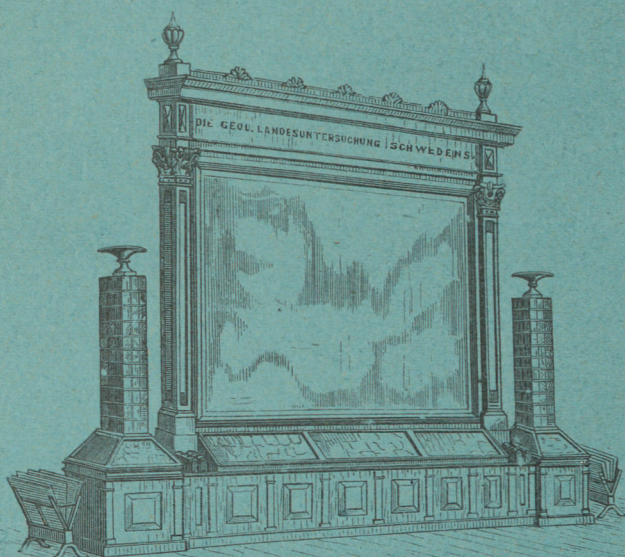


THE EXHIBITION  
OF THE  
GEOLOGICAL SURVEY OF SWEDEN

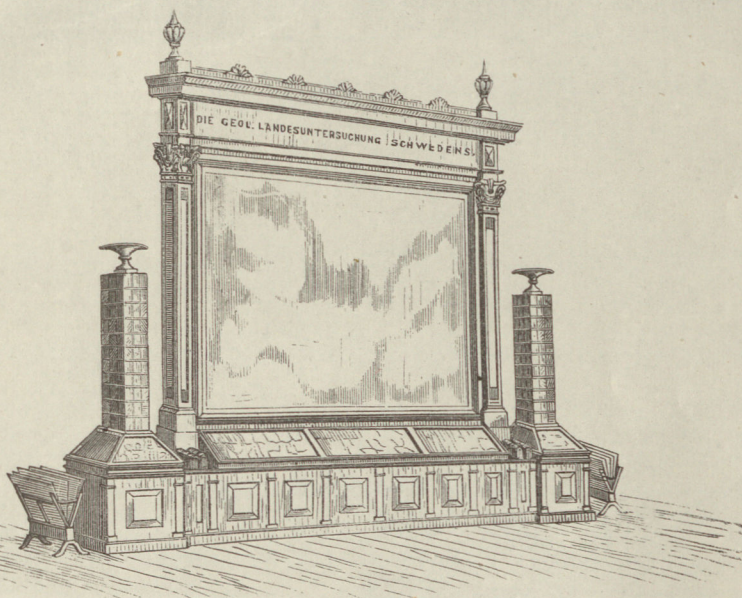


E. MESTERLE P. C. N. A.

AT  
THE EXHIBITION IN PHILADELPHIA 1876.

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THE EXHIBITION  
OF THE  
GEOLOGICAL SURVEY OF SWEDEN



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STOCKHOLM, 1876.  
KONGL. BOKTRYCKERIET,  
P. A. NORSTEDT & SÖNER.

## HISTORICAL SKETCH OF THE ORIGIN AND PROGRESS OF THE GEOLOGICAL SURVEY OF SWEDEN.

The idea of a Geological survey of Sweden at the cost of the state appeared the first time publicly in a petition from the Agricultural Society of Upsala, on the 4:th of June 1855, for a geological survey of that "län" (county), the Society offering to pay half the expense; and shortly afterwards the seventh Swedish Agricultural Congress sent also a petition to the King, praying for a geological survey of the whole kingdom.

The Agricultural Academy and the Academy of Science, to whom the matter was referred, having reported favourably on the subject, the King on the 30:th of October 1856 proposed to the Diet a grant of 60,000 crowns during the years of 1858—1860 for the establishment of a geological survey of the kingdom.

The proposition being assented to by the Diet, the King in a letter of the 27:th of April 1858 ordained concerning the geological survey, that it should be executed according to a general plan, having principally in view the study of the geological structure of the country, with due regard to the scientific, agricultural and manufacturing interests, and to make the results known by detailed maps and descriptions.

The work of the new survey commenced in the year 1858 with the construction of a geological map of the basin of the lake of Mälaren

The result of the work during the first two years, based on the map of the General-Staff of the army in the scale of  $\frac{1}{50000}$ , was laid before the Diet of 1859, who declared it of great importance that the geological map should be printed on a scale sufficiently large to represent with due distinctness every thing that might be useful to the agriculturist or manufacturer.

Accordingly three sheets in the scale of  $\frac{1}{50000}$  were published in the year 1862 and the publications have ever since been continued.

The geological survey of such a country as Sweden, naturally, has to struggle against very considerable difficulties, arising from the uniformity of the fundamental rock, and the want of greater sections of the rock, where the laws of superposition, the relative age of the rocks etc. might be studied, and finally from the large and uniform beds of loose materials covering the fundamental rock.

Hence a map, merely petrographical, would have been very monotonous when made on so large a scale as the above mentioned, had not the custom of reproducing also the quaternary deposits on the same sheet offered the means of avoiding this tiresome inconvenience as also of acquiring a truer image of the surface of the country, than might have been possible on an ordinary geological map.

The scale of  $\frac{1}{50000}$ , the only one used in the beginning of the survey, is now only applied for those parts of the kingdom, where through either the variety of geological formations or the importance of those formations for metallurgical, agricultural and other purposes, the use of so large a scale is absolutely necessary. In regions of more uniform nature or with a scarce population, as for instance the province of Småland, maps on the scale of  $\frac{1}{100000}$  are considered sufficient enough for the survey itself, and the scale of  $\frac{1}{200000}$  for publication. Those maps, representing both the loose deposits and the solid rocks visible at the surface, but

without the topographical features of the land, are accompanied by others only indicating the petrographical nature and the topography of the country.

The maps used for the survey are partly those of the Ordnance survey in the scale of  $\frac{1}{50000}$ , partly the economical (statistical and agricultural) maps on the same scale and also those of the Ordnance survey in  $\frac{1}{100000}$ .

The whole area now surveyed on the scale of  $\frac{1}{50000}$  is 415 swedish square miles and on the scale of  $\frac{1}{100000}$  96 d:o.

Since the beginning of the geological survey 60 sheets on the scale  $\frac{1}{50000}$  with accompanying descriptions have been published, 6 are ready to leave the press and 19 are more or less surveyed.

In the scale of  $\frac{1}{200000}$  two sheets have been published, one is now in press and one completely surveyed.

The geological survey is always followed by height-measures made with the aid of the usual levelling instruments.

Simultaneous with the above work, preliminary surveys have been carried on for a general geological map of the whole country.

This work has especially been prosecuted in the large and remote districts of the northern provinces, such as Dalecarlia (Dalecarlia) Herjeådalen, Jemtland and Lappland.

As for Lappland a scientific expedition has during the summer of 1875 explored a large part of that vast barren country with special regard to its uncommonly abundant ores of iron and copper. And, finally, both the iron-ore-regions of the middle part of Sweden and the coal regions of Skåne (Scania) have during the last five years been surveyed for the sake of the mining industry.

Great many monographies and essays have also been published from the geological survey of Sweden.

The appropriation by the state-governement, and which has been successively increased, now amounts to 71,200 crowns for the year 1876.

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The first director of the Geological Survey of Sweden was Professor *Axel Erdmann*, who died in the year 1869. After him Mr *A. E. Törnebohm* was appointed acting director for the following year, whereupon the present director, Professor *O. Torell*, took charge of the office.

The corps of officers consists of 12 persons, inclusive the director, and besides those permanent surveyors other temporary assistants have been employed during the summer months, from the 15<sup>th</sup> of May until the 15<sup>th</sup> of October.

During the wintermonths maps, descriptions, monographies, chemical and microscopical researches are made. The geological survey has in Stockholm offices of ist own, consisting of several large rooms, chemical laboratory, and a large museum, where the collections of paleontological and rockspecimens are exhibited.

## A BRIEF REVIEW OF THE GEOLOGY OF SWEDEN.

The formations of Sweden embrace chiefly the two extremes in the series of geological formations. Generally, the loose deposits of the quaternary period follow immediately upon the crystalline pre-cambrian rocks. Of the intermediate formations only a part is represented and among those only the Silurian is of any greater extension.

In the extensive tracts of the country, which are formed out of rocks belonging to the Laurentian age, the *gneisses* and other stratified rocks alternate with *granites*. As in other countries, the gneiss territory of Sweden consists of partly red, partly grey gneiss.

The former is found to predominate in the western parts of the kingdom, in the north of Skåne (Scania) in Halland, Westergötland and a part of Wermland, the latter in the eastern, in Blekinge, Södermanland, Upland, Helsingland and Medelpad.

Another division of the Laurentian formation, probably the most recent, is formed out of a series of fine-grained up to compact rocks as "*eurit*" and "*hällflinta*" (petrosilex).

These rocks, although not of very great extension, comparatively, are to the miner and metallurgist of very great interest as forming the constituting rock of the most important of the iron-ore districts of central Sweden. The *iron-ores* do not occur in veins but generally in form of lenticular masses, with their major axis of less or greater length, which masses are imbedded in layers, somewhat different in their nature from the surrounding rock. These

metalliferous layers are evidently of the same age as the adjoining rock and constituted from different minerals in different places, thus giving the ores their special character. This is also sometimes the case with the *copper-* and *zinc-ores*, as for instance at Falun and Ämmeberg, which also in all probability belong to the most recent period of the pre-cambrian age. To the same group, and often in the neighbourhood of the ores, large beds of *granular limestone* occur. Such limestone also occurs in the gneissformation, but only in its upper parts, where also occasionally iron-ores are to be found.

*Granites* of many different structures, and of different ages occur, but the chief masses appear however to belong to a time anterior to the cambrian period. They present themselves generally in masses of great extension, and of which the principal follow the major axis of Sweden from North to South. The granites there form the interior of the country while the gneiss is the predominating rock along the coasts.

Veins of *Pegmatite* occur here and there, generally in the gneiss-districts, and are sometimes, as for instance in the archipelago of Stockholm, quarried out for the sake of its pure felspar, which is used in the manufacture of china-ware.

Of igneous rocks occur in Sweden, besides the granites, *Porphyries* and *Greenstones* (diabase, diorite, gabbro, hyperite). The former, largely prevailing especially in Dalarne (Dalecarlia), are renowned for the beautifully polished articles that are made out of them. The greenstones occur sporadically in all parts of the country, generally in form of massives, or smaller or larger veins. Sometimes they cover sedimentary beds of the Silurian age, as for instance in Westergötland.

