

# GEOLOGICAL SURVEY OF CANADA

## MITE POINT SOURCES PROJECT

### List of publications

#### Geological Survey of Canada publications

**Alpay, S., Veillette, J.J., Rosa, F., and Douma, M.**

2005: Rationale, research approach, and study sites for investigating vertical metal distributions in lacustrine sediments; *in* Metals in the Environment Around Smelters at Rouyn-Noranda, Quebec, and Belledune, New Brunswick: Results and Conclusions of the GSC MITE Point Sources Project, (ed.) G.F. Bonham-Carter; Geological Survey of Canada, Bulletin 584.

**Bonham-Carter, G.F.**

1999: Understanding metals in the environment; *Geos*, September 1999.

**Bonham-Carter, G.F., Henderson, P.J., Kliza, D.A., and Kettles, I.M.**

2005: Smelter emissions deposited in the environment around the Horne smelter, Quebec: comparison of regional snow, peat, soil, and lake-sediment and lake-water surveys; *in* Metals in the Environment Around Smelters at Rouyn-Noranda, Quebec, and Belledune, New Brunswick: Results and Conclusions of the GSC MITE Point Sources Project, (ed.) G.F. Bonham-Carter; Geological Survey of Canada, Bulletin 584.

**Cranston, R.E.**

2000: Geochemical data for the Bay of Chaleur – MITE Project # 1.2 (Phase 1); Geological Survey of Canada, Open File 3860, 19 p.

**Cranston, R.E. and Parsons, M.B.**

2001: Geochemical data for the Bay of Chaleur – MITE project # 1.2 (Phase 2); Geological Survey of Canada, Open File 4114, 56 p.

**Goodarzi, F., Sanei, H., and Duncan, W.F.**

2003: Deposition of trace elements in the Trail region, British Columbia: an assessment of the environmental effect of a base metal smelter on land; Geological Survey of Canada, Bulletin 573, 50 p.

**Grenier, A. and Kliza, D.A.**

2005: Pollen analysis of sediment cores from lakes in the Rouyn-Noranda region, Quebec; *in* Metals in the Environment Around Smelters at Rouyn-Noranda, Quebec, and Belledune, New Brunswick: Results and Conclusions of the GSC MITE Point Sources Project, (ed.) G.F. Bonham-Carter; Geological Survey of Canada, Bulletin 584.

**Hall, G.E.M., Vaive, J.E., Pelchat, P., Bonham-Carter, G.F.,**

**Kliza, D.A., and Telmer, K.**

2005: Effects of sample drying on phase distribution of elements in lake-sediment cores; *in* Metals in the Environment Around Smelters at Rouyn-Noranda, Quebec, and Belledune, New Brunswick: Results and Conclusions of the GSC MITE Point Sources Project, (ed.) G.F. Bonham-Carter; Geological Survey of Canada, Bulletin 584.

**Henderson, P.J. and Knight, R.D.**

2005: Regional distribution and mobility of copper and lead in soils near the Horne copper smelter at Rouyn-Noranda, Quebec; *in* Metals in the Environment Around Smelters at Rouyn-Noranda, Quebec, and Belledune, New Brunswick: Results and Conclusions of the GSC MITE Point Sources Project, (ed.) G.F. Bonham-Carter; Geological Survey of Canada, Bulletin 584.

**Henderson, P.J., Knight, R.D., and McMartin, I.**

1999: Heavy-metal concentrations in soils surrounding Canadian base-metal smelters: a comparative study; *in* Current Research 1999-D; Geological Survey of Canada, p. 17–26.

2002: Geochemistry of soils within a 100 km radius of the Horne Cu smelter, Rouyn-Noranda, Quebec; Geological Survey of Canada, Open File 4169 (CD-ROM).

**Kettles, I.M.**

2005: Metal distribution in peat hummocks and hollows within 100 km of the copper smelter, Rouyn-Noranda, Quebec; *in* Metals in the Environment Around Smelters at Rouyn-Noranda, Quebec, and Belledune, New Brunswick: Results and Conclusions of the GSC MITE Point Sources Project, (ed.) G.F. Bonham-Carter; Geological Survey of Canada, Bulletin 584.

