OFR ME 2009-1

2009 Fall Field Trip

Selected Mineral Deposits and Other Sites of Geological Interest in Kings and Western Hants County Area, Nova Scotia

Field Trip Leaders

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Mineral Resources Branch

September 12th and 13th, 2009

Field Trip Itinerary:

Saturday, September 12, 2009

9:00 am Meet at the Irving Station at Greenwich on Highway #1 at it's intersection with Highway #358 that leads north to Port Williams and Canning. This intersection is best reached by taking Exit #11 on Highway #101 and proceeding down the hill (right) to the traffic lights at Highway #1. The Irving station is immediately to right of the traffic lights. Leave for Stop 1 (Davidson Cove) at 9:15 am.

Stop 1-1 Davidson Cove Chert/Chalcedony Beds and Paleo-Indian Site.

Stop 1-2 Paddys Island.

Lunch at Paddys Island Stop.

Stop 1-3 Blue Beach Fossil Museum.

Stop 1-4 Greenfield Au Placer.

Return to Windsor

Sunday, September 13, 2009

9:00 am Meet at the Tim Hortons off Exit #5A of Highway #101. Leave for Stop 2-1, Castle Frederick Pb-Zn-Ag Occurrence by 9:20 am.

Stop 2-1 Castle Frederick Pb-Zn-Ag Occurrence.

Stop 2-2 Falmouth Paleoplacer Overview, Castle Frederick Bridge.

Stop 2-3 Millet Brook Uranium Deposit (C2 Zone).

Lunch in Millet Brook/Mill Brook area.

Stop 2-4 Mill Brook Quarry Uranium Occurrence, Leminster.

Stop 2-5 Reduction/Oxidation Front in Maple Brook Quarry, Three Mile Plains.

Day 1 - Saturday, September 12, 2009

Stop 1-1. Davidson Cove Chert/Chalcedony Beds and Paleo-Indian Site.

Directions:

Depart from Irving Station at Greenwich on Highway #1 and proceed to the traffic lights. Turn right on Highway #358 and drive north through Port Williams for 11.1 km to the village of Canning. In the centre of Canning, turn left at the monument where Highway 358 leads north to the Lookoff and Scots Bay. Continue north for 6 km to "The Lookoff" parking lot on North Mountain. From The Lookoff, continue on Highway 358 for another 9 km to Bayside Drive on the left. Bayside is a small country lane leading to a row of cottages along the Fundy shore. Currently, a broken road sign with the letters "ich Road" are all that marks the entrance into Bayside Drive. Follow Bayside and stop at the last cottage before a locked gate (approximately 500 m). Bayside is a private lane but we have obtained permission of the cottagers to park for this field trip but please try to leave enough space for locals to pass should any be there on that day. From here we will proceed on foot west along the shore to Davidson Cove. We will be on a falling tide with low tide occurring in the early afternoon. We have been granted permission to access the beach via the stairway below the cottage located immediately before the locked gate. From the base of the stairway it is about a 900 m walk west to Davidson Cove.

Background and Description:

Davidson Cove is a site of important archeological significance to our local Mi'kmaw people. Although it is a registered archeological site, it is not a protected site, so collecting is allowed. However, given it's importance to our native Mi'kmaw people, we ask that you show the site the respect it deserves. Exercise some manner of restraint in your search through the discarded flakes and chips found in the area of the ancient Mi'kmaw workshop (Fig. 1).

Along the Bay of Fundy shore in the Scots Bay area, several coves and inlets have exposures of the late Triassic age Scots Bay Formation (Fig. 1-1). The late Triassic (200 million years ago) in Nova Scotia was marked by a period of tremendous volcanism along rifts zones created along faults that comprised the Cobequid-Chedabucto Fault Zone. The volcanism resulted in extrusion of a voluminous flood of basaltic lava, the remnants of which now form the cap of the North Mountain. In the warm climate that followed the volcanism, a shallow lake formed on top of the basalt and in this lake were deposited lacustrine limestones and sediments that eventually the Scots Bay Formation. During early formation of this formation, hot gases and silica-rich fluids escaping from the underlying basaltic pile permeated up into the sediments and replaced the lowermost 2 or 3 metres of the limestone units and formed beds and cigar-shaped nodules of chert, chalcedony, jasper and agate. The silicious material occurs mostly as beds but also as discrete veins and pods intruding the sediments as well as the underlying basalts.

These replaced beds of the Scots Bay Formation have long been known as excellent sites to collect samples of chalcedony, jasper, agate and amethyst and are frequently visited by mineral collectors. However, at one location, Davidson Cove, it was established by Professor M. Deal of Memorial University of Newfoundland in 1988 that these beds served as a major source of materials that were fashioned into tools and weapons by the First Nations peoples that populated our province following the last ice age some 13,000 years ago. Everyone thinks of