*Basalt* only occurs in two or three places in Skåne.

The *Silurian formation* is found in several places, as in Skåne, on the island of Gotland (upper silurian) and Öland, in the mountains of Westergötland, in Östergötland, Nerike, in the environs of the lake Siljan in Dalarne, and in Jemtland around the lake Storsjön. The last mentioned territory, the largest of them all, embraces more than 120 geographical square miles and extends as far as into Lappland. The highland mountains that occupy the west of this silurian region, the highest summits of which, as for instance Åreskutan and Sulitelma, rising more than 5,000 feet above the level of the sea, consist chiefly of metamorphic schists and are no doubt younger than the middle silurian age. In Dalarne and Herjeådalen there are also large mountains consisting of sandstone and quartzite, partly younger, partly contemporary with the silurian age.

The undoubtedly true silurian formations, as for instance the mountains of Westergötland, have all the same features. — The undermost layer is sandstone, upon which comes alum-schist with bituminous (fetid) limestone, — both of which rocks are sometimes reckoned to the cambrian formation — again superposed by orthoceras limestones and clay-slates. Over this, as above mentioned, often spreads a covering of trap. The sandstone is used as a building material, for millstones and other purposes; the alum-schist delivers alum, or is used as fuel in the burning of lime etc. Out of the limestone, flags and other building materials are made. — A composition of lime and burnt alum-schist gives a hydraulic cement of approved quality.

The remainder of the younger formations anterior to the quaternary period are to be found only in the southernmost part of Sweden or the province of Skåne. In the northwest part of that province occur sandstones and clay-slates, that seem to belong to the end of the *triassic* or the beginning of the *jurassic period*. It is in those formations the coal

beds of Sweden are to be found, and coal is now raised in the coalfields of Höganäs, Billesholm, Bjuf and several other localities. One part of the clay belonging to this formation is fireproof.

The *cretaceous* period is represented in the southeast and east part of Skåne.

The *quaternary* formations in Sweden are partly glacial, partly postglacial. The oldest deposit belonging to the first period is the "till". It consists of a mass of unstratified clay and sand, with blocks and boulders of stone stuck in it promiscuously, the whole seeming to be the result of an irregular pell-mell carrying forward and deposition of materials. The colour and general composition of the mass vary according to the nature of the rock, from which it has been derived.

There can hardly be any doubt that this *till* is the product of vast masses of ice grinding over the country. Additional evidence of the former land-ice is furnished by the smoothly polished and striated surface of rock, on which the till or boulder clay is usually found to rest. The till thus represents the bottom moraine of the same icemass.

In Scania are in several places found layers of stratified sand and clay ("diluvial sand and diluvial clay") covered by great beds of till.

When the till during a later period was sunk under the sea level, it was more or less washed down from the hills into the valleys, where it was covered with marine deposits. Above this marine boundary, chiefly determined by the presence of the *glacial clay*, and which in Sweden not reaches above 500 feet over the present level of the sea, the till forms the surface of the ground nearly without interruption, and almost completely covers the bottom rocks. Beneath the same marine boundary, that rises a little towards the north and sinks a little towards the south, the solid rock

projects in the hills, which are surrounded by the sand and clay deposits of the quaternary period.

Among the quaternary deposits the kames or eskers (swed. *Asar*) are remarkable. They occur most frequently, as for instance in the plains of the Mälarslake bassin. They consist almost exclusively of stratified sand and rounded gravel, intermixed with boulders; they are long, narrow and sharp-edged ridges, generally going in the direction from North to South, and may be followed for many miles.

From the *postglacial deposit* marine clays are found in the neighbourhood of the present coasts, and freshwater deposits all over the kingdom. Among the last mentioned deposits the numerous peatbogs are remarkable for their practical importance.

From the above geological relations it follows, that the adaptability of the country for cultivation depends chiefly upon its position within or outside the boundary of the quaternary and marine formations, and, in the latter case, also on the nature of the bottom rock, since this determines the till or boulderclay, which, wherever the marine or postglacial clays are wanting, forms the cultivated soil. Though the till, in consequence of the great number of boulders which it incloses, may be difficult and troublesome to bring into cultivation, yet it generally affords a soil, which is by no means ungrateful and when the materials, from which it is derived, are clay-slates or limestone rocks, it usually forms an excellent soil for cultivation, as for instance in Skåne. The marine clays, on the contrary, being free from stones, are easily cultivated, and therefore, wherever they occur, they have almost always been appropriated by the farmer. In districts situated to the south of calcareous formations, carbonate of lime is always in more or less degree intermixed with the glacial clay, which very considerably increases its fertility (for example, the glacial marl in Upland).

A striking difference in the distribution of the cultivated soil is perceptible between those districts in which the cultivable land consists of till, and those in which it consists of marine clay deposits. In the former, the arable land, in general, lies on the slopes of the hills, and seldom forms any large fields, but usually small scattered pieces, often irregular of shape. In the territory of the marine claybeds, on the contrary, the cultivated land is chiefly concentrated on these, and the other soils are generally left to the growth of forests. The arable fields are there also, generally, larger and more connected, as for example in the Mälars-basin, on the plains of Östergötland, and in the vicinity of the Lake Wenern.

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The Exhibition of the Geological Survey of Sweden consists of:

- I. **Geological maps and papers**, published by the Geological Survey of Sweden, and *Magnetic geological maps of the Lapland iron ore mountains*, made by a Royal Commission, 1875, presided over by the Director of the Geological Survey.
- II. **278 specimens** of Swedish quaternary deposits, concretions (Swed. Marlekor), glacial shells, lake- and bog-iron ore (Limonite).
- III. **176 polished cubic specimens** of Swedish rocks. Size 5 Cubic inches (0,12 mètres).

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The Exhibition has been arranged by *Edward Erdmann* — Geologist of the Geological Survey of Sweden — and this catalogue together with the description has also for the most part been made by him.

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## I.

### GEOLOGICAL MAPS AND PAPERS.

An isolated map, 13 feet long and 10 feet in height: "**Geological map of the Environs of the Mälars-lake.**" This map, which is composed of 31 sheets published by the

Geological Survey of Sweden, embraces an area of 178 Swedish (370 geographical) square miles in central Sweden, illustrates (in colours) not only the solid rocks but also loose deposits, or the quaternary formations, and thus represents, as far as possible, a true picture of the surface of the country. In one or two islands in the lake Mälaren occurs a "non fossiliferous" sandstone (possibly cambrian), but for the rest the fundamental rock everywhere is præcambrian and consists of *Mica-schist*, *Hälleflinta*, *Granular Limestone* and *Dolomite*, *Diorite*, *Diorite-schist*, *Hornblendestone*, several varieties of *Gneiss* and *Diabase*, and various kinds of *Granite* \*). The scale is 1 : 50,000. A section (in the right-hand corner at the bottom of the map) shows the succession of the quaternary deposits. The map very distinctly shows the direction of the numerous Sandridges, Kames or Eskers, (in Swedish Åsar, Sandåsar, Rullstensåsar) which run from N. N. W. to S. S. E.

The back of the Mälarmap contains several smaller maps and sections, namely:

- a) at the top, **Section across the sandstone territory of the Province of Dalecarlia, and Section of Mount Åreskuta, Province of Jemtland.**

Both are constructed by *A. E. Törnebohm*.

The latter illustrates the position of the crystalline schists of the "Köli-" and "Seve-groups", which are younger than the Silurian formation \*\*).

- b) **Geological map of Eastern Dalsland and a part of Westergötland.**

This map, composed of 7 published sheets, shows the extension of the so-called *Dal-formation*, the rocks

\*) Specimens both of the rocks and the quaternary deposits are exhibited in the Cases D, E, and F; see further on.

\*\*) See a Pamphlet, published by *Törnebohm*: "Coupe géognostique de la chaîne centrale de la Scandinavie entre Östersund et Levanger". Öfv. af K. Vet. Akad. Förh. 1872.

belonging to the laurentian formation and the quaternary deposits.

A section illustrates the order of stratification of the various beds of sandstones, quartzites, and schists of the Dal-formation. Specimens are exhibited in Case B. (Scale 1 : 50,000).

- c) **Map of the middle and south parts of Sweden, showing the extension of glacial clay and marl**, by *Axel Erdmann*.

In this map the localities where glacial and post-glacial shells and other quaternary fossils have been found are indicated by special signs. (Scale 1 : 1,000,000).

- d) **Geological map of the iron-ore district of Persberg. Province Vermland** by *A. E. Törnebohm*. Hand-drawing.

From the sections it is plainly seen, that the ore (Magnetic iron ore) forms real layers. Specimens are exposed in Case L. (Scale 1 : 8,000).

- e) **Geological map of the Province of Skåne (Scania)** by *Edward Erdmann*.

This map illustrates the extension of the pre-glacial formations. (Scale 1 : 400,000).

It is probable, that the present geological structure of Skåne, as well as the distribution of the different formations, and the relations of contact between them, have been caused by great *faults* (Swedish *förkastningar*).

These faults are indicated in the map by thick black lines. Specimens are exposed in Case A.

- f) **Geological map of the eastern part of the Province of Dalsland**. (Scale 1 : 200,000).

- g) **Index to the Geological Survey map of Sweden, 1876**.

- h) **Geological map, with equidistant curves, of the Estates of Skottorp and Dömmestorp, Prov. Halland**, by *Leon. Holmström* and *Axel Lindström*. (Scale 1 : 20,000).

*i*) **geological maps and sections of the Tosterup Estate, Province Skåne (Scania)** by *Edward Erdmann* and *J. A. Wallin*. (Scale 1 : 20,000).

*k*) **geological and agronomical map of a part of the Skottorp Estate, Province Halland**, by *Leon. Holmström* and *Axel Lindström*. (Scale 1 : 4,000).

The character of the ground or subsoil is represented in the map, as usual, by colours. The composition of the mould or soil, i. e. its percentage of hygros. water and organic matter, clay and fine powdery sand, fine sand, middle fine sand, coarse sand and gravel, as well as the percentage of carbonate of lime and magnesia contained in it, is indicated by special signs, for example, +, —, —, |, ●, ○, &c.

Specimens belonging to *h*, *i*, and *k*, are exhibited in Case C.

The three last-mentioned maps of Skottorp and Tosterup are constructed according to a plan of Professor *O. Torell*.

On a separate case in the proximity of the large chief-case represented on the titlepage, there is an isolated large map, 5 feet by 8, of which the one side is occupied by

*l*) **Geological map of the iron-ore regions of Örebro Län** (northern part). Scale 1 : 50,000.

