

Polymorphites (Polymorphites) spp. indet.

MATERIAL. — Several fragments.

REPOSITORY. — Stockholm, G. I. C 1211.

PROVENANCE. — Kurremölla area, southeastern Skåne.

COLLECTOR. — The author.

AGE. — Lower Pliensbachian; *polymorphus* subzone of the *jamesoni* zone.

REMARKS. — Several fragments in the collection seem to be referable to *Polymorphites* s. str. They are all pieces of small ammonites with a squarish whorl section, more or less straight and radial ribs and spinate ventrolateral tubercles. Owing to the state of preservation of the material the ventral ornament could not be satisfactorily studied. As stated further on, study of the inner whorls of *Uptonia* indicate that *Polymorphites* and its subgenus are identical at comparable diameters, as regards the external morphology at least. Inasmuch as the present fragments appear to be parts of the body chamber of small, but fully grown individuals, they are referred to the smaller group of *Polymorphites*.

The typical development of true *Polymorphites* occurs somewhat earlier than that of subgenus *Uptonia* and it would seem that there is evidence for the *polymorphus* and *jamesoni* subzones in southeastern Skåne.

Subgenus *Uptonia* BUCKMAN, 1898

TYPE SPECIES. — *Ammonites jamesoni* SOWERBY.

REMARKS. — The name *Uptonia* was proposed by BUCKMAN (1898, p. 453) for ammonites in which the spinous stage is never strongly developed, the ventrolateral tubercles vanishing at some stage during the development. The strong ribbing was regarded as a prominent feature of the group. DONOVAN (1954, p. 16) placed *Uptonia* as a subgenus of *Polymorphites*; the differences between the two are slight and the inner whorls are inseparable. Nor does there seem to be any good reason for separating *Jamesonites*, which was erected for forms that are more feebly ribbed and slightly more strongly tuberculated than *Uptonia jamesoni*, even subgenerically from *Uptonia* and *Polymorphites* (cf. ARKELL et al., 1957, p. L 249).

In this paper, therefore, *Jamesonites* BUCKMAN, 1923 (type species *J. reticulatus* BUCKMAN) is regarded as synonymous with *Uptonia* BUCKMAN, 1898; *Uptonia* is placed as a subgenus of *Polymorphites* HAUG, 1887.

Polymorphites (Uptonia) jamesoni (SOWERBY)

Pl. XVI, figs. 2, a—b

1827 *Ammonites jamesoni* SOWERBY, pl. 555, figs. 1, 2.

1882 *Aegoceras Jamesoni* SOWERBY, WRIGHT, p. 352, pl. 51, figs. 1, 2, ?3.

?1884 *Ammonites Jamesoni costosus* QUENSTEDT, pl. 31, fig. 11.

1925 *Uptonia jamesoni* (SOWERBY), TUTCHER & TRUEMAN, p. 646, fig. 15a.

1954 *Polymorphites (Uptonia) aff. jamesoni* (J. DE C. SOWERBY), DONOVAN, p. 42.

Not *Ammonites Jamesoni* in MOBERG, 1888, p. 68, pl. 3, figs. 1—3.

MATERIAL. — One specimen (in two pieces).

REPOSITORY. — LUND, LO 3946.

PROVENANCE. — Outcrop near the abandoned mill dam, Kurremölla, southeastern Skåne.

COLLECTOR. — J. C. MOBERG.

AGE. — Lower Pliensbachian; *jamesoni* subzone of the *jamesoni* zone.

DESCRIPTION. — A single, large specimen is referred here. It consists of parts of the inner whorls and a small part of what is probably the final whorl. At a whorl radius of 28 mm the specimen is ornamented with moderately strong but sharp ribs that begin inside the umbilicus and which run in almost a straight line to the venter where they thicken slightly. They are very slightly concave forwards. At this radius there are 15 ribs over a whorl length of 35 mm.

