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LENNART JEPPSSON and SVEN LAUFELD

THE LATE SILURIAN ÖVED-RAMSÅSA GROUP IN SKÅNE, SOUTH SWEDEN

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Addresses:

Lennart Jeppsson
Dept. of Historical geology and palaeontology
Sölvegatan 13
S-223 62 Lund, Sweden

Sven Laufeld
Geological Survey of Sweden
Box 670
S-751 28 Uppsala, Sweden

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ABSTRACT

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The history of research on the Öved-Ramsåsa Group is outlined and a formal lithostratigraphy is introduced. The group is composed of the Klinta Formation and the overlying Öved Sandstone. The Lunnarna, Bjär, Bjärsjö, and Bjärsjölagård Limestone Members are defined in the Klinta Formation. The Lunnarna Member contains several siltstone beds, the Bjär Member consists of soft shale, the Bjärsjö Member is characterized by hard mudstone, and the Bjärsjölagård Limestone Member is dominated by more or less impure limestone and marl. Parts of the Klinta Formation are not available in sections and are not included in any of the new members. Similarly only minor parts of the Öved Sandstone are accessible. The Öved Sandstone includes both grey and red beds. Most of the grey beds weather to a rusty yellowish colour, but some turn red or brown when a red pigment is unmasked. The pigment is secondary and not older than the Permian. Sections exposed today or available by hand-digging are described and the localities are defined and described.

Introduction

The Silurian of Scandinavia is nowhere as complete as in Skåne (Scania), the southernmost province of Sweden. Due to a large number of faults cutting the Silurian bedrock into an immense number of blocks and slices which make correlations difficult and due to the scarcity of exposures the total thickness of the Silurian of Skåne can be estimated only roughly. This is especially true of the uppermost two of the four Silurian main rock units, viz. the Colonus Shale and the Öved-Ramsåsa Group which together comprise more than 80% of the thickness of the entire Silurian of the province. Despite the fact that these two stratigraphic units form the bedrock of an area of more than 1200 km^2, which is more than 60% of the areal extent of all Lower Palaeozoic rocks in Skåne, the Colonus Shale and the Öved-Ramsåsa Group are by far the most poorly understood stratigraphic units in the Palaeozoic of Sweden. However, a large number of publications have been devoted to the geology and palaeontology of the two units. Most early publications are in Swedish, others in German and a few in Latin and several of them are of very difficult access. Hence, we will start with a historical review of the early studies on these late

Silurian rocks in Skåne. The reason why so little work has been done on the Öved-Ramsåsa beds during recent decades cannot be solely the difficult access of literature. The lack of good permanent exposures can explain in part this lack of interest. However, in our opinion the main reason is that nobody has published measured and reasonably well-described sections from localities that are so well defined that they can be restudied and the data reevaluated. This lack of published measured sections of Öved-Ramsåsa rocks has, of course, made a formal lithostratigraphic subdivision of this rock unit impossible. As micropaleontologists we felt that our collecting of samples in the Öved-Ramsåsa rocks must be done at well-defined localities and levels if we should have a chance for making a biozonation of these rock units. As a first step in these studies we exposed by hand-digging a number of sections which were measured and briefly described in the field before the individual beds were sampled. The bulk of this publication is devoted to the presentation of these field data. Although much work remains before we will have a complete picture of the Öved-Ramsåsa Group we will establish herein a formal definition of the group and name its formations and most of their members.

Since the top formation, the Öved Sandstone, contains red-coloured beds we will also discuss the possible causes for this colouration in a regional context.

We measured and described the sections together, S. Laufeld authored the Introduction and Historical review and L. Jeppsson the succeeding and main parts of this paper. Both of us take full responsibility for the work and we would feel rewarded if it could stimulate petrographers and macropalaeontologists to do further work on the Öved-Ramsåsa Group.

Historical Review

Colonus Shale

Review articles in English on the Colonus Shale have been published by Moberg (1911:30–33), Hede (1958:67, 253–254, 300), Regnéll (1960:28–30), and Laufeld *et al.* (1975:207–211) in which further references can be found. The boundary between the Colonus Shale and the underlying Cyrtograptus Shale remained undefined until 1975 when the transition between the units became exposed by quarrying operations. The base of the Colonus Shale was defined as the base of the *Pristiograptus ludensis* Zone, that is at the base of the latest Wenlockian graptolite zone (Laufeld *et al.* 1975:220, Fig. 1).

Much earlier Hede (1919a:150, 1919b:20) had proved the two early Ludlovian *Monograptus nilssoni* and *M. scanicus* Zones in the Colonus Shale. No graptolite or other stratigraphic zonation has been made in the post-*scanicus* part of the shale which represents a considerable amount of time as will be shown here. It should be mentioned, however, that a few fairly shallow and properly located borings west and/or south of Lake Ringsjön would yield material for such an undertaking. When such boring cores are at hand the boundary between the Colonus Shale and the overlying Öved-Ramsåsa Group should also be defined and a reasonably accurate estimate be made of the thickness of the Colonus Shale.

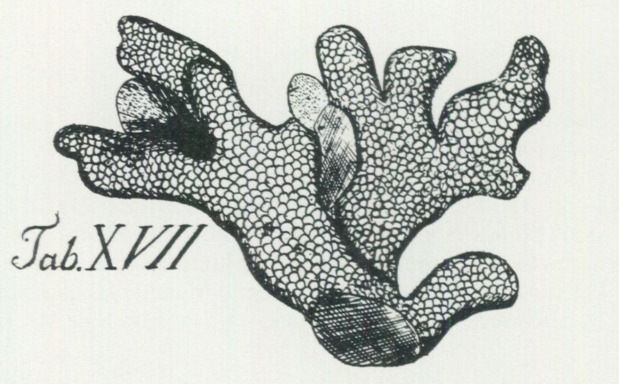


Fig. 1. The first published illustration of a fossil from the Öved-Ramsåsa Group, probably a favositid coral from Bjärsjölagård. Woodcut in Stobaeus 1741 and 1752 (Pl. XVII), reproduced here in its original scale.

Öved-Ramsåsa Group

In the earliest geological publications in Sweden, e.g., Hiärne 1694, 1702, 1706, rocks of the Öved-Ramsåsa Group are not mentioned. The first records of these beds and their fossils were made by Magnus von Bromell in 1728 (von Bromell 1725–1729) in the first part of the second chapter of his Lithographia Svecana (Regnéll 1949:16–17). In 1728 von Bromell reported two fossils from what we now call the Öved Sandstone at Övedskloster but he did not name them. According to Reyment (1973:4) one of the fossils described (von Bromell 1725–1729:367) from Övedskloster was a *Favosites,* a statement which seems improbable if von Bromell's fossil was collected from beds *in situ* at Övedskloster. In 1729 von Bromell (1725–1729) mentioned the Övedskloster locality again and also for the first time he described an unidentified fossil from the Bjärsjölagård Limestone at Bjärsjölagård. In 1730 and 1739 von Bromell published two geological treatises without mentioning the Öved-Ramsåsa fossils but in the new edition in German of his Lithographia Svecana he reported (1740) crinoid ossicles from Gotland and Scania. It seems probable that he had material from Bjärsjölagård at hand.

Thus Magnus von Bromell (1725–1729, 1740) was the first to report the occurrence of fossils in our Öved-Ramsåsa Group and at least two fossil localities–Övedskloster and Björsjölagård–were known to him. In 1741 Kilian Stobaeus became the first to publish an illustration of a fossil from the Öved-Ramsåsa Group. His woodcut showing a coral from Bjärsjölagård is reproduced here (Fig. 1). Stobaeus' locality designation was "ad villam Bieroeds Ladugårdh". In 1752 Stobaeus once more published his illustration from 1741.

In Corallia Baltica by Linnaeus (1745) corals from Skåne are mentioned but without locality designations. It seems obvious that at least one Silurian coral from Skåne was collected at Bjärsjölagård since quarrying according to Retzius (1776) probably began before 1745 close to the manor house at Björsjölagård (Regnéll 1949:51).

About 1750 a quarry was opened in the Öved Sandstone (close to the quarry called Helvetesgraven) which was used for building the Övedskloster manor-house (Regnéll 1964:71, foot-note) and later (1780) for rebuilding the Maltesholm manor-house (Angelin 1877:28). It can not be excluded that the Royal Castle of Beritzholm, mentioned in the literature for the first time in 1363 and pulled down in the beginning of the 16th Century, was partly built of rocks from the Öved-Ramsåsa Group. According to Regnéll (pers. comm.) the limestone quarry at Bjärsjölagård was mentioned 1765 by J.L. Gillberg (in Historisk, oeconomisk och geographisk Beskrifning öfwer Malmö Hus Lähn uti hertigdömmet Skåne. Facsimile Edition Lund 1980, p. 92).

Neither Daniel Tilas (1742, 1743, 1765) nor Torbern Bergman (1766, 1773, 1774) mentioned anything about these rocks or their fossils and we have to go to Anders Jahan Retzius and 1776 for new information. In his account of the geology of Skåne Retzius (1776:84–85) mentioned rocks nowadays referred to the Öved-Ramsåsa Group and reported that there was a limestone quarry at "Bieröds Ladugård, commonly called Biärslagård" and that the quarry had been in operation for a considerable time. He refers to the Bjärsjölagård Limestone when he states that the rock is "full of fossils" and specifically mentions corals and crinoid stems.

During the last decades of the 18th Century the Öved-Ramsåsa Group and its fossils were not discussed at all by e.g. A.J. Retzius (1781) or Wilhelm Hisinger (1790). A major step forward in the understanding of our subject was taken by the publication of Hermelin's remarkable geological map of Skåne in 1804. On this relatively overlooked map (Fig. 2) two of the three areas with outcropping Öved-Ramsåsa rocks are outlined. The Klinta area west of Ringsjön is not distinguished, but the second – the Öved-Bjärsjölagård area east of Ringsjön – is distinguished by symbols for limestone in the Bjärsjölagård quarry, symbols for a sandstone occurrence northwest of Branstad and symbols for an occurrence of shale west of Tullesbo. The third area, at Ramsåsa, is distinguished by symbols for sandstone NNW of Ramsåsa church.

In Hisinger's (1808) outline of the geology of Sweden the stratigraphical position of the Öved-Ramsåsa rocks was within his "Transitional limestone" (Group IV) overlying the "Transitional shale" (group III) and overlain by "Transitional basalt" (*Öfvergångstrapp,* group V). Hisinger did not, however, discuss the Öved-Ramsåsa rocks in the Scanian part of his description. Wahlenberg (1818a; 56–57, 1818b, 1824:63–64) used the designation "Transitional formation" for the rocks including the Öved-Ramsåsa Group and specifically mentioned corals (1818:13), *"Anomites Plicatella"* (1818:67) and *"Madreporitae favosi"* (1818:98) from the Bjärsjölagård Limestone at our locality Bjärsjölagård 1. Sven Nilsson reported "Transitional limestone" with "corals, crinoid ossicles, ammonites, etc." at Bjärsjölagård 1 and Kärrby but did not discuss other Öved-Ramsåsa rocks and stratigraphy in his Geology of Skåne (1823). On December 22, 1825 Hisinger wrote a letter (now in Lund University Library) to Sven Nilsson in which he indicated that the sandstone (=Öved Sandstone) could be an equivalent to the Old Red Sandstone of Great Britain. However, Hisinger did not maintain his first interpretation and later correlated the Öved Sandstone with the Triassic Buntssandstein (1828:186–187, 1831a:151–152), Keuper (1831a:96, 1834), Triassic-Cretaceous (1834b:6) or Permian Rotliegendes (1831a:96), though in 1829 he stated that the New Red or Rotliegendes was missing entirely in Sweden. The remaining beds of the Öved-Ramsåsa Group were referred to as "Transitional limestone" or "Transitional beds" (1834a, b).

Fig. 2. Hermelin's geological map (29,5×28 cm) of Skåne from 1804 was printed in colour. Two of the three areas where Öved-Ramsåsa rocks are exposed are shown and the quarries at Bjärsjölagård, Helvetesgraven and Ramsåsa are marked on the map. In 1985 the Geological Survey of Sweden issued a coloured post-card of this map.

Despite the fact that the first Öved-Ramsåsa fossil was mentioned already 1728 by von Bromell no other fossils than those discussed above were reported during the following 100 years. It is noteworthy that not even Dalman in his treatises on Swedish trilobites (1827), bivalves and brachiopods (1828) described any fossils from the Öved-Ramsåsa Group. However, between 1828 and 1840 Wilhelm Hisinger, an independent owner of manufacturing estates who is widely known in the annals of Swedish geology for his scientific contributions, published a number of papers and books containing information on, i.a., new localities and fossils in Öved-Ramsåsa rocks.

In 1828 Hisinger mentioned the occurrence of Öved Sandstone at Frualid (1828:186–187) and limestone at Kärrby and Bjärsjölagård 2. From the Bjärsjölagård

Limestone at the latter locality he reported "crinoid stems and *Terebratula plicatella* Wahlenberg". He also stated that Sven Nilsson had collected *"Encrinites flexilis* Wahlenberg" and *"Calymene Blumenbachii"* at Kärrby and Skartofta (1828:187–188). In 1831 (b) Hisinger stated that 320 species of fossils were known in Sweden as compared to 104 species in 1819. Of the 320 species only one was from the Silurian in Skåne, *"Calymene Blumenbachii"* from Skartofta (cf. Hisinger 1829a). In the description to his geological map of 1834 (a) Hisinger distinguished the Öved Sandstone, named it for the first time as "Öfvedsklosters sandsten" (1834b:6) and placed it in the Triassic Keuper (1834b:15–17). Bjärsjölagård, Skartofta and Kärrstorp were referred to the "Transitional limestone". The Klinta area of Öved-Ramsåsa rocks west of Ringsjön was not singled out and not placed in the "Transitional limestone" on his map but on his own copy of the map (now in the library of the SGU) Hisinger has marked the area by pencil and written "Klintakalk" (Klinta limestone). In 1837 Hisinger added further to our knowledge of the Öved-Ramsåsa Group by briefly discussing Helvetesgraven (a gastropod in the Öved Sandstone, 1837a:98–99), Tullesbo (corals and brachiopods, 1837a:99), Skartofta (*Leptaena,* 1837a:99, 1837b:10), and Bjärsjölagård (*"Anomites Plicatella"*). He also stated (1837a:162) that the Bjärsjölagård quarry ("Bjeröds ladugårds kalkbrott") is located 292 Paris feet (=319 Swedish feet) above sea level. The most important new information on Öved-Ramsåsa in Hisinger's contributions of 1837 is the discovery that the strata at Klinta belong with the Öved-Ramsåsa Group. Hisinger mentioned that the Klinta area is very fossiliferous (a large trilobite, *"Avicula"*, brachiopods – 1837:104, *"Orthis Pecten"* – 1837b:70, and *"Tentaculites annulatus"* – 1837b:113). We know from Hisinger's letters to Sven Nilsson (Lund University Library) that Hisinger visited Helvetesgraven and sampled the Öved Sandstone in 1831 and possibly also the Klinta area. But Hisinger's wealth of information from Klinta in 1837 and onwards stemmed from Sven Nilsson's own collections. Nilsson sent fossils to Hisinger for descriptions and drawings of them to be used by Hisinger with no restrictions. In 1840 Hisinger listed the known occurrence of fossils from the Öved-Ramsåsa Group at Klinta in the following way (1840:40–41):

"*Calymene*? nov. sp.
Steinkerns of *Turritella*?
Cardium sp.
Nucula antiqua (Hisinger 1837b, Pl. 37, fig. 9)
Nucula costata (Ibid., Pl. 37, fig. 10)
Mytilids
Avicula sp. similar to *Avicula retroflexa*
Pinna or *Gervillia*?
Orthis pecten
Orthis striatella
Other brachiopods, three species
Crinoid stems and ossicles
Tentaculites annulatus Schlotheim
Orthoceratites tenuis Wahlenberg
Fucoids" (here probably trace fossils.).

In addition to these Klinta fossils Hisinger listed the following from other Öved-Ramsåsa Group localities (1840:41):

Skartofta: "*Calymene Blumenbachi* Brongn., *Nucula* sp".
Tullesbo: "*Patella*", crinoid stems and ossicles.
Bjärsjölagård: "*Terebratula plicatella* Dalman".

According to Regnéll (1983:48) Sven Nilsson in 1840 held the opinion that the Öved Sandstone could be of either Keuper or Old Red or Wealden age but in 1841 Nilsson considered it of Keuper age because of a find of a supposed cycad fossil. In the following year Hisinger renamed his earlier (Hisinger 1834:6) "Öfvedsklosters sandsten" to "Öfveds Sandsten" (Hisinger 1842:3) and briefly discussed its lithology at Helvetesgraven. Strangely enough Lovén (1845, 1846a, 1846b) did not mention any Öved-Ramsåsa material in his treatises on Swedish trilobites.

In a brief but very stimulating review of the "Transitional formation" in Skåne, Forchhammer (1846:80–84) discussed the exposures at Bjärsjölagård, Kärrby, Tullesbo, Skartofta, Helvetesgraven, Klinta, Pugerup, and Ramsåsa and fossils collected by Angelin. Forchhammer correlated the Öved Sandstone with the Old Red Sandstone of Great Britain (see Fig. 3, third column from left).

In 1845 Murchison (who named the Silurian system ten years earlier) together with his assistant De Verneuil visited among other localities Bjärsjölagård, Skartofta, Övedskloster and possibly Klinta. Murchison also studied Sven Nilsson's collection of fossils, including those from the Öved-Ramsåsa Group, and thus gathered a lot of first hand information. Having promised Sven Nilsson to have his cranium after his death (Regnéll 1983:47) Murchison published an important paper on the geology of certain parts of Sweden (1847). He (1847:33–34) correlated the limestone at "Bielo-gåard" (Bjärsjölagård 2) with "true Upper Silurian rocks" because of its fossil contents: *"Avicula, Spirifer* and serpuline bodies, with fragments of Orthoceratites, *Favosites (Calamopora) Gothlandica, F. polymorpha, Aulo-*

Time \ Publications	Old British Names	Forchhammer 1846	Murchison 1847	Tullberg 1882 a,b, 1883	Marr 1883
DEVONIAN					
SILURIAN – PRIDOLI	Ledbury Shale Temeside Shale Downton Castle Sst.	Öved Sst.		C. Sh. ? Öveds Sst.	Oeved Sst.
SILURIAN – LUDLOW – Ludfordian – Whitcliffian l.	Upper Whitcliffe or *Chonetes* Flags	Skartofta Bjärsjölagård Tullesbo	Reddish, earthy finely micaceous sst . . . (= Öved Sst.)		Kaerrstorp Sst.
SILURIAN – LUDLOW – Ludfordian – Whitcliffian e.	Lower Whitcliffe or *Rhynchonella* Flags				
SILURIAN – LUDLOW – Ludfordian – Leintwardinian l., e.	Mocktree or *Daya* Shales		Grey and greenish shale and hard flaglike limestone (= Colonus Shale)		
SILURIAN – LUDLOW – Gorstian – Bringewoodian l., e.	Aymestry or *Conchidium* Limestones			Klinta Ls. + Sh. Kärrstorps Sst., Ls. & Sh. Bjärsjölagårds Ls. & Sh. *Cardiola* Shale	
SILURIAN – LUDLOW – Gorstian – Eltonian l., m., e.	Lower Ludlow Shales				Bjersjoe-lagorod Ls.
SILURIAN – WENLOCK		Ls. at Kärrby	Grey ls. & sh. at Bielo-gåard Kärsbye & Skärtofta		*Cardiola* Schists

Fig. 3. Some different opinions about correlation of the Öved-Ramsåsa Group. The left column shows the stages introduced by Holland *et al.* 1963 as well as the less precise new terms (Holland *et al.* 1980) which are now officially adopted.

