ICAM8 Abstracts
Arctic Evolution and Plate tectonic models

Tectonic model of the Arctic

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The new International Tectonic map of the Arctic was finished in 2018. The work started in 2003, carried out by geological surveys of the Arctic countries, participation of universities, and national academies, under the aegis of the UNESCO CGMW. The map is based on over 35,000 km of refraction and DSS lines, analyses of bottom samples from central Arctic highs and geological mapping of Arctic areas.

One of the main achievements of this work was the creation of a modern plate tectonic model of the Arctic. It shows that the present-day tectonic structure of the region is controlled by interaction of three lithospheric plates: two continental (North American and Eurasian) and one oceanic (Pacific). The young Arctic Ocean developing along Gakkel Ridge, the Nansen and Amundsen Basins is early Cenozoic to present in age.

The Amerasian and Eurasian basins, margins of the North American and Eurasian plates, document intraplate modern tectonic processes. It is confirmed by intraplate trap magmatism, continental and transitional types of the crust of the Alpha-Mendeleev and Lomonosov Ridges, and their close structural ties with the shallow shelf. The sedimentary cover reaches >10-12 km thickness in the Canadian basin, the Podvodnikov and Makarov basins, typical of deep intraplate sedimentary basins, such as the South Barents or Caspian basins.

The Pacific oceanic plate descends under the North American and Eurasian plates leading to active continental margins. The seismicity delineating the boundaries of modern lithospheric plates indicates these modern tectonic processes.

Cretaceous tectonic reconstructions of the High Arctic in the global plate kinematic framework

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Due to the last years intensive scientific campaigns, the High Arctic is now better covered with modern geophysical and geological data which reveal even more than before the complexity of this remote area. The opening of the North Atlantic ocean give us first order information about the motion between the North America and Eurasia plates, whose shared plate boundary runs through the Arctic region. According to this model, an episode of tectonic quiescence is predicted for the Aptian-Albian time, contemporaneous with postulated phases of large igneous province formation. Here we are using new geophysical data for unraveling possible Arctic tectonic scenarios for the Aptian to Recent time.

Using geophysical data, sparse information from drilling wells, and geological data, a new tectonostratigraphic model has been established for numerous sub-parallel rifts in the Arctic Siberian shelf. We have interpreted an Aptian-Albian extension episode with west-east orientation in the Arctic Siberian shelf and have estimated β-factors for the extension in the North-Chukchi, East-Siberian and Anisian basin. The single rotation pole for the Cretaceous Normal Superchron is now replaced with few stage rotations based on geological constraints identified in the Siberian Shelf data. We also address the Campanian compressional episode in the Arctic predicted by the fast opening of the North-Atlantic. Since there are no evidences of compression in the Siberian Shelf, we discuss possible scenarios to explain the discrepancy. The study was funded by RFBR - projects № 18-35-00133 and 18-05-00495.

New Kinematic Models for evolution of the Amerasia Basin: Overview and evidence

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New kinematic models for the formation of the Amerasia Basin were developed from comprehensive analysis of the bathymetry, gravity, and magnetic anomaly fields of the Arctic region, combined with available seismic data. Considering insufficient amount of tectonic and age constraints, two different tectonic models and three age models were examined.

The two tectonic models (A and B) provide two alternatives for the development of the proto-Canada Basin at its early stage, assuming different kinematics. The timing assignment for the tectonic models uses three alternative age models: with the opening of the central part of the Canada Basin occurring prior to ~124 Ma (Model 1), after ~124 Ma (Model 2), or with the entire basin forming after ~125 Ma (Model 3). Combining of tectonic and age models led to creation of six self-consistent kinematic models, referred to as “older” (1A and 1B) and “younger” models (2A, 2B, 3A, and 3B).

