Ph.D. Candidate

Hassan Heidarian

Graduate Academic Unit

Earth Sciences

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March 16, 2022

2:00 p.m. (Atlantic)

Virtual Defence

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Examining Board:
Dr. Chris McFarlane (Earth Sciences)
Dr. Adrian Park (HRA - Earth Sciences)
Dr. Gilles Villemure (Chemistry)
Dr. David Lentz (Earth Sciences) Supervisor

External Examiner: Dr. Gema R. Olivo, P.Eng
Department of Geological Sciences and Geological Engineering
Queens University

The Oral Examination will be chaired by:
Dr. Rob Moir, Acting Assistant Dean of Graduate Studies

BIOGRAPHY

Universities attended (with dates & degrees obtained):

2017 – present	Ph.D. candidate, University of New Brunswick
2013	Master of Economic Geology, Shahid Beheshti University of Tehran
2008	B.Sc. Geology, Payame Noor University

Peer-Reviewed Publications:

Heidarian, H., Lentz, D., K. Thorne, N. Rogers., 2021, Application of portable X-ray and micro-X-ray fluorescence spectrometry to characterize alteration and mineralization within various gold deposits hosted in southern New Brunswick, Canada. Journal of Geochemical Exploration 229, p. 1–20.

Heidarian, H., Lentz, D., Alirezaei, S., McFarlane C.R.M., Peighambari., 2018, Multiple stage ore formation in the Chadormalu iron deposit, Bafq metallogenic province, Central Iran: evidence from BSE imaging and apatite EPMA and LA ICP-MS U-Pb geochronology. Minerals 8, 87, 30p.

Heidarian, H., Alirezaei, S., Lentz, D., 2017, Chadormalu Kiruna-type magnetite-apatite deposit, Bafq district, Iran: Insights from hydrothermal alteration evidence, geochemical, fluid inclusion, and sulfur isotopic data. Ore Geology Review 83, 43-62.

Heidarian, H., Lentz, D., Alirezaei, S., Peighambari, S., Hall, D., 2016, Using the chemical analysis of magnetite to constrain various stages in the formation and genesis of the Kiruna-type Chadormalu magnetite-apatite deposit, Bafq district, Central Iran, Mineralogy and Petrology 110, 927-942

Peighambari, S., Uysal, I., Stosch, H-G., Ahmadipour, H., **Heidarian, H.,** 2016, Genesis and tectonic setting of ophiolitic chromitites from the Dehsheikh ultramafic complex (Kerman, southeastern Iran): Inferences from platinum-group elements and chromite compositions. Ore Geology Review 74, 39-51.

Selected Conference Presentations:

Heidarian, H., Lentz, D., K. Thorne., 2022, Relationship between gold mineralization in the Annidale and Clarence Stream areas of Southern New Brunswick. AGS, Fredericton, New Brunswick, Canada. AGS. Held online.

Heidarian, H., Lentz, D., Thorne, K.G., 2021. Lead and Sulphur Isotope Analysis of Gold Zones in the Clarence Stream and Oak Bay deposits, southwestern New Brunswick; examination of fluid sources and controls on distribution of mineralization. In Abstracts 2021: Exploration, Mining and Petroleum New Brunswick. Editor: E.A. Keith. New Brunswick Department of Natural Resources and Energy Development, Geoscience Report 2021-1, p. 12.

Heidarian, H., Lentz, D., McFarlane, C.R.M., Thorne, K.G., 2021. U-Pb geochronologic and mineral-chemical results from apatite and titanite in the Clarence Stream gold-antimony deposit, southwestern New Brunswick, Canada. AGS, Fredericton, New Brunswick, Canada. AGS, Wolfville, NS. Held online.

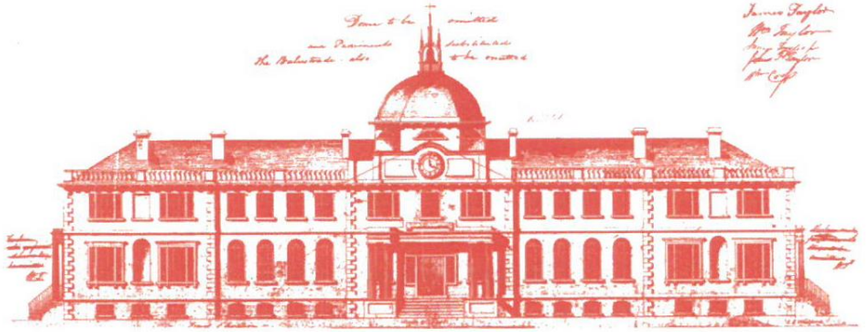
Examination of mesothermal to epithermal orogenic- to intrusion-related Sb-bearing gold systems in the southern New Brunswick segment of the Northern Appalachians

Abstract

Several Sb-Au mineralization styles are diversly scattered within the boundary of Gondwana and Laurasia in Southern New Brunswick. Some research has been completed regarding the time and genesis of the structurally-controlled, mesothermal to epithermal orogenic and intrusion-related Sb-Au mineralization types in the regionally correlative Annidale (New River and Annidale belts) and Clarence Stream areas (St. Croix and Mascarene belts).

LA-ICPMS U-Pb and 40Ar-39Ar geochronology of hydrothermal rutile and white mica in the Annidale area suggested that orogenic gold type mineralization is related to Ordovician Penobscot orogeny. However, several further orogenies overprinted some mineralizations in the area. The apatite and titanite U-Pb and white mica 40Ar-39Ar data confirmed the Early Devonian age for intrusion-related gold type in the Clarence Stream area. Zircon U-Pb data on several mafic to felsic intrusive rocks showed the age range of Silurian to Late Devonian; however, the relation of the Early Devonian intrusions (Magaguadavic and Lower Tower Hill granites) to the gold mineralization has been confirmed. The sulphur isotope data suggests the mantle-derived source for sulphide phases. The lead isotope results show high radiogenic Pb, which might be due to the addition of Pb during or after ore formation, that overprinted the initial Pb-isotope system.

As no later major magmatic activities occurred, Ordovician orogenic gold was preserved in the Annidale area. It is probable that similar orogenic gold mineralization was formed at the same time in the southwestern part of the New River Belt (Clarence Stream area). The combination of several factors, including pre-existing orogenic gold deposits, advanced hydrothermal activities related to the generating the multi-phase intrusions during Devonian, and the presence of local brittle-ductile shear zones, were crucial and explained the greater concentration of gold in intrusion-related deposits in the Clarence Stream area than the orogenic gold deposits in the Annidale area.



Home of the School of Graduate Studies, Sir Howard Douglas Hall was designed by J.E. Woolford in 1825 and is the oldest university building in Canada still in use.

The University of New Brunswick recognizes that the university sits on traditional Wolastoqey territory. The river that runs right by our university – the St. John River – is also known as Wolastoq, along which live the Wolastoqiyik -- the people of the beautiful and bountiful river.

UNIVERSITY OF NEW BRUNSWICK

SCHOOL OF GRADUATE STUDIES

ORAL EXAMINATION

Hassan Heidarian

IN PARTIAL FULFILMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY