The Field Trip Guide.

This field trip guide offers additional information and resources about our field trip stops.

Please note that we will not actually visit all stops listed here and instead will combine stops in a logical and appropriate sequence given the circumstances and weather conditions.

General Information and Resources.

- Geology and the Formation of New England (PDF)
- Visitor's Guide To Franklin County Geology (website)
- A Dramatic Past (Beneski Museum of Natural History, Amherst College).

Field Trip Stop #1: The Glacial Erratic.

This large glacial erratic is located in the Boulder Park section of Chester-Blandford State Forest with easy access from the parking lot. How did the boulder get here? A glacier brought it!

Information and Resources.

- Chester-Blandford State Forest
- Chester-Blandford State Forest Map

Field Trip Stop #2: The Knightville Dam.

The Knightville Dam in Huntington (MA) is operated by the U.S. Army Corps of Engineers as a flood control dam in the Westfield River watershed.

Information and Resources.

- Knightville Dam
- Knightville Dam Map

Field Trip Stop #3: The Chesterfield Gorge.

The Chesterfield Gorge is a dramatic rock canyon with 70-foot walls - carved by centuries of fluvial erosion from the East Branch of the Westfield River. Across the river, you'll see stone abutments from a historic bridge that spanned the river around 1762, swept away by floodwaters in 1835.

Information and Resources.

- The Chesterfield Gorge (Trustees of the Reservation)
- The Chesterfield Gorge Map

Field Trip Stop #4: Mount Greylock.

Mount Greylock (3,491 feet) is the highest point in Massachusetts with great 360 degree views. Unfortunately, the road to the summit is not scheduled to open until sometimes in May 2024. The wide valley to the east of Mount Greylock (Adams / North Adams) is underlain by marble bedrock = metamorphosed limestone formed during the formation of Pangea.

Information and Resources.

- Mount Greylock State Reservation
- Mount Greylock State Reservation (Trail Map)

Field Trip Stop #5: Natural Bridge State Park.

The marble ‘canyons’ were formed by chemical weathering of the limestone bedrock and fluvial erosion over the last ~15,500 years after the glaciers had vacated the area - these fluvial features could not have survived the glacial erosion under the glaciers.

Information and Resources.

- Natural Bridge State Park
- Self-Guided Tour

Field Trip Stop #6: Glacial/Fluvial Potholes (Shelburne Falls).

These are actually not glacial potholes, but rather fluvial potholes. These ‘post-glacial’ potholes were formed over the last 14,000 years after GLH had drained (and are still forming). The exposed bedrock here is a gneiss = metamorphosed granite, formed some 400 million years ago about 10 miles or so inside the Earth during the plate collisions that assembled Pangea. This means that 10 miles of rocks have been eroded-away over 400 million years.

Information and Resources.

- The Deerfield River (5:29 minute, YouTube)

Field Trip Stop #7: The GCC Rock Walk.

This geology path on the campus of Greenfield Community College (GCC) displays local rock specimens showing evidence of plate tectonic movements that first created the Pangea supercontinent and later broke it apart.

Igneous, sedimentary, and metamorphic rocks represented here record the dramatic Earth events that assembled and broke-apart the Pangea supercontinent. Metamorphic rocks, like quartzite, formed from intense heat and pressure as tectonic plates collided. Granite, an igneous rock, was created from magma chambers that cooled within ancient volcanoes. During Pangea's split 200 million years ago lava flowed out of a rift-faulted valley and cooled to form igneous basalt. Dinosaurs roamed over sandy deposits, leaving tracks later preserved in sedimentary rock.

Information and Resources.

- Guide to the GCC Geology Path (handout)
- The Geology Path @ Greenfield Community College (YouTube, 8:53 minutes)
- Armored Mud Balls: Comic & Information

Easy access from Route 2, bathrooms available.

Field Trip Stop #8: Turners Falls Dam and Fish Ladder.

The Great Falls of the Connecticut River has been a gathering place for over 10,000 years. Native Americans and, later, colonists regarded the falls as one of the region's fishing grounds. In 1798, the Great Falls was dammed to construct a navigational canal. The canal and nine locks allowed riverboats to travel from Long Island Sound up the Connecticut River to Vermont.

