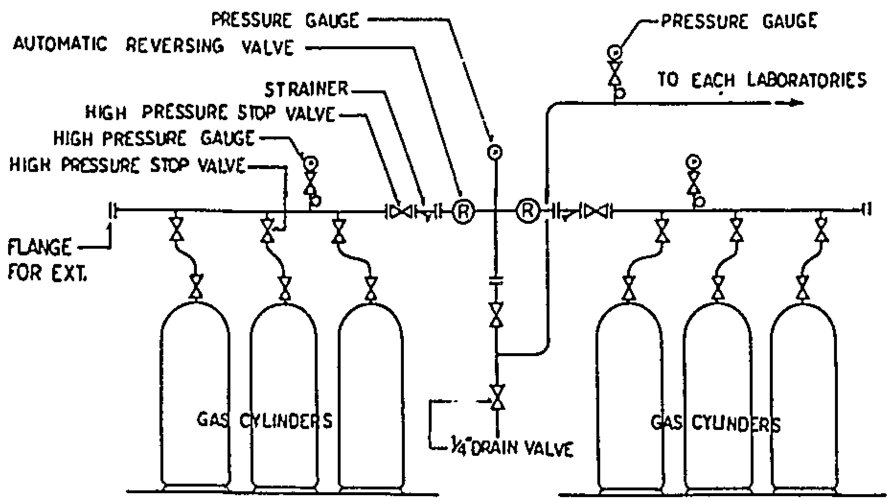
The drainage system will be separated into systems for sewage water, sanitary water and storm water. Sanitary water will be combined with sewage water through the septic tank and connected to the seepage pit. Storm water will be connected to the site drainage network which is being planned by GRDC. Indonesia has a peculiar type of septic tanks and seepage pits which are to be applied in this project.



DRAINAGE SYSTEM (except Rain Water)

(4) Gas System

Propane gas central distribution system will supply gas to necessary places. Gas cylinders will be separated into two systems with an automatic interchange valve to secure stability. Valves will be located in each zone.



LPG SUPPLY SYSTEM

4-9-2 Air-conditioning and Ventilation System

A minimal air-conditioning system for cooling only will be provided for the laboratory equipment. Air-conditioned rooms are to be the Scanning-Electron Microscope Room and ^{14}C Analyzer Room.

Air-conditioning will be of the split type in principal, with exterior equipment and interior equipment. Ventilation will be basically provided by a wall mounted fan type unit. Weather-proofing covers will be provided on the exterior walls.

4-9-3 Electric System

(1) Electric Power Supply

Electric power will be supplied from the distribution center which GRDC is now planning for the complex. Voltage will be 3 ∅ 220 V for power supply and 1 ø 220 V for lighting and receptacle and outlet systems. The incoming line will be embedded under the ground. Based on the estimated capacity, a CTV 250 mm^2-3C power supply cable is to be necessary from the above distribution center to the incoming board of the Quaternary Geology Laboratory.

A generator system with minimal capacity for the interphone system, emergency lighting, fire alarm, cooling unit and the laboratory equipment which will not stop in case of power failure, will be installed separately from the common receiving system. The generator room will be located in a separate building to isolate its noise and vibrations.

(2) Main Line Facilities

A distribution board is to be arranged in each zone for power supply, for the laboratory equipment, and for lighting system.

(3) Lighting Fixtures

In general, fluorescent lamps will be used for the common rooms and otherwise incandescent lamps will be used.

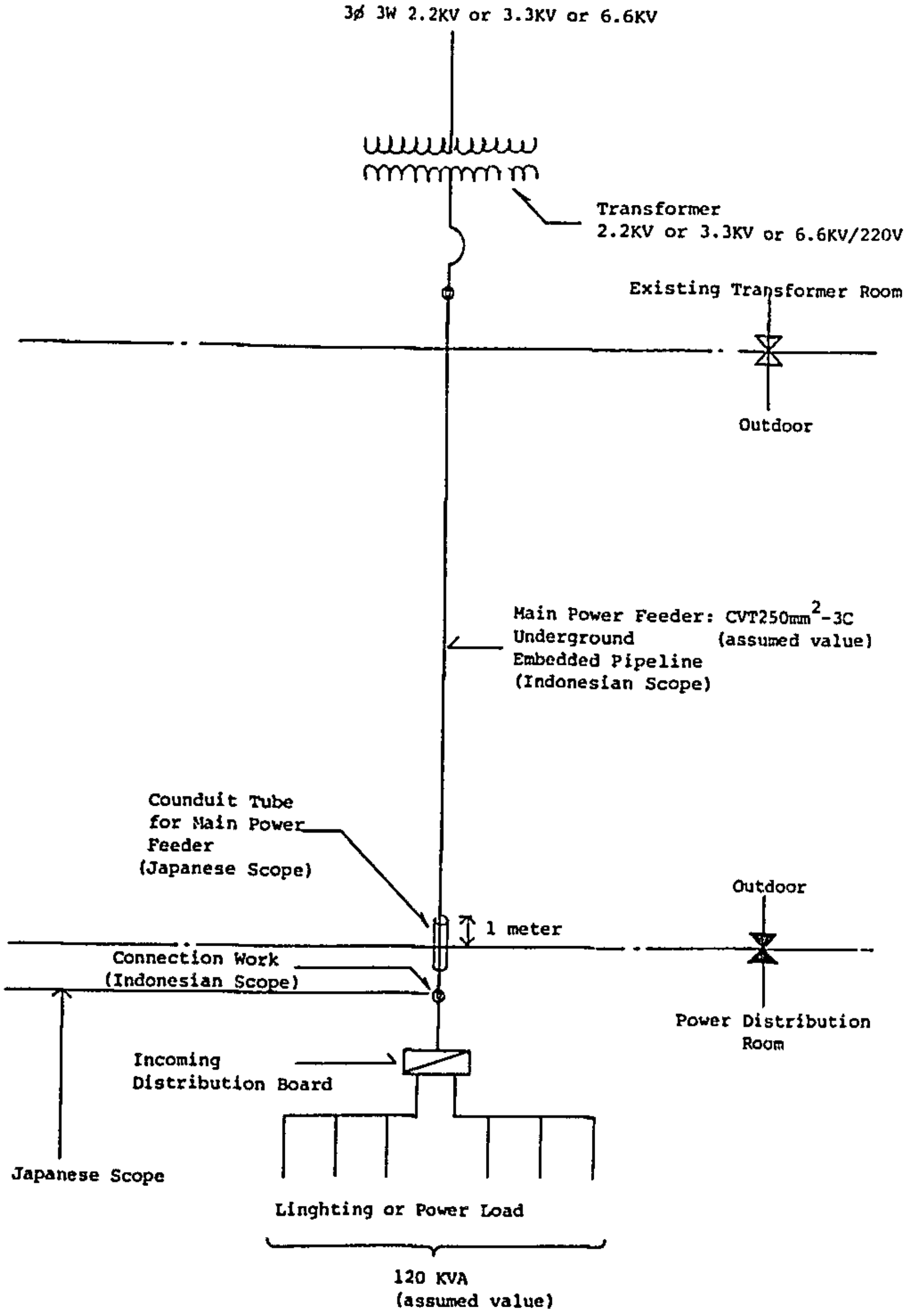
(4) Receptacle Outlets

1 ø 220 V receptacle outlets will be provided at necessary places in each room. The receptacle outlets for common use will be the flush-mounted type, while the outlets for the laboratory equipment will be surface-mounted type to correspond with the future change of arrangement of the laboratory equipment.

(5) Weak Current Electric System

1) Telephone System

One (1) of the circuits which GRDC is applying now will lead to the project building. The telephone will be located in the office. For interior



ELECTRIC POWER SUPPLY SYSTEM

intercommunications, interphones will be provided in the main rooms.

2) Fire Alarm System

A spot type fire alarm will be installed in the main rooms to control fires.

4-10 Construction Materials and Machinery Planning

Indonesian domestic materials and machinery are to be used as far as practicable considering that Indonesia is rather far from Japan and Bandung is located in an inland area, 180 kilometers by road from Jakarta, the port of unloading. All the partitions will be of concrete blocks or bricks except for earthquake resistant walls on both ends. Locally produced materials are to be used such as terrazzo tiles for the entrance floor finish and vinyl tiles for other areas; paint for wall finishes; panel ceilings with glass-wool insulation boards; a steel trussed roof; roofing tiles for the roof finish, and tiles for the lavatories.

For the facilities for water supply, drainage, plumbing, air-conditioning, Indonesian domestic products will be applicable. However, products not produced in Indonesia or those made in Indonesia involving difficulties with quality, quantity and/or delivery schedules may revert to imports from Japan.

4-11 Laboratory Equipment Planning

In the selection of laboratory equipment, as requested by Indonesia, utility, simplicity and minimal possibilities of malfunction are essential. An electric stabilizer system will be incorporated in the electric system to protect the laboratory equipment from voltage fluctuation. A generator system with minimal capacity will be provided for some of the equipment which should not stop in a power failure.

