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GUIDE FOR THE PRINCIPAL SILURIAN DISTRICTS OF SCANIA

(WITH NOTES ON SOME LOCALITIES OF MESOZOIC BEDS)

BY

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EXCURSION D

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1.

Andrarum.

Andrarum, situated near the SE. corner of the geological map-sheet *Övedskloster*, and 11 *km* from Löfvestad Station on the Ystad and Eslöf Ry., has long been famous for its *Cambrian strata*, rich in fossils and relatively undisturbed. (See the sketch-map, fig. 1, p. 7.)

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Among the many works more or less directly occupied with the fauna and stratigraphy of the deposits at Andrarum, the following are probably the most important:

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rian districts of Scania in 1874). — Geologiska Föreningens i Stockholm Förhandlingar (G. F. F.) Bd 2.

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1880. TULLBERG, S. A.: Om Agnostusarterna i de kambriska aflagringarna vid Andrarum. (On the species of Agnostus in the Cambrian deposits at Andrarum). — S. G. U. Ser. C, N:r 42.

1882 : 1. — — Skånes graptoliter. I. (The graptolites of Scania. I). — S. G. U. Ser. C, N:o 50.

1882 : 2. — — Beskrifning till kartbladet Övedskloster.

(Explanation to the geological map-sheet Övedskloster). — S. G. U. Ser. Aa, N:o 86.

1882. LINNARSSON, G.: De undre Paradoxideslagren vid Andrarum. (The lower Paradoxides strata at Andrarum). — S. G. U. Ser. C, N:o 54. (Posthumous work, edited by TULLBERG, S. A.)

1893. HOLM, G.: Sveriges kambrisk-siluriska Hyolithidæ och Conulariidæ. (The Cambro-Silurian Hyolithidæ and Conulariidæ of Sweden). — S. G. U. Ser. C, N:o 112.

1898. MOBERG, J. C. and MÖLLER, HJ.: Om Acerocare-zonen. (On the Acerocare zone). — G. F. F. Bd 20.

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1904. PERSSON, E.: Bidrag till kännedomen om Oleniderna i »zonen med *Eurycare* och *Leptoplastus*» vid Andrarum. I. (Contributions to the knowledge of the Olenids in »the zone of Eurycare and Leptoplastus» at Andrarum. I). — G. F. F. Bd 26.

1907. MOBERG, J. C.: Om ett gåtfullt fossil från Sveriges olenidskiffer. (On a puzzling fossil from the Olenus beds in Sweden). — G. F. F., Bd 29.

1908. — — Bidrag till kännedomen om de kambriska lagren vid Torneträsk. (Contributions to the knowledge of the Cambrian strata at Torneträsk). S. G. U:s Årsbok, N:o 2.

Partly in the extensive shale-quarries round the alum works of Andrarum (»Alunbruket»), partly along the Verka river and its affluent, the Sawmill rivulet (»Sågverksbäcken»), we have, in a stretch of 1.3 *km*, from Forsemölla, furthest in the NW., to the Boilerhouse (»Pannhuset»), furthest in the SE., fine sections through well-nigh every part of the Cambrian

series, from its oldest to its most recent stratum. Before we proceed to describe the various localities, we will rapidly survey the fauna and the division into zones that is founded upon it.

The predominating element in the fauna consists of trilobites. Of the c:a 275 trilobites described by ANGELIN in his »Palæontologia Scandinavica», no less than 46 were mentioned even then as occurring at Andrarum. And in TULLBERG's work, »On the species of Agnostus», there are recorded from Andrarum 28 *Agnosti*, of which only 9 had been mentioned by ANGELIN. Further information about the trilobite fauna is to be found in LINNARSSON's works, especially in those from 1880 and 1882. Of other fossils we may mention one or two Phyllocarida,[1] 7 species of *Hyolithus*, described by HOLM 1893, Brachiopoda, worked out by LINNARSSON 1876, and a Sponge, *Protospongia fenestrata* SALTER.

The formation of the strata is, on the whole, very regular, dipping gently towards the SE.; only in the Great Quarry (»Stora brottet») has a dip-fault been observed. The stratification has consequently been easy to work out, and the alterations in the scheme have been mainly such as were necessitated by our increased knowledge of the fossils and the consequent accession of details. A single noticeable exception is ANGELIN's placing of the *Andrarum limestone* (zone with *Paradoxides Forchhammeri*) above the *Olenus* beds.

He placed the lowest sandstone in his *regio Fucoidarum*, but in his *regio A* he included both the *Tessini* zone, the lowest from which determinable fossils were then known, and the *Olenus* beds, while he placed the *Andrarum limestone* in the succeeding *regio B*. LINNARSSON, however, in 1868 proved the *Andrarum limestone* to be above the *Tessini* zone but below the *Olenus* beds (»Bidrag till Westergötlands geologi», Öfvers. Kgl. Vet.-Akad. Förh.). and in 1869 NATHORST fur-

[1] See note to p. 110 in HOLM 1893.

nished a complete account of the sedimentary rocks, which he has slightly corrected in a subsequent work from 1876.

Especially with regard to the stratification of the *Olenus* beds, his scheme is very detailed. Subsequent amplifications, therefore, mainly touch on the older strata only.

In 1870 TORELL furnished a survey of the *Paradoxides* beds, and mentioned »Paradoxides Wahlenbergii strata» as the oldest. Since in TORELL's work *P. Wahlenbergi* is synonymous with *Holmia Kjerulfi* LINRS. sp., the *Olenellus* zone thus enters the scheme for the first time.

In TULLBERG'S »Om Agnostusarterna» we have, besides a survey of the sequence of strata, information as to localities where each zone is to be found; on the sketch-map appended to his work he also gives, by means of numerals, the position of the various localities. It is this sketch-map of TULLBERG, with its accompanying description, which in substance is the basis of the following account. However, the definitive completion of the scheme in its present form was achieved first through LINNARSSON'S work of 1882 and TULLBERG'S essay on »The graptolites of Scania. I», which, so far as the stratification of the *Paradoxides* beds is concerned, may be regarded as joint compositions by the two authors.

In its present form the scheme of the sequence of strata of the Cambrian rocks of Andrarum appears as follows:

III. Upper Cambrian or Olenidian.[1]

24. Zone of *Acerocare* and *Parabolina heres* { Locality 19. By the Boiler-house (»Pannhuset»).

[1] Braces immediately before the numbers of zones indicate, unless other explanation is given, that the zones thus united are usually classed under one single zone; so that 23 and 22 are the »zone of *Peltura* and *Sphærophthalmus*», 21 and 20 the »zone of *Eurycare* and *Leptoplastus*», 15 and 14 are usually grouped as »Andrarum limestone». The more minute distinctions applicable to Andrarum cannot, it will readily be understood, be extended to the whole of Sweden.

23.	Zone of *Peltura* and *Sphærophthalmus alatus*	Locality 18	
22.	» » *Ctenopyge* spp.		
21.	» » *Eurycare angustatum* and *Leptoplastus stenotus*	Loc. 18 b (and 17)	Caroli Shaft.
20.	» » *Eurycare latum* and *Leptoplastus ovatus*	Rillet b	
19.	» » *Parabolina spinulosa* (and *Orthis lenticularis*)	Loc. 16	
18.	» » *Oleni* spp. and *Agnostus pisiformis* var. *obesus* BELT	Loc. 15 (S. side)	Great Quarry (»Stora Brottet»).
19.	» » *Agnostus pisiformis* forma typica TULLB.	Loc. 14 (N. side)	

II. Middle Cambrian or Paradoxidian.

Forchhammeri beds	16. Zone of *Agnostus lævigatus*	Loc. 14 (N. side in the Great Quarry).	
	15. *Andrarum limestone*	Loc. 13. The Deep (»Djupet»).	
	14. *Hyolithus limestone*		
	13. Zone of *Agnostus Lundgreni*	Loc. 12. On the road to Andrarum village.	
Tessini beds	12. » » *Paradoxides Davidis*	Loc. 11. By the Sawmill.	Sawmill rivulet (»Sågverksbäcken»).
	11. » » *Conocoryphe æqualis*	Loc. 10. Closer to the Slöjd School.	
	10. » » *Agnostus rex*	Loc. 7. The Little Work (»Lilla Verket»).	Verka river.
	9. » » *Agnostus intermedius*	Loc. 9. By the bridge to the E. of the Little Work.	
	8. » » *Microdiscus scanicus*	Loc. 6	
	7. » » *Conocoryphe esulans*	Loc. 5	
	6. » » *Agnostus atavus*	Loc. 4	
Oelandicus beds?	5. *Fragment limestone*	Loc. 3 (Forsemölla.)	
	4. *Alum shales* (NATHORST'S »ritskiffer»)		

I. Lower Cambrian or Olenellidian.

Kjerulfi beds	3. *Phosphatic limestone*	Loc. 3 (Forsemölla).	Verka river.
	2. *Greywackè shales*		
Torelli beds	1. *Bottom sandstone*	Loc. 1 and 2 (N. of Forsemölla).	

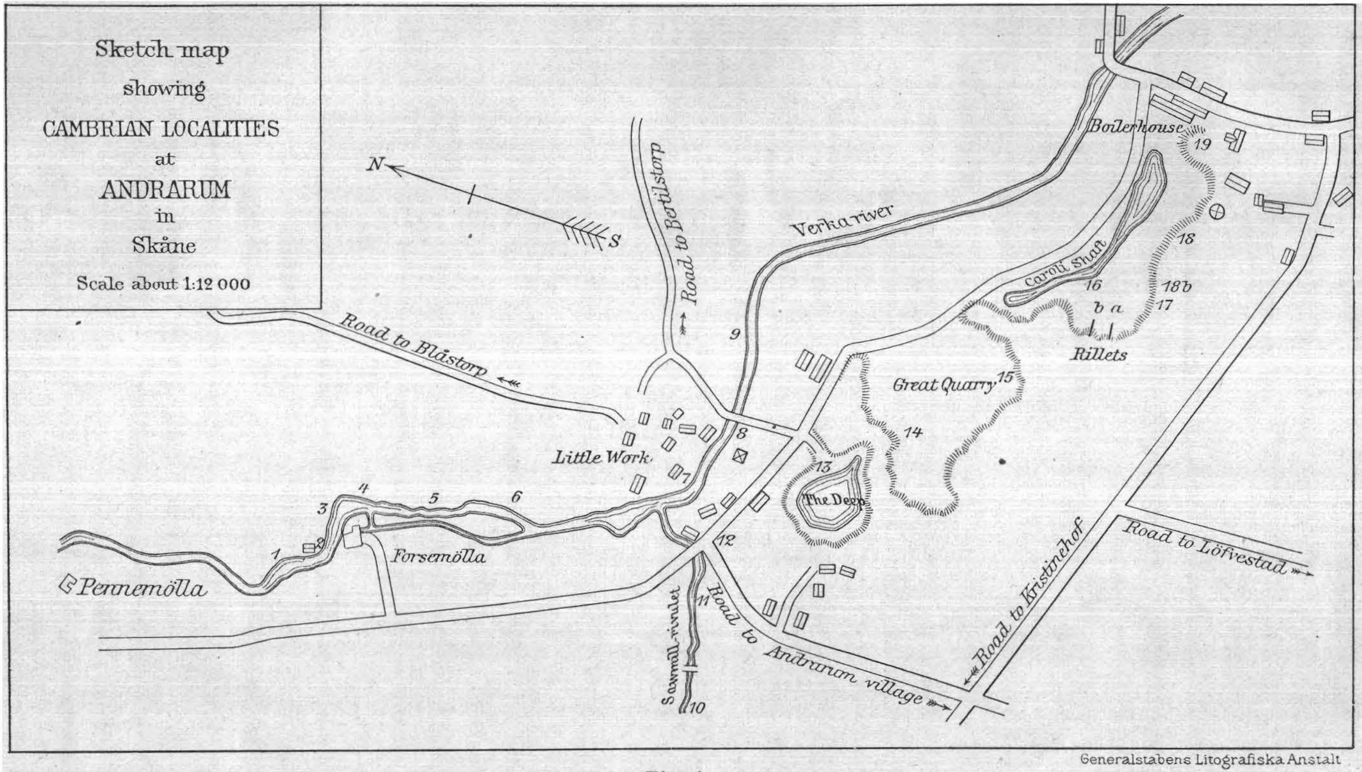
Sketch map
showing
CAMBRIAN LOCALITIES
at
ANDRARUM
in
Skåne
Scale about 1:12 000
N
S
Road to Blåstorp
Road to Bertilstorp
Verka river
Boilerhouse
Caroli Shaft
Rillets
Great Quarry
The Deep
Little Work
Forsemölla
Pennemölla
Sawmill-rivulet
Road to Andrarum village
Road to Kristinehof
Road to Löfvestad
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
18 b
19
b a
Generalstabens Litografiska Anstalt

Fig. 1.

Where no other indication is given, the rock is alum shale with or without interstratified layers or spheroids of stinkstone (»orsten»).

Before passing to a more detailed account of each zone and its fossils, we must add a few words on the stratigraphy. In the main, all the localities indicated, except *7* to *11*, run successively from *1*, in the extreme NW., up to *24*, in the extreme SE., along a line of south-easterly dip, hereinafter referred to as the »dip-line». As to the sequence of zones along this line, the geologist needs not be in two minds. But for the zones met with at localities *7—11*, the question is somewhat more difficult, since those localities lie on a line running from E. to W., i. e. more in the direction of the strike. Both TULLBERG and LINNARSSON, however, have without hesitation placed the beds at loc. *10* and *11*, W. of the dip-line, i. e. the zones of *Paradoxides Davidis* and of *Conocoryphe æqualis*, whose mutual relation is unmistakeable, immediately below the *Forchhammeri* beds (zone of *Agnostus Lundgreni* included). As for the zones at loc. *7—9*, E. of the dip-line, while it is evident that they are to be fitted in between the zones of *Conocoryphe æqualis* and of *Microdiscus scanicus*, their mutual situation cannot be directly observed. Though loc. *9* lies furthest away, if we regard the direction of the dip, from the other localities along the Verka river, LINNARSSON considers the zone of *Agnostus intermedius* at *loc. 9* to be older than the zone of *Agn. rex* at loc. *7*. He bases his opinion mainly on the circumstance that the rock of the former zone is more like that in the underlying stratum. As the localities in question lie on a line approximating to the direction of the strike, but loc. *9* lies lower down by the river — and therefore at a considerably lower level — there is nothing, even from a stratigraphical point of view, to object to in LINNARSSON's view; it should, however, be remarked that in this single case the sequence of the strata is not, as elsewhere, based on direct observation.

At Andrarum only Cambrian strata are found. Ordovician strata first occur about 1 *km* S. of the alum works. S. of Kaneledshuset is a rather inaccessible outcrop of *Orthoceras* limestone, which continues for some distance westward and is said also to occur somewhat to the S. of Andrarum church. At Kaneledshuset, according to TULLBERG 1882: 2, we shall probably find *Dictyograptus* shales. FEARNSIDES[1], whose statements, however, are very unreliable, mentions that in the river bed, below the Boilerhouse, he happened to find a stinkstone (»orsten») containing *Dictyograptus* together with *Hysterolenus*.

Zone 24. *Acerocare strata* by the Andrarum Boilerhouse (*loc. 19*). In these beds the commonest fossil is *Boeckia? illænopsis* WESTERGÅRD; there also occur *Parabolina heres* BRÖGGER var. and *Boeckia scanica* WESTERGÅRD, the latter sparsely. In a stink-stone, belonging to older collections from this locality, is also found *Acerocare granulatum* MBG and MÖLLER var. The fossils for the most part are badly preserved. Earlier statements, that *Acerocare ecorne* ANG. or *Acerocare micropygum* LINRS. sp. occur, are incorrect.

Zone 23, *the strata with Peltura and Sphærophthalmus.* At *loc. 18*, somewhat to the W. of the belfry (»Klockstapeln»), we find, in the upper strata, *Peltura scarabaeoides* WAHLENB. and *Sphaerophthalmus alatus* BOECK. A *Megalaspis*-hypostoma and a puzzling fossil that reminds one somewhat of a graptolite (see MOBERG 1902 and 1907, also PERSSON, 1904) have also been found here. — In the lower strata *Ctenopyge* spp. and *Sphærophthalmus* sp. occur abundantly; it is these strata that in our scheme are entered as zone 22.

Zone 22. *Strata, rich in Ctenopyge* spp., not yet thoroughly analysed. Found partly, as mentioned above, in lower strata at *loc. 18*, partly in upper parts of the strata accessible at *loc. 18 b* (somewhat to the W. of *loc. 18*). — At the last

[1] W. G. FEARNSIDES: »The Lower Ordovician Rocks of Scandinavia», Geol. Mag. n. s., dec. V, vol. IV (1907), p. 262.

named spot the underlying shales are characterized by a *Eurycare*, presumably *E. angustatum* ANG.

Zone 21, with *Eurycare angustatum* ANG. and *Leptoplastus stenotus* ANG., ought properly to be looked for at TULLBERG's *loc. 17*, where, however, at present nothing is accessible. The upper part of the zone can be found, however, as pointed out just above, somewhat further E. at *loc. 18 b*, between *loc. 17* and *18*.

Zone 20, characterized by *Eurycare latum* BOECK (*Eurycare camuricorne* ANG., only found at Andrarum, is, according to PERSSON, synonymous with *E. latum*) and *Leptoplastus ovatus* ANG., is accessible at »rillet *b*». — The lowest part of the vertical section there belongs to the next older zone (z. of *Parabolina spinulosa* WAHLENB.). According to PERSSON, layers with this last mentioned fossil are also found higher up, in the strata characterized by *Eurycare latum* and *Leptoplastus ovatus*. How this circumstance is to be interpreted, is not clear. It is certain, however, that it is not to be explained by any dislocation.

Zone 19, containing *Parabolina spinulosa* WAHLENB. and *Orthis lenticularis* WAHLENB., which latter often constitutes whole layers, is well accessible at *loc. 16*. The occurrence at »rillet *b*» of the zone of *Parabolina spinulosa* has been mentioned above.

Zone 18. *The Olenus beds* proper. On the S. side of the Great Quarry (*loc. 15*) and uppermost on the N. side of the same quarry (*loc. 14*) occur beds with *Olenus* species, hitherto not closely examined. The commonest of these is *Olenus truncatus* BRÜNN. — *Olenus gibbosus* WAHLENB., which also occurs here, is said, according to NATHORST, to be present at a somewhat lower level. There is also an abundance of *Agnostus pisiformis* L. var. *obesus* BELT (= var. *socialis* TULLB.[1]). On

[1] See PH. LAKE,: A monograph of the British Cambrian trilobites. Part. I. — Palæontographical Society. London 1906.

the other hand, *Agnostus reticulatus* ANG., which also belongs to this zone, is quite rare.

Above the *Olenus* beds proper we find, at *loc. 15*, a few layers which, together with an *Olenus* sp., yield »*Beyrichia*» *Angelini* BARR., *Agnostus cyclopyge* TULLBERG and a *Ceratopyge* sp. These layers are classed by TULLBERG (1882 : 1) as a special zone, »the zone of *Ceratopyge* sp.» As, however, a *Ceratopyge* sp. also occurs in the underlying *Olenus strata* proper, TULLBERG'S »zone of *Ceratopyge* sp.» should preferably be omitted from the scheme. »*Beyrichia*» *Angelini* is found also at a lower level, at other localities, so that it too cannot be used as a characteristic fossil.

Presumably it was just from these strata »high up in the S. wall of the Great Quarry» that LINNARSSON got his *Liostracus? superstes.*

Zone 17, with *Agn. pisiformis* f. *typica.* In the lower part of the northern wall in the Great Quarry (at *loc. 14*) strata are met with, in which *Agnostus pisiformis* L. *forma typica* TULLB.[1] is predominant. — In the upper part occurs a »*Leperditia*» sp., which induced TULLBERG to make a special zone of it, »the zone with *Leperditia* sp.»

Zone 16, with *Agnostus lævigatus* DALM. This appears at the very lowest part of the N. wall in the Great Quarry (*loc. 14*), there underlying the preceding zone, and, if I understand TULLBERG rightly, at the uppermost part of the layers exposed at *loc. 13* in the Deep (»Djupet»), somewhat more than 1 *m* above the Andrarum limestone. — At Andrarum this zone is little developed and only yields its name-fossil. As the latter not only passes through the whole Andrarum limestone, but is even found in underlying beds, the

[1] This *forma typica* TULLB. occurs practically everywhere in our country at this horizon and TULLBERG'S denomination is therefore justified to a certain extent. It is, however, to be observed that it differs considerably from the form reproduced in ANGELIN'S work, a form, which presumably came from Vestergötland.

zone in question would not have deserved to be kept distinct had it not been so richly developed in Vestergötland. Together with *Agnostus lævigatus* it has there as characteristic fossil *Liostracus costatus* ANG., which has not yet been met with in Scania.

Zone 15. The *Andrarum limestone* is easily accessible in the E. side of the Deep (*loc. 13*) and contains a peculiarly rich and varied fauna. Here are found:

Paradoxides Forchammeri ANG.
Centropleura Lovéni ANG.
Conocoryphe breviceps ANG. sp.
» *laticeps* ANG. sp.
Acrocephalites stenometopus ANG. sp.
Liostracus microphthalmus ANG.
Anomocare excavatum ANG.
» *læve* ANG.
» *limbatum* ANG.
Ancuacanthus acutangulus ANG.
Corynexochus spinulosus ANG.
Arionellus aculeatus ANG.
» *difformis* ANG.
» *acuminatus* ANG.
Solenopleura brachymetopa ANG.
» *canaliculata* ANG.
Dolichometopus suecicus ANG.
Agnostus aculeatus ANG.
Agnostus bituberculatus ANG.
» *brevifrons* ANG.
» *exsculptus* ANG.
» *fallax* LINRS. var.
» *glandiformis* ANG.
» *Kjerulfi* BRÖGGER.
» *lævigatus* DALM.
» *Lundgreni* TULLB.
» *Nathorsti* BRÖGGER.
» *nudus* BEYR. var. *marginatus* BRÖGG.
» *parvifrons* LINRS. var.
» *planicauda* ANG.
» *quadratus* TULLB.
Hyolithus obscurus HOLM.
Protospongia fenestrata SALT.
Orthis exporrecta LINRS.
Lingula sp.
Obolella sagittalis DAV.
Acrotreta socialis v. SEEB.
Acrothele coriacea LINRS.
Kutorgina pusilla BILL.
Iphidea ornatella LINRS.

Zone 14. The *Hyolithus limestone*, a band 0.3 *m* below the Andrarum limestone at the preceding locality, rich in *Hyolithus*, both individually and in species. HOLM quotes from here *Hyolithus affinis* HOLM, *H. excavatus* HOLM, *H. lineatulus*

HOLM and *H. tenuistriatus* LINRS. As formerly no distinction was made between the *Hyolithus* limestone and the Andrarum limestone, it is possible that the *Hyolithus obscurus* HOLM, mentioned above from the Andrarum limestone, rightly belongs here also, just as on the other hand it is possible that one or several of the *Hyolithus* species mentioned also occur in the Andrarum limestone. Moreover, a number of the forms that belong to the Andrarum limestone, especially *Agnosti* and Brachiopoda, already occur in the *Hyolithus* limestone.

The shales in which the *Hyolithus* limestone is embedded are marked by their richness in *Protospongia fenestrata* SALT.

Zone 13. *The zone of Agnostus Lundgreni* TULLBERG; black shales in which only the name-fossil occurs, overlie at the Sawmill (*loc. 11*) the zone of *Paradoxides Davidis* SALTER and are themselves overlaid in the Deep (*loc. 13*) by *Hyolithus* limestone. They are also accessible at *loc. 12* in the S. corner between the road to Forsemölla and the road to Andrarum village.

Zone 12, with *Paradoxides Davidis* SALTER, is found by the Sawmill rivulet near the Sawmill and is there overlaid by the foregoing zone. In general it is made up of alum shales strongly weathered, rusty on the surfaces of the layers in which, together with the abundant name-fossil, we find *Paradoxides Tessini* BRONGN. (very rare), *P. brachyrhachis* LINRS. (rare), *Agnostus elegans* TULLB., *A. fallax* LINRS. var., *A. incertus* BRÖGGER, *A. nudus* BEYR. var. *scanica* TULLB., *A. punctuosus* ANG. and *A. pusillus* TULLB.

Zone 11, with *Conocoryphe æqualis* LINRS. This zone, too, whose rock is exactly like that of the zone of *P. Davidis* SALTER, is found by the Sawmill rivulet, but somewhat further up, nearer the Slöjd School (*loc. 10*). Here have been found the following fossils.

Paradoxides sp. indet.
Conocoryphe æqualis LINRS.
Conocoryphe breviceps ANG.
Liostracus Linnarssoni BRÖGG.

Microdiscus eucentrus LINRS.
Agn. Barlowi BELT (= *A. Cicer* TULLB.)
Agnostus fallax LINRS.
Agnostus nudus BEYR. var. *scanica* TULLB.
» *parvifrons* LINRS.
Protospongia fenestrata SALTER.

Zone 10, with *Agnostus rex* BARR., accessible in the left bank at the Little Work (»Lilla Verket»), nearly opposite the Sawmill (*loc. 7*). In these alum shales we find, besides the name-fossil, *Paradoxides Tessini* BRONGN., *Liostracus Linnarssoni* BRÖGGER, *Agnostus fallax* LINRS., *A. nudus* BEYR. var. *scanica* TULLB. and *A. parvifrons* LINRS.

Zone 9, with *Agnostus intermedius* TULLB., is also to be found on the left side of the stream, a little to the E. of the bridge across the Verka river to the Little Work (*loc. 9*). Besides the name-fossil there are here found *Paradoxides Tessini* BRONGN., *Liostracus Linnarssoni* BRÖGGER, *Agnostus Cicer* TULLB., *A. fallax* LINRS., *A. nudus* BEYR. var. *scanica* TULLB. and *Protospongia fenestrata* SALTER. The fossils here are in general somewhat distorted, which otherwise is never the case at Andrarum. — From the layers, accessible immediately beside the above-mentioned bridge (at *loc. 8*), there is quoted only *Agnostus parvifrons* LINRS.

Zone 8, with *Microdiscus scanicus* LINRS. This occurs at *loc. 6* between Forsemölla and the inflow of the Sawmill rivulet into Verka river. Here, on the W. side of the river, at a height of about 3 *m*, are shales of circa 1 ½ *m* in thickness, and peculiarly rich in fossils. TULLBERG, who originally (in his »Agnostusarterna etc.») called this zone the »*Tessini-Hicksii* strata», mentions the following fossils:

Paradoxides Tessini BRONGN.
» *Hicksi* SALTER.
Liostracus Linnarssoni BRÖGG.
Conocoryphe Dalmani ANG.
Microdiscus scanicus LINRS.
Agnostus fallax LINRS.
» *fissus* LUNDGR.
» *gibbus* LINRS.
» *parvifrons* LINRS.

Somewhat lower down, halfway between the zone named and the level of the river, occurs a band of stink-stone with *Agnostus fissus* and *A. gibbus.*

Zone 7, with *Conocoryphe exulans* LINRS., (usually called *Exulans limestone*) is met with on the same side of the stream as the preceding zone, at *loc. 5*, situated about midway between *loc. 6* and Forsemölla. Here, in a small space, lie a number of loose spheroids of stink-stone, in a moraine-like mass of shales, presumably worked out by the water from surrounding shales on the spot. The following species have been found:

Paradoxides Tessini BRONGN.
» *Hicksi* SALT. var.
» *palpebrosus* LINRS.
Conocoryphe Dalmani ANG.
» *exulans* LINRS.
» *impressa* LINRS.
» *tenuicincta* LINRS.
Liostracus aculeatus ANG.
Solenopleura parva LINRS.
Agnostus fallax LINRS. (rare).
» *fissus* LUNDGR. (sparsely).
» *gibbus* LINRS. (common).
Metoptoma Barrandei LINRS.
Hyolithus socialis LINRS.
Lingulella sp.
Obolella sagittalis SALTER.

Zone 6, with *Agnostus atavus* TULLB., at Forsemölla (*loc. 4*). On the underlying »Fragment limestone» follow alum shales rich in iron pyrites, but poor in fossils, *Obolella sagittalis* SALTER, *Lingulella* sp. and *Protospongia fenestrata.* About 2 *m* above the »Fragment limestone» occur, according to TULLBERG, a number of stink-stone spheroids, and in such a spheroid lying loose (fallen down?) have been found *Agnostus atavus* TULLB. and a *Liostracus.* — Whether this zone, formed as it appears, on quite loose foundations, deserves to be upheld, may be open to question.

Zone 5. The *Fragment limestone*, so called from its great wealth of fossils, chiefly trilobites, but also Brachiopoda, which, however, all occur merely in indeterminable fragments, can be followed from *loc. 3*, somewhat above Forse-

mölla, away to *loc. 4*. The limestone band is not quite half a metre thick. The rock is a tough light-gray limestone with iron pyrites, glauconite grains, and phosphorite. Of the trilobites not one was determinable as to genus, save a *Paradoxides*, which is probably akin to *P. Hicksi* SALTER. The Brachiopoda belong to the genera *Lingulella*, *Acrotreta* and *Acrothele*. By reason of its position *under* the *Exulans* limestone and *above* the greywackè shales belonging to the Olenellus division, the fragment limestone is to be looked upon as equivalent to the zone of *Paradoxides oelandicus* SJÖGR.

Zone 4. *Black shales* with gray streak, about half a metre thick, which, between *loc. 3* and *4*, underlie the *Exulans* limestone, were first distinguished by NATHORST as »ritskiffer». Only a few indeterminable Brachiopoda of the genera *Lingulella*, *Obolella*, *Acrotreta* and *Acrothele?* with possibly a *Hyolithus* sp., have been found here.

Zone 3. *Phosphoritic limestone*, at times replaced by light-gray shales or dark quartzite-like sandstone, which also contain phosphorite, overlies (at *loc. 3*), just above Forsemölla, the greywackè shales. It is poor in fossils; in the limestone has been found a Lingulid, in the sandstone *Lingulella* and *Acrothele*. It is thus only for petrographical reasons that this zone is distinguished.

Zone 2. *Greywackè shales*, which at *loc. 3* directly overlie the sandstone bed, over which the Verka river flows for a good distance, are something between sandstone and shale, in colour light-gray or greenish, fine-grained, and slightly laminated. They are not quite 2 *m* thick. Here are found *Holmia Kjerulfi* LINRS. (rare), *Ellipsocephalus Nordenskiöldi* LINRS. (the commonest fossil), *Arionellus primævus* BRÖGGER, *Hyolithus* sp. and *Lingulella Nathorsti* LINRS.

Zone 1. The *bottom sandstone* can be followed from Forsemölla (*loc. 3*) along the Verka river northwards past *loc. 2* and *1*. No fossils have been found in it, but by reason of the position and the nature of the rock, the stra-

tum must be identified with those which, S. of Brantevik (in the Simrishamn tract), underlie the greywackè with *Holmia Kjerulfi* LINRS. and in which, just S. of Simrishamn, has been found *Olenellus* (*Schmidtiellus*) *Torelli* MBG. The uppermost stratum of the Cambrian sandstone at Forsemölla (*loc. 2*) is much permeated with iron pyrites. In the underlying strata we find, at the wash house (»Tvätthuset») (*loc. 1*), and further to N., at Pennemölla, intervening layers of Lydian stone.

It is perhaps worth noting that, further north along the Verka river, about 1 *km* from Forsemölla, there crop out higher Cambrian strata belonging to the zone of *Parabolina spinulosa*, and still further on occur beds with *Peltura* and *Sphærophthalmus*.

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2.

Fogelsång.[1]

Fogelsång, known of old to geologists for the occurrence in its shales and limestones of richly fossiliferous bands, belongs to an extensive Silurian district, of which the southern part, formed of Cambrian sandstone, embraces the most northerly point of the Archæan rocks of the horst Romeleklint.

In this district (cfr the sketch map, fig. 1, on pag. 21) good sections through the fossiliferous strata are, as a rule, rare and, with few exceptions, occur exclusively in or near the channels formed by the Sularpsbäck, or its affluent, the Fogelsångsbäck. Indeed, a good number of the points of observation, indicated on the accompanying maps, have to be dug out every time access to them is desired. For a right understanding of the geological structure of the district, however, all these points of observation, by themselves of trifling importance, are essentially significant. It is this, which makes their inclusion in the map a necessity.

Within the Fogelsång district — in the wide sense of the word — practically the whole Silurian System is represented,

[1] This guide is a *resumé*, with the necessary emendations and additions, of my »Geological Guide to the Fogelsång district», which I published in its Swedish garb in 1896, and to which I may refer those interested for a more detailed description of the localities (see »List of works» at end).

from the *Olenellus* beds to the uppermost Gotlandian, both inclusive. The occurrence of so many different strata, squeezed, as it were, into a comparatively small compass, is due, in the first place, to the numerous faults that run, partly from N. to S., partly from E. to W., across the district, which is also intersected by several diabase dikes. With a few exceptions, however, the downthrow of the faults is inconsiderable. One of the biggest and most important must be that which runs E. and W., somewhat S. of a line from Sularp through Fogelsång to Sandby, and separates the high-lying Cambrian sandstone from the relatively low-lying, younger Silurian strata to the immediate north of it. Yet to put one's finger directly on the fault is impossible. And between the sandstone and the younger strata there is a strip from 500 to 1000 *m* broad, within which every indication of the nature of the rock may be said to be almost absolutely lacking. N. of this assumed fault, the accessible part of the Silurian furthest to the S. is composed of *Cyrtograptus* beds in the extreme W. (at Hardeberga Station), but of *Olenus* beds in the extreme E. (at the east mill of Sandby). In the middle of the district, however, by the Fogelsång rivulet itself, the *Ceratopyge* beds occur so far south that not much more than 100 *m* separate them from an imaginary line connecting the most northerly outcrops of sandstone on the east and west. The fact, that the Silurian strata are cut off at Fogelsång by a large diabase dyke indicates, that a considerable displacement has taken place. It seems, however, hardly likely that the fault-line in question should have an absolutely rectilinear course. An indication that *Paradoxides* beds also occur in the floor of the above-mentioned earth-covered strip N. of the sandstone district, is furnished by NATHORST'S discovery of fossils from the zone of *Conocoryphe exulans* somewhat to the E. of the most southerly Silurian localities of the Fogelsång rivulet. For it is stated that blocks of limestone from the zone in question have been found (at the point of

observation *I 2* on the maps) in circumstances that point to its existence there in the rocky floor.

To this general survey of the rocks of the district we have only to add that the Gotlandian, of which a complete series occupies its most northerly part, is easy of access in a number of places on both sides of the road from Sandby to Räften and Linnebjer, and still further west (outside the district contained in the annexed general map), right up to the environs of Odarslöf, where *Colonus* beds crop out.

