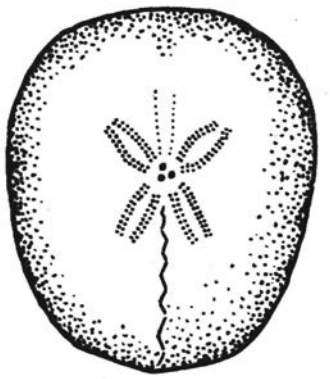

THE IRREGULAR ECHINOIDS AND THE BOUNDARY IN DENMARK

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No serious attempt has been made since Ravn (1927) to redescribe the echinoid fauna around the Maastrichtian/Danian boundary of Denmark. Possible exceptions are Wind (1953, 1954, 1959), who threw some light on stratigraphic distribution on the basis of localities in Jylland, and Kongiel (1949), who discussed the Danian species of *Echinocorys* of Denmark and Sweden.

The genus and species names are in need of revision and where the author is in doubt the names are placed in quotation marks. The holectypoids from the Maastrichtian were identified by S. Bo Andersen (unpubl. report and pers. comm.).

The zonation of the Danian used in the figures is according to Hansen (1977) who demonstrated that the dinoflagellates provide a more accurate zonation of the Danian than the traditionally used *Tylocidaris* species, which are more dependant on facies.

The distribution of the irregular echinoid taxa around the Maastrichtian/Danian boundary reflects (1) change in facies and (2) the introduction of 'modern' deep burrowing echinoids.

It should be noted that the northwestern outcrops in Jylland have been no less well investigated for echinoids than the rest of Denmark. However, the general impression is that echinoids in that region are very scarce in the chalk boundary layers (Rosenkrantz, 1924; Ødum, 1926).

Epibenthic holectypoids (*Galerites* and *Conulus* spp.) flourished in the top metres of chalk at Stevns Klint and Karlstrup, whereas they are not known from the localities in northern Jylland. They disappear at the boundary and first reappear in the middle Danian with patchy distributions of *Globator* spp. in the marginal part of the basin.

Cassiduloids are not found in the Maastrichtian and first turn up in the marginal facies of the middle and upper Danian.

Clypeasteroids are entirely lacking, although the coarser sediments of the marginal areas of the upper Danian would appear to represent favourable environments for this group. However, this was a very new group in the Paleocene, where it still had a highly restricted distribution (Tethys).

Among the ploughing to shallow-burrowing holasteroids, the ubiquitous shallow-ploughing *Echinocorys* spp. seemed unaffected by changes in facies, whereas the burrowing *Cardiaster*, *Cardiotaxis* and *Tholaster* spp. disappeared at the Maastrichtian/Danian boundary. *Hagenowia elongata* died out earlier in the Upper Maastrichtian.

No spatangoids so far have been described from the Maastrichtian of Denmark. This is surprising, since the chalk facies would appear to be suitable for *Micraster* spp. and this genus occurs in Poland in the Maastrichtian and Danian according to Kongiel (1935, 1950) and Kongiel & Matwiejewówna (1937). In the chalk of the lower Danian, however, brissids appear suddenly, represented first by *Cyclaster bruennichi*, then by *C. danicus*. These are the first forms to possess a peripetalous fasciole, better equipping them for a totally burrowing mode of life in a fine grained sediment (Asgaard, 1976). Deeply borrowing schizasterids make their first appearance in the upper Danian calcarenites.

Fig. 1. Distribution of irregular echinoids in the uppermost Maastrichtian and the Danian of Denmark. NW part of the Danish Basin. c: chalk, ca: calcarenites and calcirudites, b: bryozoan limestone, locally with coral limestone, m: marl. The thin horizontal lines are dinoflagellate zones (modified after Hansen, 1977).

Fig. 2. Distribution of irregular echinoids in the uppermost Maastrichtian and the Danian of Denmark. SE (marginal) part of the Danish Basin. c: chalk, ca: calcarenites and calcirudites, b: bryozoan limestone, locally with coral limestone, m: marl. The thin horizontal lines are dinoflagellate zones (modified after Hansen, 1977).

