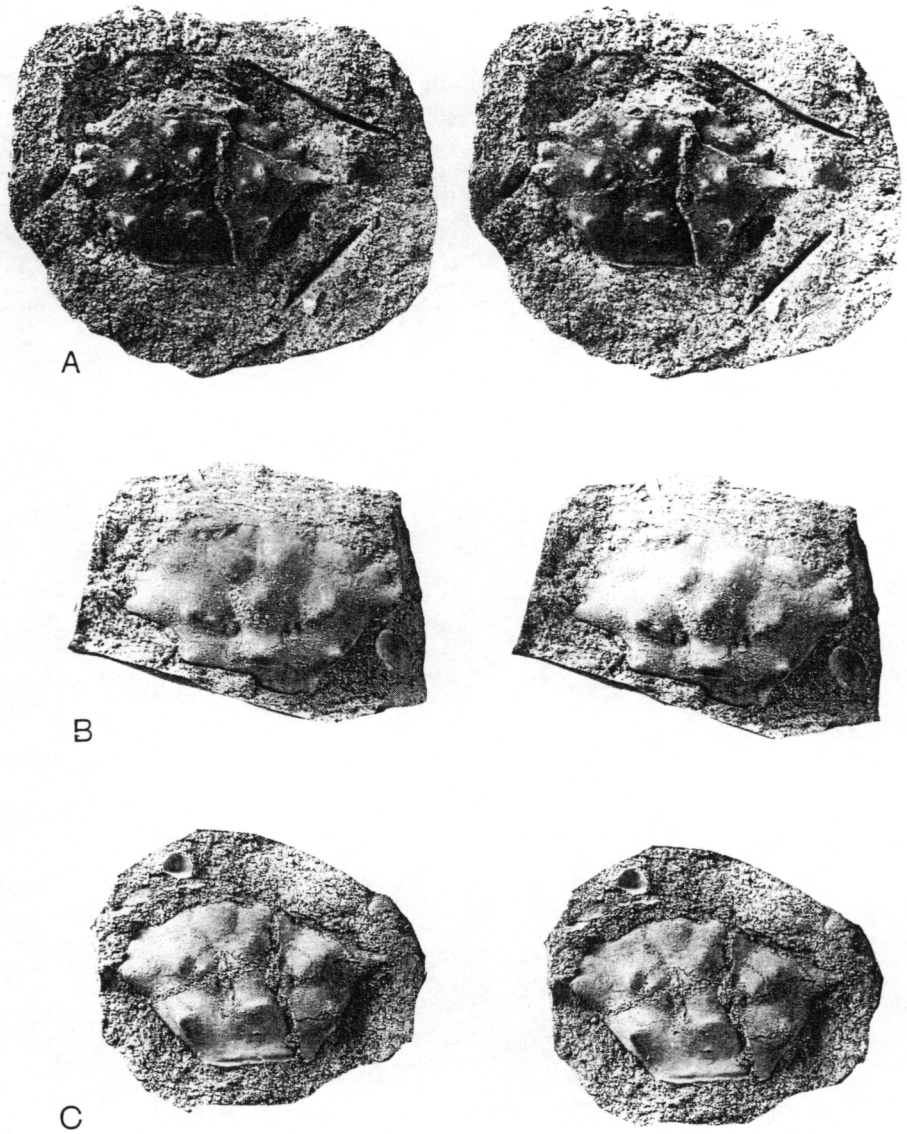

Fig. 21. *Xanthilites verrucoides* sp. nov. from the Middle Paleocene at Qaersutjægerdal, × 1.5. A, C: holotype, MGUH 21.612; A: dorsal view; C: silicone rubber cast from the external mould showing finer details of ornament; B: paratype, MGUH 21.613, dorsal view.

on the pentagonal mesogastric lobe, a large tubercle on each epibranchial lobe about level with the lateral spines, a small one close behind it on the mesobranchial lobe, and another large tubercle on each metabranchial lobe. At the widest part of the lingulate cardiac region a transverse ridge is formed from the fusion of the paired tubercles normally occurring, their summits appearing as granules. The hepatic region is depressed but weakly tumid. The cervical furrow is wide and shallow from the hinder angles of the mesogastric lobe to the lateral margins. On the posterior lateral slope of the mesogastric lobe is an oblique row of small granules which may indicate a muscular attachment and a double depression on either side of the confluent uro-cardiac region corresponds to the epimeral adductor muscle attachment. A few widely scattered granules occur on the otherwise smooth dorsal surface.