In the 1860s, the industrialists who founded Turners Falls rebuilt the canal and dam to provide power for their factories. Today, the dam and its canal generate electricity for everyone in the valley. Were the Great Falls not dammed, we would see a waterfall drop of about 40 to 50 feet – a reminder that water is still cutting and breaking down rock as it has for hundreds of millions of years.

We will see the tilted layers of the Turners Falls Formation (a sedimentary rock) and the massive Deerfield Basalt forming the ridge (Canada Hill) that rises impressively on the northwest side of the river - both about 200 million years old.

Information and Resources.

- Visit The Great Falls Discovery Center and learn about the natural, cultural, and industrial history of the Connecticut River watershed.
- Turners Falls Fishway
- Below the Dam at Turners Falls - Then & Now (1818 vs. 2007)
- Geologic Walking Tour of Turners Falls (MA) by Stever Winters.

Figure 1. Turners Fall dam, fish ladder, and tilted layers of the Turners Falls formation below. Source: Connecticut River Conservancy

Field Trip Stop #9: Sugarloaf Mountain.

The view from the summit of Mount Sugarloaf offers a beautiful panorama of the Connecticut River Valley and surrounding hills. The floodplain of the Connecticut River (550 feet below) is prominent in the foreground to the south, while the 400-feet thick lava flows of Holyoke Range and Mount Tom can be seen in the distance.

The flat upper surface of the Sunderland Delta is visible to the southeast and the stable lake level of Glacial Lake Hitchcock reached about half-way up the UMass Amherst DuBois Library – connect the two points and recreate in your mind's eye the water level of Glacial Lake Hitchcock stretching across the valley.

Information and Resources.

- Mount Sugarloaf State Reservation
- Mt. Sugarloaf State Reservation Trail Map
- Additional Map, Including North Sugarloaf

Field Trip Stop #10: The Glacial Varves.

This site is in the middle of the Connecticut Valley, far away from the shoreline of Glacial Lake Hitchcock. The Connecticut River has eroded away many of the old lake-bottom sediments over the last ~14,000 years, but this site preserves an impressive sequence of varves.

Varves are annually layered sedimentary deposits that can be used much like tree rings to infer the paleoclimatic conditions at the time of deposition. One (annual) varve consists of two layers (or couplets)"

- The summer layer (lighter color) is coarser and thicker and consists of sediments brought into the lake during high streamflow conditions such as the spring snowmelt or in response to intense summer rainfall events. These coarser sediments would have gradually settled out onto the lake floor during the summer and into fall during open-water conditions.
- The finer and usually thinner winter layer (darker color) is deposited once the lake freezes over in the fall, creating the quiet conditions needed for the much-finer clays to settle and accumulate on the lake floor. These finer sediments arrived in the lake by meltwater streams but remained in-suspension in the water column long enough to be distributed throughout the lake rather than being concentrated in or near lake-edge deltas.

Glacial Lake Hitchcock existed for about 4,000 years between about 18,000 years and 14,000 years ago. There are 100 feet or more of these lake bottom clays at the bottom of Glacial Lake Hitchcock in Franklin County, deposited over the about 1,500 years or so that the lake existed in this area (15,000 to 14,000 years ago).

Information and Resources.

- A land once under water (Daily Hampshire Gazette, 14 February 2019)
- Diving in the Connecticut River featuring underwater varves from Glacial Lake Hitchcock (YouTube video, 6:42 to 7:05 minutes).

Field Trip Stop #11: The Sunderland Delta.

The Sunderland Delta is one of the many 'old deltas' found in this area that were created by rivers flowing into Glacial Lake Hitchcock some 15,000 years ago at the end of the last ice age.

The flat upper surface, classic triangular shape, and steep slope leading down to the valley floor to the southwest identify this landform as a delta – a pile of sediment deposited by a stream where it entered a large body of standing water. In this case, the body of standing water was Glacial Lake Hitchcock, which existed within this part of the Connecticut River Valley between about 15,500 years and 14,000 years ago. The lake surface in this area was about 300 feet – meaning that the water was about 150 feet deep out in the central part of the valley and that the lake was probably several miles wide at this location. The Sunderland Delta is only one of many deltas built-into Glacial Lake Hitchcock during its existence. Of course, deltas are easily erodible once exposed and the number (and extent) of the remaining delta today is lower.

