An ichnotaxonomic and paleoenvironmental study of the xiphosuran ichnogenus Kouphichnium from the UNESCO World Heritage Site Joggins Fossil Cliffs, Nova Scotia, Canada

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The fossil record at Joggins has long been studied for its body fossil record of plants, tetrapods, and rare invertebrates. The vertebrate ichnofossil record has acted as a template for Paleozoic vertebrate ichnotaxonomy dating back to the early 1900s when studied by G.F. Matthew and previously by Sir J.W. Dawson. Despite some of the earliest descriptions of invertebrate ichnofossils (*Diplichnites*) being noted by Dawson at Joggins, and Carboniferous 'xiphosuran' trackways having been recorded in the Cumberland subbasin dating back to the 19th century (*Protichnites carbonarius*), invertebrate ichnofossils have yet to be systematically studied at Joggins in a comprehensive way. We present here the preliminary results of a restudy of the ichnogenus *Kouphichnium* from the Joggins Fossil Cliffs, that are traditionally assigned to xiphosuran walking traces. *Kouphichnium* species are dominated by the ichnospecies *K. lithographicum*; however, 2 new morphologies have been identified.

Before this study, the ichnospecies *Kouphichnium aspodon* had only been recorded from an incomplete trackway from the Mississippian-aged Mauch Chunk Formation in Pennsylvania, and from the ichnospecies type section in the Pottsville Formation of Alabama. *Kouphichnium aspodon* has now been discovered in the Springhill Mines Formation at Denis Point along the Joggins Fossil Cliffs. This makes it the third occurrence in the fossil record and is here interpreted to be produced by either a eurypterid or synxiposurian. Like limulids, eurypterids are known to travel inland from the oceans to quiescent brackish conditions to moult and mate. Eurypterids at Joggins have only been described (by Dawson in the 19th century) from cuticle fragments that were found inside lycopsid trees, where they were associated with tetrapod bones, millipedes, and land snails. This interpretation may have paleoenviromental implications as the strata exposed at Dennis Point may have been at least distally connected to open-water conditions.

A unique morphology of *Kouphichnium* has been identified from this site. Several *Kouphichnium* specimens exhibiting double telson drags were previously considered to represent mating xiphosurid traces. The interpretation for this morphology is not new; however, the ichnotaxonomic implications of this behavioral difference suggest that these traces represent a unique morphology and unique behavior (mating) compared to simple walking traces of xiphosurans. It is therefore appropriate that this unique morphotype of *Kouphichnium* be proposed as a new ichnotaxon in honour of its discoverer, the late citizen scientist Donald Reid ("The Keeper of the Cliffs").

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