

NGU

Geological Survey of Norway

Geological map of Norway

by Ellen M. O. Sigmund, Geological Survey of Norway, in collaboration with the Norwegian Rock Mechanics Group.

Geological basis: Geological map of Norway—1:1 mill.—NGU 1984
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 Geological map of Norway—scale 1:3 mill.
 Norges geologiske undersøkelse



Scale 1:3 mill. 0 50 100 200 300 km

- Legend to the index map**
- Sediments of Tertiary and Quaternary age
 - Volcanic rocks
 - Rocks of Carboniferous to Cretaceous age
 - Devonian rocks
 - Cambro-Silurian rocks
 - Precambrian and Cambro-Silurian rocks
 - Late Precambrian rocks
 - Precambrian rocks
 - Cambro-Silurian rocks
 - Late Precambrian rocks
 - Proterozoic rocks
 - Archaean rocks
 - Fault zone
 - Thrust boundary



- Rocks of Jurassic and Cretaceous age**
 - Sandstone, shales, coal
- Rocks of Devonian to Permian age**
 - Plutonic rocks (Permian age)
 - Volcanic and sedimentary rocks (Carboniferous and Permian age)
 - Sedimentary rocks (Devonian age)
- Rocks of Precambrian to Silurian age in the Caledonian mountain chain**
 - Plutonic rocks, mainly of Cambro-Silurian age
 - Granite to tonalite
 - Gabbro, chlorite, ultramafic rocks
 - Metamorphosed volcanic and sedimentary rocks of Precambrian to Silurian age
 - Phyllite, mica schist, mica gneiss, metasediment, amphibolite
 - Limestone, marble
 - Metamorphosed volcanic rocks
 - Metamorphosed sedimentary rocks of Late Precambrian age
 - Metasediment, conglomerate, in places shale
 - Limestone
 - Metamorphosed rocks of Precambrian age
 - Charnokitic to anorthositic rocks
 - Gneiss, migmatite, granite, metamorphosed volcanic and sedimentary rocks
- Rocks of Proterozoic age, in places Caledonized**
 - Granite to tonalite
 - Gabbro, amphibolite, anorthositic
 - Metamorphosed sedimentary and volcanic rocks
 - Gneiss, migmatite, amphibolite
- Basement, autochthonous rocks of Precambrian age**
 - Plutonic rocks of Proterozoic age
 - Granite to tonalite
 - Charnokitic to anorthositic rocks
 - Gabbro, ultramafic rocks
 - Metamorphosed rocks of Proterozoic age
 - Metasediment, mica schist, conglomerate
 - Metabasalt, meta-andesite, metarhyolite
 - Gneiss, migmatite, foliated granite
 - Metamorphosed rocks of Archaean age
 - Gneiss, granite, mica schist, amphibolite
- Geological boundaries**
 - Lithological boundaries
 - Thrust boundary
 - Fault

