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The Siljan Ring in central Sweden - a window into the Palaeozoic history of Baltoscandia

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The Siljan meteorite crater, the largest known impact crater in Europe, is a main target of the research project 'Concentric Impact Structures in the Palaeozoic (CISP)', an integral of the Swedish Deep Drilling Program (SDDP). A set of new drillcores now provides possibilities to document the associated Early Palaeozoic sedimentary strata that form the crater ring-structure.

In 2011 our research team has sampled the core sections for carbon isotope chemostratigraphy, thermal maturity analysis, sediment provenance, facies and microfacies studies. A dug trench at Nittsjö in the south-eastern part of the ring-structure forms complement to the drillcores and the total data set will allow intra- and intercontinental correlation of the succession and help to reconstruct Caledonian tectonic movements in the region. Based on initial analysis of the core sections, the Palaeozoic succession starts with the Tremadocian Obolus conglomerate whereas the youngest pre-Caledonian strata are Mid-Silurian shales of the Nederberga Formation.

Our first preliminary studies show that different, and yet undefined, facies belts are preserved in the Siljan District. This part of Sweden, previously regarded to represent a stable cratonic area unaffected by the Caledonian collision between Baltica and Laurentia, locally has a complex tectonic history. In the western part of the crater, the Lower to Middle Ordovician carbonate succession is about 21 m thick, with a sharp flooding surface on top of the Mid-Ordovician Holen Formation. The immediately overlying shales are of upper Llandovery age based on graptolite data and comprises a minimum thickness of about 224 m. The erosional unconformity and substantial hiatus between these units suggest an extended period of uplift and erosion, presumably related to forebulge migration towards the east due to tectonic loading by the Caledonian nappes to the west. Megaslumps, debris flows, turbidites and several synsedimentary tectonic features in the shales imply rapid tectonic subsidence and steep depositional gradients in the Silurian. The intercalation of a sandstone unit reflects a notable regression in this shale basin followed by rapid transgression and deposition of dark, organic-rich shale and mudstone. In contrast to this development, a classical Ordovician-Silurian carbonate/shale succession, well known from other parts of Sweden, formed in the northeastern part of the Siljan crater.

The recent findings of palaeokarst in the area together with similar new findings in other parts of Baltoscandia also reflect times of subaerial exposure of the basin regionally (see Lehnert et al., this session). Together, our new data pictures a complex geological history in the Siljan district and challenge the idea that the Baltoscandian basin was a deep and tranquil depositional environment throughout most of Baltoscandia.