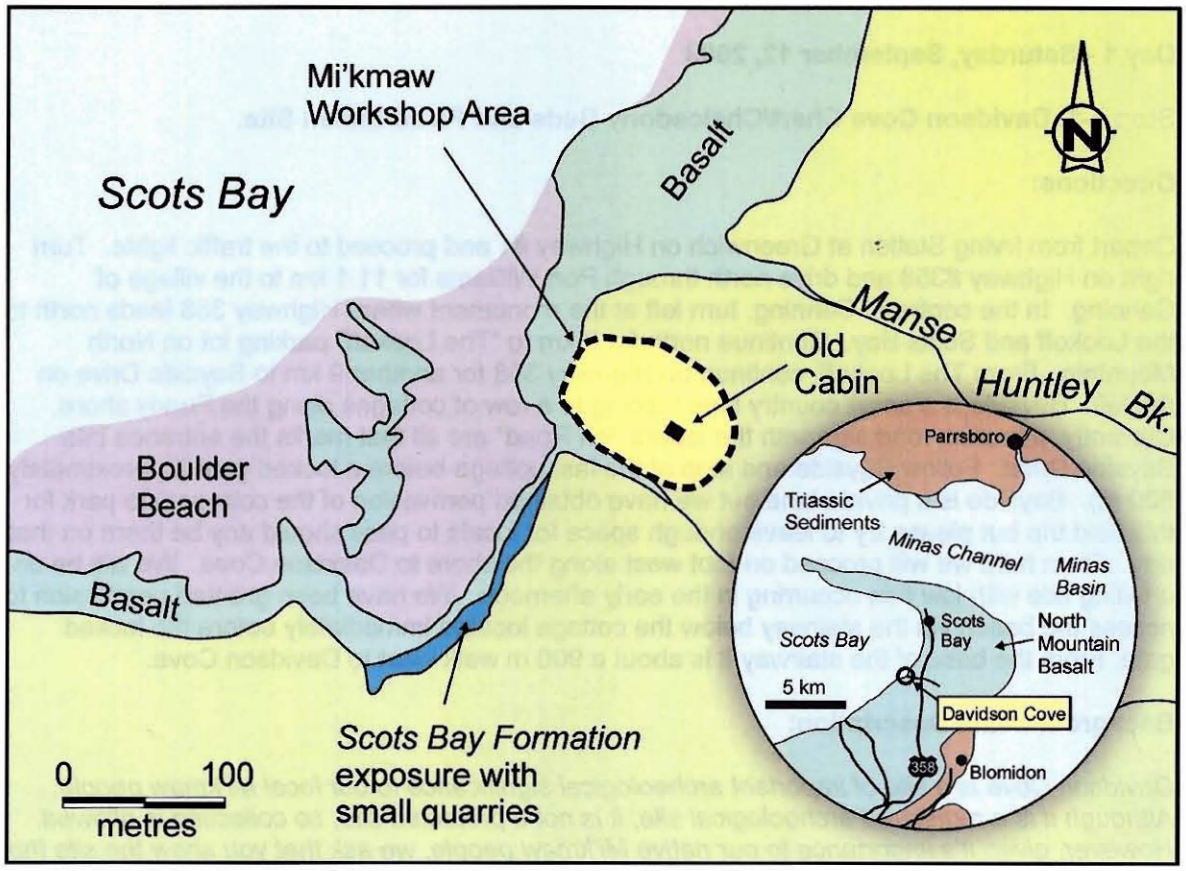

Figure 1-1. Davidson Cove chert-chalcedony occurrence and archeological site.

arrowheads and spear tips but silicious materials like are found at Davidson Cove were extremely important to the aboriginal peoples and were necessary for the making of tools they needed for everyday life. It would not be uncommon for them to travel hundreds of kilometres to obtain good stone and, in fact, stone, and the articles fashioned from them, were often traded quite widely. A rather substantial Mi'kmaw settlement existed in the Debert area and sites there are currently undergoing archeological study. To date some 4,600 lithic artifacts have been unearthed and it is believed that most of those originated at Davidson Cove. Examination of other settlements and routes travelled by the early Mi'kmaw has also turned up Davidson Cove artifacts. Places like Bear River, Mersey River, Lake Rossignol, Weymouth and the Shubenacadie River system to name a few.

The Davidson Cove area is shown in Figure 1-1 and consists of a section of Scots Bay Formation outcrop exposed along about 150 m of shore cliff and, adjacent to that, a "workshop" area. In the workshop the Mi'kmaw had set up their camp adjacent to the fresh water stream and took stone from the cliff exposures and worked them into tools and weapons. A considerable thickness of offcut chips and flakes from the long ago working of the stones is to be found as a layer now buried below the workshop area but exposed along the sides of the stream where it empties into the bay.

The beds of chert and chalcedony in the cliffs themselves show obvious evidence of past digging. A couple of cave-like indentations are to be found on the chert beds as well as a reddish-brown vein of jasper. As well, high on the bank near the western end of the exposure is found what looks to be the remnants of a small quarry on a section of chert containing several cigar-shaped chalcedony nodules. However, since the Davidson Cove site has long been known as an excellent mineral collecting locality, it is impossible to know just how much of the digging was done by Mi'kmaw and how much by mineral collectors.

Stop 1-2. Paddys Island.

Directions:

Return to the vehicles and leave Bayside Drive. Return on Highway 358 toward "The Lookoff" for 5.5 km to Steward Mountain Road on the left. Follow Steward Mountain Road south for 2.95 km to the community of Blomidon and the intersection with the Pereau Road. Turn right and drive southwest along the Pereau Road for 3.1 km to Jackson Barkhouse Road on the left. Follow Jackson Barkhouse Road for 0.95 km to North Medford Road on the left. Drive east on the paved North Medford Road for 1.2 km to a sharp right-hand turn. Continue straight through the turn on a gravel road for another 550 m and park. Walk along the lane that skirts the farmers field on the left for about 50 m and then follow a seasonal stream on the right that leads down to the beach through the brush covered area.

Warning!! Do not visit Paddys Island without a camera as severe depression may result once you realize the missed photo opportunities that lie before you.

Stop Description:

The Paddy's Island area is mostly underlain by soft red sandstones of the Triassic age Blomidon Formation. The Blomidon Formation is the sedimentary unit that directly underlies the North Mountain Basalt. The Blomidon, and it's immediately underlying red bed Wolfville Formation, underlie most of the Annapolis Valley and are the source of much of the red soil that is characteristic of this region. The contact between the Blomidon and Wolfville formations is exposed in the cliffs southeast of Paddys Island. This is recognized by the disappearance of the thick beds of cross bedded and coarse sands and conglomerates typical of the upper part of the Wolfville Formation and more finely bedded and laterally continuous mudstones that mark the base of the Blomidon Formation. The Paddys Island cliff section has some geological significance. Well preserved tracks of the Coelophysis, a fast and deadly 2.5 metre high dinosaur that roamed these regions in Triassic times (Fig. 1-2). I'm told best examples of this creatures tracks were found in the cliff along the left of where you entered the beach from the field above. Happy hunting but be careful of overlying rocks.

Paddy's Island proper is the small, rounded outcrop island located immediately to the left of where the path reaches the beach. In times past, Paddys Island was an impressive erosional formation of sculpted sandstone pocked with small caves and other unique features. However, now, after the continued ravages of storms and tidal action, the island has been reduced to a shadow of it's former glory. Nonetheless, it is still interesting to see. In any event, even though Paddy's Island is not as impressive as it once was, other rock formations along the sea cliffs to the south of where you entered the beach are well worth examining and several offer spectacular photographic vistas.

