

## INTRODUCTION

Multiple Sclerosis (MS) is a chronic inflammatory disease of the Central Nervous System (CNS)<sup>1</sup>. It is more prevalent in patients of European descent<sup>2</sup> and is relatively common in Europe, United States, Canada, New Zealand and parts of Australia<sup>3</sup> (Figure 3). It is thought to be multifactorial and though genetic predisposition may be a contributing factor, it does not explain the change in incidence in migrants, suggesting there may be an environmental cause<sup>4,5</sup>.



Figure 1 – Graphic image of MS<sup>6</sup>

## RATIONALE FOR STUDY

High incidence and prevalence of MS may be related to some carboniferous aged coal bearing or evaporite regions of Nova Scotia (NS) (Figure 4)<sup>7</sup>.

## OBJECTIVES

To conduct a review of the medical and geological literature to assess the feasibility of further data collection and analysis of MS in specific geological areas of Nova Scotia.

## METHODS AND SOURCES OF INFORMATION

- A systematic review was performed using the following options
- Dalhousie library search engines.
  - Pubmed
  - Google scholar and Google.com search engines
  - The Nova Scotia multiple sclerosis integrated database (NS MSID) Project
    - NS has almost double the national average rate of MS
    - Founded in 1979, and may be one of the longest running databases
  - Assistance from Kellogg and Killam libraries re government documents

**Keywords:** Multiple sclerosis and one or more of the following - geology, geography, minerals, rocks, coal and medical geology.



