JAPAN INTERNATIONAL COOPERATION AGENCY
EGYPT OFFICE

EVALUATION STUDY REPORT FOR REGIONAL TRAINING SEMINAR ON EARTHQUAKE OBSERVERS

APRIL 1996

P.M.P. Services
Dr. Sherif Oteifa

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INTRODUCTION

Japan Intentional cooperation Agency (JICA) has cooperated in the field of seismology for Egypt since 1971. At present , JICA is implementing the Third Country Training Program of the International Training Seminar for Earthquake Observers for Africa, in cooperation with the Egyptian Fund for Technical Cooperation with Africa ; Ministry of Foreign Affairs of Egypt , and the National Research Institute for Astronomy and Geophysics (NRIAG).

The purpose of the course is to provide the participants from African and Middle East countries with an opportunity to upgrade relevant techniques , knowledge , and research capabilities in the field of seismology. NRIAG has conducted the course for five years since 1992 . The course received 134 trainees from 25 countries up till now .

JICA planned to implement this evaluation study for the course finished five years cooperation and to examine whether JICA needs to extend the cooperation and provide additional support .The consulting office **P.M.P. Services** has been recruited to prepare a final evaluation report on the course. In conformity with JICA's ex-participants follow-up program , a four-member mission to Ghana had been dispatched to assess the impact of the course on ex-participants of one of the respective countries of the course. Moreover , a post questionnaire form was designed (see attached Appendix **A**) , and sent to the hundred and thirty four (134) ex-participants by post . In addition to this , semi -structured interviews were carried out with Egyptian ex-participants and their senior officials .

A total of 33 questionnaires were received back (25%) in which an analysis of the results is given in this report as a part of JICA's format (*Evaluation at completion monitoring sheet for technical training programs*).

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FACE SHEET

COURSE NAME: International Training Seminar for Earthquake Observers (Seismologists) For Africa .

COURSE PERIOD: 4 weeks

FIXED NUMBER OF TRAINEES : 23 Persons in addition to a number of Egyptian Participants not exceeding 10.

GOVERNMENT OFFICES CONCERNED : .. Japan International Cooperation Agency - Egypt Office
.. Egyptian Technical Cooperation Fund For Africa

TRAINING ORGANIZATION : National Research Institute for Astronomy and Geophysics.

EVALUATION AT COMPLETION TEAM: Project Management Professional Services **(P. M. P.)**
Consultant : Dr. Sherif Oteifa

DATE OF THIS EVALUATION : 1st of March to 31st of March 1996

SUMMARIZATION OF EVALUATION RESULTS:

1. EFFECTIVENESS

The course goals were achieved in equipping the participants with the knowledge and skills in the area of seismology. However , the lack of computer facilities and software in the recipient countries relevant organizations resulted in lesser applications of personal computers .Such organizations should implement plans to procure necessary hardware and software required for the new era of " Digital Seismology".

2. TRAINING EFFECTS

All participants agreed upon the course suitability to their personal objectives and career development . The course widened their knowledge to carry out their work . duties ,as seismologists, in a very effective way and to solve the problems they encounter . Moreover , the course assisted their employers in:

1. Improving their abilities in tackling faults.
2. Most problems were solved in telemetric networks , relocation of noisy stations to new sites , analogue /digital system .
3. Increasing their efficiency of the daily routine work in the observatory.
4. Identifying more phases (waves) on the seismogram .

Consequently ,the ex-participants are working now with less supervision and are having more authority from their supervisors in carrying out seismological studies at their respective countries .

The ex-participants requested the following **additions** to the course curriculum:

1.Training in digital seismology.

2.Using computers in data analysis . More software must be introduced and techniques on how to use them and to have enough time on the computers.

3.Introduce instrumentation topic to improve the skills on the maintenance of the seismic observatory and to help participants to know about the functions of the instruments used in seismology.

4.More practical sessions in the course content.

3.SYSTEM FOR CONDUCTING TRAINING COURSES

The whole concept of system for providing the course is good , for it has upgraded their knowledge in modern scientific technology .On the otherhand , the course

duration and some practical works were not enough .This evaluation study has revealed that a revised course curriculum would better include learning elements on:

- Digital seismology
- Seismic network management
- Computer application in seismology
- Building codes for earthquake engineering
- Trouble shooting and maintenance management

The following remarks on the course administration were noted :

1. More emphasis in the course should be on field work , group research , and discussions .

2. The course duration is short to cover all subjects in the field of seismology. A revised course duration would allow for more practical sessions , new additions to the syllabus , free time to study.

3. The call for nominated countries to send participants for the course - administered by the Ministry of Foreign Affairs in Egypt should be at least four months in advance.

4. More practical exercises in earthquake observatory is required , particularly on fault plane solutions .

5. The participants should submit an end of course report to the following organizations: JICA offices, and embassies of Egypt in their respective countries . This obligation should be stated in the General Information Document issued by NRIAG.

6. NRIAG should prepare an assessment for each participant to be forwarded to his employer after the end of the course.

7. Strengthening NRIAG is of vital importance to ensure the successful implementation of this training course. This can be achieved through: Develpoment of the presentation skills of NRIAG staff , creation of international linkages , and provision of computer software.

4. JUDGEMENT ON ALTERATION OR ABOLITION OF COURSE OR EXTENSION OF TRAINING PERIOD:

Based on the results of this evaluation study , it is strongly recommended to extend the course evaluated, taking into consideration the output of this report.

I. OUTLINE OF TRAINING COURSE

1. APPLICATION /SCREENING /NUMBER OF ACCEPTABLE TRAINEES

	YEAR 1992	YEAR 1993	YEAR 1994	YEAR 1995/A	YEAR 1995/B	TOTAL
NUMBER OF APPLICANTS	38	35	23	30	NA*	136
NUMBER OF TRAINEES SELECTED	22	23	23	23	NA	91
NUMBER OF TRAINEES ACCEPTED/ (ENROLLED)**	30	27	29	31	17	134

*NA: Not available
** Including Egyptian participants

2. COUNTRIES WHICH DISPATCH TRAINEES (A TOTAL OF MORE THAN 3 TRAINEES).

COUNTRY	YEAR 1992	YEAR 1993	YEAR 1994	YEAR 1995/A	YEAR 1995/B	TOTAL
ALGERIA	1	2	2	3	2	10 yes*
BAHRAIN	1		2			3
CHAD					1	1
EGYPT	8	7	6	10	7	38 yes
ETHIOPIA				1	2	3
GHANA	2		1	3	3	9
JORDAN	2	2	2	1	2	9 yes
KENYA	3		1	1		5
LIBYA	1	1				2

COUNTRY	YEAR 1992	YEAR 1993	YEAR 1994	YEAR 1995/A	YEAR 1995/B	TOTAL
MADAGASCAR					1	1
MALAWI	2	2	2	2		8
MOROCCO	2		2	2		6
NIGERIA	1					1
QATAR	1	2				3
RWANDA		1				1
SAUDI ARABIA	1		2	1		4
SYRIA	1	1	2			4
SUDAN		2				2
TANZANIA	1	1	1	2		7
TUNISIA	2	3	2			7
UGANDA		1				1
YEMEN		1	2	3		6
ZAIRE		1	1			2
ZAMBIA	1		1			2
ZIMBABWE				1		1
TOTAL PERSONS	30	27	29	31	17	134
TOTAL COUNTRIES	16	14	15	13	6	25

* yes· Indicates a country had dispatched participants for each year .

3. **TRAINING PERIOD** : 30 Days / year

	YEAR 1992	YEAR 1993	YEAR 1994	YEAR 1995/A	YEAR 1995/B
DATE	1/2-29/2	16/1-13/2	8/1-5/2	4/3-31/3	11/11-10/12

4. **EXPENSES FOR THE PROVISION OF TRAINING**

	YEAR 1992	YEAR 1993	YEAR 1994	YEAR 1995/A	YEAR 1995/B	TOTAL
BASE BUDGET	245,280	258,538	290,262	318,344	209,142	1,321,566
ACTUAL AMOUNT OF EXPENSES	245,082.2	253,808.5	292,232	337,608	229,270	1,358,000.7

5. **ORGANIZATION WITH WHICH TRAINING IS ENTRUSTED**

	YEAR 1992- 1995/B
ORGANIZATION WITH WHICH TRAINING IS ENTRUSTED	National Research Institute for Astronomy & Geophysics NRIAG
AMOUNT FOR TRAINING ENTRUSTED	**100 %**

6. **ACCIDENTS INVOLVING TRAINEES**

No accidents had occurred to participants in the course period.

7. **CURRICULUM**

7.1 CURRICULUM COMMON TO ALL COURSES REGARDLESS OF THE YEAR

A. General seismology
B. Earthquake observation and analysis
C. Earthquake engineering
D. Mitigation of earthquake hazards
E. Plate tectonic theory
F. Geophysical phenomena related to earthquake

7.2 CURRICULUM NEWLY ADOPTED , OR ABOLISHED AS A RESULT OF A REVIEW OF CURRICULUM

SUBJECTS	NEW/ABOLISHED	YEAR
-Digital seismology	New	1993
-Low cost digital seismic data acquisition system	New	1993
-Building codes and construction practices in Japan	New	1993
-Introduction to strong motion seismology	New	1993
-International cooperation in seismology	New	1994
-Global seismicity	New	1994
-Earthquake prediction	New	1994
-Kobe 1995 earthquake	New	1995/A
-Assessment of seismic risks	New	1995/B

8. STATE OD DISPATCH OF A FOLLOW UP TEAM, ETC.

JICA Egypt Office had dispatched a four -member mission to visit Ghana from the 10th of March to the 15th of March 1996 , in order to evaluate the impact of ex-participants' training and also to suggest measures to improve upon its implementation.

The team mission constitutes of : **a leader** , Prof. Dr. *Ezz El Din Ibrahim* ; **JICA expert** , Prof. Dr. *Hiroshi Murakami* ; **a consultant** , Prof. Dr. *Sherif Oteifa* ; and a **coordinator** , Mr.Eng. *Muatafa Hussein* .

The mission had interviewed seven of the ex-participants , and jointly together they carried out field visits to different seismological out-stations in Ghana.

Please find enclosed :

1..Records of meetings and highlights on mission results prepared by the consultant in Appendix **B,1**: " **The Evaluation Study Report for Regional Training Seminar on Earthquake Observers in Ghana"**.

2.. Report about the mission prepared by the leader in appendix **B,2** : " **Minutes of the Visit and Conclusions of the Evaluation Study for Regional Training Seminar on Earthquake Observers in Ghana "**.

II. EFFECTIVENESS

1. CONTINUITY OF THE COURSE NEEDS

1.1 NEEDS ASSESSED AT THE TIME OF THE ESTABLISHMENT OF THE COURSE.

Since the beginning of this century , thousands of human lives and many properties were lost by the earthquakes that attacked various places in the world, such as , Algeria in 1980 and 1994 ; Armenia in 1988 ; San Francisco in 1980 ; Iran in 1990 , the Philippines in 1990 ; Egypt in 1992 ; Japan 1994 etc..

One of the most important measures against earthquake hazards ,is to monitor the earthquake activity(how and where earthquakes take place). It is earthquake observation . systematic and well organized earthquake observation can reveal the earthquake fault linked to ground surface , stresses causing earthquake activity , underground structure of the region concerned , and so forth .

For this purpose , the course was designed to provide participants in Africa with an opportunity to upgrade relevant techniques , knowledge and research capabilities in the field of seismology. A total of 25 countries up till now has sent trainees to this course.

1.2 COURSE NEEDS AT THE TIME OF THE EVALUATION

$$\text{Application Rate} = \frac{\text{number of countries that were invited and actually applied for participation in the course}}{\text{number of selected participants' countries}}$$

	YEAR 1992	YEAR 1993	YEAR 1994	YEAR 1995/A
APPLICATION RATE	1.187	1.33	1	1.307

From the above calculations of the application rate it is obvious that throughout the 5 years of training , it is *greater than one* which indicates that the number of countries requesting participation in the course is higher than the actual countries of the selected participants.

1. 3 ANY CHANGE IN THE COURSE NEEDS AND THE NECESSITY FOR ANY ACTION TO DEAL WITH A CHANGE

In the passage of time from the establishment of the course up till now , a significant change has occurred to the course needs: The follow up evaluation mission sent to Ghana has revealed that now it is the era of digital seismology, seismic network management and computer applications in seismology . Consequently the curriculum of the course has to be fully reviewed to accommodate such change.

2. EXTENT OF AN INCREASE IN LEVEL

2.1. VERIFIABLE INDICATORS

At the end of the course , the participants are expected to be capable to :

1. Upgrade relevant techniques, knowledge and research capabilities in the field of seismology.

2. Install instruments for earthquake observation at the sites concerned in their respective countries and to operate them.

3. Analyze the data obtained from earthquake observations in order to locate hypocenters ,determine the earthquake magnitude , find the underground structures , and focal mechanisms ,etc.

4. Contribute to the mitigation and prevention of earthquakes disasters in their respective countries through the knowledge and technology acquired in the course.

2.2 EFFECTIVENESS

A post course questionnaire form was sent to the ex-participants in order to examine the effectiveness of the training course . A total of **33** questionnaires out of **134** were received . The following table indicates the degree of goal achievement of the course :

"Did you make good use of the following techniques and knowledge you have attained in the course after you returned back to your country ?"

Unit : number of persons(%)

INDICATORS	Quiet Many	Often	Few	None	*No reply
(a) Use of personal computing and programming	30	30	15	15	10
(b) Operation and installation of seismogram	61	30	3	0	7
(c) Reading seismogram	64	18	12	0	6
(d) Determining parameters such as : location and magnitudes	49	27	18	0	6
(e) Finding fault plane solutions	33	27	13	21	6

*No reply: % of respondents who did not answer this question

From the above table , it is clearly shown that the course goals were achieved in equipping the participants with the knowledge and skills in the area of seismology. However , the lack of computer facilities and software has resulted in lesser use of personal computers .

2.3. ANY CHANGE IN THE IMPORTANT ASSUMPTIONS

No change has occurred in the important assumptions assumed at the time of formulation of the course in the processes after the start of the course.

III. TRAINING EFFECTS

1. EVALUATION OF TRAINING EFFECTS BY THE PERSON IN CHARGE OF THE TRAINING AND THE TRAINING COORDINATOR

Based on the report on the provision of training submitted by NRIAG each year , the training coordinator has always expressed the full satisfaction of the training effects . His comments were as follows across the five years :

" *Most of the participants were very keen to learn every thing prepared for them . Field trips were of great benefits for the participants . Presentation of the country reports by the participants were very important and fruitful . Scientific and culture discussions among participants and with instructors may create new channels of cooperation among countries. More practical training must be done .*"

2. EVALUATION RESULTS BY TRAINEES

The following table summarizes the results of marks given to the substance of the course by participants , as provided in the course report submitted by NRIAG for each year.

Unit : Number of persons (%)

	YEAR 1992	YEAR 1993	YEAR 1994	YEAR 1995/A	AVERAGE
(1) SUBJECT					
.broad	25.3	20	25	30	25
.right	59.7	60	60	55	59
.incomplete	15	20	15	15	16
(2) LEVEL					
.too advanced	16.11	15	-	-	15
.right	74.09	75	-	-	75
.too elementary	9.80	10	-	-	10
(3) CLARITY OF LECTURES					
.clear	26.59	30	30	25	28
.adequate	62.95	60	55	60	59
.difficult	10.46	10	15	15	13
(4) TREATMENT					
.not enough practical	29.3	15	10	10	16
.right	63.5	72	75	60	68
.not enough theoretical	7.2	13	15	30	16
(5) DURATION*					
.short	14.18	12	15	15	14
.right	62.86	65	70	75	68
.long	18.63	23	10	10	15

6) **OTHERS***					
.language problems	26.88	25	25	20	24
.participants too	32.5	30	35	40	34
diversified					
.little applicability	31.75	45	40	40	39.18

* Some results over the years are , when summed , less than 100% ; this is because not all the respondents commented on it.

It is obvious that the evaluation marks tend to increase for the items of TREATMENT ,and DURATION ,as NRIAG introduces more practical sessions in the course and better allocation for the schedule .

3. STATE OF IMPROVEMENTS MADE BASED ON EVALUATION RESULTS

The report on the provision of training submitted by NRIAG annually indicates the following improvements:

YEAR (1992)

DETAILS OF IMPROVEMENTS:

..More practical training must be done

..More concentration must be oriented for computational seismology, engineering seismology and microzoning.

..It was recommended to nominate Japanese experts enough time before of the course start.

EFFECTS OF IMPROVEMENTS DURING 1993 :

..Practical sessions content in the course were increased.

..NRIAG invited several international experts (in addition to the Japanese experts) such as, Prof. / *Carl Ramni* (USA) ; Prof./ *Sedovish* (Hungry) , and Prof./ *Niewiadomesky* (Poland).

..An outline of the requirements of the Japanese experts is being stated in a draft of the course content for the next year.

YEAR 1993

DETAILS OF IMPROVEMENTS:

..More concentration must be oriented for computational seismology, engineering seismology , microzoning,and earthquake prediction .

..More practical training must be done.

EFFECTS OF IMPROVEMENTS DURING 1994 :

..Practical time was increased again .

..NRIAG invited one of the international experts (in addition to the Japanese experts) , Prof. Dr./*Karl Romni* from seismic studies center - USA.

YEAR 1994

DETAILS OF IMPROVEMENTS:

..More concentration must be oriented for computational seismology, engineering seismology , microzoning,and earthquake prediction .