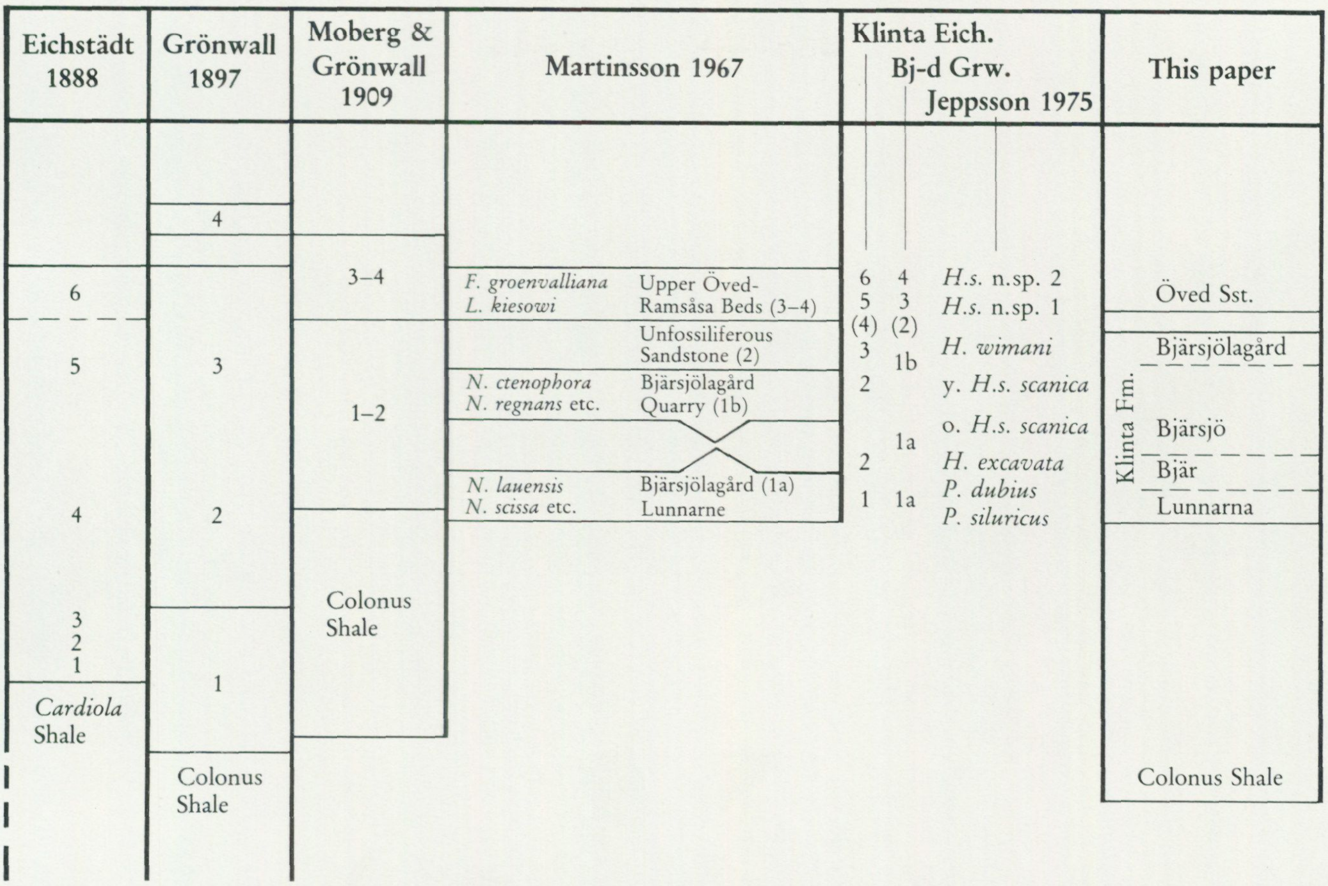
The second column lists the old British names referred to frequently in later publications (columns to the right). Our correlation of them with the time units chiefly follows Holland *et al.* 1963.

Several of the early authors did not use formal lithostratigraphic designations but instead referred to locality names. Most of these localities can be checked in our list of localities, though the old spelling deviates from the modern one used by us.

pora serpens, with many fragments of *Encrinites* fc". He stated (1847:34) that the Bjärsjölagård Limestone in some places is "an absolute coral reef, loaded with many characteristic Wenlock species" and that it had been worked in old quarries at "Kärsbye and Skärtofta". Murchison misinterpreted the underlying Colonus Shale north of the Vomb basin as being younger than the Bjärsjölagård Limestone – see Fig. 3 – but correctly referred to the Öved Sandstone as forming the top of this series of rocks. Having visited the Övedkloster area and inspected the casts of fossils in the Öved Sandstone, "forms of *Cypricardinia* and *Avicula* with Turitellae and the *Leptaena lata*" Murchison (1847:34) had "little doubt that this sandstone must be classed as an Upper Silurian rock" and not as an equivalent to the Old Red Sandstone.

Murchison (1847:34) also reported the occurrence of "*Avicula retroflexa* and the *Cytherina Baltica* of Gotland" at Klinta and correlated these Öved-Ramsåsa rocks with "uppermost Silurian".

In 1851 Angelin described "*Phacops breviceps*" from Klinta (Angelin 1851:12, Pl. 9:4). In 1852 Sven Nilsson held the opinion that the Öved Sandstone was of Devonian age (Regnéll 1983:18) as did af Forselles in 1854 (1854:26, sample no. 138). The same year Angelin (1854:30, Pl. 20:1) described a new trilobite, "*Homalonotus rhinotropis*" from Klinta. At that time Angelin guided F. Roemer to Klinta, Bjärsjölagård and Tullesbo which resulted in a publication by Roemer (1856, see pp. 812–814) with a list of fossils from Klinta. At Tullesbo Angelin told Roemer that already K. Stobaeus and M. von Bromell had identified Gotland corals there. In his textbook of 1859 G. Lindström mentioned Öved-Ramsåsa rocks and followed Murchison's stratigraphic interpretation. On Erdmann's geological map of 1872 the Öved Sandstone and the Triassic Kågeröd Sandstone are not separated but he reviewed the Öved-Ramsåsa Group in a balanced way (Erdmann 1872:5–7). A review was also published by Lundgren



Eichstädt's numbering system differs from that of Grönwall (Grönwall 1897). Eichstädt worked mainly at Klinta where he defined his units 1–3. Grönwall lumped these units under his unit 1 but mainly working at Bjärsjölagård he split this unit to 1 a and 1 b and correlated his 1 b with Eichstädt's units 2 and 3. Jeppsson (1975) showed that Eichstädt's unit 2 (=Bjärsjö Member) at Klinta is coeval with parts of Grönwall's unit 1 a at Bjärsjölagård.

(1874) when describing new fossils from the Öved Sandstone at Ramsåsa and Övedskloster and with Murchison he correlated the sandstone with Upper Ludlow. In 1875 Linnarsson published new lists of fossils from the sandstones at Ramsåsa (1875:280) and Övedskloster (1875:281) and concluded that the rocks at the two localities are of same age and belong to the Öved Sandstone. Linnarsson who was the first to report vertebrate remains from the Öved Sandstone also reviewed the Öved-Ramsåsa rocks and concluded that the Bjärsjölagård Limestone is of Ludlow age, not of Wenlock age as stated by Murchison in 1847 (Linnarsson 1875:283–284).

Angelin had started preparing a geological map of Scania with a separate description in 1856. The map was printed in 1859 but it was not distributed awaiting the description to become completed. However, when Angelin died in 1876 the printing of his description was not finished and B. Lundgren was entrusted to complete and issue the description. When the map (Fig. 4) and description were issued in 1877 Lundgren had included Angelin's own corrections as overprint on the map printed already in 1859. Angelin (1877:27–29) summed up the knowledge of his days and his map shows the three areas of Öved-Ramsåsa rocks. Angelin (1877:25–26) noted that the underlying Colonus Shale is so similar to the lower part of what we now call the Öved-Ramsåsa Group that he was unable to draw a boundary between the two units. He also stuck to Murchison's correlation of the Öved-Ramsåsa rocks with Wenlock and Lower Ludlow in Great Britain. See also Lundgren 1878.

In another posthumous publication Angelin described and figured two trilobites from Klinta, viz. "*Homalonotus rhinotropis*" (1878a:30, Pl. 20:1) and "*Phacops breviceps*" (1878a:12, Pl. 9:4). For a discussion, see Westergård 1910:30, 38. Two new crinoids from Klinta were described and illustrated the same year (Angelin 1878b:7), viz. *Periechocrinus scanicus* (Pl.

Fig. 4. Angelin's geological map of Skåne and Bornholm (exluded here) from 1856 in Lundgren's emended version published in 1877. The map (49×50 cm) which was printed in colour shows for the first time all three areas where Öved-Ramsåsa rocks are exposed, marked by G (=Gotland's Limestone), H (=Gotland's Marl) and I (=Gotland's Sandstone). The map was printed by Dr. C. Wolf & Sohn in Munich. It includes the geology of the Danish island of Bornholm.

19:16, 16a) and *P. geometricus* (Pl. 20:29). In 1880 G. Lindström described (Angelin & Lindström 1880:19–20) and illustrated two bivalves from Klinta, viz. *Goniophora acuta* (Ibid. Pl. 19:23–26) and *G. angulata* (Pl. 19:20–22).

In 1882 time was ripe for a completely new review of the Öved-Ramsåsa rocks by S.A. Tullberg who suggested (1882a:42 and 1883, plate at p. 259) that they rested on Cardiola (=Colonus) Shale and that they were lateral equivalents to the upper parts of the Cardiola Shale. He introduced some new terms and subdivided the Öved-Ramsåsa rocks into the following units (in descending order):

(a) Öveds Sandsten (sandstone) 200 m
(b) Klinta Kalksten och Skiffer (limestone and shale) 200 m
(c) Kärrstorps Sandsten, Kalksten och Skiffer 260 m
(d) Bjärsjölagårds Kalksten och Skiffer 130 m.

According to Tullberg – see Fig. 3 – the Öved Sandstone is of Downtonian age and all three lower units (b–d) of Ludlovian age and to be correlated with the Aymestry Limestone. Tullberg (1883:230–233) also pointed out localities and prepared lists of fossils in each unit. For the reader of German, Tullberg's publication of 1883 is the best of all early accounts of the Öved-Ramsåsa Group if combined with Angelin's map of 1877 and not with Tullberg's own (1883, his black and white plate 10).

In his book of 1883 on the classification of Cambrian and Silurian rocks J.E. Marr used Tullberg's account as a suitable base for an understanding of the Öved-Ramsåsa rocks but correlated Tullberg's Kärrstorp Sandstone with Lower Downtonian and the Bjärsjölagård Limestone with the Salopian (Marr 1883:79–81), see Fig. 3.

When the Geological Survey of Sweden issued a new bedrock map of our country and a description to it by A.G. Nathorst (1884:18, 20) Tullberg's interpretation of the Öved-Ramsåsa rocks was used and when G. De Geer published his description to the geological map sheet Lund (1887:21–22) no new information about the Klinta area was presented.

In 1888, however, F. Eichstädt published an entirely new review and subdivision of the Öved-Ramsåsa rocks based on his own meticulous field work, see Fig. 3. Eichstädt (1888:153–155) listed 92 species of fossils from the three separate outcrop areas. He argued against Tullberg's view of 1883 and concluded that the Öved-Ramsåsa rocks in their entirety are younger than and everywhere resting on the Colonus Shale. Eichstädt's interpretation was supported by Törnquist the following year (Törnquist 1889:335).

When Nathorst 1894 published his Sveriges geologi (Geology of Sweden) he accepted Eichstädt's interpretation that the Öved-Ramsåsa Group is Ludlovian and younger than the Ludlovian Colonus Shale (Nathorst 1894:123–124). In 1896 Stolley reported on the occurrence of *Girvanella* limestone at "Bjersjölagard" (Stolley 1896:175, 177).

Grönwall reviewed in detail the Öved-Ramsåsa group in 1897 and adopted Eichstädt's subdivision but unfortunately lumped Eichstädt's three lowermost units into one (Grönwall 1897), see Fig. 3 and caption. Further, Grönwall showed that Tullberg's Kärrstorp sandstone, limestone and shale units were based on glacial erratics. In the description to the geological map sheets of the southern half of Skåne, Törnebohm and Hennig (1904) support Eichstädt's (1888) and Grönwall's (1897) interpretation that the "Klinta group" is younger than the Colonus shale. Törnebohm and Hennig reported more than 100 species of fossils from the Öved-Ramsåsa Group, fossils grouped among calcareous algae, corals, crinoids, annelids, brachiopods, bryozoans, bivalves, gastropods, cephalopods, ostracodes, trilobites, eurypterids, and vertebrates (Törnebohm & Hennig 1904:66–69).

Our present understanding of the stratigraphy of the Öved-Ramsåsa Group is based on these early publications and on later contributions by Moberg & Grönwall (1909) – see our Fig. 3, Moberg (1910, 1911), Törnebohm (1910), Törnquist (1914), Hede (1958), Regnéll (1960), Jeppsson (1975) – see Fig. 3, Martinsson (1967, 1976) – see our Fig. 3, and Larsson (1979).

Hadding's (1927, 1929, 1933) studies of Öved-Ramsåsa rocks are still the most modern petrographic accounts.

Reviews of Öved-Ramsåsa Group fossils are scarce but the following references are of use: crinoids (Jaekel 1900), trilobites (Westergård 1910), vertebrates (Lehmann 1937, Säve-Söderberg 1941, Spjeldnæs 1950), ostracodes (Martinsson 1962, 1964, 1967, 1976), stromatoporoids (Mori 1969), plant spores (Gray *et al.* 1974), bryozoans (Brood 1974), conodonts (Jeppsson 1975), brachiopods (Bassett & Cocks 1974), tentaculitids (Larsson 1979), and corals (Kato & Ezaki 1986).

Description of formal lithostratigraphic units

Öved-Ramsåsa Group

Old names

Gotländska Gruppen (Angelin 1877, Nathorst 1894a, 1894b)
Gotlandsgruppen (Nathorst 1894a, 1894b)
Bjersjölagårds–Övedsbildningen (Tullberg 1882a)
Gotlandslager (Hennig 1900)
Klintagruppen (Törnebohm & Hennig 1904, Jakobson 1924)
Ramsåsabildningen (Moberg & Grönwall 1909)
Öved–Ramsåsa formation (Moberg 1910)
Ramsåsabildningarna (Munthe *et al.* 1920)
Öved–Klinta–Ramsåsa formations (Hadding 1929)
Öved–Ramsåsa Series (Regnéll 1960)
Öved–Ramsåsagruppen (Regnéll in Magnusson *et al.* 1963)
Öved–Ramsåsa Beds (Martinsson, 1962, 1963, 1964, Larsson 1979)
Öved–Ramsåsa Group (Brood 1974, Laufeld *et al.* 1975, Jeppsson 1975, Bergström *et al.* 1982)

Type localities – See members of the Klinta Formation and the Öved Sandstone below.

Distribution – The Öved-Ramsåsa Group is now known from three areas in Skåne: The Ringsjö area, the Bjärsjölagård-Övedskloster area, and the Ramsåsa area–see Fig. 5. Similar beds have been encountered in deep boreholes in Denmark (Christensen 1971a, b).

Description – The Öved-Ramsåsa Group is not a uniform unit; rather it is characterized by its great variation. However, in spite of this, it has been treated as one unit for a very long time, except for a brief interval between 1872 and 1874 when a part of the red sandstone was separated. Three reasons to treat the Öved-Ramsåsa Group as a unit can be listed.

(1) Older Silurian rocks in Skåne consist of grey shales and siltstones, and only exceptionally contain other lithologies and other fossils than graptolites and taxa of the *Cardiola* fauna. In the Öved-Ramsåsa Group, on the other hand, graptolites are very scarce (indeterminable graptolite fragments were reported by Grönwall 1897:22 but no specimen has been preserved) but shelly faunas are rich and common. In addition, the lithologies differ from those of older strata.

(2) No younger Palaeozoic sediments are known in Sweden. (However, it should be born in mind that the lithology of possible Devonian and Permian sediments in Skåne cannot be expected to differ much from the sometimes fairly unfossiliferous Öved Sandstone or the Triassic Kågeröd Formation.)

(3) The group is only known from a few localities in three small areas, Fig. 5.

Thickness – Tullberg (1882b) calculated the thickness to 3500 to 4000 "fot" (=1040–1190 m) using the average dip of the strata at Bjärsjölagård and the distance between Bjärsjölagård and Öved. Tullberg (1882a) calculated the thickness to 790 m. Eichstädt (1888:148) held the opinion that the Öved-Ramsåsa beds were repeated in the Bjärsjölagård-Övedskloster area. He concluded that they were folded and reduced the estimated thickness to 900 to 1000 "fot" (=270–300 m) in the Bjärsjölagård area and to 335 fot (=100 m) at Klinta. Grönwall (1897:213) suggested the presence of a fault north of Skartofta-Tullesbo instead of a folding of the beds, but did not comment on the thickness.

As noted in the Introduction and in the description of Bjärsjölagård there are many faults also over a short distance, and the dip of the beds varies strongly in different fault blocks. Thus, in our opinion the above calculations of the thickness of the beds are unreliable. The presence of the older of Eichstädt's (1888) and Grönwall's (1897) different units at the present ground level in adjacent blocks would either indicate that the vertical displacements are very large, or that the thickness of these beds is more moderate. The latter alternative seems more probable than the first one.

A thickness of more than 200 m seems possible judging from core data (Skoglund *in* Sorgenfrei 1969, Larsson 1979).

Formations – The Öved-Ramsåsa Group consists of two formations, the Klinta Formation and the Öved Sandstone Formation, see Fig. 3.

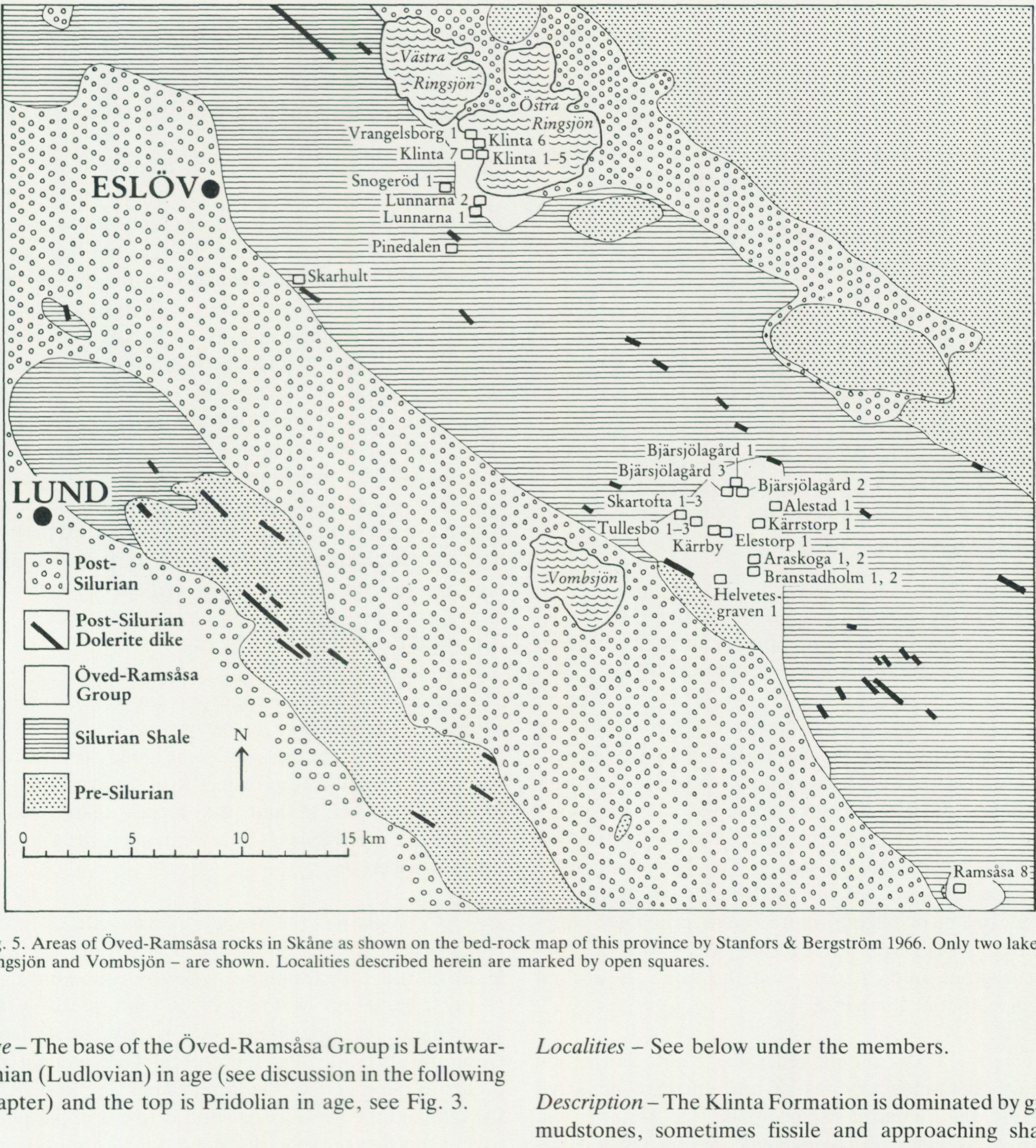


Fig. 5. Areas of Öved-Ramsåsa rocks in Skåne as shown on the bed-rock map of this province by Stanfors & Bergström 1966. Only two lakes – Ringsjön and Vombsjön – are shown. Localities described herein are marked by open squares.

Age – The base of the Öved-Ramsåsa Group is Leintwardinian (Ludlovian) in age (see discussion in the following chapter) and the top is Pridolian in age, see Fig. 3.

Klinta Formation

Older names

Bjersjölagårds kalksten och skiffer (Tullberg 1882a)
Klinta skiffer och kalk (Tullberg 1882b)
Lag 1, 2 and 3 (Eichstädt 1888)
Lag 1 (Grönwall 1897)
Bjärsjölagård Limestone (Brood 1974)
Klinta Formation (Jeppsson 1975)

Localities – See below under the members.

Description – The Klinta Formation is dominated by grey mudstones, sometimes fissile and approaching shale. Siltstone and limestone (often detrital) beds occur subordinately, except in the Bjärsjölagård Member which is dominated by impure limestone.