The length of the holotype carapace is about 16.5 mm and the width, including the lateral spine, is about 25.0 mm.

Discussion. In general outline the carapace of *X. verrucoides* approximates that of *X. gerthi* Glaessner, 1930, ?Paleocene of Argentina, but the latter differs in having the first anterolateral spine more or less in line with the outer orbital spine and relatively narrower orbits; there is a marked difference, however, in the distribution of tubercles which on *X. gerthi* are altogether smaller, those on the protogastric lobes in particular are much reduced, isolated from the epigastrics, none is devel-

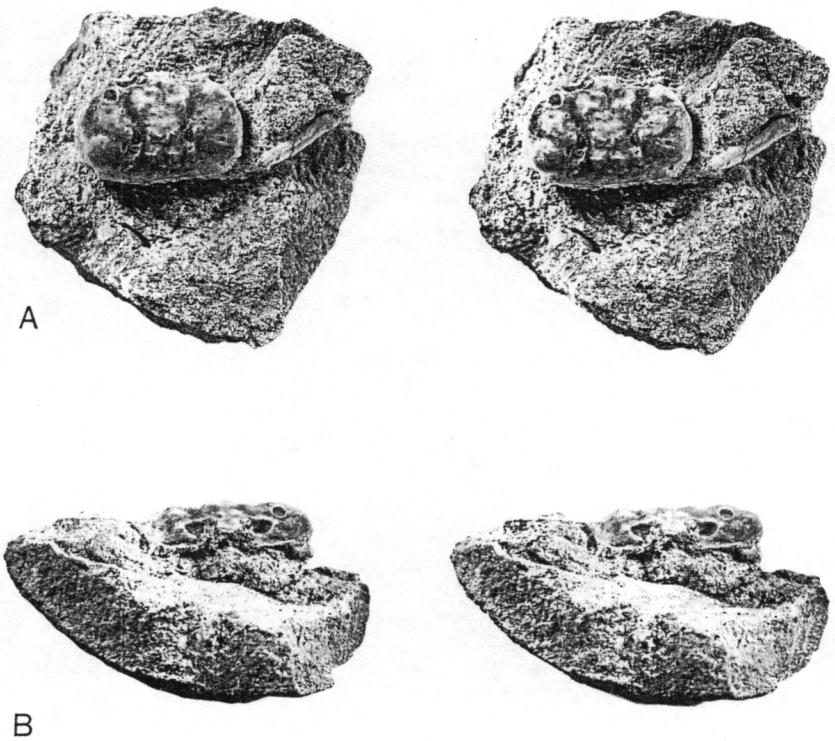

Fig. 22. *Pinnixa (Palaeopinnixa) nodosa* sp. nov., holotype, MGUH 21.614, from the Middle Paleocene at Qaersutjægerdal. A: dorsal view; B: frontal view, × 1.5.

oped on the mesobranchial lobe and that on the epibranchial is placed nearer the lateral margin. Only three lateral spines are present on the Lower Eocene *X. alabamensis* Rathbun, 1935, but by and large there is a close agreement in ornamentation, though in *X. alabamensis* the entire surface of the proto- and mesogastric lobes are swollen as if having absorbed the tubercle and the tubercles on the meso- and metabranchial lobes are larger.

Section Thoracotremata Guinot, 1977
Superfamily Pinnotheroidea de Haan, 1833
Family Pinnotheridae de Haan, 1833

Genus *Pinnixa* White, 1846

Type species. Pinnotheres cylindricum Say, 1818, by monotypy.

Range. Eocene to Recent.

Subgenus *Palaeopinnixa* Via, 1966

Type species. Pinnixa eocenica Rathbun, 1926, by original designation.

Range. Paleocene Upper Danian to ?Recent.

Pinnixa (Palaeopinnixa) nodosa sp. nov.
Figs. 22A-B

Derivation of name. Referring to the nodose dorsal surface of the carapace as seen on casts of its inner side.

Diagnosis. Carapace with a weak anterolateral spine and prominently elevated regions. The gastrohepatic furrow is short, deep and broad.

