

Managing fossil resources at the Falls of the Ohio, Indiana and Kentucky, USA: A fossil park in an urban setting

[Gestion des gisements fossilifères des chutes de l'Ohio, états d'Indiana et du Kentucky (É.U.A.) : Un site fossilifère en milieu urbain]

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Abstract: The Falls of the Ohio State Park, in Indiana and Kentucky, USA, preserves a 200-acre Devonian coral-stromatoporoid biostrome in the middle of an urban setting. The State Park, with an Interpretive Center and a program of educational activities, was established in the 1990s. There are challenges to managing a renowned paleontological site in the middle of a metropolitan area with a population of 1 million citizens, including issues of preservation, conservation, educational use and marketing, but almost all the problems have been solved or mitigated by the creation of the State Park.

Key Words: Falls of the Ohio State Park; Devonian; corals; stromatoporoids; conservation; protection; education.

Résumé : *Gestion des gisements fossilifères des chutes de l'Ohio, états d'Indiana et du Kentucky (É.U.A.) : Un site fossilifère en milieu urbain.*- Situés au coeur d'un milieu d'un secteur urbanisé, des affleurements de formations biostromales à coraux et stromatopores s'étendant sur près de 80 hectares sont protégés par le Parc National des Chutes de l'Ohio en Indiana et Kentucky (États-Unis d'Amérique). Le Parc doté d'un Centre d'Analyse et d'un programme d'activité pédagogique a été créé dans le courant des années 1990. La gestion et le développement d'un site paléontologique au sein d'une zone urbanisée d'un million d'habitants est délicate. Son statut de Parc d'État a permis de résoudre ou au moins d'atténuer ces difficultés.

Mots-Clefs : Chutes du Parc National de l'Ohio ; Dévonien ; coraux ; stromatopores ; sauvegarde ; protection ; éducation.

1. Introduction and background to the Falls of the Ohio

The Falls of the Ohio (URL: <http://www.fallsoftheohio.org/>) is a rocky outcrop of Devonian limestone, rich in fossils, forming a navigational obstacle in the Ohio River. Settlers moving westward in the late 18th and early 19th centuries had to stop before navigating the treacherous rapids at high water or drag the boats around the rocks at low water. As a result the cities of Louisville, Kentucky (on the south side) and Clarksville, Jeffersonville and New Albany, Indiana (on the north side) were established. Today the combined population of those cities is almost one million.

European explorers documented the fossils as long ago as the early 18th century. Native Americans living along the banks of the river utilized small fossils as jewelry as evidenced in archaeological objects from excavations by E.T. GUERNSEY in 1939 (preserved in the Glenn A.

BLACK Laboratory collections at Indiana University).

The limestone outcrop originally spanned the 1.6 km width of the river for a distance of 4 km (Figs. 1-2), over which the river dropped by 7.6 meters. A permanent dam constructed in the 1920s flooded most of the fossil beds. The dam was redesigned in the early 1960s, causing further silting up of a portion of the beds along the Indiana shore. Water flowing through castellations (slots) recently cut into the dam near the control gates has slowly begun to remove this silt.

Many studies describing various fossils were published throughout the 19th century (RAFINESQUE & CLIFFORD, 1820; ROMINGER, 1876; HALL, 1876; DAVIS, 1885, and in the 20th century, stratigraphic and paleoecological work was undertaken (PERKINS, 1963; KISSLING & LINEBACK, 1967; CONKIN J.E. & B.M., 1980). About 600 fossil species have been described from the Jeffersonville Limestone outcrops at the Falls of the Ohio and in the surrounding area.

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Figure 1: Aerial view of the Falls of the Ohio State Park looking west with Louisville, Kentucky, in the background.



Figure 2: Mural, showing the Falls of the Ohio State Park, in the lobby of the Park's Interpretive Center (see Fig. 3).



Figure 3: Interpretive Center at Falls of the Ohio State Park.

The Jeffersonville Limestone underlies a swath of Clark Co., Indiana, and Jefferson Co., Kentucky, and stretches north and east through Indiana, Ohio, New York and southern Ontario (CONKIN J.E. & B.M., 1984). A few kilometers north of Clark Co., Indiana, the outcrops are buried under glacial alluvium and exposures are generally restricted to limestone quarries. Devonian fossils are found in creek beds, construction sites and glades where collecting is possible. Most exposures are on private pro-

perty and permission to collect is necessary.

For most of the past two centuries, collecting of fossils at the Falls of the Ohio was unrestricted. As a result, thousands of tons of limestone and fossils were removed by quarrying and collectors. An effort was made in the mid 1960s to preserve the fossil beds. The National Park Service held hearings and initiated a study as a result of lobbying efforts by community leaders who were interested in having the Falls of the Ohio turned over to them for site management. The locality was designated a National Natural Landmark in 1966, but the NPS did not approve the site as future national park.