The ribbing on the last preserved whorl at a whorl radius of about 55 mm is rather coarser and the ribs are a little more definitely concave forwards. The material filling the air chambers has in part fallen out so that the internal structure of the cameral contacts with the shell wall are to be seen (see pl. XVI, figs. 2, a—b). The whorl section agrees with those of the few figured specimens of the species in being broadest near the umbilical margin and converging slightly towards the venter.

REMARKS. — The specimen here referred to *U. jamesoni* differs from other Swedish specimens of the genus in the development of the ornament and the dimensions of the umbilicus. Although found by MOBERG it was not recorded by him in his monograph (1888). The principal difference between *P. (U.) jamesoni* and *P. (U.) angustus* (QUENSTEDT) lies in the denser ribbing of the latter and the slightly more compressed and flat-sided whorls.

Polymorphites (Uptonia) angustus (QUENSTEDT)

Pl. XVI, figs. 1, a—b; pl. XVII, figs. 1, a—b, 2

1845 *Ammonites Jamesoni* SOWERBY, *angustus* QUENSTEDT, p. 89, pl. 4, fig. 8.

1882 *Aegoceras Jamesoni* SOWERBY, WRIGHT, p. 352, pl. 51, fig. 4.

1888 *Ammonites Jamesoni* SOWERBY, MOBERG, p. 68, pl. 3, figs. 1—3.

1951 *Uptonia jamesoni* (SOWERBY), TROEDSSON, p. 241.

1954 *Polymorphites (Uptonia) angusta* (QUENSTEDT), DONOVAN, p. 42.

MATERIAL. — Three specimens.

REPOSITORIES. — Lund, LO 844; S. G. U., Stockholm, (unnumbered specimen) cast in the museum of Geologiska Institutet, G. I. C 1205 (the original specimen is marked as original in MOBERG's handwriting). A third, unnumbered specimen from Lund was broken up completely in connection with its dissection. The plastic mold figured in the present paper (pl. XVII, fig. 2) bears a fairly close resemblance to MOBERG's figure in pl. 3, fig. 1 of his paper and it seems likely that this is a reconstruction based on the external impression. A specimen from the collection at the Paleontological Institute, Tübingen is selected as neotype, No. Ce 1158.

NEOTYPE. — Specimen No. Ce 1158, Tübingen University, from Kirchheim, Württemberg, Germany, figured in pl. XVI, figs. 1, a—b. During the author's visit to Tübingen in June, 1958, a search was made for the original specimen figured by QUENSTEDT in 1845, but without success. With Professor H. HÖLDER's friendly assistance a topotype specimen was selected as neotype to replace the lost original.

COLLECTORS. — J. C. MOBERG; a fourth specimen that may belong to *U. angustus* but which is too small and too poorly preserved for identification was collected by the author from the beds at Kurremölla.

AGE. — Lower Pliensbachian; *jamesoni* subzone of the *jamesoni* zone.

DESCRIPTION. — Specimen LO 844 is the inner whorls of a larger specimen (pl. XVII, figs. 1, a—b); it is made up of two whorls and has a diameter of 11 mm. There are 16 ribs on the last half whorl and 30 on the entire second whorl. The ribs are flat and are broader at this stage than the intercostal spaces. They begin abruptly at the umbilical margin and then run straight to the ventrolateral margin where they form a relatively prominent, rounded tubercle; they then continue onto the venter where they incline forwards to form chevrons. In the middle they develop faint thickenings (cf. *Dayiceras*). Specimen LO 844 is the original specimen to MOBERG (1888, pl. 3, fig. 3).

Specimen G. I. C 1206 with a diameter of 20 mm was broken up to permit study of the development of the inner whorls. The last preserved whorl had 29 ribs, the venter was arched and there were faint median swellings of the chevrons on the venter. The ribs terminated at spinate ventrolateral tubercles and although they continued onto the venter, were very much weaker there. On breaking back the specimen it was found that the ventrolateral tubercles weakened and at a diameter of about 10 mm, were of the same strength as those of specimen LO 844. The ribs were observed to be single, straight and changing from rounded on the innermost whorls to sharp on the last preserved whorl; the rib density was the same throughout, namely 29—30 ribs per whorl.

