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1996-09-24

Pan American Health Organisation
Emergency Preparedness & Disaster Relief Programme
Dayrells Road
CHRIST CHURCH

Attention: Dr Dana van Alphen

Dear Mesdames/Sirs,

General Hospital, Grenada

In accordance with your instructions, we have carried out a Vulnerability Assessment of the Hospital at Fort St George in Grenada. The Assessment included field surveys, interviews with various members of the hospital staff and the Ministry of Health, and desk studies.

All of the facilities are in such a state as to indicate a lack of sufficient maintenance. Some of the facilities are currently being renovated or repaired. Nevertheless, the impression is given of a hospital which does not function particularly well in normal circumstances and would therefore be hard-pressed to function adequately in times of catastrophic earthquakes and hurricanes, when the community's needs would be greatest.

If the premises are retrofitted and the renovations executed in accordance with the general guidance in our report, the Hospital should perform satisfactorily in future hazardous events such as earthquakes, hurricanes and torrential rains. The short-term retrofitting measures have been costed at approximately EC\$475,000.00. Medium- and long-term measures have also been recommended for action at the Hospital.



Most of the field surveys were undertaken by Engineer Selwyn Woodroffe from our Grenada office. He also participated significantly in the preparation of our report.

We wish to acknowledge the assistance of Ms Lana McPhail (Permanent Secretary), Mr Douglas Andrews (Hospital Administrator), Mr Gregory Sandy (Maintenance Supervisor), and Drs Budhlall and Brathwaite of the Ministry of Health. The support of Dr van Alphen and other PAHO staff members was also important to us in carrying out the exercise.

Yours faithfully,

CONSULTING ENGINEERS PARTNERSHIP LTD

A handwritten signature in black ink, appearing to read 'Tony Gibbs', with a stylized flourish at the end.

Tony Gibbs

TG/acc

**Pan American Health Organisation
Emergency Preparedness & Disaster Relief Programme**

**Ministry of Health
Grenada**

Vulnerability Assessment

**of the
General Hospital
St George's
Grenada**

September 1996

**Tony Gibbs
Consulting Engineers Partnership Ltd
Barbados and Grenada**

Vulnerability Assessment of the General Hospital St George's, Grenada

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1 INTRODUCTION

1.1 The Location

Grenada's General Hospital is located on the Fort George Point, at the south-west of the island, in the Parish of St George.

Fort George Point is one of two promontories which serve to protect the natural inner St George's Harbour. It is aligned generally in a north-east to south-west direction with the hospital site occupying the south-west portion.

Fort George Point is characterized by two distinct levels. One is at the south-west quadrant, approximately 100 feet above sea level (at which level the Hospital is located) and the other is at the north-east quadrant, approximately 150 feet above sea level, which is the site of Fort George (currently the Grenada Police Headquarters).

The site of the General Hospital is therefore somewhat protected from weather along it's eastern boundary, but exposed to weather from the west (see photo 1).

1.2 Terms of Reference

The Pan American Health Organisation (PAHO) engaged the services of Consulting Engineers Partnership Ltd (CEP) to undertake a vulnerability survey of the hospital facility in order to, *inter alia*:

- determine the current level of resistance of the hospital to natural hazards;
- recommend measures to be taken which will increase the level of resistance to natural hazards;
- prepare recommendations which will not only reduce the incidence of fatalities during natural hazards, but will also allow the critical parts of the facility to continue to function during, and immediately after, the occurrence of a natural hazard;
- provide details for implementation of short term measures;

- prepare cost estimates for retrofitting in the short term.

The full text of the Terms of Reference is given in Appendix A.

1.3 The Facility

The Hospital facility comprises several buildings of varying ages and structural forms. Most of these buildings have, however, been connected to a central core, thus providing covered access to all critical parts of the facility.

Various areas of the facility are currently under repair and consideration should be given to incorporation of some of the recommendations contained in this report into the current repair programme (see photos 5, 17 & 18).

A sketch (not to scale) is provided in Appendix B to identify the respective locations of each of the various entities comprising the overall facility.

2 HAZARDS

2.1 General

The primary natural hazards facing the islands of the Caribbean are earthquakes and hurricanes. Some of the islands, including Grenada, are also subjected to instances of volcanic activity. This, however, is outside the scope of this report.

