

## **Spectral Gamma-Ray, XRD, and Organic Geochemistry of an Offshore Lacustrine Succession, Albert Formation, Moncton Basin, Southern New Brunswick**

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Four roadcuts southwest of Sussex, New Brunswick (Figure 1) expose a near 70 m-thick stratal package, primarily of interbedded sandstone and mudstone, that is assigned to the Hiram Brook Member of the Albert Formation (Horton Group, Tournaisian). Detailed sedimentological logging and analytical work has been undertaken on the southernmost of the roadcuts (Figure 2). The sandier lower and upper intervals of the succession are interpreted as the deposits of lacustrine deltas, shorelines, and fluvial systems. The medial interval is almost entirely of mudstone and interpreted as an offshore lacustrine deposit.

The succession is considered to be analogous to strata that form the secondary reservoirs in the nearby McCully gas field (Figure 1). Indeed, part of a gamma ray (GR) log from the "C-sand" in the McCully #2 well bears a striking resemblance to a GR log produced from analysis of the southernmost roadcut using an SAIC-Exploranium GR-320 portable gamma ray spectrometer.

In the log of the roadcut, the total gamma ray (TGR) profile shows a typical response: low readings are most frequent in the upper interval where coarser-grained sandstone is more prevalent, higher readings occur in the muddier parts of the lower interval and in the medial interval where there is a lack of a diagenetic carbonate overprint. A similar response (correlation co-efficient of 0.73) is illustrated between the spectral readings that record the specific energy of the decay of potassium ( $K^{40}$ ) and thallium ( $Tl^{208}$  - part of the thorium,  $Th^{232}$ , decay series). However, several peak readings in the log that represent measurements from the decay of the radioactive isotope Bismuth ( $Bi^{214}$  - part of the uranium,  $U^{238}$ , decay series) anomalously correspond to low spectral -K and -Th values (correlation co-efficient of 0.37 for K:U and 0.18 for Th:U). Because U is of an order of magnitude less abundant than K in the rock, the anomalous U peaks also correspond to low TGR readings.

As shown in Figure 2, the U anomalies correlate well with beds in the medial interval that are observed to be darker and more dolomitic. Such beds also record highest total organic carbon (TOC) – preliminary review of XRD analyses does not suggest covariance with any mineralogical changes in the clays.

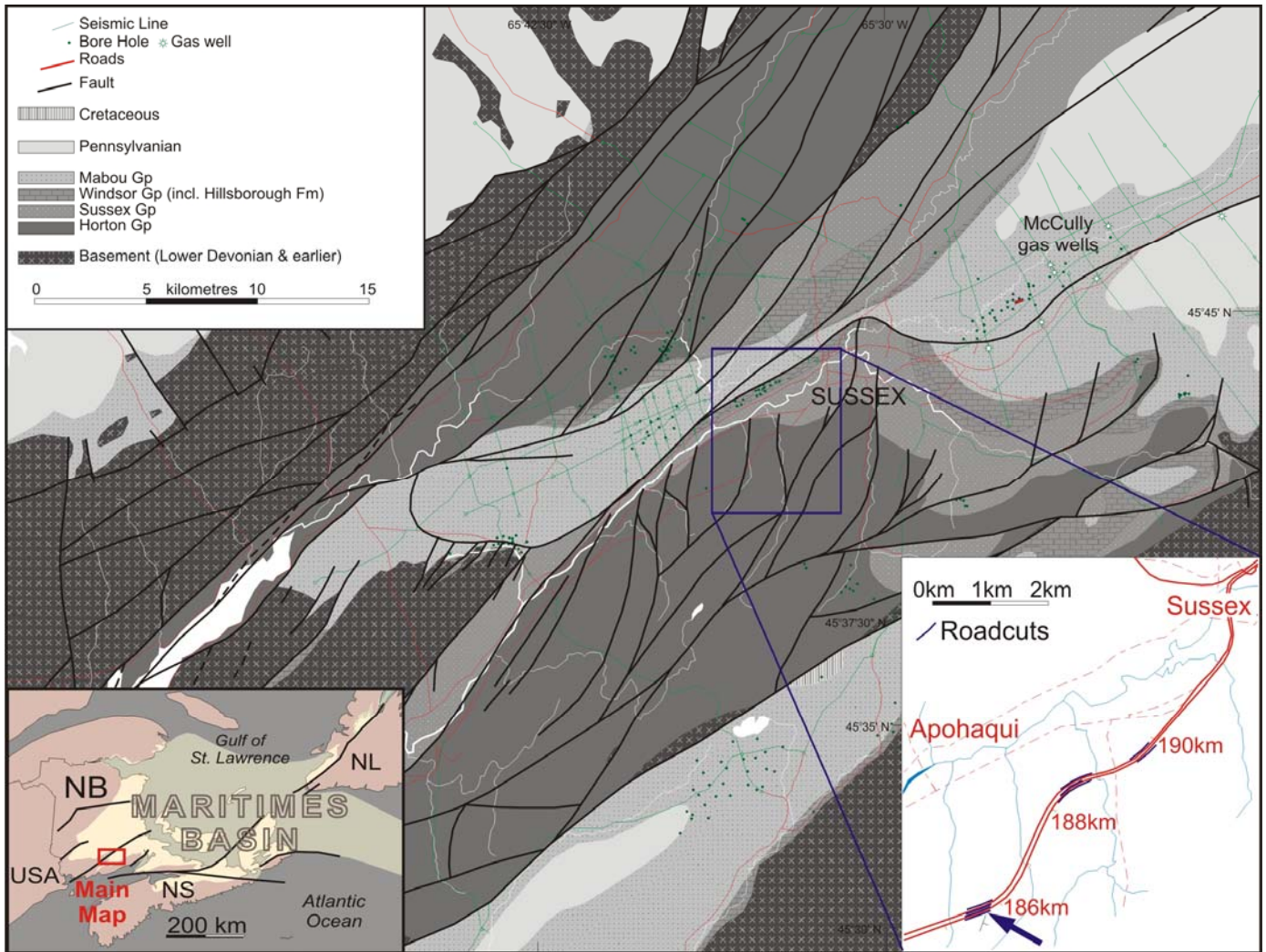
It is generally accepted that U values vary in a positive relationship with organic-rich strata, since dissolved U compounds are scavenged by decaying organic matter in anoxic conditions (e.g. Selley, 2000). However, because Albert Formation (similarly Green River Formation, see Keighley et al. 2003) lacustrine strata contain abundant K- and Th-bearing minerals, organic-rich