..More practical training must be done.

EFFECTS OF IMPROVEMENTS DURING 1995 :

..Practical time was increased again .

..NRIAG invited one of the international experts (in addition to the Japanese experts) , Prof. Dr./*Karl Romni* from Seismic Studies Center - USA.

YEAR 1995/A

DETAILS OF IMPROVEMENTS:

..More concentration must be oriented for computational seismology, engineering seismology , microzoning,and earthquake prediction .

..More practical training must be done.

EFFECTS OF IMPROVEMENTS DURING 1995/B :

Report is not yet submitted by NRIAG .

4. STATE OF UTILIZATION OF THINGS LEARNED FROM THE TRAINING AFTER PARTICIPANTS RETURNED TO THEIR COUNTRIES

The results of the post- course questionnaire has indicated as shown in the tables below , that the ex-participants had well utilized the knowledge and scientific information gained in the course.

- *" How Relevant was this training to your responsibilities in your home country?"*

Unit: Number of persons (%)

Highly applicable	**55 %**
Somewhat applicable	**42 %**
Not very applicable	**0 %**

*** 3% did not reply on this question .**

The ex-participants have confirmed that the course widened their knowledge to carry out their work duties as seismologists in a very effective way and to solve the problems they encounter . However, further training in digital seismology has been as well expressed to be essential in effectively performing their tasks in the future.

- *" How appropriate was this training in terms of your personal objectives and career objectives ?"*

Unit: Number of persons (%)

Most appropriate	**42 %**
Appropriate	**55 %**
Inappropriate	**0 %**
Most inappropriate	**0 %**

* 3% did not reply on this question .

All participants agreed upon the course suitability to their personal objectives and career development.

- *" Have you put into practice the training acquired in Egypt and to what extent?"*

The ex-participants answers were centered around :

1. Improving their ability in tackling faults.
2. As a result of the acquired training , most problems were solved in telemetric networks ,relocation of noisy stations to new sites , analogue /digital connection .
3. Increasing their efficiency of the daily routine work in the observatory.
4. Identifying more phases (waves) on the seismogram .
5. Using the graphical method to cross check the original time value with past values.

- *"Do you use some of the publications and training materials collected during the training period?"*

Unit: Number of persons (%)

YES	**88**
NO	**3**

* 9% of the respondent did not reply .

The ex-participants have described their use for the training materials as follows:

1. Reference to solving problems.

2 Introducing seismology to other colleagues who did not attend the course.

3. Using technical methods such as geoelectrical resistivity using sounding method for sitting of ground water, also seismic refraction method for foundation investigation.

4. Carrying out research work .

"After returning back to your home country, have you established network contacts?"

Unit: Number of persons (%)

YES	**91**
NO	**3**

* 6% of the respondent did not reply.

" If YES , *with whom?"*

Unit: Number of persons (%)

JICA staff	**9**
Lecturers and/or trainers	**21**
Course members	**30**
Colleagues at work	**22**
NRIAG	**16**
African Technical fund	**2**

It is suggested that a newsletter ought to be established by NRIAG to keep ex-participants updated with the latest seismology research . This would provide a good opportunity for exchanging information between participants of different countries.

4.1 EVALUATION OF TRAINING EFFECTS BY THE PARTIES CONCERNED OF RECIPIENT COUNTRIES.

Interviews carried out with the superiors of trainees and the senior officials of the parties concerned indicated that ex-participants are working now with less supervision and are having more delegation from their supervisors in carrying out seismological studies .

5. ITEMS WHICH NEED TO BE IMPROVED OR REVIEWED TO RAISE TRAINING EFFECTS OF THE COURSE

" What knowledge and techniques do you think we should emphasize more or newly introduce into the curriculum in the future , and why?"

The ex-participants requested the following additions to the course curriculum:

1. Using computers in data analysis . More software must be introduced and techniques on how to use them and to have enough time on the computers.

2. Introduce instrumentation topic to improve the skills on the maintenance of the seismic observatory and to help participants to know about the functions of the instruments used in seismology.

3. More practical sessions in the course content.

IV. SYSTEM FOR PROVIDING TRAINING

1. ORGANIZATION WHICH ACCEPTS TRAINEES

(1) NAME OF ORGANIZATION:

NRIAG - National Research Institute for Astronomy and Geophysics.

(2) LOCATION:

Helwan Observatory - Cairo - Egypt

(3) NAME AND POSITION OF THE PERSON IN CHARGE:

Prof.Dr./ *Hanafy Deebes* Director of Institute
Prof.Dr./ *Ezz El Din Ibrahim* Head of Seismology Dpt.

2. OPERATION OF ACTIVITIES

2.1 SYSTEM OF THE OPERATION OF ACTIVITIES AT THE ORGANIZATION WHICH ACCEPTS TRAINEES.

The course is being implemented by the seismological Dpt. at NRIAG.It is a national research institute serving the academic and applied field of astronomy and geophysics since 1903.

Its specialized knowledge, experience, equipment and facilities have proven a great value to astronomical, geophysical and seismological research and applied work in Egypt.

It consists of four main departments which form nine specialized laboratories in addition to several observatories and centers around Egypt. The seismological department comprises of two main laxities, several seismological observations at Helwan, Matrouh , Kattamia, Tell Amarna, Aswan , Abu Simbel in addition to seismological centers at Aswan and Hurghada.

The seismological department has organized courses for earthquake observers since 1983 in cooperation with the UNESCO, National Academy for Scientific Research and Technology in Egypt . Moreover, the results of the post-course questionnaire confirms that NRIAG has an effective system for management and operation of training courses.

2.2 SUPPORT FROM GOVERNMENT OFFICES CONCERNED

The Ministry of Foreign Affairs in Egypt through its embassies in Africa and Arab states provides great support for arrangements of the course including visas and travel arrangements.

JICA Egypt office provides coordination, assistance and follow-up to the course activities.

3. SYSTEM FOR THE OPERATION OF COURSE

The ex-participants have expressed their views concerning the system for conducting the course as summarized in the following table.

"Please Tick as Appropriate Your Personnel Assessment of the Training Course."

Unit: Number of persons (%)

NO.	ITEM	Excellent	V.Good	Good	Adequate	Inadequate
1	Course Duration	33	18	9	27	13
2	Orientation Program	15	52	21	9	3
3	lecturers Content & Presentation Methodology	30	42	28	0	0
4	Practical Work *	27	36	6	9	18
5	Theory / Practical Ratio	12	33	22	33	0
6	Observation & Study Tours*	30	40	21	3	3
7	Knowledge & Information Gained*	24	40	24	3	0
8	Relevance of Subject Matter*					
	(a) General Seismology	24	52	18	3	0
	(b) Earthquake Observation & Analysis	42	33	15	3	0
	(c) Earthquake Engineering	12	30	33	21	0
	(d) Mitigation of Earthquake Hazard	12	24	30	24	0
	(e) Plate Tectonic Theory	10	35	30	15	0
	(f) Geophysical Phenomena Related to Earthquake	15	42	36	7	0

NO.	ITEM	Excellent	V.Good	Good	Adequate	Inadequate
9	**Scientific & Technical Gains ***	15	42	12	6	0
10	**Quality of Trainer and/or Coordinator ***	33	52	6	0	0
11	**Facilities Offered ***	33	33	12	12	0

*Some values when summed up are less than 100% ,because some respondents did not comment on it.

The whole concept of system for providing the course is good , for it has upgraded their knowledge in modern scientific technology .On the otherhand , the course duration and some practical works were not enough .

3.1 COURSE OPERATION LEADERS

Prof./Dr. *Ezz El-Din Ibrahim* is assigned as the Secretary General of the course.

3.2 INSTRUCTORS

The course is being taught mainly by NRIAG staff . Over twenty academic members , in addition to recruiting professional part-timers from Egypt and international famous experts in the domain of seismology. Throughout the course period , short term Japanese experts gave lectures .

3.3 TRAINING FACILITIES

The training aids which fit the substance of the course include:

(a) Helwan Seismological Station
(b) Hurghada Seismological Center
(c) Kattamia Broad Band Seismic Station
(d) Aswan Seismological Center
(e) Portable Seismological Field Station MEQ - 800 and PDR1
(f) Processing facilities (Data Seis, Computers)
(e) Mc Seis - 1300 Engineering Seismograph equipment

However, a computer lab is urgently needed to increase the effectiveness of the course.

3.4 STATE OF THE AVAILABILITY OF TEACHING MATERIALS (TEXTBOOKS, AUDIOVISUAL AIDS)

The following textbooks are available:

NO	TITLE	SUBJECT
1	*Geophysical Activities in Egypt*	Geophysics
2	*Seismic Zoning*	Seismology
3	*Seismological Activities in Egypt*	Seismology
4	*Introduction to Seismograph Theory*	Seismometry
5	*Earthquake location*	Seismometry
6	*Graphical Representation of Focal Plane solution*	Seismometry
7	*Seismic Waves*	OBS. Seismology
8	*Seismic station*	B. Seismology
9	*Micro-earthquake Survey*	B. Seismology
10	*Seismic Hazard*	Applied Seismology
11	*Applied Seismology*	Applied Seismology
12	*Physical Background of Discrimination*	Applied Seismology
13	*Inducing Earthquake & Environment*	Applied Seismology
14	*Global Seismic Monitoring of Nuclear Explosions*	Applied Seismology
15	*Seismic Refraction Techniques*	Applied Seismology
16	*Synergy between Seismic and Non-Seismic Methods for Verification of Nuclear Explosions*	Applied Seismology
17	*Seismic Micro-zoning*	Applied Seismology
18	*Source Parameters*	B. Seismology
19	*Earthquake Sequences*	B. Seismology
20	*Earthquake Engineering*	Earthquake Engineering
21	*Paleomagnitism*	Geomagnetism
22	*Geo-electric Methods*	Geoelectric
23	*Geomagnetic Observatory*	Geomagnetic
24	*Geomagnetism*	Geomagnetic
25	*Geology of Aswan*	Geology
26	*Strong Motion Seismograph*	Strong Motion Seismology
27	*Focal Mechanism*	Earthquake Focal Mechanism
29	*Earthquakes and Plate Tectonics, outline of the 1995 Kobe japan Earthquake*	Plate Tectonics
30	*Estimation of Strong Ground Motion and Dynamic Analysis of Building Structure Damaged by 1995 Kobe Japan Earthquake*	Earthquake Engineering
31	*Kobe 1995 Japan Earthquake*	Seismology

3.5 STATE OF REVIEW OF CURRICULUM

According to the report on the provision of training submitted by NRIAG for each year , the curriculum was reviewed to allow for more practical sessions based upon the proposal by the Japanese experts and the evaluation done by the participants . More focus in the core subjects were added into computational seismology , engineering seismology , micro-zoning and earthquake prediction.
This evaluation study has revealed that a revised course curriculum would better include learning elements on:

- Digital seismology
- Seismic network management
- Computer application in seismology
- Building codes for earthquake active -zone countries : In developing countries , usually earthquake observers carry out seismological studies in addition to providing advises on eathquake engineering . So the course should provide a detailed knowledge and skills on building codes for earthquake - resistant structures .
- Trouble shooting and maintenance management

4.SYSTEM FOR SUBCONTRACTING TRAINING

4.1.REASONS FOR SELECTING THE ORGANIZATION WHICH UNDERTAKE TRAINING

Item not applicable

4.2. AMOUNT OF MONEY REQUIRED FOR TRAINING ENTRUSTED

A review and analysis of the expenses report for the training course across the five year period indicates that during the first three years , the amount of money paid to NRIAG is sufficient enough to operate and manage the training properly , however in the year 1995/A ,the actual amount of money spent on the course were more than the allocated for the following items:

Perdiem allowance
Site visits
Salaries(clerk , teaching assistants)
Domestic flights for study tours
Travel allowance
Material procurement

This resulted in an over budget of **19,264 L.E.**

In addition to this , in 1995/B , the actual amount of money spent on the course were also more than the allocated for the following items :

Perdim allowance
Accommodation
Airport attendance
External lectures
Site visits
Bus rent for study tour
Stationary and training materials
Printing costs
Text books

5. PROBLEMS WITH THE PROVISION OF TRAINING AND PLAN FOR IMPROVEMENT

1. More emphasis in the course should be on field work , group research , and discussions .

2. The course duration is short to cover all subjects in the field of seismology. A revised course duration would allow for more practical sessions , new additions to the syllabus , free time to study.

3. The call for nominated countries to send participants for the course - administered by the Ministry of Foreign Affairs in Egypt should be at least four months in advance of schedule start date .

4. More practical exercises in earthquake observatory seismology is required , particularly on earthquake fault plane solutions .

5.The participants should submit at the end of course , a report to the following organizations: JICA offices, and embassies of Egypt in their respective countries . This obligation should be stated in the General Information Document issued by NRIAG.

6.NRIAG should prepare an assessment for each participant to be forwarded to his employer after the end of the course.

7.Strengthening NRIAG is of vital importance to ensure the successful implementation of this training course. This can be achieved through: Staff development , creation of international linkages , and provision of equipment particularly personal computers

APPENDIX A

Evaluation Study For Regional Training Seminar On Earthquake Observers

Post-Course Questionnaire Form

A. Background Information

Name of Participant:----------

Nationality:---------- Age:----------

Education (Please provide dates):

Course Date:----------

Present Occupation:----------

Name and Address of Present Employer:

Date of Employment:----------

Three Major Functions of Your Employer:

1.----------
2.----------
3.----------

Five Major Tasks and Duties You Perform:

1.----------
2.----------
3.----------
4.----------
5.----------

Please attach a chart of the organization to which you belong and indicate your section in annexed paper.

Post before attending the course:----------

Post after attending the course:----------

Permanent Correspondance Address:----------

B. Please Tick As Appropriate Your Personal Assessment of theTraining Course
(1 = Excellent, 2 = V.Good, 3 = Good, 4 = Adequate , 5 = Inadequate)

No.	Item	1	2	3	4	5
1.	Course Duration					
2.	Orientation Programme					
3.	Lectures Content and Presentation Methodology					
4.	Practical Work					
5.	Theory/Practical Ratio					
6.	Observations & Study Tours					
7.	Knowledge & Information Gained					
8	Relevance Of Subject Matter (a) General Seismology (b) Earthquake Observation and Analysis (c) Earthquake Engineering (d) Mitigation of Earthquake Hazard (e) Plate Tectonic Theory (f) Geophysical Phenomena Related to Earthquake					
9.	Scientific and Technical Gains					
10.	Quality of Trainer and/or Coordinator					
11.	Facilities Offered					

Please add further comments (if any):

.....

.....

.....

.....

.....

.....

C. How relevent was this training to your responsibilities in your home country ?

* Highly Applicable ☐
* Somewhat Applicable ☐
* Not Very Applicable ☐

IF Applicable, Please specify how, if Not Applicable, describe reason:

.....

.....

.....

.....

D. Did you make good use of the following techniques & knowledge you have attained in the course after you have returned back to your country?

(1 = Quiet Many, 2 = Often, 3 = Few, 4 = None)

	1	2	3	4
(a) Use of Personal Computing and Programming				
(b) Operation and Installation of Seismograph				
(c) Reading Seismograph				
(d) Determining Parameters such as Location and Magnitude				
(e) Finding Fault Plane Solutions				

IF Your Answer is "Few or None", Please indicate reason:

.....

.....

.....

.....

.....

E. **How Appropriate was this Training in Terms of your Personal Objectives and Career Development?**

* Most Appropriate ☐
* Appropriate ☐
* Inappropriate ☐
* Most Inappropriate ☐

F. **Please State your views on the Training Programme Concerning:**

		Appropriate	Inappropriate
(a)	Size of the Class	☐	☐
(b)	Course Timing	☐	☐
(c)	Duration of the Training Period	☐	☐
(e)	Facilities Offered	☐	☐

Please Describe any Difficulties encountered during theTraining Sessions:

.....

.....

.....

G. **What knowledge and techniques do you think we should emphasize more or newly introduce into the curriculum in the future and why?**

Comments:

.....

.....

.....

.....

.....

H. **Have you put into practice of the training acquired in Egypt? and to what extent ?**

Comments:

.....

.....

.....

.....

I. **After returning back to your home country,have you established network contacts?**

Yes ☐ No ☐

If yes with whom?

(a) JICA Staff ☐
(b) Lectures and/or Trainers ☐
(c) Course Members ☐
(d) Colleagues at Work ☐
(e) NRIAG ☐
(f) African Technical Fund ☐
(g) Other .....

J. **Do you use some of the Publications and Training Materials collected duringThe training Period?**

Yes ☐ No ☐

If yes, please describe, if no , state reason.

.....
.....
.....
.....
.....

K. **What are your general recommendations concerning our training courses?**

Comments:

.....
.....
.....
.....
.....

Date: ..... Signature: .....

Thank You For Your Valuable Comments

Pleas send back this questionnaire to P.M.P services Dr. Sherif Oteifa
18 Emad El-Din Kamel, Nasr City ,Cairo . P.O. Box : 7064 Postal Code: 11371

APPENDIX B1

JAPAN INTERNATIONAL COOPERATION AGENCY
EGYPT OFFICE

EVALUATION STUDY REPORT FOR REGIONAL TRAINING SEMINAR ON EARTHQUAKE OBSERVERS IN GHANA

MARCH , 1996

P.M.P.Services
DR./Sherif Oteifa

TABLE OF CONTENTS

INTRODUCTION

Japan International Cooperation Agency (JICA) has implemented the third country training program of the international training seminar on earthquake observers for Africa , in cooperation with the Egyptian Fund for Technical Cooperation with Africa; Ministry of Foreign Affairs of Egypt and the National Research Institute for Astronomy and Geophysics.