Considering all constraints available at this point, the set of “older” kinematic models is favored. They imply formation of the Canada Basin in Jurassic – Barremian with the central part generated in Valanginian (?) – Barremian (prior to ~124 Ma). This is concurrent with the final stage of the Arctida breakup and the main phase of the HALIP emplacement. During the breakup process, large shear zones were active, contributing to the opening of the Nautilus, Makarov, and Podvodnikov basins in the Valanginian (?)/Barremian – Campanian.

Some key evidences for proposed kinematic models, originated from geophysical data, will be provided in presentation.

Dismembered Bennett-Barrovia Block in the East Siberian Arctic Shelf and its implications for the Amerasian Arctic geology

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The East Siberian Arctic Shelf (ESAS) is a key region for understanding the pre-Late Cretaceous geological history of the Arctic. Interpretation of new seismic and geologic data that became available since late 2000s allows us to develop a new tectonic model of ESAS. The latter is pictured to consist of the Kotel'nyi, De Long, & Wrangel-Chukotka crustal blocks, which are divided by the broad North Chukchi Basin (NCB) underlain by thinned lower continental crust and exhumed mantle. We infer that these blocks together with Chukchi Borderland and perhaps Arctic Alaska, represent fragments of what once was a single continental mass – the Bennett-Barrovia Block (BBB) (after Natal'in et al., 1999). BBB key characteristics include:

- Neoproterozoic basement revealed by dominant Timanian Zr signal
- Similar Paleozoic lithostratigraphy across currently separated blocks
- Evidence of a Devonian compressional event on Kotel'nyi and Wrangel islands
- Similar distribution of detrital zircon ages in Paleozoic strata

The BBB was probably separated from Arctic Alaska/Canada and dismembered by crustal thinning associated with NCB formation. Presently, there is no data to constrain the time of this extension we but speculate its relationship with pre-Canada Basin rifting to be Jurassic—earliest Cretaceous. During closure of the Anyui Paleocean, the Kotel'nyi and Wrangel-Chukotka blocks collided with the Eurasian margin along the South Anyui Suture and became parts of the Verkhoyansk-Chukotka-Brooks orogen. Compressional deformation also affected the southern part of NCB.

Development of the Amerasia Basin: Insights from analogue modeling

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The tectonic development of the Amerasia Basin and its sub-domains (the Canada Basin, the Makarov-Povodnikov basins, the Alpha-Mendeleev Ridges, and the Chukchi Plateau) has long been debated. Recent studies confirm the conjugate relationship between the Alaskan and Canadian Arctic margins, in which counterclockwise rotation of Arctic Alaska from Arctic Canada resulted in the opening of the Canada Basin; although the northward extent of this spreading is debated, the tectonic development of the Canada Basin is 'broadly' understood. The precise timing and the role of the Chukchi Plateau is also problematic. In a series of two-plate analogue models with properties homologous of homogeneous continental crust, we were able to model the development of the Amerasia basin and its sub-domains (those not related to the HALIP). In all models, a triangular (ocean) basin forms between the two 'diverging' plates, however, depending on the mode of opening and initial plate configuration transpressive, transtensive, and 'pure' strike-slip structures are generated and account for the following first order observations: i) transcurrent margins of opposite motion, ii) curvature in the fossil ridge, and ii) asymmetry of the basin. In addition, extension and clockwise rotation of the Chukchi Plateau (without compression) is achieved as part of the upper-plate of a detachment system in which lower-plate motion exceeds upper-plate motion. Our results elucidate the development of sea-floor spreading in the Amerasia Basin and are consistent with a rotational opening scenario.

Constraints on the history of the Canada Basin from Chukchi Borderland

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All tectonic models for the Amerasia Basin make predictions about the relationship between the Chukchi Borderland, the Chukchi Shelf and the Canada Basin. Using MCS data we have tested these predictions for formation of the Canada Basin. We have attempted to develop a new set of constraints for the opening of the Canada Basin.

