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Spectral gamma-ray evaluation of Lower Jurassic basalts and lacustrine sediments from the Fundy Basin (Nova Scotia, Canada)

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In the Fundy Basin (Nova Scotia, Canada), the McCoy Brook Formation corresponds to the first sedimentary unit of Early Jurassic (Hettangian–Pliensbachian) age deposited after the North Mountain basalts, part of the Central Atlantic Magmatic Province (CAMP). The McCoy Brook Formation includes at its base the Scots Bay Member, comprising red and green lutites, silicified limestones, cherts, stromatolites and sandstones. Deposition of the Scots Bay Member occurred in a shallow and oxygenated lake, where the trophic state varied from oligotrophic to eutrophic. The McCoy Brook Formation is less than 100ky younger than the end-Triassic extinction event (Olsen and Et-Touhami, 2008 and references therein).
We analysed the spectral gamma-ray (GR) response of the top of the North Mountain basalts and base of the Scots Bay member at Broad Cove (Kings County, Nova Scotia, Canada) in order to calibrate outcrop with borehole wireline data and test uranium as a proxy for organic matter richness. The North Mountain basalts have a constant and low GR profile, varying from 58–92 cts. Potassium varies from 0.5–1.3%, U from 0–3.1ppm and Th from 0–5.1ppm. Average content of these elements are 1.0 %, 1.9ppm and 2.5ppm, respectively. The Scots Bay Member presents more variation, from 162 cts at the base to 68 cts at the top. Potassium varies from 0.4–2.3%, U from 0–6.4ppm and Th from 0–10.0ppm. Average content of these elements are 1.2%, 3.4ppm and 4.1ppm, respectively. The use of U contents to estimate TOC (see for example, Correia et al., 2012) generates non-significant results, where limestones have TOC of 11wt%. Olsen and Et-Touhami (2008) report that these outcrops are organically lean, with TOC lower that 1wt%.
It is apparent that the high U contents and the overestimation of authigenic U is linked with U mineralization due the stromatolites and microbial activity, highlighting that lithological and mineralogical components are critical to accurate petrophysical interpretation of borehole wireline data through the studied time interval.

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