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Geological Carbon Sequestration in Atlantic Canada

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The most significant sources of CO_2 in Atlantic Canada are coal burning plants that generate electricity at Point Tupper (PT) and Point Aconi (PA) in Cape Breton Island, Nova Scotia. Figure 1 shows their location within a generalized map of adjacent sedimentary basins, with a radius of 300 km around the energy generating plants (Map modified from Geological Survey of Canada, Atlantic). Environments relevant to carbon storage, namely containing porous reservoirs and suitable cap rocks are:

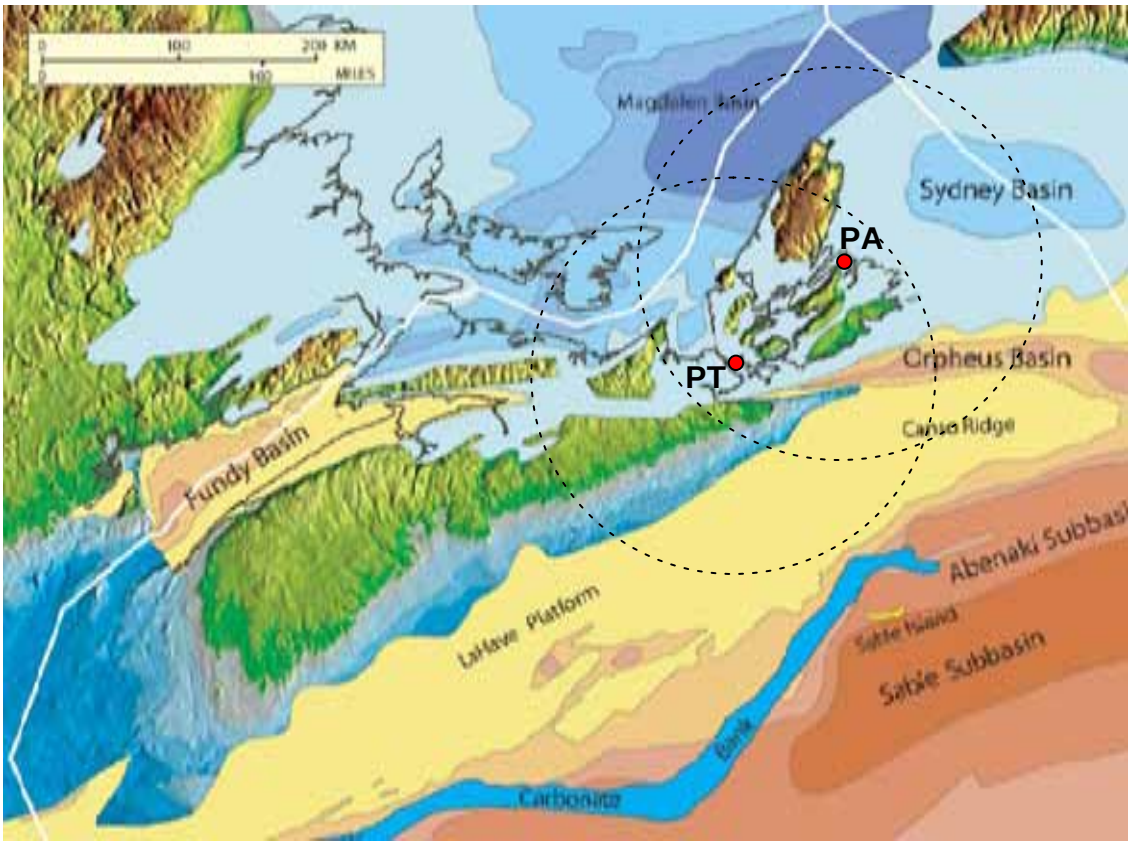

Figure 1: Map of adjacent sedimentary basins, with a radius of 300 km around the major coal generating plants (modified from Geological Survey of Canada-Atlantic).

1) Onshore and offshore strata of the Magdalen and Sydney basins of Devono-Carboniferous to Permian age. Coarse clastics underlie thick evaporites and salt of Mississippian age that in tectonically complex sites form relatively small gas reservoirs; large salt diapirs occur near surface that could provide solution cavities for storage. Above the evaporites there are

clastic formations and coal beds alternating with shales that could have some interest as potential reservoirs. However, diagenesis and relatively deep burial formed high bituminous coal in the Late Carboniferous, followed by inversion in the Triassic, have reduced porosity and extensively fractured the rocks. Assessment of storage potential in these basins would require a careful structural analysis and evaluation of porosity and reservoir capacity of deep aquifers. Fortunately the Province of Nova Scotia has maintained an extensive and excellent archive of cores from onshore and offshore wells that are available for study.

2) Triassic to Neogene strata in the offshore Orpheus, Abenaki and Sable sub basins to the south offer more realistic possibilities for CO2 storage, and petroleum exploration provides suitable seismic and petrophysical data from deep wells, to assess the sequestration potential. Autochthonous and allochthonous Jurassic salt provides potential reservoir structures, and the Cretaceous and Cenozoic strata contain significant porous formations that have led to economic oil and gas exploitation. A few of the best suited (Cretaceous) sands for storage are those occupied by compartmentalized and overpressured gas reservoirs in the Sable Subbasin, but they are rather distal from the CO_2 sources (more than 300 km). Suitable sands and subsalt plays in the structurally deformed Orpheus Subbasin should be the focus of carbon sequestration studies.