The purpose of the course is to provide the participants from African countries with an opportunity to upgrade relevant techniques , knowledge and research capabilities in the field of Seismology. The course received nine trainees from Ghana's Geological Survey Dpt. in 1992 , 1993, 1994, and 1995 respectively.

In conformity with JICA's ex-participants follow up program , JICA Egypt office had dispatched a four-member mission to visit Ghana from 10th of March to 15th of March 1996 , in order to evaluate the impact of ex-participants training and also to correct measures to improve upon its implementation .

The team members constitutes of : a Leader , Prof. Dr./ Ezz El din Ibrahim ; a JICA Expert , Prof. Dr./ Hiroshi Murakami ; a Consultant , Prof. Dr. /Sherif Oteifa; and a Coordinator, Mr. Eng./ Mustafa Hussein. The aim of this report is to record the evaluation study for regional training seminar on earthquake observers in Ghana.

The team had met with members of JICA Ghana office and Japanese Embassy, as well as the Egyptian Ambassador.

During the study , the team mission made several visits to senior officials of Ghana's relevant authorities . These are Ministry of Finance , Ministry of Mines and Energy , and the Geological Survey Dpt., University of Ghana.

Moreover ,the team had interviewed seven of the ex-participants and jointly together, they carried out field visits to Out-stations of the Geological Survey Dpt. in Shai Hills, Akosombo , Kurkurantumi , Amanokrom and Weija.

The team had also visited Noguchi Memorial Institute for Medical Research in Accra , where a training course in " Polio Diagnostic Procedures and Vaccine Potency Testing " was being carried out meanwhile , in order to exchange information and experiences on implementing third country training programs .

At the end of the study, the team was introduced to the executive board of JICA's Alumni Association of Ghana .

MEETING NO.1

DATE:
11/3/1996

VENUE:
JICA Ghana Office

PURPOSE:
Introduction of JICA - Egypt team and the purpose of the mission .

ATTENDEES:

1.Mr./ Toshiharu Kai Deputy Resident Representative.

2.Mr./ Kimio Abe Ast. Resident Representative.

3.Ms./ Rabi Ali Asst. Administrative Officer.

4. Study Team

RECORD OF DISCUSSIONS

- Purpose of the study mission .
- Scheduling of visits .
- Briefing on the activities of JICA Egypt Office, with emphasis on third country training programs .
- Briefing on the activities of JICA Ghana Office.
- Project development cycle in Ghana and the role of Ministry of Finance.

MEETING NO.2

DATE:
11/3/1996

VENUE:
Embassy of Japan

PURPOSE:
Courtesy call to introduce JICA - Egypt team and the aim of the evaluation study.

ATTENDEES:

1.Mr./ Makoto Wakasugi	Minister - Counselor of Embassy of Japan.
2.Mr./ Honda	Junior Development Officer - Embassy of Japan.
3.Mr./ Kimio Abe	Ast. Resident Representative.
4.Ms./ Rabi Ali	Asst. Administrative Officer.
5. Study Team	

RECORD OF DISCUSSIONS

- Purpose of the study mission .
- Briefing on the schedule of the study.

MEETING NO.3

DATE: 11/3/1996

VENUE: Embassy of Egypt

PURPOSE:

Introduction of JICA - Egypt team and the aim of the evaluation study.

ATTENDEES:

1.Mr./Mohammed F.El Zayat	Ambassador of Egypt
2.Mr./ Kimio Abe	Ast. Resident Representative
3.Ms./ Rabi Ali	Asst. Administrative Officer.
4. Study Team	

RECORDS OF DISCUSSIONS

- Purpose of the study mission.
- Briefing on the schedule of the study.
- Briefing on other training programs - not funded by JICA - and administered by Egypt's Technical Fund for cooperation with Africa. Example of which is : Army and Police officers training in Egypt.
- Services offered to the course participants by the embassy; air tickets, visas ,etc...

COMMENTS

-- No feedback from ex- participants after the end of the training period A one page report would have been enough.

-- No coordination with JICA Ghana office .

-- End of course report should be submitted by NRIAG.

-- Qualifications of participants need to be more detailed in the General Information document issued by NRIAG/JICA Egypt/Egyptian Technical Fund for Cooperation with Africa.

MEETING NO.4

DATE: 11/3/1996

VENUE: Ministry of Finance

PURPOSE:

Introduction of JICA - Egypt team and the aim of the evaluation study.

ATTENDEES:

1.Mr./ M.A.Quist-Therson	Project Director.
2.Mr./ Akilagpa Sawyer	Principal Economic Planning Officer.
3.Ms./ Rabi Ali	JICA Ghana Office.
4.Study Team	

RECORD OF DISCUSSIONS

- Purpose of the study mission .
- Role of Ministry of Finance in managing international cooperation between Ghana and other countries.
- Procedure for nomination of candidates for attending the training course.

COMMENTS

--Early call for announcement of the training course is required .

-- Disaster relief management techniques should added to the course syllabus.

--Acceptance of candidates is sometimes late , which causes difficulties in travel arrangements.

-- A standard form of feedback reporting is quite essential to help in accessing the effectiveness of the participants.

-- A wider database is needed to allow nomination from several organizations.

MEETING NO.5

DATE: 11/3/1996

VENUE: Ministry of Mines and Energy

PURPOSE:
Introduction of JICA - Egypt team and the aim of the evaluation study.

ATTENDEES:

1.Mr./ Kwaku Addai - Gymbrah	Deputy Minister for Mines Sector.
2.Ms./ Owiredy	Acting Chief Director.
3.Mr./A. Banson	Director of Geological Survey Dpt.
4.Ms./Rabi Ali	JICA Ghana Office.
5.Study team	

RECORDS OF DISCUSSIONS

- Purpose of the mission .
- Briefing on activities of the Geological Survey Dpt.
- Future Plans for installation of digital seismological network in Ghana.

COMMENTS

-- Ex-participants are working now with less supervision.

-- Course duration is short.

-- A need for further focus study at an advance level .

-- An evaluation of each participant should be received from NRIAG , this would assist the department in identifying key talents .

-- Technical cooperation with Japan was requested in the field of Seismology.

-- Production of Newsletter by NRIAG is desirable to always update the knowledge of the ex-participants.

-- Establishment of information network with other seismic institutions is very important.

-- Seismic Network management can be added as a new learning element in the course.

MEETING NO.6

DATE: 11/3/1996

VENUE: Geological Survey Dpt.

PURPOSE:

Evaluate the five years training program , and meeting the ex-participants.

ATTENDEES:

1.Mr./ A. Banson	Director of Geological Survey Dpt.
2.Mr./ Amoaku	Regional Director , Geological Survey Dpt.
3.Mr./ Owusu	Geological Survey Dpt.
4.Mr./Wuaku	Geological Survey Dpt.
5.Mr./Victor Abutiate	Geological Survey Dpt.
6.Mr./Solomon Anum	Geological Survey Dpt.
7.Mr./Sylvanus T.Abulu	Geological Survey Dpt.
8. Miss Rabi Ali	JICA Ghana Office.
9. Study Team	

RECORD OF DISCUSSIONS

- Seismic Activities in Ghana (See Appendix A).
- Requirements for modern earthquake observatory equipment , such as surface webs for horizontal component forces, subsurface survey equipment ,and digital telemetry .
- Prof. Dr./ Marukami shall advice Geological Survey Dpt. on ways to improve their equipment management after the field visits to Out-Stations.

COMMENTS

-- Course duration should be extended to six weeks at least .
-- Unavailability of PCs at the Geological Survey Department.

-- PC learning element should be added to the syllabus with emphasis on computer applications in seismology.
-- Advance courses are requested, particularly in maintenance of equipment.
-- The course was very benificial to the participants in carrying out their work duties.
-- Building codes and earthquake engineering to be added to the course syllabus.
-- Digital seismology should be added to the curriculum.
-- Course announcement arrives too late .

MEETING NO.7

DATE:
12/3/1996

VENUE:
Geological Survey Dpt.

PURPOSE:
Interviews with Ex- participants and their senior officials.

ATTENDEES:

1.Dr./E.K.Brantuoh	Regional Director - Geological Survey Dpt.
2.Mr./ Owusu	Geological Survey Dpt.
3.Mr./Wuaku	Geological Survey Dpt
4.Mr./Victor Abutiate	Geological Survey Dpt
5.Mr./Solomon Anum	Geological Survey Dpt
6.Sylvanus T.Abulu	Geological Survey Dpt
7.Miss./ Paulina Ekua	Geological Survey Dpt
8.Study Team	

RECORD OF DISCUSSIONS

- Structured interview with each participant based on the questionnaires filled by him.
- Presentation of earthquake observatory equipment located at the main station .
- Samples of records showing magnitude and location of local and international earthquakes recorded by the department such as, Aquaba Bay (22nd of Nov.1995) and Kobe (17th of Jan.1995).

COMMENTS

-- Seven ex-participants attended the evaluation workshop. One ex-participant has left the department and the other is on a study leave at the university .

-- Course duration is short.

-- PCs are not being used in interpretation of data.

-- Audio-Visual aids are not being used in the training course, especially video films.

-- Some participants arrive to the course after the orientation program due to late travel arrangements.

-- Competent ex-participants might benefit from group training courses held in Japan for advance seismology applications .

--The issue of increasing the duration of practical excercices was raised .

-- Ex-participants has expressed their full satisfaction of the accmmodation, living conditions and transportation during the course.

MEETING NO.8

DATE: 12/03/96

VENUE: Shai Hills and Akosombo

PURPOSE:

Field Visit To Seismic Out-Stations at Shai Hills and Akosombo

ATTENDEES:

1. Mr. Kimio Abe	JICA Ghana Office
2. Mr. S.A. Anum	Geological Survey Dpt.
3. Mr. S.A. Owusu	Geological Survey Dpt
4. Miss Paulina Essel	Geological Survey Dpt
5. Mr. Victor Abutiate	Geological Survey Dpt
6. Mr. Abraham Wuaku	Geological Survey Dpt
7. Mr. Herbert Sunu	Geological Survey Dpt
8. Mr. Slyuanus Ahulu	Geological Survey Dpt
9. Mr. Ansah Sasraku	Geological Survey Dpt
10. Mr. P.Y. Amoako	Geological Survey Dpt
11. Mr. Thio Hesse	Geological Survey Dpt
12. Mr. Nicolas	Geological Survey Dpt
13. Mr. K. Dake	Post & Telecommunications
14. Study Team	

COMMENTS

-- The location of Shai Hills Out-Station is very good and in a highly secured area (within a game reserve park).

-- Although, the location of Akosombo Out-Station is highly secured - within a Presidential Chalet - the seismometers are located on a high altitude level.

RECORD OF VISITS

Please Refer to Photographs

MEETING NO.9

DATE: 13/03/96

VENUE: Kukurantumi

PURPOSE:

Field Visit To Seismic Out-Station at Kukurantumi

ATTENDEES:

1. Mr. Abraham Wuaku	Geological Survey Dpt.
2. Mr. Abban Bashiru	Geological Survey Dpt.
3. Mr. S.A. Anum	Geological Survey Dpt.
4. Mr. Samuel Owusu	Geological Survey Dpt.
5. Mr. Robert Nartey	Geological Survey Dpt.
6. Mr. Victor Abutiate	Geological Survey Dpt.
7. Study Team	

RECORDS OF VISIT

- Please refer to Photographs

COMMENTS

-- This is a World Wide Seismic Station (WWSS). Seismic records has been sent to the International Seismological Center (ISC) in London and the US Geological Survey Dpt. (USGS).
-- Long Period Seismometers are not in a working order.

MEETING NO.10

DATE: 13/03/96

VENUE: Amanokrom

PURPOSE:
Field Visit to Repeater Station at Amanokrom

ATTENDEES:

1. Mr. Abraham Wuaku	Geological Survey Dpt.
2. Mr. Abban Bashiru	Geological Survey Dpt.
3. Mr. S.A. Anum	Geological Survey Dpt.
4. Mr. Samuel Owusu	Geological Survey Dpt.
5. Mr. Robert Nartey	Geological Survey Dpt.
6. Mr. Victor Abutiate	Geological Survey Dpt.
7. Study Team	

COMMENTS

--This repeater station is located within a water treatment plant.

RECORD OF VISIT

Please Refer to Photographs

MEETING NO.11

DATE: 14/03/96

VENUE: Geological Survey Dpt.

PURPOSE:

Continue Discussions with Ex-participants

ATTENDEES

1. Mr. Abraham Wuaku	Geological Survey Dpt.
2. Mr. Abban Bashiru	Geological Survey Dpt.
3. Mr. S.A. Anum	Geological Survey Dpt.
4. Mr. Samuel Owusu	Geological Survey Dpt.
5. Mr. Robert Nartey	Geological Survey Dpt.
6. Mr. Victor Abutiate	Geological Survey Dpt.
7. Study Team	

RECORD OF DISCUSSIONS

- Briefing by Study Team on the evaluation study results
- Enquiry by the ex-participants on the noise level recorded at Weija Out-Station

COMMENTS

--The ex-participants have expressed their satisfaction of the results of the evaluation study.

MEETING NO.12

DATE: 14/03/96

VENUE: Weija

PURPOSE:

Field Visit to Seismic Out-Station at Weija

ATTENDEES:

1. Mr. Abraham Wuaku	Geological Survey Dpt.
2. Mr. Abban Bashiru	Geological Survey Dpt.
3. Mr. S.A. Anum	Geological Survey Dpt.
4. Mr. Samuel Owusu	Geological Survey Dpt.
5. Mr. Robert Nartey	Geological Survey Dpt.
6. Mr. Victor Abutiate	Geological Survey Dpt.
Study Team	

COMMENTS

– The study team has indicated that the noise levels recorded at this station might be due to the nearby power generator also, the seismometers are located within a Post & Telecommunication Center.

RECORD OF VISIT

Please Refer To Photographs

MEETING NO.13

DATE: 14/03/96

VENUE: Novotel Hotel

PURPOSE:

Lunch Hosted by the Study Team with Ex-participants and their Senior Officials and Ministry of Finance Officials.

ATTENDEES:

1. Mr. M.A. Quist-Therson	Ministry of Finance.
2. Mr. A. Sawyer	Ministry of Finance.
3. Mr. A. Banson	Geological Survey Dpt.
4. Mr. E.K. Brantuoh	Geological Survey Dpt.
5. Miss Paulina Essel	Geological Survey Dpt.
6. Mr. S. A. Anum	Geological Survey Dpt.
7. Mr. S.A. Onusu	Geological Survey Dpt.
8. Mr. Victor Abutiate	Geological Survey Dpt.
9. Mr. Abraham Wuaku	Geological Survey Dpt.
10.Mr. Herbert Sunu	Geological Survey Dpt.
11.Mr. S. Ahulu	Geological Survey Dpt.
12.Mr. A. Sasraku	Geological Survey Dpt.
13.Mr. P.P. Amoako	Geological Survey Dpt.
14.Mr. R. Nartey	Geological Survey Dpt
15.Mr. Kimio Abe	JICA Ghana Office.
16.Ms Rabi Ali	JICA Ghana Office.
17.Study Team	

MEETING NO.14

DATE: 14/03/96

VENUE: Noguchi Memorial Institute for Medical Research

PURPOSE:

Visit Similar Third Country Training Program Funded by JICA in Ghana

ATTENDEES:

1. JICA Coordinator	Noguchi Memorial Institute
2. Administrative Assistant	Noguchi Memorial Institute
3. Ms Rabi Ali	JICA Ghana Office
4. Study Team	

RECORD OF DISCUSSION

- The Ghana/Japan International Cooperation Agency/WHO training course in polio diagnostic procedures and vaccine potency testing was initiated at the Noguchi Memorial Institute for Medical Research in Ghana for 5 consecutive years from 1992. The purpose of the course is to create virologists and technicians competent in the laboratory methods to support the polio eradication initiative in Africa. The participants are invited mainly from anglophone countries in the region.

COMMENTS

-- Original Curriculum and text books were prepared by the WHO according to their Standard Manual.

-- Selection of Participants is carried out through WHO offices in Africa.

-- One of the critical success factors of this training program is the technical assistance and support provided by JICA's project-type technical cooperation which is already being provided to Noguchi Memorial Institute.

-- A resident JICA Coordinator position has been established for the course to ensure effective technical transfer and management strengthening.

-- End-of-Course evaluation is carried out by participants using practical examination tests.

MEETING NO.15

DATE: 14/03/96

VENUE: Geological Survey Dpt.

PURPOSE:
Final Discussions with Director of Geological Survey Dpt.

ATTENDEES:

1.Mr. A. Banson	Director, Geological Survey Dpt.
2.Mr. P.P. Amoaku	Regional Director, Geological Survey Dpt.
3.Miss Paulina Essel	Geological Survey Dpt.
4.Mr. S. A. Anum	Geological Survey Dpt.
5.Mr. S.A. Onusu	Geological Survey Dpt.
6.Mr. Victor Abutiate	Geological Survey Dpt.
7.Mr. Abraham Wuaku	Geological Survey Dpt.
8.Mr. Herbert Sunu	Geological Survey Dpt.
9.Mr. S. Ahulu	Geological Survey Dpt.
10.Mr.A. Sasraku	Geological Survey Dpt.
11.Mr.R. Nartey	Geological Survey Dpt
12.Miss Rabi Ali	JICA Ghana Office
13.Study Team	

RECORD OF DISCUSSIONS

- Presentation by Prof. Dr. Ibrahim and Prof. Dr. Murakami on the management of seismic equipment at Ghana's Geological Survey Dpt.
- Briefing by Prof. Dr. Oteifa on findings of the evaluation study.

