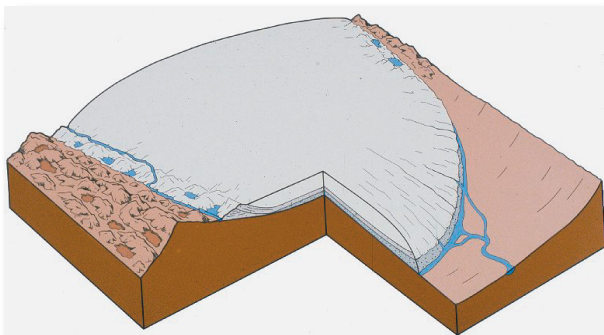


Glacial terminology

On a sweltering, 100-degree high-humidity day, it's hard to imagine a majority of Iowa covered by mile-thick glacial ice. But only a few thousand years ago the Iowa landscape looked more similar to modern-day Greenland than what it looks like today. Mega-fauna such as woolly mammoths, giant sloths and giant beavers freely roamed the terrain. To better understand Iowa's terrain today, it's important to know some terms associated with glaciers.



End moraines – a moraine that marks the greatest extent of a glacial advance (diagram above). Moraines form by drift deposited by direct glacial action, and can include debris as large as boulders (glacial erratics), or as small as clay.

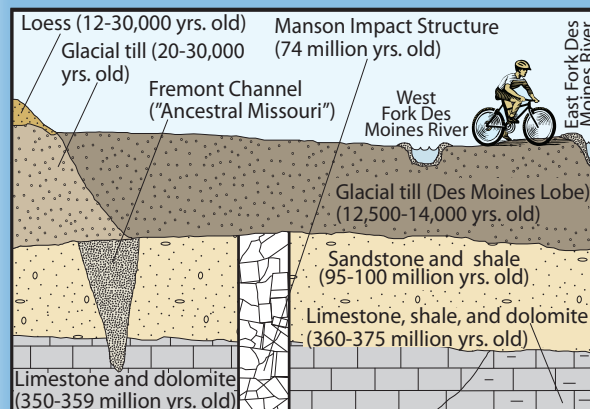
Hummocky topography – topography consisting of randomly arranged knobs (hummocks) that are separated and defined by low-lying areas that are part of linked-depression systems.

Laurentide Ice Sheet – massive ice sheet that covered hundreds of thousands if not several million square miles of Canada and the United States from ~160,000 to 10,000 years ago (Pleistocene Epoch).

Till – sediment released directly from the glacial ice that has not undergone subsequent disaggregation and resedimentation. Till on the Des Moines Lobe is deposited by a slow release of glacial debris from ice (not deformed).

COVER PHOTO: Entrance to the Grotto of the Redemption, located in West Bend, Iowa.

Day 2 Milestones



Start: Storm Lake

Des Moines Lobe Landform Region: mile 0.8

North Raccoon River: mile 6.8

Varina (Manson Impact Crater): mile 16

Des Moines River: mile 52

Algona Moraine: mile 70

Finish: Algona – mile 79

For More Information...

on the landscape of Iowa, including the Des Moines Lobe, Northwest Iowa Plains, and Loess Hills, go to:

www.igsb.uiowa.edu/browse/landform.htm

The Geological Society of Iowa (GSI) has published numerous guidebooks on Iowa's geologic, biologic, and cultural history. These guidebooks, as well as information on GSI membership and future GSI field trips are available at:

www.iowageology.org

The Des Moines Lobe has many interesting structural characteristics, including moraines, linked depressions, and glacial lakes. A description of some of these formations can be found at:

www.igsb.uiowa.edu/Browse/depress/depress.htm

The Grotto of the Redemption website:

