
**Geochemistry of the Three Mile Plains
uranium deposit, Nova Scotia**

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Heavy metal mineralization occurs in the clastic and chemical sedimentary units of the Maritimes Basin, Nova Scotia, Canada. The Carboniferous MacCumber Formation contains carbonate-hosted Pb-Zn massive sulphide mineralization at Gays River, and the Devonian-Carboniferous Cheverie and Horton Bluff clastic rocks of the Horton Group host roll-front uranium mineralization at Three Mile Plains. These uranium occurrences are presently poorly understood, partly because of the uranium exploration moratorium that has been in effect for over 25 years. This study investigates the geochemistry of the Three Mile Plains uranium occurrence to determine what other metals exist in the deposit.

Over 1100 rock samples from 16 drill cores through the deposit, stored since 1979 at the provincial core storage facility in Stellarton, Nova Scotia, were analyzed by aqua regia digestion for 37 major and trace elements. Enrichments of elements other than uranium indicate that well-defined geochemical zoning exists in the deposit, and several of the elements exhibit anomalous concentrations (Mo, Cu, Pb, Zn, Co, Ni, As, Ag, Cd, Se, and V). The geometry of this geochemical zoning can be related to the primary and/or secondary permeability of the host rocks, illustrating the importance of authigenic and diagenetic reactions and their control on groundwater flow. Furthermore, petrographic observations suggest that the host rocks have undergone a complex history of oxidation, due to the influx of oxidized water, possibly during intense weathering episodes, and reduction, due to maturation of organic matter in the underlying Horton Bluff Formation. Petrographic data

do not preclude the accumulation of additional uranium mineralization today, derived from weathering of local rocks with anomalous uranium concentrations (e.g., the South Mountain Batholith, or even the Millet Brook uraninite vein deposit). Geochemical zonation within the Three Mile Plains deposit can be adequately defined once marker horizons within the Cheverie Formation have been identified and used to establish correlations within the host sedimentary sequence.

Results from this study have both local and regional importance. Many residents derive their domestic water from local wells that could be impacted by the presence of soluble heavy metals in the Horton Group. In addition, these strata exist throughout Eastern Canada, and thus geological features existing at Three Mile Plains could be widespread.