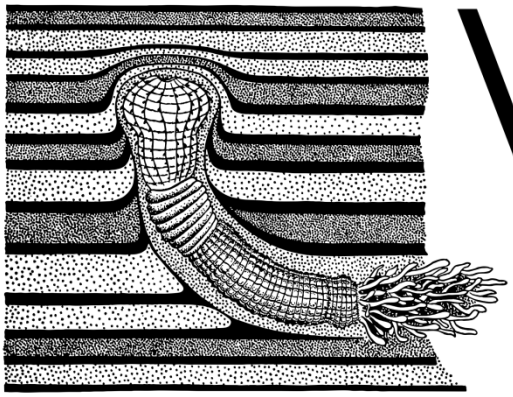

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X-ray computed tomography of Lower Palaeozoic trace fossils from the carbonate succession of Estonia: Preliminary results

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Trace fossils are common in the Ordovician–Silurian shallow marine carbonate succession of Estonia, with more than 40 ichnogenera recently reported. However, the number of well-preserved ichnofossils is relatively small and their identification is often complicated due to the fact that three-dimensional architectures cannot be easily observed in consolidated carbonate rocks. The identification of different bioerosional structures is especially problematic. For instance, *Trypanites*, a common ichnogenus on hardgrounds and organic substrates, is highly variable and may be accompanied by other taxa such as *Palaeosabella*, *Sanctum*, *Osprioneide*s as well as enigmatic grooves and borings with unknown architecture. A characteristic is also the clumping behaviour of different tracemakers and the occurrence of symbionts (e.g., conulariids, cornulitids and the unknown *Anoimaichnus* animal). Studying the size and morphology of such trace fossils and their assemblages is impossible by conventional methods, at least without destroying the host specimens completely. X-ray computed tomography (X-CT) has been successfully used for analysing three-dimensional architectures of trace fossils hidden in hard substrates. However, this method has rarely been used for Early Palaeozoic limestones. In this study we tested X-CT scanning on different types of carbonate facies trace fossils found from Estonia in order to reconstruct their 3D morphology and assess the potential of the method. The analyses were made at the Geological Survey of Finland with Phoenix v|tome|x s 240, running at 120–150 kV accelerating voltage with 1500–2700 projections, resulting in 20–60 minute scan time and 20–100 micron voxel resolution.

The preliminary results show that burrows and bioerosional structures on hardgrounds having pyritic impregnation can be easily distinguished in great detail. We were able to observe and describe *Trypanites* and several enigmatic structures, some possibly of microbial origin. Another type of trace fossil preservation common in the lowermost Upper Ordovician strata of Estonia are carbonate burrows within kerogen-rich oil shale. Such traces were also well-defined in X-CT scans with denser carbonate clearly distinct from the lighter matrix. Bioerosional traces within stromatoporoids and bryozoans appeared to be the least distinct type tested, with rather faint contrast difference between the trace infills and the matrix. Due to this, 3D reconstructions were problematic, but the traces could still be identified and measured on individual image slices. We conclude that X-CT is a very powerful method for studying trace fossils in carbonate rocks and further efforts are planned to study the problematic specimens from Estonia.