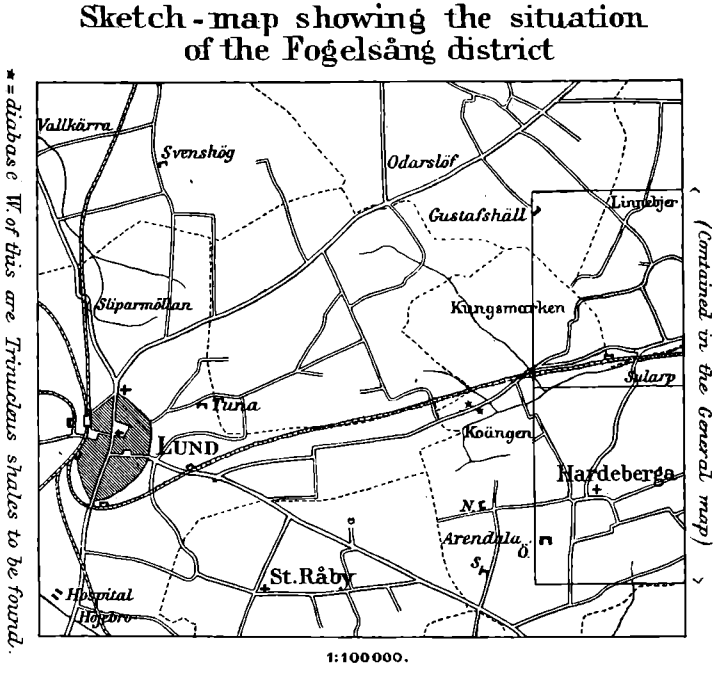


Fig. 1.

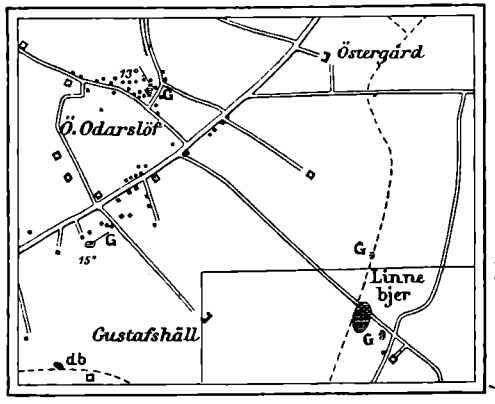
The chief interest of the Silurian district of Fogelsång lies in the almost exclusively argillaceous nature of its formations, in which many zones, especially within the Ordovician series, are unique in their development.

The central parts of the Fogelsång district are now easy of access, thanks to the railway line from Lund to Refvinge

and Harlösa, the first two stations after leaving Lund (namely Hardeberga and Sandby) lying within the district (cfr Fig. 1 and the maps). Between the lastnamed stations is Fogelsång, where passengers can alight. To reach Odarslöf it is best to start from Hardeberga Stn, but at other times it may be advantageous to go direct by the road running N. from Lund (cfr Fig. 1 and 2).

Localities for the Odarslöf beds

After Sveriges Geologiska Undersöknings kartblad "Lund".
1: 50000



G = Gotlandium *db = diabase*

Fig. 2.

I. Description of the Localities.

A 1. Road-cutting at Linnebjer. In the S. wall of the road may be seen strongly folded shales containing *Monograptus testis* BARR. (TULLBERG'S zone with *Cyrtogr. Carruthersi* LAPW.). In the well of a house E. of the cutting, *diabase* is said to have been reached.

B 1. N. of the road, in the channel of a little brook, *diabase*; close by, shales.

B 2. Bottom and walls of a ditch in the depression in the ground N. of the cottage: dark shales containing graptolites from the *Cyrtograptus beds.*

B 3. In the road itself, outcrop of *diabase.*

B 4 and B 5. Small quarries on the N. side of the road. *Diabase*, bounded on the N. by shales.

B 6. Pit in the field about 50 *m* from the road. Shales containing *Monograpti*.

B 7. Marl-pit. In its N. wall, shales belonging to the *lower part of the Rastrites beds.*

B 8. Slope N. of the road. *Lower part of the Rastrites beds.*

B 9. Ditch running E. and W. Shales containing *Monogr. runcinatus* LAPW. and *Monogr. jaculum* LAPW., therefore *uppermost part of the Rastrites beds.*

B 10. Slope E. of the road. Shales with *Monogr. Sedgwicki* PORTL., therefore *middle part of the Rastrites beds.*

C 1. Ditch. *Lower part of the Rastrites beds.*

D 1. Ditch. *Diabase amygdaloid*, not very accessible.

D 2. Ditch. Here in 3 places shales, at one spot in it graptolites, belonging to the upper part of the *Cyrtograptus beds*, have been found (zone of *C. rigidus* TULLB.).

D 3. Southern bank of the stream. *Cyrtograptus beds.*

D 4. On the W. side of the diabase dyke *E 1* shales of uncertain age.

D 5. Marl-pit 100—150 *m* N. of the farm, shales, now inaccessible.

D 6. *Diabase.*

D 7. Ditch. Shales of uncertain age.

D 8. Well at Hardeberga Station. When this was being sunk, shales containing *Monogr. priodon* BARR. and *Retiolites Geinitzianus* BARR. were found. We have therefore here, in all probability, *the lower part of the Cyrtograptus beds.*

D 9. Ditch. Here in two places shales in situ. Without doubt the strata belong, just as the adjacent locality *D 2*, to the *Cyrtograptus beds.*

E 1. *Diabase*, amygdaloid.

E 2. The »large diabase dyke». *Diabase*, partly with spherical jointing.

E 3. Section W. of the north end of the »large diabase dyke». *Lower part of the Cyrtograptus beds.*

E 4. E. of the north end of the »large diabase dyke». *Lower part of the Cyrtograptus beds.*

E 5. To the E. of the S. end of the »large diabase dyke». *Geminus beds.*

E 6. *Diabase dyke.*

E 7. In the hillside, little exposed: Shales containing *Climacograptus Scharenbergi* LAPW., belonging therefore to the *Lower Dicellograptus beds.*

E 8. On the W. side of the diabase dyke *E 6* and partly enclosed by it as in a niche: *Lower Dicellograptus beds.*

E 9. Ditch on the E. side of the diabase dyke *E 8*. *Dicellograptus beds*, not easily accessible.

E 10. In the S. part of the field, immediately NW. of the west mill of Sularp, and just under the mould, are lydian-like rocks containing *Orthis argentea* HIS. (The »Orthis shales»).

E 11. Shelf on the N. border of the field SW. of the west mill of Sularp: *Diabase.*

E 12. In the bed of the rivulet and its N. bank, just to the NE. of the west mill of Sularp: *Orthis shales.* — To the E. of this occur the same beds at a number of places, partly as rocky floor (in the river or at its excavations in the N. valley-wall), partly in loose pebbles or blocks along the S. side of the glen, where undoubtedly, by digging, it would also be found as rocky floor.

E 13 *a* and *b*. S. valley-wall. Shales with *Climacograptus rugosus* TULLBERG, and S. of it *Orthis shales*, both separated by a fault running E. by W. and filled with white plastic clay.

E 13 *c* and *d*. In the furrow of the Sularp river. Graptolite-

bearing shales with calcareous lenses. According to TULLBERG this, too, should belong to the zone of *Climacogr. rugosus* TULLB.

E 13 *e* and *f*. In the S. valley-wall and in the bed of the river *diabase*.

E 14 *a-c*. Excavation of the river in the S. valley-wall. With *E 15* the finest natural sections of the district in the *Lower Dicellograptus beds*. The highest strata (the zone of *Nemagraptus gracilis* HALL) are met with at the top of the most westerly section *E 14 a*, where this zone, by a layer of phosphoritic limestone, is separated from the underlying zone of *Diplogr. putillus* HALL. In the more eastern sections (*E 14 b* and *c*) the next older strata are to be found.

E 15. River section in the S. valley-wall: *Lower Dicellograptus beds*. Uppermost, we have the zone of *Diplograptus Linnarssoni* TULLBERG, which is underlaid by the zone of *Glossograptus Hincksi* HOPK. Moreover, we may, according to a communication received from A. HADDING, among other interesting fossils from this locality, mention *Janograptus laxatus* TULLBERG *Azygograptus Mobergi* n. sp. HADDING mscr. and *Annelid* jaws of various kinds.

E 16. Hillocks in the valley: Shales belonging to the *Geminus beds*, but probably not in situ.

E 17. E. bank of the river: *Geminus beds*.

E 18. In the Fogelsång rivulet: Alum shales with *Clonogr. tenellus* LINRS. var. *Callavei* LAPW. and crystalline stink stones without fossils.

E 19. Drain from the most northerly limestone quarry: Alum shales with *Dictyogr. flabelliformis* var. *norvegica* KJERULF and *Bryogr. Kjerulfi* LAPW.

E 20. *Limestone quarry*, now filled with water: *Orthoceras limestone*, according to TÖRNQUIST.

E 21 *a* and *b*. *Limestone quarries*: Orthoceras limestone, only

visible in the S. quarry *E 21 b*, in the W. wall of which also the lower part of the *Upper Didymograptus beds*, the zone of *Phyllograptus* cfr *typus* HALL, is accessible, overlying the Orthoceras limestone. The same zone is also to be found in the upper part of the W. wall of the middle limestone quarry *E 21 a*. At the bottom of the most southerly limestone quarry *E 21 b*, on the occasion when it was pumped dry, a slaty limestone was found, rich in trilobites, among which may be noted *Trinucleus coscinorhinus* ANG. and *Aeglina umbonata* ANG. sp.

E 22 *a*. In the Fogelsång rivulet, *under* the limestone beds, and in the E. bank of the rivulet, *above* the limestone: Shales belonging to the *Lower Didymograptus beds*. In the last-named place *Phyllogr. cor* STRANDMARK.

E 22 *b*. NW. of the preceding, in a drain from the southerly limestone quarries. Same shale as the foregoing, but not easily accessible.

E 23. Steep wall of shales on the S. side of the Sularp river, just to the E. of the mouth of the Fogelsång rivulet. Here uppermost, *Geminus beds* (with *Lonchograptus ovatus* TULLB.); below, zone with *Phyllogr.* cfr *typus* HALL.

E 24. Ditch. Shelf of *diabase*, not easily accessible.

E 25. Ditch or rivulet on the N. side of the road. *Diabase*. To the W. of it *Lower Dicellograptus* beds altered (hardened).

E 26. Shelf of rock in the field. *Diabase*.

E 27. Shallow road-ditch. Lowest part of the *Rastrites beds*. Shales containing *Monogr. tenuis* PORTL. and *Climacogr. scalaris* L.

E 28. A ditch running N. by S., in the E. wall of which, somewhat to the N. of Sularp river, there are fossiliferous, very fissile shales with *Calymmene dilatata* TULLB. and other fossils.

E 29. Ditch between the most easterly diabase dyke of Sularp (*E 6*), and the *Orthis shales* (*E 10*) to the NW. of Sularp mill. Shales of uncertain age.

E 30. Road-ditch. Same shales as in *E 28*, therefore *Chasmops beds*.

E 31. Road-ditch. Altered shales of uncertain age.

E 32 *a* and *b*. Bed and southern bank of the Sularp river: *Geminus beds*; here, at *E 32 a Pterogr. scanicus* MOBERG.

E 33. Marl-pit. *Diabase* and *Orthis shales?* Now inaccessible.

E 34. At the bottom of a marl-pit, now filled with water: *Orthis shales?*

E 35. The Fogelsång rivulet, E. bank. Limestone bed and shales. Uncertain age.

E 36. E. bank of the Fogelsång rivulet: *Geminus beds*.

E 37. S. of the bridge in the village of Fogelsång. Bed and banks of the rivulet. *Geminus beds*. *Lonchograptus ovatus* TULLB. was found here by HADDING.

E 38. N. side of the Sularp river. In the river *Orthis shales*, N. of them a fault, on the other side of which there are shales belonging to the *Chasmops beds* and like those at the localities *E 28* and *E 30*.

E 39. Ditch at right angles to the road. Here shales belonging to the *Chasmops beds* like those met with at *E 28*, *E 30*, and *E 38*.

E 40. N. valley-wall between the two most westerly diabase dikes by the Sularp river. Shales containing *Retiolites Geinitzianus* BARR.

E 41. Boundary ditch. *Chasmops beds*, dark, fissile like those at *E 28*, *E 30*, *E 38*, and *E 39*.

E 42. In the field, E. of the Fogelsång rivulet and S. of the road, shales not quite certainly in situ: *Geminus beds*.

E 43. S. valley-wall of Sularp river, about 100 *m* to the W. of the Fogelsång rivulet: *Geminus beds*.

E 44. Ditch running N. from the road; shales belonging to the *Chasmops beds.*

E 45. Ditch along the road. *Diabase*, not easily accessible.

E 46. Ditch in the valley-bottom S. of the railway and W. of the »large diabase dyke» (*E 2*): *Orthoceras limestone*, possibly in situ.

F 1. N. valley-wall of the Sularp river. Shales containing *Climacograptus Scharenbergi* LAPW., at present not very accessible.

F 2 *a* and *b*. 100 *m* W. of Sandby west mill; cutting in the N. bank of the river. — Furthest W., at *F 2 a*, *Orthis shales*, separated by a fault from *F 2 b* which is situated to the E. of it. At the last named place we find greenish-gray shales containing *Lichas laxatus* M'COY etc.; on a level with the river, hence in the lowest part of the strata on locality *F 2 b*, is found a band of limestone containing *Calymmene dilatata* TULLBERG, *Remopleurides latus* OLIN, and other fossils. OLIN enters these greenish-gray shales (before classed with the *Trinucleus beds*) to the *Chasmops beds.*

F 3. In the Sularp river and its S. bank, strongly dipping shales: *Geminus beds.* Just to the E. of this, alum shales, which, however, have not been seen with certainty in situ.

F 4. Ditch (or rivulet) close to the N. valley-wall: *Lower part of the Dictyograptus beds*, not easily accessible.

F 5. N. bank of the Sularp river (below the dam of Sandby east mill). Alum shales and big stink-stone spheroids, some of which contain *Acerocare ecorne* ANG. and *Parabolina acanthura* ANG.

F 6. W. part of the mill-race below Sandby east mill. Zone of *Acerocare granulatum* MOBERG et MÖLLER and *Parabolina heres* BRÖGGER.

F 7. E. of the foregoing, partly in the most easterly part

of the mill-race, partly in the Sularp river itself, both somewhat above and somewhat below the inflow of the mill-race: *Dictyograptus beds, lower part.* Just at the mouth of the mill-race some thin bands of limestone, containing *Dictyograptus flabelliformis* EICHW., *Obolus Salteri* HOLL, *Capulus simplex* MBG, *Hysterolenus Törnquisti* MBG, and *H. levicauda* MBG (the 3 last rare), run straight across the river.

F 8. Shelf of rock in a ditch: *Diabase.*

F 9. Shelves in a ditch. Here, limestone and light shales, not with certainty in situ and moreover not easily accessible.

F 10. In the lower part of the N. bank of the Sularp river, just E. of the plantation on the S. side of this river, E. of the Fogelsång rivulet: *Lower Dicellograptus beds* with *Climacogr. Scharenbergi* LAPW.; not easily accessible.

F 11. S. bank of the Sularp river, just E. of Sandby west mill. *Orthis shales* and *diabase.* Coming on due W. of locality *F 3*, the *Orthis shales* can be followed in a westerly direction for a total of 78 *m*, then the 23 *m* broad diabase dyke included. The Orthis shales are at the contact burnt white.

F 12. Ditch in the field between the Sularp river and the Fogelsång-Sandby road and about 50 *m* E. of the Hardeberga-Sandby parish boundary. Gray shales, containing *Climacogr. Scharenbergi* LAPW. and a *Didymograptus* of the *Murchisoni*-type. Presumably belonging to the *Upper Didymograptus beds.*

F 13. S. valley-wall: *Orthis shales.*

F 14. Ditch along the S. valley-wall. *Lower Dicellograptus beds?* In the ditch which continues right up to locality *F 13* may also be seen, further to the E., shales in situ, in which, however, no fossils have been found.

F 15. Bottom of a shallow water-basin cut by the Sandby Distillery and skirting the Sularp river. Here, alum shales and stink-stones. In the shales *Parabolina* (*heres* BRÖGG.?) and *Acerocare granulatum* MBG et MÖLLER. In the stink-stones *Euloma primordiale* WESTERGÅRD, *Acerocare* sp., and *Megalaspis* sp. — Trilobites have also been found in a stink-stone spheroid, lying in situ in the S. river-bank, and in alum shales dug up in the N. river-bank N. of the water-basin. In the stink-stone *Parabolina* sp., *Boeckia illænopsis* WESTERGÅRD, *Niobe primæva* WESTERGÅRD, *Megalaspis* n. sp., and *Agnostus* sp. were found.

G 1. Shelf of *Cambrian sandstone.* A grayish-white sandstone merges above into a conglomerate 5 *cm* thick, which in turn is covered by a greenish sandstone. We have here, therefore, the boundary layer between Lower (white) and Upper (greenish) sandstone.

G 2 and G 3. Ledges of *Lower* (white) *Cambrian sandstone.*

G 4. Ledges of *white arkose-like Cambrian sandstone*, with small quarries.

G 5. Ledge in ditch running N. and S. *White sandstone.*

G 6. Ledge in the field. *Upper greenish-gray sandstone.*

G 7. Shallow ditch on the E. side of the highway. *Cambrian sandstone* greenish-gray, brown-flecked, in certain parts dark-brown and loose. In this, *Obolus Mobergi* WALCOTT, *Hyolithus De Geeri* HOLM, both abundant in the brown rock, and sparsely *Schmidtiellus Torelli* MOBERG. Not easily accessible.

G 8. Pit, partly filled up. According to information received, *Cambrian sandstone* crops out at the bottom. Here have been found boulders of a fine diabase breccia.

H 1. E. bank of the Fogelsång rivulet. Alum shales containing *Bryogr. Kjerulfi* LAPW. and *Dictyogr. flabelliformis* var. *norvegica* KJERULF, only accessible by digging.

H 2. Cutting just S. of the foregoing locality. Here are found
a. *Diabase dyke*, weathered through.
b. SW. of the diabase, and with intercalated shales rich in brachiopods, are bands of limestone, of which the upper belong to the *Ceratopyge limestone*, the lower, mostly weathered through, to the »*Shumardia zone*». By blasting here it has been found that the limestone is underlaid by shales containing *Bryogr. Kjerulfi* LAPW.

H 3. *Diabase dyke*, little exposed (almost grassed over).

H 4. Broad shelf of rock in bottom of the ditch. *White Cambrian sandstone* with the surface scratched.

H 5. Gravel-pit, in the N. and W. sides of which may be seen shelves of *diabase* and of *Cambrian sandstone*, partly Upper (greenish), partly Lower (white). On this latter a finely polished slickenside face, due to yielding and differential movement.

H 6. In a pit, 0.7 *m* deep, on the E. side of the Fogelsång rivulet, just S. of locality *H 2*, gray shales with indeterminable brachiopods and graptolite fragments were found. The pit is now filled up.

H 7. Section in or by the NW. end of the diabase dyke *H 2 a*. *Lower Didymograptus beds*, strongly metamorphosed, yet with recognizable fossils.

I 1. Ledge in the field. *Diabase*, continuation of the diabase dyke *H 3*.

I 2. Old marl-pits, filled with water. At the N. side of a similar one were found large cast up blocks of hard, dark, limestone, crowded with iron pyrites and with adherent black shales; both in the shales and in the

limestone fossils belonging to the zone of *Conocoryphe exulans* LINRS.

I 3 Ledge of rock in the W. ditch of the highway. *Brown-spotted Cambrian sandstone.*

I 4. Ledge at the bottom of a gravel-pit. *Upper* (greenish-gray) *Cambrian sandstone* with »tracks». Ledge scratched and polished.

I 5. Quarry. Same rock as at foregoing locality.

I 6. Ledge in the field. Same rock as at localities *I 4* and *I 5.*

I 7. Quarry, partly planted over. Same rock as at foregoing localities.

I 8. Little quarry S. of the cottage. Here a brown-spotted grayish-green rock in certain parts dark-brown, loose. In it abound *Obolus Mobergi* WALCOTT. *Hyolithus De Geeri* HOLM and *Schmidtiellus Torelli* MOBERG have also been found here. Mr. KALLENBERG has kindly informed me, that he also came across an *Arionellus* sp.

I 9. Quarry. Same rocks as at the foregoing locality.

I 10. According to the Geological map-sheet »Lund», *Cambrian sandstone* has been noted here. It is no longer visible.

I 11. Ledge of *greenish-gray, brown-spotted sandstone* with »tracks».

I 12. Large quarries, both E. and W. of the high-road: *Greenish-gray, brown-spotted sandstone.* Fragments of trilobites have been observed in it.

I 13. Gravel- or marl-pit, now filled with water, in which, according to the the Geological map-sheet »Lund», *Cambrian sandstone* is said to have been found *in situ* at a depth of 4.2 *m.*

I 14. Ledge of *Cambrian sandstone*, merging above into a conglomerate 20 *cm* thick.

I 15. Ledge of *Cambrian sandstone*, greenish-gray or white with green lenses. The surface scratched.

I 16. Ledge of *Cambrian sandstone*, white, in places coarse-grained nearly as a conglomerat.

K 1. In the high-road. Ledges of thin-bedded, *greenish-gray sandstone*, filled with »tracks».

K 2. The great quarry of Hardeberga on both sides of the high-road. Here *Lower* (white) *Cambrian sandstone*, partly with ripple-marks.

K 3. Ledge of *Lower* (white) *Cambrian sandstone*. The ledge continues from locality *G 2*.

K 4. Old abandoned quarries E. of Hardeberga. *Upper Cambrian sandstone*, dark with lighter »tracks».

L 1—15. *Red gneiss.*

L 1. The ledge in the water-works' most westerly basin, at the N. edge of it and visible only at low water, consists partly of dark mica-schist, and is splendidly ice-grooved and polished.

L 6 and 7. Both refer to the same ledge, the former indicates a metre-broad *diabase dyke* in the most W. part of the ledge, *L 7* a couple of smaller *apophyses of diabase* nearer the E. end of the ledge.

L 11. 100 *m* from the E. end of the ledge, a *diabase dyke*, partly weathered away.

L 12. In the S. part of the ledge, which, to a great extent, lies outside the area of the annexed general map, a *diabase dyke* more than 6 *m* broad.

M 1. In the walls of the influx canal to the water basins: *Greenish-gray Cambrian sandstone*, filled with »tracks» (*Scolithus errans* TORELL).

M 2. In a well (0.7 *m* below the surface). Ledge of *white Cambrian sandstone.*

M 3. Ledge in the road: *White Cambrian sandstone.*

M 4. Ledge of *white Cambrian sandstone.*

M 5. In the ditches on each side of the road: *Cambrian sandstone.* The ledge E. of the road is ice-grooved.

M 6. In the road and close to the house: *Greenish-gray, brown-spotted sandstone* with »tracks» (and fragments of fossils?)

M 7. Small quarry. Same rock as at foregoing locality.

M 8. Gravel-pit. Here (as local moraine?) *greenish-gray, brown-spotted Cambrian sandstone.*

M 9. In the ditch. *Cambrian sandstone,* greenish-gray or white with green lenses.

N 1. Banks of the rivulet. Ledges of *Lower* (white) *Cambrian sandstone.* — The spot is of interest, because it shows that the Archæan is bordered by the Cambrian sandstone on its W. side also.

II. The points of observation grouped according to the age of the strata.

Gotlandian.

Colonus beds: *Odarslöf* (see fig. 2).

Cyrtograptus beds

- Upper
  - Zone of *Monogr. testis* Barr. *A 1.*
  - Zone of *Cyrtogr. rigidus* Lapw. *D 2,* (*D 9*).
- Middle *B 2.*
- Lower (*Retiolites beds*) *D 3, D 8, E 3* and *E 4.*

Rastrites beds

- Zone of *Monograptus runcinatus* Lapw. *B 9.*
- » » *Monogr. Sedgwicki* Portl. *B 10.*
- » » *Monogr. tenuis* Portl. *E 27.*
- Lower part generally *B 7, B 8* and *C 1.*

Ordovician.

Trinucleus beds: Zone of *Staurocephalus clavifrons* ANG. *Koängen* (see fig. 1).

Chasmops beds or ***Middle Dicellograptus beds***

- Zone of *Ampyx rostratus* SARS and *Calymmene dilatata* TULLB. *F 2 b.* — Same zone developed as *Orthis shales E 10, E 12, E 13* southernmost, *E 33?, E 34?, E 38, F 2 a* and *F 11.*
- Zone of *Climacogr. rugosus* TULLB. (= Z. of *Dicranograptus Clingani* CARR.) *E 13* nothernmost.
- *Chasmops beds* in general *E28, E 30, E 38, E 39, E 41* and *F 2 b.*

Asaphus beds

- *Lower Dicellograptus beds*
  - Zone of *Nemagraptus gracilis* HALL *E 14 a* uppermost.
  - Zone of *Diplogr. putillus* HALL *E14a* lowest, *E 14 b* and *E 14 c* uppermost.
  - Zone of *Diplogr. Linnarssoni* TULLB. sp. *E 14 c* lowest, *E15* uppermost.
  - Zone of *Glossogr. Hincksi* HOPK. *E15* lowest.
- *Lower Dicellograptus beds* in general *E 7, E 8, E 9, F 1, F 10, F 14?*
- *Upper Didymograptus beds*
  - *Geminus beds E 5, F17, E23* upperm., *E 32 a* and *b, E 36, E 37, E 42?, E 43, F3, F12* and *F 14?*

Asaphus beds (continued)

- *Upper Didymograptus beds* (continued) — Zone of *Phyllogr.* cfr *typus* HALL *E 21 a* and *b* uppermost and *E 23* lowest.
- *Orthoceras limestone* (limestone with *Trinucleus coscinorhinus* ANG.): *E 20*, *E 21 a?*, *E 21 b*, *E 22?* and *E 46?*
- *Lower Didymograptus beds: E 22 a* and *b* and *H 7*.

Ceratopyge beds

- *Upper*
  - Zone of *Apatocephalus* (or *Ceratopyge limestone*) *H 2 b*.
  - Zone of *Shumardia H 2 b*.
- *Lower* or *Dictyograptus beds*
  - Zone of *Bryograptus Kjerulfi* LAPW., *E 19*, *H 1* (and *H 2 b*).
  - zone of *Clonogr. tenellus* LINRS. *E 18*.
  - Zone of *Dictyogr. flabelliformis* EICHW. *F 4* and *F 7*.

Cambrian.

Upper Cambrian or **Olenus beds**

- *Acerocare zone*
  - Layers with *Parabolina heres* BRÖGG. *F 5* uppermost in the E. part?, *F 6* and *F 15*.
  - Layers with *Acerocare ecorne* ANG. *F 5*.

Middle Cambrian or **Paradoxides beds**

- *Tessini zone* (*Exulans limestone*) *I 2* (blocks?).

Lower Cambrian or **Olenellus beds**

- *Upper* (greenish-gray, fossiliferous) *sandstone: G 6*, *G 7*, *H 5*, *I 3*, *I 7*, *I 8*, *I 9*, *I 11*, *I 12*, *K 1*, *K 4*, *M 1* and *M 6—8*.

Lower Cambrian or ***Olenellus beds*** (continued)	*Lower* (grayish-white, fossilfree) *sandstone* *G 2—5*, *H 4*, *H 5*, *K 2*, *K 3*, *M 2—4* and *N 1*.
	Boundary stratum between the Upper and Lower sandstone: *M 9*.
	Cambrian sandstone in general *G 8*, *I 10*, *I 13* and *M 5*.

Diabase: *A 1*, *B 1*, *B 3—5*, *D 1*, *D 6?*, *E 1*, *E 2*, *E 6*, *E 11*, *E 13* *e* and *f*, *E 24—26*, *E 33?*, *E 45*, *F 8*, *H 2 a*, *H 3*, *H 5*, *I 1*, *L 6*, *L 7*, *L 11*, *L 12*, and *Koängen*.

Archean: *L 1—15*.

Works dealing with the Silurian strata of the Fogelsång District and their fossils.

1852, 54. ANGELIN, N. P.: Palæontologia scandinavica.

1865. TÖRNQUIST, S. L.: Om Fogelsångstraktens Undersiluriska lager (The Lower Silurian strata of the F. District). — Lunds Univ. Årsskr.

1875. LINNARSSON, G.: Anteckningar från en resa i Skånes silurtrakter år 1874 (Notes from a journey in the Silurian Area of Scania in 1874). — Geologiska Föreningens i Stockholm Förhandlingar (= G.F. F.) Bd 2.

1875. TÖRNQUIST, S. L.: Berättelse om en geologisk resa genom Skånes och Östergötlands paleozoiska trakter sommaren 1875. (Report of a geological journey through the paleozoic districts of Scania and Ostrogothia during the summer of 1875). — Öfvers. Kgl. sv. Vet.-Akad. Förh.

1877. ANGELIN, N. P.: Geologisk öfversigts-karta öfver Skåne med åtföljande text. (Geological General-map of Scania with explanation). Lund 8:o.

The map was printed in Munich 1859 and the two first sheets of the explanation in Lund 1862. The scale of the map is indicated (by B. LUNDGREN, the Editor) to 1 : 275 000 and later on (by A. REMELÉ 1883) to 1 : 350 000, but is really 1 : 360 000.

1879. LINNARSSON, G.: Iakttagelser öfver de graptolitförande skiffrarne i Skåne. (Observations on the graptolite-bearing shales in Scania). — G. F. F. Bd 4.

1880. TULLBERG, S. A.: Tvenne nya graptolitslägten (Two new graptolite genera). — G. F. F. Bd 5.

1882. — — On the graptolites described by Hisinger and the older Swedish authors. — Bihang t. Kgl. sv. Vet.-Akad. Handl. Bd 6.

— — Skånes graptoliter. 1. (The graptolites of Scania I). — Sv. Geol. Unders. Ser. C, No. 50. — (See also review of this in G. F. F. Bd 6).

— — Über die Schichtenfolge des Silurs in Schonen nebst einem Vergleiche mit anderen gleichalterigen Bildungen. (On the sequence of the Silurian strata in Scania and a parallel with other formations of the same age). Zeitschr. d. D. Geol. Ges.

1887. DE GEER, G.: Beskrifning till geologiska kartbladet Lund (jemte karta). (Explanation to the geological map-sheet Lund [with map]). — Sv. Geol. Unders. Ser. Aa, N:o 92.

1894. SEGERBERG, K. O.: Iakttagelser från gemensamma exkursioner i Fogelsångstrakten (Observations from joint excursions in the F. district). — Medd. n:o 1 från Lunds Geol. Fältklubb. — G. F. F. Bd 15.

1896. MOBERG, J. C.: Geologisk vägvisare inom Fogelsångstrakten (Geological Guide to the F. District). — Meddel. n:o 2 från Lunds Geol. Fältklubb. Lund 8:o.

1897. ANDERSSON, J. G.: Om fosforitbildning och fosforitförande sediment (On formation of phosphorite and on phosphorite-bearing sediments). — G. F. F. Bd 19.

1898. MOBERG, J. C. and MÖLLER, HJ.: Om Acerocarezonen (On the Acerocare zone). — Meddel. n:o 3 från Lunds Geol. Fältklubb. G. F. F. Bd 20.

1898. MOBERG, J. C.: En trilobit från Skånes dictyograptusskiffer (A trilobite from the Dictyograptus beds of Scania). — Meddel. n:o 5 från Lunds Geol. Fältklubb. G. F. F. Bd 20.

1900. NILSSON (-WESTERGÅRD), A. and TELLANDER, A.: Geologiska åldern af skiffern med *Clonograptus* cfr *flexilis* HALL vid Fogelsång (The geological age of the shales with *Clonograptus* cfr *flexilis* HALL at Fogelsång). — Meddel. n:o 6 från Lunds Geol. Fältklubb. — G. F. F. Bd 22.

1900. MOBERG, J. C.: Nya bidrag till utredning af frågan om gränsen mellan undersilur och kambrium. (Fresh contributions towards solving the problem of the boundary between Ordovician and Cambrian). — G. F. F. Bd 22.

1901. — — *Pterograptus scanicus* n. sp. — Meddel. n:o 7 från Lunds Geol. Fältklubb. — G. F. F. Bd 23.

1901. STRANDMARK, J. E.: Undre graptolitskiffer vid Fogelsång (Lower Didymograptus beds at Fogelsång). — Meddel. n:o 8 från Lunds Geol. Fältklubb. — G. F. F. Bd 23.

1902. MOBERG, J. C.: Om Sularpsbäckens dalgång (The glen of the Sularp river). — Meddel. n:o 10 från Lunds Geol. Fältklubb. — G. F. F. Bd 24.

1906. OLIN, E.: Om de chasmopskalken och trinucleusskiffern motsvarande bildningarna i Skåne (On Scanian formations corresponding to the Chasmops and Trinucleus beds). — Lunds Geol. Fältklubbs meddel. n:o 1, ser. B. — Kgl. Fysiogr. Sällsk. i Lund Handl. N. F. Bd 17.

1906. MOBERG, J. C. and SEGERBERG, C. O.: Bidrag till kännedomen om ceratopygeregionen med särskild hän-

syn till dess utveckling i Fogelsångstrakten. (Contributions to our knowledge of the Ceratopyge region with special reference to its development in the F. district). — Lunds Geol. Fältklubbs meddel. n:o 2, ser. B. — Ibidem.