COMMENTS

-- A stand-by power supply source should be available at each out-station to ensure the continuous recording of earth movements.

-- The location of Akosombo out-station is not ideal for recording seismic activities (High Altitude). It is advisable to be located at a lower level, whereas the antenna can be kept at the original location (Long cables can be used to link between the seismometers and antenna)

-- Kukrantami out-station is very beneficial to recording the world seismic activities for the West African region. To maintain the links with ISC in London and US Geological Survey Dpt. is very important in exchanging seismic information.

- The Government of Ghana should consider installation of Wide range/Long period seismometers at Kukruntami out-station.

- It is advisable to convert from analogue recordings to digital system. However, the two systems should work in parallel for a period of 1- 3 years to allow for comparison of both earthquake observation results.

- A revised course syllabus shall include learning elements on:

* Digital Seismology
* Seismic Network Management
* Computer Applications in Seismology
* Earthquake Engineering
* Seismic Risk Assessment and Zoning

- More emphasis in the course should be on field work, group research and discussions.

MEETING NO.16

DATE:

15/03/96

VENUE:

Egyptian Embassy

PURPOSE:

Reporting to Egyptian Embassy

ATTENDEES:

1.Mr./Mohamed F.El Zayat	Ambassador of Eygpt
2.Ms./ Rabi Ali	JICA Ghana Office
3.Study Team	

RECORD OF DISCUSSIONS

- Reporting on the study team activities in Ghana.

MEETING NO.17

DATE:	VENUE:
15/03/96	Japanese Embassy

PURPOSE:

Reporting to Japanese Embassy and JICA Ghana Staff.

ATTENDEES:

1.Mr./ Makoto Wakasugi	Minister - Counselor of Embassy of Japan.
2.Mr. A. Yatsubayashi	JICA Ghana Resident Representative.
3.Mr./ Kimio Abe	Ast. Resident Representative.
4.Ms./ Rabi Ali	Asst. Administrative Officer.
5.Study Team	

OUTPUT

- Reporting on the evaluation study results.
- Requests by the Geological Survey Dpt. for technical assistance from Japan in the field of seismology.

MEETING NO.18

DATE:

15/03/96

VENUE:

Ministry of Energy & Mines

PURPOSE:

Reporting on evaluation study results.

ATTENDEES:

1. Ms. Owiredu — Acting Chief Director.
2. Miss Rabi Ali — JICA Ghana Office.
3. Study Team

RECORD OF DISCUSSIONS

- Reporting on the evaluation study results.
- Information of Procedure for Requesting Technical Assistance from Japan .

MEETING NO.19

DATE:
15/03/96

VENUE:
Ministry of Finance

PURPOSE:

Reporting on evaluation study results

ATTENDEES:

1. Mr. A. Sawyer	Planning Officer, Ministry of Finance
2. Miss Rabi Ali	JICA Ghana Office
3. Study Team	

RECORD OF DISCUSSIONS

- Reporting on the evaluation study results.
  Presentation on other donor agencies evaluation procedure for training courses participants. Please refer to Appendix B.

MEETING NO.20

DATE: /03/96

VENUE: Lunch with JICA Alumni Association in Ghana

PURPOSE:

Awareness on JICA Egypt Activities and the purpose of the team mission

ATTENDEES:

1. Mr. Nyarko-Mensah	President , JICA Alumni Association in Ghana
2. Mr. Andrews Williams	Vice President, JICA Alumni Association in Ghana
3. Mr. Divine Dugbartey	The General Secretary, JICA Alumni Association in Ghana
4. Mr. Emmanuel Quansah	The Treasurer, JICA Alumni Association in Ghana
5. Miss Rabi Ali	JICA Ghana Office
6. Study Team	

RECORD OF DISCUSSIONS

- Briefing on JICA Egypt Activities, particularly on JICA Alumni Association in Egypt.

- Third Country Training programs conducted in Egypt by JICA

COMMENTS

-- Ex-Participants of third country training courses should be members of Alumni associations

-- The exchange of information and visits between different JICA Alumni Associations in Africa is highly recommended.

MEETING NO.21

DATE:	VENUE:
15/03/96	Geology Dpt. - University of Ghana

PURPOSE:

Understand the activities of the Geology Dpt. in the field of seismology.

ATTENDEES:

1. Mr. Mawuli Akoto	Professor of Seismology
2. Mr. David Atta Peters	Lecturer - Geology Dpt.
3. Miss Rabi Ali	JICA Ghana Office
4. Study Team	

RECORD OF DISCUSSIONS

- Role of the Geology Dpt. in the field of seismology.
- Briefing on the results of the evaluation study.

COMMENTS

-- The main earthquake observation station currently located at the Headquarters of the Geological Survey Dpt. was previously located (till 1995) at the Geology Dpt where it has offered technical assistance in the operation of equipment and interpretation of data. Due to the increasing level of competency of the seismologists and technicians trained in Egypt, the decision was made to reinstall the equipment at the Geological Survey Dpt.

-- A new research project is being proposed in the area of digital seismology. NRIAG can assist them in carrying out research activities.

HIGHLIGHTS ON:

1. The Training Course:

.. The training program is excellent . It has actually enhanced the knowledge of the participants in the field of seismology . Most problems faced before concerning telemetric networks were solved due to the training acquired . More of such training courses should be encouraged for upgrading the skills of the ex-participants.

..The course duration is short to cover all subjects in the field of seismology . A six weeks period would be more appropriate.

.. The call for nominees for the course should be at least four months in advance of schedule start date .

.. The course has to be revised to include more advanced level in addition to the already existing basic course. As a result , a training needs analysis is required to design an updated syllabus .

.. A revised course syllabus would include learning elements on:

* Digital Seismology
* Seismic Network Management
* Computer Applications in Seismology
* Earthquake Engineering
* Seismic Risk Assessment and Zoning
* Mitigation of earthquake hazards
* Trouble shooting and maintenance management

..More emphasis in the course should be on field work, group research and discussions.

..More practical exercises in earthquake observatory is required , particularly on fault plane solutions .

.. Training on PC computers should allow more practical sessions.

.. The participants should submit an end of course report to the following organizations : NRIAG - JICA Office and Egyptian Embassies , in their countries. This obligation should be stated in the GI document issued by NRIAG .

.. The participants' countries could have the privilege of receiving technical equipment from JICA , particularly personal computers.

2. NRIAG

.. Strengthening NRIAG is of vital importance insure the successful implementation of this training course .This can be achieved through : staff development and creation of international linkages.

.. NRIAG should prepare an assessment for each participant to be forwarded to his employer after the end of the course.

.. A newsletter ought to be established by NRIAG to keep ex-participants updated with the latest seismology research. This would provide a good opportunity for exchanging information between participants of different countries.

3.Geological survey Dpt.- Ghana

.. A stand-by power supply source should be available at each out-station to ensure the continuous recording of earth movements.

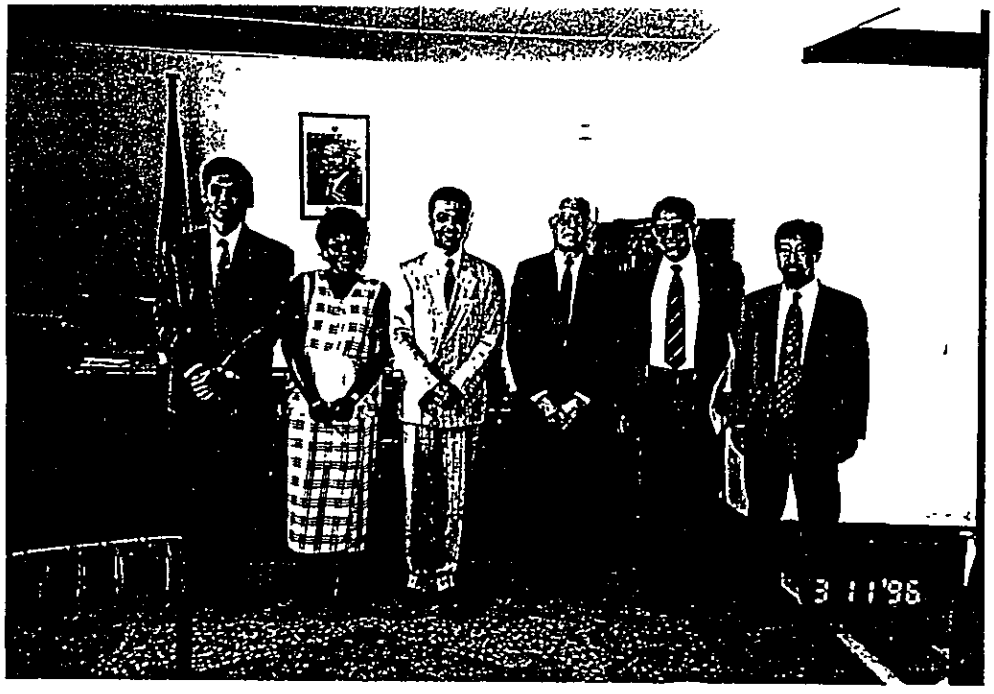
.. The location of Akosombo out-station is not ideal for recording seismic activities (High Altitude). It is advisable to be located at a lower level, whereas the antenna can be kept at the original location (Long cables can be used to link between the seismometers and antenna).

..Kukrantami out-station is very beneficial to recording the world seismic activities for the West African region. To maintain the links with ISC in London and US Geological Survey Dpt. is very important in exchanging seismic information. The Government of Ghana should consider installation of Wide range / Long period seismometers at Kukruntami out-station.

.. It is advisable to convert from analogue recordings to digital system. However, the two systems should work in parallel for a period of 1- 3 years to allow for comparison of both earthquake observation results.

PHOTOGRAPHS

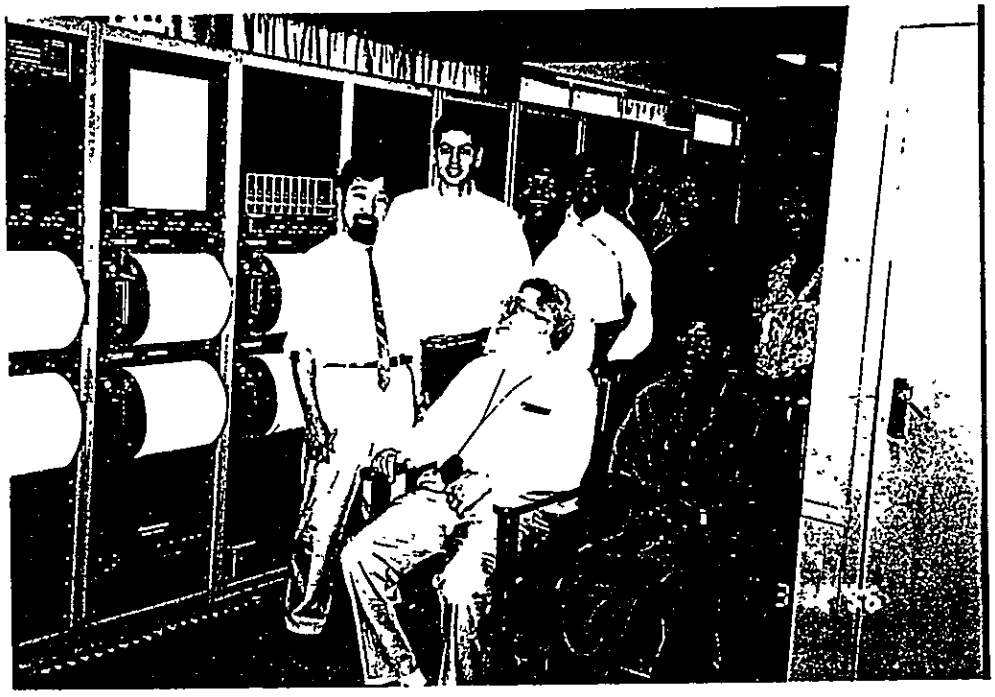
THE EGYPTIAN EMBASSY



JICA GHANA OFFICE

GEOLOGICAL SURVEY DPT. OF GHANA

MINISTRY OF ENERGY AND MINES



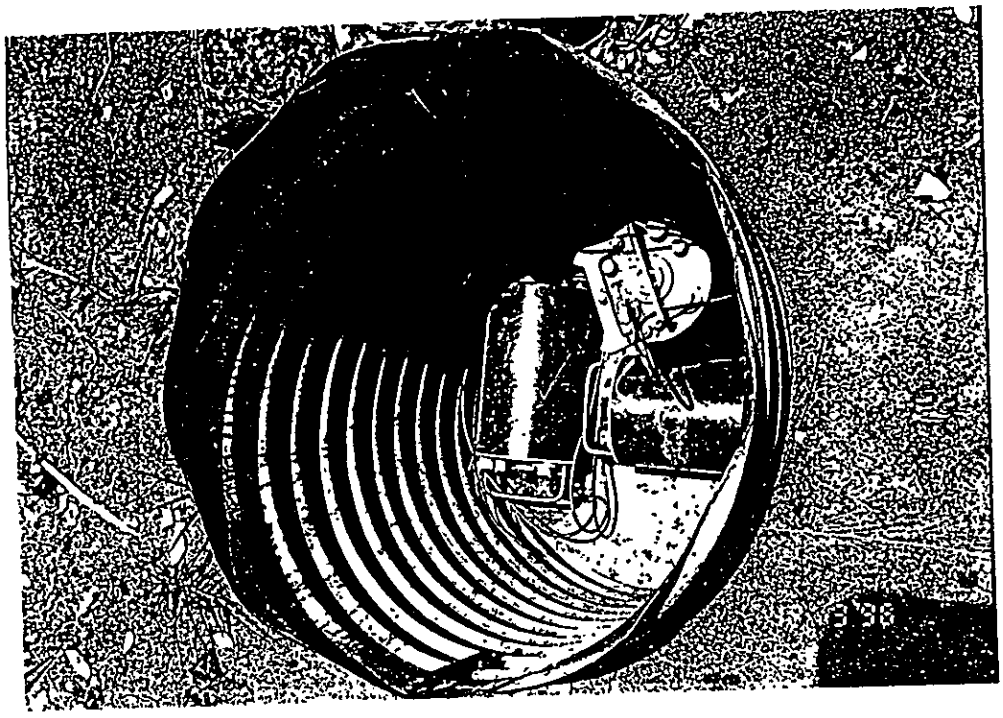
DISCUSSIONS WITH GEOLOGICAL SURVEY DPT.

