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Rocks and the Rise of Ordovician Life

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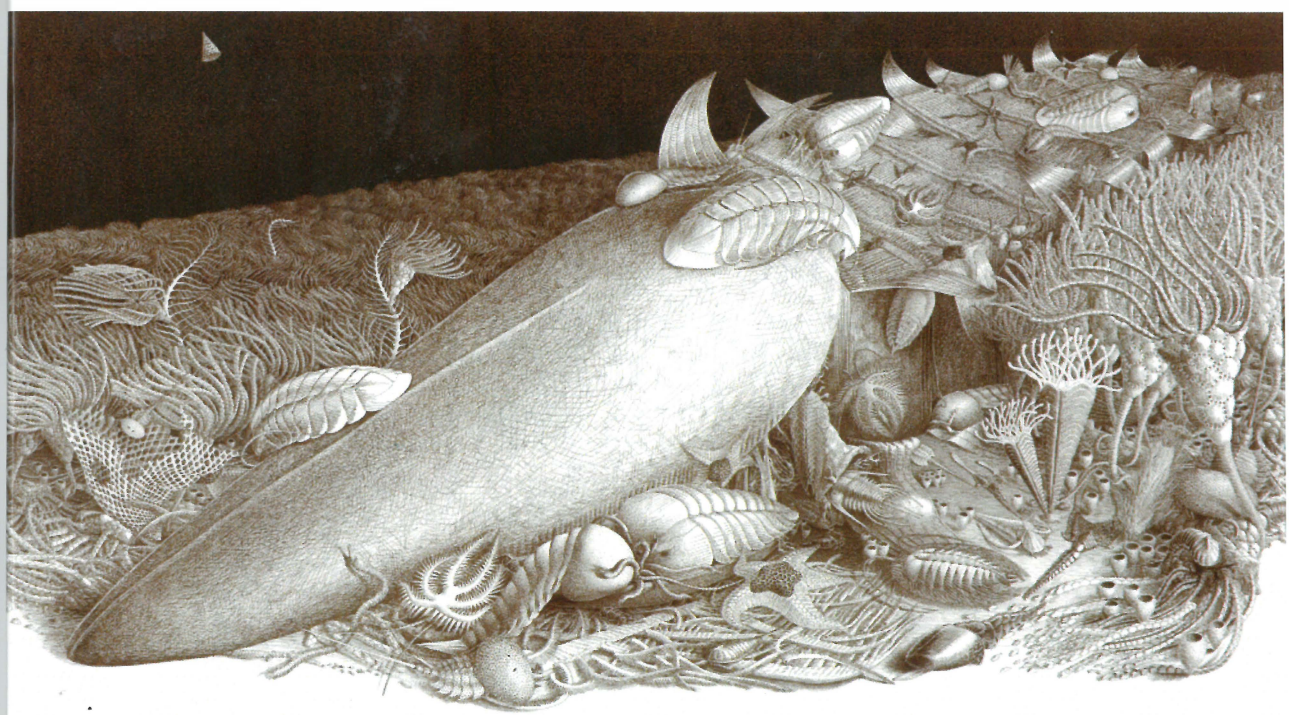
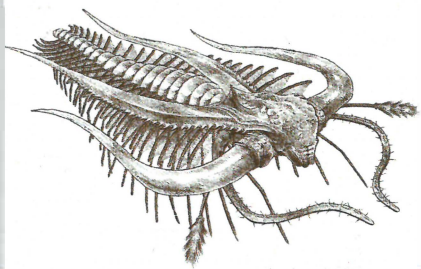
ROCKS AND THE RISE OF ORDOVICIAN LIFE

Filling knowledge gaps in the Early Paleozoic Biodiversification and Promoting Geological Heritage





ABSTRACT BOOK

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Trace element signatures in Early Ordovician phosphorites and black shales from the Baltic Palaeobasin: sulfidic facies control of the P cycle

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The late Neoproterozoic and the beginning of the Phanerozoic witnessed unprecedented changes in the ocean oxygenation and elemental reservoirs and cycles. The complex nature of those transformations is now widely recognized. The Cambrian-Ordovician transition is commonly regarded as a period with exceptionally high global temperatures and sea levels; however, the details of the redox state of the ocean and the P biochemical cycle remain poorly understood. We studied co-occurring shelly phosphorites and black shales from the shallow peripheral part of the Baltic Palaeobasin based on detailed geochemical profiles from several drill cores from North Estonia. The recorded distinct geochemical signatures include hyper-enrichment of V (>1000 ppm) in organic-rich (average TOC 11%) and metalliferous but phosphate-poor black shales, coupled with anomalously low content of Cd and Zn, both in the phosphorites and black shales. Similar enrichment patterns could be found in the phosphorite-black shale couples from the late Neoproterozoic and Cambrian but are atypical for later upwelling-related settings. However, other redox-sensitive trace element proxies, such as the Mo_{EF} vs U_{EF} trend in the studied black shale, match those of modern anoxic sediments under ocean upwelling. We suggest that the observed variations reflect exceptionally high biomass production and highly heterogeneous redox conditions in the palaeobasin in this time period. The low Cd and Zn in primary sediments agrees with the drawdown of chalcophile nutrient-type elements in seawater in the regional or global scale. This is likely a cumulative effect of combined primary production and development of unusually widespread shallow sulfidic facies in the transgressive epicontinental sea. P release back to the water column from euxinic sediments self-sustained high dissolved P in the seawater and pushed phosphogenesis to the shallow water rims of the palaeobasin.

Key words: Black shale, phosphorite, trace elements, phosphate, Baltic palaeobasin