NEW FINDS OF BATHONIAN, CALLOVIAN, AND OXFORDIAN AMMONITES IN NORTHERN JAMESON LAND, EAST GREENLAND

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A short description is given of Middle and Upper Jurassic deposits in northern Jameson Land. New finds of specimens of *Oxycerites* and *Oecotraustes* from the Boreal *Arcticoceras kochi* Zone are described and the correlation of Boreal Middle Jurassic deposits with standard zones is discussed.

A find of *Kosmoceras (Zugokosmokeras)* cf. *proniae* in the lower part of the Koch Fjeld Formation provided the first evidence of marine Upper Callovian beds in East Greenland.

A *Cardioceras* species found in the upper part of the Koch Fjeld Formation indicates an Oxfordian age for the youngest beds in this region.

During the summer of 1968 parts of northern Jameson Land were mapped by geologists taking part in a systematic field mapping programme in the Scoresby Sund area of East Greenland which is being carried out by the Geological Survey of Greenland (Birkelund & Perch-Nielsen 1969). A number of ammonites, not previously known from this area, were found in deposits outcropping around Olympen, Parnas and Mikael Bjerg (see figs 1 and 3). In 1970 J. H. Callomon and T. Birkelund visited the same area and found further evidence of new faunas. Only a few of the specimens, collected on this occasion, are described here together with the 1968-collections, while their main results will be described elsewhere.

Earlier investigations

As the history of research on Jurassic deposits in East Greenland is summarized by Rosenkrantz (1934) and Donovan (1957) only the most important works on Middle and Upper Jurassic deposits of the area in question need be mentioned.

The earliest work on Middle Jurassic ammonites from Jameson Land is

by Madsen (1904), who described material collected by the Danish Expedition (1898–1900) led by G. C. Amdrup. Extensive collecting in Middle Jurassic beds was carried out by A. Rosenkrantz, who was a member of Lauge Koch's expedition to East Greenland in 1926–27. His collections were monographed by Spath (1932). The lithological division of the Jurassic was also established by Rosenkrantz (1929).

In 1958–59 J. H. Callomon visited Jameson Land, as a member of Lauge Koch's expedition (Callomon 1970), and the state of knowledge of the Middle Jurassic ammonite fauna was considerably advanced (Callomon 1959, 1961).

J. H. Callomon has under preparation a monograph on the Middle Jurassic ammonites from the whole Jameson Land area. Hence only special finds are treated here.

Geological description

Most of the new finds of ammonites described in this paper originate from the area around Olympen which is shown on the map fig. 3. On the basis of the renewed investigations in this area short descriptions of the fossiliferous Vardekløft and Koch Fjeld Formations are given (fig. 2).

These formations, being the youngest preserved in northern Jameson Land, include a series of sediments 600–700 m thick, overlying the Neill Klint Formation, the top of which contains a marine fauna of Toarcian age (Rosenkrantz 1934).

No marked unconformities can be shown in the sequence in this area and faults seem to be absent. The dip is always very gentle (2–4°), generally towards S and SE.

Vardekløft Formation

It has to be stated that the use of the lithological names within this part of the section is in a rather unsatisfactory state and therefore must be regarded as provisional. This applies particularly to the "Yellow Series" the problem of which has been outlined by Donovan (1957, p. 36) and Callomon (1970, p. 6). It is the hope of the authors that the following years of field-work in southern Jameson Land will settle the matter.

Lower Vardekløft Member. This member is almost completely built up of a very uniform sequence of dark-grey to black, finely laminated silty shales, usually badly exposed.

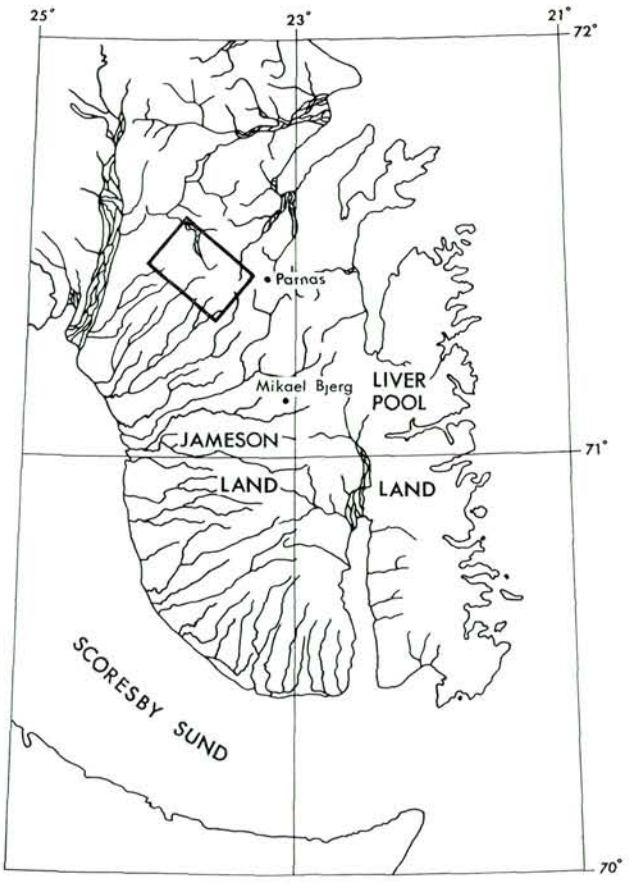


Fig. 1. General map of Jameson Land giving the position of the area shown in fig. 3.

