

Evaluating the Presence of Paleoenvironmental Stress Using Variations in Bioturbation Patterns: Ichnology of an Ancient, Shallow Marine Embayment

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The upper Ben Nevis Formation in the Hibernia Field of the Jeanne d'Arc Basin is an ichnologically complex interval. It consists of highly bioturbated, silty sandstone initially interpreted as lower shoreface deposits. Upon closer examination of the biogenic fabric, trace fossil assemblages that are not representative of fully marine conditions were identified. The presence of these suites is indicative of periodic changes in the environmental or ecological parameters. In order to account for these fluctuations, the depositional system must be 'stressed', as in a restricted, shallow marine embayment or sound.

A 'stressed' system is characterized by environmental parameters that diverge from 'normal marine' conditions. The development of 'stressed' conditions occurs as a result of changes in a number of environmental factors. In addition to salinity, any significant variations in oxygenation, temperature, water energy, substrate consistency, sedimentation rates and/or turbidity will result in a deviation from fully marine conditions. In a rift basin setting, this 'stress' can be initiated by tectonic modification to the basin and the associated depositional systems. Syn-depositional faulting, subsidence and rollover in the Hibernia area could have imposed sufficient restriction to the marine environment.

Any 'stress' invoked in a depositional system will be reflected in the behavior and type of burrowing organisms. The resulting trace fossil suite is low in diversity (often dominated by one ichnogenera) and composed of morphologically simple burrows. In the upper Ben Nevis Formation, assemblages consisting predominantly of inclined to branching, mud-lined *Palaeophycus* sp. burrows are especially indicative of a shift in environmental factors.