Radon Soil Gas in Nova Scotia[1]

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Introduction

The North American Soil Geochemical Landscapes Project (NASGLP; cf. Goodwin *et al.,* 2009b) is a trinational initiative involving federal, provincial and state geological surveys of Canada, the United States and Mexico and will produce the first continental-scale map of the soil geochemistry of North America. The program will provide a comprehensive continental-scale framework of inorganic, organic and microbiological soil geochemical data as well as radiometric data.

One component of the NASGLP that is unique to Canada involves the collection of radon soil gas measurements at each soil sample site. Radon sampling protocols including: (1) sample site selection, (2) field methods, and (3) the type and proper use of accepted sampling equipment, were designed by the Geological Survey of Canada (GSC) in conjunction with the Radiation Protection Bureau of Health Canada.

During the 2007 and 2008 field seasons, a total of 72 sample sites (including 3 field duplicates) were sampled for radon soil gas concentrations from across Nova Scotia at an average sampling density of approximately 1 sample per 800 km^2. This sampling program represents the first regional radon soil gas survey completed in Nova Scotia. A limited orientation program was also completed during the spring of 2008.

Preliminary regional results for radon concentrations are presented here for the first time.

What is Radon?

Radon 222 (Rn^{222}) is a naturally occurring, invisible, odourless, tasteless radioactive gas found throughout the environment. Radon is highly radioactive. It has a very short half-life of 3.8 days. Radon is produced when unstable uranium 238 (U^{238}) undergoes a natural, spontaneous radioactive decay by releasing ionizing radiation in the form of alpha and beta particles and high energy gamma radiation. During the decay process of U^{238}, new elements, including radon, are formed. Once formed, radon quickly decays into polonium 218 (Po^{218}) by discharging an alpha particle. It is the decay of radon and the release of alpha particles into the air that are potentially harmful to human health if these particles are inhaled and attached to the inner lining of the lungs.

Radon gas is heavier than ambient air and cannot be detected by humans, but its presence can be identified by sensitive instruments capable of detecting minute amounts of energy as alpha particles are released into the atmosphere. It is very mobile in air and water, but is limited by its short half-life. Radon is a commonly used pathfinder in mineral exploration, particularly in the search for uranium.

Radon and its parent element, uranium, occur naturally and can be found and measured in detectable concentrations in soils and rocks. Elevated radon is typically associated with rocks such as granite and shale that are enriched in uranium (Je, 1997).

Radon and Uranium in Nova Scotia

Radon soil gas data are severely lacking for Nova Scotia. Limited, but very focused radon data, collected by mineral exploration companies engaged in the search for uranium deposits during the 1970s and early 1980s, are tabulated in 'Uranium in Nova Scotia: A Background Summary for the Uranium Inquiry, Nova Scotia' (Nova Scotia Department of Mines and Energy, 1982).

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The association of radon and uranium is well understood. Naturally occurring concentrations of uranium have been detected in all types of geochemical sample media (soil, till, lake bottom sediment, stream sediment, stream water, humus, vegetation and rock) throughout the province and analyzed by the Nova Scotia Department of Natural Resources and previously, the Nova Scotia Department of Mines and Energy. Uranium concentrations range from parts per billion (ppb) up to percentages in mineralized environments, depending on the sample medium analyzed. Examples of uranium concentrations in various sample media can be found in Nova Scotia Department of Mines and Energy (1982) and Lombard (1991), and references contained therein.

A compilation of airborne radiometric surveys covering Nova Scotia has been completed by the Geological Survey of Canada and demonstrates that uranium exists throughout the province (Carson *et al*., 2003). Regional concentrations range from a low of 0.025 ppm to a high of 7.80 ppm (equivalent) uranium. These data also indicate that broad areas are characterized by background uranium concentrations, in contrast to other distinct areas that are characterized by their elevated (2x to 3x) background levels.