**Kettles, I.M. and Dion, K.M.**

2000: Geochemical composition of hummock and hollow peat and feather moss in the vicinity of the Horne Smelter, Rouyn-Noranda, Quebec; Geological Survey of Canada, Open File 3882, 185 p.

**Kliza, D.A. and Telmer, K.**

2001: Phase I. Lake sediment studies in the vicinity of the Horne smelter in Rouyn-Noranda, Quebec; Geological Survey of Canada, Open File D2952 (CD-ROM).

**Kliza, D.A., Bonham-Carter, G.F., and Zdanowicz, C.**

2005: Geochemistry of snow around the copper smelter at Rouyn-Noranda, Quebec: comparison of 1998 and 2001 surveys; *in* Metals in the Environment Around Smelters at Rouyn-Noranda, Quebec, and Belledune, New Brunswick: Results and Conclusions of the GSC MITE Point Sources Project, (ed.) G.F. Bonham-Carter; Geological Survey of Canada, Bulletin 584.

**Kliza, D.A., Telmer, K., Bonham-Carter, G.F., and Hall, G.E.M.**

2000: Geochemistry of snow from the Rouyn-Noranda region of Western Quebec: an environmental database; Geological Survey of Canada, Open File 3869, 169 p.

**Kliza, D.A., Zdanowicz, C., and Bonham-Carter, G.F.**

2002: Geochemistry of snow from the Rouyn-Noranda region of Western Quebec: an environmental database, Part II; Geological Survey of Canada, Open File 4205 (CD-ROM).

**Knight, R.D. and Henderson, P.J.**

2005: Characterization of smelter dust from the mineral fraction of humus collected around Rouyn-Noranda, Quebec; *in* Metals in the Environment Around Smelters at Rouyn-Noranda, Quebec, and Belledune, New Brunswick: Results and Conclusions of the GSC MITE Point Sources Project, (ed.) G.F. Bonham-Carter; Geological Survey of Canada, Bulletin 584.

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**Parsons, M.B.**

2002: Metals in the Environment (MITE) research in Canada: the marine connection; *in* Bedford Institute of Oceanography 2002 in Review; Fisheries and Oceans Canada and Natural Resources Canada, p. 54–56.

**Parsons, M.B. and Cranston, R.E.**

2005: Distribution, transport, and sources of metals in marine sediments near a coastal lead smelter in northern New Brunswick; *in* Metals in the Environment Around Smelters at Rouyn-Noranda, Quebec, and Belledune, New Brunswick: Results and Conclusions of the GSC MITE Point Sources Project, (ed.) G.F. Bonham-Carter; Geological Survey of Canada, Bulletin 584.

**Savard, M.M., Bégin, C., Parent, M., Marion, J., Smirnoff, A.,**

**Hou, X., Tassé, N., and Sharp, Z.**

2005: Distinction des accumulations de métaux provenant de sources géogènes et anthropiques aux environs de la fonderie Horne : la dendrogéochimie en tant qu'outil de surveillance environnementale; *in* Metals in the Environment Around Smelters at Rouyn-Noranda, Quebec, and Belledune, New Brunswick: Results and Conclusions of the GSC MITE Point Sources Project, (ed.) G.F. Bonham-Carter; Geological Survey of Canada, Bulletin 584.

**Veillette, J.J., Paradis, S.J., and Buckle, J.**

2005: Bedrock and surficial geology of the general area around Rouyn-Noranda, Quebec and Ontario; *in* Metals in the Environment Around Smelters at Rouyn-Noranda, Quebec, and Belledune, New Brunswick: Results and Conclusions of the GSC MITE Point Sources Project, (ed.) G.F. Bonham-Carter; Geological Survey of Canada, Bulletin 584.

**Zdanowicz, C., Kliza, D., Paktunc, D., and Bonham-Carter, G.F.**

2005: Physico-chemical characterization of airborne particulate impurities deposited in snow around a copper smelter, Rouyn-Noranda, Quebec; *in* Metals in the Environment Around Smelters at Rouyn-Noranda, Quebec, and Belledune, New Brunswick: Results and Conclusions of the GSC MITE Point Sources Project, (ed.) G.F. Bonham-Carter; Geological Survey of Canada, Bulletin 584.

