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A paleontological study of the Campanian (Upper Cretaceous) sedimentary succession at Åsen, Kristianstad Basin, southern Sweden



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Aim of the project

A diverse fossil fauna was collected from Late Cretaceous deposits at Åsen, Kristianstad Basin, representing a ca. 4.15 m thick section during June-August 2010-2012 (see Fig 3). A total of 169 kg material was sorted. The main aim of the project is to give an overview and make a stratigraphical illustration of the total fossil fauna and ecology at Åsen, Kristianstad Basin, during the Late Cretaceous (see Fig 1). The overview makes it possible to study the changes in the invertebrate fauna through time, from early to late Campanian at Åsen. A quantitative analysis was performed based on weight percentage of the individual fossils groups in order to assess the variation between the different beds at the studied locality. The project further aims to elucidate local paleotemperatures and sea level changes by studies of the geochemistry and charcoal fragments. XRF analysis of the sediment samples is used to study the geochemistry of the different beds and XRF analysis of the belemnites is used to study the variation of the Sr/Ca between different beds in the sequence. SEM and binocular microscope is used to study the charcoal fragments.

Results and conclusions

The stratigraphically older *B. mammillatus* Zone assemblages comprise storm-accumulated remains (associated with coquina beds and oyster banks) that include selachians, chimaeroids, bony fish (pachycormiforms, pycnodontids, and teleosts), dyrosaurid crocodylians, elasmosaurid and polycotyloid plesiosaurs, mosasaurs (mosasaurines, halisaurines, tylosaurines, and plioplatecarpines), and cheloniid sea turtles. Coeval invertebrates comprise abundant belemnites, bivalves, brachiopods, and echinoderms. This rich biodiversity abruptly declines up-sequence through the oyster bed layer and into the *B. balsvikensis* Zone; this is characterised by a sandier facies, which is exceptionally poor in reptile remains and manifests only small teleosts and sharks. Benthic mollusks and brachiopods also decline in abundance while worm tracks and decapod crustaceans (crabs) make a first appearance. Although, this observed change clearly corresponds to an environmental shift. Lower values of the XRF results on Sr/Ca ratios of the belemnites from the *B. balsvikensis* Zone suggest drop in local water temperatures during the earliest-late Campanian at Åsen.

The high amount of charcoal in the sediments of the *B. mammillatus* Zone suggests high erosion rate on land with high influx of sediments, or it may be reworked from the lower flood plain deposits. The charcoal fragments consists mainly of conifer wood but with some angiosperm wood present.

XRF analysis of the sediment samples show that silica (Si) and calcium (Ca) are the elements constituting the main part of the sediments. Si and Ca show an inverse relationship through the whole succession. Si shows a decreasing trend all through the succession with highest values in the samples from the terrestrial flood plain deposits and lowest values within the *B. balsvikensis* Zone. Ca on the other hand, shows the opposite trend with highest values in the *B. balsvikensis* Zone.

Geological background

The Kristianstad Basin is located in Skåne, southern Sweden and has c. 200 m thick Cretaceous marine strata exposed. During the latest Triassic to Middle Jurassic the temperature was warm and humid, the weathering of the kaolinized bedrock resulted in the development of the uneven topography of the Precambrian bedrock (Lidmar & Bergström 1982). During the Cretaceous period the basin was formed due to the southwest dipping of the crystalline bedrocks, with faults forming the Nävlingeåsen and Linderödsåsen horsts (Bergström & Sundquist 1978). During the Late Cretaceous there were repeated episodes of sea transgression in southern Sweden, which resulted in the development of an archipelago environment and irregular coast line morphology of the Kristianstad Basin (Christensen 1984).

The deposits of this study are exposed at Åsen, within the Kristianstad Basin and consists of shallow coastal calcareous sands and calcarenites. The depositional succession at Åsen is conformably divided into two zones: the latest-early Campanian *Belemnellocamax mammillatus* belemnite Zone (a lateral equivalent of the northern European *Belemnitella mucronata seniori/Gonioteuthis quadrata gracilis* Zone), and an overlying earliest-late Campanian *Belemnellocamax balsvikensis* Zone. The *B. mammillatus* Zone is further divided into distinct units; the Coquina bed, the Green sand bed and the Oyster bank. The *B. balsvikensis* Zone is divided into Balsvikensis Green and Balsvikensis Yellow (see Figs 1 and 2). The Campanian sediments yield a diverse vertebrate fauna including 34 shark species, five ray species, six mosasaur species, one plesiosaur species, and minor dinosaur and turtle remains. The succession also contains an invertebrate fauna including bivalves, cephalopods, gastropods, brachiopods, bryozoans, echinoderms and belemnites. The succession also contains coprolites and charcoal fragments. Most of the charcoal fragments are encountered in the lowermost part representing the latest-early Campanian marine strata.

