



Western Norway
University of
Applied Sciences

The journey that conceived new branches to science

The Ice age discoveries

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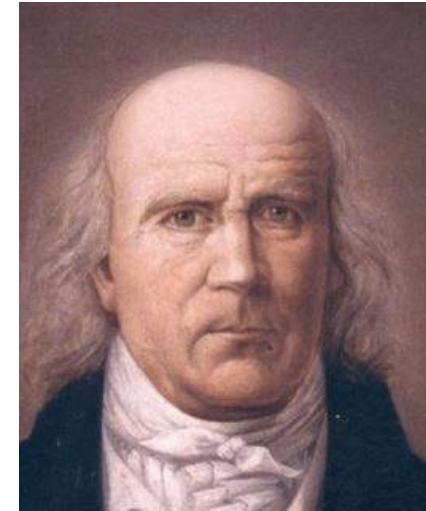
1823 - 2023

Two professors deserves great gratitude
from the geologists of today



Professor Esmark (1762 – 1839)

- › Esmark published the first theories about the continent covering ice sheet.
- › This should be well known by all geologists.
- › But most people would not know more than that, if it was not for



Professor Hestmark (f. 1958)

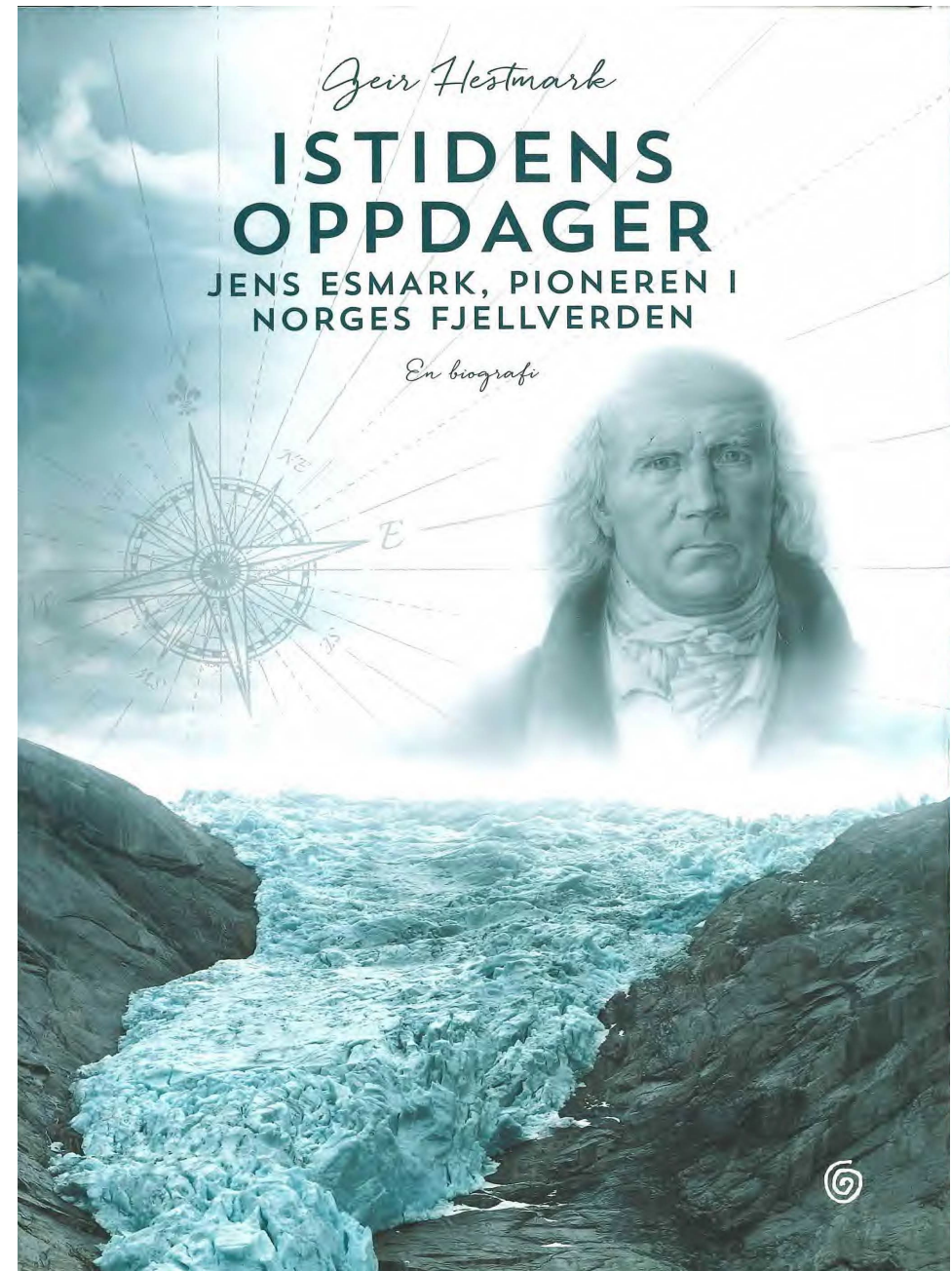
- › Hestmark wrote the biography of Jens Esmark.
- › He presents the life, the works, the field trips, journeys, and glaciation theories from the Danish/Norwegian geology professor Jens Esmark.