The tectonic setting of the extinct MOR that bisects the Canada Basin argues that it was formed by ultra-slow seafloor spreading. Given the time required to explain the amount of seafloor delimited by paired magnetic anomalies and the apparent absence of the Cretaceous long normal interval in the magnetic anomalies, seafloor spreading must be younger than currently conceived, occurring no earlier than the Cenomanian.

The absence of significant deformation along Northwind Ridge suggests that the current structure was formed in the events that created the Canada Basin. In this light, it becomes possible to consider a progression of extension, which began by dissection of the Borderland, and progressed to the East, culminating in the onset of seafloor spreading and the development of the extinct spreading center known from the magnetic and gravity anomaly maps.

While the observations and crude kinematics outlined in this talk present testable hypotheses for future work, they fall short of a complete model for the development of the Canada Basin. Understanding this history will, eventually, make it possible to understand the development of the Mesozoic-aged Amerasia Basin and the continents that ring it.

Circum-Arctic Lithosphere Evolution (CALE) Project: Origin and evolution of the Arctic-Alaska–Chukotka Microplate (AACM) – links between paleo-Pacific margin tectonics and opening of Amerasia Basin

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Integration of newly available data with published regional geological constraints refines the crustal identity, limits, and history of the AACM. We propose a new plate tectonic model in which the AACM originated within a re-entrant in the paleo-Pacific margin. The AACM comprises parts of the pre-Devonian platforms of Baltica and Laurentia, along with the intervening Devonian "Arctic Caledonian" orogen, an important constraint for Arctic plate restoration. Pacific marginal arc subduction first migrated into the re-entrant during Jura-Cretaceous back-arc convergence and then, following arc-continent collision, migrated away again with back arc extension. The AACM moved to its present position during this Pacific-driven back-arc extension, opening Amerasia Basin in its wake. Although Arctic rifting began in Jurassic, timing and kinematics of Amerasia Basin opening are controversial. Most agree AACM crust on the Pacific side of Amerasia Basin must restore to Lomonosov Ridge and/or the Canada Arctic margin prior to opening. A re-entrant geometry explains the delayed timing of arc-continent collision with the AACM during closure of the Slide-Mountain–Angayucham–Anyui marginal oceanic basins. We propose that the AACM did not move away from Lomonosov Ridge and Arctic Canada until Aptian, driven by post-collisional southward retreat of paleo-Pacific subduction. Our model thus suggests ~125 Ma onset of Amerasia Basin opening is a coeval kinematic back-arc response to Pacific margin retreat facilitated by crustal heating associated with the High Arctic Large Igneous Province (HALIP).

Age and tectonic setting of northern circum-Pacific magmatic belts and their potential constraints on the opening of the Amerasia Basin of the Arctic

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The evolution of continental margin subduction-related magmatic belts is key to understanding the nature of plate margin tectonics through time as the histories of these belts are sensitive to plate motion changes and re-organizations. A synthesis of northern circum-Pacific magmatism aims to establish the regional timing of magmatic belts, their nature, tectonic setting and, more specifically, how changes in their age and evolution might be spatially and temporally linked to formation of the Amerasia Basin of the Arctic. Our findings suggest that the likely time span for rifting in the Amerasia Basin is coeval with a widespread episode of ~125-90 Ma potassic to calc-alkaline syn-extensional plutonism across Chukotka and central Alaska (whose inception is syn-HALIP). This magmatic belt post-dates development of a ~160-135 Ma Pacific margin fold-thrust/accretionary belt whose elements are now displaced by rifting/extension. The ~80-90 Ma subduction related Okhostsk-Chukotka volcanic belt mostly post-dates rifting/transtension in the NE Russia sector of the Arctic but is coeval with continued extension in the Bering Strait and Alaska, suggesting that opening of the Canada Basin might be linked to younger events, possibly as young as the subsequent southward migration of 90 to 60 Ma magmatism as well as to differences in tectonic setting from shortening (east Alaska) to extension (Bering Strait) in the Late Cretaceous to Tertiary. This timing is the reverse of what has been suggested for the relative ages of the western (younger) versus eastern (older) Amerasia Basin.