This map, embracing the territory for the geological sheets of "Hjulsjö", "Riddarhyttan", "Nora", "Linde", "Latorp", and "Örebro", illustrates the extension of the laurentian, cambrian and silurian beds, the eruptive rocks, the site of the mines, &c. The quarternary deposits are considered as being removed. Some sections give an idea of the order of superposition of the laurentian rocks. Rock-specimens illustrating the map, are to be found in the adjoining case.

On the opposite side of the map are attached

*m*) **magnetic geological Maps of the Lapland iron mountains**, constructed by a Royal Commission, 1875, presided

over by Professor *O. Torell*. Commissioners: *D. Hummel*, *O. Gumælius*, *C. A. Dellvik*, — Geologists and Metallurgists; *W. Bergman*, *L. Ruuth*, *O. R. Hederström* — Surveyors.

These maps embrace the iron-ore districts of Swappawara, Kirunavaara, and Gellivare (Scale 1 : 8,000).

On the same is also a *Geological map of the Alpine regions* between Gellivare and Torneträsk, by *D. Hummel*. Scale 1 : 400,000.

Rock-specimens illustrating the maps are arranged in the case below.

The above-mentioned maps \*), in the scales of 1 : 50,000 and 1 : 200,000, together with descriptions, monographs, and minor papers, published by the Geological Survey of Sweden, are also separately exhibited, nameley:

(Scale 1 : 50,000)

Numbers and names of the sheets.	Author.	Year of Publication.
1. Vesterås ..... with Text	V. Karlsson .....	1862.
2. Arboga ..... »	Elis Sidenbladh .....	1862.
3. Skultuna ..... »	O. F. Kugelberg .....	1862.
4. Södertelje ..... »	A. E. Törnebohm .....	1862.
5. Eskilstuna ..... »	V. Karlsson .....	1863.
6. Stockholm ..... »	Fries, Wahlqvist and Törnebohm .....	1863.
7. Enköping ..... »	O. F. Kugelberg .....	1863.
8. Fånö ..... »	A. E. Törnebohm .....	1863.
9. Säfstaholm ..... »	Elis Sidenbladh .....	1864.
10. Ängsö ..... »	J.O. Fries and V. Karlsson	1864.
11. Köping ..... »	V. Karlsson .....	1864.

\*) The maps have been engraved and printed in colours in the Lithographic Establishment of the General-Staff. Lieutenant Colonel *G. L. Dreyer* was the director of this establishment until the end of the year 1872, when the present director, *A. Börtzell*, took charge of it

Numbers and names of the sheets.		Author.	Year of Pu- blication.
12. Hellefors .....	with Text.....	O. F. Kugelberg .....	1864.
13. Lindholm .....	» » .....	C. W. Paijkull .....	1864.
14. Lindsbro .....	» » .....	Edward Erdmann .....	1865.
15. Skattmansö .....	» » .....	David Hummel .....	1865.
16. Sigtuna .....	» » .....	O. Gumælius and C. W. Paijkull .....	1865.
17. Malmköping .....	» » .....	A. E. Törnebohm .....	1865.
18. Strengnäs .....	» » .....	V. Karlsson and I. O. Fries .....	1865.
19. Ramnäs .....	» » .....	M. Stolpe .....	1866.
20. Wårgårda .....	» » .....	I. O. Fries .....	1866.
21. Ulricehamn .....	» » .....	A. E. Törnebohm .....	1866.
22. Eriksberg .....	» » .....	David Hummel .....	1867.
23. Nyköping .....	» » .....	Edward Erdmann .....	1867.
24. Tärna .....	» » .....	E. Sidenbladh .....	1867.
25. Sämsholm .....	» » .....	I. O. Fries .....	1867.
26. Sala .....	» » .....	O. Gumælius .....	1868.
27. Rånäs .....	» » .....	E. Sidenbladh .....	1868.
28. Borås .....	» » .....	M. Stolpe .....	1868.
29. Leufsta .....	» » .....	A. H. Wahlquist .....	1868.
30. Eggegrund .....	» » .....	A. H. Wahlquist .....	1868.
31. Upsala .....	» » .....	M. Stolpe .....	1869.
32. Örbyhus .....	» » .....	M. Stolpe .....	1869.
33. Svenljunga .....	» » .....	V. Karlsson .....	1870.
34. Åmål .....	» » .....	A. E. Törnebohm .....	1870.
35. Baldersnäs .....	» » .....	D. Hummel and Edward Erdmann .....	1870.
36. Wingershamn .....	» » .....	A. E. Törnebohm .....	1870.
37. Upperud .....	» » .....	A. E. Törnebohm .....	1870.
38. Degeberg .....	» » .....	V. Karlsson .....	1870.
39. Rådanefors .....	» » .....	V. Karlsson and A. H. Wahlquist .....	1870.
40. Wenersborg .....	» » .....	Elis Sidenbladh .....	1870.
41. Wiskafors .....	» » .....	I. O. Fries .....	1870.

Numbers and names of the sheets.	Author.	Year of Pu- blication.
42. Engelsberg ..... with Text	O. Gumælius	1871.
43. Salsta ..... » »	A. L. Th. Pettersson	1871.
44. Rydboholm ..... » »	Edward Erdmann	1871.
45. Hörningsholm ..... » »	M. Stolpe	1871.
46. Riddarhyttan ... » »	V. Karlsson	1873.
47. Linde ..... » »	David Hummel	1873.
48. Örebro ..... » »	O. Gumælius	1873.
49. Segersjö ..... » »	V. Karlsson	1873.
50. Årsta ..... » »	L. Palmgren	1874.
51. Nynäs ..... » »	L. Palmgren	1874.
52. Trosa ..... » »	D. Hummel	1874.
53. Björksund ..... » »	M. Stolpe	1874.
54. Riseberga ..... » »	M. Stolpe	1875.
55. Latorp ..... » »	G. Linnarsson	1875.
56. Nora ..... » »	O. Gumælius	1875.

(Scale 1 : 200,000.)

Numbers and name of the sheet of map.	Author.	Year of Pu- blication.
1. Huseby, map showing the extension of the fundamental rocks	D. Hummel	1876.
ditto ditto, map showing the extension of the fundamental rocks and the qua- ternary deposits	d:o	»
2. Ljungby, map showing the extension of the fundamental rocks	d:o	»
ditto ditto, map showing the extension of the fundamental rocks and the qua- ternary deposits	d:o	»

The height measures on these maps have nearly all been made by *A. Börtzell*.

*Öfversigt öfver glaciællerans utbredning inom södra delen af Sverige* (Map of the middle and south parts of Sweden showing the extension of glacial clay and marl.) by *Axel Erdmann*. Scale 1 : 1,000,000. Stockholm, 1866.

*Bladindelning för det Geologiska Kartverket.* (Index to the Geological Survey of Sweden.) Stockholm 1866.

*Bidrag till kännedomen om Sveriges Quartära Bildningar.* (On the quaternary formations of Sweden) by *Axel Erdmann*. Text (8:vo, 297 pages) and atlas with 14 maps. Stockholm, 1868.

*Exposé des Formations Quaternaires de la Suède* par *Axel Erdmann*. Edition abrégée, par l'auteur, pour l'étranger. Texte et Atlas, contenant quatorze cartes générales. Stockholm, 1868. (8:vo 118 pages.)

*Geologisk Öfversigtskarta öfver bergarterna på Östra Dal.* (Geological map of the eastern part of the Province of Dalsland). Scale 1:200,000. Stockholm, 1870.

*Geognostisk profil öfver den Skandinaviska fjällryggen mellan Östersund och Levanger* af *A. E. Törnebohm*, with *Résumé: Coupe géognostique de la chaîne centrale de la Scandinavie entre Östersund (Suède) et Levanger (Norvège), un peu audessous du 64° de latitude.* Reprinted from *Öfvers. af Kongl. Vet.-Akad. Förh.* 1871. Stockholm, 1872. (8:vo, 24 p.)

*Bidrag till kännedomen om Sveriges erratiska bildningar, samlade å geologiska kartbladet "Örebro"* af *Otto Gumælius* (With a *résumé* in French.). Reprinted from *Öfvers. af Kongl. Vet.-Akad. Förh.* 1871. Stockholm 1872. (8:vo, 20 pages.)

*Öfversigt af de geologiska förhållandena vid Hallands-ås* af *David Hummel* (Avec un *résumé* en Français). Reprinted from *Kongl. Vet.-Akad. Förh.* 1871. Stockholm, 1872. (8:vo, 40 pages.)

*Beskrifning öfver Skånes stenkolsförande formation* af *Edward Erdmann*, with geological map of the Province of Scania (Skåne) and 4 Tables. (Avec un *résumé* en Français: *Description de la Formation carbonifère de la Scanie.*) Stockholm 1872, (4:to 87 pages.)

*Beskrifning öfver Besier-Ecksteins Kromolitografi och Lito-  
typografi*, använda vid tryckningen af Geologisk Öfversigts-  
karta öfver Skåne, meddelad af Algernon Börtzell. Stock-  
holm, 1872. (4:to. 24 pages.)

*Ueber die Geognosie der Schwedischen Hochgebirge* von  
*A. E. Törnebohm*. With a map. Stockholm 1873. (Reprin-  
ted from Öfvers. af Kongl. Vet.-Akad. Förhand. 1872.) 8:vo  
60 pages.

Geological Map, with equidistant curves, of the estates  
of Skottorp and Dömmestorp, Province Halland, by *Leon.*  
*Holmström* and *Axel Lindström* (Scale 1 : 20,000.)

Geological Maps and Sections of the Tosterup estate,  
Province Skåne (Scania) by *Edward Erdmann* and *J. A.*  
*Wallin* (Scale 1 : 20,000).

Geological and agronomical map of a part of the Skot-  
torp estate, Province Halland, by *Leon. Holmström* and *Axel*  
*Lindström* (Scale 1 : 4,000).

*Om några försteningar från Sveriges och Norges "Prim-  
ordialzon"* (Some fossils from the Swedish and Norwegian  
Primordial zone) by *G. Linnarsson*, with a table. Reprinted  
from Öfversigt af Kongl. Svenska Vet.-Akad. Förhandl. 1871.  
Stockholm 1873 (8:vo 8 pag.)

*Om mellersta Sveriges glacials bildningar.* (On the gla-  
cial deposits of the middle part of Sweden) by *Otto Gumæ-  
lius*. I. Krosstensgrus, glacialsand och glaciallera (Till, gla-  
cial sand and glacial clay). Reprinted from Bihang till K.  
Svenska Vet.-Akad. Handlingar, 1874 (Avec un résumé en  
Français). Stockholm 1874 (8:vo 36 and IX pages with  
three tables.)