In addition to areas of elevated background levels, occurrences of uranium are also known throughout Nova Scotia. Many different styles of uranium mineralization, including granite vein-type, roll-front type, pegmatite-hosted, and black shale-hosted occur throughout the province.

The most significant uranium deposit currently known in Nova Scotia is the Millet Brook uranium deposit. Non 43-101 compliant total reserves reported by Chatterjee *et al.* (1982) for three zones outlined by 139 diamond-drill holes totalling 11 342 m are in the order of 453 592.4 kg (1.0 million pounds) of U_3O_8 with an average grade of 0.15-0.20% U_3O_8 (using an average cutoff of 0.10% over a 2.0 m width). Uranium exploration ceased in the province in September 1981, when the Government of Nova Scotia issued a moratorium on the issuing of new uranium licences and the renewal of existing licences. As of January 2009, the moratorium remains in effect and uranium exploration is not permitted in the province.

2007-2008 Sampling Program

A total of 72 sites were sampled for radon soil gas concentrations across Nova Scotia during the 2007 and 2008 field seasons resulting in an overall average sampling density of approximately 1 sample per 800 km^2 (Fig. 1). Goodwin (2008) and Goodwin *et al.* (2009b) provide a description and overview of the NASGLP sampling program as it pertains to Nova Scotia.

Additional detailed sampling for radon soil gas was conducted within the Halifax Regional Municipality (HRM) during the summer of 2008. Results of that sampling program are presented in Goodwin *et al*. (2009a).

Field Sampling Methodology

Introduction

Each sample 'site' is represented by a single radon (and permeability) level associated with a single geographic co-ordinate point. In reality, each reported level is actually a composite of five individual readings that have been averaged to represent the site. Each site is approximately 100 m^2 (10 m x 10 m). Hollow probes are inserted into the ground at each of the four corners and the fifth probe is located at the approximate centre of the sample site. Similarly, *in situ* gamma ray spectrometric readings of Total Count, eU, eTh and K were collected at each of the five probes and a mean level representing the site was calculated.

Sample location coordinates (UTM 20T, NAD83) were collected with a GARMIN GPS map 76Cx and crossreferenced to the NASGLP soil sample site. Descriptive notes were recorded for each sample site and a digital photograph was taken for future reference.

Soil Permeability

In situ soil permeability measurements were determined using Radon-JOK portable sampling equipment using the following procedure. Approximately 1 m long hollow probes are fitted with a long tip and each probe is hammered to a consistent depth of 60 cm. A thin punch wire is