The original to MOBERG's pl. 3, fig. 1 according to the label written by MOBERG is a poorly preserved impression in ferruginous sandstone,

a rubber mold of which is figured in pl. XVII, fig. 2. MOBERG's figure has about 65 ribs on the last whorl and this costal frequency agrees well with that of the cast.

The neotype here selected has about 58 ribs in the last whorl at a diameter of approximately 150 mm; it agrees well in its proportions with the Swedish specimens.

DIMENSIONS. —

	LO 844	G. I. C 1026
diameter	= 11 mm (= 1.00)	20 mm (= 1.00)
thickness	= 4 » (= 0.36)	5.5 » (= 0.27)
umbilicus	= 3.5 » (= 0.32)	9 » (= 0.45)
height of last whorl	= 3.5 » (= 0.32)	6.5 » (= 0.33)

REMARKS. — The ribbing of the specimens referred here is much finer (ribs about double as numerous in the case of *P. (U.) angustus*) than that of *P. (U.) jamesoni* and the ribs of the latter species are also more coarsely developed.

As already noted above, the density of costation of the neotype and our material agrees closely. The specimen figured by WRIGHT (1882, pl. 51, fig. 4), which seems generally to agree with *P. (U.) angustus* has fewer ribs per whorl and may be a transitional form between *jamesoni* and *angustus*, and there seems to be good reason for regarding the two species as close relatives.

FAMILY DACTYLIOCERATIDAE HYATT, 1867

Genus *Dactylioceras* HYATT, 1867

TYPE SPECIES. — *Ammonites communis* SOWERBY (cf. ARKELL et al., 1957, p. L252; SYLVESTER BRADLEY, 1958).

Dactylioceras cf. *tennicostatum* (YOUNG & BIRD)

Pl. IX, fig. 4; pl. XII, figs. 2, 3; pl. XVII, fig. 3

1822 *Ammonites tennicostatus* YOUNG & BIRD, p. 247, pl. 12, fig. 8.

1884 *Stephanoceras annulatum* SOWERBY, WRIGHT, p. 475, pl. 84, figs. 7, 8.

1920 *Dactylioceras tennicostatum* YOUNG & BIRD sp., BUCKMAN, pl. 157.

1954 *Dactylioceras tennicostatum* (YOUNG & BIRD), DONOVAN, p. 17.

MATERIAL. — 9 well preserved aragonitic fragments.

REPOSITORY. — Lund, LO 3948—50 as well as unnumbered specimens.

PROVENANCE. — Core taken from 170—170.5 m in the borehole at Vilhelmsfält, northwestern Skåne (see TROEDSSON, 1951, p. 30).

COLLECTOR. — The author.

AGE. — Lower Toarcian; the *tennicostatum* zone.

DESCRIPTION. — The fragments all seem to belong to the same species. Specimen LO 3950 consists of about the first two and a half whorls (pl. XII, figs. 2, a—b). On the last preserved half whorl there are about 24 principal ribs with about a little less than half of the ribs undivided. The forked ribs fork either in the inner third or in the outer third although the proportions seem to vary with the result that a few ribs fork in the middle of the flank. The bifurcation takes place in such a manner that one part of the rib continues without deviation while the other swerves to the side and then runs parallel to the principal rib. Exactly the same sort of division is shown by BUCKMAN (1920, pl. 157, fig. 2). The ribs are slightly flexed and seem to become somewhat stouter on the venter. Most of the ribs seem to fork in the outer third of the flank. Fine sutures are to be seen beneath the shell material, but they are too indefinite to permit reproduction.

Specimen LO 3949 is a fragment of a larger whorl (pl. XII, fig. 3, a—b); it indicates that the ribbing becomes more robust at greater diameters and that most of the forked ribs divide in the middle or outer part of the flank. The shell material is also thicker than in the case of the inner whorls. There is still a certain degree of irregularity in the costation of the same nature as shown by the inner whorls.