Material. Eight more or less complete carapaces. Holotype, an internal mould of a carapace retaining part of a walking limb, in a sandstone concretion from the Turritellakløft Member of the Agatdal Formation of Qaersutjægerdal in the central area of Nûgssuaq, MGUH 21.614. Additional specimens, a fragmentary carapace from the *Gilbertina* sandstone lens in the Turritellakløft Member at Turritellakløft, central Nûgssuaq; six carapaces from the Sonja lens of the Agatdal Formation in the south wall of Agatkløften, central Nûgssuaq.

Description. Carapace length about two thirds the width, moderately rounded longitudinally and almost flat in transverse section. Broadly ovate orbits occupy the outer thirds of the orbitofrontal margin which reaches about half the carapace width. The almost straight

front has a shallow median depression, its concave sides curve with no evidence of a notch into the finely beaded upper orbital margin, terminating in an obscure outer spine. The lower orbital margin extends beyond the upper and bears a spine near the inner angle. The anterolateral margins are short and well rounded, there is a small, rather upstanding spine immediately behind the cervical furrow. Finely ridged postolateral margins, moderately rounded in juvenile forms, become almost straight as growth advances and lead by shallow coxigeal incisions to a very wide, nearly straight posterior margin. The sides are inclined a little inwards. The cervical furrow runs from a weak marginal notch about one third distant from the front in a broad shallow groove round the hepatic region to join the hepatic furrow, then becomes very faint – almost indiscernible on the shell surface along the base of the mesogastric about mid-carapace length. Short, deep hepatic furrows lead from near the outer orbital angles almost straight back, curving inwards at the union with the cervical furrow they continue at this angle to the base of the urogastric lobe. The equally prominent branchiocardiac furrow curves broadly between the confluent tumid epi- and mesobranchial lobes and laterally tumid metabranchial lobe; at the anterior border of the cardiac region it divides, one furrow delimiting the cardiac region, the other sweeping round to the coxigeal incisions. Shallow furrows delineate the protogastric lobes from a very small subtriangular mesogastric lobe and the narrow anterior process extends to rounded epigastric lobes level with the upper orbital margin. Rounded hepatic regions are slightly tumid. A slender median extension unites the cardiac region with an otherwise separated large, sub-ovate urogastric lobe. The cardiac region is lingulate and on either side an elongate node lies between it and the meta-branchial lobe.

The median course of the cervical furrows, in particular, and some of the nodes are absorbed by the shell thickness. The outer shell surface retained on a juvenile specimen from Agatkløft has fine granules on the gastric lobes, rather larger ones on the hepatic and branchial lobes and a few lining the anterolateral margin are particularly noticeable. There is a smooth depressed area behind the upper orbital margins. Internal casts reveal three tubercles on the cardiac region. On each protogastric lobe a curving ridge reaches almost to the outer orbital angle; traces of this ridge are seen on the juveniles and it becomes considerably more prominent as growth advances. Along the posterior edge of the urogastric lobe is a V-shaped muscle scar; a pit on either side of the midline and rugose adductor epimeralis muscle scars mark the nodes abutting the cardiac region.

The sternites as a whole are much rounded longitudinally; the fifth pair are large and subtriangular; the sixth-eighth pairs are trapezoidal and decrease in size posteriorly, the eighth pair being about half the size of the sixth. The deep abdominal trough extends nearly the length of the fifth sternites and becomes broadly triangular from the seventh sternites posteriorly.

The carapaces range from 4.5 mm to 15.0 mm in width and from 3.4 mm to 9.6 mm in length and while the longitudinal curvature of the juveniles is flatter the regions and coarser ornament, as evidenced by internal casts, are clearly defined.

Discussion. Apart from a small lateral spine and a slight thickening of the orbital margin the new species has the essential characters of *Palaeopinnixa* and can, for the time being at least, be included in that subgenus.

Remnants of the nodular ornament of *P. (P.) nodosa* are seen on the Lower or Middle Eocene *P. (P.) perornata* Collins & Morris, 1976, on which the protogastric 'ridge' is reduced to two nodes (on this species two nodes are also present on the hepatic regions). The three cardiac tubercles persist, as does the node on either side of that region. Vestigial portions of the cervical furrow remain on *P. (P.) perornata* (as they do on some Recent *Pinnixa* spp.) although the major furrows are much weaker. *P. (P.) nodosa* has rather larger orbits than *P. (P.) perornata* and in this respect is closer to *P. (P.) eocenica* Rathbun, 1926, which while having prominent hepatic, cardiac and metabranchial furrows, lacks any evidence of the cervical furrow. *P. (P.) nodosa* may be further distinguished from other members of the subgenus in having more clearly defined mesogastric and urogastric lobes.