Contacts and age – The lower contact is not exposed, but in our opinion it should be drawn above the highest graptolitiferous beds. Graptolites occur at Pinedalen, south of Lunnarna 1 (Martinsson 1967). During a visit to Lund in 1977 Hermann Jaeger identified a fauna with *Monograptus haupti* and *Monograptus bohemicus* from a sample which was collected there by Sigurd Holmberg. From the evolutionary level of *M. haupti* and other data Jaeger (pers. comm.) places the fauna well above *M. leintwardensis* and compares it with the fauna in the middle part of the *Cardiola* beds in the Carnic Alps. These beds belong to the conodont Zone of *Polygnathoides siluricus*. The zone fossil of that zone occurs in the lowermost of the studied part of the Klinta Formation (Jeppsson 1975, see also below). Thus:

1. The graptolites range much higher in Skåne than believed earlier (the *M. scanicus* Zone), into the Leintwardinian according to ostracode data (Martinsson 1967).
2. The transition from the graptolite-containing sequence to the Öved-Ramsåsa Group occurs in the *P. siluricus* Zone (probably low in that zone), and in the *Neobeyrichia lauensis* range (Martinsson 1967:371). The latter is Leintwardinian in age (Martinsson 1967).
3. There is no major gap in the sequence between the graptolite-containing beds and the Öved-Ramsåsa Group.

The Klinta Formation is overlain by the Öved Sandstone. The top of the Klinta Formation is Late Whitcliffian or possibly early Pridolian in age (Jeppsson 1975).

Thickness – In the boring Björsjölagårdborrningen 1 the upper boundary of the Klinta Formation was penetrated. Using Larsson's (1979) correlation with Bjärsjölagårdborrningen 2, 101 m of rocks defined as Klinta Fm were drilled through. No data on the dip of the beds in the cores have been published, and thus the stratigraphic thickness cannot be calculated. However, a thickness of about 100 m or slightly more seems probable. Graptolitiferous beds were not recorded. The lower beds contain siltstone intercalations and the same tentaculitid fauna as that at Lunnarna.

Members – In ascending order the Klinta Formation includes the following units: an unstudied and unnamed interval, the Lunnarna Member, the Bjär Member, the Bjärsjö Member, an unnamed interval, the Bjärsjölagård Limestone Member, and an unnamed thin uppermost part. The lowermost unstudied interval may well turn out to have the same character as the Lunnarna Member and if so, it should be included in that member. The latter two unnamed intervals may well turn out to be better described as a single member, the middle part of which is locally replaced by the Bjärsjölagård Limestone Member.

Lunnarna Member

Older names
The Lunnarna beds (Martinsson 1967:371).

Type locality – Lunnarna 1 in the Ringsjö area.

Other localities – Judging from the few beds exposed at 261 and at 249 m west of the bridge, the beds in the westernmost part of Bjärsjölagård 1 probably belong to the Lunnarna Member. Also the lowermost beds in Bjärsjölagårdborrningen 1 intercalated by siltstone (Larsson 1979, Fig. 70) belong to the Lunnarna Member.

Description – It is characteristic for this member that the shale is intercalated with siltstone beds and some lenses or beds of detrital limestone. Abundant trace fossils indicate extensive bioturbation and the composition of the beds is usually more or less mixed. The coarser particles may have been transported by turbiditic currents, judging from the very uneven lower surface of some beds. However, most groove casts have been enlarged and deformed to elongated load casts.

Thickness – Neither the upper nor the lower contact is identified at Lunnarna 1. In the measured section, 8.8 m of strata occur. If the dip is the same along the ditch, and if there are no faults, then over 30 m of strata would occur between the lowest and the highest exposures at Lunnarna 1. Until borings have been made the thickness remains uncertain.

Age – At Lunnarna 1 the *Neobeyrichia lauensis* ostracode fauna occurs (Martinsson 1967:371) as does the zone fossil of the *Polygnathoides siluricus* conodont Zone (Barrick in letter 18 Feb. 1980), and probably the succeeding *Pelekysgnathus dubius* conodont fauna (Jeppsson 1975:8). The tentaculitid *Odessites inflatus* occurs in samples with the latter fauna (Larsson 1979). On Gotland the same association is found in the upper part of the Hemse Beds (the *P. siluricus* Zone in the top and the *P. dubius* fauna in the topmost Hemse Beds, Martinsson 1967, Jeppsson 1975, 1983, Larsson 1979). Using ostracodes, Martinsson (1967) correlated these beds with the uppermost Leintwardine Beds. The member is of the same age at the other localities where it has been identified, as far as can be judged from the less well-studied faunas.

Bjär Member

Name – In its present shape the place name Bjärsjölagård sounds as if it were formed to the name of a lake ("Bjärsjön") which was named after a hill (Bjär). The name is, however, not of that origin as at least until 1845 the name in use was Bjerrödsladugård. Despite this and chiefly for mnemotechnic reasons this and the following member are named the Bjär and the Bjärsjö Members, respectively.

Older designations – At least most of Eichstädt's "lag 1" belongs here.

Type locality – Bjärsjölagård 1. Here the top of the member is exposed at 2.34 m in our measured section. Also beds west of this section along the ditch belong here, but the precise location of the boundary to the underlying Lunnarna Member is not known because of the patchy exposure of the beds (the beds are less hard after weathering than the succeeding ones), but at least the beds up to 219 m west of the bridge probably belong here.

Other localities – Klinta 6, and Bjärsjölagårdborrningen 1 (Larsson 1979, Fig. 70).

Description – Eichstädt (1888) described these beds at Klinta as about 40 feet (=11 m) of soft shale similar to the Colonus Shale intercalated by thicker beds of hard grey, micaceous shale and thin beds of detrital limestone. Most fossils extracted by him were found in the lower part. Possibly the lowermost part of this "lag 1" instead belongs to the Lunnarna Member as defined here. The rest of the beds form a distinct unit (compare Grönwall 1897:17, where he notes that Eichstädt's subdivision was easily identified). At the type locality the beds are similar in appearance; however, they seem to be more fossiliferous and they include limestone beds thicker than those at Klinta 6.

Thickness – At Klinta the beds are about 10 m thick (Eichstädt 1888, see above).

Age – The *Pelekysgnathus dubius* fauna continues up into this member and occurs at Klinta 6. At Bjärsjölagård 1, where the top of the member is exposed, both this and the succeeding *Ozarkodina excavata* fauna are present. The latter fauna occurs in the Lower Whitcliffian of the Welsh Borderland (Jeppsson 1975). On Gotland, the lower part of the Eke Beds is of the same age. Probably the lowermost part of the member correspond in age to the very uppermost part of the Hemse Beds. (The lower boundary of the member is within the range of the *P. dubius* fauna which is present in the topmost part of the Hemse Beds; Jeppsson 1983).

Bjärsjö Member

Older designations – At Klinta these beds are known as "lag 2" of Eichstädt (1888), or the middle part of Grönwall's "lag 1" (Grönwall 1897). At Bjärsjölagård they have been included in Grönwall's "lag 1a".

Derivation of name – See under Bjär Member.

Type locality – Bjärsjölagård 1. The lower boundary at 2.34 m in our measured section is distinct, but the upper boundary is more difficult to define. Considering the fact that the strata below 5.98 m, the highest level sampled, only include the oldest conodont fauna found in these beds it is likely that the soft shale above 5.98 m only represents a minor intercalation like those soft beds found at Klinta (e.g. above 4.14 m at Klinta 3).

Other localities – Klinta 5, 3, 2, 4, Bjärsjölagårdborrningen 1 and 2, and the strata below 1.94 m at Klinta 1.

Description – The Bjärsjö Member differs from the underlying beds in the high frequency of hard calcareous mudstone beds, many of which include limestone beds and lenses. The frequency of these beds and lenses varies much. Groove casts occur on the lower surface of some of the hard beds. These casts are casually filled by detrital limestone, whereas the rest of the bed consists of a calcareous mudstone, locally replaced by detrital limestone.

Thickness – Eichstädt (1888) gave the thickness of his "lag 2" as about 45 "fot" (=13.4 m) at Klinta. With the most probable correlation of our sections, 14.6 m below the top are represented in them. At Bjärsjölagård only the basal 4.1 m could be measured.

Age – At Klinta the member contains the *Ozarkodina excavata* and the older as well as the younger *O. steinhornensis scanica* conodont faunas. Of these, only the *O. excavata* fauna is as yet known from the Welsh Borderland, where it occurs in the Lower Whitcliff Beds (Jeppsson 1975). On Gotland the middle and upper parts of the Eke Beds are of the same age as the Bjärsjö Member.

Bjärsjölagård Limestone Member

Older designations
"Lag 1 b" (Grönwall 1897), possibly also parts of "lag 1 a"
Sphaerocodium limestone (Hadding 1933, 1958)
Bjärsjölagård Limestone (Jeppsson 1975, Larsson 1979).

Type locality – Bjärsjölagård 2.

Other localities – Bjärsjölagård 1, between 92 m (83 m in the southern wall) west of the bridge and 237 m east of it, except in the southern wall between 96 and 150 m; Bjärsjölagård 3; Elestorp 1; Tullberg's description of Tullesbo 1 indicates that at least parts of the beds at that locality also belong here. Similarly, Alestatorp 1 can be included. The member is thus only known from the Bjärsjölagård-Övedskloster area.

Description – The member is characterized by an abundance of limestone beds. However, mudstone is also important. Many of the limestone beds are dominated by smooth nodules and *Girvanella* nodules. *Girvanella* is absent from other parts of the Öved-Ramsåsa Group, except for Eichstädt's layer 3 at Klinta (Grönwall 1897:50) at a level that may be correlated. However, also other kinds of limestone occur, e.g. bryozoan limestone (e.g. Bjärsjölagård 1 at 90 m west of the bridge), stromatoporoid limestone (Bjärsjölagård 1 at 42 m west of the bridge and at Elestorp 1), and crinoid limestone (at Alestatorp 1).

Thickness – In Bjärsjölagårdsborrningen 1 and 2 the member occupies an interval of 24.9 m (Larsson 1979, Fig. 70). To get the true stratigraphic thickness the figure must be corrected for the dip.

Age – At Bjärsjölagård 2, the upper part of the Bjärsjölagård Limestone contains the *Ozarkodina wimani* conodont fauna (Jeppsson 1975:11). On Gotland *O. wimani* is now known to range down into the basal Burgsvik Beds. The oldest *O. steinhornensis* with alternating denticulation has been found in the Hamra Beds, unit b (i.e. middle part of the Hamra Beds, Jeppsson 1983:137) but older ones might be found. None has been found in the Bjärsjölagård Limestone. Thus, the Bjärsjölagård Limestone can probably be correlated with parts of the Burgsvik Beds. A find of *O. wimani* from the Upper Whitcliff Beds was published recently by Aldridge (1985).

Öved Sandstone Formation

Older names
Öfvedsklosters sandsten (Hisinger 1834, 1837a)
Öfveds sandsten (Hisinger 1842, Erdmann 1872, Lundgren 1874, Grönwall 1897).
Ramsåsasandsten (Munthe *et al.* 1920)
Öved Sandstone (Hadding 1927:27, Jeppsson 1975, Bergström *et al.* 1982).

Type locality – Helvetesgraven 1 (see below) in the Bjärsjölagård-Övedskloster area.

Other localities – Ramsåsa 8 (F), Branstadholm 1, earlier also exposed at Klinta, but no exposure remains in the Ringsjö area.

Boundaries – As discussed earlier a subdivision of the sandstones based on their colours is doubtful. Our locality Branstadholm 1 seems to be the only one where grey, presently yellow-weathering sandstone has been found *in situ* (compare Grönwall 1897:211). Grönwall (1897:212), included such sandstones in the Öved Sandstone. Usually, however, the informal term "Öved sandstone" seems to have been restricted to only the red sandstones (cf. Törnebohm & Hennig 1904:67). There seems to be good reasons for a wider concept of the "Öved Sandstone".

The section in Övedsklosterborrningen 1 (Skoglund in Sorgenfrei 1969) indicates that several sandstone beds alternate with shale units and that the sandstone units from being very subordinate become dominating (below 80 m to the bottom at 118 m there is only one, three metres thick sandstone unit; between 43 and 80 m there are three sandstone units, altogether 12 m thick; between 29 and 43 m two sandstones, altogether 11 metres; and between 29 m and the base of the Quaternary at 5 m no shale is marked). In the Klintaborrningen 1 (Skoglund in Sorgenfrei 1969) there is a sandstone between 95 and 90 m, then shale and mudstone up to 12 m and finally sandstone below the five metres of Quaternary. The stratigraphic thickness is less since the strata are not horizontal. However, even after correcting this thickness the shale and mudstone are about 3 times thicker than Eichstädt's unit 5, which according to him and Grönwall (1897) separates the red and white sandstones. Probably an unknown fault occurs in either Eichstädt's or Skoglund's section. However, both sections agree in having only one sandstone unit below the red sandstone and in having a transition which is not gradual like that in Övedsklosterborrningen 1 and 2. In the Ramsåsa area the transition seems to be more similar to that of the Övedskloster boreholes. Thus, when defining the uppermost formation of the Öved-Ramsåsa Group, the Öved Sandstone, we have four alternatives.

(1) To include only the uppermost thick sandstone unit. This would cause problems in identifying all small exposures (two of the lower sandstones in the Övedsklosterborrningen 1 and 2 are about seven metres thick).

(2) To arbitrarily draw a boundary where the amount of sandstone is e.g. 50%. The problems of identification are still larger than in alternative (1).

(3) To include the primarily red-coloured beds, if such exist. As discussed below that alternative would require a proof of a primarily red colour of the included beds and an identification of the primarily red beds as such in all localities.

(4) To include all beds above the Klinta Formation in only one formation. That formation would be mappable since the faunas would help in identifying smaller exposures. The main drawback is that it would include too much, and that the problems of subdividing the beds would reappear when members were to be identified.

At the present the fourth alternative seems to be the best. The next question is whether this formation should be called the "Öved Formation" or whether Öved as a place name should be used only for the upper member. We have used the place name Öved for the formation. As far as the definition of the upper boundary of the Öved Sandstone is concerned it should be mentioned that a contact to overlying rocks has not been seen or described. However, it is generally assumed that the Triassic Kågeröd Formation directly overlies the Silurian Öved-Ramsåsa Group (or older units when the latter is destroyed by erosion).

Description – Grey sandstones and shales with subordinate thin limestone beds. The sandstones weather to a rusty yellow colour unless they have weathered red earlier. The limestone beds contain marine fossils, as do many sandstone samples, but other levels may well be non-marine. A shallowing upwards is indicated by an increasing importance of bivalves among the macrofossils.

Thickness – A conservative estimate yields slightly more than 100 m. In the core from Övedsklosterborrningen 2 the dikes may indicate a repetition of the sequence. The sequence of shale and sandstone between 100 and 130 m below sea level is closely similar to that between 42 and 72 m below sea level. If there is no repetition this formation may be at least about 200 m thick.

Remarks – The name Öved sandstone was coined 144 years ago (1842) and is probably one of the oldest formational names still in use in Swedish geology, conforming with the guidelines of stratigraphic nomenclature.

Red-colouration in the Öved-Ramsåsa Group

Sandstones and siltstones of many different colours occur in the Öved-Ramsåsa Group. Most earlier publications refer to slabs collected in local till or in glacially disturbed beds. Some of these sandstones change colour more than once during weathering. The slabs in the till are often weathered through, and thus the first of these weathered colours can be mistaken for the colour of the sandstone as unweathered. Sandstones of different colours can obtain the same weathering colour but other varieties can instead become different during weathering. Most published data on the colour of a particular lithology do not include information on whether it refers to the weathered or to the unweathered state. Further, many of the reported localities are based on blocks in the local till; e.g. Grönwall (1897:211) showed that Tullberg's (1882a:13, 1882b:25) "Kärrstorps sandstenar" (260 m of red, white and grey sandstones intercalated by thin layers of shale and limestone) were based on such occurrences. Together these uncertainties make it very difficult to evaluate most of the records published on these sandstones.

At Branstadholm 1 a slightly bluish grey siltstone occurs. The upper beds have rusty yellowish surfaces and this weathering colour penetrates several centimetres into the uppermost beds and less in the lower beds. These *in situ* beds were overlain by deeply weathered, rusty yellowish, glacially disturbed beds. Slabs of the same colour are locally abundant in the till. These and all reported yellow sandstones may very well derive from grey beds of the colours found at Branstadholm 1. Probably also the "white sandstone" is only a weathered, grey sandstone, since at least some of the yellow-weathering grey sandstones obtain white surfaces during weathering.

Haematite red and other shades of red and brownish sandstones, siltstones, shales, and subordinate limestones are also well known in the Öved-Ramsåsa Group. The present climate of the area is not such that haematite is formed during weathering. In spite of that, at Ramsåsa 8 (F) thick beds of dense lithologies may have a distinctly less red core (compare Grönwall 1897:222, reprinted in Moberg & Grönwall 1909:12), indicating that at least parts of the red appearance is a result of Recent weathering. Similarly, beds at Klinta 2 and 4 change from shades of grey to red and brown colours. The explanation must be that the present weathering alters grey and black minerals, whereas the haematite is more stable. Its colour is thus unmasked or combined with that of newly formed rust-coloured minerals.

The red or brown colour of at least some of the beds is thus secondary but based on an older pigment. In several beds haematite is not the only iron mineral. In the heavy fraction from the conodont studies, pyrite is the dominating iron mineral in samples from Klinta, but subordinate grains of specular haematite (steel grey to black metallic crystals) occur in some samples. The pyrite is clearly secondary (often replacing or lining fossils). Thus, during early parts of the diagenesis the environment in the lime sediment-limestone was strongly reducing.

Most studies of the formation of red beds discuss nonmarine beds (for a review see, e.g. Van Houten 1973). However, the beds discussed here contain marine fossils, e.g. echinoderms, brachiopods, trilobites, and conodonts. A few kinds of primary red marine deposits are known to form today, but the appearance of the Öved-Ramsåsa Group does not agree well with any of them. Neither do their palaeogeographic setting agree with those red deep sea sediments discussed by Ziegler and McKerrow (1975). The red colour of marine beds is usually not inherited from the sediment-producing area, as the red pigment is destroyed during the marine transport (Hintze & Meischner 1968). Thus the red pigment can hardly be ascribed to as primarly formed under the influence of an early, local Old Red climate (compare Van Houten 1973:51), as has been done. The unlikeliness that detritial haematite is incorporated in the sediment should be added to the issue discussed above, viz. that these sediments have passed through a strongly reducing diagenetic stage when pyrite was formed. Alternatively, also the red pigment is secondary and formed after the pyrite during continental conditions (Late Palaeozoic beds are absent in the area). Further indications of this are discussed below.

In the grey limestone at 1.36–1.42 m at Klinta 4, there are haematite-coloured calcite-veins (healed fractures). As noted above, many beds at Klinta 2 and 4 turn brown during weathering. These beds may have been below ground level where the weathering only affected the most susceptible of the existing rocks and these only incompletely. Different iron minerals would differ in stability, and each particle may be more or less completely altered. If the calcite that healed the fractures was formed contemporaneously with the weathering, then there was no old mineral in it that resisted colour alteration; thus the veins turned bright red.

Furthermore, there are some indications of secondary haematite formation in the red sandstone. In these the calcium carbonate shells may not only be stained red, but can be more or less replaced by haematite (the original replacement mineral may have been pyrite, i.e. the same as still found in the samples from Klinta).

In addition, one of the sandstone varieties at Helvetesgraven 1 is not evenly red but finely mottled white and red. Under a microscope the red mineral is found as minute grains in the spaces between the sand-grains, forming very irregular, small stained spots in a white micaceous sandstone (compare Turner 1979:291). There is no way in which such a colour distribution can be primary, so the red spots must have formed secondarily, each spot being formed by the weathering of one or a couple of iron-containing larger grains (compare Turner 1974).

In the heavy fraction from the red bone beds and limestones dissolved in connection with the conodont studies, much of the haematite occurs as specular crystals (specular haematite, compare Turner 1979:292).

It is well known that the Silurian change to red-coloured sediments occurs at very different stratigraphic levels in different areas. Thus, e.g., the Ludlovian sediments in the Oslo region are red, whereas the limestones in the Baltic are grey throughout most or all of the Pridolian. However, the evidence presented above regarding beds in Skåne should make us expect variations also within that area, as the red colour would depend less on the stratigraphic level than on the local amount of denudation and on the porosity of the beds. Within the areas where the Öved-Ramsåsa Group is still preserved, lack of exposure and good datings make it difficult to prove that the red colour penetrates to different stratigraphic levels at closely located localities. However, at Klinta in the Ringsjö area (Fig. 5) some of the beds of the Bjärsjö

Member of the Klinta Formation are slightly affected by the red weathering (see above), but in the Bjärsjölagård-Övedskloster area only the upper part of the Öved Sandstone Formation is known to be affected, except for a red soil on top of the Bjärsjölagård Limestone at Bjärsjölagård (Thomé 1932).

In areas where the Öved-Ramsåsa Group is absent, the otherwise grey Colonus Shale is red-coloured at some exposures (Moberg 1895:5–6, footnote). Moberg (1895) described one such locality with an unusual fauna at "Munka-Tågarps profilen". Here the shale is light red, in places bluish grey (Moberg 1895:5). This description seems to indicate that the relationship between the colours is the same as that in, e.g., Ramsåsa 8 (F), i.e., the red colour results from weathering (cf. Törnebohm & Hennig 1904:69, footnote). Hede (1915) showed that at another locality (675 m NE of Tolånga church) the same fauna occurred in grey shale together with graptolites, i.a. *Monograptus nilssoni.* Earlier this red shale had been correlated with the upper parts of the Öved-Ramsåsa Group because of its colour. Later Moberg (1904) interpreted the red colour as secondary and related to the proximity of Keuper red beds.

