

Surficial pop-ups as geological indicators of major seismicity in eastern North America

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Pop-ups are surficial, stress-relief structures typically characterized by unbent limbs, and abrupt, elongate hinges. They form in response to high horizontal stress, and are present in both quarries and open fields. In eastern North America they generally occur along, and in proximity to, the St. Lawrence Valley and its southwestward extension through the lower Great Lakes.

Large-scale earthquakes are sub-surface, stress-relief phenomena and have been triggered in unexpected locations in eastern North America. Pop-ups have been recognized in, and near, the epicentral areas of some of the larger ones,

including those in Montreal (est $m_b = 5.6-6.0$), Attica ($M = 5.8$), Cornwall-Massena ($M = 5.9$), and the Miramichi region ($m_b = 5.7$). However, pop-ups are also found in aseismic areas.

Sub-surface earthquakes and surficial pop-ups are both kinematically congruent with the current regional stress field. This, and the presence of pop-ups in several known seismically active areas, suggests that pop-ups may signal areas subject to a greater seismic hazard than estimated exclusively from seismicity data.