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**GEOLOGICAL SURVEY OF CANADA
OPEN FILE 8984**

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stockwork-disseminated Archean gold deposit,
Abitibi, Québec**

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Whole-rock geochemistry of the Canadian Malartic stockwork-disseminated Archean gold deposit, Abitibi, Québec

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 889 analyses of 878 samples from Canadian Malartic mine, collected during the 2012 to 2015 field seasons as part of a post-doctoral study by the senior author at the Geological Survey of Canada, in Quebec City (GSC-Q). Research at the Canadian Malartic mine was conducted under the Lode Gold project, in collaboration with the Canadian Mining and Innovation Council, Osisko and Mine Canadian Malartic. Analytical data is presented in a format easily importable in a geographic information system (GIS). Samples were collected on surface, from the mine (open pit) and from drillcore to document host units, their petrogenesis, the alteration assemblages and the ore. Interpretations are presented in De Souza et al. (2015, 2017a, b, 2019, 2020), and in Dubé and Mercier-Langevin (2020) and Mercier-Langevin et al. (2020). 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. 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.

CO₂ 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 Fe₂O₃. This adjusted value of LOI is LOI2. Total1 is the total of all major oxides using Fe₂O₃(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 are within 2 standard deviation (2σ) of the mean standard value and 3 standard deviation (3σ) for analysis near the detection limit for most elements except for Ta_FUS_ICPMS_ppm in certificate A12-14470 that gave values slightly higher ($>\text{mean} + 2\sigma$) than expected, although at relatively low concentrations. Limitations include insufficient material for analysis of some standards. Blank sample analyses show minimal contamination between samples except in blank analysis respectively for Cu_TD_ICPMS_ppm and Zn_TD_ICPMS_ppm for one sample in certificate A13-02794 and for FeO_TITR_% in one in certificates A12-14470 and A13-15104.

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