P. (P.) nodosa represents the earliest known member of the subgenus. From its appearance in western Greenland it would appear to have spread rapidly southwestwards and southerly, *P. (P.) eocenica* reaching Washington State, and *P. (P.) perornata* Barbados by the Upper Eocene. Via (1966) described *P. (P.) mytilicola* from the Miocene of Barcelona and considered the Recent *Pinnixa minuta* Rathbun, 1901 formed a living representative of the subgenus.

Superfamily Ocypodoidea Rafinesque, 1815
Family Retroplumidae Gill, 1894

Genus *Costacopluma* Collins & Morris, 1975

Type species. Costacopluma concava Collins & Morris, 1975 by original designation.

Range. Cretaceous to Paleocene.

Costacopluma binodosa sp. nov.

Fig. 23A-B

Derivation of name. Alluding to the distinct rounded nodes at the posterior angles.

Diagnosis. A *Costacopluma* with the carapace only a little wider than long and almost straight lateral margins slightly convergent anteriorly. Nodes on either side of the cardiac region are nearly isolated from that region and there is a prominent node above each posterior angle. The elevated areas are prominently granulated and the depressions finely pitted.

Material. A unique carapace, MGUH 21.615, from an Upper Campanian sandy concretion from the black shales in Brudkløft at Ikorfat on the north coast of Nûgssuaq.

The specimen is possibly that of a female and shows the dorsal surface, except the crushed anterior margin and protogastric lobes, and much of the ventral surface.

Description. Carapace almost rectangular a little wider than long and not much arched transversely. The lateral margins diverge to well rounded lateral angles set about three fourths distant from the front and short posterolateral margins lead by wide, shallow incisions for the fifth coxae to a narrow nearly straight posterior margin which occupies about half the carapace width. The posterior margin and incisions are bounded by a rim of fine granules. The lateral edge is raised and narrowly rounded as far as the posterior transverse ridge and coarsely granulated; the sides, almost vertically inclined anteriorly, become slightly splayed out towards the posterolateral angles. The cervical furrow is acutely V-shaped where it crosses the midline about mid-carapace length, after which its course is obscure; at the lateral edge it runs steeply down and, becoming very shallow passes round the somewhat overhanging hepatic region and continues to the buccal frame. The mesogastric lobe is flatly tumid, subpyriform and barely separated from the small depressed urogastric lobe. The cardiac region is pentagonal, but its outline is distorted by its partial union to tumid nodes laterally and behind to close proximity to the intestinal region.

The foremost of the transverse ridges appears to be interrupted by the anterior mesogastric process. The rather broad second, or epi-mesobranchial ridge is forwardly inclined at about 51° to the longitudinal axis. The third, metabranchial, ridge occurs about midway from the second ridge to the posterior margin, it is directed forwards in a slightly sinuous curve and is continued across the carapace by the tumid anterior portion of the cardiac region. From the inner angle of this ridge a short ridge (more strongly developed on the right-hand side) runs back to the node at the cardiac angle.

The triangular pterygostomian process is inflected almost at right angles to the carapace margin and is finely granulated along the pleural margin. The buccal cavity is about as broad as long; its margins are covered by the exognaths of the third maxillipeds. The exognath is fusiform and reaches to about the middle of the meropodite, its width is about one fourth its length. Of the endognath, the ischiopodite is about twice as long as wide, subreniform in outline and flattened; the meropo-

