North American Soil Geochemical Landscapes Project

Earth Sciences Sector

PROGRESS ON THE TRI-NATIONAL PROTOCOLS MANUAL

Documenting field, laboratory, and data handling procedures

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Project Aims

- **To develop a continental-scale framework, including set of protocols, for generating soil geochemistry and related data**
- To provide soil geochemical data that are available and useful for a wide range of applications and disciplines.

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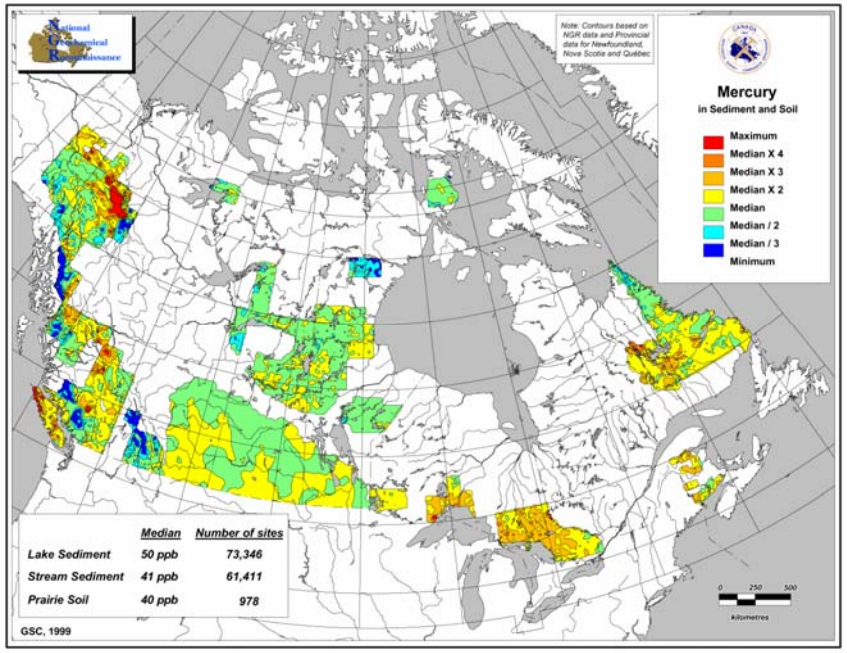
Protocols Manual - field, laboratory, and data handling



- All field, laboratory, and data handling procedures are being documented in minute detail
- Methodology can be duplicated
- Ensures that data collected by numerous groups in many geographic areas over a long time period will be consistent.
- Manual will be in digital form, web accessible, and updated as needed

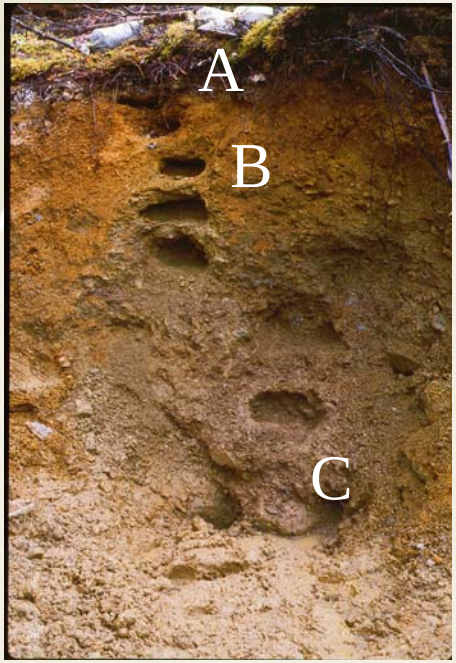
Developing the Protocol Manual

Challenges for documenting protocols

- Diverse soil types and field situations requiring diverse types of equipment and procedures

Developing the Protocol Manual

Challenges



- Complex field and lab operation - many different analyses (core and add-on), sample types, and sampling horizons
- Plenty of repetition in the protocol requirements (e.g. many analyses require preparation of the <2.00 mm fraction)
- Need to think ahead to requirements in future
- Manual is a work in progress – for the next few years it will be constantly expanding - numerous protocols still to be developed (e.g. sampling in peatlands and permafrost areas)