At the time of completion of establishing the Laboratory, some of the laboratory equipment granted by the government of Japan during the technical cooperation, CTA-41 Project, and those purchased by GRDC, which are relating to quaternary geology study are to be collected and moved to the Laboratory. Major equipment to be installed in the Laboratory is as follows:

(1) Scanning Electron Microscope

(2) ION Sputter

(3) Fluorine analysis equipments

(4) Water distiller and deionizer

(5) Water bath

(6) Centrifuge

(7) Research Microscope

(8) Etching equipment unit

(9) Frantz Isodynamic

(10) Heavy liquid mineral separation equipment

(11) Astatic Magnetometer

(12) Rock cutting unit

(13) Dentist equipment

(14) Drying shelf

(15) Mammalian fossil specimen cabinets

A scanning electron microprobe, an accessory of the above listed scanning electron microscope has already been planned to be purchased by GRDC's budget. The listed equipment is mainly for paleontology, geochronology, petrology and geophysics. ^{14}C analyzer, planned to be granted in this Project, is a new type of equipment for geochronology, is the most capable of geochronological dating of any samples with carbon contents and is expected to establish a new geochronological dating method in Indonesia. Spinner magnetometer, also planned to be granted, is for geophysical study, which is expected to develop this field of study along with the above listed astatic magnetometer. A brief explanation follows below about these two machines.

The expenses for the moving and installation of the listed existing equipment will be borne by the government of Indonesia while electric, water and other power supply works necessary for the laboratory equipment will belong to Japan's responsibility.

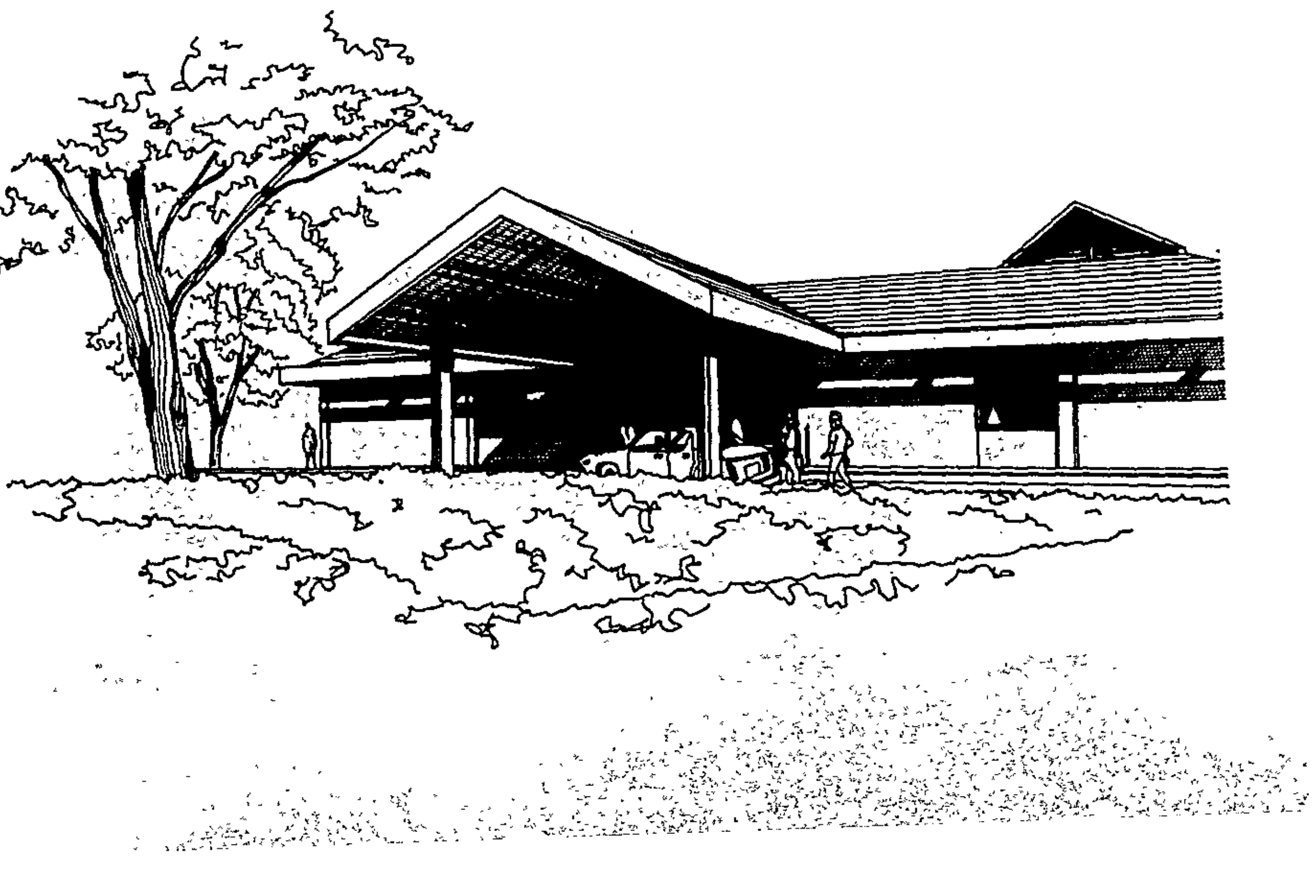
(1) ^{14}C Analyzer

As is mentioned in Sec. 4-2, Functional Components, the ^{14}C analyzer is used for sample dating by measuring the rate of disintegration of the radiocarbon contents in all the living or dead samples that contain carbon. Generally, the half life of ^{14}C, 5730 years, is utilized for measurement. The ^{14}C analyzer is said to indicate the precise value for measurement over a span of 2.5×10^4 and 8×10^4 years. The process of extracting carbon by burning the samples is called sample preparation. There are two (2) ways for preparing samples, to make gaseous samples and liquid ones. Liquid samples can be obtained more speedily and more precise measurement obtained as their volumes are smaller, but they require skillful technique. Gaseous samples are easy to prepare, but they are more sensitive to outer influences like cosmic rays because they have larger volumes, which requires special consideration in architectural design. If we compare the liquid sampling and gas sampling methods, the gas sampling method is recommendable as it is simpler and easier to handle.

(2) Spinner Magnetometer

A spinner magnetometer is to measure residual magnetism in rocks, as is mentioned in Chap. 4-2-23, Paleomagnetic Study. At present there is a Czechoslovakian magnetometer several decades old, which is not precise. It has frequent troubles but availability of the maintenance parts is scarce. So this magnetometer is hardly usable. The request for a new magnetometer follows from this situation.

CHAPTER 5 BASIC DRAWINGS



CHAPTER 5 BASIC DRAWINGS

List of Floor Area

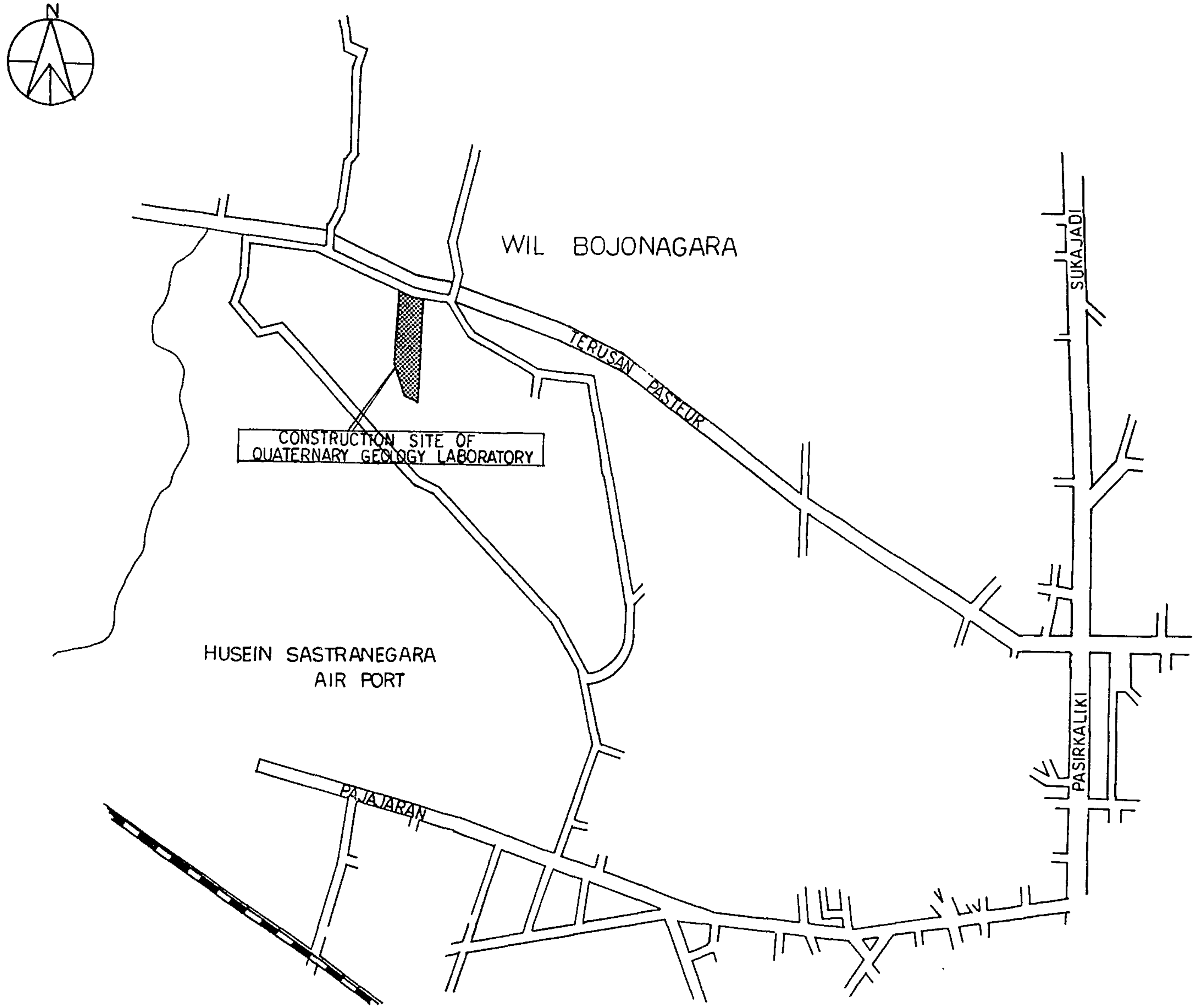
Room No.	Room Name	Floor Area
(1)	Main Laboratory Building	
01	Pollen Analysis	80 m^2
02	Micro Fossil Study	120 m^2
03	Mammalian Study	160 m^2
04	Guard Room	13.75 m^2
05	Office	41.25 m^2
06	Fluorine Study	41.25 m^2
07	Conference Room	55 m^2
08	Library	55 m^2
09,14	WC (for Men)	7 m^2
10,13	WC (for Women)	6.75 m^2
11	Entrance Hall	40 m^2
12	Back Hall	40 m^2
15	Drawing Room	41.25 m^2
16	Dark Room	13.75 m^2
17	Dining Room	27.5 m^2
18	Store Room	41.25 m^2
19	Drilling Core Stock	41.25 m^2
20	Power Distribution Room	27.5 m^2
21	Store	13.75 m^2
22	Fission Track Study	120 m^2
23	Pedological Study	80 m^2
24	Paleomagnetic Study	120 m^2
25	Work Shop	40 m^2
26,27	Corridor	140 m^2
	Total	1,520 m^2