EARTHQUAKE RECORD - ACCRA MAIN STATION

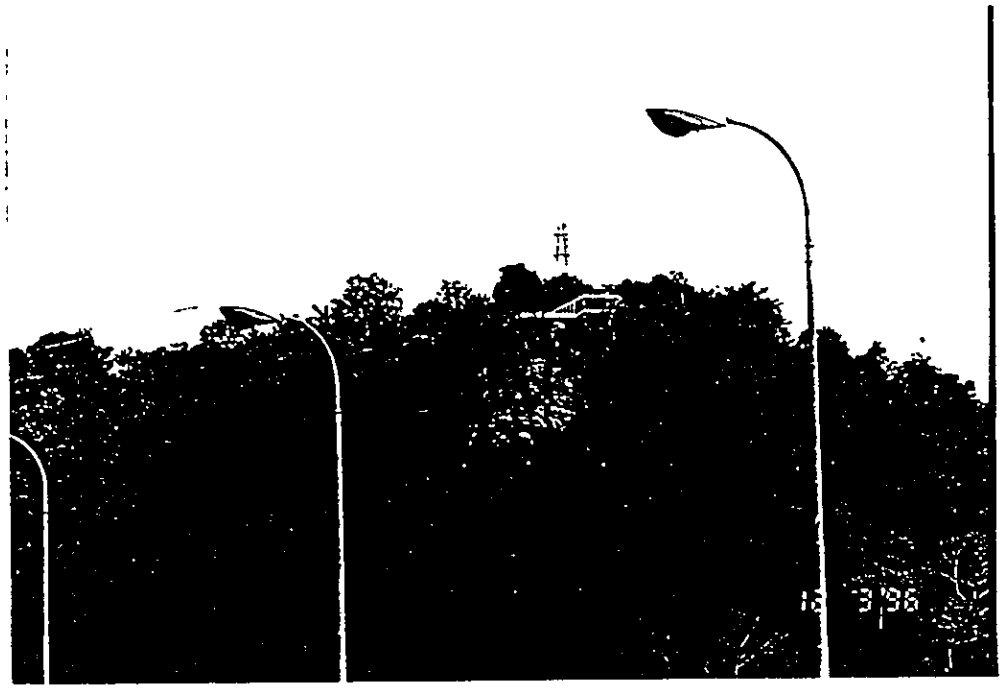
DISCUSSIONS WITH EX-PARTICIPANTS
ACCRA MAIN STATION

FIELD VISIT - SHAI HILLS OUT-STATION

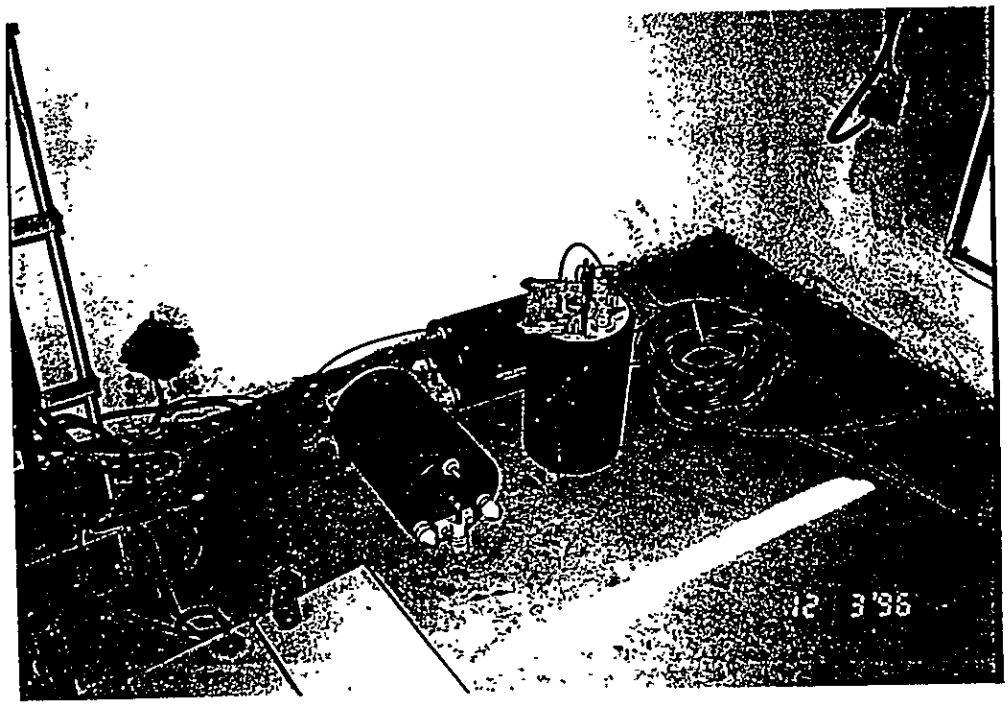
SEISMOMETERS - SHAII HILLS OUT-STATION



SEISMOMETERS - AKOSOMBO OUT-STATION

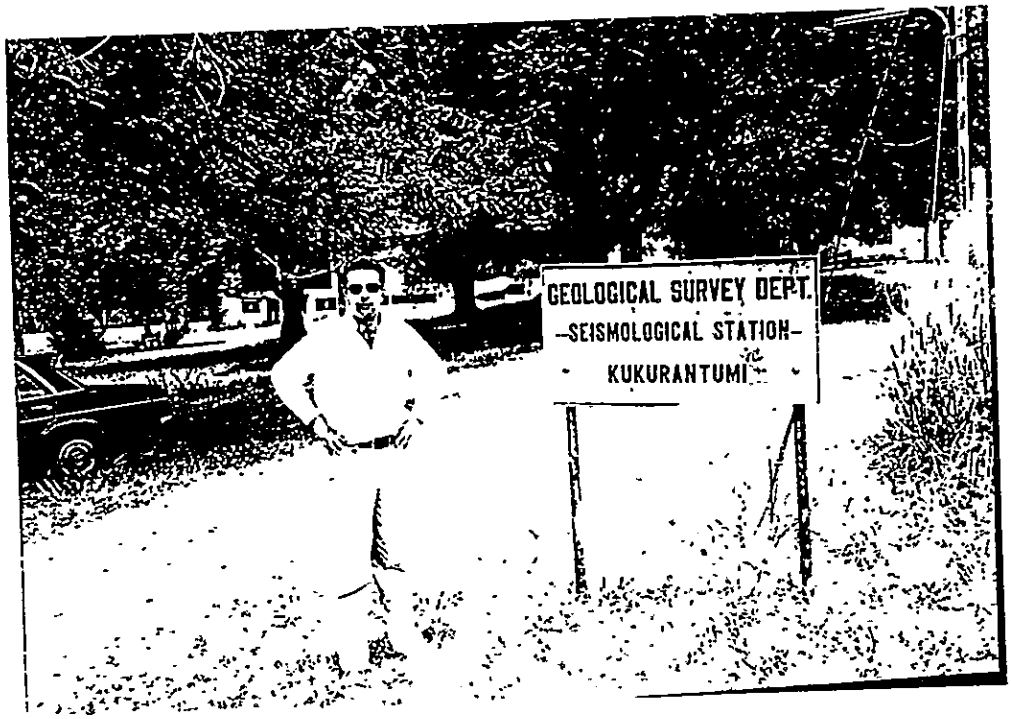


SEISMOMETERS-AKOSOMBO OUT-STATION

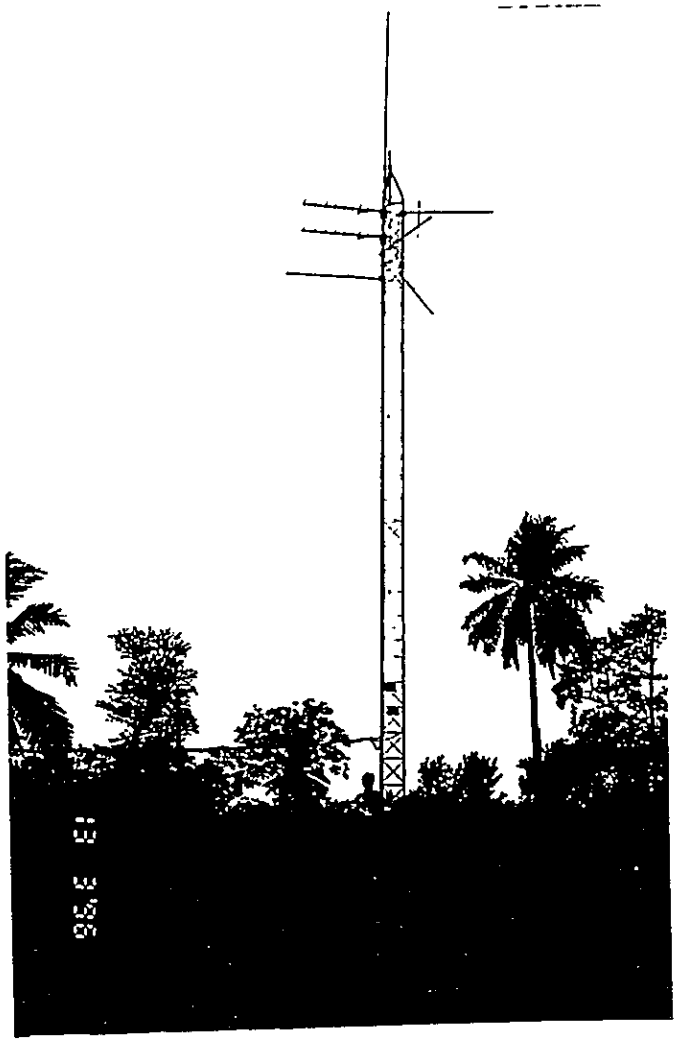


SEISMOMETERS - KUKURANTUMI OUT-STATION

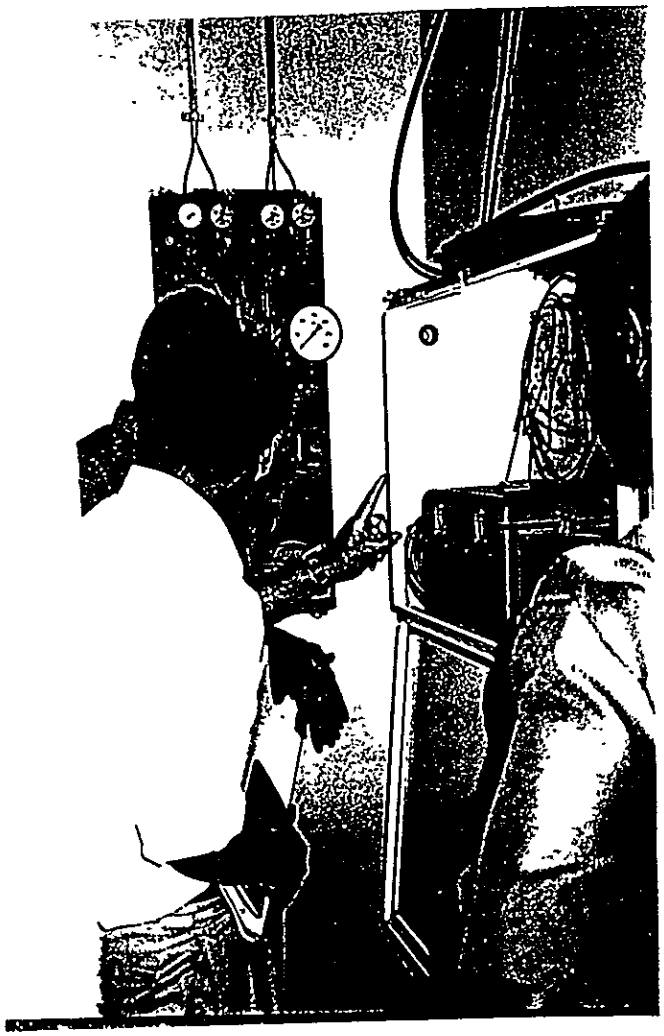
SEISMOLOGICAL STATION - KUKURANTUMI



REPEATER ANTENNA - AMANOKROM



WEIJA OUT-STATION



LUNCH HOSTED BY STUDY TEAM

JICA ALUMNI ASSOCIATION OF GHANA

UNIVERSITY OF GHANA
DPT. OF GEOLOGY

REPORTING TO JICA-GHANA OFFICE AND JAPANESE EMBASSY

APPENDIX A

SEISMIC ACTIVITIES IN GHANA

REPORT ON

SEISMIC ACTIVITIES

IN GHANA

****

SEISMOLOGICAL UNIT

GEOLOGICAL SURVEY
DEPARTMENT

ACCRA, GHANA

MARCH, 1996

TABLE OF CONTENTS

LIST OF FIGURES

HISTORICAL REVIEW

Earthquakes have occurred in Ghana as far back as 1636.In 1862 there was an earthquake which shocked the Christianborg Castle in the gold coast (The present Ghana) and rendered it uninhabitable.

The first attempt to record earthquakes in Ghana,then known as the Gold Coast was in 1914, when the colonial Government installed a Milne - shaw seismograph in Ghana.It operated for 16 years until 1933 when recording was stopped due to lack of funds.

In 1964, a magnitude of 4.5 earthquake on the Ritcher scale occurred not far from the multi - million dollar hydroelectric dam in Akosombo, and in 1969, a 4.7 magnitude event was felt in the capital, Accra.

Following these events, the necessity of monitoring earthquakes in the country was realised and a programme was initiated which resulted in the commissioning of a 6 - Component World Wide Standard Seismic Network (W W S S N) at Kukurantumi in the Eastern Region in March 1973.

In February 1977 the Geological Survey installed a single vertical component strengnether MEQ - 800 seismograph in the university of Ghana. Similar instruments, with ink recorders were installed at Ho in September 1979 and Saltpond in February 1980. All these stations operated for sometime, but stopped due to lack of funds.

The network of seismograph stations presently in Ghana was installed in July 1987. It is a (9)nine stations radio telemetry network with the central recording station at the Geological Survey Department Head Office in Accra.

SEISMOLOGICAL STATIONS IN GHANA

(1) KUKURANTUMI STATIONS

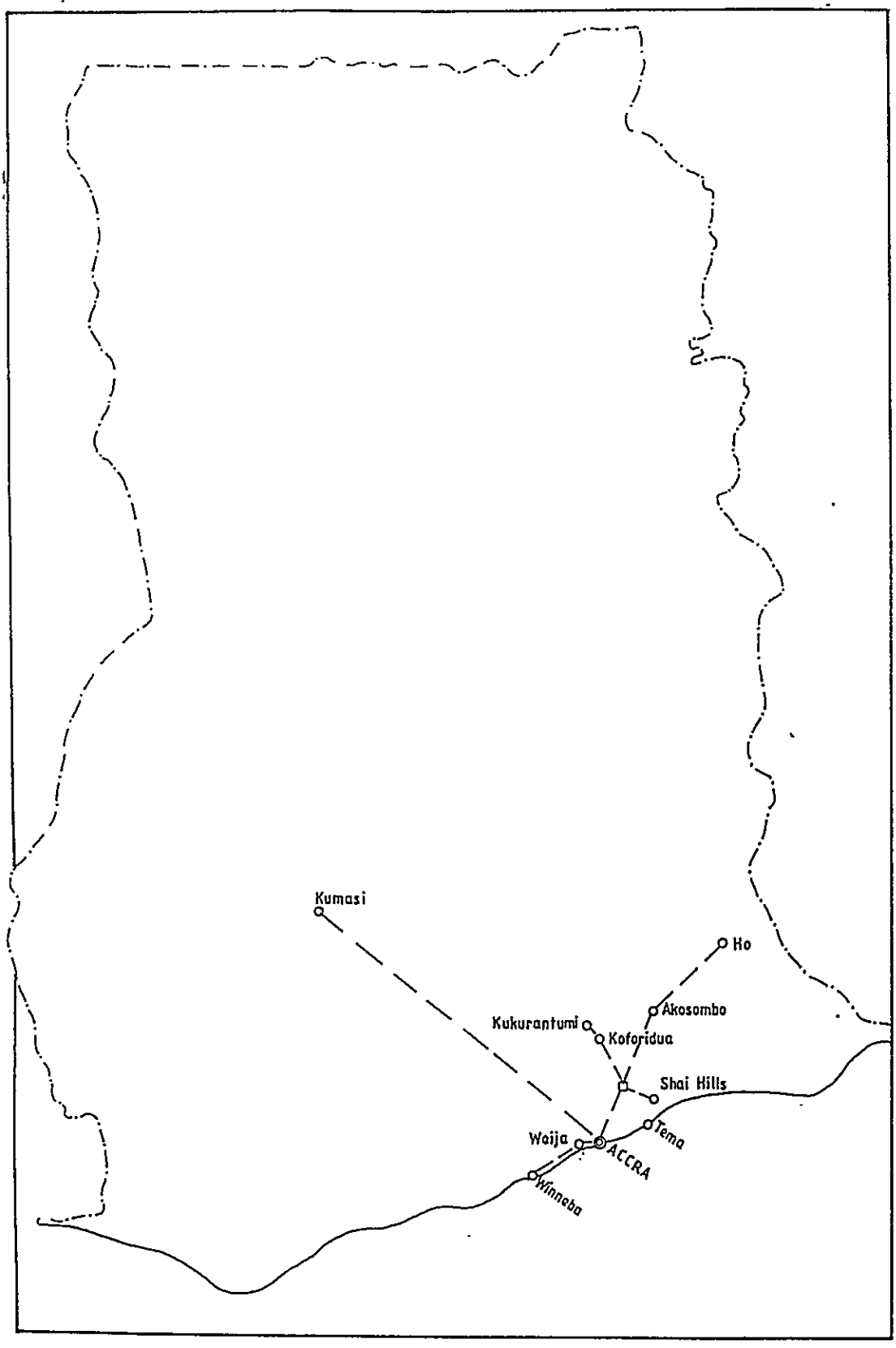
Modern earthquake recording began in Ghana in 1973 with the establishment by the Geological Survey Department of an observatory in Kukurantumi, Eastern Region, a town about 110 kilometres north of Accra with 3 - Component short and long period seismometers. Initially the recordings were done on photographic paper. This was later changed to ink recording. Presently, modern heat pens (Hot - Stylus) are being used. The initial idea of establishing, this station was to include magnetic broad band and digital recording,but lack of funds has delayed this project up to this day.

(2) SOUTHERN GHANA TELEMETRY NETWORK

To intensify the earthquake research and hazard assessment, the Geological Survey installed a modern telemetry system with Teledyne Geotech instruments (U.S.A.) in June 1987. This net work consists of (9)nine 3 - Component short period remote sites telemetering data via radio to a central recording observatory located at the head Office of the Geological Survey Department in Accra. The net work has operated successfully for the past eight (8) years with relatively high professional standards. The sensitivity is very good, such that it detected the Armenian Earthquake. The Egyptian Earthquake in 1993. The Kobe (Japan) Earthquake in 1995, etc.

Outstations were installed at Winneba, Weija, Tema, Shai Hills, Kukurantumi, Koforidua, Akosombo, and Ho. All seismic signals are relayed back to the main observatory in Accra, and frequencies have been carefully chosen to avoid any interference with each other. All the outstations use high gain directional antennas and low power transmitters. The use of such low power allows for highly reliable operation as well as allowing those stations where electricity is not available to operate on solar panels. To allow easy transmission of seismic signals from the outstations to the main observatory, a repeater station was established at Amonokrom in the Eastern Region. This place was chosen, because of it's elevation,and it's central location.