The Falls spans a multi-jurisdictional area (federal, local and state governments), a situation that has slowed down the process of preserving and developing the site. In 1982, 1404 acres of the Falls of the Ohio and its surroundings were designated a National Wildlife Conservation Area (NWCA) administered by the Army Corps of Engineers. In 1990, a portion of the Falls of the Ohio National Wildlife Conservation Area along the Indiana shore became the Falls of the Ohio State Park, administered by the Indiana Department of Natural Resources, Division of State Parks and Reservoirs. The state park designation was coupled with design plans to construct the Falls of the Ohio Interpretive Center, a 1487 square meter, \$5.1 million visitor exhibit complex (Fig. 3). A few residences and fishing bait houses existing prior to the establishment of the park were purchased and razed before construction of the center.

2. Preservation and conservation issues solved or mitigated by establishing a park

The fossil beds have only been accessible along the Indiana shore or by boat since the dam was built. The main protection of the fossils was from the river itself. During much of the year, the coral beds are under water (Fig. 4) although they are well exposed at low water (Fig. 5). The table list the areas of greatest concern and the effect after 1994 of the establishment of the state park.

Driving on the fossil beds is a problem that has been solved by closing off vehicular access by means of a gate. Previously, it was not unusual to see several cars parked on the fossil beds, typically by people fishing. The area had also been used as a dump for waste of all types-from construction debris to chemicals. Even today, bricks, pieces of tile, ceramic pipe fragments, and other building remnants can be found mixed with the glacial pebbles and fossil bed limestone fragments along the riverbank.

Problem	Before 1994	After 1994
Driving on fossil bed	Problem	Eliminated
Dumping	Problem	Eliminated
Flood Debris	Seasonal	Seasonal
Fires on fossil bed	Seasonal	Reduced
Fossil collecting	Problem	Reduced
Illegal activities	Problem	Reduced
Litter	Problem	Reduced
Vandalism	Problem	Reduced

Table: Conservation and preservation activities.

Fires have caused damage on the limestone including discoloration and fracturing. Fishermen occasionally build fires during overnight treks when the weather is cool. In the past, we provided 55-gallon drums and encouraged them to be used in areas where they were not in direct contact with the fossil beds. Today we discourage all fires, but as we do not have 24-hour security on the fossil beds, the problem has not been eliminated. The fact that there is a nearly infinite source of driftwood for fuel does not help.



Figure 4: Falls of the Ohio at high water. Most fossiliferous outcrops are covered by water.



Figure 5: View of the Falls of the Ohio State Park at low water showing the fossiliferous outcrops usually covered by water. City of Louisville, Kentucky, can be seen in the background.

Flood debris has always been a seasonal issue. During the spring the river level causes an eddy to form below the dam. This brings in large amounts of driftwood and trash (tires,

plastic containers and toys, refrigerators, foam materials, and wood with nails or other metal) to accumulate along the shore. If it floats, we have seen it at one time or another. Much of the debris comes from tributaries that flow into the river. A lot is from dumping along the river, extending for hundreds of miles upstream. Park volunteers remove a lot of trash, but the source is ongoing and unending. This is a problem that will not be solved in the near future.

Despite the laws in place when the WCA was established, fossil collecting continued because there was no enforcement, nor were conspicuous signs posted. Establishment of the park Interpretive Center coupled with numerous signs posted forbidding collecting have reduced - but not eliminated - rock and fossil collecting. Most people caught tell us they did not see any signs (Fig. 6). Some visitors pick up river gravel or slabs of limestone thinking that those are not fossils and are therefore "okay" to collect.



Figure 6: Warning sign noting the prohibition of collecting fossils located by steps down to the river.

A site like the Falls of the Ohio cannot be protected by fences. Good communication and community support are the best tools. When people collect at the park, other visitors inform the staff and we go out and intercept those people. The excuses are as diverse as the people, but they put the rocks back to avoid being prosecuted.

Illicit and illegal activity was widespread in less visible places. Fishermen often carried a handgun for personal protection. Despite the less-than-ideal conditions, more than a quarter million people visited the Falls of the Ohio each year before the Interpretive Center and its staff

were in place. That number has more than doubled since the park facilities were established.

Litter is another never-ending problem. Excluding the trash that floats in with the river level fluctuations, the greatest source is fishermen. Empty containers and plastic wrappers from bait, food and beverages are commonly found on the fossil beds. Human waste and broken glass bottles are another ongoing concern. A large number of fish hooks, lead sinkers, and meters of tangled fishing line are found as the river level drops. We have volunteers, inmates and staff picking up trash and cleaning the outcrops (Fig. 7), but the quantity of trash always exceeds our ability to keep ahead. A trash-free view one day is not guaranteed, despite our best efforts.



Figure 7: Volunteer students from St. Frances school helping to pick up trash and clean the outcrops exposed at low water.

Vandalism is a sporadic problem. The most common type is where people break up loose rock or try to remove a fossil by hitting it with another piece of rock. The use of rock hammers and chisels is very rare. Spray paint and other markings on the limestone occur infrequently. The effects of vandalism on the lower fossil bed are usually erased by the river's high water each year.