#### External publications

**Bonham-Carter, G.F. and Kettles, I.M.**

2001: Estimating the size of a metal anomaly around a base-metal smelter in Quebec, Canada using peatland data: a Monte Carlo error analysis; *in* Geologic Modeling and Simulation: Sedimentary Systems, (ed.), D.F. Merriam and J.C. Davis; Kluwer-Plenum, New York, New York, p. 303–326.

**Goodarzi, F., Sanei, H., and Duncan, W.F.**

2001: Monitoring the distribution and deposition of trace elements associated with lead and zinc smelter in the Trail area; *Journal of Environmental Monitoring*, v. 3, p. 515–525.

**Goodarzi, F., Sanei, H., Garrett, R.G., and Duncan, W.F.**

2002: Accumulation of trace elements on the surface soil around the Trail smelter, British Columbia, Canada; *Environmental Geology*, v. 43, p. 29–38.

**Goodarzi, F., Sanei, H., Labonté, M., and Duncan, W.F.**

2002: Sources of lead and zinc associated with metal smelting activities in the Trail area, British Columbia, Canada; *Journal of Environmental Monitoring*, v. 4, p. 400–407.

**Kettles, I.M. and Bonham-Carter, G.F.**

2002: Modelling dispersal of metals from a copper smelter at Rouyn-Noranda (Québec, Canada) using peatland data; *Geochemistry: Exploration, Environment and Analysis*, v. 2, no. 2, p. 99–110.

**McMartin, I., Henderson, P.J., Plouffe, A., and Knight, R.D.**

2002: Comparison of Cu-Hg-Ni-Pb concentrations in soils adjacent to anthropogenic point sources: examples from four Canadian sites; *Geochemistry: Exploration, Environment, Analysis*, v. 2, p. 57–74.

**Savard, M.M., Bégin, C., and Parent, M.**

2002: Are industrial SO<sub>2</sub> emissions reducing CO<sub>2</sub> uptake by the Boreal Forest?; *Geology*, v. 30, p. 403–406.

**Savard, M.M., Bégin, C., Parent, M., Smirnov, A., and Marion, J.**

2005: Effects of smelter sulfur dioxide emissions: a spatiotemporal perspective using carbon isotopes in tree rings; *Journal of Environmental Quality*, v. 33, p. 13–26.

**Telmer, K., Bonham-Carter, G.F., Kliza, D.A., and Hall, G.E.M.**

2005: The atmospheric transport and deposition of smelter emissions: evidence from the multi-element geochemistry of snow, Quebec, Canada; *Geochimica et Cosmochimica Acta*, v. 68, no. 14, p. 2961–2980.

## Conference abstracts and posters

**Alpay, S., Lortie, L., Gould, W.D., Rancourt, D.G., Mayer, B.,**

**Rosa, F., Wong, H.K.T., Prévost, C., and Hall, G.E.M.**

2001: Diagenetic metal remobilization versus chronological metal loading in lake sediments; *in Proceedings, 6th International Conference on the Biogeochemistry of Trace Elements*, (ed.) K. Bolton, University of Guelph, Guelph, Ontario, Special Publication 312.

**Bonham-Carter, G.F., Kettles, I.M., and Kliza, D.A.**

2002: An empirical model for atmospheric metal deposition around Rouyn-Noranda, based on peat and snow surveys; *Geological Association of Canada–Mineralogical Association of Canada, Annual Meeting, Saskatoon, Saskatchewan, May 27–29, 2002, Abstracts Volume 27*, p. 12.

**Bonham-Carter, G.F., Kliza, D.A., and Buckle, J.L.**

2001: Exploratory spatial data analysis of regional lake-sediment data from the Rouyn-Noranda region, Quebec; *in Proceedings, 6th International Conference on the Biochemistry of Trace Elements (ICOBTE)*, July 29–August 2, 2001, Guelph, Ontario, Special Publication 312, p. 541.

**Garrett, R.G. (co-ord.)**

2002: GSC-Metals in the Environment (GSC-MITE) final review of activities; February 25–26, 2002, Ottawa, Ontario; Program with Abstracts, 39 p.