(2) Unloading Building

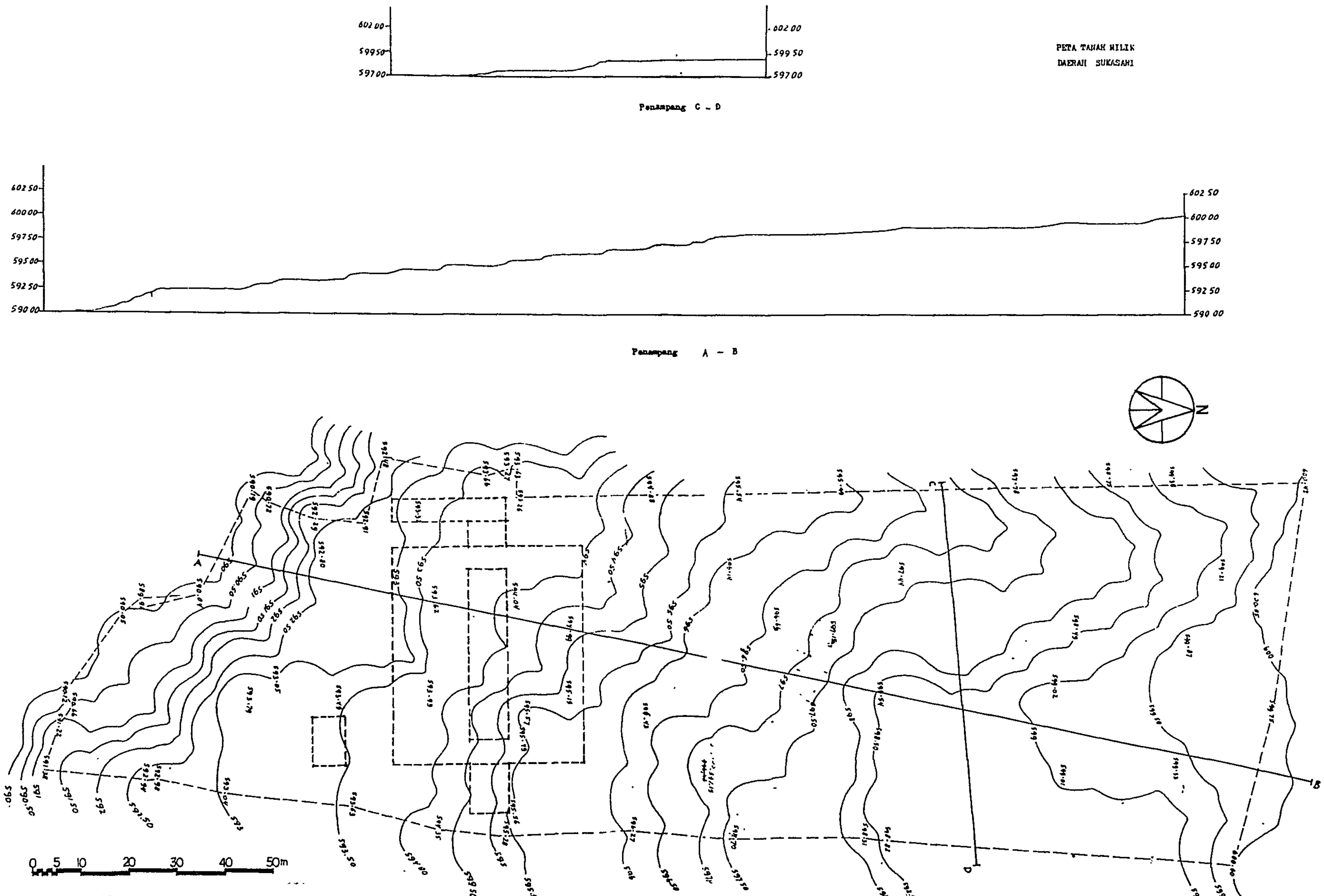
28	Generator Room	40	m^2
29	Unloading & Sample Preparation Room	80	m^2
	Total	120	m^2

(3) Astatic Magnetometer Building

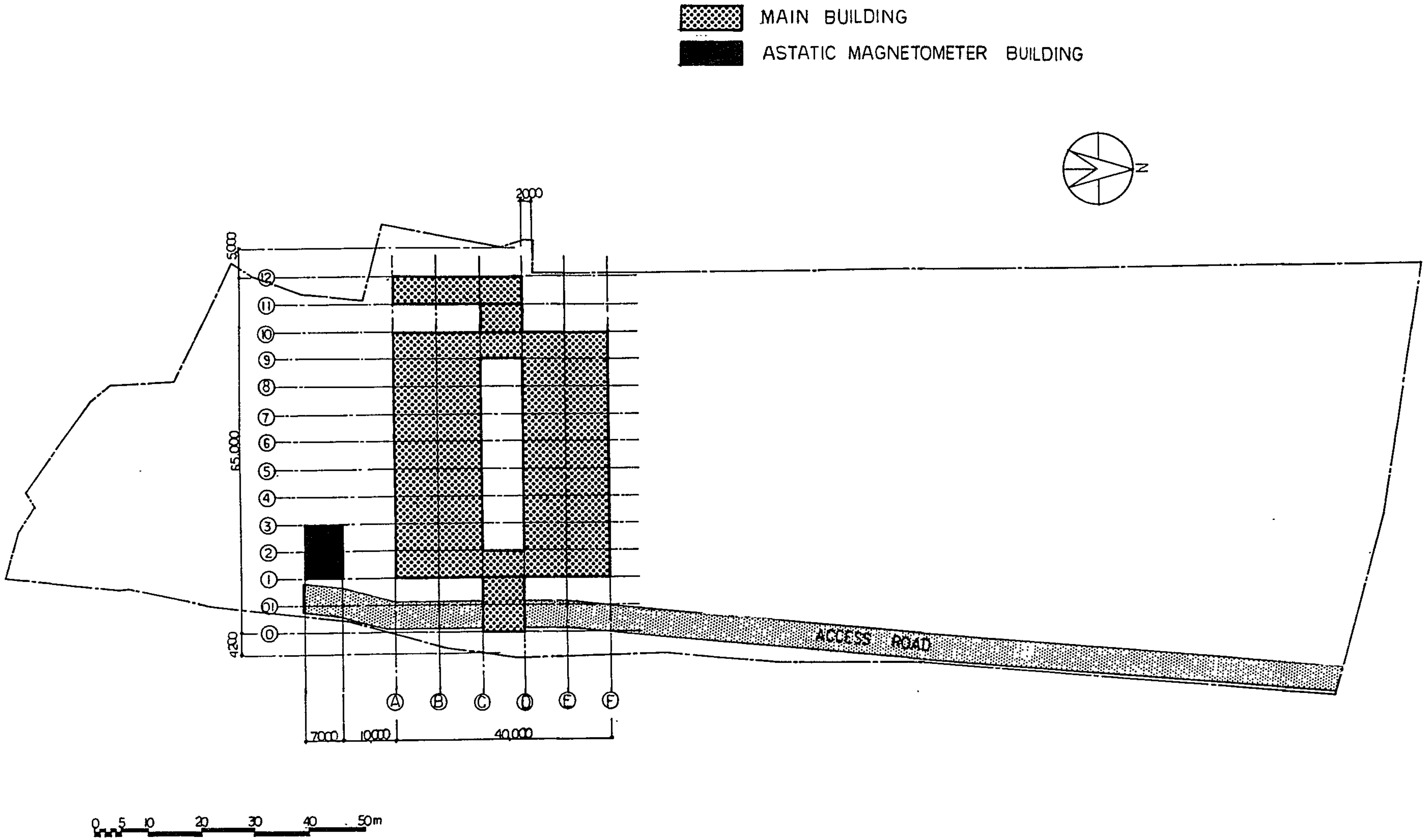
30	Astatic Magnetometer Room	70	m^2
	Total	70	m^2
	(1) + (2) + (3) Grand Total	1,710	m^2