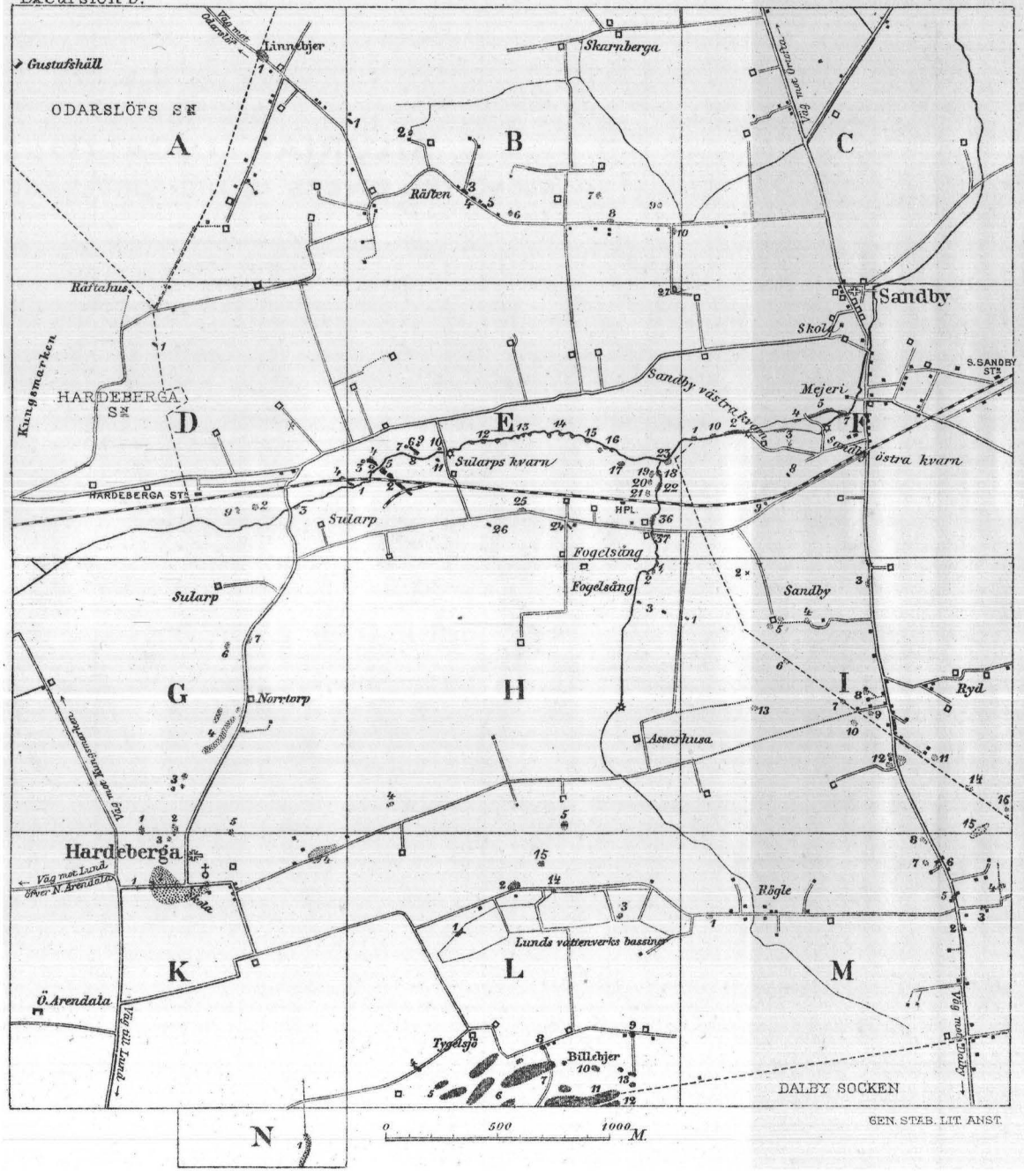
1907. MOBERG, J. C.: *Aeglina umbonata* ANG. sp. — Meddel. n:o 12 från Lunds Geol. Fältklubb. — G. F. F. Bd 29.

1908. NÖRREGAARD, E. M.: Nogle Bemærkninger om Orthocerkalkens petrografi. (Some remarks on the petrography of the *Orthoceras limestone*). — Meddel. n:o 14 från Lunds Geol. Fältklubb. — Medd. från Dansk Geol. Forening, no. 13, (Bd 3).

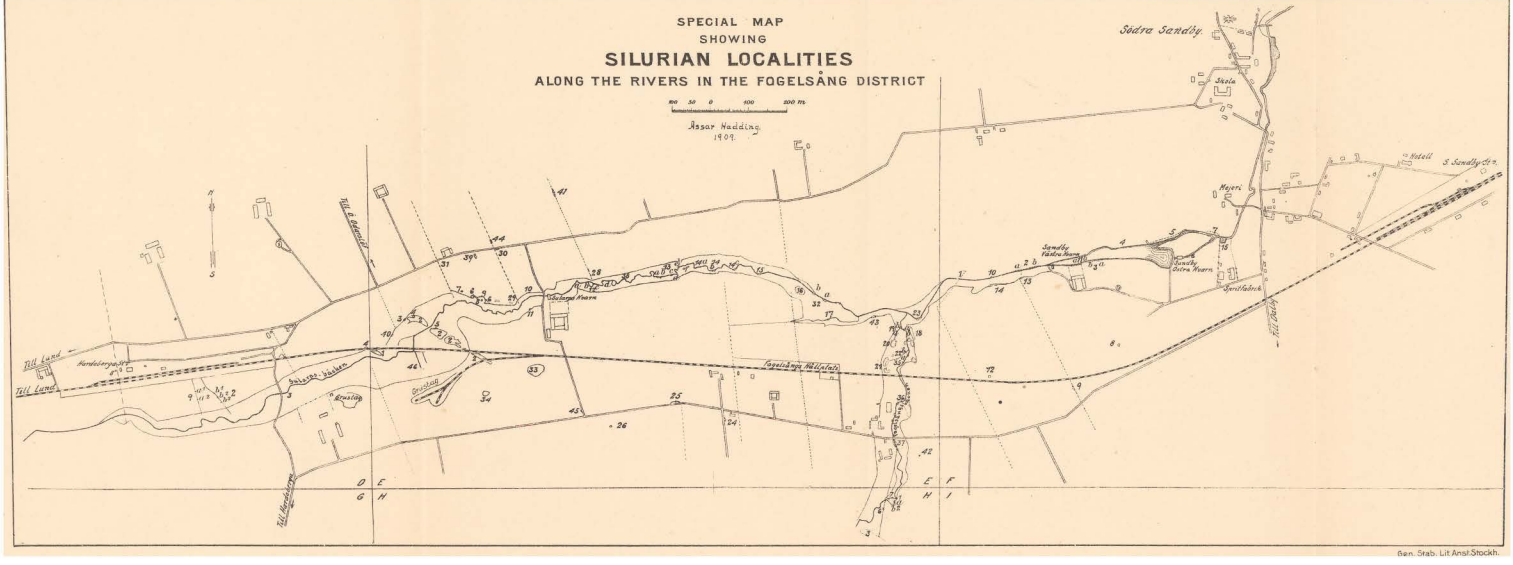
1909. WESTERGÅRD, A. H.: Studier öfver dictyograptusskiffern och dess gränslager med särskild hänsyn till i Skåne förekommande bildningar. (Researches into the Dictyograptus beds and their bounding strata especially as they are met with in Scania). — Lunds Geol. Fältklubbs meddel. n:o 4, ser. B. — Kgl. Fysiogr. Sällsk. i Lund Handl. N. F. Bd 20.

General map of the Silurian district of Fogelsång

Excursion D. Pl. 1.



SPECIAL MAP
SHOWING
SILURIAN LOCALITIES
ALONG THE RIVERS IN THE FOGELSÅNG DISTRICT



(Reprinted from Geol. Fören. i Stockholm Förhandl. Bd 32. Häft. 1. Jan. 1910.)

3.

The Jerrestad—Tommarp valley.

In the Silurian district of South-East Scania the rocks are comparatively well exposed. To the north-east, resting on the Archæan, the Silurian basement-bed, the Cambrian sandstone, extends from the environs of Simrishamn, where it has a breadth of more than 15 *km* (nine English miles),[1] in a belt, narrowing to the north-west, right up past Fogeltofta, near the north-west corner of the geological map-sheet »Simrishamn». The south-west boundary line of this belt of sandstone is somewhat sinuous and exhibits here two great arcs, of which one reaches Wemmerlöf church, and the other ends east of Jerrestad.

Beyond it, on the south-west, the higher strata of the system cover a wide tract, and are most easily studied as a whole in the so-called Jerrestad—Tommarp Section (or, more correctly, section-series). This stretches south-west of the village of Tommarp and further, along the stream known as Tommarpsån or Jerrestadsån, between Tommarp and Jerrestad. This stream winds just south of the villages, and since each has a station on the railway from Malmö to Simrishamn, which passes

[1] It may be mentioned in passing that it is on the hard, smooth ledges of this sandstone that the well-known ancient rock-carvings are to be found in many places in this district.

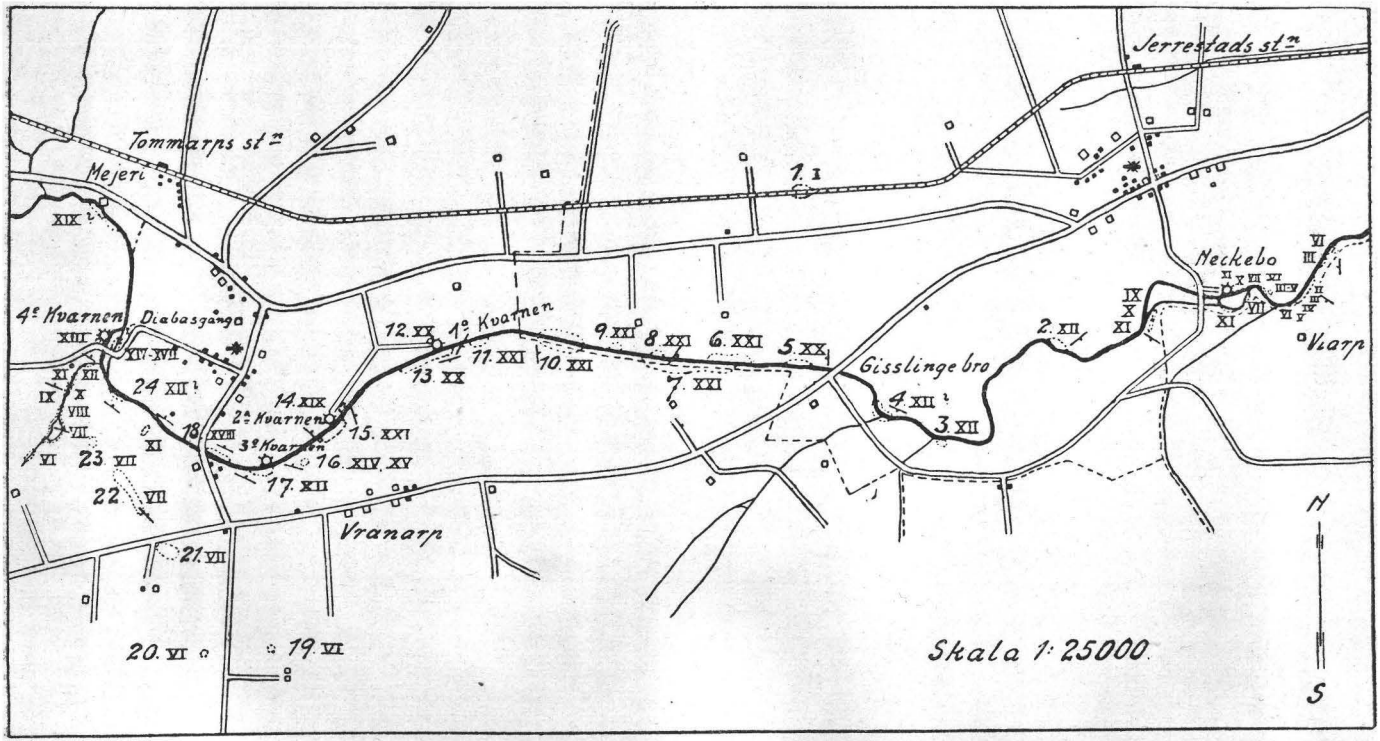


Fig. 1. *Main map of the valley Jerrestad-Tommarp.*

immediately on their north, the section is particularly easy of access.

The Cambrian sandstone mentioned above does not appear in this section, though exposed as a small shelf just to the north, namely in a little railway cutting between Tommarp and Jerrestad (cfr *loc. 1* in the main map). The *Paradoxides* beds, as well as the greater part of the *Olenus* beds, are also completely lacking. With these exceptions there is a fairly complete representation of the Silurian strata, from the uppermost *Olenus* shales (zone of *Acerocare*) to the *Colonus* beds inclusive.

Before dealing in detail with the several zones of the Silurian strata, we may direct attention to the geological structure of this district. As in other Scanian localities, where the Silurian is more or less fully represented in a narrow compass, the strata are cut by a number of faults into huge dice or blocks, which have been shifted relatively to one another in vertical, and even in horizontal, directions. Thus denudation has exposed one zone here, another there. There is rarely any great difference in age between the surface strata belonging to adjacent »blocks»; on the contrary, they follow one another in more or less connected sections, and usually in the regular order of their geological age. But here and there the gap is somewhat greater, either because intervening zones have been lost by dislocation, or because they happen to be hidden by Quaternary deposits. Occasionally, however, a gap of this sort may be merely apparent, and due to the fact that some of the Silurian beds have a peculiar development or facies within this district, as will now be shown.

The Silurian sequence in South-East Scania differs decidedly from that in West Scania as regards the Ordovician strata. The differences are clearly shown in the accompanying table, where the Jerrestad-Tommarp section is taken as the type of the Silurian in East Scania and the rocks of the Fogelsång-Sandby district as typical for West Scania.

The Silurian of East and West Scania compared.

				Zone.	*E. Scania.* Jerrestad-Tommarp.	*W. Scania.* Fogelsång-Sandby.
Gotlandian	*Colonus beds*	Zone of *Monogr. colonus*		XXI	+	+
	Cyrtograptus beds	» » *Cyrtogr. Carruthersi* and *Monogr. testis*		XX	+	+
		» » *Cyrtogr. Murchisoni*		XIX	+	?
	Rastrites beds	» » *Monogr. runcinatus*		XVIII	+	+
		» » » *Sedgwicki*		XVII	?	+
		» » *Diplogr. cometa*		XVI	+	lacking?
		» » » *folium*		XV	+	lacking?
		» » *Monogr. triangulatus*		XIV	+	lacking?
		(» » » *cyphus*)		.	?	?
		» » *Diplogr. acuminatus*		XIII	+	lacking
Ordovician	*Harpes beds (Brachiopod beds)*	Upper Dicellogr. shales	Zone of *Phacops eucentra*	XII	+	lacking
	Trinucleus beds		» » *Staurocephalus clavifrons*	.	lacking	+
			» » *Ampyx Portlocki*	XI	+	+
	Chasmops beds	Middle Dicellogr. shales	» » *Pleurogr. linearis*	X	+	lacking
			» » *Calymmene dilatata* (Orthis shales) and *Climacogr. rugosus*		lacking	+
			» » *Dicranogr. Clingani*	IX	+	lacking
	Asaphus beds	Lower Dicellogr. shales[1]	» » *Nemagr. gracilis*		lacking	+
			» » *Diplogr. putillus*		lacking	+
			» » » *Linnarssoni*		lacking	+
			» » *Glossogr. Hincksi*		lacking	+
		U. Didymogr. shales	» » *Didymogr. geminus*	.	lacking	+
			» » *Phyllogr.* cfr *typus*	.	lacking	+
		Zone of *Trinucleus coscinorhinus*		VIII	+	+
		» » »Orthoceras limestone»		VII	+	+
		Lower Didymogr. shales		VI	+	poorly developed

[1] That the Lower Dicellograptus shales are classed under Asaphus beds (and not with the Chasmops beds) is due to the fact that *Robergia microphthalma* LINRS., which has been found in those beds at Röstånga by OLIN, was found in Jemtland by WIMAN together with *Ogygia dilatata* BRÜNN., one of the characteristic fossils of the Upper Asaphus beds (cfr W. C. BRÖGGER: Geologisk Kart over öerne ved Kristiania. Nyt Mag. f. Naturvid. *31*, 1887)

			Zone.	*E. Scania.* Jerrestad-Tommarp.	*W. Scania.* Fogelsång-Sandby.
Ordovician	*Ceratopyge beds*	Ceratopyge limestone	V	poorly developed	+
		» shales or Shumardia zone .	IV	poorly developed	+
		Dictyograptus shales	III	+	+
Cambrian	*Olenus beds*	Zone of *Parabolina heres* and *Acerocare*	II	+	+
	Paradoxides »	Exulans limestone	.	lacking	boulders?
	Olenellus »	Cambrian sandstone	I	+	+

From this it appears that the *Shumardia* zone and *Ceratopyge* limestone, which are well developed in West Scania, are very poorly represented in East Scania. The same is the case with the Upper *Didymograptus* shales and Lower *Dicellograptus* shales, which are altogether lacking in East Scania. On the other hand, the Lower *Didymograptus* shales (*Phyllograptus* shales), occur in both districts, though better developed in the eastern than in the western.

The *Chasmops* beds are very variously developed. In the Fogelsång-Sandby district there dominates the flinty zone of *Calymmene dilatata* (»Orthisskiffer»), or shales with *Climacograptus rugosus*, while at Jerrestad and Tommarp, shales with *Dicranograptus Clingani* are well developed. The zone of *Pleurograptus linearis* has only been distinguished at Jerrestad.

The zone of *Staurocephalus clavifrons* ANG. has only been found in West Scania, which, on the other hand, lacks the zone of *Phacops eucentra* and perhaps that of *Diplograptus acuminatus*.

On the whole, the various zones of the *Rastrites* beds are more fully known from Tommarp,[1] but this is probably

[1] The zones of *Monograptus cyphus* LAPW. and *M. Sedgwicki* PORTL. have not been observed at Tommarp, but TÖRNQUIST considers that the latter will eventually be found there.

due to a lack of sections in those parts of the Fogelsång—Sandby district where *Rastrites* beds occur.

In general the two districts may be said to supplement each other in a fortunate manner, as regards not only the occurrence of the different zones, but also the differences in their development.

The Jerrestad—Tommarp section has a unique character in that the zones of *Pleurograptus linearis* and of *Diplograptus acuminatus* are not known from any other spot in our country, unless indeed the latter is found at Röstånga, also in being the only place in Scania, where a sequence through the *Dictyograptus* shales can be perfectly observed in a continuous section from the underlying to the overlying beds.

As the main map shows, the oldest strata of the district occur at the two ends of the section, in other words, at Jerrestad and Tommarp; and successively younger strata are found as the central parts of the section are approached, so that the middle, between Gislinge bridge and the first mill of Tommarp, is quite occupied by the *Colonus* beds, which are flanked, on the east and west, by shales belonging to the zone of *Monograptus testis* BARR. The dislocations mentioned above seem chiefly to have affected the lower strata, while the upper are, to all appearance, but little displaced. This may, however, be due in part to the fact that the disturbances are not so conspicuous in the thicker and more uniform upper strata. Owing to the peculiar distribution of the strata, the section as a whole presents the appearance of being cut through a basin, though evidently there is no such structure here.

Among the works dealing directly with these localities and their fossils, the following are the most important:

1874. LUNDGREN, B.: Om i Skåne förekommande bildningar, som motsvara Brachiopodskiffern i Vestergötland. [Formations occurring in Scania equivalent to the

Brachiopod beds in Westrogothia]. Geol. Fören. i Stockholm Förh. Vol. II.

1875. LINNARSSON, G.: Anteckningar från en resa i Skånes silurtrakter år 1874. [Notes from a journey in the Silurian tracts of Scania, 1874.] Geol. För. i Stockholm Förh. Vol. II.

» TÖRNQUIST, S. L.: Berättelse om en geologisk resa genom Skånes och Östergötlands paleozoiska trakter sommaren 1875 etc. [Report of a geological journey through the paleozoic tracts of Scania and Ostrogothia in the summer of 1875, etc.] Öfvers. af Kgl. sv. Vet.-Ak. Förh.

1882, 1883. TULLBERG, S. A.: Skånes graptoliter. [The graptolites of Scania.] Sver. Geol. Unders. Ser. C, No. 50, 55.

1892. HOLST, N. O.: Beskrifning till kartbladet Simrishamn. [Explanation to the map-sheet Simrishamn.] Sver. Geol. Unders. Ser. Aa, No. 109.

1896. NATHORST, A. G.: Sphenothallus en Conularia. [Sphenothallus a Conularia.] Geol. Fören. i Stockholm Förh. Vol. 18.

1897. TÖRNQUIST, S. L.: On the Diplograptidæ and Heteroprionidæ of the Scanian Rastrites beds. Kgl. Fysiogr. Sällsk. i Lund Handl. N. F. Vol. 8.

1899. TÖRNQUIST, S. L.: Researches into the Monograptidæ of the Scanian Rastrites beds. Kgl. Fysiogr. Sällsk. i Lund Handl. N. F. Vol. 10.

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A detailed examination has as yet been made of but few of the strata and fossils from this tract. Those best studied are the *Dictyograptus* zone and its contiguous strata (by WESTERGÅRD, 1909), the Lower *Didymograptus* shales (by TÖRNQUIST, 1901, 1904), the *Chasmops* and *Trinucleus* strata (by OLIN, 1906) and the *Rastrites* beds (by TÖRNQUIST, 1897, 1899).

As the position of the points of observation and the geological age of the strata may be gathered directly from the accompanying maps, the following detailed description only aims at giving a general summary of the various zones, their distribution and fauna. Since the scale of the main map does not permit of a perfectly clear representation of the more complicated conditions in Jerrestad and Tommarp, enlarged special maps of these areas have been added. In referring to these special maps, the numbers that indicate localities are accompanied by the letter J (for Jerrestad) or T (for Tommarp), as the case may be; where these letters are lacking, the numbers refer to the main map.

I. ***The Cambrian sandstone.*** Within the limits of the map this is only exposed at *loc. 1*, in a small shelf of rock in the south cutting of the railway line. In the uppermost strata of the sandstone, accessible on the coast south of Simrishamn, we find *Olenellus* (*Schmidtiellus*) *Torelli* MOBERG and other fossils.

II. ***Acerocare beds.*** *Loc. J 3.* In alum shales from the bed of the Jerrestadså at the numeral (J) 3 WESTERGÅRD found *Parabolina heres* BRÖGGER, *Acerocare micropygum*

LINRS, *Megalaspis* sp., *Agnostus* sp., and an *Orthis*. In a stink-stone, cropping out about 1 metre higher up on the edge of the eastern shore, we find the two first-

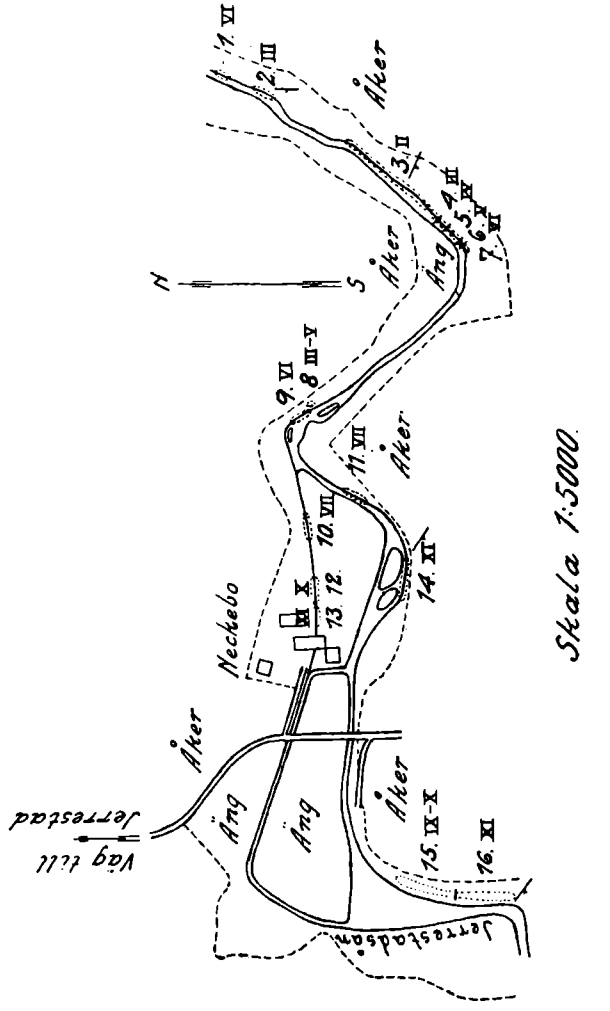

Fig. 2. *Special map of the Jerrestad area.*

mentioned trilobites in abundance, and *Acerocare paradoxum* MBG more sparingly.

III. ***Dictyograptus beds.*** *Locs. J 2, J 4, J 5 and J 8.* These lie immediately above the *Acerocare* shales that are expo-

sed at *loc. J 3.* Passing *north-eastwards* from that locality, we first find the *Dictyograptus* beds *in situ* at *loc.*

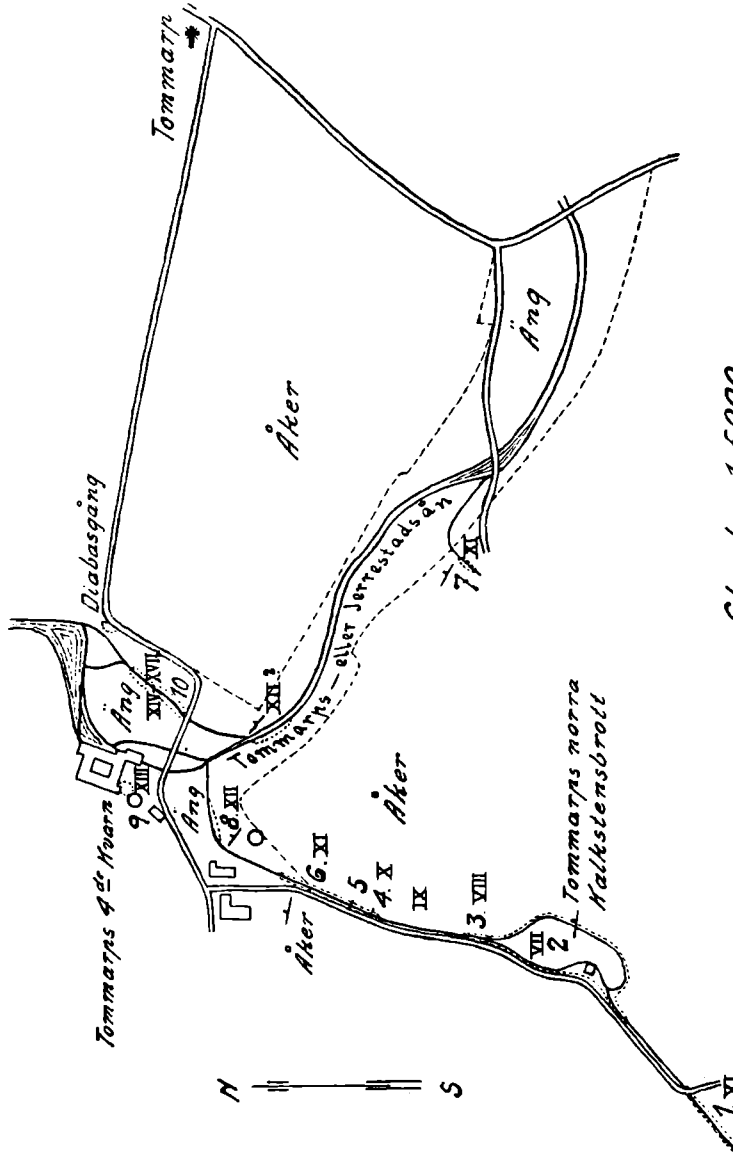

Fig. 3. *Special map of the Tommarp area.*

J 2. Here they lie in the bed of the stream, at first horizontally, but dipping north further to the north-east.

The occurrence of *Dictyograptus flabelliformis* EICHW. sp. in the southern part of this exposure proves the presence of the lowest subzone of the *Dictyograptus* beds, while further north the middle subzone is proved by finds of *Clonograptus tenellus* var. *Callavei* LAPW. and *Cl. tenellus* var. *hians* MBG.

When followed *south-westwards* from the before named locality (*J 3*), the strata are seen to dip in the same direction, at first gently, then more steeply, till at about 30 metres from the stink-stone in the *Acerocare* beds, the dip is vertical. The strata can be followed a little further towards the south-west up to the bend of the stream, where they again assume a SW. dip. — The *Dictyograptus* beds begin at *loc. J 4* (20 *m* from the above-mentioned stink-stone); here is their lowest subzone, yielding *Dictyograptus flabelliformis* f. *typica* while, further to the south-west, this is accompanied by *Clonograptus* and *Bryograptus Hunnebergensis* MBG which characterize the middle subzone. At *loc. J 5* (30 *m* from the stink-stone) where, as was said, the strata are vertical, we come across *Dictyograptus flabelliformis* var. *norvegica* KJERULF and *Bryograptus Kjerulfi* LAPW. (indicating the uppermost subzone of the *Dictyograptus* beds). These graptolites are also met with in the shales south-west of the vertical strata. We have consequently here a complete section through the three subzones of the *Dictyograptus* beds. At *loc. J 8*, on the brink of the stream, are shales with *Bryograptus Kjerulfi*, overlaid by the following zones.

IV. ***Ceratopyge shales.*** At *locs. J 5* and *J 8* the *Dictyograptus* beds are overlaid by the *Ceratiocaris* shales, alum-shales filled with *Ceratiocaris scanicus* WESTERGÅRD, which, by reason of their position, may be regarded as equivalent to the *Ceratopyge* shales.

V. ***Ceratopyge limestone.*** At *loc. J 6* dark gray shales, alternating with light gray limestone, cover the *Ceratiocaris* shales seen at *loc. J 5*. The same sequenec at *loc. 8*. The limestone, in which only indeterminable fragments of trilobites, brachiopods, and an *Orthoceras* have been found, is considered, by reason of its position, to be equivalent to the *Ceratopyge* limestone.

VI. ***The Lower Didymograptus beds.*** *Locs. J 1, J 7, J 9* and *T 1*. At the first locality we find, partly in the bed of the stream, partly two or three metres above it, in the east bank, TÖRNQUIST's zones *c* and *d* of the beds in question, i. e. zone of *Phyllograptus densus* TÖRNQ. (=*Ph. angustifolius* HALL) and zone of *Isograptus gibberulus* NICH. At *loc. J 7* occurs TÖRNQUIST's zone *b*, or the zone of *Didymograptus balticus*, directly superposed on the *Ceratopyge* limestone seen at *loc. J 6*. Besides the name-fossil, there are found here *Didymograptus geometricus* TÖRNQU., *D. constrictus* HALL, *Tetragraptus quadribrachiatus* HALL and *Schizograptus rotans* TÖRNQU. At *loc. J 9*, in the bed of the stream, the same shales are met with, separated by a fault from the older strata cropping out higher up, at the edge of the stream (at *loc. J 8*).[1] The patch of this beds, which crops out at *loc. T 1*, at the bottom of a ditch, is difficult of access and little known, but belongs surely to the upper part of the beds. According to HOLST 1892, these beds are also met with at *locs. 19* and *20*.

VII. ***Orthoceras limestone.*** *Locs. J 10, J 11* and *T 2*. At *loc. J 11* are found in and by the stream several beds dipping at a high angle towards the west. At *loc. J 10*, in the walls of the mill-race, the limestone is difficult of access. It is most easily studied in the

[1] Among graptolites quoted by TÖRNQUIST, from the Lower Didymograptus beds at Jerrestad, are *Didymograptus patulus* HALL, *D. Kurcki* TÖRNQU. and *Dichograptus octobrachiatus* HALL too.

northern limestone quarry of Tommarp (*loc. T 2*), but even there fossils are sparse and little known. — According to HOLST 1892, this limestone also occurs at *locs. 21*, *22* and *23*.

VIII. ***Limestone with Trinucleus coscinorhinus*** ANG. *Loc. T 3.* Superposed on the *Orthoceras* limestone in the northernmost part of the quarry just mentioned.

IX. ***Shales with Dicranograptus Clingani*** CARR. *Loc. J 12* and (perhaps somewhat disturbed) between *locs. T 3* and *T 4*. At the first locality this zone forms the lowest accessible strata in the high scarp. Here, together with *Dicranograptus Clingani* CARR., are found *Climacograptus bicornis* HALL, *Diplograptus quadrimucronatus* HALL var. *spiniger* LAPW., *Lasiograptus margaritatus* LAPW. and *Corynoides calicularis* NICH. In the upper part of the scarp among them only *Climacograptus bicornis* occurs, and that sparsely; instead, *Diplograptus foliaceus* MURCH. var. *calcaratus* LAPW. and *Dicellogr. Forchhammeri* GEIN. are abundant.[1]

X. ***Zone of Pleurograptus linearis*** CARR. *Locs. J 12*, *J 15* and possibly *T 4*. At the first locality the black, coarsely laminated, often pyritiferous shales of this zone occur in the south wall of the outlet-channel of the Neckebo mill, where they have yielded *Pleurograptus linearis* CARR. and *Climacograptus styloideus* LAPW. At *loc. J 15*, where all strata dip SSW., this zone is met with about 50 *m* SW. of the most northerly part of the scarp mentioned above; and here also *Pleurograptus linearis* is accompanied by *Climacograptus styloideus*. At *loc. T 4*, black, compact, coarsely laminated shales crop out for a length of at least 8 *m* in the wall of the ditch. It is true that in these shales *Pleurograptus* is not found, but *Climacograptus*

[1] According to OLIN (*loc. cit.*).

styloideus, its associate at *locs. T 12* and *J 15* is abundant; *Dicellograptus pumilus* LAPW. also occurs. At *locs. T 5* and *J 15*, are shales rich in iron pyrites, the concretions of it at Tommarp often being the size of a fist. At *loc. J 15*, where these pyritiferous shales immediately overlie the zone of *Pleurograptus*, they are ranked by OLIN as the boundary between the *Chasmops* beds and the *Trinucleus* beds.

XI. ***Zone of Ampyx Portlocki*** or ***Trinucleus beds.*** *Locs. J 13*, *J 14*, *J 16*, *T 6* and *T 7*. At *J 13*, immediately east of Neckebo in the outlet-channel of the mill, are loose, gray shales containing *Diplograptus truncatus* LAPW. The horizontal strata can be followed for nearly 15 *m*, till separated by a fault from zone X at *loc. J 12*. At *loc. J 14*, at the base of the south bank of the stream, *Ampyx Portlocki* has been found in a little layer of limestone, intercalated in loose gray shales, which have alga-like markings on their surfaces. At *loc. J 16*, according to OLIN, is the following sequence (from upper to lower beds).

e) Two strata of limestone of 5 *cm* each, interstratified with 35 *cm* of loose, gray shales. In the upper limestone bed have been found *Trinucleus Bucklandi* BARR. and *T. cerioides* ANG.

d) 140 *cm* of loose, gray shales with fine alga-like markings. In these are *Pseudosphaerexochus laticeps* LINRS., *Phillipsia parabola* BARR. and *Agnostus trinodus* SALT.

c) Loose, gray non-fossiliferous shales, 20 *cm*, covered by limestone 10 *cm* thick, which is crowded with very elongate crystals of calcite, or cavities from which such crystals have been dissolved away.

b) Stratum of limestone, 10 *cm*, fairly rich in fossils such as *Pseudosphaerexochus laticeps* LINRS., *Remopleurides radians* BARR., *Phillipsia parabola* BARR.,

Asaphus ingens BARR., *Illaenus megalophthalmus* LINRS. and *Trinucleus cerioides* ANG.

a) 2 *m* gray shales with alga-like markings, poor in fossils, namely *Leptaena quinquecostata* M'COY and *Acestra subularis* F. ROEMER (?).

At *loc. T 6*, southern part, is the following sequence (from upper to lower beds):

c) 1,5 *m* loose, gray shales with *Calymmene incerta* BARR., *Phillipsia parabola* BARR. and *Trinucleus cerioides* ANG.

b) An upper stratum of limestone (20 *cm*), separated by 25 *cm* of gray shales from a lower one (10 *cm*). In the limestone are found *Dindymene pulchra* OLIN, *Phillipsia parabola* BARR., *Illænus megalophthalmus* LINRS., and *Ampyx Portlocki* BARR.

a) 50 *cm* loose, gray shales, poor in fossils.