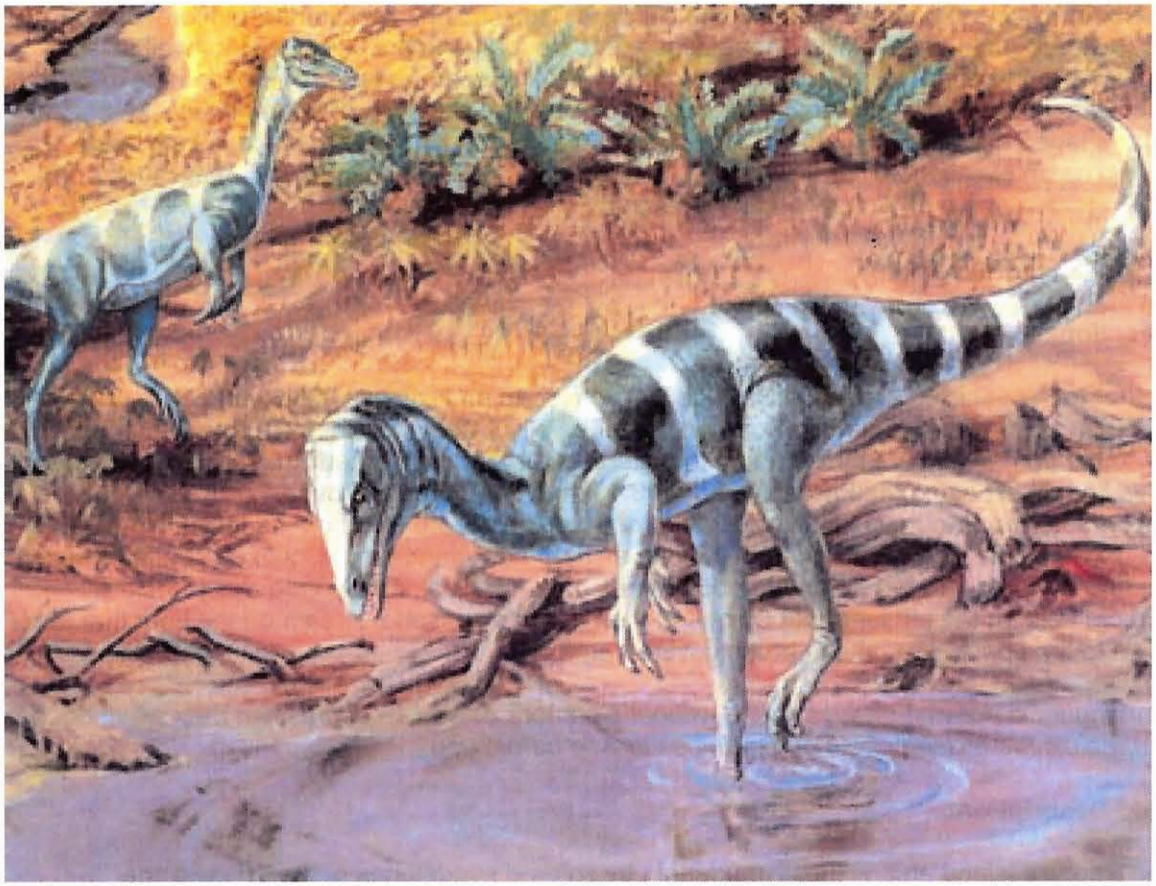

Figure 1-2. A pair of Coelophysis, a 2.5 m high dinosaur that roamed Nova Scotia in the Triassic. Footprints of the Coelophysis have been found at Paddys Island.

The Paddy's Island area is truly one of the picturesque, but little known, locations found throughout Nova Scotia and it is well worth a hike along the shore for some photo taking.

The Paddy's Island Stop will serve as our lunch stop.

Stop 1-3. Blue Beach Fossil Museum.

Directions:

Leave Paddy's Island and return to Jackson Barkhouse Road. Turn left then immediately right and drive for 1.5 km to a stop sign. Again, turn left and then immediately right on to Bessie North Road and drive for 1.8 km to North's Corner and the intersection with Highway #358. Turn left and drive south on Highway #358 through Canning and Port Williams to the intersection of Highway #358 with Highway #1 at Greenwich. Drive up the hill to Exit #11 on Highway #101 and drive east on the 101 toward Halifax to Exit #9 at Avonport. Take the off ramp, turn left, and go about 100 m and turn left again over the bridge that crosses Highway #101. Proceed around the small rotary and exit on to Oak Island Road. Follow this road for 3.9

km to Blue Beach Road on the left. The Blue Beach Fossil Museum is located at the end of Blue Beach Road.

Blue Beach Fossil Museum:

Our visit to the Blue Beach Fossil Museum will cost each field trip participant $2.00 which you will pay on entry. This charge includes an overview presentation by museum staff followed by some time to examine the impressive collection of fossils in the museum.

Stop Description:

Blue Beach is considered a world class fossil site for creatures that roamed the earth and swam in our oceans in the latest Devonian to early Carboniferous periods (350 million years ago). Blue Beach is the world's only source of tetrapod fossils from that era, a time when animals were in the process of leaving the oceans to inhabit the land. The history of fossil collecting at Blue Beach is long and storied. Sir William Logan, the first Director of the Geological Survey of Canada, made the first discovery ever of Carboniferous age tetrapod footprints here in 1841. In 1966, a young palaeontologist named Donald Baird, made the world's first discovery of fossilized bones of this creature here at Blue Beach. Since then, fossilized remains of tetrapods from rocks older than those at Blue Beach have been found but, in all cases, those creatures were aquatic animals that lived much like a fish but had the beginnings of legs. The world's oldest truly terrestrial animals that lived predominantly on land, are from Blue Beach.

Fossilized examples of these tetrapods and some of their footprints and trackways are to be found in the museums collection. As well, there are many other fossils such as fish remains, worm tubes, burrows, fern and plant fossils.

Stop 1-4. Greenfield Au Placer.

Directions:

On leaving the Blue Beach Museum, return to Oak Island Road and turn left toward Lockhartville and drive for 1.6 km to a road on the right. Follow this road for 900 m to a stop sign. Continue straight for another 500 m to old Highway #1. Turn left and drive on Highway #1 for 800 m to a road on the right leading to Exit #8A on Highway #101. Follow this road over the overpass on Highway #101 to the intersection with Ben Jackson Road. Follow Ben Jackson Road south for 2.6 km to the intersection with Bishopville Road. Turn right and drive west on the Bishopville Road for 11.9 km to the bridge over Gold Brook. Note, if there is foliage in the trees, Gold Brook can easily be missed. About 50 m east of the Gold Brook bridge there is a logging road that leads north off the Bishopville Road. Follow this road for 180 m and then walk 30 m west to Gold Brook. Within about 50-60 m upstream of this point you will start to encounter the trenches and pits that comprise the Greenfield Au Placer.