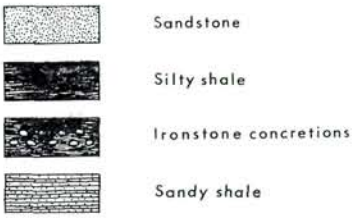


Fig. 2. Idealised lithological section within the mapped area.

In the lower part of the member frequent dark-reddish ironstoneconcretions are found. They are very hard and in a few cases they form nearly continous layers. In the upper part the shales become gradually lighter in colour and are less regularly bedded. A few beds of impure grey, poorly consolidated sandstones occur.

The thickness of the member varies from 65 to 100 m within the area.

As diagnostic fossils are unknown from this member the age is uncertain.

"Yellow Series". This member is composed predominantly of medium- to coarse-grained light coloured sandstones, usually well-sorted and now and then with subordinate layers of finer-grained sandstones or siltstones. In general the colour is light-grey to almost white, and with weathering it becomes light-yellow or occasionally more red and brown. Throughout the series there are frequent but apparently random alternations between beds of varying thickness. Individual beds vary from massive (up to 10 m thick) to shaly, and are consolidated to varying degrees. The sandstones have great concentrations of muscovite on many bedding-planes and show cross-bedding in many places. There are a few conglomerates which contain well-rounded, oval quartzite pebbles of less than 5 cm length. There is a regional trend from the more massive coarse-grained beds in the ENE to more shaly beds in the WSW.

The thickness of the member within the area increases from a little less than 300 m in the south to more than 400 m in the northern part. Further to the north the thickness tends to increase even further. The series probably has a more or less deltaic origin.

Throughout the series various trace-fossils are found, comprising both trails and burrows, and in some beds these are very abundant. Some of the trace-fossils from the "Yellow Series" are described by Heinberg (in press).

A number of ammonite-zones are known from this member of the Vardekløft Formation (Callomon 1959, 1961). The "Yellow Series" seems, however, to be almost barren in this area except for a few occurrences of ammonites in scree. In a few conglomeratic horizons, mostly near the top of the series, abundant, but much weathered, belemnites are found. Carbonised plant-remains and poorly preserved casts of fragments of wood occur rather frequently throughout.

Upper Vardekløft Member. This member is about 80–100 m thick within the area. It consists largely of rather dark, silty shales, rich in muscovite, and subordinate, fine- to medium-grained micaceous sandstones. The shales weather to a very light silver-grey crumbly sediment. The lower part of the

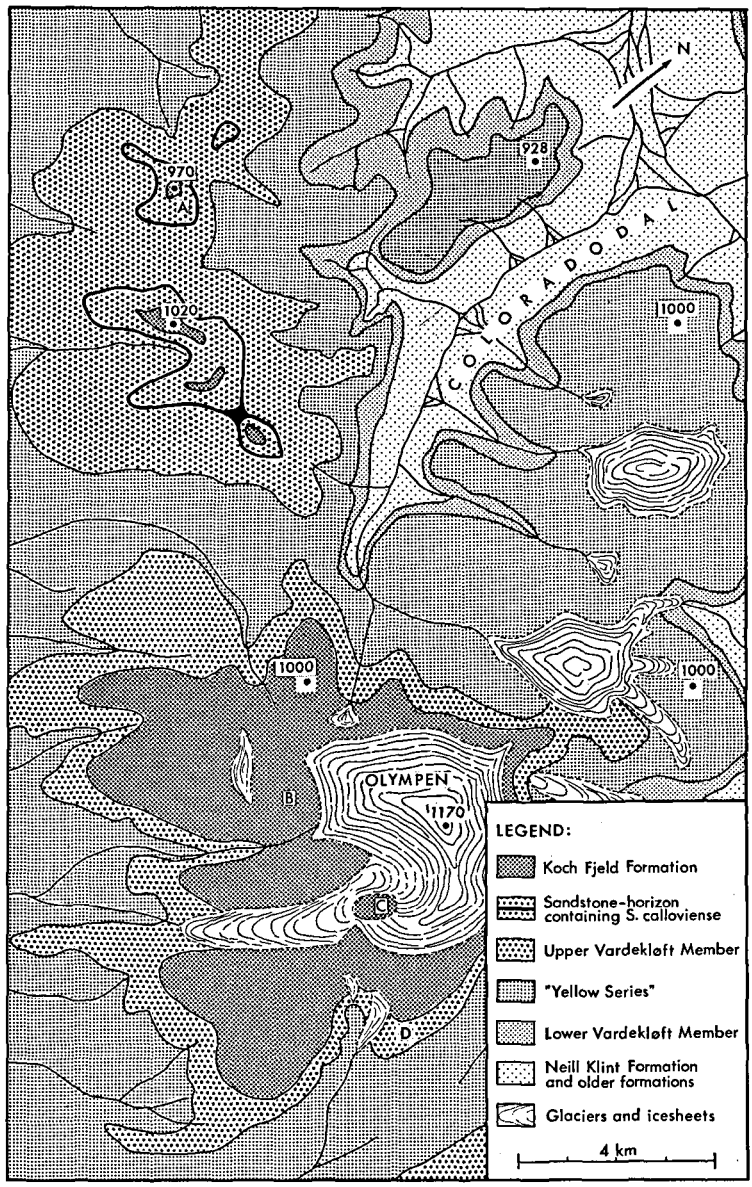


Fig. 3. Geological map of the area indicated in fig. 1. Based on the field-work of E. Håkansson and F. Surlyk.

member is more sandy than the upper part and contains glauconitic horizons and phosphatic nodule beds. Sandy, more or less calcareous concretions and indurated sandstones occur at many horizons. The vertical lithological changes can often be followed laterally over large parts of the area.

Prolific assemblages of ammonites were mainly found at two horizons:

1) In the far southeastern part of the area (SSE of Olympen) fairly regularly bedded or cross-bedded sandstones outcrop in the lower part of the member. Besides plant-remains these beds have yielded a rich fauna belonging to the *Arcticoceras kochi* Zone (fig. 7). The fauna is dominated by specimens of *Arcticoceras* and also includes *Oxycerites* aff. *jugatus* (loc. D in fig. 3), belemnites, trigonids, and a few pectinids. Above this horizon ammonites belonging to the *Cadoceras variabile* Zone occur, partly in sandy-silty scree, partly in irregularly bedded, strongly bioturbated concretionary sandstones up to 15 m above the *Arcticoceras* bed.

2) Through most of the northwestern part of the area, a very distinctive sandstone up to 3 m thick can be traced as a marker bed in the very monotonous series of shales belonging to the upper part of the member. Carbonised plant debris gives this sandstone a grey colour which weathers to a characteristically reddish or brownish hue. The sandstone is irregularly bedded or shows large scale cross-bedding. It contains usually vertical burrows, especially in the upper part. It has yielded a very rich and composite fauna of numerous ammonites, frequent belemnites and lamellibranchs and rarer brachiopods and gastropods. On the basis of the ammonites (i.a. *Sigaloceras calloviense*) the fauna is referred to the *Sigaloceras calloviense* Zone and subzone (fig. 7).

Koch Fjeld Formation

The Koch Fjeld Formation (cf. Troelsen 1956, p. 52) consists predominantly of fine to very coarse-grained and usually well-sorted sandstones, often with a high content of muscovite. In colour, when freshly broken, the beds are mostly light-grey or almost white but they are normally weathered to shades of yellowish brown. Locally the weathering imparts very strong shades of red and yellowish brown. Individual beds vary in thickness, they may be massive (up to 15 m) or platy and they are consolidated to varying degrees. Individual beds are very often cross-bedded, sometimes with ripple-marks on the bedding-planes.

In the lower part of the formation some finely bedded large spherical sandstone concretions (up to 1 m in diameter) are found.

In the region of Olympen itself a thick shale member occurs in the

lower half of the formation. These shales are in part very similar in facies to the marine shales of the Upper Vardekløft Member below. Characteristically extremely thick and well-consolidated massive beds of sandstone occur above this shale series.

The upper limit of this formation is not preserved in the area. The thickness of the preserved part varies from 15 m in the most northwestern locality to about 250 m at Olympen.

Fossils are very sparse in this formation and in addition to scattered trace-fossils, and in some places rather common plant-remains, only three ammonites and a few belemnites have been found. At the most northwestern locality, one fragment of *Kosmoceras* (*Zugokosmokeras*) cf. *proniae* and a few poorly preserved belemnites have been found 15 m above the base of the formation (loc. A in fig. 3), and two impressions of a *Cardioceras* sp. have been found at Olympen about 225 m above the base of the formation (loc. B and C in fig. 3). Further one *Cardioceras* specimen was collected at Parnas, about 125 m above the base of the formation.

The age of the Koch Fjeld Formation within the area, until now uncertain, is thus Upper Callovian to Oxfordian.

Systematic descriptions

All specimens, whether with MMH numbers (Mineralogical Museum, Copenhagen) or GGU numbers (Greenland Geological Survey) are housed in the Mineralogical Museum.

Oxycerites aff. *jugatus* Ershowa & Meledina, 1968

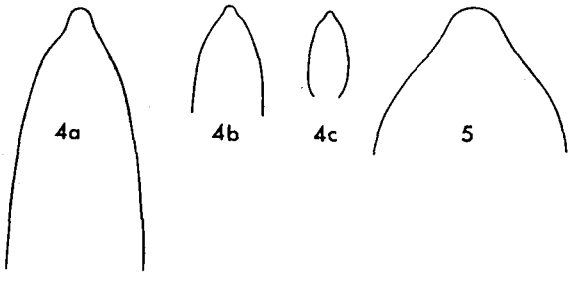
Pl. 1, figs 1a–b, 2; pl. 2, figs 1–4; text-figs 4a–c, 5.

Material

Mikael Bjerg, northwestern slope, 403 m above sea-level: 2 fragments, MMH Nos 11005–11006. Olympen, 728 m above sea-level (loc. D in fig. 3): 5 fragments, MMH Nos 11007–11009, GGU Nos 137357, 137379.

Stratigraphical level

All the specimens were found in the *Arcticoceras kochi* Zone of the Vardekløft Formation together with rich assemblages of *Arcticoceras* spp.



Figs 4, 5. *Oxycerites* aff. *jugatus* Ershowa & Meledina. 4a–c: MMH No. 11005, cross-sections, × 1; Bathonian, Mikael Bjerg. 5: MMH No. 11008, cross-section, × 1; Bathonian, Olympen.

Description

The diameter of the largest well preserved phragmocone, which lacks most of the body chamber (pl. 1, fig. 1) is about 107 mm at the last suture but a septate fragment (pl. 2, fig. 1) shows that the species may attain an even greater size.

The shape is compressed and involute. The later whorls have a steep umbilical wall and parallel flat sides with only the outer third converging towards the venter. The angle of the convergence at the venter is about 60° in MMH No. 11005 (pl. 1, figs 1a–b, text-figs 4a–c), MMH No. 11007 (pl. 1, fig. 2), GGU Nos 137357 and 137379, but is considerably more, about 70°, in MMH No. 11008 (pl. 2, fig. 1; text-fig. 5).

The venter has a distinct hollow keel at all growth stages.

Fine falcoid ribs, 7–8 per cm, occur at a whorl height of 11–14 mm on the outer part of the sides, the inner part having fine growth-lines only. No ternary ribs are visible at the venter. At a whorl height of about 20 mm the ribs are still rather closely set (4 per cm) (pl. 2, fig. 4). On the youngest part of the shell weak sparse ribs and growth lines are seen on the outer side of a distinctly raised spiral band (pl. 1, fig. 2; pl. 2, fig. 3).

Suture lines on the later whorls are deeply incised, but rather poorly preserved.

Measurements (in mm)

	Shell diameter	Umbilical diameter	Whorl height	Whorl width
Pl. 1, fig. 1:	c. 107	c. 10	c. 60 12.2	c. 21 5.5
Pl. 1, fig. 2:	c. 93	7.8	55.5	21.7
Pl. 2, fig. 2:			12.8	5.4

Affinities

One of the authors (T.B.) has compared the specimens described here with *Oxycerites* material in the collections of the British Museum (Natural History), the Institute of Geological Sciences, London, and the Geologisches Bundesanstalt, Hannover.

The specimens from Greenland differ from all European species in having a distinct keel on the venter. Some *Oxycerites* species from Jurassic deposits in northern North America and Siberia are also keeled.

Imlay (1961, 1962b) described *Oppelia* (*Liroxyites*) *kellumi* from the Upper Bajocian of Alaska. He referred it to a new subgenus since it differs from *Oxycerites* in having much broader and more closely spaced falcoid ribs, conspicuous falcoid striae, and by the ribs and striae persisting well onto the adult body chamber. *O. (L.) kellumi* has a low hollow keel like the specimens from Greenland, but differs from that material in its strong, closely spaced falcoid ribs and striae on the later whorls, its weakly crenulated keel and slightly smaller size.

Frebold (1957a) described two specimens of *Oxycerites* of uncertain origin and age from the Fernie Group of Canada. He referred them to *Oppelia* (*Oxycerites*) ex gr. *fallax* Gueranger et *aspidoides* Oppel. One of the specimens (Frebold 1957a, pl. 28, fig. 2) is similar to *Oppelia (Liroxyites) kellumi* and was referred to that species by Imlay (1961, 1962b). The other specimen (Frebold 1957a, pl. 28, fig. 1) is nearly smooth and is similar to those from Greenland in shape and size, but differs in having a sharp venter without a keel.

The Callovian species *O. (Oxycerites) chinitnana* Imlay, 1953, from Alaska, represented only by the holotype, is similar to the Greenland specimens in shape and in having a distinct ventral keel. It differs in having a very strong sickle-like ribbing on its body chamber and is also smaller than the specimens described here. Smoother specimens, occurring at about the same level as *O. (Oxycerites) chinitnana* and of the same size and shape, are referred by Imlay to *O. (Oxycerites)* sp. These smoother forms are rather like the specimens from Greenland.

Ershowa & Meledina (1968) described two new species from the *Arctocephalites* beds of northern Siberia: *Oxycerites jugatus* and *O. undatus*. Other specimens were referred to *O.* cf. *aspidoides* (Oppel).

Oxycerites jugatus resembles the specimens from Greenland in having a low hollow keel at all growth stages. The sculpture of *O. jugatus* is rather similar but is more strongly developed on the inner whorls and the species also differs in its smaller size, in being less compressed and in the rate of convergence of the sides towards the venter producing a more obtuse angle (close to 90°).

O. undatus also has a low hollow keel, but on the interior whorls only. This species is considerably smaller than the specimens from Greenland and the sculpture seems to be weaker and the shape less compressed.

One of the specimens referred to *O.* cf. *aspidoides* by Ershowa & Meledina seems to possess a ventral keel. Poor preservation renders closer comparison difficult.

The specimens from Greenland and most other *Oxycerites* forms described from the Boreal Jurassic are poorly preserved and rare. It is thus difficult to make closer comparisons or to evaluate the species established on material from that region.

The specimens described here probably belong to a new species related to the forms described from northern Siberia, but because of the limited amount of material, no new name is introduced.

Oecotraustes sp.

Pl. 2, figs 5a–c; text-fig. 6.

Material

Mikael Bjerg, northwestern slope, 403 m above sea-level: 1 fragment – internal cast of part of a phragmocone, MMH No. 11010.

Stratigraphical level

The specimen was found in the *Arcticoceras kochi* Zone together with some of the *Oxycerites* specimens described above.

Description

The shape is compressed and involute, the latest preserved whorl having flat parallel sides with only the outermost part strongly converging towards the keeled venter. The slope of the umbilical wall forms an obtuse angle with the sides. The outer part of the sides has rather strong, falcate ribs,

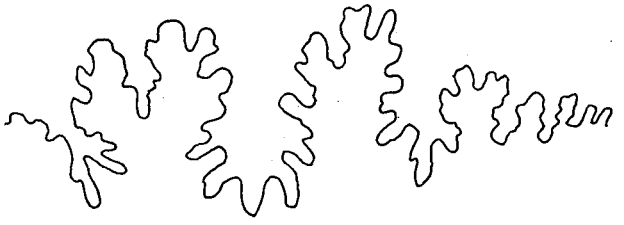


Fig. 6. *Oecotraustes* sp. External suture at a whorl height of 9 mm, × 8; Bathonian, Mikael Bjerg.

