ICAM8 Abstracts -Posters

Arctic Evolution and Plate tectonic models

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.

Circum-Arctic onshore/offshore geological sampling

A sedimentary provenance study of modern river sands from northern Fennoscandia and its insight into the source of Mesozoic successions deposited on the southwest Barents Shelf.

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A series of sedimentary provenance techniques were applied to 20 modern sand samples collected from twelve major river catchments in northern Fennoscandia. This was carried out in order to evaluate the extent that Mesozoic successions deposited on the southwest Barents Shelf were sourced from northern Fennoscandia.

One of the most distinctive provenance signatures in northern Fennoscandia comes from samples collected along the Tana River, which traverses the Lapland Granulite Belt (LGB). Downstream of exposures of the LGB, modern sands are dominated by rutile with c. 1.9 Ga U-Pb ages and a chemistry which indicate crystallization at c. 850 °C from a pelitic protolith. A rutile signature similar to the Tana River detritus is replicated in the Late Triassic – Early Jurassic Realgrunnen Subgroup deposited in the vicinity of the Nordkapp Basin, and indicates a common origin from the LGB. A strikingly different pattern comes from the Realgrunnen Subgroup deposited in the Hammerfest Basin where rutiles are mostly c. 430-515 Ma and crystallised at c. 650 °C from a pelitic protolith. The similarity of this pattern to rutile data collected from the Målselva River modern sands indicate a source from Caledonian allochthons affected by Palaeozoic amphibolite-facies metamorphism.

Models depicting rejuvenation of a Fennoscandian sedimentary source region and Late Triassic drainage reorganisation are supported by these data. The rutile technique provides one of the clearest mechanisms for tracing the dispersal of Fennoscandian-derived sediment across the Barents Shelf.

Age and provenance of the Mesoproterozoic-Lower Neoproterozoic strata of the Chetlass Stone (Timan Range): Constraints from U-Pb detrital zircon study

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Mesoproterozoic-Lower Neoproterozoic strata of the Chetlass Stone (Timan Range) are subdivided based on their lithology into siliciclastic and carbonate units. Three units were analyzed using LA-ICP MS. The detrital zircon age spectra of the Mesoproterozoic Novobobrovsk Formation and the Neoproterozoic (?) Paun Formation are similar, suggesting a common provenance. About 40% of all grains of the Paun and Nobobrovsk Formation have an age of 1.9 to 1.6 Ga, up to 30% of grains fall in the age interval 1.6-1.4 Ga. Most of dated zircon grains are much older than proposed age of host units and their most likely provenance is basement of the Baltica paleocontinent.

In the sample from the Upper Mesoproterozoic Svetlinskaya Formation detrital zircons of Late Mesoproterozoic age predominate with the main populations at ca. 1.0-1.5 Ga (40% of all grains) pointing on the erosion of Sveconorwegian Orogen. Lorenz et al. (2012) suggested that the orogen extended along the present northern margin of Baltica, and the abundance of Late Mesoproterozoic grains in the sample from Svetlinskay Fm. is consistent with this model.

This research was supported by RFBR grant 17-05-00858 & RCN project NOR-R-AM (no. 261729).

This will be a poster presentation in the "Circum-Arctic onshore/offshore geological sampling" session.

Bedrock sampling data for the continent-ocean constraints in the Circumpolar Arctic

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Geological sampling of seabed outcrops collected during recent Arctic cruises are used to test geological models of the last decade. Combined with seismic and bathymetric data, the data is used to start developing a new tectonic concept instead of popular tectonic hypotheses created in data deficit.

A main achievement in the Central Arctic was the videography of a large number of bedrock outcrops in the seafloor scarps of the Alpha-Mendeleev Rises made by Russian research submarine in 2012, 2014, 2016. These data show most samples obtained by dredge, grab or other traditional methods from such scarps reflect the local geology, but not IRD as previously thought.

Seabed rock samples show: (1) discontinuous volcanic cover of Cretaceous basalts (HALIP) in the Amerasia Basin was formed in shallow marine or subaerial setting and then submerged to 3.5 km; (2) Paleozoic and Lower Mesozoic carbonate and terrigenous rocks underlay the volcanic cover are shallow marine shelf facies typical for platform cover; (3) Carboniferous-Cretaceous uplift of the central Amerasia Basin providing detritus to peripheral sedimentary basins; (4) isotopic data reveal the Laurentian marks of the Central Amerasia Basin cratonic block; (5) the Precambrian block is surrounded by Timanide, and Caledonide-Ellesmerian orogenic belts, tectonically reworked in the Early Cretaceous.

The next step is deep-sea drilling of Lomonosov Ridge and Mendeleev Rise basement, which may be performed by ECORD and the Russian geological survey.

