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A REPORT ON EARTHQUAKE ACTIVITY IN THE
ANTIGUA/BARBUDA REGION JULY 1980 - OCT 1983

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Introduction

This report has been prepared in response to requests from government and regional agencies for a comprehensive description of recent earthquake activity in the Antigua/Barbuda region. A complete file of all earthquakes which originated in the entire Eastern Caribbean region during this period is maintained on computer tapes at the Seismic Research Unit in St. Augustine, Trinidad and a print-out of the part of the file relevant to Antigua has been placed at the Headquarters of the Pan-Caribbean Disaster Preparedness and Planning Project in St. John's, Antigua, where it is available for consultation. Periodic updates are issued at approximately three-monthly intervals. Copies of the complete file or of any specified part of it and detailed reports on individual earthquakes are available on request. There is no charge to governments or government and regional agencies. Commercial organizations and the general public are asked to pay a small fee.

Seismograph Stations in Antigua and Barbuda

Three seismograph stations were in continuous operation in Antigua and Barbuda during this period. The stations are located at Boggy Peak in the south of Antigua (BPA) at Friars Hill in the north of Antigua (ANG) and at the Codrington Police Station in Barbuda (CPB). Signals from these stations are transmitted continuously to St. Augustine, Trinidad together with signals from stations in St. Kitts (BSK), Nevis (NEV), Montserrat (MGH) and Dominica (DMD). In Trinidad the signals are displayed on visual recorders and stored on magnetic tape for subsequent, more-detailed, analysis. When an earthquake large enough to be felt is recorded a preliminary estimate of its location and magnitude can be made within a few minutes.

For subsequent analysis, data from seismographs operated by other agencies in the region are also available. The most important stations are those operated in the Guadeloupe archipelago by the French Institute de Physique du Globe. Until December 1982 the Lamont-Doherty Observatory of Columbia University, USA operated a high-quality network in the Virgin Islands and the northern Lesser Antilles which included stations in Barbuda, Saba and St. Martin and all data from these stations were used in compiling the earthquake file.

The system described came into full operation on July 1, 1980 and, since that date, high-quality earthquake data have been collected from the Leeward Islands at a considerably-faster rate than was possible previously. For this reason the data summarized here cannot be compared directly with previous data sets for this region. The present data are much more comprehensive than previous sets and as a result there has been an apparent increase in the overall rate of earthquake activity in the Antigua region. We wish to emphasize that this increase has no geophysical significance, it is simply the result of better data-gathering and data-analysis techniques.

Earthquakes in the Eastern Caribbean

During this period a total of 1137 earthquakes originating in the Eastern Caribbean were sufficiently well-recorded for estimates to be made of hypocentral coordinates and magnitudes. The data set is complete for earthquakes of magnitude greater than about $m_b = 2.6$ and therefore includes all earthquakes which were of sufficient size to be felt anywhere in the region. In general, all hypocentral coordinates are believed to be accurate to better than ± 10 km in epicentral location and ± 20 km in depth.

Earthquakes affecting Antigua/Barbuda

Of the total of 1137 earthquakes, 271 occurred within one degree (about 110 km) of St. John's, Antigua. Of these earthquakes 132 originated within 0.5° of St. John's and 111 originated within 0.5° of Codrington, Barbuda. The comparative figures for other islands in the Eastern Caribbean are:-

<u>Island</u>	<u>Earthquakes within 1°</u>	<u>Earthquakes within 0.5°</u>	<u>Felt</u>
Trinidad	194	49	6
Tobago	76	32	
Barbados	43	2	None
Grenada	51	4	1
St. Vincent	25	7	3
St. Lucia	67	13	
Dominica	176	66	
Montserrat	206	50	
St. Kitts	271	33	
Nevis	200	45	
Antigua	271	132	11
Barbuda	255	111	?
Martinique	151		

(Figures for St. Vincent exclude small volcanic earthquakes associated with the Soufriere volcano).

