

GEOLOGICAL THINKING AND MAPPING IN THE NETHERLANDS BEFORE AND DURING STARING'S LIFETIME^{1,2}

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ABSTRACT

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This paper deals with geological thinking and mapping in The Netherlands before and during the life of W. C. H. Staring (1808-1877). During the last two centuries there have been two centres of geological activity, viz. Groningen and Haarlem.

Some outstanding pre-Staring geological achievements are mentioned. As typical items, which may give an idea of the geological thinking in The Netherlands in the past, special attention is paid to theories about the origin of peat, the provenance of erratic boulders, and the mapping of Quaternary areas.

The first geological map of The Netherlands (scale 1:200,000) was made by Staring, who is considered the father of Netherlands geology.

INTRODUCTION

On June 7th, 1877, the founder of geology in The Netherlands, Dr. Winand Carel Hugo Staring (Fig. 1), died at his country-seat 'De Wildenborgh' near Vorden in the province of Gelderland. To commemorate this fact, 1977 has been proclaimed the 'Staring commemorative year', jointly by Netherlands geologists. In honour of this geologist, the Royal Geological and Mining Society of The Netherlands annually organizes a so-called 'Staring lecture'. This 1976 lecture can be considered as a preamble to the 1977 Staring commemorative year.

In this lecture South Limburg, although belonging in its present state and extent to The Netherlands since the early 19th century, is not taken into consideration. The reason is that geologically this part forms a chapter on its own.

CENTRES OF EARLY GEOLOGICAL ACTIVITIES

While examining the history of geological thinking and mapping in The Netherlands, some historical aspects came to the fore, which had not been fully realized up to now.

Apart from South Limburg (Maastricht and Heerlen), Groningen appears to have been a centre of geological activity and interest (and also of applied geology) for at least two centuries. Reasons may have been: the keen interest in agriculture (especially in the marine-clay district); the care for safety from incursions of the sea (resulting in land reclamation and the building of many dikes); and also the occurrence of erratic boulders in the Pleistocene areas.

Evidences for this early geological activity are the following facts. The first scientific book in the world on peat was published in Groningen by SCHOOCK(IUS) (1658), a professor at Groningen University. The thesis of BRUGMANS (1781) 'De lapidibus et saxis agri Groningani', also known as 'Lithologia Groningana', already mentioned at that early date the Scandinavian origin of erratic boulders. The first coloured geological map of The Netherlands was a 1:110,000 map of the province of Groningen by ACKER STRATINGH (1837). In 1877 the first chairs of geology at Dutch universities were established, viz. in Groningen and in Leiden, the former by F. J. P. van

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Fig. 1
Winand Carel Hugo Staring (1808-1877).

Calker. Much later, this chair was occupied by Ph. H. Kuenen, of world-wide fame. Nowadays, geological interest in, and knowledge of, the surface and subsurface is larger in Groningen than elsewhere in The Netherlands, because of the largest productive gasfield in the world (Slochteren), which underlies almost half of the province, and because of many subsidence measurements.

For more than two centuries, Haarlem has also been a centre of geological thinking and mapping. The oldest scientific society of The Netherlands was founded there, in 1752: the 'Hollandsche Maatschappij der Wetenschappen' (Holland Society of Sciences), followed in 1778 by the Teyler's Foundation which, apart from a museum, comprised two learned societies: one for the furtherance of theology; the other one for the encouragement of arts and sciences. These two scientific societies served their aims by scientific prize contests. Since several of the secretaries and directors were natural scientists who were largely interested in geosciences, many important geological problems were raised.

In Haarlem (owing to the presence of the two societies

mentioned above), the Central Committee for the Geological Map was installed in 1852, whose task it was to prepare a geological map of The Netherlands on a scale of 1:200,000.

In 1918 the Geological Survey of The Netherlands was founded, taking residence in the building of the Holland Society of Sciences; at present, its main office is still there in Haarlem. There is, however, a tendency to move government offices from the crowded western part of the country toward the periphery. Ironically, Heerlen (in South Limburg) and Groningen were designated as possible places to set up the future headquarters of the Geological Survey. At present, it seems that the Survey will stay in Haarlem.

EARLY GEOLOGICAL ACTIVITIES

Prize contests

As mentioned above, the prize contests of the learned societies often concerned geological problems. We mention:

- 1753: the filling up of rivers with sand;
- 1754: retreat of the beach near Petten;
- 1761: lay-out of high and low lands;
- 1781: the stepwise development of living beings;
- 1781: fossil woods in The Netherlands;
- 1786: the origin of the Texel tidal inlets;
- 1827: the origin of erratic boulders in The Netherlands;
- 1830: what in these times is really known of geology;
- 1832: temperature at great depth below the surface of the earth;
- 1835: the transition of one species of algae into another;
- 1841: the origin of iron in subsurface layers;
- 1844: the formation of coal layers from plants;
- 1847: fossil flora in coal beds;
- 1861: comparison of the Groningen erratic blocks with Silurian formations in SW Norway.

Various subjects on this list like the genesis of peat; the provenance of erratic boulders; the history of the coast; the problem of relative vertical movement of the land) are typical of lowlands. Unfortunately, the results obtained from these contests have not become well known in the geological world literature, due to the language. We have already mentioned that the first book on the origin of peat was written in The Netherlands (1658), and that the first notions on the transport of erratic boulders by drift (and later according to the land-ice theory by Torell) had their origin in The Netherlands as an answer to one of the prize contests.

International recognition was, however, received by Staring for his first coloured, large-scaled geological map of The Netherlands, dating from 1859-1866.

Other activities

As elsewhere in the world, the first people who paid attention

to geological problems of The Netherlands, were medical doctors, theologians, surveyors and natural scientists. Thus they were all 'amateurs'⁴ in the strict sense. The main interest in the geology of the low country was, apart from mineral resources like peat, sand, clay and some hard-rock, focussed on agriculture. In fact, the oldest geological maps were made by agriculturists, though scientific curiosity certainly played a role in their activities.

In 1808 – thus one year before the famous 'Philosophie Zoologique' by Lamarck – J. E. Doornik, a philosophical scientist and medical doctor, studying the origin of mankind, published in Amsterdam 'Wijsgeerig natuurkundig onderzoek aangaande den oorspronkelijken mensch' (philosophical-physical investigation on the original man); a few years later, in 1816, he published in Arnhem 'Over het begrip levenskracht uit een geologisch standpunt beschouwd' (on the notion of vital force, from a geological point of view). In these two works he gave an extensive exposition of his views about the step-by-step development of mankind, with the 'diermens' (animal man) as the original step. In this way he opposed Herder, Zimmermann and Kant who considered the white man to be the original form.

The titles of all old publications on the geology of The Netherlands can be found in the excellent geological bibliographies compiled by JONKER (1907), STEENHUIS (1934, 1953) and miss Jongmans; hardly any item since 1552 has been missed. This allows a good reconstruction of the geological thinking in our country.

I think that Staring can best be honoured by reviewing the development of geological thought and activity in The Netherlands before and during his lifetime. This will be done in the following pages for three subjects: peat, erratic blocks and geological mapping.

THE ORIGIN OF PEAT

Early thoughts

We have already mentioned that in 1658 Martinus Schoock(ius) (Fig. 2) (1614-1669; professor in Groningen 1640-1666) published his 'Tractatus de turffis, ceu cespitibus bituminosis' (on peat or combustible sods). He described the distribution of peat according to the available literature, mentioned seven hypotheses concerning its genesis, and added his own ideas about the origin. He thought that the clayey peat (so-called darg) of Zeeland (*Phragmites* peat, grown in a brackish environment) originated from bituminous material,



Fig. 2
Martinus Schoock(ius) (1614-1669).

supplied by the sea and covered by fine-grained sediments. This bituminous material would have formed peat after sulphur had been added. Schoock supposed that the trees (which can frequently be found in the peat) had grown on top of it, and afterwards had sunk through the weak topsoil into the peat. The tree stumps in the peat, in his opinion, were formed within the peat itself, just like other fossils

Schoock also discussed other components of the peat (probably referring to minerals like vivianite and siderite), which may cause a characteristic smell when the peat is burned, and which determine the colour of the ashes. Finally, he considered the question of whether or not the peat bogs should be drained and used for agriculture.

In 1660 JOHANNES PICARDT (1600-1670), a clergyman (Pastorem Covordiensem Primum) and agriculturist, wrote a book about 'Antiquiteiten' (antiquities). He realised that peats are not as old as the earth since one finds many trees in them; in The Netherlands peats these trees often lie in a NW-SE direction, owing to the NW storms at the time of the peat growth.

⁴ It is noteworthy that the last few decades have witnessed a remarkable flourishing of amateur geology in this country, in spite of the scarcity of exposures. There are various interesting periodicals in this field (Grondboor en Hamer; Staringia; Gea; Mededelingen van de Werkgroep voor Tertiaire en Kwartaire Geologie).



Fig. 3
Johannes le Francq van Berkhey (1729-1812)

Apart from this, Picardt was fully aware of the economical value of the peat, and he raised the question of 'how many people would have died from freezing if they had not had the treasure of peat'.

JOHANNES LE FRANCO VAN BERKHEY (Fig. 3), physician, author, poet, organist and lecturer in natural history at Leiden university, who lived from 1729 to 1812, dealt with peat, clayey peat and bog soils in the second volume of his 12-volume work 'Natuurlijke historie van Holland' (Natural history of Holland; 1771) in the third chapter (p. 71-95); in the ninth chapter (p. 431-635) he gave a substantial treatise on peat bogs and on peat exploitation. This second volume (with some 1200 pages) of his work also deals with various other aspects of geology, like mineralogy, fossils, rock types and mineral resources. In a table of these mineral resources he distinguished six classes: earth, sand, rocks, minerals, metals and 'growing together' (fossils).

In his study about bricks, peat and soils, he paid attention to their origin, exploitation, use and quality. He was the first to make a distinction between 'lage venen' (low peat bogs) and

'hoge venen' (high peat bogs), and he stated (p. 548) that peat is a combustible, black, more or less consistent soft mineral or earth, which rots together from all kinds of weak parts of decayed plant remains; mainly, however, from waterplants in the low peat bogs, and from landplants in the high peat bogs. The way of peat digging was described and it was shown that the inhabitants of Friesland and Holland were the first to dig peat in a 'decent' way, and also the first to make rules for concessions, taxes, trade and customary measurements.

The ideas of Staring

STARING was the first to make more modern studies on peat. In his thesis (1833) he gave a review of the knowledge at that time. After that he studied many more peat bogs, and his work (1853) 'De veenen en veenwording in Nederland' (The peat bogs and the origin of peat in The Netherlands) forms the result of these studies.

In 1856 and 1860 his main work 'De bodem van Nederland' (The soil of The Netherlands) was published in two volumes. It was to be the definitive study of peat for almost half a century. However, as it was rather difficult to read, and had only a limited circulation, STARING (on request) wrote a series of essays on Dutch soils and geology (1858) under the title 'Voormaals en thans, opstellen over Neerlands grondgesteldheid' (Of old times and new, essays on The Netherlands' soil conditions).

In our times of energy crises it is interesting to read Staring's essay on the depletion of the Netherlands peat resources. Almost all the items with which we are confronted nowadays had already been treated by him, some of them according to the evidently liberal philosophy of his time. In their fear for depletion, many people asked to inventory the reserves; for taxes on concessions in order to slow down the consumption; for promoting forestry (since wood was considered to be a good substitute for peat); etc. Staring, however, thought that it would be very difficult and expensive to make such inventories; moreover, he thought it of no use. In his opinion the digging of peat should be done as intensely and fast as possible, in order to create more arable land and new forests. Therefore, the government should pay a premium for peat digging instead of asking for royalties. Staring praised the abolition of the excise imposed on peat, as a result of which the consumption would increase and the exhaustion occur sooner.

According to Staring's ideas in 1851 the Dedemsvaart (a canal through the vast peat area W of Coevorden) was dug as a drainage canal as well as for the transport of peat. The peat paid for the canal, and the value of the new arable land was considered to be pure gain. In the lower (western) part of the country, however, peat diggers had to pay for pumping, since the dug-out areas lay below the groundwater table and were left as wide expanses of water ('plassen'), which had to be reclaimed, if wanted as arable land.

Apart from wood as a substitute for peat, Staring also emphasized the increasing importance of coal for heating and

industry. He pointed to London as an example, and expected that in the future gas would be produced from coal; not only for the rich, but also for the lower and middle-class houses. Finally, he referred to the possibility of increasing the yield, when coal would be used for producing energy. He foresaw gasworks producing gas for cooking and for lighting houses and streets. It was then 1858.

According to Staring, the only task of the government in this matter was to take care that, after peat digging, the dug-out area was actually converted into arable land or wood.

ERRATIC BOULDERS

Another typically Netherlands subject of geoscience was (and still is) the provenance and composition of erratic blocks.

PICARDT (1660) still explained the presence of these erratics as the work of giants, and gave an impressive picture of the building of giant graves. BRUGMANS (1781) (Fig. 4) was aware of their Scandinavian origin, and explained their presence as a result of the 'deluge', the large biblical flood. D'OMALIUS D'HALLOY (1818), one of the founders of geology in Belgium (even before Dumont), although believing – as an admirer of Cuvier – in the catastrophe theory, thought of local granite massifs, which are now concealed below the surface.

In 1831, contemporaneously with Lyell's 'Principles of geology' in which the glacial drift theory was brought forward, Hausmann from Göttingen, in answer to a prize contest of the Holland Society of Sciences in 1827, explained the occurrence of the Scandinavian boulders by the drifting of ice blocks from the north. VAN BREDA (1831), at that time professor of natural history in Leiden, translated the winning answer into the Netherlands language.

R. BERNHARDI from Saxony (1832), in his contribution to a Teyler prize contest, vaguely alluded to what later became known as the landice theory. Some years later, Acker Stratingh in a paper by Westerhof and him (1839) was aware of the Scandinavian origin of the blocks but still adhered to the deluge theory for the transport.

STARING (1856, 1858) supported the drift theory as the best explanation for the erratics. In his paper 'De keijen der heidevelden, of het Nederlandsch alluvium' (The boulders of the moors, or The Netherlands' Diluvium), he tried to explain the possibility of ice bergs, floating in Pleistocene times from Scandinavia towards The Netherlands. In 1870, in his book 'Natuurkunde en Volksvlijt' (Natural science and human activities) STARING mentioned (p. 152) that former glaciers, once present between the Alps and the Jura Mountains in Switzerland, had left large amounts of rock waste after melting. He understood that this proved that the explanation of erratic boulders as a result of transport by glaciers only, was far from unreasonable.

O. Torell (1868), professor in Lund (Sweden) and from 1870-1897 director of the Geological Survey of Sweden, for the first time expounded the land-ice theory, in answer to the



Fig. 4
Sebald Justinus Brugmans (1763-1819).

1861 prize contest, which asked for a comparison of the Groningen erratic blocks with Silurian formations in SW Norway. Torell explained their presence as a result of transport by glaciers, which extended as huge ice caps from Scandinavia as far as Gelderland and Holland. He traced the extent of these glaciers by the occurrence of glacial striae. The Society's jury (with Staring and Van Breda as members) thought it was such a new and remarkable answer that, before publishing it, they wanted the collection of boulders in the Leiden Natural History Museum to be studied, too, in this new light. Several years later (1872-1873) the manuscript was published in the memoirs of the Swedish Academy of Sciences.

It was Lorié, a disciple and friend of Penck, who introduced the landice theory in The Netherlands.

GEOLOGICAL MAPPING

A third item in this lecture and the main one, is the geological mapping of The Netherlands. We may distinguish various phases.

Early large-scale maps

The oldest geological map on which The Netherlands are represented is the first General Geological Map of Germany

(scale 1:2,300,000), compiled by CHRISTIAN KEFERSTEIN (1821-1831). The first issues of this map were dedicated to Johann Wolfgang von Goethe, who advised on the colours to be used. In his foreword to the explanations to the map, Keferstein states that the colours were chosen not only to indicate the various formations, but also in order to accommodate the eye and to get an acceptable distribution of the colours. Later, this Goethe colour-scale had to be abandoned.

In 1822 J. J. D'OMALIUS D'HALLOY, one of the founders of geology in Belgium, published a coloured geological map of the Low Countries, France and the surrounding areas (scale 1:3,500,000). d'Halloy, who later became governor of the Province of Namur, did his fieldwork and drafting of the map between 1808 and 1813. Since mapping was not his main task, he only published this map some 10 years later (1822), and then on request. His explanatory notes to the map were published in 1828; he then still used the outdated nomenclature which he had adopted in 1813.

d'Halloy was an admirer of Cuvier, adhered to the catastrophe theory, and at that time more or less ignored the British geological map by William Smith (1815). He philosophized on the background of a geological map. The subdivisions might, in his opinion, be based on either geological (that is genetic and age) criteria; or mineralogical and/or chemical criteria. The second (mineralogical) approach seemed to him effective with regard to the exploration of mineral resources and to the impact of the soil on vegetation and agriculture; the first approach, however, seemed to have advantages with regard to the 'furtherance of the geological science'; seemed to 'respond to the curiosity'; and seemed to give the opportunity to take different lithological units together into one 'époque'. So, his problems (while establishing a legend) were vast, and once he concluded: 'il vaut mieux faire mal que de rien faire' (it is better doing wrong than doing nothing). Another conclusion of d'Halloy was that nature is able to create similar rocks in different 'époques', due to which mineralogy and petrography are unsuitable as a base for the legend. Only superposition can serve for the age determinations which one needs for a geological map.

On his map the Quaternary, together with the Tertiary, belongs to the 'terrains mastozootiques'. The rocks of these 'terrains' certainly deserve their description 'aqueuses' (originated in water). At that time the study of these was already considered important and worthwhile, but it was also apparent that one would need a much larger scale to map these 'terrains aqueuses'. Since d'Halloy lacked time to map on such a scale, these Quaternary areas were not mapped in any detail. As a consequence, the lowlands on his map, including The Netherlands, are represented by only one colour, indicating that the outcropping rocks all belong to the same era.

In his explanatory notes d'Halloy divided the 'terrains mastozootiques' into seven lithological units. One of them, the 'terrains d'alluvion et de débris', consists of pebbles, gravels, clays and sands. Part of these dated, in this opinion, from the



Fig. 5
Geological map of Groningen by G. Acker Stratingh (1837).

last great catastrophe; the remainder was formed in the present times of stability.

The first large-scale map

In 1837 G. ACKER STRATINGH, a physician, edited a coloured geological map of the province of Groningen (scale 1:110,000), compiled from data and information by municipalities, schoolmasters and amateurs, and designed by the surveyor J. A. Smit van der Vegt. On this map (Fig. 5), probably for the first time, 'alluvie' and 'diluvie' were distinguished. It is a lithogenetic map, indicating in the 'diluvie': normal sand; sand with yellow loam, rocks and petrifications; and sand with yellow and grey loam (pot clay). The 'alluvie' comprises: normal clay soil, fat clay, low stiff clay soil (knipklei), clay with much fertile humus (Dollart clay), sandy clay, dune sands, bog iron-ore soil, clayey peat (Darg), low peat bogs, high peat bogs, and worked peat bogs.

Stratingh was an adept of the theory of Sedgwick (*Annals of Philosophy*, 1825). He stated that the 'alluvie' consists of rocks which were formed in recent times by the action of rivers, the sea or fire, ruled by still existing natural laws. The recent character was recognized since the fossils in the 'alluvie' are identical to plants and animals which still exist. The 'diluvie', in contrast, comprises all rocks from before these times; which lack human remains; and in which fossils of only extinct species occur. Stratingh believed in the deluge, and he could not understand or accept the principle of uniformitarianism (actualism), although he stated that his belief did not collide with the account on the creation in the Bible.

STEENHUIS (1953) described the way in which Stratingh's map was made at the instigation of the Educational Committee of the Province of Groningen. Before permission for publication was given, the map was 'laid out on the table' for

inspection by the 'honoured publicum'. The resulting map had important implications for agriculture and water management.

Staring's map

STARING, who was an agriculturist, a geologist and a jurist, was the first person to make a geological map of The Netherlands as a whole. In his thesis 'De geologia patriae' (1833), which may be considered as the first outline of the geology of The Netherlands, he summed up twelve points on which investigations should be focussed in the future. The first point was that a geological map of The Netherlands should be made.

During his whole career (from his thesis till the end of his life) Staring was aware of the relationship between the lithology (both subsurface and at the surface), and the vegetation and agricultural possibilities. He adhered to the theory of actualism and was aware of the long duration of geological time. For instance, he made an estimation of the time needed for the deposition of one metre of clay. Staring thus opposed Cuvier's catastrophe theory and followed Lyell's 'Principles of geology'. He also adhered to the drift theory; at the end of his life he became aware (as a member of the jury in the 1861 prize contest of the Holland Society of Sciences) of the land-ice theory of Torell.

In 1844, STARING published a tentative geological map of The Netherlands on the scale of 1:800,000. In a chronostratigraphical framework, lithogenetic units are depicted in colours. Represented are the boundaries of the 'Secondary' (Mesozoic) formations and the extension of the Tertiary formations, whereas the 'diluvial' soils (flood formations) have one colour, and the 'alluvial' soils are subdivided into low peat bogs, high peat bogs, sea-water deposits, fresh-water deposits, dunes and cover sands.

At its first meeting (1852), the Committee for the Geological Map, established by the Netherlands government, decided that a map on a larger scale should be made, and that:

- (1) the Cretaceous and the coal-bearing rocks (Carboniferous) should be shown on the map;
- (2) there should be 24 correspondents;
- (3) the field survey should be made on the scale of 1:50,000, but that the map should be printed on the scale of 1:200,000;
- (4) the survey should be done in five years, to be followed by compilation and printing in two years.

The fieldwork, however, took more time (1852-1860), mainly because of an interruption from 1855-1857. Among the correspondents were the best Netherlands (amateur) geologists and palaeontologists of that time. The resulting 1:200,000 map was the first geological map which showed boundaries and subdivisions both in the 'Diluvium' and the 'Alluvium'. These units together were named the Quaternary as they have been ever since that time. Apart from the composition and origin of peat (which had been studied earlier by STARING: 1853, 1856),

still very little was known about the origin and composition of the other Quaternary sediments.

On the map are indicated: Palaeozoic, Mesozoic, Tertiary, Diluvium and Alluvium. The Diluvium is shown in eight colours, which indicate respectively: silex Diluvium, Meuse Diluvium, Rhine Diluvium, mixed Diluvium, Scandinavian Diluvium, sand Diluvium, and natural levees ('oeverwallen'). The latter three are considered to be post-glacial Diluvium. In the Alluvium the following thirteen units are distinguished and indicated by different colours: sand drifts; coastal dunes and 'geestgronden' (sandy soils along the feet of the dunes); old sea sand in the reclaimed polders; old sea clay in the reclaimed polders; beaches and tidal flats; sea clay; river sands with river banks and river dunes; river clay; brook clay; worked-out high peat bogs; high peat bogs; marsh peat bogs; and low peat bogs. In total there are 54 colours on the map. The light colours have been used for the most frequently occurring deposits.

The printing of the map was of outstanding quality. The geological quality was also high: in 1869 the map was awarded a prize at the World Fair in London for 'the accurate distinction of the grounds younger than Tertiary'. This 1:200,000 map consists of 28 sheets. Only 250 copies were printed, of which 100 have been distributed as free copies to both Netherlands and foreign scientists. Since the number of copies is so limited, we should be careful with those still existing in libraries, schools, institutions and private collections.

VELDINK (1970) mentions some very interesting data from a lecture by Staring for the Royal Netherlands Academy of Sciences on September 23rd, 1867. The total cost for the map (including publication of the transactions of the Committee, the collection of samples, maps and books, the borings, the travelling expenses, and the salary for Staring himself) amounted 54,413 guilders (4,413 guilders more than was originally estimated and allocated).

In this same thesis by VELDINK (1970) an up to date and almost complete biography of Staring is provided (with an exhaustive bibliography). One finds the whole sad 'story' and the annoyances during the years that he was preparing his map.

The Netherlands government had hoped that, just as in Belgium, the geological mapping of The Netherlands would stimulate industry, traffic and trade by the discovery of new mineral resources. No new discoveries were made, however. Therefore the government stopped the geological work of Staring in 1863, although the costs were very low. The printing of the map had not been finished at that time, so the government asked Staring to supervise the printing. This he did until 1867 when all sheets had been published.

Later developments

After finishing his fieldwork in 1860 STARING (apparently having a foreboding of the events which would come in 1863) wrote in the periodical 'Algemeene Konst- en Letterbode':

'that the geology of The Netherlands was far from a finished and closed book; that we scientifically never will be ready in that respect; that continuous work, even very important work, has to be done; that therefore interruptions of this work would mean throwing away those results (map, collections, notes to the map), gathered with a great effort and with so much money'. After the printing of the map nothing was done for a long time, except that in 1889 an unchanged reprint was made (only new canals and railway tracks were added).

Since Staring's death in 1877, the Royal Netherlands Academy of Sciences (and also geologists such as Lorié, Schroeder van der Kolk, Grutterink and many others) have on many occasions tried to convince the government that the geological work in The Netherlands should be continued. But only after Parliament found out that money could be earned by mining (as was experienced in the Netherlands East Indies) was their advice followed: in 1903 the 'Rijksopsporing van Delfstoffen' (ROvD, Governmental Exploration for Mineral Resources) was started. This service found coal, rock salt, and even the first traces of oil and gas in the subsurface. After it had finished its programme in 1918, this service was converted into the 'Rijksgeologische Dienst' (RGD, Geological Survey of The Netherlands). Geological mapping in The Netherlands was then discontinued.

The development of geological knowledge in The Netherlands since the time of Staring is, however, a story in itself, which is considered to be beyond the scope of this paper.

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