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Summary

The lithology of the Upper Cretaceous Raritan Formation (RF) consists of two members: an upper clay member (Raritan clay) and a lower unit, the Lloyd Sand Member. RF is unconformably overlain by upper Pleistocene glacial deposits. The RF consists of stratified white, light- to dark-gray, and red beds and lenses of clay, silt, and sand; lignite and pyrite are common. Variegated, thin to thickly-bedded Lloyd sandstone (LS) is considered to be one of the extensive regional aquifers in Long Island and interpreted to be nearshore, fluvio-deltaic deposit. Proximity to fluvial axes and active deltaic lobes plays an important role in sequence thickness and maintaining an overall architecture of deltaic sandbodies. Presumably large amounts of deltaically derived sand are reworked by wave action and redistributed by longshore currents. LS is generally identified as containing clayey lenses, pyrite and hematitic, highly micaceous reddish silty sandstone. Its upper surface lies about 400 feet below sea level in northwest Huntington and at Orient, and over 1,500 feet below sea level at western Fire Island. The exposed unit is about 30 m thick in Caumsett State Park, Long Island (Figure 1-5).

Figure 7. Representative Trace Element Distribution (in ppm).

Figure 1. Caumsett State Park is located on Lloyd Neck, Long Island, New York. A small peninsula projects northward from the south shore into Long Island Sound. <https://3dparks.wr.usgs.gov/nyc/parks/loc64.htm>

Figure 2. Dr. Gilbert Hanson (Distinguished Professor of Geology, Stony Brook University) led the field trip to Caumsett State Park, Suffolk County, Long Island, New York. May 15, 2017

Figure 3. Field trip participants: From left to right: Belal Sayeed (Dewberry Geotechnical Company), Masud Ahmed (Geotechnical, New York City Department of Environmental Protection), and Nazrul.

Figure 4. Exposed Raritan clay (highly plastic and presumed to be kaolinitic) with recently formed mudcracks on the exposed surface.

Figure 5. Lloyd sandstone showing hoodoo like structure at the top (white unit) due to differential weathering of the host rock.

Conclusions

Preliminary geochemical investigations using ICP-MS (Inductively coupled plasma mass spectrometry), Ultra Trace Aqua Regia ICP-MS, and routine petrography on selected samples (both outcrop and subsurface) revealed a distinctive geochemical signature associated with RF units (Raritan Clay and Lloyd Sandstone).

Clay unit known as Raritan Clay contains 60-42% silica, 27-15% alumina, 7% iron-oxide, and 3% K₂O, whereas LS is found to be dominantly silica rich (97%) and remarkably poor in alumina, iron-oxide, and K₂O. RF clayey unit also showed LOI to be 7-40% (Figure 6).

Field exposure of RF clay resembles a kaolinitic-illitic type of high plasticity. Selected trace elements were identified and included Cu, Rb, Ba, Ce, Cr, Y, and Zn.

Clayey units in RF were found to contain significantly higher proportion of Cu (80-30 ppm), Rb (35-15 ppm), Ba (80-40 ppm), Ce (105 ppm), Cr (60-20 ppm), Y (30 ppm) and Zn (200-40 ppm), compared to LS (Figure 7).

Distinctive geochemical variations between the RF clay and LS point to variable provenance, diagenetic pathways, and depositional environments. Further investigations will proceed to differentiate subunits within the LS and RF clayey unit.

Figure 6. Representative Bulk Oxide Plot.