The natural weathering / erosion of the fossil beds by river action and the freeze-thaw cycle are an ongoing concern. We do not attempt to mitigate natural processes. When a rock is fractured by frost action and the river moves it away, additional fossils are exposed. As a consequence, each year brings opportunities to find new specimens and new evidence to interpret.

3. Educational use of the Falls of the Ohio

A decision was made to develop the site for numerous reasons. The fossil beds have been used as an outdoor classroom by K-16 educators for decades. More than a dozen educators realized that the fossil beds were an ideal place to conduct science lessons. The Museum of History and Science (now known as the Louis-

ville Science Center) organized fossil programs from September through mid November (the months when the river levels are at their lowest) for more than 20 years before the Falls of the Ohio State Park interpretive naturalists took over the program. There was also interest from scientists in the region to do something to preserve the fossil beds.

A group of citizens in Clarksville (the town in which the state park is located) and surrounding communities established the Clarksville Riverfront Foundation (a non-profit organization) to spearhead the campaign to create a park. Support at the grassroots level quickly reached local and state government level. Partnerships with federal agencies, particularly the U.S. Army Corps of Engineers (which manages navigable inland waterways such as the Ohio River) and the U.S. Department of Fish and Wildlife, were critical for project success.

Nearly 200,000 students have visited the park since the Interpretive Center opened in 1994. This number is dwarfed by the estimated 7 million visitors to the park, of which less than 10% visit the Interpretive Center (opened from 9:00 a.m. to 5:00 p.m. Monday-Saturday and 1:00 p.m. to 5:00 p.m. on Sunday). Today hundreds of classes bring more than 10,000 students to the Falls of the Ohio State Park each year. Some teachers bring a class annually, others bring them every other year or less frequently. Most groups have naturalist-led programs, though experienced educators will work independently when we do not have staff to lead their group. All groups are required to reserve their time slot, so that they do not interfere with one another; although the most accessible fossil beds cover a few acres along the Indiana shore, it is easy for groups to impede each other's work because there are no trails on the limestone outcrops.

In 1995 we established the Falls Fossil Festival as a weekend event to highlight earth science as a hobby. A partnership with a local limestone aggregate company has proven beneficial. Hanson Aggregates (formerly Liter's Quarry, Inc.) brings in dump truck loads of Silurian shale and Devonian residual soil rich in fossils. We keep these piles in the park year round in hopes that it will reduce souvenir rock collecting from the fossil beds.

We have school groups most of the year. In January and February we focus on our annual report, collections management, strategic planning, and other tasks that are difficult to coordinate when our educational programs are running. When the river level is up and/or the weather is too cold for outdoor programs, we hold paleontology programs in our indoor classroom. The program utilizes the fossil-rich shale from the fossil pile. Groups may keep some of the fossils for use in their own classroom.

4. Marketing the Falls of the Ohio

One reason our park gets more than a half million visitors each year is its location along the river. People like to be around water. Many of these visitors use the park grounds for walking, picnicking and fishing without any particular connection to the fossil beds.

To attract people interested in the fossil beds, we use several very low cost methods (we have no marketing budget). We have a great rapport with the local media. Between temporary exhibits, monthly programs, special events and photographic opportunities we are in the public's eye many times each year. Our media area covers about a one hour driving radius.

Located adjacent to the crossroads of several interstate highways, our site has large overhead highway signs maintained by the Indiana Department of Transportation. Smaller signs on side streets direct travelers from the highway to the park. We have contracted to have brochures placed at Indiana lodging and highway rest stops between our site and Indianapolis on I-65.

We recently completed a project at the closest rest stop on Interstate Highway 65 in the southbound direction. We moved a three-ton boulder of fossil-rich Jeffersonville Limestone to the front of the rest stop facility. An interpretive panel was placed next to the boulder with photos and descriptions of some of the fossils as well as an introduction to the state park. It is seen by an average of 500 people per day throughout the year.

In partnership with our foundation, the park has maintained a web site (URL: <http://www.fallsoftheohio.org/>) since early 1997. It features information about the history of the park, a virtual tour of the fossil beds, most of our brochures, program and events schedules, links to other sites of paleontological interest, educator material, and more.

5. Special events at the Falls of the Ohio

Our long-running special event is the Falls Fossil Festival. This weekend event focuses on earth science as a hobby with many activities for visitors of all ages. The event brings in between one and two thousand people from more than a dozen states. Vendors sell specimens (items from locations where collecting/exporting is illegal are not permitted). The local limestone aggregate quarry brings in about 30 tons of Silurian Waldron shale and Devonian residual soil containing numerous fossils. As many as 800 "children" age 2 to 92 dig into the piles and wash their discoveries. Hikes on the

fossil beds are organized, and we invite guest speakers to present talks on subjects related to the theme of the event. Under our "Resource Tent" several amateur paleontological and geological organizations are present to help identify specimens and answer questions. We also have brochures from some 50 paleontological sites in the U.S. and Canada, as well as brochures for organizations and publications.

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