"Natural toxicant" is not an oxymoron. Earth and health scientists need to meet.

STEPHANIE L. DOUMA [1*], R.A. KLASSEN[2],

[1]Associate of Nova Tox Inc.,Population Health Risk Assessment and Management , Geochemistry, Ottawa, Canada, douma@novatox.ca; stdouma@gmail.com

[2]Retired NRCan Geological Survey of Canada, Ottawa, Canada r.klassen@sympatico.ca

Large parts of Canada may be characterized by natural enrichments in toxicants having a potential to harm health. Originating in bedrock and environmentally re-distributed in air, water, and soil, such toxicants include metals (e.g., Cr, Ni, Cd, Hg), metalloids (e.g.,As), radioactive elements (e.g., Rn, U) and organic compounds (e.g., coal, PACs). Large areas in Alberta, Ontario, New Brunswick, Nova Scotia and Newfoundland with elevated natural arsenic in lake sediments and water. Fluorite elevated in Waterloo, Ontario. Sporatically across Canada areas underlain by chromium and nickel bearing rocks enriching soils and drinking water. Arsenic and uranium in lake sediments (water) on Melville Peninsula in Inuit hunting grounds.

Far from trivial, these naturally occurring toxicants have the potential to cause morbidity (carcinogenic and non-carcinogenic disease) that exceed those that would develop from 'a pack a day' smoking habit.

Despite its potential to inform on the nature and extent of natural toxicants, and their health costs, the earth sciences remain poorly integrated with current approaches to environmental, ecological and human health protection.

All of these toxicants are naturally occurring, present in the environment at levels that will cause harm to human health and despite each toxicant being listed Health Canada's Priority Substance List 1, there is little research in their occurrence. Health officials are not aware they exist, earth scientists are unaware of the implications of their existence. It is time for earth and health scientists to meet.

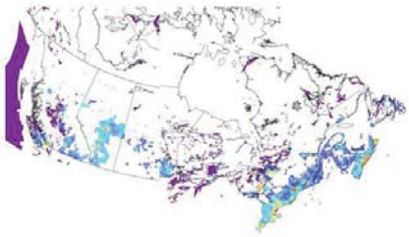

Figure #1: Risk of exposure to nickel and chronium in soil, water, food. Population (2006) of Canada living on rocks that contain chromium and nickel (mafic, ultramafic rocks) . Rocks based on Wheeler's (1997) Scale: 1:7,600,000. Blue, yellow, range polygons delineate census areas (Statistics Canada, 2006).

1. **Wheeler,G.M.,** ***1997*** *Geological Map of. Canada. Geological Survey of Canada*, Map D1860A.

2. **Statistics Canada,** 2006. *Statistics Canada Website*. Census http://www12.statcan.ca/english/census06/reference/dictionary/tables/table1-dictionary.htm Accessed November 20, 2008.

Evidence of ocean acidification viewed by boron isotopes and B/Ca in scleractinian corals

ERIC DOUVILLE[1*], CECILE GONZALEZ-ROUBAUD[1], PASCALE LOUVAT[2], JEROME GAILLARDET[2], GUY CABIOCH[3] PAOLO MONTAGNA[1], NORBERT FRANK[1], MARION GEHLEN[1]

[1] LSCE/IPSL, UMR 8212 UVSQ-CNRS-CEA, F-91198 Gif/Yvette *Eric.Douville@lsce.ipsl.fr; Cecile.Gonzalez@lsce.ipsl.fr Norbert.Frank@lsce.ipsl.fr; Marion Gehlen@lsce.ipsl.fr; Paolo.Montagna@lsce.ipsl.fr

[2] IPG-Paris, Département de Géochimie et Cosmochimie, F-75274 louvat@ipgp.fr; gaillardet@ipgp.fr

[3] IRD, Nouméa in New Caledonia and Bondy in France

The monitoring of ocean acidification (seawater pH fall due to rising anthropogenic CO_2 in the atmosphere) is mainly based on three 20-30 years long pH records: ALOHA at Hawaii in the central North Pacific, BATS at Bermuda in the west North Pacific and ESTOC at Canary Islands in the eastern North Atlantic. The current acidification rate of the surface waters deduced from these records is well established at -0.018 ± 0.001 pH-units/yr [1]. This trend is in good agreement with model projections. However the impact of ocean acidification on marine biology and ecosystems, in particular on key marine species such as foraminifera, corals, pteropods, bryozoan and molluscs still remains poorly constrained and further quantification of pH fall and its impact is needed for the high latitudes and the deep environments. While ocean acidification, since the start of the industrial era, was estimated at around -0.07 pH-units for tropical surface waters, the pH decrease since 1870 could reach values higher than 0.15 pH-units at high northern and southern latitudes.

It has been suggested that the isotopic composition of boron trapped in marine biogenic carbonates can be used to infer the pH of the ambient seawater [2]. Since the publication of this pioneering paper, a number of studies have 1) investigated the existing relationship between boron isotopic composition of carbonates (foraminifera, corals) and seawater pH in order to "calibrate" boron isotopes as pH-proxy and 2) used boron isotopes to reconstruct paleo pCO_2 over the Quaternary and further, for the whole Cenozoic. With the development of analytical techniques to measure precisely B-isotopes by MC-ICPMS, intense studies become feasible to precisely quantify ocean acidification over the industrial era using corals.

With the aim to reconstruct the major carbonate chemistry changes of the ocean, we analyzed the B-isotopic composition of long-lived sub-equatorial Pacific surface corals (*Porites* sp.) and Atlantic mid-depth dwelling cold-water corals (*Lophelia pertusa* and *Madrepora oculata*). Boron isotopes were here measured using MC-ICPMS. Our results demonstrate that boron isotopes in scleractinian corals are sensitive to small ambient seawater pH changes and can thus be reliably used to quantify past ocean acidification. The B-isotope results will be discussed together with B/Ca ratios to enlighten the crucial role of temperature in the paleo-pH reconstructions. Finally, a few examples of quantification of the anthropogenic pH fall during the twentieth century will be presented and compared to expected trends for the surface waters of the Pacific Ocean and for the intermediate waters of the North Atlantic. This research was supported by the European integrated project EPOCA and the French INSU/LEFE/CYBER project PHARE.

[1] Dore (2009) *PNAS* **106,** 12235-40.
[2] Hemming & Hanson (1992) *GCA* **56,** 537–543.