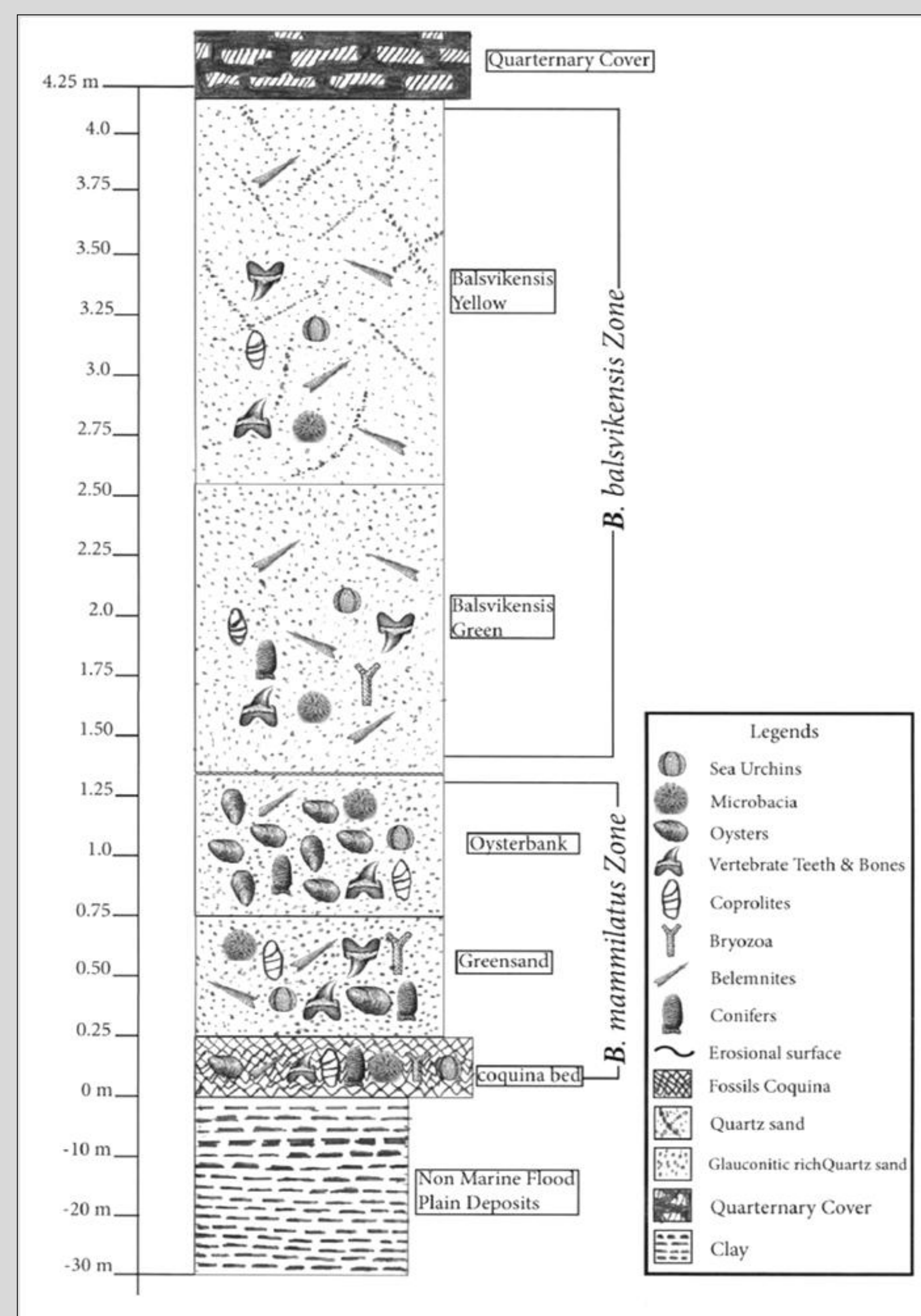


Fig. 1. Stratigraphical log showing the lithology and fossil fauna of the Campanian marine strata at Åsen representing the *Belemnellocamax mammillatus* Zone (latest-early Campanian) and the *Belemnellocamax balsvikensis* Zone (earliest-late Campanian).