The sequence given here is separated by a fault from other strata further north, which are similar on the whole. In them, according to OLIN, the following trilobites are found: *Phacops recurva* LINRS., *Chirurus subulatus* LINRS., *Remopleurides radians* BARR., *Phillipsia parabola* BARR., *Illaenus megalophthalmus* LINRS., *Trinucleus Bucklandi* BARR., *T. latilimbus* LINRS., *Ampyx gratus* BARR., *A. Portlocki* BARR., *A. tenellus* BARR., *Dionide euglypta* ANG. and *Agnostus trinodus* SALTER.

At *loc. T 7* also are shales belonging to this zone and containing *Phacops recurva* LINRS., *Agnostus trinodus* SALTER, *Diplograptus pristis* HIS., and *D. truncatus* LAPW., These shales, which, however, occur in a shallow ditch and are not easy of access.

XII. ***Zone of Phacops eucentra*** ANG. or ***»Brachiopod shales»***. *Locs. 2, 3, 12* (south of the second Tommarp mill), and *T 8*. Most accessible at *loc. 2* in the south bank of the stream, in a scarp several metres high. Furthest to the west, the shales are hard and splintery; further

to the east, softer and in certain strata fairly rich in fossils, among which *Phacops eucentra* ANG. and a little gastropod (*Turbo?*) are the commonest. The fauna is little known. At *loc. T 8* the strata were formerly visible in the open drain from the limestone quarry; now that the drain has been covered over, they are no longer to be seen.

At *locs. 4 and 24* (on the main map marked »XII?») are shales containing *Climacograptus scalaris* L. and *Diplograptus* sp., ranked by TULLBERG as the uppermost part of the Ordovician, and therefore indicated here as »brachiopod shales». Where they rightly belong it is impossible to decide, before the fauna is better known.

XIII. ***Zone of Diplograptus acuminatus*** LAPW. *Loc. T 9.* At the fourth mill of Tommarp, on the north side of the windmill. Unfortunately the shales noware here hidden by the dungmeer and cesspool. The zone occurs also at the bottom of the stream at *loc. T 10.* Besides the name-fossil only *Climacograptus scalaris* L. and *Conularia gracilis* HALL? are known from this zone.

The zone of *Monograptus cyphus*, as has been mentioned, has not been observed here with certainty. However *Dimorphograptus* cfr *Swanstoni* LAPW. of this zone is found at *loc. 16.*

XIV. ***Zone of Monograptus triangulatus*** HARKN.

XV. ***Zone of Diplograptus folium*** HIS.

XVI. ***Zone of Diplograptus cometa*** GEIN.

According to TÖRNQUIST, these three zones are found at *loc. T 10*, cropping out at the bottom of the stream between the bridge and the mill-dam at the fourth mill of Tommarp, where the strata dip north and can be followed for a distance of rather more than 20 *m.* The two first-named zones are also met with at *loc. 16.*

XVII. ***Zone of Monograptus Sedgwicki*** PORTL. is not known for

certain from this district, but is assumed by TÖRNQUIST to be present at *loc. T10*, immediately north of zone XVI.

XVIII. ***Zone of Monograptus runcinatus*** LAPW. *Loc. 18.* In the cutting in the north bank of the stream, just east of Tommarp bridge.

The zonal distribution of the graptolites found in the Rastrites beds at Tommarp, according to TÖRNQUIST, is shown in the following table:

Species.	Z. of *Diplogr. acuminatus.*	(Z. of *M. cyphus.*)	Z. of *M. triangulatus.*	Z. of *Diplogr. folium.*	Z. of *Diplogr. cometa.*	Z. of *M. Sedgwicki.*	Z. of *Monogr. runcinatus.*
Climacograptus scalaris (L.) HIS. . . .	+	.	.	+	+	.	.
» *medius* TÖRNQU. . . .	.	+	+	.	.	.	.
» *rectangularis* M'COY .	.	+	+	.	.	.	.
» *undulatus* KURCK . .	.	+	+	+	+	.	.
Diplograptus palmeus BARR.	.	.	+	+	.	.	.
» *folium* HIS.	.	.	.	+	?	.	.
» *acuminatus* NICH. . . .	+	.	.	.	.	.	.
» *cometa* GEIN.	.	.	.	.	+	.	.
» *tamariscus* NICH.	.	+	+	+	+	.	.
» *cyperoides* TÖRNQU. . . .	.	.	.	.	+	.	.
» *bellulus* TÖRNQU.	.	.	.	+	+	.	.
Dimorphograptus cfr *Swanstoni* LAPW.	.	+	.	.	.	.	.
Monograptus gregarius LAPW.	.	.	+	.	.	.	.
» *leptotheca* LAPW.	.	.	.	+	.	.	.
» *regularis* TÖRNQU. . . .	.	.	?	+	+	.	.
» *jaculum* LAPW.	.	.	.	.	.	+	.
» *nudus* LAPW.	.	.	.	.	.	.	+
» *inopinus* TÖRNQU. . . .	.	.	.	+	.	.	.
» *tenuis* PORTL.	.	.	?	.	.	+	.
» *difformis* TÖRNQU. . . .	.	.	+	.	.	.	.
» *limatulus* TÖRNQU. . . .	.	.	.	.	+	.	.
» *runcinatus* LAPW. . . .	.	.	.	.	.	.	+
» *priodon* BRONN	.	.	.	.	.	.	+
» *harpago* TÖRNQU.	.	.	.	.	+	.	.

Species.	Z. of *Diplogr. acuminatus.*	(Z. of *M. cyphus.*)	Z. of *M. triangulatus.*	Z. of *Diplogr. folium.*	Z. of *Diplogr. cometa.*	Z. of *M. Sedgwicki.*	Z. of *Monogr. runcinatus.*
Monograptus elongatus TÖRNQU. . . .	.	.	+	.	.	.	.
» *denticulatus* TÖRNQU. . .	.		.	+	.	.	.
» *triangulatus* HARKN. . .	.	.	+	.	.	.	.
» *nobilis* TÖRNQU.	.	.	+	.	.	.	.
» *decipiens* TÖRNQU. . . .	.	.	.	.	+	.	.
» *convolutus* HIS.	.	.	.	+	+	.	.
» *turriculatus* BARR. . . .	.	.	.	.	.	.	+
» *discus* TÖRNQU.	.	.	.	.	.	.	+
» *exiguus* LAPW.	.	.	.	.	.	.	+
Rastrites peregrinus BARR.	.	.	.	.	+	.	.
» *distans* LAPW. var. *abbreviatus* LAPW.	.	.	.	.	+	.	.

Within the *Cyrtograptus* beds only the two next following zones are to be distinguished, viz.

XIX. ***Zone of Cyrtograptus Murchisoni*** CARR. *Loc. 14.* Found by GRÖNWALL in a ditch just NE. of the second Tommarp mill. [1]

XX. ***Zone of Cyrtograptus Carruthersi*** LAPW. *Locs. 5, 12 and 13*, especially easy to recognize from the frequently occurring *Monograptus testis* BARR., whence the beds are often called »testis shales».

XXI. ***Zone of Monograptus colonus*** BARR. *Locs. 6—11* and *15.* As usual, poor in fossils; little examined.

Diabase dykes are unusually rare in the valley Jerrestad—Tommarp. The only obvious one runs along the east side of the stream, at the bend in the road east of the fourth

[1] At the dairy (»mejeri») of Tommarp, north of the fourth mill, Cyrtograptus beds are found in the stream-bed. Their age is not exactly known but they may belong to this zone (See the main map).

Tommarp mill. According to the explanation to the map-sheet Simrishamn (special map, p. 38), two other dykes of diabase are, however, to be found; one to the south-west of the fourth Tommarp mill (between our *locs. T 6* and *T 18*), another near Jerrestad mill (Neckebo). And TULLBERG states that the »brachiopod shales» at the third Tommarp mill (at *loc. 7*) are cut off on the west by a large diabase dyke, and are penetrated by a narrow one (only about 9 *cm* broad); but I have not succeeded in coming across them.

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4.

Röstånga (with the lake Odensjön) and Skäralid.

After a railway journey of 38 kilometres N. from Lund we reach the station of Röstånga on the Eslöf-Klippan railway and have here the lake Odensjön 1 *km* to the W. The nearest station to Röstånga in a northward direction is Skäralid.

Röstånga.

Röstånga lies on the N. border of the broad Silurian zone which on the S. side of the two mountain ridges Linderödsåsen and Söderåsen stretches from Sandhammaren and Simrishamn (Stenshufvud) in a NW. direction up between two lakes, Wombsjön and Ringsjön, right up past Tågarp and Kågeröd. The conditions on the N. border of the Silurian area are quite different from those on the S. border, since in the former we have Archæan everywhere, in the latter mostly Mesozoic formations. Whereas along the limit of the Archæan we find, as a rule, at least a narrow zone formed by the *oldest* stratum of the Silurian system (the Cambrian sandstone), along the S. limit we find almost everywhere the *youngest* Silurian strata. The most important exceptions to this we find, *on the N. boundary line of the Silurian*, in the tract S. of Röstånga up to the E. end of Lake Ringsjön and, *on the S. boundary line*, in the tract S. of Sandby and Hardeberga (the

»Fogelsång District»), where the Cambrian sandstone immediately approaches the Archæan rock of Romeleåsen. [1]

The distance hetween Röstånga church and Sandby church, which lies practically due S. of the former, is little more than 18 kilometres. The districts of Röstånga and Fogelsång, which lie opposite to one another, the former at the N. limit of the Silurian territory, the latter at the southern, display in very many respects considerable conformity. In both we can follow the Silurian, despite of gaps of smaller or larger extent, from the limits of the Archæan (running E.—W.) along all the sedimentary rocks from the oldest (Cambrian) sandstone right up to the *Colonus* beds, inclusive. In both districts prevails the same (argillaceous) facies; so, e. g., the lower Dicellograptus shales are known in Scania only from these two districts. In the lower parts of the system, however, the gaps seem to be larger at Röstånga than at Fogelsång, just as the dislocations seem to be greater in the first mentioned district.

At Röstånga we find the Silurian strata mostly at the bottom of the watercourses or in their often very inaccessible banks, and we are, therefore, not so little dependent on the incidental height of the water. Thus, for instance, in order that the strata in situ in Kvarnbäcken may be in some degree accessible, it is necessary, for the mill above it, to keep the sluice-gates shut. But even where regular open sections occur, as in the Gotlandian shales along the diabase dyke between Röstångamölla and the Ask road, one only gets at fresh rock, with determinable fossils, after masses of mouldered shales have been removed.

The first detailed description of the Silurian of the Röstånga district was given by TULLBERG in 1880 (see the bi-

[1] The actual contact between the Silurian on the one hand, and the Archæan or Mesozoic on the other, is, however, seldom to be seen. At Forsemölla, W. of Rörum, on the geological map-sheet Simrishamn (consequently not at the similarly named place on the geological map-sheet Övedskloster, N. of Andrarum), the sandstone can be seen discordantly overlaying the gneiss, and at Tosterup and Kågeröd the Silurian can be found, owing to faults, separated from the Keuper that is in contact with it.

bliographical list). The position of the localities was indicated by means of an appended very loosely compiled sketch-map, which has often been copied since. In the introduction to TULLBERG'S later work (Skånes Graptoliter II)[1] we find an account of the geological sequence of this district which differs in various points from the foregoing. The annexed geological sections, embracing all the more important natural sections within this district, are unfortunately too schematic to enable anyone, *by means of them*, to recognize with certainty the strata referred to by TULLBERG. In a more recent time OLIN has been the only one to subject the Silurian of the Röstånga district to a detailed examination. OLIN'S work, devoted in the main to the *Chasmops* and *Trinucleus* beds, led in several respects to results quite divergent from TULLBERG'S, and, as far as I have been able to look into the matter, I have had to agree with OLIN'S interpretation.

It was, therefore, evident that a complete revision of the Silurian of the Röstånga district had become a desideratum, but the vast field work this would have demanded would have taken more time than was at my disposal. Most of my working therefore, has had to be concentrated upon drawing up a new, fully reliable map, on which all now accessible points of observation could be entered with certainty. In the subjoined account of the various sections I have, of course, paid all due regard to OLIN'S as well as my own observations, but, notwithstanding that, I have had to content myself, to a large extent, with simply reproducing TULLBERG'S statements; this is especially the case with the different zones of the *Cyrtograptus* beds.

Before passing on to the detailed description, we may offer a systematic survey of all the zones that could be distinguished within the district, mentioning at the same time the localities where they were found.

[1] This work is also, as for the Silurian of Röstånga, presumably the main basis of the explanation accompanying the geological map-sheet Trolleholm.

Survey of the Silurian strata in the district of Röstånga.

Zones.			Localities: Acc. to the accompanying map, Pl. 1. Sections [1] I.	II.	III.	IV.	V.	Acc. to TULLBERG's sketch-map of 1880 and sections of 1883.
Gotlandium	*Colonus* beds	24 Zone of *Monogr. colonus* BARR.						7, 16
		. . . . .						—
	Cyrtograptus beds	23 Zone of *Cyrtogr. rigidus* TULLB.			*Cyrtograptus* beds: Upper part *l*	Upper part *d, h, i*		13
		22 » *Monogr. Riccartonensis* LAPW.						12, 17
		21 » *Cyrtogr. Murchisoni* CARR.						18
		20 » » *Lapworthi* TULLB.			*Cyrtograptus* beds: Lower part *k*	Lower part *e, f*		11
		19 » » *spiralis* GEIN.						Between 10 and 11.
		18 » » *Grayae* LAPW.			*j*			6 (and S. of 10?)
		17 » *Monogr. runcinatus* LAPW.						10
		. . . . .						—
	Rastrites beds	16 Zone of *Diplogr folium* HIS.						9
		15 » *Monogr. triangulatus* HARKN.					*f*	9
		14 » » *cyphus* LAPW.					*c, d*	9
		13 » *Diplogr. acuminatus* LAPW.					*b*	—

Ordovicium	*Harpes* beds (Brachiopod shales)	12	»	*Phacops eucentra* ANG.			*d*, *i*		*a*		5, 9
	Trinucleus beds	11	»	*Staurocephalus clavifrons* ANG. and *Dicellogr. complanatus* LAPW.			*h*		*a* .		4, 9
		10	»	*Ampyx Portlocki* BARR.			*g*			Mill-stream	4
	Chasmops beds	9	»	*Calymmene dilatata* TULLB.			*e*, *f*	*c*		Mill-stream	4, 8
		8	»	*Climacogr. rugosus* TULLB.						Mill-stream	3
	Asaphus beds	7	Lower *Dicellograptus* shales				*b*				—
		6	Upper *Didymograptus* shales				*a*	.			—
		5	*Orthoceras* limestone					*b*			2
		. . . . .									—
Cambrium	*Olenus* beds	. . . . .				*f*, *g*					—
		4	Zone of *Peltura & Sphærophthalmus*			*f*, *g*					1 South.
		3	» *Parabolina spinulosa* WAHLENB.			*e*					1 North.
		. . . . .				.					—
	Olenellus beds	2	Greywacké shales (Kjerulfi zone)			*d*		*a*			See geological map-sheet Trolleholm.
		1 b	Upper gray-green Sandstone[2]		.	*c*					
		1 a	Lower white Sandstone[2]		*d*	*a*, *b*	.	.	.		

[1] Section I = Railway cutting, Section II = Boarpsbäcken, Section III = Kyrkbäcken, Section IV = Kvarnbäcken (Mill-stream), Section V = Trappbäcken. Compare the following page.

[2] The remaining occurrences not mentioned in the above survey, but indicated on the map, belong to the Lower white Sandstone.

As already mentioned, the Silurian strata of the district are best visible in or along the watercourses, of which *Kyrkbäcken* and *Kvarnbäcken*, which are the largest, run into one another just above the dam of the Röstånga mill. Noteworthy also, from a geological point of view, are two feeders to Kvarnbäcken, of which the one, *Boarpsbäcken*, joins Kvarnbäcken just above (W. of) the mill-dam of *Nedangården;* the other, called *Trappbäcken* by TULLBERG, supervenes a little to the NW of Röstångamölla, after traversing a large diabase dike, along which the Silurian lies exposed extensively. Of interest is also the fresh *railway-cutting*, first mentioned by HENNIG, S. of Röstånga Stn. A tolerably complete survey of the Silurian geology of the district should be obtained, therefore, from the following five sections: the railway-cutting, the Boarpsbäcken, Kyrkbäcken, Kvarnbäcken, and Trappbäcken sections, which we will here describe in detail, proceeding all the time from older to younger strata and thus, as a rule, from N. to S. (though for the Boarpsbäck section rather from NE. to SW.) and always up the watercourses.

As shown by the survey over leaf, the Silurian of the Röstånga district is especially interesting because the lower part of Gotlandium, i. e. the *Rastrites* beds and, above all, the *Cyrtograptus* beds, is here singularly well developed and quite accessible. Both the zone of *Monogr. Riccartonensis* and the zone of *Cyrtogr. Grayæ* are only reported from this tract of Sweden. And of the many zones of the *Cyrtograptus* beds, the uppermost, or »testis shales», is the only one, according to TULLBERG, which possibly does not occur. On the other hand, several zones of the *Rastrites* beds are said to be wanting. We must moreover emphasize the zone of *Dicellogr. complanatus*, which has not been found elsewhere in Sweden.

We will now pass on to an account of the sections mentioned in the foregoing.

Section I. The Railway cutting just SE. of Röstånga Stn.

a. About 100 *m* SE. of the spot where the Färingtofta highway crosses the railway, we find, on both sides of the latter, a *quartz breccia* belonging to the Archæan, which can be followed past Röstånga mill and hostelry (»Gästis») towards the NW. up to the valley of Nackarp (»Nackarpsdalen»). From the place where the railway cuts through the quartz breccia, rocks, with insignificant interruptions, can be followed along the whole cutting past the church and the high-road viaduct.

b. Immediately S. of the quartz breccia we find a fine-grained greenish rock, which, according to the microscopic examination to which it has been subjected [1], is probably a *strongly weathered diabase.* About a third of the way along the cutting (reckoning from the N.) we also meet with a somewhat fresher rock, dark gray with lighter portions, which, however, even there has proved under the microscope to be strongly altered. This may with tolerable certainty be called a diabase of the Konga type.

c. About half way along the cutting the rock gets darker and fresher. We have here a quartz diabase of the proterobase kind, nearest related to TÖRNEBOHM'S *Konga diabase.*

d. About 30 *m* N. of the high-road bridge the diabase cease on a fault-plane dipping 75°—80° towards the SW., and striking in a NW.—SE. direction. S. of the fault ensues a zone of about 1 *m* in breadth, and constituted of a fine *crush breccia* with a reddish ground-mass cementing angular fragments of white Cambrian sandstone, or the same rock, which can be followed thereafter for some distance beyond the high-road bridge in regular banks, dipping 25° towards

[1] The rocks have been examined by Lektor Dr P. J. HOLMQUIST.

the S. From here the rocky floor is not to be seen before we come to the Kyrkbäck section.

Section II. Along Boarpsbäcken (the Boarp brook).

In the explanation accompanying the geological map-sheet Trollehom, the Cambrian sandstone at Röstånga mill is said »to rest upon the gneiss with concordant bedding». At the place mentioned, however, there is neither gneiss nor sandstone. The directly overlying bedding is nowhere to be seen at present, but at the W. end of Nedangården's mill-pond the formations in question are but slightly distant each from another.

a. S. of the smithy. In the upper part of the slope, *gneiss*; somewhat nearer the level of the mill-pond, thick-banked *Lower white Cambrian sandstone*, but slightly exposed.

b. The same sandstone, on the other hand, is easily accessible in the slope, about 70 *m* further W. — Just NE. of this, and somewhat higher up the slope, *Kaolin* has been met with.

c. If we continue some twenty metres to the W., on the N. side of the brook, we find a laminated, grayish-green sandstone in a little quarry; in it I found a *lingulid.* These strata may belong to the *Upper division* of the *Cambrian sandstone.*

d. In the S. wall of the valley of the Boarp brook, along a stretch of at least 50 *m* in a westward direction, going from the valley of Kvarnbäcken, we find a kind af greywacke, rather thickly bedded, in part well exposed. The same rock is also met with further E., viz. on the east edge of Kvarnbäcken, close to the influx of the Boarp brook (*loc. a* in sect. IV). The strata have the same dip as the underlying sandstone strata mentioned above. Fossils have not been found, but on stratigraphical and petrological grounds these strata should

be identified with the greywackès of Andrarum, which belong to the *Kjerulfi* zone of the Olenellidian.

e, *f* and *g*. W. of the Ask road we come across alum shales (with stink-stone) in the bed and banks of the brook, generally somewhat inaccessible. It is best got at at the three localities indicated on the map. At the *most northerly* of these, *loc. e*, we find in the shales and stink-stone *Parabolina spinulosa* WAHLENB. and *Orthis lenticularis* WAHLENB., the latter as usual often quite filling the rock. — At the *more southerly* localities, *f* and *g*, we are in an upper zone, the zone of *Peltura* and *Sphærophthalmus*. *P. scarabœoides* is here quite sparse; the more plentiful is a *Sphærophthalmus*, according to the explanation to the map-sheet Trolleholm, presumably *S. teretifrons* ANG. Higher strata have not been discovered.

Section III. Along Kyrkbäcken (the Church Brook).

The railway-line from Billinge follows the E. side of Kyrkbäcken for a long way, and only leaves it at about 300 *m* SE. of Röstånga church, Kyrkbäcken going W. of the church and joining Kvarnbäcken, while the railway runs E. of the church to the cutting described above. On the engineering of the railway the brook was diverted, *where it skirts the line*, into a deep ditch, the stone-faced sides of which leave the Silurian exposed only at the bottom of the ditch, and accessible only at low water. With regard to the strata found here, in the »railway-ditch», we shall in the main follow OLIN's description, based on a careful, detailed examination (see works referred to).

If we follow the brook in a SE. direction, setting out from where Kyrkbäcken intersects the road S. of Röstånga church, we shall reach a spot, after 100 *m* walk, where the brook makes a little bend at a small diabase dyke, disclosed to the E. of it. Between the diabase and the brook shives of shales are abundant, but shales *in situ* are not to be seen.

a. 40 *m* above this bend, by a little ford, there are, however, black shales in the bank of the brook, dipping 40° to the S. 10° E., not easily accessible, it is true, but get-at-able. In this OLIN has found, among other fossils, *Didymogr. geminus* HIS. Thus we here have *Upper Didymograptus beds.*

b. From the last loc. the shales can be followed for about 100 *m* to the SE. Some 60 *m* from the most northerly part (i. e. from *loc. a*), OLIN has found in the shales near a slight bend of the brook, *Climacogr. Scharenbergi* LAPW., *Diplogr. teretiusculus* HIS., *Dicellogr. moffatensis* CARR., *Dicellogr. sextans* HALL., *Glossogr.* sp., *Corynoides calicularis* NICH. and *Primitia strangulata* SALTER (copiously in some layers). The fossils indicate the *Lower Dicellograptus beds.* Besides the species named, there were found here tails of a large trilobite, as well as the cranidium of *Robergia microphthalma* LINRS. sp., known hitherto only from Jemtland where it occurs in a corresponding zone, which there, however, is somewhat differently developed.

c. As we have said, the shales continue yet a little way further to the SE., though determinable fossils from their uppermost strata have not been found.

In 1883 TULLBERG reported from a *loc. 3*, which may be said to correspond to the strata mentioned here under the headings *a*, *b* and *c*, the zone of *Climacogr. rugosus* TULLB. which is belonging to the Middle *Dicellograptus* beds. (In the work of 1880 he speaks, instead of the above named zone, of »graptolite-bearing shales interstratified in *Orthis* shales»). It might be questioned, perhaps, whether the uppermost strata of the shales now classed under *c* do not correspond to the zone mentioned by TULLBERG 1883.

d. 30 *m* from the N. end of the railway-ditch, the rocky floor is again to be found in it, viz. calciferous shales, 20 to 30 *cm* thick, fossiliferous, hard, and overlaid by somewhat loose, fossil-frée shales to a few decimetres in thickness. In the calciferous shales occur *Phacops eucentra* ANG., fairly

plentifully, as well as a gastropod (*Turbo?*), both characteristic of the Brachiopod beds (= *Harpes* strata). Faults separate these strata from both those in the NW., described above, and from those further SE., of which more below.

22 *m* SE. of the last locality other strata are met with in the railway-ditch. These can be followed up in a SE. direction almost uninterruptedly for about 70 *m* and as the strata have a S. dip (according to OLIN 35° in the S. 15°W.) we always advance to younger strata. In this series (TULLBERG'S *loc. 4*) we can distinguish several different zones, which will be described in the following under the headings *e*, *f*, *g* and *h*.

e. In the extreme NW. we have several thick layers of a fairly light-coloured, hard and fossiliferous limestone, full of fissures, intercalated in bright or almost white, soft, fossil-free shales. This formation, which continues for a distance of 16 *m* is bounded by a more weathered band of limestone, rich in badly preserved fossils. In the limestone the following species occur, among others: *Phacops macroura* SJÖGR., *Remopleurides sexlineatus* ANG., *Calymmene dilatata* TULLB., *Phillipsia parabola* BARR., *Ptychopyge glabrata* ANG., *Ampyx rostratus* LINRS., *Climacogr. Scharenbergi* LAPW. and *Diplogr. pristis* HIS. We have, consequently, here the upper part of the *Chasmops* beds or the *zone of Calymmene dilatata* TULLB.

f. Further to the SE., along a stretch of 10 *m*, follow black, fissile shales with well preserved graptolites (chiefly *Diplogr. pristis* HIS.) and spicules of sponges turned into iron pyrites. These shales, according to OLIN, are to be looked upon as *boundary strata* between the *Chasmops* beds and the overlaying *Trinucleus* beds. As the commonest fossil of these layers, *Diplogr. pristis* HIS., already occurs in the underlying, we have classed these boundary strata too, in our survey on p 4, among the *zone of Calymmene dilatata* TULLB.

The *Trinucleus* beds, which overlie the above-named boundary strata here exhibit two zones, viz. *the zone of Am-*

pyx Portlocki BARR. and *the zone of Staurocephalus clavifrons* ANG., described in the following under the headings *g* and *h*, respectively.

g. The zone of *Ampyx Portlocki* BARR., or the *Trinucleus* beds proper, occupies in the railway-ditch a stretch of 31 *m*. In it we can distinguish a lower and an upper division.

The lower division (the bottom stratum of the *Trinucleus* beds) can be followed for a distance of 21 *m* and is formed chiefly of hard, dark-gray shales that are poor in fossils and have alga-like markings. In the upper part of these shales we find two intercalated bands of hard, gray limestone; the lower one is rather poor in fossils, but the upper fairly rich. The following species are found here: *Phacops recurva* LINRS., *Dindymene venusta* OLIN, *Asaphus ingens* BARR.[1], *Symphysurus superstes* OLIN, *Illœnus Angelini* HOLM, *I. megalophthalmus* LINRS., *Trinucleus Bucklandi* BARR., *T. cerioides* ANG., *Ampyx Portlocki* BARR., and *Phillipsia parabola* BARR.

The upper division, which can be followed for a distance of 10 *m*, is formed of hard, *black* graptolitiferous shales including several bands of limestone. Characteristic of this upper division are the following trilobites: *Chirurus pectinifer* BARR., *Pseudosphærexochus Ravni* OLIN, *Trinucleus latilimbus* LINRS., *Ampyx tenellus* BARR. and *Ampyx globifrons* OLIN. To these must be added the following, which continue up into higher layers: *Phacops ecclesiastica* OLIN, *Pseudosphærexochus laticeps* LINRS., *Remopleurides radians* BARR., *Illœnus megalophthalmus* LINRS., *Dionide euglypta* ANG., and *Agnostus trinodus* SALTER. As to the graptolites it is to be noted that *Diplogr. pristis* HIS. ceases in the *lower* part of this division, while *Dicellogr. complanatus* LAPW. makes its appearance in the *upper* and continues into a somewhat higher geological level.

h. The shales that follow, which can be observed for a distance of 8 *m* in the railway-ditch, are mostly soft, *gray*,

[1] TULLBERG'S *Niobe lata* ANG.

and rich in well preserved graptolites. About the midst of this gray shales, however, we find a couple of strata, each of about 6 *cm* in thickness, of *black* graptolitiferous shales, and in the upper part of the gray shales there is an interstratified limestone band 10 *cm* thick.

Besides a number of trilobites continuing from the underlying zone, among which there also occur *Ampyx Portlocki* BARR., we note *Staurocephalus clavifrons* ANG. and *Dindymene cornuta* OLIN, which in this zone are only found in its uppermost strata. Among the graptolites we may specially mention *Dicellogr. complanatus* LAPW., belonging to the lower strata only, and *Diplogr. truncatus* LAPW., which runs through the whole of this suite, marked on our scheme as *the zone of Staurocephalus clavifrons* ANG.[1]

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[1] TULLBERG, as we know, divided (in Skånes Graptoliter I) the Scanian *Trinucleus* beds into 4 zones, counting from older to younger, as follows: dark-gray and greenish-gray shales, the zone with *Niobe lata* and *Dicellogr. complanatus*, marls, whithout fossils, and the zone of *Staurocephalus clavifrons*. An indication of the cause of the divergencies from TULLBERG's scheme, which occur in mine, seems necessary here. As TULLBERG's oldest zone, dark-gray and greenish-gray shales, from which he mentions such fossils as *Lichas laxatus* M'COY, *Ampyx rostratus* SARS and *Diplogr. pristis* HIS., was already assigned by OLIN to the *Chasmops* beds, and TULLBERG's highest zone but one, marls *without fossils*, can evidently be ignored, there remains only the zone with *Niobe lata* and *Dicellogr. complanatus*, and the zone of *Staurocephalus clavifrons*. The lists of fossils given by OLIN and cited above, show that the so-called *Niobe lata* ANG. (= *Asaphus ingens* BARR.), actually belongs to the bottom layer of the real *Trinucleus* beds (lower division of the zone of *Ampyx Portlocki*), whereas *Dicellogr. complanatus*, it is true, begins in the *upper* part of the same zone, but can be more closely connected with the lower part of the *Staurocephalus* zone. It has, therefore, seemed most expedient, on my part, to class the shales with *Dicellogr. complanatus* together with the *Staurocephalus* zone, despite the fact that *St. clavifrons* touches a higher level than the above-mentioned graptolite. In the shales, which here we have classed together as the *Staurocephalus* zone, we also find, as already indicated, *Ampyx Portlocki*. That we notwithstanding have separated them from the zone of *A. Portlocki*, depends partly on the importance, that *Staurocephalus clavifrons* has as for parallelizing with the Silurian of Vestergötland, partly on the fact, that this trilobite continues further up than *Ampyx Portlocki*.

Not taking into account that further in the SE., after an interval of only 7 *m*, we again find in the railway-ditch a small section of loose, gray shales, almost devoid of fossils, and whose age cannot be exactly determined, it is first another *km* to the SE. (in the SE. corner of the map, at TULLBERG'S *loc. 4*) that Silurian (*Colonus* beds) are to be found. Though, consequently, we in Kyrkbäcken itself have no direct continuation toward the SE. of the section described, we come across Silurian strata accessible at several isolated points along the east side of Kyrkbäcken in the district between the railway and the high-road to Billinge, which points are indicated on the map with the letters *i—l*.

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i. (TULLBERG'S *loc. 5*.) Marl-pit about 200 *m* SE. of the strata of the *Staurocephalus* zone at *loc. h*. In the *NW. part* of it have been found strata containing *Phacops eucentra* ANG. and a little gastropod (*Turbo?*), i. e. the usual Scanian *Brachiopod* shales. The strata here dip 35° in S.30°W. In the *S. part* there crop out loose, gray shales overlaid by a band of limestone, in which, together with *Phacops eucentra* ANG., are found *Calymmene trinucleina* LINRS. and *Proetus scanicus* OLIN. These layers, which dip 32° in S.15°W., must be somewhat older than the strata at the NW. part of the marl-pit and separated from them by a small fault.

j. SE. of the foregoing locality occurs a marl-pit (TULLBERG'S *loc. 6*) with greenish-gray or brownish shales, which contain fossils only in a few thin horizons. TULLBERG mentions from here *Cyrtogr. Grayæ* LAPW., *C. dubius* TULLB., (= *Monogr. subconicus* TÖRNQU.), *Monogr. priodon* BRONN, *M. personatus* TULLB. (= *M. crenulatus* TÖRNQU.), *M. cultellus* TÖRNQU., *M. spinulosus* TULLB., *M. nodifer* TÖRNQU., *M. sartorius* TÖRNQU., and *Retiolites Geinitzianus* BARR. This is the only place in our country where the existence of *the zone of*

Cyrtogr. Grayæ, the bottom layer of the *Cyrtograptus* beds, has been directly proved.

k. Road-cutting SE. of the foregoing locality. Only *Monogr. priodon* BRONN has been met with here (in loose, gray shales). The strata, which dip 35° in S.10°W., presumably belong to the *lower* part of the *Cyrtograptus* beds.

l. Further to the SE., in the SE. corner of the map, Silurian again become visible in Kyrkbäcken. Furthest to the N. we find here loose, gray shales, in which only *Monogr. Flemingi* SALTER and indeterminable Orthocera have been discovered. The strata seem to belong to the *upper* part of the *Cyrtograptus* beds.

According to TULLBERG, further to the SE. (at his *loc. 7*) *Colonus* beds containing *Monogr. colonus* BARR. and *Cardiola interrupta* SOW. occur, which can be followed almost uninterruptedly »right up to Billinge and still further towards Ringsjön».

Section IV. Along Kvarnbäcken (the Mill stream).

It has not been possible, as we have already said, to find out all the localities indicated by TULLBERG or to distinguish all the zones he gives. This is especially true of the localities along Kvarnbäcken. Just at the time when TULLBERG examined this district, large cuttings were made for marl plying, which have now been partly filled in. He had, therefore, considerable more opportunity than now offers of access to sections in perfectly fresh shales and, of course, TULLBERG's account of his observations is of special importance, even if we are at present unable to bring our own observations into perfect accordance with his.