The eastern Gakkel Ridge: Crustal asymmetry, ridge segmentation and propagation into the Laptev Sea revealed by geophysical data

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The present day plate boundary between the Eurasia and North America plates, the Gakkel Ridge, runs through the Eurasia Basin in the High Arctic, and is considered the slowest mid-ocean ridge on Earth (c. 6-13 mm/yr). New Russian seismic data and other available geophysical data reveal the asymmetry of the basement and sedimentary structure of the eastern Eurasia Basin. We describe new tectonic structures, previously undetected: few seamounts in the Amundsen Basin, a detailed asymmetric structure of the eastern Gakkel Ridge, and a peculiar deep mid ocean ridge valley, the Gakkel Ridge Deep (GRD), and its volcanic flanks, formed at the slowest spreading segment of the Gakkel Ridge. We find that GRD is anomalously wide and may host much more volcanic-like features than expected for an ultra-sow spreading segment. From GRD, the Gakkel Ridge continues towards the Laptev Sea as a magmatic segment characterized by high seismicity and occurrence of seamounts, among them the Shaykin and Trubyatchinsky seamounts. In the easternmost part of Eurasia Basin, close to the Laptev Sea shelf, the Gakkel Ridge can be seen as a deep, buried mid-ocean ridge valley, and its current activity is reflected by the recent dense faults that disturb the younger sediments and the seafloor. The continuation of the Gakkel Ridge into the Laptev Sea complex rift system may have been offset by transform faults, and we show evidence of Eocene strike-slip motion along the Khatanga-Lomonosov Fault.

On the origin of the marginal plateaus north of Svalbard and Greenland

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The marginal plateaus north of Svalbard and Greenland are conjugate features with respect to the Gakkel Ridge and likely to share a geologic history.

Dredge hauls from three sites on the Yermak Plateau have recovered an abundance of metasediments and gneisses with strong affinities to known lithologies from northwest Spitsbergen. The results support the earlier idea of the plateau being a continental outlier except for its northeasternmost tip. The outlier rifted off the margin north of Svalbard and was emplaced as part of the Greenland plate which implies significant Paleogene dextral shear motion close to the coast of Spitsbergen. Past coast-parallel shear is supported by observed seismic velocity anomalies in the crust characteristic of continental transform boundaries.

A seismic reflection transect across Morris Jesup Rise show an eastern flat-topped spur of undeformed west-dipping layers and a western dome-structure cored by deformed sediments, possibly an imbricate stack of thrust sheets. High amplitude rough seismic reflections interpreted as lava flows are present at depth in the 40 km wide depression between these two structures.

The shared geologic history of the marginal plateaus involve Yermak Plateau rifting off north of Svalbard at Chron 24 and the eastern Morris Jesup Spur rifting off the Yermak Plateau at about Chron 15. The Morris Jesup Spur is likely to represent the pre-Cenozoic continental slope north of Svalbard.

Conjugate dipping reflectors: implication for multiple ridge jumps during incipient spreading and along the Faroe Bank segment of the NE Atlantic continental margins

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We identified two sets of conjugate dipping reflectors (CDR) in an area west of the Faroe Bank, NE Atlantic Ocean, which is characterised by apparent asymmetric spreading in early Eocene, just after breakup. During breakup, a c. 70 km transverse segment of the continental margin evolved south of the study area.

The two sets of CDR correspond to extinct spreading segments and are located in oceanic lithosphere east of magnetic lineament C21 and terminate southwards on the transverse section of the continental boundary. Each set of CDR comprise a central zone characterised by a complex/chaotic reflection pattern with indication of faulting. Reflectors dipping toward the central zone characterise the areas adjoining the central zone.

