SOCIO-ECONOMIC AND POLITICAL CONSTRAINTS ON DISASTER PREPAREDNESS IN THE EASTERN CARIBBEAN

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Abstract:

The Eastern Caribbean comprises the archipelago which runs roughly north/south from the Dutch Antillean islands of Saba in the north to Trinidad and Tobago in the south. The islands range in size from tiny Saba of 5 sq. ml to Trinidad with over 1800 square miles. Most of the islands are of intermediate sizes of approximately 60 - 100 sq ml. Except for the largely meta-sedimentary Mesozoic-Early Tertiary, Trinidad and Tobago, the southermost islands of the chain, all of the other islands are associated with a Tertiary to Recent subduction zone which forms the eastern edge of the Caribbean tectonic plate. The dynamics of this subduction zone generate two major natural hazards in the form of earthquake and volcanic activity. During the period of recorded history, 16th century to present, these islands have been subjected to a number of devastating earthquakes and, though less frequently, equally significant volcanic eruptions or volcanically-related seismic crises. During this century alone there has been five significant volcanic eruptions in these islands, as well as an approximate occurrence of a few tens of earthquakes of magnitude 5 and greater in every decade.

During the European colonial expansion into the western hemisphere, nowhere did their rivalry and clash of navies occur more regularly than in the Eastern Caribbean. The end result is that after five centuries of political and social development, the region now comprises eight independent states, a number of self-governing colonies in a fluid population of approximately 3 million people who speak four languages. The historical ebb and flow of peoples and influences has resulted in a cross-fertilization of genes and loyalties alongside fierce nationalism among various elements on the islands. It is not uncommon for one portion of a family to live in one island under one flag whereas another portion of the same family resides in a neighbouring island under a different administration.