5 per cm at a whorl height of 10.5–9.5 mm. They disappear at a deeply impressed spiral in the middle of the sides. No sculpture is visible on the inner part of the sides. The youngest preserved suture lines are rather simple with six auxiliary lobes in addition to the lateral lobe.

Measurements (in mm)

	Shell diameter	Umbilical diameter	Whorl height	Whorl width
Pl. 2, fig. 5:	c. 23	c. 6	10.3	5.6
			7.5	4.2

Affinities

A possible sexual dimorphism between the genera *Oxycerites* and *Oecotraustes* was discussed by Stephanov (1966). Hahn (1968) has drawn attention to the remarkable similarity between *Oecotraustes fuscus* and *Oxycerites seebachi* and between *Oecotraustes nivernensis* and *Oxycerites limosus* and has suggested that these pairs may be examples of sexual dimorphism.

The specimen described here may possibly be a sexual dimorph of *Oxycerites* aff. *jugatus* which occurs in the same layer.

Kosmoceras (Zugokosmokeras) cf. *proniae* Teisseyre, 1883

Pl. 2, fig. 6.

Material

One fragment of a septate whorl collected west of Olympen, 970 m above sea-level (loc. A in fig. 3), MMH No. 11011.

Stratigraphical level

The specimen was collected near the base of the Koch Fjeld Formation.

Description

The venter is slightly flattened and the surface finely ribbed with secondary ribbing bundled at the ventro-lateral margin. The ventral ribs are sligthly

thickened at the ventro-lateral edge forming weak tubercles. The number of ventral ribs in relation to secondary ribs is about 1:2.

Affinities

The fragment is rather similar to *Kosmoceras (Zugokosmokeras) proniae duplicosta,* as figured by Quenstedt (*Ammonites duplicosta* Quenstedt, 1886–1887, p. 796, pl. 89, fig. 17) and Brinkmann (1929a, pl. 2, fig. 7). It differs from the specimen figured by Brinkmann in having more paired ventro-lateral ribs. Forms with such large numbers of paired ventro-lateral ribs are found in England not below the Middle *P. athleta* Zone, whereas Brinkmann's rather less strongly bundled specimen came from the Lower *P. athleta* Zone. (Callomon 1968, p. 275 retains the separate name *K. phaenium* Buckman for the form figured by Brinkmann).

Stratigraphy

Kosmoceratidae with secondary ribbing bundled at the ventro-lateral margin into tubercles or clavi are characteristic of the Upper Callovian (Brinkmann 1929a; Callomon 1964, 1968).

According to Arkell (1939) and Callomon (1964, 1968) *K. (Zugokosmokeras) proniae* occurs in the middle and upper parts of the *Peltoceras athleta* Zone. It is not known from the overlying *Quenstedtoceras lamberti* Zone.

The fragment described here thus seems to indicate the presence of early Upper Callovian in East Greenland.

Cardioceras sp.

Pl. 2, figs 7–9.

Material

Olympen, 964 m above sea-level (loc. B in fig. 3): 1 fragment, MMH No. 11012. Olympen, 995 m above sea-level (loc. C in fig. 3): 1 fragment, MMH No. 11013. Parnas, southern slope, 1030 m above sea-level: 1 fragment, MMH No. 11014.

All the specimens are preserved as impressions in coarse sandstones.

Description

The smallest specimen, MMH No. 11013 (pl. 2, fig. 8) shows the shape and the sculpture of a half whorl, 15 mm in diameter, the whorl height is about 6 mm. The whorl is finely ribbed and strongly keeled ventrally. The ribbing is of cardioceratid type, but poorly preserved and rather undiagnostic.

In MMH No. 11012, figured pl. 2, fig. 7, the ventral side of a whorl at a width of about 15 mm is preserved. The ribs are strongly developed at the ventro-lateral edge and pass uninterrupted over the strongly serrated ventral keel.

MMH No. 11014, figured pl. 2, fig. 9, shows the lateral side of a half whorl, 53 mm in diameter, the whorl height is about 20 mm. This specimen shows, besides a coarse ribbing similar to MMH No. 11012, strong nodes about one-third of the whorl height from the umbilical margin.

Affinities

The specimens are too poorly preserved for a closer determination. MMH Nos 11012 and 11014 (pl. 2, figs 7,9) seem to belong to the subgenus *Vertebriceras* and to show similarity with *Cardioceras (Vertebriceras) densiplicatum* (Boden) (Arkell 1942, p. 240).

Stratigraphy

The specimens indicate an Oxfordian age, probably lower *P. plicatilis* Zone, for the upper part of the Koch Fjeld Formation in the Olympen area, although the slightly older *C. cordatum* Zone cannot be altogether discounted.

Stratigraphy

Madsen (1904) referred Middle Jurassic deposits in Jameson Land, containing *Cranocephalites,* to the Callovian because of the similarity to Russian *"Macrocephalites" ishmae* faunas.

On the basis of the ammonite faunas Spath (1932, p. 138) divided the Middle Jurassic Vardekløft Formation into (a) *Cranocephalites* Beds, (b) *Arctocephalites* Beds, (c) *Arcticoceras* Beds and (d) *Kepplerites-Cadoceras* Beds (youngest) and subdivided each bed into several horizons. The *Kepplerites-Cadoceras* Beds of Spath were correlated with the *Sigaloceras calloviense* Zone of Europe. On the strength of the apparently close relationship between the genera *Cranocephalites, Arctocephalites* and *Arcticoceras* he correlated the lowest horizon recognized by him, the *Cranocephalites pompeckji* Zone, with the Upper Bathonian *Clydoniceras discus* Zone.