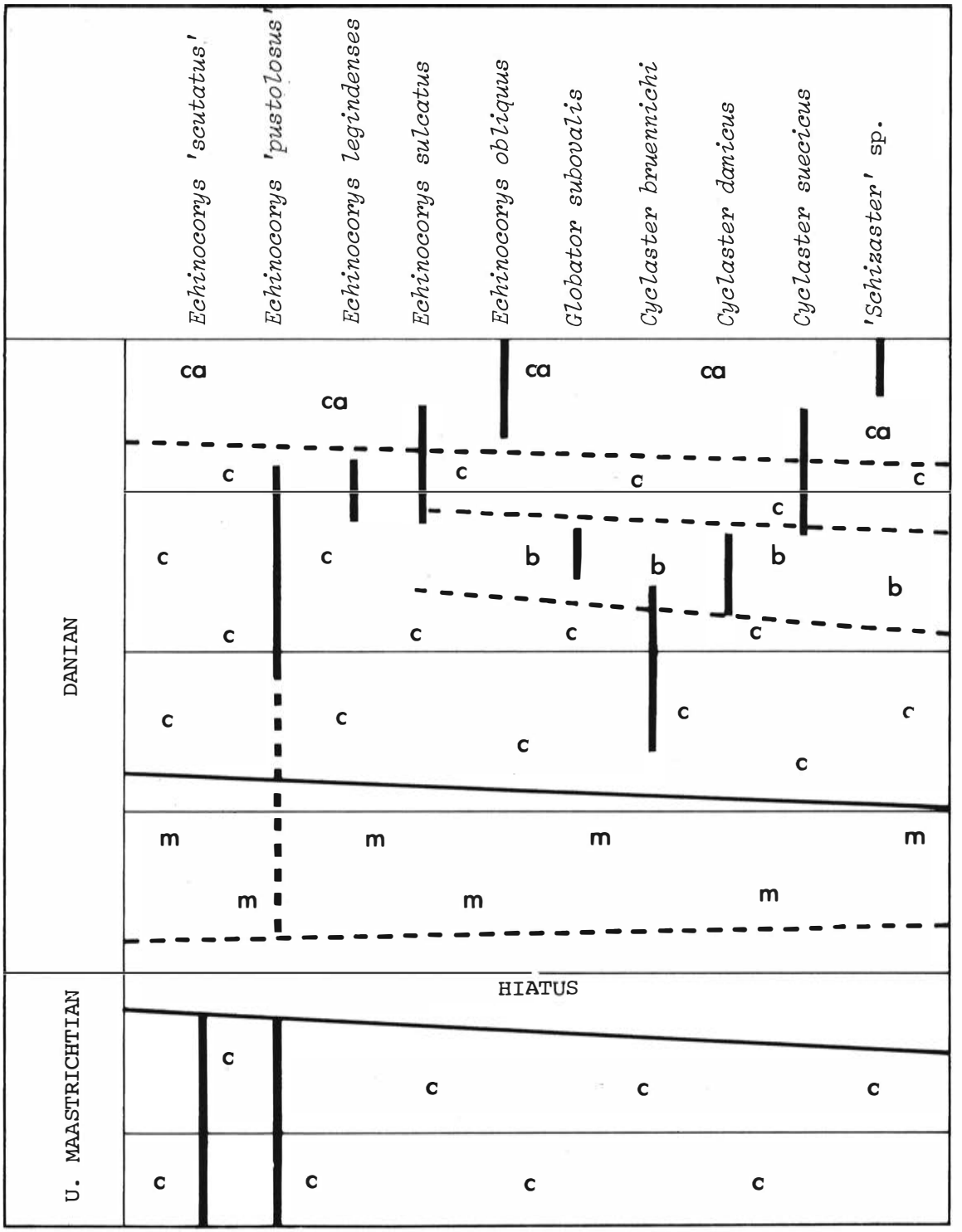
Echinocorys 'scutatus'
Echinocorys 'pustulosus'
Echinocorys legindenses
Echinocorys sulcatus
Echinocorys obliquus
Globator subovalis
Cyclaster bruennichi
Cyclaster danicus
Cyclaster suecicus
'Schizaster' sp.
DANIAN
U. MAASTRICHTIAN
HIATUS
ca
c
b
m

Fig. 1.