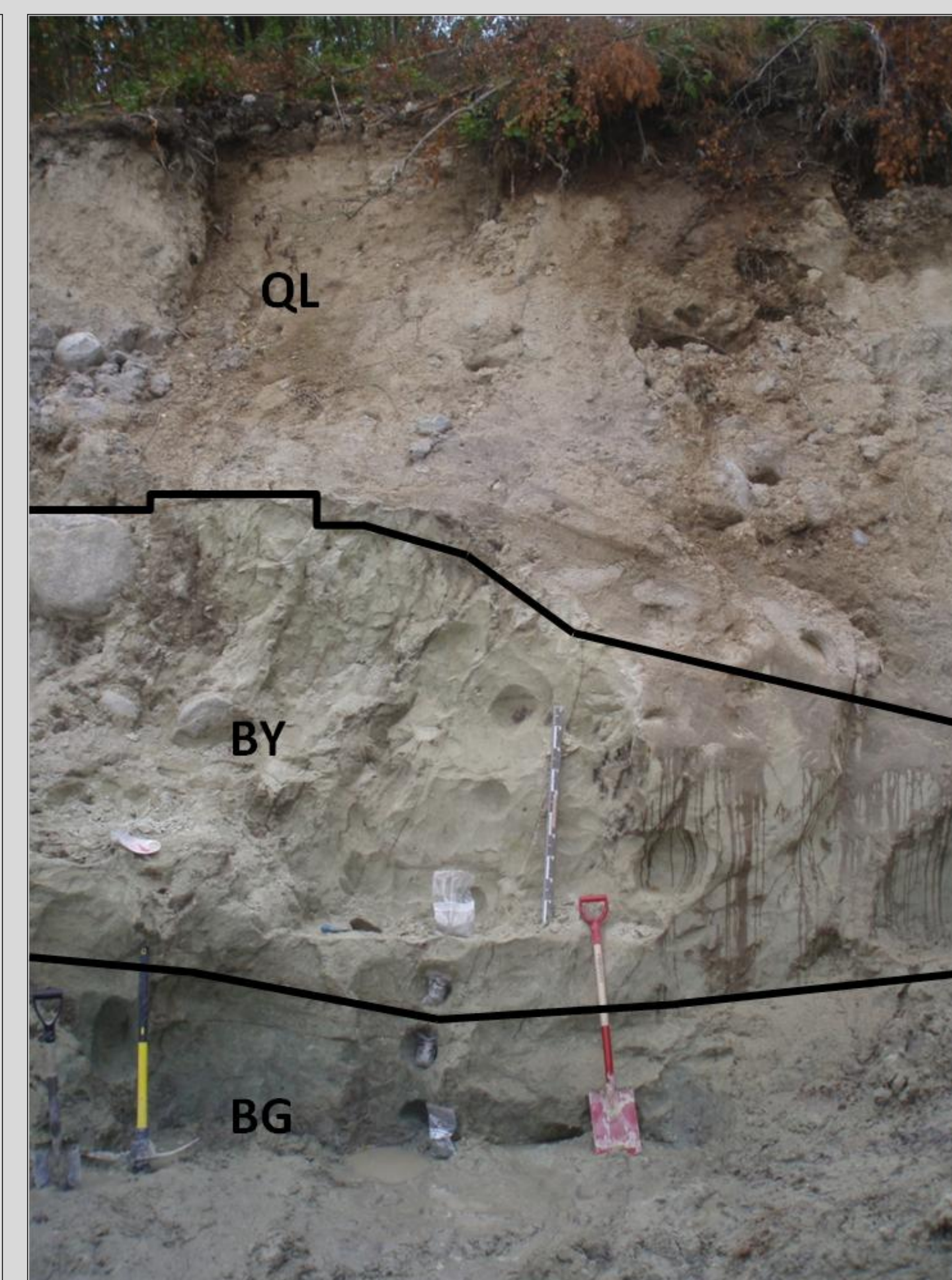


Fig. 2. Upper part of the sedimentary sequence at Åsen. BG = Balsvikensis Green, BY = Balsvikensis Yellow and QL = Quaternary Layer. BG and BY are included in the *B. balsvikensis* zone (earliest-late Campanian).



Fig. 3. Working process during the excavation at Åsen summer 2012: digging, sieving and sorting.

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