

Terrestrial to marine transitions recorded in invertebrate trace fossils of the Joggins Formation

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The Joggins Fossil Cliffs, a renowned Carboniferous UNESCO World Heritage Site, is found along the shores of Chignecto Bay, Nova Scotia. This spectacular outcrop has a well-established stratigraphy, with 14 cycles comprising alternations between open-water, poorly drained floodplain and well-drained floodplain facies assemblages. The ichnology of the formation has been previously studied; however, the trace fossils identified primarily include surface trails and vertebrate trackways, resulting in a limited record of infaunal activity. Analyses of primarily invertebrate trace fossils from both the Joggins Fossil Cliffs and approximately 700 m of Joggins Formation onshore core (REI B2-1) provide further documentation of the trace fossil record for these Carboniferous rocks. The diverse suite of traces includes: *Acanthichnus*, *Arenicolites*, *Beaconites*, *Chondrites*, *Cochlichnus*, *Diplichnites*, *Diplocraterion*, *Diplopodichnus*, fugichnia, *Gordia*, *Haplotichnus*, *Kouphichnium*, *Limulichubichnus*, *Lingulichnus*, *Palaeophycus*, *Phycosiphon*, *Planolites*, *Protichnites*, *Rhizocorallium*, *Skolithos*, *Stiaria*, *Teichichnus*, *Thalassinoides*, *Treptichnus*, *Undichnia*, tunnel and chamber structures, plausible wood borings, and rhizoliths. A number of these traces fossils have not been previously recognized from the formation and reflect the work of annelids, arthropods, fish and mollusks. Combining the trace fossil record with the sedimentological framework provides a robust approach in interpreting depositional settings. Within alluvial plain to fluvial channel margin settings, the trace fossil suites include both the *Skolithos* and *Scoyenia* ichnofacies. In marine-influenced strata, including bayhead-delta and brackish-bay settings, trace-fossil suites reflect proximal to archetypal *Cruziana* Ichnofacies and include some strictly marine trace fossils such as *Chondrites* and *Phycosiphon*.