www.westbendgrotto.com

RAGBRAI 2010

Learn about the Land

Day 2

Monday, July 26



Iowa DNR – Geological and Water Survey

109 Trowbridge Hall
Iowa City, IA 52242
www.igsb.uiowa.edu

US Geological Survey - IA Water Science Center

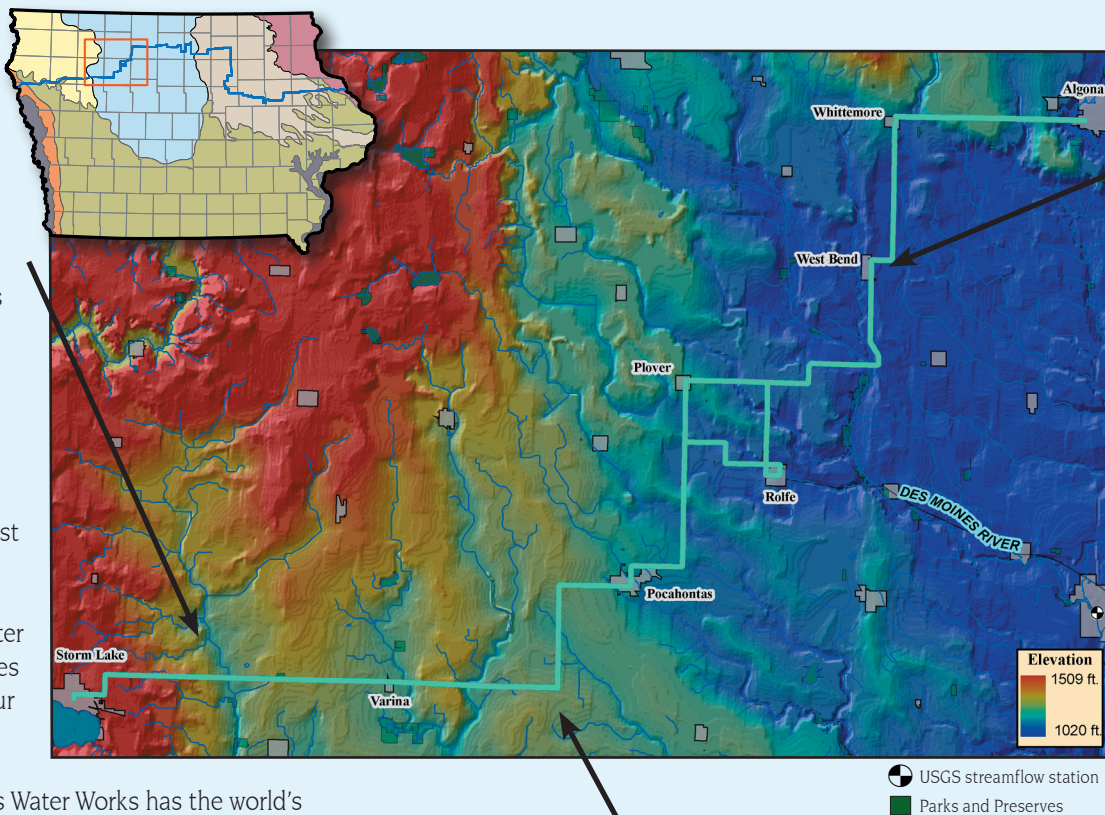
400 S. Clinton St.
Iowa City, IA 52240
<http://ia.water.usgs.gov>

Iowa Limestone Producers Association

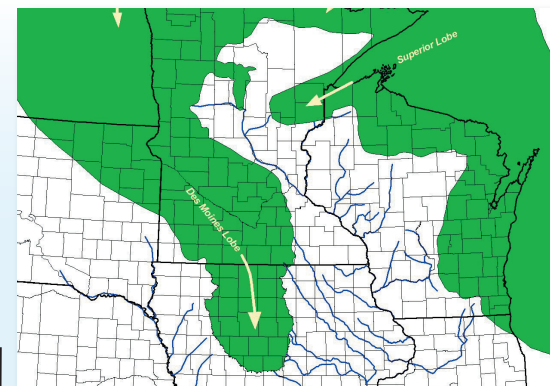
5911 Meredith Dr.
Des Moines, IA 50322
www.limestone.org

For the next couple of days you'll be biking over a distinctive Iowa landform region known as the **Des Moines Lobe** (blue area in the map below). During the end of the last "ice age," approximately 16,000 years ago, the *Laurentide Ice Sheet* (green area on right map) split into several lobes that flowed down through the low lying regions of Canada and the Upper Midwest. One of these, the rapidly advancing Des Moines Lobe, extended from Canada through the Dakotas and Minnesota into Iowa until stopping 14,000 years ago at what now is the City of Des Moines. The Des Moines Lobe ice sheet advanced into Iowa during a relatively warm period of time (for an ice age). Today, as you depart Storm Lake you will rise onto the crest of the Bemis Moraine, the terminal *end moraine* of the Des Moines Lobe. It is characterized by *hummocky topography* which is associated with stagnating ice at the former ice margins. Near Varina you will ascend onto two slightly younger curvilinear moraines, the Altamont I and II Moraines.

Today you will be crossing the **North Raccoon River** (photo below) near Three Waters Wildlife Area between the towns of Storm Lake and Varina. At this location, you are ~25 miles south of where the North Raccoon River begins (as outflow from tile lines). The North Raccoon River is one of 75 rivers monitored regularly in Iowa to assess water quality. Data indicate that the North Raccoon River has some of the highest nutrient concentrations for rivers in Iowa. The Raccoon River is a major drinking water source for many communities in Central Iowa, including our state capitol of Des Moines. Because of the high nitrate concentrations, Des Moines Water Works has the world's largest nitrate removal system to ensure that the water meets the drinking water standard for nitrate.



The **Manson Impact Structure** is a 24-mile diameter crater hidden beneath the glacial deposits in parts of Pocahontas, Calhoun, Humboldt, and Webster counties. The crater was created 74 million years ago (only 9 million years before the impact in Yucatan, Mexico killed off the dinosaurs) when an asteroid about 1.5 miles in diameter crashed into the earth at about 40,000 mph (see artist interpretation at right). The ensuing explosion (with energy equivalent to 10x all of the nuclear weapons on earth at the height of the Cold War) blasted a crater over 5 miles deep. The crater is centered near Kalsow Prairie in Pocahontas County, and the northern edge of the crater passes through the southern part of the towns of Pocahontas and Gilmore City. This year's RAGBRAI route passes over the edge of the Manson Crater about 8 miles east of Varina as it turns north on County Road N41.



The **Grotto of the Redemption** (cover photo) in West Bend is one of Iowa's most iconic geologic attractions. Listed on the National Register of Historic Places, the Grotto is actually a composite of nine separate grottos that cover an area larger than a city block. Most of the grotto was constructed by Father Paul Dobberstein, a Catholic Priest who from 1912 dedicated the next 42 years to collecting rocks, minerals, crystals, shells, and fossils from localities around the world and cementing them into a beautiful maze of structures. The materials that comprise the grotto include spectacular and rare geologic specimens that have been valued in excess of \$4 million.