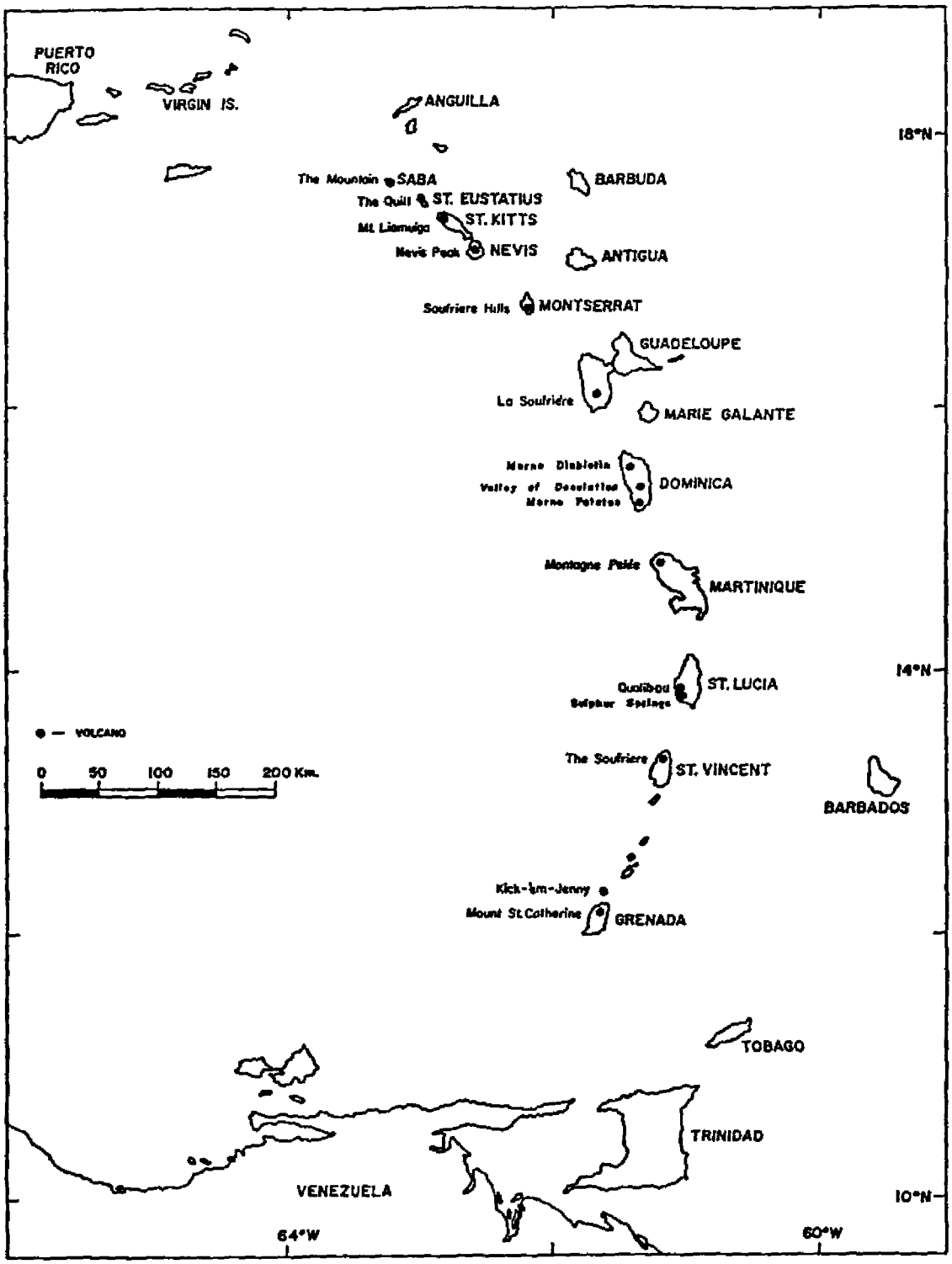
The proliferation of independent and semi-autonomous states have necessarily produced a large number of isolated decision-making centres in the form of island governments which zealously guard their autonomy and sovereignty. This situation poses serious considerations with respect to the management of natural hazards such as volcanic eruptions and earthquakes. The occurrence of any such major event is not likely to have its effects confined to a single territory. Even when the event or threat of such an event may be confined to a particular state the social links between the various populations result in immediate refugee problems for neighbouring states as people seek shelter with their blood relatives in adjacent islands.

The fact that the territories are small and have relatively large populations, many of whom tend to live in or near the capital town and seat of administration, creates an additional dimension to hazard management when it is the capital itself which is exposed to the greatest hazard and potential risk. This development and all its implications could unduely influence political decisions which are required for timely evacuation in the event of an emergency.

Except for Trinidad and Tobago, the island economies are all heavily dependent on one or two agricultural crops and tourism, all of which are extremely susceptible to the disruptions which occur during a volcanic eruption, an earthquake and aftershocks or, equally important, the movement of people in response to the events themselves. It is anticipated that individual island economies will never be able to adequately handly major local natural hazard crises. In which case, there is a need for urgent forward planning if the post-hazard developments are not themselves to become calamities on their own. While it is true that the region is an amalgam of cultures, governments and individualism, there are some regional groupings which have the potential to address these problems and press for them to be dealt with at the widest regional and international level. These include the University of the West Indies (U.W.I.), Caribbean Common Market (CARICOM), and the Organisation of Eastern Caribbean States (OECS). Although seismic monitoring and

volcano surveillance are currently being carried out on the regional scale, crisis management still remains a matter for individual governments. The natural hazards of volcanic activity and earthquakes provide little time for rehearsing during the actual events, therefore, it is imperative that socio-economic studies as well as scientific studies, be carried out in these islands in anticipation of these developments. Arising out of these studies would be a body of contingency plans for dealing with the major hazards. It is only through the successful implementation of plans arrived at in this manner that the projected disasters associated with natural hazards can be either eliminated or ameliorated. The political initiatives required to advance the preparatory process cannot proceed satisfactorily in the absence of proper studies which identify and quantify the potential problems. Information obtained in this manner would be of immense value both to larger neighbouring countries, as well as the international agencies which have been and are expected to be in the forefront of the necessary relief efforts which will be required in the event of a major natural hazard emergency in the region.

