Introduction

The first comprehensive search for radioactive minerals in the province was conducted by the Geological Survey of Canada less than 50 years ago (Gross, 1957). A flurry of uranium exploration followed in the 1970's and early 1980's and a number of major mining companies were active in the province, including Shell, Uranerz, Canadian Nickel, Séru Nucleaire, Can-Oxy and BP. This activity resulted in the discovery of several new occurrences. An evaluation of New Brunswick's uranium potential was undertaken by Hassan and others in the late 1980's (see references) and much of the information that follows is taken from their work. Approximately 35 primary uranium occurrences are known in the province, and several more contain anomalous levels of radioactivity and uranium minerals associated with other commodities. Detailed information on these occurrences is included in the New Brunswick Mineral Occurrence Database, where each locality is identified by a unique record number (URN).

In addition to detailed geological maps covering most prospective areas, multiparameter airborne geophysical surveys including radiometrics, electromagnetics and magnetics are available for much of the province. The most recent surveys are available as contour and/or colour interval maps at 1:20 000 and 1:50 000 scales. The gamma-ray survey coverage is shown in Fig.1.

Geological Setting

The diversity of New Brunswick's geology and mineral deposits reflect its position within the Northern Appalachians. The New Brunswick segment of this mountain chain records the complex history of a long-lived Paleozoic accretionary orogen that culminated in oblique continental collision during the latter part of the Paleozoic era. Most important to uranium metallogenesis was the generation of voluminous late- to post-orogenic batholitic suites and related volcanic rocks, and slightly younger terrestrial sedimentary rocks deposited in a successor basin (Maritimes Basin) that developed as a consequence of tensional collapse and thermal subsidence within the uplifted Appalachian Orogen. On the basis of their stratigraphic setting, host rock geology, age and type of mineralization, the occurrences are divided into three main metallogenic types. From oldest to youngest they comprise: 1) intramagmatic and associated magmatic-related veins associated with Early to Late Devonian, highly differentiated felsic intrusions 2) stratabound volcanogenic and associated vein occurrences hosted by Late Devonian to Early Carboniferous subaerial volcanic and volcaniclastic rocks and 3) stratabound, sediment-hosted occurrences within Late Devonian and Carboniferous continental clastic rocks.

Deposit Types & Examples

Granite-related : Magmatic and associated vein-type uranium occurrences are spatially and perhaps genetically related to highly evolved, post-orogenic felsic intrusions of Early to Late Devonian age (Hassan *et al*., 1987). A number of these occurrences are associated with shear zones that likely contributed to their enhancement. In southwestern New Brunswick several uranium showings are associated with Late Silurian to Late Devonian granitoid rocks of the Saint George Batholith. In the Miramichi Highlands uraniferous minerals are found chiefly in association with the Middle - Late Devonian Burnthill and Dungarvon plutons and the Early Devonian North Pole Stream Granite in north-central New Brunswick.

The Long Lake uranium showing (URN 1274) in north-central New Brunswick (Fig.2) is considered to be the most favourable uranium mineralization thus far identified in New Brunswick (Hassan *et al.,* 1987). The mineralization consists of autunite and torbernite within altered and brecciated jasperoid-veined muscovite granite and quartz feldspar porphyry of the North Pole Stream Granite. The alteration, which is inferred to be associated with northwest-trending faults cutting the granite, consists of silica, sericite, limonite, chlorite and pyrite. Associated minerals are mainly fluorite and molybdenite but covellite, sphalerite, galena and silver are also locally present. A boulder of altered muscovite granite with fluorite and pyrite yielded 0.54 % U_3O_8 and several other radioactive boulders ranged from 500 – 11 000 cps. The best drill hole intersection was 0.34 % U_3O_8 over 0.15 metres. The presence of unaltered muscovite granite boulders containing up to 3300 ppm U in the form of microscopic torbernite are also encouraging.

