Research on Mechanical Limestone Erosion: Dr. Eric Law

Among all types of rock I learned and taught, limestone is my least favorite. But in the past two years, it became the rock which took much of my study time. The reason is on its unique property that limestone dissolved in surface water (rain, river and shallow groundwater). And I always think this should mean a lot to the origin of surface landscape than merely having a few sinkholes on the surface and caves in the ground.

About 15 years ago, I had a question: Assume there are three layers of rock from top to bottom: sandstone, shale and limestone. How would these three layers of rock be eroded by the surface erosion process? The answer seems to be that they would be eroded away one after another from the top to the bottom. But what if the groundwater dissolved the limestone at the bottom and formed a cave? When the roof of cave collapsed, so goes together the other two rock layers above it. Would this process accelerate the rate of erosion and make the landscape much younger? I thought it might be worthwhile to explore further on this simple idea because the western half of Ohio has thick layers of limestone and is overlaid with glacial tills. Many natural lakes on the glaciated plain are thought to be sink hole in origin. How were the sink holes made? How are they related to a few small caverns in the western Ohio? In particular, when were they made? Research proposal based on this idea was supported by the Faculty Development Fund of the university. And I should also thank Dr. Ray Rataiczak for his support on the use of the SEM. The result and discovery of this simple study is beyond my original expectations.

Most people who studied the erosion of limestone focused on the process of chemical dissolution. Very few tried to explore the effect of mechanical erosion directly done by the impact of running water. Ohio’s caverns are mostly developed along major fractures in limestone. The fractures provided passages for the majority of the running water flows in the ground. When visited some caverns, the guide said there is a high water stage every year when the cave is flooded and sometimes the site has to be closed. This makes me wonder how much damage would the fast running flood water do to the cave? Would the cave become larger due to the flood?

With the help of Dr. Selvi in Physics Department and two bright geology students Tanya Jones and Sebastian Teas. We made a water tank and let water run in the tank and hit a few limestone samples. We tried to use this simple device to test the effect of mechanical erosion. It turned out that we might just open up a can of worms. The factors involved in this simple test are too many for the primitive set up to handle. Initial result was read by two students in the regional meeting of the Geological Society of America at Dayton Ohio in April. And more testing and measuring are still going at the current time.

What have we learned so far? We know one thing for sure: the rate of underground limestone erosion should be much faster than people have thought due to the contribution of mechanical erosion. And we speculate that most Ohio caverns could probably be developed from finger-wide fractures to the current size in just a few several thousands of years under the effect of both chemical and mechanical erosion. The current task is to refine the test parameters and to make more precise calculation on how fast the mechanical erosion could be. An improved water tank is under construction and some new data should become available in the Fall semester.
Lee Dunn, 1962

Lee attended the Alumni weekend on campus this year. He is happy to report that the 1962 classmates presented the university with a gift of over $3,165,000. It was an enjoyable weekend with nearly 100 classmates headquartered at the Salt Fork Lake Lodge.

Bob Prout, 1966

Bob retired from criminal department chair duties. He now teaches fall semesters at St. Cloud State University. Bob also does police training during the summers. His wife, Susan, and he are well.

John Van Fleet, 1970

John is working at Forest Oil in Houston as a Senior Geological Consultant.

Bob Pope, 1974

After graduating from Muskingum, Bob went on and got his MS in Geology from Northern Arizona University. After NAU he embarked on a 34-year career exploring for oil and natural gas in primarily the Permian Basin of west Texas and the Anadarko Basin of Texas and Oklahoma. Bob retired last September after 14 years with Chesapeake Energy located in Oklahoma City. Their plans are to remain in Edmond, Oklahoma for their retirement.

Dale Gnidovec, 1976

For the past five or six years Dale has been part of a committee of around 16 people working on a Ohio geology walk. The committee is chaired by former First Lady, Hope Taft and includes people from the Ohio Geological Survey, Ohio State, Wright State, COSI, and the mineral industry. Originally to be constructed in the Heritage Garden at the Governor’s Mansion in Bexley (a suburb of Columbus), the venue was changed to the ODNR complex at the State Fairgrounds. The walk is to a scale of 1 foot = 1 million years, and will have large rocks (with interpretive signage) from the various geologic periods along the way. It will also include a large geologic map of Ohio. In the photo (see photo below) the brick walkway can be seen extending from the north end of the map.

The grand opening is the first day of the Fair, Wednesday, July 25, and about 250 people are expected for the opening ceremony. Dale will not be there—he will be out west searching for dinosaur bones. For the past 12 summers he has been working with Cincinnati Museum crews at a site in the Late Jurassic Morrison Formation in south-central Montana. This summer they will be prospecting in the Hell Creek Formation, deposited during the last one and a half million years of the Cretaceous and home of Triceratops and Tyrannosaurus. They will be working in southwestern North Dakota, northwestern South Dakota, and south eastern Montana.

Shale I tell you about my college days?
I sometimes take them for granite.

From: "Kha’tie"
<katietakeoutpostma@nomoSpam.home.com>
"It strikes me that all our knowledge about the structure of our Earth is very much like what an old hen would know of the hundred-acre field in a corner of which she is scratching."

-Charles Darwin

**Faculty**

| Dr. David Rodland | Current Research Interests:  
| **Dr. David Rodland**  
Assistant Professor  
| Current Research Interests:  
| Ecology and paleocology of brachiopods.  
| Time-averaging of encrusting communities.  
| Sclerochronology in freshwater bivalves.  
| |  
| Dr. Eric Law  
Associate Professor  
| Current Research Interests:  
| Origin of calcite sand crystals.  
| Diagenesis of Berea Sandstone.  
| Crystal habit of smithsonite.  
| Emplacement of kimberlite diatremes.  
| Lamprophyre dikes from Vermont.  
| Origin of stylolites in the Columbus Limestone.  
| |  
| Dr. Stephen Van Horn  
| Current Research Interests:  
| GIS planning on city development.  
| Water chemistry at the Wilds (a reclaimed coal mine).  
| Dike emplacement mechanisms.  
| Garnet zoning and P-T-t pathways.  
| |  

**More Geology News**

Geology Student Presents Research at Muskingum Poster Session

BORING BRACHIOPODS FROM BRAZIL  
Elizabeth M. Bullard and David L. Rodland

EVALUATION OF PARAMETERS INVOLVED IN THE EROSION OF LIMESTONE BY SOLID PARTICLE IMPACTION  
Tanya Jones and Sebastian Teas

INVESTIGATING BRACHIOPOD PYRITIZATION UNDER LABORATORY CONDITIONS  
Sara Young and David L. Rodland