

ERIC GRUNSKY

Geochemical and Statistical Consultant – Canada/Australia

B.Sc. (Hons) Geology, (Univ. Toronto); M.Sc. Geology (Univ. Toronto); Ph.D. Geology (Univ. Ottawa)

Registered Professional Geoscientist (P.Ge.) – Province of British Columbia; Fellow of the Association of Applied Geochemists; Member of the International Association for Mathematical Geosciences; Member of the Society of the Geochemical Society; Recipient of three distinguished awards in the applications of mathematical/statistical geosciences.

Eric has +35 years of experience in a range of geosciences disciplines including mineral exploration, geologic mapping, geochemical surveys and resource assessment. Eric is an internationally recognized expert in the evaluation and interpretation of geochemical survey data at continental, regional and camp scales. This includes geochemical data derived from rock/drill core, till, lake sediment, stream, soil and weathered materials geochemistry. His expertise has been used to identify and isolate areas of mineralization for a range of commodities including precious metal, diamond, base metal and uranium deposits. Eric employs the use of advanced statistical methods that include spatial analysis to characterize and validate geochemical processes associated with background lithologies, alteration assemblages and key mineralization signatures. He has published extensively in peer-reviewed journals and has made many presentations at mineral industry conferences.

Eric's studies and consultancies have included the following commodities and deposit types: Lode gold, volcanic-hosted massive sulphides, porphyry, intrusion and sedimentary hosted uranium, IOCG

Eric has carried out work in: Canada, Australia, USA, Ireland, Greenland, Argentina, Mexico, Indonesia, Middle East

He has extensive experience in statistical and modelling software including: R Statistical Modelling Environment, Quantum GIS, ENVI, ERMapper, ArcGIS

Working Experience

Consulting 1991-2015

Senior Research Scientist, Applied Geochemistry, Geological Survey of Canada, Ottawa, 2002- 2015

Remote Sensing Geologist / Information Geologist (Senior): Alberta Geological Survey, Alberta Energy and Utilities Board, Edmonton, 1998 –2002

Senior Geologist and: Vancouver Office Representative, Mining and Minerals; Geomatics International Inc. Vancouver, 1997 –1998

Senior Geologist, Photosat Inc. (formerly RGI Ltd.) Vancouver, BC, 1997

Senior Project Geologist - Computer Applications; Geological Survey Branch, Ministry of Employment and Investment, Victoria, Canada; 1991 – 1997

Senior Research Scientist; Division of Exploration Geoscience, Commonwealth Scientific Industrial Research Organisation (CSIRO), Perth, Western Australia; 1988 – 1991

Senior Geoscientist, Precambrian Division, Ontario Geological Survey, Toronto, Ontario, Canada, 1977 – 1988

Ontario)

Recent Publications

Yang, J., **Grunsky**, E., Cheng, Q. 2018. A novel hierarchical clustering analysis method based on Kullback–Leibler divergence and application on Dalaimiao geochemical exploration data, *Computers & Geosciences*, <https://doi.org/10.1016/j.cageo.2018.11.003>.

Talebi, H, Mueller, U., Tolosana-Delgado, R., **Grunsky**, E.C., McKinley, J.M., Caritat, P, 2018. Surficial and Deep Earth Material Prediction from Geochemical Compositions, *Natural Resources Research*, <https://doi.org/10.1007/s11053-018-9423-2>

Yang, J., **Grunsky**, E., Cheng, Q. 2018. Guidelines for Enhancing the Signature of Multi-element Mineralization Using Principal Component Analysis: Part 1 – Monte Carlo Simulation, *Natural Resources Research*, <https://doi.org/10.1007/s11053-018-9392-5>

Chen, S., Hattori, K., **Grunsky**, E.C. 2017. Identification of sandstones above blind uranium deposits using multivariate statistical assessment of compositional data, Athabasca Basin, Canada, *Journal of Geochemical Exploration*, 188 pp 229-239. <https://doi.org/10.1016/j.gexplo.2018.01.026>

Schetselaar, E., Ames, D., **Grunsky**, E. 2017. Integrated 3D Geological Modeling to Gain Insight in the Effects of Hydrothermal Alteration on Post-Ore Deformation Style and Strain Localization in the Flin Flon Volcanogenic Massive Sulfide Ore System, *Minerals*, 8(1), 3. <https://doi.org/10.3390/min8010003>.

Chen, S., Hattori, K., **Grunsky**, E.C., 2017. Multielement statistical evidence for uraniferous hydrothermal activity in sandstones overlying the Phoenix uranium deposit, Athabasca Basin, Canada, *Mineralium Deposita*, DOI: 10.1007/s00126-017-0756-2.

