NORWEGIAN WORLD HERITAGE SITES

1 Bryggen in Bergen (1979)
2 Urnes stave church (1979)
3 Røros Mining Town (1980) and Circumference (2010)
4 The Rock Art at Alta (1985)
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7 The Struve Geodetic Arc (2005)
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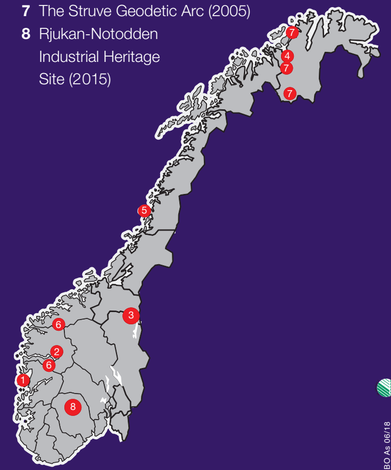

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BACKGROUND

The idea that the Earth might be round was suggested in learned circles as long ago as 500 B.C. However, in the 1600s AD, at the dawn of modern scientific discovery, Sir Isaac Newton suggested that the Earth is not exactly spherical – rather that it is flattened at the Poles. The question of how much the Earth is flattened then came into focus in the 18th and 19th Century.
Meanwhile, technical developments began to produce more accurate instruments, which in turn fuelled moves for improved surveying and mapping. As a direct consequence, it became increasingly more important to determine the Earth's equatorial radius and it's Polar Flattening with greater precision.

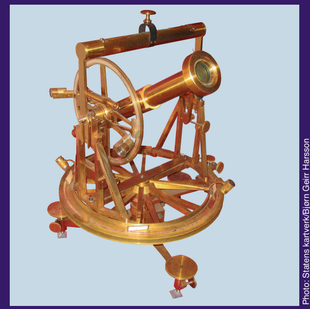
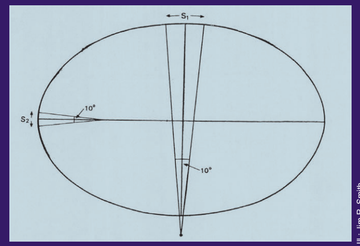


Photo: Statens kartverk/Bjørn Geirr Harsson

Instrument (Theodolite) used by the Norwegian surveyors in Finnmark.

HOW IS THE SHAPE AND SIZE OF THE EARTH MEASURED?

The physical length of a degree of latitude was measured through the chain of triangulation from North to South along a meridian. In addition astronomical observations to well catalogued stars were made to determine the difference in latitude from one end to the other of the triangulation chain. The astronomical latitude was measured at 13 stations spread along The Struve Geodetic Arc, one of them in Norway (Hammerfest).
In this way the Earth's equatorial radius and its flattening could be computed. The shorter the physical length of an astronomically measured single degree of latitude was, the



Ill.: Jim R. Smith

For this shape of the Earth the figure shows that the radius of curvature at equator is shorter than at the poles

shorter would the Earth's surface curvature be, and *vice versa*. (See figure above)
The Struve Geodetic Arc yielded the result that one degree of latitude was 359 metres shorter on the Black Sea than on the coast of the Norwegian Sea.

NORWEGIAN PARTICIPATION

The Russian astronomer and geodesist Friedrich Georg Wilhelm Struve (1793-1864) was responsible for this major geodetic project, triangulating his way through Europe for 39 years from 1816 to 1855. This international effort was of fundamental importance for numerically determining the figure of the Earth, and Norway became seriously involved in 1845. At that time, the concepts of international co-operation were somewhat unknown, and it was necessary to obtain the agreement and blessing of the Norwegian Government, the Parliament, and the King in order for Norway to officially take part in the work. Eventually, resources were allocated and Christopher Hansteen (1784-1873) was authorised to render assistance. Hansteen was at the time Director of "Norges geografiske oppmåling", the forerunner of today's "Statens kartverk" – the Norwegian Mapping Authority. Hansteen was also Professor of Astronomy and the Head of the Christiania Observatory.
The actual fieldwork was carried out by two military officers, Fredrik L. Klouman and Christopher Lundh. Their task was to select appropriate points for the triangulation and then to carry out the required observations. This demanded the movement of considerable quantities of equipment to remote sites in sparsely populated Finnmark, and represented a not insignificant achievement that deserves much respect.