**Garrett, R.G. and Pacyna, J.**

2001: Industrial and atmospheric sources of cadmium into the food chain; *in Proceedings, Workshop on Environmental Cadmium in the Food Chain: Sources, Pathways, and Risks*, (ed.) J.K. Syers and M. Gochfeld; Scientific Committee on Problems of the Environment (SCOPE), International Council of Scientific Unions (ICSU), Paris, France, p. 34–39.

**Goodarzi, F., Sanei, H., Garrett, R.G., and Duncan, W.F.**

2002: Moss monitoring survey as a measure of deposition and accumulation of metals on surface soils in the vicinity of the Trail smelter, British Columbia; *Geological Association of Canada–Mineralogical Association of Canada, Annual Meeting, Saskatoon, Saskatchewan, May 27–29, 2002, Abstracts Volume 27*, p. 40.

**Grenier, A. and Kliza, D.A.**

2001: Relative age dating of 8 lake sediment cores from the Rouyn-Noranda area using *Ambrosia* pollen and <sup>210</sup>Pb; *in Proceedings, 6th International Conference on the Biogeochemistry of Trace Elements*, (ed.) K. Bolton; University of Guelph, Guelph, Ontario, Special Publication 313, p. 542.

**Hall, G.E.M., Vaive, J.E., Pelchat, P., Bonham-Carter, G.F., Kliza, D.A., and Telmer, K.**

2001: Effects of air drying on element forms in lake sediment cores; *in Proceedings, 6th International Conference on the Biogeochemistry of Trace Elements*, (ed.) K. Bolton; University of Guelph, Guelph, Ontario, Special Publication 310, p. 539.

**Henderson, P.J. and Knight, R.D.**

2001: Regional distribution of trace metals in soils surrounding a Cu smelter in the boreal shield ecozone, northern Quebec, Canada; *in Proceedings, 6th International Conference on the Biogeochemistry of Trace Elements*, (ed.) K. Bolton; University of Guelph, Guelph, Ontario, Special Publication 309, p. 538.

2002: The regional distribution of metals in soils near the Horne smelter, Rouyn-Noranda, Quebec; *Geological Association of Canada–Mineralogical Association of Canada, Annual Meeting, Saskatoon, Saskatchewan, May 27–29, 2002, Abstracts Volume 27*, p. 49.

**Kettles, I.M.**

2000: Cu in peat from hummocks and hollows and feather moss near the Horne Smelter, Rouyn-Noranda, Quebec, Canada; *in 11th Annual International Conference on Heavy Metals in the Environment*, (ed.) J. Nriagu; University of Michigan School of Public Health, Ann Arbor, Michigan, contribution no. 1309 (CD-ROM).

2002: Patterns of smelter-related metals in peat hummocks and hollows around the Horne Cu smelter, Rouyn-Noranda, Quebec; *Geological Association of Canada–Mineralogical Association of Canada, Annual Meeting, Saskatoon, Saskatchewan, May 27–29, 2002, Abstracts Volume 27*, p. 60.

**Kettles, I.M. and Bonham-Carter G.F.**

2001: Modelling metal anomalies in peat in the vicinity of the Cu-Zn smelter at Rouyn-Noranda, Quebec, Canada; *in Proceedings, 6th International Conference on the Biogeochemistry of Trace Elements*, (ed.) K. Bolton; University of Guelph, Guelph, Ontario, Special Publication 307, p. 536.

**Kettles, I.M., Henderson, P.J., and Knight, R.D.**

2001: Comparison of the metal record in peat and humus near the Cu-Zn smelter at Rouyn-Noranda, Quebec, Canada; *in Proceedings, 6th International Conference on the Biogeochemistry of Trace Elements*, (ed.) K. Bolton; University of Guelph, Guelph, Ontario, Special Publication 306, p. 535.

**Kliza, D.A., Zdanowicz, C., and Bonham-Carter, G.F.**

2001: Metals in snow pack around the Horne smelter, Rouyn-Noranda, Quebec: preliminary results from winter 2001; *in Proceedings, 6th International Conference on the Biogeochemistry of Trace Elements*, (ed.) K. Bolton; University of Guelph, Guelph, Ontario, Special Publication 314, p. 543.

