WaterColumn

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This is the last printed version of *WaterColumn*. All future issues will be in electronic format only. If you wish to continue receiving *WaterColumn* via e-mail, e-mail Bill Jones and we will add you to the electronic distribution list.

It is Difficult to Say Goodbye

~ Bill Jones

This is my last *WaterColumn* newsletter. Since the first issue debuted in Winter 1988, I've prepared 95 issues. There have been a number of changes in this newsletter over the years – different colors and paper used, we added an electronic version in 2000 and began posting issues on our Indiana Clean Lakes Program website (**http://www.indiana.edu/~clp/**), and now we are moving to an electronic version only.

In that first issue, we included articles about the newly-created Indiana Clean Lakes Program, planning for the first Indiana Lake Management Conference, fish tissue and sediment monitoring in Indiana, a telephone locator for lake assistance in Indiana, a fisheries renovation plan for Palestine and Caldwell lakes, and other stories.

Within these pages, we've always tried to identify and discuss topics of interest and concern to the "lakes community" of lake users and shoreland homeowners alike. While some topics have come and gone, many are still with us.

- **Eutrophication** is still the greatest threat to the long-term sustainability of Indiana's lakes.
- Humans have the ability and available tools to prevent and treat lake degradation, but we are also the cause of this degradation. All of us must **better educate** ourselves about lake ecology and how our actions, collectively and individually, impact lakes.
- For whatever the cause, our **climate** is changing and with it, drought and surplus precipitation work to affect lake levels on many of our lakes. This, in turn, impacts all lake users.
- **Invasive species**, both aquatic plants and aquatic animals, continue to cause problems in our lakes by crowding out native species, by their undesirable characteristics, and/or by excessive growth.
- **Recreational use** of lakes continues to increase but the number of lakes in Indiana remains largely the same. The demands caused by lake users can have significant negative impacts on sensitive lake resources.
- **Funding** for lake protection and management is woefully inadequate given the positive economic impact lakes have on our local and state economies.

I don't wish this last column be all doom and gloom for I am optimistic that we can make things better for our lakes through continued education, adopting sustainability practices, and being more involved locally and statewide through your own lake association, with ILMS, and with your local and State governments.

The Indiana Clean Lakes Program will continue to provide the services that we have been providing over these last 23 years, but now under the capable leadership of Melissa Clark. These services include lake water quality assessments, the volunteer lake monitoring program, this *WaterColumn* newsletter, keeping our website informative and updated, and providing technical assistance to lake communities throughout Indiana.

I'm not moving away and will continue to visit and enjoy our beautiful Indiana lakes and reservoirs for personal joy and recreation. I'll likely even dip a Secchi disk or two. Thanks for all of the support, encouragement, inspiration, and friendship you've shown me over the years. I hope to see you on the lakes in the coming years!

Indiana Clean Lakes Program 2011 Summary

We've had a busy year with the program. The CLP graduate students and staff conducted comprehensive water quality assessments on 81 Indiana lakes and reservoirs this past summer. The data are nearly all compiled and we will be updating our website with these new results soon.

During 2011 our dedicated volunteer lake monitors made 553 Secchi disk measurements, took 183 total phosphorus and 183 chlorophyll-*a* samples, and made 65 temperature and dissolved oxygen depth profiles on their lakes. We are also preparing a final project report for 2009-2011 for the Volunteer Lake Monitoring Program that will be posted on the website when completed.

With additional funding from the Indiana Department of Environmental Management (IDEM), we've been able to collect one water sample from each lake assessed by our staff and analyze the samples for microcystin, a potent algal toxin. Results were reported to IDEM and are included on the following website under "Test Results": **http://www.in.gov/idem/algae/**.

Marl and Marl Lakes in Indiana

~ Ryan Largura

My only memory of Steuben County was as a child when my family visited Pokagon State Park in the summer, and I remember marveling at the toboggan run that to this day has escaped me during winter. This past summer I returned to the county as part of the Clean Lakes Program to collect water samples from Indiana's so-called Lakes District in northeastern Indiana. One of the lakes we sampled, Lake Gage, shone a color that appeared as though it belonged in Frank Baum's Emerald City. It left an impression on me fitting of the lake's kettle origin. I came to discover this color was due to the water chemistry taking place between marl in the sediments and water in the lake (Figure 1).

As is often the case, a little bit of research can shed new light on the seemingly mundane environment we live in. My objective in this article is to first provide a very brief background of Indiana's geological history, then discuss the chemistry causing Lake Gage's color, and, finally, the historical importance marl once played in Indiana's economic history.