Torrential rains can also, by themselves, be considered natural hazards since they often occur without the concurrent occurrence of hurricanes and sometimes result in disastrous flooding of low-lying areas. Because of the relatively low potential of the hospital site for flooding, torrential rains will be discussed, in this exercise, only in the context of the associated damage during hurricanes.

2.2 Earthquakes

Seismic activities in the Eastern Caribbean, where Grenada is located, are principally associated with a subduction zone at the junction of the

Caribbean Plate and the Americas Plate. Figures 1, 2 and 3 (at the end of this sub-section) show the tectonic setting of the Caribbean, the main physical features of the Eastern Caribbean and a cross section through the island arc.

The most recent earthquake to have caused significant damage in Grenada occurred on 10 January 1888 with an estimated Richter magnitude of 7.5 and a Modified Mercalli intensity of VII. Isoseismal maps of this and two other events which affected Grenada are reproduced in figures 4, 5 and 6. These were provided by Dr J Grases.

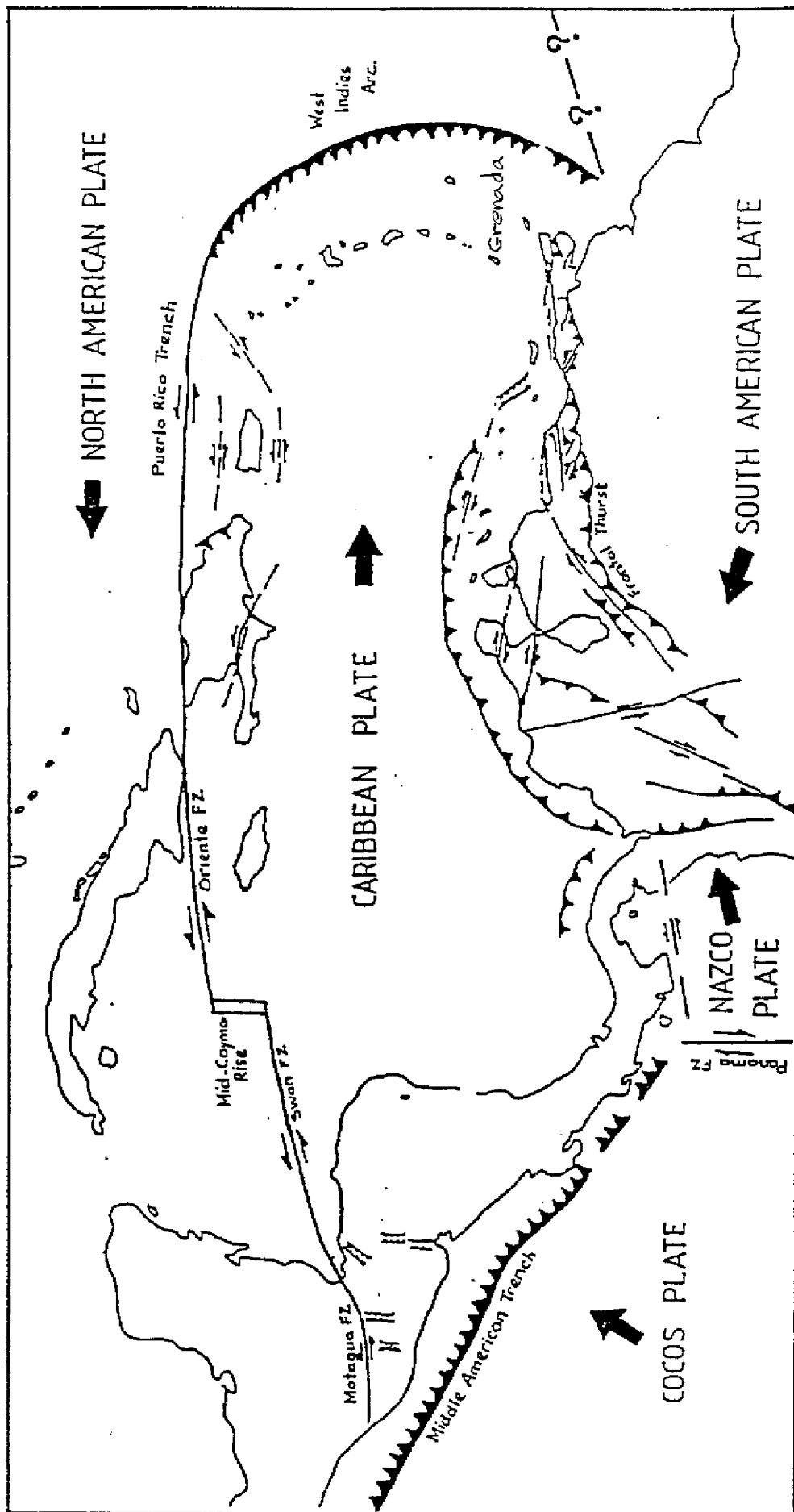
The Caribbean Uniform Building Code (CUBiC) recommends a **Z**-factor of 0.5 for Grenada. This is generally at the lower end of **Z**-factors for the Eastern Caribbean with the Leeward Islands and northern Windward Islands having a **Z**-factor of 0.75. A **Z**-factor of 0.5 is recommended for St.Vincent, Grenada and parts of Trinidad & Tobago.