Donovan (1957) discussed in detail the correlation of the Middle Juras-

sic of East Greenland. He established the following zones: (a) the *Cranocephalites pompeckji* Zone, (b) the *Arctocephalites nudus* Zone, (c) the *Arcticoceras kochi* Zone and (d) the *Kepplerites tychonis* Zone (youngest). The *Cranocephalites pompeckji* Zone and the *Arctocephalites nudus* Zone were very doubtfully correlated with the *Clydoniceras hollandi* and *C. discus* Zones of the Upper Bathonian. The *Arcticoceras kochi* Zone was correlated with the *Macrocephalites macrocephalus* Zone and the *Kepplerites tychonis* Zone with the *Sigaloceras calloviense* Zone.

Callomon (1959, 1961) proposed a new zonal scheme for the Middle Jurassic deposits of East Greenland on the basis of renewed collecting:

(i) *Sigaloceras calloviense* Zone
(h) *Kepplerites tychonis* Zone
(g) *Cadoceras variabile* Zone
(f) *Arcticoceras kochi* Zone
(e) *Arctocephalites greenlandicus* Zone
(d) *Arctocephalites nudus* Zone
(c) *Cranocephalites pompeckji* Zone
(b) *Cranocephalites indistinctus* Zone
(a) *Cranocephalites borealis* Zone

It was demonstrated that there were two new ammonite zones (the *Cranocephalites borealis* Zone and the *C. indistinctus* Zone) at the base of the section, and also a zone at the top of the section containing a fauna similar to that of the *Sigaloceras calloviense* Zone in England. Callomon correlated beds characterized by *Kepplerites tychonis* with the Zone of *Macrocephalites macrocephalus* on the basis of the presence of identical species of *Kepplerites*. This correlation was supported by the presence of a *Sigaloceras calloviense* fauna in the overlying beds. Hence the age of the seven lower zones was considered pre-Callovian. Callomon (1961) stated that exact correlation of these zones remains impossible, but on morphological grounds the ammonites from the lowest *Cranocephalites* Zone seem most closely related to Upper Bajocian stephanoceratids (for example *Chondroceras*), and therefore the *Cranocephalites borealis* Zone was placed tentatively in the Upper Bajocian.

In 1952 Imlay referred a *Cranocephalites* fauna from the Alaskan Tuxedni Formation to the Lower Bathonian. This assignment was supported by the presence of an Upper Bajocian ammonite fauna containing i.a. *Sphaeroceras, Spiroceras?* and *Leptosphinctes* in beds unconformably underlying the *Cranocephalites* beds (Imlay 1952, 1962a, 1962b).

Frebold (1957b) favoured the opinion expressed by Spath, Donovan and Arkell (1956) and assigned the *Cranocephalites* beds of Alaska and Prince Patrick Island to a stratigraphic position close to the Upper Bathonian–

STAGES	NORTH-WEST EUROPE	NORTHERN JAMESON LAND		
	Ammonite zones	Lithological divisions		Ammonites
Oxfordian		Koch Fjeld Formation		*Cardioceras sp.*
Upper Callovian	*Q. lamberti*			No ammonites observed
	P. athleta			*Kosmoceras* cf. *proniae*
Middle Callovian	*E. coronatum*	Upper Vardekløft Member		No ammonites observed
	K. jason			
Lower Callovian	*S. calloviense*			*Sigaloceras calloviense* Zone
	M. macrocephalus			*Kepplerites tychonis* Zone
Upper Bathonian	*C. discus*	?		*Cadoceras variabile* Zone
	O. aspidoides			*Arcticoceras kochi* Zone
	"P. retrocostatum"		"Yellow Series"	*Arctocephalites greenlandicus* Zone
				Arctocephalites nudus Zone
Middle Bathonian	*M. morrisi*			*Cranocephalites pompeckji* Zone
	T. subcontractus			*Cranocephalites indistinctus* Zone
	P. progracilis			
Lower Bathonian	*Z. zigzag*			*Cranocephalites borealis* Zone
Upper Bajocian	*P. parkinsoni*			
	G. garantiana		Lower Vardekløft Member	
	S. subfurcatum			

Fig. 7. Stratigraphical table.

Lower Callovian boundary. Later (1961) he referred the *Cranocephalites* beds to the Upper Bajocian–Lower Bathonian following Callomon (1959). The presence of the *Cranocephalites borealis* Zone in the Richardson and British Mountains Region was demonstrated and referred to the lower part of Upper Bajocian.

Westermann (1964) described a new species of *Arkelloceras* from the Middle Bajocian Rock Creek Member of the Fernie Group of the Alberta Foothills. The species shows affinity to *Arkelloceras mclearni* Frebold, 1957, known from the *Arkelloceras* beds in Prince Patrick Island. However, the stratigraphic position of these *Arkelloceras* beds in relation to the *Cranocephalites* beds in the same area needs more precise definition (see Frebold, 1961) before this find can support a closer age-determination of the *Cranocephalites* beds.

Voronets (1957, 1962) described what were regarded as two representatives of the genus *Morrisiceras* from the *Cranocephalites* beds of the Yuryung-Tumus peninsula in northern Siberia. This suggested a Middle Bathonian age for at least part of the *Cranocephalites* beds; but as these forms were misidentified and are in fact *Cranocephalites* cf. and aff. *borealis* Spath, they provide no new evidence on the problems of correlation.

