

## Controls on O and H isotope compositions of clay minerals and porewater in Ordovician shales, Ontario, Canada

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Porewater hydrogen (H) and oxygen (O) isotope compositions provide information concerning its origin and evolution. Such data are useful for tracking subsurface water movement and comprise part of the safety case for evaluating potential deep geological repository sites. Porewater-host rock interaction, however, can change both porewater and host rock O and H isotope compositions. Porewater can be especially sensitive to isotopic exchange in low water content, clay-rich rocks. Clay minerals are variably susceptible to H and O isotope exchange depending on crystal-chemistry and diagenetic reactions [1-4].

Illite > kaolinite > chlorite dominate the <2 $\mu$ m fraction of SW Ontario Ordovician shales. Their O and H isotope compositions plot to the left of terrestrial clay weathering lines. Calculated water O and H isotope compositions in equilibrium with these clays at maximum burial temperatures (60-90°C) [5], as determined using available clay-water isotope geothermometers, match porewater O and H isotope compositions measured by various techniques [6-8]. Short-term experiments at 68°C using isotopically labelled water also demonstrated the H isotope exchangeability of these clays. Water/rock interaction may therefore play a role in determining porewater O and H isotope compositions at low temperatures in silicate-dominated, low water content rocks.

[1] Savin & Lee (1988) *Rev. Mineral.* **19**, 189-223. [2] Longstaffe & Ayalon (1990) *Appl. Geochem.* **5**, 657-668. [3] Longstaffe (2000) *Mineral. Assoc. Canada Course* **28**, 115-162. [4] McKay & Longstaffe (2013) *Clay. Clay Miner.* **61**, 440-460. [5] Al-Aasm & Crowe (2018) *Mar Pet Geol* **92**, 160-178. [6] Mazurek *et al.* (2013) *NWMO TR-13-19*. [7] Hobbs *et al.* (2011) *Geofirma TR-08-40*. [8] Clark *et al.* (2010) *Intera TR-08-19*.