mudstone frequently does not correspond to peak TGR. Accordingly, in standard petroleum well logs where only TGR is recorded, it is stressed that care should be taken, for example, not to misinterpret high TGR peaks as being indicative of source rocks (or maximum flooding surfaces) when they could represent soils (or sequence boundaries).

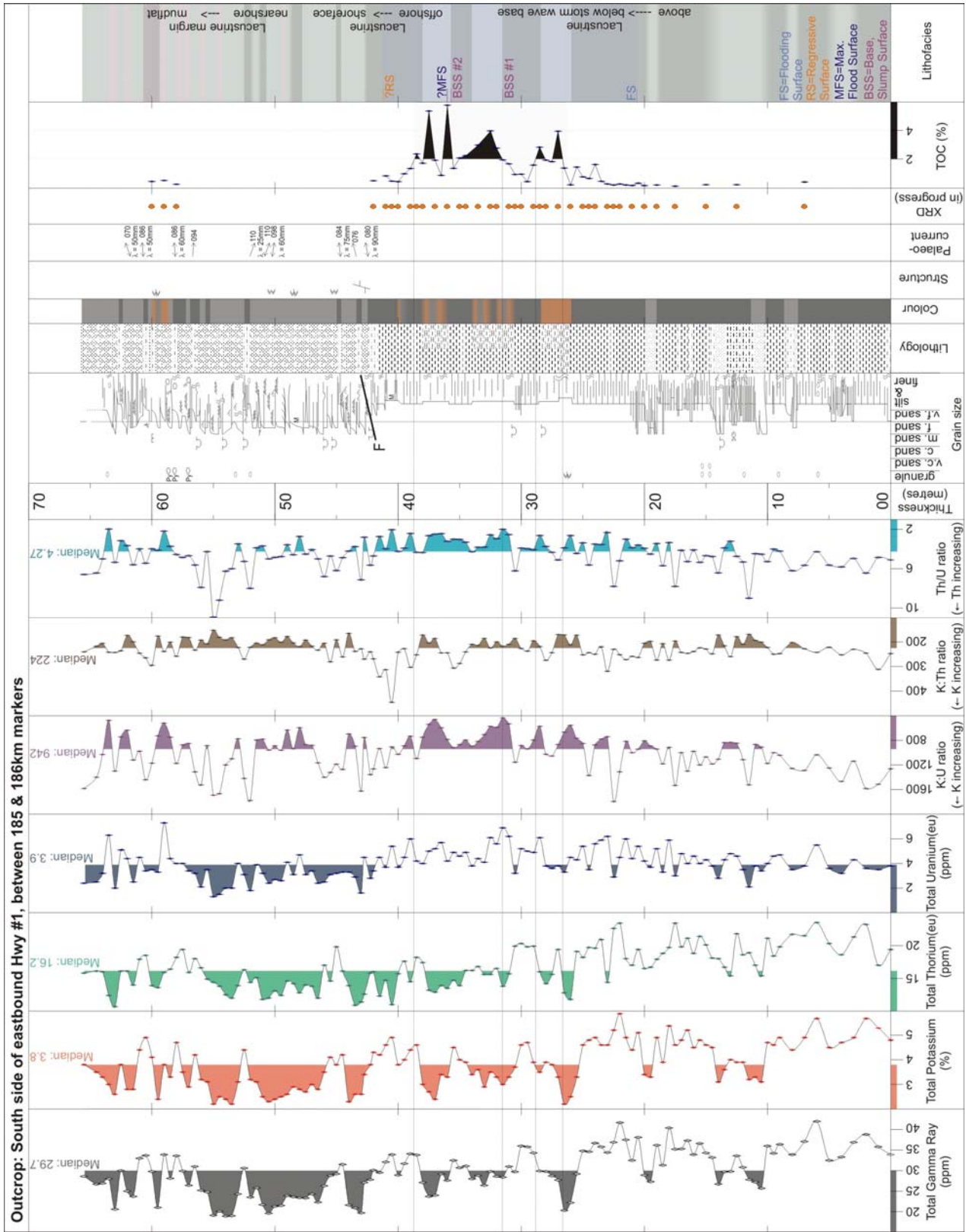
**References**

Keighley, D., Flint, S., Howell, J., and Moscariello, A., 2003. Sequence stratigraphy in lacustrine basins: a model for part of the Green River Formation (Eocene), southwest Uinta Basin, Utah. *Journal of Sedimentary Research*, v. 73, pp. 987-1006.

Selley, R.C., 1998. *Elements of Petroleum Geology*, 2<sup>nd</sup> Edition. Academic Press. 470 pp.



**Figure 1.** Geological location map of field area, Sussex area, New Brunswick



**Figure 2.** Sedimentological log of the succession (Hiram Brook Member, Albert Formation) exposed in the southernmost roadcut, incorporating Spectral Gamma Ray and TOC data.