The diabase dike at Frualid (700 m W of Helvetesgraven 1) is reddish brown, because the magnetite has weathered to haematite (Tullberg 1882b:33, Törnebohm & Hennig 1904:82, Veldi 1951). The diabase dike at Helvetesgraven 1 is as red as the sandstone (Veldi 1951:13).

Thus, within Skåne beds ranging in age from early Ludlovian to Pridolian are found to be more or less incompletely red-weathered in places, and so are some Carboniferous-Permian dikes. The following sequence of events is probable: Most or all of the beds were formed as grey beds and due to strongly reducing conditions in early diagenesis pyrite was formed. Later, probably in connection with continental weathering haematite was formed. The more porous beds may have become red, other beds only tinted red, and some may have remained unaffected (see below). Recent weathering unmasks this red colour and changes beds unaffected by the red weathering to rusty yellow. It cannot be excluded that the uppermost beds were red initially, but evidence for this is lacking, and as the beds are marine as far as known, it is less likely.

At i.a. Helvetesgraven 1 red, brown and grey beds alternate (Törnebohm & Hennig 1904:68). Some of the beds may be grey, because their red pigment may not yet have been unmasked. Other beds may have remained unaffected by the red weathering. Much has been written about the origin of alternating red and drab beds, and the patchy red colouring of some beds. Modern reviews are found in, e.g., Van Houten (1973) and Turner (1974, 1979). The alternation of red and drab beds indicates that the intensity of at least one of the required factors varies, probably due to fluctuations in the rate of sedimentation. This crucial factor is neither the amount of inherited red pigment (for a discussion, see Hintze & Meischner 1968) nor the amount of iron in the beds (e.g. Jaanusson 1972, compare also Van Houten 1973:42). Lewis & Schwertmann (1979) studied the effect of the amount of aluminium available and showed that this factor is important for forming haematite, and so are the pH and Eh. To our knowledge nobody has shown so far whether or not variation in one of these factors causes the selective red colouration of the beds. However, we do not consider the colour alteration of beds at e.g. Helvetesgraven 1 (see Törnebohm & Hennig 1904) as indicating a synsedimentary colouration of these beds (see discussion above; compare also Hintze & Meischner 1968).

In Denmark late Silurian red beds are known from the two boreholes, Nøvling 1 and Rønde 1 on Jylland (Rasmussen 1972, Christensen 1971a:11, 1973). Grey and red Silurian beds are also found in the boring Slagelse 1 (Sorgenfrei & Buch 1964:75). The beds at Nøvling are closely similar to those at Ramsåsa 8 (F) (Christensen 1971a, 1973, Rasmussen 1972:45, 1973:15, 27) and have been referred to the "Öved-Ramsåsa serie" (Rasmussen 1972:45). Basalt interpreted as extrusive was met with at a couple of levels in the Silurian. Like the sediments, the basalts were strongly red-weathered (Jacobsen 1973). The age of this basalt is thus crucial for dating the red-weathering.

Volcanic units are known from pre-Zechstein beds in several deep wells in Denmark (e.g. Rødby 2, Rønde 1, Nøvling 1) and from the Danish part of the North Sea (Nordsøen 1, 2, 3, 4) (Larsen 1972). Larsen (1972) has radiometrically dated three of these to early Permian (or latest Carboniferous), viz. Nøvling 1, Nordsøen 1 and 4. The others give lower "K-Ar ages", but from their stratigraphic location Larsen (1972) dated them as pre-Zechstein. The volcanic rock from Rødby was interpreted as an extrusive lava, and thus its stratigraphic level can be used. To our knowledge none of the volcanic rocks are known to penetrate into the Zechstein or younger beds. Because of the low density of the Zechstein salt compared to the magmatic rocks, however, younger igneous rocks may well be expected to form sills in older beds instead of continuing upwards as dikes. However, in the light of the large spread usually found in K-Ar dates, we find Larsen's conclusion well founded, viz., that the post-Permian K-Ar dates are too low.

In Scandinavia outside the Caledonides, there is only one well-known wide-spread volcanic episode in the Palaeozoic, viz., in the (latest Carboniferous?-) Early Permian. Volcanites of this age are known from Rügen (Albrecht 1967:155), from Skåne, southernmost Halland, Västergötland, Bohuslän, and northern Dalarna in Sweden (Bylund & Patchett 1977), from the Oslo area and southernmost Norway, and from deep wells in Denmark and the North Sea (Larsen 1972). In spite of this, e.g. Larsen (1972), Christensen (1973:151) and Jacobsen (1973:162) accepted the interpretation of the volcanics from Nøvling and Rønde as extrusive Silurian and invoked a Permian regional heating to explain the fact that none of the volcanics gave such high ages.

The maximum temperature to which the area has been subjected can be deduced from the colour of the conodont elements. Epstein *et al.* (1977) calibrated the colour changes in the conodont elements and described a Conodont Alteration Index. The higher the CAI value, the higher the temperature. Conodont elements have been extracted from a limestone only about 40 m above the highest volcanic unit in Nøvling 1 (Hansen 1973). From the present temperature of the beds (about 95°C according to Henriksen 1973), the known accumulation rate of the overburden (presently about 3540 m thick) and assuming an unchanged temperature gradient, the conodonts would be expected to be between CAI 2 and CAI 3. A regional heating to 200°C during a few Ma would give a colour close to CAI 4 alone, and the following time of lower temperatures up to the present would have raised it further. The conodont elements found have a colour between CAI 2 and CAI 3. Thus a regional heating in the early Permian, which could reset the K-Ar clock, is excluded. Two other explanations should be discussed instead.

(1) It is a very thin Permian dyke with a dip nearly parallel to that of the Nøvling borehole. As such it could have been chilled rapidly, and its extension upwards outside the borehole could have caused the slight extra heating permitted by conodont colouration.

(2) It is a Permian extrusive. Faulting and/or slumping in Permian time caused the present alternation of the beds.

Of these the first alternative seems most probable.

The red Silurian beds with the red-weathered basalt in Nøvling are overlain by Zechstein salt. Thus, at least the red weathering of the basalt is bracketed to the Permian by the age of the basalt and that of the salt. It cannot be excluded that the Silurian beds already were more or less red-weathered at that time. However, it seems plausible that the relief of the landscape caused by Permian faulting would create a favourable local climate and that the relief together with the faulting and jointing of the bedrock would permit the weathering to affect locally the beds deep below the surface.

Several localities with red-weathered beds do have a close relationship to major Carboniferous-Permian faults. The Munka-Tågarp, Ramsåsa and the Bjärsjölagård-Övedskloster localities are all close to the Tornquist Line (cf. Grönwall 1897:47). An area SW of this line has been lifted up, apparently in Permian or Triassic time and lost most or all of its cover of Palaeozoic beds. Later, all of it except for some minor horsts have been downfaulted again (in late Cretaceous time, Norling & Bergström, in press) and are now covered by Mesozoic sediments. In the Ramsåsa area, there is a 50 m wide basement horst between the areas with Mesozoic and with red-weathered Pridolian beds (Moberg & Grönwall 1909). The red-weathered beds are found within 2 km E of this horst. At Munka-Tågarp, there is a less than 200 m wide horst with basement and Lower Cambrian. Grey Silurian beds occur 200 m S of it, and red beds 20 m further to the SW and separated from vertical Mesozoic beds by a fault (Moberg 1895:4). The Bjärsjölagård-Övedskloster area is bordered to the SW by Torpaklint, an about 1.3 km wide (Regnéll 1960:33) and more than 6 km long horst (Bergström & Shaik 1982). Red beds occur up to c. 1.5 km NE of it. The borehole Nøvling 1 is on the north flank of the Ringkøbing-Fyn High (Rasmussen 1973:27), i.e., in a similar position as the Munka-Tågarp, Ramsåsa and Bjärsjölagård-Övedskloster areas had before the late Cretaceous down-faulting of the area SW of the Fyledal Fault (Norling & Bergström, in press). The locality Rødby is situated on the southern slope of the Ringkøbing-Fyn High, and the red beds at Klinta are within a few km SW of the Ringsjö fault. The occurrence of red beds is patchy probably because of variable permeability and fracturing of the rocks in the Klinta and Bjärsjölagård areas.

Superficial beds, red-weathered during the Devonian, would have been eroded away during the following geological periods. Similarly, traces of late Carboniferous humid climate remain to be found. The patchy occurrence of red-weathered rocks indicates that most traces of the Permian red-weathering episodes also have been lost. Only where it would penetrate deep, e.g., adjacent to dikes, faults or joints, small areas of affected bedrock remain. A Carboniferous-Permian dike dissects the Öved Sandstone at Frualid, some hundreds of metres W of Helvetesgraven 1. This dike is vesicular and so are some of the boulders at Skartofta 2 which indicates that the rock was formed at a very shallow depth, probably less than some tens of metres below the ground level at the time of intrusion. The fact that this shallow part of the dikes and that the Öved Sandstone at Helvetesgraven still are preserved in spite of the extensive erosion known to have taken place in Skåne (Lidmar-Bergström 1982) indicates that they were covered by Mesozoic beds and remained covered probably well into the Quaternary.

In most places the (remaining) thickness of the affected beds is only a few tens of metres. Only at Helvetesgraven 1 and at Nøvling 1 the red-weathered beds are known to be thicker. A diabase dike cuts through Helvetesgraven 1 (Törnebohm & Hennig 1904:84, Veldi 1951). The jointing connected with it may have contributed to local deep-weathering. There are 75 m of weathered beds (if the boundary between the Ludlovian and Downtonian in the core of Övedskloster Bh 1 is drawn below the lowermost red level by Skoglund in Sorgenfrei 1969). At Nøvling 1 the sedimentary and volcanic rocks are red-weathered to a depth of at least a couple of hundred metres. At Nøvling there is also either one dike approximately parallel to the hole and hit several times, or several dikes, assuming that the thickness of the red beds was not caused by faulting or slumping. Thus, the deep weathering of the red beds at Nøvling 1 is also related to a dike.

It is beyond the scope of this publication to try to trace the extension of this episode of red-weathering and its other effects in other areas. However, we note that in areas where the sub-Cambrian peneplane lacks traces of having become red-weathered in Sweden, this is an indication of a substantial thickness of lower Palaeozoic beds remaining here at least to the end of the Permian (in Västergötland the intrusive diabase supports this conclusion too). Further evidence for a much longer persistence of such a cover is the fact that the sub-Cambrian peneplane is preserved over wide areas in south Sweden. Haematite-red Precambrian rocks are well-known, and from a cursory study they seem to be most abundant in areas where the sub-Cambrian peneplane is destroyed. Whether this is a coincidence or indicates that some received their colour in Permian or Triassic time remains a guess. In Great Britain Devonian red beds yield Permain-Triassic magnetic pole positions because of red-weathering during that time (Turner 1979:297).

The conclusion reached here effects also palaeomagnetic studies (compare Turner 1979). Both in N America and in Great Britain lower Palaeozoic beds have been found often to have Permian poles (for a summary and references, see Turner 1979:297). In Sweden Claesson (1978, 1979) encountered problems when trying to define an Early Palaeozoic polar wandering curve.

There is still another indication showing that the Öved-Ramsåsa Group was at such a level below the ground surface in the early Permian that its strata should be susceptible to weathering. The conodont elements from the Öved-Ramsåsa Group (Jeppsson 1975) show only a very slight thermal alteration, that is, they are still very close to a CAI value of 1 (they are closer to 1 than to 1.5). This is noteworthy since Bergström (1980) reported CAI values of 4–6 in his Ordovician samples from Skåne. The highest value was found very close to a dyke, but even the other values, mostly 4.5 or higher indicate a heating to 190–400°C (Bergström 1980) while the Öved-Ramsåsa conodont elements have not been heated to above 80°C. Only a few conodont elements are available from the Colonus Shale (from Skarhult and Skillinge) but they have a CAI value of at least 2. Conodont elements from the youngest graptolitiferous beds in Pinedalen, (S of Lunnarna) have about the same CAI value as those from the Öved-Ramsåsa Group. Even if the Ordovician values are not based on conodont elements taken directly below the Silurian ones, they are distributed in such a way in Skåne that there are reasons to believe that CAI values from Ordovician strata directly below the studied Öved-Ramsåsa Group would be about the same as those reported by Bergström (1980). Thus, combined with those reported here, they indicate a very steep thermal gradient up to the ground surface in connection with the injection of the dikes. Since the effects on the conodont elements from the Öved-Ramsåsa Group were negligible the conclusion is that this group formed the local bedrock surface at that time (thus any latest Silurian to late Carboniferous sediments had been removed again). In such a position it would be expected to have been affected by deep weathering when the beds were faulted.

Summing up, there is no evidence for considering the red colour of the Late Silurian beds in Skåne and Denmark as "early Old Red" which has been done earlier. On the contrary, available evidence indicates that the colour is of "New Red" age (or even younger) and contemporaneous with the red-weathering of Carboniferous-Permian dikes.

Localities and measured sections

The Öved-Ramsåsa Group is known from the following three areas:

The Bjärsjölagård-Övedskloster area – The area is situated at about N55° 42' and E13° 40' of Greenwich. The localities studied are found on the topographical map sheet 2D Tomelilla NV ("Version 1", printed 1964), and the geological map sheet Aa 86 Övedskloster. They are all within an area which is about 5 km in N–S direction and 7 km in E–W.

The Ramsåsa area – This area is situated at about N55° 33' and E13° 53' of Greenwich. All the classical localities are found in a narrow, about 2 km long E–W strip, most of them in the valley of Trydeån. Topographical map sheet 1D Ystad NO och 2D Tomelilla SO ("Version 1", 1964). Geological map sheet Aa 142 Sövdeborg. The localities were described and lettered by Grönwall in 1897. In 1979 Larsson introduced a numbering system for these localities.

The Ringsjö area – The area is situated at about N55°51' and E13° 30' of Greenwich. Topographical map sheet 2D Tomelilla NV ("Version 1", 1964). Geological map sheet Aa 92 Lund. The localities studied occur in an area which is about 4 km in N–S direction and 1–2 km in E–W.

ALESTAD 1, 61783 13700 (VB 207 756), 750 m NE of Ö. Kärrstorp church. Bjärsjölagård-Övedskloster area.

Boulders on the field immediately N of the railway, S of the hamlet Alestad, 900 m SSE Alestadtorp. Nowadays there are no traces of the limestone quarry mentioned in the description to the geological map (Tullberg 1882b:29) and marked on the map as a sandstone exposure.

In the field there are boulders of a bluish grey crinoid limestone. The crinoid ossicles are more than 20 mm in diameter and separated. The matrix is silty, argillaceous and dolomitic. According to Tullberg 1882b:29 the limestone boulders are rich in corals, but Grönwall (1897) found crinoid limestone similar to that of the Bjärsjölagård quarry. (We know that Tullberg himself never saw the limestone boulders.)

Sample: Alestadtorp.
Klinta Formation, Bjärsjölagård Limestone Member.
References: Tullberg 1882:29, Grönwall 1897:26, Jeppsson 1975:50.

ARASKOGA 1, 617642 136850 (VB 192 735), 2.75 km SSW of Ö. Kärrstorp church. Bjärsjölagård-Övedskloster area.

Five metres S of the road and 200 m E of Kullagården dumped excavated material including large slabs (over 1 m across and up to 0.5 m thick) was brought together during ditch works (see Branstadholm 1). They probably derived from glacially disturbed strata a few hundred metres from the place. Limestone was absent as were all kinds of red rocks. Grey, more or less rust-weathered mudstones and sandstones dominated.

ARASKOGA 2, 617656 136822 (VB 1895 7365), 2.7 km SSW of Ö. Kärrstorp church. Bjärsjölagård-Övedskloster area.

Five metres S of the road, 25 m NW of Kullagården, there was a temporary heap of stones adjacent to a refilled ditch. Mudstone dominated, but a few pieces of at the most 20 cm thick limestone beds were also found.
Sample: Sk 80-2, a limestone slab.

BJÄRSJÖLAGÅRD 1, 617961 136801 (VB 1870 7672), 2.3 km NW of Ö. Kärrstorp church. Bjärsjölagård-Övedskloster area.

Ditch exposures and sections from 278 m NW to 250 m SE of the road from Bjärsjölagård to the main road between Hörby and Sjöbo (road 13).

Reference points: The northwestern edge of the bridge for localities NW of the bridge and the southeastern edge for those SE of the bridge. The distances are measured along the ditch.

Klinta Formation, Lunnarna, Bjär, Bjärsjö and Bjärsjölagård Members. *Age:* Ludlovian, late Leintwardinian to late Whitcliffian.

References to the Bjärsjölagård area in general: von

Bromell 1728, Wahlenberg 1818:13, Hisinger 1828:187, 1837a:162, 1837b:81, Murchison 1847, Angelin 1854:8, 1877, Roemer 1856, Erdmann 1872:5, Angelin & Lindström 1880, Tullberg 1883:232, Törnebohm & Hennig 1904:67, Hadding 1929:191–2, Nathorst 1884, Regnéll 1960.

References: Tullberg 1882a:24, 1882b:13, Eichstädt 1888:142, Grönwall 1897:206, Martinsson 1967:371, Mori 1969:44, Jeppsson 1969:18, 20, 1972:55, 63, 1975:10, 1976:107, 1982:24, Carls 1977:29, 30, 33, Larsson 1979:180 and in Bergström *et al.* 1982:73–74, Kato & Ezaki 1986.

Description of the exposures and measured section: The ditch is covered beyond (upstream) of 278 m NW of the bridge. There are two small exposures in the most distant part of the ditch, the direction of which is N63°W. See Fig. 6 for section.

261 m Shale, thinly fissile and a few silty, hard beds, up to 0.5 m thick. Bj 67-47 from 0.40–0.50 m above water level. *Klinta Formation, probably Lunnarna Member.*

249 m Limestone, one 0.1 m thick bed, light grey, silty and rich in mica. Fossils: chonetid brachiopods. Bj 67-46 from 0.95–1.05 m above water level. *Klinta Formation, probably Lunnarna Member.*

Between about 240 and 170 m NW of the bridge, the direction of the ditch is N60°W. There is a small stand of ashtrees at 180 m. Probably the beds consist of soft shale with a few harder beds, which are the only ones accessible without digging.

237 m Limestone, fine–grained and lacking macrofossils. Bj 67-45 from 0.40–0.50 m above water level. *Klinta Formation, Lunnarna or Bjär Member.*

219 m Limestone, one bed, fossiliferous. Bj 67-44 from 0.45–0.50 m above water level. *Klinta Formation, probably Bjär Member.*

208 m Limestone, one bed, fossiliferous. Dip 11° N150°E. Bj 67-43 from 0.25–0.30 above water level. *Klinta Formation, Bjär Member like the exposures which follow.*

197 m Limestone, one bed, fossiliferous. Bj 67-42 from 0.03–0.10 m above water level.

187.5 m Limestone, an 8 cm thick fossiliferous bed. The dip is very small. Bj 67-41 from 0.17–0.25 m above water level.

187 m Limestone, two beds, fossiliferous. Bj 67-40 from 0.35–0.40 m above water level.

178 m Bj 67-39 from 0.10–0.15 m above water level.

176 m Shale, in places very calcareous, with large lenses and beds of limestone.

Between 173 and 167 m the beds are disturbed.

Distance from bridge	Metres above water level	Metres above base of section	Symbol in the field notes
163	2.00	2.17 (−2.22)	1 a
150	1.15	2.34	1 b
150	1.00	2.17	1 a
149	0.90	2.17	1 a
138	1.40	3.70 (−3.82)	2
138	0.10	2.34	1 b
125	–	4.68	3
125	–	4.03 (−4.15)	hj
125	–	3.70 (−3.82)	2
121–122	1.35	4.68	3
121–122	0.25	3.70 (−3.82)	2
119	–	4.68	3
118	0.50	4.03 (−4.15)	hj
112	1.70	5.31 (−5.36)	vmb
112	0.00	4.03 (−4.15)	hj
108	1.30	5.31 (−5.36)	vmb
100	⩾0.25	–	vmb

Between 167 m NW of the bridge and the bridge, the direction of the ditch is N72°W.

Between 167 and 100 m there is a continous, at the most 2–3 m high exposure. During several years of field work, the following section was sampled, measured and painted at sevel levels in the southeastern wall (Fig. 6).

At least levels 1 b and vmb are easily identified even when the paint has disappeared. 1 b is in the lowermost bed of the Bjärsjö Member and vmb is on a bed divided in two by a ripple-marked surface.

The basal part of the section was measured at 167 m from the bridge:

0–0.10 m Shale.

0.10–0.13 m Detrital limestone, grey to greenish grey, fine-grained and fossiliferous (crinoid ossicles and brachiopods).

0.13–0.78 m Shale, regularly bedded, thinly fissile, medium hard and slightly calcareous.

0.78–0.83 m Mudstone, one bed, hard, grey and fossiliferous (e.g. brachiopods), in the upper part with lenses of fine-grained detrital limestone rich in beyrichiid ostracodes.

0.83–1.36 m Shale, thinly to medium fissile, soft and grey to greenish grey. At about 1.2 m there is a bed with abundant bivalves.

