The UNIVERSITY CONSORTIUM

Dr. Tom Al

- Professor, Department of Earth and Environmental Sciences, University of Ottawa
- Tom.Al@uottawa.ca

Tom Al obtained his PhD from the University of Waterloo in 1996. He worked as Professor at the University of New Brunswick until he moved to the University of Ottawa in 2015. Tom teaches Hydrogeology and Aqueous Inorganic Geochemistry and Modelling, and manages a team of post-graduate students and staff on the different research projects. The work that Tom and his team is involved with makes use of a wide range of state-of-the-art analytical techniques to determine the chemical and isotopic composition of rocks, minerals and water, and to understand the transport and reaction of solutes in groundwater systems.

Fields of Interest

- Geochemistry
- Hydrogeology
- Solute transport
- Waste management
- Water-rock interaction

Tom's research is focussed on understanding geochemical reaction processes between groundwater and minerals that affect the transport and distribution of natural and anthropogenic (contaminant) species. This involves aqueous geochemistry, mineralogy and hydrogeology. The research is commonly tied to the need to ensure secure management of waste materials from industries such as metal mining and nuclear power generation, but also involves studies of natural and anthropogenic contamination in aquifers. In many cases, advancement of the science requires development of new experimental and measurement techniques. Examples include the following:

- Development of spectroscopic methods for measuring nanoscale oxidation state changes in minerals adjacent to fractures in bedrock, as an aid to predicting the depth of penetration of potentially corrosive oxidizing fluids in potential host rocks for a geological repository of radioactive waste
- Development of non-destructive x-ray imaging techniques for measuring diffusion properties of rocks
- Characterization of pore-water geochemistry in low-permeability sedimentary rocks

Selected Papers

Jautzy, J.J., Petts, D.C., Clark, I.D., Al, T.A., Stern, R.A., Jensen, M. (2020). Diagenetic evolution of a sedimentary system (Michigan Basin): Insights from petrography and S-isotope micro-analysis of pyrite. Chemical Geology, 541.

Loomer, D.B., MacQuarrie, K.T.B. Al, T.A. (2019). Using permutational and multivariate statistics to understand inorganic well water chemistry and the occurrence of methane in groundwater, southeastern New Brunswick, Canada. Science of the Total Environment, 675: 667–678.

Nunn, J., Xiang, Y., Al, T.A. (2018). Investigation of partial saturation effects on diffusion in shale. Applied Geochemistry, 97: 93-101.

Celejewski, M., Barton, D., Al, T. (2018). Measurement of Cl−:Br− Ratios in the Porewater of Clay-Rich Rocks — A Comparison of the Crush-and-Leach and the Paper-Absorption Methods. Geofluids, 2018.

Loomer, D. B., MacQuarrie, K. T., Al, T. A., Bragdon, I. K., Loomer, H. A. (2018). Temporal variability of dissolved methane and inorganic water chemistry in private well water in New Brunswick, Canada. Applied Geochemistry.

Zhao, J., Al, T., Chapman, S.W., Parker, B.L., Mishkin, K.R., Cutt, D., & Wilkin, R.T. (2017). Determination of Cr (III) solids formed by reduction of Cr (VI) in a contaminated fractured bedrock aquifer: Evidence for natural attenuation of Cr (VI). Chemical Geology, 474, 1-8.

Petts, D.C., Saso, J.K., Diamond, L.W., Aschwanden, L., Al, T.A., Jensen, M. (2017). The source and evolution of paleofluids responsible for secondary minerals in low-permeability Ordovician limestones of the Michigan Basin. Applied Geochemistry, 86, 121-137.

Xiang, Y., Al, T., Mazurek, M. (2016). Effect of confining pressure on diffusion coefficients in clay-rich, low-permeability sedimentary rocks. Journal of contaminant hydrology, 195, 1-10.

Williamson, M.D., Nickerson, B.G., Al, T.A. (2016). Efficient 3D Rigid Body Image Registration. IEEE Transactions on Image Processing.

Zhao, J., Al, T., Chapman, S.W., Parker, B.L., Mishkin, K.R., Cutt, D., Wilkin, R.T. (2015). Determination of hexavalent chromium concentrations in matrix porewater from a contaminated aquifer in fractured sedimentary bedrock. Chemical Geology. 419: 142-148.

Al, T.A., Clark, I.D., Kennell, L. Jensen, M. Raven, K.G. (2015) Geochemical evolution and residence time of porewater in low-permeability rocks of the Michigan Basin, southwest Ontario. Chemical Geology, 404: 1-17

Hussein, E.M.A., Agbogun, H.M.D., Al, T.A. (2015). Calibration-free quantification of interior properties of porous media with x-ray computed tomography. Applied Radiation and Isotopes, 97: 130-139.

Celejewski, M., Scott, L., Al, T.A. (2014). An absorption method for extraction and characterization of porewater from low-permeability rocks using cellulosic sheets. Applied Geochemistry, 49: 22-30.

Al, T.A., Leblanc, J., Phillips, S. (2013). A study of Groundwater Quality from Domestic Wells in the Sussex and Elgin Region, New Brunswick: with Comparison to Deep Formation Water and Gas from the McCully Gas Field.; Geological Survey of Canada, Open File 7449, 40p. doi:10.4095/292762

Clark, I.D., Al, T.A., Jensen, M., Kennell, L., Mazurek, M., ad Mohapatra, R. (2013). Paleozoic Brines Preserved in an Ordovician Aquiclude. Geology, 41:(9), 951–954.

Agbogun, H.M.D., Al, T.A., Hussein, E.M.A. (2013). Assessment of X-ray Micro-CT Measurements of Porosity and Solute Concentration Distributions during Diffusion in Porous Geologic Media, Journal of Porous Media, 16:(8), 683-694.

Xiang, Y., Al, T.A., Cavé, L., Loomer D. (2013). Diffusive anisotropy in low-permeability Ordovician sedimentary rocks from the Michigan Basin in southwest Ontario, Journal of Contaminant Hydrology, 155: 31–45.

Loomer, D.B., L. Scott, T. A. Al, K. U. Mayer and S. Bea. 2013. Diffusion-reaction studies in low permeability shale using X-ray radiography with cesium. Applied Geochemistry, 39: 49-58.

Agbogun, H.M.D. T.A. Al and E.M.A. Hussein. 2013. Three Dimensional Imaging of Porosity and Tracer Concentration Distributions in a Dolostone sample during Diffusion Experiments using X-ray Micro-CT, Journal of Contaminant Hydrology, 145: 44-53.

Foucher, D., Hintelmann, H., Al, T.A. MacQuarrie, K.T. (2012). Mercury isotope fractionation in waters and sediments of the Murray Brook mine watershed (New Brunswick, Canada): Tracing mercury contamination and transformation. Chemical Geology, 205: (3–4), 367-390.