FOSSIL BEDS OF THE FALLS OF THE OHIO

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FOSSIL BEDS OF THE FALLS OF THE OHIO

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PART I—INTRODUCTION

The Falls of the Ohio on the Ohio River at Louisville, Kentucky, is world famous for its fossil beds. Fossils can be seen in the rocks along the shore most of the year, but the best time to see large areas of exposed fossil beds is when the Ohio River is at low levels during the summer. This booklet was put together to help educators, students, geologists, and amateur rock hounds understand the geologic history of the Falls area. It is divided into three parts. Part I discusses the general geology and history of scientific discovery of the Falls area (p. 1 to 5). Part II is a walking tour, and describes the fossil beds and some of the key areas in which to see fossils (p. 5 to 10). Part III describes common fossils at the Falls and includes numerous photographs and discussions about the types of animals that formed the fossils (p. 10 to 29).

The fossil beds at the Falls of the Ohio are part of a National Wildlife Conservation area and an Indiana State Park and are therefore protected by both Federal and State laws. ROCK AND FOSSIL COLLECTING IS NOT PERMITTED. Also remember that the Falls area is subject to flooding. For your own safety read warning signs in the parking area before walking down to the fossil beds.

Location

The Falls of the Ohio is located on the Ohio River between Louisville, Kentucky, and Clarksville, Indiana, north of McAlpine Dam (No. 41) and south of the elevated railway bridge (Fig. 1). The best access is to take the Jeffersonville, Indiana, exit off of Interstate Highway 65 (first exit north of the river if driving north, last exit before the river if driving south), then drive south to Riverside Drive and west along the river $^1/_4$ mile past the railroad bridge underpass. Look for signs to the fossil beds. A parking lot and Visitors Center are planned for completion in 1993.

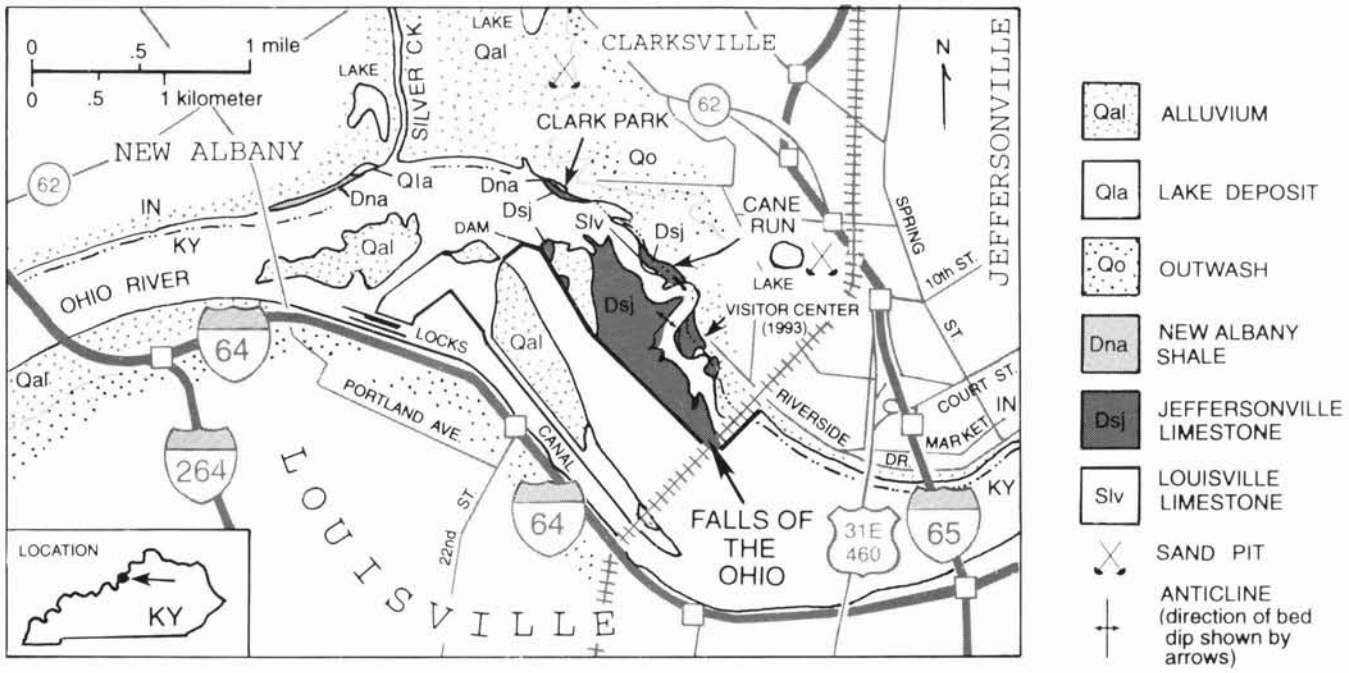

Figure 1. Geologic map of the Falls of the Ohio area showing the units of rock exposed. The main fossil beds are shown in detail in Figure 5.