Specimen LO 3948 is a fragment of a middle-sized whorl (pl. IX, fig. 4). By this stage the ornament has become more stabilized, the aragonitic shell material is coarser and the ribbing more uniform and a little less dense than on the innermost whorls. The whorl height of our specimen is 8 mm and the length of it 11 mm. On this fragment there are 21 ribs of which two or three are simple (regarding in this case a bifurcated pair as one rib entity); there is, however, no regularity in the appearance of divided ribs. The ribs are usually stronger at the umbilical margin where they pass into the umbilicus; they are sloped and slightly sigmoidal. Most ribs divide in the inner third of the flank, a few in the middle; they are hollow (see pl. XII).

REMARKS. — The fragments here described are characterized by very densely located, flexed, bifurcated ribs. The most closely comparable species is *Dactylioceras tenuicostatum* (YOUNG & BIRD), which differs slightly, however, in having the majority of the bifurcations in the vicinity of the ventrolateral margin and not in the middle of the side or even nearer the umbilicus, but this may be due to size differences. *Dactylioceras commune* (SOWERBY) is also similar but the ribbing is coarser. Another finely costate species is *D. directum* (BUCKMAN) but it differs mainly in having straight ribs.

D. cf. tenuicostatum is the youngest Jurassic ammonite yet found in Sweden. Its occurrence at a depth of 170 m in the borehole at Vilhelmsfält also clearly suggests the possibility of still younger finds. Besides this form, other Middle and Upper Liassic forms were found at a depth of around 180 m in the same borehole. Dr. HOFFMANN, Hannover, has

recognized at this depth fragments belonging to the following genera. — *Dactylioceras* (Toarcian), *Onychoceras* (Toarcian), and *Pleuroceras* (Upper Pliensbachian). From a nearby borehole at Pankarp he obtained forms indicative of an Upper Sinemurian age.

In the international zonal scale *Dactylioceras tenuicostatum* is the zonal fossil for the *tenuicostatum* zone, the lowermost subdivision of the Toarcian. Less finely ornamented *Dactylioceras* are also found at higher levels in the Toarcian.

SUMMARY OF THE ZONAL STRATIGRAPHY OF THE LIAS OF SKÅNE

In the following chapter the reasons for the age assignments used in the systematic section are given. As a basis, the standard English scheme is adhered to in which the French and German successions also are largely incorporated. Unfortunately, natural sections do not occur in Skåne, where the Lias is poorly exposed and the material comes from isolated outcrops and boreholes. Luckily, many well known guide fossils occur and this has enabled an accurate correlation with areas with better known sequences. Owing to the fact that previous workers on the Swedish Jurassic have principally used the stage divisions currently in employment in Germany it was deemed advisable, where possible, to also refer the sequence in Skåne to the German succession. The possibilities of exact correlation with the English Lias have been greatly increased by recent publications by ARKELL, DONOVAN, and SPATH. The ammonite assemblages are dealt with in ascending order beginning with the lowermost stage of the Lias.

HETTANGIAN

No ammonites belonging to this stage have yet been found in Skåne. TROEDSSON (1951 and earlier) made a close survey of the plant-bearing beds and revised much of the earlier zonal scheme proposed by LUNDBLAD (1881) and NATHORST (1880, 1894) (see TROEDSSON, 1951, p. 14). TROEDSSON's field observations indicated the presence of a disconformity just above the zone with *Lepidopteris Ottonis* (GOEPP.) SCHIMPER (TROEDSSON, 1951, p. 14), which he considered to mark the boundary between Trias and Jurassic (see also LUNDBLAD, 1949, p. 1). *Lepidopteris Ottonis* is considered to be an important zonal fossil in the European Rhaetic and it has also been found at 1450—1485 m in the borehole Höllviken II, Skåne (cf. LUNDBLAD, 1949, p. 7); there can therefore be little doubt that the beds with *L. Ottonis* are of Upper Triassic age. It should be mentioned that TROEDSSON regarded the Rhaetic as being the basal part of the Jurassic (TROEDSSON, 1951, p. 16) and quoted Dr. W. J. ARKELL as one of his authorities for this viewpoint. However, ARKELL has repeatedly stated

the Rhaetic to be of Upper Triassic age (for example, ARKELL, 1956, pp. 38, 172) and he also placed the Swedish Rhaetic in the Trias (ARKELL, 1956, p. 465).

