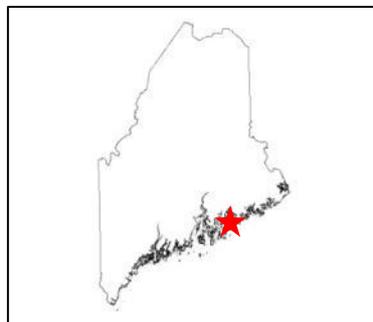


Geologic Site of the Month
November, 1998

Somes Sound, Mount Desert Island, Maine



44 20' 40.13" N, 68 18' 54.72" W

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Introduction

To early scientific visitors, whose coastal experiences were mostly in the relatively flat Coastal Plain south of New York City, the topography of the New England coast seemed extraordinary. It was called a "fjord coast," and the best example of a fjord was Somes Sound on Mt. Desert Island, Maine (Shaler, 1875).



Figure 1. Location map of Mt. Desert Island along the coast of Maine.



Somes Sound

Later researchers took exception to this designation and found the region, including Somes Sound, lacking many of the properties of a true fjord coast like that of Norway (Johnson, 1925). The overall relief was insufficient to warrant designation as a fjord and no shallow accumulation of glacial sediment was known from the mouth of the sound (Johnson, 1925). Later workers found that the muddy sediment which floored the sound was well oxygenated (Folger and others, 1972) and that the water of the sound was well mixed, contrary to conditions in a true fjord. Though these observations are true, Somes Sound remains an extraordinary coastal embayment. Recent observations on the seafloor geology reveal that it has experienced a complex history and has some fjord-like aspects.

Somes Sound is located on the south-central coast of Mt. Desert Island, between Blue Hill Bay and Frenchman Bay (Figure 1). The bedrock geology of the island is dominated by granite, and all of Somes Sound is bordered by granitic rock. The granites of Mt. Desert Island possess many fractures in various orientations. Also, the granite is intruded by several thin, vertical sheets of diabase, a dark-colored igneous rock, with orientations 10 to 30 degrees west of north (Gilman and others, 1988). During the past two million years, many glaciations have occurred and glaciers have eroded Mt. Desert Island. Fractured rocks were preferentially eroded by the glaciers, and deep ravines were carved with a north-south alignment parallel to some of the fractures in the granite. These ravines have no upland source (headwaters), and although some contain small streams and lakes today (Jordan Pond, Echo Lake, Somes Sound), they are glacier-carved, not river-carved valleys.



Geological Setting

About 14,000 years ago, as the most recent glaciers were melting back across the Maine coast, the southern edge of the glacier stood for a short time across Somes Sound. With the ice margin temporarily in this location, the glaciers deposited large mounds of gravel, sand, and mud, called moraines, at the southern side of many ravines. These moraines blocked drainage and impounded lakes on their northern sides (Figure 2). The Jordan Pond House, in Acadia National Park, is built on one of the moraines.

