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IODP Proposal Cover Sheet

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☒ **New** ☐ **Revised** ☐ **Addendum**

Please fill out information in all gray boxes

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Title:	Evolution of the Mesoproterozoic Baltic Sea rift basin system		
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Keywords: *(5 or less)*	Baltic Sea, sedimentary basin, rift, LIP, paleoclimate	Area:	Northern Europe

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Permission to post abstract on IODP-MI Sapporo Web site: ☒ Yes ☐ No

Abstract: (*400 words or less)*

The Baltic Sea Basin in northern Europe was formed on Palaeoproterozoic crust in a failed rift environment in the Mesoproterozoic (1500-1300 Ma). The basin has continued to evolve though time and displays three separate basin stages recording tectonic events in the surrounding onshore areas. These basin stages are (1) Mesoproterozoic (1500-1300Ma), (2) late Neoproterozoic to Paleozoic (600-350Ma) and (3) Recent.

Although Baltica may have been part of a supercontinent when the failed rift was formed, the crust of was fundamentally reconstructed during a LIP event characterized by the emplacement of the voluminous rapakivi granites and associated mafic rocks as well as formation half graben systems and deposition of continental sandstones (redbeds). Structures inherited from this tectonic stage have largely controlled the further evolution of the region by localizing the tectonic movements and by controlling basic basin geometry. The formation and destruction of supercontinents has major effects also on climate. The warm climate recorded in the redbeds may reflect either a major climate change or the southerly paleolatitudes of the supercontinent.

During thermal relaxation (1400-1200Ma), when the thermal domes associated with the rapakivi complexes were eroding, the Baltic Sea basin was filled with clastic sediments. The basin experienced the distal effects of LIP event associated with the opening of the Grenvillian Sea (1100 Ma and1300 Ma) as evidenced by the intrusion of dikes and sills. The Grenvillian Sea was closed during the Sveconorwegian orogeny (900-1000Ma), but its effects on the BalticBothnian foreland basin is poorly known. In response to the opening of the Iapetus Ocean at 600 Ma, a shallow marine continental margin was formed. At ~400 Ma, the closure of the Tornquist Sea and docking of Avalonia and Baltica as well as the formation of the Caledonian thrust and fold belt in Scandinavia caused the formation of the 'BalticBothnian foreland basin' on the eastern and northern side of the orogens.

A drilling initiative is proposed to study tectonic, temporal and spatial connections between the bimodal magmatism, basin evolution and associated diagenetic fluid flow and mass transport. These studies will yield first order information as to how longlasting intracontinental basins are formed in LIP environments prone to produce with continental breakup. The impact of a supercontinent on global climate will also be studied.

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Scientific Objectives: (*250 words or less*)

This drilling initiative aims at solving a) the timing of the basin formation and its evolutionary history by dating the volcanic and dyke rocks; b) formation mechanism and structural evolution of the basin of by studying deformation zones and contact relationships of the sedimentary and basement; c) nature of the basin by lithological and facies association studies and the evolution of the basin lithological studies; d) evaluation of the former thickness and extension of the basin on the Baltic Shield through P, T, x, t path reconstructions; e) heat, mass and fluid transfer processes within the basin and the crust in a LIP setting; and f) how recent permeability steers fluids and gases from depth to the surface.

The basin evolution is tied with the evolution of the East European platform and with the breakup of Hudsonland supercontinent by dating of the volcanic rocks and associated dykes and using paleomagnetic data. Erosional periods belonging to the opening and closing of the Iapetus, Tethys and Atlantic Oceans, paleoclimate and its relationship with LIPs are studied by analysing facies changes of the sedimentary record. The sedimentary and volcanic rocks can also be used to study the evolution of ancient epicontinental environments. Paleomagnetic studies will also be used to test whether the redbeds within the Mesoproterozoic sequence reflect a climate change or just a shift in paleolatitudes.

Please describe below any non-standard measurements technology needed to achieve the proposed scientific objectives.

Proposed Sites:

Site Name	Position	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
BBS01	58°26' N, 18°28' E	500	40	2130	2170	Mesoproteorozoic, basin formation, Lithological variation, reactivation of structures, fluid migration paleoclimate, paleomagnetism
BBS02	57°16’ N, 20°16’ E	100	30	2050	2080	PhanerozoicMesoproterozoic lithology, Basin formation, reactivation, fluid migration, paleoclimate, paleomagnetism
BBS03	62°15' N, 18°40' E	84	50	1310	1360	PhanerozoicMesoproterozoic lithology, Basin formation, reactivation, fluid migration, paleoclimate, paleomagnetism
BBS04	63°N, 20°E	80	50	1800	1850	alternative site to BBS3 no Phaneroxoi sediments
BBS05	65°10' N, 23°30' E	85	10	360	370	Neoproteorozoic, basin formation, Lithological variation, reactivation of structures, fluid migration, paleoclimate, paleomagnetism