Information and Resources.

- Richard Little explains the Sunderland Delta and its context in his YouTube video (4:00-5:30 minutes).
- A land once under water (Daily Hampshire Gazette, 14 February 2019)

Field Trip Stop #12: The Sunderland Dunes.

Imagine this location about 14,000 years ago.
Glacial Lake Hitchcock has just drained, exposing the loose sediments of the old lake floor to the atmosphere. The margin of the Laurentide Ice Sheet is located north of us, somewhere in Vermont. It is cold, windy, and dry. The landscape is barren and without vegetation to stabilize the ground. The westerly winds picked-up the easily erodible lakebed sands and transported them eastward. The Sunderland Delta then blocked the wind, and the sand was deposited transverse (i.e., perpendicular) to the wind direction in a so-called Echo Dune = a dune formed in-front of a topographic obstruction.

Information and Resources.

- Sand Dune Formation (California State Parks, 4:00 minutes)
- Sand Dunes Shouldn't Exist (Here's Why They Do) (Be Smart, 16:21 minutes)
- Aeolian Dunes and Sandstone: Overview and Terminology (fun animation)

Field Trip Stop #13: Mount Tom / Goat Peak.

The drive along Christopher Clark Road offers great views of Easthampton below and the Berkshires. On the east side of Christopher Clark Road you can see the sheer basalt cliffs (or palisades) of Mount Tom with distinct columnar jointing. The basalt columns along the road have fallen from those cliffs. The Holyoke Basalt consists of two major lava flows (320 feet and 255 feet thick in Holyoke, but thinner elsewhere) that can be traced for about 75 miles from Amherst to New Haven.

Along Reservation Road you see an outcrop with thin layers and fine sediments, indicating a calm and quiet depositional environment - maybe a lake.

Goat Peak offers one of the best available views of the valley. As we walk up, we see that the Sugarloaf Arkose is much coarser with thicker beds. This indicates more turbulent conditions and faster flow of water - maybe shoreline/beach deposits. The route climbs-up through the upper Sugarloaf Arkose until finally cresting on a small remnant of basalt that underlies the peak itself. The contact is great - here molten lava flowed across the sedimentary rocks 200 million years ago - imagine the dinosaurs living here!

- Note the vesicular basalt. The vesicles are bubbles of gas trapped in the cooling lava.
- Note the pillow lava when you get to the cement stairs that lead up the steep slope to the metal tower, look left at the leafy overgrown slope. The pillows are blobs of lava whose outer surfaces cooled very rapidly as they came in contact with water (in this case, a lake within the old Mesozoic valley).
- Stairs / top of stairs: basalt columns.

Information and Resources.

- Mount Tom State Reservation (trail map)
- Mt Tom Wild: Wildlife on the Mt Tom Range (YouTube, 1:19:20 minutes)
- The Faces of Mount Tom (YouTube, 33:17 minutes)

Field Trip Stop #14: The Dinosaur Tracks.

Follow the trail for about 100 yards to an extensive outcrop of the Portland Formation. This unit, like all the other valley rocks, is tilted gently toward the east as a result of the faulting that created the old rift valley. The rocks here include fine sandstones and mudstones, with obvious ripple marks in places, and a variety of dinosaur tracks – identifying the time of sediment deposition as early in the Mesozoic.

The most prominent tracks are known as Eubrontes and in a couple of locations you can find several tracks in a row, made by the same dinosaur! Careful inspection will reveal examples of other smaller tracks as well, with a total of three varieties generally being recognized. Most of the tracks at this site indicate motion toward the west, which has led to the suggestion that the Eubrontes track-maker moved in herds. provides an excellent overview of the discovery of dinosaur tracks in the Connecticut River Valley.

You can also walk down to the Connecticut River to see lacustrine deltaic sandstones interbedded with deeper-water gray mudstones that are stratigraphically above (= younger) than the dinosaur tracks.

Information and Resources.