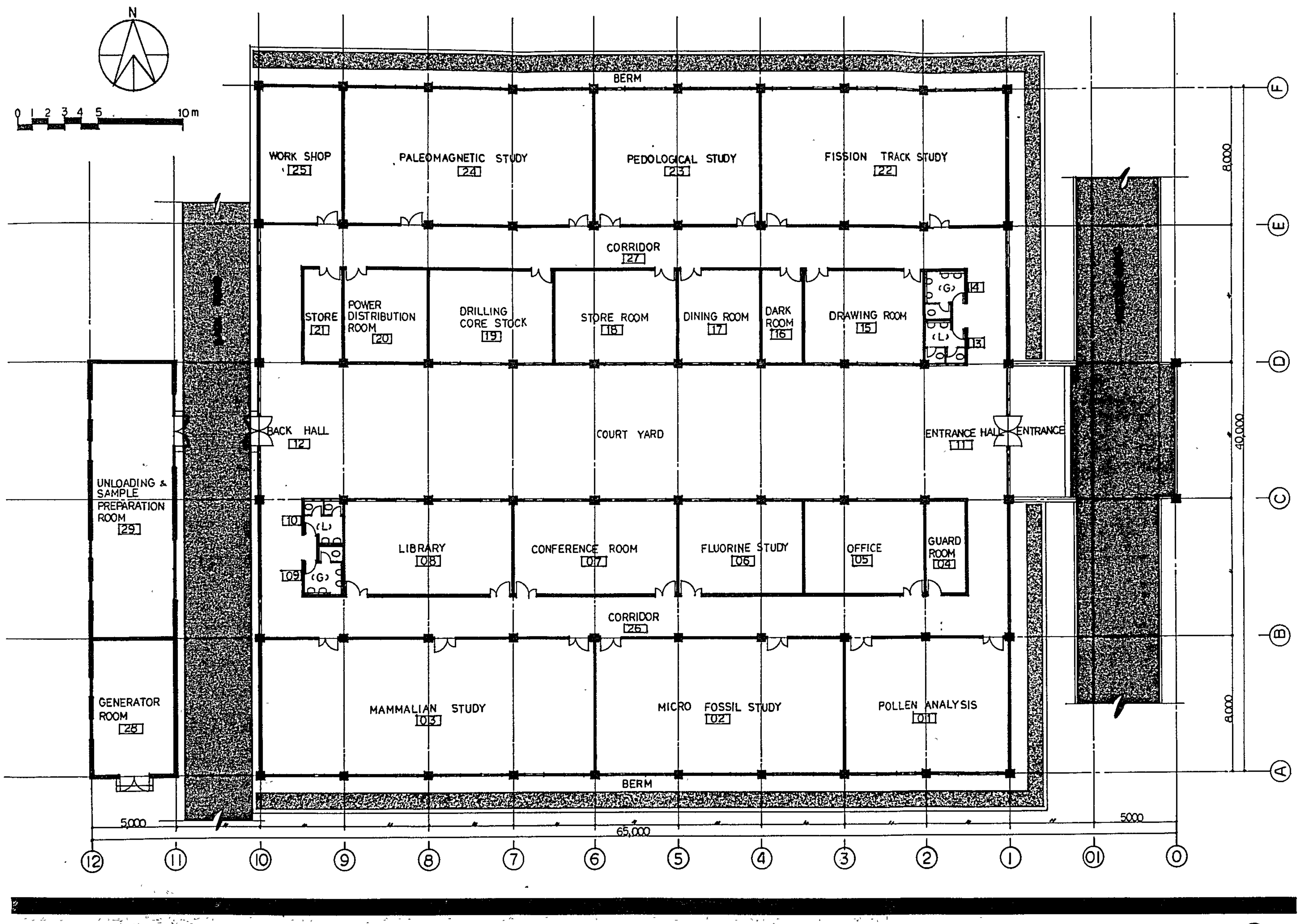
LOCATION MAP 01



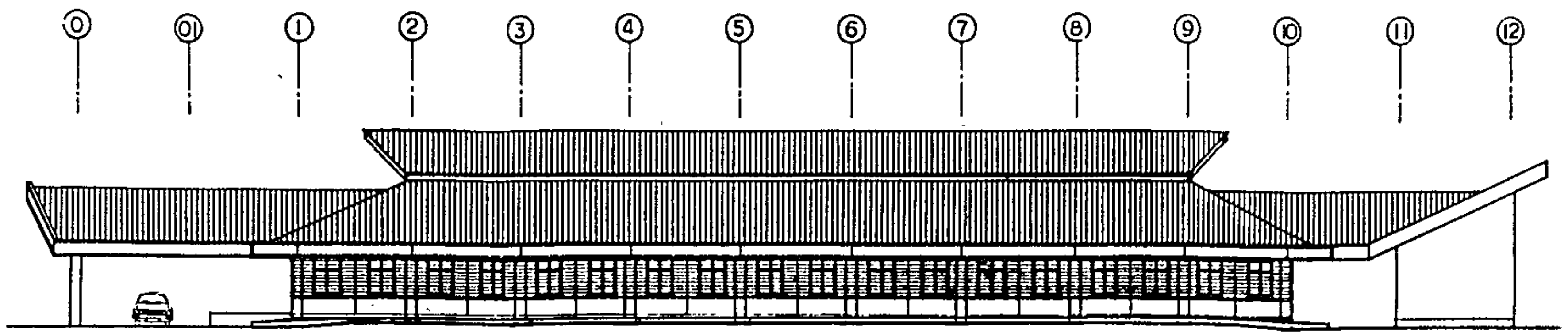
TOPOGRAPHIC PLAN & SECTION 02


MAIN BUILDING
ASTATIC MAGNETOMETER BUILDING
N
2000
5000
65,000
4200
12
11
10
9
8
7
6
5
4
3
2
1
01
0
ACCESS ROAD
A
B
C
D
E
F
7000
10,000
40,000
0 5 10 20 30 40 50m

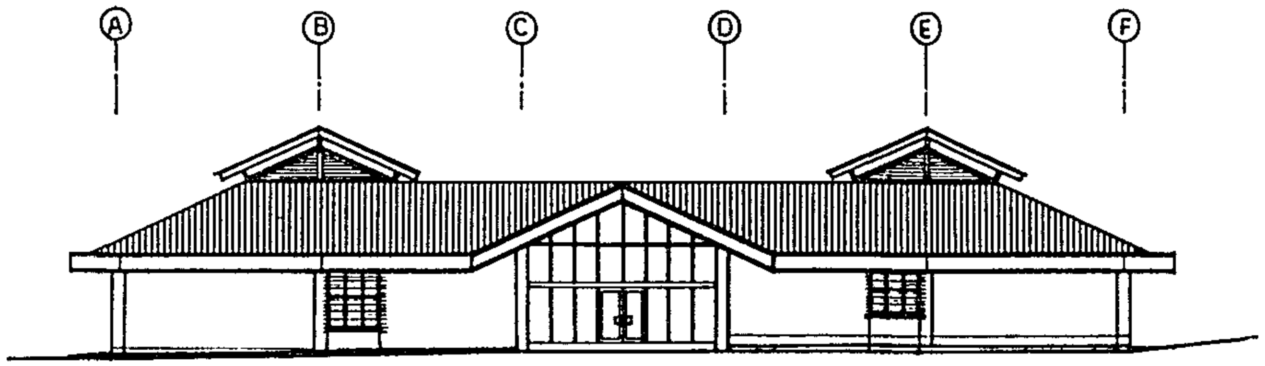
SITE PLAN 03


N
0 1 2 3 4 5 10m
BERM
WORK SHOP 25
PALEOMAGNETIC STUDY 24
PEDOLOGICAL STUDY 23
FISSION TRACK STUDY 22
CORRIDOR 27
STORE 21
POWER DISTRIBUTION ROOM 20
DRILLING CORE STOCK 19
STORE ROOM 18
DINING ROOM 17
DARK ROOM 16
DRAWING ROOM 15
(G) 14
(L) 13
BACK HALL 12
COURT YARD
ENTRANCE HALL 11
ENTRANCE
UNLOADING & SAMPLE PREPARATION ROOM 29
10 (L)
09 (G)
LIBRARY 08
CONFERENCE ROOM 07
FLUORINE STUDY 06
OFFICE 05
GUARD ROOM 04
CORRIDOR 26
GENERATOR ROOM 28
MAMMALIAN STUDY 03
MICRO FOSSIL STUDY 02
POLLEN ANALYSIS 01
BERM
8,000
40,000
8,000
F E D C B A
5,000
65,000
5000
12 11 10 9 8 7 6 5 4 3 2 1 01 0

