



Natural Resources  
Canada

Ressources naturelles  
Canada

**GEOLOGICAL SURVEY OF CANADA  
OPEN FILE 8367**

**Whole-rock lithogeochemistry of the turbidite-hosted  
Mustang Au showing, Lower Eastmain greenstone belt,  
Superior Province, Quebec**

**A.M. Beauchamp, B. Dubé, M. Malo, V. Bécu, and K. Lauzière**

**2018**

**Canada** 



**GEOLOGICAL SURVEY OF CANADA  
OPEN FILE 8367**

**Whole-rock lithochemistry of the turbidite-hosted  
Mustang Au showing, Lower Eastmain greenstone belt,  
Superior Province, Quebec**

**A.M. Beauchamp<sup>1, 2</sup>, B. Dubé<sup>3</sup>, M. Malo<sup>1</sup>, V. Bécu<sup>3</sup>, and K. Lauzière<sup>3</sup>**

<sup>1</sup>Institut national de la recherche scientifique—Centre Eau, Terre et Environnement, 490 rue de la Couronne, Québec, Quebec G1K 9A9

<sup>2</sup>Present address: Ministère de l'Énergie et des Ressources naturelles, 400 boulevard Lamaque, Val-d'Or, Quebec J9P 3L4

<sup>3</sup>Geological Survey of Canada, 490 rue de la Couronne, Québec, Quebec G1K 9A9

**2018**

© Her Majesty the Queen in Right of Canada, as represented by the Minister of Natural Resources, 2018

Information contained in this publication or product may be reproduced, in part or in whole, and by any means, for personal or public non-commercial purposes, without charge or further permission, unless otherwise specified.

You are asked to:

- exercise due diligence in ensuring the accuracy of the materials reproduced;
- indicate the complete title of the materials reproduced, and the name of the author organization; and
- indicate that the reproduction is a copy of an official work that is published by Natural Resources Canada (NRCan) and that the reproduction has not been produced in affiliation with, or with the endorsement of, NRCan.

Commercial reproduction and distribution is prohibited except with written permission from NRCan. For more information, contact NRCan at [nrcan.copyrightdroitdauteur.nrcan@canada.ca](mailto:nrcan.copyrightdroitdauteur.nrcan@canada.ca).

Permanent link: <https://doi.org/10.4095/308180>

This publication is available for free download through GEOSCAN (<http://geoscan.nrcan.gc.ca/>).

**Recommended citation**

Beauchamp, A.M., Dubé, B., Malo, M., Bécu, V., and Lauzière, K., 2018. Whole-rock lithochemistry of the turbidite-hosted Mustang Au showing, Lower Eastmain greenstone belt, Superior Province, Quebec; Geological Survey of Canada, Open File 8367, 1 .zip file. <https://doi.org/10.4095/308180>

Publications in this series have not been edited; they are released as submitted by the author.

## Table of Contents

Foreword/Context .....	1
Summary.....	1
Analytical Methods .....	1
References .....	2

# Whole-rock lithochemistry of the turbidite-hosted Mustang Au showing, Lower Eastmain greenstone belt, Superior Province, Quebec

## Foreword/Context

The Targeted Geoscience Initiative 4 (TGI-4) was a five year (2010-2015) research program by Natural Resources Canada to conduct collaborative, multidisciplinary, thematic, and knowledge-driven ore systems studies aimed at assisting in the discovery of future resources through more effective targeting of buried mineral deposits in Canada's established and emerging mining camps.

Seven of Canada's major ore systems were studied through TGI-4, including a major project on lode gold deposits. The TGI-4 Lode Gold project, which comprised numerous site-specific and thematic research activities, covered the entire spectrum of crustal settings for lode gold deposits, from orogenic banded iron formation-hosted and greenstone-hosted quartz carbonate vein-type gold deposits formed deep in the crust (>5 km), to intrusion-related deposits that are formed at shallower crustal levels (~2–5 km), to deposits formed at or near the seafloor (Dubé et al., 2011). The main findings of the Lode Gold project are summarized in Dubé et al. (2015, and references therein).

## Summary

This report releases whole-rock geochemical and assay results of 176 samples from turbidite-hosted Mustang Au showing, collected during the 2012 to 2013 field seasons as part of a MSc study by the senior author (Beauchamp, 2018) at the Institut National de la Recherche Scientifique, Centre Eau, Terre, Environnement (INRS-ETE) in Quebec City. Research at the Mustang Au showing was conducted under the Lode Gold project and analytical data is presented in a format easily importable in a geographic information system (GIS). Samples were collected on surface and from drillcore to document host units, their petrogenesis, the alteration assemblages and the ore. Interpretations are presented in Beauchamp (2018) and Beauchamp et al. (2015). Sample information and geochemical results are presented in Appendices 1 and 2 (worksheet "Results") respectively.

## Analytical Methods

Whole-rock analyses were performed at Activation Laboratories Ltd. in Ancaster, Ontario, using a combination of their standard preparation and analytical packages, the details of which can be found at [www.actlabsint.com/methods\\_can.htm](http://www.actlabsint.com/methods_can.htm). Methods and detection limits are reported for oxides and elements in Appendix2-worksheet "DetectionLimit" while method abbreviations appear in *italic* below.