Era*	Mill. years	Period*	Geological events in Norway (read from bottom to top) The numbers in parentheses correspond to those on the map	Important geological events	
CENOZOIC	1.8	Quaternary	Cold climate, several ice ages. Landscape moulded further by ice and water. Deposition of superficial sediments. Uplift, especially in the west, and development of main features of the present-day landscape.	Ice ages	
	66	Tertiary	Formation of the Norwegian Sea, Barents and GIN Seas. Rapid sedimentation in the North Sea.		
	100	Cretaceous	Thick Cretaceous deposits in the North Sea region.		
MESOZOIC	135	Jurassic	Sandstone, shale and coal on Andøya (7). Sediments deposited in fault-basins in Trondheimfjorden.	Earthquakes, faults, volcanism in the Oslo area	
	205		Triassic		Development of the continental shelf by sediments accumulated in the North Sea and Norwegian Sea. Rifting, downwarping along the Norwegian coast and subsequent transgression of the sea.
	250	Triassic	Rifting, detrital dykes in Sunnhordland and the Oslo-region.		
	290	Triassic	Close conditions. No deposition on the coastland. Sediments deposited in the southern and central parts of the North Sea.		
	300	Carboniferous	Deposition of the Oslo-region followed by steep faults. Volcanic and sedimentary rocks (3, 4) and plutonic rocks (2) in the Oslo-region. Thick layers of salt in the North Sea.		
PALAEOZOIC	380	Devonian	Evolution of the sea-level, penetration of Norway. Extensive tropical forests in the west of the North Sea. No deposition on the continental shelf for the remainder of the Permian deposits in the Oslo area.	Formation of the Caledonian mountain chain	
	400		Devonian		Deposition of sandstone, conglomerate and breccia in Devonian fault-basins.
	425	Devonian	The second main episode of the Caledonian orogenesis. Extensive rock complexes (13, 14) formed in from the NW about the Caledonian mountain chain. Precambrian basement rocks (16, 18, 19) inside the older rocks. Closure of the ocean between Norway and Greenland-North America and formation of a major orogenic belt with smaller orogenic areas.		
	500	Ordovician	Deposition of sediments and eruption of volcanic rocks (7, 9).		
	515	Ordovician	The first major episode of the Caledonian orogenesis, with subsequent tectonic of the mountains and deposition of sediments (7, 8). Large parts of Norway covered by ice. Deposition of sediments and eruption of volcanic rocks (7-9). Close, sand and clay deposited on the sea bottom (2). Renewal of tectonics (8).		
PRE-CAMBRIAN	590	Late Precambrian	Mainly transgression across the peninsula. Cooling and expansion of the tectonic. Closure west of the basins which later become Norway.	Norway partly covered by ice-sheets. The Svecofennian folding and metamorphic phase	
	600		Late Precambrian		Widespread consolidation of the land surface to form the sub-Cambrian peneplain. Ancient mountains eroded by water and ice. Sandstone deposits in southern Norway and Finnmark (10, 11).
	900	Middle Precambrian	Sandstone deposits in Finnmark (12).		
	1000		Middle Precambrian		Plutonic rocks (16, 18, 19-21) intrude the older Precambrian rocks in southern Norway.
	1400		Middle Precambrian		Volcanic and sedimentary rocks in Telemark (22, 23).
PRE-CAMBRIAN	1800	Early Precambrian (Archaean)	Gneisses in the Precambrian basement (24) and in the Høgaland-Finnmark region (17-18).	Formation of the Svecofennian mountain chain	
	2000		Early Precambrian (Archaean)		Older gneisses in Møre-Finnmark (13), Ostfold-Finnmark and Kongoberg-Garåle regions and in Troms and Nordland (21).
	2800		Early Precambrian (Archaean)		Sedimentary and volcanic rocks in Finnmark (22, 23), gneisses and plutonic rocks in Lofoten (24).
4000	Early Precambrian (Archaean)	The oldest rocks in Norway (Lofoten and Finnmark, 25).	Origin of the Earth and solar system		
4600		Early Precambrian (Archaean)			

* There are no hard and fast rules concerning division of the Precambrian into eras and periods.