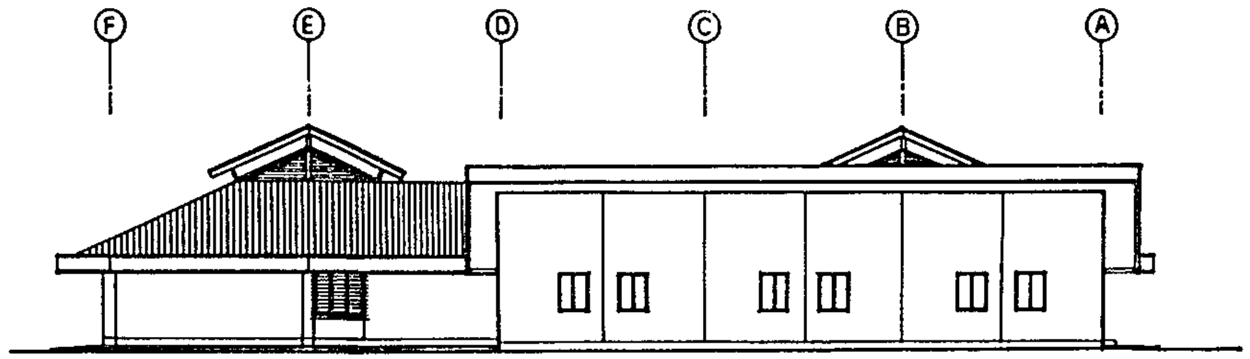
PLAN 04



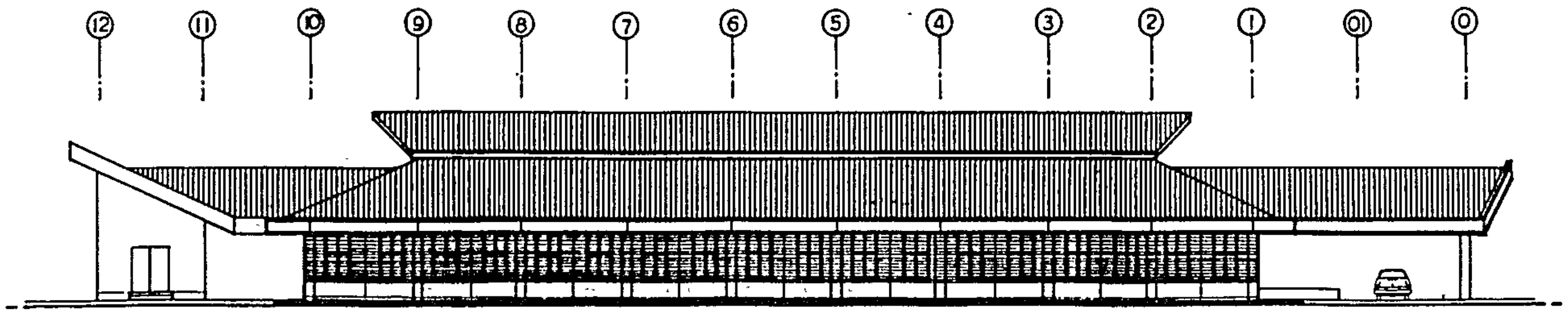
SOUTH ELEVATION



EAST ELEVATION

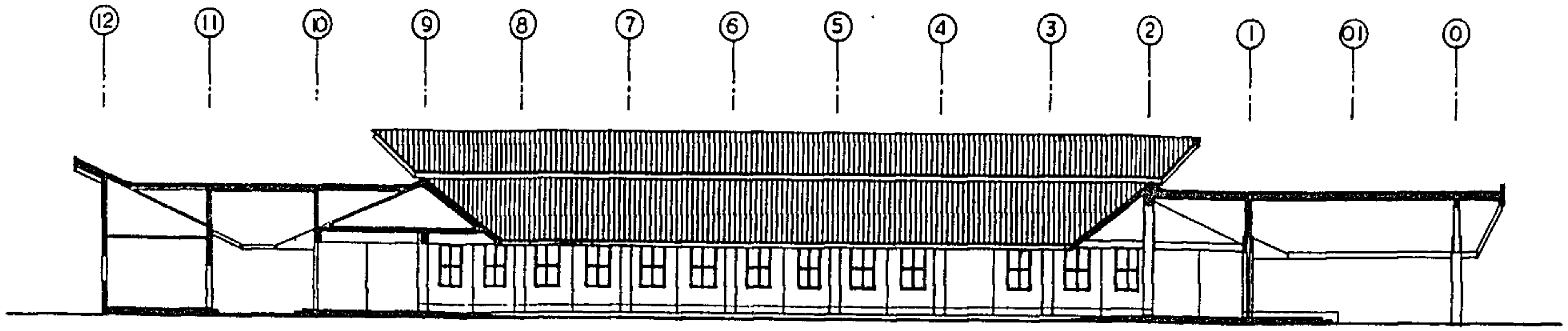


WEST ELEVATION

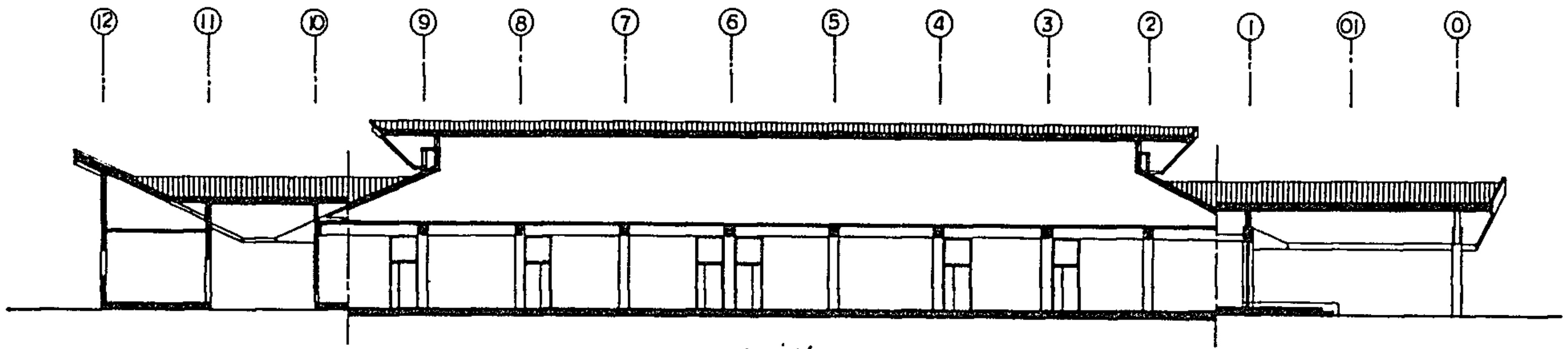


NORTH ELEVATION

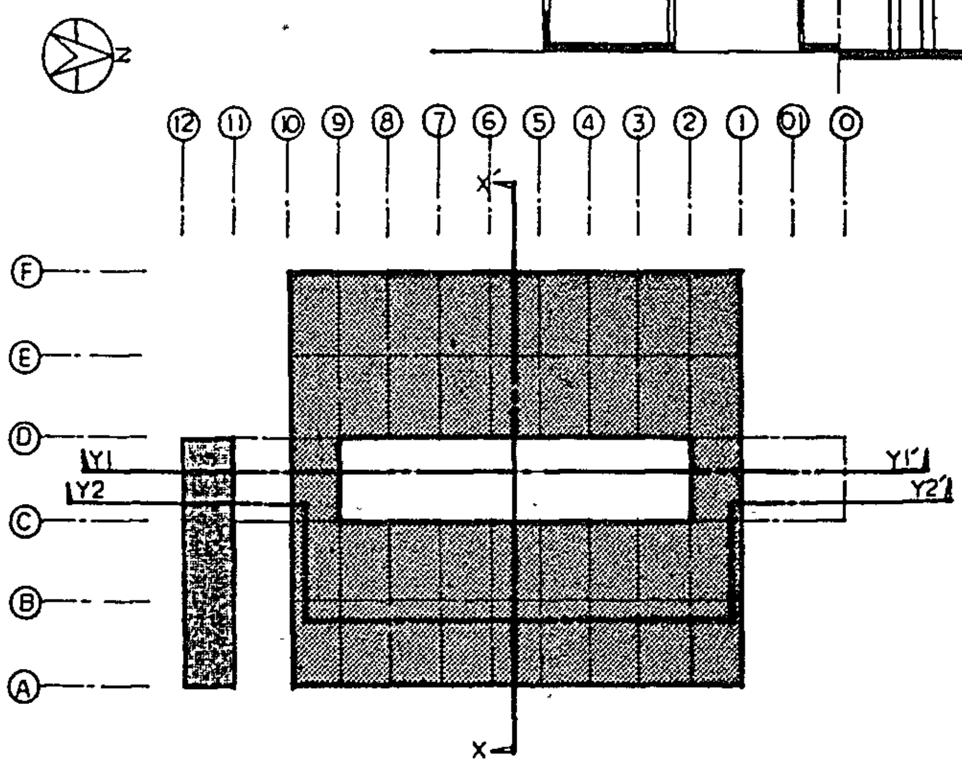
ELEVATION 05



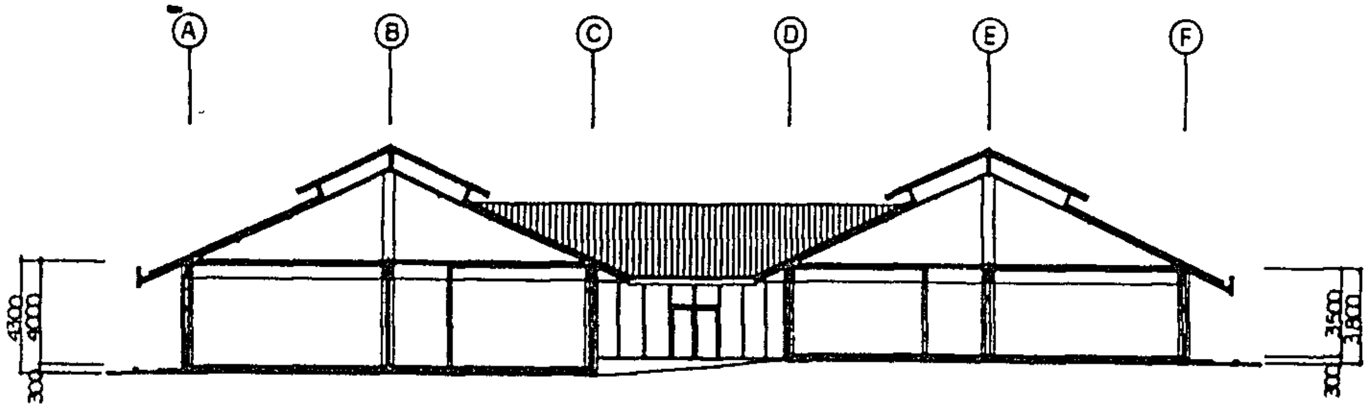
Y1-Y1′ SECTION