Samples were initially dried (60°C) and crushed to at least 90% (-2mm) in a steel jaw crusher. A mechanically split fraction was pulverized in a chromium-free steel mill until 95% of the sample material passed through a 74 µm mesh. Major elements were determined by lithium metaborate-tetraborate fusion followed by inductively coupled plasma mass spectrometry (ICP-MS; *FUS-MS* or *XRF*). Trace and rare earth elements were determined by a combination of lithium metaborate-tetraborate and total digestion (four acids) followed by inductively coupled plasma mass spectrometry (ICP-MS; *FUS-MS*) and inductively coupled plasma atomic emission spectrometry (ICP-OES; *FUS-ICP*). FeO was determined by titration using a cold acid digestion (ammonium metavanadate and hydrofluoric acid) in an open system (*TITR*).

For chalcophile elements a four-acid digestion ICP-MS (*TD-MS*) method was preferred. Aqua regia (*AR-MS*) digestion coupled with ICP-MS was chosen to analyze As, Sb, Bi, Se and Te.

Boron was determined by gamma neutron activation analysis (*PGNAA*).

Gold and Ag were measured by a combination of atomic absorption (*FA-AA*), fire assay, and gravimetry (*FA-GRA*). High-grade ore zone samples were re-analyzed with a combination of fire assay and gravimetric methods for gold and silver (*FA-GRA*) and aqua regia dissolution (*ICP-OES*) or sodium peroxide fusion (*FUS-Na2O2*) with ICP-OES depending on the analyte.

CO<sub>2</sub> and Total (S) were determined by combustion infrared analysis (*IR*).

Fluorine was determined by lithium metaborate and tetraborate fusion and fluoride ion electrode analysis (*FUS-ISE*). Chlorine was determined by instrumental neutron activation analysis (*INAA*). Mercury was determined by cold vapour flow injection (*FIMS*) following aqua regia digestion.

Actlabs reports LOI, LOI2, Total and Total 2. LOI is determined by weighing a small amount of the sample before and after ignition. However because FeO was measured, it was possible to adjust LOI to take into account the weight gain resulting from oxidation of FeO to Fe<sub>2</sub>O<sub>3</sub>. This adjusted value of LOI is LOI2.

Total1 is the total of all major oxides using Fe<sub>2</sub>O<sub>3</sub>(T) and LOI, whereas Total2 includes LOI2.

## Quality assurance and quality control (QA/QC)

Activation Laboratories internal QA/QC system under ISO 17025 or ISO 9001:2008 accreditation, quality control materials (certified standards and duplicates and Blanks) are reported in Appendix 2 in worksheets “Lab\_Standards”, “Lab\_Duplicates” and “Lab\_Blanks”. In addition to these laboratory quality control measures, blind internal standards were also included to monitor analytical reliability.

Precision estimated from internal standards and duplicates reported from the lab, are within 10% of the mean standard value. Limitations include insufficient material for analysis of some standards. Blank sample analyses show minimal contamination between samples.

## References

Beauchamp, A.M., 2018, L’indice Mustang : Géologie et altération d’une minéralisation aurifère mise en place dans les turbidites de la ceinture de la basse-Eastmain, Eeyou Itschee Baie-James, Unpublished M.Sc. thesis, Institut national de la Recherche Scientifique, Centre Eau, Terre, Environnement, Québec, Québec, 343 pages.

Beauchamp, A.M., Dubé, B., Malo, M., McNicoll, V.J.; Brisson, T., Archer, P., Lavoie, J., and Chartrand, F., 2015. Geology, mineralization and alteration of the turbidite-hosted Mustang Au showing, Lower Eastmain greenstone belt, Superior Province, Quebec, *In: Targeted Geoscience Initiative 4: Contributions to the Understanding of Volcanogenic Massive Sulphide Deposit Genesis and Exploration Methods Development*, (ed.) J.M. Peter and P. Mercier-Langevin; Geological Survey of Canada, Open File 7852, p. 227–243.

Dubé, B., Mercier-Langevin, P., Castonguay, S., McNicoll, V.J., Pehrsson, S.J., Bleeker, W., Schetselaar, E.M., and Jackson, S., 2011, 38. Targeted Geoscience Initiative 4. Lode gold deposits in ancient, deformed and metamorphosed terranes – Footprints and exploration implications : A preliminary Overview of themes, objectives and targeted areas : Ontario Geological Survey, Summary of Field Work and Other Activities 2011, Open File report 6270, p. 38-1 to 38-10.

Dubé, B., Mercier-Langevin, P., Castonguay, S., McNicoll, V., Bleeker, W., Lawley, C.J.M., De Souza, S., Jackson, S.E., Dupuis, C., Gao, J.-F., Bécu, V., Pilote, P., Goutier, J., Beakhouse, G.P., Yergeau, D., Oswald, W., Janvier, V., Fontaine, A., Pelletier, M., Beauchamp, A.-M., Malo, M., Katz, L.R., Kontak, D.J., Tóth, Z., Lafrance, B., Gourcerol, B. Thurston, P.C., Creaser, R.A., Enkin, R.J., El Goumi, N., Grunsky, E., Schneider, D.A., Kelly, C.J., and Lauzière, K., 2015. Precambrian Lode Gold Deposits – A Summary of TGI-4 Contributions to the Understanding of Lode Gold Deposits, with an Emphasis on Implications for Exploration: Geological Survey of Canada, Open File 7852, p. 1-24.