Based on a steady-state model of oceanic spreading systems we propose that the outer zones of the CDR are emplaced while magma supply to the rift was sufficient to accommodate both continental separation by intrusion of dykes and the additional emplacement of an effusive succession imaged as the dipping reflectors of the CDR. In contrast, the central zones of the two set of CDR are considered the result of spreading while the magma supply was just sufficient to accommodate continental separation, possibly with some of the separation accommodated by faulting.

Based on published rates of spreading between Greenland and Europe while the two sets of CDR were formed, it is estimated that the eastern set of CDR formed in the first c. 1.7 My after breakup. Following a ridge jump the western set formed in c. 4.8 My.

Poster session

Circum-Arctic Lithosphere Evolution (CALE) Project: Crustal Transect C from Lomonosov Ridge and Canada Basin to the Pacific plate in the Aleutian trench – links between paleo-Pacific margin tectonics and opening of Amerasia Basin

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CALE Transect C follows two offshore routes across Amerasia Basin to the Pacific margin, which share a common path south of Lisburne Peninsula, Alaska. Transect C1 (west branch) spans 5100 km from Lomonosov Ridge in the Arctic Ocean to the Aleutian trench in the northern Pacific Ocean. This western route begins at the Eurasian Basin margin of Lomonosov Ridge and extends southward across Makarov Basin, Alpha Ridge, Chukchi Borderland, Chukchi Shelf, Bering Shelf and Aleutian Basin to the Aleutian arc, subduction complex and trench. Transect C2 (east branch) spans 4350 km from the northern margin of Canada Basin to the Aleutian trench. This eastern route begins on the south flank of Alpha Ridge and extends southward across Canada Basin, Western Beaufort margin, and Chukchi Shelf, where it merges with Transect C1 just offshore Lisburne Peninsula. Transects C1 and C2 integrate published marine seismic reflection and refraction data with regional onshore geology, geochronology, well, gravity, and dredge data constraints. Transects C1 and C2 were chosen to traverse many of the most important basins, bathymetric highs, and tectonic features of Amerasia Basin, as well as the main convergent, extensional, and magmatic belts of the western Alaska Pacific margin. The transects suggest that the Pacific subduction margin was ~1800 km closer to the Barents Shelf in Early Cretaceous time, migrating south from ~125 to 45 Ma with opening of Amerasia Basin, crustal extension and magmatism on Bering Shelf, and a southward subduction zone jump from the Bering shelf margin to the Aleutian arc.

Circum-Arctic Lithosphere Evolution (CALE): 5 years of integrated geology and geophysical Arctic research

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Understanding the evolution of the lithosphere over time involves the integration and interpretation of geological and geophysical data, combined with good knowledge of the physical processes at work in the lithosphere giving rise to past and present structures. CALE (Circum Arctic Lithosphere Evolution), an international and multidisciplinary effort, involved more than 30 geologists and geophysicists from 10 different countries investigating the Greenland & Canada, Alaska & Chukotka, the Laptev Sea region, and the Barents/Kara shelf regions. This 5-year program has concluded its research linking circum-Arctic onshore and offshore regions through investigations of sedimentary cover and crust-to-mantle onshore to offshore transects culminating with Special Publication 460 (2018, Geological Society, London). The book includes 17 papers that summarize the latest scientific knowledge and data sets available for the Arctic. The first manuscript in each chapter presents the regional integrated onshore - offshore lithosphere-scale transect. Subsequent papers in each chapter represent contributions that address the science behind the synthesis and interpretation(s) associated with each transect. The fifth and final chapter addresses pan-Arctic theme(s) that are relevant to all the CALE regions. Areas of future research beneficial to resolving the Amerasia Basin conundrum are highlighted throughout the book, which is available at:

http://sp.lyellcollection.org/content/460/1

Seismic and geological evidences of the heterogeneity of the Amerasian basin acoustic basement

