Hazards of the Jamaican Coastline. Part One.
THE GREAT SAV SUBMARINE SLIDE

This is the first in a series of articles on the Hazards of the Jamaican Coastline contributed by The Marine Geology Unit, Department of Geography and Geology, University of the West Indies.

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What Devastated Savanna-la-Mar in 1780? Was the weapon of mass destruction a hurricane? an earthquake? a tsunami? Or all three?

The time was midday on October 3, 1780. In the small seaport of Savanna-la-Mar residents were looking skywards at the signs of an approaching storm. Some were shuttering their dwellings and business places, most of which were scattered along the waterfront and straddling either side of the single main street. At this time Savanna-la-Mar, with its sixty or so houses, was the capital of the Parish of Westmoreland and considered to be the foremost town in the county of Cornwall. The town had been established some seventy-five years before. Montego Bay's assumption as the leading town in western Jamaica had not yet taken place. Most of the produce of Westmoreland, as well as much from other parts of the county, was exported through Sav, although the harbour, really an open roadstead, lacked the shelter and protection offered by others, such as Bluefields or Long Bay. The coast, flat and low-lying, with elevations seldom more than a metre above sea level, formed the flood plain of the Cabarita River. The fort on the waterfront, dilapidated and in a sad state of disrepair, was being undermined by erosion from the sea.

It is probably not an exaggeration to say that what happened in the next few hours changed the character of Savanna-la-Mar for ever. An account of the hurricane that swept the island of Jamaica has come down to us through a report contained in the Annual Register for 1781, quoted by Thomas Southey in his 1827 book on the history of the West Indies.

> *"About 1 p.m. the gale began (at Savanna-la-Mar), from the S.E., and continued increasing with accumulated violence until four in the afternoon, when it veered to the S. and became a perfect tempest, which lasted in force until near eight; it then abated. The sea during the last period exhibited a most awful scene; the waves swelled to an amazing*

height, rushed with an impetuousity not to be described on the land, and in a few minutes determined the fate of all the houses in the Bay. About ten the waters began to abate, and at that time a smart shock of earthquake was felt. All the small vessels were driven ashore and dashed to pieces. The ships Princess Royal, Henry, and Austin Hall, were forced from their anchors and carried so far into the morass that they will never be got off. The earthquake lifted the Princess Royal from her beam-ends, righted her, and fixed her on a firm bed. The circumstance has been of great use to the surviving inhabitants, for whose accommodation she now serves as a house."

The accompaniment of the hurricane by an earthquake is unusual for Jamaica and is recorded only on one other occasion. However, hurricanes do seem to be able to trigger earthquakes during their passage. Randall Peters of Mercer University in Macon, Georgia, has recorded submarine earth tremors during the passage of Hurricane Charley over Florida in 2004.

Judy Tomblin and Geoffrey Robson, in their 1977 catalogue of earthquakes in Jamaica, assigned an intensity of IV on the Modified Mercalli scale to the Savanna-la-Mar event, which is to say that the earthquake would have caused vibrations, rattling windows, doors and dishes, and swaying parked vehicles, but would not have caused any serious structural damage. These writers summarized the happenings of that fateful afternoon as follows:

"*Savanna-la-Mar, 22.00 hr. A great sea wave devastated the western coast of Jamaica and swept away the town of Savanna-la-Mar. About 300 persons perished. Terrific storm 13.00-20.00 h. At 22.00 h there was a smart shock of an earthquake, and the waters subsided.*"

Tomblin and Robson added that Stephen Taber, in his 1920 account of Jamaican earthquakes commented, regarding the Savanna-la-Mar event, that "*The information that has been preserved concerning the earthquake and sea wave is far from satisfactory*", While the hurricane of October 3 was very destructive throughout Jamaica, the earthquake "*seems to have caused little or no damage and the effects of the sea wave were of importance only on the west coast which has few settlements*".