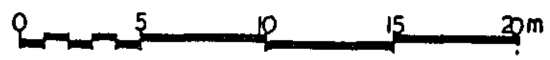
Y2-Y2′ SECTION

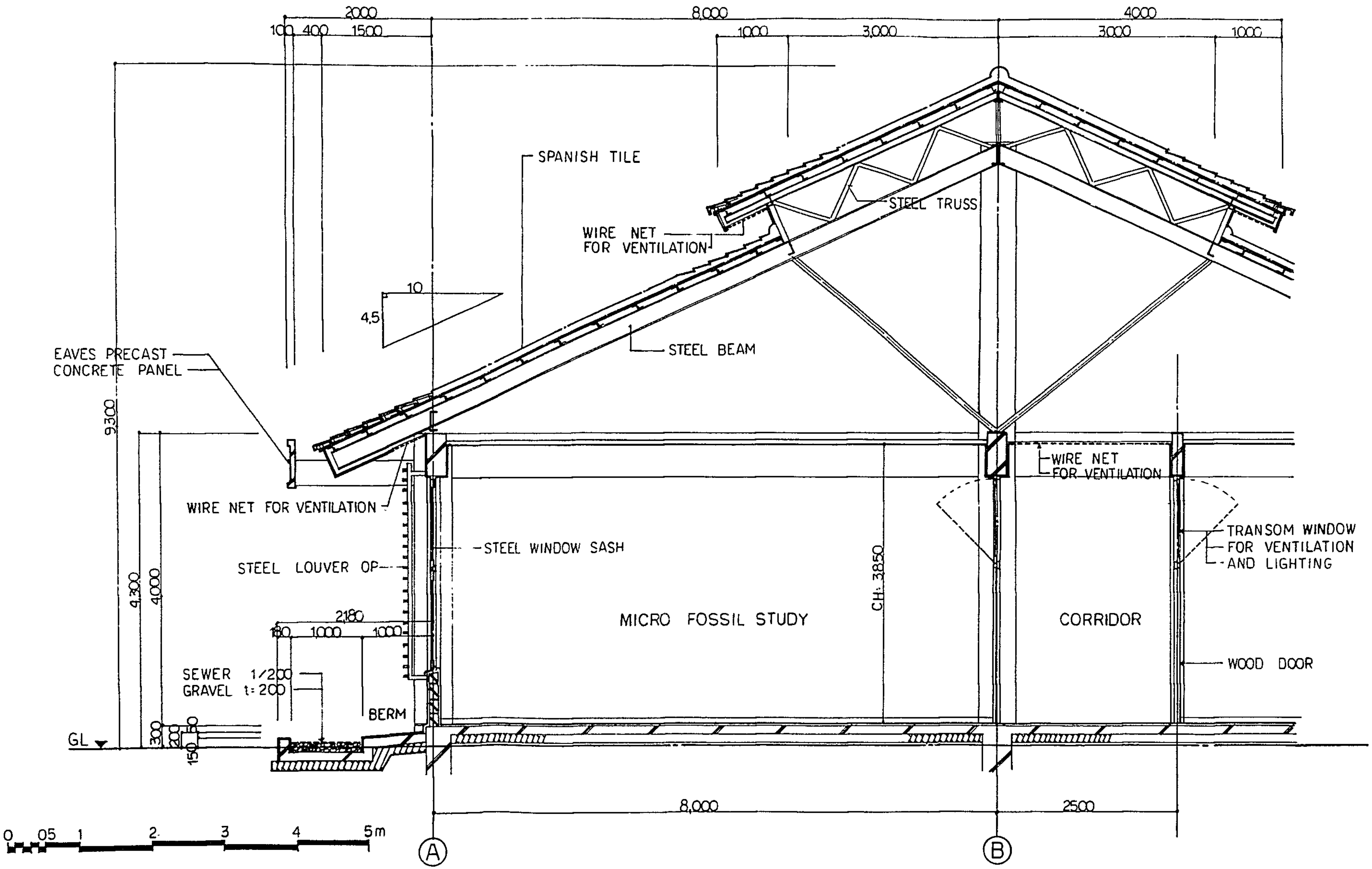


KEY PLAN

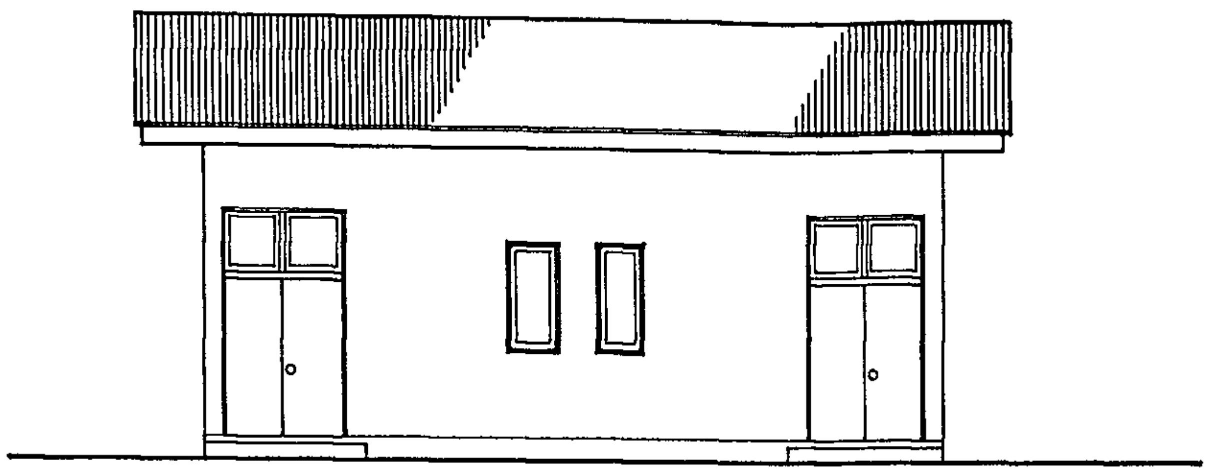


X-X′ SECTION

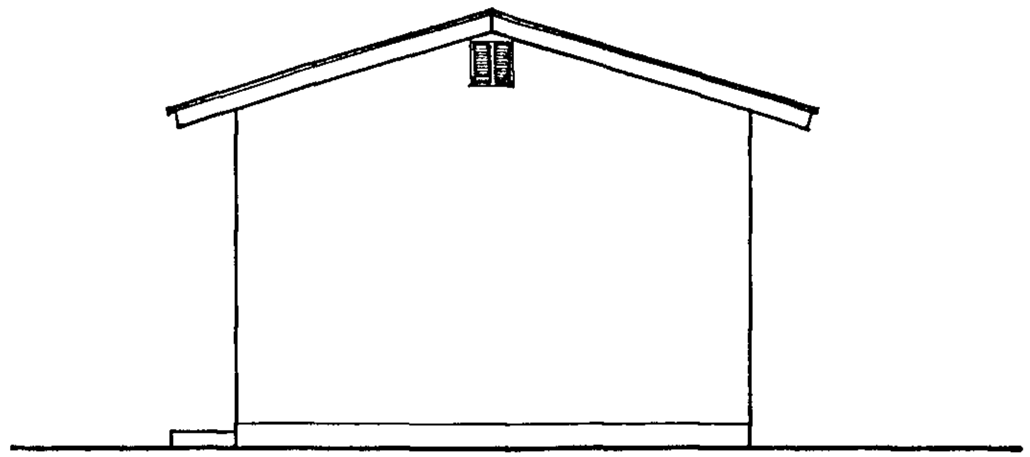




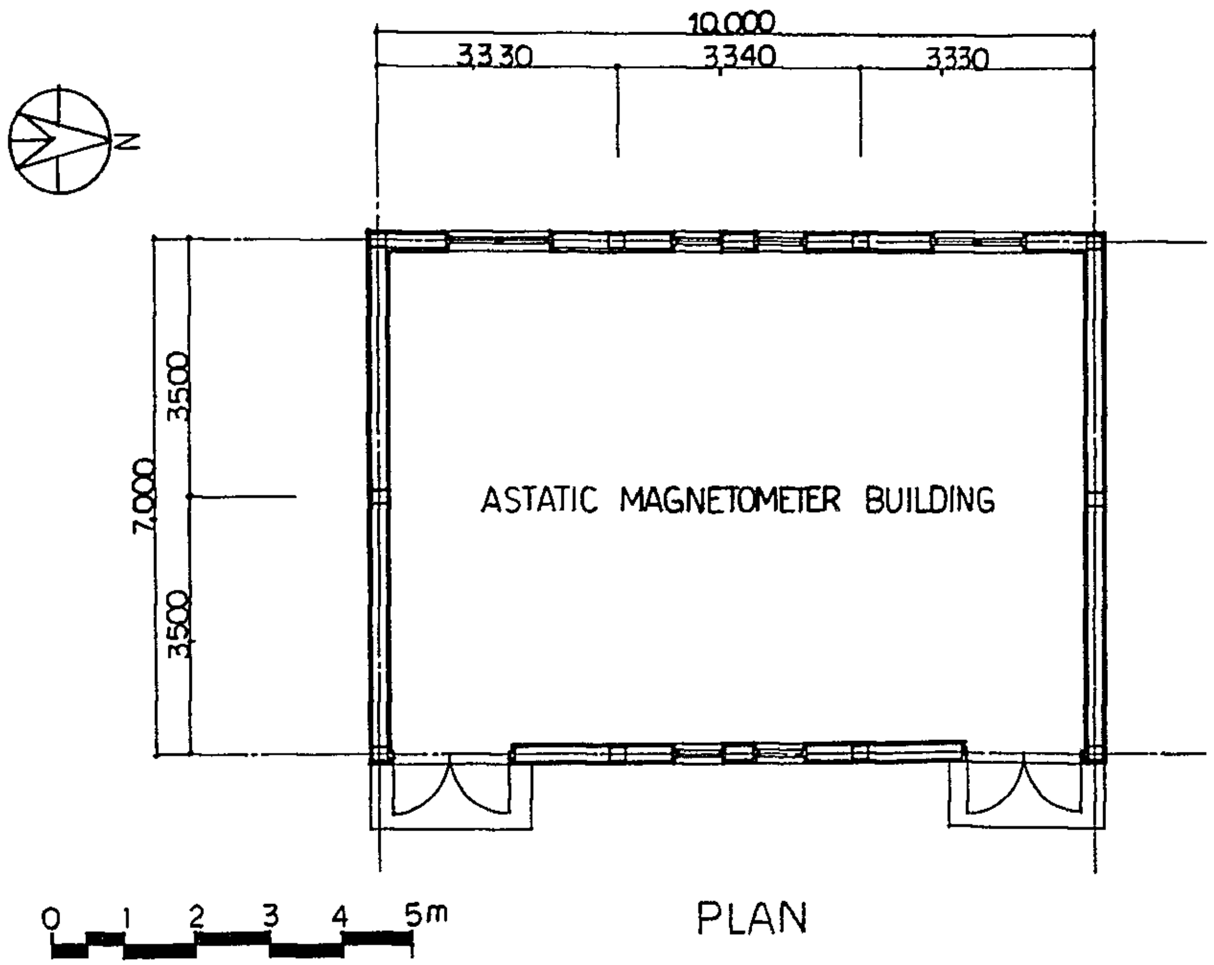
SECTIONAL DETAIL 07



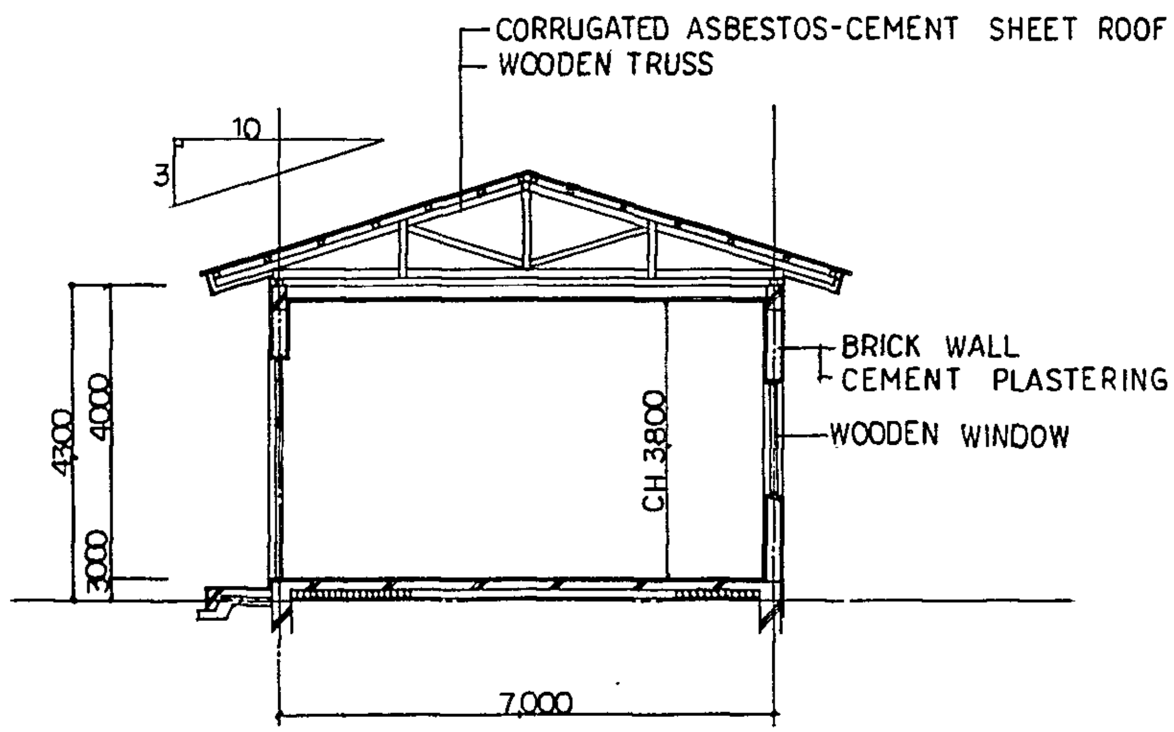
EAST ELEVATION



NORTH ELEVATION