Developing the Protocol Manual

The Plan

- Series of modules or appendices for flexibility and ease when adding and changing.
- One module for each unique type of field acquisition, laboratory procedure, or aspect of data management
- Introductory document based on an overview of protocols; user is directed to the appropriate modules related to the desired protocol.
- Descriptions of core and add-on procedures
- Background information

Developing the Protocol Manual

Overview

- Field sampling design – site selection in office and field, field controls
- Field sampling protocols
  - Mineral soils
    - Permafrost free (Equipment, steps for on-site measurements and sample collection; field data recording);
    - Adjustments for permafrost-affected (cryosols) or disturbed terranes, including agriculture, urban, mining or other contaminated areas
  - Organic Soils (same scheme as shown above for mineral soils)
- Laboratory protocols
  - Sample preparation, storage, archiving
  - Sample analysis and data recording
    - Core analysis, add-on analysis to core splits, add-on analyses on additional samples from core site; add-on analyses on samples collected away from core site
- Data management
  - Database structure
  - QA/QC – quality control from collection to database
  - Summary statistics
  - Data reporting for all the above

Core Determinations

•<2.00 mm fraction for all analyses (Note: <2.00 mm splits ball-milled for 4-acid and carbon analysis.)
•<0.063 mm for selected analyses (carbon, 4-acid, and aqua regia)

- ICP-MS/ES analysis (42 elements) after aqua regia digestion (0-5 cm , A, B, C) [after GSC OF 4823 Sec 6-3]
- ICP-MS/ES analysis (42 elements) after 4-acid near total digestion (0-5 cm , A, B, C) [after GSC OF 4823 Sec 6-3]
- ICP-MS/ES analysis after water leach (0-5 cm and C) [See Module - Water Leach]
- Carbon – organic and inorganic content (0-5 cm , A, B, C) [GSC OF 4823 Sec 4-25]
- Loss-on-ignition (0-5 cm , A, B, C) [Part of the carbon determination; GSC OF 4823 Sec 4-25]
- Moisture content (0-5 cm, A, B, C) [GSC OF 4823 Sec 5-5]
- Bulk density (0-5 cm , A, B, C) [Determination based on field collection of sample with known volume and results of moisture content analysis (GSC OF 4823 Sec 5-5)]
- Munsell colour (0-5 cm , A, B, C) [GSC OF 4823 Sec 5-3]
- Particle size analysis [modified from GSC OF 4823 Sec 5-18; new treatment of coarse fraction to be documented]
- Electrical conductivity (0-5 cm , A, B, C) [GSC OF 4823 Sec 5-27]
- Cation exchange capacity [to be confirmed and documented]

Add-On Determinations

"Add-on" determinations on splits from core tri-national samples

- Selected minor elements (N, P) (0-5 cm, A, B,C) [to be documented]
- Biomethods for assessing soil toxicity (A and C) [See Module – Soil Toxicity]
- X-ray diffraction (A, B, C) [See Module - XRD]
- Radiometric tests in laboratory (0-5 cm, A, B,C) [to be documented]
- Gastric leach (A and C) [to be documented]

"Add-on" determinations on additional samples or other data collected at the tri-national sites

- Soil gas radon measurements [See Module – Soil Gas Radon]
- Radiometric tests (including measurements of U, Th, K) [to be documented]
- Anthrax (whole sample size fraction) [See Module - Anthrax]
- Ecotoxicological studies and analysis for selected organic compounds on 0-30 cm sampling interval [See Module – Studies on 0-30 cm]
- Collaborative sample and data collection for NFI [See Module – NFI]
- Perchlorates (A and C) [to be documented]
- Note: above determinations require no extra work in the field except for collection of extra materials from selected horizons.

"Add-on" determinations on additional samples or other data collected outside the tri-national sites

- Stream waters and sediments analysis [to be documented]

Core Determinations

- Methodologies are built on those developed in earlier programs.
  - *National Uranium Reconnaissance Program*
  - *Mineral Development Agreements (1 and II)*
  - *Metals in the Environment*
  - *Targeted Geoscience Initiatives*

- Some "core" analytical procedures are documented.

Girard, I., Klassen, R.A., and Laframboise, R.R. (2004) Sedimentology Laboratory Manual; Terrain Sciences Division GEOLOGICAL SURVEY OF CANADA OPEN FILE 4823

Protocols Manual

- Please have a look at our very preliminary first draft