In the following we shall, therefore, attempt first to give a *résumé* of TULLBERG's statements from 1883, and

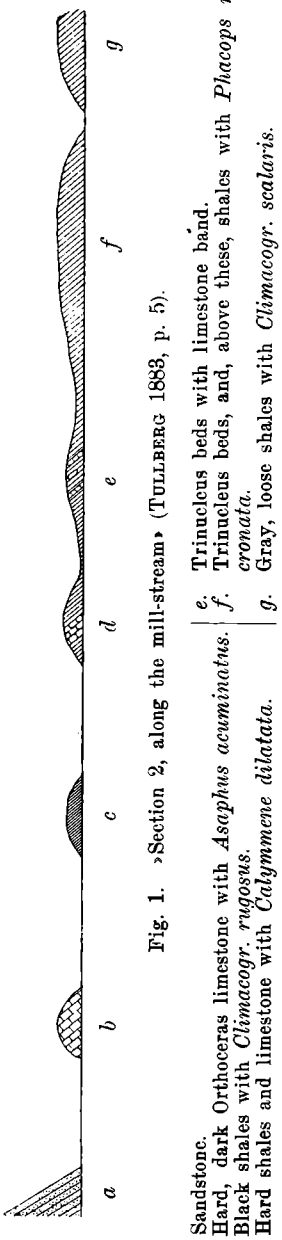


Fig. 1. »Section 2, along the mill-stream» (TULLBERG 1883, p. 5).

a. Sandstone.
b. Hard, dark Orthoceras limestone with *Asaphus acuminatus*.
c. Black shales with *Climacogr. rugosus*.
d. Hard shales and limestone with *Calymmene dilatata*.
e. Trinucleus beds with limestone band.
f. Trinucleus beds, and, above these, shales with *Phacops cronata*.
g. Gray, loose shales with *Climacogr. scalaris*.

then to give an account of things as they are now to be seen. The strata we intend to describe as our »Section IV», were divided by TULLBERG into two separate sections: one of these, TULLBERG'S »Section 2, along the mill-stream», embraces the strata along the northerly part only of Kvarnbäcken, or a stretch of 600 *m*, going S. from the mill-pond of Nedangården; the other, TULLBERG'S »Section 4, along the mill-stream on the north side of the diabase dyke (= trappgången)», embraces the strata along the part of Kvarnbäcken where this is running along the N. side of the diabase dyke between Röstångamölla and the Ask road.

The first-named section, reproduced here as fig. 1, is described in the following way: »By the mill-stream lies, at a good distance from the place where the sandstone forms somewhat steep walls, a black, hard, often crystalline limestone, which crosses the stream (*loc. 2*); it is difficult of access and has only yielded few fossils. This *Orthoceras* limestone contains *Asaphus acuminatus* ANG., *Aeglina umbonata* ANG. sp., *Illænus Esmarki* SCHLOTH. and a cystoid. Further S. occur black shales with *Climacogr. rugosus* TULLB. and *Cl.* cfr *coelatus* LAPW., and after these a hard, siliceous rock with *Calymmene dilatata* TULLB., *Ampyx rostra-*

tus SARS and *Orthis argentea* HIS.; the zone of *Diplogr. quadrimucronatus* HALL does not appear, but the *Trinucleus* beds are accessible for a good distance; they are overlaid by dirty-brown, loose shales. At the bottom of the brook lie strata of gray shales, rich in *Climacogr. scalaris* L.»

The other part of the section, of which a copy is given in fig. 2, p. 122, is described in the following manner: »On the sides of the diabase dyke between »Trappbäcken» and the mill-stream lie masses of gray shales, in which no organic remains are discoverable; but just at the place where the mill-stream bends (*loc. 10*), cutting through similar gray shales, we find a rich fauna in several intercalated layers of black shales, often surrounded by inch-thick layers of white clay. The commonest species here are *Monogr. priodon* BRONN, *M. galaënsis* LAPW., *M. proteus* BARR., *M. Hisingeri* CARR., *M. runcinatus* LAPW., *M. turriculatus* LAPW. and *Diplogr. palmeus* BARR. A bed of gray shales interstratified by some limestone bands form the bottom of the stream above this locality; as the strata are difficult of access, no fossils could be discovered, but in the upper part of the strata the fauna should lie which was mentioned in dealing with the *loc. 6* at Kyrkbäcken, namely the zone of *Cyrtogr. Grayæ* LAPW.

It is not till we get further on *a high wall* of shales leaning on the diabase that we again can examine the shales successfully. Lowest in the brook itself lie gray shales of about 0.6 *m* in thickness; they include lamellæ of black, bituminous shales with *Monogr. priodon* BRONN, *M. crenulatus* TÖRNQU., *Cyrtogr.* sp. indet. and *Retiolites Geinitzianus* BARR. Gray shales without fossils then occupy about 1.2 *m*, overlain by black, sligtly splitting shales 0.6 *m* thick, containing *Cyrtogr. spiralis* GEIN., *Monogr. nodifer* TÖRNQU., and *Retiolites Geinitzianus* BARR.

Gray, rust or chocolate coloured, thinly splitting and somewhat loose shales 2.7 *m* thick, in the upper part of which we find scattered specimens of *Monogr. priodon* BRONN, *M.*

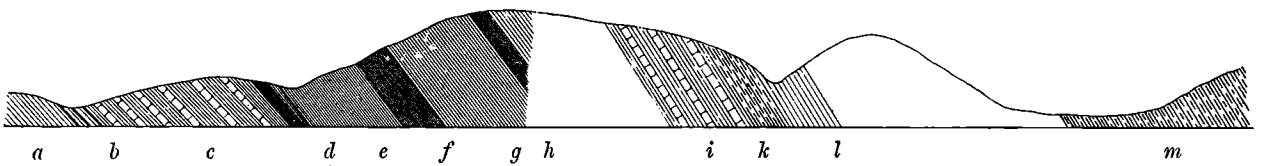


Fig. 2. »Section 4. Along the mill-stream on the north side of the diabase dyke». (TULLBERG 1883, p. 6).

loc. 10, high wall:
- *a.* Gray shales without fossils.
- *b.* Gray shales with thin layers of white clay and of black shales with Monogr. runcinatus.
- *c.* Gray shales with interstratified limestone.

high wall (continued):
- *d.* Black shales with Cyrtogr. sp. indet.
- *e.* Black shales with Monogr. priodon and M. crenulatus TÖRNQU.
- *f.* Black, highly fissured shales with Cyrtogr. spiralis, Monogr. nodifer and Retiolites Geinitzianus.
- *g.* Gray, loose shales with Monogr. priodon and Retiolites Geinitzianus.
- *h.* A thin bed of black shales rich in graptolites.
- *i.* Gray and green shales without fossils; with bands of limestone. [1])

loc. 11:
- *k.* Coarse-grained, gray shales with Cyrtogr. Lapworthi etc.
- *l.* Shales with Monogr. speciosus.

loc. 12:
- *m.* Gray, coarse-grained shales with Monogr. Riccartonensis.

[1]) The stratum *i* should, according to the section sketch, copied above, belong to *loc. 11.* MOBERG.

nodifer TÖRNQU., *Cyrtogr. spiralis* GEIN. and, at a certain level, *Monogr. Sartorius* TÖRNQU. abundantly, separate the foregoing stratum from a thick bed of black, hard shales of about 0.5 *m* in thickness and unusually rich in graptolites: *Monogr. priodon* BRONN, *M. Hisingeri* CARR., *M. nodifer* TÖRNQU., *Cyrtogr. spiralis* GEIN., and *Stomatogr. Törnquisti* TULLB. The upper part consists of gray, greenish and reddish-gray shales and thin limestone bands; no fossils occur there.

If we follow the dyke, no strata seem to be exposed before we come to another marl-pit (*loc. 11*). Lowest lie darker and somewhat rugged shales with graptolites preserved in relief: *Cyrtogr. Lapworthi* TULLB., *C. pulchellus* TULLB., *C.* sp. indet., *Monogr. priodon* BRONN, *M. Linnarssoni* TULLB., *M. crenulatus* TÖRNQU. and *Retiolites Geinitzianus* BARR. The upper strata consist of reddish-gray, weathered shales, in which fossils are scanty.

About a hundred steps from here, just at Röstångamölla (*loc. 12*), there is a marl-pit in gray, somewhat coarse-grained, flaggy shales; at certain levels there are plenty of graptolites, which are especially fine just at the splitting, but after that are easily destroyed. In this *Monogr. Riccartonensis* LAPW., *M. vomerinus* NICH., *M. Flemingi* SALTER, and *M. dubius* SUESS occur.»

After having thus presented TULLBERG's description of the sections along Kvarnbäcken, it remains for us to give a short account of the points of observation at present available by the same sections.

a. Just above the mill-pond of Nedangården (as mentioned in the foregoing) we find in the E. river-bank of Kvarnbäcken, opposite the place where Boarpsbäcken joins it, shales of the greywackè type.

b. The rocky floor is not met with after that for another 140 *m* further S., where a limestone shelf, when the water is not too high, can be seen to cross the brook. (The

place can be easily recognized, as just here debouches the road going down from the fields above on the E. side of the brook). We may add to TULLBERG's description given above, that the limestone is of varying kind, it being at one part of the shelf light-gray and almost compact, at another dark-gray and crystalline[1]; fragments of fossils abundant, determinable fossils on the other hand difficult to get out. Besides the species which TULLBERG mentioned, we can name from here *Ampyx carinatus* (ANG.) LINRS., *Niobe emarginula* ANG., *Ptychopyge* sp., *Trinucleus* sp. and *Orthis* sp. The limestone belongs with certainty to the upper part of the Scanian *Orthoceras* limestone (*Asaphus* beds).

c. About 400 *m* S. of the *Orthoceras* limestone we find, directly accessible or easily exposed, banks of hard *Orthis* shales (= the zone of *Calymmene dilatata* TULLB.) cropping out for a stretch of about 40 *m* at the base of the steep, high, east river-bank and dipping 15° in N. 70°W.

According to TULLBERG, between my points of observation *b* and *c* in Section IV we should have shales belonging to TULLBERG's zone of *Climacogr. rugosus* and, furthermore above (S. of) *c*, *Trinucleus* beds (to judge from the section sketch, possibly also *Brachiopod* beds) and, furthest to the S., »shales with *Climacogr. scalaris*», which, as is well known, TULLBERG always considered as the youngest stratum in the Ordovicium of Scania. Neither OLIN nor I have succeeded, however, in discovering anything here of all these strata.

d. 150 *m* further S., partly in the east river-bank, partly at the bottom of the brook, for a distance of a few metres we find flaggy hard shales, rich in iron pyrites dipping 10° in S. 45°E. Here fairly abundant *Monogr. dubius* SUESS and *M. capillaceus* TULLB.?; thus the shales certainly belong to the *upper part* of the *Cyrtograptus beds.*

[1] TULLBERG was inclined in 1880, evidently owing to the nature of the rock, to assume that this limestone belonged to the Andrarum limestone (= zone of *Paradoxides Forchhammeri* ANG.).

This locality is not mentioned by TULLBERG. But on the other hand he mentions from »the place where the mill-stream makes a bend (*loc. 10*)» black shales belonging to the *zone* of *M. runcinatus* or the uppermost part of the *Rastrites* beds. I have not succeeded in finding these strata, about whose situation moreover I have been unable to see my way quite clearly; perhaps they should be looked for where Trappbäcken flows into Kvarnbäcken.

e. After passing Röstångamölla, Kvarnbäcken turns to the W. and then to the SW. towards the diabase dyke and the shales following it on its N. side, which shales here form a high wall for some distance; further on the brook divides into two branches, enclosing an island-shaped plot, of which branches the southern, mostly dry, runs straight into the shales wall. Just where the branches unite again the brook runs to the NW., leaving the valley wall. At the point where the two branches unite, our point *e* is marked on the map, and this must be the locality of which TULLBERG speaks as »*a high wall*». Down in the brook occur fairly fresh, dark-gray shales, dipping 22° in S.45°W., rich, in certain strata, in graptolites, which mostly are unfortunately preserved in dorsal or ventral aspects and consequently are impossible to determine. I have here found *Monogr. priodon* BARR., *M. subconicus* TÖRNQU. and *M. crenulatus* TÖRNQU. Here is present therefore the *lower part* of the *Cyrtograptus beds.* — S. of this in the valley-wall we find a great semi-circular cutting, bounded by high walls of shales, but which are now so weathered that determinable fossils are scarcely to be found.

f. About 60 *m* further up the brook, in the S. branch, we again come to easily accessible strata, dipping to the SE., partly at the bottom of the brook, partly, 1 *m* further S., in the bank itself. At the first-named place were found, in dark-gray shales, abundant and well preserved graptolites, of which the following species could be determined: *Monogr. priodon* BRONN, *M. crenulatus* TÖRNQU., *M. nodifer* TÖRNQU., *M. subconi-*

cus TÖRNQU. At the latter, where the shales are somewhat coarser and rusty, were found *Monogr. priodon* BRONN, *M. crenulatus* TÖRNQU. and *Retiolites Geinitzianus* BARR. — Just as the strata mentioned from *loc. e*, which can be but little older than these, the strata at *loc. f*, belong to the *lower part* of the *Cyrtograptus beds*. In TULLBERG's work this locality is not mentioned.

f^1. Also on the N. branch of the brook shales, in which determinable fossils were, however, not to be found, are available in the bank of the brook.

g. Just to the W. of the southernmost bend below Röstångamölla we find shales accessible some distance up the slope. Determinable fossils were not found in the decayed shales. This seems to be TULLBERG's *loc. 11*.

h. N. of Röstångamölla, just where the brook leaves the N. wall of the valley for going over to the S. wall, we again get the shales, partly in the bottom of the brook, partly in the valley-wall to the NE. In the latter the shales are gray, strongly weathered and have yielded only a few badly preserved specimens of *Monogr. vomerinus* NICH. From what we can still see there was here formerly a large marl-pit. This is TULLBERG's *loc. 12*.

i. Bend in the brook NE. of and close to Röstångamölla. Partly in the channel of the brook, partly in the E. bank are found gray, coarse, somewhat flaggy shales. In these a *Cyrtograptus*, whose species could not be determined with certainty.

k. Just N. of the mill-pond of Röstångamölla we come to gray shales cropping out up in the slope on the N. side of the diabase dyke. No fossils were discovered. The two last-named localities are not specially mentioned by TULLBERG.

This brings us to the end of Section IV. As it often happens, that the Silurian strata on both sides of a diabase dyke are of somewhat different age, we have not considered it suitable in this section to include localities from the *S. side* of the diabase dyke.

Section V. The »Trappbäck» section.

a. The cutting for the Ask road. Partly in the walls on both sides of the road, partly in the quarry E. of the road and along the S. side of the diabase dyke going from Röstångamölla, greenish-gray shales or mudstones, in part strongly altered (baked), crop out along the diabase. According to TULLBERG (at his *loc. 9*) *Trinucleus beds* crop out in the highway itself, and just E. of it the zone of *Staurocephalus clavifrons*. — Since masses of shales have recently been broken and carried away for filling up the newly laid causeway to the north, the fossiliferous horizon cannot be found again for the present. But that fossils of the *Staurocephalus* zone were found here once, is certain. The real *Trinucleus beds* should possibly crop out to the west of the road. Richly fossiliferous boulders of the same have been found about 50 *m* from the high-road at the bottom of a little runnel that appears there. Now fossils in rocks in situ are only found in the thick-banked, hard shales about 30 *m* from the road, measuring along the diabase dyke. In these sparingly *Phacops eucentra* ANG. and a *Primitia* sp. These strata, which belong to the *Brachiopod beds* are overlaid by a few thick banks of limestone.

b. Above the limestone banks come black shales, accessible here and there in the declivities between the pits, which occupy the ground nearest to the S. of the diabase dyke, along which the shales can be followed for a distance of 70 *m*. In these brittle, strongly weathered shales I have not been able to find other fully determinable fossils than a *Climogr. Törnquisti* ELLES et WOOD. But, as he has kindly informed me, TÖRNQUIST has here met with *Diplogr. acuminatus* NICH. and possibly also *Diplogr. vesiculosus* NICH., whence we here certainly have the bottom layer of the *Rastrites beds* or the zone of *Diplograptus acuminatus* LAPW., previously known only from Jerrestad, and possibly have, if TÖRNQUIST's observations

prove to be fully reliable, also the next higher zone, the zone of *Diplogr. vesiculosus* NICH., hitherto quite unknown in our country.

c. In the most SE. part of the »pitted» ground we find (100 *m* from the high-road, still measuring along the diabase dyke) the black shales described above, overlaid by gray, soft shales; in these sparsely *Dimorphogr.* cfr *Swanstoni* LAPW., *Climacogr. Törnquisti* ELLES et WOOD, *Monogr. acinaces* TÖRNQU., and *M. revolutus* KURCK, and consequently they belong to the lowest part of the zone of *Monogr. cyphus* LAPW.

d. About 700 *m* S. of the former loc. and at the place where Trappbäcken receives a small runnel from the NW., we again find the same gray shales as at *loc. c.* The strata are accessible both in the slope above the junction of the brooks and in the channel itself below the junction. At the last-named place the shales also enclose bands of limestone. Fossils scanty: we may name *Climacogr. Törnquisti* (and a fish scale?).

e. If we continue up Trappbäcken we meet with dark-gray, richly fossiliferous shales, with a dip of 22° towards S. 60° E., at several places easily accessible, partly at the bottom of the brook, partly in the W. bank. In these shales I have found *Monogr. cyphus* LAPW., *M. revolutus* KURCK, *M. incommodus* TÖRNQU., *Climacogr. Törnquisti* ELLES et WOOD, *Cl. medius* TÖRNQU. and *Diplogr. tamariscus* NICH. The shales belonging to the upper part of the zone of *Monogr. cyphus*, can be followed about 55 *m* to the S.

f. At the place named, the dark-gray shales are overlaid by deep black, strongly weathered shivering shales, in which only fragments of *Monogr. triangulatus* HARKN. were found. — According to TULLBERG we should find here, further to the SE., first black, loose shales with *Monogr. leptotheca* LAPW., *M. lobifer* M'COY, *M. convolutus* HIS., *M. communis* LAPW., and *Diplogr. folium* HIS. (consequently TÖRNQUIST's zone of *D. folium*), which in its turn should be overlaid by gray shales

with strips of yellowish clay and thin, black shales, from which, however, he did not know any fossils. These strata are now invisible.

Besides at the last described points of observation from our section IV, Silurian shales are found, more or less accessible, at several other places S. of Röstångamölla diabase dyke, even if several of the localities named by TULLBERG in the area in question, as for instance his *locs. 17* and *18*, are now closed. Among the more noteworthy of these may here be named two, of which the one is situated on the E. side of Trappbäcken high up in the slope on (S of) the diabase dyke. Here, at the bottom of a little pit in the shales, have been found a few richly fossiliferous strata. Of fossils we can name, among others, *Retiolites Geinitzianus* BARR., *Monogr. subconicus* TÖRNQU., *M. nodifer* TÖRNQU., Brachiopods and a *Primitia* sp., which latter quite fills the surface of some strata. The locality, not mentioned by TULLBERG, belongs to the *lower part* of the *Cyrtograptus beds*.

Another noteworthy locality occurs E. of the mill-pond of Röstångamölla S. of and close by the diabase, which has greatly hardened the adjacent shales. From here (TULLBERG'S *loc. 13*) TULLBERG mentions *Cyrtogr. rigidus* TULLB., *C. moniliformis* TULLB., *Monogr. Flemingi* SALTER, *M. vomerinus* NICH., *M. dubius* SUESS and *M. retroflexus* TULLB. In the S. wall of the pit the shales have not been hardened and are therefore now highly weathered.

Odensjön.[1]

Sunk in the Archæan rock, which on three sides forms the high, steep shores, this little lake, situated, as already said, about 1 *km* W. of Röstånga Station, has of old attracted much attention. It was formerly considered to be a crater lake, an opinion which has also had an advocate in recent times (KJELLÉN *1902*). In the explanation to the geological map-sheet Trolleholm (published 1885), however, NATHORST confuted such an opinion, and pointed out, that the surrounding rock is the usual gneiss of the district, and that the »crater-shape» arose owing to the fact that »the extreme end of a crevice-valley in some way or other was hollowed out, while the bottom presumably sank at the same time». The greatest depth of the lake is 18—21 *m*. — HENNIG, who (1902) examined the place in consequence of KJELLÉNS abovementioned statement, was of the opinion that the Odensjö valley is an erosion valley and that the lake itself was formed by a moraine having dammed off the inner part of the valley. The N. shore of the lake (skirted by the valley bottom) consists of a peat formation.[2] KJELLÉNS latest work dealing with these questions, attempts to make plausible that the Odensjö valley is a corrie and that the Odensjö was not worn out by the water but by side-weathering and subglacial erosion on and under a hanging glacier.

[1] As the geologically interested visitor to these parts will scarcely resist paying at least a measure of attention to the localities named in the following, I have thought it advisable to mention them very briefly, albeit they are really outside the limits of this guide.

[2] A ditch digged in 1909 for taking through the Odensjö valley a conduit from the lake, seems to show, however, that the valley bottom, apart, of course, from the peat nearest the lake, consists of deep sand, here and there enclosing blocks that perhaps may have slipped down from the surrounding rocks.

Rallate.

The main road from Röstånga to Skäralid runs at first W. of the railway, but about 1.5 *km* from Skäralid Station it crosses the line and then continues on its E. side, while only a smaller road continues N. along the W. side of the railway. Just to the W. of the point, where this smaller road begins, we come across a little quarry, established on a little dyke or neck of *basalt*, noteworthy for its long and almost horizontal prisms, a form of jointing which, in older times, was known only from this place of our country. According to EICHSTÄDT the rock is a felspar basalt, in which, however, the felspar is so very sparse that with equally good, or even greater, reason one might class the rock among the vitreous basalts.

Skäralid.

Skäralid Station lies just E. of the aperture of the valley that crosses the mountain ridge of Söderåsen, and which is more than 5 *km* long and generally little more than 100 *m* broad, winding zig-zag and traversed by the little Skära stream, from which it gets its name. The gneiss walls of the valley, are perpendicular or precipitous and covered with debris. An easily accessible point, the so-called »Kopparhatten», situated on the NW. side of the glen, affords a good view over the valley and is much visited on that account. According to the explanation to the geological map-sheet Trolleholm, the valley is a crevice valley afterwards widened by erosion. But in »Jordens Historia» (note 1, p. 376) NATHORST says (1890) that the formation presumably is epigenetic and the valley probably not, as had hitherto been assumed, a crevice valley, but rather the work of erosion.

Among works dealing with the geology of this district the following are the most important.

1874. LUNDGREN, B.: Om i Skåne förekommande bildningar, som motsvara Brachiopodskiffern i Vestergötland. — Geol. Fören. i Stockholm Förh. Bd 2.

1875. TÖRNQUIST, S. L.: Berättelse om en geologisk resa genom Skånes och Östergötlands paleozoiska trakter 1875. — Öfvers. af Kgl. sv. Vet.-Ak. Förh.

1879. LINNARSSON, J. G. O.: Iakttagelser öfver de graptolitförande skiffrarna i Skåne. — Geol. Fören. i Stockholm Förh. Bd 4.

1880. TULLBERG, S. A.: Om lagerföljden i de kambriska och siluriska aflagringarna vid Röstånga. — Sver. Geol. Unders. Ser. C, N:r 41.

1882, 1883. TULLBERG, S. A.: Skånes Graptoliter I, II. — Sver. Geol. Unders. Ser. C, N:r 50 and 55.

1882. EICHSTÄDT, FR.: Skånes basalter, mikroskopiskt undersökta och beskrifna. — Sver. Geol. Unders. Ser. C, N:r 51.

1885. NATHORST, A. G.: Beskrifning till kartbladet Trolleholm. — Sver. Geol. Unders. Ser. Aa, N:r 87.

1888—1904. NATHORST, A. G.: Jordens historia. — Stockholm. 8:o.

1900. HENNIG, A.: Geologischer Führer durch Schonen. — Berlin. 16:o. (The railway cutting S. of Röstånga was first mentioned here.)

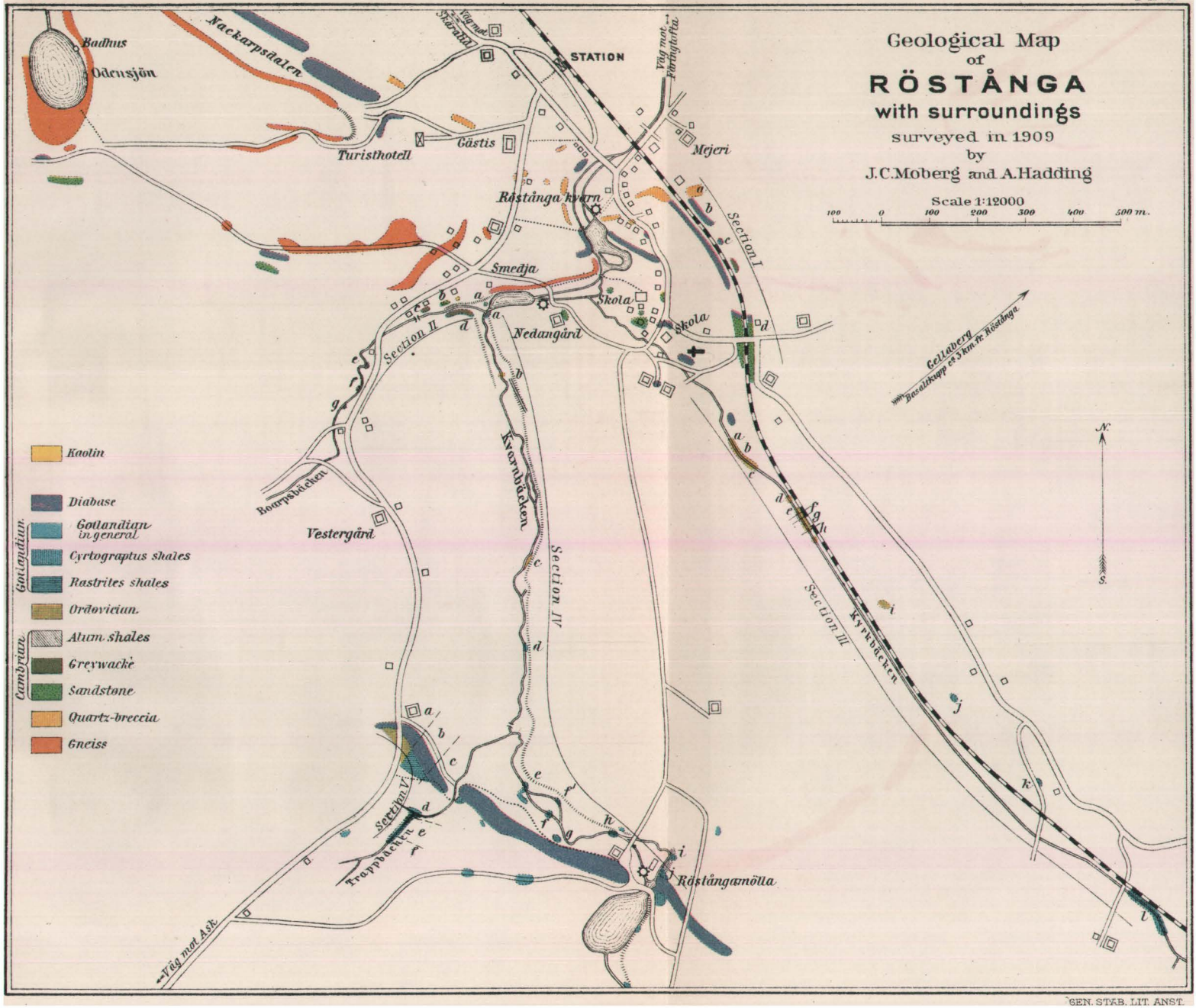
1902. KJELLÉN, R.: Bidrag till Sveriges endogena geografi. III. En svensk kittelkrater? — Geol. Fören. i Stockholm Förh. Bd 24.

» HENNIG, A.: Studier öfver Skånes ytskulptur. I. Odensjön. — Geol. Fören. i Stockholm Förh. Bd 24.

1903. KJELLÉN, R.: Bidrag till Sveriges endogena geografi. VI. Kittelkrater eller dödt fall? — Geol. Fören. i Stockholm Förh. Bd 25.

1906. OLIN, E.: Om de chasmopskalken och trinucleusskiffern motsvarande bildningarna i Skåne. — Meddel. från Lunds Geol. Fältklubb Ser. B, N:r 1. Kgl. Fysiogr. Sällsk. i Lund Handl. N. F. Bd 17.

1907. MOBERG, J. C.: Ett par bidrag till kännedomen om Skånes dicellograptusskiffer. — Geol. Fören. i Stockholm Förh. Bd 29. (The find of *Robergia microphthalma* LINRS. sp. at Röstånga is mentioned here.)



GEN. STAB. LIT. ANST.

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5.

Fyledalen (The Valley of Fylan).

Between the stations of Eriksdal and Högestad the Malmö-Simrishamn railway runs through the valley. To the south of Högestad station, originally called Lyckås, the line winds to the east, just by Fyledal farm, into the cross-valley of the brook of Trydeån, and then follows this valley to the vicinity of Tomelilla. The valley of Fylan, however, continues in a SE. direction down to Benestad, clearly skirted all the way by more or less steep, wooded slopes. The valley, which in the extreme SE. is quite narrow, broadens out somewhat beyond Högestad station, about opposite Röddinge, at the same time assuming a more westerly direction, and finally opens, beyond Eriksdal station, into the large plain called »Moslätten». The valley is traversed throughout by the river Allevadsån, or Köpingeån as it is called near its outlet, somewhat to the east of Ystad. There is no good carriage road along the valley, except in the south part from Högestad Station. Passage from one side of the valley to the other is rendered difficult by the river and by peat-bogs or swamps that occupy the bottom of the valley..

A survey of the more important places and spots situated on the two sides of the valley will enable the visitor to make out his bearings. *On the SW. side of the valley*, farthest to the N. we have Eriksdal station and farm, then the woodward's cottage, from which we soon reach Högestad Station and then Fyledal farm. After passing Fylan's sawmill we get to the

S. end of the valley and pass Kullemölla, situated a little way from the main valley itself in a cross-valley, and finally come to Lyckås mansion, which rises in the background of the valley. *On the NE. side of the valley* of Fylan, a little further S. than Eriksdal station, we reach Kurremölla, in a little cross-valley; then the village of Röddinge on the plateau above the valley; then Ramsåsa, situated right in front of Fyledal farm, a little way up the rivulet Trydeå and on the N. side of it; further to SW. there is the brickyard of Fylan, and lastly, almost opposite the mansion of Lyckås, Sqvaltemölla, belonging to the parish of Benestad. The main road between Eriksdal and Lyckås goes from the former place over the river into the NE. side of the valley, which it follows, at a distance, until opposite Fyledal farm, where it again crosses the river and continues along the south-west of the valley up to Lyckås mansion. Besides the two bridges mentioned, at Eriksdal and Fyledal farm, the two sides of the valley are connected by smaller bridges at Fylan's brickyard, Fylan's sawmill, and the woodward's cottage, while foot-bridges are placed both at Högestad station and where the Högestad and Snogeholm estates join.

In the slopes of the valley of Fylan and in the cross-valleys debouching into it, the rocky floor in many places is more or less accessible. With the exception of Kågeröd formation (Keuper) all the systems included in the rocks of Scania are represented here, at least in some measure. As we know, Lias (accompanied in places by Keuper) appears between Sandhammaren and Wombsjön (the lake of Womb) as a narrow strip, which here and there may possibly attain a breadth of some 500 metres, but is, as a rule, considerably narrower. To the north-east of this strip Silurian predominates, to the south-west Cretaceous. Along the north-east side of the strip there occur at several places, e. g. at Löderup, Munka Tågarp (on the Tosterup estate), Fyledal and Torp near Övedskloster, small portions of primary rock, often accompanied by Cambrian

sandstone, either exactly on the border or quite close to it. But the Lias formations are not always accessible; generally speaking, we may say that they lend themselves to close observation only at Tosterup, where the strata have been most exposed in a number of cross-sections, and in Fyledalen, which has been mainly excavated in Lias.

The Lias strata, which are everywhere very much tilted or even vertical, run mainly in a north-west direction; in its southern part the valley (Fyledalen) consequently coincides in direction with the strike; only in the extreme north-west, where it turns more towards the west, the valley is crossed by the Lias strata. Thus from Lyckås right up to where the Högestad and Snogeholm (Eriksdal) estates join, we have Lias on the south-west side of the valley and Silurian on the north-east. Further north, however, somewhat beyond Röddinge, we have Lias on the north-east side of the valley, whilst the Cretaceous here occupies the south-west side.

After this general survey we pass to an account of the different systems, from the oldest to the most recent.

The Archæan.

This occurs opposite Fyledal farm, at about the middle of the north-east side of the valley, in a little hill cut through by the railway. Thanks to this cutting, a good opportunity is afforded of studying the occurrence. The rock is a granite traversed by clefts and fissures, in part developed as pegmatite, and for the most part strongly weathered. In the outer portion, facing the valley, there is a well developed breccia. In the north-east wall of the cutting we see a small band of crushed black clay-slate, pressed into the granite, thinning out towards the east, and containing angular boulders of the Archæan embedded in it. The remaining part, SW. of the cutting, consists almost exclusively of a similar crush-breccia. Originally the clay-slate was supposed to be derived from the adjoining Lias stratum; later observations, however, have not

supported this assumption, but rather the reverse. The breccia must, in part at least, have received its material from Silurian rocks, for in 1895 Dr. K. A. GRÖNWALL found embedded in the breccia a couple of stink-stones, rich in *Peltura scarabæoides* WAHLENB., *Sphærophthalmus alatus* BOECK, and *Ctenopyge pecten* SALTER.

Gotlandian crops out immediately east of the Archæan rocks, which are, as we have mentioned, cut off on the south by a breccia, but to the north-west the granite can be followed for a little way along the slope bordering the valley, being best observable on and along a foot-path. The most northerly point, where the Archæan rocks are to be found, lies about S. 30°E. of the most northerly crofter's cottage (»Stathus»). Further to the NW. we find the base of the Silurian.

The Silurian.

Cambrian sandstone occurs immediately NW. of the Archæan rocks. It is gray or greenish gray, sometimes quartzitic, and, if I remember rightly, has gnarled, indistinct stratification. Proceeding north-westwards along the north-east side of the valley, from the most northerly point where granite appears, we can easily trace the sandstone on the rather steep slope, though mostly somewhat covered by soil; but soon the valley widens, the slope becomes more gentle, and with that the sandstone ceases. Further to the north-west we come across nothing but Gotlandian strata.

Together with the above-mentioned boulders from the *Peltura* zone, this sandstone is all the Cambrian to be found here.

There is not the slightest trace of *Ordovician in situ*. *Gotlandian*, on the other hand, is very prevalent, though only its upper strata are met with here. These are, first, the Ramsåsa formation, which is the uppermost member of the system, secondly, the *Colonus* beds, which, it is probable, directly underlie the preceding.

The Ramsåsa formation occupies a district situated mainly to the east of the above-mentioned Archæan rocks, and is surrounded both on the north and south by *Colonus* beds.

The *Colonus* beds consequently appear in the north-east slopes of Fyledalen in two separate areas, a southerly and a northerly. On the map the points of observation of these beds are marked with the numbers 1—19, while the places, where the Ramsåsa formation has been found, are marked with the letters A—K.

In the southern area (*loc. 1—4*), the strata are undisturbed at *localities 1* and *2*, and the usual graptolites of the *Colonus* beds, as far as I can recollect at the moment, were also found there. At the more northerly localities *3* and *4*, which lie on the southern boundary of the Ramsåsa field, the strata are much contorted, and so completely traversed by small sliding-planes that no trace of fossils is to be found.

