Marine influence at the Joggins Fossil Cliffs UNESCO World Heritage Site and its implications

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The Joggins Fossil Cliffs coastal section was selected as a UNESCO World Heritage Site for representing the Late Carboniferous Period, while the Joggins Formation is considered the best example of Pennsylvanian coal swamps in the world. Despite an abundance of research over the past 150 years, significant questions remain regarding the paleoenvironments of deposition, including the degree of marine influence. Accumulation of cyclothems occurred in the Cumberland Basin, a subbasin of the Maritimes Basin complex of southeast Laurasia. Previous work suggests that brackish water lithofacies are associated with rising sea-level, indicating that the Cumberland Basin was only weakly connected to the open ocean. Lowstand conditions are interpreted to have caused complete restriction, producing an intracontinental basin.

New sedimentological and paleontological data from interbedded limestone beds indicate that Joggins was closer to the ocean than previously surmised. Open marine lithofacies characterize the base of the section and gradually change upward into fluvial dominated deposits. Limestone beds are 15 to 100 cm thick and contain ostracods, bivalves, and echinoderm fragments. They occur primarily at the base of cyclothems interbedded with coal and flood plain deposits. The presence of echinoderm fragments and framboidal pyrite infilling ostracods in older limestone beds, antithetic abundances between ostracods and freshwater bivalves, and an overall upwards coarsening into fluvial lithofacies provide independent lines of evidence for diminishing marine influence with time. These data indicate that the Cumberland Basin was well connected to the open ocean and thus much closer to the margin of Laurasia than previously thought. Such results also suggest that early

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Cordaites trees from the Joggins section are the oldest known examples of mangroves.