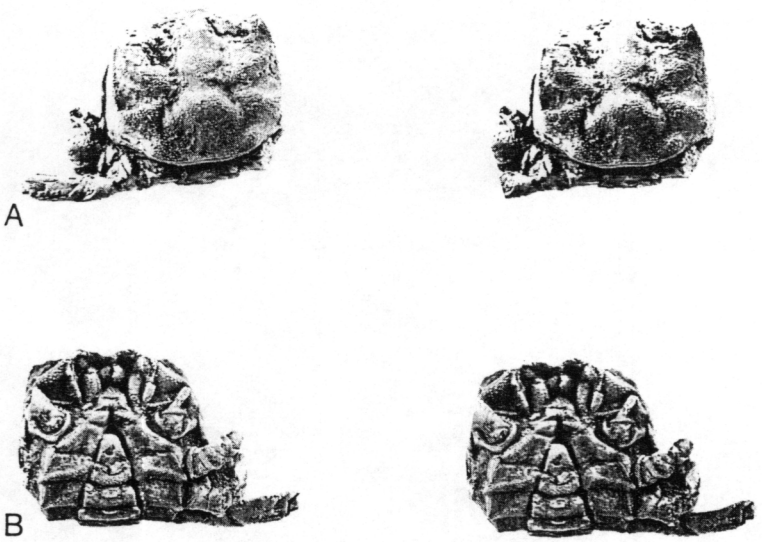

Fig. 23. *Costacopluma binodosa* sp. nov., holotype, MGUH 21.615, from the Upper Campanian at Ikorfat. A: dorsal view; C: frontal view, × 1.5.

Fig. 24. Stratigraphical distribution of decapod crustaceans from Nûgssuaq, West Greenland.

SPECIES \ CHRONOSTRATIGRAPHY	UPPER SANTONIAN-LOWER CAMPANIAN	LOWER CAMPANIAN	UPPER CAMPANIAN	MAASTRICHTIAN	LATE LOWER PALEOCENE	MIDDLE PALEOCENE
Mecochirus rostratus sp. nov.			●	●		
Linuparus (Podocrates) spinosus sp. nov.			●			
Galathea cf. *G. strigifera* Fischer-Benzon						●
Dromiopsis granulata sp. nov.				●		
Eohomola adelphina gen. et sp. nov.			●	●		
Cristella hastata gen. et sp. nov.					●	
Camarocarcinus quinquetuberculatus sp. nov.						●
Hemioon eysunesensis sp. nov.			●			
Lyreidus succedanus sp. nov.		●	●	●		
Lyreidus rosenkrantzi sp. nov.				●		
Lyreidus bispinulatus sp. nov.						●
Notopocorystes (C.) paututensis sp. nov.	●					
Laeviranina borealis sp. nov.						●
Xanthilites verrucoides sp. nov.						●
Costacopluma binodosa sp. nov.			●			
Pinnixa (P.) nodosa sp. nov.						●

dite is subovate and the three terminal segments of the palp are of equal length. Strong, subcircular mandibles occupy the median part of the buccal cavity.

The first abdominal sternites are triangular and depressed, the second are rectangular, strongly nodose with ridges running to attenuated outer angles. The subtriangular third sternites rise steeply from the second become flattened posteriorly and are separated by a shallow furrow from the large trapezoidal fourth sternites on which a broadly rounded ridge borders the chelipeds. The fifth-eighth sternites are subrectangular, on each the posterior edge is ridged and each has the outer margin overlapped by an extension of the one preceding. The abdomen is folded against a deep median trough, it occupies half the sternal width at its proximal part and gradually decreases to less than a third at the sixth somite. The subtriangular telson reaches almost to the fourth sternites. The width diminishes very gradually without any lateral expansion and it is only a little wider than in the males of *C. concava* Collins & Morris (1975, pl. 97). The present specimen, therefore, may be a young female, similar to *Archaeo-*

pus antennatus Rathbun (1908, pl. 48, fig. 3), but in the latter the median trough is considerably shallower and the telson extends a short distance between the fourth sternites.

The bases of the chelipeds and parts of the first-third pereiopods are preserved; the cheliped bases are slightly stouter than those of the pereiopods and a fragment of the merus of the fourth pereiopod shows a smooth, flattened inner side and a granulated arched outer side.

The carapace has a width of 16.5 mm and rather exceeds 14.0 mm in length.

Discussion. Costacopluma binodosa differs from *C. concava* and *C. senegalensis* (Remy, 1960) in having a more rectangular outline and a somewhat flattened median transverse ridge. The node on either side of the cardiac region, which Collins & Morris (1975, p. 826) referred to as the outer pair of four tubercles on the cardiac region, are more isolated in *C. binodosa*. In addition the elongated tubercle close to the posterior angle, moderately developed in *C. concava* and apparently subdued in *C. senegalensis*, is much enlarged in *C. binodosa*. On the underside, the ridges on the fifth and sixth sternites of *C. binodosa* are obliquely rather than transversely directed as on *C. concava*.