Background and Stop Description:

There is very little reported information about the past workings that have taken place on the Greenfield Au Placer. A Mr. J. R. Hea wrote in the 1861 Mines Report a description of a visit he made to this site (then called Little Chester or Pencil Brook) following someone showing him some auriferous sand supposedly collected there. He wrote "Yesterday I visited the locality,

and found that with little labour, and the roughest appliances, gold was really to be had. A dozen or more of persons were at work during parts of the day, washing sand and soil in ordinary tin pans, and there was one regular cradle or rocker on the ground. In order to satisfy myself fully, I collected a panful of the material, and found seven small pieces of gold. I afterwards washed another, and obtained five pieces and during the time I was there, scarcely a panful was washed that did not contain more or less of the precious metal. It is in small particles or scales, similar to that of Lunenburg, but of a lighter colour and probably containing more silver. The largest piece obtained during the three or four hours I was there, was found by myself in the second washing, and weighed fourteen grams. A number of persons, who have been at Lunenburg, are preparing to go to work in this locality and profess to consider the prospect better than in the great majority of the claims at the Ovens, while several of the late owners of the celebrated "Benjamin's Claim" state that they did not at anytime procure from it as large a piece as that now in my possession.

The washings are about seven miles south of Wolfville, on the margin of a brook that empties into Halfway River. The gold is procured by washing the sand or soil overlying the rocky bed, and on breaking apart the rock itself, small particles are found in the crevices, very much as at Lunenburg. The quartz veins in the neighbourhood, and from which the gold doubtless came, in the first place, are contained in slates similar to those of Lunenburg, with occasional dykes of igneous rocks, and are of remarkable uniformity in thickness and regularity in direction. It is said that specimens of gold have been found in the quartz, and have no reason to doubt the correctness of the report, though I have not seen them. In the immediate vicinity of the washings I found specimens, in loco, of calcareous spar and barite."

Myself and Ron Mills field checked this property in 1998 and noted that a substantial number of now heavily overgrown trenches and pits are found along about almost 100 m of Gold Brook starting from a point about 275 m upstream of the bridge. In some of the trenches pyrite-bearing quartz rubble is to be found but there is no confirmation whether or not this quartz is auriferous. However, Mills was able to extract a rather impressive looking small nugget of Au from a fracture in the bedrock in the stream bed immediately downstream of where a seasonal stream enters Gold Brook from the east. It is also interesting that the section of the brook along which the gold placer activity took place, coincides with a zone of pronounced carbonate alteration associated with one or more small mafic dykes. It appears as if the mafic dykes have intruded the Halifax Formation country rocks along a northeast-trending crumple or fault. This is evidenced by a marked change in orientation of the Halifax Formation bedding from steeply dipping on one side to shallow dipping on the other. It's also interesting to note that Stewart Ferguson's 1983 geology map of this region shows 2 arsenopyrite-bearing mafic intrusions intruding the Halifax Formation along the Halfway River along strike of the dykes found at the Greenfield Placer. Whether or not these are from the same intrusion, or intrusive swarm, is not known.

It is clear that this property warrants further examination. This would include not only it's placer Au potential but also the potential for Au mineralization in the underlying bedrock associated with the mafic intrusions and associated carbonate alteration zone.

End of Day 1 of the Field Trip.

If you are overnighting at the Downeast Motel, Currys Corner, return to Exit #8A on Highway #101 and drive east on the 101 to Exit #5. Take the off ramp and turn right on Highway #14 and

drive 800 m to the intersection of Highway #14 and Highway #1. The Downeast Motel is located at this intersection.

Day 2 - Sunday, September 13, 2008

9:00 am - Meet at Tim Hortons off Exit #5A of Highway #101, Windsor (the Tim Hortons by the Superstore). Leave for Stop 2-1 the Castle Frederick Pb-Zn-Ag Occurrence at 9:20 am.

Stop 2-1. The Castle Frederick Pb-Zn-Ag Occurrence.

Directions:

Leave Tim Hortons and drive west on Highway #101 to Exit #7, the Falmouth exit. Take the off ramp and proceed to the stop sign at the intersection with old Highway #1. Turn right and drive for 200 m on Highway #1 to a "Y" intersection with Falmouth Back Road. Turn left on Falmouth Back Road and drive for 630 m to the intersection with Falmouth Dyke Road. Turn left on Falmouth Dyke Road and drive for 7.05 km through Upper Falmouth to the bridge over the West Branch Avon River at Castle Frederick (Fig. 2-1). Continue past the bridge for another 520 m to a woods road on the right. Follow this road west for 700 m to a gated road on the left. We have arranged to have the gate left open for our trip. Drive on the gated road for 1.1 km to a "Y" intersection. Take the left branch and drive for 1.35 km up a long grade to where the road passes through a small bedrock quarry. Veins in the walls of this quarry comprise the Castle Frederick Pb-Zn-Ag Occurrence.

