Student Corner

Ryan Largura

Marl Lakes and Marl Mining in Indiana

Figure 1. Lake Gage, a marl lake (and kettle lake) in Steuben County, Indiana. Estyer Photo.

Before accepting a position as a student research assistant at Indiana University's School of Public and Environmental Affairs with the Indiana Clean Lakes Program two summers ago, I had not traveled along northeast Indiana's country roads extensively. The rolling landscape and winding roads occasionally gave the impression that all roads led back to our initial starting point, but only if you ignore a few wrong turns along the way. Nevertheless, it quickly became apparent on the initial lake sampling trip into this region why Blatchley and Ashley (1900) called the lakes of northern Indiana "the brightest gems in the corona of the State." One of the little gems we sampled, named Lake Gage, reflected an alluring turquoise hue. Later, I was informed that Lake Gage held marl deposits (Figure 1). A quick Internet search revealed a report entitled "The Lakes of Northern Indiana and Their Associated Marl Deposits," courtesy of the Indiana Department of Geology and Natural Resources (Blatchley and Ashley, 1900). Blatchley was the state geologist at the time and was also a nationally important entomologist. It turned out that marl deposits were the cause of the turquoise color in Lake Gage and marl was also a mineral mined in Indiana lakes beginning in the 19th century. What began as a curiosity about the color of a lake eventually lead me to information about marl and discoveries about historical figure Willis S. Blatchley.

Marl Formation and Composition

Discussion of lakes both present and historic in northeast Indiana inevitably begins during the Pleistocene Epoch when glaciers sculpted the landscape seen today. Indiana's topography was formed less by successive glaciations of the pre-Illinoian and Illinoian drifts, but ultimately by the final retreat of the Wisconsinan drifts. Research conducted by the Indiana Academy of Science indicates the prevailing reason for kettle lake formation in northeast Indiana was from the slow deterioration of the Saginaw Lobe as part of the Wisconsinan drift. Quicker recession of the neighboring Michigan and Erie Lobes created outwash channels that cut off the Saginaw Lobe and allowed burial of fragmented ice blocks in the glacial drift to later form kettle lakes.

Marl derives its chemical composition from the high percentage of calcium carbonate left behind from glacial drift. Marls of the Great Lakes region differ in geologic formation from "greensand" marl found in New Jersey, which contains the mineral glauconite and a high ratio of phosphorus. Common descriptions of marl are of soft, amorphous, calcareous clay, and in the title of Michigan's 1903 geological survey they refer to it as "bog lime." Its actual composition may also contain varying amounts of shells, sand, and organic matter in addition to other constituents such as magnesium and silica. Marl deposits in Indiana lakes, present and extinct, are up to 45 feet thick and are often associated with springs that percolated up through glacial clays and limestone in the drift. The springs dissolved and became saturated with calcium carbonate. The precipitation of marl within littoral zones arises from the reduced solubility of calcium carbonate as a result of macrophytes' uptake of carbon dioxide, a process called biogenic decalcification. Backscattering of light through the calcium carbonate floc suspended in the water of marl lakes give the water its characteristic turquoise color (Figure 2).

Figure 2. Typical turquoise water color of a northern Indiana marl lake.

Marl beds are found in the New England states and in New York. Deposits are frequent and important in Michigan and in the northern portions of Illinois, Indiana, and Ohio. They occur in Wisconsin and Minnesota, but deposits in these two states haven't been exploited much (Eckel,1905).

Lakes of the Great Lakes region that harbor marl deposits are considered to be of low productivity. Wetzel (1970) found that photosynthesis rates were lagging in these lakes having low levels of dissolved organic compounds, high concentrations of divalent cations, and increased alkalinity. The particulate $CaCO_3$ found in marl causes the adsorbtion and complexion of some dissolved organic compounds so they are no longer available for use. Photosynthetic production is hindered by the buffering capacity in these lakes because of the lack of carbon accessible to algae and macrophytes.

Marl Use

Marl was used in Indiana as early as 1834 as a flux in the blast furnaces of the "St. Joseph Iron Works," a five-to-six block area that would later become the city of Mishawaka. Other documented uses of marl in the state include its enduring role as a fertilizer and as a component of mortar if first it was burned to create lime. This predates its later use in the production of portland cement. As the story goes, the oölitic building stone found on the Isle of Portland, England, inspired Joseph Aspdin to name his newly created artificial cement after the island in 1824. Fittingly, Joseph worked in the construction industry as a bricklayer who lived in Leeds and no doubt shared with many other great inventors, little appreciation for how widespread his creation would become. Nearly 50 years passed, however, before portland cement manufacturing made its way stateside and opened the first U.S. plant in the state of Pennsylvania in 1872. Five years later in South Bend, Indiana, a father-and-son duo, Thoms and Duane Millen, were joined by John H. Leslie to establish the first portland cement plant in the state. Another son, Homer, soon joined them and the company became known as Millen and Sons. Their stake in history was the first plant to use marl and clay in the manufacture of portland cement. The marl was mined from nearby lakes around the University of Notre Dame's campus.

Marl mining in northern Indiana reshaped the morphology of many glacial lakes. In the late 1800s, it was common for companies to own the lakes they extracted marl from. Big Turkey Lake in Steuben and Lagrange Counties is but one example. The Wabash Portland Cement Company owned both Big Turkey and Little Turkey lakes and had their cement works nearby. Figure 3 shows an 1899

Figure 3. Big Turkey Lake, Indiana (l) 1899 with marsh and drained lake area containing marl deposits in black; water surface area was 250 acres, and (r) the lake today at 450 acres.

map from Blatchley and Ashley (1900) of the two-basin lake before marl extraction compared with a current aerial image of the lake. Blatchley and Ashley's 1900 report listed 32 lakes in the northern three tiers of Indiana counties that had workable marl deposits. Many of these were worked by marl mining operations.

The fine texture of marl made it an ideal raw material for cement production, but economics proved to be the deciding factor when compared to the use of cheaper crushed limestone. The variation of marl deposits in both quantity and quality ended marl mining in Indiana for portland cement in 1940. The agricultural use of marl, however, continued and allowed companies to mine marl on a relatively large scale. Self-reported data by marl mining companies to the Indiana Geological Survey between 1954 and 1980 showed the largest annual amount, corrected for inflation, to be worth about $620,000 in 1958. The largest volume mined came in 1964 at 97,898 cubic yards. In 2010, only four sites reported marl production to the USGS, three were in South Carolina and one in Michigan. Collectively, the quarries output in sales totaled $21.4 million.

Next Issue – Spring 2013 *LakeLine*

The spring issue will have the theme, "Lake Management for Fish and Wildlife."

In addition to fisheries, we'll explore birds', turtles', and otters' use and impacts upon lakes, and we'll see how shoreland management can enhance wildlife use.

References

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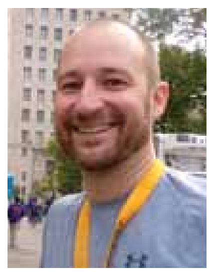
Ryan Largura was a December 2012 MSES graduate of Indiana University's School of Public and Environmental Affairs. He now resides in St. Louis, MO with his wife and daughter.



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