

Extension of the St. Lawrence fault zone into, and beyond, western Lake Ontario

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It had been suggested that the St. Lawrence fault zone extends upstream along the St. Lawrence Valley, through Lakes Ontario and Erie, toward New Madrid Missouri in the central USA. Seismic activity associated with this zone includes at least four magnitude 7 earthquakes in the Charlevoix region of Québec, as well as earthquakes of approximately magnitude 6 near Montreal and Cornwall. Thus, if the St. Lawrence fault zone extends into western Lake Ontario, its presence would add significantly to the risk of a major earthquake in the vicinity of the Darlington and Pickering Nuclear Generating Stations because that zone passes within about 30 km of both. The current seismic hazard assessment, however, implies that the St. Lawrence fault zone does not continue upstream beyond Cornwall, Ontario.

Numerous examples of mesoscopic-scale brittle faults, which are adjacent, and parallel, to the St. Lawrence River, occur in the rocks of the 1000 Islands region, southwest of Cornwall. The Hamilton-Presqu'île Fault, which lies along the

projection of the St. Lawrence, extends further to the southwest, from Prince Edward County almost into Hamilton Harbour. Finally elevation measurements of stratigraphic contacts in exposures on opposite sides of the Dundas Valley, west of Lake Ontario and aligned with the projection of the St. Lawrence fault zone, indicate evidence of vertical fault separation across the valley. That makes a compelling argument for the continuation of the St. Lawrence fault zone at least as far southwest as the Dundas Valley.

In addition to bedrock faulting, faulting has been recorded in unconsolidated sediments beneath Lake Ontario. Those young faults, with throws in the lake-bottom sediments of up to 22 m, lie in a 15 km-wide zone along the southern margin of the extension of the St. Lawrence fault zone. The foregoing argues that an earthquake of $M=7$, in the vicinity of the Pickering and Darlington Nuclear Generating Stations, should not be regarded as impossible.