Shale to soil: Geochemistry and clay mineral transformations

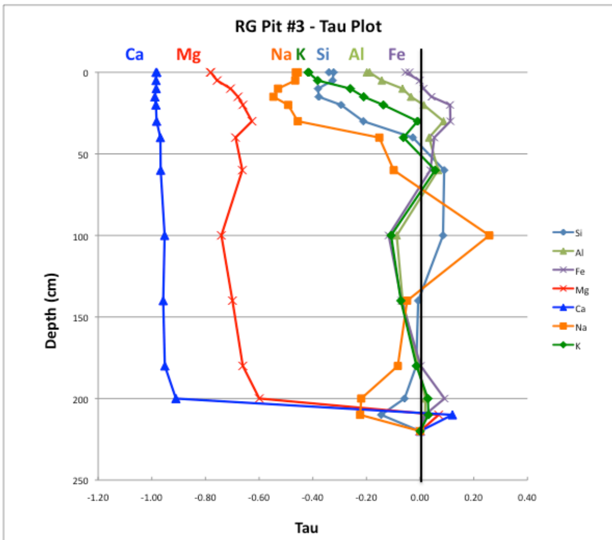
R.H. APRIL*, S. LEMON AND D. KELLER

Geology Department, Colgate Univ., Hamilton, NY 13346, USA (*correspondence: rapril@colgate.edu)

We are studying the weathering characteristics of Clinton group (middle Silurian) shales as part of a larger climate transect study to better understand chemical weathering and soil formation in the Critical Zone. Our research site (Roger's Glen, NY) is the northernmost of six satellite sites - extending from Puerto Rico to New York State – tied to a larger ongoing study of shale weathering at the Shale Hills Critical Zone Observatory in Pennsylvania, USA.

The shales at our site comprise the Sauquoit and Willowvale Formations, green-gray calcareous shales and mudstones containing the clay minerals illite and chlorite. The area was glaciated and soils have developed over the past ~14,000 years on till rich in shale fragments. Illite is resistant to weathering and persists in the soil profile, but chlorite weathers to vermiculite, likely through a mixed-layer chlorite-vermiculite intermediate. Vermiculite in the upper part of the soil profile contains hydroxy-aluminum interlayers, as determined by the gradual collapse of the clay interlayer structure with K-saturation and heat treatments.

Both exchangeable cations and bulk soil chemistry show interesting trends down profile suggesting that a weathering front has developed. Exchangeable Ca and Mg, especially, show sharp increases in the uppermost and lowermost soil horizons where the influence of organic matter decay in the former and shale decomposition in the latter account for these trends. Similar increases in Ca and Mg at depth are apparent in the bulk chemistry (see figure below). Soil pH increases from 4.3 at the top of the profile to 8.1 at depth near where the soil-bedrock interface occurs. Tau plots show depletion of base cations and accumulation of Fe and Al in B-horizons as weathering proceeds down-profile.



An empirical approach to estimate melting temperature and its pressure dependence of some rocks of Oman ophiolite suite

SAYYADUL ARAFIN*, RAM N. SINGH AND ABRAHAM K. GEORGE

Physics Department, College of Science, Sultan Qaboos University, Box:36, Al – Khoudh 123, Oman (*correspondence: sayfin@squ.edu.om)

Pressure Dependence of Melting temperature

We have derived an empirical relation to determine melting temperature, T_m and its pressure dependence. Seismic p- and s-wave velocities and density data [1] were used as inputs to compute Debye temperature, Θ_D which forms the important ingredient of the empirical relation. We have applied the formalism to estimate T_m and its pressure dependence for harzburgite and gabbro rocks of Oman ophiolite suite respectively.

Discussion of Results

At room temperature and atmospheric pressure, the computed values of Θ_D are found to be 694K and 547K, and those of T_m are 1532K and 1132K for harzburgite and gabbro, respectively. A comparison of the pressure dependence of T_m obtained from the empirical approach with those from Lindemann and Simon's formula will be made after we complete the full analysis.

[1] Christensen N.I.and Smewing J.D., (1981) Geology and the seismic structure of the Northern section of the Oman ophiolite, *J Geophys Res*, **86**, 2545 – 2555.