A great research work

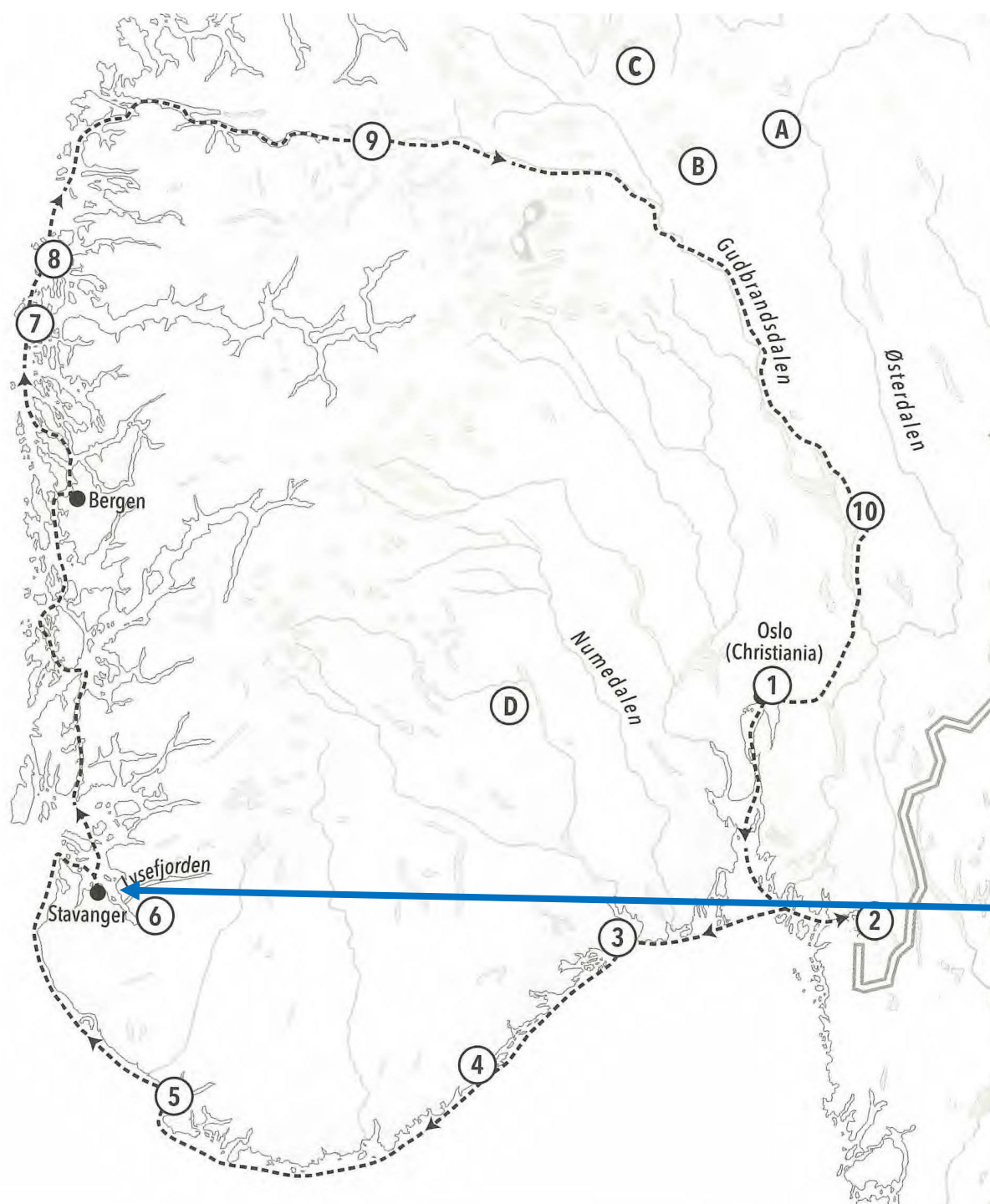
700 pages

260 references pages



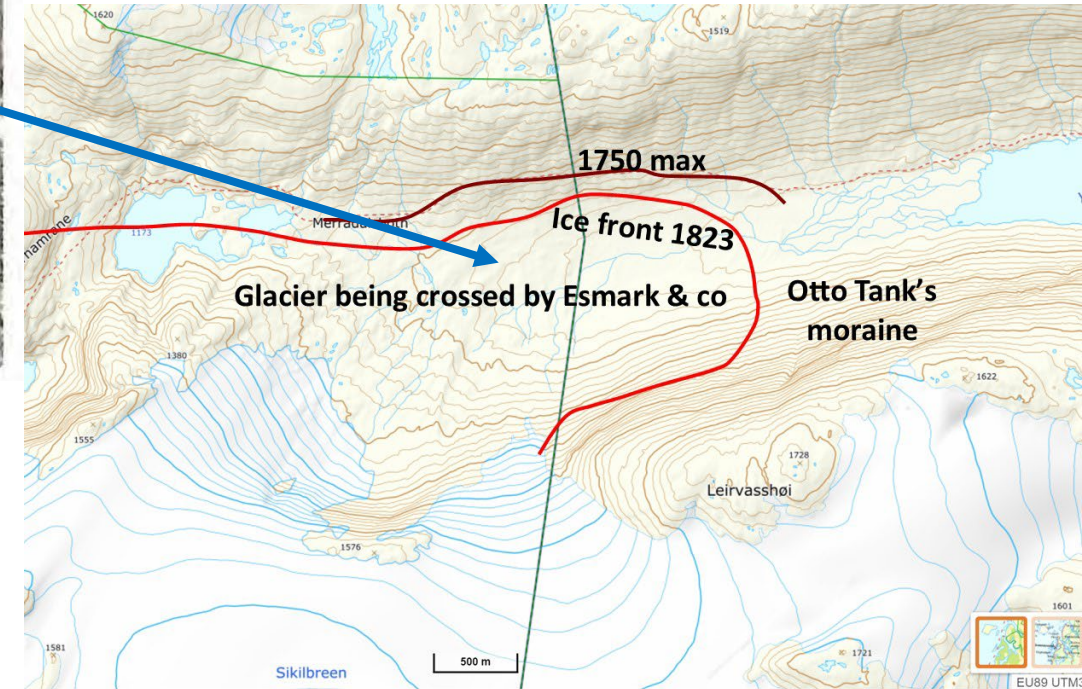
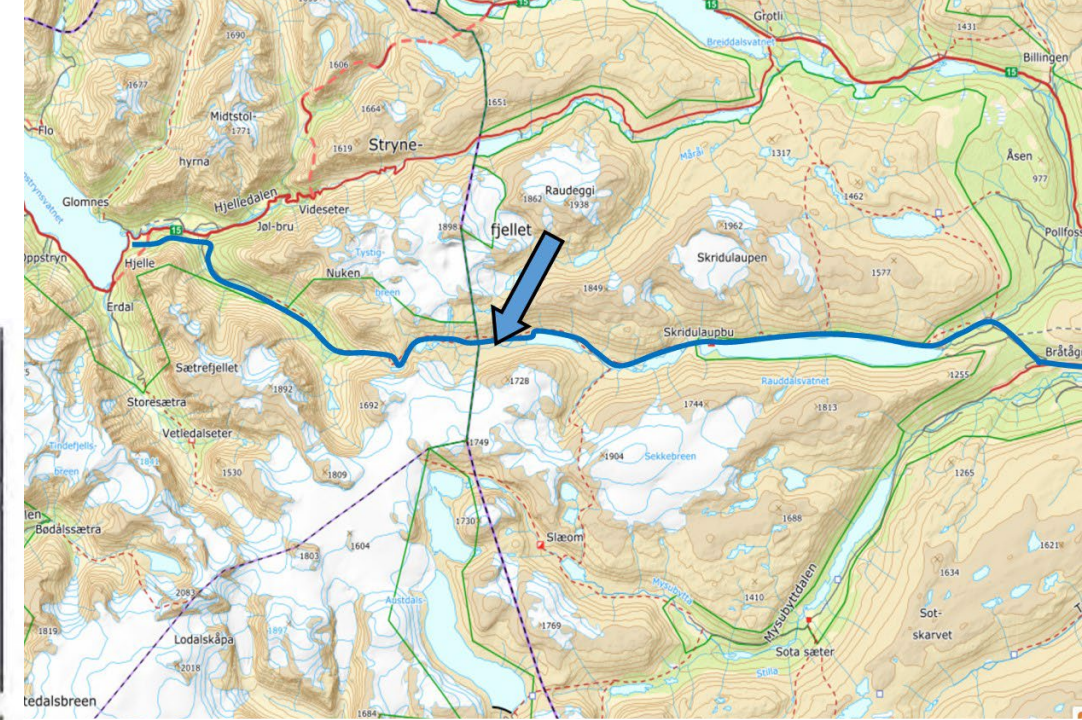
Jens Esmark

- › Esmark was appointed to the first Norwegian professor in rock science
- › He did many research journeys.
- › 1794-96 he travelled around eastern Europe to study the Habsburg empire's quarries.
- › 1802 He studied the moraines around Snøhetta and later on the glaciers in Jotunheimen.
- › 1823 He travelled around the south and west Norwegian coast, a more or less geological undescribed territory. His companions were Otto Tank and Theodor Kielland.
- › They did a lot of new discoveries, like the rare mineral yttrium, and four other unknown minerals.
- › The threshold ridge in front of the Lake Haukalivatn by the outlet of Lysfjorden was described and drawn in details by Esmark .
- › Later on they searched for the fossils in Sula (Sogn) described by the bishop Erik Pontopidan, with no results. Probably because they do not exist.
- › On their way across the mountains from Nordfjord to Gudbrandsdalen, they passed the Jostedalsbreen glacier and the great moraine that seemed to be similar to the Haukalivatn moraine. This was later named the Tank's moraine
- › The idea that the entire country had been glaciated was born by this discovery, and published in 1824.