In the northern area (*loc. 5—19*), on the other hand, the *Colonus* beds are not only more accessible and better preserved, but also more developed. Before proceeding to a more detailed description of the various strata and localities, it will be as well to say a few words about the development of the *Colonus* beds in general.

The Colonus beds are of all the Silurian formations in Scania (possibly with the exception of the Cambrian sandstone) the thickest and most widely distributed. They were, for the most part, deposited in comparatively shallow water. Their rocks are mostly gray shales, limestones and sandstones. The shales are in part slightly weathering marl-shales,[1] in part more sandy and micaceous; sometimes the two alternate in layers as thin as paper. The limestones sometimes form thin, continuous beds, but usually occur in the form of irregular lenses, often of huge dimensions. The boundary between these

[1] In a number of the geological map-sheets of Sveriges Geologiska Undersökning and their explanations the *Colonus* beds are distinguished from other Gotlandian shales under the name of »mergelskiffer», i. e. marl-shale.

latter and the shales is often imperceptible, so that the stratification of the shales, especially in the weathered rind, can be followed for a space into the limestone. That rock is mostly dense, and then always devoid of fossils; more rarely it is crystalline, and in that case fairly often quite rich in fossils. Among fossils characteristic of the zone, *Monograptus colonus* BARR., *M. dubius* SUESS, *M. bohemicus* BARR., and *Cardiola interrupta* SOW. are the commonest. In a few layers the graptolites mentioned may entirely cover the surface of the shales; but between such fossiliferous layers there occur, as a rule, thick beds very poor in fossils, if not altogether devoid of them. For this reason poverty in fossils has almost come to be reckoned a characteristic feature of the *Colonus* beds; later investigations, however, have shown that in places the beds possess a somewhat richer fauna. E. g. we may mention that, in addition to those already mentioned, a few graptolites are met with, namely: *Monograptus Roemeri* BARR., *M. Nilssoni* TULLBERG, *M. scanicus* TULLB., *Plectograptus macilentus* TÖRNQUIST, *Retiolites spinosus* WOOD, and *Gothograptus nassa* HOLM. There also occur a coral (rare), crinoids (columnals), brachiopods, cephalopods, several trilobites and other crustaceans, among which the ostracods are sometimes abundant. Apart from the graptolites, however, the fauna of the *Colonus* beds has not yet been investigated.

At several places a micaceous, thin-bedded sandstone, usually nonfossiliferous, has been observed in the lower part of the *Colonus* beds, and has been called Odarslöf flags (»Odarslöfsskiffer») from Odarslöf, N. of Lund, the locality from which it was first mentioned.

Odarslöf flags of ordinary character and without fossils have been found at *localities 13* and *14*, where they are most accessible, also at *15* and *16* (see the map). The strata usually dip eastwards.

At all the other localities marked as *Colonus* beds (i. e. *1—12* and *17—19*), the strata should belong to the upper

part of the zone. They are most accessible at *loc. 8* (Stafringabacken), *loc. 12*, and in Röddinge Lerberg (*loc. 17*). Of these three localities, however, only the last-named has yielded fossils. We will therefore describe it in this place.

Lerberget, in the village of Röddinge, lies in the little cross-valley of the Röddinge rivulet, and has been carved out of the slope by the rivulet and its feeder, so that its outline is a triangle pointing southwards, and its sides are steep. The rock here is for the most part easily accessible and fully exposed on the west side of the hill. The strata dip 10°—25° N. and NE. The older strata are consequently at the south end of the hill. A section through them showed, at different levels, fossiliferous strata with the zone's customary graptolites and with trilobites, ostracods, and a coral. But most noteworthy is a horizon found in the upper part of these older strata, rich in retioloid graptolites previously unknown in Swedish *Colonus* beds, viz. *Plectograptus macilentus* TÖRNQUIST (abundant) and *Retiolites spinosus* WOOD (quite common). Here is also found *Gothograptus nassa* HOLM (rare). In a section in the extreme north there are strips of limestone with brachiopods and a few trilobites.

The Ramsåsa formation has its main distribution on the north side of (the rivulet) Trydeån, between Ramsåsa village in the east and the Archæan horst by Fyledal farm in the west. A locality belonging to this is found, however, somewhat further south, in the hillside just north of Fylans brickyard. The localities are marked on the map with the letters A—K. On the strength of a sequence along the south shore of Ringsjön at Klinta, where the strata in question also occur, the formation has been divided, chiefly on petrological and stratigraphic grounds, into four zones, 1—4, of which zone 1 is the oldest. Wherever zone 2 could be distinguished, it lacked fossils. In the Ramsåsa district only zones 1, 3 and 4 are known.

Zone 1 is only found at *loc. K*, north of Fylan's brickyard. Its commonest fossils are *Homalonotus Knighti* var. *platyrhi-*

nus ANG. and *Chonetes striatella* DALM. Also found: *Calymmene intermedia* LINDSTR., *Phacops Downingiæ* MURCH., *Pterygotus* sp., *Thlipsura tetragona* KRAUSE, *Beyrichia* sp., *Tentaculites annulatus* SOW., *Pterinea retroflexa* WAHL., *Sanguinolites anguliferus* M'COY, *Pholidops antiqua* SCHLOTH., *Spirifera elevata* DALM., *Rhynchonella borealis* SOW., with other brachiopods and a bryozoan, *Eridotrypa scanensis* HENNIG. The rock is gray shale and limestone.

Within the Ramsåsa area proper we only find zones 3 and 4. The former is developed at both the most easterly localities, *A* and *B*, and at the three most westerly localities, *G*—*I*; zone 4 is developed at the remaining localities here, i. e. at *C*—*F*. Within the localities along the W. border, the dip of the strata is SE., but in the rest of the field chiefly W. Everywhere the rocks, sandstones (freestones) and shales, have, as a rule, a very red colour. At present the strata are best accessible at *loc. C*, along a little rill, at *loc. F*, the large quarry, and at *loc. I*, on the hillside. *Locs. B*, *D*, and *I* have yielded most of the fossils, among which the ostracods, 17 species altogether, take a prominent place. There occur *Calymmene*, *Leperditia inaequalis* GRÖNWALL, especially characteristic of the sandstone as its commonest fossil, *Tentaculites* and *Hyolithus*, several *Bellerophon* species (among them *B. expansus* SOW.) and other gastropods, many lamellibranchs, among which *Cucullella ovata* SOW. or (in some places) a *Megalomus* sp. occasionally fill whole beds, brachiopods, among which *Chonetes striatella* DALM. and *C. Piperi* MOBERG et GRÖNWALL are the commonest, annelids, and others. The fauna has recently been described in detail in a work on the Gotlandian of Fyledalen (»Om Fyledalens gotlandium») by J. C. MOBERG and K. A. GRÖNWALL.

In certain strata the sandstone in the quarry yields a splendid building-stone of exactly the same kind and age as the widely known Öveds sandstone. In the strata exposed in the quarry may also be observed a considerable fold accompanied by a fault.

The Lias.

Rocks of this age are found on the south-west side of the valley, from Kullemölla rivulet in the extreme south, right up to the district south of Röddinge, i. e. almost as far as the Högestad estate extends in this valley. On the north-east side of the valley the strata come to light in the valley wall or in the cross-valleys that cut it, from the S. of Röddingeberg, past Kurremölla, to a point situated quite 300 metres WNW. of the last-named place. The strata are everywhere strongly tilted, and strike chiefly NW. The prevailing rock is a sandstone of a pronouncedly rust-coloured yellow, shading into brown, occasionally yellowish-red, and of variable hardness, here and there enclosing lumps of clay or clay ironstone. The rusty-brown sandstone often shows within the rust coverings a core of fresh greenish sandstone. White, fine-grained sand or loose sandstone also appears in huge strata; more rarely we find, interstratified in the sand, a gray or blackish clay, with worthless coal-seams.

The southernmost locality is a little hillock west of the road between Lyckås and Fyledal, and immediately south of Kullemölla rivulet. Here is rusty brown sandstone.

The next point of observation is the way-cutting somewhat north of the bridge over Kullemölla rivulet. Here is rusty-brown and greenish sandstone with occasional fossil shells.

In the wood to the north-west of the lane to Kullemölla the same sandstone can be seen.

Between the lane to Kullemölla and the lane to Fylan's brickyard, in small cross-valleys on the west side of the main road the same rock can be seen cropping out at several places in the wood. At a point, situated twice as far from the brickyard lane as from the Kullemölla lane, the main road crosses the mouth of a ravine which can be followed for nearly 150 metres and, practically all the way, shows rust-

brown sandstone cropping out; here are a few fossils, among which a *Pecten* sp.

Partly in a cutting for the Baldringe road, partly in a ravine just north-west of (beside) the same road, the Lias strata are accessible. In the ravine was noted at one place a strike of N.35°W. with a dip of 84° SW.; at another place the vertical strata had a strike of N.27°W. At the former place a *Tancredia Johnstrupi* LUNDGR. was found in the rusty-brown sandstone.

Just S. of Fyledal farm a narrow forest road leads into a little glen, called Högabränte. In the steep wall on its N. side, somewhat more than 100 metres from the main road, we may find vertical strata, partly of loose sand, partly of rusty-brown or greenish sandstone, with a strike of N.30°W. In a few spots are layers rich in shells, some of them in a good state of preservation.

The nearest locality in the north is a cutting made for a little forest road NW. of Fyledal farm. Here rusty-brown sandstone crops out striking N. 5° to 15° W.; strata vertical.

Just south of the lane to Högestad Station, there is on the west side a little dale, on the north side of which rusty-brown sandstone crops out, but this is not easily accessible.

In the cutting for the road to Ållskog, a rusty-brown sandstone crops out in the north bank and has yielded a few shells.

On the slope somewhat north-west of the woodward's cottage, on the other hand, loose white sandstone crops out, of the same kind as that at Kurremölla, of which more anon.

About 700 metres north-west of the woodward's cottage and on the south-west side of the glen, is a cross valley, called Skyttedalen, in the north side of which, about 100 metres from the railway line, occurs rusty-brown sandstone containing *Pecten Tullbergi* LUNDGR., *Sphæriola Kurremolinae* MBG, *Tancredia securiformis* DUNK., *Dentalium etalense* TERQU. et PIETTE, and others.

Between this locality and the one above mentioned we

can see everywhere in the slopes of the valley rusty-brown sand, often filled with pieces of similar sandstone, whence it is clear that the sandstone constitutes the rocky floor along the whole distance, although *on the south-west side of the valley* the rock has not been surely traced further north-west than to »Skyttedalen».

Similar rock is again met with further to the north-west, at several places, but *on the north-east side of the valley*, in the narrow belt of wood that there borders it. Here the most easterly points of observation are found in the wood south of Röddingeberg. Their exact position can be seen from the sketch-map above. Two brooks cross this belt of wood; for the sake

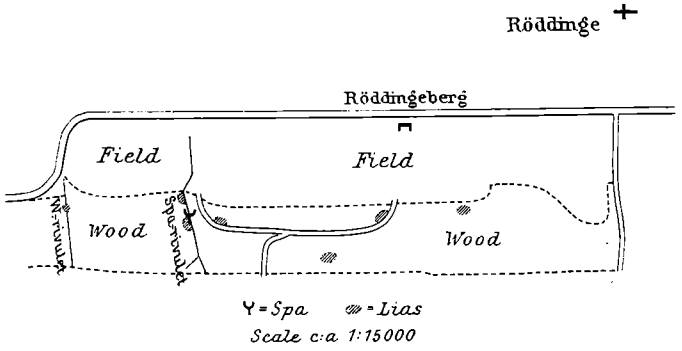


Fig. 1. Sketch map showing *localities of Lias* in the wood S. of Röddingeberg.

of brevity we will call the one further to the W., along the bend of the road, »Vestbäcken» (W. rivulet); the other, »Surbrunnsbäcken» (Spa rivulet), there being a ferruginous spring from the Lias strata. A little woodland road, running along the slope, opens into the field above, quite close by Surbrunnsbäcken in the W. and south of Röddingeberg in the E.; from this road there is also a road down to the meadow-ground S. of the wood.

About 200 metres E. of the eastern end of the woodland road rusty-brown sandstone has been observed among the material cast up from a badger-hole at the border of the wood.

Presumably the rock crops out here, and this consequently constitutes the most easterly point of observation for Lias on the north-east side of the valley.

Just by the E. end of the woodland road properly exposed strata of the same rock may be found, with sparse fossil shells; the strike is N.65°W.

Midway between the last-named occurrence and the road down to the meadow-ground, and 50 metres S. of the woodland road, under a perpendicular cliff of some metres high, occur strata of gray sandstone and white sand, with a strike of N.60°W. The locality is of interest in so far as here is plainly seen how furthest to the N. (or NE.) we have rusty-brown sandstone, succeeded in the S. (or SW.) by gray and white sandstone. This, as we shall see later, is the sequence also at Kurremölla.

Nearer the west end of the woodland road, rusty-brown sandstone is seen at several places, partly in the north bank of the road, partly in Surbrunnsbäcken, cut out to the west of it. The strata have a strike of N.70°W. at the last-named spot and are quite vertical.

In Vestbäcken the rusty-brown sandstone is found cropping out for a short distance in the channel of the brook itself. The strata have a strike of N.60°W. and dip 75° NNE.

If we follow the road west of the last named locality towards Kurremölla, then at a bend of the road near that place, where wood borders the road on each side, we shall find that Lias strata crop out both north and south of the road. On the south side of the road strata of gray clay are exposed in a small pit. A little further west, the bank of the road has been cut through a gray clayey sand with thin layers of white sand; on this is a thin coal-seam and above it gray sand. The strike observed here is N.85°W., the dip 45° NE. Somewhat nearer Kurremölla, in the same bank of the road, white sand has been found. The strata here are not easily accessible.

Almost at the cross-valley cut by the Kurremölla brook, the following sequence was found by MOBERG in a section taken in 1886 in the slope on the N. side of the road, now forest-clad. A new section, taken in 1909 in the neighbourhood of the other, shows almost the same sequence, with but slight variation as to the thickness of the layers (see below).

		1886.	1909.
(Uppermost)	Sand, gray		
	Coal	0,18 *m*	0,85 *m*
	Sand, whitish yellow	0,30 »	0,80 »
	Clay, blackish-gray, with thin layers of sand	0,42 »	0,50 »
	Coal	0,45 »	0,85 »
	Clay, gray (uppermost a thin seam of yellow sand)	0,60 »	0,45 »
	Coal	0,60 »	0,55 »
	Clay, blackish gray	0,78 »	0,85 »
	Coal	0,36 »	0,40 »
	Sand, gray, with occasional indeterminable plant-fossils	1,20 »	1,15 »
	Clay, gray, with plant fossils, best preserved in the lower or middle layers [1]	1,77 »	2,00 »
(Lowest)	Sand, grayish	1,80+ »	0,90 »
	Sand, white		7,00+ »

Also in the S. slope of the road these sand strata could be traced. The strata have a strike of N. 40°—45°W. and dip strongly to the NE.

A continuation upward of this section will be found (though not immediately) at the E. side of the road on the E. of Kurremölla brook — the road leading to the mills.

Opposite the lowest little mill-building there is an almost perpendicular wall of compact, brownish-green, nonfossiliferous sandstone, with a strike of N. 45°W., and a dip of 80°—83° NE. In the continuation to the north, we come across strata of

[1] As the clay is usually much crushed and traversed by sliding planes, it is difficult to obtain from here suitable material for determining the species. The plants are therefore only partly known; the most common species is *Nilssonia fallax* NATH. (see NATHORST 1909); besides there occur *Equisetites Mobergi* MÖLLER (see HALLE 1908), *Sagenopteris* cfr *Montelli* DKR, etc.

loose sandstone (or sand) of very variable character, one of which, of a fine reddish-yellow and plainly laminated with subordinate layers of white sand, attracts attention by its bright colour.

Similar sandstones can also be traced on the W. side of Kurremölla brook. At the S. corner of the large mill, in the bank of the brook, the sandstone also includes clay-ironstone, in which stems of fossil plants are not uncommon. And somewhat further north, by the bridge, the sandstone in the bank of the brook contains layers with an abundance of small pebbles, which give them the appearauce of a conglomerate. At the southern end of a cutting, higher up in the slope of the hill, we come across a conglomerate formed of lumps of clay and lighter sandstone embedded in the darker sandstone. Northwards above this conglomerate follows again a loose fine-grained sandstone. The strike and the dip are the same as elsewhere in this district.

Just north of the last-mentioned cutting, on the west side of the mill-pond and most readily approached at the bottom of a little runnel, there is a rusty-brown, richly fossiliferous sandstone, which forms the upper part of the Lias of Fyledalen. The sandstone, which is divided into angular pieces, has often in its interior a core of fresher, greenish rock. Besides very rare fragments of plants, there is a fauna, embracing at least 59 species, whose nearest equivalent is found in the zone of *Aegoceras Jamesoni* Sow., i e. in the lowest part of the Middle Lias. This sandstone is commonly called the »Cardium bank», after its characteristic fossil, *Cardium multicostatum* PHILL., partly for the sake of conformity with the nomenclature used by LUNDGREN in his scheme of the Jurassic rocks of Scania, partly because the stratum is by no means a normal representative of the *Jamesoni*-zone as developed elsewhere. It is true that *Aegoceras Jamesoni* (the only determinable Ammonite in the rock) is found here, but of the fossils that can serve for direct comparison with the foreign

Jurassic, eleven are common to the *angulatus*-zone, seventeen to the *Bucklandi*-zone, ten to the *ziphus*-zone, thirteen to the *Jamesoni*-zone, twelve each to the *centaurus*- and *Davoei*-zones.

To enumerate here all the species found would take too long. More detailed information has been given in my work »Om Lias i sydöstra Skåne». From the list of fossils we will only give the most important or commonest species. —

Ostrea arcuata Sow. (dwarfed), *Plicatula spinosa* Sow., *Limea acuticostata* Münster, *Pecten Lundgreni* Moberg, *Avicula inaequivalvis* Sow., *Leda Bornholmiensis* v. Seebach, *L. Renevieri* Oppel, *Sphaeriola Kurremolinae* Moberg, *Tancredia securiformis* Dunk. var., *T. Johnstrupi* Lundgr. sp., *Cardium multicostatum* Phill., *Pleuromya Forchhammeri* Lundgr., *Dentalium etalense* Terqu. et Piette, *Pleurotomaria expansa* Sow., *Turbo solarium* Piette, *Aegoceras Jamesoni* Sow., and *Acrodus nobilis* Ag. — As has been mentioned, fossil shells are met with in many parts of this district in the rusty-brown sandstone that occurs all the way from Kullemölla, in the S., to Kurremölla, in the N., and everywhere the species are such as recur in the fauna of Kurremölla; whence it follows that the outcrops all belong to one and the same series of strata.

There remains only the locality west of Kurremölla, somewhat N. of the road to Eriksdal, where the white sandstone is easily accessible in a huge sand-pit. The strata here have a strike of N. 45° W. and dip 55°—68° NE. The size of the grains in the sandstone varies somewhat, but a fine-grained rock predominates. Lumps of white clay or pebbles of light quartzite are occasionally found in it. — See also the footnote of the next page.

The Cretaceous.

The Cretaceous strata of Scania fall into two districts, the one in NE. Scania (to which must be added also the occurrences in W. Blekinge), the other in SW. Scania. Within

the latter, the most recent formations lie furthest to the south-west, the oldest furthest to the north-east. The north-east boundary of the Cretaceous formation of the south-west district has been followed from Sandhammaren in the south-east past Tosterup and Lyckås, to Eriksdal.[1] Everywhere along this boundary are found the *oldest* strata, which are here of Lower Senonian age.

That the boundary indicated was also once the boundary of the Cretaceous sea in these parts, follows both from the nature of the rocks (conglomerates, sandstones, and sandy marls) and from the profusion of belemnites. In the district of Fyledalen, which belongs to the boundary area in question he rock is predominantly a gray or grayish-yellow, sandy marl, often with a greenish tinge; in one place only has a ledge of fine-grained, greenish conglomerate been met with. About thirty years ago this marl was extensively used as a soil-improver, and it is chiefly in the large marl-pits dug at that time that the strata in question were exposed. The most important points of observation are *two* marl-pits on the Eriksdal property, *one* at Lyckås, and *two* at Kullemölla, where moreover are a couple of less important points of observation. Kullemölla lies somewhat south-west of the valley (Fyledalen), but the other localities mentioned are all in the south-west slopes of it.

The fauna of this formation is as yet little known. Most abundant among the more characteristic forms are: *Actinocamax verus* MILLER and *A. westphalicus* SCHLÜTER.[2] Among

[1] We are informed (by TÖRNEBOHM and HENNIG: Beskrifning till blad 1 & 2, Sver. Geol. Unders. Ser. A 1 : a, 1904, p. 133) that the Cretaceous has been traced by boring as far to the NW. as the brickyard of Womb, S. of the lake Wombsjön. According to TULLBERG (Beskrifning till kartbladet Övedskloster. Sver. Geol. Unders. Ser. Aa, N:r 86, 1882) also white Lias sandstone in that manner is traced in the neighbourhood, namely at Torp, E. of the same lake.

[2] *Actinocamax westphalicus* seems to be closely connected by means of transition forms (among which a forma *ovata* MBG is most widely spread) with *A. quadratus* BLAINV., which latter, however, has not been met with

other fossils we may mention *Inoceramus cardissoides* GOLDF., which is very common, several species of *Ostrea*, *Pecten*, and *Lima*, many gastropods, among them a *Brunonia* MÜLLER. A little *Cristellaria* is very abundant in places. Of ammonites only rare, indeterminable fragments have been found.

A Quaternary formation.

Although formations belonging to the Quaternary System are not within the scope of this guide, the reader's attention may be briefly directed to the remarkable calcareous tufa of Sqvaltemölla near Benestad. Calcareous Tufa is to be found at many places in the slopes of the valley, for instance at Fyledal farm and at Slagarp, but at Benestad it is best developed in solid layers of great extent, exhibiting a rich flora (56 spp.) and fauna (68 spp.), worked out by Baron C. KURCK.

List of more important works bearing on this district.

1872. ERDMANN, E. Beskrifning öfver Skånes stenkolsförande formation (Description of the coal-bearing formation of Scania). — Sver. Geol. Unders. Ser. C, N:r 3.

1880. NATHORST, A. G. Om de växtförande lagren i Skånes kolförande bildningar och deras plats i lagerserien. (On the plant-bearing strata in the coal-bearing formations of Scania and their position in the geological sequence). — Geol. Fören. i Stockholm Förh. Bd 5.

here in its typical development. As all the belemnites belonging to the form-series have the surface of the rostrum granulated and can be included in BLAINVILLE's *Belemnites granulatus*, I proposed 1894 (Über schwedische Kreidebelemniten. Neues Jahrb. für Mineralogie etc.) the name *granulatus* beds for the strata in question. STOLLEY, without being able to deny the close connection of the forms, yet wished to reserve the name *A. granulatus* for one of these (i. e. for MOBERG's forma *ovata*), and later proposed to use the name *granulatus* beds only for the most recent part of the strata, which, according to him, is to be found at Lyckås and Kullemölla.

STOLLEY's proposal (since accepted by Dr. A. HENNIG) does not commend itself to me; a further discussion on the subject would be better deferred, however, until the fauna has been more closely examined and worked out.

1884/1885 MOBERG, J. C. Cephalopoderna i Sveriges kritsystem I, II. (The Cephalopoda of the Cretaceous System of Sweden). — Sv. Geol. Und. Ser. C, N:os 63, 73.

1888. MOBERG, J. C. Om Lias i sydöstra Skåne (On Lias in the south-eastern Scania). — Kgl. sv. Vet.-Akad. Handl. Bd 22, N:o 5.

1893. MOBERG, J. C. Bidrag till kännedomen om Sveriges mesozoiska bildningar. (Contributions to the knowledge of the Mesozoic formations of Sweden). — Bih. till Kgl. sv. Vet.-Akad. Handl. Bd 19.

1897. STOLLEY, E. Üder die Gliederung des norddeutschen und baltischen Senon, sowie die dasselbe charakterisirenden Belemniten. — Archiv für Anthropologie und Geologie Schleswig-Holsteins Bd II, Heft 2.

1897. GRÖNWALL, K. A. Öfversikt af Skånes yngre öfversiluriska bildningar. (General Survey of the upper division of the Upper Silurian of Scania). Geol. Fören. i Stockholm Förh. Bd 19.

1901. KURCK, C. Om kalktuffen vid Benestad. (On the calcareous tufa of Benestad). Bih. till Kgl. sv. Vet.-Akad. Handl. Bd 26.

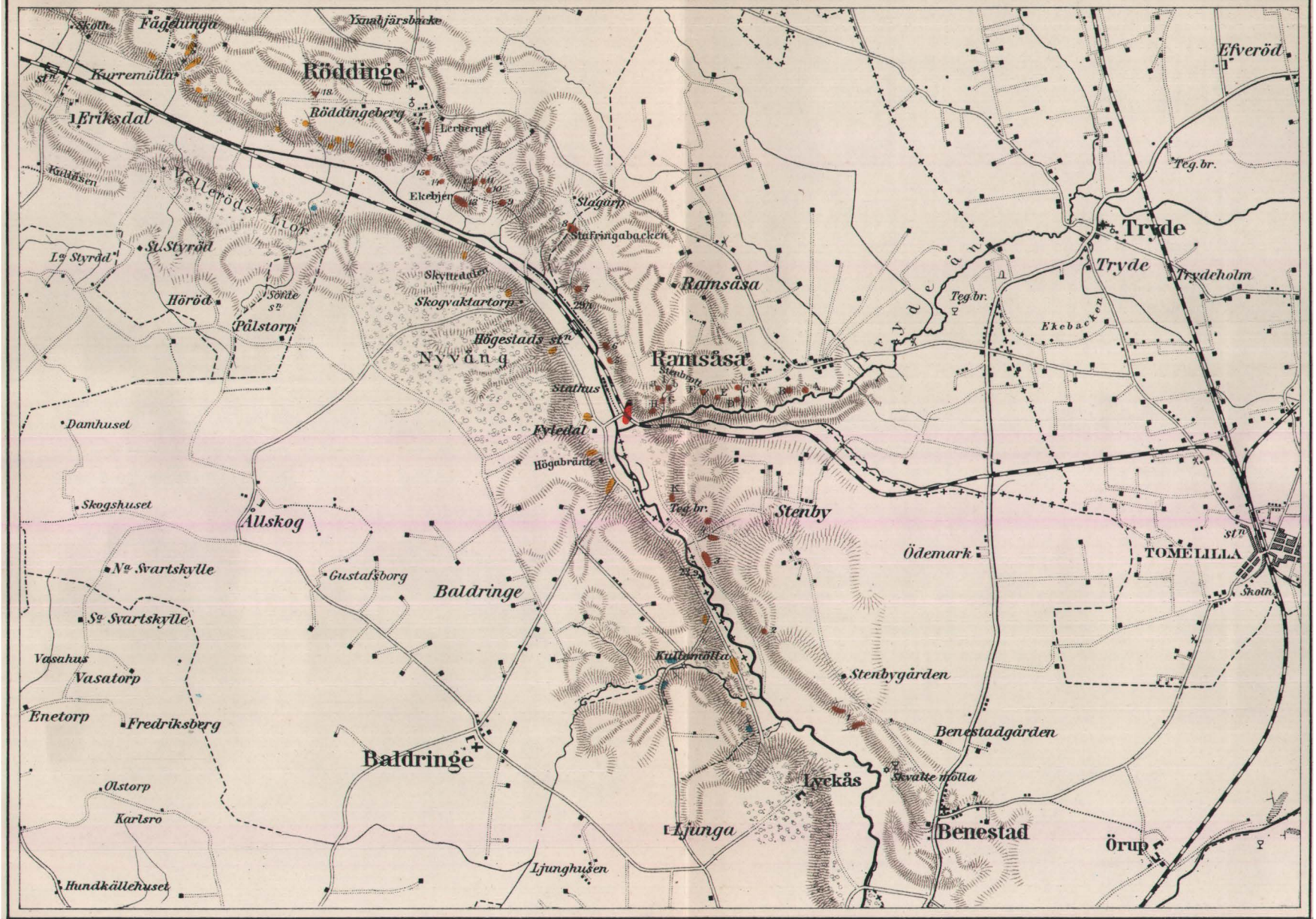
1908. MOBERG, J. C. och TÖRNQUIST, S. L. Retioloidea från Skånes colonusskiffer. (Retioloidea in the Colonus beds of Scania). — Sver. Geol. Unders. Årsbok N:o 2.

1908. HALLE, T. G. Zur Kenntnis der mesozoischen Equisetales Schwedens. — Kgl. sv. Vet.-Akad. Handl. Bd 43, N:o 1.

1909. MOBERG, J. C. och GRÖNWALL, K. A. Om Fyledalens gotlandium. (On the Gotlandian of the valley of Fylan). — Lunds Univ. Årsskrift N. F. Afd. 2, Bd 5.

NATHORST, A. G. Über die Gattung *Nilssonia* BRONGN. mit besonderer Berücksichtigung schwedischer Arten. Kgl. sv. Vet.-Akad. Handl. Bd 43.

GEOLOGICAL MAP OF THE FYLEDAL-REGION



Cretaceous | Lias | Gotlandian (A–K Ramsåsa-series; 1–19 Colonus shale) | Cambrian | Archæan

GEN. STAB. LIT. ANST.

Scale 1:50000.

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6.

Tosterup.[1]

The estate of Tosterup, situated about 12 *km* NNE. of Ystad, extends 4 *km* N.—S., 5.5 *km* E.—W., and in its western part almost touches the Station of Svenstorp on the Ystad—Eslöf railway. The boundary line between the Scanian paleozoic formations in the NE., and the mesozoic in the SW., runs from NW. to SE. across the estate. It is this position which is the predominant cause why Tosterup, the coherent area of which is not more than 1277 hectares, can nevertheless present almost all the geological formations of which Scania is built up. This is also the only place where one can find a complete sequence through the Senonian Cretaceous of Scania.

In the main the ground rises very equably from SW. to NE.; only the elevated Munka-Tågarp's hill, formed by Archæan and by Cambrian sandstone, rises somewhat abruptly over the surrounding fields. The flatness of the ground is relieved, however, by the generally deep river valleys through which the watercourses of the district make their way. These, following the prevalent slope, run all in a SW. direction, with

[1] As this paper is also intended to give the first collected account of all the forthcoming data touching the geology of the older systems of Tosterup, a number of details have had to be included, which could have been dispensed with as far as the *guide* is concerned. It is to be hoped, however, that this will not make the work any the less serviceable in its capacity of guide.

but one exception. Furthest to the W. the *Köpinge river* (»Köpingeån») for a small stretch forms the boundary of the estate, and furthest to the E. the *Rödmölla brook* marks or nearly marks the limits of the property. In its upper course where, evidently influenced by the strike of the surrounding Silurian strata, Rödmölla brook runs almost due W., it is joined by two very small affluents coming from the north, the more easterly occasionally owning to the name of *Ljungbergsbäcken*. Besides the watercourses named, there run in a SW. direction two streams, one from the village of Munka-Tågarp and one from the village of Lilla Gärarp, both of which debouch into »*Wallabäcken*». The last-named, which at present seems to spring from a little moss, now quite filled with water, situated to the W. of Tosterup Castle, runs, differently to the other watercourses, through a broad valley to the NW., debouching into Köpinge river. Wallabäcken seems to follow pretty closely the strike of the Liassic strata, and its course has certainly been predestinated by the loose rocks of that formation.

2. Historical dates.

NILSSON in his Petrificata Suecana (1827, p. VI) says that at Tosterup the strata of the Cretaceous rest on Silurian: »rarius in depositis formationis transitionis jacent, ex. gr. ad prædium Tåsterup», and the same faulty statement occurs in HISINGER, who (1828) more definitely mentions the spot, where the observation is supposed to have been made, viz. on the W. side of the road that crosses the river S. of Tosterup (»Tåstarp»), i. e. at our loc. *C V: 4*. In 1837 HISINGER also speaks of the *Orthoceras* limestone here present. For the rest the geology of Tosterup does not seem to have attracted any special attention before O. TORELL (1871) started a systematic geological and agronomical survey of the property. The actual work was carried out by E. ERDMANN,

assisted in the detail of paleontological investigation by B. LUNDGREN and J. A. WALLIN. The field-work was finished in the phenomenally short time of 12 days and maps, both of the solid formations and of the quaternary deposits, were worked out and printed the same year. The maps, however, were never published, nor has any explanation to them appeared in print. In 1874 LINNARSSON visited Tosterup, but his visit was a very short one and led to no result worth mentioning. In 1882 TULLBERG reviewed the Silurian formations of this district[1], while in 1887 and a few subsequent years I myself made some researches here, especially into the Mesozoic formations[2], and, on several occasions since then, studied some details of the geology of Tosterup.[3]

We may also recall here that in 1906 E. OLIN gave an account of his observations touching the *Chasmops* and *Trinucleus* beds and that in 1909 A. H. WESTERGÅRD examined the *Dictyograptus* beds.

Since 1871, when TORELL planned a geological description of the estate of Tosterup, many years have passed, and though in several respects, we have considerably added to the material upon which such a description must be based, to a still greater extent have the demands that a work of this kind calls for, become exacting. To now produce a compact and up-to-date sketch of the geology of Tosterup, it will, therefore, be necessary not only to undertake a very thorough revision of the dates already at our disposal, but to in many directions institute entirely fresh investigations too.

With regard to the consequences from investigations already carried out at Tosterup, our attention is especially drawn to the map of the underground given by ERDMANN. For it is in this map that we find the first start of the net

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[1] As for the geological sections then drawn up we refer to TULLBERG *1883* (see the Bibliography at end of this paper).

[2] See MOBERG *1888* and *1893*: 2.

[3] » » *1893*: 1 and *1895*.

of fault-lines, which, outlined in ERDMANN'S survey-map of the Scanian rocks (1872), afterwards appears, extended and varied in every possible manner, in practically all the maps of this kind that have been drawn up by later writers.[1] The reasons why the Tosterup map has come to play the part of predecessor in the way indicated, are not far to seek. For one thing the Tosterup district is to a great extent covered by very thick layers of earth, for which reason a map of the rocky floor, as one had to be drawn up, must to great extent be a matter of construction, Then again, it was here that one met with faults of which one (at »Stengrafshus») was directly visible, another (at the hill of Munka-Tågarp) quite obvious. It will, therefore, be easily understood that in constructing the rock map, faults came to play an important part, especially as, the real facts being unknown — at that time, for instance, they were ignorant of the occurrence here of the older mesozoic systems between the Silurian and Cretaceous — it was assumed that the gaps in the sequence of strata, which gaps should have been explained by the faults, were considerably larger than later investigations have shown them to be.

From what has been said above, it is scarcely necessary for me to call special attention to the circumstance that I have not the confidence to draw up a reliable rock map of the estate of Tosterup.[2] Moreover, there are unfortunately such large gaps in the dates at my disposal concerning the geology of Tosterup, that only the very roughest outlines on the subject can here be set before my readers.