LOCATION OF LESSER ANTILLEAN VOLCANOES.
(modified from Robson and Tomblin 1966)



Volcano-Earthquake Hazards and Disaster Planning

The Eastern Caribbean chain of islands exists at the margin of the widely recognised tectonic feature known as the Caribbean plate. Except for the extreme south around Trinidad and Tobago, this area represents a Miocene-Recent subduction zone province. The dynamics of this feature account for two major natural hazards in the form of earthquakes and volcanic activity. Further to this, the geographical location of the islands places them in the paths of frequent hurricanes which usually originate in the Atlantic Ocean and migrate towards the Gulf of Mexico by way of the Eastern Caribbean. This discussion is largely confined to volcanic, and to a lesser extent, earthquake hazards.

Whereas hurricanes and other tropical storms are seasonal and occur fairly frequently, the crustal events such as earthquakes and volcanic activity are less frequent as well as non-seasonal. Although each of these major natural hazards has the ability to cause, and have caused, severe devastation to life and property, the greater frequency of occurrence of hurricanes has resulted in a higher level of awareness and better preparedness to cope with this hazard. No similar awareness level and thorough advance planning exist to deal with the kinds of earthquake and volcanic activity which are an integral part of the geological landscape of the region. It is not so much that

there is widespread ignorance of the potential hazards but there appears to be a willingness to delay the extensive regional advance planning with the hope that by ignoring the potential for dislocation this will somehow result in an indefinite postponement of the inevitable, hopefully to another generation.

Systematic record-keeping in the Eastern Caribbean dates back to the early 16th Century when European settlers began their colonisation of these islands. Strongly felt earthquakes have always demanded attention in these records which indicate quite clearly that the Eastern Caribbean has had a history of significant earthquake activity which continues to the present. A magnitude 6.2 event occurred off the east coast of Trinidad in 1988 and 53 events of magnitude >5 were recorded in the region during the last ten (10) years. A more comprehensive picture of earthquake energy release through lower magnitude events which occur much more frequently in these islands is contained in the SISRA Catalogue (Shepherd and Latchman 1984). During the last 450 years virtually all of these islands have been known to have experienced repeated violent shocks from tremors which frequently generated MM Intensities of VII to IX (Robson 1964).