Map and pictures from Hestmark, 2017

The mountain and glacier crossing 1823



A new understanding of landscapes

- › Like all new revolutionary theories, Esmark's ice age theory was not met with total agreements
- › But later on geologists have seen moraines all along the Norwegian coast confirming the ice sheet
- › Esmark described the ice sheet to be aged back to precambrium. A great mistake by a rock geologist who should have recognized the till to be unconsolidated. A mistake we should forgive and hide behind his great discoveries and the birth of the ice age theory. The Biggánjarga moraine in Varanger proves his idea of precambrian ice ages, though not the one he discovered.
- › The Swedish scientist Jacob Berzelius (1779 – 1848) reviewed and presented Esmark work. He did in a gentle way disregard Esmark's age interpretation, and described the ice age as a younger phenomenon.
- › Esmark tried to explain the ice age phenomenon with the change of sun exposure through time, due to changing sun distance during the earth's elliptic orbit. He was aware that the earth's orbit followed a wider ellipse in earlier days, and that William Herschel described cosmic clouds of meteoric material that may shade the sun's rays.

The ice age theory became recognized in several countries

- › Ignaz Venetz claimed in a meeting in Switzerland science society 1829, that the sediment ridges to be found in lowland around the alpine mountains, was remnants from a greater ice sheet covering the alps.
- › The Swiss geologist Louis Agassiz (1807 – 1873), living in Scotland claimed in 1840 that the entire Scotland had been glaciated. Morianes are to be found all over Scotland.
- › Later on traces from the ice sheet were described from Denmark, Sweeden, Germany, Russia and Polen.
- › The traces of ice ages from the rural parts (Denmark and Germany) was enterpreted to belong to different ages. This raised the idea of several glaciations. The last glaciation in Norway had resolute removed most of the traces from earlier glaciations.
- › Similar traces of glaciations was discovered and described in Canada and USA.

The new theory conceived new subjects

- › The ice age theory gave a new understanding and lots of new studies of landscapes, geomorphology and geography.
- › Studies of the migrations of animals and plants after the deglaciation gave a new understanding of biology, evolution and climate changes.
- › Discoveries of sea fossils in dry land gave new understanding of shore level displacement, isostasy and eustasy.
- › Studies of glacier movement in Norway and Arctic/Antarctic gave us new knowledge in glaciology.
- › Studies of sea bottom sediments was dated to correspond to glacier deposits from dry land, hence the marine geology gave new understanding of the ice sheet's occurrence, grows and declines.
- › The meteorology studies, started by Vilhelm Bjerknes in Bergen fitted in to the climate changes recognized by ice ages.
- › The astronomy studies showed ice ages to be corresponding to the earth's rotation axis and elliptic orbit (Some ideas raised by Esmark as well).

Quaternary studies 200 years after Esmark

- › The ice age periods was given the name **Quaternary**, to be the last era after the precambrian **Primary**, cambrian- mezosoic **Secondary**, post mezosoic **Tertiary**. Today only tertiary and quaternary are used, and the geological name committee wants to replace them with more detailed names referring new new datings
- › The quaternary period is dated to start 2 588 000 YBP, and it does still exists.
- › The last three ice ages recognised from end deposits in central Europe: Elster, Saale and Weischel, have later been enriched with a longer family tree of totaly 40 glaciations proven by the sea botom deposits, alternating ^{16}O / ^{18}O -isotopes