Geology of the Falls Area

The Falls of the Ohio is the only outcropping of bedrock along the length of the Ohio River. The area is so named because the bedrock forms a natural series of rapids in which the river falls 8 m (26 ft.) in 4 km (2.5 miles). The rapids were a natural obstacle to explorers of the region, and were the reason the cities of Louisville, Jeffersonville, Clarksville, and New Albany developed where they did. The famous explorer George Rogers Clark founded the first permanent English-speaking settlement of the Northwest Territory at the Falls. Later, in 1803, his brother William set out from the settlement adjacent to the exposed bedrock with Meriwether Lewis to explore the Louisiana Purchase.

Figure 1 is a map of the Falls area showing the types of rocks and sediments and the names of rock units exposed at the surface in the area. Figure 2 arranges the rock units from youngest to oldest in a geologic column. These units and the fossils they contain can be used to determine the geologic history of the Falls area.

Quaternary Period

Within the last 50,000 years, great sheets of glacial ice moved south from northern Canada toward the modern Ohio River Valley. Geologists call this time the Pleistocene Epoch of the Quaternary Period, but most people call it the Ice Age. Two ice sheets may have reached the present-day location of Louisville, Kentucky. The last ice sheet, which was part of the Wisconsinan glacial interval, reached to within 96 km (60 miles) of Louisville (Wayne, 1952; Powell, 1970). As the glaciers spread south from Canada they eroded huge amounts of rock and sediment, which were pushed in front of or became frozen into the moving ice. When the glaciers reached into Indiana they began to melt, releasing vast amounts of water that carved deep river valleys into southern Indiana and Kentucky. The valleys were filled with the sediment eroded by the glaciers. Each time another glacier advanced into Indiana, the existing drainages were altered by the new meltwaters and sediment. Twelve thousand years ago the meltwater from the Wisconsinan ice sheet changed the course of the pre-glacial Ohio River and formed the modern Ohio River Valley. Much of the valley was filled with sediment washed from the ice sheet when it finally melted (called outwash). Other parts of the valley were filled by sediment deposited in large lakes when streams became choked by the huge volume of sediments being deposited. In some areas more than 65 m (200 ft.) of outwash and lake sediments were deposited (Fig. 2).

Although much of the present Ohio River Valley is filled with sediment, bedrock is still exposed at the Falls. It is possible that the modern river has eroded through a part of its own valley and exposed a part of an older, bedrock ridge or valley wall left over from an older glacial river (Powell, 1970). Another explanation is that geological structures buried deep beneath the river valley may have pushed the bedrock upward at the Falls. Evidence for this explanation is that the rocks at the Falls are high-

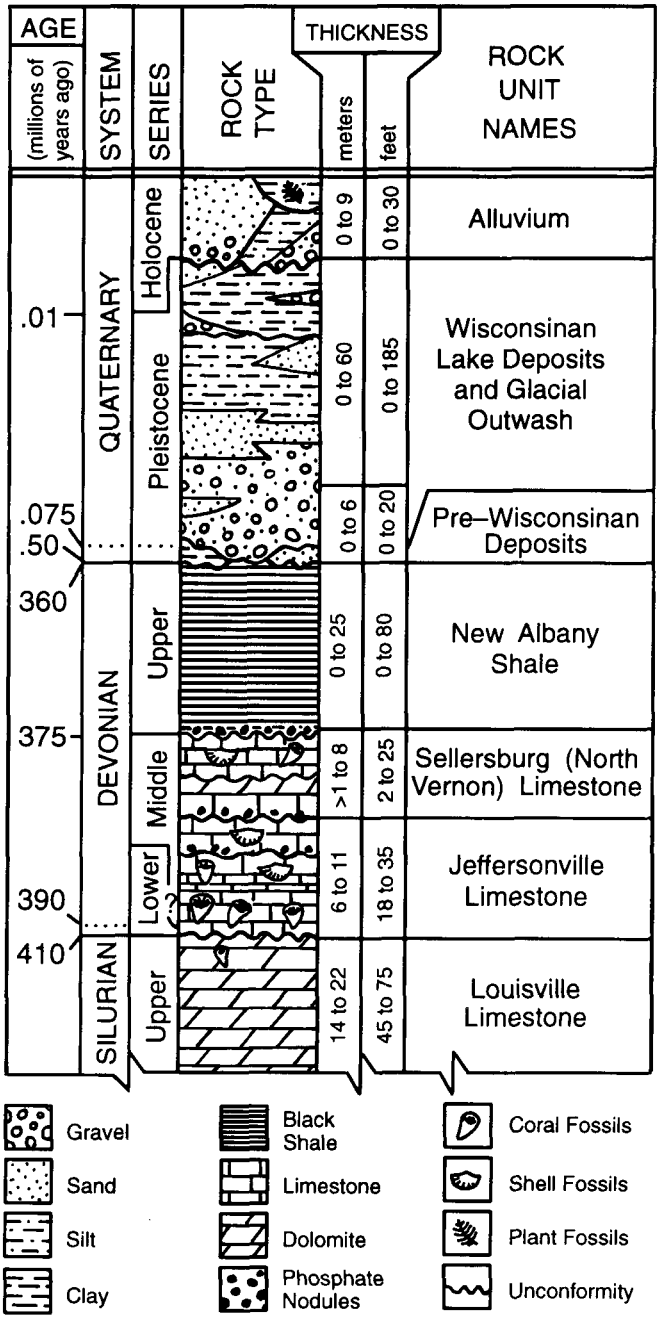

Figure 2. Generalized geologic column showing the rock units exposed in the Falls area (*after* Kepferle, 1974).

ly jointed, and rock strata just west of the railroad bridge dip to the east while strata west of the main fossil beds dip to the west; this upward bulging of strata is called an anticline (Fig. 1).