This table shows two points quite clearly. One is that the northern half of the Lesser Antilles (islands from Dominica northwards) is considerably more active than the southern half (Grenada to Martinique). The second point is that a high proportion of activity in the northern Lesser Antilles is concentrated in the Antigua/Barbuda region.

Earthquakes reported felt in Antigua and Barbuda

Nine earthquakes were reported felt in Antigua/Barbuda during this period. In the Commonwealth Eastern Caribbean this number was exceeded only in Dominica and Tobago. For both Dominica and Tobago there were special reasons why the numbers were high. During the period considered, both islands experienced earthquake swarms - periods of frequent low-magnitude, shallow earthquakes, many of which were felt at low intensities. Earthquakes of this type are not truly independent events. In contrast, all earthquakes reported felt in Antigua were truly independent of each other. It is emphasised that the list presented here is not exhaustive. We list only those earthquakes which we know to have been felt, and it is likely that some low-intensity earthquakes were felt in Antigua but not reported to us. However, we are confident that the list includes all earthquakes of intensity MM IV or more which were felt in Antigua. For all earthquakes which we suspect may have been felt in Antigua we are able to make prompt enquires of the Pan-Caribbean Disaster Planning and Preparedness Project (PCDPPP), whether in fact they were felt. We are less confident that all earthquakes felt in Barbuda have been reported.

<u>Date</u>	<u>Time</u>	<u>Lat.</u>	<u>Lon.</u>	<u>Depth</u>	<u>Max. Intensity</u>
09/01/81	0831	17.01	61.23	22	MMV Antigua
12/07/81	1716	17.06	61.55	62	MMIV Antigua
04/08/81	2200	16.84	61.16	9	MMV Antigua
25/12/81	0455	17.46	61.76	58	MMIV Antigua
30/01/82	0235	16.80	61.30	65	MMV Antigua
28/10/82	0758	17.71	61.46	79	MMIII Barbuda
23/11/82	1931	17.67	61.99	107	MMV Barbuda MMV Antigua
05/04/83	1559	17.60	61.65	19	MMII Antigua
28/06/83	0232	17.45	61.89	36	MMIV Antigua

All times are Coordinated Universal Time (equivalent to GMT).

From this table it can be seen that no earthquake has been reported felt at an intensity greater than V on the Modified Mercalli scale. The distinction between MMV and MMVI, the next highest degree of intensity is as follows.

MM V - Felt outdoors, direction estimated. Sleepers awakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate.

MM VI - Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books etc. off shelves. Pictures off walls. Furniture moved or overturned. Small bells ring (church, school). Trees and bushes shaken visibly or heard to rustle. Weak materials such as adobe, poor mortar, low standards of workmanship or weak horizontally are cracked.

Therefore, none of the intensities reported to us from Antigua/Barbuda during this period was strong enough to cause damage to constructions even of the weakest type. However, it is important to distinguish between the highest intensity reported to us and the highest intensity which was in fact observed, and which may not have been reported to us. Judging on other criteria (earthquake magnitude, distance from Antigua/Barbuda and focal depth), we estimate that three of the earthquakes listed may have been felt at intensity VI in Antigua and/or Barbuda. These were the earthquakes of January 9, 1981, August 4, 1981 and 23 November 1982. No earthquake was sufficiently strong to have been felt at intensities greater than VI so that any genuine earthquake damage in Antigua/Barbuda during this period should be confined to cracks in weak materials or

overturning of unstable objects.

Summary

Data collected during the first three years of operation of an improved seismograph network in the Antigua/Barbuda region have been summarized. The results confirm that Antigua/Barbuda is in the most seismically-active part of the Lesser Antilles but do not show any long-term increase or decrease in the rate of activity. No earthquake is known to have been felt in Antigua or Barbuda during this period at intensities greater than V on the Modified Mercalli scale of earthquake intensities but three earthquakes may have reached intensity VI which is sufficient to cause minor damage in poor-quality buildings.