Indiana's Geologic History

Indiana's "basement" was being built with igneous and metamorphic rock in the longest timeframe of earth's history as a planet, the Precambrian super-eon beginning around 4.5 billion years before present (BP). Outcrops of these rocks (for example, granite) are not present at the land surface in Indiana unless deposited from the north by the glaciers, and can only be accessed by drilling deep into the ground. The start of the Paleozoic era (544 million years BP) found the state of Indiana submerged by a shallow sea that deposited limestone, shale, and dolomite, among other sedimentary rocks. The bedrock geology of Indiana began to form during this era. Now zoom ahead past one and one-half geologic eras amounting to nearly 247 million years until arriving at the Pleistocene period around two million years ago. North America was under the Laurentide ice sheet

Figure 1. Marl lakes have an emerald green color and often clear water as shown with this Secchi disk. The water's color isn't caused by suspended algae as in many eutrophic lakes, but by staining due to marl.

during the Pleistocene epoch, commonly referred to as the Ice Age. The story of Steuben County lakes begins here with the most recent glacial advance into Indiana, around 20,000 years ago, called the Wisconsin glacier episode. Indiana had been above sea level for close to 300 million years, but the Wisconsin glaciers covered about one-half of the state resulting in plastic surgery for surficial geology (Figure 2). Ice sheets associated with the Wisconsin glacier were, in some places, three miles thick.

In the 25th annual report from the Indiana Department of Geology and Natural Resources published in 1900, W.S. Blatchley and Geo. H. Ashley described the northern lakes as "mementos of those mighty ice sheets which, in the misty past, covered the northern two-thirds of our State." The scenic country roads taken to reach public access points on the lakes we needed to sample in Steuben County revealed the handiwork of those glaciers. Geological features included mixed ground moraines (unconsolidated debris deposited by glaciers) and end moraines with elevations reaching 1,000 feet above sea level only to be cut by valleys filled with glacial outwash.

Lakes in Indiana were formed in the glacial drift as opposed to glacial scouring of rock that carved out the Great Lakes. These glacial drift lakes are called "kettle" lakes and they represent nearly all of the glacial lakes prevalent in Steuben County and northern Indiana. Kettle lakes were formed from blocks of ice becoming embedded in the glacial till deposits as the glacier retreated northward. As the ice melted, it left behind depressions in the loose glacial till filled with water (Figure 3). Lake *morphology* (physical dimensions such as size, shape, and depth) is thus dependent on the size and shape of the ancient ice chunk. Lake Gage happens to be one of those living mementos that convey a sense of wonder from the misty past of the Saganaw-Erie ice lobe from the Wisconsinan glacier.

The Nature of Marl

Marl is an older term referring to "a soft, earthy material, composed principally of an amorphous form of carbonate of lime," as described by Blatchley and Ashley. A more modern definition describes marl as a combination of calcium carbonate and clay of varying percentages that precipitates in lakes and streams. Marl deposits in lakes have been described as uncemented limestone. The geologic history of Indiana explains how these mineral inputs came to be, while rain and carbon dioxide explain how they mix.

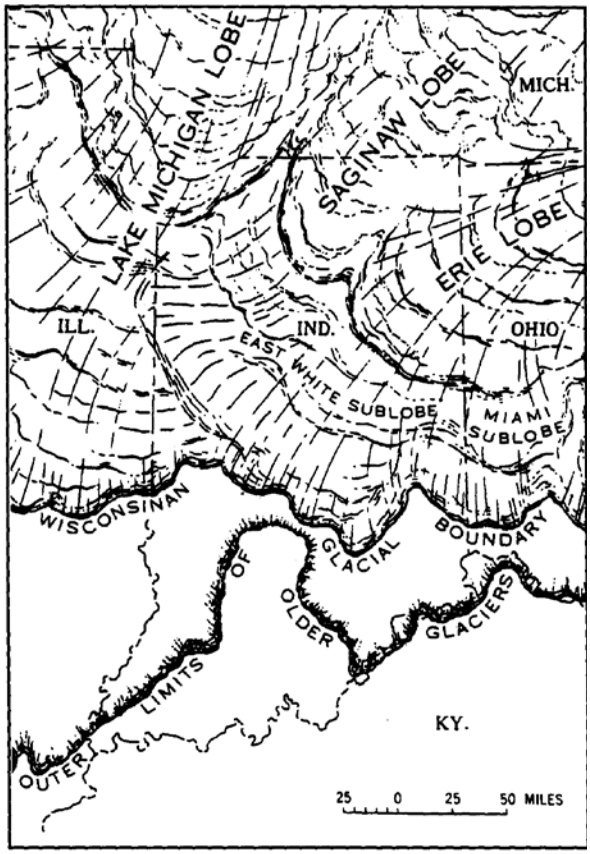

Figure 2. Much of Indiana has been covered by ice sheets but the most recent Wisconsin-age glaciers, particularly the Michigan, Saginaw, and Erie lobes, were restricted to northern Indiana.

