COMMENT ON: *TSUNAMIS AND TSUNAMI-LIKE WAVES OF THE EASTERN UNITED STATES* BY PATRICIA A. LOCKRIDGE, LOWELL S. WHITESIDE AND JAMES F. LANDER WITH RESPECT TO THE NOVEMBER 18, 1929 EARTHQUAKE AND ITS TSUNAMI

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This most valuable compilation by Patricia Lockridge *et al.* (2002) covers a wide range of tsunamis and tsunami-like events ranging from marine tectonic, volcanic, and landslide tsunamis to possible meteorologic tsunami-like events. Lockridge *et al.*'s (2002) massive text table (pp. 124-141) entitled "Description of Events" covers events from 1668 to 1992. The 2002 paper in *Science of Tsunami Hazards* was clearly intended to be an update of, an extension to, and a sequel to, the first east coast and Caribbean tsunami compilations contained in Lander and Lockridge's 1989 National Geophysical Data Center volume *United States Tsunamis (including United States Possessions) 1690-1988*.

The Lockridge *et al.* (2002) compilation contains a small error with respect to the 1929 "Grand Banks" Earthquake and Tsunami of which I may be cause in part. In addition the tsunami histories of oceans without a tsunami warning system will be now receiving much closer attention, including historic events in the Atlantic Ocean given the events of December 26, 2004 and March 18, 2005 in the Indian Ocean; both the Atlantic and the Indian Oceans have no tsunami warning system and have an incomplete tsunami history.

THE "GRAND BANKS" EARTHQUAKE AND TSUNAMI

The November 18, 1929 tsunami was created by an M_s 7.2, M_w 7.1, m_B 7.1 earthquake at 2032 UT that occurred 18 km below the 2-km-deep upper continental slope at the mouth of the Laurentian Channel (Bent, 1994; 1995) some 265 km south of the Burin Peninsula on the south coast of Newfoundland at 44.691°N, 56.006°W (Dewey and Gordon, 1984). The earthquake shook loose and mobilized about 200 km^3 of material on the continental slope and rise in what was the first identified and first defined 'turbidity current' (or underwater landslide). Lockridge *et al.* (2002) cited the key 1929-1930 period references, but did not cite W.W. Doxsee's most important review of the event published in 1948, or a number of the more recent references. The Doxsee review appears to be what may have spurred the thinking of the Lamont-Doherty Geological Observatory scientists at Columbia University who were finally able to so nicely explain the cause of the November 18, 1929 tsunami four years later - what we would now call a landslide tsunami (Heezen and Ewing, 1952; Kuenen, 1952; Kullenberg, 1954; Shepard, 1954; Heezen *et al.*, 1954; Heezen and Drake, 1964; Fruth, 1965).
I would recommend that students of the November 18, 1929 tsunami that struck southern

Newfoundland and Nova Scotia obtain a copy of the Doxsee 1948 reference. More modern references vis-à-vis this 1929 underwater landslide event would now include Adams and Basham, 1989; Basham and Adams, 1982; Basham *et al.*, 1982; Bent, 1994; 1995; Dewey and Gordon, 1984; Fine *et al.*, 2005; Hughes Clarke, 1986; 1987; 1990; Hughes Clarke *et al.*, 1989; 1990; Mayer *et al.*, 1988; Piper and Normark, 1982; Piper *et al.*, 1985; 1988; 1999; Ruffman, 1991; 1993; 1995; 1996; Shor *et al.*, 1990; and Tuttle *et al.*, 2004.

1929 TSUNAMI'S HEIGHT AND RUNUP HEIGHT

Lockridge *et al.* (2002) stated that the November 18, 1929 tsunami "surged up several inlets to a height of 15 m" (p. 131). My studies of this event have documented a tsunami wave height of 4 m above sea level on a rising 'spring', or perigean, tide in Great St. Lawrence Harbour (Ruffman, 1996) and 7 m above sea level in Taylor's Bay (Ruffman, 1993; Tuttle *et al.*, 2004) as the tsunami rolled up the harbour as a breaking wave in both locations. We really have no firm data of the depth to which the sea initially withdrew other than anecdotal observations that people saw the harbour floors exposed under the light of a full moon in places where they had not ever seen the seafloor before.

In the first case, in St. Lawrence Harbour, we documented a runup height of about 13 m and at Taylor's Bay about 10 m; in St. Lawrence mainly from oral history and modern detailed topographic maps (Ruffman, 1995; 1996) and in Taylor's Bay from oral history and detailed levelling (Tuttle *et al.*, 2004). I do not believe that the true runup height of the 1929 tsunami has been determined at any other locations at this point.

This section of Lockridge *et al.* (2002) also noted the November 18, 1929 M_s 7.2 earthquake "generated a local tsunami (perhaps a landslide tsunami) that was recorded at Atlantic City ..." (p. 121). I believe that the authors could have been much more definite. The November 18, 1929 hypocentre was 18 km below the ocean floor at the mouth of the Laurentian Channel where water depths were 2 km. Dewey and Gordon (1984) and Allison Bent (1994, 1995) provided a modern relocation and a fault plane solution respectively. No modern authors have suggested that there was a tectonic break of the ocean floor, but rather that the earthquake's shaking precipitated a significant landslide on the upper continental slope. Modern sidescan sonar and seamarc data as well as submersible observations from ALVIN have confirmed the landslide hypothesis (Piper and Normark, 1982; Piper *et al.*, 1985; 1988; 1999; Hughes Clarke, 1986; 1987; 1990; Hughes Clarke *et al.*, 1989; 1990).