TROEDSSON (1955, p. 605) considered the four plant-bearing subzones belonging to the *Thaumatopteris* zone of paleobotanists, and the four pelecypod levels (*Mytilus*-, *Cardinia*-, *Cyclas nathorsti*- and *Pullastra*-) to correspond to Lias α_1 and the "Ostrea" level, and possibly also the *Avicula* level to be the equivalent of the Lias α_2 .

In Denmark, beds with ammonites were encountered in the borehole Gassum I (FREBOLD in GREGERSEN & SORGENFREI, 1951) amongst which *Schlothemia angulata* (SCHLOTHEIM) and *Psiloceras* sp. were found to occur. Both are typical of the Hettangian. In Skåne this stage is represented by coal measures (termed the Helsingborg Stage by TROEDSSON, see this author, 1951, p. 121) in which plant remains are common and occasional levels with pelecypods occur. On the basis of these fossils the beds were correlated by TROEDSSON with the Hettangian or Lias α_1 — α_2 of the German succession.

SINEMURIAN

In order to facilitate comparison with the German sequence the Sinemurian is here discussed under two sections, the Lower Sinemurian and the Upper Sinemurian (Lotharingian). The Lower Sinemurian corresponds to the Lias α_3 of the German succession and embraces the *bucklandi* and *semicostatum* zones. The zonal evidence for the former in Skåne is not strong but the latter is fully developed.

The *bucklandi* zone. — The three subzonal indices of this zone are as follows:

Arietites bucklandi

Coroniceras rotiforme

Coroniceras conybeari

expressed in order of increasing age downwards.

Whilst there is no ammonite evidence at all for the lower two subzones, there seems to be a certain possibility for the presence of the *bucklandi* subzone, although the guide fossil is not known. As already pointed out, the fossils come from isolated outcrops and the relative positions of the subzones can only be inferred by analogy with the sequences in standard profiles. *Megarietites meridionalis* (REYNÈS) is a rather common form in the collection. Although regarded as a typical species of the *gmuendense* subzone by DONOVAN (1955, p. 14), in a later paper he noted (DONOVAN, 1956, p. 203) that *Megarietites* occurs in the *bucklandi* subzone and ranges into the lower part of the *gmuendense* subzone. In conclusion we may say that although it is not decisively proved that the *bucklandi* subzone is represented in the marine sequence of the Döshult area, there is nevertheless a strong possibility that such is the case.

The *semicostatum* zone. — This zone is completely developed in the Swedish Lias and in fact the majority of the specimens in the collection come from it. Forms appertaining to the *semicostatum* zone were the first to be discovered and LUNDGREN's monograph is entirely concerned with species of this age. The three subzones of the *semicostatum* zone are:

Euagassicerias sauzeanum

Agassicerias scipionianum

Coroniceras reynesi (= *gmuendense*)

with the youngest subzone at the top.

The evidence for the presence of the last-named subzone is strong and besides the leading form, *Coroniceras* (*Primarietites*) *reynesi* (SPATH), the following species also occur:

Paracoroniceras charlesi DONOVAN

Paracoroniceras crossi (WRIGHT)

Megarietites cf. *meridionalis* (REYNÈS)

The genus *Arnioceras* also makes its first appearance in this subzone. It is of interest to note that SPATH (1956, p. 161) recorded that this genus was found as early as in the top of the *bucklandi* zone in the boring at Stowell Park, England. The subzone is represented at Djuramåsa and Dompång and seems to be the least well developed of the three.