*Om rullstensbildningar* (On Kames) by *David Hummel*.  
Reprinted from Supplement to the K. Svenska Vet.-Akad.  
Handlingar 1874. (Avec un résumé en Français). Stock-  
holm 1874. (8:vo 34 och VI p. with 2 maps.)

*Om malmlagens åldersföljd och deras användande såsom*  
*ledlager* (On the successive age of the iron ores and their

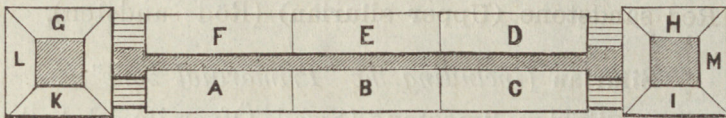
use for determining the age of the surrounding rocks) by *O. Gumælius*. Reprinted from *Öfvers. af K. Svenska Vet.-Akad. Förhandl.* 1875. Stockholm 1875. (8:vo 30 pages, with a geological map.)

*Om Sveriges lagrade urberg jemförda med Sydvestra Europas af David Hummel.* (On the stratified primitive rocks of Sweden compared with those of the Southwest of Europe). Reprinted from *Supplement to K. Vet.-Akad. Handl.* Avec un résumé en Français.) Stockholm 1875. (8:vo 68 och IX p. with a geological map).

*Geognostisk beskrifning öfver Persbergs grufvefält.* (Geognostic description of the iron ore district of Persberg. Province Vermland) by *A. E. Törnebohm*. Stockholm, 1875. (4:to 21 p. with a geological map.)

## II.

## SPECIMENS OF SWEDISH ROCKS AND QUATERNARY DEPOSITS \*).



Ground plan of the Cases in which the following collections are exhibited.

**Case A.**

Rock specimens illustrating the geological map of  
Skåne (Scania).

(Stratigraphically arranged.)

**Cretaceous \*\*).**

1. Saltholm-Limestone with flints (Swed. Saltholmskalk med flinta).
2. Ignaberga-Limestone (Ignabergskalksten).
3. Younger Greensand (Köpinge sandsten, Grönsandskalk).
4. White Chalk (krita).

**Liassic.**

5. Sandstone coalbearing (Swed. kolförande sandsten).
6. Shale (Swed. Skifferlera).

\*) The places where all these rocks and quaternary deposits are found, are indicated on the labels attached to each specimen.

\*\*) That the white chalk is older than the Saltholm limestone, is fully authenticated; but on the other hand, the place of the Ignaberga-Limestone and of the Greensand in the order of stratification, is not yet established.

7. Sandstone, coalbearing (kolförande sandsten).
8. Coal (Stenkol).
9. Coal.
10. Fireclay (Eldfast lera).
11. Sandstone, Hör sandstone (Hörs sandsten Angelin).
12. Ditto ditto.

#### Triassic (?) and Upper Silurian.

13. Sandstone (triassic?) (Swed. Kågeröds sandsten. Angelin).
14. Red Clay (triassic?) (Röd lera. Angelin).
15. Red sandstone (Upper silurian) (Röd sandsten).

#### Silurian (including the "Primordial zone").

16. Upper Silurian limestone (Swed. Öfversilurisk kalksten).
17. Upper Silurian clayslate (Öfversilurisk lerskiffer).
18. Clayslate with graptolites (Graptolitskiffer).
19. Orthoceras limestone (Orthoceratitkalksten).
20. Alum schist (Alunskiffer), Primordial zone.
21. Bituminous limestone (Orstenskalk), as layers and nodules in alum-schist.

#### Cambrian.

22. Sandstone.
23. Sandstone.

Besides the above-mentioned rocks in Scania also occurs *Gneiss*, chiefly Red gneiss with magnetite (which occupies the north-east half of the province), and also *Diabase* and *Basalt* which appear in veins and small masses, both in the territory of the Gneiss and in that of the Silurian formation.

Of the rocks of the cretaceous formation, *Saltholm-* and *Ignabergalimestone* are raised in several places (Limhamn near Malmö and Ignaberga), in very large quantities for the burning of lime, and as material for the manufacturing of cement. From the *white Chalk*, several Chalk-manufactories (Qvarnby, Qvarnby nya, Sallerup, Jordberga) situated in the

neighbourhood to the east and south-east of Malmö, annually prepare upwards of 110,000 Centners (4,680,851 Kilogr.) purified chalk. The *younger Greensand* (Swed. Grönsandskalk) owing to the phosphoric acid contained in it (0,05 %) is a very valuable manure.

*Coal* (belonging to the Lias) occurs in several seams from 1 to 3 feet in thickness, and is at present raised at *Höganäs, Billesholm, Helsingborg, Bosarp, Bjuf* and *Stabbarp*. The coal-bearing formation embraces in the north-west part of Scania an area of about 10 geographical miles. The fire-clay occurring together with the coal, constitutes at Höganäs, Bjuf and Stabbarp the raw material for a very extensive manufacture of fire-bricks, glazed water-pipes, crockery, &c. which are in high repute both in this country and abroad. A very considerable quantity of fire-clay is annually exported to Copenhagen and other foreign places. The fine-grained Lias-sandstone is raised at Helsingborg for making grinding-stones. — The species of sandstone (Hör-sandstenen) (N:o 11 and 12) occurring at Hör and other places to the north of Ringsjön are in great request for building purposes and for the making of mill-stones and grinding-stones.

Of the red clays and red sandstones (Keuper? and Upper Silurian) (N:o 13, 14, and 15) which underlie the coal-bearing formation, only the sandstone occurring in the vicinity of Öfved and Ramsåsa (to the north of Ystad) has been used on a small scale as a building-material, and for grinding-stones.

At Bjersjöladugård, between Ystad and Eslöf, the *Upper Silurian limestone* is used for burning lime.

The *Orthoceras limestone* is used in a few places in the south-east of Skåne (Scania) as a building material, and for the burning of lime.

Those varieties of the *Silurian schists* which contain from 10 to 20 % of carbonate of lime are in several places

employed for marling the soil of the farms. From the *Alum-schist*, is prepared at Andrarum, *Alum*, *Green Vitriol*, and *Red Ochre*.

## Case B.

### Rock specimens from Dalsland.

(Stratigraphically arranged.)

24. Breccia (Swed. Breccia); Younger than the Dal-formation.  
 25. Breccia ditto ditto ditto.

**The Dal-Formation.** (Nonfossiliferous, Age not yet determined).

26. "Liane-schist" *Greywacke* (Swed. Lianeskiffer).  
 27. Conglomerate (Konglomerat); Layers in Liane schist.  
 28. Quarzite (Hvit qvartsit).  
 29. Quartzitic schist (Qvartsitskiffer).  
 30. Clayslate (Lerskiffer).  
 31. Chlorite-stone (Chloritsten).  
 32. Chlorite-stone.  
 33. Calcareous clayslate (Kalklerskiffer).  
 34. Clayslate (Lerskiffer).  
 35. Quartzitic sandstone (Qvartsitsandsten).  
 36. Conglomerate with a bowed pebble of quartzite.  
 37. Greywacke (Grävacka), composed of fragments of hällflinta.  
 38. Greywacke, composed of fragments of gneiss.

### Primitive Formation.

39. Green eurite (Grön eurit).
40. Eurite-conglomerate (Euritkonglomerat).
41. Quartzitic eurite (Euritquartsit).
42. Hälleflinta (Hälleflinta).
43. Hälleflinta schist (Hälleflintskiffer).
44. "Jerbogneiss", protogine-gneiss (Jerbogneis).
45. "Kroppefjäll-gneiss" Protogine-gneiss (Ögongneis, Kroppefjällsgneis).
46. Red gneiss (Röd gneis).

The *Clay-slate* of the Dal-formation is in some strata very applicable as roofing-slate, and in several places, for example, at *Hällan* and *Kjellsviken*, large slate-quarries, have been established out of which 2,700,000 plates are annually dug. The price per 1,000 pieces, is for example,

for Slate of 1 $\frac{1}{2}$ square foot *)	.....	200	Crowns
» » » 1 » »	.....	76	»
» » » 1 $\frac{1}{2}$ foot by 1	.....	63	»
» » » 0,7 by 0,4	.....	11	»

and in the same proportion for a number of other dimensions occurring in the market.

The *Quartzite* (N:o 28) occurring in thick beds, is in several places nearly of a white colour, and so pure (98,5 % silicic acid), that, in all probability, it might be advantageously employed in the manufacture of glass. In the clay-slate frequently occur beds of *limestone*, which is used for burning lime.

\*) 1 Swedish foot = 0,297 Mètre.



- 61. Silurian schist with graptolithes.
- 62. Orthoceras limestone (Orthoceratitkalksten).
- 63. Alum schist (Alunskiffer), Primordial zone.
- 64. Cambrian sandstone.

#### Primitive Formation.

- 65. Red gneiss (Swed. Röd gneis).
- 66. Diabase; eruptive, post-silurian; in dykes.

## II. SKOTTORP.

#### Recent Alluvium.

- 67. Peaty soil (Swed. Torfjord).
- 68. Alluvial clay (Svämmlera).
- 69. Alluvial sand (Svämmsand).
- 70. *Coarse sand and gravel*, obtained through sifting, from N:o 69.
- 71. *Middling fine sand*; First washing-product from N:o 69.
- 72. *Fine sand*; Second washing-product from N:o 69.
- 73. *Clay and fine powdery sand*; third washing-product from N:o 69.

#### Post-glacial Deposits.

- 74. Sand (Post-glacial-) (Mosand), from the subsoil.
- 75. Sand, (Post-glacial-), from the soil.
- 76. *Coarse sand and gravel*, obtained through sifting, from N:o 75.
- 77. *Middling fine sand*; First washing-product from N:o 75.
- 78. *Fine sand*; second washing-product from N:o 75.
- 79. *Clay and fine powdery sand*; third washing-product from N:o 75.

#### Glacial Deposits.

- 80. Glacial marl (Swed. Glacialmergel).
- 81. Crushed and destructed cretaceous deposits, Till (Swed. Krosstensgrus).

The great number of different rocks and quaternary deposits which occur in the parish of Tosterup (which forms a private estate and embraces an area of 2,500 acres in the south-east of Scania, are to be noticed. The extension and position of the rocks are shown in the maps and sections. — The calciferous Diluvial sand and the calciferous boulderclay (Krosstenslera), as well as the calcareous sandstone (younger greensand, Köpings-sandstone) belonging to the cretaceous formation, are of great value as fertilizers. The presence of *Orthoceras* limestone and Alum-schist is likewise of great importance to the farmer. — For the estates of Skottorp (and Dömmerstorp) in Halland, where the upper soil consists mostly of sand, the deposits of glacial marl and the gravel from a destroyed cretaceous formation, is of great importance.