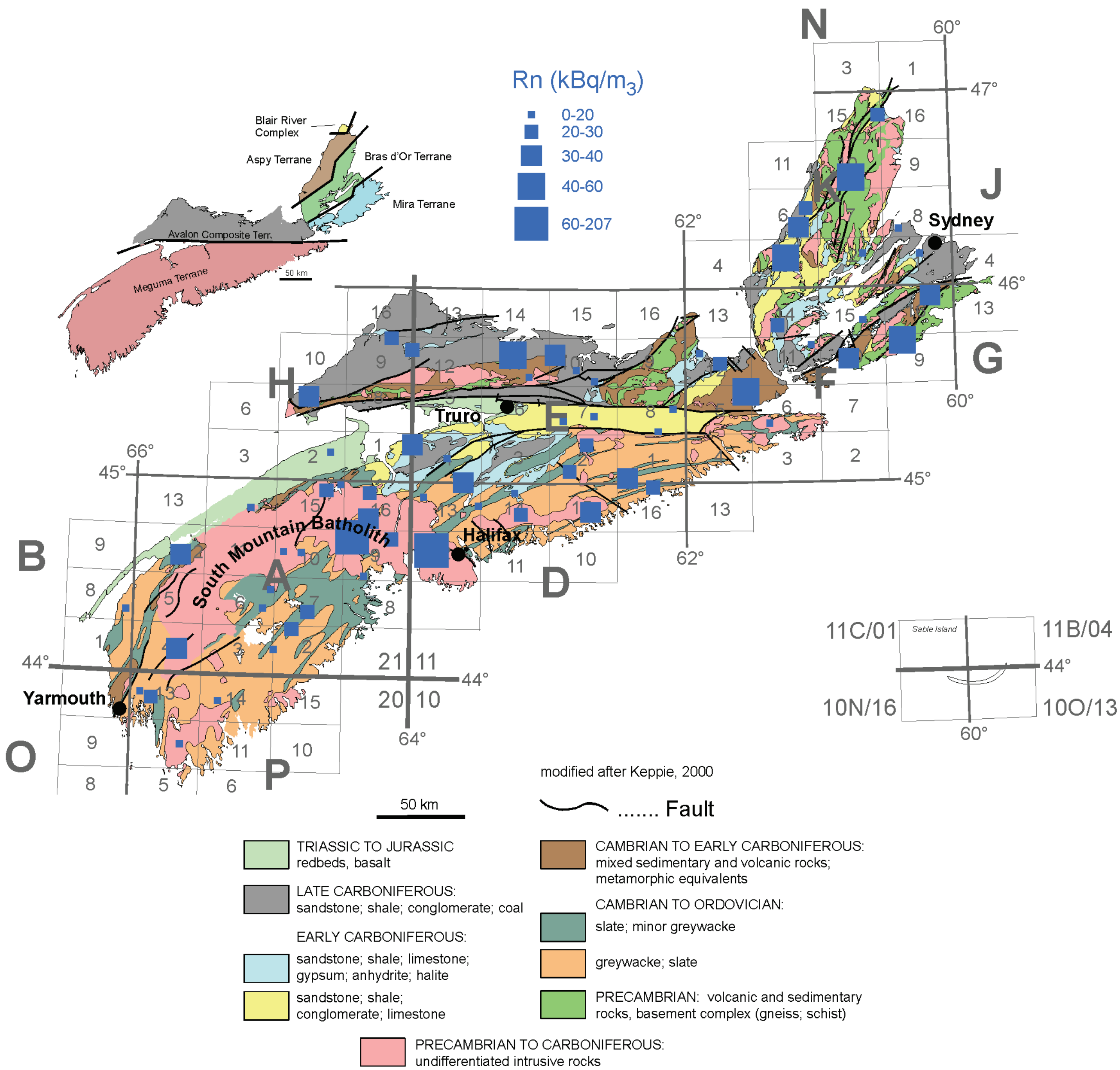

Figure 1. Sample locations and results for radon concentrations (kBq/m^3) in soil gas samples collected during the 2007 and 2008 summer field seasons. Note that radon in soil gas is measured in kBq/m^3. Radon in air is measured in Bq/m^3 (1 kBq/m^3=1000 Bq/m^3).

placed in the hollow probe. The punch wire is slightly longer than the hollow tube and the exposed end of the punch wire is covered with a spacer and an adjustable cap. Once the cap has been adjusted to the spacer, the spacer is removed, and a nylon mallet is used to drive the punch wire down until the cap reaches the top of the probe. The purpose of the spacer and the adjustable cap is to ensure the long tip is driven down to a consistent distance from the base of the probe, creating an empty space from which soil gas will be drawn.

The probe is then attached to the Radon-JOK portable sampling equipment using rubber tubing. The tubing is attached to expandable bellows. The bottom of the bellows is attached to one or two weights. When the weights are allowed to drop, soil gas is drawn into the bellows using negative pressure. The rate at which the bellows expand determines the soil permeability at the probe. A standard stop watch is used to measure the time it takes for the bellows to fully expand. If the bellows have not expanded after 20 minutes, the soil is recorded as having 'low permeability'.

