

EGU24-1542, updated on 25 Jan 2025

<https://doi.org/10.5194/egusphere-egu24-1542>

EGU General Assembly 2024

© Author(s) 2025. This work is distributed under the Creative Commons Attribution 4.0 License.



## Neotectonics in southern Ontario: Pop-up structures and their implications for seismic hazards in intraplate settings

**Abigail Clark**, Alexander Peace, Carolyn Eyles, and Ethan Davies

McMaster University, School of Earth, Environment and Society, Hamilton, Canada

Intraplate neotectonism is generally not well documented and understood despite its significance for seismic hazards in areas such as eastern Canada. This study aims to provide an in-depth structural analysis of potential neotectonic pop-up structures in southern Ontario, Canada, leading to a more comprehensive definition of pop-up structures, and ultimately constrain the processes involved and extent to which neotectonism impacts the region. Three locations in Southern Ontario were documented using a combination of ground and drone-based structural analysis: 1) Fletcher Creek Ecological Preserve, 2) Wainfleet Wetlands, and 3) multiple sites on Manitoulin Island. Sites were chosen where previous work had documented neotectonic activity, and/or where initial geomorphic analyses indicated the possibility of pop-up structures. The locations are all located within the Ordovician to the Devonian Niagara Escarpment stratigraphy. Fracture patterns at each site were analyzed using ground-based measurements or drone-based photogrammetry (DJI Phantom 4 V2 and Phantom 4 Pro acquisition followed by analysis in Pix4D), where applicable. Orthomosaics were then analyzed using FracPac to determine fracture statistics including orientation, intensity, and density. Where access permitted, ground-based structural measurements were also obtained on structures such as fractures and folds, in addition to RTK-DGPS (real time kinematic differential-global positioning system) profiles over potential pop-up structures. The analysis revealed inconsistencies in the definition of a "pop-up", prompting further inquiry into the definition of a pop-up versus stress relief features more generally. To address this ambiguity, a classification system was developed to differentiate between pop-ups and other tectonic stress relief features. It was concluded that pop-up structures exhibit a distinct geomorphic expression, manifesting as a linear elevated ridge. In southern Ontario, regardless of whether a feature is identified as a stress relief feature or a pop-up, it nonetheless demonstrates that the region is tectonically active despite often being characterized as a stable continental interior. This study adds to a growing body of work documenting neotectonic activity in southern Ontario, with the several stress-related structures documented for the first time in this study showing their prevalence over a wide area.