McKinley, J.M., **Grunsky**, E.C., Mueller, U.A., 2017. Environmental monitoring and peat assessment using a multivariate analysis of regional-scale geochemical data, *Mathematical Geosciences*, V. 50, (2), pp, 235-246. doi.org/10.1007/s11004-017-9686-x.

Grunsky, E.C., de Caritat, P., Mueller, U.A., 2017. Using surface regolith geochemistry to map the major crustal blocks of the Australian continent, *Gondwana Research*, 46, 227-239, <http://dx.doi.org/10.1016/j.gr.2017.02.011>.

Brauhart, C.W., **Grunsky**, E.C., Hagemann, S.G. 2016. Magmato-hydrothermal space: A new metric for geochemical characterisation of metallic ore deposits. *Ore Geology Reviews*, v.86, pp. 867-895. [doi:10.1016/j.oregeorev.2016.11.001](https://doi.org/10.1016/j.oregeorev.2016.11.001).

de Caritat, P., **Grunsky**, E.C., Mann, A.W. 2016. Recognition of geochemical footprints of mineral systems in the regolith at regional to continental scales, *Australian Journal of Earth Sciences*, doi:10.1080/08120099.2017.1259184.

McMartin, I., Dredge, L.A., **Grunsky**, E.C., Pehrsson, S. 2016. Till geochemistry in west-central Manitoba: interpretation of provenance and mineralization based on glacial history and multivariate data analysis. *Economic Geology* (2016),111(4):1001. ESS contribution number 20100407. <http://dx.doi.org/10.2113/econgeo.111.4.1001>.

Mueller, U.A., **Grunsky**, E.C., 2016. Multivariate Spatial Analysis of Lake Sediment Geochemical Data; Melville Peninsula, Nunavut, Canada, *Applied Geochemistry*, doi:10.1016/j.apgeochem.2016.02.007.

Makvandi,S., Ghasemzadeh-Barvarz, M., Beaudoin, G., **Grunsky**, E.C., McClenaghan, M.B., Duchesne, C., Boutroy, E., 2016. Partial least squares-discriminant analysis of trace element compositions of magnetite from various VMS deposit subtypes: Application to mineral exploration, *Ore Geology Reviews*, Volume 78, October 2016, Pages 388-408, ISSN 0169-1368, <http://dx.doi.org/10.1016/j.oregeorev.2016.04.014>.

Chen, S., Hattori, K., & **Grunsky**, E. C., 2015. Multivariate statistical analysis of the REE-mineralization of the Maw Zone, Athabasca Basin, Canada. *Journal of Geochemical Exploration*. Volume 161, February 2016, 98–111. doi:10.1016/j.gexplo.2015.11.009 (ESS Cont.# 20160021).

Makvandi, S., Ghasemzadeh-Barvarz, M., Beaudoin, G., **Grunsky**, E. C., McClenaghan, M. B., & Duchesne, C., 2016. Principal component analysis of magnetite composition from volcanogenic massive sulfide deposits: Case studies from the Izok Lake (Nunavut, Canada) and Halfmile Lake (New Brunswick, Canada) deposits, *Ore Geology Reviews*, Volume 72, Part 1, January 2016, Pages 60-85, ISSN 0169-1368, <http://dx.doi.org/10.1016/j.oregeorev.2015.06.023>.

Harris, J. R., & **Grunsky**, E. C., 2015. Predictive lithological mapping of Canada's North using Random Forest classification applied to geophysical and geochemical data. *Computers & Geosciences*, 80, 9-25. 10.1016/j.cageo.2015.03.013.

Harris, J.R., **Grunsky**, E.C., Behnia, P., Corrigan, D. 2015. Data- and knowledge-driven mineral prospectivity maps for Canada's North. *Ore Geology Reviews*, 71, pp. 788-803. Doi: <http://dx.doi.org/10.1016/j.oregeorev.2015.01.004>.

Grunsky, E.C., Mueller, U.A., Corrigan, D., 2014. A study of the lake sediment geochemistry of the Melville Peninsula using multivariate methods: Applications for predictive geological mapping. *Journal of Geochemical Exploration*, 141: 15-41 doi 10.1016/j.gexplo.2013.07.013.

de Caritat, P., **Grunsky**, E.C., 2013. Defining element associations and inferring geological processes from total element concentrations in Australian catchment outlet sediments: multivariate analysis of continental-scale geochemical data, *Applied Geochemistry*, <http://dx.doi.org/10.1016/j.apgeochem.2013.02.005>, ESS contribution number: 20120362.

Grunsky, E.C., 2013. Predicting Archean Volcanogenic Massive Sulfide Deposit Potential from Litho geochemistry: Application to the Abitibi Greenstone Belt, *Geochemistry: Exploration, Environment, Analysis* vol. 13, 2013; p. 317-336, doi:10.1144/geochem2012-176.