Rocks from the Ice Age can be seen several places in the Falls area. Several large blocks of sandstone with quartz pebbles occur above the Falls; these rocks are unlike rocks from the surrounding area. The nearest source for these kinds of conglomeratic sandstones is 65 km (40 miles) away. These blocks may be glacial "erratics." Erratics are rocks that have been transported by glaciers to an area where they are not normally found. The erratics in the Falls area may have dropped out of chunks of ice that floated south of the last glacier.

Several sand and gravel pits in the Falls area are mined for alluvial and outwash sediments from the Wisconsinan glacial interval (Qal and Qo in Figure 1). Also, silt and mud that have been deposited between the last ice sheet and the present are exposed along the north bank of the Ohio River near the mouth of Silver Creek (Qla in Figure 1). The muds may represent an older position of Silver Creek that was plugged with sediment to form a lake. Dark, black to blue clays and silts in the outcrop contain well-preserved leaf fossils from trees that surrounded the lake. The fossils have been radiometrically dated at 2,840 ±250 years before the present (Kepferle, 1974).

Devonian and Silurian Periods

The Ice Age deposits of the Falls area rest directly on much older rocks of the Devonian and Silurian Periods (Fig. 2). These rocks were deposited between 350 and 425 million years ago, and are nearly one and a half times older than the oldest dinosaur! Rocks that were deposited in the time between the Ice Age and the Devonian Periods were eroded at the Falls, although they are preserved in other parts of the Midwest. This type of gap in the rock record is called an unconformity. Geologists have divided the rocks that were preserved into units called formations. Formations share distinctive features such as rock type and grain size, and can be mapped across large areas.

The Devonian-age formations in the Falls area, from youngest to oldest, are the New Albany Shale, the Sellersburg Limestone, and the Jeffersonville Limestone. West of the mouth of Silver Creek, dark shales of the New Albany Shale crop out along the north shore of the Ohio River (Fig. 1). The dark color of the rock is caused by organic material in the shales. In fact, so much organic material is in these shales that they are called oil shales and are considered a potential source of energy. In western Kentucky, where these organic-rich shales are between 300 and 1,500 m (1,000 to 4,500 ft.) beneath the ground, they are thought to be the source of millions of barrels of oil and trillions of cubic feet of natural gas.

The shale is underlain by a thick sequence of limestones. The Middle Devonian Sellersburg Limestone (called the North Vernon Limestone in Indiana) is as much as 8 m (25 ft.) thick in the area (Fig. 2), although just west of the railroad bridge at the Falls only the lower 1.7 m (5.2 ft.) is exposed beneath Quaternary alluvium (Perkins, 1963; Kepferle, 1974). The Sellersburg Limestone is mostly fine grained, massive to thin bedded, often dolomitic (has a sugary texture), and contains few fossils.

The Sellersburg Limestone is underlain by the Lower to Middle Devonian Jeffersonville Limestone (Fig. 2). This unit forms most of the bedrock at the Falls of the Ohio, and contains the famous fossil beds. This unit is described in more detail in the following sections. The Jeffersonville Limestone is underlain by the Silurian Louisville Limestone (Fig. 2). The Louisville Limestone is often dolomitic and is only exposed at low water levels along the river's edge at the fossil beds and sometimes at the mouth of Cane Run (Fig. 1). More complete descriptions of these units are provided in Appendix A.

The limestones and fossils these rocks contain were formed when the earth was very different than it is today. Three hundred fifty million years ago the earth's continents had not yet moved into their present-day positions. There was no Atlantic Ocean, and parts of North America were connected to what is now Europe. In fact, the Falls area was located 15 to 20 degrees *south* of the equator (Fig. 3). During Devonian and Silurian times, the Falls of the Ohio had a tropical climate, much like the Bahamas have today. Not only was the area warmer, but during Devonian and Silurian times the Falls area and much of North America were covered by a vast sea (Fig. 3). The fossils in the rocks at the Falls of the Ohio are the preserved remains of the creatures that lived in that sea.

History of Scientific Study

Fossils of Devonian and Silurian sea creatures have brought scientists to the Falls of the Ohio for more than a hundred years. In 1820, paleontologists C. S. Rafinesque of Transylvania University and J. D. Clifford named several species of corals from the Falls of the Ohio, which they described as resembling "fossilized buffalo horns." These "horn" corals are one of the most abundant kinds of fossils at the Falls. In 1882, one of America's most renowned geologists, James Hall, bought a collection of fossils from the Reverend H. Her-