Stratabound Volcanogenic : Stratabound and associated vein-type uranium occurrences in the southwestern part of the Maritimes Basin are hosted by subaerial volcanic and volcaniclastic rocks of the Late Devonian and Early Carboniferous Piskahegan and Harvey groups (Fig.2). The host rocks represent the remnants of an epicontinental caldera complex that formed during the initial stages of development of the Maritimes Basin as a consequence of the voluminous late- to post-orogenic magmatism (McCutcheon and Robinson 1987). Like some of the granite-hosted occurrences to which they are related, the stratabound, volcanogenic uranium mineralization is commonly associated with fluorite.

At West Mill Settlement (URN 629) the mineralization is contained within intensely altered volcanogenic sandstone and conglomerate of the Piskahegan Group (Fig.2). Grab samples of the anomalous material associated with chlorite- and hematite - fluorite alteration zones assayed up to 0.52 % U_3O_8. The best drill intersection was 0.04 % U_3O_8 over 1.2 metres. To the northwest of West Mill Settlement rhyolite and rhyolite tuff of the Harvey Group contain uranospinite and saleeite associated with kaolin-fluorite masses in shear zones associated with a major northeast-trending fault. Along strike, linear fracture zones contain veins of pitchblende, pyrite, fluorite, arsenopyrite and secondary uranium minerals.

Sedimentary "roll-front" : Sedimentary-hosted uranium occurrences are found in a variety of fluvial, lacustrine and alluvial rocks within the Carboniferous succession of the Maritimes Basin. Uranium mineralization occurs at several stratigraphic levels, commonly in close proximity to faults. These occurrences are formed by supergene processes, although the source of uranium is not clearly known (Hassan *et al*., 1987). Grey fluvial sandstones of the Upper Carboniferous Pictou Group contain a number of uranium occurrences, commonly associated with plant matter or diagenetic pyrite nodules. Although the mineralization tends to be sporadic it is relatively high grade and has potential to be laterally extensive. An example of this type of uranium mineralization occurs near Shippagan (URN 059) in northern New Brunswick (Fig.2). Uraninite at this locality is associated with carbonized plant matter in hematite-stained zones along with barite, manganese and minor pyrite and copper. Assays range from 0.25 % - 1.47% U_3O_8 .

Uraniferous horizons are also found within the Lower Carboniferous rocks of the Horton Group. Mineralization is typically associated with reducing agents such as hydrocarbons, plant material and/or phosphate-rich lacustrine rocks. In the Sussex area anomalous radioactivity is associated with Lower Carboniferous organic-rich mudstones and pyrite or coaly material in conglomerate and sandstone of the Horton Group. Several occurrences are spatially associated with major faults suggesting that the faults provided a conduit for mineralizing fluids. A cluster of uranium occurrences north of Moncton appear to be associated with northeast-trending faults bounding an uplifted basement block of Proterozoic and Lower Paleozoic rocks near the Carboniferous unconformity. The mineralization occurs as pitchblende in fractures and as coatings on clasts within Early Carboniferous conglomerate and sandstone of the Horton Group. Canadian Nickel drilled three holes at Berry Mills (URN 741) north of Moncton (Fig.2). Drilling intersected a narrow (45 cm) mineralized zone containing 0.3 % U_3O_8 , although subsequent drilling was disappointing.

Additional Information

Information on metallic mineral commodities in New Brunswick can be obtained from the Mineral Occurrence Database available on-line at http://www.gnb.ca/0078/minerals/index-e.asp. Click on Publications and Information/ Geoscience Databases/ Mineral Occurrence Database/ Query using drop down menu.

For additional data on mineral occurrences in New Brunswick contact: Geological Surveys Branch offices in Sussex (506-432-2010), Bathurst (506-547-2070) or Fredericton (506-453-2206).