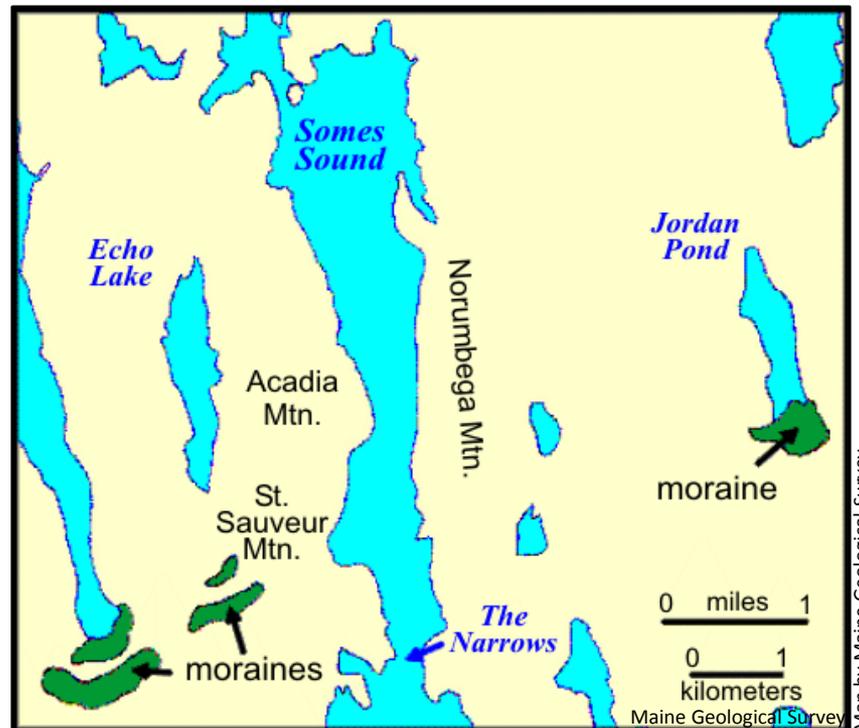


Figure 2. The Somes Sound area showing moraines located at the southern end of lakes.

A Description of Somes Sound

Somes Sound is a five-mile long embayment bordered by Norumbega Mt. (852 ft., 260 m) to the east, and Acadia (681 ft., 208 m) and St Sauveur Mts.(249 ft., 207 m) to the west (Figure 3).



Figure 3. Aerial photograph of Somes Sound from offshore looking almost due north. Greening Island is in the foreground at right, Norumbega Mt. is in the background to the right and Acadia Mt. is in the background to the left. The Narrows are seen at the entrance to the sound.

A Description of Somes Sound

At its deepest point, the sound is slightly deeper than 40 m, and in several places it is between 30 and 40 m deep (Figure 4). The entrance to the sound, called "The Narrows," is 10-20 m deep and is bordered by boulder-strewn bluffs to either side.

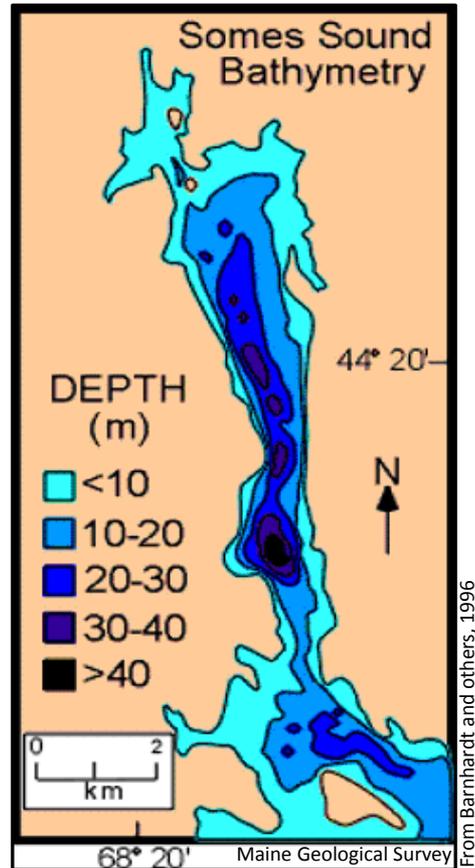


Figure 4. Bathymetry of Somes Sound

A Description of Somes Sound

All of the inner area of the sound is covered with mud, while within The Narrows, bouldery gravel covers the seafloor (Barnhardt and Kelley, 1995). Acoustic images of this area reveal that the gravel exists as morainal mounds up to 10 m in relief (Figure 5).

