Industry and government research joint venture; sharing and integrating multisource data for an holistic evaluation for sustainable resource development

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The recent development of unconventional reservoirs (gas and oil) has changed the energy landscape in North America. For areas with little past history of hydrocarbon development, the perceived risk for groundwater contamination due to hydraulic fracturing has led to exploration moratoria in many jurisdictions [1]. The industry and government regulators must demonstrate that development can be made in an environmentally safe manner. Transparent collaboration between the industry with academia and government research centers is the prerequisite for an unbiaised evaluation of the potential environmental impacts in a given region.

In eastern Canada, the Ordovician (Quebec) and Carboniferous (New Brunswick) shale basins are under exploration moratoria. The Geological Survey of Canada (GSC) has built research agreements with local operators in which industry grants access of multisource data to GSC scientists. The study of the Ordovician shale has recently been completed [2, 3, 4, 5, 6], an integrated framework has been developed, including rock and water geochemistry, geophysics, hydrogeology and geomechanics to assess possible upward migration pathways. Such holistic evaluation could not have been possible without the access to industrial data: seismic surveys, well logs, shale cores and geochemistry. The new framework is largely based on extensive industry and GSC geoscience data from hydrocarbons in deep and shallow shales units ([C1+C2+C3], ^{13}C, ^{14}C, ^{2}H) and groundwater (ions, DIC, DOC, ^{18}O, ^{3}H, ^{14}C-DIC, ^{14}C-CH_4, [C1+C2+C3], ^{13}C, ^{2}H, $^{87}Sr/^{86}Sr$, ^{36}Cl). The research results, openly available, allow to explain the source of dissolved microbial and thermogenic methane in shallow groundwater and its temporal and spatial variations.

[1] Rivard *et al.* (2014) *Int. J. Coal Geol.* **126**, 64-76. [2] Lavoie *et al.* (2016) *Int. J. Coal Geol.* **158**, 44-64. [3] Bordeleau *et al.* (submitted) *Sci. Tot. Env.* [4] Bordeleau *et al.* (submitted) *Appl. Geoch*. [5] Ladevèze *et al.* (submitted) *J. Struc. Geol.* [6] Rivard et al. (submitted) *Hydrogeol. J.*