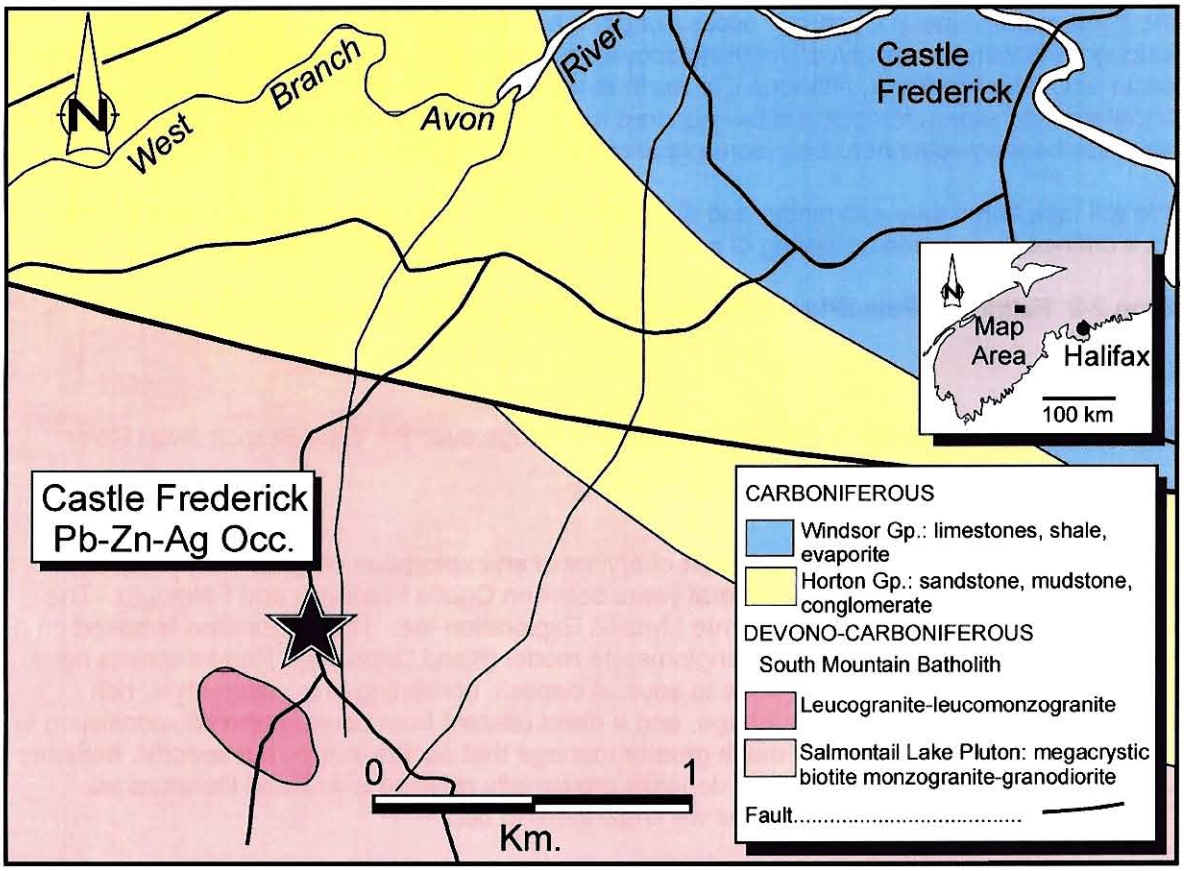

Figure 2-1. Geology of the Castle Frederick Pb-Zn-Ag Occurrence western Hants County.

Background and Stop Description:

This occurrence was discovered in 2006 by DNR regional geologist Donald Weir while examining a bedrock aggregate quarry that was opened up that year and was being considered as a source of rip-rap for local uses. Weir noted the presence of galena-rich quartz-carbonate veins intruding the granitic wall rock. At that time the quarry was 50 m long by 15-20 m wide and 4 separate veins ranging from 1-2 cm thick were noted. Since then, the quarry was extended another 20 m and additional veins have been exposed, some veins swelling to as much as 8 cm thick. As well, there are also some veins consisting mostly of a mix of pyrite-marcasite. The galena-rich veins are zoned, with an outer rim of galena and sphalerite and an inner core of carbonate, quartz, chalcedony and jasper. Most veins have an E-W trend and steep southerly dip. In places, the veins have an impressive content of galena with sections consisting almost entirely of massive sulphide. P. K. Smith (then with DNR) analysed one sample which returned 52% Pb, 25% Zn, 38 ppm Ag, 132 ppm Sb and 140 ppm Cd.

The origin of these veins within their host South Mountain Batholith is a bit of a question mark as similar style veins are not known anywhere else. There are base metal-bearing occurrences within the South Mountain Batholith but none have a similar, epithermal style to these at Castle Frederick. Perhaps the closest analogy may be the Pb-Cu-Zn bearing veins present at the Dunbrack Deposit in the Musquodoboit Batholith just north of Musquodoboit Harbour. However,

the base metal veins at Dunbrack occur along the brecciated contact of a highly evolved leucogranite with less-evolved biotite-muscovite monzogranite. Such a relationship does not occur at Castle Frederick, although it is worth mentioning that there is a leucogranite pluton of undetermined size outcropping a few hundred metres southwest of the quarry. It is possible the sulphide-bearing veins here bear some relationship to that intrusion.

We will take some time examining and discussing the veins. At minimum, the stop will provide us a chance to do some collecting of some fairly impressive mineralized material.

Stop 2-2. Falmouth PaleoPlacer Potential Overview, Castle Frederick Bridge.

Directions:

Leave Stop 2-1 and return to the Castle Frederick Bridge over the West Branch Avon River.

Stop Description:

At this stop Ron Mills will provide a short overview of an exploration program for paleoplacer gold that has been operating for several years between Castle Frederick and Falmouth. The exploration is being undertaken by True Metallic Exploration Inc. The exploration is based on a Witwatersrand-type quartz pebble conglomerate model (Rand Deposits). Rand deposits have two main elements, a proximal (close to source) deposit, consisting of a Yukon-style, rich nuggety, sinuous placer of low tonnage, and a distal (distant from source) deposit, consisting of an ore of much lower tenor, but much greater tonnage that occurs in thin, but specific, horizons within the alluvial fans. These distal deposits are usually referred to in Rand literature as, "reefs", although they are not reefs as we know them to be.

The structural and mechanical elements of the exploration model are identical to the lucrative African Witwatersrand deposits. That is, a rifting environment, somewhat mountainous, with erosional breakdown and alluvial fan development in the grabens. The chemistry of the host rocks is almost identical as well (almost pure silica clasts cemented together by subsequent silicate invasion). The chemistry of the environment is the big difference and this is linked directly to age (Rand-Precambrian vs. Horton-Carboniferous).

Described as, "Mid Paleozoic", in promotional literature by True Metallic, the source is believed to be associated with Africa using the inference that the North American and African continents were joined together in Carboniferous times. Fluvial fans developed in braided channels overlying a major unconformity (Meguma/Horton) with an underlying auriferous (Meguma) source.

The model has been tested through 28 diamond drill holes incorporating almost 13,000 metres of drilling to date.

Stop 2-3. The Millet Brook Uranium Deposit (C2 Zone).

Directions:

Unfortunately, the favoured and much shorter route to Stop 2-3 through Sangster Bridge at Windsor Forks is not available to us as the Sangster Bridge is currently being replaced. The

required detour will add quite a few kilometres to our trip to the next stop. Leave Stop 2-2 and return to Highway #101 via Exit #7 at Falmouth. Drive south on Highway #101 to Exit #5 and take the off ramp. Drive east on Highway #14 for 800 m to the intersection with Highway #1. Turn right on Highway #1 (Kings Street) and drive for 1.8 km to the intersection with Highway #14 where it leads south to Chester. Turn left on Highway #14 and drive south for 18.7 km to the community of Vaughan and the intersection with the New Ross Road on the right. Follow the New Ross Road for 3.2 km to a road on the right leading into Falls Lake Estates. Turn right and follow this road across Mill Brook for 440 m to where a gated woods road leads toward the north. This gated road is usually locked but we have been granted permission to access and have been provided with a key. Drive north along the woods road for 3 km to a sharp left-hand turn and a cement slab on the left which are the remnants of the Kidd Creek Exploration camp and core sheds. The road to the C1 and C2 zones of the Millet Brook Uranium Deposit leads north from here but is only accessible by 4-wheel drive so cars will be left here and participants ferried to Stop 2-3 by trucks and SUV's. The C2 Zone of the Millet Brook Deposit is 450 m north along this woods road from the Kidd Creek Exploration campsite.

