

## Mackinac Island State Park, Michigan

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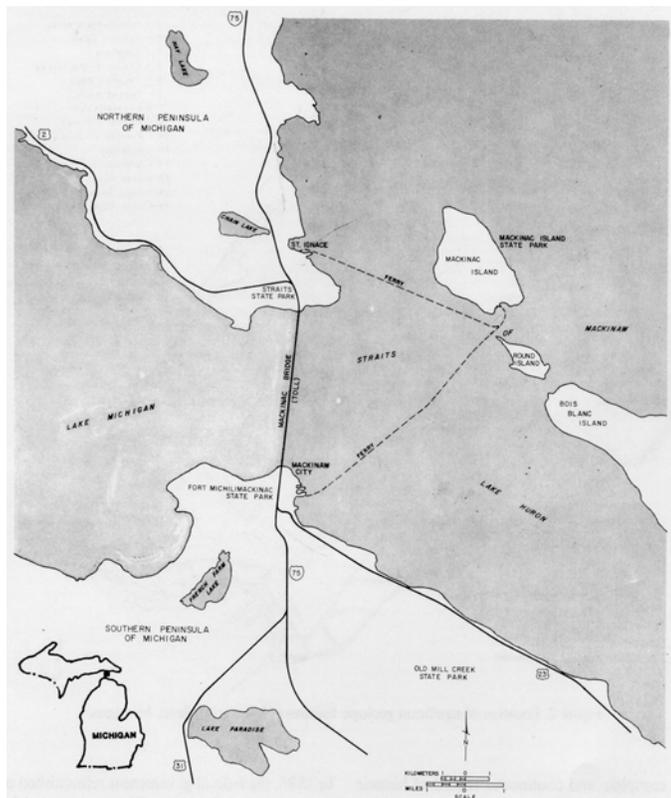


Figure 1. Location of Mackinac Island State Park and landmarks of the Straits of Mackinac Region, Michigan.

## LOCATION

Mackinac Island State Park, T.40N.,R.3W., Mackinac County, Michigan; Cheboygan, Michigan, U.S.G.S. 30 x 60 minute series. Mackinac Island is located 3 mi (5 km) east of St. Ignace, Michigan, in the Straits of Mackinac (Fig. 1). Access to the Island from St. Ignace is provided by Arnold Transit or Star Lines from mid-April to late-December. From Mackinaw City, service is provided by Arnold Transit or Shepler's Mackinaw Island Ferry from mid-May to mid-October. Service is at least hourly during the summer months. Air charter service is provided by Great Lakes Charters, St. Ignace, or Michigan Airways, Pellston. From December to mid-April, transportation is by Air Charter Service only from the Mackinac County Airport, St. Ignace. No motorized vehicles are permitted on Mackinac Island. On the Island, transportation is available in the form of rental bicycles, horses and horse drawn carriages.

## SIGNIFICANCE

The location of Mackinac Island, and its composition of erosion-resistant limestone breccia, has resulted in the island maintaining a fairly complete and continuous record of historic glacial lake stages of Algonquin and later age. The most striking features of Mackinac Island are the well-developed shoreline structures related to the changes in ancient lake levels (Fig. 2). The most distinctive and dramatic shore features are magnificent limestone structures including a variety of sea caves, stacks, arches, and wave cut bluffs. Additional features include strand lines, bars, terraces, and karst structures.

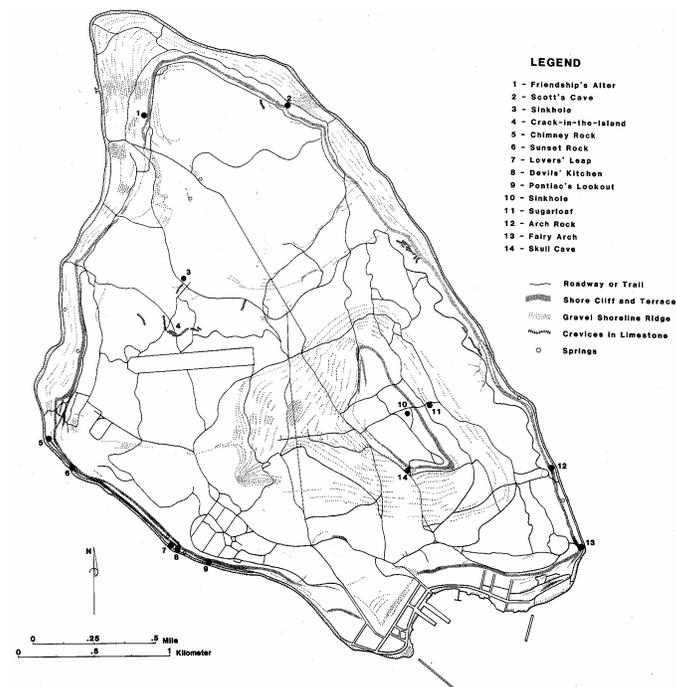


Figure 2. Location of significant geologic features of Mackinac Island, Michigan.

