geoconvention
Calgary • Canada • May 15-17 2023

Absolute ages and stratigraphic timing for late-postglacial mass-failures in St. Anns Basin, offshore Nova Scotia

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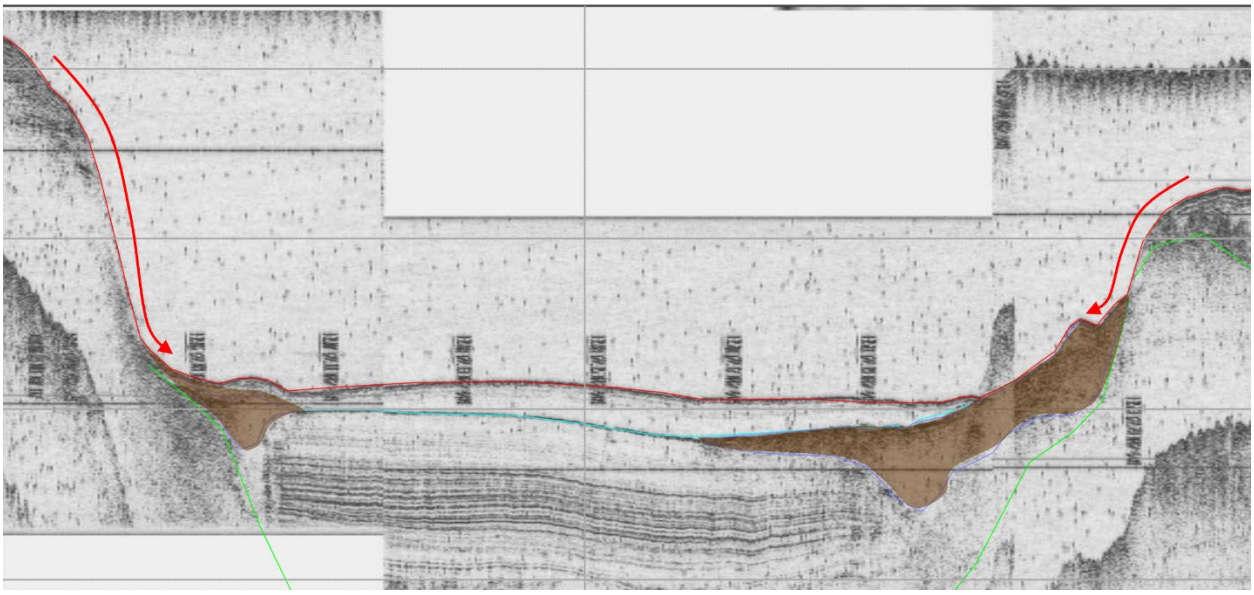
Summary

St. Anns Basin is a small (1200 km^2) intrashelf basin on the Eastern Scotian Shelf south of Cape Breton Island. It is the site of multiple mass transport scarps, deposits and related phenomena hosted in glacial and post-glacial mud. The Eastern Scotian Shelf is one of the last places with ice cover on the Scotian Shelf during the retreat of the Laurentide Ice Sheet. Unravelling the deglacial history in this region remains challenging due to the complex inherited seabed geomorphology alongside the reworking of existing shelf sediments with the marine transgression that followed deglaciation, and until now, lack of absolute dating. Here we present the first chronology for the glaciomarine strata in the basin from an archival sediment core using radiocarbon ages from mixed benthic foraminifera and shell fragments.



Theory / Method / Workflow

Radiocarbon dating was conducted on an archival sediment core to bracket multiple suspected deglacial marker units. Absolute ages and core site location were correlated with multi-source seismic reflection data that intersects known mass-transport deposits. This was used to establish relative ages using glaciomarine and marine mud strata combined with mapping using seabed morphology from OLEX bathymetry data to distinguish scarp features and extent of mass failures.

Results, Observations, Conclusions

The ages from the core site indicate this region was free of ice cover as early as 14.1 ka and experienced much higher sedimentation rates compared to those found in nearby Laurentian Channel. This is interpreted as indicating a local sediment source that formed the pre-conditions allowing for slope instability. Basin-wide seismostratrigraphy shows unique, isolated sediment deformation features with no associated geometry to mass-failures. This and updated chronology in the glaciomarine sediments alongside a pre-existing post-glacial core date (~8 ka) correlated to these failure sites suggest a seismically induced event as a trigger. The late post-glacial occurrence of these features may indicate that glacio-isostacy was a less influential trigger. Alternative hypothesized seismicity sources include local fault movement or being induced by salt diapirism. This updated chronology of sediments in St. Anns Basin has the potential to further constrain the timing and process of glacial cover on the eastern Scotian Shelf. Future work in this area should attempt to characterize the geotechnical properties of these sediments to determine the conditions allowing these slopes to fail.

Novel/Additive Information

The Nova Scotia government has made commitments to invest significant money into renewable energy to meet its energy transition goals for 2030. Development of offshore wind energy has currently been proposed on the Scotian Shelf with an environmental impact assessment currently underway in both Nova Scotia and Newfoundland. The Eastern Scotian shelf remains a potential corridor for renewable energy, communications, and pipelines. The potential implications of geohazards should be considered while this assessment is undertaken, and future work should refine the causal relationship of these mass-failures in the region.

Acknowledgements

Funding for this project provided by the Marine Geoscience for Marine Spatial Planning Program (MGMSP) at the Geological Survey of Canada, Government of Canada

Bathymetric data of the Eastern Scotian Shelf provided by OLEX

Special thanks to:

- Kimberely Jenner – Geological Survey of Canada - Atlantic
- Anne Jennings – University of Colorado
- Lori Campbell – Geological Survey of Canada Atlantic
- Philip Sedore – Geological Survey of Canada - Atlantic
- Geoffery Sweet – Geological Survey of Canada - Atlantic
- John Shimeld – Geological Survey of Canada – Atlantic
- Carla Skinner – Geological Survey of Canada – Atlantic