Lockridge *et al.* (2002) need not have qualified their statement on p. 121 -- It ***was*** a landslide tsunami -- not 'perhaps' a landslide tsunami!

1929 TSUNAMI'S DEATH TOLL

Lockridge *et al.* (2002) cite deaths of 28 persons in Newfoundland and one in Nova Scotia (p. 131). In their introductory section on 'Notable Historical Events' they cite "29 deaths along the coast of Newfoundland ... but none of these deaths were in the United States." (p. 121). I am cited as a source, and I am afraid I may be the cause of a slight error, in the number of deaths noted by Lockridge *et al.* (2002). In Ruffman *et al.* (1989), a paper given at the June 22-24, 1989 meeting of the Canadian Nautical Research Society in Halifax, Nova Scotia, I indeed did cite 29 possible deaths, including a death in Nova Scotia -- a Mr. John MacLeod.

However, I've since corrected that with a 1994 article in *Cape Breton's Magazine* and in a 'Comment' in *Geology* (2001) which perhaps was published too late to be included in the Lockridge *et al.* (2002) review article? I have established that John MacLeod, who was reported missing at the time in local newspapers, was in fact having a meal with local people that I've now interviewed, so that he must now be struck from the list of 1929 victims.

On the occasion of the 75th commemoration of the "Grand Banks" Earthquake and Tsunami, a local Newfoundland genealogist and I have prepared a major paper, wherein we seek to correct many large and small errors in the list of the names of the victims of the November 18, 1929 tsunami (Ruffman and Hann *et al.* In Press). In this we put the Nova Scotia reported 1929 tsunami death to bed:

> If any readers are diligent, they may find a couple of documents archived at the Centre for Newfoundland Studies at the Queen Elizabeth II Library of Memorial University of Newfoundland, and in a published abstract of a talk given to the Canadian Nautical Research Society on June 22-24, 1989 that the senior author for a while used a 1929 tsunami death toll of 29 persons. John MacLeod was employed in November 1929 as a night watchperson in a sawmill facility owned by R. Dunphy of Point Tupper, Nova Scotia. The sawmill and the watchperson's shed were on a barge anchored in Lower River Inhabitants in Richmond County, southern Cape Breton Island, Nova Scotia. The barge broke loose as the tsunami ran north up the river, and was smashed into the underside of the new railroad bridge some distance upstream. The barge's topsides were crushed and destroyed.
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> The Halifax *Herald* newspaper of Monday, December 16, 1929 (p. 3, cols. 7 and 8) reported that MacLeod, a "middle aged man", was missing, and that "interested parties are making inquiries in the vicinity in the hope that something definite will be found out within the next few days." The matter never reappeared in the Nova Scotia newspapers. Eventually Ruffman established that Mr. MacLeod was at a local home sharing a meal when the tsunami destroyed his place of work, and that he did not die in the event so Mr. John MacLeod was removed from the list of the 1929 tsunami victims.

I apologise for any confusion I may have caused with my 1989 abstract.

This small criticism and refinement of the work of Patricia A. Lockridge, Lowell S. Whiteside and James F. Lander should not be construed in any way as a criticism of their important work and that of the U.S. National Geophysical Data Center. Rather I recognise that with the loss of James Lander and Patricia Lockridge to the field of research, through illness and retirement, the tsunami work of the National Geophysical Data Center has gone into a period of quiescence. The horrendous events in the Indian Ocean as a result of the Sumatra subduction zone mega earthquakes will, I hope, spur the tsunami research community to action to insist that the tsunami database of the National Geophysical Data Center be continued and expanded. All of us working in the historical tsunamis and seismicity field will have new data, and refinements to data, to contribute to what I trust will be an ongoing compilation, especially in the Atlantic and Indian Oceans.

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REQUEST FROM AUTHOR

Alan Ruffman is a marine geophysicist who has done historical seismicity research on the November 18, 1929 Laurentian Slope or "Grand Banks" Earthquake and Tsunami, on the Pre-Confederation Historic Seismicity of Nova Scotia from 1752 to 1967, on a very tragic September 11-12, 1775 Hurricane and storm surge in Newfoundland, on the Saxby Gale, a hurricane of October 4-5, 1869 in Maine and New Brunswick and its record storm surge in the upper reaches of the Bay of Fundy, and on an August 1873 tragic hurricane in Atlantic Canada. He is presently actively searching for primary accounts of the arrival of the November 1, 1755 Lisbon Tsunami along the east coast of North America and in the Caribbean. He has realised that the historic tsunami history will be of greater interest since the Boxing Day tsunami in the Indian Ocean given that the Atlantic Ocean is no better protected than was the Indian Ocean on December 26, 2004 when it comes to a Tsunami Warning System. He has also realised that while many people refer to the Lisbon Tsunami arriving in the eastern Caribbean islands, few - very few - writers cite period, or primary, sources for such data. He would welcome any leads of readers to such coeval, or near-coeval, documentation relevant to the arrival of the November 1, 1755 Lisbon Tsunami along the shores of the western Atlantic, in the Caribbean or along the northeast coast of South America.