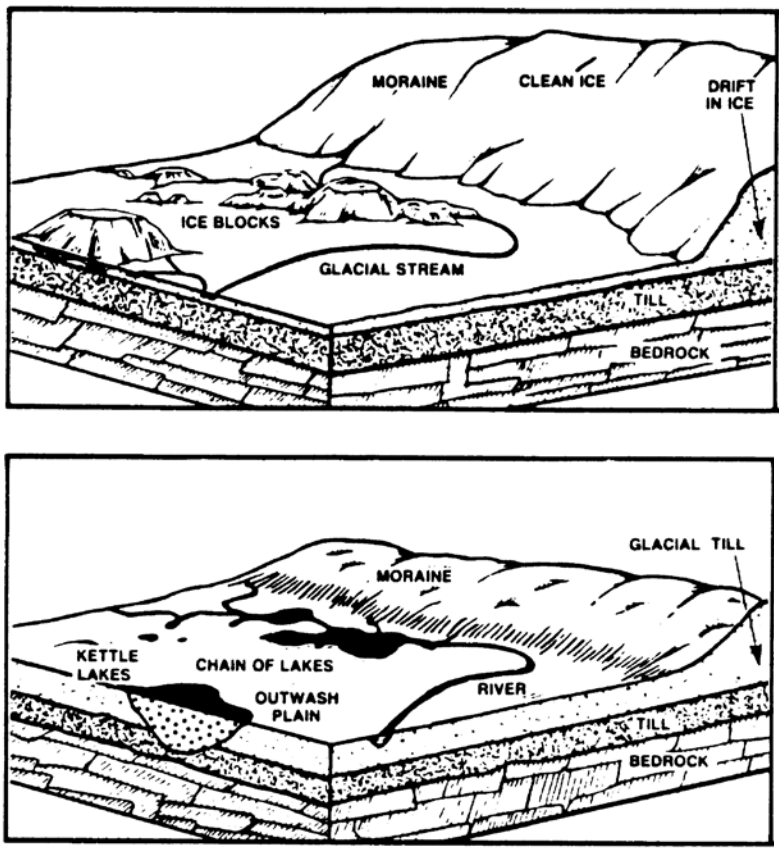

Figure 3. Indiana's glacial lakes were largely created by blocks of ice left on the land surface as the Wisconsin glacier retreated northward. As the ice block melted, the meltwater filled the depression.

Rainwater reacts with carbon dioxide in the atmosphere to form a dissolved inorganic carbon compound called carbonic acid. After falling to earth and infiltrating soil rich with clay and limestone, the slightly acidic water dissolves minerals until a new equilibrium of carbon compounds is reached within the solution. Springs that feed nearby lakes and streams subsequently contain a soluble form of marl until changes in temperature and pressure occur that causes the solid (calcium carbonate) to precipitate out. This slow chemical reaction has been taking place over thousands of years, and some shallow lakes have accumulated enough of it to become extinct.

An abundance of aquatic plant vegetation such as Stonewarts or Chara in the lake can expedite this process. The plants' consumption of a large amount of carbon dioxide in the form of carbonic acid will change the equilibrium in the lake so when spring water emerges the carbon dioxide is lost quicker and more calcium carbonate precipitates to the sediments.

Use of Marl

Marl is still used as a soil conditioner, but an old European saying warns against overuse, "Lime without manure, makes the father rich and the son poor." Other historical usages include applying it as a polishing powder or as a mineral food for poultry in order to help strengthen egg shells. The viable deposits of marl found in Indiana lakes over a century ago also played a large role in the cement industry.

Portland cement was first developed in England, and exhibited to the public in Hyde Park circa 1851 after displaying superior tensile strength. Three key ingredients constitute the Portland cement formula: calcium, silica, and aluminum. Pennsylvania became the first state to manufacture Portland cement in 1872, but because of a lack of technical knowledge over the manufacture process, widespread production did not begin until 1890 in the U.S. Engineers working stateside came to the conclusion, after American manufacturers perfected production, that domestic Portland cement was of a higher grade and lower price than imported brands. Marl played a role in Midwestern cement companies producing cheaper Portland cement. The added cost of crushing and grinding raw material such as limestone was saved when using marl. Other merits engineers admired about domestic supply were its fireproof qualities, in tandem with imperviousness to moisture and vermin.

South Bend was home to the first Portland cement factory in Indiana in 1877, using marl taken from lakes at Notre Dame. Marl mining in Indiana was confined to lakes or marshes that once were lakes. The 1900 report identifies 32 lakes in the northern three tiers of counties that had workable marl deposits at that time. Lake Gage was considered to have a workable deposit of marl in some areas of over 16 feet deep. (A side note about its history during this time period: Lake Gage became well known for its large population of eels, that at one point stopped the mill wheel at Jamestown with 200 pounds of them!)