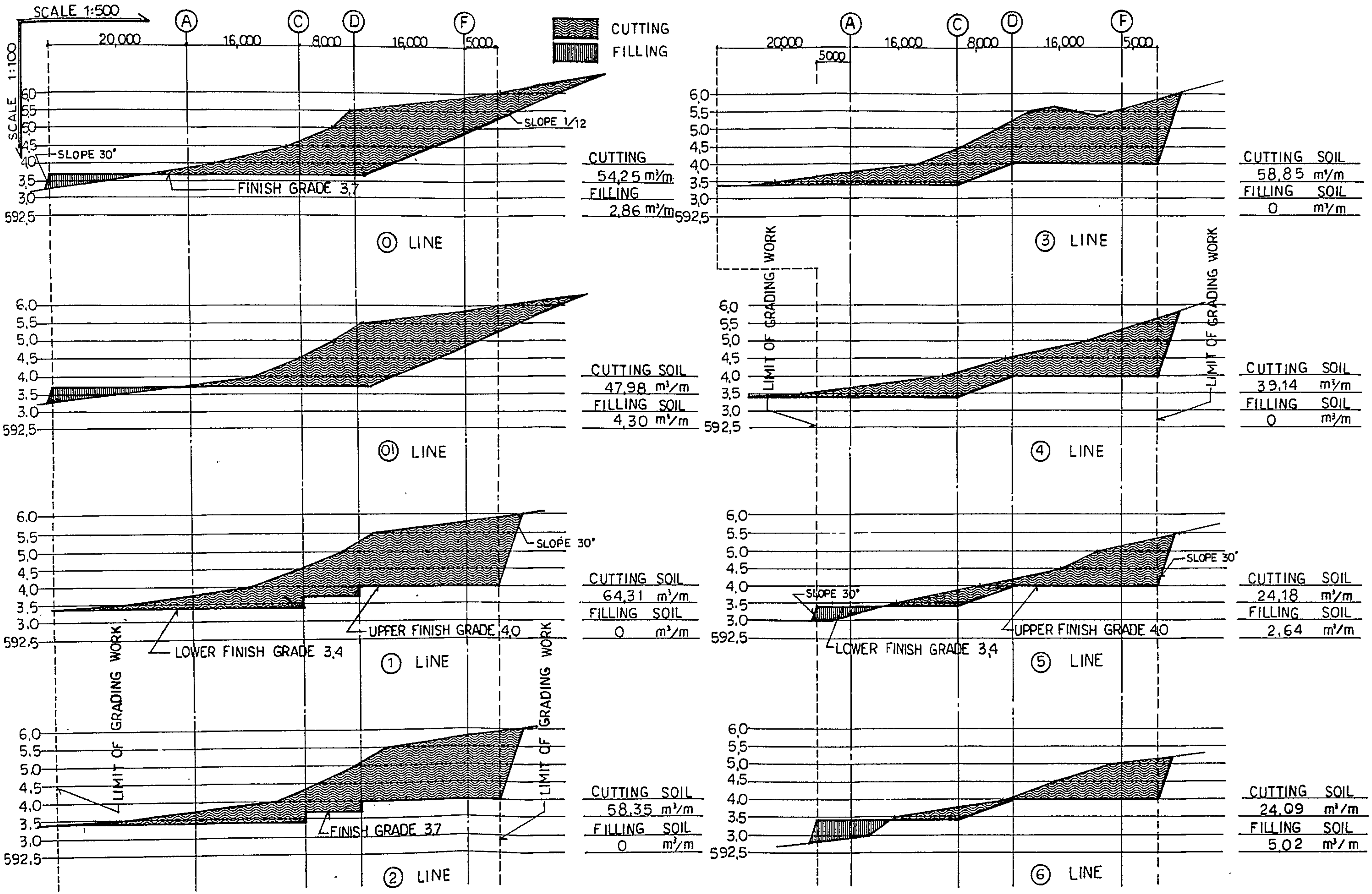


PLAN

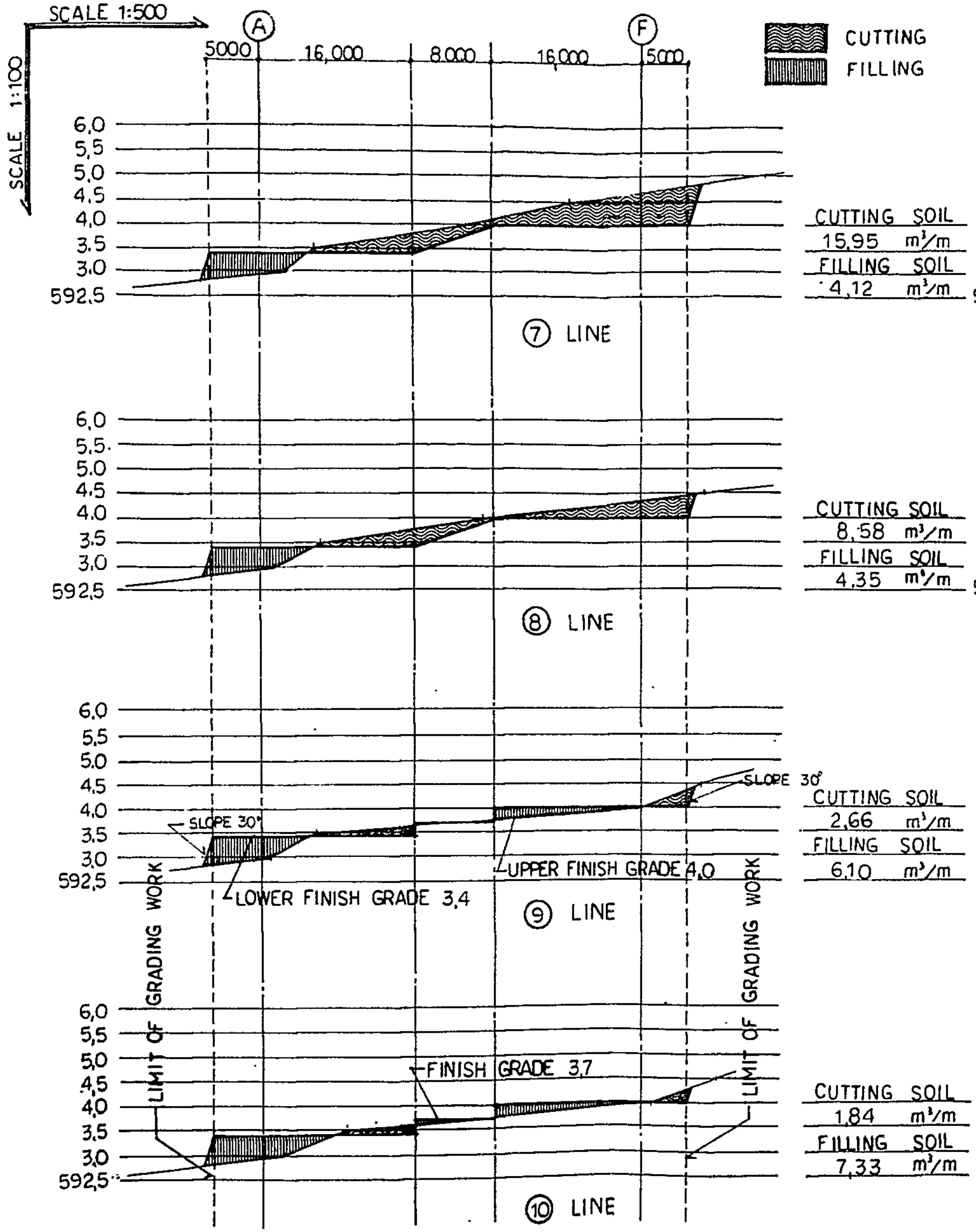


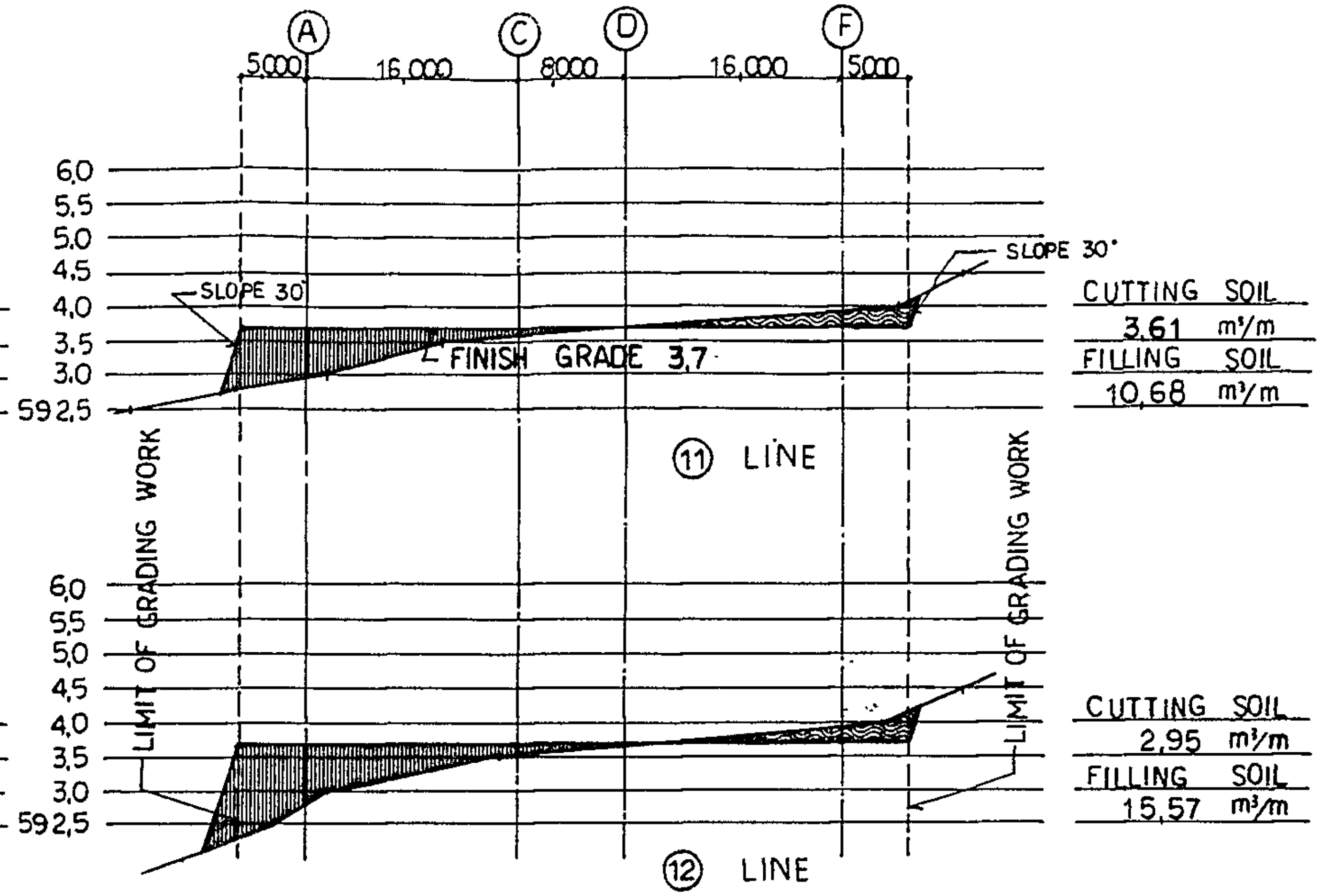
SECTION

ASTATIC MAGNETOMETER BUILDING 08



SECTION OF FINISH GRADING WORKS 09





Line	CUTTING			FILLING		
	Volume/m	Width m	Volume	Volume/m	Width m	Volume
0	54,25	5	271,25	2,86	0,5	1,43
01	47,98	5	239,90	4,30	5	21,50
1	64,31	5	321,55	0	5	0
2	58,35	5	291,75	0	5	0
3	58,85	5	294,25	0	5	0
4	39,14	5	195,70	0	5	0
5	24,18	5	120,90	2,64	5	13,20
6	24,09	5	120,45	5,02	5	25,10
7	15,95	5	79,75	4,12	5	20,60
8	8,58	5	42,90	4,35	5	21,75
9	2,66	5	13,30	6,10	5	30,50
10	1,84	5	9,20	7,33	5	36,65
11	3,61	5	18,05	10,68	5	53,40
12	2,95	2,5	7,38	15,57	5	77,85
TOTAL	2026,33 m³			301,98 m³		

SECTION OF FINISH GRADING WORKS 10