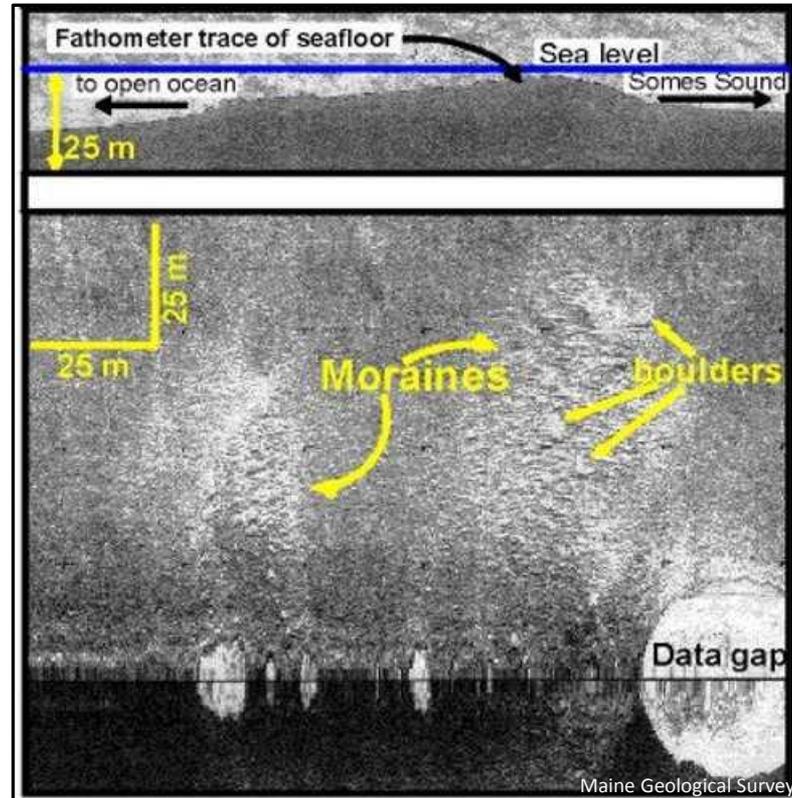


Figure 5. Side-scan sonar image of The Narrows area of Somes Sound. Upper panel shows a profile of the seafloor and a shallow area (near arrow) that forms a sill at The Narrows. The lower panel is a plan view (looking down from the sea surface) at boulders that cover the sill. Boulders and gravel dominate the seafloor of this area.

A Description of Somes Sound

Small cliffs, or scarps, cut into the moraines suggest erosion occurred on their seaward side in the past (Figure 6).