EASTERN CARIBBEAN EARTHQUAKE EPICENTRES JUL – DEC 1990

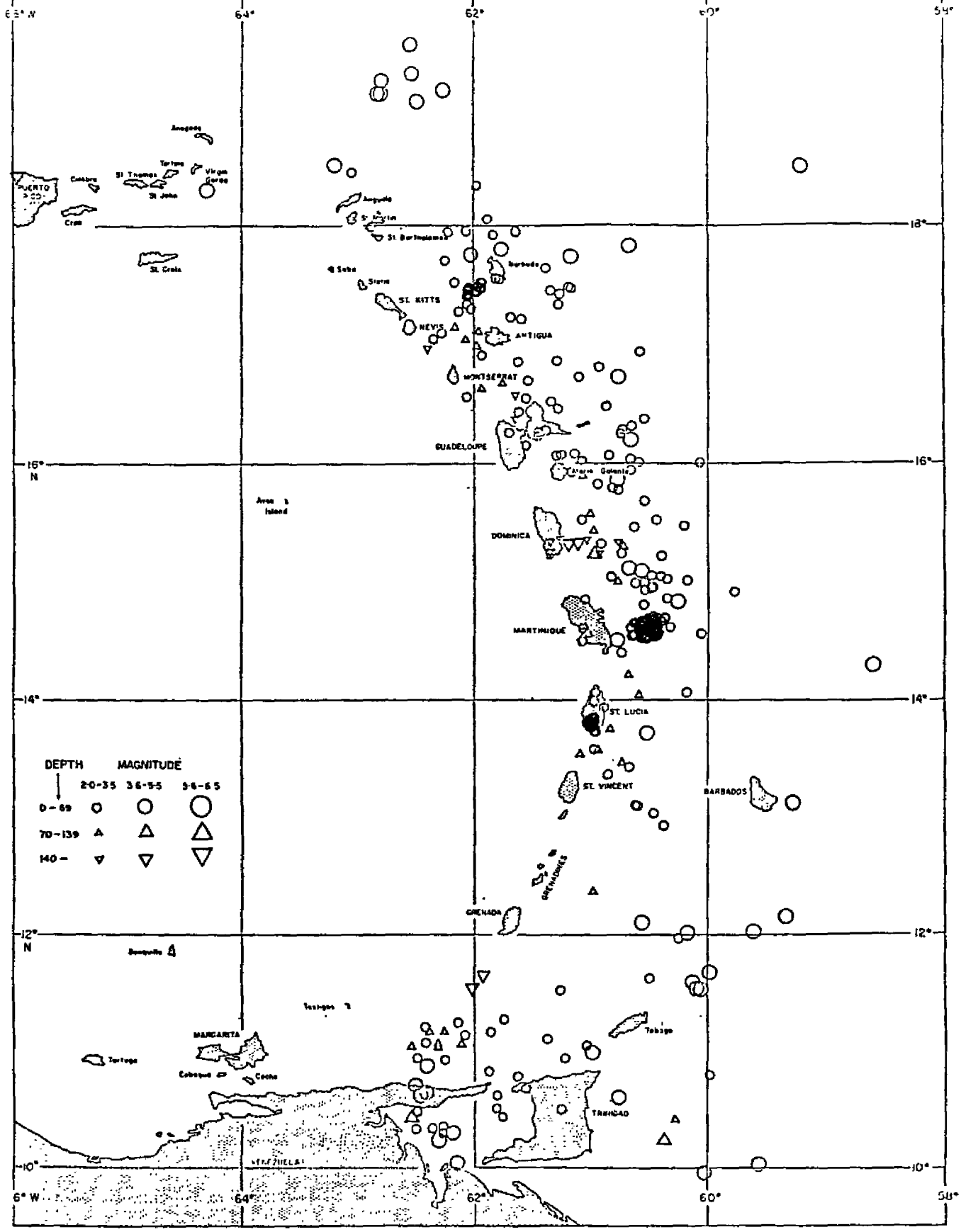


TABLE 1: Synopsis of Major Damaging Earthquakes

MM Intensities VIII-IX, (17th-20thC)

TERRITORY	DATE OF OCCURRENCES
St. Kitts/Nevis	1690, 1833, 1950
Martinique	1702, 1727, 1766, 1787, 1839
Guadeloupe	1843
St. Lucia	1788, 1839
Grenada	1822, 1888
St. Thomas	1824, 1867
St. Vincent	1834, 1844
Trinidad	1825, 1954
Antigua	1843
Dominica	1849
Montserrat	1897, 1934, 1935

(Source: Robson 1964)

Whilst the potential for serious damage and disruption exists with each significant occurrence this potential has been realised on many occasions such as the Trinidad 1825 earthquake when "scarcely a house escaped damage" and the 1843 Guadeloupe event which caused widespread damage from Guadeloupe to Montserrat. Should any event such as these occur today it is to be expected that their effects could be just as catastrophic. While it is recognised that a greater number of higher quality structures have been built during this century it is also true that a substantial portion of low quality construction still exists. Further to this the islands have been experiencing population growth in the order of 1-2% per annum resulting in significant increases in numbers in recent times (Table II).