The *scipionianum* subzone is well represented by not only the guide fossil, *Agassicerias scipionianum* (D'ORBIGNY), but also the closely related *Agassicerias nodulatum* (BUCKMAN). Other species are: *Arnioceras* cf. *falcaries* (QUENSTEDT), and some indeterminate species of *Arnioceras*. Some fragments of *Arnioceras* from the borehole at Oregården that were included under *A. falcaries*? in the descriptive portion of the paper, seem to be rather like some figures of juvenile whorls of *Arnioceras semicostatum* (YOUNG & BIRD); for example, the fragment figured in pl. XII, fig. 3. Other finds of *Arnioceras* of stratigraphic importance are that in the sandstone outcrop on the spit at Kulla Gunnarstorp and that in the plantiferous grit exposed in the beach at Hittarp. Unfortunately, neither of the specimens could be specifically determined and no close information on the dating can therefore be supplied, apart from the fact that these ammonites prove that the beds at the two localities cannot be older than the upper part of the *bucklandi* zone. This subzone is represented in the borehole at Oregården, Djuramåsa, and Döshult.

The *sauzeanum* subzone, which should now be called the *resupinatum* subzone owing to the priority of SIMPSON's name over that of D'ORBIGNY's, is, as regards number of individuals, the best developed subzone of the Swedish Lias and the guide fossil is present in large quantities. The following species occur in this subzone:

Euagassicerias resupinatum (SIMPSON)

Euagassicerias spinaries (QUENSTEDT)

Euagassicerias lundgreni sp. nov.

Cymbites striaries (QUENSTEDT)*Arnioceras* spp.

The subzone is developed in the borehole at Oregården, in most of the Döshult area, but in particular at Dompäng and Löparehus in this district.

The *semicostatum* zone was not encountered in southeastern Skåne and in fact seems to be confined to the area in northwestern Skåne north of Hälsingborg, near Viken and up to Oregården. In the holes drilled in Jutland no ammonites belonging to the zone were found.

It is of interest to note that at the type locality of the Sinemurian at Semur, France there is a slight difference in the ammonite sequence as compared with northern Europe (including England) (ARKELL, 1956, p. 67). There, *Euagassicerias resupinatum* (SIMPSON) does not mark the absolute top of the *semicostatum* zone there being two *Arnioceras* "horizons" recognized above it.

Another very important point in connexion with the type Sinemurian is that *Megarietites meridionalis* (REYNÈS) occurs as a leading form, together with *Coroniceras kridion* (ZIETEN), in the upper part of the *bucklandi* zone and below the "horizon" of *Arietites bucklandi* (SOWERBY). This is another piece of evidence that suggests that the occurrence of *Megarietites meridionalis* in Skåne may indicate the presence of beds of upper *bucklandi* age. As regards the already noted full development of the *resupinatum* (= *sauzeanum*) subzone in northwestern Skåne it is worth pointing out, that SPATH (1956, p. 154) recorded a similar feature for the borehole at Stowell Park, England. He noted that whereas the *resupinatum* part of the sequence is fully represented the *scipionianum* subzone does not seem well developed. This also seems to be true of Skåne.

The boundary between the Lias α_3 (Lower Sinemurian) and the Lias β (Upper Sinemurian) is often placed between the *semicostatum* and *turneri* zones (see, for example, HOFFMANN, 1949, p. 114). SPATH (1942) placed it between the *turneri* and *obtusum* zones in accordance with the original definition. There is as yet no faunal evidence available for the presence of the *turneri* zone, although the lowermost part of the Gantofta—Kattslösa sequence may belong here, as also part of the subsurface succession in the Pankarp—Vilhelmsfält area.

The *obtusum* zone. — This zone comprises the following three subzones (youngest at the top):

Eparietites denotatus

Asteroceras stellare

Promicroceras planicostum

TROEDSSON (1951, p. 68) applied the name "Kattslösa Stage" to part of a temporarily exposed sequence in the Kattslösa—Gantofta district (he consistently spelled the place name as Kattslösa; the Official Survey Department spelling is Kattslösa). On the basis of the occurrence of two am-