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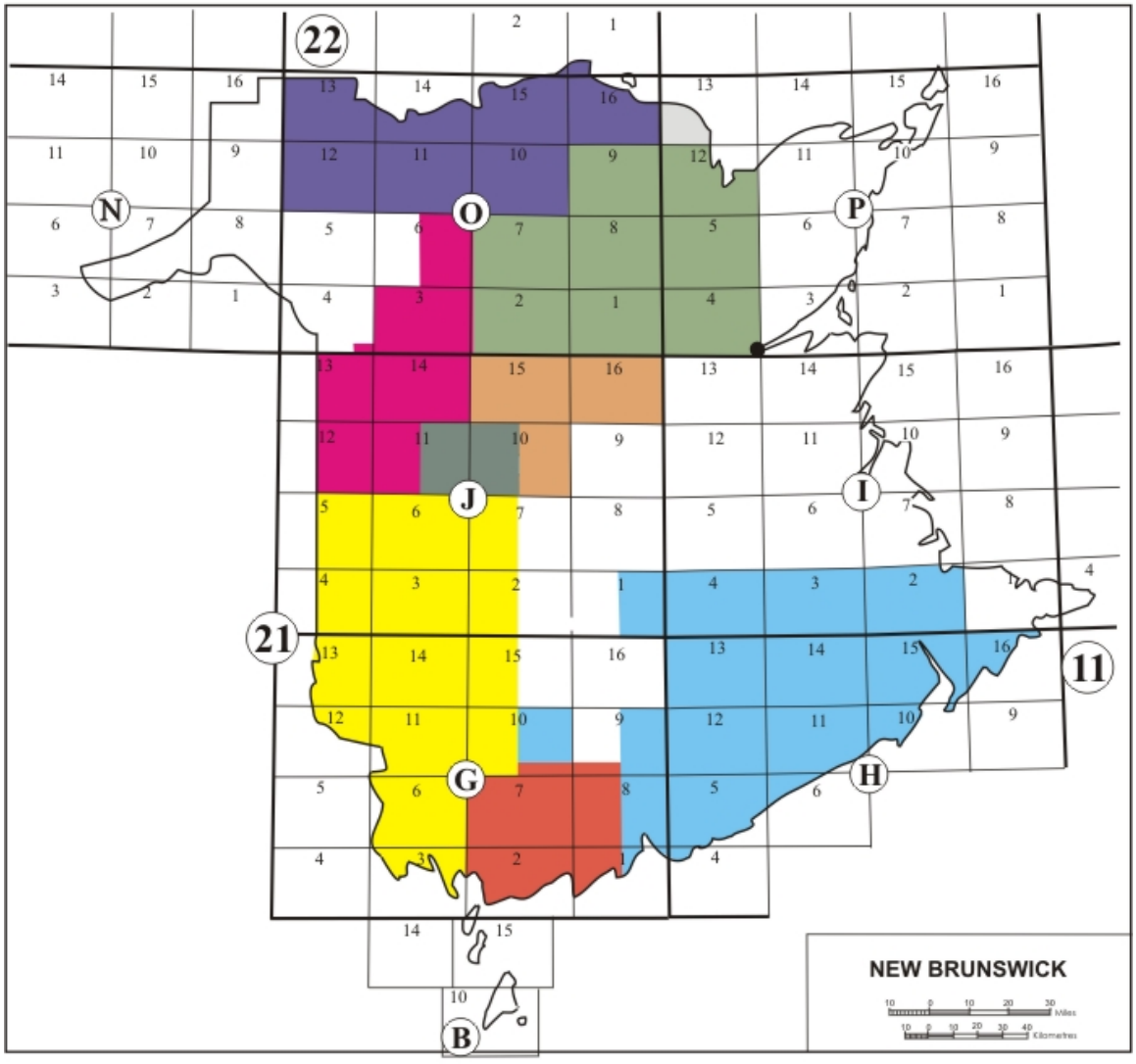
AIRBORNE RADIOMETRIC SURVEYS

(line spacing of 1 km or less)



Year Conducted	Survey Area
1978	Juniper E.- Hayesville
1983	Saint George Batholith
1984	Miramichi Highlands
1985-86	Woodstock - Fredericton
1986	Campbellton - Bathurst
1988	Andover - Riley Brook
1991	Sussex
1996	Bathurst Camp (200m spacing)
1998-2000	Restigouche (200m spacing)

URANIUM OCCURRENCES IN NEW BRUNSWICK