CONCLUSION

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Christensen's and Norling's research on the belemnite and foraminifera material independently shows that there is no appreciable difference in age between the Santonian limestone and the overlying calcareous sandstone at Särdal. The above authors also agree that the stratigraphic level of the Särdal beds except for the derived phosphatised rock fragments is very close to the boundary between the Lower and Middle Santonian. The derived phosphatised fragments are too hard to yield any foraminifera, and the age has been deduced from the poor belemnite fauna. At least some of these rock fragments represent the Upper Cenomanian and/or the *A. plenus* Zone between the Cenomanian and Turonian. It is also possible that the Turonian and/or Coniacian may be represented by some rock pieces, but this cannot be verified at present.

Apart from the phosphatised rock fragments, the pebbles and cobbles of the conglomeratic limestone consist mainly of Precambrian gneiss. There are also a few pieces of a white quartzite with veins, which probably is of Precambrian age.

The fauna of the derived phosphatised nodules is of a highly mixed character. Several bivalves are infaunal; they are mostly articulated and cannot have been transported far. Still, the poorly sorted character of the sediment with pebbles, shells, belemnite rostra, etc. gives the impression that the collection spot was not a typical bottom for infaunal bivalves. Therefore, most of the infaunal bivalves were probably transported to the locality from nearby. The epifauna includes a number of polychaetes, brachiopods, and bivalves which required a hard substratum for fixation. This may also be the case with at least some of the sponges. Bivalves, such as *Inoceramus* and *Lima* may have lived unattached, whereas others may have been semi-infaunal. The echinoids are also clearly epifaunal. It is reasonable to suppose that the epifaunal component of the fauna lived in the environment where it is deposited, although it is not certain that the specimens lived exactly where they became embedded. The third component of the fauna consists of the heterogeneous group of nektobenthos and nekton. *Ptychodus, Pycnodus,* and the chimaerid with their crushing teeth may well have fed on the bivalves and other constituents of the local fauna. The different isurid sharks were more or less nektic and independent with regard to bottom communities, and some of them also occur in the Santonian sandstone (division B).

The same is apparently true of the Santonian belemnites, which were completely independent of the shift in facies and benthic communities between the limestone and the sandstone, at least if their occurrence is not due to the drift of dead individuals. The ecological significance of the ammonites, the nautiloid, and the mosasaurians is uncertain.

The nine species of glass sponges (hexactinellids; cf. Table 8 and pl. 13, figs 5, 6) are particularly interesting for their bearing on the water depth. Modern reviews of the depth distribution of extant and extinct hexactinellid faunas reveal that they have never been collected at depths of less than 82 m, if isolated species are excepted (Reid 1968; Koltun 1970). Provided that the Särdal hexactinellids did not have unique depth requirements, it appears that the depth temporarily in Cenomanian time or slightly later must have reached about 80–100 m or more. Nestler (1961; 1965) used the hexactinellids in a similar way to show that a Late Cretaceous sea at Rügen ought to have been between 100 and 250 m deep.

The derived phosphatised rock pieces in the limestone may have been broken up in a littoral environment in Santonian time. However, this does not indicate the ultimate depositional environment. The presence of argillaceous material is probably in part due to a comparatively calm microenvironment between the shells, where strong water turbulence was less noticeable. The rate of sedimentation apparently was low or zero at times, as indicated by corrosional features and hardground surfaces with glauconite, phosphorite and limonite (cf. hardground signature schematically drawn in Fig. 3).

The abrupt change in lithology between the limestone and sandstone and the boulder level is evidence that the physical environment changed profoundly within the time for Santonian sedimentation at Särdal. Apparently there was a total break, probably with upheaval above sea level, and a period with littoral conditions including the rounding of the large shore boulders. When the locality was resubmerged by the second transgressing sea in Santonian times, impure quartz sand was deposited between and above the shore boulders. According to Karna Lidmar-Bergström (personal communication) the gneiss in this area is commonly very fast weathering, and recent shore sand locally appears to be the result of post-glacial denudation. Consequently the presence of a fair amount of quartz in the sandstone bed need not indicate that the deposition was preceded by a long period of subaerial weathering. The presence of grains of feldspar and other minerals is consistent with this line of reasoning.

The epifauna in the Santonian limestone is so poor that a meaningful comparison with that in the sandstone is impossible. Both rock divisions are devoid of infaunal elements. Apart from *Inoceramus* and echinoids, the epifauna in the sandstone and limestone consists of species of bryozoans, brachiopods, bivalves, annelids, and cirripeds, all of which in life were fixed to a hardground substrate. The epifauna found in the sandstone may have been fixed to the boulders in the boulder bed although this has not been directly observed. The nektobenthic and nektic faunas of the limestone and the sandstone are practically identical as far as the belemnites are concerned. The sandstone also contains shark teeth, but it is possible that these have been redeposited from the derived phosphatised rock fragments. In the presence of a consequently asymmetrical brachiopod, determined as *"Rhynchonella" flustracea* Buch?, there are similarities to Danian faunas in coral limestone (Asgaard 1968). No corals have been found at Särdal, and it is possible that the asymmetry in both cases is connected with a life on an irregular hardground substrate, although this was different in detail.

The well sorted sand in the sandstone bed may indicate upper sublittoral conditions. In particular the sublittoral aspect of the foraminiferal microfauna substantiates this conclusion. There is a peak for planktic foraminifera relative to benthic forms in the limestone, which therefore may have been formed further from the original shore than the sandstone (see detailed discussion by Norling, herein). As the quartz grains in the sand are subangular and grains of feldspar and other minerals are present the position must have been a fairly sheltered one. The topography of the area is very low (cf. pl. 1, fig. 1), and it appears probable that the water was very shallow far out from the shore.

Acknowledgments. Dr. Alan Lord, Norwich, and Dr. Peter M. Sheehan, Berkeley, kindly improved the English manuscript. Mr. John Sommer, Aarhus (pl. 9–12) and Mr. Sven Stridsberg, Lund (pl. 1, 2 and 13 except exposures in the field) made the photographs with great skill and care. The Stereosocan photographs (pls 3–8) were kindly processed by Mr. Uno Samuelson, Stockholm, while Norling made the exposures. Some figures and tables were drawn by Mrs. Siri Bergström, Lund (figs 1–3, tables 8–10), Mrs. Greta Hellström, Stockholm (tables 1–4), and Mrs. Jette G. Nielsen, Aarhus (tables 5,7). Mrs. Erna Nordmann, Copenhagen, masked off the photographs (pls 9–12) and prepared fig. 3B on pl. 11. For this and additional aid by many persons the authors wish to express their sincere thanks. Many of these persons are mentioned in the text.

Dansk sammendrag

En ny lokalitet ved Särdal mellem Halmstad og Falkenberg på den svenske vestkyst har flyttet grænsen for sikre faststående øvre kretaciske sedimenter ca. 25 km mod nordvest. Herved er muligheden for at drage slutninger vedrørende de øvre kretaciske sedimentære bjergarter på Kattegats bund øget.

De ældste sedimenter tilhører den øvre del af Cenomanien og/eller *A. plenus* Zonen på grænsen mellem Cenomanien og Turonien, og de repræsenteres af omlejrede