monites, identified by TROEDSSON (1951) as *Coroniceras sauzeanum* (D'ORBIGNY)? (TROEDSSON, 1951, p. 241, not figured) and *Arietites* sp. (TROEDSSON, 1951, p. 241, pl. 24, fig. 11) he referred the lower part of the section to the Lower Sinemurian (Lias a_3) and correlated these beds with the middle to upper part of the Döshult formation (at its type locality), principally of *semicostatum* age (TROEDSSON, 1951, p. 69), although he tentatively realized the possibility of at least the presence of basal Upper Sinemurian (TROEDSSON, 1951, pp. 114, 117). The middle and upper parts of the sequence were placed in the Lower Pliensbachian (Lias γ) (cf. TROEDSSON, 1951, p. 16). This assignation was grounded to a considerable extent on the evidence supplied by the identification of a doubtful ammonite fragment as "*Uptonia jamesoni*", but also on the presence of certain belemnite fragments.

The present investigation has shown, however, that the two ammonites from the lower part of the succession should be referred to the genera *Eparietites* and *Promicroceras*. Species of the genus *Eparietites* are confined to the subzone of *Eparietites denotatus* at the top of the zone of *Asteroceras obtusum*. Species of the genus *Promicroceras* appear first in the top *birchi* subzone of the *turneri* zone and continue through the two lower subzones of the *obtusum* zone, the subzones of *Promicroceras planicostum* and *Asteroceras stellare*.

The *obtusum* zone is consequently known at present only from the lower part of the Kattslösa sequence. It seems possible that *turneri* zone forms may eventually be encountered in the beds underlying that part of the sequence as was treated by TROEDSSON in 1951. The *Eparietites* was found at a stratigraphical position slightly above that of the *Promicroceras* and the latter in all probability represents the *planicostum* subzone or the *stellare* subzone.

In the opinion of the present writer there is a strong possibility that the uppermost part of the Kattslösa—Gantofta succession is also of Upper Sinemurian age. Unfortunately, the specimen identified by TROEDSSON as *Uptonia jamesoni* cannot be found. In conclusion it may be emphasized that the writer is in full agreement with TROEDSSON as regards the recognition of a separate rock unit for the Kattslösa area. Summing up we may say of this entity that it is younger geologically than the Döshult formation and that it embraces the entire section excavated and shown schematically in the sketch map published by TROEDSSON (1951, p. 67) and in more detail in the map on p. 69 and the sections on p. 72. The age of the Kattslösa formation is here considered to be Upper Sinemurian (Lias β).

The *oxynotum* zone. — There is no ammonite evidence for this zone in northwestern Skåne, although FIEBOLD (1951, in GREGERSEN & SORGENFREI) tentatively recorded *Oxynoticeras* from the Gassum I borehole, Jutland. At Kulladal in southeastern Skåne numerous fragments of *Oxynoticeras*? sp. indicate the possible presence of this zone,

and would thus mark the oldest Lias of this area. The ammonite fragments are small and resemble in appearance ferriferous concretions that occur in the same bed, particularly since they too occur as ironstone steinkerns. Close study shows them to have inner whorls preserved and one has the trace of a suture. Some of the steinkerns display a sort of concretionary banding; this is also common in the ammonites from northwestern Skåne, particularly those preserved in ironstone. These specimens are all strongly ornamented and there can be no doubt of their origin. The banding seems to be of secondary origin and to have arisen by weathering. It may here be mentioned, that Lower Cretaceous ammonites collected by the writer from lateritized sediments in West Africa also display an identical type of banding.

There is as yet no concrete evidence for the top Sinemurian *raricostatum* zone in Skåne, although a cursory perusal of new borehole material obtained from a drilling put down in Öresund between Hälsingborg and Helsingör (June, 1958) disclosed the presence of fragments of what may prove to be echioceratids. Unfortunately, this interesting borehole collection, preserved at Sveriges Geologiska Undersökning, is not yet available for paleontologic study. Part of the sequence at Vilhelmsfält may be referable to this zone and some of the ammonite fragments studied by FREBOLD from the Gassum I borehole may be indicative of it.

PLIENSACHIAN

The boundary between the Sinemurian and the Pliensbachian runs between the *raricostatum* and *jamesoni* zones, which also delineate the Lias β from the Lias γ . There is good reason to believe that the majority of the zones of the stage are developed in Skåne.