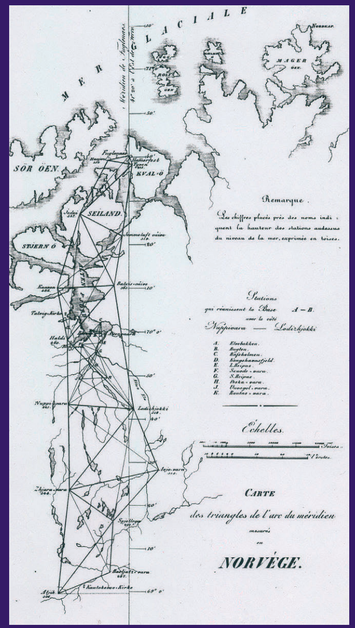
INTERNATIONAL CO-OPERATION

Struve's work on the Geodetic Arc became the starting initiative to concentrated international efforts to achieve a common scientific objective. The International Union of Geodesy and Geophysics (IUGG) can be said to have emerged from Struve's original work, and is fully active to this day as a Union within the International Council for Science (ICSU) under the general umbrella of the United Nations.
Struve's results made a very significant contribution to geodetic research, and most Western European nations have used his data in connection with surveying and mapping right up to the time when satellite positioning became a dominant method in the 1970s.
The Struve Geodetic Arc was originally known as the Russian-Scandinavian Geodetic Arc. However, in recent years the Arc has taken Struve's name in commemoration of this prominent Russian geodetic scientist. The Struve Geodetic Arc was the longest Arc measured until the 1900s, and represents a devotion to accuracy and precision without comparison in the history of Man's measurement of the Earth.

The ten countries through which Struve's Arc had passed, joined together to have 34 of the original triangulation stations entered into the UNESCO World Heritage List.
In its decision statement, UNESCO judged that The Struve Geodetic Arc represents the first accurate measuring of a long segment of a meridian, helping in the establishment of the exact size and shape of the world exhibits an important step in the development of earth sciences. It is also an extraordinary example for interchange of human values in the form of scientific collaboration among scientists from different countries. It is at the same time an example for collaboration between monarchs of different powers, for a scientific cause.

Geodesy is the science of the figure and the size of the Earth, and a geodesist is a practitioner of that science.

Northernmost point:	Hammerfest (Fuglenes)	70° 40' 11,23" N
Southernmost point:	Ismail (Staro-Nekrassowka)	45° 20' 02,94" N
Difference in Geodetic Latitude:		25° 20' 08,29"
Distance in kilometres:		2 821,853 ± 0,012



Map from Struve's publication in French from 1860. Christopher Hansteen (Norway) was co-author.

Year	Earth's Equatorial Radius	Earth's Flattening
1740	6 396 800 m	1/178
1858	6 378 360,7 m	1/294,26
2005	6 378 136,8 m	1/298,257 222 101

Norwegian Points on
The STRUVE Geodetic Arc

Photo: Riksantikvaren. Tegning av ark. Wilhelm von Hanno (1854)

United Nations Educational, Scientific and Cultural Organisation

World Heritage in Norway
The Struve Geodetic Arc

UNESCO

UNESCO is the abbreviation for the "United Nations Educational, Scientific and Cultural Organization". UNESCO's goal is to contribute to peace and safety through international cooperation within these areas. The organization was established in 1945, and Norway became a member in 1946.

❖ The UNESCO convention for the protection of the world's cultural and natural heritage

The convention for the protection of the world's cultural and natural heritage was approved in 1972, after cultural heritage and natural areas were increasingly exposed to threats from war, natural disasters, pollution, tourism or, more simply, neglect.

The convention encourages all countries to promote the protection of cultural and natural heritage of both local and national significance. The most important goal of the convention is to identify cultural and natural heritage of universal value. The need for a coordinated effort, both human and economic, was demonstrated by the international rescue of cultural heritage monuments in Egypt and Nubia, when the Aswan dam was built in the 1960's. Sixty countries, including Norway, participated.

Cultural and natural heritage can include monuments, single buildings or groups of buildings, cultural landscapes or natural areas. These can be created by nature, or by people in cooperation with nature. They can be buildings representing important historic developments, or natural phenomena of exceptional esthetic or scientific value.

Norway ratified the convention on May 12.1977. The World Heritage Committee has so far approved eight Norwegian nominations to the World Heritage List. Beeing nominated as a World Heritage Site does not include any new form of legal protection, rather it offers additional recognition and status.

