Chemical weathering and pedogenesis in rubified paleosols of central Pennsylvania

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A sequence of paleosols in central Pennsylvania presents an opportunity to reconstruct pedogenic conditions in the mid-latitudes that commenced prior to the last glacial maximum. Soil formation can be considered as a sequence of events, including the initial mechanical disaggregation of bedrock and saprolite, followed by transport and deposition of colluvium. Once deposited the regolith undergoes alternating periods of quiescent pedogenesis and disruptive events that rework and bury the soil structure. The pedogenic history is recorded in hillslope stratigraphy, including their soils and paleosols.

In this work, we report on the soil evolution developing through complex colluvial stratigraphy at two sites in central Pennsylvania. The hillslope stratigraphy in the Shale Hills CZO consists of thin (< 2 m) shale chip colluvium in the swales and very thin (<1 m) rubble shale colluvium on the interfluves underlain by the Rose Hill Shale. In the Millheim Narrows of central PA thick colluvial wedges (>4m) have been deposited on the Bald Eagle Sandstone.

In the shallow soils of the Shale Hills watershed find that the bedrock-regolith contact is marked by a thin (several cm) saprolite with distinct gleyed mottles. Above this saprolite in the swales is one or more deposits of well-sorted 0.1 – 2 cm angular shale chips, interpreted as periglacial sorted talus (grèzes littés) that can exceed 2 m in thickness. In the thicker soils of the Millheim Narrows site, we find a 2 m thick highly weathered colluvium with saprolitized clasts and a deep red (5 - 2.5YR) color with patchy manganese staining. Above this deposit is a brown colluvium with poorly weathered clasts.

Geochemical and grain size data from these parent materials illustrate the degree of chemical weathering and pedogenesis from parent materials. Oxalate and dithionite extractable iron assists in the estimation of the pedogenic chronology. We present one possible sequence of events consistent with these deposits.