Figure 2. Image from Romanian salt mine<sup>8</sup>

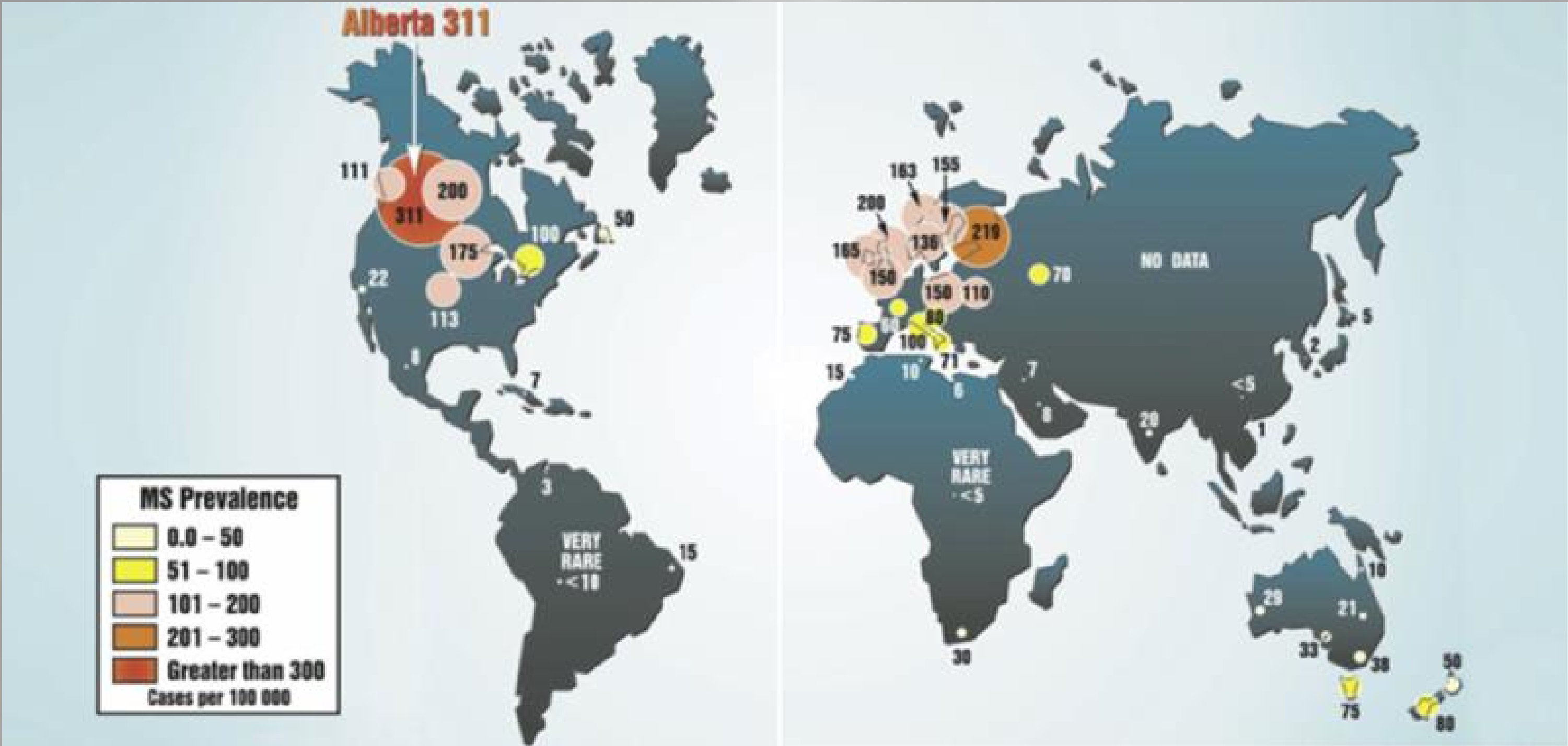


Figure 3. – Multiple Sclerosis rates across the globe<sup>3</sup>

## RESULTS

- There was no evidence showing a definitive etiologic link between MS and geology including coal mining areas.
- The risk of developing MS was representative of the place of birth and early development rather than the present place of residence if different from the birth place<sup>9</sup>.
- A correlation between latitude and MS is well documented<sup>1</sup>
- An inverse correlation between MS and Vitamin D serum has been shown<sup>10</sup>

## Discussion

Reports correlating MS with geology appeared in the literature as far back as 1948, when Limburg proposed a connection between the mean annual temperature and hence latitude<sup>11</sup>. There was interest in an etiologic link between the two based on articles in the 1950's and 1960's but there has not been new information. Recent evidence points to a correlation between MS and latitude and by extension exposure to sunlight and Vitamin D<sup>9,10</sup>.

Some reports<sup>12</sup> could not find a clear connection to specific minerals that may be associated with geological rock types such as radon and lead, but other reports have suggested further study based on results of minerals found in soil<sup>13,14</sup>. There was no overlap between the possible areas of MS and the presence Radon and Uranium in Nova Scotia (Figure 5&6). In a study of an MS cluster in Henribourg, Saskatchewan, the bedrock geology was the same in the study population in the cluster as it was in 2 of the 3 control groups (Figure 7).

## Limitations

- Difficult to obtain information online about incidence and prevalence rates at sub-provincial levels in Canada. Therefore it is difficult to identify clusters or areas of higher concentration and correlate this with the geology of the area.

## Recommendations

- Collaborate with MS medical specialist.
- Examine data on MS cases from the NS MSID including place of residence by county, town or postal code.
- Design and implement questionnaire to identify the place of birth and childhood (up to age 15) if different from present residence for patients confirmed to have MS.
- Compare the incidence and prevalence of MS in different provinces and correlate with the geology.