NORWAY IN BRIEF

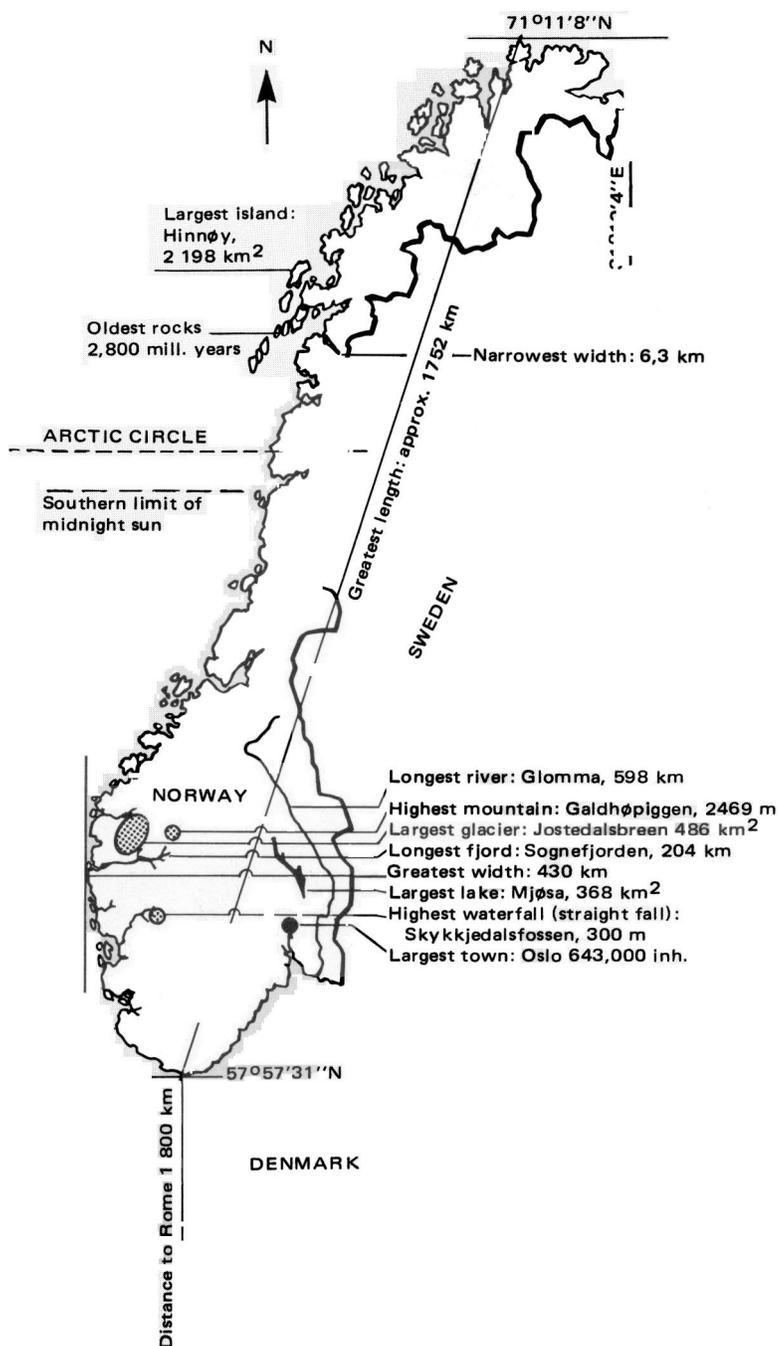
NORWAY (originally Nordweg, meaning the "northern way") is a part of Scandinavia, the large peninsula in northwest Europe. It borders with Sweden (1619 km), Finland (716 km) and the Soviet Union (196 km).

The land area is 324,000 km² (excluding Spitsbergen and Jan Mayen). About 50% of the country is made up of exposed bedrock. A mere 2.8% of the area is cultivated soil, 5% lakes, 20% productive forest, while less than 1% is populated. Although Norway is the country with the second lowest population density in Europe, it is the fifth largest in terms of area.

Norway has a population of 4,538,400 (2002), with about 45% living in towns and built-up areas.

The first people came to Norway at least 10,000 years ago when the huge inland glacier receded.

Oslo is the capital and the largest city with a population of 974,500 (2002).



Other large towns are:

Bergen	233,300
Trondheim	151,400
Stavanger	109,700
Kristiansand	73,900
Fredrikstad	68,500
Tromsø	60,500
Drammen	55,800

The oldest town Tønsberg was founded about 900 AD. Hammerfest is the most northerly town in the world.

The coastline (excluding fjords) measures 2,650 km, including the 50,000 islands the total shoreline is as much as 55,000 km.

There are great climatic variations in Norway. Thanks to the Gulf Stream and the prevailing westerly winds the country enjoys a more pleasant climate than the location between 58° and 71° north should indicate. The temperature varies little from north to south, but there is a significant contrast between the inland and the coastal regions. The average temperature is 8°C (46°F) along the west coast and -2°C (28°F) in the northern most parts (Finnmark).

The average annual precipitation is 1,960 mm in Bergen and 740 mm in Oslo. The lowest recorded temperature is -51°C (-60°F) in Finnmark.