Population pressures on the limited landspace have influenced widespread use of some sites which are not ideally suited for development. Additionally, it is usually the lower income groupings who occupy these marginal locations and they often do not incorporate the required engineering input to make their structures sufficiently earthquake resistant. To the extent that they are conscious of disaster preparedness their economic constraints induce a certain measure of fatalism which usually contributes to the horrendous statistics which accompany ground-shaking in less developed countries. A preliminary analysis in Trinidad alone indicates that approximately 100,000 persons fall into this category. Similar types of exposure may also be observed for areas occupied by higher income groupings

TABLE II: Socio-Economic and Political Configuration

TERRITORY	LANGUAGE	SIZE (sq ml)	POPULATION	GNP/CAPITA 1988(US$)
* Antigua	English	108	80,000	2800
* St. Kitts/Nevis	English	68	45,000	2770
# Montserrat	English	39	12,500	
% Saba	Dutch/Eng	5	1,000	6000
% St. Eustatius	Dutch/Eng	8	1,800	6300
+ Guadeloupe	French	1510	290,000	5000
+ Martinique	French		337,000	5000
* Dominica	English	305	82,000	1650
* St. Lucia	English	238	150,000	1540
* St. Vincent	English	150	114,000	1100
* Grenada	English	133	96,000	1370
* Barbados	English	166	255,000	5990
* Trinidad/Tobago	English	1864	1,300,000	3350

* Independent States (British Commonwealth)

\+ Department of France

% Self Governing Dutch Colonies

\# Self Governing British Colony

who may choose fashionable sites on landfill next to the seafront or similar areas. Although greater engineering input is observed in some of these latter cases, there are also glaring shortcomings which may lead experts to believe that the degree of earthquake resistance which is required in these areas has not been attained.

Cultural preference in design for specific purposes as well as traditional choices and utilisation of some indigenous materials contribute to a lower level of disaster preparedness than could be achieved for equivalent costs. For example, in Trinidad, it is not uncommon to see very expensive houses, and indeed whole communities, built after the 'top-heavy' design which includes a masonry structure with a substantial roof precariously suspended 8-14 feet off the ground on a dozen or so stilt posts of poorly reinforced concrete. Whereas this design maximises the available landspace and permits the operation of a small business or the rearing of cattle beneath the impressive superstructure, the latter is not expected to perform very well in a moderately large earthquake. In many areas where flooding is a perennial problem this type of construction minimises the inconvenience of one kind of hazard whilst dramatically increasing the risk for another hazard viz. earthquake. Particularly, in the case of Trinidad-Tobago which has experienced significant economic expansion in the last twenty-five years resulting in impressive growth of the physical assets

of houses etc, no serious survey has been done to evaluate the risk exposure associated with the afore-mentioned combinations of causative factors.

The Lesser Antilles contain approximately 20 potentially active volcanoes. With the exception of Trinidad - Tobago and the few outer arc or "Limestone Caribees", every island contains at least one volcano which warrants surveillance. In the unusual case of Dominica and to a lesser extent Montserrat there are a number of volcanic centres which are distributed across virtually the entire length of the island. More commonly is the situation as it exists in Martinique, Guadeloupe, St. Vincent and Grenada where the active volcano is located at one end of island with the rest of the island comprising largely extinct volcanic mountains. In the case of the smaller islands such as Nevis and Saba the volcanic edifice makes up the entire island.

From the early 17th century to present there have been approximately twenty (20) volcanic eruptions in these islands. One of the characteristic features of Caribbean volcanism which is typical of island arcs is the relatively long period of repose between major eruptions and the high level of explosivity of such eruption when they eventually occur. Absolute dating techniques, using the radiocarbon method, have identified a number of large eruptions during the not too distant past (Table III). All of this point to the likelihood of some repeat

TABLE III

C14 DATES OF SOME MAJOR ERUPTIONS OF ANTILLEAN VOLCANOES DURING THE LAST 5000 YEARS (numbers = years before present)

Soufriere ST. VINCENT	Mt. Pelee MARTINIQUE	Soufriere GUADELOUPE	Mt. Misery ST. KITTS	Soufriere MONTSERRAT
12	90	194	581 ± 68	304 ± 54
90	310 ± 60	429 ± 66	1480 ± 31	
320 ± 60	535 ± 80	1250 ± 70		
555 ± 70	615 ± 75	1440 ± 100		
615 ± 60	1140 ± 70	1545 ± 65		
1045 ± 70	1670 ± 20	1700 ± 75		
2480 ± 70	2010 ± 140	1800 ± 100		
2700 ± 90	2440 ± 70	3100		
3980 ± 80	4060 ± 90			
4260 ± 120	4225 ± 125			
	4610 ± 50			

occurrences at various volcanic centres at sometime in the future.