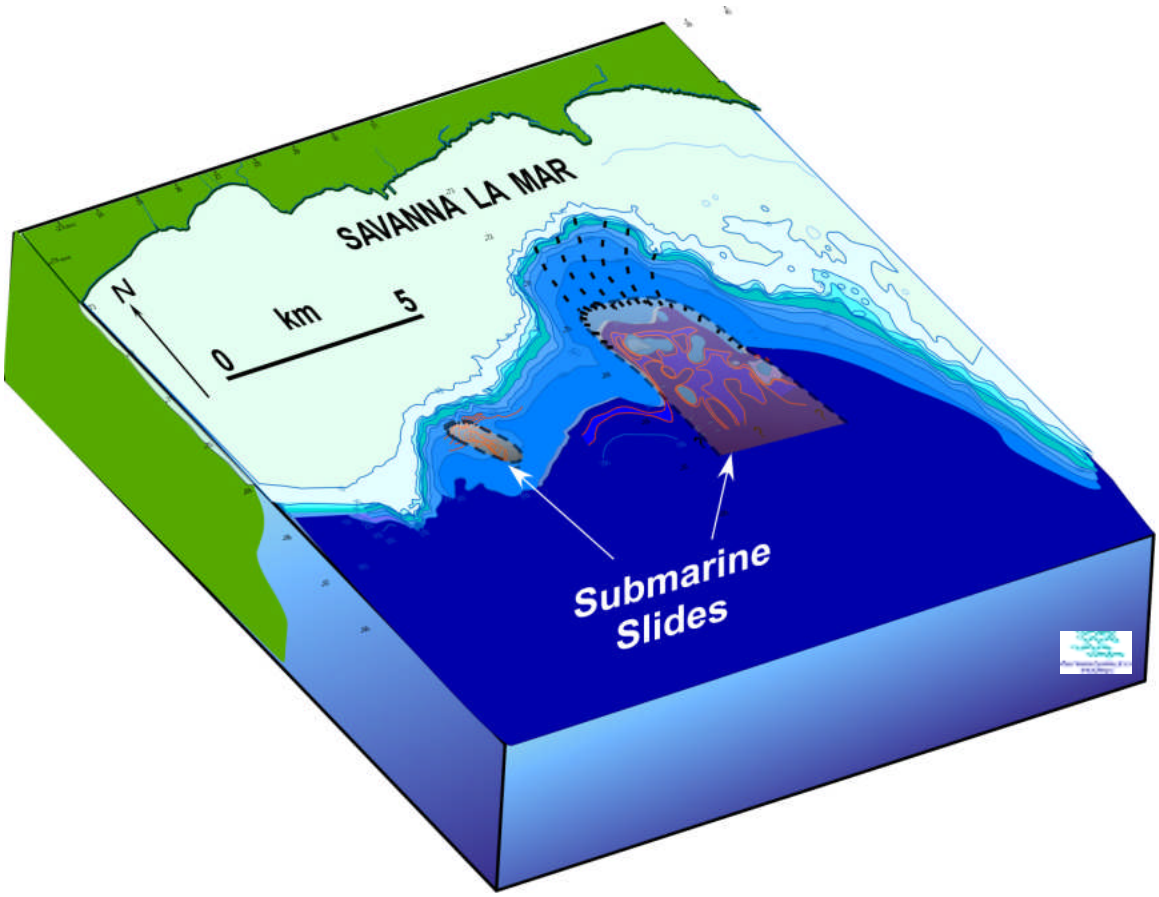
These comments by Taber are worth reviewing. Were the boats dashed ashore before or after the earthquake? It appears that both the earthquake and the extremely destructive waves were limited to the southwestern part of the island, although the hurricane was island-wide. From the description given of the changing wind direction, it is apparent that the hurricane was moving in an easterly or northeasterly direction, which would be typical of a late-season hurricane in the western Caribbean. That this was the direction of movement is borne out by the account covering Montego Bay which put the hurricane's greatest fury there in the night hours.

Some commentators have suggested that the intensity of the storm surge generated by the hurricane might have been augmented by a "tidal wave" or tsunami, possibly the result of the earthquake. But until now the evidence for such an event has not been substantiated.

Recently, the research team of the Marine Geology Unit, at the Department of Geography and Geology, University of the West Indies, began carrying out an examination of the high density soundings of the sea floor around Jamaica, carried out in surveys by the British Royal Navy during the middle and later parts of the last century. Among the areas examined has been that along the southwest coast of Jamaica, between Whitehouse and Savanna-la-Mar. Almost immediately we discovered strong evidence of two, perhaps three submarine landslides (or submarine slides). Two of these lie directly south of Savanna-la-Mar, some five to six km off the coastline, in about 300 metres of water.

Why are submarine slides important? Because they can generate tsunamis. Notwithstanding the terrible earthquake-generated event in the Indian Ocean, most tsunamis probably result from submarine slides. When such a slide occurs, there is an immediate, local change in the configuration of the sea floor. It is the sudden change in sea floor shape that gives rise to the tsunami waves, whether caused by fault movements as in the Indian Ocean, or by a downslope slippage of sediments into or under the sea, as happened at Port Royal in 1692. The telegraph cable breaks that have occurred during recent hurricane activity around Jamaica were probably due to local, small slope failures. If the larger of the two Savanna-la-Mar slides occurred as a single event, the volume of material that moved would have been almost 30 times larger than the slide that wiped out Port Royal. Imagine the effect of such an event today, now that there are so many more people living along Jamaica's coastline. If we can learn more about what our submarine terrain looks like, we can identify the slides which may exist and perhaps predict where they may occur in the future.

Having identified the submarine slides off the coast of Savanna-la-Mar we then asked ourselves, could either of these slides have resulted from that storm of 1780? Could the local earthquake have been powerful enough to trigger a submarine slide? More interestingly, could a submarine slide, perhaps triggered by the storm, have generated the earthquake? Peters, in the same article in the New Scientist magazine mentioned above suggests the tremors he recorded may also have caused a subterranean slide as indicated by a sharp seismic spike that showed on his instruments as the hurricane grazed the continental shelf on its way back out to sea.



One completely speculative scenario for Savanna-la-Mar is as follows. The hurricane, which evidently hit the southwest corner of Jamaica first, was of such intensity that the storm waves disturbed the seafloor sediments lying on the edge of the island shelf in about twenty metres of water. Eventually the repeated pounding by the waves triggered a submarine slide, depositing up to 20 million cubic metres of the shelf edge into the deeper water beyond. This sudden change in the undersea topography caused the earthquake registered onshore, and also generated a final large tsunami (the great sea wave of Tomblin and Robson) that helped in pushing various boats far in from the coastline and contributed to the final destruction of the town.

These are speculations that can only be addressed more positively when we know how old the submarine slides are. A very important question that cannot presently be answered is "How often do such slide-generated tsunamis occur in the Jamaican region?" It is quite feasible to carry out dating on deposits 300 metres below sea level, provided the right kinds of ship and equipment are available. Until we obtain such assistance, our questions remain purely speculative. But we think this may be the smoking gun….

And what about the huge, hundred-ton boulders that litter the rocky shoreline west of Savanna-la-Mar? How did they get there? Where do our beaches come from anyway? And why is the study of beach erosion and rising sea level so important for the future well-being of development along the Jamaican coastline? We hope to address these topics in future stories on hazards of the Jamaican coastline.

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