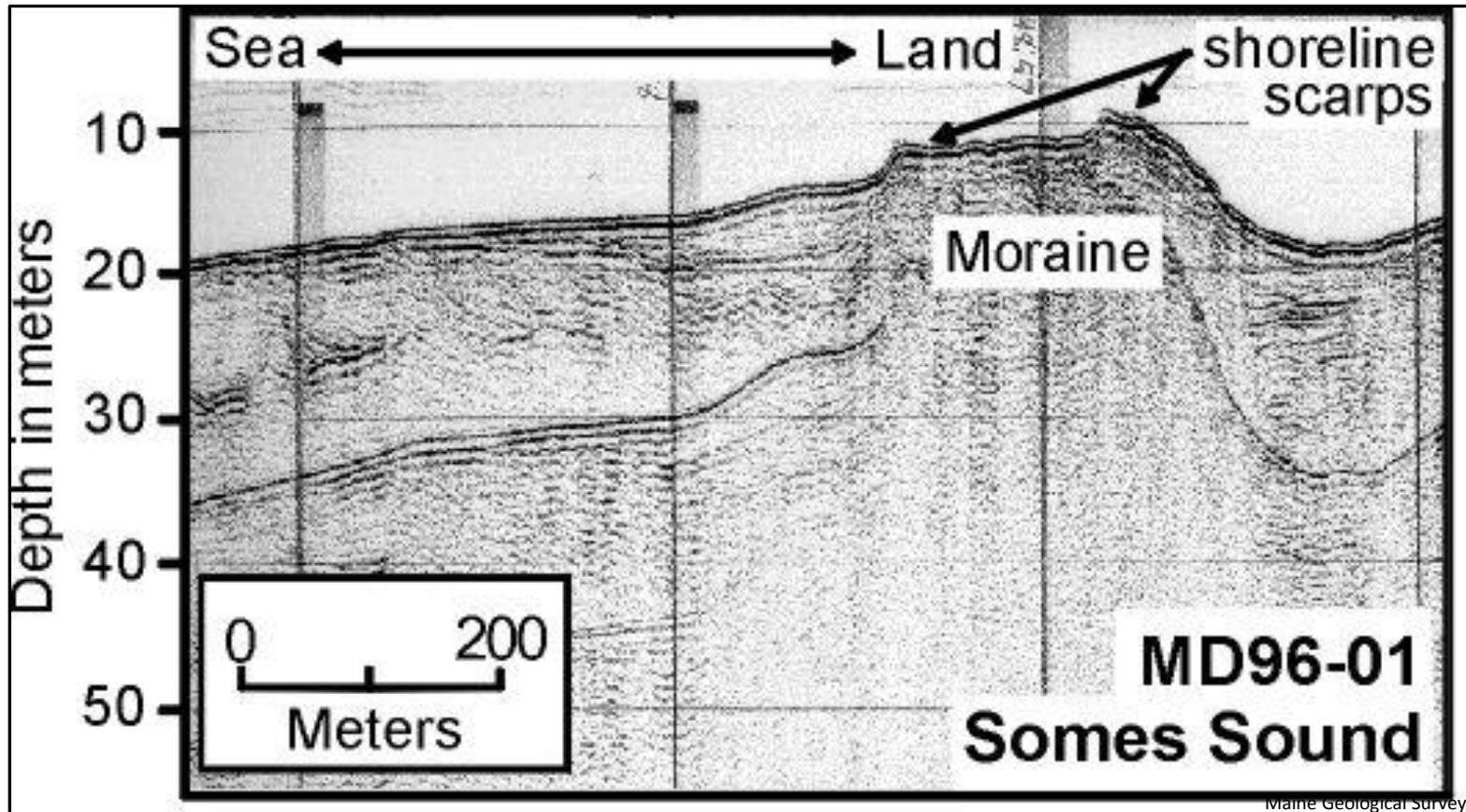


Figure 6. Seismic reflection profile over The Narrows area of Somes Sound. The small scarps (arrows) are suggestive of erosion from the seaward side.

A Description of Somes Sound

In the inner, muddy areas of the sound, the seafloor is mostly smooth and flat, with several large depressions (Figure 7). Natural gas, methane, is imaged within the sediment of the inner sound and is inferred to have escaped to form the depressions, or pockmarks. Such a process has been observed in Belfast Bay (see [Belfast Bay Pockmark Field](#)).