Millet Brook Exploration History:

The Millet Brook Uranium Deposit was discovered in 1978 by Aquitaine Company of Canada Limited, a North American subsidiary of Societe Nationale Elf Aquitaine of France, a French exploration company. Aquitaine was exploring Nova Scotia's granites because of their very close similarity to granitic plutons of the Massif Centrale of France, a region in which there were several producing uranium mines of the vein type variety at that time. First order of business by Aquitaine was to carry out a helicopter-borne airborne radiometric survey over their substantial claim holdings and follow this survey up with ground proofing of detected anomalies. Several anomalies were detected in the Millet Brook area and two of them were found to occur along northeast-trending swampy, low-lying areas and several patches of glacial till within them contained the Cu-U-bearing phosphate torbernite. Further followup exploration and diamond-drilling quickly confirmed the presence of northeast trending, fault controlled, vein-type uranium mineralization and the two sites subsequently became known as the C1 and C2 Zones (Fig. 2-3a).

Aquitaine's interests were eventually purchased by Kidd Creek Mines Limited who continued exploration of the property and carried out geophysical and geochemical surveys over a substantial claim block. Continued followup exploration also detected literally dozens of other prospective sites consisting either of clusters of radioactive boulders or patches of radioactive till and these were prioritized for systematic exploration (Fig. 2-3a). One site, named the A9 Zone (or Upper Salter Lake Zone) was also found to be underlain by a substantial altered fault/fracture zone of granite heavily mineralized with uranium bearing fractures. The A9 Zone, being covered by a substantial till cover that is more clay-rich than that covering the other zones, did not have the same radiometric response. However, once drilling commenced, it was realized that it is by far the most substantial mineralized zone found on the property to that date.

The Kidd Creek geologists quickly recognized a close association of uranium mineralized zones with northeast-trending faults and fractures and, more importantly, that these zones have a pronounced association with negative anomalies in their resistivity geophysical data. Collectively, the C1, C2 and A9 Zones comprised what they termed the Millet Brook Uranium Deposit (i.e. the zones from which a reserve figure was being calculated) and exploration was being carried out under a development license. The C1 and C2 Zones were considered to have

been drilled off (i.e. exploration completed) while the A9 Zone was still undergoing active exploration at the time of calling of a moratorium on uranium exploration and mining by the provincial government late in 1981.

By 1981, collectively, the C1, C2 and A9 Zones had a resource of just under 1,300,000 lbs of uranium with a grade of 0.2% U_3O_8 at the time of calling of the moratorium. However, it's important to note that the A9 Zone is still open along strike to the northeast and southwest as well as at depth. There has been no further exploration at Millet Brook since the calling of the moratorium and the Millet Brook Deposit represents, by far, the largest uranium deposit known in the province.

The holdings of Kidd Creek Mines Limited were acquired by Falconbridge Limited in 1986 a move done mostly to gain control of Kidd Creeks substantial base metal holdings. Falconbridge, having no interest in uranium exploration, reclaimed the exploration trenches at Millet Brook in the mid 1990's and dismantled and sold the Kidd Creek buildings. Falconbridge was eventually acquired by Xstrata and, therefore, now hold the rights to explore the Millet Brook property should the moratorium ever be lifted.

Stop Description:

On our field trip we will visit and examine the C2 Zone as it is the only exploration site remaining in the Millet Brook District at which geological relationships can still be seen (Fig. 2-3b). We will discuss the deposit from it's economic geology and genesis viewpoint but also it will be discussed from an environmental geology standpoint.

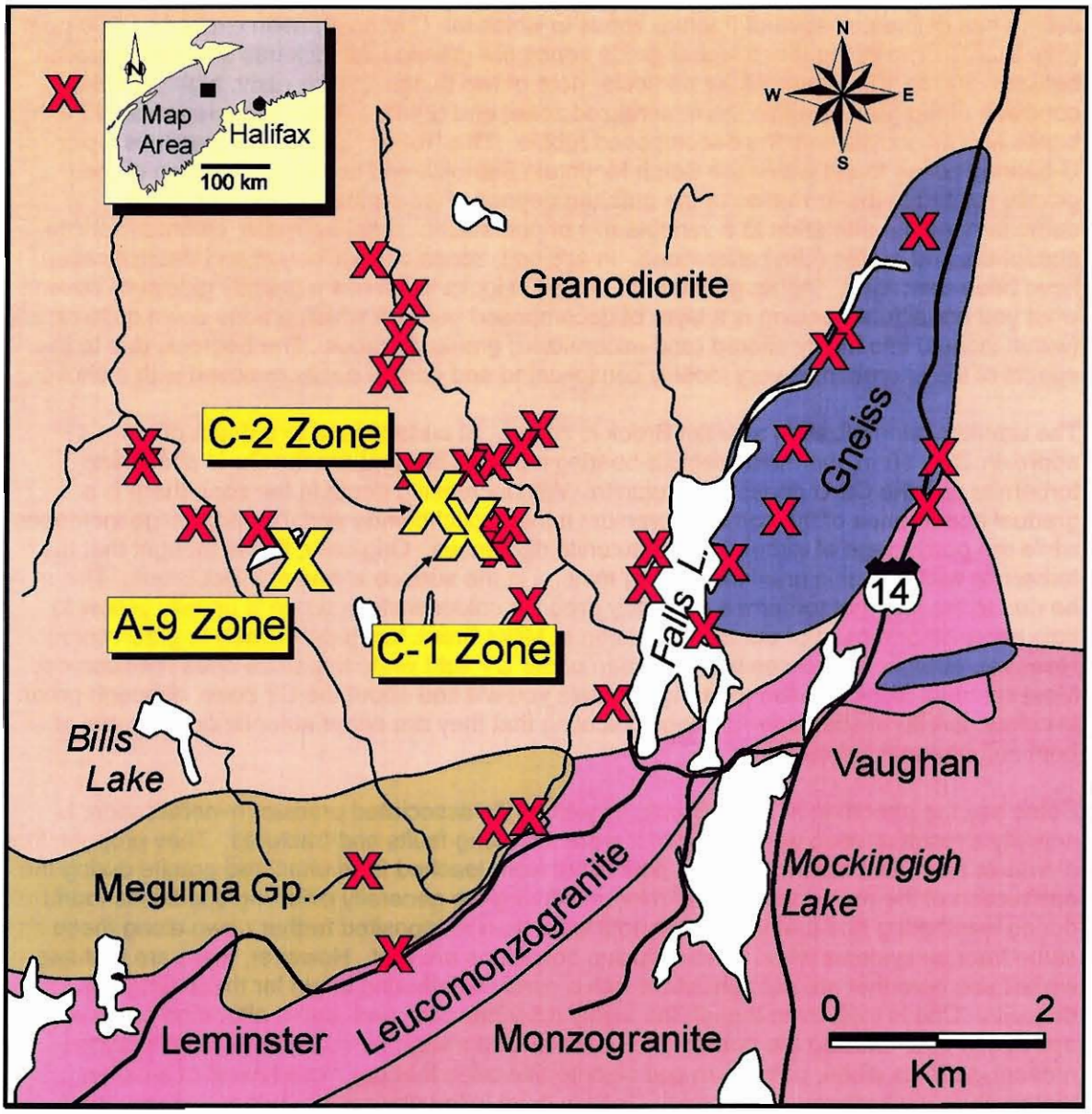

Figure 2-3a. Geology map of the Millet Brook area showing the location of the Millet Brook Uranium Deposit (C1, C2 and A9 Zones) and numerous other prospects and occurrences of uranium (red X's) found throughout the area.