More recently, the work of Dr J Shepherd for the Pan American Institute for Geography and History (PAIGH) developed the iso-acceleration maps which are reproduced at the end of this section.

The level of seismicity in Grenada is therefore considered to be moderate. However, it is sufficiently important not to be ignored.

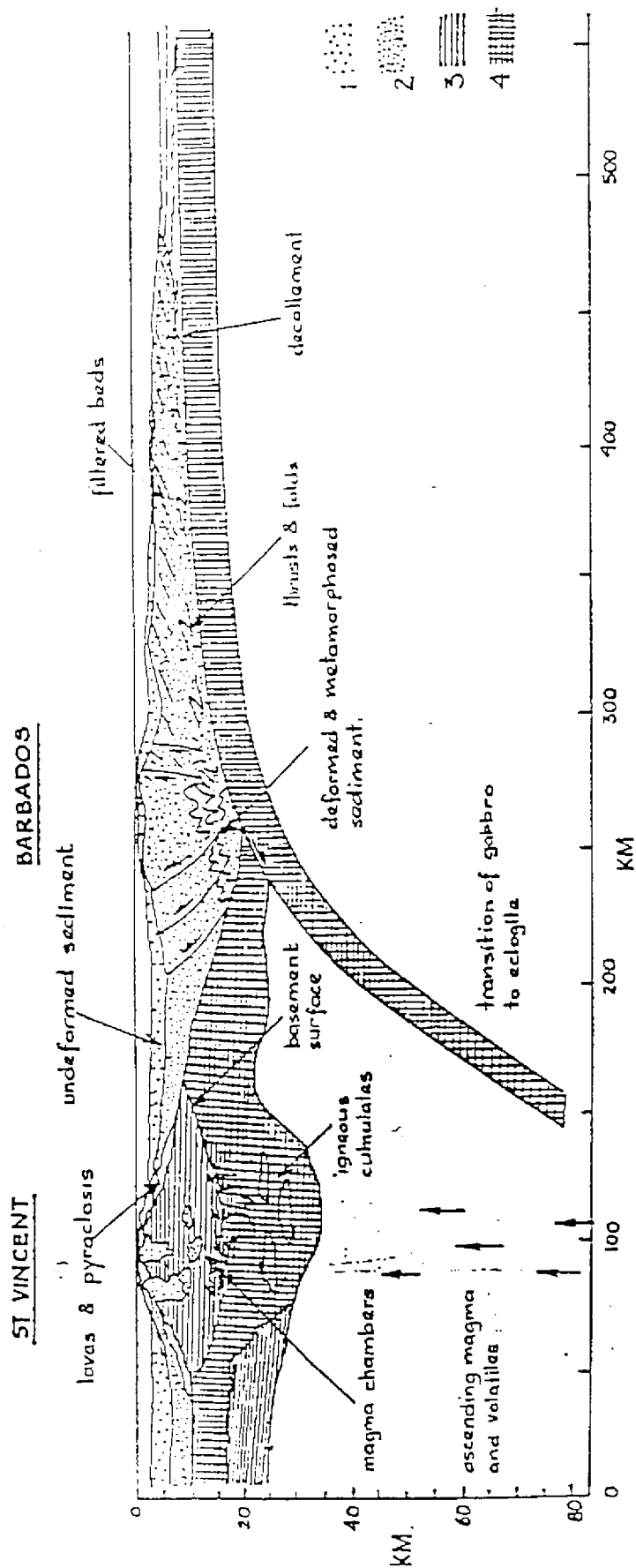
The pages following this section contain the following figures:

Fig 1	Tectonic Setting of the Caribbean
Fig 2	Main Features of Eastern Caribbean
Fig 3	Structure in Region of Barbados
Fig 4	Earthquake of 10 January 1888
Fig 5	Earthquake of 26 September 1928
Fig 6	Earthquake of 19 March 1953
Fig 7	Iso-acceleration Map for Grenada and north
Fig 8	Iso-acceleration Map for Grenada and south



Tectonic Setting of the Caribbean
(after Molnar and Sykes, 1969)

Figure 1



Diagrammatic cross-section of the Eastern Caribbean island arc illustrating the structure and the processes acting on it. 1. Undeformed sediment. 2. Deformed and/or consolidated sediment. 3. Igneous crust produced by the volcanic arc. 4. Main oceanic crustal layer and lower crust of arc. Vertical exaggeration 2:1.

Structure in Region of Barbados
(Westbrook, 1970)

Figure 3

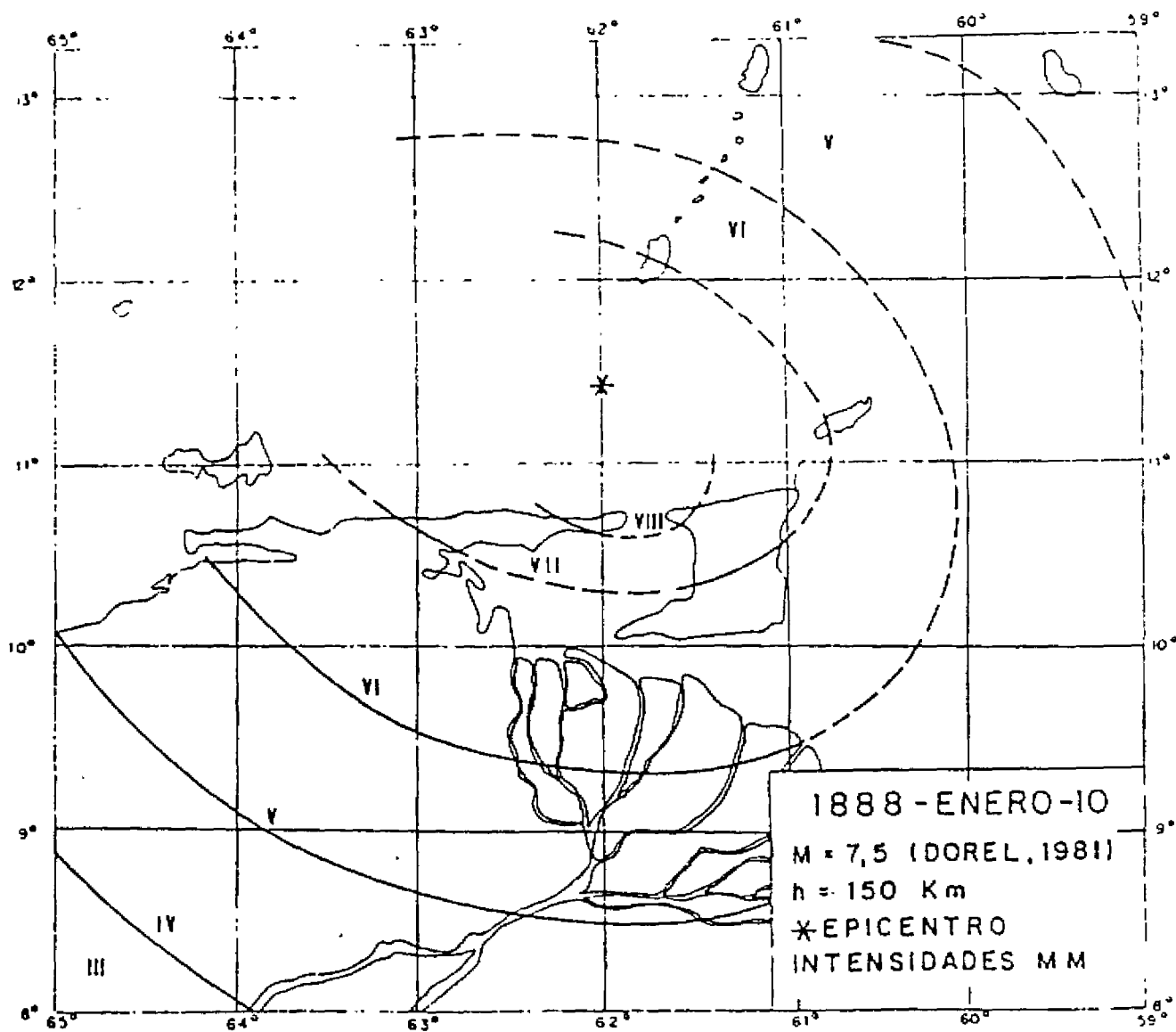


Figure 4

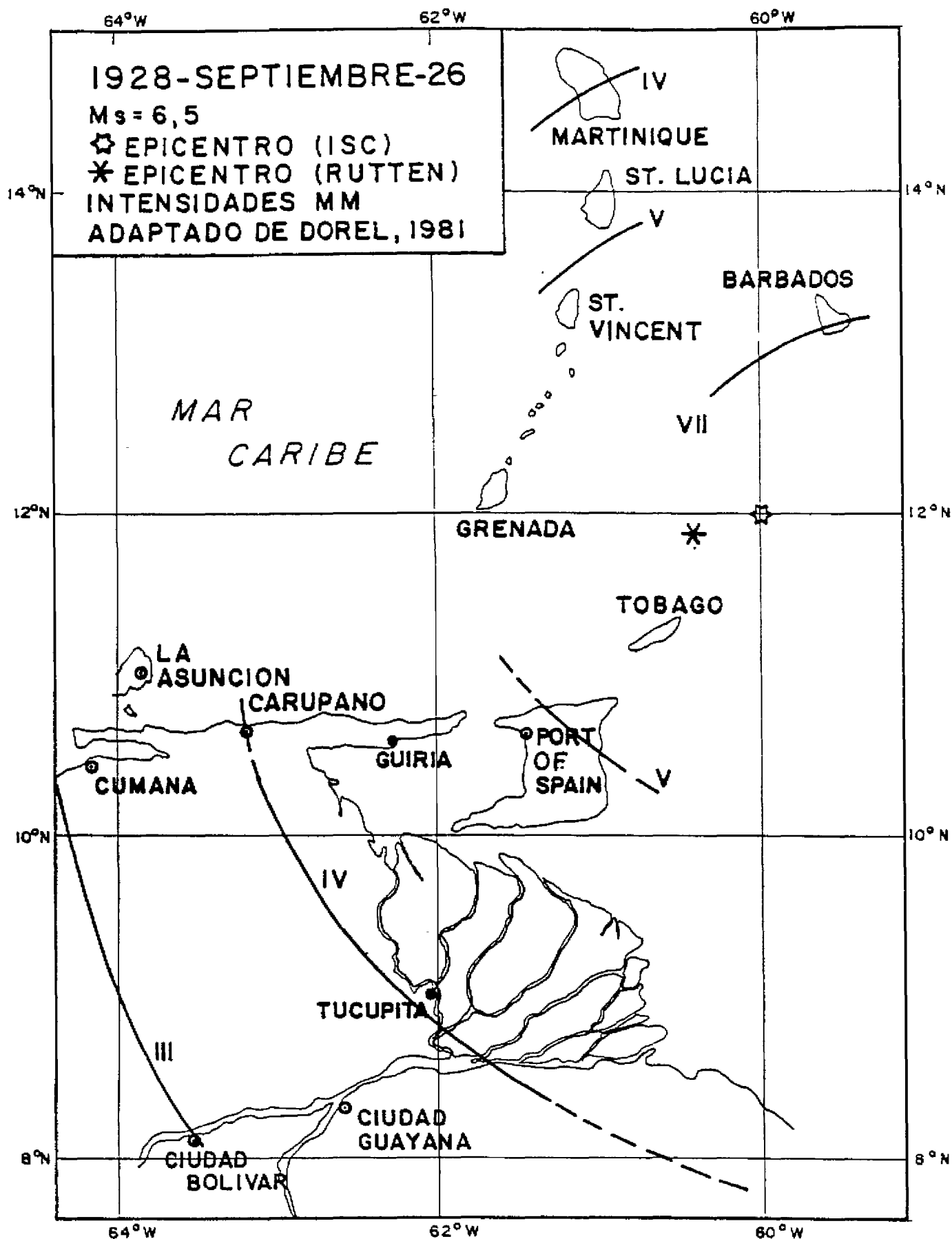


Figure 5