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The comprehensive East Arctic dataset containing >750 seismic lines and accompanied with geological, borehole and sampling data, was collected in VSEGEI. As the result of its thorough interpretation and cross-data correlation, the acoustic basement map was created. Acoustic basement of Amerasian basin contains pre-Cambrian, Caledonian and Mesozoic consolidated blocks. The deepest basins of the East Arctic – Hanna Trough, North Chukchi and Podvodnikov Basins form an epi-Caledonian mega-depression, wedged between pre-Cambrian continental blocks (Chukchi Borderland - Mendeleev Rise – Toll Saddle) on the north and Mesozoic deformation front on the south. The initial subsidence of the mega-depression started with dextral transtension in the Hanna Trough in Late Devonian. The significant Late Cretaceous-Cenozoic subsidence of North Chukchi Basin was caused by Late Mesozoic deformation front advancing. The compressional environments were recorded in some places, instead of previously postulated extensional structures. The framework of N-trending reverse and strike-slip faults within Chukchi Borderland is considered to be a northern continuation of Hanna Trough. It evidence of Paleozoic dextral transtension resulting in the formation of the Northwind pull-apart Basin. The significant along-strike variations in the morphology and structure of the Lomonosov Ridge are caused by different tectonic history and heterogeneity of the basement.

Basement morphology and sedimentary packages in the Eastern Eurasia Basin

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We present a review of the basement morphology and main sedimentary packages imaged by recent seismic data in the Eastern Eurasia Basin. From the northern Amundsen Basin seismic lines, we observe that: 1) The basement topography is much more rugged than in the conjugate Nansen Basin, as shown by numerous faulted, c. 10-20 km wide blocks; 2) The first morphological change in interpreted basement topography occurs at C21 (47.33-45.68 Ma), where a prominent trough and ridge system is observed on all profiles, and the crust younger than C21 becomes shallower; and 3) The transition between the continental Lomonosov Ridge and oceanic Amundsen Basin is usually across gentle slopes. Following the correlation between sedimentary packages, age of oceanic lithosphere determined from the magnetic data, and dated sedimentary succession from the ACEX drill sites, the age of the four main sedimentary packages identified in the new seismic dataset may be: (1) Early to Mid Eocene (c. 56 to 45.7 Ma), (2) Mid Eocene to Early Oligocene (45.7 to 33.2 Ma), (3) Early Oligocene to Early Miocene (close to Aquitanian) (33.2 to 19.7), and (4) Early Miocene (close to Burdigalian) to Present (19.7 to 0 Ma). Based on all available geophysical and geological data we construct first order Eocene and Miocene paleobathymetric maps of the eastern Eurasian Basin.

Khatanga-Lomonosov Transform Fault: Arguments for and against

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In the present-day plate tectonic setting, the Laptev Sea represents a rare case of a direct intersection of an oceanic spreading ridge (the Gakkel Ridge; GR) with a continental margin that can be described as a *T-junction*. Understanding how this junction formed and evolved represents a fundamental task that allows us to address processes governing the breakup of continents.

Grachev (1970 & 1982) was the first who suggested that GR penetrates into the Laptev Shelf resulting in a series of rifts developed on the shelf (Laptev rift system; LRS) and south of it. Fujita et al. (1990) inferred a Severnyi Transfer fault as an accommodation zone between the Eurasian spreading basin (ESB) and LRS. The Severnyi Transfer closely resembles the Khatanga Lineament proposed by Galabala (1983).

The idea of a transform fault boundary between ESB and LRS was further developed by Drachev et al. (1998, 2003, 2018), Drachev (2011) who called it a Khatanga-Lomonosov fracture zone (KhLFZ). KhLFZ is needed to accommodate a presumably greater plate divergence rate in ESB as compared to LRS, where continental lithosphere has not undergone complete rupture. The KhLFZ acted as a major shear zone that prevented direct penetration of the GR into the continent ('stalled rift' of Van Wijk & Blackman 2005) and accommodated eastward displacement of the Lomonosov Ridge with regard to the adjacent shelf. Recent long-offset seismic refraction data have, for the first time, provided reliable evidence in support of the KhLFZ. In this presentation, we consider such evidence and test opposing concepts.