A circum-Arctic zircon uranium-lead age database

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Understanding how and when the Amerasia Basin opened has significant implications for the geological histories and petroleum systems of sedimentary basins within the circum-Arctic region. Uranium-lead detrital zircon geochronology, employed alone or in conjunction with Lu–Hf isotopes, is a widely employed tool for reconstructing sedimentary provenance. It can provide insights into the opening of the Amerasia Basin by constraining the pre-rift configuration of Arctic tectonic terranes and sediment transportation pathways.

Despite being comparatively remote, a large volume of published U–Pb age data exists from the onshore margins and offshore continental shelves of the Arctic Ocean. Rigorous comparison of these data is, however, seldom straightforward and often requires recalculation of data against a common set of parameters and criteria; for example, using the same U–Pb age system and employing thresholds on analytical precision and U–Pb age discordance.

To address some of these problems, a standardised dataset of published zircon U–Pb ages and Lu–Hf isotope data from the circum-Arctic region is being developed as a geographical information system (GIS) database using ArcGIS®. Custom database tools have been developed within ArcGIS® using Microsoft Visual Studio®. These facilitate the searching of the database and visualisation of U–Pb age and Lu–Hf isotope data within the GIS environment. Furthermore, similarity measures, using multidimensional scaling, are being developed to enable data to be compared with statistical rigour.

Zircon provenance in Mesoproterozoic-Cambrian sandstones of the northeastern Russia: Implications for the evolution of the Timanian orogeny

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Timan Orogen is considered to be the main source of clastics in Late Neoproterozoic - Cambrian across the Russian part of the Arctic (Severnaya Zemlya, Novaya Zemlya and New Siberian Islands Archipelagoes) and in the northern part of the Russian Platform (Lorenz et al, 2008, 2013; Ershova et al, 2015, 2016 Ivleva et al, 2016). U-Pb dating of detrital zircons from the Late Mesoproterozoic-Cambrian (Riphean-Cambrian) deposits of northwestern Russian platform (Baltic and Ladoga Monocline) and Mezen syncline allow us to restore prevailing provenance areas. The Paleo- and Early Mesoproterozoic ages of detrital zircons predominant in studied samples indicate that basement of the East European platform could be considered as one of the main provenance area during deposition of Meso-Early Neoproterozoic strata. Latest Neoproterozoic marked by significant shift in provenance area with prevailing zircons with ages close to age of sedimentation and Late-Middle Mesoproterozoic grains. This indicates that Timanian orogen became the main source of clastics across northern part of East European platform by the end of Neoproterozoic and possibly sourced the nowadays separated Arctic terranes. This research was supported by RFBR grants 18-35-00407.

Dredged samples provide new insights on the geological evolution of the Alpha Ridge, Arctic Ocean

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In August 2016, a collaborative Canada-Sweden Polar Expedition under Canada's Extended Continental Shelf (ECS-UNCLOS) Program dredged approximately 100 kg of volcanic rocks from two localities on the Alpha Ridge. Samples dredged from the Fedotov Seamount (on the crest of the Alpha Ridge) include volcanic breccia, fossiliferous carbonate rocks and a single fragment of fossilized plant material. The samples recovered from Nautilus Spur consist mainly of volcaniclastic rocks.

Here, we present new laboratory results on the dredged samples in light of current knowledge of the Fedotov Seamount and surrounding area acquired from bathymetric and seismic surveys. On a local scale, multibeam bathymetric data enable the identification of volcanic features such as constructional edifices, summit calderas, terraces and individual lava flows. A rigorous classification of these morphological features may provide additional constraints on the eruptive style of lapilli tuffs recovered from the edge of Fedotov Seamount. On a regional scale, seismic reflection data constrain the lithological character and lateral continuity of igneous layers, providing new insights on the volcanic style and scale of magmatism in this part of the Alpha Ridge.

Analytical Results of Canada's 2016 Dredge Sampling of Lomonosov Ridge

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In 2016, the Geological Survey of Canada recovered over 700 kg of rock samples from a steep slope on the flank of Lomonosov Ridge near the North Pole in the Arctic Ocean. Dredging operations were conducted aboard the Swedish Icebreaker Oden. The recovered samples were predominantly sedimentary facies with mixed litholgies of sandstones, siltstones and mudstones. The samples have fresh angular surfaces and are remarkably well preserved. The siltstones typically have well defined thin laminations. The fine-grained sandstones commonly have significant cross-bedding structures indicating a high-energy fluvial depositional environment. Many of the samples exhibit minor compactional deformation, and in some cases, brecciation. Metamorphic biotite and brittle high-angle cleavage are observed in most samples. There is no evidence of micro-fossils.