- Guide to Dinosaur Tracks (PDF)
- Impressions from a Lost World (interactive website)

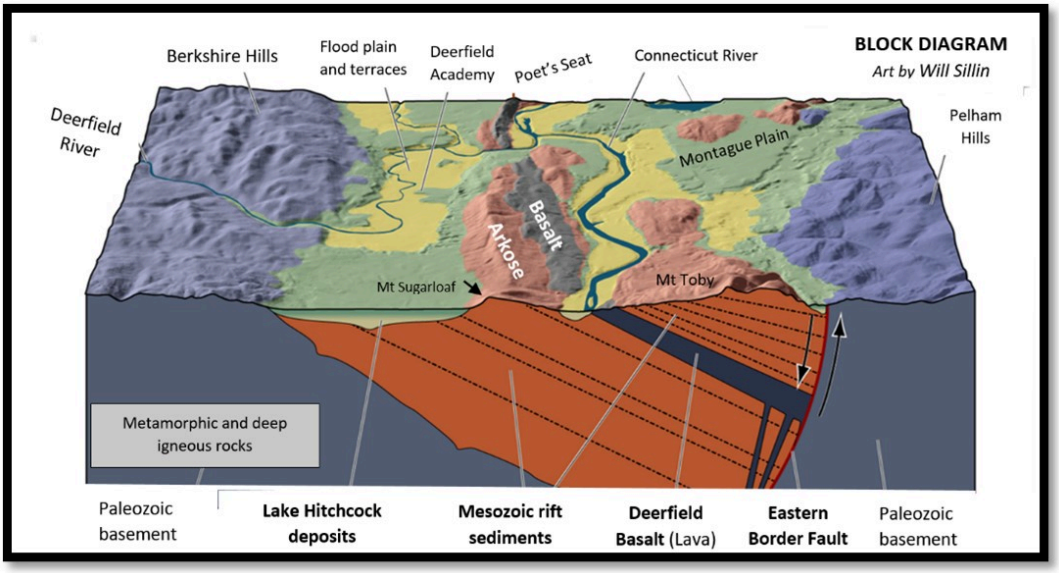

Figure 2: Schematic 3D cross-section of the Connecticut Valley between Deerfield and Greenfield (MA) showing the main rock types, faults, and surrounding topography. Artwork by Will Sillin (source).

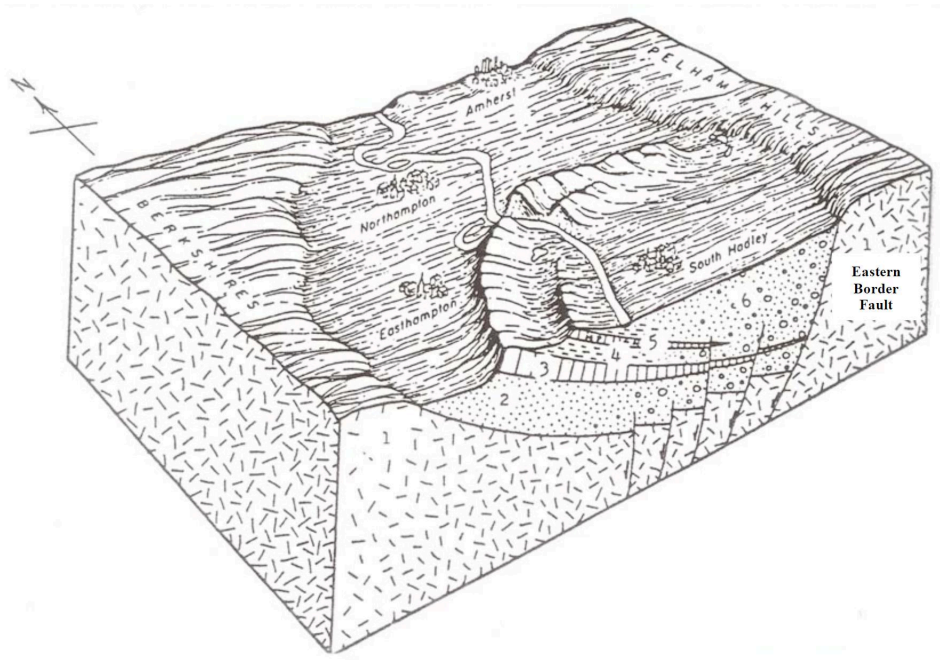

Figure 3: Topography and geology of the Connecticut River Valley around Amherst, Northampton, Easthampton, and South Hadley. Modified from Tollo and Nicholson (1979) by Young, Weiss, and Little (2008). Art by Marie Litterer.