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[1] This is well exemplified in »Blad 1 & 2». Sver. Geol. Undersökn. Ser. A 1, a, by A. E. TÖRNEBOHM and A. HENNIG, published in 1904.

[2] In order to indicate at least one of the variants resulting from the attempts of other authors to construct a rock map of Tosterup, we add, as *Plate I*, a copy of Plate II from TÖRNEBOHM'S and HENNIG'S *op. cit.*

On the enclosed map I have therefore only included the points of observation, where I or others have been able to really observe the rocky floor[1]; further information about each special point is given in the following. For the sake of convenience the map has been divided by means of parallel, equidistant, straight lines into five different zones, *I—V*, the direction and number of the lines being determined by the water-courses, in such a way that each river valley, with the natural sections accessible in it, falls into *one* zone. By means of another system of lines, practically at right angles to the former, the map is furthermore divided into 3 stripes, *A—C*, of which the most south-westerly, *C*, embraces all localities for the Mesozoic systems; the middle part, *B*, whose N. boundary line has been drawn almost parallel to the boundary between *B* and *C*, embraces *inter alia* the majority of the more important localities for directly accessible Silurian. In the »squares» that have arisen through the intersection of the lines, the points of observation have been marked with ordinary figures in continuous numerical order, so that each »square» has its own series of figures.

Having thus explained the notation, which has, of course, also been used in the text, we will go on to the following.

3. Description of the Localities.

a) Archæan and Silurian.

A I
A II } In these squares the rock could not be observed.
A III

(*A IV: 1*). *White* (older) *Cambrian sandstone*, according to

[1] Not all the older points of observation could be included. In some cases the statements, which seem to have been based only on the nature of the ground moraine, have not been taken to be reliable. As the interval between the Silurian and the Cretaceous is here only about 400 *m*, a moraine, derived exclusively from Silurian rocks, may easily have been dragged into the district of the Cretaceous, and this has also been directly observed.

E. ERDMANN, has been found at a depth of about 2 *m* in a well; also in the field around, the same rock is reported to have been found at the depth named. The locality lies outside the limits of the property.

(*A IV : 2*). *Orthoceras limestone* has been met with, according to ERDMANN, in digging the well. The spot lies outside the Tosterup property.

A IV : 3. Shelf of *Cambrian sandstone*, with ice-grooves running N.52°E.

A IV : 4. *Alum shales* beneath about 1.5 *m* of moraine, in a well; here, at a depth of some 4 *m*, was found a stink-stone spheroid containing *Peltura* and *Sphæroph-thalmus alatus* BOECK. This according to WALLIN and LUNDGREN. The fossils point to the Upper part of the *Olenus beds*.

A IV : 5. *Black shales* (alum shales?) have been found here at a depth of about 4 *m* in a well.

A IV : 6. *Lower Didymograptus beds*, cropping out in the brook.

A IV : 7. *Orthoceras limestone*, according to WALLIN, crops out here, with a dip of 5° to the NW.

A V : 1. »Blackish shales» have been met with, according to ERDMANN, at a depth of about 6.5 *m* in a well. — At the same depth, and according to the same author, at 250 *m* S. of the spot named, a similar rock is said to have been found in a well 7 *m* deep; the strata *in situ* are said to dip 30 to 40° to the SW. This locality is not included in my map, since the occurrence is *not* marked on ERDMANN'S rock map.

B I : 1. *Colonus beds*, dipping 30—40° to the WNW., are said by ERDMANN to have been found in a ditch; in my revision 1887, I did not succeed in finding this spot, but in its stead I found the same beds,

here containing *Monogr. bohemicus* BARR. and other graptolites, in a slope about 100 *m* further to the SW., close by the border of the property; the shales here had a dip of 35° to the N.40°W.

B I: 2. *Bluish-gray argillaceous shales* at a depth of 2.5 to 3 *m* in a well. On the authority af ERDMANN.

(*B I: 3*). *Colonus beds*, reddish, with lenses of limestone. In the shales, which are accessible in the E. wall of an old marl-pit, situated on the property of Öfraby-borg, just outside the boundary of Tosterup, I found scanty fossils: *Monogr. dubius* SUESS, *Cardiola interrupta* SOW. and *Orthoceras* sp.

B II: 1. *The hill of Munka-Tågarp* consits of *Archæan* (with *diabase*) and *Cambrian sandstone.* — The *Archæan*, a red granite? (so pressed, traversed by fissures and slides, that it is hard to determine its original nature), owing to the covering of earth on the upper plateau-like part of the hill, only shows itself for the most part in the steep side-slopes, especially in the N. one. In this (W. of the figure) has also been found a fine-grained *diabase*, whose further distribution could, however, not be followed up by reason of the covering of earth. — In the SE. end of the hill, N. of the road, appear shelves of Archæan, but between them and the little cottage S. of and close to the hillside, we find *Cambrian sandstone*, not only in the side-slopes but also on the crest of the height, well exposed in a number of quarries, from which material has been taken for macadam. The sandstone (mostly older, white) is partly a breccia, and in part built up of large, clear grains of quartz together with scanty grains of red, weathered felspar in a more opaque cement. At one place in the N. side a large, vertical slicken-side was seen in this rock. — On the S. side, just NE. of

the above-named cottage, following section, reproduced in fig. 1, was seen in a small quarry:

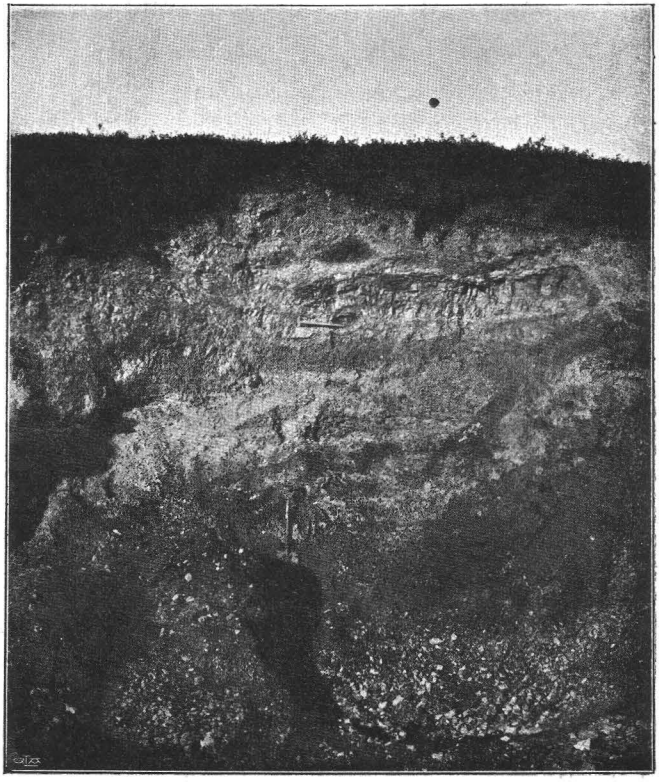

Fig. 1. Wall in a quarry situated on the S. side of the hill of Munka-Tågarp.

In the upper part of the inner wall (above the white quartzitic sandstone) can be seen a gray, micaceous sandstone, divided into thin beds, with intervening layers of laminated micaceous sandstone; all strata are strongly folded. — Somewhat closer to the crest may be seen another, darker gray (almost black when in a moist state), micaceous sandstone. All these strata above the quartzitic sandstone presumably belong to the *Upper part* of the *Cambrian sandstone.*

The contact between the Archæan and the sandstone is

not visible, but could surely be discovered without much difficulty.

B II: 2. *Colonus beds*, very likely *in situ*, in a little marl-pit, now almost filled up, on the N. side of the road.

B II: 3. *Silurian shales* at the bottom of a well; on the authority of ERDMANN.

B II: 4. } *Gray shales* at a depth of 0.5 *m* in the drain-ditches;
B II: 5. } on the authority of ERDMANN.

B II: 6. *Colonus beds*, easily accessible in the ditches and river-banks, especially on the E. side of the road.

B II: 7. *Gotlandian shales*, gray, dipping 15° to N.40°W., are accessible here in a ditch running from the NE. into the N. end of Munka-Tågarpsbäcken.

B II: 8. *The upper part of the Cyrtograptus beds* crops out here in the E. bank of Munka-Tågarpsbäcken. In these shales, which have about the same inclination though dipping somewhat more abruptly than those in the last-named locality, TULLBERG has found *Monogr. Flemingi* SALT.

B II: 9. *Testis shales.* In a gray shale, accessible in a small marl-pit on the W. side of Munka-Tågarpsbäcken and dipping S.53°W., there have been found, together with *Monogr. testis* BARR., *M. Flemingi* SALT. and *Cyrtogr.* sp., the curious *M. pala* MBG, found nowhere else.

B II: 10. *Cyrtograptus beds*, in which, according to TULLBERG, were found *Monogr. testis* BARR. and *Cyrtogr.* sp. — The shales can be followed up on the SE. side of Munka-Tågarpsbäcken for a distance of about 100 *m* to the SW., reckoning from the high-road bridge, everywhere more or less directly accessible in the upper part of the valley-wall. The strike and dip of the strata vary considerably. Fig. 2 (on the following page), taken from a spot S.

of the foregoing loc., shows a detail from a vertical wall with contorted zig-zag folded strata.

B II : 11. *Archæan*, E. of the numeral, and *Cambrian sandstone*, S. of the numeral. Here we have an abased continuation towards the SE. of the hill of Munka-Tågarp. The *Archæan* is accessible in the slope facing to the N., as well as in the valley-wall along the brook; the *white sandstone* is to be found in the same valley-wall, immediately S. of the Archæan, at the most N. end of which strongly contorted shales, almost kneaded together, appear on the level of the brook itself.

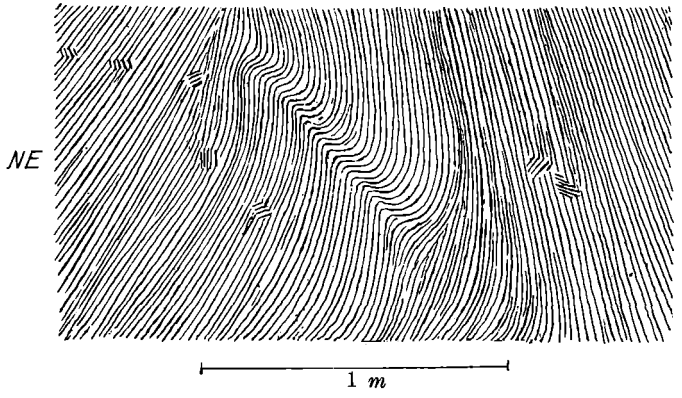

Fig. 2.

B II : 12. Opposite the former locality, an Archæan *rock breccia* (reddish violet), by cutting the E. valley-wall, was exposed at a depth of about 1 *m*.

B II : 13. *Silurian Posidonomya shales* are met with somewhat further S., partly at the bottom of Munka-Tågarpsbäcken and in its low banks, partly, furthest to the S., in the W. valley-wall. — Furthest to the N., along a stretch of 15 *m*, we have gray, soft shales, but after an interval of about 10 *m*, where the rock is hidden, the same shales reappear,

though with rather brick-red colour; these red shales can be followed for about 30 *m* till they are cut off by the Keuper strata (cf. further description under *C II: 5*). In the red shales, which in their upper part often show blue spots and waves, fossils are quite plentiful in certain strata. Common are especially *Posidonomya glabra* MÜNSTER and a little ostracod, *Eoconchoecia mucronata* MOBERG. Besides these we may mention *Cypridina Tosterupi* MOBERG, *Colpos insignis* MBG, *Primitia mundula* JONES, *Orthoceras Poseidonis* MBG, and brood of gastropods. In the gray shales, which are less accessible than the red, only *P. glabra* MÜNSTER has been found. According to TULLBERG, LINNARSSON found a *Monogr. bohemicus* BARR. here. The strata should, therefore, be a peculiar formation of the *Colonus beds*.

B III: 1. *Upper part of the Olenid beds.* In the field named »Norra Hundslavångenn» a shaft was dug in 1871 under TORELL'S direction, and in it they penetrated into crushed alum shales to a depth of 7 *m*. ERDMANN considered the dip to be 35° to the N. In stink-stones, lying in these shales, were found *Peltura* and *Sphærophthalmus*.

B III: 2. Limestone quarry, the so-called »Stengrafven», and the localities bordering it on the S. In the quarry, abandoned long ago, we have furthest to the N. *Orthoceras limestone*, which is also said to have been observed in the ditches just to the N. of it. Towards the S. this is cut off by a fault, running about N.60°W. and here skirted by the *Dictyograptus beds* cropping out in the S. part of the quarry. The fault-plane dips, according to WALLIN, 65° to the NE. Just S. of the *Dictyograptus* beds we find *Lower Didymograptus beds*, partly NW. of the nu-

meral, at the bottom of the shallow, canalized brook, partly NE. of the numeral, in the well S. of and close by Stengrafshus, in both places with scanty, badly preserved fossils; TULLBERG mentions a *Didymograptus* sp. from the first-named locality.

The *Orthoceras limestone*, which dips 15° to the N.40°W., is now slightly accessible and, generally speaking, poor in determinable fossils; *Nileus Armadillo* DALM., *Megalaspis* (*planilimbata* ANG.?), *Agnostus* sp. and *Orthoceras* sp. with a few Brachiopoda being practically all that can be named [1]. In the W. wall of the quarry the thick-banked limestone is traversed, close to the fault, by clefts, parallel with the plane of the fault. Also in the N. wall may be seen thick-banked limestone, from the lowest part of which has been noted a layer relatively rich in fossil. In the E. part of the quarry, immediately N. of the house, the limestone is thin-bedded, interstratified with greenish-gray knobby argillaceous layers.

In the *Dictyograptus beds*, which dip 40—45° to the N. or NNE., WESTERGÅRD found *Clonograptus tenellus* LINRS. (f. typica sparsely, var. *Callavei* LAPWORTH on the other hand abundant, in certain strata), *Obolus Salteri* HOLL, *Lingulella lepis* SALTER?, *Acrotreta* sp., and sponge spicules?

Of the *Lower Didymograptus beds* (= the Lower graptolite shales or Phyllo-Tetragraptus beds of older writers) we have spoken above.

B III : 3. *Orthoceras limestone*, but slightly accessible in (the S. side of) an older quarry which is now almost entirely fallen in.

Here, above the limestone which dips 25° to

[1] However, TULLBERG also mentions from here *Symphysurus palpebrosus* DALM., *Chirurus clavifrons* ANG., and *Illænus Esmarki* SCHLOTH.

the W., there are, according to WALLIN, gray, non-calciferous shales, which were even specially marked on an enlarged map of ERDMANN and WALLIN and called »Beyrichia limestone» (an older name for *Chasmops beds*). LINNARSSON already looked in vain for these strata. — According to the above-mentioned enlarged map there are another shales (*Lower Didymograptus beds?*) to be found just to the SE. of this quarry, in the NW. corner of »Norra Hundslavången».

B III: 4. *Orthoceras limestone* in an old quarry that is now obliterated. According to WALLIN, the limestone met with here dips 25° to the NW. — On the same authority, the above-mentioned lower shales (*Lower Didymograptus beds?*) have been found also in the neighbourhood of this limestone quarry, viz. about 40 *m* S. of it.

B III: 5. Shales, belonging to the zone of *Dicranograptus Clingani* CARR., or, as they are usually called, »*Clingani beds*», crop out just to the W. of the quarry mentioned under *B III: 3*, in the valley-walls both in the NW. and in the SE. sides of »Gärarpsbäcken». They dip 25—30° to the N.46°—70°W. TULLBERG mentions from here *Dicranograptus Clingani* CARR., *Dicellogr. Forchhammeri* GEIN., *Climacogr. bicornis* HALL and *Diplogr. foliaceus* MURCH. In the shales from the bluff wall on the NW. side of the brook I myself have found not only graptolites but a large gastropod and a *Remopleurides* sp., which latter is worthy of attention, since trilobites in our country have never before been found in shales of that age.

B III: 6. *Diabase dyke* crossing »Gärarpsbäcken». — On the S. side of the brook there are, according to TULLBERG, just W. of the diabase, *Rastrites beds* with *Monogr. Sandersoni* LAPW. and *Climacogr. scalaris* L., for

which reason he classes these shales with his »zone of *Monogr. gregarius*», i. e. with the *zone of Monogr. triangulatus* HARKN., to adopt the now used terminology. As all the surrounding strata are considerably older, TULLBERG here finds himself forced to assume a fault.

Somewhat further to the W. (down the brook), according to TULLBERG, gray, soft shales with compact, hard limestone are tobe found, which he assigns to his »zone of *Trinucleus coscinorhinus* ANG.», a zone which was deemed to be next younger than the *Clingani zone*, but which, from what I have shown elsewhere, is older than that. I have not included this locality in my map, partly because TULLBERG says, he is not sure that the layers are *in situ*, and partly because he expressly states in another part of his journal that the zone of *Tr. coscinorhinus* at Tosterup is found *exclusively in blocks*. Under such circumstances one must really ask oneself the question: Does not perhaps the above-named mode of occurrence stand in direct connection with TULLBERG'S faulty conception of the sequence of the strata? (See further about this zone in the »systematic survey» further on.)

B III: 7. Somewhat to the SW. of the diabase dyke, mentioned under *B III: 6*, we find at several places in the SE. valley-wall black shales, which, according to TULLBERG, contain *Diplogr. foliaceus* MURCH., *Dicellogr. Morrisi* HOPK., *Leptogr. flaccidus* HALL and *Retiolites fibratus* LAPW. TULLBERG assigned later on these »strata with *Leptograptus flaccidus*» to his »zone of *Diplogr. quadrimucronatus* HALL.» — Following OLIN (see OLIN *1906*, p. 76) we discard the zone with *D. quadrimucronatus* and assign the strata here to the upper part of the *Clingani zone*.

B III: 8. Trinucleus beds. SW. of the foregoing locality

there follows, in the S. valley-wall of Gärarpsbäcken, loose, dirty-gray or greenish-gray, brown-spotted mudstone with nodes of limestone; the upper strata are lighter and enclose bands of limestone. The shales, which dip 20° to the NW. are very poor in fossils; TULLBERG only mentions a *Trinucleus* sp.

B III: 9. NE. of the numeral: *Rastrites beds.* In the S. valley-wall of Gärarpsbäcken, somewhat more than 200 *m* N. of the high-road from the Castle of Tosterup, and dipping 35° to the NW., were found rusty shales, in which TULLBERG came across *Monogr. crispus* LAPW., *Monogr. galaënsis* LAPW.[1] and *Monogr. priodon* BRONN. — In these strata TULLBERG saw a representative of the English zone of *Rastrites maximus* CARR. which is unknown in Scania. Together with TÖRNQUIST (*1897*, p. 3) I consider these strata should more suitably be classed with the zone of *Monogr. runcinatus* LAPW.

SW. of the numeral, and quite close to the boundary between the N. and the S. Hundslavång, occur somewhat similar shales, though lighter gray and with a continuous bank of limestone. In these strata, which have about the same inclination as the former, no fossils were found.

B III: 10. The *zone of Cyrtogr.? spiralis* GEINITZ; shales dipping 30—35° to the NW. are met with in the NW. valley-wall, somewhat N. of the highroad. TULLBERG mentions from here *C.? spiralis* and *Monogr. priodon* BRONN.

B III: 11. *Diabase dyke*, visible in the road (between Tosterup Castle and the village of Munka-Tågarp) just NW. of the bridge over Gärarpsbäcken. — Along the

[1] This according to TULLBERG *1883*, p. 10, and TULLBERG's journal; on p. 16, TULLBERG *1882*, the same author gives *M. turriculatus* BARR. instead of *M. galaënsis* LAPW.

diabase crop out almost inaccessible shales, in which TULLBERG found *Monogr. priodon* BRONN and *Retiolitus Geinitzianus* BARR. The shales consequently belong to the lower part of the *Cyrtograptus beds.*

B III:12. In Gärarpsbäcken we find, immediately S. of the bridge just named, and also some 50 *m* further to the SW., gray shales with a northerly dip (amounting to 40—80° in the extreme N., 20—25° in the extreme S.); since the shales have yielded such fossils as *Cardiola interrupta* Sow. and *Monogr.* sp., they are belonging to the *Colonus beds.*

B III:13. SW. of the foregoing locality we find, on the E. side of Gärarpsbäcken, a wall of black shales, over 2 *m* high and 3 *m* long, containing large ellipsoids of well stratified limestone. A similar one *in situ* measures close on 1 *m* in diameter and 0.5 *m* in height. Still larger ones lie loose at the bottom of the brook. The geological section shows here a little anticline, with the shales dipping 40—50° to the N.35°E., in the extreme NE., and 25° to the N.35°W., in the extreme SW. Fossils have not been found here. As far as I know, apart from this occurrence, similar limestone ellipsoids in the Gotlandian shales of Scania are found only in the *testis zone* at the first mill of Tommarp.

B III:14. In the southern end of the E. valley-wall of Gärarpsbäcken crop out *Colonus beds* with *Monogr. bohemicus* BARR., dipping, according to ERDMANN, 80° to the SSW.

B III:15. *Colonus beds*, dipping 70° to the S.35°W., were found by digging in the bottom of a deep marl-pit, in the S. part of »Södra Hundslavången» and near the E. end of the pond, at a total depth of 4.5 *m.*

B IV:1. E. of the road to the »Hundslahus», about 100 *m* S. of the house, a shaft was sunk in 1871, in which

crushed alum shales were encountered throughout. LUNDGREN found there *Olenus* sp., *Agnostus reticulatus* ANG. and *Agn. pisiformis* L.? The fossils thus point to the *lower part* of the *Olenid beds.*

B IV:2. In a shaft, opened in 1871 in »Norra Spjelevången», E. of the last-named locality, it was found that the strata, from a depth of about 1 *m*, consisted exclusively of crushed alum shales, in which LUNDGREN found *Paradoxides* sp., *Conocoryphe* sp., *Agnostus fallax* LINRS., *Agn. fissus* LUNDGR., *Agn. gibbus* LINRS. and *Agn. punctuosus* ANG. This alum shale consequently belongs to *the zone of Paradoxides Tessini* BRONGN. (or at least originates from it). It is of interest that this point, where the oldest alum shales were found, also lies nearest to the Cambrian sandstone.

B IV:3. Round the point where the boundary lines of Spjelevången, St. Kyrkovången and the village of St. Gärarp meet, there are five ledges of *Cambrian sandstone*, of which two show a dip of 30° to the NNW. In the most westerly of the ledges (the one in Spjelevången) the rock has a greenish-gray colour, and should, therefore, be classed with the *Upper part of the sandstone*, an assumption already made by TORELL, as recorded by ERDMANN in his journal. The other ledges consist of light, almost white quartzitic sandstone.

B IV:4. SE. of the Tosterup Castle, in the hillside N. of the little house at Kråkekärr, I came across *reddish Colonus shales*, containing *Cardiola interrupta* Sow., cropping out with strata dipping 45° to the N.15°E. — It is curious that TULLBERG mentions from here not only *Colonus shales*, but also »limestone with *Trinucleus coscinorhinus* ANG.», the former as boulders, but the latter cropping out in a well, E. of the

last-named house and with the same dip that I found for the *Colonus* shales.

B IV: 5. Marl-pit at »Östervång». According to ERDMANN's journal, strata of a red limestone (in a later note, shales with 12 % of calcium carbonate) was found in the N. wall of the pit at a depth of about 3 *m.* And WALLIN notes about the same rock: »Looked in vain for petrifications in the reddish-brown limestone in the marl-pit at Östervång.»

The real nature and age of the strata in question are not yet quite stated. To judge from the descriptions given by ERDMANN and WALLIN, who were able to examine the strata when they were best accessible, there is no doubt that they came across a sedimentary rock with few or no fossils and of a reddish colour, then unknown in the Silurian of Scania, excepting in the Ramsåsa formation. The position of the locality, in the neighbourhood of the boundary between the Paleozoic and the Mesozoic groups, and the knowledge that the Silurian strata have a tendency to assume a reddish colour along that boundary (we have examples of this at *loc. B I: 3* on the Öfrabyborg estate, at *loc. B II: 13* by Munka-Tågarpsbäcken, and at *loc. B IV: 4* at Kråkekärr) induce me, however, to consider it highly probable, that the strata in question were *red-coloured Colonus beds* (shale and limestone); in all the other localities, situated on the S. boundary of the Silurian system, thus not only in the above-named localities but also in locs. *B III: 14* and *B III: 15*, we have *Colonus* beds.[1]

[1] In 1887 I made an attempt to dig down to the strata in question, and found then, besides plentiful »boulders of ruddy *Colonus* shales, though not until a depth of 5 *m* had been reached, a reddish-brown rock. Whether this was *in situ* and if it was really the rock looked for, is quite problematical. In my journal I noted that the rock, which I could not class, seemed »to

B V:1. At about the place marked, the geological map-sheet »Simrishamn» has the sign for Ordovicium and in the explanation to the same it appears that in 1873 *Orthoceras limestone* there was »observed at the bottom of a large marl-pit which is now filled with water».

B V:2. W. of Ljungbergshuset two small brooks from the N. cross the Bollerup road; between them, on the N. side of the road, there lies a woody ridge, partly separated from the fields, adjoining on the N., by the brook channel of the W. runnel. In the side of the ridge facing the road can be seen (N. of the numeral *2*) a treeless slope, on which a bank of limestone, dipping 15—20° to the S.15°E., forms the surface of the ground; in it fossils of the *Trinucleus beds*, which fossils, however, are difficult to detach from the hard, splintery limestone. This is underlaid of loose, light shales, almost free of fossils; that the same shales also overlie the limestone band is seen in the meadow-land on the other side of the road, where, in several places, the shales practically come to light (e. g. at both the spots where outlines are inserted E. and NE. of the numeral *2*). — See, as for the fossils, furthermore under *B V:4* and *B V:5*.

B V:3. The ridge is traversed along the *east* brook, »Ljungbergsbäcken», by a little field-path. In the cutting for the path, about 20 *m* from the high-road, occur the same loose, gray *Trinucleus shales* as those mentioned above; here they dip 15—20° to the S.25°E.

remind me of a weathered diabase», though in other parts it appeared to be conglomeratic or concretionary.

TÖRNEBOHM and HENNIG in their map of Tosterup, a copy of which is here reproduced as *Plate I*, marked the occurrence of a diabase dyke at the spot in question. Whether this was based simply on my note just referred to, or on an examination of samples that were taken, I do not know. In the latter case, we might perhaps assume that both *Colonus* shales and *diabase* are to be found.

Somewhat further N. there also occurs a limestone band, weathered and rich in fossils, and below it, according to OLIN, the loose shales can be followed a little way to the N. — See moreover under *B V: 5.*

B V: 4. SW. of the numeral. On the N. side of the ridge occur black shales belonging to the *zone of Dicranogr. Clingani* CARR. and yielding the usual fossils of this. — Directly above them lie the same loose *Trinucleus shales* as mentioned under *B V: 2*, in the lowest part of which shales was found *Diplogr. truncatus* LAPW. This direct superstratification is noteworthy, as it shows that in this part of the sequence there is no special »zone of *Calymmene dilatata* TULLB.».

B V: 5. If we follow the E. brook, Ljungbergsbäcken, in a N. direction from the high-road we shall, here too, come across *Trinucleus beds*, up in the E. bank. 85 *m* from the high-road can be seen two limestone bands highly weathered and with an intervening bed of 30 *cm* of loose shales. — Here or in the other, adjoining localities for *Trinucleus beds* OLIN found the following trilobites: *Phacops recurva* LINRS., *Ph. ecclesiastica* OLIN, *Acidaspis Törnquisti* OLIN, *Dindymene* sp., *Remopleurides radians* BARR., *Calymmene pulchra* BEYR., *Phillipsia parabola* BARR., *Symphysurus superstes* OLIN, *Illænus megalophthalmus* LINRS., *Trinucleus Bucklandi* BARR., *Tr. cerioides* ANG., *Ampyx Portlocki* BARR., *Amp. tenellus* BARR., and *Agnostus trinodus* SALTER.

B V: 6. SSW. of and close to Ljungbergshuset, in a dug out pit, TULLBERG came across *Trinucleus beds* dipping 15° to the S.

B V: 7. Locality inserted after ERDMANN, who states that here in Rödmöllabäcken, just by the stone embankment, he exposed strata of gray, graptolite-bearing shales, horizontal or gently dipping to the S.

b) **Mesozoic.**

C I:1. On either side of the Tosterup boundary on the W. (towards Öfrabyborg) we find, under a thin covering of earth, rusty-brown *Lias sandstone*, in the extreme S. nonfossiliferous, rich in grains of quartz or small lumps of a dark material, in the extreme N. more homogenous, fossiliferous. Here have been found, chiefly in loose stones turned up in the field, *Pecten æquivalvis* Sow., *P. priscus* Schloth., *Avicula inæquivalvis* Sow., *Tancredia Johnstrupi* Lundgr. sp., *Tancr. elegans* Mbg, *Cardium multicostatum* Phill., *Dentalium etalense* Terqu. et Piette, *Pleurotomaria expansa* Sow., *Turbo solarium* Piette, and *Chemnitzia craticia* Mbg. We have here, consequently, strata of the same age as the »*Cardium bank*» at Kurremölla, which is rather corresponding to the *zone of Aegoceras Jamesoni* of other countries.

C I:2. In a now inaccessible, smallish clay-pit I observed, in 1887, at a depth of 1 or 2 *m*, varying strata of yellow, gray and white sand and clays; all strata were considerably disturbed. The formation belongs probably to the *Rhætic-Lias strata* (or possibly to the Keuper).

C I:3. Marl-pit, in which, under a few metres of earth, a loose calcareous sandstone, »sandkalk» (*zone of Belemnitella mucronata* Schloth.), appeared.

C II:1. Road-cutting in the most westerly part of the hill of Rödalsberg. In the *Lias strata* here, which strongly upraised (furthest to the SW. perpendicular. furthest to the NE. dipping 80° to the N.55°E.) strike to the N.35°W., I took, in 1887, the following section (fig. 3).

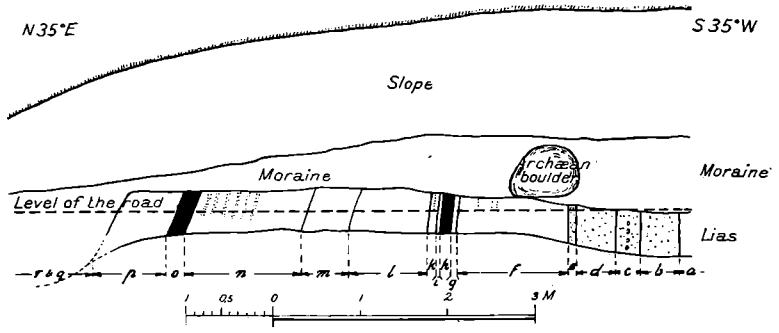

Fig. 3. Cutting in the W. end of the hill of Rödalsberg. Section *C II : 1.*

The strata, reckoned from the SW. (lowest?) to the NE., are as follows:

a.	Sand; gray, clayey.		
b.	» ; yellow	45	*cm*
c.	» ; brown with rusty (irony) nodules	30	»
d.	» ; light yellow	45	»
e.	» ; white	9	»
f.	Clay, laminated; dark-gray with lengthened lenses of white sand, 1 to 2 *m* in thickness, arranged in stripes	127	»
g.	» ; black, richly intermingled with coal-dust	8	»
h.	Coal, in which a bore of 2 *m's* depth was made	11	»
i.	Clay; like *g.*	4	»
k.	» , laminated; like *f.*	12	»
l.	» ; gray below, gradually becoming yellow upwards	90	»
m.	» , gray; with irregular ledges of white sand, 1 *cm* thick	49	»
n.	» ; like *l*, but above with glands of gray sand with an enveloping crust of rust	132	»
o.	Coal	20	»
p.	Clay; laminated, like *l.*	67	»
q and *r.*	Gray sand and reddish-yellow, laminated clay, the latter with plant fossils .	160	» +

These upper strata (*q* and *r*) were displaced, and even at

a depth of 75 *cm* beneath the level of the road were wholly undisturbed layers here not to be found.

C II: 2. Somewhat SE. of the foregoing, up the slope, I exposed in 1883 the section here reproduced (fig. 4).

Under the moraine, which in the extreme S. consists mostly of material carried away from the more northerly strata, the following *Lias strata* appeared:

a (farthest to the NE.). White sand.

b. White sand; with nodules of brownish-yellow sandstone arranged in layers, *c.*

d. Rusty-brown, well stratified sandstone, rich in badly preserved plant fossils.

e. White sand; with stripes of yellow or brown sand, *f.*

g. White sand; whith thin strata of gray clay, *h.*

i. White sand.

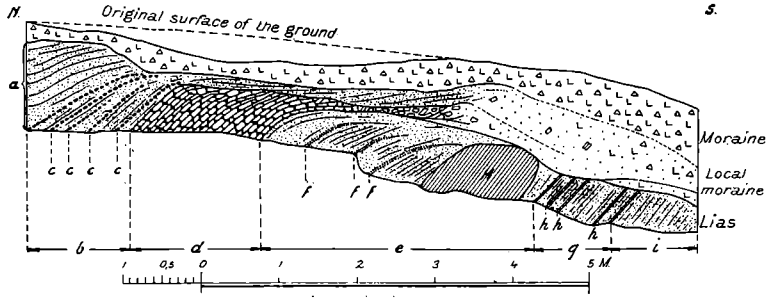

Fig. 4. Lias in the hill of Rödalsberg, near the E. end. Section *C II: 2.*

H is the end of a sand-pit, which has been gradually shifted here from the NE., following the strike of the strata, the older parts of the sand-pit having been gradually filled up. A depression in the surface of the soil clearly marks the course of the sand-pit. The strata strike to the N.52°W. and dip 60° in a NE. direction.

C II: 3. In the W. valley-wall of Munka-Tågarpsbäcken, close to where the brook flows into Wallabäcken, the following section was taken in the *Lias strata* there:

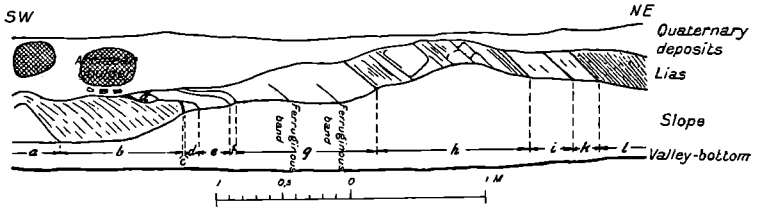

Fig. 5. Lias in the E. end of Rödalsberg, southernmost in the valley of Munka-Tågarpsbäcken. Section *C II : 3.*

We have here from SW. (lowest) to NE.:

a.	Sand; white	33	*cm*
b.	Clay; grayish-yellow, somewhat sandy	106	»
c.	Coal	3	»
d.	Clay; white	12	»
e.	Clay; brown	24	»
f.	Clay; gray, with stripes of sand	6	»
g.	Sand; white, with sparse, thin, hard rusty stripes	112	»
h.	Sand; white, with numerous hard, rusty stripes and layers constituted of quader-shaped rust covered pieces, mostly with a kernel of white or reddish sand	127	»
i.	Sand, like *g.*	30	»
k.	Sand; white or yellow, hard, laminated	27	»
l.	Sand; yellow or gray, somewhat clayey, hard, laminated	61	» +

The strata here dip 45° to the NE.