The surface overlying the C2 mineralized shear zone has a background of radiation that is several times above that which would be expected over "normal" unmineralized granite. Typically, a granite of the South Mountain Batholith, when measured by most gamma-ray spectrometers or scintillometers, would have a background of radiation in the order of 100-180 counts per second (cps). The surface over the C2 Zone generally has a radiation level between 3,000 to 5,000 cps with sporadic patches up to 26,500 cps. Underlying the zone diamond-

drilling has delineated several fracture zones in which the U concentration exceeds 1,000 ppm (Fig. 2-3b). Enveloping these higher grade zones the granite wall rock has a U concentration between 100 to 1000 ppm. Make particular note of two things: (1) the rusty, highly friable, condition of the granite within the mineralized zone; and (2) the widespread presence of fresh biotite and muscovite with the decomposed rubble. This "rotten" look to the granite is typical of U-bearing zones found within the South Mountain Batholith and is due to alteration of the granite related to the formation of the uranium deposit. Researchers in the past have demonstrated the alteration to a variable mix of potassium, albite, hematite, chloritie, sericite, phosphate and argillic (clay) alterations. In addition, zones of silicification and desilicification have been described. Although much of this zone looks like it has a gravely glacial till cover, what you are actually seeing is a layer of decomposed bedrock which grades down quite rapidly (within inches) into highly altered (and mineralized) granite bedrock. The bedrock, due to the effects of the alteration, is very loosely consolidated and can be easily removed with a shovel.

The uranium mineralization at Millet Brook is zoned. At surface, and to a depth of approximately 50 m, the main uranium-bearing minerals present are the Cu-U phosphate torbernite and the Ca-U phosphate autunite. With increasing depth in the zone there is a gradual appearance of the common uranium mineral pitchblende and it's percentage increases while the percentage of torbernite and autunite decreases. Originally, it was thought that the torbernite was the main uranium-bearing mineral in the surface zones at Millet Brook. This may be due to the fact that torbernite is usually green in colour while autunite is usually yellow to pale greenish and most of the mineralization at Millet Brook has a pale green to green colour. However, autunite fluoresces brilliant green under UV light while torbernite does not fluoresce. Most samples of the uranium-bearing minerals you will find about the C2 Zone, although green in colour, will fluoresce under UV light indicating that they are either autunite or are a mix of both autunite and torbernite.

Some say the alteration at Millet Brook, as well as it's associated uranium mineralization, is actually a result of deep weathering of the granite along faults and fractures. They propose that elements such as uranium, iron and potassium were leached from unaltered granite during the destruction of the main rock forming minerals during the generally oxidizing conditions found during weathering and that these elements were then redeposited further down along these same fracture systems when more reducing conditions are met. However, there are features we will see here that are not consistent with a purely weathering origin for these uranium deposits. One is that, even though the highly rusty hematite and argillic alteration catch your eye due to their causing the granite to breakdown like a weather rock, there are alterations present, such as albite, potassium and chlorite alteration that are more typical of a higher temperature, hydrothermal alteration. Case in point is the obvious abundance of very fresh biotite and muscovite found throughout the zone. It is these minerals that give the "sparkle" to the rubble on sunny days. Weathering generally consists of destruction of these micas, not production of them. At Millet Brook these extra micas are alteration products and secondary in origin.

The true origin of the Millet Brook Deposit likely involves some component of both of these models. There is a strong association of the uranium mineralization with highly porous fault and fracture zones in amongst the much more solid unaltered granite bedrock. Logically, migrating groundwater in these rocks will pass through these same porous pathways, and thus, come in contact the uranium minerals and their associated soft secondary alteration products of the