Caribbean volcanoes are notorious for producing a variety of deadly flow hazards, the most disturbing of which is the nuee ardente or glowing avalanche, also called 'death cloud'. These extreme hazards have the capability to totally devastate areas much larger than the total size of the islands themselves. More often then not though, when .pyroclastic flows occur they are confined to particular sectors of the volcanic edifice and its surroundings but invariably they run from the summit to well beyond the coastline. During this century we have had eruptions of these types of flow phenomena which have accounted for over 30,000 deaths. In the case of Mt. Pelée, Martinique 1902, except for two persons, the entire city of St. Pierre was wiped out with the loss of 29,000 lives. An estimated 240,000 persons are currently exposed to the potential of similar hazards at this time in the Eastern Caribbean. In some cases it is the main administrative centres, the capital towns, which appear to be most exposed. From time to time many of the volcanic centres become highly seismically active but these seismic crises have not culminated in eruptions, however, their manifestations require the same careful monitoring as actions which eventually result in explosive activity.

Recently, investigations have identified debris avalanche

events similar to the much publicised 1980 Mt. St. Helens occurrence. Evidence for this type of super hazard has been advanced for volcanoes in Martinique, Guadeloupe, St. Vincent and St. Lucia (Vincent et. al 1989, Boudon et al 1988, Rowley 1978, Wright et al 1985).

Airfall ash from vertical explosions can affect a very wide area, well beyond the territory which contains the erupting volcano. As is the case of earthquakes a major volcanic eruption does not recognise political boundaries therefore a hazard source in one island may easily produce serious physical inconvenience, psychological stress and economic ruin in areas outside of the source territory. Many of the northern or Leeward Island territories are only a few tens of miles apart and are heavily dependent on tourist arrivals as their economic mainstay. An erupting volcano which spews ash in sufficient volume and on a sustained basis to interrupt air transport in this cluster of islands will have serious economic consequences even if it does not cause a single casualty. The same is true for an earthquake which damages utilities and accommodation facilities. In the case of the Windward group of the Lesser Antilles, in addition to tourism there is also a substantial dependence on banana exports. Moderate to heavy airfall ash on banana plantations could spell instant intolerable losses in a very fragile economy. Even though the duration of the actual event itself may be short-lived the economic disruption could have much more lasting deleterious

effects. This aspect of the potential problem becomes clear when it is realised that virtually all of the Caribbean economies are perennially operating with very little surplus and in most cases have great difficulty in posting any form of positive economic growth.

Given the landscape of political fragmentation and a history of zealously guarding the preservation of authority in each island state it comes down to a situation where planning for disaster preparedness is being made virtually on an island by island basis with each decision being taken by a different government. Although, the English speaking unit of the region maintains a joint monitoring system through the U.W.I. this functions mostly as an alarm bell. The French maintains individual observatories in Martinique and Guadeloupe with back-up from metropolitan France. The Dutch population may simply be evacuated since they are relatively small and no monitoring is currently being done. Once the alarm is sounded it becomes a matter for the particular government which may not have established disaster preparedness lines of communication with its neighbours on whom may descend thousands of affected persons who seek refuge with relatives or friends nearby. It is estimated that in Trinidad there are over 100,000 persons with close familial links with Grenada, St. Vincent and Barbados. A similar relationship exists between Antigua and its neighbours. St. Thomas and St. Croix, U.S.V.I. are now home to a large number of

persons of Kittitian and Antiguan parentage. In the context of the socio-economic and political peculiarities of the Eastern Caribbean island states, the sudden displacement of a few thousand persons from one island to another in response to a manifest or impending natural hazard could in itself be as big a political and economic problem as the direct effects of the phenomenon itself.

