

The first geognostic Map of Denmark - 1835

Johan Georg Forchhammer
(1794-1865)

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Danmarks
geognostiske Forhold,

forsaavidt som de ere afhængige

af Dannelser, der ere sluttede,

fremstillede

i et Indbydelseskrift til Reformationsfesten den 14^{de} Novbr. 1835,

af

Dr. Georg Forchhammer,

overordentlig Professor i Mineralogien.

Kjøbenhavn.

Trykt hos Directeur Jens Hostrup Schult,

Kongelig og Universitets-Bogtrykker.

8 6 15.

Denmark's geognostic relations, in so far as they are dependent on formations which are finite, presented an invitation letter to the Reformation festival on Nov 14, 1835

Johan Georg Forchhammer (1794-1865)

Youth

July 26, 1794: Birth in Husum (Schleswig).

Mother tongue: German.

Father, a schoolteacher and deputy director of the school, with a passion for natural history.

Numerous naturalist excursions in the region.

1810: death of his father; became assistant apothecary in Husum, botany and chemistry, starts a mineral collection.

Introduced to geognosy and mineralogy by the Husum's doctor, who recommended him to Prof. Christoph Heinrich Pfaff (1773-1852) in Kiel.

1815: student of chemistry and pharmacy in Kiel and assistant to Prof. Pfaff, close friend of Cuvier.

1818: assistant in chemistry and secretary to Hans Christian Ørsted (1777-1851), professor of physics and chemistry at the University of Copenhagen.



Johan Georg Forchhammer (1794-1865)

by Emilius Ditlev Barentzen (1799-1868) & Co.

Source <http://www.past.dk/biographies/0000/0020.tkl>

The Bornholm missions: a turning point in Forchhammer's career



Hans Christian Ørsted
(1777-1851)

Painting of C.W. Eckersberg – 1822
Source: <http://www.utc.fr/~tthomass/Hommes/Unites/Hommes/oer/Hans%20Christian%20Oersted.pdf>

September 1818: 1st mineralogical trip to Bornholm with Hans Christian Ørsted and the court counsellor Lauritz Esmarch (1765-1842).

July 1819: 2nd mineralogical trip to Bornholm, preceded by a visit to the Höganäs coal mine, the mineralogical collections at Lund University and contact with the university's mineralogists.

Book-based knowledge → practical knowledge, in the field
Amateur → professional
Chemist → mineralogist and geologist

April 1, 1820: defends his doctoral thesis *De Mangano*, a chemistry thesis on two manganese acids, begun in Kiel under the supervision of Professor Pfaff.

1820 Study trip to England: birth of a theory

*...den Zweck desselben (meiner Reise)... indem ich
mich mit dem bekannt machte, was in meiner
Wissenschaft neues in England geschehen sei, mit
besonderer Rücksicht auf deren Anwendung...*

*und da in dieser Wissenschaft die Vergleichung
verschiedener Länder einen entschiednen Werth hat,
so schien mir das Studium der brittischen Gebirge für
die Kenntniss Dännemarks höchstwichtig.*

London den 16. Novembr. 1820.

Ihro Königlichen Majestät...

by RIGSARKIVET, 1902, *Fonden ad usus publicos*, 2 Bind, 1801-1826, Kjøbenhavn, C.A. Reitzel.p.
85-286

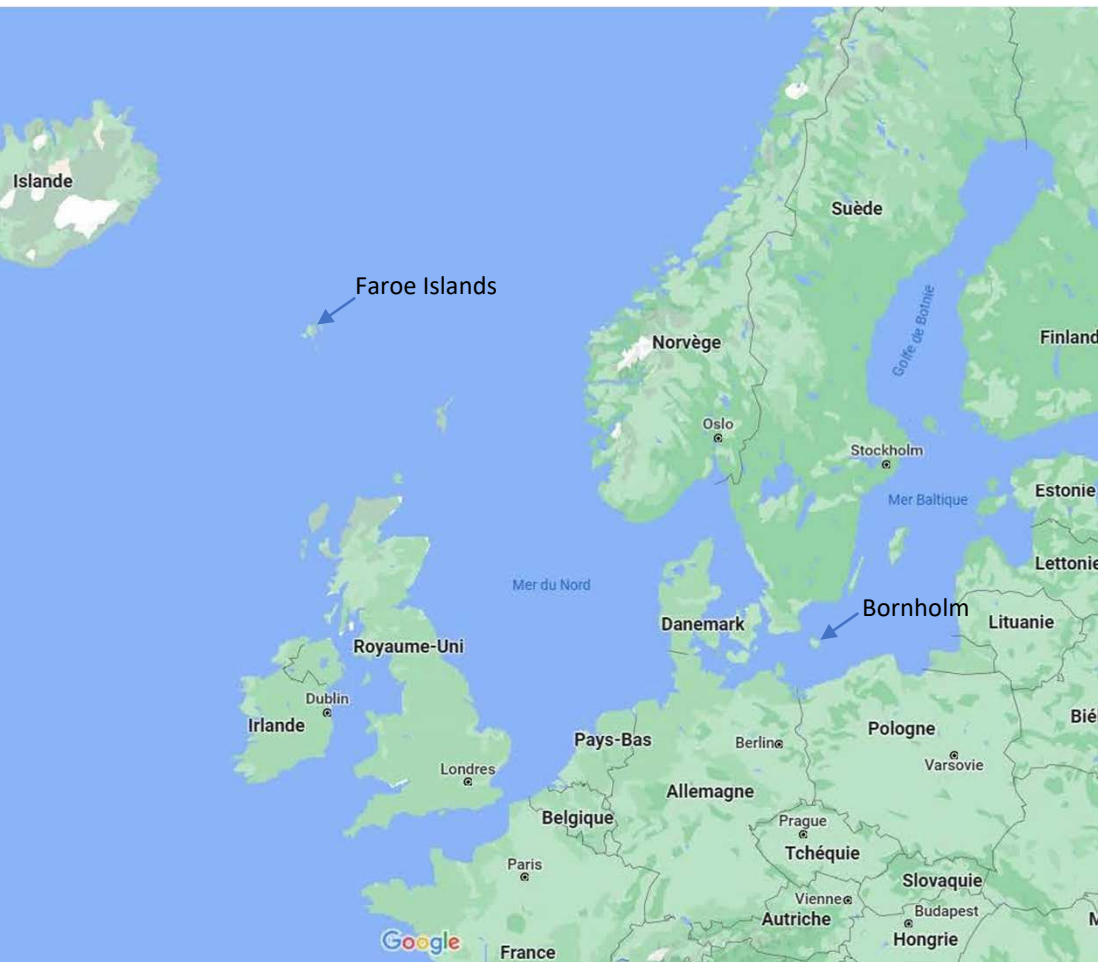
... the purpose of it (of my trip) was to acquaint myself with what was new in my science (i.e. mineralogy) in England, with special regard to its application ...

and as, in this science, the comparison of different countries has a definite value, the study of the British mountains seemed to me to be of the utmost importance for the knowledge of Denmark.

London, November 16, 1820

Your Royal Majesty...

1820 Study trip to England: birth of a theory



“A large part of England has the same structure as Denmark; what is true of England's coal and iron works will also be true of Bornholm; what is true of England's salt springs will certainly be confirmed in those of Segeberg; and the English mountains of chalk and limestone are perfectly similar to those on our coast. Scotland has in a part of its mountains the greatest resemblance to the Faroe Islands and Iceland, only more distinct and clearer, and in order to make myself capable of a journey to the Faroe Islands, I made a large part of an arduous journey through the Scottish Highlands.”

In RIGSARKIVET, 1902, Fonden ad usus publicos, 2 Bind, 1801-1826, Kjøbenhavn, C.A. Reitzel.p. 28

Birth of his global theory of geognostic relations
in northern Europe

The Forchhammer theory: a large northern European basin



His whole plan is based on a great idea, namely, that the Faroe Islands and Iceland, England and Scotland, north-eastern France and neighboring Germany in a stretch connecting with Denmark, and this kingdom, including Bornholm, belong to a large basin, filled with one and the same order of formation. To compare all the principal parts of this stretch would throw a new light on the theory of the globe.

Copenhagen, December 11, 1820

Yours sincerely

H. C. Ørsted.

In RIGSARKIVET, 1902, Fonden ad usus publicos, 2 Bind, 1801-1826, Kjøbenhavn, C.A. Reitzel, p. 287-288.



Thick layers of basalt

No coal for Denmark

The Faroe Islands and Iceland are not part of this large northern European basin : his theory is not validated

Restricts the northern European basin and looks for the Denmark's place in it.

The trip to the Faroe Islands

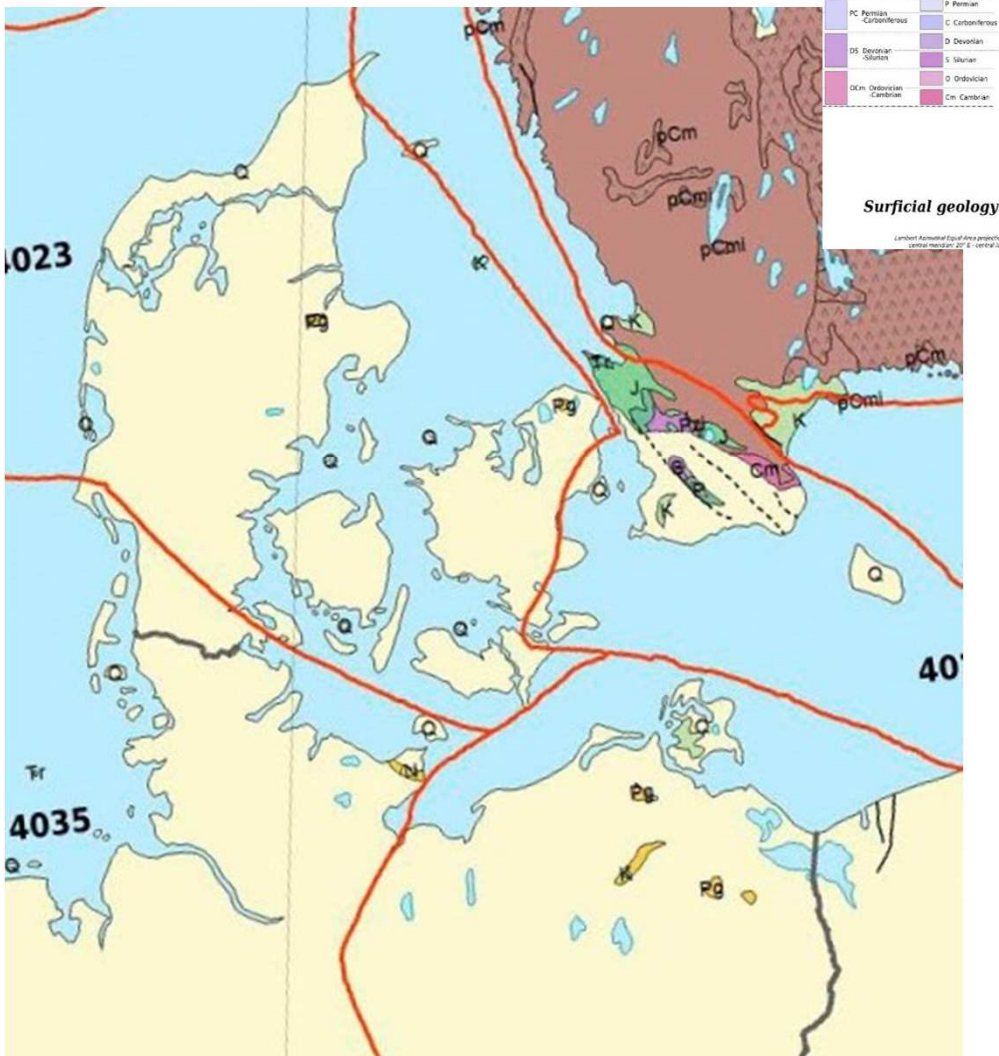
April 28, 1821 – October 16, 1821



1835 Forchhammer map



2023 current geological map



Eric Gaba, Wikimedia Commons user Sting, CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=11171117>

What are the theories and concepts behind this map?

1835 Forchhammer map

Kullesteensformation.

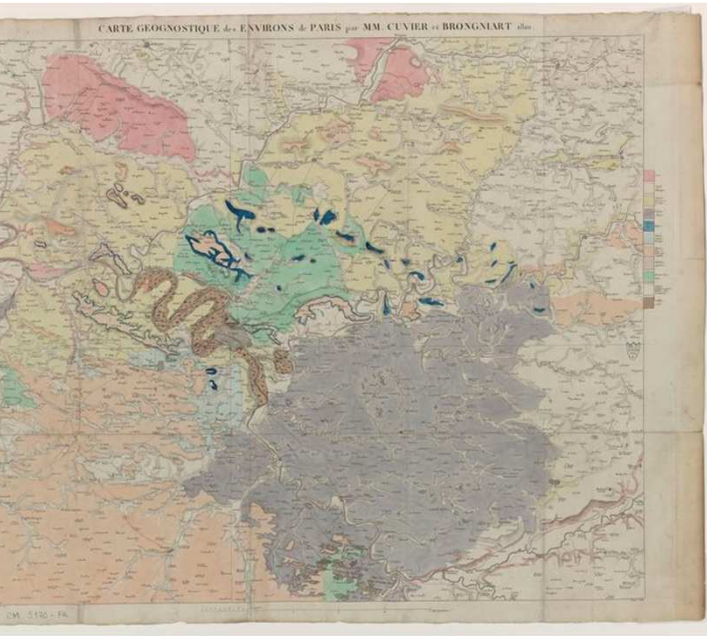
Vi komme nu til den vigtigste Dannelse i hele Landet, den som bedækker alle andre, og bliver selv ifkun skjult af et Par, der altsaa ere endnu nyere. Naar vi altsaa paa Kortet finde store Strækninger betegnede, som Liimsteen eller Skrivekridt, saa er Meningen ikke at Kullesteens Sand og Leer mangle i de Strækninger, men ifkun den, at de dybere Lag let kunne naaes; hvis man vilde have fulgt andre Grundsætninger, maatte vi have betegnet næsten alt som Kullesteensdannelse, med enkelte Kridt- og Liimsteen-Puncter, thi Kullesteensformationen bedækker Alt, som ikke er Ahldannelse, Kalksinter og Alluvium, vi finde den paa Toppen af Gipsbjerget ved Segeberg, over hele Stevnsklint, og selv Møens høie Klint er bedækket deraf.

In Forchhammer, 1835, p.91

Pebble formation

... Therefore, when we find on the map large stretches labeled as limestone or chalk, the meaning is not that the sand and clay of the pebble formation are missing in those stretches, but only that the deeper layers could be easily reached if other principles were followed, we must have designated almost everything as pebble formation, with a few chalk and limestone points, because the pebble formation covers everything that is not Ahl formation, calcareous sinter and alluvium, we find it on the top of the gypsum mountain at Segeberg, all over the Stevnsklint, and even Møn's high cliff is covered by it...

What are these principles? How did he create his map?

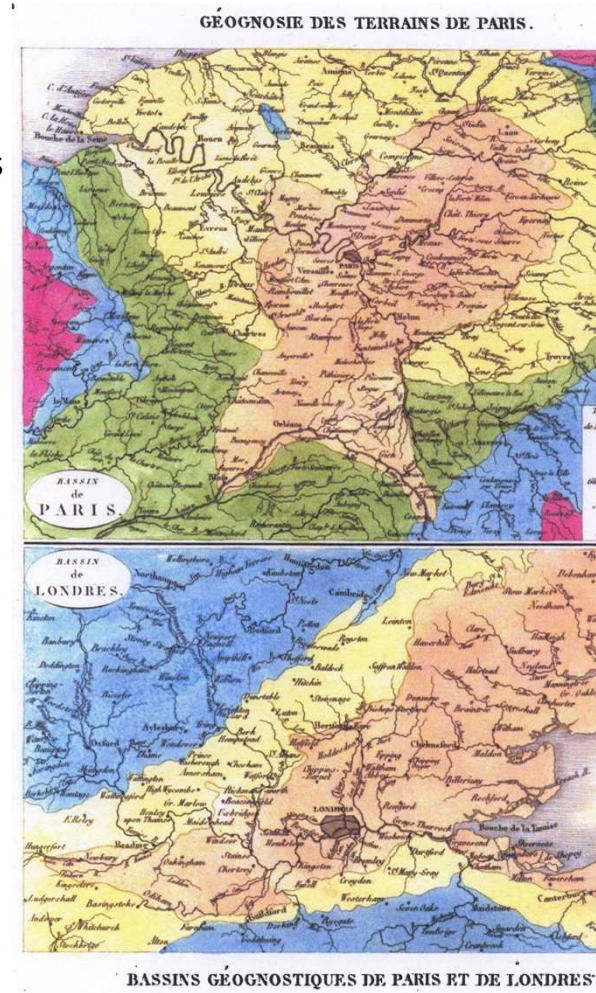


1811
 Geognostic map of the vicinity of Paris
 In G. Cuvier et A. Brongniart (1811)

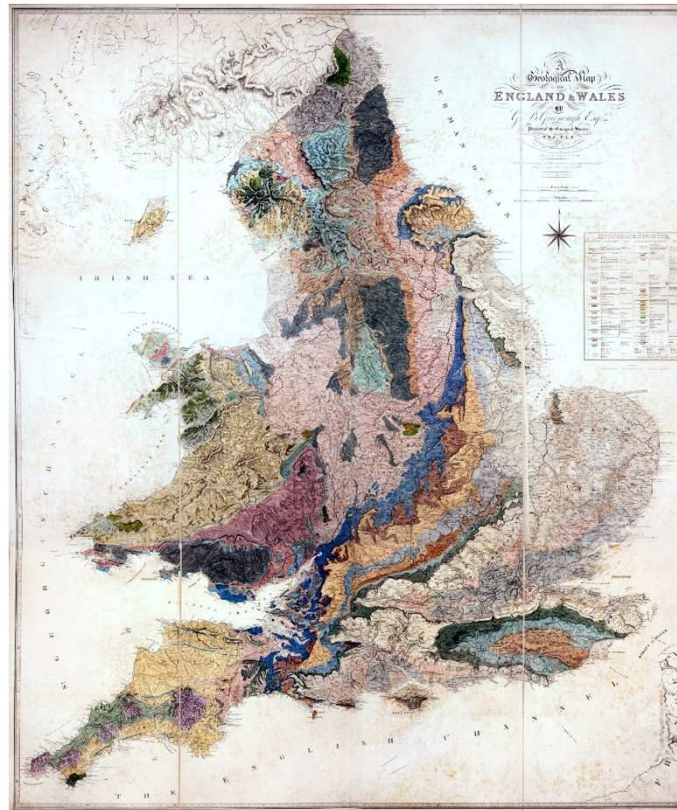
Cuvier and Brongniart

1822

Geognostic bassins of Paris and London
 In G. Cuvier et A. Brongniart (1822)



A delineation of Strata of England and Wales, Scotland
 Smith, 1815
 Wikimedia commons



Geological map of England and Wales
 Greenough, 1820
 Wikimedia commons

1835 Forchhammer map



Alle disse Belter af kridtformationens enkelte dele løbe i en nordvestlig og sydøstlig retning, og parallel med urbjergkjederne i det sydlige sverrig.

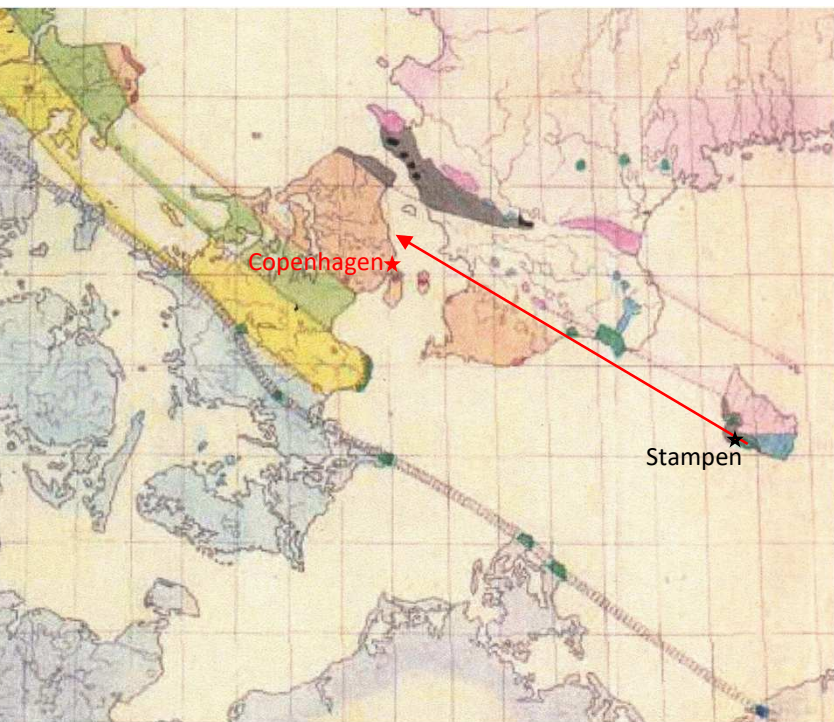
All of these belts of the individual parts of the chalk formation run in north-west south-east direction, parallel to the primitive mountain ranges in southern Sweden.

Following the coal formation in north-westerly direction (red arrow) coal could be found in North Jutland. Forchhammer looked for the coal there, but he found only iron ore, the same as that which accompanied coal at Bornholm.

Grændse bestemmelserne ere tagne for en stor deel efter egne jagttagelser, næst efter disse tildeels efte mundtlige efterretninger fra Hr: Dr Beck og Hr. Stud. med. Steenstrup, og tildeels efter amtsbeskrivelserne og enkelte ældre meget brugbare topographiske beskrivelser, og paa kortet ere jagttagelsespuncterne betegnede ved mørker farve.
In Forchhammer, 1835, p. 44

The boundary determinations are taken for a large part after own field surveys, in addition to these partly according to oral information from Mr. Dr Beck and Mr. Stud. med. Steenstrup, and partly according to the county descriptions and some older very useful topographical descriptions, and on the map the survey points are marked by dark colour.

He fills in the gaps by the simple logic of geognosy.



The greensand : water for Copenhagen

Et boreforsøg viiste indtil 80 fod den sandige kalksteen, derpaa et lag af sand, som var saa vandriigt, at vandet flød meget stærkt ud af munden af borehullet.

In Forchhammer, 1835, p. 45

About a borehole drilled near Stampen on Bornholm:

One drilling attempt exposed up to 80 feet the sandy limestone, then a layer of sand that was so water-rich that the water flowed very strongly out of the mouth of the borehole.

Forchhammer assumes the continuity of this greensand formation in a north-westerly direction and as it dips slightly to the SW, he thinks that it should be found at a reasonable depth below Copenhagen, allowing for drilling and supplying Copenhagen with fresh water.

The boundary between greensand and chalk

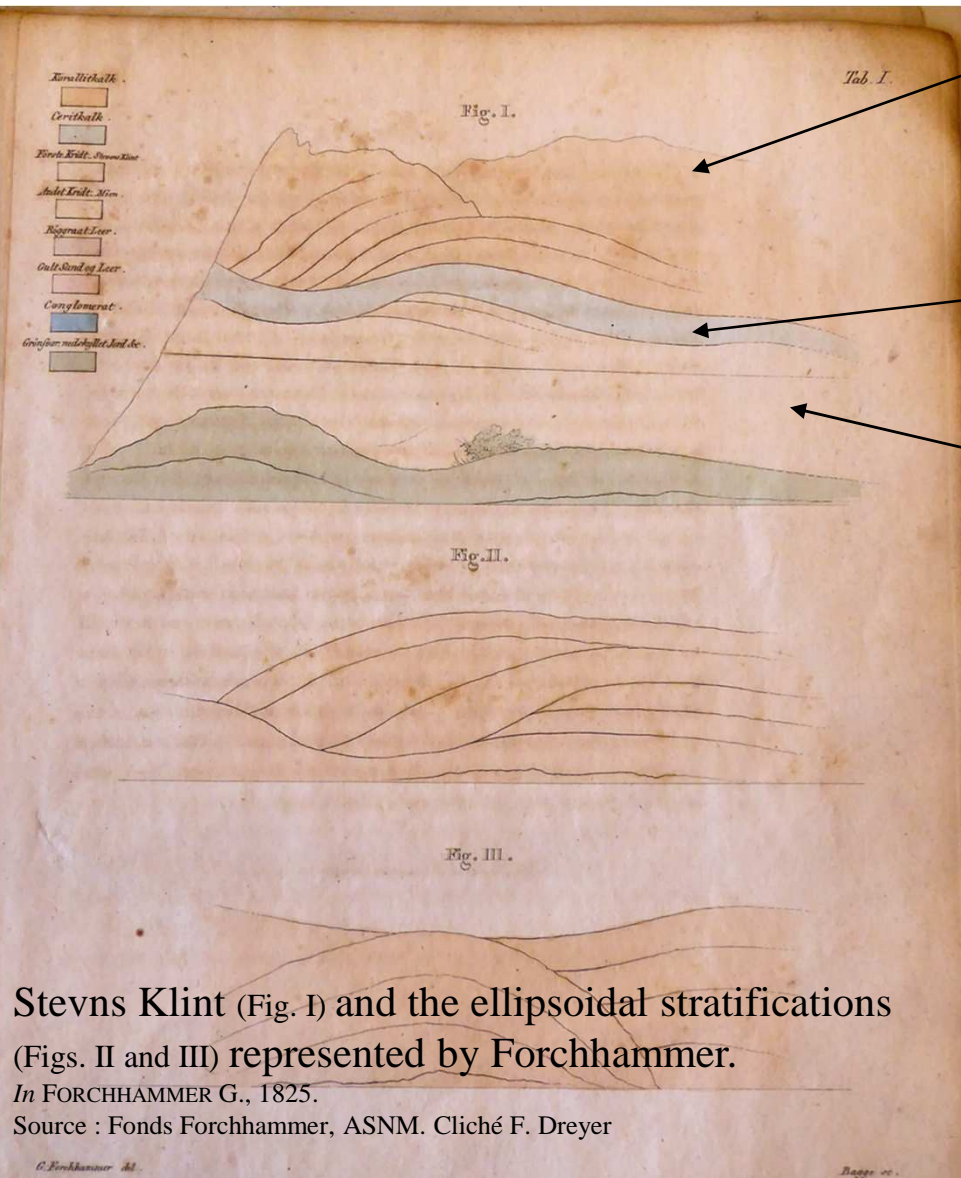
Hvis Havet ikke forhindrede videre Undersøgelse, vilde man med en stor Sikkerhed kunne opsøge Forbindelsen af det grønne Sand og Kridtet ; men Havet hindrer det.

FORCHHAMMER G., 1822, p. 376

If the sea did not prevent further investigation, one could with great certainty seek out the connection between the greensand and the chalk; but the sea hinders it.

The upper limit of the chalk:

Stevns Klint



Coral limestone

Basins of limestone with ceriths underlined by a very thin bed of black clay = Faxoekalk

Chalk



Forchhammer compared the Cerith limestone and black clay with the Calcaire grossier and plastic clay of the Paris Basin, two Tertiary formations described in 1822 by Cuvier and Brongniart. He therefore refers to the cerith limestone as a Tertiary formation.

A controversy with Lyell

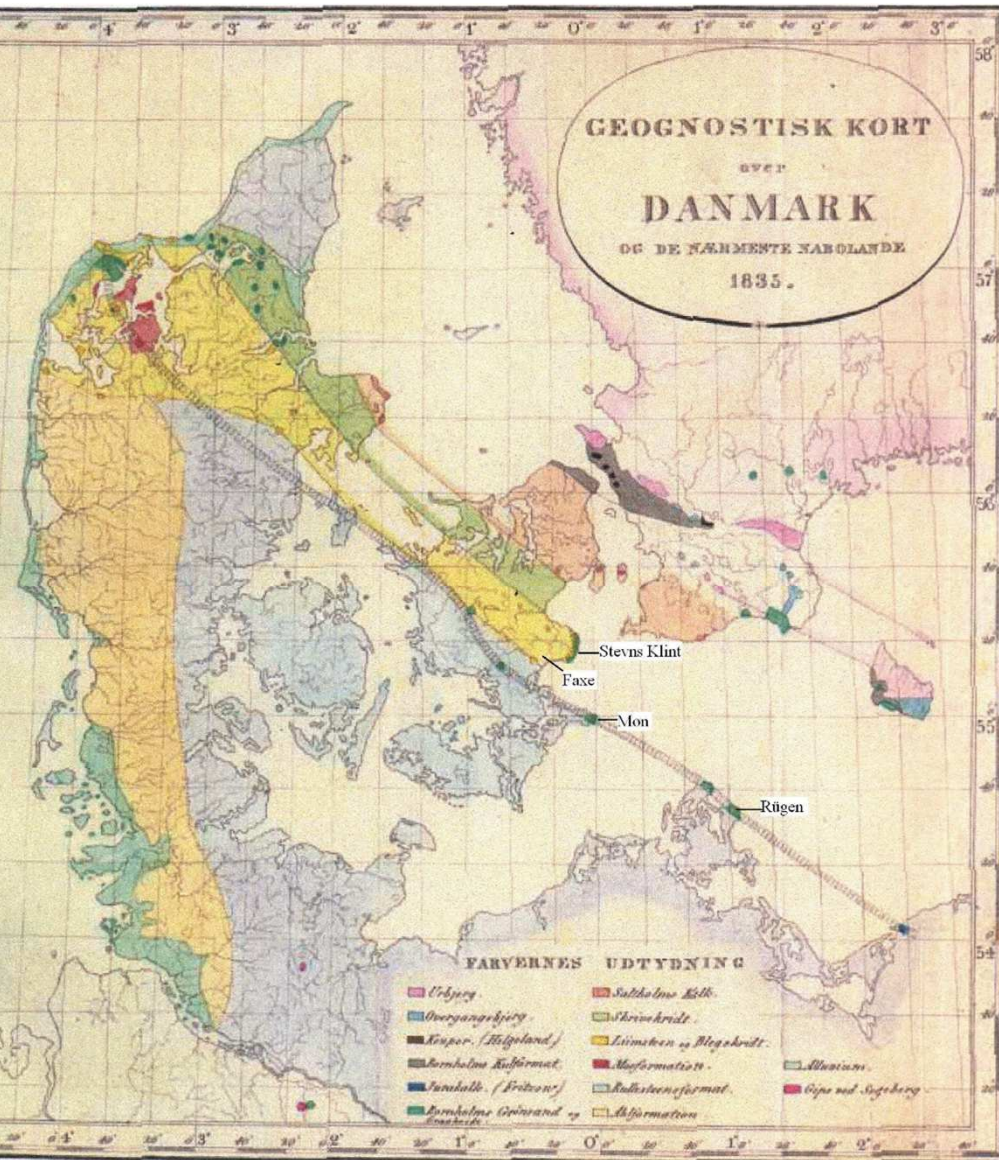
Lyell, when he came to Denmark and Stevns Klint with Forchhammer in 1834, on the basis of fieldwork and fossils, asserted that it was Cretaceous, which Forchhammer agreed in his 1835 book.

The controversy continued until 1979, when the Cretaceous-Tertiary boundary was fixed at the level of the very thin bed of black clay.

Stevns Klint (Fig. I) and the ellipsoidal stratifications (Figs. II and III) represented by Forchhammer.

In FORCHHAMMER G., 1825.

Source : Fonds Forchhammer, ASNM. Cliché F. Dreyer



In conclusion

Jeg tør haabe, at have undgaaet feiltagelser i dette forsøg, men ere tildeels afhængige af videnskabens standpunct; og hvis jeg ved dette arbeide kunde vække en mere almindelig interesse for danmarks geognosie, hvis dette lille skrift kunde foranledige, at man vilde meddele, ved trykken eller til mig personiigen, jagttagelser, enten de ere bekræftende for min mening eller i strid dermed: vilde en hovedhensigt af mit arbeide være opnaaet.

In Forchhammer, 1835, Forword

I dare to hope that I have avoided mistakes in this attempt, but they are partly dependent on the standpoint of science; and if by this work I could arouse a more general interest in the geognosy of Denmark, if this little booklet could cause people to communicate, in print or to me personally, their observations, whether they confirm my opinion or contradict it: a main purpose of my work would have been achieved.

Thank you for your attention

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