The genus *Costacopluma* was erected by Collins & Morris (1975) on *C. concava* which ranges from the Coniacian to Maastrichtian of Nigeria; a Paleocene member of the genus was recognised in *C. senegalensis* (Remy) from Senegal. The presence of *C. binodosa* in the Upper Campanian of West Greenland indicates a very rapid northern migration of the genus during Upper Cretaceous, while a continuing favourable environment remained in the African province.

Summary

The geologically earliest crab in the present collection is *Notopocorystes (Cretacoranina) paututensis* preserved on slabs of red-burned clay considered to be of Upper Santonian or lowermost Campanian in age (Fig. 24). The raninid species recorded by Rosenkrantz (1970, p. 425) from the uppermost Lower Campanian deposits in Turritellakløft (Agatdal region) is described herein as *Lyreidus succedanus* and is the earliest known member of the genus the northerly range of which is also extended. It is a fairly common species in the lower Campanian and ranges into the Maastrichtian, where it occurs with *L. rosenkrantzi*.

The Upper Campanian of the region has yielded four other species of crabs; of these a single carapace of *Costacopluma binodosa* considerably extends the northerly range of the genus. *Eohomola adelphina* has a well developed bifid rostrum and shares this and other characters with *E. dispar* (Roberts) from the Campanian of North America. *Eohomola adelphina* also occurs in the Maastrichtian and clearly foreshadows some members of the Recent *Homola. Hemioon eysunesensis*, which apparently descended from *H. elongatum* (H. Milne Edwards), appears to have been another fairly common member of the bottom fauna; the well preserved specimens provide an insight to the structure of the underside and limbs, knowledge of which is scant among other members of the genus. *Linuparus spinosus* and *Mecochirus rostratus* are each represented by only one specimen. Over 2000 specimens of *M. rostratus*, however, are known from the Maastrichtian where the species occurs with the raninids *Lyreidus rosenkrantzi* and *L. succedanus; Dromiopsis granulata* would appear to be related to *D. rugosus* (Schlotheim, 1820).

Numerous callianassid remains included in the crustacean collection from the Cretaceous of West Greenland are not included within the scope of this work.

Late Lower Paleocene deposits have yielded only one crab bearing nodule. It contains *Cristella hastata*, seemingly an offshoot of the Campanian *Necrocarcinus pierrensis* (Rathbun). The crab fauna of the Middle Paleocene, however, is more extensive, although raninids still predominate. A third member of *Lyreidus*, *L. bispinulatus* is present and *Laeviranina borealis* is the most northerly member of that genus and has characters in common with both European and North American species. Also taking its place among burrowing forms is *Camarocarcinus quinquetuberculatus* which is somewhat closer to *C. arnesoni* Holland & Cvancara from the Cannonball Formation of North Dakota than to *C. obtusus* Jakobsen & Collins from the Selandian of Klintebjerg, Denmark. A single fragmentary specimen of a *Galathea* is tentatively referred to *G. strigifera* Fischer-Benzon. So far as the present collection is concerned the *Xanthidae* is known from the Middle Paleocene by *Xanthilites verrucoides* which has much in common with *X. gerti* Glaessner from Argentina, while *Pinnixa (Pa-*

laeopinnixa) nodosa extends the known geological and geographical limits of this little known pinnotherid subgenus.

Acknowledgements

Grateful thanks are accorded to the many people who have made this work possible, both in its initial stages and those subsequent to Dr. H. Wienberg Rasmussen's death. Mr. S. Floris kindly provided facilities in the Geological Museum, Copenhagen for J. S. H. C. to examine the extensive collection and Dr. Wienberg Rasmussen's original notes. Dr. W. K. Christensen undertook the editorial processing involved. Mr. S. F. Morris, British Museum (Natural History), London, provided access to material in his charge for comparison and offered much valuable advice. The delicate preparation of the specimens was carried out by Mr. S. L. Jakobsen, Geological Museum, Copenhagen, who also prepared the stereo-pair photographs. Direct support for this project was received by J. S. H. C. from the Geological Museum, Copenhagen and the Geological Survey of Greenland.

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