Given the economic tightrope and the structure of political authority there exists the potential for disaster preparedness to be overly influenced, not by what the circumstances demand, but by what is logistically palatable, politically expedient and economically affordable. This being the case there is a very good chance that the decision to evacuate a capital town threatened by a volcano may be unduly delayed in the face of the magnitude of the effect of such action in a tiny independent territory. In view of the fact that evacuation is the only sensible action in response to a massive volcanic threat there exists in the Caribbean today the potential for a repeat of the Soufriere (Anderson & Flett 1903) or Mt. Pelee type (Lacroix 1904) disaster of 1902.

Equally disastrous is a panic response which triggers an unwarranted evacuation for fear of risking too large and important a section of the population. All the Eastern Caribbean islands are run by multi-party democracies constantly caught up

in election fever or furore. It is not too difficult to appreciate how fertile a field this aspect of governance becomes for nurturing political issues. Recent experiences, St. Vincent 1971 (Aspinall et al, 1972) Guadeloupe (Fiske 1984) have demonstrated that a seismic crisis at a volcanic centre or a geologically insignificant explosion at a crater could be even more politically deadly than a major event such as Mt. St. Helens or Soufriere 1902. In the latter cases there is the possibility of obtaining national approval if not consensus whereas in the case of the false alarms there is no chance of a sitting government escaping villification. This situation could only result in political nervousness which can undermine the best laid disaster preparedness plan. The Guadeloupe event of 1979 was instructive in this latter scenerio (Fiske 1984). It was only the political nexus of this island with metropolitan France which prevented this evacuation from becoming a calamity on its own accord.

It is generally accepted that the successful management of any risk is dependent on the degree of preparation which is associated with the hazard potential. The first step is an awareness of the condition or the likelihood of its development. This is to be followed by mitigative action. With respect to the Eastern Caribbean and its major geodynamic hazards potential the agenda for future action must include not just an appreciation of the character of the hazards themselves but the likely economic

and political reactions which will be triggered by the ocurrence of a major hazard-causing event. It is only against this background that appropriate disaster preparedness can be fashioned for the region. The current deficiencies really show up when an action scenario is modelled. Many island states have some form of documented hazard response proposals but very few, if any, contain assessments of the economic impact of the event and its immediate effect in reducing the capacity of the affected territory to cope with the immediate aftermath. Current response procedures are usually based on a "freeze-frame" pre-event condition which automatically ceases to be valid once an event begins, thereby reducing the effectiveness of these projected or anticipated responses.

In short, the Eastern Caribbean states have a relatively high vulnerability to some natural hazards which have the potential to cause serious social and economic disruption whilst the states themselves, acting on their own, have only a very limited response capability. This being so, reliance on regional cooperation dictates a well laid pre-arranged political avenue to overcome the current disadvantages embodied in the political jigsaw. Even so the regional response may itself not be adequate to provide a satisfactory pre-event monitoring capability as well as a post-event response. In which case there is need for in-depth advance planning in conjunction with larger neighbours and the relevant international agencies so as to procure the

necessary resources. Appropriate studies of a social and scientific nature are urgently required to provide the information for advance planning and general decision making at the regional political level.

The Eastern Caribbean contains three institutions, the U.W.I., the Caricom Secretariat (CARICOM) and the Organisation of Eastern Caribbean States (OECS), which have the existing framework within which the future action can be developed and channelled. What seems to be lacking is the elevation of disaster preparedness to a sufficiently high priority level to attract the serious attention of the decision-makers to influence the allocation of scarce resources in this direction. The writer is of the view that if the regional information is properly assimilated and addressed at the correct quarter then those international agencies and friendly neighbours who will be looked upon to respond during any major disaster could also be encouraged to participate in the necessary advance planning efforts aimed at disaster mitigation.

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