Ershowa & Meledina (1968) record *Siemeradzkia* from northern Siberia occurring above beds containing *Arctocephalites*. *Siemeradzkia* is supposed to indicate a Bathonian age or perhaps an Upper Bathonian age for these beds. According to Torrens (1969) the genus is not zonally significant.

The *Oxycerites* specimens found in Middle Jurassic Boreal regions are also not particularly diagnostic. The genus occurs in Europe through all the Middle Jurassic and in the Arctic regions keeled *Oxycerites* forms are known from the Upper Bajocian to the Lower Callovian.

In summary it can be stated that the evidence of finds from Alaska and Siberia seems to indicate that Boreal *Cranocephalites* faunas did not appear before the late Upper Bajocian. More exact correlation of the Bathonian Boreal ammonite zones with European zones is not yet possible.

The find of *Kosmoceras (Zugokosmokeras)* cf. *proniae* in the lower part of the Koch Fjeld Formation and a *Cardioceras* sp. in the upper part makes it possible to determine the age of that formation as Upper Callovian–Middle Oxfordian in the area concerned. The presence of Upper Callovian in East Greenland has not been shown before. The similarity of the faunas in East Greenland and England during the *Sigaloceras calloviense* Zone, stressed by Callomon (1959, 1961), may thus persist into the Upper Callovian.

The earliest known rocks from the Upper Jurassic in East Greenland belong to the Middle Oxfordian. A single fragment of *Cardioceras (Vertebriceras)* was collected from the top beds of Koch Fjeld Formation on

Mikael Bjerg in central Jameson Land (Callomon 1970). In southern Jameson Land a loose block has yielded *Cardioceras (Vertebriceras) densiplicatum* (Boden) (Spath 1935, pl. 15, fig. 3) and black shales have yielded amoeboceratids and *Decipia* (Callomon 1961). Also the Charcot Bugt Sandstone on Milne Land and deposits on Traill Ø have yielded Oxfordian ammonites (Aldinger 1935; Spath 1935; Callomon 1961). In the Koch Fjeld Formation of the type area in southern Jameson Land amoeboceratids of Lower Kimmeridgian age occur (Callomon 1961).

Fig. 7 shows the correlation which is proposed here for the Middle and Upper Jurassic sequence of northern Jameson Land with European zones.

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Dansk sammendrag

På grundlag af feltarbejde udført i 1968 under Grønlands Geologiske Undersøgelses kortlægningsprogram i Scoresby Sund området beskrives de mellem- og øvre-jurassiske aflejringer omkring Olympen i det nordlige Jameson Land. Disse aflejringer tilhører Vardekløft Formationen og Koch Fjeld Formationen (jfr. tekst-fig. 1–3).

Nye ammonitfund fra dette område viser, at øvre del af Vardekløft Formationen tilhører nedre Callovien, og at nedre del af Koch Fjeld Formationen tilhører øvre Callovien (tilstedeværelsen af aflejringer fra øvre Callovien har ikke tidligere været påvist i Østgrønland). Desuden viser ammonitfund i øvre del af Koch Fjeld Formationen, at denne del af lagserien kan henføres til Oxfordien (sandsynligvis mellem-Oxfordien). Lagserien omkring overgangen fra mellem til øvre Jura er således betydelig mere fuldstændig end tidligere antaget, og alderen på den omdiskuterede Koch Fjeld Formation i det nordlige Jameson Land endelig fastlagt.

Slægterne *Oxycerites* og *Oecotraustes* beskrives for første gang fra Grønland. Disse slægter er hovedsagelig kendt fra sydligere områder, men optræder sporadisk i Sibirien og Nordamerika sammen med rent boreale ammonitfaunaer fra mellem-Jura.

Endelig diskuteres korrelationen af boreale og europæiske Jura-aflejringer (jfr. det stratigrafiske skema, tekst-fig. 7).

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Plate 1

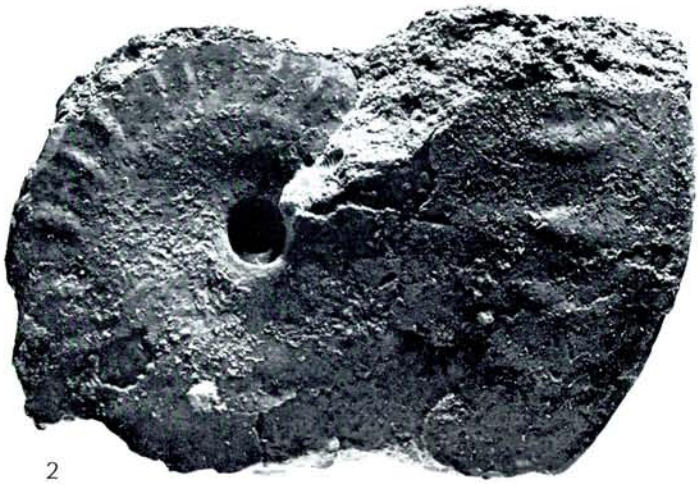
Oxycerites aff. *jugatus* Ershowa & Meledina.

Fig. 1a–b: MMH No. 11005. a: Lateral view, × 1; b: Peripheral view, slightly reduced. Bathonian. Mikael Bjerg, 403 m above sea-level. The surface of the outer whorl is strongly weathered.

Fig. 2: MMH No. 11007. Lateral view, × 1. Bathonian. Olympen, 728 m above sea-level.

