Pedogenic mud aggregates in the Boss Point Formation, Joggins, Nova Scotia

Jordana Gardiner and Martin Gibling
Department of Earth Sciences, Dalhousie University, Halifax, NS, B3H 3J. <jlgardin@dal.ca>

Pedogenic mud aggregates are sand- and silt-sized particles composed largely of clay flakes, and are commonly formed in modern vertisol-type soils during seasonal wetting and drying. Where the soils are rich in smectite, clays expand and shrink seasonally, causing aggregation of the flakes under pressure, and the aggregates may be transported as fluvial bedload with quartz-rich sands. A major problem associated with studying mud aggregates is the low potential for preserving them in the rock record, as the muddy sediments are destroyed by compaction during burial. The presence of calcretes in the Pennsylvanian Boss Point Formation, suggesting semi-arid and seasonal conditions, led to a successful search for aggregates using thin sections and the scanning electron microscope (SEM).

Samples from fluvial channel sandstones, crevasse-splay sandstones and floodplain mudstones in the upper part of the formation all contain preserved aggregates, Although sand-sized aggregates are present, most aggregates are typically 10–15 μ in diameter in all three sediment types, suggesting a common origin. The abundance of aggregates in these sediments is highly variable, ranging from 10–50 %. Some of the best occurrences are concentrated in thin laminae in otherwise structureless floodplain mudstones, where they occur with a few silt-sized grains of quartz and feldspar. Small aggregates are also prominent in large mud fragments within channel sandstones, probably eroded from river banks. Chemical analysis of clays using the SEM-EDS and XRD techniques shows a predominance of illite with lesser proportions of chlorite and kaolinite. No smectite was observed but may have altered to illite during deep-burial diagenesis.

The Boss Point is now one of very few formations in the rock record that have yielded pedogenic aggregates. However, many aggregates are an order of magnitude, smaller than those identified in most previous studies. They are also unusually well preserved within floodplain muds, where small aggregates were probably concentrated by gentle overbank floods and transported across floodplains and into channels. Aggregate preservation probably reflects early carbonate cementation in some samples, as well as shielding by silicate grain frameworks in coarser sediments.