Figure 4: Major glacial lakes in New York, Connecticut, Massachusetts, and Vermont. Source: Little (2020, Page 14)

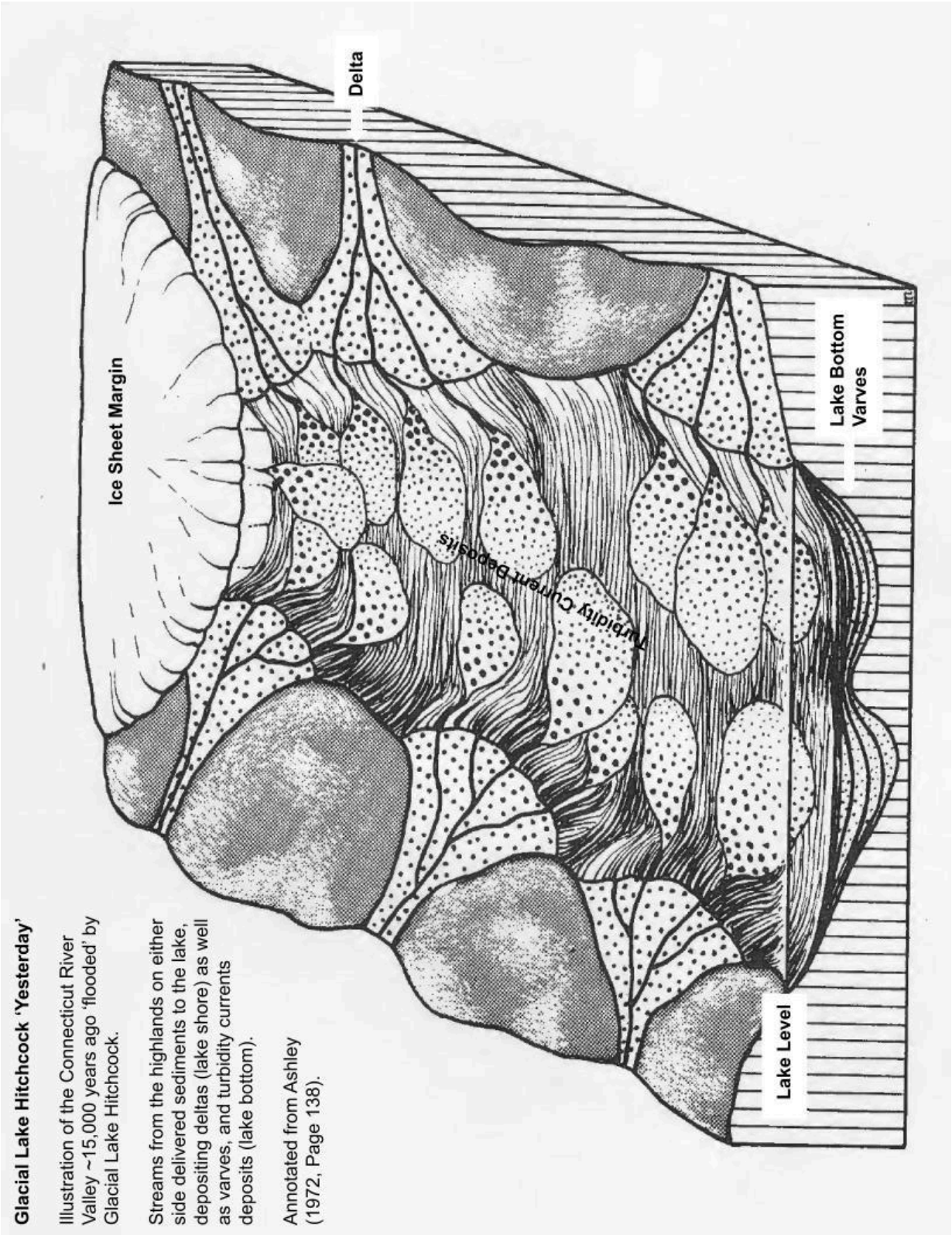
Glacial Lake Hitchcock 'Yesterday'
Illustration of the Connecticut River Valley ~15,000 years ago 'flooded' by Glacial Lake Hitchcock.
Streams from the highlands on either side delivered sediments to the lake, depositing deltas (lake shore) as well as varves, and turbidity currents deposits (lake bottom).
Annotated from Ashley (1972, Page 138).
Ice Sheet Margin
Delta
Turbidity Current Deposits
Lake Bottom Varves
Lake Level

Figure 5.