**McMartin, I., Henderson, P.J., Plouffe, A., and Knight, R.D.**

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**Paktunc, D.A., Kingston, D., and Skeaff, J.**

2001: Characterization of individual particles emitted from a copper smelter and a coal-fired power plant — winter sampling; *in Proceedings, 6th International Conference on the Biogeochemistry of Trace Elements*, (ed.) K. Bolton; University of Guelph, Guelph, Ontario, Special Publication 303, p. 532.

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**Paktunc, D.A., Kingston, D., and Smith, D.**

2002: Automated detection, microanalysis and characterization of particles by variable-pressure scanning electron microscope; *Geological Association of Canada–Mineralogical Association of Canada, Annual Meeting, Saskatoon, Saskatchewan, May 27–29, 2002, Abstracts Volume 27*, p. 87.

**Parsons, M.B. and Cranston, R.E.**

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**Parsons, M.B. and Cranston, R.E. (cont.)**

- 2001: Distribution and sources of metals in marine sediments near a coastal lead smelter in New Brunswick, Canada; *in* Proceedings, 6th International Conference on the Biogeochemistry of Trace Elements, (ed.) K. Bolton; University of Guelph, Guelph, Ontario, Special Publication 311, p. 540.
- 2001: Distribution, transport, and sources of metals in marine sediments near a coastal lead smelter in northern New Brunswick; Geological Association of Canada–Mineralogical Association of Canada, Joint Annual Meeting, St. John's, Newfoundland, May 27–30, 2001, Abstracts Volume 26, p. 112–113.
- 2002: Influence of lead smelter emissions on the distribution of trace elements in marine sediments from the Bay of Chaleur, Eastern Canada; Geological Association of Canada–Mineralogical Association of Canada, Annual Meeting, Saskatoon, Saskatchewan, May 27–29, 2002, Abstracts Volume 27, p. 89.

**Savard, M.M., Bégin, C., Parent, M., Marion, J., Smirnov, A., Hou, X., Tassé, N., and Sharp, Z.**

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**Savard, M.M., Bégin, C., Parent, M., and Sharp, Z.**

- 2001: Discrimination between natural and anthropogenic sources of metals in the environment using high resolution H, C and Pb Isotopic Dendrogeochemistry; *in* 4th International Symposium on Applied Isotope Geochemistry, Pacific Grove, California, Program and Abstracts, Extended abstract, Invited plenary lecture, p. 83–85.

**Savard, M.M., Bégin, C., Parent, M., Smirnov, A., Marion, J., and Sharp, Z.**

- 2002: Spatio-temporal records of smelter emissions by stable and radiogenic isotopes in *Picea* sp.; *in* Dendrochronological, Environmental Change and Human History, 6<sup>th</sup> International Conference on Dendrochronology, Québec, Quebec, August 22–27, Extended abstract, p. 294–296.

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- 2002: Chemical characterization and speciation of a sample of copper smelter stack particulates; Geological Association of Canada–Mineralogical Association of Canada, Annual Meeting, Saskatoon, Saskatchewan, May 27–29, 2002, Abstracts Volume 27, p. 110.

**Veillette, J.J., Paradis, S.J., and Buckle, J.L.**

- 2002: Bedrock and surficial geology of the general area around Rouyn-Noranda, Quebec and Ontario; Geological Association of Canada–Mineralogical Association of Canada, Annual Meeting, Saskatoon, Saskatchewan, May 27–29, 2002, Abstracts Volume 27, p. 119.

**Zdanowicz, C., Kliza, D.A., Paktunc, D.A., and Smith, D.**

- 2002: Physico-chemical characterization of airborne particulate impurities deposited in snow around a metal-ore smelter, Rouyn-Noranda, Quebec; Geological Association of Canada–Mineralogical Association of Canada, Annual Meeting, Saskatoon, Saskatchewan, May 27–29, 2002, Abstracts Volume 27, p. 130.

**Thesis****Campbell, R.**

- 2000: Metal impact on benthic foraminifera in Baie des Chaleurs, New Brunswick: a reconnaissance review of marine geochemistry and species distribution; B.Sc. Thesis, Dalhousie University, Halifax, Nova Scotia.