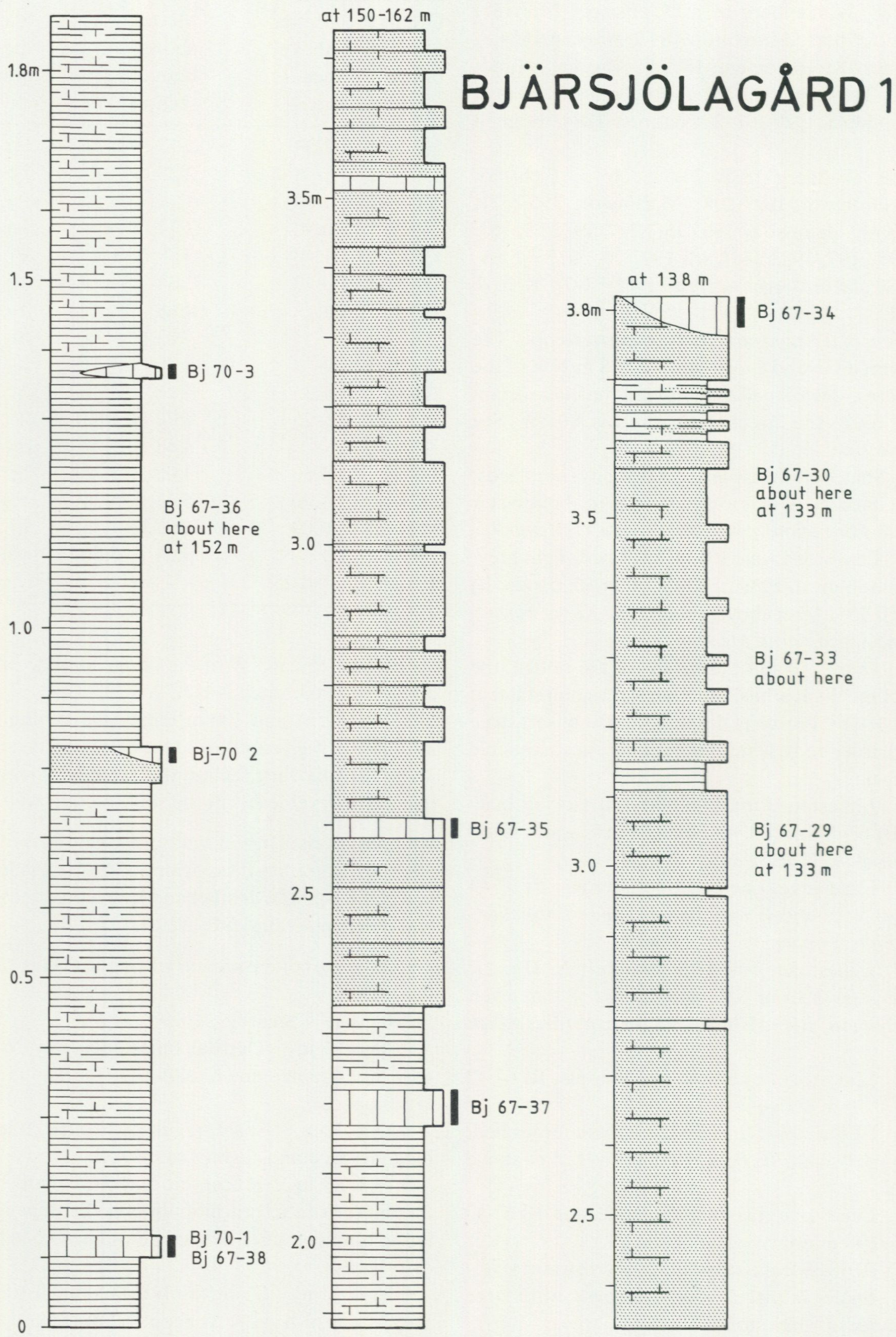
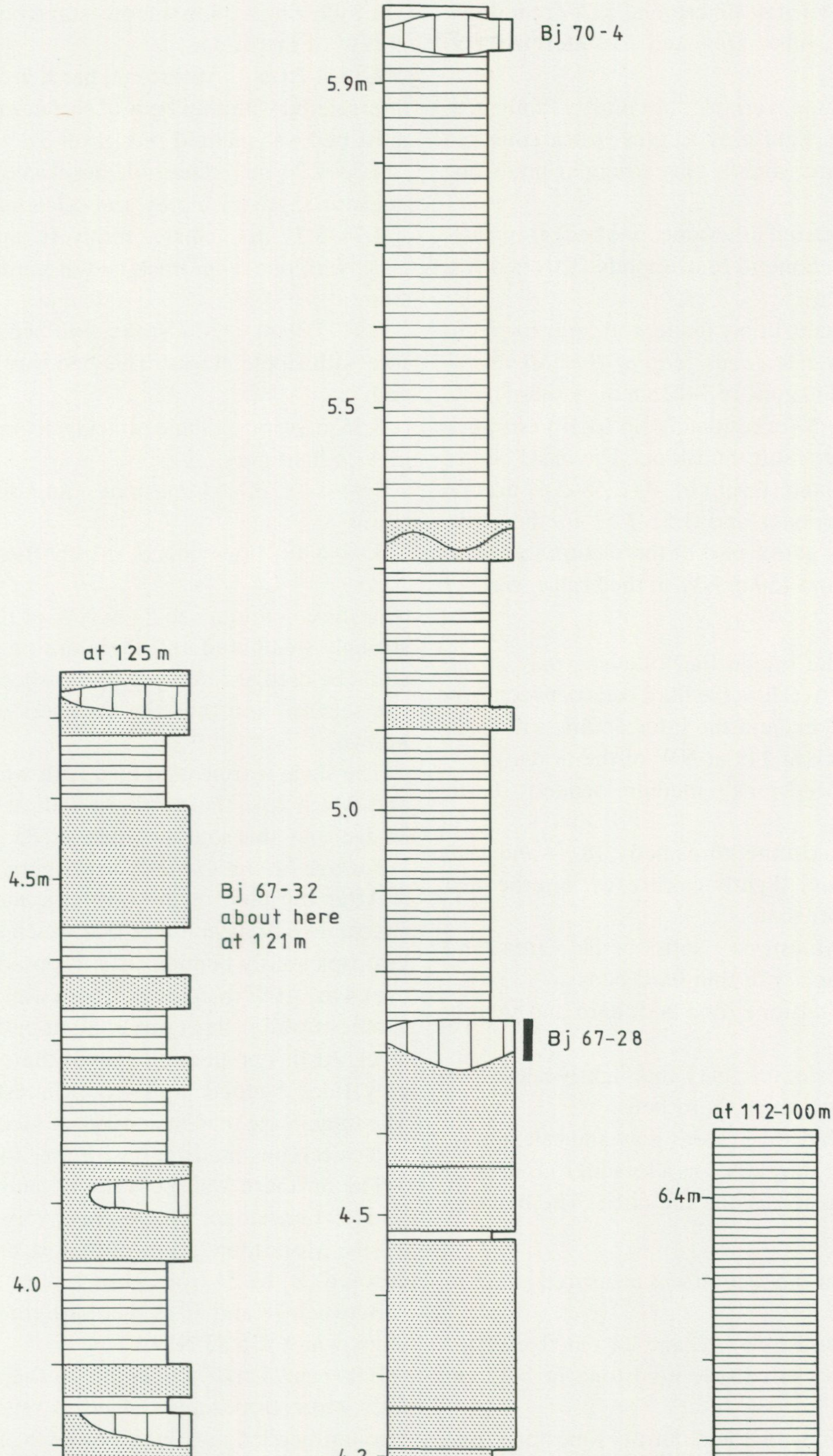


Fig. 6. Lithostratigraphy and sample levels at Bjärsjölagård 1. For details, see the text. See caption to fig. 7 for rock symbols.


Bj 70-4
5.9m
5.5
5.0
Bj 67-28
4.5
4.2
at 125 m
4.5m
Bj 67-32
about here
at 121 m
4.0
3.7
at 112–100 m
6.4m
6.0

1.36–1.37 m Detrital limestone, ≤20 mm thick lenses, grey to brownish grey and fossiliferous (e.g. crinoid ossicles).

1.37–2.17 m Shale, variable, but mostly thinly bedded, medium fissile, light grey to grey, calcareous and with a few harder and slightly silty irregular mudstone beds.

2.17–2.22 m Detrital limestone, one bed, grey, fine-grained and rich in chonetid brachiopods. This bed was painted red (level 1 a).

2.22–2.34 m Shale, thinly fissile, soft, grey to greenish grey and slightly calcareous. *Top of Bjär Member.*

2.34–3.79 m Mudstone in 3–12 cm thick, hard beds, intercalated by 1 to 5 (occasionally up to 10) cm thick beds of thinly bedded, soft mudstone. The basal bed of this unit was painted red (level 1 b). At 2.58–2.61 m (rich in chonetid brachiopods) and 3.51–3.53 m there are limestone beds. The above part of the section was measured between 167 and 150 m NW of the bridge. *Base of Bjärsjö Member.*

At 138 m NW of the bridge the following part of the section was measured. (Here the hard beds between 2.34 and 3.18 m are thicker, and the intercalating soft shale beds are thinner than at 149 m NW of the bridge).

2.34–2.77 m Mudstone, medium-bedded, hard, grey and calcareous.

2.77–3.18 m Mudstone, three beds, 18, 14 and 3 cm thick, hard, grey, and slightly calcareous, interbedded with thin beds of soft shale.

3.18–3.57 m Mudstone, soft, fissile, grey and slightly calcareous and with thin hard beds.

3.57–3.61 m Mudstone, one bed, hard and slightly calcareous.

3.61–3.70 m Shale, soft, grey and slightly calcareous and with up to 1.5 cm thick, hard beds.

3.70–3.82 m Mudstone, hard, grey and calcareous. The top of this bed is developed as a fossiliferous detrital limestone in many places along the ditch. The bed was painted red (level 2).

The following part of the section was measured at 125 m NW of the bridge.

3.70–4.03 m Mudstone, 12 and 14 cm thick hard beds, intercalated by soft fissile mudstone in 2–12 cm thick beds.

4.03–4.15 m Mudstone and detrital limestone, one hard bed that was painted red between 119 and 112 m NW of the bridge (level hj).

4.15–4.68 m Mudstone, shale, thinly to intermediately fissile, soft and grey, intercalated with 0.5–3 cm thick, hard beds.

The following section was measured between 110 and 100 m NW of the bridge.

4.15–4.70 m Mudstone, hard, in 5–12 cm thick beds intercalated with thin beds of soft mudstone. The uppermost bed was painted red (level 3).

4.70–4.74 m Detrital, argillaceous limestone and mudstone, greenish grey and calcareous.

4.74–5.31 m Shale, thinly to medium fissile and grey, with one 3 cm thick bed of hard, calcareous mudstone.

5.31–5.36 m Mudstone, two beds divided by a surface with ripple marks. This bed was painted red (level vmb).

5.36–5.94 m Shale, thickly to medium fissile and grey to light grey.

5.94–5.98 m Limestone, impure and with large fossils.

5.98–6.48+ m Shale, thickly fissile and soft.

The shale continues to 83 m NW of the bridge, but it is strongly weathered and there are no hard levels which could be used as reference levels when making a composite section, and thus the thickness of the shale is unknown.

The shale is truncated by a fault which dips 48°N41°E and which cuts the northern wall at 92 m NW of the bridge and the southern one at 83 m. *The following exposures belong to the Bjärsjölagård Limestone.*

After the fault in the northern wall, there is a biostrome-like bryozan limestone which is argillaceous and inconspicuously bedded. It is exposed to a thickness of over 4 m. At 83 m in the northern wall it thins out. In the southern wall it thins out at 80 m c. 0.8 m above water level. At this point and below it there is 0.30 m of dark grey, thick, bedded, argillaceous limestone rich in fossils. The underlying 0.50 m consists of medium-bedded, silty and calcareous mudstone with rare fossils.

The northern wall between 80 and 70 m NW of the bridge: Limestone, bluish grey, very silty and lacking fossils. More than 2.5 m of almost horizontal beds are exposed. Bj 67-24 from 71 m NW of the bridge.

Between 78 and 75 m there are three or more master joints which dip 85°N39°E.

Between 75 and 71 m in the southern wall: Limestone with stromatoporoids, slightly brecciated, thin- to medium-bedded, fine-grained and in places nodular. The beds are separated by very calcareous, thin mudstone intercalations. Bj 67-25 at 74 m NW of the bridge.

Between 70 and 66 m, the beds are strongly brecciated.

At 55 m there is a bedded (3–5 cm) mudstone. Bj 67-23 from 1.20–1.30 m above water level.

At 53 m there are two or more faults. NW of the faults, there is biostrome-like limestone with stromatoporoids, but it cannot be connected with the following limestone.

Between 53 and 26 m NW of the bridge there is a stromatoporoid biostrome. It reaches its maximum exposed size at 42 m in the northern wall, where it reaches 1.8 m above water level, while it is only 1 m thick in the southern wall. The ditch is thus cut in its southern flank. At 40 m its exposed height decreases to 0.30 m. The biostrome is dominated by stromatoporoids which occur in growth position in a silty and calcareous mudstone matrix. Mori (1969) described 3 new stromatoporoids from this biostrome. The beds above the biostrome show periclinal dips.

Above the biostrome there is 0.3 m medium-bedded, grey, silty and argillaceous limestone rich in bryozoans. Scattered crinoid ossicles occur. Upwards the limestone grades into a shale which is irregularly fissile, silty and calcareous. Sample at 40 m: Bj 67-21 from 1.20–1.30 m and Bj 67-22 from 1.80–1.90 m above water level.

At 26 m NW of the bridge 0.60 m of the biostrome is exposed. Above it, there is 0.60 m of dark grey limestone in about 0.2 m thick beds, rich in algal nodules.

At 26 m the beds are cut by a fault and the biostrome cannot be followed farther.

At 20 m NW of the bridge there is a grey, very silty and argillaceous limestone 0.70–0.80 m above water level (Bj 67-20). It is underlain by an 0.1 m thick bed of grey, as weathered yellowish brown limestone rich in algal nodules.

At the northwestern edge of the bridge the limestone is dark grey in the lower part of the section and light grey in the upper part. It grades from thick-bedded to slightly nodular and irregularly bedded or massive reef-like in its upper part. The lower part is rich in crinoids. The frequency of algal nodules increases upwards. Bj 67-18 from 0.20–0.25 m, Bj 67-19 from 1.55–1.60 m above water level.

The bridge is 18 m wide. SE of the bridge, the algal limestone continues. At the bridge the dip is horizontal. Samples SE of but at the bridge in the northern wall: Bj 67-1 from 0.10–0.15 m, Bj 67-2 from 1.10–1.15 m, and Bj 67-3 from 1.55–1.60 m (=top of section) above water level.

Samples 15 m SE of the bridge: Bj 67-4 from 0.05–0.10 m, Bj 67-5 from 1.40–1.45 m (=top of section) above water level.

At 51 m SE of the bridge, in the southern wall the dip is 7°N113°E. The beds here consist of limestone, dark grey and very rich in algal nodules. In the lower part of the section (the section is 1.50 m high), the beds are about 5–10 cm thick and slightly nodular and that part is also very argillaceous. The upper part is more thick-bedded (two beds are 15 cm thick). Bj 67-6 from 0–0.10 m, Bj 67-7 from 1.45–1.50 m above water level.

At 69 m SE of the bridge the water level is about 0.3 m below the earlier one. The dip is 9°N150°E. The beds consist of grey algal limestone. In the lower part of the section, it is thin-bedded and argillaceous, and in the upper part, the beds are about 0.1 m thick and intercalated with thin calcareous mudstone.

At 91 m SE of the bridge the water level is another 0.1 m lower. Bj 67-10 from 0.05–0.10 m, Bj 67-11 from 0.95–1.10 m above water level.

At 96 m SE of the bridge there is a fault along the ditch. Limestone is exposed in the northern wall, shale in the southern. *We can not assign this shale to any of the defined members.*

At 101 m SE of the bridge there is a soft, slightly greenish grey and calcareous marlstone, and a soft shale: Bj 67-10 from 0–0.1 m above water level.

The shale continues to 150 m SE of the bridge, where the limestone is exposed again.

At 155 m SE of the bridge the dip is 0°. The limestone is grey, fine-grained and rich in algal nodules. Bj 67-13 from 0.20–0.50 m above water level.

At 180 m SE of the bridge the water level is another 0.2 m lower. Bj 67-14 from the limestone 0.60–0.65 m above water level.

Between 208 and 224 m SE of the bridge the dip is 0°. Bj 67-15 from limestone from 0.50–0.60 m above water level.

At 237 m SE of the bridge Bj 67-16 was collected at 0.20 m above water level. *This is the southeasternmost exposure of the Bjärsjölagård Limestone.*

At 470 m SE of the bridge white sandstone occurs. Bj 67-17 was collected 0–0.10 m above water level.

BJÄRSJÖLAGÅRD 2, 617940 136817 (VB 1897 7648), 2.0 km NW of Ö. Kärrstorp church. Bjärsjölagård-Övedskloster area.

Quarry 500 m ESE of the Bjärsjölagård manor-house. This old quarry has long been abandoned and is now water-filled and marked as a pond on the topographical map.

Klinta Formation, Bjärsjölagård Limestone Member (type locality). *Age:* Ludlovian, Late Whitcliffian.

References: von Bromell 1725–1729: i.a. 364, 409, 534 (references to the area in general and its fossils); Stobaeus 1741 and 1752 Tab 17; Retzius 1776:84–85, Wahlenberg 1818:13, 67, 98; Hisinger 1827:317, 1828:187, 1837a:162, Forchhammer 1845:81, 83, Murchison 1847:33, Angelin 1854:8, 1877, Roemer 1856:813, Tullberg 1882a:18, 1882b:24, Eichstädt 1888:141, Stolley 1896:175, 177, Grönwall 1897:206, Törnebohm & Hennig 1904:67, 84, 186, Thomé 1932:505–514, Hadding 1958:160, Regnéll 1960:30, Martinsson 1967:371, Brood 1974:381–382, Jeppsson 1975:11, 1976:112, 1982:24, 1983:136, Mori 1980, Larsson 1979:180, in Bergström *et al.* 1982:72–74, Bergström & Shaik 1982:40.

BJÄRSJÖLAGÅRD 3, 617900 136765 (VB 184 761), 2.2 km NW of Ö. Kärrstorp church. Bjärsjölagård-Övedskloster area.

The Bjärsjölagård Limestone Member has been quarried immediately N of the railway and 50 m W of the road to Bjärröd.

Klinta Formation, Bjärsjölagård Limestone Member.

References: Grönwall 1897:211. See also under Bjärsjölagård 1 for references to the area in general.

BRANSTADHOLM 1, 617565 136864 (VB 1933 7271), 2.35 km SSW of Ö. Kärrstorp church. Bjärsjölagård-Övedskloster area.

In 1979 and 1980 water and sewer pipes were laid down along and W of the main road from Sjöbo to Hörby (road 13) from Branstad boställe (on topographical map sheet 1D Ystad NV and 2D Tomelilla SV) northwards to the intersection with the road through Elestorp. From that intersection it continued S of and along that road but S of the hamlet Elestorp to just E of the house between Elestorp and Kärrby (in some maps Tjärrby) and from there northwards to the sewage plant (*Reningsverk*).

The temporary exposure Brandstadholm 1 is 800 m ENE of Branstadholm, and W of the highest parts of the road-cut north of the place where the road passes over the brook. Here the ditch for the pipes cut down into the bedrock. A 5 m long and up to 0.5 m high exposure was available in May 1980, under about 4–5 m of Quaternary strata.

Sample: Sk 80-1.

Öved Sandstone.

References to the area in general: Grönwall 1897.

BRANSTADHOLM 2, 617520 136858 (VB 193 723), 2.75 km SSW of Ö. Kärrstorp church. Bjärsjölagård-Övedskloster area.

W of the main road, E (and slightly S) of Branstadholm slabs of a grey yellow-weathering sandstone occurred in the ditch-filling (see Branstadholm 1). The slabs derived from the till.

ELESTORP 1, 617704 136726 (VB 1800 7415), 2.3 km WSW of Ö. Kärrstorp church. Bjärsjölagård-Övedskloster area.

Temporary exposure 10 m S of the road and 50 m W of the western house on the southern side of the road in Elestorp in connection with the ditch (see Branstadholm 1). The exposure was about 10 m long and 0.5 m high. The bedrock here is covered by only about 0.2–0.3 m of soil. Large stromatoporoids dominated in the section, but also algal limestone of the type at Bjärsjölagård 2. Large quantities of excavated limestone were temporarily dumped at the ditch. Most blocks had fresh surfaces and were broken up from *in situ* positions. Most limestone types found a Bjärsjölagård 1 and 2 also occured here.

Sample: Sk 80-3.

Klinta Formation, Bjärsjölagård Limestone Member.

Reference to the area in general: Tullberg 1882a:18, 1882b:26, Eichstädt 1888:148, Grönwall 1897:27.

HELVETESGRAVEN 1, 617504 136682 (VB 176 722), 2.8 km E (and slightly S) of Öved church. Bjärsjölagård-Övedskloster area. The quarry is so close to the southern margin of the topographical map sheet, that also map sheet 2D Tomelilla SV is useful when visiting the locality.

The quarry is water-filled and marked on the topographical map as a pond 1.0 km WSW of Branstadholm. A section with reddish sandstone is available on the southern side, and there is a section also in the northern part.