Radon

After the soil permeability has been measured, the radon soil gas concentration measurements are determined using the RM-2 portable soil radon monitoring system. Five IK-250 Sampling Ionization Chambers (ICs) were prepared by measuring the IC background radon concentration by using ambient air. If the IC filled with ambient air was >0.7 kBq/m^3 then the IC was cleaned with deionized water until it read <0.7 kBq/m^3. (If an IC reading of <0.7 kBq/m^3 could not be achieved through cleaning, the IC was taken out of the queue and replaced with a different IC that, when tested, reported <0.7 kBq/m^3). Next the ambient air in the ICs is evacuated with the use of a converted bicycle pump fitted with a oneway reversible valve. The oneway valve draws air out of the IC creating negative pressure which is used to draw the 150 ml soil gas sample from the syringe into the IC.

The long tip for each probe is punched out as described above. Rubber tubing is used to attach the probe to a 150 ml syringe. To isolate the probe from ambient air, 150 ml of soil gas is removed, the tubing is clamped to isolate the system, then the soil gas in the syringe is discarded. The syringe is again attached to the probe and a fresh 150 ml sample is withdrawn from the probe.

This fresh sample is drawn into a clean IC, sealed and held within the IC for approximately 15 minutes. Next, the IC is connected to the ERM-3 electrometer and the radon concentration of the soil gas is expressed in kBq/m^3 after 2 minutes of processing time.

If water was drawn into the syringe at any stage, the syringe and affected equipment were replaced with new, dry equipment. The probe would then be moved (sometimes up to 5 m away from the original probe) and soil gas extracted from this new location. Groundwater extracted into the syringe was an issue more common in spring than during the drier conditions of summer. Spatially, groundwater was problematic in areas of lower topography, both regionally and locally.

Radioactivity

At each site radioactivity was measured by two means. A geometrics GR-101A gamma ray scintilometer was used to determine the ambient radioactivity associated with the entire site. At each probe, however, an Exploranium GR-320 spectrometer was suspended approximately 50 cm above the ground and measured *in situ* gamma ray spectrometric readings of Total Count, eU, eTh, and K using a five minute counting time.

2008 Orientation Survey

During the 2007 NASGLP field season, a number of issues were raised with regard to the acquisition of radon soil gas data. These included concerns regarding: (1) accuracy and precision of the radon data, (2) unacceptably high site variance, and (3) the optimum sampling depth.

In order to address these concerns, a limited orientation program was conducted in the spring of 2008 at several sites across Nova Scotia. These sites involved the acquisition of radon soil gas measurements over: (1) various surficial units and bedrock units, and (2) mineralized and unmineralized sources using various sampling depths in order to determine the optimum sampling depth. In the fall of 2008, an additional test over a mineralized bedrock source was undertaken to test how quickly radon dissipated in ambient air.

Results

A brief summary of the results of the orientation study are reported here for the first time. The results obtained from the orientation study were very useful and conclusions drawn were ultimately incorporated into the radon soil gas sampling protocols of the NASGLP. Results of regional, province-wide radon soil gas concentrations are also being reported here for the first time.

2008 Orientation Study

Temporal, spatial and duplicate testing of radon concentrations from various bedrock and surficial units suggest the RM-2 portable soil radon monitoring system is accurate and precise and the data collected during 2007 and 2008 are of excellent quality.

Site variance is strongly influenced by the texture of the material being tested. Uniform and coarse till (e.g. Beaver River Till - granite facies) exhibits moderate site variance. Clay-rich till, characterized by rare and randomly distributed friable sandstone clasts (e.g. Lawrencetown Till), exhibits a high degree of variability particularly when some probe tips end in (effectively) nonpermeable clay and other probes end in highly permeable, friable, disaggregated sandstone clasts (Table 1). These friable clasts probably also act like local radon ‘sinks’. Retesting of the 92.9 kBq/m^3 probe site returned highly repeatable levels of 90.7 and 94.0 kBq/m^3. Similarly, retesting of the 63.1 kBq/m^3 probe returned a duplicate concentration of 62.8 kBq/m^3.