We present an overview of the different sedimentary facies and analytical results conducted on a sub-set of the collected samples, including photography of polished slabs, thin section petrographic descriptions, XRD bulk mineralogy, SEM imaging, grain size analysis, bulk density, magnetic susceptibility, zircon dating, and apatite fission track thermochronology. A new multibeam bathymetric map and seismic reflection data provide an overview of the geological setting for this portion of Lomonosov Ridge. Additionally, we compare laboratory P-wave and S-wave velocity measurements with velocities modeled from sonobuoy data.

Arctic foreland fold & thrust belts & foreland basins

Preliminary tectonic map of the central and southwestern Pearya Terrane, Ellesmere Island, Canada

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The Pearya Terrane is a 350 km long and 100 km wide geotectonic unit situated at the north coast of Ellesmere Island. It consists of five Mesoproterozoic to Paleozoic structural units with a different geological history than the Neoproterozoic and Paleozoic Franklinian Basin to the south, that represents the northern margin of Laurentia. The final collision of the Pearya Terrane and Laurentia took place during the Ellesmerian Orogeny, prior to the Early Carboniferous. The Pearya Terrane is penetrated by a large number of ductile and brittle fault zones resulting in a complex mosaic of different tectonic blocks, indicating that Pearya was already a composite terrane before collision with Laurentia. Most of the pre-Ellesmerian fault zones were re-activated during the Ellesmerian Orogeny as SE-and SW-directed steep, often ductile, reverse faults. Present day, the Pearya Terrane is dominated by a complex system of up to 500 m wide, brittle strike-slip faults zones predominantly parallel to the continental margin. Those faults have affected Carboniferous through Triassic cover rocks of the post-Ellesmerian Sverdrup Basin, Cretaceous dikes, plutons and volcanic rocks and Paleocene sediments on Wootton Peninsula, indicating that the Paleogene Eurekan deformation controlled the present day structure of the Pearya Terrane. It should be noted that the Eurekan tectonic episodes were characterized by opposing sinistral and dextral motions parallel to the continental margin before the final break-up of Laurasia and the separation of Greenland and Svalbard after the Eocene/Oligocene.

Evolution of the southern Chukotka margin based on sedimentary record of the Late Jurassic – Early Cretaceous basins

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The accumulation of the Upper Jurassic-Lower Cretaceous deposits on the southwestern edge of Chukotka microplate occurred under the influence of processes related to its convergence with an active margin of Siberia. The South Anyui Ocean and the Kulpolney Island Arc located between the two margins. E.L. Miller based on a comparison of the first results of U-Pb dating of detrital zircon from the J3-K1 deposits (6 samples) came to the conclusion about existence in the study area an extensive foreland basin at Late Jurassic – Early Cretaceous (Miller at al. 2008). After more detailed research we suppose two stages of sedimentation: Oxfordian-Kimmeridgian and Tithonian-Valanginian.

The Oxfordian-Kimmeridgian arcosic sandstones accumulated on the southwestern edge of the Chukchi microplate due to erosion of the Precambrian granitoids and the Triassic clastic rocks located mainly in the north in modern coordinates. At the Tithonian time, sediment transport direction were changed to northerly because of the accretion of the Kulpolney Island Arc to the southwestern edge of Chukotka. As a result of the oceanic crust subduction under the Chukchi microplate, a continental arc was formed. The suprasubduction volcanic complexes contaminated with crustal material became the main source for the Tithonian greywackes. The Lower Cretaceous deposits continued to accumulate due to erosion of the Jurassic volcanic complexes and recycling of the Triassic and the Oxfordian-Kimmeridgian clastic rocks.

Zircon provenance studies along the Alatna River in the Brooks Range, Alaska.

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The provenance and tectonic affinity of the metasedimentary and metaigneous rocks making up the Brooks Range, Alaska, will help reveal the nature of the opening of the Amerasian basin in the Arctic Ocean. One hypothesis suggests that Alaska was juxtaposed with Canada and Greenland and later separated in a rotational fashion to form the Amerasian basin. If the rotational hypothesis holds true, rocks derived from these terranes should compose the Brooks Range. By analysing zircon from the Brooks Range metasedimentary and metaigneous rocks, U–Pb dates and trace elements are used to identify the provenance.

The Brooks Range is a fold-and-thrust belt striking parallel to the Alaska Arctic margin and is cut by rivers perpendicular to the orogenic strike. The Alatna River flows through the Central- and Schist Belts and ends up in the Yukon-Koyukuk Basin. It offers excellent exposure along the riverbanks. Rock samples for U–Pb and trace element analyses were collected with the aim to determine the source rock and maximum depositional age of these sedimentary rocks. Comparing the detrital zircon U–Pb age data to known geological units from the Circum Arctic, it appears that the units with maximum depositional ages of >900 Ma derive from Baltica and Siberia. The younger rocks, with ~300 Ma max depositional ages, are not possible to pair up with a specific source as several known terranes in the Circum Arctic derive from this time span. Zircon trace element data can possibly distinguish the different terranes.