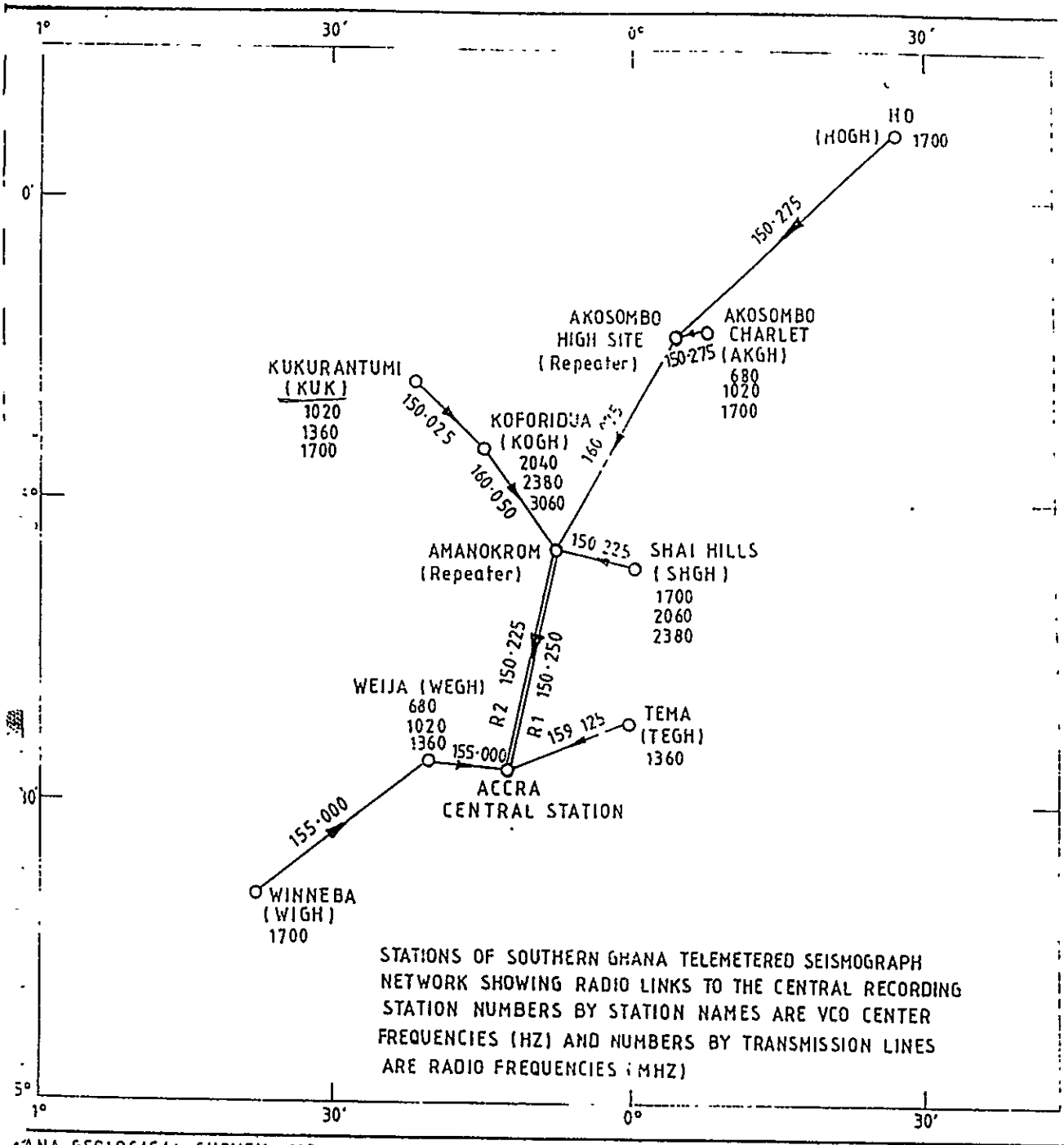
SEISMOGRAPH STATIONS IN GHANA



LEGEND

FIG. 1

- Seismograph station
- Central station



GHANA GEOLOGICAL SURVEY, 1993
A Owusu (S. T. O)

SCALE 1 :400000

FIG: 2

LAKE BOSUMTWI TELEMETRY NETWORK

The Geological Survey Department has initiated Seismic hazard studies at Lake Bosumtwi and Kumasi in the Ashanti Region. The necessity of the Lake Bosumtwi project can be judged from the calamity which befell the Cameroons in Lake Nios, a few years ago. Lake Bosumtwi has been classified in the category as Lake Lios by earth scientists and it has never been monitored. The Geological Survey has set up three seismic stations at Apewu, Duase and Abono around the Lake. (See Fig 3). It was initially planned that the signals from the Lake would be transmitted to Kumasi P & T for onward transmission to Accra P & T through microwave link. Due to technical and financial problems this plan could not materialise. Plans are fast advance for the signals to be recorded at Kumasi the Geological Survey Office.

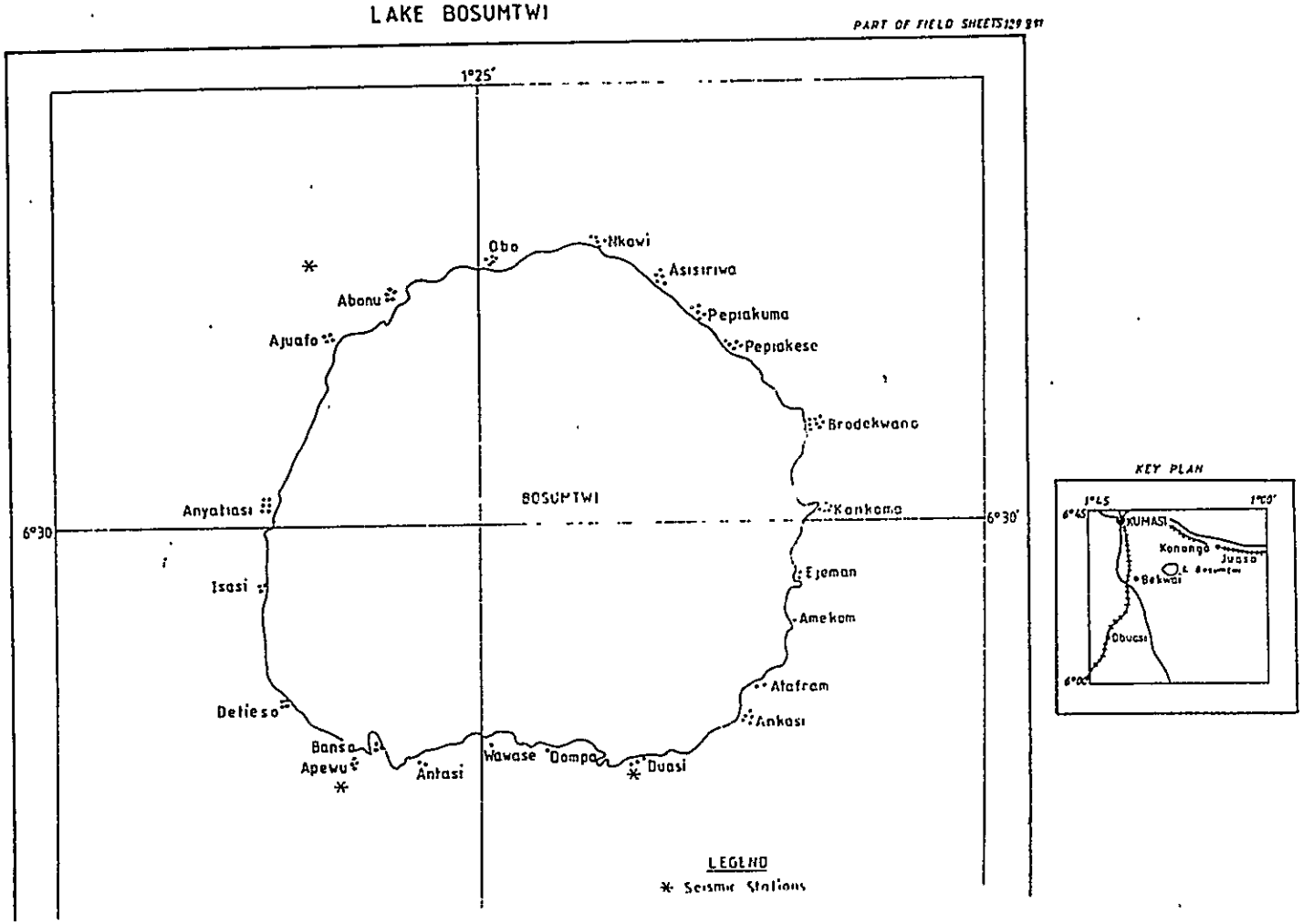

LAKE BOSUMTWI
PART OF FIELD SHEETS 129 B II
1°25'
6°30
6°30'
BOSUMTWI
Obo
Nkawi
Asisiriwa
Abonu
Pepiakuma
Ajuafo
Pepiakese
Brodekwano
Anyatiasi
Konkoma
Isasi
Ejeman
Amekom
Atafram
Detieso
Ankasi
Bansa
Apewu
Antasi
Wawase
Dompoa
Duasi
LEGEND
* Seismic Stations
KEY PLAN
1°45
1°30'
6°45
6°00
KUMASI
Konongo
Juaso
Bekwai
Obuasi

FIG 3

SITE INFORMATION

STATION NAME	CODE	LATITUDE	LONGITUDE	ELEVATION M	GEOLOGIC FOUNDATION
Kukurantumi	KUK	06°11' 20"N	00 22' 08"W	198	Granite
Wenja	WEGH	05 21' 49"N	00 19' 37"W	680	Quartzite
Winneba	WIGH	05 21' 49"N	00 37' 08"W	64	Granite
Shai Hills	SHGH	05 55' 42"N	00 02' 31"W	84	Gneiss
Akosombo	AKGH	06°14' 36"N	00 02' 25"E	377	Quartzite
Ho	HOGH	06 36' 33"N	00 26' 42"E	372	Quartzite
Koforidua	KOGH	06 05' 10"N	00 14' 35"W	483	Granite
Tema	TEGH	05 38' 12"N	00 05"W	141	Gneiss
Apewu	APGH	6 28' 13 N	1° 26' 15"W	450	Granite
Abono	ABGH	6 32' 10'	1° 27' 05W	400	Phyllites
Duase	DUGH	6 28 02'	1° 24' 15"W	610	Phyllites

INSTRUMENTATION OF GHANA SEISMOGRAPH

STATION NETWORK IN GHANA

Station	Seismometers	Component	Recording Type
Kukurantumi	S-13	Z,NS,EW	Hot-Stylus
Koforidua	S-13	Z	Hot-Stylus
Shai Hills	S-13	Z,NS, EW	Hot-Stylus
Weija	S-13	Z,NS, EW	Hot Stylus
Tema	S-13	Z	"
Akosombo	S-13	Z,NS, EW	"
Ho	S-13	Z	"
Winneba	S-13	Z	"

AN EARTHQUAKE CATALOGUE FOR GHANA. 1636 - 1995.

The catalogue can be divided into two.

(i) The Historic period from

1636-1972 when there was no instrumental recording.

(ii) Period of Instrumental recording 1973 - 1995.

HISTORIC EARTHQUAKES

DATE/TIME	MAGNITUDE	LOCATION	REMARKS
18th Dec 1636	-	Axim in the Western Region	Workers buried in a Gold Mine and several building collapse
10 July 1862	-	Accra	Some Buildings in Accra were affected
1863	-	Accra	After shock of 1862 Earthquake
20th Nov 1906	-	Ho	Felt in Accra, Aburi,Akuse,kpon -g.etc
1907 - 1930	-	Southern Ghana	Several Minor Shock in Southern Ghana.
22nd June 1939	6.5	Offshore Accra	(17) people were killed,(135)inju red and over one million pounds sterling worth of property was damaged.
1964	4.5	New Akosombo	Felt
1969	4.7	New Tema	Felt

LOCAL EARTHQUAKES RECORDED FROM 1973/74/77.

DATE	TIME			LOCATION		MAGNITUDE	REMARKS
	Hrs	Mins	Secs	Lat(°N)	Long(°W)	RICHTER SCALE	
23Aug"73	17	14	59.6	5.7	0.3°E	2.5	
28Nov"73	11	33	21.3	7.0	0.8°E	2.0	
11Jan"74	05	29	51.5	5.0	2.6	3.8	Felt
16Jan"74	17	08	50.3	6.5	0.5°E	2.0	
20Feb"74	03	13	42.5	5.0	2.6	3.3	
02Jun"74	23	15	08.9	5.8	0.8°E	2.7	
08Jun"74	15	03	04.8	5.1	2.5	3.6	
02Feb"77	02	56		5.7	0.2	2.1	
25Feb"77	01	19		6.02	0.2	2.6	
01Mar"77	20	50		5.72	0.2	2.8	
01Mar"77	20	58		5.58	0.28	2.0	
02Apr"77	16	11		6.23	0.13°E	2.2	
15Apr"77	23	46		5.95	0.07	2.5	
29Apr"77	18	23		5.67	0.2	2.6	
18Jun"77	04	17		5.63	0.02	2.2	
20Jul"77	19	34		5.65	0.28	2.1	
26Jul"77	09	15		5.57	0.38	2.5	
08Oct"77	03	15		5.97	0.03	2.9	
18Nov"77	23	11		5.58	0.38	2.3	
23Nov"77	22	09		6.00	0.12°E	2.1	

LOCAL EARTHQUAKES RECORDED FROM 1978/79

DATE	TIME			LOCATION		MAGNITUDE	REMARKS
	Hrs	Mins	Secs	Lat(°N)	Long(°W)	RICHTER SCALE	
01Feb"78	01	44		6.58	0.13°E	2.9	
03Mar"78	05	35		5.53	0.50	3.1	
06Jul"78	18	10		6.60	0.27°E	2.1	
05Sep"78	22	59	30.4	5.63	0.35	3.9	Felt
06SEP"78	12	39		5.63	0.35	2.2	
21Sep"78	01	22		5.53	0.40	2.0	
02Dec"78	11	10		5.53	0.37	2.0	
09Jan"79	13	58	53.0	5.58	0.32	3.6	Felt
25Jan"79	09	00		5.50	0.33	2.3	
09Mar"79	20	16		5.57	0.38	2.3	
15Mar"79	17	37		5.52	0.35	2.4	
18Jun"79	18	51		5.50	0.42	2.0	
27Jun"79	20	26		5.53	0.43	2.0	
28Jun"79	21	54		5.77	0.28	2.0	

LOCAL EARTHQUAKES RECORDED FROM 1987/88/89

DATE	TIME			LOCATION		MAGNITUDE	REGION
	Hrs	Mins	Secs	Lat(°N)	Long(°W)	RICHTER SCALE	
05Nov"87	00		18.0	5.59	0.35	2.6	North West of Weija,Accra
03Dec"87	10	37	37.7	5.53	0.42	3.1	West of Weija Accra.
27Feb"88	00	51	03.4	5.50	0.44	3.4	South West of Weija,Accra
06Mar"88	12	15	07.5	5.65	0.30	2.0	North East of Weija,Accra
24 " "	01	00	33.6	5.55	0.35	2.1	North West of Weija,Accra
29 " "	16	54	04.6	5.61	0.11	3.0	Offshore Teshie Nungua. (Tema)
06May"88	01	48	42.1	5.54	0.39	2.2	North West of Weija,Accra.
05Dec"88	07	35	08.0	5.45	0.37	2.4	
23Mar"89	13	32	47.3	5.59	0.33	1.9	North West of Weija,Accra
27Jun"89	18	28	13.6	5.54	0.47	2.5	East of Weija

LOCAL EARTHQUAKES RECORDED FROM 1990/91/92

DATE	TIME			LOCATION		MAGNITUDE	REGION
	Hrs	Mins	Secs	Lat(°N)	Long(°W)	RICHTER SCALE	
12Feb"90	01	34	41.0	5.59	0.34	2.6	North West of Weija,Accra.
14Apr"90	11	43	26.4	5.59	0.34	3.0	North West of Weija,Accra.
14Dec"90	00	23	20.7	5.44	0.41	2.7	East of Weija
01Jan"91	07	58	08.0	5.93	0.12	2.4	Around Akro-pong.
30Jan"91	20	44	17.7	5.64	0.35	2.4	North West of Weija,Accra.
06Mar"91	14	54	33.2	5.61	0.30	2.2	North of Wei-ja,Accra.
06Mar"91	16	50	33.1	5.62	0.31	2.4	North of Wei-ja,Accra.
27Jun"91	22	18	21.9	5.64	0.29	3.0	North of Wei-ja,Accra.
23Aug"91	09	51	06.3	5.62	0.33	3.9(Felt)	North of Wei-ja,Accra.
23Oct"91	00	15	12.0	5.33	0.35	2.4	South of Wei-ja,Accra.
29Mar"92	20	02	22.6	5.62	0.33	2.1	North of Wei-ja,Accra.

LOCAL EARTHQUAKES RECORDED IN 1993

DATE	TIME			LOCATION		MAGNITUDE	REGION
	Hrs	Mins	Secs	Lat(°N)	Long(°W)	RICHTER SCALE	
03Apr"93	22	33	10.0	5.50	0.26	2.2	North East of Weija,Accra.
22Jun"93	14	55	51.0	5.63	0.57	2.4	North West of Weija,Accra.
27Jun"93	03	38	23.0	5.33	0.27	2.8	North East of Weija,Accra.
28Jun"93	05	49	07.0	5.59	0.32	2.5	North East of Weija,Accra.
08Sep"93	03	52	39.4	5.52	0.34	2.2	North East of Weija,Accra.
07Oct"93	18	17	10.0	5.55	0.36	2.4	North of Weija,Accra.
28Oct"93	10	08	02.0	5.50	0.34	2.2	North of Weija,Accra.