Notwithstanding the clay-rich till, characterized by randomly distributed friable sandstone clasts previously described, the optimum sampling depth was determined to be 60 cm. After 60 cm, radon soil gas concentrations remain nearly constant (Fig. 2). Testing of radon in soil gas by Neznal *et al.* (1997) also concluded that soil gas radon remains constant at depths ranging from 60-100 cm below the ground.

Radon soil gas concentrations associated with mineralized bedrock sources (C2 Zone, Millet Brook) are clearly discernable from unmineralized background sources. At Millet Brook, for example, radon concentrations in soil gas associated with known uranium mineralization were in excess of 500 kBq/m^3 and up to 1500 kBq/m^3.

A small study was also carried out over the C2 Zone at the Millet Brook deposit to assess radon concentrations in ambient air above a known uranium occurrence. Results of this study indicate that highly anomalous radon soil gas concentrations, in excess of 1000 kBq/m^3 at 60 cm depth, drop to 1 kBq/m^3 at the ground-air interface and drop to not detectable at heights $\geq$10 cm above the ground-air interface (Table 2).

2007-2008 Regional Radon Results

Radon in soil gas was detected at all sample sites (except one, described below) tested during the 2007 and 2008 sampling program, regardless of the soil type and conditions, or the underlying bedrock geology. It is important to stress that the radon soil gas concentrations measured for this project represent natural background conditions and are not related to what would be termed uranium occurrences.

The only location where soil gas radon was not detected was a sample site near Meaghers Grant. It is acknowledged that a very low concentration of radon soil gas probably exists at this site, but was less than the lower detection limit of the instrumentation. At this particular site, extraction of soil gas was extremely difficult from each of the five probes. This was the only site tested during the 2007 and 2008 field seasons where the required 150 ml of soil gas could not be evacuated from any of the five probes. Only about 100 ml of soil gas could be extracted from any of the probes. Further inspection of the soil profile at this site revealed thick red clay (effectively void of clasts) ubiquitous throughout the area. This site may represent previously unrecognized glaciolacustrine clay, characterized by its very low to negligible permeability. Water was drawn into the syringe at this site. New probe sites with drier soil conditions were located less than 20 m away upgradient. The presence of radon soil gas could not be tested at three other sites across the province because excessive groundwater was present and some water was drawn into the syringe on every attempt.

With the exception of the Meaghers Grant sample site, radon soil gas concentrations (calculated as the mean of the concentrations from the five probes) ranged from a low of 0.1 kBq/m^3 to a high of 207.0 kBq/m^3 with a mean of 25.3 kBq/m^3 (median of 20.8 kBq/m^3). It is also important to stress that the raw field data were used to calculate the mean radon level for each site.

Regional mean radon concentrations in soil gas results are presented in Figure 1. The highest radon concentration (207.0 kBq/m^3) in soil gas was from a site located approximately 5 km southeast of New Ross. The bedrock consists of Middle-Late Devonian leucomonzogranite. The second highest radon concentration of 88.3 kBq/m^3, collected from a site approximately 5 km south of Five Island Lake, is also located in Middle-Late Devonian leucomonzogranite. Leucomonzogranite is often

Table 1. An example of radon concentration variability associated with the inhomogeneous, clay-rich Lawrencetown Till. Data are from a 2008 retest of NASGLP site NS07 1008.

Depth (cm)	Radon (kBq/m^3)	Comments
10	3.0	probe ended in clay matrix
20	0.0	probe ended in clay matrix
30	92.9	probe ended in friable sandstone clast
40	63.1	probe ended in friable sandstone clast
50	0.0	probe ended in clay matrix
60	1.0	probe ended in clay matrix
70	0.5	probe ended in clay matrix
80	0.0	probe ended in clay matrix

Table 2. An example of the very rapid dilution of radon soil gas as it interacts with ambient air. Sample site located directly over uranium occurrence associated with the C2 Zone, Millet Brook.