Lower Mesozoic paleogeography of circum-Arctic basins

Provenance of the Upper Triassic on the Barents Shelf; a multi-technique approach

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A correct interpretation of provenance of the Late Triassic Snadd and De Geerdalen formations on the Barents Shelf plays a key role in paleogeographical reconstructions of northern Pangea. The provenance of Arctic Late Triassic sediments has been tied to the Uralide orogenic belt, the Siberian Traps and to the hypothetical Crockerland landmass. Here, we combine several techniques in order to investigate the provenance of Late Triassic deposits in an N–S transect from Svalbard to the Nordkapp basin; including detrital zircon U–Pb and Lu–Hf analysis, petrographic analysis, and chemical analysis of lithic fragments and the heavy minerals chromium spinel and rutile. This multi-technique approach, working with minerals and lithic fragments, will provide provenance-sensitive information on rocks in addition to felsic source rocks favored in detrital zircon studies. Preliminary petrographic observations have identified lithic fragments of volcanic, metasedimentary and sedimentary origin with plagioclase dominating over K-feldspar. Detrital zircon age spectra resemble published spectra of the larger Arctic region with three recognizable age peaks: a Permian to Carboniferous age peak compatible with an inferred Uralide provenance, a significant Silurian age component possibly tied to a Caledonian source, and a Triassic peak of unknown origin. The results increase our understanding of the complex provenance of the Late Triassic deposits on the Barents Shelf, which includes mafic, ultramafic, (meta)sedimentary, as well as felsic source rocks.

Major drainage reorganization at the Triassic – Jurassic transition and the implications for reservoir development on the Western Barents Shelf

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At the Triassic – Jurassic transition on the Barents Shelf, thick, mud-dominated intervals containing sands with variable reservoir properties gave way to thin sand-dominated intervals with favourable reservoir qualities. Consensus has yet to be reached regarding the mechanisms causing these sedimentological and mineralogical changes. Climatic and tectonic forcing, leading to depositional environment and provenance shifts have been suggested, but resultant models are conflicting. A multi-proxy sedimentary provenance study has aimed to refine and improve these models.

The analyses reveal that a distinct and rapid provenance change followed an early Norian maximum flooding surface. This is seen by an increase in grain size, compositional maturity and proportion of stable heavy minerals.

These data are interpreted to reflect an episode of major drainage reorganisation prompted by tectonism on Novaya Zemlya. Uplift of the Finnmark Platform and Central Barents Arch choked incoming sediment from the Uralian Orogen whilst hinterland rejuvenation resulted in extensive recycling of pre-Norian units and an influx of material originating from crystalline basement.

Following the transition, detrital zircon age spectra are dominated by Proterozoic ages that are difficult to interpret. However, through complementary heavy mineral analysis and chemical/age data from rutile and K feldspar in particular, west and east Caledonian sand types have been delineated. These can be used to help predict the location and quality of reservoir intervals within the Realgrunnen Subgroup.

The outcropping strata in the Kong Karls Land archipelago, Arctic Norway; a key reference point for the Upper Triassic to Lower Cretaceous succession in the northern Barents Sea

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Kong Karls Land in the eastern Svalbard archipelago, northern Barents Sea, displays a 300 m thick Upper Triassic to Lower Cretaceous succession. The unique exposures provide essential data for evaluation of the Mesozoic basin fill on the nearby platforms and in the more remote Arctic areas of the Barents Sea. The Norian to Aptian succession in Kong Karls Land, coupled with immediately nearby offshore regional 2D seismic lines, reveals eight key sequence stratigraphic surfaces. Six of them define the lower boundary of larger tectonic mega sequences (TMS) linked to larger scale plate tectonic reorganisations in the Barents Sea or nearby landmasses. The TMS reflect; i) denudation of Fennoscandia and Uralian mountain chain and probably landmass in north east; ii) the evolving Novaya Zemlya Fold and Thrust Belt, iii) uplift and shear movements of the Barents Platform; iv) incipient North Atlantic and Amerasian rifting in the west and north; v) upper Jurassic folding; vi) Lower Cretaceous rejuvenation of folding, and finally vii) magmatism. While the Triassic and Lower Jurassic succession is fairly complete in Kong Karls Land, the Middle Jurassic to Lower Cretaceous strata are only remnants reflecting a major shift in tectonism.