Grunsky, E C; McClenaghan, M B. 2015, An integrated study of till geochemical, indicator mineral, and pebble lithological data, Thompson Nickel Belt, Manitoba, Geological Survey of Canada, Scientific Presentation 38,; 40 pages, doi:10.4095/295695.

Chen, S; Hattori, K; **Grunsky, E C;** Liu, Y. 2015, Principal component analysis and Mg/Fe ratios of sandstones overlying the Phoenix Deposits: Implications for uranium exploration in Athabasca Basin, Saskatchewan, Geological Survey of Canada, Scientific Presentation 35, 2015; 1 sheet, doi:10.4095/296533.

Chen, S; Hattori, K; **Grunsky, E C;** Liu, Y., 2015. Geomathematical and mineralogical study of sandstones overlying the Phoenix uranium deposits and the REE-rich Maw Zone, Athabasca Basin, Canada in, Presentations of the 2014 TGI-4 unconformity-related uranium workshop; Potter, E G (ed.); Geological Survey of Canada, Scientific Presentation 34,; p. 241-257.

Chen, S; Hattori, K; **Grunsky, E C;** Liu, Y., 2015, Principal component analysis and Mg/Fe ratios of sandstones overlying the Phoenix Deposits: Implications for uranium exploration in Athabasca Basin, Saskatchewan; Geological Survey of Canada, Scientific Presentation 32, 2015; 1 sheet, doi:10.4095/296514.

Grunsky, E.C., Drew, L.D., Sutphin, D.M., 2010. Process recognition in multi-element soil and stream-sediment geochemistry, *Applied Geochemistry*, 24(8), pp 1602-1616, 10.1016/j.apgeochem.2009.04.024.

Grunsky, E.C., 2010. The interpretation of geochemical survey data; *Geochemistry, Exploration, Environment Analysis* 10(1), p. 27-74, doi: 10.1144/1467-7873/09-210.

Arne, D., Mackie, R., Pennimpede, C., Grunsky, E., Bodnar, 2018. Integrated Assessment of Regional Stream-Sediment Geochemistry for Metallic Deposits in Northwestern British Columbia (Parts of NTS 093, 094, 103, 104), Canada, Geoscience BC Report 2018-14, CSA Global Report N° 110.2018, 18 May 2018. 96p.

Chen, S; Hattori, K; Grunsky, E C; Liu, Y., 2015, Geomathematical study of sandstones overlying the Phoenix Uranium Deposits and the REE-rich Maw Zone, Athabasca Basin, Saskatchewan in, Targeted Geoscience Initiative 4: unconformity-related uranium systems; Potter, E G (ed.); Wright, D M (ed.); Geological Survey of Canada, Open File 7791, 2015; p. 21-31.

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Books, Chapters, Monographs.

Grunsky, E.C., Drew, L.J., Smith, D.B., 2018, Analysis of the United States Portion of the North American Soil Geochemical Landscapes Project – A Compositional Framework Approach, in Handbook on Mathematical Geosciences: Fifty Years of IAMG, ,313-346, Springer. ISBN 978-3-319-78999-6. Invited Contribution.

Bonham-Carter, G.F., Grunsky, E.C. 2018. Two Ideas for Analysis of Multivariate Geochemical Survey Data: Proximity Regression and Principal Component Residuals. In: Daya Sagar B., Cheng Q., Agterberg F. (eds) Handbook of Mathematical Geosciences. Springer, Cham. https://doi.org/10.1007/978-3-319-78999-6_23. Invited Contribution

Grunsky, E.C., Kjarsgaard, B.A., 2016. Recognizing and Validating Structural Processes in Geochemical Data. In Compositional Data Analysis, J.A. Martin-Fernandez and S. Thio-Henestrosa (eds.), Springer Proceedings in Mathematics and Statistics, 187. 85-116, 209pp., doi: 10.1007/978-3-319-44811-4_7, ISBN 978-3-319-44811-4.

Mueller, U.A., Lo, J., de Caritat, P., Grunsky, E.C., 2014. Structural Analysis of the National Geochemical Survey of Australia Data. *Mathematics of Planet Earth*, pp.99-102.

Grunsky, E.C., Harris, J.R., McMartin, I., 2009. Predictive mapping of surficial material, Schultz Lake Area (NTS 66A), Nunavut, Canada; in Remote Sensing and Spectral Geology, (ed.) R. Bedell, A. Crosta and E. Grunsky (eds.), Reviews in Economic Geology, Special Publication v. 16, p. 177-198.

Bedell, R., Crosta, A, Grunsky, E.C., 2009. Preface; in Remote Sensing and Spectral Geology, (ed.) R. Bedell, A.P. Crosta, E. C. Grunsky, Reviews in Economic Geology, Special Publication v. 16, p. xv-xix.