

Protracted and complex fluid histories the norm in orogenic-type gold deposits as revealed by LA ICP-MS sulfide mapping

Daniel Kontak, Jacob.J. Hanley, Blandine Gourcerol, Joseph Petrus, Kelly Malcom, Mitch Kerr, Chris Kelly, Marie Letourneau, Jordan Mcdivitt, Kevin Neyedley, et al.

► **To cite this version:**

Daniel Kontak, Jacob.J. Hanley, Blandine Gourcerol, Joseph Petrus, Kelly Malcom, et al.. Protracted and complex fluid histories the norm in orogenic-type gold deposits as revealed by LA ICP-MS sulfide mapping. RFG 2018 - Resources for Future Generations, Jun 2018, Vancouver, Canada. hal-02284231

HAL Id: hal-02284231

<https://hal-brgm.archives-ouvertes.fr/hal-02284231>

Submitted on 11 Sep 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Protracted and complex fluid histories the norm in orogenic-type gold deposits as revealed by LA ICP-MS sulfide mapping

Kontak, Daniel dkontak@laurentian.ca, Harquail School of Earth Sciences, Sudbury, ON P3E2C6

Hanley, Jacob, Department of Geology, Saint Mary's University, Halifax, NS B3H3C3, Jacob.hanley@smu.ca

Gourcerol, Blandine, Bureau de Recherches Géologiques et Minières (BRGM), F-45060, Orléans, France gourcerol.blandine@gmail.com

Petrus, Joe japetrus@gmail.com

Kelly, Chris CKelly2@laurentian.ca

Kerr, Mitch mkerr3@laurentian.ca

Letourneau, Marie marie-letourneau@hotmail.com

Malcolm, Kelly kj_malcolm@laurentian.ca

McDivitt, Jordan jmcdivitt@gmail.com

Neyedley, Kevin kevinneyedley@gmail.com

Tokaryk, Scott stokaryk@gmail.com

Hydrothermal ore deposits are the culmination of many processes, commencing with generation of fluids, metal transport and mineral precipitation. This process can involve mixing of fluids, in addition to metals sourced from different reservoirs. The convention of inferring elemental enrichment and associations using bulk methods is limited with such data, although ore petrology provides insight into elemental paragenesis. The advent of in situ LA-ICP-MS analysis provides the means to readily analyse many elements at various detection limits (wt. % to ppb) and apply spatial resolution (10s μm) in a way not possible previously. Application of this procedure to pyrite and arsenopyrite has increased in recent years and with it the realization of a complex chemistry in ore systems. Here LA-ICP-MS data from a wide variety of orogenic-type gold settings is used to illustrate the power of the method and assess generalizations in regards to deposit formation based on: 1) elemental mapping; 2) generating an elemental paragenesis for the mapped sulfides; 3) conversion of the data to time slice domains (TSD) or semi-quantitative concentrations which provides 10s of thousands of analyses in small domains to assess elemental trends and processes; and 4) statistical treatment of such data. Application of the latter protocol to deposit samples reveals a general paragenesis of: 1) early enrichment of Co, Ni, As \pm Au, Ag, Cu, Te, In, Sb, Se, Mo; 2) later overgrowths or fracture controlled Bi, Sb, Te, Pb, Zn, Au, Ag; and 3) a late Ti, Mo and W stage. Relevant to Au are: 1) its increase through the paragenesis from 10s to 100s ppm; 2) late occurrence as VG with lower Au:Ag ratios; and 3) variable elemental associations. These data indicate a protracted elemental paragenesis, remobilization of early Au by later fluids, and coupled dissolution-precipitation reactions as important processes in these deposits.