### Case D.

#### Specimens from the quaternary deposits of Sweden.

(Stratigraphically arranged).

##### Recent alluvium.

82. Mossy peat (Swed. Mosstorf); ashes 1 %.
83. Peat (Torf, Torfdy).
84. Peat; (askes 6,3 %).
85. Peat.
86. Freshwater slick (Gyttja).
87. Freshwater slick mixed with shells (Snäckgyttja).
88. Alluvial clay with freshwater shells (Alluviallera, med sötvtattensnäcker).
89. Alluvial sand (Alluvial sand, Svämmsand).

### Post-glacial Deposits.

90. Post-glacial clay (Swed. Postglaciallera, åkerlera).
91. Post-glacial clay.
92. Fucus-clay (Fucuslera, Svartlera).
93. Fucus-clay, with *Tellina Baltica*.
94. Sand (Post-glacial-) (Postglacialsand, Mosand).
95. Shell-bed (Snäckgrus, Skalgrus, Snäckmergel).
96. Sand, (Post-glacial-).
97. Sand, (Post-glacial-).
98. Sand, (Post-glacial-).

### Glacial Deposits.

99. Glacial clay (Swed. Glaciallera, Hvarfvig lera).
100. Glacial clay.
101. Glacial marl (Glacialmergel, Hvarfvig mergel).  
Carbonate of lime and magnesia = 16,0 %.  
Phosphoric acid..... = 0,3 »
102. Glacial marl.
103. Pebbly gravel and sand, **Kames, Eskers** (Swed. Rullstensgrus [Åsar]).
104. Sand and gravel.
105. Boulderclay (Krossenslera).
106. Till, **Morainematter** (Krosstengräs).
107. Diluvial sand (Diluvialsand). Carbonate of lime and magnesia = 12,5 %.

In almost every Swedish province occur large and thick beds of peat, of which some are cultivated, others used for preparing peat for fuel, but the greater part, especially in the northern half of the country is still unemployed. The uppersoil mostly consists of post-glacial clay (åkerlera) and glacial clay. For the improvement of soil wanting lime, *Freshwater slick mixed with shells* (Snäckgyttja), *Shells-beds* (Snäckgrus), *Glacial marl* (Glacialmergel), *Calcareous Boulder-*

*clay*, (Krosstenslera), and Calcareous Diluvial sand, may be mentioned as particularly valuable. From the various post-glacial and glacial clays are manufactured, in innumerable places in the country, Bricks, Roof-tiles, Earthen-ware, &c. — The sand and pebbles occurring in the "Åsar" make an excellent material for the improvement of the highways. — The stratigraphical relation of the quaternary deposits of Sweden are illustrated by a section on the great geological map.

### Cases E and F.

#### Characteristic Rock specimens from the Primitive Formation of Sweden.

(Stratigraphically arranged).

##### Clay-slate, Pre-Cambrian.

- 108. Clay-slate (Swed. Lerskiffer).
- 109. Clay-slate.

##### Eurite Group.

- 110. Hällefinta (Swed. Hällefinta).
- 111. Porphyric Hällefinta (Hällefintporfyr).
- 112. Hällefinta-slate (Hällefintskiffer).
- 113. Streaky Hällefinta (Randig Hällefinta).
- 114. Eurite (Eurit).
- 115. Dolomite (Dolomit) in Eurite.
- 116. Crystalline limestone (Kornig kalksten, Marmor).
- 117. Magnetic iron-ore (Magnetisk Jernmalm).
- 117<sup>a</sup>. Red iron-ore (Blodstensmalm) (in Eurite).
- 118. Eurite.
- 119. Mica schist (Glimmerskiffer).
- 120. Mica schist.

### Red Gneiss Group.

- 121. Red Gneiss (Röd Gneis).
- 122. Red Gneiss.
- 123. Red Gneiss.
- 124. Amphibolithe schist (Hornblendeskiffer), (Layer in red gneiss).
- 126. Magnetic iron-ore (Magnetisk Jernmalm) (in red gneiss).
- 127. Crystalline limestone, (in red gneiss).
- 128. Crystalline limestone, (in red gneiss).
- 129. Crystalline limestone.

### Grey Gneiss Group.

- 130. Grey Gneiss (Grå Gneis).
- 131. Hornblendic gneiss (Hornblendegneis).
- 132. Grey gneiss.
- 133. Garnet Gneiss (Granat-gneis).
- 134. Eulysite (Eulysit. A. Erdmann), composed of Olivine, Augite, and Garnet.
- 135. Diorite-schist (Dioritskiffer).
- 136. Diorite-schist.

### Magnetite Gneiss Group.

- 137. Magnetite gneiss (Redgneiss sparkled with small grains of magnetic iron-ore) (Magnetgneis, Jerngneis).
- 138. Magnetite Gneiss.
- 139. Magnetite Gneiss.

### Basic Plutonic Rocks.

- 140. Diabase (Trapp).
- 141. Diabase.
- 142. Labradore Porphyry (Labradorporphyr).
- 143. Diabase (Diabas).
- 144. Diorite (Diorit).
- 145. Diorite.

### Granite.

146. Pegmatite (Pegmatit), (with Turmalin).
147. Stockholm Granite (Stockholmsgranit).
148. Stockholm Granite, with fragments of gneiss.
149. Granite.
150. Granite (Örebrogranit,) with Titanite.
151. Granite.
152. Syenitic Granite (Hornblendegranit, Syenitgranit).
153. Syenitic Granite.

Among all the formations in Sweden, the *primitive formation* embraces the greatest area. The primitive formation, especially its younger group (the Eurite group) contains the principal of the iron-, copper-, lead-, and zinc-ores in Sweden, and many of its rocks, as granite, porphyry, and crystalline limestone, are extensively employed for architectural, monumental, and artistic purposes\*). — From the primitive clay-schist and Hällefrinta slate (N:o 108 and 112) roof-slate is made, and the crystalline limestone (N:o 116, 127, and 128) is generally used for burning lime.

### Case G.

#### Concretions (Swed. Marlekor, Imatra stenar) from the glacial and post-glacial deposits of Sweden.

154—165 show various forms of the concretions, so-called marlekor (Imatrastones) occurring in the glacial and post-glacial deposits. They are more or less regularly and completely developed. N:o 158 from Lapland consists of a hard ferruginous clay, and the rest of hard calcareous clays.

\*) See further in this respect, page

## Cases H and I.

## Shells from the Glacial Deposits of Sweden.

166. *Balanus porcatus*.  
 167. *Balanus Harmerii* (*B. tulipa*).  
 168. *Balanus crenatus*.  
 169. *Buccinum undatum*.  
 170. *Buccinum Grönlandicum*.  
 171. *Fusus despectus*.  
 172. *Fusus latericius*.  
 176. *Fusus Turtoni*.  
 173. *Trophon clathratus*. var. *Major*.  
 174. *Natica clausa*.  
 174<sub>a</sub>. *Natica Grönlandica*.  
 175. *Natica Nelicoides*.  
 177. *Scalaria Eschrichtii*.  
 178. *Margarita undulata*.  
 179. *Puncturella Noachina*.  
 180. *Piluscus commodus*.  
 181. *Lepeta cœca* (*Patella cœca*).  
 182. *Pholas crispata*.  
 183. *Mya truncata*, var. *Uddevallensis*.  
 184. *Tellina proxima* (*T. lata*, Lovén).  
 184<sub>a</sub>. *Tellina solidula* (*T. baltica*, Linné).  
 185. *Saxicava arctica*.  
 185<sub>a</sub>. *Lucina flexuosa*.  
 186. *Astarte arctica*. (*A. Corrugata*, Lovén, Torell).  
 187. *Astarte compressa*.  
 188. *Astarte sulcata*.  
 189. *Modiola modiolus*.  
 190. *Mytilus edulis*.  
 191. *Yoldia pygmæa*, var. *gibbosa*.  
 192. *Yoldia arctica*, var. *b.* (Sars).

193. *Leda pernula*.

194. *Pecten islandicus*.

In the districts about the west coast of Sweden, entire and broken shells, enclosed either in glacial clay or sand and gravel, are found in several places, and at heights varying from 90 to 500 feet above the level of the sea. These remains of shells occur both isolated (generally in clay) and in large or small heaped up masses (*snäckgrus*, *skalgrus*), so-called *bancs of shells* (*skalbankar*), which mostly are distinct coastformations. Of these shell-banks, that at the greatest level above the sea, or about 500 feet, lies in the neighbourhood of Gustafsfors near Lake Westra Silen in Dalsland, distant five miles from the German Ocean. Among places well known as localities for glacial mollusca may be mentioned: *Kapellbacken* near Uddevalla, *Marieberg*, *Bräcke*, and *Risån* immediately to the east of this town, *Billingsfors* and *Tusendalersbacken* in *Dalsland*, and *Hunneberg* in *Wester-götland*.

In the glacial marl of the neighbourhood of Lake Mälaren, *Yoldia arctica*, var. *b.* Sars. has been met with; but the *shells-banks* which occur in the eastern parts of the country, as far as has been hitherto ascertained, do not belong to the glacial, but to the post-glacial period.

### Case K.

**Lake- and Bog-iron-ore** (Swed. *Sjömalm* och *Myrmalm*).

198. **Lake-ore** (var. *Gunpowder-ore*).

199. Ditto (ditto ditto).

200. Ditto (ditto *Pearl-ore*).

201. **Lake-ore** (var. Pearl-ore).  
 202. Ditto (ditto ditto ).  
 203. Ditto (ditto ditto ).  
 204. Ditto (ditto ditto ).  
 205. Ditto (var. Money-ore).  
 206. Ditto (ditto ditto ).  
 207. Ditto (var Skragg-ore [Swed.]).  
 208. Ditto (ditto ditto ).  
 209. Ditto (ditto ditto ).  
 210. **Bog-ore.**  
 211. Ditto.  
 212. Ditto.  
 213. Ditto.

A great many of the Swedish lakes and bogs contain iron-ores of a recent age, nay, in many places deposits of the same are still daily accumulating. The ore consists of knotty or cloddy, conglobate, oval, unicular and money-formed concretions. An hydrous peroxyd of iron is their chief component.

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### Case L.

Rock Specimens illustrating the geological map of the iron-ore district of Persberg.