Though a nearly complete section of Devonian, Mississippian, and Pennsylvanian rocks was deposited within the Michigan Basin, the rocks exposed on Mackinac Island are like no Paleozoic rocks exposed elsewhere within the basin. Probably throughout millions of years the island was above sea level and subjected to intense aerial erosion.

In 1875, the United States government created Mackinac Island National Park. This was the nation's second National Park. In 1895, the federal government relinquished control of the island to the State of Michigan. The same year, Mackinac Island was designated Michigan's first State Park.

## DESCRIPTION

Approaching by boat, Mackinac Island appears to rise in two gigantic steps from the lake shore to the summit of a small, high hill (Fig. 3). The small hill stood as an isolated wave cut island during Lake Algonquin times and is referred to as the "Ancient Island." The lower hill, only about 50 ft (15 m) above present lake level, for the most part is a wave cut cliff related to the Nipissing stage of the modern Great Lakes.

The Ancient Island is slightly more than 2,600 ft (800 m) long and more than 1,300 ft (400 m) wide, with the highest natural point on Mackinac Island (elevation 904 ft; 275 m above mean sea level) recorded at its southeast end.

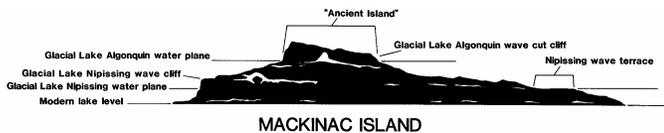


Figure 3. Topographic indicators of Ancient Great Lake levels seen when approaching Mackinac Island, Michigan from the east.

The Ancient Island is almost completely skirted by wave cut cliffs. Only along a portion of the west flank of the Ancient Island are the cliffs absent. Here deposition predominated over wave erosion and the eroded materials were deposited as gravel ridges. At this point the highest shoreline of glacial Lake Algonquin is recorded.

Adjacent to the Ancient Island are two limestone breccia stacks associated with the Algonquin shoreline. These stacks were small rocky islands separated from the coastal cliffs by wave erosion. Sugarloaf stack (Fig. 4), about 300 ft (90 m) east of the Ancient Island, stands 75 ft (23 m) above the surrounding level and is the largest stack on Mackinac Island. Sugarloaf is a magnificent display of Mackinac Breccia (Houghton, 1840: 1841; Landes and others, 1945). The breccia is composed of broken fragments of limestone in varying sizes, cemented into rock masses more solid and resistant than the parent limestone. The most plausible theory for the formation of the breccia is that salt beds deposited during the Silurian Period were dissolved, forming vast caverns into which the overlying Silurian and Devonian limestone beds collapsed and were recemented. Nearly every rock feature of interest on Mackinac Island—stack, cave, or arch—is a result of erosion around a mass of this breccia. A large number of fossils are identifiable within the Mackinac breccia. The most notable fossils being the trilobite, *Anchiopsis anchiops*; the tetracoral, *Acrophyllum oneidaense*; the brachiopod, *Centronella glansfagea*; and the pelecypod, *Conocardium* sp. (Landes and others, 1945).

Skull Cave stack is not as conspicuous as Sugarloaf, but is similarly composed of Mackinac breccia. The stack is approximately 50 ft (15 m) high and about 50 ft (15 m) from the southwest cliffs of the Ancient Island. Skull

Cave, the hiding place of Alexander Henry following the massacre at Fort Michilimackinac in 1763, is located in the west side of the stack and is a sea-cave produced by wave action. The entrance to the cave is approximately 3 ft (1 m) in diameter and was awash or slightly submerged at the lake's highest level. The cave's interior is pocketed due to erosion in the softer parts of the breccia. The rounding and smoothing of rock surfaces which characterize wear by waves is not very evident, though this is probably due to subaerial erosion.