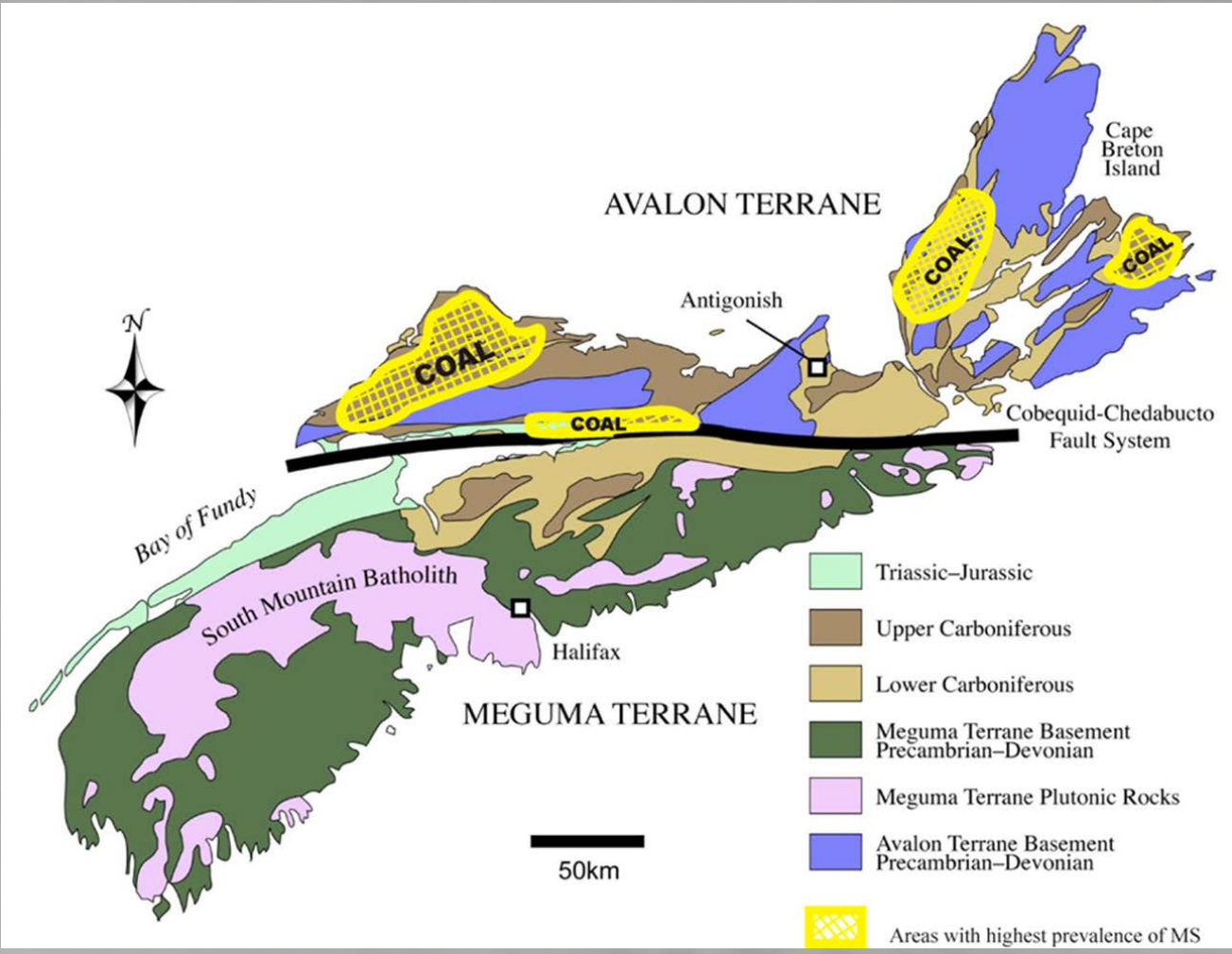


Figure 4 – Possible areas with highest prevalence of multiple sclerosis in Nova Scotia<sup>7</sup>.