Blatchley and Ashley further wrote that Lake Gage ranked as being one of the prettiest lakes in Steuben County at the turn of the 20th century because of its clear water and lack of adjoining marshes or aquatic vegetation. The mining of marl from Lake Gage must have changed its basin morphology to some degree as well, and subsequently its biological and chemical parameters. The lifespan of a lake large or small undoubtedly can hold a rich and varied story hidden below its surface showing only the reflection of ourselves. A quote from the 1900 report perfectly captures the sentiment of these lakes.

"They are mere babes born yesterday and destined to die tomorrow. The present dominant race of men may pass away and leave these lakes still lying like bright jewels among the hills; but every one is doomed to final extinction" (Author unknown).

EPA Announces the *Healthy Watersheds Initiative National Framework and Action Plan*, 2011

The U.S. Environmental Protection Agency (EPA) recently announced the release of the *Healthy Watersheds Initiative (HWI) National Framework and Action Plan*. The HWI is intended to protect the nation's remaining healthy watersheds, prevent them from becoming impaired, and accelerate restoration successes.

The *HWI National Framework and Action Plan* aims to provide a clear consistent framework for action, both internally among EPA's own programs and externally in working with the Agency's partners. EPA will work with states and other partners to identify healthy watersheds at the state scale and develop and implement comprehensive state healthy watersheds strategies that set priorities for protection and inform priorities for restoration.

Healthy watersheds provide many ecological services as well as economic benefits. If successfully implemented, the HWI promises to greatly enhance our nation's ability to meet the Clean Water Act Section 101(a) objective of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters.

For more information and to read the action plan, visit **http://water.epa.gov/polwaste/nps/watershed/index.cfm**.

Water Chestnuts...

Not to be Confused with a Holiday Favorite

Chestnuts are often associated with this wonderful holiday season. Made somewhat famous by Nat King Cole in "The Christmas Song" as he sings about "Chestnuts roasting on an open fire." In recent years, however, it is more about "Chestnuts floating in open water."

Water chestnut is an aquatic plant that has been slowly invading Northeastern U.S. waters since 1859 (Figure 1). Thankfully, it is not yet in Indiana. Once introduced in a waterway, the plant's stems branch out to lengths of up to 16 feet, spreading rapidly over large surfaces of area. The infestation is very thick, blocking out light that penetrates the water, resulting in the loss of oxygen, which is hazardous for fish and other aquatic plants.

Water chestnuts are often used in Chinese cooking. The knobby vegetable with the papery brown skin is a staple in Chinese cooking. The water chestnut is actually not a nut at all, but an aquatic vegetable that grows in shallow water. The name "water chestnut" comes from the fact that it resembles a chestnut in shape and coloring. Indigenous to Southeast Asia, it has been cultivated in China since ancient times.

The "nuts," which are actually seeds, are 1 - 1 1/2 inches wide and have four spines that are sharp enough to puncture the sole of a shoe (Figure 2). These nuts cause puncture injuries to swimmers and people or wildlife walking along the shore, while the thick vegetation impedes boating and fishing, as well as making swimming difficult. Controlling the plant is quite expensive with numbers reaching well into the millions of dollars. Mechanical harvesting and hand-pulling seem to be the best methods of controlling a water chestnut infestation. In order to interrupt the reproductive cycle, mechanical harvesting, which offers a fast and efficient solution, can cut, collect, and dispose of water chestnut before the nuts can grow. The removal of the thick canopy of vegetation results in more available oxygen for the fish. The additional sunlight gives the desirable native plants an opportunity for growth.

Figure 1. U.S. distribution of water chestnut, Trapa natans. *U.S. Geological Survey, December 2003.*

Figure 2. Water chestnut. Alfred Cofrancesco, U.S. Army Corps of Engineers.

Source: Adapted from Aquarius Systems

Events

March 23-24, 2012
24th Indiana Lake Management Conference
Indiana Lake Management Society
Abe Martin Lodge, Brown County State Park
Nashville, Indiana

For more information:
http://www.indianalakes.org/

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under "Publications."

Perspectives

To shorten winter, borrow some money due in spring.

~ W.J. Vogel

WATER COLUMN

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Editor's Note: WaterColumn *reader Joan Harris was inspired by the Summer 2011 issue, so she sent me the following poem, which we publish here with our thanks and approval.*

Steuben Shores

Joan Harris, May 2011

In our county, woods and lakes abound.
A place for living we have found.

Overlooking a glistening lake
We value all that nature can make.

Oaks and hickories bring birds to nest.
Shorebirds give us a show that's the best.

Mowed lawns are neat and tidy, it's true,
But lakes need a buffer to keep them clean, too.

Naturalizing the shore of our lake
Brings pleasant surprises for us to partake.

Yellow flag iris, mint, and much more
Attract hummingbirds here to our shore.

A little known fact we want to say,
Tall growing plants keep geese at bay.

With conservation, because we care,
Lakes benefit when we *all* do our share.