Successive shorelines of Lake Algonquin are recorded at several locations about Mackinac Island. Eleven shoreline ridges are displayed during a 40-ft (12-m) change of elevation on the Short Rifle Range behind Fort Mackinac. Fourteen additional ridges are cut by Custer Road, while British Landing Road passes over 15 ridges. In each case the succession of ridges drops abruptly from the crest of the lowest ridge to flatter ground in front.

The shoreline of Lake Nipissing cannot be traced in a complete circuit about the Island (Stanley, 1945). In some places the distinction between the true Nipissing shore and the shore of a later lake stage is indistinguishable. Terraces evident below the South Sally Port of Fort Mackinac and along bluffs near Scott's Cave represent the true Nipissing shoreline. From the foot of the ramp leading to Fort Mackinac, the Nipissing terrace extends eastward along the high cliffs for more than 2,600 ft (800 m). To the west the terrace encounters a great gravel bar, the result of deposition from storms and currents during Nipissing time.

South of Carver Pond a mass of resistant breccia makes a projection from the cliffs. Similar projections of breccia are at Eagle's Crest, Scott's Cave, and Friendship Altar. Like the stacks of Algonquin age, the Nipissing Friendship Altar is made of Mackinac breccia. The Altar (stack) is about 8 ft (2 m) wide and 13 ft (4 m) high and is separated from the Nipissing bluff by a 10 ft (3 m) gap.

Scott's Cave is an excellent example of Nipissing wave erosion within the Mackinac breccia. The cave is 15 ft (5 m) long and 95 ft (3 m) wide with 9 ft (3 m) ceiling. The ceiling is rough and weathered. The floor and lower wall surfaces show heavy wave scour and rounding.

While looking like stacks, Lover's Leap and Sunset Rock are not true stacks. During the Nipissing stage of the lake they were not islands, but were chimney promontories attached to the cliffs below water level. Regardless, Lover's Leap and Sunset Rock are the result of wave action similar to that responsible for the formation of Friendship Altar. These hard breccia chimneys merely stood up as the softer cliffs wore back around them. A number of smaller detached promontories can be identified elsewhere along the Nipissing bluffs.

Arch Rock (Fig. 5), the most striking geologic feature on Mackinac Island, is of a somewhat similar origin. Though the arch is at a level that would correspond to Lake Algonquin, its proximity to the eroded Nipissing

cliffs suggests the later as its time of creation. Arch Rock was more than likely the byproduct of wave action undermining and removing softer material and leaving the firmer breccia as a bridge. The arch is approximately 10 ft (3 m) thick with an impressive hollow below. Sanilac Arch, a secondary feature, exists at the base of Arch Rock.



Figure 4. Sugarloaf Stack, Mackinac Island, Michigan. The largest of several stacks on the island, Sugarloaf stands 75 ft (22.5 m) above ground level and is located 300 ft (90 m) east of the Ancient Island.



Figure 5. Arch Rock, Mackinac Island, Michigan.

On Mackinac Island, water at the surface and underground has been active in dissolving the bedrock

and forming cavities in the rock. While no well-developed sinkholes are on Mackinac Island, numerous small depressions are obviously solution related.

Long fissures in the limestone bedrock are common in many places over the Island. The largest of these fissures is known as “Crack-in-the-Island.” The cavities are very likely the result of solution work along major joints in the carbonate bedrock, though some researchers credit Crack-in-the-Island to local earth rifting.

In addition to its importance as a geologic site, Mackinac Island is botanically and historically interesting. Mackinac Island is home to 415 species of wildflowers (Porter, 1984) and has been the site of past botanical studies by such noted botanists as Thomas Nuttall and Henry David Thoreau. At least six terrestrial community types exist on Mackinac Island; these include boreal forests, marshes, bogs, meadows, beaches, and hardwood forests, each exhibiting rich and diverse plant and animal life. Historically, Mackinac Island was an Indian gathering place, a Jesuit mission, an early fur trading outpost, and a strategic military stronghold, fought over and possessed by the French, British, and American forces during the French and Indian War, the American Revolution, and the War of 1812. Restorations of the Island's historic forts and settlements are major tourist attractions. Mackinac Island affords a spectacular view of the Mackinac Bridge, the world's longest suspension bridge as measured from anchor pier to anchor pier. The bridge spans the Straits of Mackinac and connects Michigan's two peninsulas. Mackinac Island is also home of the Grand Hotel. “The Grand” is the world's largest summer hotel and noted for its traditional glamour and its use as a backdrop for motion pictures. Additional information about Mackinac Island can be obtained by writing The Mackinac Island State Park Commission, Mackinac Island, Michigan 49757.

## REFERENCES CITED

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