Preliminary reconstructions for the western Arctic and North Atlantic since the Devonian

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In conventional plate tectonic reconstructions, major plates are assumed to be rigid and are delineated through time by subduction zones, mid-ocean ridges and transform faults. However, rifting lithosphere experiences significant deformation that is usually not accounted for. The North Atlantic region has experienced an usually protracted rifting history, commencing after post-Devonian Caledonide collapse. While several pre-breakup reconstructions have been proposed for the western and eastern North Atlantic branches, they are often limited to a paleogeographic, structural and stratigraphic framework. Those with published finite rotations are largely limited to the last 200 Myrs and/or do not capture the documented rifting episodes at sufficient resolution. Furthermore, they predict variable kinematics; compression, tectonic quiescence and extension, that must be accounted for. Placing basin-scale observations and models (here including conjugate seismic profiles and stratigraphic data) into a testable, regional framework is now possible. Initial work has focused on the implementation of five phases of extension for the Møre, Vøring and Barents conjugate margins; Late Devonian to Carboniferous, Early Permian- Early Triassic, Jurassic to Early Cretaceous, Aptian to Albian, and Late Cretaceous to Paleocene. We present a preliminary update for a digital reconstruction for the North Atlantic domain that include time-dependent basin geometries and kinematics, and also includes the Eurekan orogeny and Arctic margins farther afield.

New details on Cretaceous ocean formation in the High Arctic based on satellite gravity data

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Understanding the evolution of ocean basins, critical for global studies in plate tectonics, mantle dynamics and sea-level through time, relies on identifiable tectonic plate boundaries. Based on the latest generation of global satellite gravity models, recent marine geophysical data and vintage aeromagnetic data, we document consistent tectonic details on the remote and ill-defined Canada Basin spreading system; the oldest ocean system in the High Arctic and part of the long-disputed greater Amerasia Basin. We infer two phases of possibly Cretaceous sea-floor spreading. The early stage being sub-orthogonal spreading, while the late stage being highly oblique and segmented. We further demonstrate that the southern part of the Canada Basin spreading system may serve as an ancient analogue of modern mid-ocean ridge propagation into continental crust.

The value of DTU15/DTU17 high resolution marine gravity field for Arctic geological interpretation

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Global altimetric marine gravity field modelling has gone through a revolution during recent years due to the availability of new high resolution and new generation satellites in geodetic orbits. These are Cryosat-2 (369 days repeat mission) as well as Jason-1 end-of-life mission which are the first new “geodetic mission” data sets released in nearly 2 decades since the ERS-1 and Geosat geodetic missions were conducted in the early 90’th and late 80’th. However the story does not end there as the French-Indian SARAL/AltiKA was put also put into a geodetic mission orbit for global gravity field modelling in 2016 and recently Jason-2 has been moved to a geodetic mission with the goal to increase the track spacing from 8 km today to 4 km in 3 years.

All this revolutionary great new data have further lead to huge improvements in the accuracy of recent global marine gravity fields like the fields from Sandwell and Smith (v23.1 and 24.1) and the DTU15 and DTU17 global altimetric fields where global and regional comparisons frequently converge around the 2 mGal level resolving signals down to 8 km spatial wavelength. Another revolution in altimetric mapping is the fact that Cryosat-2 for the first time provides data all the way up to 88N only 200 km from the North Pole enabling modelling of the tectonic fabrics and gravity in the Arctic Ocean.

High resolution marine gravity fields are important in support for geological interpretation in the Arctic. In the Canadian Basin we present the use of the DTU17 gravity field by applying for 3D gravity inversion and data enhancement.