Norway on the World Heritage Committee

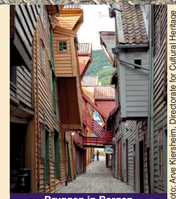
The World Heritage Committee consists at any time of the representatives of 21 nations. The Committee's primary mandate is to implement the World Heritage Convention.

Norway has been a member of the World Heritage Committee on two previous occasions, from 1983 to 1989 and from 2003 to 2007. Norway has also now been elected to the Committee for the period 2017–2021.

As a member of the Committee, Norway will prioritise improving the protection of existing World Heritage sites and also contributing to a more representative World Heritage List. After more than 40 years, the developing countries in particular continue to be under-represented on the List.

It is also important to raise awareness through the involvement of local communities and to highlight best practices in the management of sites on the List through the World Heritage Leadership programme. Norway will also stress the importance of List nominations being made on the basis of professional assessments rather than political interests. A further goal will be a more holistic approach to and management of the global natural and cultural heritage.

The Directorate for Cultural Heritage and the Norwegian Environment Agency represent Norway on the World Heritage Committee.



Bryggen in Bergen

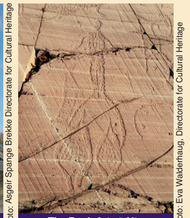
Photo: Arve Kjersheim, Directorate for Cultural Heritage

Urnes Stave Church

Photo: Arve Kjersheim, Directorate for Cultural Heritage

Røros Mining Town

Photo: Asgeir Spange Brekke Directorate for Cultural Heritage



The Rock Art at Alta

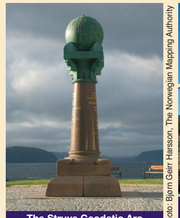
Photo: Eva Walderhaug, Directorate for Cultural Heritage

The Vega Archipelago

Photo: Cyril Ruoso

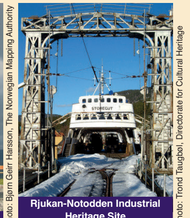
The West Norwegian Fjords

Photo: Arne Aasheim



The Struve Geodetic Arc

Photo: Bjørn Geirr Harsson, The Norwegian Mapping Authority



Rjukan-Notodden Industrial Heritage Site

Photo: Trond Taugbøl, Directorate for Cultural Heritage

Norwegian Points on The Struve Geodetic Arc

Photo: Statens kartverk/Bjørn Geirr Harsson

The Struve Geodetic Arc was the first technical and scientific object to be inscribed on the UNESCO World Heritage List. Measurements were made in the form of a chain of triangulation along the meridian stretching from Ismail on the Black Sea in the South to Fuglenes in Hammerfest in the North. A meridian is an imaginary line on the Earth's surface running from Pole to Pole.

The Struve Geodetic Arc was observed by means of angle measurements from Ismail at the Black Sea to Fuglenes in Hammerfest. The angle measurements were connected in a chain of triangles, with measurements at 265 primary points separated by 20 to 40 km, and 60 supporting or secondary points. The distance between the northernmost and southernmost points in the triangulation chain was 2 821,853 km, and passed through what is today Norway, Sweden, Finland, Russia, Estonia, Latvia, Lithuania, Belarus, Moldova and the Ukraine. At the time of Struve this area was covered by Norway, Sweden and Russia.
The ten countries joined together to have 34 of the original triangulation stations entered into the UNESCO World Heritage List. The Norwegian Mapping Authority was the responsible agency for Norway in this matter. All 34 points in the List have one form or another of monumentation – be it a hole in rock, an iron bolt, a cairn, an obelisk or pillar. Four of these points are in Norway.

The four Norwegian points are:
1 The obelisk in Hammerfest (photo to the left); (70°40'12"N 23°39'48"E

Photo: Statens kartverk/Bjørn Geirr Harsson

2 Summit Lille Raipas (Unna Ráipásaš) in Alta; (69°56'19"N 23°21'37"E

Photo: Statens kartverk/Bjørn Geirr Harsson

3 Summit Luvddiidčohkka (Lodiken) in Kautokeino; (69°39'52"N 23°36'08"E

Photo: Statens kartverk/Bjørn Geirr Harsson

4 Summit Bealjásvárri/Muvravárri in Kautokeino; (69°01'43"N 23°18'19"E