

Hitan is, since July 2005, a World Heritage Site on par with our own Jurassic Coast. It is the one place in the world where the skeletons of these animals can be seen *in situ* and in some cases still articulated. In addition to the fossils, the desert scenery is spectacular. Day excursions from Cairo are possible and well worth a day away from the bazaars. Transport may vary but experience of deep desert travel suggests a modern 4x4 with forward facing seats is worth paying for. The Fayum is an under-visited area. The road south from Cairo passes pyramid sites off the usual tourist itinerary, including Abu Sir, Saqqara and Dashur, all three worthy of time and attention. Two important pyramids, Hawara and Maidum, as well as Lahun are in the Fayum. Other archaeological sites include the Ptolemaic Temple of Qasr Qarun and the ruins of Dionysias, a Ptolemaic-Roman town.

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Fig.3, Pavel Riha

Fig.4, Conty

Figs.6,7 & 8, Nobu Tamura

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Joggins Fossils Cliffs, Nova Scotia, September 2012.

Open University Geological Society
Field Trip led by Prof. Brian Williams
and Prof. Ken Higgs.

Melissa Freeman

Joggins Fossil Cliffs at Chignecto Bay, Nova Scotia, is a UNESCO World heritage site situated on the eastern shores of the Cumberland basin and forms the northern extension of the Bay of Fundy. The highest tidal range in the world is experienced here, reaching 16.8 m twice a day. The cliffs contain a comprehensive record of Carboniferous coal-bearing strata with the most complete fossil record of Carboniferous terrestrial life in existence today; this includes the remains and tracks of very early animals and the rainforest in which they lived. On display is a 15 million year succession of sedimentary layers made up of ochreous sandstone (up to 30m high) forming the headlands. These are interbedded with thin layers of coal and there is a wide intertidal bedrock platform that runs into the sea. The low-grade coal seams, of varying thickness, exposed in the Joggins Formation, have been exploited since the late 1600s by local and British settlers. Large scale industrialisation came to the area in the late 1800s following the construction of the Joggins Railway. The mines were finally closed after a mining disaster in 1958 and the area is now a popular tourist destination.



Joggins Cliffs looking north

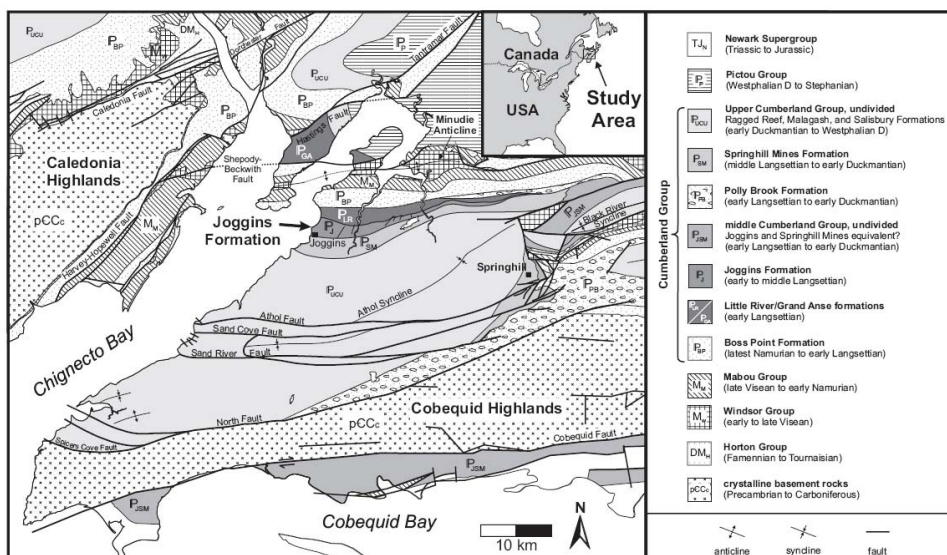
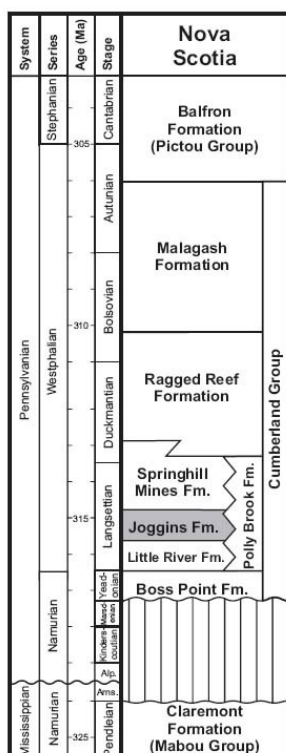


Fig. 1 Geological map of the western Cumberland Basin and adjacent areas showing the distribution of the Joggins Formation and the location of the Joggins section near Joggins village. Modified from Ryan *et al.* (1990), St. Peter (2001), and New Brunswick Department of Natural Resources and Energy (2000).

The Joggins Formation, visible in the bay, lies on the southern limb of an anticline. The best continually exposed section belongs to the Langsetian (formally Westphalian) stage (fig1). To the south lie the younger Springhill Mines and Ragged Reef Formations that were once above the Joggins Formation. To the north are the red beds of the Little River and Boss Point Formations that were originally below (fig2). Comprised of stacked marine transgressive-regressive cycles and overlain by prograding coastal / alluvial deposits, these rocks reflect changes to sea-level and

Fig. 2 Stratigraphic position of the Joggins Formation within the Cumberland Group. Modified from Ryan *et al.* (1990) and St. Peter (2001).



sediment flux caused by changes in climate (glacial-interglacial climate fluctuations) and the continued movement of the continents.

The sedimentary environment recorded in these rocks is one of estuarine rain forests and swamps. During the Carboniferous, Nova Scotia was located near the equator and was part of the supercontinent Pangea that was

forming at the time. Continued movements along major fault lines during the Lower Carboniferous uplifted some parts of this region but caused subsidence in others allowing sedimentary basins to develop in low lying coastal regions. The warmer climate and higher O₂ levels that characterise the Lower Carboniferous allowed lush vegetation, particularly the large trees and swamp plants to develop. The decay of these created the coal-bearing layers of the Upper Carboniferous rocks we see today. Terrestrial life was already well established at this point.

These cliffs were described by Charles Lyell following one of his many visits to the area as "the finest example in the world of a natural [Carboniferous coal measures] exposure". The earliest known reptile (*Hylonomus lyelli*), the first land snail (*Dendropupa vetusta*) were found here and today, the fossilized remains of these trees still stand where they grew.

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The Joggins Fossil Cliffs, Nova Scotia, Canada
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