Depth (cm)/Height (cm)	Radon (kBq/m^3)	Comments
80	0.0	ambient air above ground level
60	0.0	ambient air above ground level
40	0.0	ambient air above ground level
20	0.0	ambient air above ground level
10	0.0	ambient air above ground level
0	1.0	ambient air taken at ground level
-60	1491.0	soil gas

characterized by elevated concentrations of incompatible elements such as uranium, as well as tin, tungsten, lithium, beryllium and tantalum. A summary of the provincial bedrock geology can be found in Keppie (2000) and a more detailed description of the leucomonzogranite bedrock, host of the highest radon soil gas concentrations, can be found in MacDonald and Horne (1987). The next five highest radon concentrations (40.0 kBq/m^3 to 60.0 kBq/m^3) occur in variable geology in northern Nova Scotia and Cape Breton Island (Fig. 1).

The data have been presented in Table 3 on the basis of surficial geology (after Stea *et al.,* 1992). At the provincial scale, it is difficult to make any interpretations regarding the radon concentrations and the associated till units. A few general observations are possible.

The overburden that comprises the stony till plain can be derived from a number of bedrock types including slate, metasandstone and granite. In general, radon concentrations in soil gas were highest in the stony till plain material. Water was not drawn into the syringe in the stony till plain unless the sample site was located in a topographic low. The silty till plain/drumlin overburden more commonly was characterized by wetter ground, regardless of its topographic setting, so water was drawn into the syringe more often. The content of

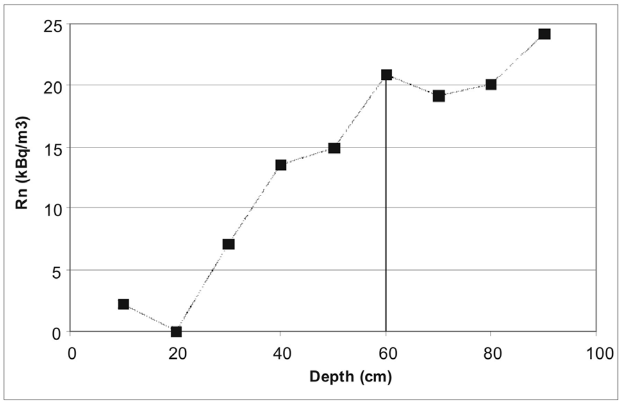

Figure 2. An example of radon soil gas concentrations increasing with depth. Note concentrations remain more constant at depths of 60 cm and deeper. Site location in the Three Mile Plains area near Windsor.

the silty till plain/drumlin material was highly and locally variable, ranging from silty-sand to clay. This variability, particularly when clay was present, increased variance within a site (described below). There were not enough samples collected from glaciofluvial or alluvial deposits to draw any meaningful conclusions.

Site variance was very high regardless of the till unit. The silty till plain/drumlin soil often exhibited the highest site variance. For example, radon concentrations for the five probes at site NS08 1008 were 0.0, 0.0, 23.4, 0.0, and 55.5 kBq/m^3. Site variance was tested in 2007 by collecting field duplicates from three sites. Field duplicates here are defined as a new grid of five probes located within 10 m of the original grid of five probes. Results of the field duplicates are presented in Table 4.

Site variance, either probe to probe variance within the same sampling site, or variance from site to site, was also noted in soil gas radon studies in Ontario (Chen *et al*., 2008a). The 2007 and 2008 results for Nova Scotia clearly demonstrate that natural radon soil gas variability is related to: (1) the lithology of the underlying bedrock, (2) the texture and provenance of the overlying surficial material, and (3) the local geomorphologic terrain conditions.

