

penepplain. Soft ores and remnants of a kaolinitic saprolite are associated with hilly relief in central Sweden, which suggests a longlasting protective cover also here. Similar conditions occur along the coasts of southern Norway. In contrast the inselberg plains in northern Sweden are associated with some type of gravelly saprolites and thus are judged to have formed when the hilly relief still had a cover in accordance with the conditions around the SSD. These plains might correlate to the Palaeic plains of southern Norway.

Oncoids and stromatolites in the Holen Limestone (Darrivilian, Middle Ordovician) at Kinnekulle, Västergötland, Sweden

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Oncoids and small stromatolites occur in the Darrivilian (Dw1–Dw2, Middle Ordovician) ‘orthoceratite limestone’ at Kinnekulle, Västergötland, Sweden. The characteristics and stratigraphic distribution of these microbialites appear to reflect relative sea level; they are preferentially found in beds that record notable lowstands. Micro-oncoids occur throughout much of the c. 13.5-m-thick Holen Limestone (=entire Kunda Baltoscandian Stage, BIII). Notable concentrations are present in the Volkhov–Kunda (Lanna Limestone–Holen Limestone, BII–BIII) boundary interval, in the ‘Täljsten’ (BIII α –BIII β transitional beds), and in the middlemost Holen Limestone. Well-developed macro-oncoids have only been found in the ‘Täljsten’ and its enclosing beds, in total a c. 3-m-thick interval. The lowermost beds of the ‘Täljsten’ host the largest and most well developed oncoids in the entire succession, and also the highest abundance of specimens. Stromatolites are most common in a bed c. 0.5 m above the ‘Täljsten’. Diagenetic alteration hinders confident identification of the producers of these microbialites, but characteristics of associated endolithic microborings indicate that they formed in photic waters. The cortical fabrics and rounded morphologies of macro-oncoids indicate a relatively high-energy, shallow-water depositional environment, sensitive to high-frequency environmental change. Stromatolite-like lamination occurs in the uppermost Holen Limestone, but this feature is likely of abiogenic origin.

Micropaleontologic and sedimentologic changes across the Volkhov–Kunda boundary at Kinnekulle, Västergötland, Sweden

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The transition between the Volkhov and Kunda Baltoscandian stages (lower Darrivilian, Middle Ordovician) has been associated with a notable drop in sea level, which resulted in gaps in the sedimentary record throughout much of the Baltoscandian paleobasin. Owing to a relatively deep-water depositional setting, the ‘orthoceratite limestone’ at Kinnekulle, Västergötland, Sweden, preserves an essentially complete record of the Volkhov–Kunda transition – a stratigraphic interval that is excellently exposed in the abandoned Hällekis Quarry, northwestern Kinnekulle. Upper Volkhov beds are characterized by a successive coarsening of carbonate textures, increasingly frequent limonitic discontinuity surfaces, and ferruginous skeletal debris and coated grains. These lithologic/sedimentologic changes are

associated with a change from a distinctly trilobite-dominated to an increasingly diverse skeletal grain fauna. Especially echinoderms and gastropods show notable increases in abundance in the uppermost Volkhov beds. The shift between Volkhov (Lanna Limestone) and Kunda (Holen Limestone) is marked by a temporary change in lithology from dense limestone to less weathering-resistant marly limestone. This lithologic change is coupled with a fining of carbonate textures and the return of a distinctly trilobite-dominated skeletal grain fauna. Upwards through the Kunda beds, carbonate textures coarsen significantly. Concurrently, echinoderms become increasingly abundant and ultimately form the dominant component in skeletal grain assemblages. Gastropods and other mollusks also become increasingly conspicuous and are most abundant in and around the so-called Täljsten.

Exceptional cellular preservation in Mesozoic and Cenozoic plants, fungi and invertebrates

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We present three cases of exceptional three-dimensional preservation to cellular and sub-cellular level amongst ferns, ectomycorrhizal fungi and cocoons of clitellate annelids. Innovative analytical techniques and novel investigative strategies have opened up new fields for the study of cell organelles and soft-bodied organisms previously deemed too delicate or transient to leave a fossil record. In the first case, standard light microscopy, supplemented by scanning electron microscopy and synchrotron x-ray microtomography, illustrates cell organelle preservation in a calcite-permineralized fern from the Jurassic of Sweden. In the second case, thin-sectioning, coupled with confocal laser scanning microscopy provides high resolution, deep-focus imaging of ectomycorrhizal fungal spores from Triassic silicified peats of Hopen in the Svalbard archipelago. Finally, scanning electron microscopy and fluorescence microscopy offers the potential for identifying a new range of fossil soft-walled micro-organisms and spermatozoa entombed in the waxy cocoon walls of clitellate annelids from the Eocene of Antarctica.

First evidence of Devonian strata in Sweden – Palynological study of the Övedskloster drillcores 1 and 2 from Skåne

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A palynological study of the Övedskloster #1 and 2 drillcores from Skåne, Sweden, reveals a rich and well-preserved spore-dominated palynoflora. The assemblages include 55 spore species from early land plants. These diverse assemblages contain several biostratigraphically important taxa including: *Cymbohilates allenii*, *Cymbohilates allenii* var. *magnus*, *Retusotriletes maccullockii* and *Chelinohilates erraticus*. The succession is interpreted to span the Silurian–Devonian boundary (Přídolí–Lochkovian) and provides the first evidence of Devonian strata in Sweden. Palynofacies analyses reveal a shallowing-upward succession corresponding to nearshore marine marls at the base of the investigated core, grading into

sandstones expressing a decrease in the relative abundance of marine palynomorphs. The strata in the uppermost 70 metres of the Övedskloster 2 drillcore are dominated by red sandstones that are devoid of palynomorphs and contain only phytodebris. This interval is interpreted to consist of predominantly paralic to fluvial deposits comparable to the facies represented in the Old Red Sandstone of Britain and reflects a retreat of marine conditions from Baltica linked to regional uplift associated with the Caledonian Orogeny.