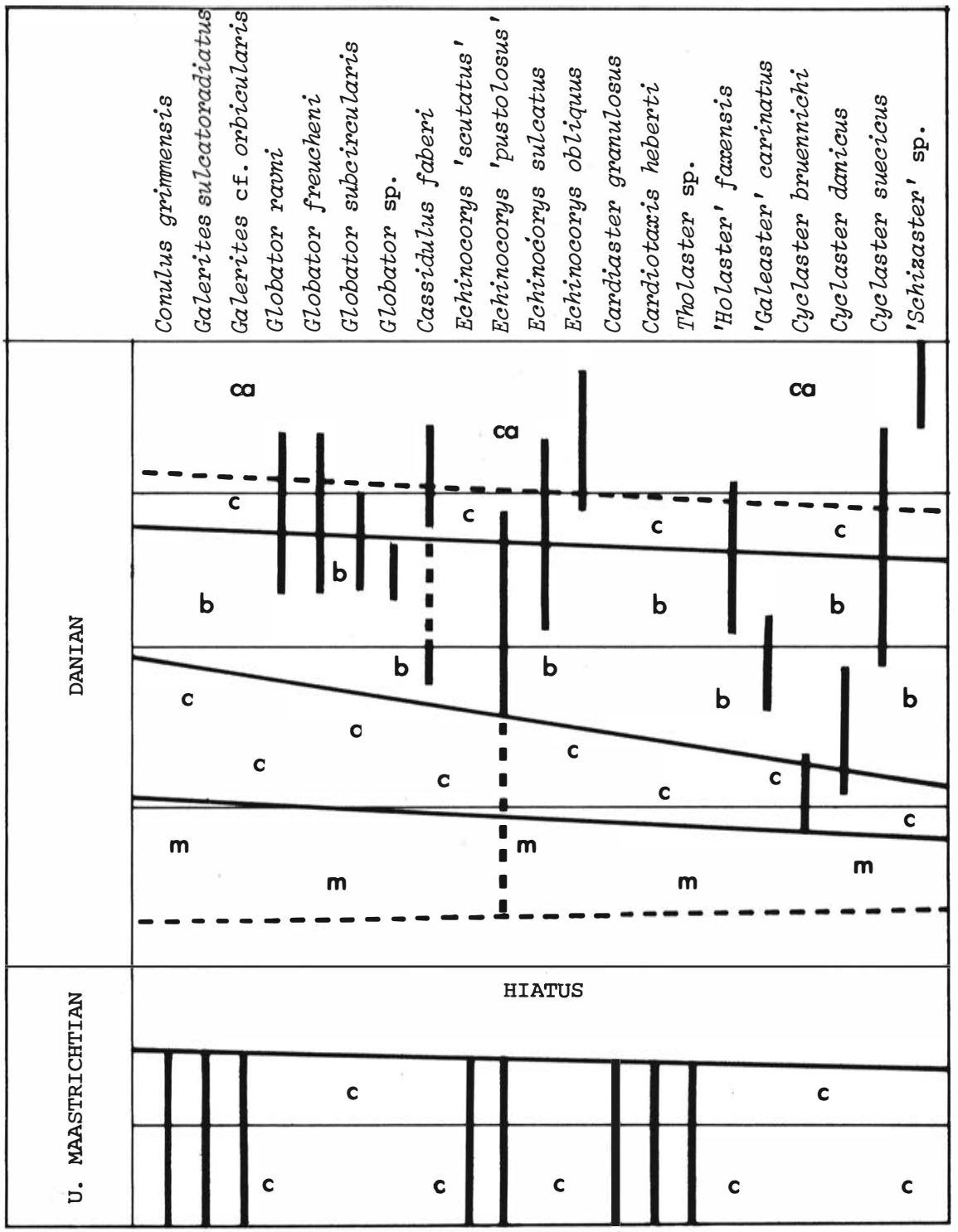
Conulus grimmensis
Galerites sulcatoradiatus
Galerites cf. orbicularis
Globator rami
Globator freucheni
Globator subcircularis
Globator sp.
Cassidulus faberi
Echinocorys 'scutatus'
Echinocorys 'pustolosus'
Echinocorys sulcatus
Echinocorys obliquus
Cardiaster granulosus
Cardiotaxis heberti
Tholaster sp.
'Holaster' fawensis
'Galeaster' carinatus
Cyclaster bruennichi
Cyclaster danicus
Cyclaster suecicus
'Schizaster' sp.
DANIAN
U. MAASTRICHTIAN
HIATUS
ca
c
b
m

Fig. 2.