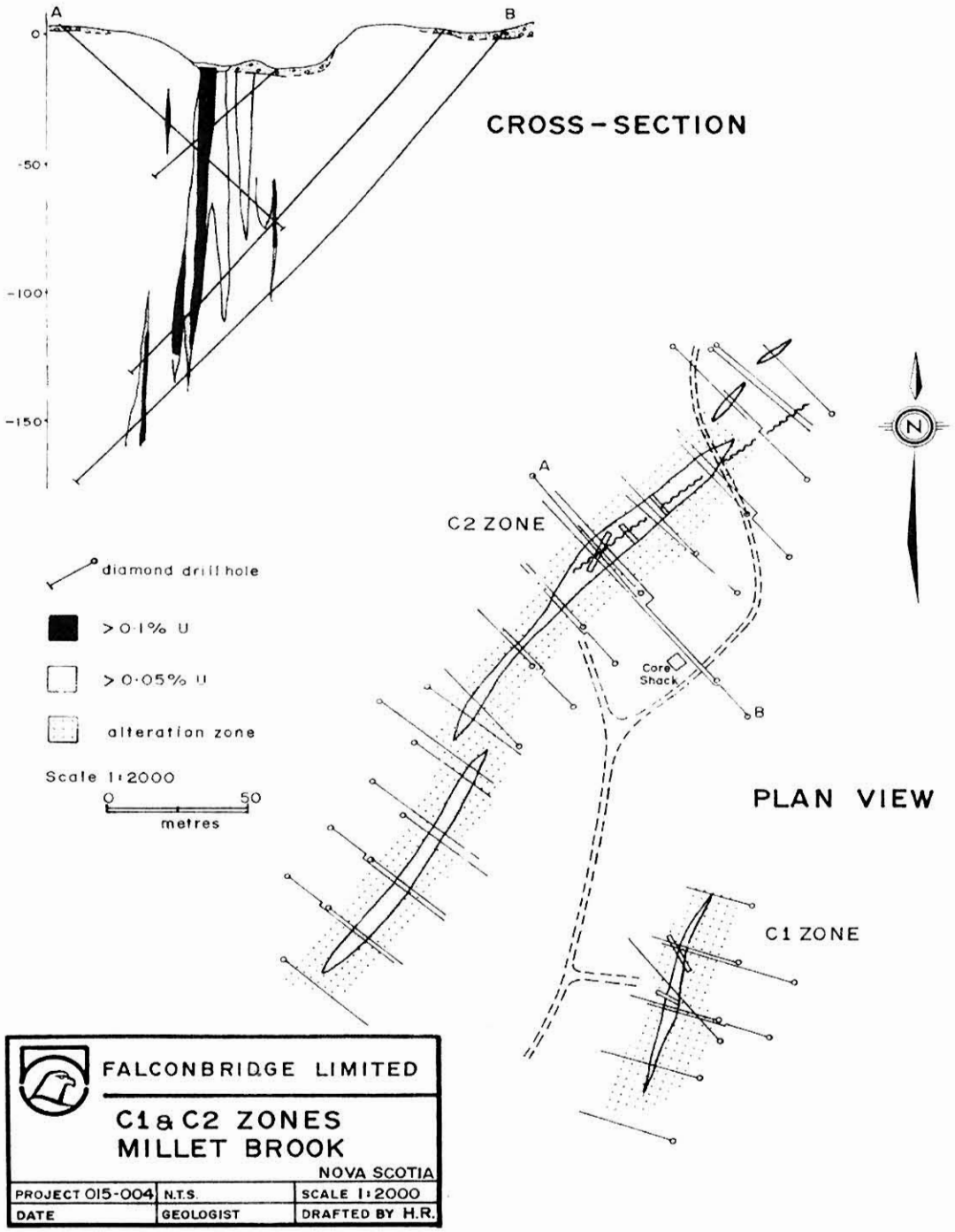

Figure 2-3b. Plan map of the C1 and C2 Zones of the Millet Brook U Deposit. Section of the C2 Zone is in upper left.

hydrothermal process that gave rise to the mineralization. It's entirely within reason that the uranium mineral assemblage that is of hydrothermal origin could, and most likely did, have some degree of supergene alteration imposed on it from the migrating groundwater. Quite possibly, the pitchblende is the result of the original hydrothermal uranium mineralization and the replacement of that mineral by autunite and torbernite toward the surface is a more recent, supergene event. I can live with that.

The bridge over Mill Brook will serve as our lunch stop.

Stop 2-4. The Mill Brook Quarry Uranium Occurrence.

Directions:

Leave the C2 Zone and return to the gate at the entrance to the logging road. Drive 400 m south toward the New Ross to Vaughan Road to the bridge over Mill Brook. This will serve as our lunch stop. After lunch we'll proceed back up the road for 150 m to a gated entrance on the right to a little used aggregate quarry dug into Meguma Group metasedimentary rock. We'll park at the gated entrance and walk the 200 m into the quarry. Hard hats will be required and will be provided.

Stop Description:

There are two sites where minor uranium occurrences can be found here, one along the northern face of the quarry and another amongst outcrop and rubblecrop about 30 m north of the north face of the quarry. Although from an economic standpoint, these are minor uranium occurrences, from an environmental standpoint they are worth examining and discussing. The occurrence found along the quarry face consists of smears of greenish autunite/torbernite along a fracture surface surrounding a rusty (reduced) patch of altered pyrite found within the host metawacke. It would appear as if the presence of the sulphide served as a reductant around which migrating uranium-bearing waters precipitated uranium minerals. You cannot see the uranium mineralization in the other site immediately to the north as it occurs simply as an area of elevated radiation amongst metawacke rubblecrop. However, it does appear that it too, occurs along a fracture zone in the metawacke bedrock.

From an environmental standpoint, uranium occurrences such as these, although economically insignificant, will have an impact on groundwater throughout this region. It is now known that large areas of our province have groundwater in which the levels of uranium and it's associated daughter radioelements like radon and lead 210 are elevated to at, or above Health Canada's recommended guidelines for human consumption. That elevation of radioelements is due predominantly to small occurrences such as these exposed here in this quarry rather than the much larger, but much fewer, uranium deposits like we just saw at Millet Brook

Stop 2-5. Maple Brook Quarry Reduction/Oxidation (RedOx) Front.

Directions:

Return via the New Ross Road to the intersection with Highway #14 at Vaughan. Drive north on Highway #14 through Windsor Forks for 14.7 km to the "Y" intersection where Highway #14 meets Windsor Back Road on the right. Turn right on to Windsor Back Road and drive north for

5.2 km to a point about 50 m before the Windsor Back Road intersects Highway #1 at Three Mile Plains. At this point there is a lane on the right that leads east across a farmers field to end at a small bedrock quarry dug into Horton Group sediments in the woods about 800 m away. This quarry is Stop 2-5 (Fig. 2-5).

Figure 2-5. Maple Brook aggregate quarry showing a typical redox front with oxidized beds (reddish colour) occupying the top half of the section and reduced beds (dark grey) the lower half.

Stop Description:

As we discussed at Stop 2-4, we are trying to stress the environmental significance of the multitude of small (economically speaking) uranium occurrences that are present throughout many of our geologically sequences. Here at the Maple Brook quarry we have a situation somewhat similar to the last stop in that there is a relatively minor uranium occurrence which could easily impact migrating groundwater in this area. Alone, this occurrence would not have much impact but take into account the very many of like sized occurrences that are in these same rocks but remain undetected.

Here we have exposed in the quarry face a classic reduction-oxidization front (RedOx front). Often referred to as roll fronts, they result from waters passing through oxygen-rich geological sequences, such as red beds, in which the waters become "oxidized" and thus able to readily carry uranium in it's very soluble U^{+6} oxidization state. In these waters, and while in this

oxidization state, the uranium will remain in solution. However, if the water passes into reduced conditions, such as in organic-rich units, grey of black graphitic units or the like, the chemistry of the water changes to a reduced condition and the uranium will transform into it's much less soluble U^{+4} oxidization state and it will precipitate from the water. In many instances this "dumping" of the uranium will occur actually at the transition from the oxidized to reduced conditions thus forming a front-like structure. Hence the term roll fronts.

Here at the Maple Brook quarry we will show you an example where oxidized beds exposed along the top half of the quarry have very low radiometric response and the top couple of metres of the underlying much more reduced dark grey to black shales have elevated radiometric response (4-5 times background). As one scans the profile below this redox front you will note the level of radioactivity decreases downward into the reduced beds away from the overlying oxidized zone.

So Ends the Field Trip – The Route Home:

From the Maple Brook stop you can return to Highway #101 in 2 ways. Return to Highway #1 at Three Mile Plains and either drive west (left) to Currys Corner and access to Exit #5 or east (right) through St. Croix and Exit #4. It's six of one or half dozen of the other as to which route is best although the drive to the St. Croix Exit #4 is prettier. In any event, we thank you and please drive safely.