In the arts, sciences, and humanities the country has fostered many personalities of international stature, among them Henrik Ibsen, Edvard Grieg, Bjørnstjerne Bjørnson, Gustav Vigeland, Sam. Eide, Roald Amundsen and Fridtjof Nansen.

The first tourists found their way to Norway at an early date, but it was not until after the First World War that this new industry really gained momentum, leading to the building of a wide network of roads and a host of up-to-date hotels, pensions and mountain lodges. Norway's unique attraction lies in her unpolluted lakes and rivers, clean, fresh air, and a wealth of unspoiled scenery that includes tumbling waterfalls, breathtakingly beautiful fjords, and vast expanses of mountain moorland far removed from the bustle of city life. Fascinating too is the vivid contrast between snowcapped mountain peaks and verdant valleys.

In summer, days are long and nights but a fleeting twilight. And for weeks on end in the north, in the Land of the Midnight Sun, the sun never sinks below the horizon.

A SHORT INTRODUCTION TO THE GEOLOGICAL HISTORY OF NORWAY

Arild Palmstrom

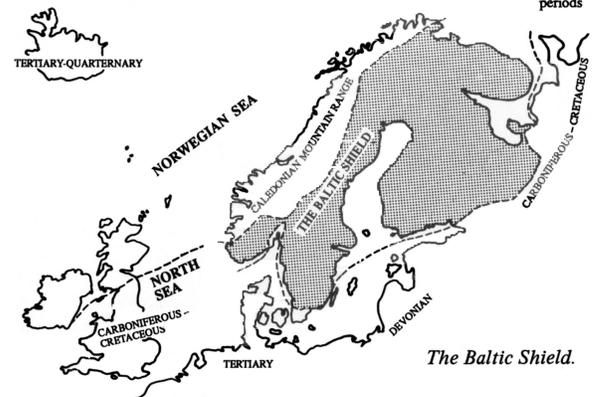
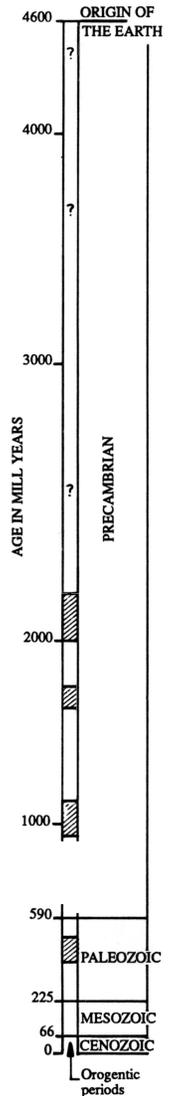
Ing. A. B. Berdal A/S

Precambrian

The Norwegian continent is part of the Baltic shield, one of the bigger continental shields in the world. It includes Fenoscandia (Norway, Sweden, Finland) and the western part of Russia. The dominating rocks originated in medium and late Precambrian, presently some of the older types of rocks on earth. The Baltic shield is limited by the Caledonian mountain range on the western edge, and by the much younger sedimentary types of rocks on the continental shelf towards the Norwegian Sea and the North Sea.

Paleozoic

The geology of Norway and Scandinavia is basically a result of folding and metamorphism during the Caledonian orogeny 550-400 mill. years ago, when the sea bottom with sediments from Cambrian-Silurian time was compressed to form this Caledonian mountain range. It is assumed that the range was eroded down to a low



hilly scenery over a period of 50 mill. years.

Mesozoic

During this era Scandinavia was mostly flatland. There are only very few remnants left from the events during this 160 mill. years long era.

Cenozoic

Tertiary sediments are not found onshore in Norway. The flat Scandinavian landmass only a few meters high is believed to have been uplifted and tilted in connection with faults outside western Norway. This event is responsible for the characteristic highlands in Norway. In the following periods, rivers and later glaciers were eroding their way down to create the valleys we find in Norway today.

The glacier erosion in Quaternary during several ice ages ending some 10.000 years ago has effectively removed the weathered rocks. The rock surface of today is therefore fresh and in many parts uncovered by soils. This feature frequently offers excellent possibilities to study the bedrock conditions from simple surface observations.