SCIENCE AND FOLKLORE TEACHING FROM THE NOVEMBER 18, 1929 'GRAND BANKS' EARTHQUAKE AND TSUNAMI: "LIKE A RIVER RETURNING"

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ABSTRACT

The 'Grand Banks' event was Canada's most tragic, known, historic earthquake. It was an event quite unknown in the lives of most who felt it in Atlantic Canada. The M_s (surface wave magnitude) 7.2 earthquake of Monday, November 18, 1929 struck at 1702 NST (1632 AST; 2032 UTC). The hypocentre was some 18 km below the seafloor at the mouth of the Laurentian Channel in 2 km of water depth on the continental slope south of the Burin Peninsula on the south coast of what was then the British Colony of Newfoundland. It was felt as far away as Montréal, in the New England states as far south as New York City, and there is even a serendipitous felt report in Bermuda of a probable seismic 'surface wave'; it registered on seismographs around the world. It is still remembered by older residents of the Atlantic Provinces as the only felt earthquake experienced in their lives. Onshore the damage from the earthquake's shaking was restricted to some slumping and minor building damage in Cape Breton Island; some chimneys were dislocated resulting in subsequent chimney fires in the next few days. Newfoundland, despite its proximity to the epicentre, experienced virtually no physical damage onshore.

Two-and-a-half hours after the event, on a dead calm, bright, moonlit night, on a rising high tide, three main pulses of a tsunami arrived, quite unexpectedly, along the coast of the Burin Peninsula, with amplitudes of 6 to perhaps 14 m. There was an initial slow withdrawal of the sea to expose ocean floor in places never before seen by local inhabitants, then the water returned in three positive pulses over a half-hour period that rose 3 to 7 m above sealevel in St. Lawrence harbour and Taylor's Bay respectively. The height and forward momentum of the arriving tsunami caused the runup to rise to as much as 10 to 13 m above sealevel at the ends of the long narrow harbours such as Port au Bras, St. Lawrence, Little Lawn Harbour, Lawn, Lord's Cove, Taylor's Bay, and Lamaline. Twenty-eight persons lost their lives, and the fishing capability of the coastal communities was devastated.

There was as yet no road to connect the communities to each other or to link the Burin Peninsula to the rest of Newfoundland to the north. Landline telegraph communications with the rest of the Island had been broken by a storm two days earlier, and the tsunami took out the land lines between the coastal communities. In St. Lawrence the telegraph station ended up floating in the harbour. The Burin had to cope on its own for two-and-a-half days before a coastal ferry named the *PORTIA*, which had a working wireless radio, arrived on the scene. Despite the success of wireless 17 years earlier during the *TITANIC* disaster, the local communities had no radio sets, and while a wireless was available on the *DAISY* situated in Burin harbour, no-one knew how to operate it to get a message out!

The tsunami was seen in Cape Breton Island, Nova Scotia, at about 2000 AST on November 18th, where it did minor damage. The one possible death in Nova Scotia has been shown to be false and was based on incomplete information. The tsunami refracted counterclockwise around the Avalon Peninsula to arrive in the Bonavista area about 0130 NST the next morning. The tsunami was physically seen along the coast of Nova Scotia as far southwest as Lunenburg, and in Bermuda at about 2000 local time in the evening. It rose in Halifax Harbour, where it flowed over the gates of the commercial drydock at Halifax Shipyards for five minutes and is recorded on the tide gauge record. The only tide gauge operating in Atlantic Canada to record the tsunami was in Halifax; the British had not yet installed a tide gauge anywhere in their colony of Newfoundland (or in Bermuda).

The tsunami travelled at about 615 km/hr south and eastwards in the deep ocean; the tsunami travelled at about 105 km/hr over the shallower continental shelf of Canada north and westwards. The tsunami was recorded on tide gauges as far south as Charleston, South Carolina, in the United States, in the Azores, and on the west coast of Portugal; it was not seen on the gauge in France. The tide gauge records for the United Kingdom were destroyed during WW II bombings. The rather high water recalled by many Newfoundlanders as the "tidal wave" on the next morning of Tuesday, November 19, 1929 was not the tsunami. It was a significant storm surge of an early winter storm that had tracked up the Atlantic coast from New England and the Maritimes over the past day. It snowed that day on the Burin and turned bitterly cold, making life even more miserable for people affected by the tsunami.

At the instant of the earthquake, five transAtlantic telegraph cables broke in numerous places near the top of the continental slope as the underwater landslides began to move down into deeper water. Over the next thirteen hours, seven more cables parted progressively in deeper and deeper water, and more and more distant from the initial breaks. The repairs to the twenty-eight breaks in the twelve transAtlantic telegraph cables required all available cable ships, and repairs stretched well into 1930. At the time, the mechanism of the seafloor disruption was not understood, and was not successfully worked out for some 23 years. It is now known that the earthquake's strong vibrations shook loose and mobilized up to 200 cubic kilometres of ocean floor sediments on the continental slope. The underwater slump, or landslide, travelled downslope, initially at speeds of up to 50 to 70 km/hr (≈19 m/s), as a slurry of water and sediment, now called a "turbidity current". The turbidity current has been documented to be 300 m thick on the continental slope. The turbidity current laid down a graded deposit in its distal areas; this has been cored up to 1200 km from its source out across the Sohm Abyssal Plain.

The onshore geological signature of the 1929 tsunami has been found in many of the harbours along the south coast of the Burin. At Taylor's Bay the tsunami's signature clearly shows as a band of white sand about 10 cm down in the brown peat (see photograph at the Dalhousie University Department of Earth Sciences website http://earthsciences.dal.ca/people/hap/ruffman/ruffman.html). A case study at St. Lawrence and a careful mapping survey around "the bottom" of Taylor's Bay have allowed the zone of tsunami runup and the tsunami deposit to be mapped. In St. Lawrence community growth has gone forward without regard to the 1929 runup zone, or a possible recurrence. In contrast, the village of Taylor's Bay has never recovered from its losses on that fateful November 18th evening. Documenting of community folklore has allowed a rich oral history of the event, songs, stories, poems, photographs and myths surrounding the event, to be documented throughout the Burin Peninsula.