LOCAL EARTHQUAKES RECORDED IN 1994

DATE	TIME			Lat(°N)	Long(°W)	MAGNITUDE RICHTER SCALE	REGION
	Hrs	Mins	Secs				
15Jan"94	19	15	40.5	5.35	0.33	2.6	North of Weija,Accra.
17Jan"94	05	49	27.0	5.47	0.56	2.4	West of Weija,Accra.
27Jan"94	18	28	01.0	0.27	0.27	2.5	North of Weija,Accra.
26Aug"94	12	48	20.0	0.27	0.27	2.1	North of Weija,Accra.
28Aug"94	09	44	25.0	5.18	0.31	2.0	East of Weija
06Sep"94	01	03.5		5.31	0.42	2.4	South of Weija,Accra.
06Sep"94	17	32	08.0	5.52	0.42	2.1	West of Weija,Accra.
22Sep"94	12	04	02.0	5.60	0.40	2.0	West of Weija,Accra.
10Nov"94	09	38	02.6	5.52	0.35	2.4	South of Weija,Accra.
15Nov"94	10	16	45.5	5.50	0.40	1.6	West of Weija,Accra.
02Dec"94	21	32	48.0	5.58	0.21	1.8	South of Weija,Accra.
07Dec"94	01	21	07.0	5.52	0.26	2.1	South of Weija,Accra.
16Dec"94	01	04	27.0	5.43	0.50	1.7	Offshore Coast of Bortianor

LOCAL EARTHQUAKES RECORDED IN 1995

DATE	TIME			LOCATION		MAGNITUDE	REGION
	Hrs	Mins	Secs	Lat(°N)	Long(°W)	RICHTER SCALE	
27Jan"95	19	16	16.0	5.45	0.		Offshore the Coast of Bortianor.
28Jan"95	20	22	00.0	5.50	0.30	2.4	South of Weija.
28Jan"95	20	33	14.0	5.50	0.35	2.4	South of Weija.
28Jan"95	20	37	10.0	5.34	0.33	3.3(Felt)	South of Weija.
28Jan"95	20	39	14.0	5.55	0.40	3.4(Felt)	North West of Weija.
1Feb"95	03	43	53.0	5.53	0.40	1.5	North West of Weija.
01Feb"95	03	44	17.0	5.63	0.56	2.6	North West of Weija.
01Feb"95	03	45	20.0	5.63	0.45	4.0(Felt)	North West of Weija.
01Feb"95	03	58	39.0	5.50	0.30	2.7	North East of Weija.
09Feb"95	19	55	18.0	5.60	0.33	3.4(Felt)	North Of Weija.
03May"95	20	42	20.0	5.43	0.50	2.3	
03May"95	19	34	01.0	5.55	0.30	2.6	
27Jun"95	23	43	00.0	5.52	0.26	2.5	
12Oct"95	01	08	35	5.50	0.24	2.6	South West of Weija.
27Oct"95	20	01	33.0	5.50	0.35	4.0(Felt)	South of Weija.

DISTRIBUTION OF EARTHQUAKES IN GHANA.

From the historical information obtained from Isoseis maps for 1939 Earthquake (fig.4), and epicentral location from instrumental data ((fig.5).

The most seismically active areas in Ghana can be classified as follows.

1. West of Accra where the Akwapim Fault Zone approaches the coastal boundary fault, especially at Weija and the surrounding villages.

2. Coastal towns in Accra, especially Tema, Teshie, Nungua and La which are all near the coastal boundary fault.

3. Areas around the Akwapim Fault including HO, Aburi, Akosombo and Koforidua.

4. The coastal areas between Axim and Tema.

MAP I

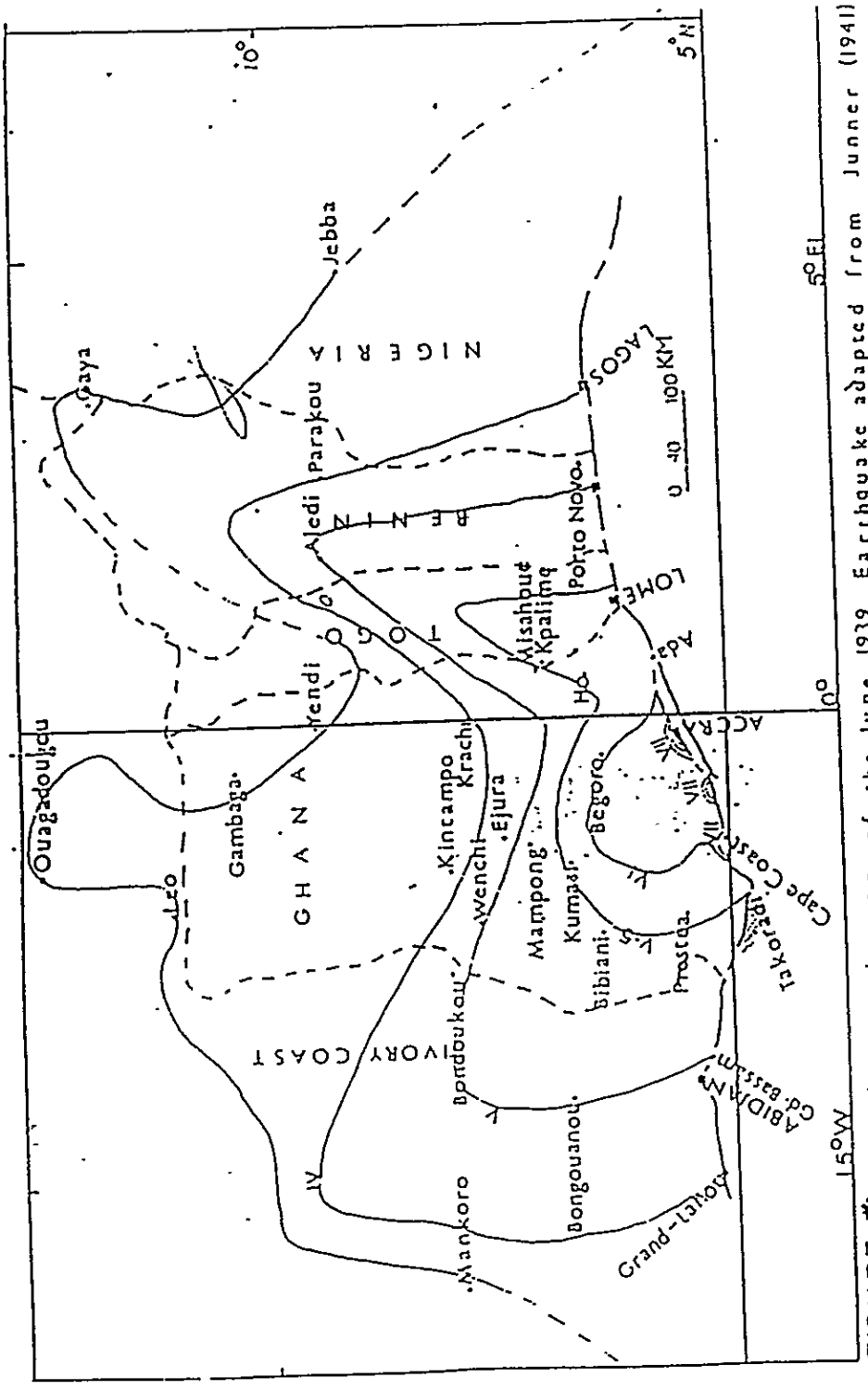
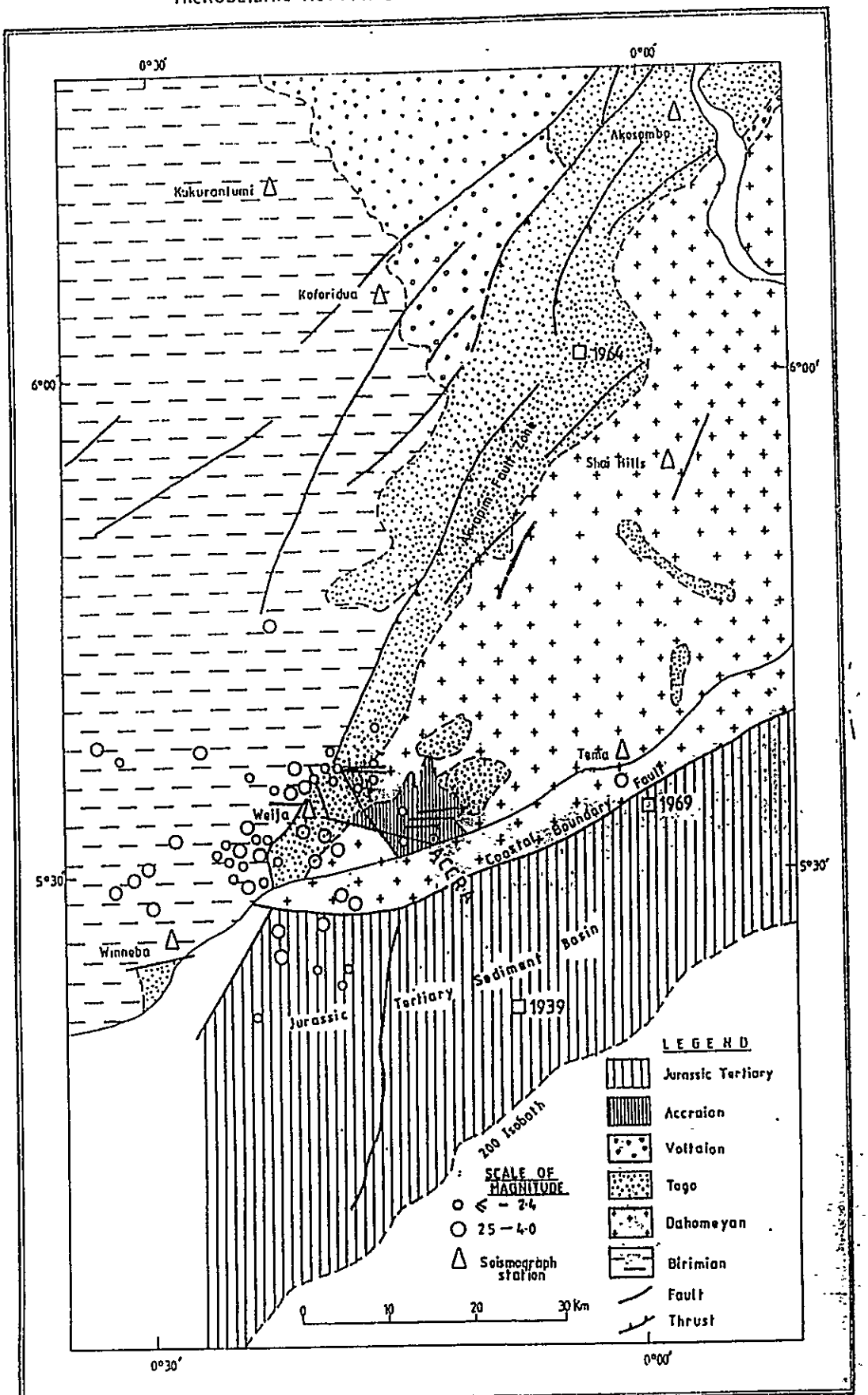


FIGURE 4 : Isoseismal map of the June 1939 Earthquake adapted from Junner (1941)

MICROSEISMIC ACTIVITIES IN SOUTH-EASTERN GHANA



GEOLOGICAL SURVEY DEPARTMENT, 1995

S. A. Anum, Geologist

SRG/987

D. A. O.

SCIENTIFIC ACTIVITIES AND ACHIEVEMENTS

The Seismological unit of the Geological Survey conducts research programmes and provides information in the field of earthquake activities.

These activities of the Seismology unit can be spelt out as follows

(a) PROVIDING SEISMIC DATA TO OTHER ESTABLISHMENTS

The Seismology unit records earthquakes and determines their parameters like Epicentres Location, Magnitudes etc. Upon request from some organizations like the Insurance Companies, Private and Governmental Agencies, we provide relevant informations on the seismicity, and seismic hazard for the various part of the country.

In 1995, the seismology unit provided seismic data on the effect of micro-seismic activities of the Akosombo Dam to the Volta River Authority (V.R.A.).We also have a permanent seismic station at Akosombo which records any seismic activity around the Dam.

We have likewise been supplying seismic data in areas of public constructions such as Dams,High Buildings, Gas and Turbine Electric Power Stations.

(b) CONTRIBUTION TO GLOBAL SEISMIC STUDIES.

Geological survey seismic network records long distance earthquakes from other countries. The information on these long distance teleseismic are sent to the International Seismological Centre (I.S.C.) in the UK, and the National Earthquake Information Service (N.E.I.S.) in USA.

During large earthquakes catastrophes, especially within Europe, Asia, the Mediterranean area, and Africa, the department replies to request from the government involved about the parameters of the event from our W.W.S.S.N. station at Kukurantumi.

(c) MONITORING QUARRY BLAST.

The unit of the department conducts seismic investigation into the effect of quarry blasting in the communities, where these quarries operate.Such services are rendered to Water and Sewage Cooperation, and some District Assemblies where quarry blasting cause damage to Dams and Buildings.

(d) SERVICES TO OTHER COMMITTEES

Geological survey department seismology unit provides information to the Building Code Committee,and the National Disaster Relief Committee. The director of the department Mr J.K.A.Banson who is a seismologist by profession and a member of these committees.

(e) SEISMICITY AROUND LAKE BOSUMTWI AND THE SURROUNDING AREAS.

The seismology unit instituted, seismic monitoring activities within this area for some time now. Three stations were installed,and transmission of signals were by radio waves through the telecom organization to our seismograph at the Kumasi office. We hope operations will get to it's peak very soon.

FUTURE PLANS

(a) To convert most of our analog recordings to digitals on magnetic tapes

(b) To set up strong motion equipment at the Akosombo Dam

(c) Train more Seismologists and Technicians.

(d) Liaise with the Environmental Protection Agency for effective monitoring of blast in the mines and quarries.

(e) Extend our network to western region where there were reports of historic earthquakes in the beginning of the twentieth century.

(f) Create public awareness, on earthquake activities.

TRAINING

Nine of the staff members from the seismology unit of the department had under gone some training in basic observatory practice and introduction to seismology activities in Egypt.This was organized by the assistance of JICA.
There is however a need for more training in digital,and the use of computers for seismic data analysis.

. . . . . STAFF OF THE SEISMOLOGICAL UNIT

J.K.A. Banson	Director (Seismologist)
Solomon Anum	Geologist
Paulina Essel	Assist. Geophysicist
Sylvanus T. Ahulu	"
Victor Abutiate	Principal Technical Officer (Head of Instrumentation)
Samuel Owusu	Principal Technical Officer
Attu Mensah	Technical Officer
Robert Nartey	Technician
Abraham Wuaktt	"
David Asare	"
Bashiru Abban	"
Isaac Agyman	"
Herbert Sunu	"

APPENDIX B

SAMPLE

OF

A PARTICIPANT

EVALUATION SHEET

Please complete this report fully and promptly. It is intended to provide the trainee's employer with a factual account of the training undertaken and an initial indication of how far the original training objectives have been achieved. If possible, please discuss it with the trainee before sending it to us. The report is copied to our representative in the trainee's home country who sends it to the employer and nominating government.

Please return the report to me at the address below by / /199 . Thank you

---

Award administrator/programmme officer:

Address:

Trainee's name:

O/seas file ref:

Training institution:

Period of training:

---

1 Summary. Please give a summary of the contents of the academic course or training programme followed.

---

2 Training objectives. Please comment on how far the training has helped the trainee meet each of the objectives outlined in the application form/Training specification form.

3 Skills. Please give a summary of the main skills/knowledge acquired

4 **Academic results.** Please give the qualification obtained and list examinations taken with marks/grades in each subject. (not for practical training).

5 **Major assignments.** Where relevant, please give title of thesis/dissertation/report, Please also list major graded assignments where relevant with marks/grades obtained. (Not for practical training).

6. **Practical attachments and study visits.** Where relevant, please give details of practical attachments, field work, visits undertaken and conferences attended by the trainee.

7 **Proficiency in English.** Please comment on the trainee's proficiency in reading, writing, listening and speaking during the training.

Signature: Date:

Name: Designation:

I have read this report and checked the contents.

Signature Date:

Name: Post title:

APPENDIX B2

Evaluation Of The Third Countries Program
Of The International Training Seminar
For (Seismologists) Earthquake
Observers For Africa
(1992 - 1995)

Effectiveness :

Five seminars were held from January until the end of March in the years 1992,1993, and 1995. The 5th or the last seminar was held in the period from the 11th of November to the 10th of December 1995 .Hundred and fifty participants from 25 countries including Egypt attended the seminar . These countries are : Ghana ,Kenya. Malawi, Ruwanda, Zimbabwe, Madaguascar, Zaire, Ethiopia, Chad, Sudan ,Nigeria ,Tanzania, Zambia , Tunisia, Libya, Algeria, Morocco, Uganda, Jordan , Syria, Qater ,Bahrain, Saudi Arabia , Yemen and Kuwait.