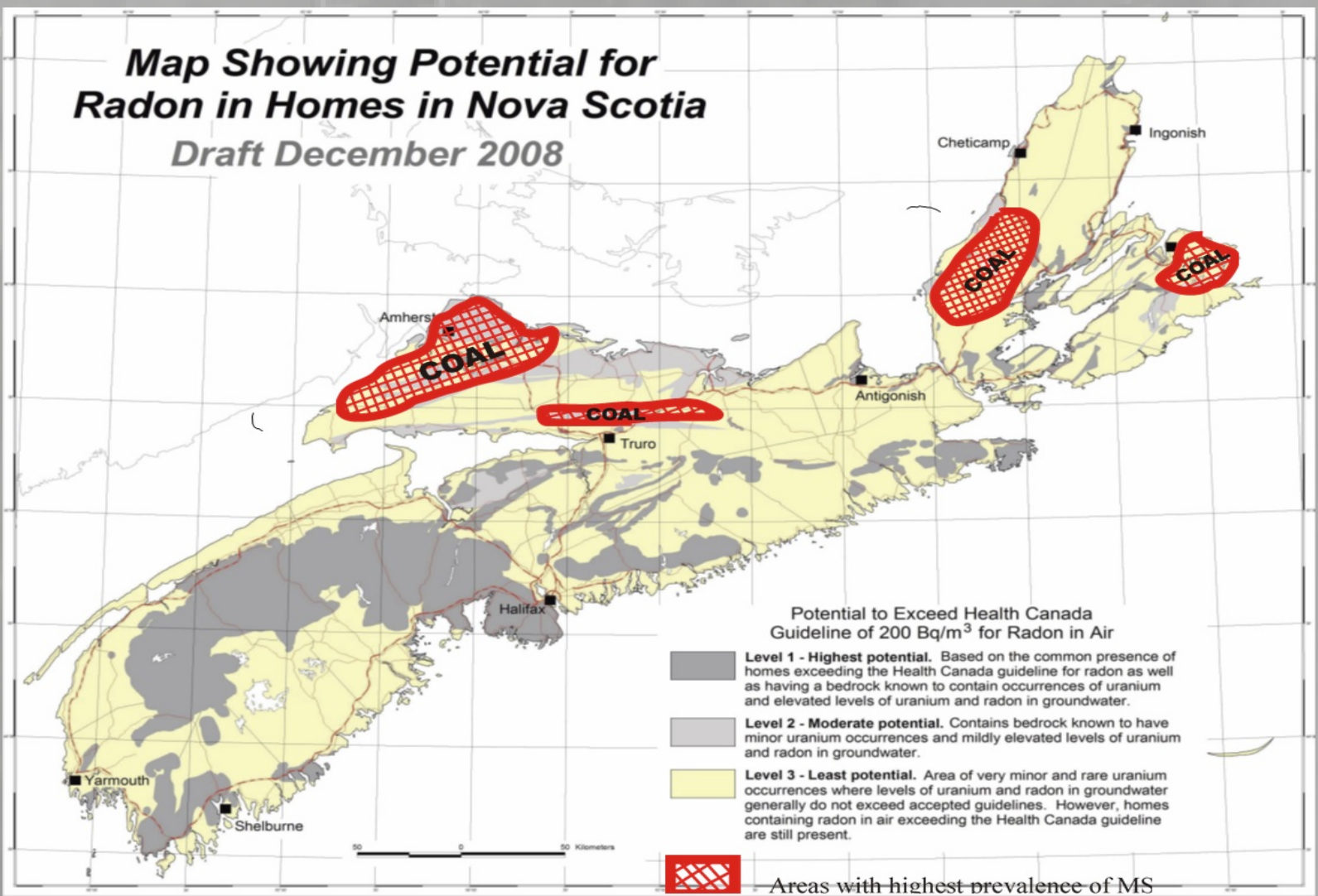


Figure 6. Preliminary map showing potential for radon in air within homes in Nova Scotia<sup>15</sup>.