1a

1b



2

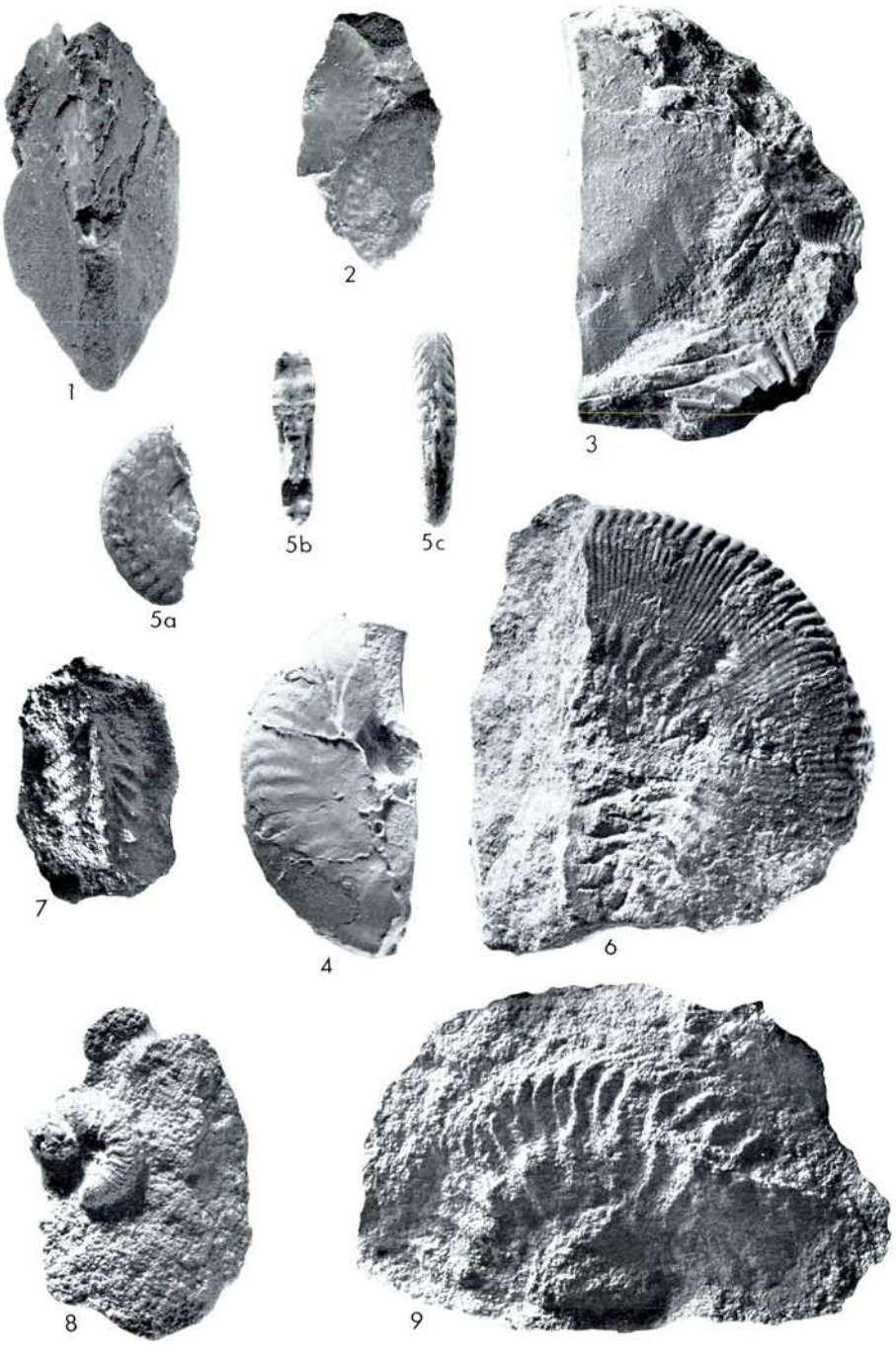

1
2
3
5b
5c
5a
7
4
6
8
9

Plate 2

Oxycerites aff. *jugatus* Ershowa & Meledina.

Fig. 1: MMH No. 11008. Peripheral view, × 1. Bathonian. Olympen, 728 m above sea-level.

Fig. 2: MMH No. 11006. Lateral view, × 1. Bathonian. Mikael Bjerg, 403 m above sea-level.

Fig. 3: MMH No. 11009. Lateral view, × 1. Bathonian. Olympen. 728 m above sea-level.

Fig. 4: MMH No. 11005. Lateral view of artificial cast, × 1. Bathonian. Mikael Bjerg, 403 m above sea-level.

Oecotraustes sp.

Fig. 5a–c: MMH No. 11010. Lateral and peripheral views, × 1. Bathonian. Mikael Bjerg, 403 m above sea-level.

Kosmoceras (Zugokosmokeras) cf. *proniae* Teisseyre.

Fig. 6: MMH No. 11011. Lateral view, × 1. Callovian. West of Olympen, 970 m above sea-level.

Cardioceras sp.

Fig. 7: MMH No. 11012. Ventral view of artificial cast, × 1. Oxfordian. Olympen, 964 m above sea-level.

Fig. 8: MMH No. 11013. Lateral view of artificial cast, × 1. Oxfordian. Olympen, 995 m above sea-level.

Fig. 9: MMH No. 11014. Lateral view of artificial cast, × 1. Oxfordian. Parnas, 1030 m above sea-level.