214. Crystalline limestone.  
 215. Dolomite.  
 216. Granite.  
 217. Schistose eurite.  
 218. Laminated eurite.  
 219. Transition-form between eurite and veinstone.  
 220. Veinstone (*Amphibolie rock*) (Amphibolfels).  
 221. Veinstone (*Garnet-pyroxæn rock*) (Granat-Pyroxenfels).

222. Garnet rock.

223. Magnetic iron-ore.

These specimens show the transition from a dead rock to ore, and they may therefore answer the purpose of proving that the Swedish iron-ores occur in real *strata*, and not in veins.

### III.

#### POLISHED CUBICAL SPECIMENS OF SWEDISH ORNAMENTAL AND BUILDING STONES.

1. **Diorite** from Långviksnäs, Parish of Änimskog, Dalsland.
2. **Marble**, grey and light-green, flamy, from Krackelbacken near the Sala mine, Vestmanland.
3. **Marble**, green, from the marble-quarry of Vrå in the parish of Hölö, Södermanland.
4. **Limestone**, Upper-Silurian, from the north-west side of the island Great Carlsö, Gottland.
5. **Granite**, red, coarse-grained, from Strand-See, Parish of Tibble, Upland.
6. **Marble** from Senneby, Parish of Wäddö, Upland.
7. **Granite**, light-grey, fine-grained, from the quarry of Solna, by Stockholm.
8. **Potstone** from Tegen, Parish of Ödeborg, Dalsland.
9. **Fonolith**, green, with crystals of Natrolite grown in it; erratic blocks on the banks of the river East Dalelfven in the parishes of Elfdal and Särna and the river West Dalelfven in the parish of Transtrand, Dalecarlia.
10. **Orthoceras limestone** from Latorp, Nerike.
11. **Granite**, red, from the parish of Nora, Upland.
12. **Marble** from the Carl-Shaft of the Sala mine, Vestmanland.
13. **Porphyry**, dark-brown, from Blidberg, parish of Elfdal, Dalecarlia.
14. **Marble**, white, from the vicinity of Lake Elflängen, Parish Nora, Vestmanland.

15. **Fetid limestone** or **bituminous limestone** from the Nygård-quarry at Hunneberg, Parish Tunhem, Vestergötland.
16. **Limestone, Upper-Silurian**, from the south east side of the island Great Carlsö, Gottland.
17. **Limestone, Upper-Silurian**, from the south-east side of the island Great Carlsö, Gottland.
18. **Orthoceras limestone** from the stone-quarry of Thorvalla, Parish Brunflo, Jemtland.
19. **Marble**, white, from the marble quarry of Claestorp, Parish East Vingåker, Södermanland.
20. **Diorite** from Berga, Parish Kila, Vestmanland.
21. **Marble**, reddish, from Vikersvik, Parish Nora, Vestmanland.
22. **Limestone, Silurian**, from the village of Berga in Frösö, Jemtland.
23. **Granite**, gray, fine-grained, from the Tyskbagar-hills near Stockholm.
24. **Marble**, green and brown, streaky, from the quarry of Kolmården, Östergötland.
25. **Marble**, from the marble quarry of Claestorp, Parish East Vingåker, Södermanland.
26. **Orthoceras limestone** from Öland.
27. **Diorite** from the village of Stälbo, Parish Nora, Upland.
28. **Marble**, variegated flamy, from the marble-quarry of Claestorp, Parish East Vingåker, Södermanland.
29. **Diorite** from the neighbourhood of Tverred church, Vestergötland.
30. **Limestone, Upper-Silurian**, from the parish of Garda, Gottland.
31. **Porphyry**, brownish red, erratic blocks from the villa of Roth, Parish Elfdal, Dalecarlia.
32. **Magnetite gneiss** from Vårgårda, Parish Sköfde, Vestergötland.
33. **Syenitic granite**, grey, from the neighbourhood of Upsala.

34. **Marble** from the marble-quarry of Claestorp, Södermanland.
35. **Granite**, red, coarse-grained, from Ramnäs Iron Works, Parish Ramnäs, Vestmanland.
36. **Limestone, Upper-Silurian**, from the south-east side of Carlsö, Gottland.
37. **Granite**, grey, fine-grained, from Örnsköldsvik, Ångermanland.
38. **Marble**, green, and yellow, from the marble quarry of Kolmården, Östergötland.
39. **Gneiss** from the mountains north of Åmål, Dalsland.
40. **Marble** from the parish of Glanshammar, Nerike.
41. **Diorite** from Eriksberg, Parish Rinkarleby, Nerike.
42. **Orthoceras limestone** from Öland.
43. **Schillerspar** with crystals of anorthite grown in it, from Snörom, Parish Nora, Upland.
44. **Orthoceras limestone**, transparent brownish grey, streaky, from Öland.
45. **Magnetite gneiss** from Trandared, Parish Torpa, Västergötland.
46. **Diorite** from Hylla, Parish Kila, Vestmanland.
47. **Orthoceras limestone** from Berg, Östergötland.
48. **Granite** from the parish of Ringkarleby, Nerike.
49. **Marble**, green and grey with yellow flames, from the marble quarry of Kolmården, Östergötland.
50. **Conglomerate**, erratic blocks on the banks of the river West Dalelfven, Parish Transtrand, Dalecarlia.
51. **Marble** from the Carl-shaft of the Sala mine, Vestmanland.
52. **Granite**, with pistazite grown in it, from Hult, Parish Ånimskog, Dalsland.
53. **Garnet gneiss** from Gustafsvik, Parish Lerbo, Södermanland.
54. **Marble**, dull green, flamy and streaky, from the marble quarry of Kolmården, Östergötland.

55. **Granite**, grey, fine-grained from the hills of Inge-marshof near Stockholm.
56. **Marble**, white with yellow streaks, from the neighbourhood of Lake Elflången, Parish Nora, Vestmanland.
57. **Syenitic granite** from Elfgärde, Parish Rasbo, Upland.
58. **Sandstone** from Stenskogen, Parish Hör, Scania.
59. **Limestone, Upper-Silurian**, from the parish of Nähr, Gottland.
60. **Diorite** from the neighbourhood west of Långviken, Parish Änimskog, Dalsland.
61. **Marble** from the parish of Glanshammar, Nerike.
62. **Clay-slate** from the roofing-slate quarry of Hällan, Dalsland.
63. **Marble**, grey, spotted light-red, from the Sala mine, Vestmanland.
64. **Trap** from Hunneberg, Parish Tunhem, Vestergötland.
65. **Marble** from the Carl-shaft of the Sala mine, Vestmanland.
66. **Granite**, grey, fine-grained, from the stone-quarry at Hufvudsta near Stockholm.
67. **Bituminous limestone**, from the Latorp Alum-work, Parish Tysslinge, Nerike.
68. **Limestone, Upper-Silurian**, from the parish of Nähr, Gottland.
69. **Granite**, dark-grey, porphyritic, from Strömbacka near Sala, Vestmanland.
70. **Marble**, grey, streaky brown, from the Wäddö-district in Roslagen, Upland.
71. **Marble**, dark greenish grey, white-spotted, from the marble-quarry at Claestorp, Parish Öster Wingåker, Södermanland.
72. **Sandstone** from the Hals stone-quarry, Parish Motala, Östergötland.
73. **Sandstone** from the Hals stone-quarry, Parish Motala, Östergötland.

74. **Uralite-Porphry** from the parish of Waksala, Upland.
  75. **Limestone, Upper-Silurian**, from Hoberg, Gottland.
  76. **Marble**, dark grey, from the Sala mine, Vestmanland,
  77. **Marble**, light greenish grey with redflamy stripes, from the marble-quarry of Kolmården Östergötland.
  78. **Hälleflinta** from Elvansborg, Parish Rasbo, Upland.
  79. **Limestone, Upper-Silurian**, from the neighbourhood of the Ljugarn harbour, Gottland.
  80. **Orthoceras limestone** from Öland.
  81. **Marble**, light greenish grey, white-spotted, from the marble-quarry at Claestorp, Parish Öster Wingåker, Södermanland.
  82. **Sandstone** from Hör in Skåne.
  83. **Diorite** from Hylla, Parish Kila, Vestmanland.
  84. **Marble**, yellow and green, from the marble-quarry at Claestorp, Parish Öster Wingåker, Södermanland.
  85. **Sandstone** from the south side of Gottland.
  86. **Granite**, red, from Ytterby 1,5 miles north-east of Stockholm.
  87. **Granite** from the parish of Ringkarleby, Nerike:
  88. **Sandstone** from the parish of Hör in Skåne.
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89. **Porphyry**, dark green, from Klittberg, Parish Elfdal, Dalecarlia.
  90. **Marble** from the Drottning-shaft of the Sala mine. Vestmanland.
  91. **Marble**, yellowish green, white-flamy, from the marble quarry at Claestorp, Parish Öster Wingåker, Södermanland.
  92. **Limestone, Upper-Silurian**, from Hoberg, Gottland.
  93. **Diorite** from Läckarbo, Parish Nora, Upland.
  94. **Granite**, dark, micareous, from "the white hills", (Swed. Hvita bergen) Stockholm.
  95. **Granite**, red, from Ytterby 1,5 miles north-east of Stockholm.

96. **Marble**, green and black, from the marble-quarry at Claestorp, Parish Öster Vingåker, Södermanland.
97. **Porphyry**, light brownish red, from Orrlockskärn, Parish Elfdal, Dalecarlia.
98. **Hyperite** from the hill Kasberget near the Iron Works of Billingsfors in the parish of Laxarby, Dalsland.
99. **Porphyry**, black, white-spotted, from Mount Hyckieberget, Parish Elfdal, Dalecarlia.
100. **Granite** from Norrbybacke, Parish Sala, Vestmanland.
101. **Granite**, red, coarse-grained, from the Iron Works of Lisjö, Parish Sura, Vestmanland.
102. **Granite**, grey, fine-grained, from the isle of Malmö, Bohuslän.
103. **Marble**, veiny light-green, from the quarry at Singö, Parish Singö, Upland.
104. **Marble**, variegated striped and spotted, from the marble-quarry at Claestorp, Parish Öster-Vingåker, Södermanland.
105. **Marble**, white, green-striped, from the marble-quarry at Singö, Parish Singö, Upland.
106. **Marble**, green- and grey-striped, from the marble-quarry of Kolmården, Östergötland.
107. **Granite**, grey, fine-grained, from the stone-quarry at Hufvudsta near Stockholm.
108. **Marble**, dark grey, from the Sala mine, Vestmanland.
109. **Granite** from the Iron-Works of Virsbo, Vestmanland.
110. **Marble**, green-flamy, from the Sala mine Vestmanland.
111. **Porphyry**, dark brown, from Mount Klittberget, Parish Elfdal, Dalecarlia.
112. **Marble**, green with white stripes and yellow flames, from the marble-quarry of Kolmården, Östergötland.
113. **Porphyry**, reddish brown, from Orrlockskärn, Parish Elfdal, Dalecarlia.
114. **Diorite** from Kattelberg, Parish Sala, Vestmanland.