Samples from the dumps: Helvetesgraven 67, 69-1, -2, -3, -4. The samples studied originated from one or more bone beds. Samples 67 and 69-4 are very similar to each other. They might well have formed parts of one and the same 10–20 mm thick dark red lens. One side is mottled with cm-sized red dots on a grey bottom and has mm-sized white fossil fragments. The samples are only slightly calcareous and break down very slowly in acetic acid. The residues consist of extremely finely grained haematite, fish scales and subordinate conodonts, and various amounts of quarts sand.

Öved Sandstone (type locality). *Age:* Pridolian.

References: von Bromell 1728 (reference to the area in general), Hisinger 1826:215, 1828:185–188, 1831a:95, 151, 1837a:99, 134, 1842:3, Nilsson 1841:77, Forchhammer 1845:78–84, Murchison 1847, Erdmann 1872, Lundgren 1874, Linnarsson 1875:279, Angelin 1877, Tullberg 1882a:12, 1882b:27, Grönwall 1897:213.

These references deal with the old quarry used between 1753 and 1775. The present quarry was opened in 1896 100 m from the old quarry (Anonymus 1905), and the name of the old quarry has since then been used for the new quarry by geologists but of course not by the owners of the quarry during the time of its operation (they used the name Övedskloster sandstensbrott). References to the new quarry include Törnebohm & Hennig 1904:67–68, 84, 173, 186–187, Anonymus 1905, Hadding 1929, Lehman 1937, Säve-Söderberg 1941, Regnéll 1960:31, Jeppsson 1969:23, 1975, 1982:25, Carls 1977:29, 30, 33.

KLINTA 1–5, 61925 13564 to 61926 13563 (VB 069 922 to 069 921), 1.6 km SSW of Bosjökloster church. Ringsjö area.

From the main road between Rolsberga and Höör, a small road passes Vrangelsborg; 350 m SE of this mansion, at the edge of the woods, the road becomes a path (see the topographical map); after 110 m this comes close to the shore, where the cliff is very low (less than a metre); in the shape of a bridle-path it then continues up along the cliff edge. In 1967 the first part of the path, from the forest edge down to the very low cliff was formed by wheel tracks, which continued down to the shore, where the cliff was lowest. There are two sections exposed in the cliff 155–160 m and 205–210 m, respectively, south of the point where the cliff is lowest. The southernmost of them shows the beds between 1.10 and 3.3 m in our Klinta 1 section (Fig. 7). The other section exposes the beds between 3.40 and 5.40 m in our Klinta 2 section (Fig. 8). Klinta 4 was excavated 20 m N of section 1 (i.e. 30 m S of section 2); Klinta 3 was dug 30 m N of Klinta 2, and Klinta 5 further 30 m to the north. The order and distance between them are thus:

South 1		4	2	3	5	North
	20	30	30	30		metres

References to Klinta: Hisinger 1837a:104, 1840:40, Forchhammer 1845:82, Murchison 1847:34, Angelin 1854:8, 1877 Roemer 1856:812, Erdmann 1872:6, Angelin & Lindström 1880:19–20, Tullberg 1882a:13, 1882b:27, Nathorst 1884, De Geer 1887:21, Eichstädt 1888:133, Grönwall 1897:16, Törnebohm & Hennig 1904:54–55, Hadding 1929:191–192, Lehman 1937, Regnéll 1960:30, Martinsson 1963:14, 25, 27, 28, 29, 31, 32, 33.

KLINTA 1, 619519 135636 (VB 0691 9210).
For description of location, see above.

Samples: Kl 67-1–11.

Klinta Formation, Bjärsjö and overlying, unnamed member. *Age:* Ludlovian, Whitcliffian.

References: Jeppsson 1975, 1976, 1979a: Figs. 5 B, C, J; 7 C, 1983:136, Larsson 1979.

Description of the measured section (Fig. 7):

0–0.75 m Mudstone, fissile, soft, grey, and calcareous, with 2–8 cm thick beds of hard calcareous mudstone and limestone.

0.75–1.22 m Mudstone, grey, calcareous, in places slightly nodular.

1.22–1.24 m Limestone, nodular, bluish to greenish grey, impure and with shells and crinoid ossicles.

1.24–1.94 m Mudstone, irregularly bedded, and calcareous. In the middle of the unit, there is a thick, hard bed.

1.94 m Limestone, 5 mm thick or less, nodular. *Top Bjärsjö Member.*

1.94–2.11 m Shale, thinly fissile, calcareous and intercalated by a few thin (<10 mm) limestone beds and slightly thicker, silty beds.

2.11–2.16 m Mudstone, one bed, hard, dense and silty.

2.16–3.19 m Shale, thinly fissile and calcareous.

3.19–3.21 m Limestone, one bed, bluish grey.

3.21–3.27 m Mudstone, irregularly bedded, calcareous and silty.

3.27–3.33 m Limestone, one bed.

KLINTA 2, 619522 135632 (VB 0688 9314).
For description of location, see Klinta 1–5.

Samples: Kl 67-12–23.

Klinta Formation: Bjärsjö Member. *Age:* Ludlovian, Whitcliffian.

References: Jeppsson 1972:66, 1975, 1976, Carls 1977:29, 30, 33, Larsson 1979.

Description of the measured section (Fig. 8):

0–0.62 m Mudstone, thickbedded, hard, dense, bluish to greenish grey and calcareous.

0.62–0.77 m Mudstone, irregularly bedded, finely laminated, soft, and silty.

0.77–1.04 m Mudstone, intermediately to thickly bedded, hard and dense.

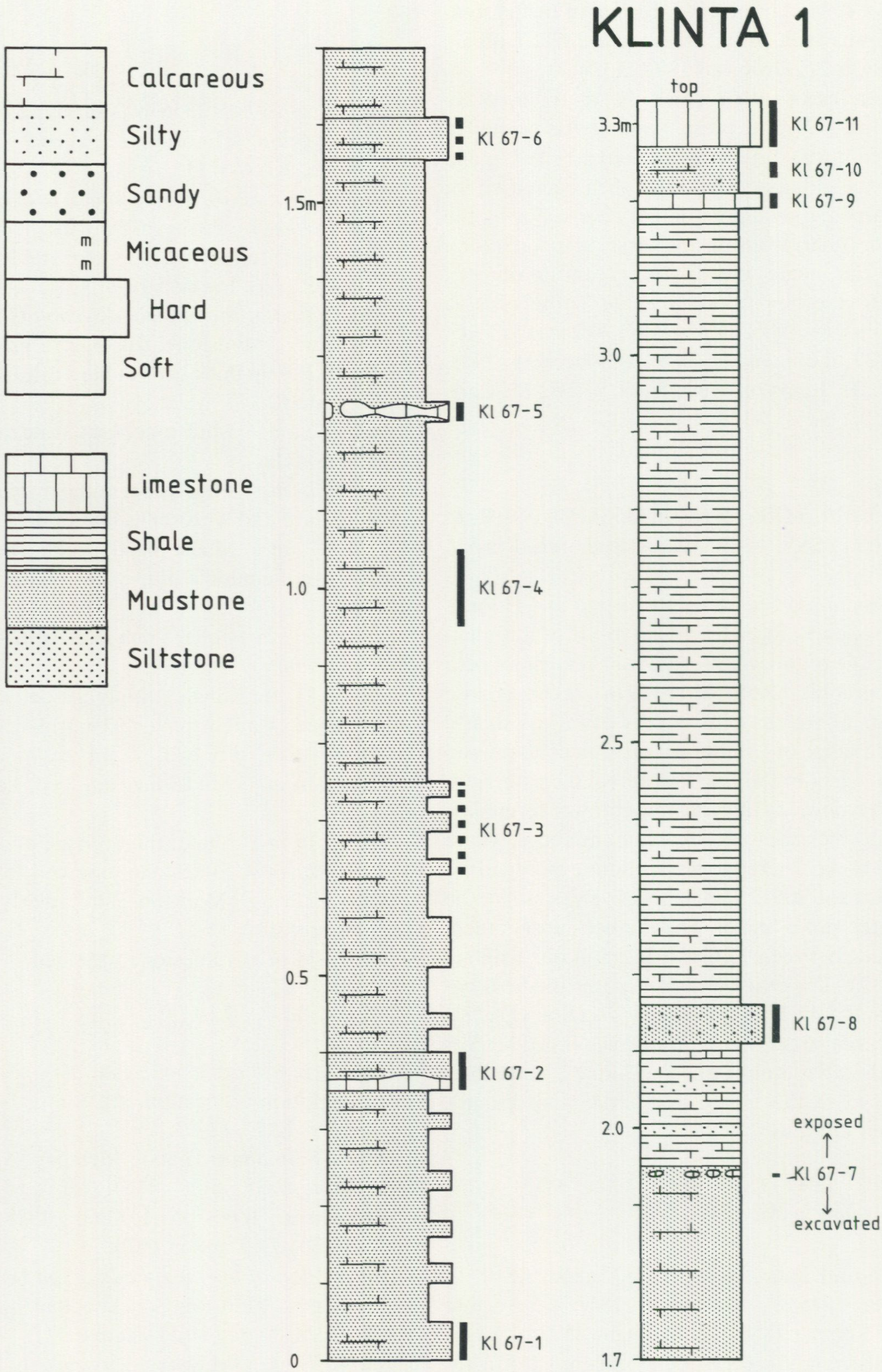


Fig. 7. Legend for Figs. 6–14 and lithostratigraphy and sample levels at Klinta 1. For details, see the text.

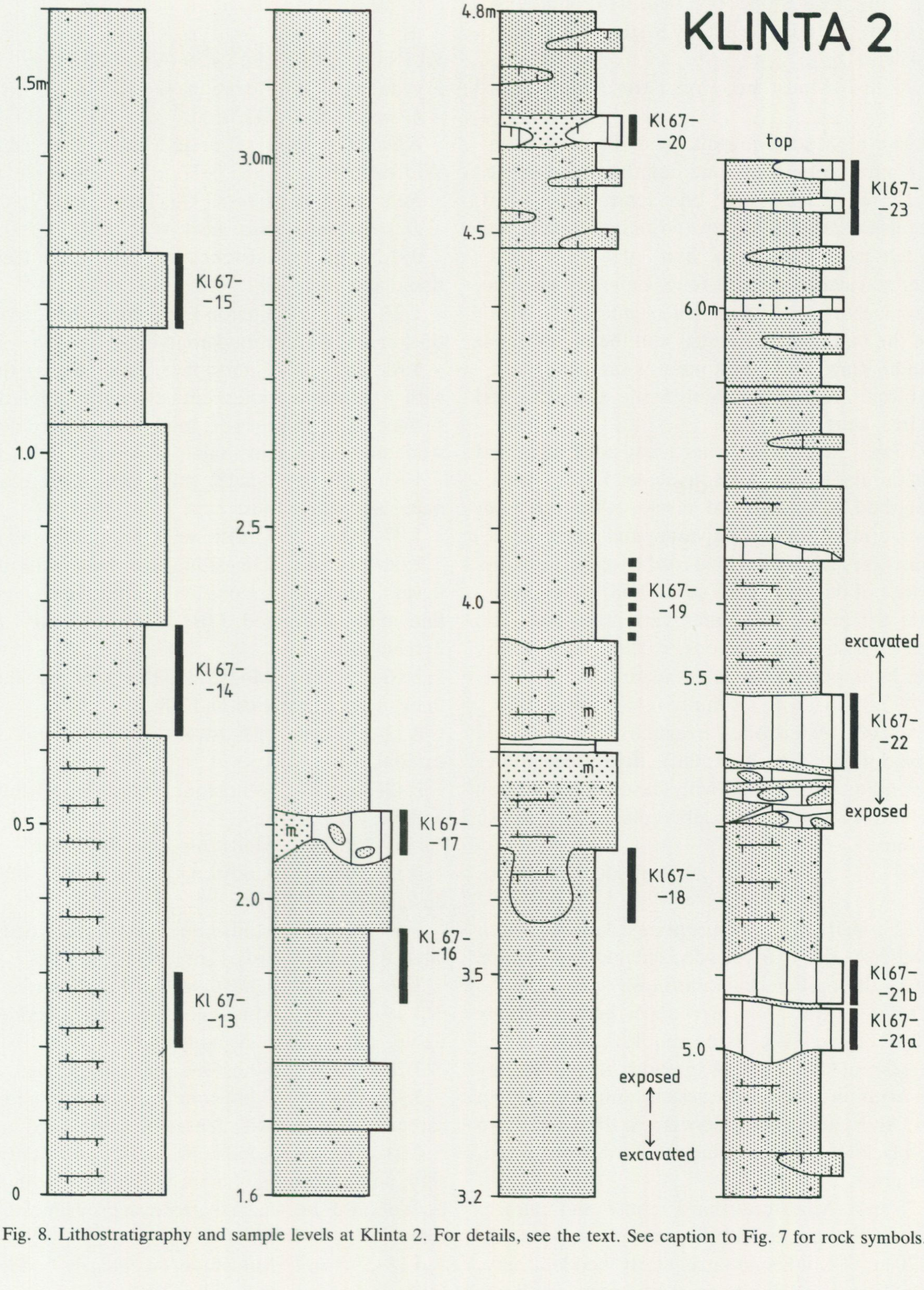


Fig. 8. Lithostratigraphy and sample levels at Klinta 2. For details, see the text. See caption to Fig. 7 for rock symbols.

1.04–1.17 m Mudstone, irregularly fissile, soft, greenish grey and silty.

1.17–1.27 m Mudstone, one bed, hard and dense.

1.27–1.69 m Mudstone, thinly fissile, soft, greenish grey and silty.

1.69–1.78 m Mudstone, irregularly bedded, hard and silty.

1.78–1.96 m Mudstone, soft, thinly fissile and silty.

1.96–2.05 m Mudstone, one bed, hard and dense.

2.05–2.12 m Limestone, one lense-shaped bed, hard, greenish to brownish grey and rich in fossils, with irregular lenses and lumps of hard, dense, bluish to greenish grey, calcareous mudstone. Laterally the limestone is replaced by siltstone rich in mica. The lower surface of the bed is very irregular and the upper one is slightly undulating. The limestone was sampled.

2.12–3.67 m Mudstone, thinly fissile, soft, silty, and in places irregularly bedded.

3.67–3.95 m Two beds of hard mudstone separated by 2 cm of thinly fissile, calcareous shale. The lower part of the lower bed consists of hard, dense, calcareous mudstone which upwards grades into more and more micaceous greenish grey siltstone. Long load casts occur on the lower surface of this bed. They strike N53°W, and penetrate up to 0.1 m into the underlying mudstone. The upper bed consists of micaceous, calcareous and silty mudstone. Its upper surface is undulating.

3.95–4.48 m Mudstone, thinly fissile and silty.

4.48–4.86 m Mudstone, irregularly bedded and silty, in places with lenses of hard, dense, calcareous mudstone and at 4.62–4.66 m with lenses of bluish grey limestone surrounded and laterally replaced by greenish grey siltstone.

4.86–5.00 m Mudstone, thinly fissile, calcareous and silty.

5.00–5.12 (–5.16 m) Limestone, dark brownish grey to lead-grey, rich in fossils, divided into two or three beds by very thin, green shale partings.

5.12–5.66 m Mudstone, irregularly bedded, thinly fissile, calcareous and silty. In the middle third of the unit there are several thin beds of greenish to bluish grey limestone with mudstone intraclasts and with slump structures. Above these beds there is a ca 10 cm thick bed of dense, blackish grey limestone with a brownish red, weathered crust.

5.66–5.76 m Mudstone, hard, dense and calcareous. Its lower part grades into limestone.

5.76–6.20 m Mudstone, irregularly bedded, silty, with several lenses and thin beds of mudstone, argillaceous limestone and dark brownish to greyish blue limestone.

KLINTA 3, 619524 135630 (VB 0686 9216).
For description of location, see Klinta 1–5.

Samples: K 67-24–29.

Klinta Formation, Bjärsjö Member. *Age:* Ludlovian, Whitcliffian.

References: Jeppsson 1975, Larsson 1979.

Description of the measured section (Fig. 9):

0–1.27 m Mudstone, irregularly bedded, thinly fissile and silty.

1.27–1.61 m Siltstone, irregularly bedded with a few thicker and harder mudstone beds.

1.61–1.83 m Limestone, grey, two or three beds with irregular thickness and strongly undulating lower surface. In the upper part intraclasts of hard dense mudstone and a few thin shale partings.

1.83–1.97 m Shale, thinly fissile, regularly laminated and calcareous.

1.97–2.06 m Mudstone, hard, dense and nodular.

2.06–2.16 m Limestone, one bed, with undulating lower surface, greenish to brownish grey and fine–medium-grained. Rich in fossils (chonetid brachiopods).

2.16–2.32 m Mudstone, the beds are about 2 cm thick, soft, calcareous and silty.

2.32–2.43 m Mudstone, hard, dense and calcareous.

2.43–2.61 m Mudstone, hard beds, intercalated with very soft beds.

2.61–2.73 m Mudstone, one hard bed.

2.73–2.80 m Mudstone, thinly fissile, soft, calcareous and silty.

2.80–3.36 m Mudstone, 2–8 cm thick beds intercalated with thinly fissile, silty mudstone.

3.36–3.46 m Mudstone, hard and dense.

3.46–3.74 m Mudstone, irregularly bedded, thinly fissile, soft, calcareous and silty.

3.74–3.85 m Mudstone, hard and dense.

3.85–4.04 m Mudstone, irregularly bedded, calcareous, silty and with lenses of dense hard mudstone.

4.04–4.18 m Mudstone, hard and flinty, dense, silty, and micaceous. Laterally replaced by thin nodular beds of hard, brownish to greenish grey limestone rich in fossils.

4.18–5.48 m Mudstone, irregularly bedded, thinly fissile, light greenish to yellowish brownish grey and silty.

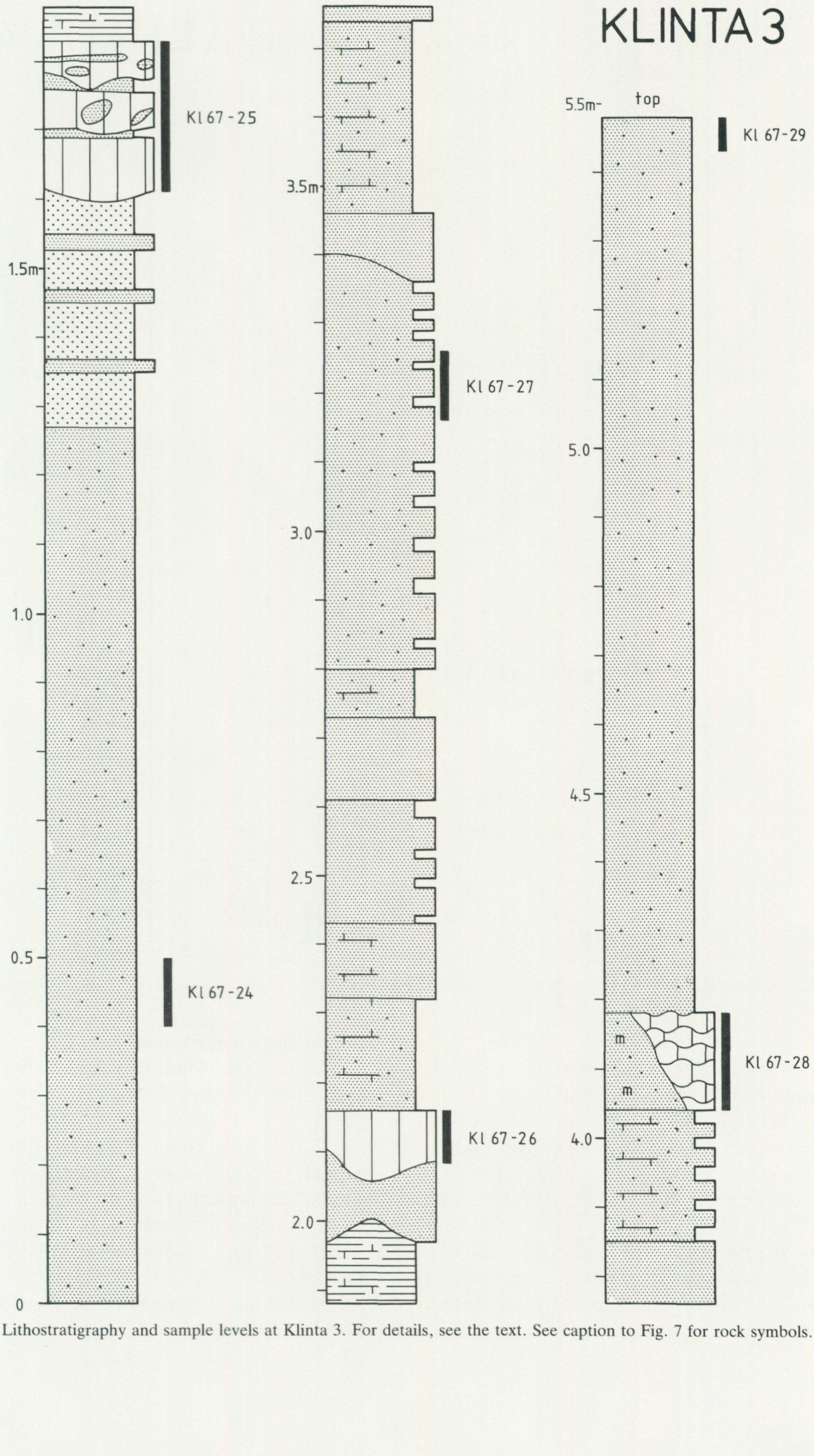


Fig. 9. Lithostratigraphy and sample levels at Klinta 3. For details, see the text. See caption to Fig. 7 for rock symbols.

