Constraining a bi-modal volcanic sequences in a Devonian half-graben using multi-parameter petrophysics on drill core

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In northeastern New Brunswick, Canada, a Devonian rift basin beneath glacial sediments is delineated by both airborne and ground magnetic data. The volcano-sedimentary strata was deposited in a half-graben shallow marine environment with wide-spread hydrothermal activity. Ground magnetic surveys imaged the north-south trending basin-bounding fault and defined a series of secondary normal faults associated with the rift. The New Brunswick Government's core storage facility at Madran hosts complete core from a 580-meter-deep historic exploration borehole probing the preserved basin fill. The drill core was investigated using petrophysical methods including magnetic susceptibility, radiometrics, and specific gravity. From top to bottom, lithologies include Devonian limestone, massive basalt flows and a thick sequence of predominantly flow banded rhyolite with associated hydrothermal alteration and mineralization. The felsic unit can be divided into four groups using the newly acquired petrophysical data. The top group is characterized by the elevated potassium and thorium content. The second group is defined by elevated uranium levels within a wide alteration zone in the felsic volcanics. The third group is defined by low density and low magnetic susceptibilities. The bottom group of the rhyolite sequences is characterized by elevated potassium, copper, and magnetic susceptibility values. The subdivided rhyolite sequence allows us to better constrain the volcanic stratigraphy, fault geometry and associated alteration zones within the Devonian rift basin.