115. **Granite**, red, porphyritic, erratic blocks at the village of Roth, Parish Elfdal, Dalecarlia.
116. **Limestone, Upper-Silurian**, from the neighbourhood of the harbour of Ljugarn, Gottland.
117. **Marble** from the neighbourhood south-west of the town of Nora, Vestmanland.
118. **Marble**, yellow- and white-spotted, from the marble-quarry of Kolmården, Östergötland.
119. **Syenitic granite**, grey, from Vik, Parish Balingsta, Upland.
120. **Schillerspar** from the district between Karbo and Rödjebro, Parish Harbo, Upland,
121. **Marble**, light, green-spotted, from the marble-quarry of Kolmården, Östergötland.
122. **Granite** from the neighbourhood of Edsviken, Parish Danderyd, Upland.
123. **Marble**, reddish, from Vikersvik at Lake Vikern, Parish Nora, Vestmanland.
124. **Diorite** from the neighbourhood of Tarmlången and Strandsjö, Parish Järlåsa, Upland.
125. **Orthoceras limestone**, brownish grey, from the limestone-quarry of Borghamn at Omberg, Parish Roxlösa, Östergötland.
126. **Marble**, grey with dark veins and flames, from the neighbourhood of Mårshyttan and Fauthyttan, Parish Linde, Vestmanland.
127. **Marble**, greenish white, from the marble-quarry at Singö, Parish Singö, Upland.
128. **Granite**, grey, fine-grained, from the isle of Malmö, Bohuslän.
129. **Hyperite**, coarse-grained, from Åsby, Parish Elfdal, Dalecarlia.
130. **Orthoceras limestone**, brown, from the limestone-quarry of Borghamn at Omberg, Parish Roxlösa, Östergötland.
131. **Limestone, Silurian**, from Latorp, Nerike.

132. **Limestone, Upper-Silurian**, from the parish of Öja, Gottland.
133. **Marble** from the Carl-shaft of the Sala mine, Vestmanland.
134. **Granite**, grey, coarse-grained, from the neighbourhood of Tarnlängen and Lake Strand, Parish Järlåsa, Upland.
135. **Phonolite**, greyish green with crystals of natrolith and hornblende scattered in it, erratic blocks on the banks of the river West-Dalelven in the parish of Transtrand, and on those of the river Ost-Dalelven in the parish of Elfdal and Särna, Dalecarlia.
136. **Limestone** from the stone-quarry south of Märshyttan, Vestmanland.
137. **Porphyry** from Långviksnäs, Parish Änimskog, Dalsland.
138. **Marble**, green-striped, from the marble-quarry at Claestorp, Parish Öster Vingåker, Södermanland.
139. **Marble**, green- and grey-flamy, from the marble-quarry at Claestorp, Parish Öster Vingåker, Södermanland.
140. **Orthoceras limestone** from Öland.
141. **Granite**, red, coarse-grained, erratic blocks from the village of Gåshvarf, Parish Elfdal, Dalecarlia.
142. **Orthoceras limestone**, reddish brown, from the stone-quarry of Borghamn at Omberg, Parish Roxlösa Östergötland.
143. **Marble**, grey, green-spotted, from the marble-quarry at Claestorp, Parish Öster Vingåker, Södermanland.
144. **Hornblendic gneiss** from the stone-quarry south-west of the town of Upsala.
145. **Marble** from the marble-quarry at Singö, Parish Singö, Upland.
146. **Granite**, north of Hinseberg, Parish Näsby, Nerike.
147. **Diorite** from Berga, Parish Kila, Vestmanland.
148. **Orthoceras limestone** from Yxhult, Parish Kumla, Nerike.

149. **Marble**, greyish white, from Bengtstorp, Parish Nora, Vestmanland.
150. **Diorite** from Örlösa, Parish Örlösa, Västergötland.
151. **Marble** from Edeby, Parish Wäddö, Upland.
152. **Porphyry**, dark green, from the parish of Waksala, Upland.
153. **Marble**, greenish grey, from the marble-quarry of Kolmården, Östergötland.
154. **Granite** ("Örebro-Granite"), red, from the parish of Fellingsbro, Nerike.
155. **Marble** from the quarry of Skrikarhytta, Parish Nora, Vestmanland.
156. **Sandstone**, erratic blocks, from Roslagen, Upland.
157. **Marble** (so-called "Grey-limestone") from the Cobolt-mine at Tunaberg, Parish Tunaberg, Södermanland.
158. **Limestone**, **Upper-Silurian**, from the parish of Nähr, Gottland.
159. **Granite**, red, coarse-grained, from the neighbourhood of Edsviken, Parish Sollentuna, Upland.
160. **Limestone**, **Upper-Silurian**, from Hoberget, Gottland.
161. **Marble**, transparent, from Limbergsås, Parish Fernebo, Vermland.
162. **Sandstone**, **Upper-Silurian**, from the grindingstone-quarry at Bursviken, Gottland.
163. **Sandstone**, **Silurian**, from Frösö, Jemtland.
164. **Sandstone**, red, erratic blocks from Ernhörna, Södermanland.
165. **Marble**, yellowish white, from the parish of Nora, Vestmanland.
166. **Marble**, yellowish green, veiny white, from the stone-quarry of Kolmården, Östergötland.
167. **Orthoceras limestone** from Skärsäter, Nerike.
168. **Diorite-porphyry** from Käggholm, Parish Ödeby, Nerike.

169. **Marble** from the neighbourhood south-west of Nora and Lake Vikern, Vestmanland.
170. **Sandstone**, erratic blocks in the parishes of Årsunda, Ofvansjö, and Valbo, Gestrikland.
171. **Limestone, Upper-Silurian**, from the parish of Nähr, Gottland.
172. **Syenitic Granite** from Håga, Parish Bondkyrka, Upland.
173. **Malacolite** from the mine of Tunaberg, Södermanland.
174. **Marble** from the southern shores of Lake Vikern, Vestmanland.
175. **Sandstone**, erratic blocks, from Roslagen, Upland.
176. **Limestone, Upper-Silurian**, from the south-east side of Carlsö, Gottland.

### Review of the practical use of these Rocks.

**Granite**, N:o 5, 7, 11, 23, 35, 37, 48, 52, 55, 57, 66, 69, 86, 87, 94, 95, 100, 101, 102, 107, 109, 115, 119, 122, 128, 134, 141, 146, 154, 159, 172.

This stone is extensively used for architectural, and monumental purposes. Among the varieties of the same here exhibited, the following deserve in these respects a more particular notice.

- a) From *Hufvudsta*, N:o 66 and 107. Like all the granite occurring in the immediate neighbourhood of the capital, it is of a grey colour, varying in texture from small-grained to fine-grained, and of a very compact and hard composition. The new sluices, the pillars of the new bridge between Skeppsholm and Blasieholm, the splendid quays of the Skeppsbro and the Mälar-harbour, &c. are constructed of granite

from the extensive quarries at Hufvudsta. The pedestals of the statues of *Berzelius* and of *Charles XII* have also been cut from the same quarries. Several orders from abroad during the last few years prove that this kind of stone is also justly in high repute in foreign countries.

- b) From the island of *Malmö* in the province of Bohus N:o 102 and 128. The colour is grey with a very slight tinge of red, and the texture varies from small-grained to fine-grained. The granite from the island of *Malmö* is noted for being easily quarried and for the facility of working it. This species of rock is likewise extensively used for various monumental and architectural purposes, and it is also exported.
- c) From *Solna* N:o 7, *Ingemarshof hills*, N:o 55, and the *Tyskbagar hills* N:o 23, near Stockholm, are all extensively used as stones for building purposes, for tombs and other monuments, &c. In colour and texture, they resemble more or less the granite from Hufvudsta. The pillars (monoliths) and the rest of the masonry of *Lejonbacken* (the Lion-hill) at the north side of the king's place are beautiful specimens of the granite from *Solna*.
- d) From *Gåshvarf* in Dalecarlia, N:o 141. The colour is reddish, and the texture coarse-grained. The sarcophagus of *Charles XIV*, and also the magnificent large vase at *Rosendal Royal place* are made of this beautiful, rather porphyritic granite.
- e) From *Roth* in Dalecarlia, N:o 115. The colour is almost deep red, and the texture not coarse-grained porphyritic. At the *Elfdal Porphyry Works*, it is made into table-tops, urns, vases, &c.
- f) From *Örnsköldsvik*, N:o 37. Of this granite, which is of a fine-grained texture and a grey colour, blocks of very large dimensions may be dug out of the

quarry without any great difficulty. Its quality of being easily split in almost any direction and with perfectly smooth surfaces still more increases its practical use.

g) From *Lisjö*, N:o 101, *Edsviken*, N:o 122 and 159, *Ramnäs*, N:o 35, *Ytterby*, N:o 86 and 95, *Strandsjön*, N:o 105, are all of a red colour and coarse-grained texture, and when cut and polished they look very handsome. The pillars in front of the so-called Ugglas' house in Queen-Street in Stockholm, and the pedestal of the equestrian statue of Gustavus II Adolphus, are constructed of the same species of stone. The granite occurring in the neighbourhood of Ramnäs, has been employed at the construction of the Strömsholm Canal, and two fine pillars of the same kind of granite ornament the principal building of the Ramnäs Iron Works.

h) *Hornblende-granite* from the neighbourhood of *Upsala*, N:o 57, 119, and 172. It is generally of a grey colour, but rather dark, owing to the presence of the hornblende. This fine rock, distinguished by its bluish grey quartz, is very extensively used, being the only kind of stone serviceable for building purposes that is at the command of the town of Upsala. The new foundation of Upsala Cathedral consists of this stone.

*N. B.* The specific gravity of the different varieties of granite is from 2, 56 to 2, 67. A cubic foot (26,1 K. = decim.) of this stone weighs from 157 to 164 Swedish pounds (66,7—69,7 Kilogr.), and, when put into water for about 90 hours, absorbs from 3 to 7 Ort (from 12,73 to 29,75 Grammes) of water.