The participants attended lectures that included the following :

Elasticity and Seismic waves
Introduction to the Theory of Seismograph
Seismological Stations
Seismographic Networks
Earthquake Parameters
Fault Plane Solutions
Earthquake Geology
Micro-Earthquake Survey
Applied Seismology including physical background of discrimination between earthquake and explosions
Seismic Hazard
Refraction Seismology
Iintroduction to Earthquake Engineering
General Seismology
The surface of the Solar System
Outline of Engineering of Earthquakes and Provisions in the recently revised Japanese building code
Geological seismology

Seismogram Reading
Source Mechanism
Identification of Fracture zone through curved ray seismic topography
Prices Movement Monitoring
Geophysics Goemognetism
Geoelectircity
Plate Tectonics

The lecturers are Professors and Instructors from the Egyptian National Research Institute of Astronomy and Geophysical NRIAG , Faculty of engineering ,Cairo University , high Dam and Aswan Authority - Egypt , Lake Nasser Development organization. Moreover , there were also Japanese Experts from Earthquake Research Institute , Tokyo University, IISEEE - Building institute, Tsukuba,Tsukuba University ,Kyoto University , Hakkaido University, seismic studies center , USA Hungarian Academy of Sciences ,Polish Academy of sciences and Hamburg Geophysical Institute, Germany, Russian Federation, China Academy of Sciences, Italian National Geophysical Institute, Institute of Geophysics, Paris, France.

The required knowledge used

Many earthquakes of moderate to strong intensity , and of magnitude ranges of 3.5 to 7.0 Rekhtar took place all over the world , and inside participants' countries : Cairo 1992 earthquake ; the gulf of Aqaba 1993' 1994' , and the 22'nd November 1995 earthquake which caused from slight to severe damages in Sinai and Cairo.

Almost all the Participants of the last 2 seminars had visited north Red Sea Seismic station , Jerusalem, Palestine , Jordan , Saudi Arabia , Lebanon and , Syria .These countries have seismic station net work , seismic observatory or seismic station . All the earthquakes that took places in Egypt , Algeria , Palestine , Tunisia ,Morocco ,Ghana ,Kenya. Malawi, Ruwanda, Zimbabwe, Madaguascar, Zaire, Ethiopia, ,Tanzania, Zambia , Tunisia, Algeria, Morocco, Uganda, Jordan , Syria, Qater ,Bahrain, Saudi Arabia , Yemen and Kuwait.All except Chad, Sudan ,Libya and Nigeria were during , before and after the last five years (1992 - 1996).

Egypt ,Algeria ,Morocco, Tunisia, Palestine (Israel) Lebanon and Syria have seismic building codes .

IMPACT:

The seminar material and subject contributed much to the plan of the invited countries ,as all the invited countries trainees are working in seismological observation ,seismic station , seismic network geological survey institutes , civil engineering societies and universities.

EFFICIENCY:

The seminar continued for four weeks . It included cultural, monumental , field ,practices and observations, seismogram readings, design of earthquake resistant structures studies of seismic building codes, strong motion seismology Analysis observation of recent faults , using of micro earthquake observation sets and every day the lecturers, Instructions, Practice continued from 9 'O a.m. till 5 O' . p.m. including 2 hours as coffee \ tea breaks and lunch time . Actually most the number of the participants asked for practice and field observation time with more time should be given for fault zones, refraction seismic, seismic network and seismogram reading and determination of earthquake parameters.

SUSTAINABILITY

Still countries like Ghana , Malawi ,Uganda ,Sudan ,Nigeria ,Chad Senegal, Eriteriya, and specially Libya have not even one seismic station All of this countries and particularly Kuwait , which started seismic station network installations on 1995 need to have earthquake observers from their countries . Some of them are in a bad need for seismic network seismic observatories ,seismic station since they earthquakes are serious and of actual threat . There is an urgent need for establishing seismic building codes . It is a must not only for them but for all of the Middle and central to east African countries to have seismic stations and observatories ,network and seismic building codes or at least seismic zoning Maps to develop and integrate the life of their people .

This program of training seminars for earthquake observes should be continued from 1996 up to the 2000 .Especially after the evaluation team sponsored by JICA headoffice and arranged and managed by JICA - Cairo office , had visited Accra-Ghana . The Ghanaian officials and earth scientists; particularly the seismological department , the geological survey of Ghana , Ministry of mines and Energy , insisted to continue the seminar and to extend its duration from 4 week to 6 weeks. This would give the chance to the new participants to participate in this seminar .The ex-participants of the seminar asked for more time to carry out practical lessons and exercises applied in Engineering seismology ,Digital and telemetric seismic network establishment and operation, computer software and hardware seismological Analysis , in addition to more advanced courses in the mentioned above techniques .

Seven out of nine of the ex-participants of Ghana, their directors and the high officials of the Ministry of Mines and Energy of Ghana and Deputy Minister of Finance of Ghana for international cooperation, H.E. the Ambassador of the Arab Republic of Egypt in Ghana Accra, recommended the same.

The seismological condition in Ghana is promising not only for Ghana , central west Africa, but for the international seismological scientists too .

E.M. Ibrahim
Dept. of Seismology , NRIAG

APPENDIXES "B3"

Report of Evaluation Study for "Regional Training Seminar on Earthquake Observers (Seismologists) for Africa"

April 1996

Hiroshi MURAKAMI

JICA Expert on Seismology

The author reports here of evaluation study for 'Regional Training Seminar on Earthquake Observers(Seismologists) for Africa' on seismological view point.

The author has been engaged in "Joint Study Project on the Evaluation of Seismic Activities in the Plate Boundaries in Egypt' for two years as a long-term expert. The while he was the lecturer in seismology as well as the witness or the inspector at the fourth and the fifth seminars, March 1995 and November/December 1995. He is one of the members of the 'Evaluation Study' and was dispatched to Ghana.

The author's conclusion on this evaluation is as follows:

1. African and Middle Eastern countries must install and maintain seismological obsevative stations with capable 'earthquake observers',

2. Egypt, or NRIAG, has been the only and the best country, or organization, in African and Middle Eastern countries to implement this 'training seminar on earthquake observers',

3. This 'training seminar on earthquake observers' should be continued and should be implemented by NRIAG, with some modifications.

The author mentions three points above, as the main report documents must have made detailed investigations according to the request of JICA Egypt office.

1. Seismological Background of 'Training Seminar'

1-1. Role of Earthquake Observers in Developing Countries

The earthquake has two aspects for human, a scientific interest and a natural disaster. Seismology is the science to reveal the truth of earthquakes. Earthquake engineering is the technology to prevent and decrease the social damages of earthquakes. Both earth science and social system request 'earthquake observers' to provide basic and reliable informations of earthquakes.

Frequent earthquakes bring the advance of seismology and earthquake engineering concurrentry in such developed regions of the world as Japan or California. Developed regions with rare earthquakes such as Germany or northeastern U.S. have made the progress in seismology as a pure science as physics or mathematics.

In developing regions, rare earthquakes bring unexpected damages as in India or Egypt, because of irregal constructions and underfunded infrastractures. Frequent earthquakes in developing regions mostly cause disasters as in Iran, Turkey or southern inland China. (ref. appendant Table)

The governors and the nations of developing countries must have the seismological knowledge and should apply the earthquake engineering technology to avoid their damages and disasters. Developed countries can provide adequate opportunities to study seismology and learn technology of earthquake engineering for developing countries through the training seminars for 'earthquake observers'.

1-2. Demands on Earthquake Observers from Global Science and Politics

Recent progress in seismology has been revealing the detailed earth internal

structure, using a huge number of digital data of long distance earthquakes from worldwide seismological stations. This is called global seismology.

Even after the cold war, the detection of underground nuclear test is still neccessary to keep the world peace, using also digital data of long distance explosion from worldwide seismological stations.

These science and politics request 'earthquake observers' reliable digital informations propagated from outside of their countries.

2. Training Implemental Organization

Egypt and Japan has more than 30 years of long history on seismological cooperation. In this while, more than 30 of Egyptian trainees have been to Japan to learn and study the recent seismology and seismological engineering(seismic instrument technology). More than half of them has been working on seismology and seismological engineering as professors, researchers or engineers in NRIAG(National Research Institute for Astronomy and Geophysics).

At the same time, more than 40 of Japanese seismologists and earthquake engineers have visited Egypt frequently as long or short term experts, lecturers, or research team members. Every time they come to Egypt, they visit NRIAG to provide up-to-date topics on seismology in Japan for elder ex-trainees and young researchers and engineers.

More than half of Ph.D. staffs on seismology finished their theses in Europe or Japan. Recently, they have brought up several Ph.D. colleagues by themselves in Egypt. These Ph.D. staff on seismology and seismological engineers have led the accademic distinction on seismology and earthquake engineering not only in Egypt but also in Middle Eastern and African countries.

Seismological departmet of NRIAG has sufficient experience on installation and maintenance of seismiological observatory and seismiological observation networks. Hurghada Seismiological Network of 10 stations has been set up by NRIAG in cooperation with JICA and Japanese experts.

3. Improvements in 'Training Seminar' Implementation Hereafter

3-1. Content of Course Curriculum

Thus far provided contents has been efficient enough and the participants request further careful and detailed lectures and practices. They also requested to have good knowledges about their future digital seismic networks to provide for worldwide seismic information systems.

3-2. Lecturers

The lectures with up-to-date interests are neccessary. Such lectures from Japan or another foreign country should have been contacted in early opportunity.

3-3. Textbooks

Textbooks of this course contain efficient materials. But they have essentially not been revised for last 5 years. They also need up-to-date items and papers.

Main Earthquakes In Mediterrenean, Middle East, Africa Regions (1900~1994)

year	mon	day	M	lat(°N)	long(°E)	depth(km)	region, damage(dead)
1904	10	3	7.1	12.0	58.0		Arabian Sea
1908	12	28	7.0	38.2	15.6		southern Itary(58,000~110,000)
1909	1	23	7.4	33	53		middle Iran(5,500)
1912	8	9	7.6	40.5	27		Turkey(216~3,000)
1913	3	24	5.8	26.8	53.7		southern Iran
1915	5	21	6.8	4.4	31.9		Sudan
1921	8	14	5.9	15.6	39.6		Ethiopia
1923	5	28	5.5	35.3	59.2		Iran(2,200~)
1923	8	1	7.1	35.0	25.0		Greece
1926	7	26	7.5	36.5	27.5		off southwestern Turkey
1926	8	30	7.4	36.7	23.3		Greece
1927	7	1	7.3	36.7	22.7		Greece
1929	5	1	7.2	38	58		Iran, USSR border(3,000~5,803)
1930	5	7	7.2	38	44.5		Turkey, Iran border(3,000?)
1935	2	25	7.1	35.7	25.		Greece
1935	4	19	7.6	31.4	15.4		Libya
1939	6	22	6.5	5.4	0.1W		Ghana, off Accra(17)
1939	12	27	7.8	39.5	38.5		Turkey(23,000~40,000)
1941	1	11	6.5	16.4	43.5		Yemen, Saudi border
1942	12	20	7.3	40.5	36.5		middle Turkey(1,000~3,000)
1943	11	27	7.6	41	34		middle Turkey(4,000~5,000)
1944	2	1	7.4	41.5	32.5		middle Turkey(2,790~5,000)
1946	4	11	7.2	1. S	14.5W	sh	North of Ascension Is.
1947	10	6	7.0	37.	22.	sh	southern Greece

(to be continued)

year	mon	day	M	lat(°N)	long(°E)	depth(km)	region, damage(dead)
1948	2	9	7.1	35.5	27.	40	Crete
1948	7	24	7.1	34.4	24.5		Crete
1948	10	5	7.3	37.5	58	sh	Iran, USSR border(19,800)
1950	1	19	5.8	27.3	52.8		southern Iran
1953	3	18	7.2	40.0	27.5	sh	Turkey(1,070～1,103)
1953	8	12	7.1	38.3	20.3	sh	Ionian Sea(800)
1954	3	29	7.0	37.0	3.5W	603	southern Spain
1954	3	31	7.3	12.5	58.	sh	Arabian Sea
1954	4	30	7.0	39.	22.	sh	Greece(31)
1954	9	9	6.7	36.3	1.5		Algeria(1,243～1,460)
1955	9	12	6.5	32.2	29.9	10	off Alexandria(18～)
1957	4	25	7.1	36.5	29.	sh	Near south coast of Turkey(67)
1957	5	26	7.1	41.	31.	sh	Turkey(500)
1957	7	2	7.0	36.1	52.7	sh	Iran(1,100～2,000)
1957	12	13	7.2	34.4	47.7	sh	Western Iran(1,130～2,500)
1960	2	29	5.5	30.5	9.6W		Morocco(10,000～13,100)
1960	4	24	6.0	27.7	54.1		Iran(380～1,000)
1961	6	1	6.5	10.6	39.8		Ethiopia
1962	9	1	7.3	35.6	50.0	21	Western Iran(12,225)
1964	10	6	7.	40.3	28.2	10	Turkey(23)
1965	3	31	7.	38.6	22.4	78	Greece(6)
1966	3	20	7.	0.6	30.2	36	Uganda(100～)
1966	8	19	6.7	39.2	41.6		eastern Turkey(2,470～3,000)
1966	10	9	5.6	12.6	30.7		Sudan
1967	7	22	7.3	40.7	30.8	4	Turkey(173)
1967	11	23	7.0	14.5	52.1	3	eastern Gulf of Aden

(to be continued)

year	mon	day	M	lat(°N)	long(°E)	depth(km)	region, damage(dead)
1968	2	19	7.5	39.4	25.	7	Aegean Sea(20)
1968	8	31	7.1	34.2	59.0	13	Iran(12,000～15,000)
1968	9	1	7.0	34.1	58.2	15	Iran(2,000～)
1969	3	29	6.2	11.9	41.2		Ethiopia(24～)
1969	3	31	7.3	27.7	34.0	140	Red Sea, Egypt, Shadwan Is.(3)
1970	3	28	7.3	39.2	29.5	20	western Turkey(1,086～1,300)
1971	5	21	6.7	38.9	40.5		Turkey(755～995)
1972	4	10	6.9	28.4	52.8		southern Iran(5,010～17,000)
1972	7	2	5.4	30.0	50.9		southern Iran
1975	5	26	8.1	36.0	17.7W		North Atrantic Ocean
1975	9	6	6.7	38.5	40.8		Turkey(2,300～3,000)
1976	5	6	6.5	46.6	13.3		Itary(929～1,000)
1976	11	24	7.3	39.1	44.0	36	Turkey, Iran border(3,626～10,000)
1977	3	21	7.0	27.6	56.4	29	southern Iran(167)
1978	9	16	7.8	33.4	57.4	33	Iran(15,000～20,000)
1979	11	27	7.1	34.1	59.9	10	Iran(17)
1980	10	10	7.7	36.2	1.4	10	Algeria(2,950～5,000～)
1980	11	23	7.2	40.9	15.3	10	southern Itary(2,928～4,680)
1981	6	11	6.9	29.9	57.7		Iran(3,000)
1981	7	28	7.3	30.0	57.8	33	Iran(1,500)
1981	12	19	7.6	39.2	25.2	15	Aegean Sea
1982	1	18	7.0	40.0	24.3	10	Aegean Sea
1982	12	13	6.0	14.7	44.2		Yemen(2,000～5,000)
1983	1	17	7.2	38.0	20.2	320	Greece
1983	8	6	7.3	40.1	24.8	.2	Aegean Sea

(to be continued)

year	mon	day	M	lat(°N)	long(°E)	depth(km)	region, damage(dead)
1983	10	30	6.9	40.3	42.2		northeastern Turkey(1,342～1,400～)
1988	12	7	7.0	41 0	44.2	10	Turkey, USSR border(25,000)
1989	8	20	6.1	11.8	42.0		Ethiopia
1989	10	29	5.9	36.8	2.4	6	Algeria(30～)
1990	5	20	7.1	5.1	32.1	15	Sudan
1990	5	24	7.0	5.4	31.8	16	Sudan
1990	6	20	7.7	37.0	49.4	19	western Iràn(40,000～50,000)
1990	11	6	6.7	28.3	55.5	11	southern Iran(22～)
1990	12	13	5.5	37.3	15.4	11	Sicily(19～)
1991	7	24	5.4	36.5	44.1	26	Iran, Iraq border(20～)
1991	11	22	4.7	13.9	44.1	10	western Arabian Pen.(10)
1992	3	4	4.9	31.7	50.8	18	northern Iran(6～)
1992	3	5	6.2	11.5	42.8	7	Ethiopia
1992	3	13	6.8	39.7	39.6	27	Turkey(498～)
1992	9	8	5.2	29.1	52.2	18	southern Iran(1)
1992	9	11	7.0	6.1S	26.7	11	Zaire(8)
1992	10	12	5.9	29.8	31.1	22	Egypt, Cairo(552～)
1992	10	22	4.5	29.8	31.5	10	Egypt(4)
1992	10	23	5.3	31.4	4.3W	29	Morocco(2～)
1992	11	6	6.0	38.2	27.0	17	Aegean Sea
1992	12	17	5.8	25.9	61.4	33	southern Iran
1993	1	8	2.7	28.0S	26.8	5	South Africa(6)
1993	8	1	5.2	15.4	31.7	13	Sudan(2～)
1993	8	3	5.9	28.7	34.6	10	Egypt
1994	2	5	6.0	0.6	30.0	14	Uganda(2～)

(to be continued)

year	mon	day	M	lat(°N)	long(°E)	depth(km)	region, damage(dead)
1994	2	23	6.1	30.9	60.6	6	northern Iran(6)
1994	2	24	6.1	30.8	60.5	10	northern Iran
1994	2	26	6.0	30.9	60.5	9	northern Iran
1994	3	1	6.0	29.1	52.6	13	southern Iran(2～)
1994	5	23	6.0	35.6	24.7	76	Crete
1994	6	20	5.9	29.0	52.6	9	southern Iran(3～)
1994	8	18	5.7	35.5	0.1W	9	northern Algeria(159～)
1994	9	1	2.7	26.4S	27.4	5	South Africa(3)

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