The *jamesoni* zone. — This zone comprises the following four zones (youngest at the top):

- Polymorphites jamesoni*
- Platypleuroceras brevispinum*
- Polymorphites polymorphus*
- Pbricodoceras taylori*

The lowest subzone has not yet been encountered but the *polymorphus* subzone occurs in the Fyle valley sequence where *P. (Polymorphites)* sp. is occasionally to be found. *Polymorphites* s. l. was also recorded by FREBOLD (1951, in GREGERSEN & SORGENFREI) from the borehole Gassum I, Jutland. No definite *brevispinum* species have yet been met with in Skåne or Denmark, but the uppermost *jamesoni* subzone is fairly widely distributed in the Fyle valley where the index species *P. (Uptonia) jamesoni* (SOWERBY) occurs, as well as *P. (Uptonia) angustus* (QUENSTEDT).

The *ibex* zone. — The *ibex* zone is developed on Bornholm where *Pbricodoceras bornholmiense* (HÖHNE), *Tragophylloceras numismale* (QUENSTEDT) and *Acanthopleuroceras* spp. occur. It seems likely that beds

of this age exist in the Pankarp—Vilhelmsfält area, but no conclusive evidence is yet available.

The davoei zone. — This zone marks the top of the Lias γ and it is represented in the Gassum I borehole, Jutland, by *Androgynoceras capricornum* (SCHLOTHEIM) according to FREBOLD (1951, in GREGERSEN & SORGENFREI). Dr. K. HOFFMANN has identified a fragment of *Oistoceras* in samples from about 180 m depth in the Vilhelmsfält borehole, thus indicating the presence of the top *davoei*, *figulinum* subzone in north-western Skåne.

The margaritatus and spinatum zones. — These are discussed together as they constitute the Lias δ of the German classification (Upper Pliensbachian). The zones occur in the subsurface strata at Vilhelmsfält, although no ammonite evidence for the Lower Pliensbachian *jamesoni* zone has yet come to light. During a recent visit to Hannover (June, 1958) the author was shown a collection from a depth of 180 m in the Vilhelmsfält borehole presented to the Amt für Bodenforschung by Dr. E. BÖLAU, Hälsingborg, in which Dr. K. HOFFMANN has identified certain fragments as *Amaltheus* spp. and *Pleuroceras* sp. indet. *Pleuroceras spinatum* (BRUGUIÈRE) and *Amaltheus margaritatus* (DE MONTFORT) were reported by FREBOLD (1951, in GREGERSEN & SORGENFREI) from the Gassum I borehole, Jutland, and *Pleuroceras* sp. occurs on Bornholm. The Lias δ may therefore be regarded as well developed and widespread in Southern Scandinavia.

TOARCIAN

The youngest Lias for which ammonite evidence is available in Scandinavia was penetrated at a depth of 170 m in the borehole at Vilhelmsfält. The well preserved, aragonitic ammonite fragments are referred here to *Dactylioceras* cf. *tenuicostatum* (YOUNG & BIRD) and we have thus conclusive evidence for the presence of the basal Toarcian *tenuicostatum* zone (lower part of the Lias ϵ). In England, *D. tenuicostatum* (YOUNG & BIRD) is taken as the upper subzone of this zone. The *tenuicostatum* zone is characterized by the occurrence of finely ribbed *Dactylioceras*, the more coarsely costate species of the genus generally occurring higher up in the Toarcian.

TROEDSSON (1951, p. 30) reported the presence of ammonites in the Vilhelmsfält core at depths of 180 and 240 m, but did not attempt to identify them. BÖLAU sent these to HOFFMANN in 1956 for identification, the results of which have in brief been commented on in the foregoing. The present writer studied the remnants of the core preserved in the borehole archive at the Geological Department, University of Lund, in July, 1958, and succeeded in discovering a third ammonite level in plant-rich shales at a depth of 170 m. The part of the core above these fossils was found to be devoid of ammonites, although pelecypods and abundant