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The Cerithium Limestone in Denmark or how to recover from the Cretaceous/Paleogene mass extinction

66,1 Ma the Cretaceous-Paleogene mass extinction wiped out 75% of all marine life and 50% of all life on land. Archives telling us how the Earth recovered from such a massive mass extinction are important for understanding the Earth's ecosystems. One of these archives is located at Stevens Klint, south of Copenhagen in Denmark. The site is of importance as it contains both the clay layer recording the extinction (Fiskeler Member (Mb)) and the layer showing the recovery time, the Cerithium Limestone Mb. The Cerithium Limestone is a pale yellow, loosely consolidated limestone with a dense network of burrows and numerous flint nodules. It is an archive of a deep marine post-extinction environment where you can observe a progressive return of the fauna and flora, and in peculiar carbonate rock-forming organisms. The Cerithium Limestone was for a long time thought to be a homogenous or single characteristic unit. However, the Cerithium limestone is now considered heterogeneous, constituted by several elements in different proportions forming an ensemble called microfacies. Classifying and describing microfacies is crucial for reconstructing past environments as they show us glimpses of the depositional environment of the area.

My thesis aims to expand our knowledge of these microfacies and be the first to catalog their horizontal and vertical distribution. This was done by making thin-sections from samples taken at two different sites at Stevens Klint. One near the town of Rødvig in the south and a second site in the north at Kulstirenden. Microfacies were classified using a classification called Dunham which measures the amount of grain with biological origin like fossils (bioclast) within a limestone. In this paper only three classifications were utilized mudstone (<10% bioclasts content), wackestone (10% -50%), and packstone (>50%). However, the wackestone was further divided into bioclastic poor and bioclastic rich wackestone to increase the detail of our descriptions. The bioclastic content was measured using point counting on thin-sections where 250 points were selected on each thin-section at random. These points are then classified as either different fossils or matrix for the fine-grained middle mass between fossils.

The results showed that the Cerithium limestone contains a bryozoan-dominated packstone layer at both sites. At Rødvig it transitions into a foraminifera-dominated mudstone with a large amount of ostracods and bivalve fragments. The limestone then gradually changes to bioclastic poor wackestone with an increasing amount of siliceous sponge. For Kulstirenden, the lower levels are thicker, and the middle section is more condensed. The Cerithium limestone has a continuation in Kulstirenden not visible at Rødvig, a bioclastic poor wackestone with varying degrees of bioclasts containing a mix of sponge spicules foraminifera, as well as some bryozoans. Normally changes in limestones are often linked to either changes in the fauna or changes in water depth. These changes usually present as larger-scale systematic changes. Since the changes in the Cerithium Limestone are only visible on a microscopic scale and appear to have a random distribution pattern at both sites, the difference in the amount of bioclasts is most likely due to the burrowing of the deposited sediments by diverse organisms of different sizes.

Master's Degree Project in Geology 45 credits 2024
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