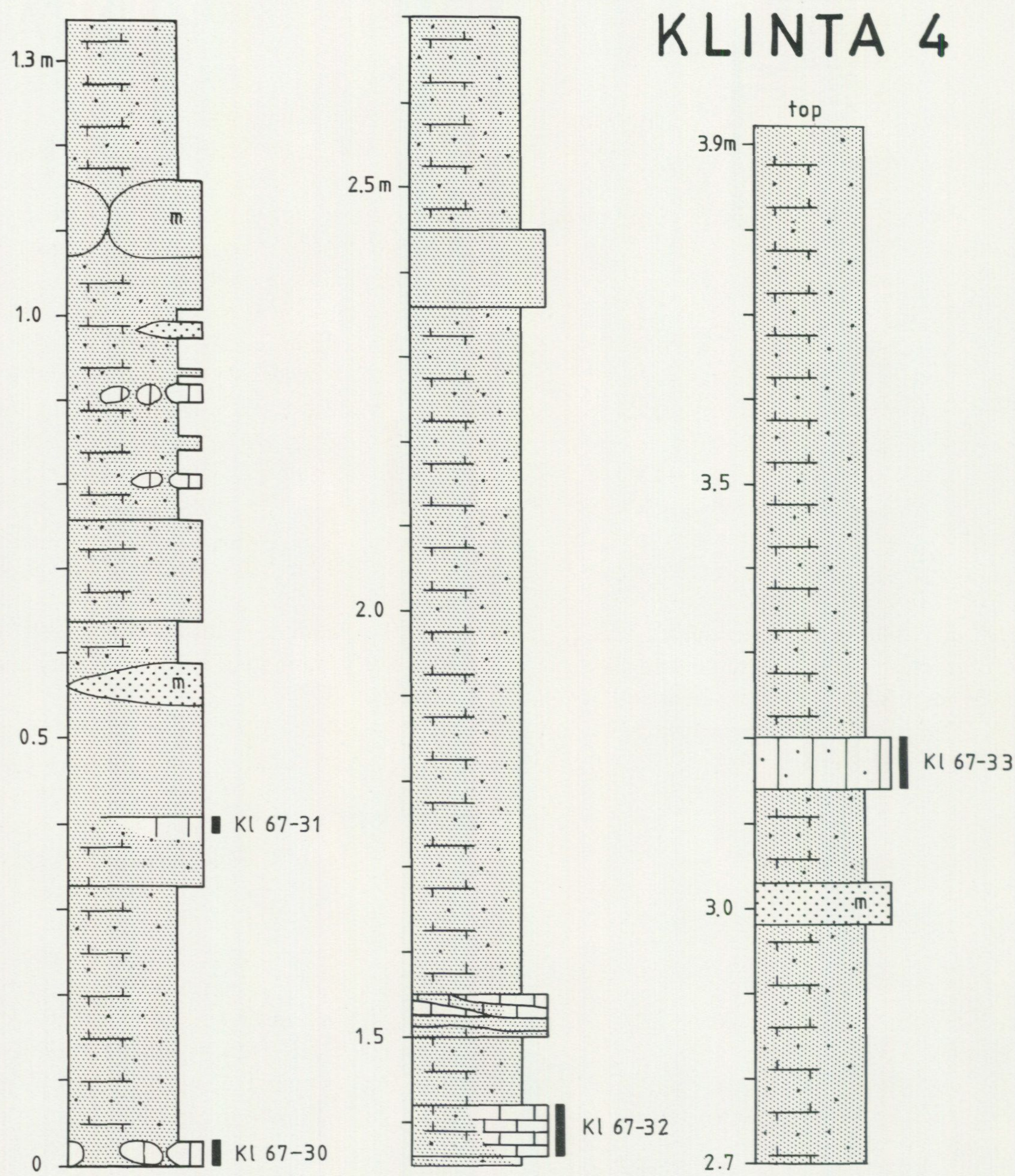


Fig. 10. Lithostratigraphy and sample levels at Klinta 4. For details, see the text. See caption to Fig. 7 for rock symbols.

KLINTA 4, 619521 135635 (VB 0690 9211).
For description of location, see Klinta 1–5.

Samples: K1 67-30–33.

Klinta Formation, Bjärsjö Member. *Age:* Ludlovian, Whitcliffian.

References: Jeppsson 1975, 1976, 1983:136, Larsson 1979.

Description of the measured section (Fig. 10):

0–0.03 m Limestone, nodular, grey, greenish grey, bluish grey, brownish grey, fossiliferous. In places replaced by greenish grey mudstone with pyrite and calcite- or rust-filled fissures.

0.03–0.33 m Mudstone, irregularly bedded, thinly fissile, soft, greenish to yellowish grey, calcareous and silty.

0.33–0.41 m Mudstone, hard, strongly calcareous, laterally replaced by silty and calcareous mudstone, the upper 2 cm of which grade into hard, dense, flinty, fractured limestone with, dark to blackish grey, fossils.

0.41–0.54 m Mudstone, irregularly bedded, hard and dense.

0.54–0.59 m Siltstone, lense-shaped, hard, dense, flinty and micaceous.

0.59–0.64 m Mudstone, thinly fissile, soft, calcareous and silty.

0.64–0.76 m Mudstone, one protruding bed, hard, dense, calcareous, silty and strongly calcite-veined.

0.76–1.07 m Mudstone, irregularly bedded, calcareous, silty, and with many thin beds of nodular limestone, hard, dense siltstone and hard, dense mudstone. All the beds are strongly calcite-veined.

1.07–1.16 m Mudstone, nodular, hard, dense and micaceous.

1.16–2.36 m Mudstone, irregularly bedded, thinly fissile, soft, greenish grey, calcareous and silty. At 1.36–1.42 m there is a bed of fossiliferous, greenish grey mudstone which grades into thin beds of limestone with hematite-coloured veins. The fossils include crinoids and trilobites. At 1.50–1.55 m there are thin beds of calcite-veined, hard, dense mudstone and grey limestone.

2.36–2.45 m Mudstone, one bed, hard, dense, and olive green or brownish grey to bluish grey.

2.45–2.98 m Mudstone, irregularly bedded, thinly fissile, soft, greenish grey, calcareous and silty.

2.98–3.03 m Siltstone, cross-bedded, in places micaceous, grey, as weathered brownish red.

3.03–3.14 m Mudstone, thinly fissile, calcareous and silty.

3.14–3.20 m Limestone, one bed, hard, flinty, brownish grey, impure and fossiliferous.

3.20–3.92 m Mudstone, irregularly bedded, soft, calcareous and silty.

KLINTA 5, 619525 135627 (VB 0684 9220).
For description of location, see Klinta 1–5.

Samples: Kl 67-35–41, Kl 69-1–4.

Klinta Formation, Bjärsjö Member. *Age:* Ludlovian, Early Whitcliffian.

References: Jeppsson 1975, 1976, 1979a Fig. 5, Larsson 1979.

Description of the measured section (Fig. 11):

0–0.40 m Mudstone, irregularly bedded, irregularly fissile, rather hard, greenish grey, calcareous, and silty.

0.40–0.44 m Mudstone, nodular, cross-bedded, irregularly fissile, calcareous and micaceous.

0.44–0.80 m Mudstone, greenish grey, calcareous and silty; 0.44–0.47 m one bed; 0.47–0.56 m thinly fissile; 0.56–0.66 m medium fissile; 0.66–0.69 m one bed; 0.69–0.77 m thinly fissile; 0.77–0.80 m one bed.

0.80–1.13 m Mudstone, thinly fissile (except for a bed at 0.96–1.00 m), greenish grey, calcareous, silty and in places micaceous.

1.13–1.24 m Mudstone (1.13–1.15 m one nodular bed, 1.15–1.24 m one massive bed), calcareous, silty and in places micaceous.

1.24–1.61 m Mudstone, finely laminated, thinly fissile, soft, greenish grey, calcareous and silty. At 1.48–1.50 m a hard siltstone bed.

1.61–1.90 m Mudstone, very irregularly bedded, greenish grey, calcareous, silty and in places micaceous. In the upper part of the unit there are irregular beds and lenses of fossiliferous, grey to dark grey limestone. The unit seems to have slided.

There is a fissure roughly parallel to the wall. The section described above was measured W of the fissure. The section described below is located E of the fissure. Possibly there is a displacement along the fissure.

1.73–1.81 m Mudstone and limestone, one bed, calcite-veined, greenish grey to light grey, as weathered light reddish. The upper part of the unit consists of fossiliferous limestone.

1.81–1.90 m Mudstone, irregularly bedded, soft and greenish grey.

1.90–1.94 m Mudstone, one bed, calcite-veined, irregularly laminated, hard, grey, silty and in places calcareous.

1.94–2.66 m Mudstone, thinly to medium fissile, soft, greenish grey, calcareous, and silty.

2.66–2.68 m Limestone, slightly nodular to lense-shaped, bluish to greenish grey and fossiliferous.

2.68–3.14 m Mudstone, irregularly bedded and laminated, soft, greenish grey, calcareous, and silty.

3.14–3.74 m Mudstone, regularly bedded, thinly fissile, finely laminated, soft, calcareous, and silty.

3.74–3.77 m Limestone, lens-shaped, bluish to greenish grey and fossiliferous.

3.77–4.13 m Mudstone, 2–5 cm thick beds, calcareous, finely laminated, grey to greenish grey, as weathered blackish grey or rusty brown.

4.13–4.16 m Mudstone, nodular, finely laminated, hard, calcareous, and silty.

4.16–4.56 m Mudstone, irregularly bedded (0–4 cm thick beds), finely laminated, soft, greenish grey, calcareous, and silty.

4.56–4.68 m Limestone, fossiliferous, in two lense-shaped beds, the upper is 1–3 cm thick.

4.68–5.09 m Mudstone, 0.5–3 cm thick beds, finely laminated soft, greenish grey, and calcareous.

5.09–5.15 m Limestone, fossiliferous (e.g. crinoid ossicles).

5.15–5.55 m Mudstone, 0.5–3 cm thick beds, finely laminated, soft, greenish grey, and calcareous, as weathered brownish yellow.

The beds above 5.55 m seem to have been glacially disturbed.

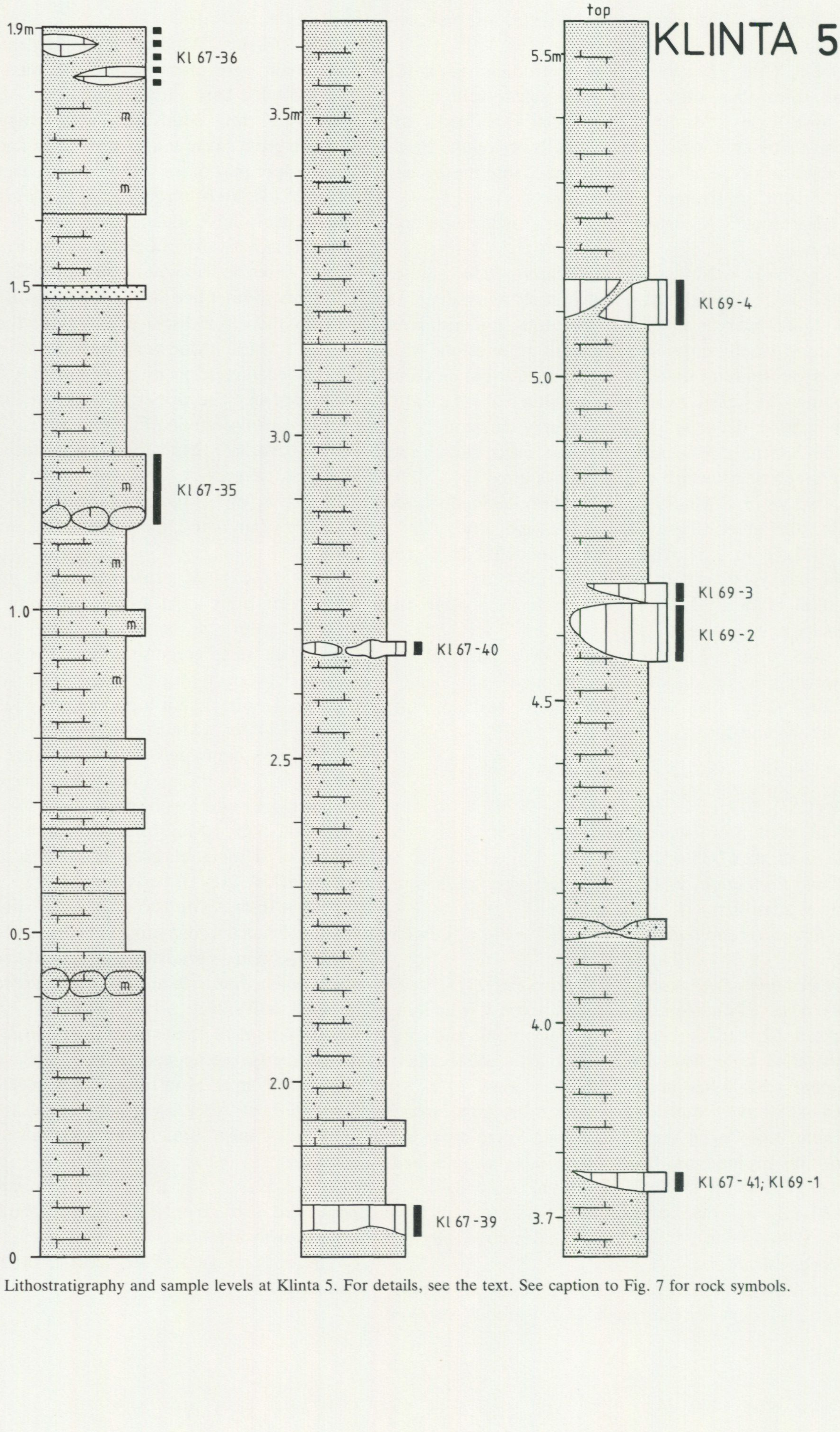


Fig. 11. Lithostratigraphy and sample levels at Klinta 5. For details, see the text. See caption to Fig. 7 for rock symbols.

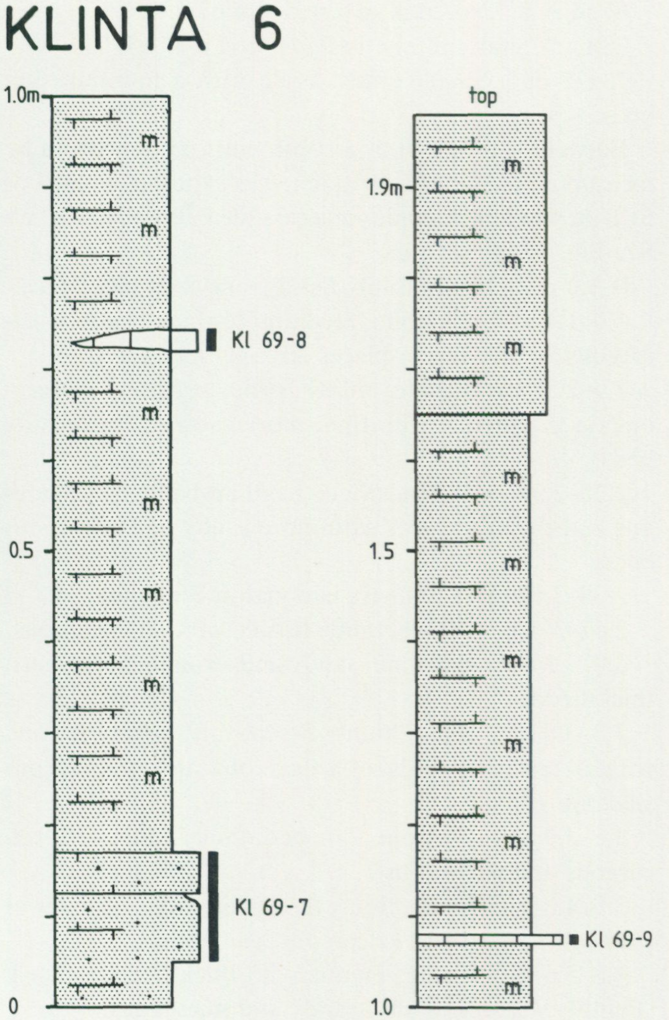


Fig. 12. Lithostratigraphy and sample levels at Klinta 6. For details, see the text. See caption to Fig. 7 for rock symbols.

KLINTA 6, 619530 135618 (VB 067 923), 1.5 km SSW of Bosjökloster church. Ringsjö area.

Straight down to the shore from the point where the road becomes a path (described under Klinta 1–5), i.e. 10–12 m outside the fence of the lot of the southeasternmost cottage, the cliff is more than 2 m high. Here, less than 1 m of talus covers the cliff face. A section was excavated and measured in 1969.

Samples: Kl 69-8, 9.

Klinta Formation, Bjär Member. *Age:* Ludlovian, Leintwardinian.

References: Eichstädt 1888:136, Jeppsson 1972:66, 1975:49, Larsson 1979.

Description of the measured section (Fig. 12):

0–0.05 m Mudstone, greenish grey, soft, calcareous and silty.

0.05–0.17 m Mudstone, irregularly bedded, hard, bluish grey, as weathered greyish brown, calcareous and silty. The uppermost bed is 4–5 cm thick, very tough and blue to bluish grey.

0.17–0.73 m Mudstone, unbedded, thinly fissile, soft (in places harder), greenish grey, micaceous and calcareous.

0.73–0.74 m Limestone, one ≤2.5 cm thick lens, fossiliferous.

0.74–1.07 m Mudstone, as that between 0.17 and 0.73.

1.07–1.08 m Limestone, one thin bed, impure.

1.08–1.98 m Mudstone, as that between 0.17–0.73 m, but from 1.65 m slightly harder and bedded.

KLINTA 7, 61946 13556 (VB 0617 9155), 2.4 km SW of Bosjökloster church. Ringsjö area.

A large temporary ditch was dug about 5 m E of the main road and parallel with it through the orchard in 1972. No bedrock was exposed. The excavated till contained large quantities of Öved-Ramsåsa rocks. Some of the boulders were large. One of them, more than half a metre across, consisted of a calcareous red-weathered sandstone. The owner of the orchard agreed to leave it above ground in the orchard when the ditch was refilled.

Sample: Kl 72-1, a 0.1 m thick slab of the boulder.

Öved Sandstone. Age: Pridolian.

KÄRRSTORP 1, 617707 136903 (VB 198742), 800 m SSW of Ö. Kärrstorp church. Bjärsjölagård-Övedskloster area.

From the house 600 m SSW of Ö. Kärrstorp church a covered drain was constructed before 1968 in SW direction to the new road. Probably it did not cut into bedrock, but the till contains abundant slabs of rust-coloured sandstone. The slabs are a couple of centimetres thick and some tens of centimetres long. Small thin slabs of a dark red sandstone occur sporadically. In one spot about 20 m from the new road grey calcareous cobblestones occur.

Samples: Sk 68-11 from the sandstone and Sk 68-12 from the grey calcareous pieces.

References: The area around Kärrstorp has been discussed by Tullberg (1882:25) and Grönwall (1897). Grönwall noted that a yellowish, slightly reddish sandstone with *Leperditia* occurs both N of the village and SE of it. However, at none of the exposures marked on the geological map did he find anything but local till. In the ditch (at VB 191 744) the local till includes a grey, hard, slightly calcareous, unfossiliferous sandstone (Grönwall 1987:212).

LUNNARNA 1, 619190 135612 (VB 066 888), 2.4 km NE Gudmundtorp church. Ringsjö area.

Ditch exposure and section south of the road at the forest edge.

Reference point: The southern edge of the bridge was used, but since then the bridge has been reconstructed.

Samples: Lunnarna I, 1b, 1c and Lu 67-1–21.

Klinta Formation, Lunnarna Member (type locality). *Age:* Ludlovian, Leintwardinian.

References: Martinsson 1967:371, Jeppsson 1969, 1972, 1975:49, 1976, 1979a: Fig 1A, 2A, 4A, 5J, 7D, 1983:107, Larsson 1979.

Description of the measured section (Fig. 13):
Between 156 and 71 m from the reference point, there were several exposures. The description of the beds between them are based on the excavated material deposited along the ditch.

156–150 m Siltstone, sandy.

150–147 m More calcareous, argillaceous and fissile beds.

147 m Siltstone, medium-bedded, micaceous and sandy. Lu 67-16.

147–137 m Probably shale.

137 m Siltstone, medium- to thick-bedded, sandy and micaceous. Dip 20°N60°E. Lu 67-15.

137–130 m Probably the same kind of siltstone as at 130 m.

130 m Siltstone, medium-bedded, sandy and very rich in mica. 0.5 m exposed. Lu 67-14.

116 m Siltstone, medium-bedded, sandy and micaceous. 0.2 m exposed. Lu 67-13.

106 m Shale, medium-bedded, calcareous and silty, in places rich in mica. 0.2 m exposed. Lu 67-12.