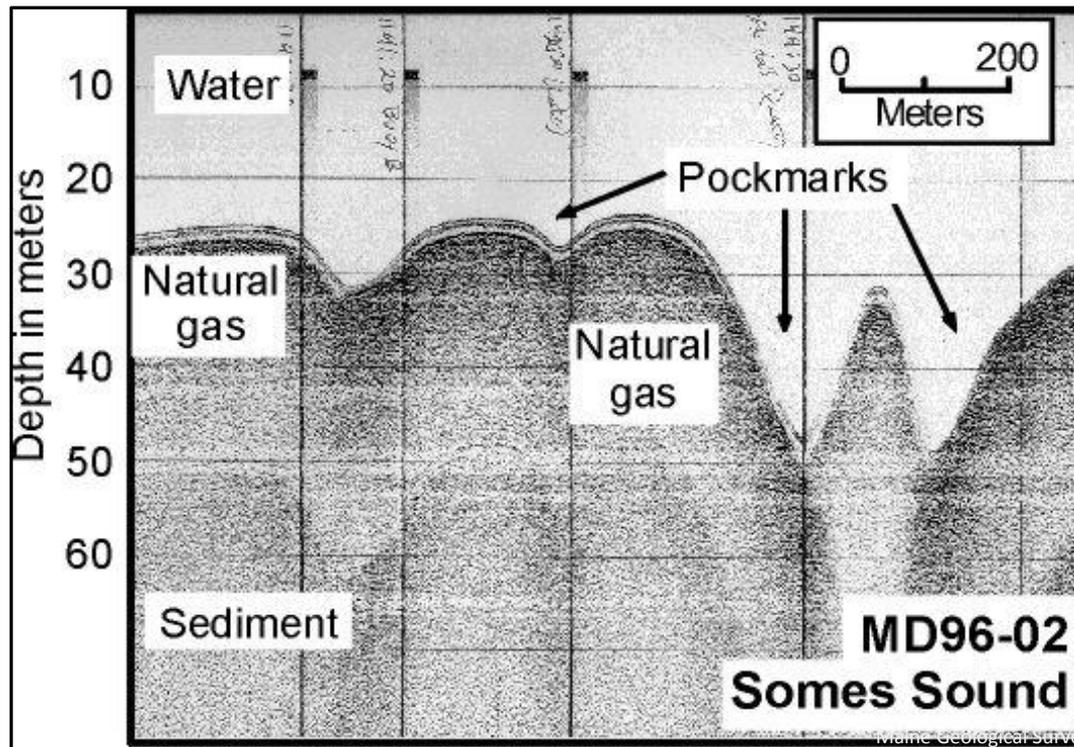


Figure 7. Seismic reflection profile over gas-escape pockmarks in Somes Sound. Due to about 10X vertical exaggeration, the slopes of pockmark walls appear steeper than they really are. Pockmarks are usually circular depressions, but appear as valleys in cross-section.

Geological History of Somes Sound

Repeated glaciations during the past two million years have eroded and deepened Somes Sound more than the adjacent mountains (Figure 3). About 14,000 years ago, the edge of the melting glaciers stood at the mouth of Somes Sound, and the other ponds of Mt. Desert Island, long enough to build a morainal deposit of boulders, sand and mud up to 10 m high in The Narrows (Figure 5 and Figure 6). Because of the enormous weight of the glacier, the crust of Maine was depressed under their load, and ocean water flooded Somes Sound after the ice retreated. Once the great ice sheet had melted, the land rebounded to its "normal" elevation, and the sound became a lake. Floating plants (phytoplankton) must have lived in and around the lake, and their organic remains accumulated in the bottom of the lake. By about 7,000 years ago, the ocean had risen to the elevation of the moraine in The Narrows and eroded shorelines into it. The ocean kept rising and eventually topped the moraines and the lake became marine. Meanwhile, as the organic matter from the lake became buried by marine mud, bacteria consumed the plant remains and generated methane. The methane continues to escape to this day, and its escape has formed the large depressions (pockmarks) on the bottom of the sound.



Somes Sound: Fjord or Fjard?

A fjord is a long, narrow, glacially-eroded arm of the sea, usually hundreds of meters deep, with steep rock cliffs and a shallow sill at its entrance to the ocean (Jackson, 1997). The great depth inhibits mixing of the water within the fjord so that as dead plants and animals sink to the bottom and decay, oxygen is removed from the water and sediment.

The prominent role of glacial erosion in forming Somes Sound was recognized long ago and is not in dispute. The relief of Somes Sound, almost 300 m, is large, but relatively small compared to the 1000 m relief of fjords found in Norway. An entrance sill exists in The Narrows of the sound, but it is not large enough to alter the circulation within the sound. Thus, on the basis of most geological criteria, Somes Sound is not a true fjord.

Somes Sound is, however, one of the most magnificent bays on the Maine coast. Its overall geology makes it like a fjord, but not quite. Another Scandinavian term, fjard, probably applies better to the sound. A fjard is smaller in all ways than a fjord, and is simply a glacially carved embayment that is drowned by the sea.



References and Additional Information

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