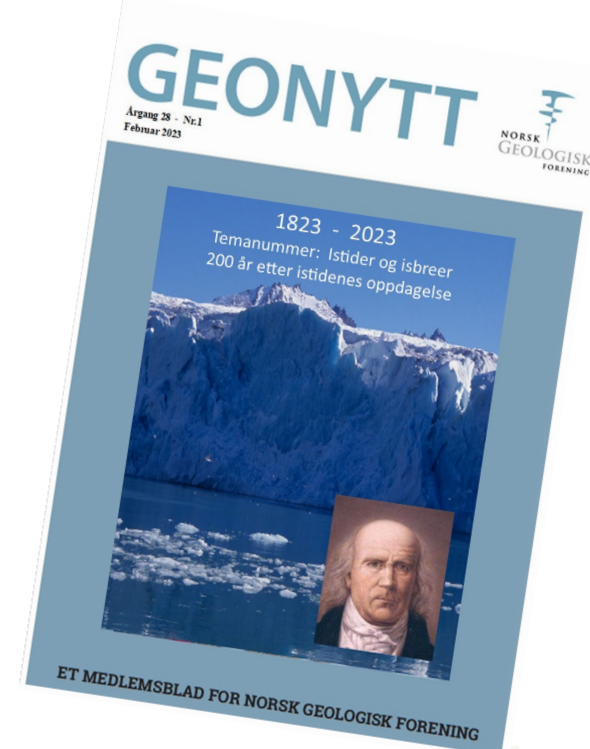
Istider og mellomistider i kvartær-perioden				
Alder fra	Isotoptrinn	Periode	Istid	Mellomistid
11 700 år	1	holocen		
109 000 år	2 - 5d	pleistocen	weichsel	
130 000 år	5e			eem
300 000 år	6		saale	
424 000 år	7 – 11			holstein
478 000 år	12		elster	
866 000 år	21			cromerkomplekset

Quaternary studies today

- › The ice age studies started by Jens Esmark in 1823 have inspired scientists through history to search for a greater understanding of
- › Glaciology
- › Ocean currents
- › Meteorology
- › Climate changes
- › Relation between human activity and climate
- › Biology and evolution
- › Future climates
- › Next ice age

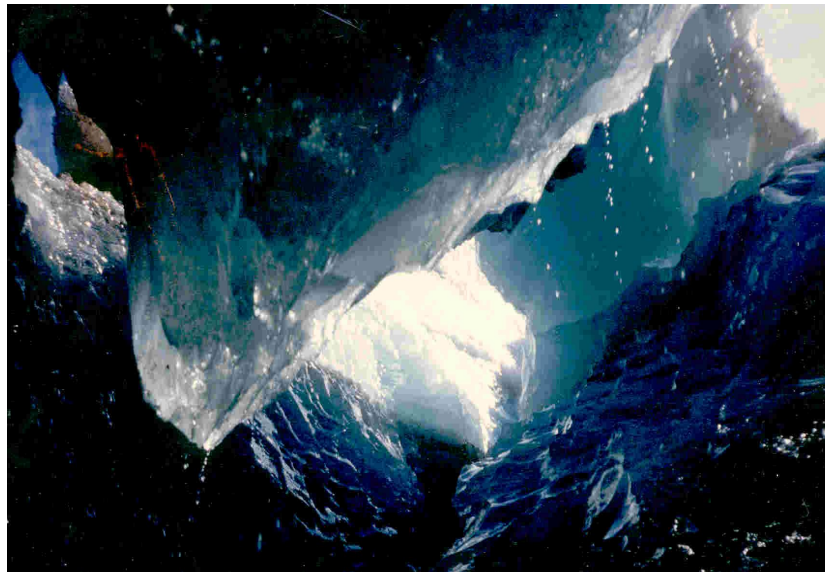
Marking and celebrating the quaternary studies started by Esmark

- › Esmark's discoveries and ice age theory will be marked properly in 2023 – 200 years after.
- › The geology magazine Geonytt will start this year with a special ice age and glacier edition
- › The science magazine Naturen will be following up with a similar Ice age/ glacier edition
- › The book ***Spor i is*** about ice ages and glaciers will soon be published
- › Articles in newspapers will address the marking of Esmark
- › Research from Jostice, Folgefonna, EASTGRIP and NVE to be exposed
- › An Esmark seminar will be arranged in Bergen in September



Celebrating the quaternary studies started by Esmark

- › An excursion to Herdla Y.D moraine north of Bergen will be arranged
- › An excursion to Jostedalén will be arranged.
- › The adventure of entering, climbing and exploring glaciers will be arranged in glacier trips



But the marking and celebrating of Jens Esmark starts at this moment in this room - with the Esmark session in the NGF VK23.



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What do you think?

<https://promshuset.no/spor-i-is>