103 m Shale, thinly fissile, soft and calcareous. 0.3 m exposed. Lu 67-11.

97 m Siltstone, medium-bedded, sandy, and very rich in mica. Lu 67-20.

87.5 Siltstone, thin- to medium-bedded, calcareous and micaceous. 0.2 m exposed. The beds are rich in trace fossils. Lu 67-19.

87.5–80 m Siltstone, medium- to thick-bedded, sandy, slightly calcareous and not as micaceous as the beds at 87.5 m.

81 m 0.15–0.20 m exposed. Lu 67-18.

78 m Shale, thinly fissile, soft. Lu 67-17.

78–72 m Shale, thinly fissile with a few thin silty beds.

Between 71 and 40 m a continuous section could be measured. The level 5.60 m in it was exposed at and S of 51.8 m, where it becomes inaccessible below water level. See Fig. 13 for section.

0–1.0 m Shale, thinly fissile, soft and calcareous.

1.0–1.4 m Siltstone, medium- to thick-bedded, calcareous, sandy and in places strongly micaceous.

1.4–2.15 m Shale, thinly fissile, soft, and calcareous; in the middle with thin, more calcareous and silty beds.

2.15–2.38 m Mudstone, medium-bedded, calcareous and silty, in places with more sandy and micaceous beds.

2.38–2.67 m Beds transitional in character.

2.67–3.0 m Shale, thinly fissile, soft and calcareous.

3.0–3.3 m Siltstone, sandy and strongly micaceous, thick-bedded.

3.3–3.8 m Shale, thinly fissile, soft, calcareous and with a few thin beds of calcareous and argillaceous siltstone.

3.8–3.9 m Siltstone, one bed, finely laminated, calcareous and micaceous.

3.9–4.8 m Shale, thinly fissile and silty; in the lower part with a hard and calcareous bed.

4.8–5.6 m Shale, medium- to thick-bedded, hard, slightly calcareous, silty, sandy and micaceous.

5.6–6.2 m Shale, thinly fissile, soft, calcareous, with a few thin, silty lenses and beds.

6.2–6.55 m Shale, thickly bedded, silty, in places with up to 7 cm thick, more micaceous lenses.

6.55–6.95 m Siltstone, very thinly fissile, and very calcareous.

6.95–7.15 m Siltstone, one bed, sandy and micaceous.

7.15–8.20 m Shale, thinly fissile, soft, calcareous, and in places with up to 5 cm thick, hard, micaceous beds; at 7.50–7.55 m one hard bed, and at 7.95–8.00 one calcareous bed.

8.20–8.33 m Siltstone, one bed, finely laminated, hard, sandy, calcareous, and micaceous.

8.33–8.53 m Shale, very soft, strongly weathered, calcareous and silty.

8.53–8.58 m Siltstone, one bed, thinly laminated, in places calcareous, argillaceous and sandy.

8.58–8.83 m Shale, very soft, strongly weathered, calcareous and silty.

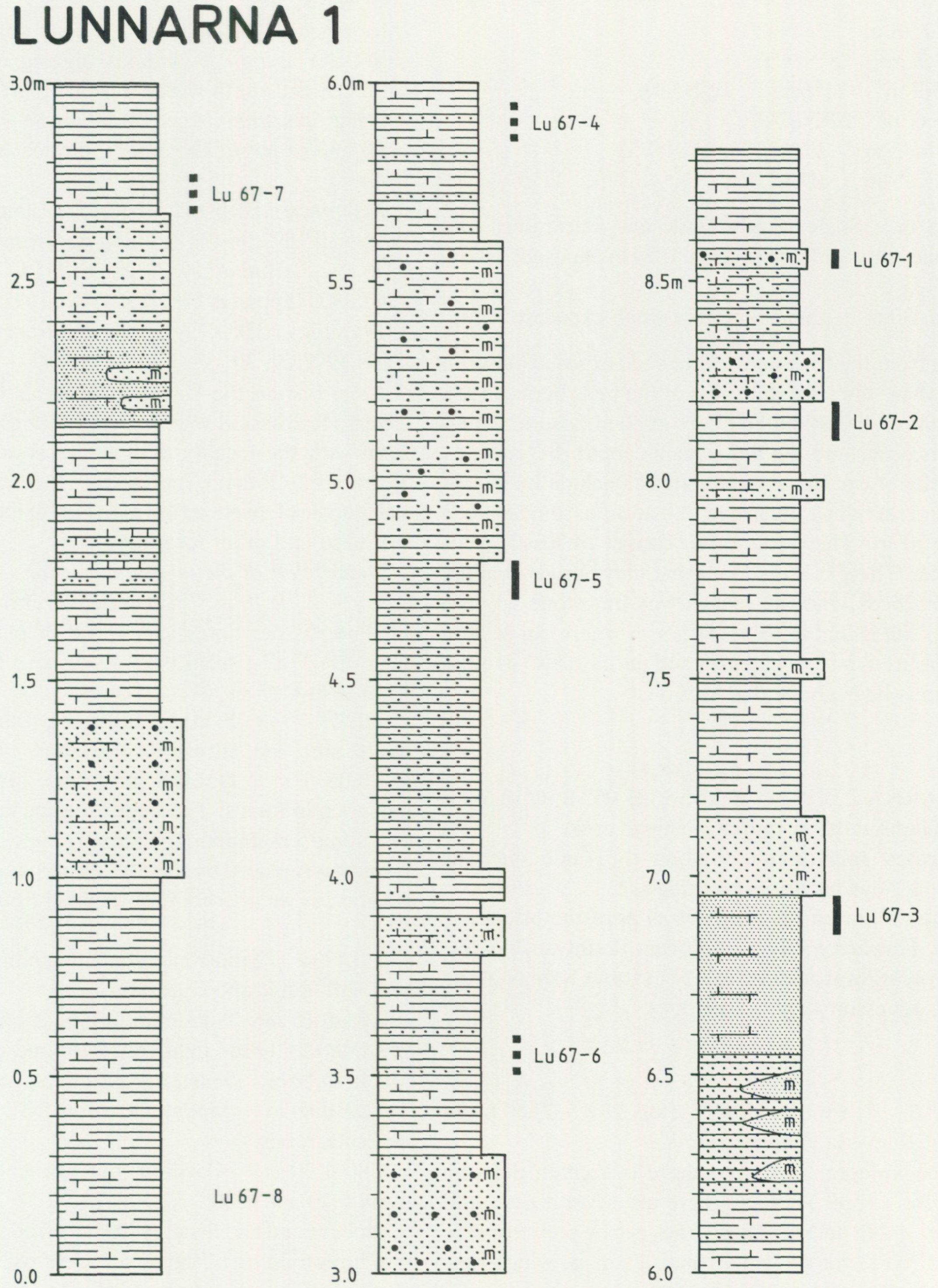


Fig. 13. Lithostratigraphy and sample levels at Lunnarna 1. For details, see the text. See caption to Fig. 7 for rock symbols.

The dip of the beds in the section was recorded as follows:

1.0–1.4 m 20°N45°E and 21°N62°E
2.15–2.38 m 21°N42°E
3.0–3.3 m 18°N66°E
3.8–3.9 m 11°N55°E, 12°N58°E
4.8–5.6 m 22°N67°E
6.20–6.55 m 20°N63°E, 21°N57°E
6.95–7.15 m 17°N55°E.

At 38 m Shale, thinly fissile and calcareous, and sandstone, silty and rich in mica. 0.20 m exposed. Lu 67-21.

About 30 m Limestone in a small exposure.

Judging from the thickness of the beds exposed between 71 and 40 m, the total thickness of the beds between 156 and 38 m can be estimated at about 30 m, assuming that no faults occur and the dip remains about the same.

Samples of excavated rock material include Lu 67-9 at 71 m, and samples Lunnarna I, 1 b and 1 c from between 20 and 70 m. The latter three consist of fossiliferous limestone. There is little doubt that they derive from the described beds, and the reason why limestone was not found *in situ* is that it occurs as lenses where our section was measured, and/or in lenses and perhaps also in more continuous beds above that section.

LUNNARNA 2, 619207 135613 (VB 067 891), 2.6 km NE of Gudmundtorp church. Ringsjö area.

Excavated rock material along the same ditch as Lunnarna 1 but north of the bridge.

Sample: Lunnarna II from 150 m N of the bridge.

Klinta Formation. Age: Ludlovian, Leintwardinian.

References: Martinsson 1967:371 (about 50 m N of the bridge), Jeppsson 1972:62, 1975:49.

RAMSÅSA 8, 616028 137832, (VB 289 577), 0.8 km WSW of Ramsåsa church.

On the topographical map there is a green dot, the symbol for a tree. Actually there are several trees and shrubs in an old quarry. These trees can be seen from the old field road (marked on Grönwall's map) which runs nearly due W just N of the quarry.

Eichstädt (1888:151) reported a test quarry WSW of Ramsåsa church. Grönwall (1897) mentioned Eichstädt's other localities but not the test quarry. Possibly Ramsåsa is identical with the test quarry. However, Grönwall stated that the quarry Ramsåsa 8 (his F) was opened in 1891 (for commercial operation?) and that it was 18 m deep in 1897 (Grönwall 1897). It was abandoned shortly afterwards, and in 1909 the quarry faces had fallen (Moberg & Grönwall 1909). Today only about 2 m of strata are accessible without digging and only in the southern and south-western wall.

Öved Sandstone. Age: Pridolian.

Reference level: The upper surface of the limestone bed.

References: Eichstädt 1888:151, Lundbohm 1891:24, Grönwall 1897:36–39, Moberg & Grönwall 1909:11–13, 1926:192, Lehman 1937, Regnéll 1960:31, Lindström 1960:330, Jeppsson 1969:23, 1972, 1975, 1976:108, 109, 1979a, Figs. 2D; 5D–E; 6C–D, Rasmussen 1973:15, Carls 1977:29, 30, 33, Larsson 1979.

Note: Earlier the Ramsåsa localities were marked by letters (Ramsåsa 8 was known as Ramsåsa F). To conform with the locality designation system used for the Silurian of Gotland (nowadays in general use for the Palaeozoic of Sweden) Larsson (1979) introduced figures for these and other localities.

Description of the measured section (Fig. 14):

−1.00 - −0.70 m Siltstone, several beds, thickly to medium fissile, hard, sandy and in places calcareous. Ramsåsa F 67-1 from 0.95–1.0 m and Ramsåsa F 67-2 from 0.90–0.95 m.

−0.70 - −0.05 m Mudstone, thinly to medium fissile, soft, red, silty and calcareous.

−0.05–0 m Detrital limestone, about 2 cm thick lens, rich in fossils. The upper surface is rich in bivalves and some brachiopods. Laterally, upwards and downwards it is replaced by slightly calcareous siltstone, greenish grey, as weathered red. Ramsåsa F 66 and Ramsåsa F 67-3.

0–0.13 m Mudstone, thinly to medium fissile, bluish red, soft, silty, and calcareous.

0.13–0.15 m Siltstone, one bed, bluish to greenish grey, as weathered light red, hard and calcareous.

0.15–0.20 m Siltstone, as that between 0.13–0.15 m.

0.20–0.80 m Mudstone, thinly fissile, soft, red, silty and calcareous.

0.80–1.30 m Covered, but probably like that between 0.20 and 0.80.

Moberg and Grönwall (1909) stressed that there is only one limestone bed, "layer p". Grönwall (1897) studied this in the northern part of the quarry, where he described it as at least 0.07 m thick. He also reported a limestone bed in the southern part of the quarry and considered the two occurrences as parts of the same bed. From the position in the quarry (the top of our section is 0.5–2 m below the bedrock surface) and the overall composition of the beds, it is obvious that the beds now

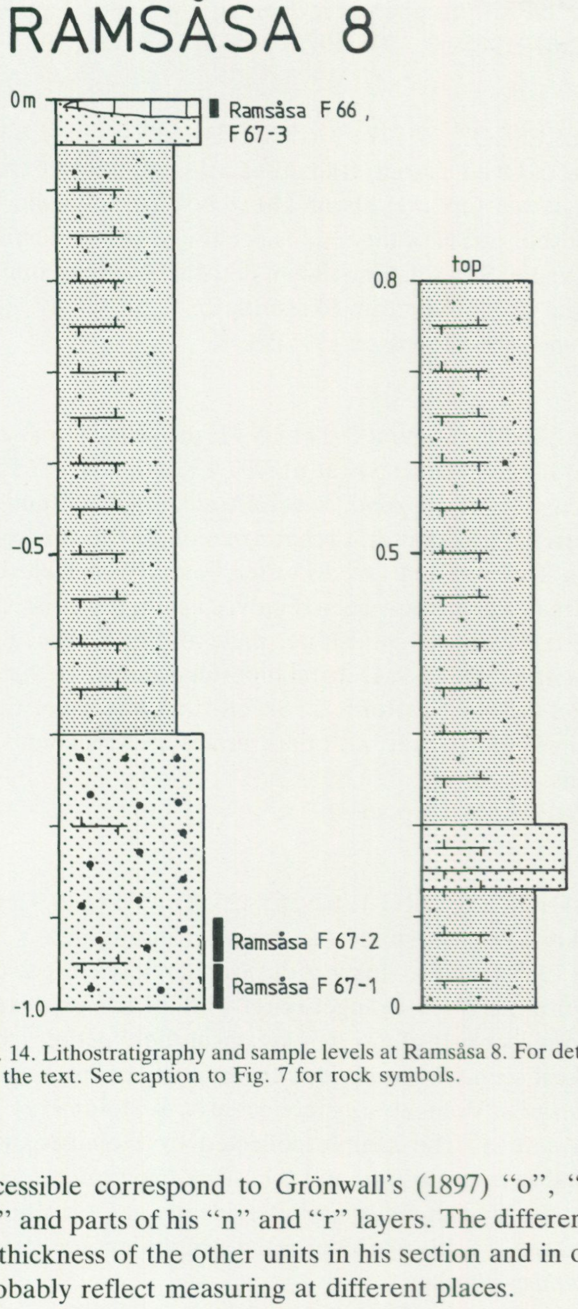


Fig. 14. Lithostratigraphy and sample levels at Ramsåsa 8. For details, see the text. See caption to Fig. 7 for rock symbols.

accessible correspond to Grönwall's (1897) "o", "p", "q" and parts of his "n" and "r" layers. The differences in thickness of the other units in his section and in ours probably reflect measuring at different places.

SKARTOFTA 1, 617770 136438 (VB 151 748), 2.4 km N (and slightly E) of Öved church and about 800 m W of Tullesbo. Bjärsjölagård-Övedskloster area.

Just S of the bend where the main road through Skartofta turns N and a private road continues westwards there is a large heap of stone, at least earlier rich in samples of the local bedrock. About 25 m S of this bend of the road, a covered drain was constructed in 1968. Judging from excavated material the bedrock is close to the surface.

Samples: Sk 68-1 and Sk 68-2 were collected from the excavated material. Sk 68-1 Limestone, dense, tough, bluish grey, as weathered light yellowish brown, silty and with very few macrofossils. Sk 68-2 Limestone, dense, argillaceous, grey, as weathered light rusty yellowish.

Sk 68-3 was collected from the large heap of stones. It consists of laminated limestone with thin seams of crinoid ossicles. Their average diameter is only 2 mm, but they are articulated and stem pieces longer than 10 mm are frequent.

References to the area in general: Hisinger 1828:188, 1837a:99, 1837b:10, Forchhammer 1845, Murchison 1847, Angelin 1854:8, 1877, Tullberg 1882a:18, 1882b:26.

References: Jeppsson 1975, Larsson 1979:180.

SKARTOFTA 2, 617767 136465 (VB 154 748), 2.4 km N to NNE of Öved church. Bjärsjölagård-Övedskloster area.

In 1968 a well was dug in the southwestern corner of the schoolyard in Skartofta. The fresh unweathered material included in addition to the grey mudstone, shale and limestone characteristic for the Öved-Ramsåsa Group also large quantities of both ordinary diabase and a diabase variety rich in calcite-filled vesicles. (Cobbles of the latter, but with a 2–5 mm thick weathered crust occur also at Skartofta 1).

Samples: Sk 68-4: Detrital limestone with blackish brown fossils which give the limestone a black-dotted appearance. The fossils include remains of a large trilobite species. Sk 68-5: A 0.1 m thick slab. One half of it consists of laminated, hard, silty and calcareous mudstone with a lense of crinoid limestone. The crinoid limestone is similar to that of Sk 68-3 from Skartofta 1. The other half of the slab consists of limestone extremely rich in bivalve shells. In addition there is an orthoceratite. Sk 68-6: Diabase, both the normal and the vesicular type.

References to the area in general: See Skartofta 1.

References: Jeppsson 1975:50, Larsson 1979:180.

SKARTOFTA 3, 617770 136487 (VB 156 748), 2.5 km NNE of Öved church. Bjärsjölagård-Övedskloster area.

Tullberg (1882) reported that the Öved-Ramsåsa Group occurs at a depth of 6 feet (1.8 m) at Skartofta vicarage. However, no exposures were found at the pond S of the road.

Sample: Sk 68-7, a loose boulder.

References to the area in general: See Skartofta 1.

References: Tullberg 1882:26, Jeppsson 1975:50.

SNOGERÖD 1, 61925 13550 (VB 056 896), 2.6 km NNE Gudmundtorp church. Ringsjö area.

A new road was constructed north of Snogeröd as a part of the road between Eslöv and Fogdarp. Boulders from the Öved-Ramsåsa Group were common in the till sections exposed. Such boulders are common in an area from the westernmost extension of the Öved-Ramsåsa Group as drawn on the map of the bedrock in Skåne by Bergström (in Stanfors *et al.* 1967) and more than 0.5 km westwards.

Sample: Snogeröd I. A boulder of reddish, sandy limestone S of "Snogeröds gård".

Öved Sandstone. Age: Pridolian.

References: Jeppsson 1975:50.

TULLESBO 1, 617750 136584 (VB 166 746), 2.8 km NE of Öved church. Bjärsjölagård-Övedskloster area.

The old small quarry S of the road, 700 m ESE of Tullesbo is abandoned since long. In 1966 it was water-filled and had for a long time been used as a dump for stones cleared from the fields around it. Today it is probably completely filled and covered.

Samples: Three samples were collected from the fields around the quarry in 1966. Tullesbo I: Limestone, dense, tough, bluish grey, as weathered light yellowish brown, silty and lacking or rare in macrofossils. Tullesbo II and III consist of laminated limestone with crinoid remains similar to those described under sample Sk 68-3 from Skartofta 1. Sample Tullesbo I agrees well with Tullberg's (1882:26) description of the lower beds in the quarry, and Tullesbo II and III agree with the higher beds in the quarry. The conodont fauna supports this similarity, as Tullesbo I contains a typical "older *Ozarkodina steinhornensis scanica* fauna" and Tullesbo II a *Hindeodella wimani* fauna (Jeppsson 1975:6).

Klinta Formation, at least parts of the beds in the quarry probably belong to the Bjärsjölagård Member. *Age:* Ludlovian, Whitcliffian.

References: Angelin 1854:8, Tullberg 1882a:18 (to the area in general), 1882b:26–27, Grönwall 1897:27, Lehman 1937, Törnebohm & Hennig 1904:186, Jeppsson 1972:63, 1975:50, 1976:107, Carls 1977:29, 30, 33.

TULLESBO 2, 617774 136510 (VB 158 748), c. 2.6 km NNE of Öved church. Bjärsjölagård-Övedskloster area.

A sewer sink dug about 140 m NW of the manor at Tullesbo, just N of the road (since the road was rebuilt).

Sample: Sk 68-8: One slab of detrital limestone similar to that of Sk 68-4 from Skartofta 2.

References: Jeppsson 1975:50.

TULLESBO 3, about 3.0 km NNE of Öved church and 400 m NE of Tullesbo (at 617797 136560, VB 163 751) and just W of the road. Several truck loads of dumped material excavated at a reconstruction of the road between Tullesbo and Övedskloster, just SW of Tullesbo. The material has now been removed again. It consisted of grey unweathered mudstone, shale and limestone.

Samples: Sk 68-9: Detrital limestone similar to that of Sk 68-4 from Skartofta 2. Sk 68-10: Limestone, fine-grained, bluish grey with dark grains and fragments of fossils.

References: Jeppsson 1975:50.

VRANGELSBORG 1, 629555 135581 (VB 0630 9256), 1.5 km SW of Bosjökloster church. Ringsjö area.

In 1966 a sewage sink was dug on the shore close to the cliff 150 m W of Vrangelsborg. Part of the excavated material consists of more or less local shore pebbles, but the rest seems to be derived from *in situ* bedrock.

Samples: Vrangelsborg (collected by S. Holmberg), Vr 69-3 and -4. The sample collected by Holmberg was probably taken *in situ,* and the other two samples were taken from fresh material, but evidently at least Vr 69-4 consisted of a shore cobble, as the sample contains *Polygnathoides siluricus.*

Öved-Ramsåsa Group. Age: Pridolian (and loose slabs from the Klinta Formation, basal part, Ludlovian, Leintwardinian).

References: Jeppsson 1975:49, Larsson 1979.

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DGU = Danm. Geol. Unders.
GFF = Geol. Fören. Stockh. Förh.
KVA = Kungl. Vet. Akad.
LUÅ = Lunds Univ. Årsskr.
SGU = Sver. Geol. Unders.
USGS = United States Geol. Surv.

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