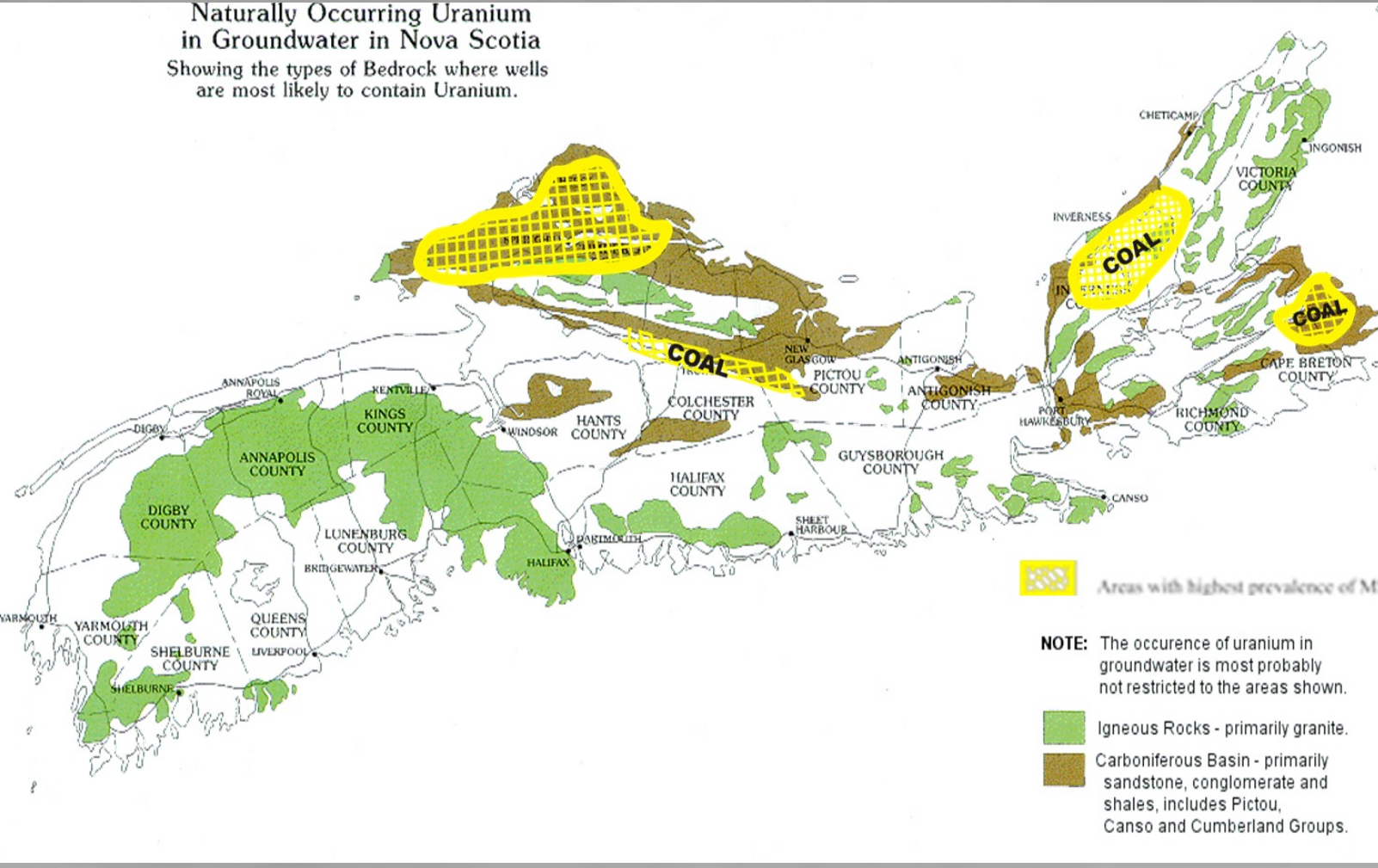


Figure 5. Map showing the bedrock where wells are most likely to contain Uranium<sup>14</sup>.