Discussion

Results of the orientation survey indicate that anomalous radon in soil gas (up to 1500 kBq/m^3) is associated with granite-hosted, vein-type uranium occurrences (e.g. Millet Brook). The radon gas, however, dissipates very rapidly to negligible concentrations in ambient air a mere 10 cm above the ground directly over the mineralized source. Anomalous radon in soil gas probably exists with other styles of uranium mineralization (roll-front, pegmatite-hosted, black shale, volcanic and basal Windsor) known to exist throughout Nova Scotia.

Regionally, very high radon soil gas associated with leucomonzogranite is probably the result of the natural radioactive decay of uranium in late-stage, highly evolved granite characterized by its elevated concentrations of incompatible elements including U-Sn-W-Li-Be-Ta. These elevated uranium-bearing granites are spatially associated with the western and eastern ends of the South Mountain Batholith. The elevated uranium concentration in these rocks is clearly discernable in airborne (eU) radiometrics (Carson *et al*., 2003) and regional lake-bottom sediment geochemistry (Lombard, 1991). Elevated uranium in C-horizon soil samples collected as part of the NASGLP are also associated with leucomonzogranite (Goodwin *et al.,* 2009b).

Additionally, high radon soil gas is also locally associated with sedimentary rocks of the Carboniferous Horton and Pictou groups. These high radon concentrations may be indicative of roll-front uranium mineralization within alternating red/grey bed sequences.

The optimum sampling depth of 60 cm, determined from the 2008 orientation survey, was introduced as part of the 2008 sampling protocol for radon soil gas. In 2007, however, the protocol required soil probes to be driven to 80 cm depth. Results of the orientation sampling also indicate that at depths shallower than 60 cm, radon concentrations decrease upwards towards the surface. This is significant because very few of the 2007 radon soil gas measurements were collected from the recommended sampling depth of 80 cm because of poor ground conditions (namely abundant boulders) nor were they collected from a constant depth. In fact, NS07 1037 is a typical sample site, where probes were driven to depths of 41, 48, 49, 50 and 61 cm. Results from 2007 should, therefore, be considered a minimum level for radon soil gas concentrations. In contrast, all 2008 soil gas samples were collected from 60 cm depth.

Table 3. Summary of radon concentrations in soil gas from across Nova Scotia. Basic statistics have been subdivided on the basis of various surficial units (after Stea *et al*., 1992).

Till Unit	n	Min. (kBq/m^3)	Max. (kBq/m^3)	Mean (kBq/m^3)	Comments
stony till plain	36	3.5	207.0	29.1	One site from 2007 drew water - no reading taken
silty till plain/ drumlin	29	0.0	48.4	20.8	One site returned zeros from all five probes, two sites drew water - no readings taken
glaciofluvial	2	16.6	21.8	19.2	Limited number of data points
alluvial deposits	2	12.5	25.6	19.1	Limited number of data points

n = number of sample sites

Table 4. Radon concentrations for field duplicates from three sites sampled during 2007. Note the high site variance.

Sample	Probe 1	Probe 2	Probe 3	Probe 4	Probe 5	Mean
NS07 1017	0.0	8.1	0.0	10.6	5.6	4.9
NS07 1018	5.2	8.4	17.6	16.7	9.2	11.4
NS07 1034	2.6	53.0	3.4	7.7	0.1	13.4
NS07 1035	0.2	0.0	1.0	0.1	0.2	0.3
NS07 1050	17.0	4.8	9.8	35.9	18.4	17.2
NS07 1051	59.1	24.4	27.7	9.4	35.5	31.2

Discussion continues among participants of the NASGLP on how to determine the soil radon concentration that will be used to represent each site. Are five readings adequate to be representative of the site? Should the highest and lowest levels of the five readings be discarded and the mean calculated from the remaining three levels? Should zero levels or levels <1.0 kBq/m^3 be eliminated before the mean is calculated?

The Nova Scotia survey used the mean of the radon concentrations from the five probes at each site as the radon concentration representative of the site. The decision to average the data collected from all five probes is based on the excellent precision and accuracy of the results obtained from: (1) the orientation survey in the spring of 2008, and (2) additional quality control tests (not described here) performed at most 2008 sites.