Middle Jurassic to basal Cretaceous foraminiferal stratigraphy and water mass features on the Mid-Norwegian shelf

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The study is based on quantitative distribution of foraminifera combined with sedimentary data in the Melke and Spekk formations (Bajocian to Ryazanian) in three wells drilled on the Mid-Norwegian shelf. Both formations consist of shales the organic carbon content of which is intermediate in the Melke (2-4%) and high in the Spekk (6-8%). The formations are typified by low diversity foraminiferal assemblages (with alpha indices below 5) strongly dominated by agglutinants suggesting restricted environmental conditions. Normal marine calcareous taxa are strongly subordinate or absent. During deposition of the organic-rich Spekk Formation, hypoxic conditions are indicated by extremely low species diversities, strong dominance of the surface-dwelling genus *Trochammina*, reduced test dimensions and low pristane/phytane ratios. High abundance of radiolaria is typical. In the Spekk Formation, low diversity agglutinated assemblages composed of nearly equal amounts of infaunal and epifaunal taxa suggest that reduced salinity acted as the main restricting factor. The foraminiferal succession is subdivided into seven assemblages regarded as informal stratigraphic zones. The assemblages recognized in the Spekk Formation are, with marker species and recognized in the Melke Formation are, with marker species and age: *Glomospira otorica*, Kimmeridgian; *Recurvoides scherkalyensis*, Callovian – Early Oxfordian; *Riyadhella schpkinaensis*, Bathonian; *Riyadhella sibirica*, Bajocian – Bathonian; *Recurvoides aff. pachyspirus*, Bajocian. The assemblages reveal close similarities with those of the Barents Sea, Western Siberia, and Canadian Arctic Archipelago according to direct communication and gross water mass similarities between the Mid-Norwegian shelf and the Boreal Realm.

The Hawke Bay Event: A complex regression at the Early/Mid Cambrian transition

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The boundary between the Lower and Middle Cambrian is developed as an extensive unconformity in Scandinavia. The responsible regression is traditionally correlated with the Laurentian Hawke Bay Event. A regional study, based on some 500 localities and wells, reveals that the boundary hiatus is diachronous across Scandinavia and locally straddles up to 6 my. The label "event" is thus a misnomer. The Hawke Bay regression reflects a major sea level fall, estimated at ≥ 100 m, taking place in concert with simultaneous uplift of Scandinavia, estimated at c. 40 m across the Scandinavian peninsula and up to 150 m

along the craton margins. The isostatic disturbance probably reflects plate tectonic reorganisation, maybe onset of subduction in the Iapetus Ocean. The uplift progressively and differentially subsided during the early Mid Cambrian. Overall, the sea level was low during the early Mid Cambrian and strongly fluctuating and the period likely represents a glacial interval. Four 3rd order sequences are recognized between the Hawke Bay unconformity and the *Acidus atavus* Zone. A series of maps have been produced showing subcrop and onlap of the unconformity, thickness of Middle Cambrian formations and palaeogeography of selected time slices. Associated with the low sea level, progradation shifted the coastline across the Baltic Sea during the earliest Mid Cambrian and eventually it reached a position roughly corresponding to the modern east coast of mainland Sweden (*Triplagnostus gibbus* Zone). From then on the sea level rose significantly, shifting the coastline some 500 km eastwards during the *A. atavus* Zone.

Deep weathering, neotectonics and strandflat formation in Nordland, northern Norway

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The strandflat area of Nordland is a region with frequent deep weathering and increased seismic activity. We argue that there is a causal relationship between the phenomena. We have carried out chemical and geophysical studies of the weathering and measured the tectonic strain using the GPS method. There is a parallel and shallow zone of increased seismicity along the coast largely reflecting extensional stress. GPS data and previous datasets such as DInSAR, repeated levelling and focal plane solutions indicate that outer Ranafjorden is under E-W extension and subsidence. In 1998-1999 a local seismic network detected earthquake clusters along N-S trending fracture zones. Fault-plane solutions indicate E-W extensional faulting. An irregular relative subsidence pattern in the order of 1-2 mm/year has previously been recorded on InSAR-PS data. During the period 1999-2008, GPS stations to the west of the earthquakes moved c. 1 mm/year to the NW relative to GPS stations to the east. Deeply weathered bedrock occurs around Vestfjorden and southwards to Ranafjorden. Electrical resistivity profiling reveals weathered bedrock extending to 20-100 m depth over large areas. XRF analysis and mass balance calculations show a 30-65% leaching of the major elements. The weathered sites can be found up to an altitude of 500 m asl. and were most likely exhumed during the Plio-Pleistocene. This observation is supported by previous marine-geological studies suggesting a Pleistocene erosion of ~500 m along the coast. We argue that the weathering is partly of Early Mesozoic age, since the Jurassic faults in the Lofoten-Vesterålen area are little affected by the alteration. The unloading of the crust along the coast thus most likely caused flexuring and accompanying fracture extension.

Preglacial weathering crust in Finland

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The gold rush in Finnish Lapland in the late 19th century led to the discovery of the in situ preglacial weathering crust (saprolite) under glacial deposits. Later studies have revealed in