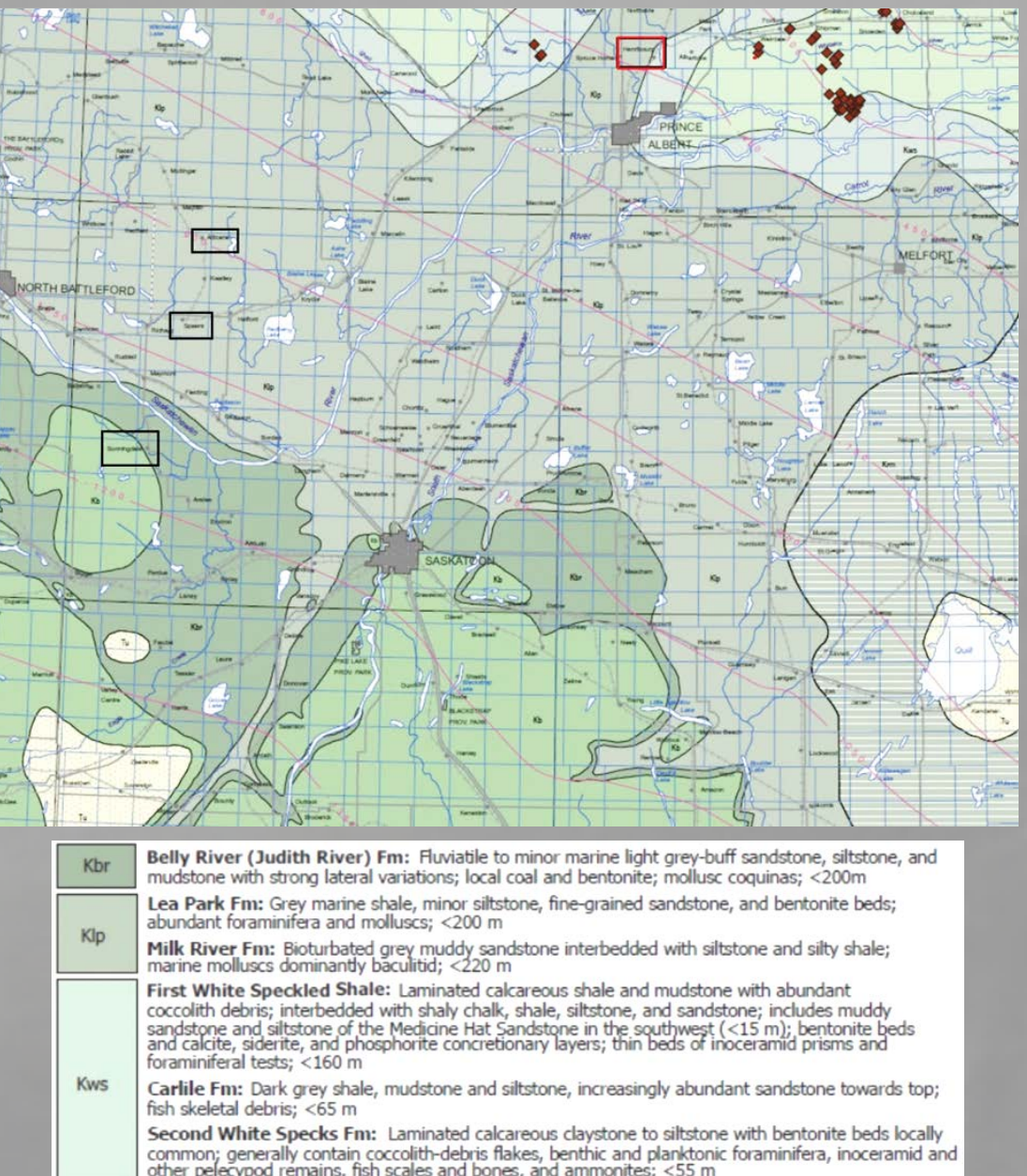


Figure 7. Map showing the location of control and study group in Henribourg, Saskatchewan.



Figure 8. Images from Coal mining areas in Cape Breton: clockwise i) Glace Bay in 1980, ii) Miners iii) loaded coal cars<sup>16</sup>.

References

- Alonso, A., Hernán, A. (2008). Temporal trends in the incidence of multiple sclerosis. A systematic review. *Neurology* 71, 129-135
- Kurland, J.F. (1977). Geography and Multiple Sclerosis. *Neurology* 215, 1-26
- Multiple Sclerosis, The Alberta Disadvantage (2005). Retrieved on May 10, 2013 from <http://www.google.ca/url?sa=t&rc=tj&q=&src=s&source=web&cd=2&ved=0CC8QfjAB&url=http%3A%2F%2Fwww.direct-ms.org%2Fsites%2Fdefault%2Ffiles%2FAlbertaDisadvantage.pdf&ei=8svUBuPoFMK-QAGETtE4&usq=AFQjCNH0wdUmKvZwDzLoWwjdGukqJWw&bvm=bv48293060,d,dmQ>
- Kurtzke et al. (1979). Epidemiology of multiple sclerosis in U.S. veterans. I. Race, sex and geographic distribution. *Neurology* 29, 1228-1235
- Kurtzke, J.F., Beebe, G.W., Norman, J.E. (1985). Epidemiology of multiple sclerosis in US veterans. III. Migration and the risk of MS. *Neurology* 35, 672-678
- Graphic image of MS. Retrieved on July 12, 2013 from <http://havasutherapeuticcenter.com/multiple-sclerosis-massage-treatment/>
- Zentilli, M (2013). Personal communication.
- Images (background included) courtesy of Dawn Tobey
- Acheson, E.D. (1977). Epidemiology of multiple Sclerosis. *Br Med Bull* 33(1), 1-14
- Munger KL, Levin LJ, Hollis BW, Howard NS, Ascherio A (2006). Serum 25-hydroxyvitamin D levels and risk of multiple sclerosis. *JAMA* 296, 2832–2838
- Irvine, D.G. & Shaleifer, H.B. (1988). Geototoxicology of Multiple Sclerosis. *A.J.P.H.* 54 (4), 588-597.
- Bolviken, B., Celius, E.G., Nilsen, R., Strand, T. (2003) Radon- a possible risk factor in Multiple Sclerosis. *Neuroepidemiology* 22, 87-94
- Ingalls, T.H. (1989). Clustering of Multiple Sclerosis in Gallion, Ohio, 1982-1985. *The American Journal of Forensic Medicine and Pathology* 10 (3), 213-215
- Irvine, D.G. & Shaleifer, H.B. (1988). Geototoxicology of Multiple Sclerosis. The Henribourg, Saskatchewan cluster focus II. The Soil. *The Sci Total Envir.* 77, 175-188
- Nova Scotia Canada, Environment (2013). Retrieved on June 25, 2013 from <http://www.gov.ns.ca/nse/water/waterquality.natural.water.contaminants.asp>
- O'Reilly, G.O. (2009). Map Showing Potential for Radon in Indoor Air in Nova Scotia. In: Mineral Resources Branch. Report of Activities 2008: Nova Scotia Department of Natural Resources. Report ME 2009-1, 111-113
- Coal Mining in Cape Breton () Retrieved from <http://members.kos.net/sdaganon/sydb.html>