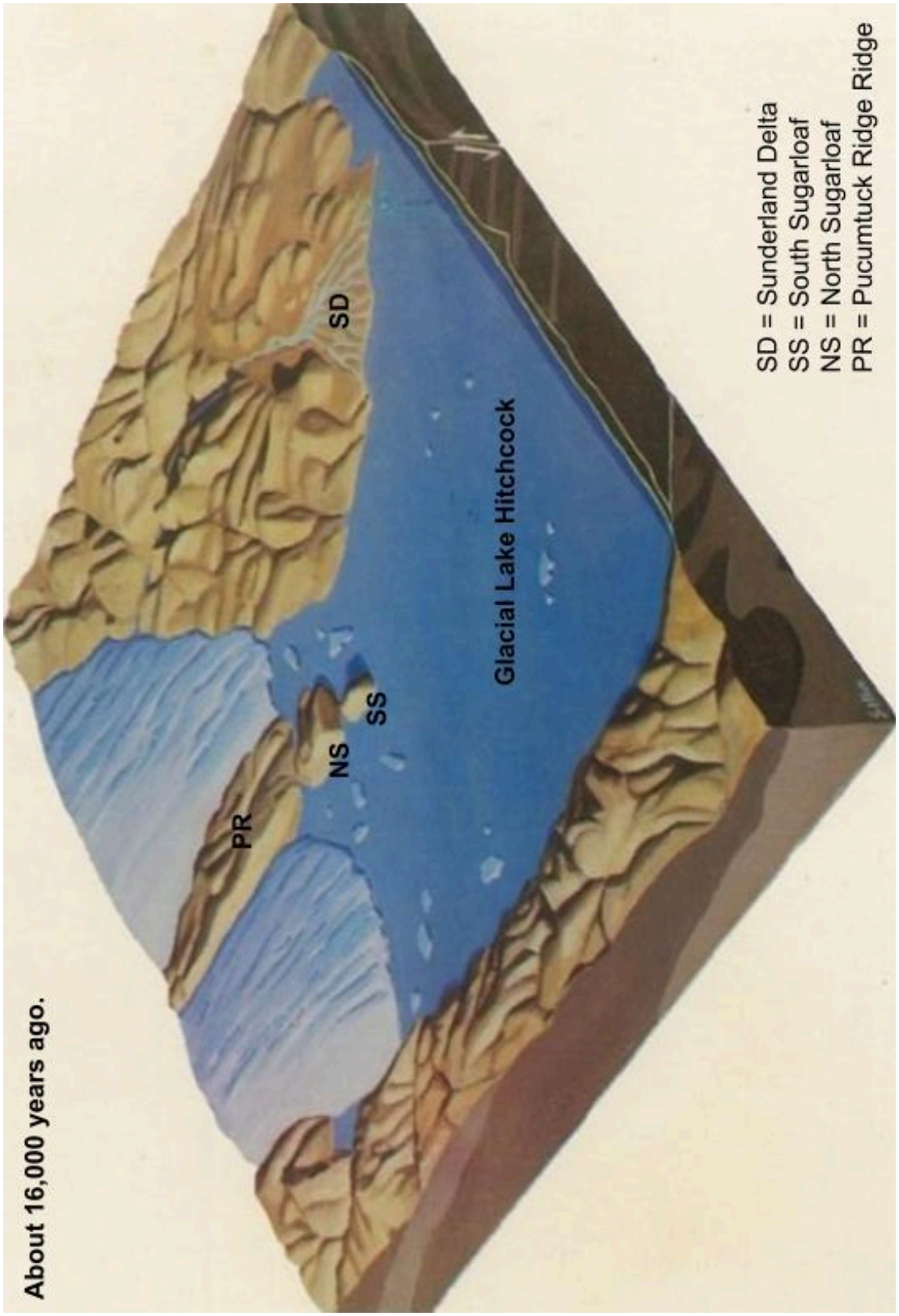

Figure 6: Diagram of Glacial Lake Hitchcock based on a painting by Will Sillin. (Source)