Chen *et al*. (2008a, b) also measured soil radon concentrations from five probes at each sampling site. They excluded the lowest reading and any level <1.0 kBq/m^3 before calculating the mean value used to represent the sample site. On a direct comparative basis, the Nova Scotia results will be low relative to the Ontario results simply because the mean concentration was calculated differently for each survey.

The possibility that seasonal variance could influence site results was taken into account. In order to minimize seasonal variance, the survey was completed in the summer season of Nova Scotia, mid-June to mid-August. Temperatures were recorded at each site and barometric pressures, if required, can be obtained from Environment Canada. Site variance, recognized early in the 2007 sampling program, was ultimately determined to be caused by textural changes in the soil and not related to instrumentation.

Sundal *et al*. (2004) and Smethurst *et al*. (2008) identified highly permeable overburden as an important factor in outlining areas in Norway that are characterized by anomalously high radon soil gas regardless of the uranium concentration of the overburden. This may, in part, explain the moderately high radon soil gas concentration of 54.2 kBq/m^3 obtained in the Strathlorne-Lake Ainsle area, although additional research is required to confirm this association. The opposite occurs at the Meghers Grant sample site where radon was not detected in any of the five probes tested. This site is unique because very low permeability clays underlie the entire area and this inhibits airflow and resulted in exceptionally low radon soil gas concentrations.

The results of this study have resulted in a basic understanding of the relationships between radon concentrations in soil and bedrock type, as well as radon concentrations in soil and surficial geology. These relationships will assist in the development of a radon potential map of the province. In particular, the characteristics of the surficial geology including: (1) uranium concentration, (2) permeability, (3) thickness, and (4) areal extent are probably very important factors when dealing with indoor radon gas.

Conclusions

Measures of radon concentrations in soil gas collected from 72 sample sites at an average sampling density of approximately 1 sample per 800 km^2 during the 2007 and 2008 were part of the NASGLP. This province-wide program represents the first regional radon soil gas survey attempted across Nova Scotia. Results from the 2007 and 2008 summer sampling programs demonstrate that naturally occurring radon soil gas is present throughout Nova Scotia.

Radon soil gas concentrations ranged from a low of 0.1 kBq/m^3 to a high of 207.0 kBq/m^3 with a mean of 25.3 kBq/m^3. The highest concentrations were associated with late-stage, highly evolved Middle - Late Devonian leucomonzogranite on the eastern margin of the South Mountain Batholith.

Site variance was typically high among the five probes generally contained within a 10 m x 10 m sample site. Radon soil gas variability is related primarily to the lithology of the bedrock and the texture and provenance of the overlying surficial materials, and to a lesser extent on the local geomorphologic terrain conditions. Site variance was especially high in the clay-rich Lawrencetown Till.

A limited orientation survey was completed prior to the commencement of the 2008 sampling program. Testing of the RM-2 portable soil radon monitoring system over various mineralized and unmineralized bedrock and surficial units indicate the system is very accurate and precise. Radon concentrations in soil gas remained fairly constant at depths of 60 cm and deeper; therefore, the optimum sampling depth was determined to be 60 cm.

Radon concentrations up to 1500 kBq/m^3 were found associated with known, granite-hosted, vein-type uranium occurrences. The radon content of the mineralized soil is diluted by ambient air and dissipated very quickly, to the point that it is effectively nondetectable with the RM-2 system at heights 10 cm or higher above the mineralized overburden-air interface.

Results from this component of the NASGLP will be useful in establishing natural background concentrations for radon and assist in the development of a radon potential map for the province. These data, combined with the radon potential map, will assist in policy decisions regarding human health as well as issues pertaining to land-use planning, particularly when it relates to issues of indoor radon. In February 2008, Health Canada lowered its guideline for exposure to radon in indoor air from 800 Bq/m^3 to 200 Bq/m^3.

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