**Diorite** N:o 1, 20, 27, 29, 41, 46, 60, 83, 93, 114, 124, 147, 150.

This stone, which hitherto has been of no practical use, is generally distinguished by its dark-green, monotonous colour. In some varieties, for example, N:o 20, 29, 46, 83, and 114, in which the felsparlike mineral occurs in rather larger proportions, the grainy texture is, however, more conspicuous, which gives to the polished surface a pretty, spotted appearance. But the hardness and toughness of the stone will probably be great obstacles to its being more generally used.

**Hyperite**, N:o 98 and 129; **Trap**, N:o 64; **Schillerspar**, N:o 43 and 120.

Of the rocks belonging to this division, which are here exhibited, the pretty *Hyperite from Åsbyn* at Elfdal, N:o 129, is the only one that has hitherto been used, though only on a small scale, for table-tops, urns, vases, paper-weights, &c. and also for tombstones, for which purpose it is very suitable on account of its gloomy colour.

The Schillerspar from Snärom, N:o 43, with its white anorthite crystals strewn in the block mass of schillerspar is a rock, to which no attention has hitherto been paid, but the appearance of which ought to make it very applicable for monumental purposes.

**Porphyry** N:o 13, 31, 74, 89, 97, 99, 111, 137, 152.

The porphyries from Elfdal in Dalecarlia here exhibited (all excepting N:o 74, 137, and 152) comprise only a part of the varieties employed at the porphyry-works, formerly in operation there; all are well known for their fine appearance and for the beautiful and lasting polish they take. Their application for the making of urns, vases, columns, pedestals, bases, tombstones, table-tops, dishes, plates, knife-handles, boxes, &c. is generally known both in Sweden and abroad.

*N. B.* The specific gravity varies between 2,60 and 2,64. A cubic foot (26,1 Cubic decimeters) weighs from 160 to 162 Swedish pounds (68—69 Kilogr.), and absorbs only from 3 to 5 ort (12,8—20,8 Grammes) water after having been steeped in it for about 90 hours.

**Phonolite** N:o 9 and 135. This fine rock has hitherto been met with only in the shape of larger or smaller boulders on the banks of the river Ost-Dalelven in the parishes of Elfdal and Särna, and on those of the West-Dalelven in the parish of Transtrand. Hence it follows that only small objects, such as paper-weights, butter-dishes, boxes, knife-handles, &c. can be made out of it. At the former porphyry-works of Elfdal, it was known under the name of "serpentine".

**Potstone.** N:o 8. This rock which can be worked with the greatest facility does also occur in several other places in Sweden, as, for example, at Handöl in Jemtland, Löddby in Upland, in the parishes of Töksmark and Glafva in Vermland, &c. It is distinguished by its quality of being fire-proof, and is employed for making hearth-stones, bottoms of ovens, linings of furnaces, in the building of smelting houses and all sorts of fire-places, as well as for making various sorts of household-utensils, such as pots, pans, butter-tubs, inkstands, &c.

**Hälleflinta,** N:o 8. Has hitherto been used only as a material for building and repairing roads.

**Gneiss,** N:o 32, 39, 45, 53, and 144.

Of the few specimens here exhibited, N:o 53 belongs to the *garnet-gneiss*, which is much spread in the provinse of Nyköping, and N:o 32 and 45 to the *magnetite-gneiss* generally occurring in Vestergötland, which latter is in general distinguished for the

facility with which it may be dug out and cut, or split into more or less thick squares or slabs.

**Marble.** a) From the *marble-quarry at Claestorp*, N:o 19, 28, 34, 71, 81, 84, 91, 96, 104, 138, 139, 143.

The species here exhibited, excepting the white grainy variety N:o 19, do all belong to the rock named *Ophicalcite*, i. e. a limestone intermixed or filled up with veins, streaks, dots, or flames of variously coloured *Serpentine* (Ophite). Here we meet with an uncommonly great number of beautiful varieties, which, at the marble-works established a few years ago, are made into many different objects, such as columns, pedestals for statues, &c., vases, urns, table-tops, inkstands, match-boxes, chess-boards, &c.

b) From the *Marble-quarry at Kolmården*, N:o 24, 38, 49, 54, 77, 106, 112, 118, 121, 153, 166.

These species of marble here exhibited are likewise more or less intermixed with serpentine, and ought therefore to be considered as *Ophicalcites*. They have for many years continually been made into various objects, such as pillars, pedestals, tombstones, borders for gates and walls, table-tops, vases, urns, mortars, inkstands, match-boxes, &c.

The outer portico of the National-Museum in Stockholm is of Kolmård-marble, and so are the columns of the Royal Post-Office, and of the house in Charles XIII square formerly called Davidson's, and the entrance-hall, the stair-cases, together with their pillars and wainscoting, in the house of the Private Bank in Lilla Nygata (Little New-Street). The marble used for these and similar architectural purposes, is chiefly brought from the so-called Bruksbrott, which is situated close to the Marble Works.

For the whole of the interior adornment of the staircases and vestibules, &c. of Stockholm Royal Palace, marble from the so-called Limbrott has been used; but this quarry has not been worked for upwards of a century.

c) From the *neighbourhood of the town of Nora* N:o 14, 21, 56, 117, 123, 126, 149, 165, 169, 174.

The beautiful varieties of marble which here occur, have not in an architectural point of view attracted so much notice as they actually seem to deserve. The portal of Hotel Rydberg in Stockholm is of Nora marble.

d) From *Sala* N:o 2, 12, 51, 63, 65, 76, 90, 108, 110, 133.

The specimens here exhibited show what a variety of beautiful colours the Sala marble affords. It has, however, not as yet been used for any architectural purpose.

e) From *Singö marble-quarry*, N:o 103, 105, 127, 145.

The different varieties here occurring are used for door- and window-frames, tessellated floors, tombstones, table-tops, &c.

f) From the *other localities*, N:o 3, 40, 61, 7P, 151, 155, 157, 161.

N. B. The specific gravity of the different marbles varies between 2,60 and 2,85, and in such a way, that the purer and freer from foreign intermixtures the rock is, the greater is generally the specific gravity. A Swedish cubic foot (26,1 Cubic decimètres) weighs between 161 and 175 Swedish pounds (68,4 74,4 Kiligr.) and absorbs from 0,01 to 0,26 pounds of water after having been steeped in it for about 90 hours. The purer varieties are less apt to absorb moisture.

The employment of this rock for burning lime and for the mixing of the ores in furnaces is well known.

**Bituminous limestone** N:o 15 and 67. This rock, which occurs in various places in the country, as at Kinnekulle, in the so-called Falbygds Mountains, in Scania, in Öland, in Östergötland, &c. has hitherto been used only for the burning of lime, but if somewhat larger coherent flakes could be obtained, it might be worth the trial to use it as black marble for ornamental or monumental purposes.

**Sandstone.** a) *Grey Sandstone* from *Lilla Hals* in Östergötland N:o 72 and 73 is used on a large scale as a stone for building, and is also cut for millstones.

b) *Grey and red Sandstone* from *Roslagen* N:o 156 and 175, and *red sandstone* from *Enhörnaland* N:o 164. Erratic blocks of this species of sandstone are used on a large scale by the stone-cutters of the capital for various building purposes, as door-frames, flagstones, stairstones, socles, &c. The high base round the Royal Palace in Stockholm is coated with this sandstone. — The new English church in Stockholm is a very fine example in recent times, showing the employment of this sandstone on a large scale.

c) *Red Sandstone* from *Storsjö* N:o 170. From the large erratic blocks of this rock, which are spread in considerable quantities on the banks of Storsjö in the parishes of Årsunda, Walbo, and Ofvansjö in Gestrikland, the inhabitants of that district manufacture *mill-stones*, which meet with a ready sale all over the country.

d) *Grey Sandstone* from *Gottland* N:o 85 and 62. From this rock, *grinding-stones* are cut, the excellent quality of which have made them very much noted and spread in all the different parts of the country. It

is true, this sandstone can be cut and worked with the greatest facility, but owing to its porosity and the intermixture of both lime and clay, when exposed in the open air to the influence of the temperature, it does not show the strength required for a building-stone. For building-purposes, it is therefore not used so much now as formerly. The church-ruins in Gottland are mostly composed of this sandstone, and it has been used for adorning the façades of the Royal Palace at Stockholm.

The sepulchre of Charles XIV in Riddarholm church in Stockholm, has likewise been Constructed of this sandstone.

e) From *Hör* in *Scania* N:o 58, 82, and 88.

The coarser varieties are cut into millstones, and the finer are used for building-purposes. Lund Cathedral is to a great extent erected of this sandstone.

*N. B.* The gravity and tendency of the sandstone-varieties to absorb water vary much, as appears from the following table:

	Specific Gravity.	One Cubic foot (26,1 Cub.Centim.)	
		weighs Kilogr.	absorbs Water Kilogr.
Sandstone from Storsjö (Årsunda)...	2,59	67,58	0,20
ditto from Lilla Hals .....	2,29	59,93	1,50
ditto from Roslagen (grey) ...	2,30	59,93	2,03
ditto from Bursviken .....	2,13	55,68	3,37

The Conglomerate N:o 50 has hitherto been met with only in the shape of smaller or larger boulders and erratics on the banks of the river West Dalelffven in the parish of Transtrand in Dalecarlia, and, therefore, at

the Elfdal Porphyry-Works, where it is supplied from the above-mentioned places it is only made into small ornaments or household-utensils, such as boxes, paper-weights, butter-dishes, knife-handles, &c. Whole layers of this rock are met with farther north-west in Swuckerfjäll, Sölenfjäll, and the neighbouring mountain-ranges on the frontier of the kingdom.

**Orthoceras Limestone** N:o 10, 18, 22, 26, 42, 44, 47, 80, 125, 130, 136, 140, 142, 148, 163, 167.

This rock being easily quarried, cut, and worked, is employed for many different building-purposes, such as borders of gates, windows, and floors, flags for landings, mangers, reservoirs for water, slabs for mangles, billards-tables, and other-tables, paving-flags, &c., and also for tombstones, &c. The stone occurring at Borghamn has been employed for facing the outside walls of the National-Museum, and in the building of the fortifications of Carlsborg, &c.

*N. B.* The specific gravity is about 2,66. A cubic foot (26,1 Cubic-mètre) weighs about 160 Swedish pounds (68 Kilogrammes), and when immersed under water for a space of 90 hours, it absorbs from 0,4 to 0,6 pounds of moisture (from 170 to 255 Grammes).

**Upper-Silurian Limestone** N:o 4, 16, 17, 30, 36, 59, 68, 75, 79, 92, 116, 132, 158, 160, 171, 176.

These varieties of limestone occurring in the island of Gottland are employed partly for building-purposes, and partly for table-tops, tombstones, ornaments &c.