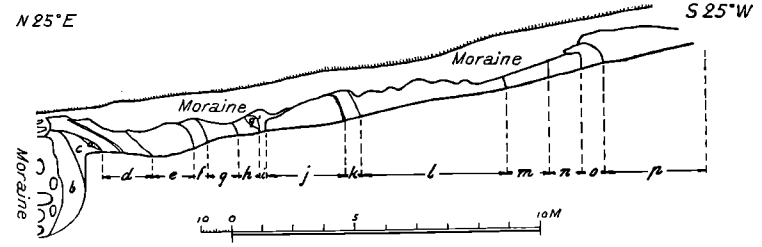

Fig. 6. Cutting in the older Mesozoic strata in the N. part of Rödalsberg. Section *C II : 4.*

C II:4. A cutting in the N. slope of Rödalsberg hill, somewhat E. of loc. *C II:2* yielded the following section (fig. 6):

Going from NE. to SW. we have the following strata:

Keuper?	*b.*	Clay; red	150 *cm*
	c.	» ; whitish-yellow	70 »
		(Between the stratum *c* and the following stratum there is a little patch of brown clay, *a*, broken loose from some stratum which now is invisible).	
Rhætic—Lias.	*d.*	Clay; light-gray with a darker stripe in the middle	160 »
	e.	Sand; somewhat clayey, yellowish-gray, flamy, striped with gray sand and yellow clay	140 »
	f.	Clay; gray, with a coal seam 8 *cm* thick	40 »
	g (and *g'*).	Sand; white, with dark-gray, undulating stripes	100 »
	h.	Sand; yellow, with gray stripes	70 »
	i.	Clay; gray	20 »
	j.	Sand, yellowish-white, flamy, in the S. half with gray stripes	60 »
	k.	Clay; gray, followed in the SW. by a *coal seam* of some *cm*; together	50 »
	l.	Sand; yellow and white, striped	475 »
	m.	» ; yellowish-white with nodules of rusty-brown sandstone	140 »
	n.	» ; yellowish-white, striped	105 »
	o.	Clay; gray	70 »
	(*p.*)	Sand: yellowish-white, not surely belonging to strata *in situ*	(350 » +)

The above division into Keuper and Rhætic—Lias is very uncertain and has been based on the assumed identity of strata *b* and *c* in this section with strata *g* and *h* in the one following.

C II: 5. A cutting in the W. valley-wall at the side of the most southerly bend of Munka-Tågarpsbäcken, gave the following section:

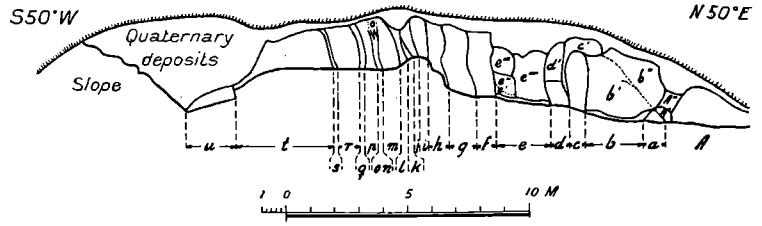

Fig. 7. Cutting in the W. valley-wall of Munka-Tågarpsbäcken. Section *C II: 5.*

Going from NE. to SW. we have the following strata:

Silurian.

A. *Red shales*, *Posidonomya* shales, most S. part of loc. *B II: 13*, in the description of which the strata were more exactly reported on. *A'* is blue, and *A''* yellow in colour, both surely more or less weathered parts of the stratum *A* . . . . . (360 *cm*+)

Keuper?

a. *Sandstone*; bluish-gray, calciferous, with large angular grains of quartz and enclosing pieces of bluish-gray micaceous shale and lumps of blue clay; often with veins of calcite . . . . . 95 *cm*

b. *Limestone*; grayish-blue (yellow when weathered), traversed by irregular fissures filled up with calcite[1] . . . . . 255 »

b' and *b''* are crushed parts of the same stratum; in the former the limestone pieces are mixed with blue clay.

c. *Sandstone*; bluish-gray, calciferous, rather like that in stratum *a* . . . . . 50 »

c', loose masses of the same material as *c*.

d. *Clay*; blue with sparse knobs of limestone . . 80 »

[1] Nodules of similar septarian limestone occur quite abundantly in the red Keuper clay at Hoby, near Lund.

Keuper? (continued).		*d'*. Loose, weathered, whitish-yellow spotted, brown sandstone.		
	e.	*Clay*; sabulous, greenish-blue	230	*cm*
		e', *e''*, *e'''*, *e''''*, clays of the same kind as *e*, but varying in colour, bluish-green, brown, orange-red.		
	f.	*Clay*; red striped, blue at the bottom, green on top	75	»
	g.	*Clay*; red, partly with white and yellow waves and stripes	110	»
	h.	*Clay*; whitish-yellow	70	»
	i.	*Sandstone*; reddish-yellow, not calciferous; partly coarse, conglomeratic	60	»
Rhætic—Lias.	*j*.	*Clay*; whitish-yellow, laminated	10 to 30	»
	k.	*Sandstone*; loose, white and yellow, pinching out at the top	30	»
	l.	*Clay*; black, laminated	30	»
	m.	*Clay* and *Sand*; the former gray, the latter white, in alternating very thin strata .	80	»
	n.	*Clay*; black, laminated; besides fish-scales, there are found here *Woodwardites microlobus* SCHENK and *Gutbiera angustiloba* PRESL., both known from the Upper Rhætic, the latter moreover from the Lower Lias	20	»
	(*o*.)	*Sandstone*; brown, embedded in the foregoing but soon pinching out.		
	p.	*Clay*; gray, laminated	40	»
	q.	*Sandstone*; yellowish-white, with a thin seam of gray clay	25	»
	r.	*Clay*; gray, with nodules of brown sandstone and thin stripes of white sand	100	»
	s.	*Clay*; black, laminated	10	»
	t.	*Sand*; yellowish-whitish-gray, with sparse thin seams of clay. The strata dip 70° to the NE.	400	»
	u.	*Sand*; white, close packed	210	»

The sandstone *a* is separated from the Silurian by a fault. Whether the stratum *j* should be classed under Keuper, or, as has been done here, to Rhætic-Lias, is hard to decide. In the series *a*—*i* (together 10.25 *m* thick) all the strata are much upraised (vertical or strongly dipping to the NE.). The rocks in the same series are to confounding like those from other Scanian Keuper localities.

C II: 6. The locality is situated on the S. side of the glen of Wallabäcken, almost in the extension to the SW. of Munka-Tågarpsbäcken. Here, in a marl-pit, at a depth of 8.3 *m*, I came across a crushed, fine-grained Tosterup conglomerate (see description of this under loc. *C V: 4*), which I assumed to be occurring *in situ*.

C II: 7. Marl-pit SW. of the foregoing. At a depth of 3 *m* (or, where the pit walls were highest, 6 *m*) I found almost horizontal strata of loose, calcareous sandstone (»sandkalk») with *Belemnitella mucronata* SCHLOTH.

(*C II: 8*). W. of the numeral the zone *of Belemnitella mucronata*, developed as loose, calcareous sandstone, with hard (more calciferous) banks or so-called »pilsten», is to be met with quite near the surface in the walls of a now fallen in marl-pit, situated just outside the S. boundary of Tosterup and SE. of Svenstorp Station. — The same rock is also to be seen N. of the numeral, in and beside the Tosterup road.

(*C III: 1*). (*C III: 2*). (*C IV: 1*). Points of observation for loose, calcareous sandstone, all situated just outside the S. boundary of Tosterup estate.

C V: 1. Near Rödmölla and in the E. valley-wall. Furthest to the N. crops out a brown (somewhat grey-speckled) *Lias sandstone*. S. of it, in contact with the Lias strata, we find a gritty chalk (»gruskalk») belonging to the Cretaceous system, which, besides the shell

fragments and the clear grains of quartz that form the chief mass also encloses small stones of rusty brown Lias sandstone. Since the vertical in N.75—80°W. striking beds of this gritty chalk are very unequally consolidated, so that in some stripes and patches they show greater resistance than in others, the harder strata now appear as »walls», projecting from the valley-wall. The most northerly of these is about 0.5 *m* thick. Between these and the nearest hard »wall» there is a distance of about 2 *m*; the intervening space is filled only by angular blocks of rusty-brown *Lias sandstone*, which, however, in the various blocks has a somewhat varying habitus. In these blocks were found the following fossils: *Avicula anserina* MBG, *Pseudomonotis oblonga* MBG, *Astarte Erdmanni* MBG, and *Tancredia lineata* MBG, all of which only occur here, with the exception of the last-named, which has also been found in the Lias strata at Kurremölla and on Bornholm.

Also in the chalk, mentioned above, we find fossils, which, however, can not be detached except in strata of looser cohesion. Most important of the finds made here is that of *Actinocamax westphalicus* SCHLÜTER, which is by no means so rare, though generally in a very fragmentary state.

Not quite 50 *m* further to the S. we again met with two »walls», projecting from the valley-wall and formed by a rock similar to the one in the northern part spoken of above, but finer-grained and with sparse and invariably small grains of the rusty-brown sandstone.

Fossils occur here, too, though none are in a fair state of preservation.

In the figure 8, copied from DE MORGAN (*1882*, p. 18),

who sketched the Rödmölla section shortly after I for the first time had exposed it, *a* and *b* indicate gritty chalk (»gruskalk»); on either side of the looser stratum *b* are seen the two vertical harder strata, »the walls». In the continuation of the section towards the S. we find that the inclination of the strata diminishes. The rock in the strata next »the walls», *c* on the sectional sketch, also consists of »gruskalk», though less consolidated. Therupon we get fine-grained sandy strata, *d* and *e*,

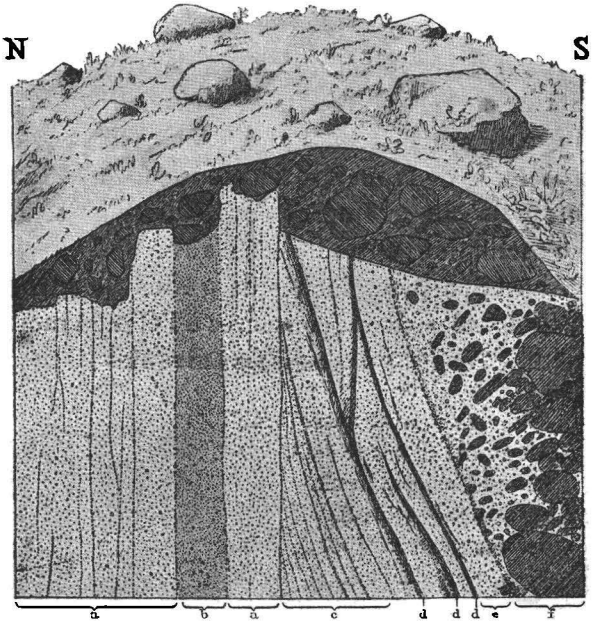

Fig. 8. The most southerly »walls» in the Cretaceous strata at Rödmölla.

in part with lignite or fragments of coal. Further away comes the *Tosterup conglomerate*[1], *f*, which is very coarse here.

Between the Tosterup conglomerate and the lower, sandy strata occurs a peculiar conglomerate, the *Rödmölla conglomerate*, in which the ordinary loose calcareous sandstone, as a sparse cement, holds together pieces of rusty-brown Lias sandstone, etc., of the size of a walnut or more. In this

[1] For this, see the description of loc. *C V:4*.

conglomerate I discovered a few specimens of *Actinocamax verus* MILLER.

C V: 2. In the E. valley-wall of Rödmöllabäcken the *Tosterup conglomerate*[1] can be followed further to the S., and in its lower part, together with the common *Actinocamax mammillatus* NILSSON and other fossils, I also got hold of a specimen of *Act. quadratus* BLAINVILLE var.

C V: 3. S. of the Glemminge road and E. of Rödmöllabäcken the »*Tosterup conglomerate*»[1] crops out as a little hillock in the bottom of the river-valley.

C V: 4. The large *Tosterup* marl-pit[2], W. of Rödmöllabäcken and SW. of the Glemminge road. Here lowest down (*i. e.* in the N. part) can be seen the common calcareous sandstone, in which, however, often occur scattered small pieces of Silurian shale that has turned green. In this rock we have a rich, hitherto little examined fauna. Both *Actinocamax mammillatus* NILSS. and *Belemnitella mucronata* occur here; inter alia we also find *Ammonites Stobœi* NILSS.?, *Scaphites spiniger* SCHLÜTER, *Sc. Römeri* D'ORBIGNY?, *Baculites anceps* LAM., *Mytilus sp.*, *Ostrea hippopodium* NILSS., *O. cornu arietis* NILSS., *O. lateralis* NILSS., *O. vesicularis* LAM., *Pecten pulchellus* NILSS., *P. septemplicatus* NILSS., *Arca* sp., *Cardium* sp., *Glycimeris Holzapfeli* HENNIG (= *Lutraria gurgitis* NILSS.), *Pholadomya Esmarki* NILSS., *Trigonia pumila* NILSS., *Rhynchonella plicatilis* SOW. and *Terebratula curvirostis* NILSS.

The strata, which dip 10° to the SE., are covered in the S. part of the marl-pit by a coarse conglomerate, the *Tosterup conglomerate*, constituted of pieces of shale, turned green and of varying size, held together by a more or less scanty cement of

[1] For this, see the description of loc. *C V: 4.*

[2] In a number of older works this locality is erroneously called »Rödmölla».

calcareous sandstone. That the shales are of Silurian age is obvious, since graptolites are found in them. In NILSSON's time, before the marl-pit existed, the conglomerate was held to belong to the Silurian, and it was therefore thought, as has been mentioned in the foregoing, that the calcareous sandstone (or greensand as it then was named), visible just S. of it, rested here on Silurian. — The strata can be followed, S. of the marl-pit, to the stream. Along this stretch, conglomerate and calcareous sandstone alternate quite irregularly, and portions of the one rock can be seen enclosed in portions of the other. In the main, the rock to the S. is finer grained, and the conglomerate can turn into a rock, which is quite homogenous, fine-grained, and highly coloured, green. In the conglomerate the same fossils, upon the whole, are found as in the underlying greensand described above, though here harder to obtain in a determinable condition. In this rock I also found a leaf (of a *Credneria?*).

C V: 5. Somewhat further to the SW., other strata, belonging to the Cretaceous System, are also accessible, i. e. up in the W. wall of the valley. Both fauna and rock are here somewhat different from the strata further to the N. Presumably we are here already in the typical *mucronata zone.*

4. Systematic Survey.[1]

Archæan: *B II : 1* and *B II : 11*. Breccia: *B II : 12*.

Silurian

- ***Cambrian*** — Lower. — Sandstone
  - Older: *A IV : 1*, *A IV : 3*, *B II : 1* *B II : 11* and *B IV : 3* (E. part).
  - Younger: *B II : 1* and *B IV : 3* (the most westerly shelf).
- ***Cambrian*** — Middle. — Alum shales in general: *A IV : 5*.
- ***Cambrian*** — Upper. — Alum shales, Tessini zone: *B IV : 2*.
- ***Cambrian*** — Upper. — Alum shales
  - Olenus zone: *B IV : 1*.
  - Peltura zone: *A IV : 4* and *B III : 1*.
- ***Ordovician*** — Ceratopyge beds — Alum shales, Dictyograptus shales: *B III : 2* (S. part).
- ***Ordovician*** — Asaphus beds
  - Lower Didymograptus shales: *A IV : 6*, *B III : 2*, and possibly S. of locs. *B III : 3* and *B III : 4*.
  - Orthoceras limestone: *A IV : 2*, *A IV : 7*, *B III : 2*, *B III : 3* and *B V : 1*.
  - (Zone of *Trinucleus coscinorhinus* Ang.: *B III : 3*, upper strata?)
- ***Ordovician*** — Chasmops beds: (Zone of *Dicranogr. Clingani* Carr.): *B III : 5*, *B III : 7* and *B V : 4*.
- ***Ordovician*** — Trinucleus beds: *B III : 8*, *B V : 2*, *B V : 3*, *B V : 5* and *B V : 6*.
- ***Gotlandian*** — Lower. — Rastrites beds
  - Z. of *Monogr. triangulatus* Harkn.: *B III : 6*.
  - Z. of *Monogr. runcinatus* Lapw.: *B III : 9*.
- ***Gotlandian*** — Middle. — Cyrtograptus beds
  - Lower: *B III : 10* and *B III : 11*.
  - Upper
    - in general: *B II : 8*.
    - testis shales: *B II : 9* and *B II : 10*.
- ***Gotlandian*** — Upper. — Colonus beds
  - in general: *B I : 1*, *B I : 2?*, *B I : 3*, *B II : 3?*, *B II : 4?*, *B II : 5?*, *B II : 6*, *B III : 12*, *B III : 14*, *B III : 15*, *B IV : 4* and *B IV : 5?*.
  - Posidonomya shales: *B II : 13*.

[1] In this are included all the solid geological formations cropping out in the estate Tosterup and its immediate vicinity, from the older to the more recent,

Diabase: *B II:1, B III:6* and *B III:11.*

Keuper: *C II:4* and *C II:5.*

Rhætic—Lias: *C I:1, C I:2, C II:1, C II:2, C II:3, C II:4, C II:5* and *C V:1.*

Cretaceous (
- Zone of *Actinocamax verus* MILLER and *A. westphalicus* SCHLÜTER: *C V:1.*
- » » *Actinocamax mammillatus* NILSS.: *C II:6?, C V:1, C V:2, C V:3* and *C V:4.*
- » » *Belemnitella mucronata* SCHLOTH: *C I:3, C II:7, C II:8, C III:1, C III:2, C IV:7* and *C V:5?.*

5. Summary.

The *Archæan* (Gneiss) is much crushed and destroyed on the property of Tosterup, just as at the other places in Scania where it appears as small horsts, surrounded by the younger formations, or near the boundaries between them. It appears in the slopes of the Munka-Tågarp hill, as well as in its continuation to the SE. towards Munka-Tågarpsbäcken, in the E. valley-wall of which occurs a *Crush breccia* skirting the Gneiss.

Cambrian sandstone is found adjoining the above-named Gneiss and also in a large field, which, beginning ENE. of the Tosterup Castle, continues towards the NE. beyond the boundary of the estate. The greater part of this sandstone is white, quartzitic. In the Munka-Tågarp hill it is partly brecciated. The actual boundary between the Cambrian and Archæan is not directly visible. Besides the usual type a darker gray sandstone, similar to the one that elsewhere in Scania has proved to belong to the upper part of the formation, has been revealed, partly in the most westerly shelf of the large sandstone field (in Spjelevången) partly in the S. part of the Munka-Tågarp hill, where it is distributed in thin seams with intervening layers of gray laminated micaceous

with a complete specification of the localities in which each special formation is to be found, or may be assumed, owing to particular reasons, as set forth in the foregoing description of the localities.

sandstone. No formations representing the transition from the Cambrian sandstone to the younger strata are here to be seen.

Alum shales, which form the next youngest Cambrian strata known, have been met with immediately W. of the large sandstone field, and in their S. part (in Norra Hundslavångenn) they take up a fairly broad zone, which narrows off considerably towards the N. and possibly tapers off, as in the parish of Bollerup, N. of Gärarp village, the Orthoceras limestone (*A IV : 2*) comes very close to the sandstone (*A IV:1*). It is true that ERDMANN thought he could establish a northerly dip in the shaft of Norra Hundslavångenn, but for the rest the alum shales everywhere are quite crushed to a considerable depth. Thus the state of the stratification there can hardly be a matter for question. The alum shale has been found partly in wells, partly in shafts, which have been specially sunk in order to examine it. If we start from the highest Cambrian sandstone in Spjelevångenn, the alum shale will prove to belong to (or originate from) ever younger zones the nearer we approach the NNW. Nearest the Cambrian sandstone we find in the alum shale fossils indicating *Paradoxides beds* (*Tessini zone?*), thereupon others from the *Olenus zone*, and finally fossils from the *Peltura zone*.

The next higher strata found belong to the *middle part* of the *Dictyograptus beds*, and also consist of alum shale. These strata only occur at Stengrafshus, in the S. part of the quarry there, and are separated from the Orthoceras limestone in the N. by a directly visible fault, and presumably separated also by another fault from the Lower Didymograptus beds which appear just S. of them. — In pieces of shales scattered on the adjoining fence LUNDGREN reports that he found *Dictyogr. flabelliformis* EICHW. f. typica; for which reason traces of the *lowest part* of the *Dictyograptus beds*, too, here seem to be at hand.

Then we come to the *Lower Didymograptus beds*. These, constituted of light-gray shales, have been found, as already

mentioned, S. of the Dictyograptus beds, namely at the bottom of the canalized brook and in the walls of the well at Stengrafshus, as well as somewhat further E., higher up the brook just referred to. The only determinable fossil hitherto discovered in these shales, is a *Didymograptus* sp. — According to WALLIN, a light shale, that presumably belongs here, has also been found E. or SE. of the two more southerly limestone quarries (*B III: 3* and *B III: 4*) dipping in under the limestone.

Besides in the three named limestone quarries, the *Orthoceras limestone* is also said to occur near the NW. edge of the large sandstone field (at *A IV: 7* and in a well, at *A IV: 2*) It is also reported to have been found SE. of the sandstone field, viz. in St. Kyrkovången (*B V: 1*). As far as can be judged by the few fossils, discovered in the quarry at Stengrafshus, it must be the *lower part* of the *Orthoceras limestone* that is present at least in this locality.

It is very uncertain what in reality in this district constitutes the next higher stratum to the Orthoceras limestone. In SE. Scania it is formed, as a rule, of »limestone with *Trinucleus coscinorhinus* ANG.» On the testimony of WALLIN there has been found, W. of the Orthoceras limestone at Stengrafshus, as well as NW. of and resting directly on the named limestone in the middle quarry (*B III: 3*), light-gray shales (with lenses and bands of limestone containing *Ampyx rostratus* SARS) which, by reason of the presence of the named trilobite, he would include in LINNARSSON'S »Beyrichia-kalk» (in later times called *Chasmops beds*). Neither LINNARSSON nor TULLBERG succeeded in finding these strata again, but the latter mentions, among other fossils from his »zone of Tr. coscinorhinus», also *Ampyx rostratus*.[1] TULLBERG states that he has found the »zone of Tr. coscinorhinus» at Gärarpsbäcken, somewhat to the W. of the great diabase dyke (*B III: 6*), between the Tosterup Castle and Kråkekärr (*B IV: 4*), and

[1] In spite of this, the zone of *Tr. coscinorhinus*, owing to particulars from other localities, must be classed with the *Asaphus* beds.

lastly at the boundary between the »Lilla Kyrkovången» and »Lilla Ljungbergsvången», *everywhere in boulders*. It now appears quite possible that WALLIN's »*Beyrichia-kalk*» and TULLBERG's »zone of *Tr. coscinorhinus*» are one and the same, and that the latter should nevertheless be to find *in situ*, not, it is true, where TULLBERG looked for it, but by and near the middle limestone quarry along Gärarpsbäcken.

Next in age after the above named strata come black shales, belonging to the *zone of Dicranogr. Clingani* CARR. Besides the characteristic fossil are to be mentioned *Dicellogr. Forchhammeri* GEIN. and *Diplogr. foliaceus* MURCH. The zone in its typical development is found at Gärarpsbäcken between the middle limestone quarry and the diabase dyke crossing the brook (here with gastropods and trilobites, too) as well as at the E. part of the estate, just W. of Ljungbergsbäcken (at *B V: 4*). — Shales with *Leptogr. flaccidus* HALL., *Dicellogr. Morrisi* HOPK., *Diplogr. foliaceus* MURCH., and *Retiolites* cfr *fibratus* LAPW., which are met with somewhat further down Gärarpsbäcken (at loc. *B III: 7*), should also be reckoned to the same zone, possibly as an upper sub-zone.

Within the uppermost part of the *Chasmops strata* we have also, according to what OLIN has shown, to look for the home of the often siliceous, hard, splintery strata, which, formerly called »*Orthis shales*», by TULLBERG are distinguished as »the *zone of Calymmene dilatata* TULLBERG». The *Orthis shales* have certainly not been found here *in situ*, but blocks of this peculiar rock are stated to have been met with W. of Ljungbergshuset and beside Gärarpsbäcken.

Trinucleus beds, which come next in order, consist of greenish-gray, brown-spotted, mostly nonfossiliferous, loose shales or mudstones enclosing often fossiliferous banks of a hard, splintery limestone. This formation has a fairly large distribution, firstly at Gärarpsbäcken (*B III: 8*), somewhat down the diabase dyke that crosses the brook, secondly in the E. part of the property, near Ljungbergsbäcken.

The Brachiopod beds (the *Harpes region*) do not seem to be represented here, while the *Rastrites beds* also are but poorly developed.

Of the *Rastrites beds* from here we only know the *zone of Monogr. triangulatus* HARKN. (which on the W. side of the diabase dyke that crosses the valley of Gärarpsbäcken appears as an isolated patch of shales containing *Monogr. Sandersoni* LAPW.) and the *zone of Monogr. runcinatus* LAPW., this, too, appearing at Gärarpsbäcken.

The *Cyrtograptus beds* are found somewhat more extensively, firstly at Gärarpsbäcken, secondly at Munka-Tågarpsbäcken, at both places in the vicinity of the road between Tosterup Castle and the village of Munka-Tågarp. At Gärarpsbäcken we have the *lower* strata; at Munka-Tågarpsbäcken again the *uppermost* part of the Cyrtograptus beds, the *testis zone*, is well developed.

On the whole, the *Colonus beds* are, here, as in our other districts, surely the most widely spread of all the Silurian strata. We find it first in the W. part of the property, round the hill of Munka-Tågarp, then along the greater part of the S. boundary of the Silurian territory. They, therefore, occur not only in the sections of Munka-Tågarpsbäcken and Gärarpsbäcken, but also further to the E., up to and possibly past the Tosterup Castle. Along the boundary to the Mesozoic formation the *Colonus shales* are highly red-coloured, and at Munka-Tågarpsbäcken they have also a peculiar development, which has caused them to be specially described from here as *Posidonomya shales.*

Before concluding this summary of the Silurian of Tosterup, we think it as well to point out that the Silurian field by no means ends here, but continues far beyond the limits of this estate. Especially to the E., on the property of Bollerup, there is a large field with very varied and easily accessible Silurian strata.

The oldest ***Mesozoic strata*** here met with are belonging to the Kågeröd formation or the *Keuper*, and appear on the S. side of Munka-Tågarpsbäcken in contact with the uppermost Silurian. The Keuper strata here, little more than 10 *m* thick, consist, like the coeval formations of other parts of Scania, of coarse sandstones or conglomerates, concretionary limestone, and mottled clays. The strata are vertically raised and no fossils occur in them. — Also NW. of this, in a section taken in the N. part of the hill of Rödalsberg, were found petrologically similar strata, which have also been classed here.

In immediate connexion with the Keuper strata and, as it would seem, not separated from them by any dislocation, come the strata belonging to the *Rhætic-Lias*, partly with plant fossils, partly with animal. As no connected section could be taken through *all* the strata, but a partial section here, another there, it is not possible to class the strata into zones according to age. In part, at least, they are probably of the same age as the »Cardium bank» at Kurremölla and on Bornholm, i. e., belong to the *zone of Aegoceras Jamesoni* Sow. The rocks consist of sandstones, mostly white or rusty-brown, partly loose as sand, partly well consolidated *compact* and sometimes conglomeratic, and of one-coloured clays and coal, which latter, however, not occurs in such quantities or in such a manner that it is of economic importance. It is curious that, starting from the vertical beds of the Keuper formation, one further away from the Silurian boundary should find the strata dip *towards* the older formations. One is tempted here to assume an *inversion*, so that here among the Lias strata the most southerly, which now are the *lower*, really should be the *upper*. But until strata more rich in determinable fossils have been discovered, or more connected sections have become accessible, the question must be left open.

The strata belonging to the *Cretaceous system* appear everywhere along the SW. boundary of Tosterup, and continue far beyond it. The greatest part of the stripe, marked *C* onthe

accompanying map, is occupied of the formations that belong here. While it may be fairly confidently asserted that the older Mesozoic formations should not take up more than a 400 *m* broad zone of the stripe in question, yet at not more than one place only, at Rödmölla, have they been discovered in contact with strata of the Cretaceous system, and there the latter stand vertically, while the position of the Lias strata could not be determined. The Rödmölla locality is also remarkable because, proceeding from it and following the course of Rödmöllabäcken, we get a tolerably connected section, the only one known, through the lower Cretaceous of Sweden from its oldest to its youngest strata, from the *zone of Actinocamax verus* MILLER and *A. westphalicus* SCHLÜTER to the *zone of Belemnitella mucronata* SCHLOTH. The transition is in all respects continuous. Furthest to the NE. we come across gritty chalk (»gruskalk»), enclosing large grains and pieces of Lias sandstone In the vertical strata occurs *A. westphalicus*. Somewhat further S., the position of the strata is less upraised, and at the same time the rock changes. A conglomerate of larger pieces of Lias rock, held together by calcareous sandstone (the »*Rödmölla conglomerate*»), in which *inter alia* was also found *Actinocamax verus* MILLER constitutes the upper part of this lowest zone.

Upon this follows the »*Tosterup conglomerate*» (see the description of loc. *C V : 4*), belonging to the *zone of A. mammillatus* NILSSON, in the lower part of which also a specimen of *A. quadratus* BLAINV. (or some form very close to it) was found. Further to the S., in the large Tosterup marl-pit, are found alternating layers of calcareous sandstone and Tosterup conglomerate, both here containing *Act. mammillatus* together with *Belemnitella mucronata*, which latter alone holds away further to the S. The Tosterup conglomerate, which further to the E. shows itself in Fröslöfsån, has been met with also in the W. part of the property Tosterup, namely near Wallabäcken (at loc. *C II : 6*),

from which it is evident that the formation had a rather wide extension.

Apart from the transition strata in and about the large Tosterup marl-pit (*C V : 4*), the *zone with B. mucronata* is always developed in these parts as a grayish-yellow, fine-grained calcareous sandstone, in part very loose, often enclosing layers of an otherwise similar but harder rock, more firmly cemented owing to a larger percentage of carbonate of lime, and called »pilsten» by the natives. Plant fossils are not quite rare in it. The zone is found with this development in all the localities known along the SW. boundary of Tosterup.

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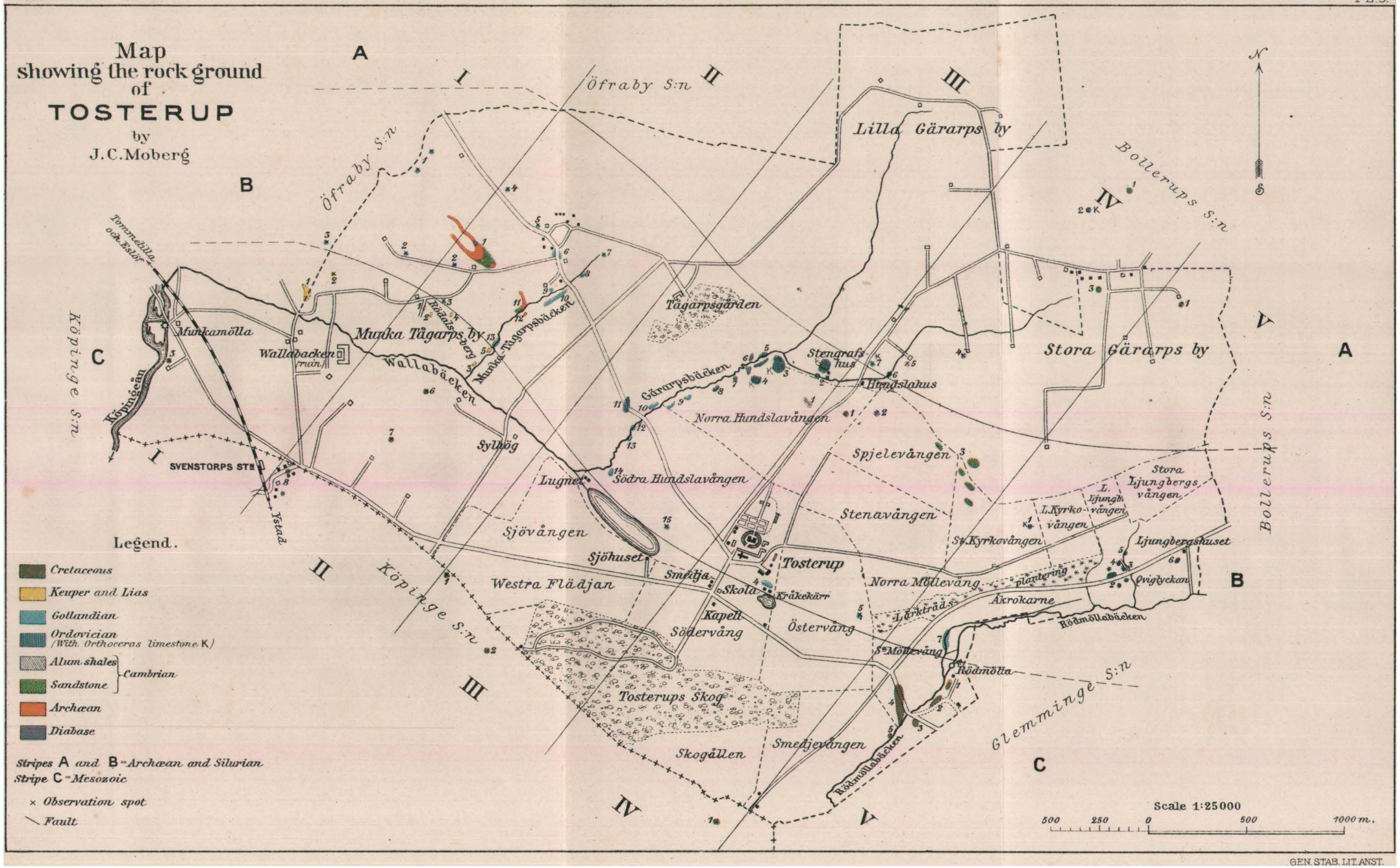
Map showing the rock ground of TOSTERUP

by J.C.Moberg



Legend.

- Cretaceous
- Keuper and Lias
- Gotlandian
- Ordovician (With Orthoceras limestone K)
- Alum shales } Cambrian
- Sandstone }
- Archæan
- Diabase

Stripes A and B = Archæan and Silurian
Stripe C = Mesozoic

× Observation spot
Fault

GEN. STAB. LIT. ANST.