

# **Alpha-Mendeleev Rise is a Eurasian aborted volcanic passive continental margin**

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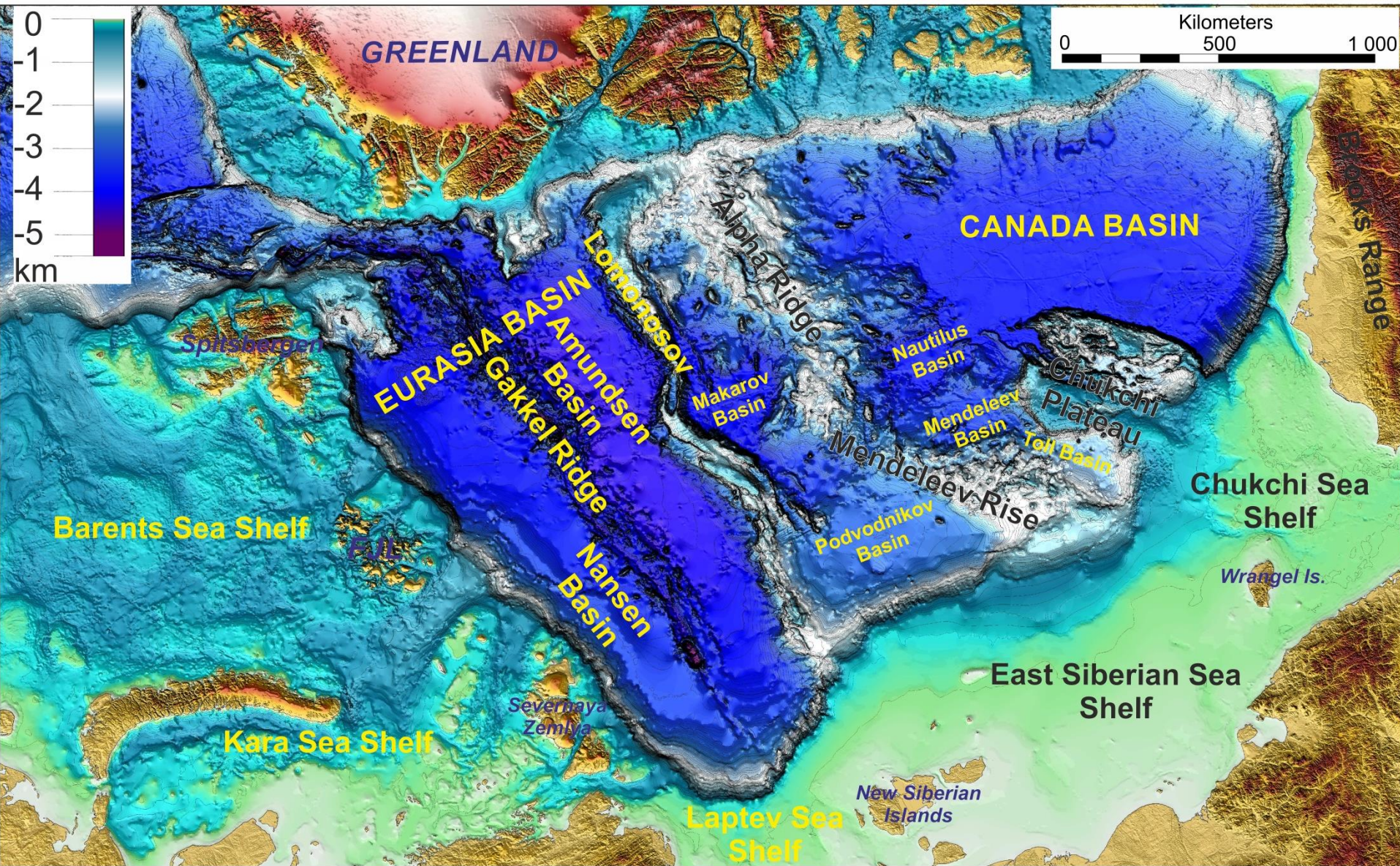
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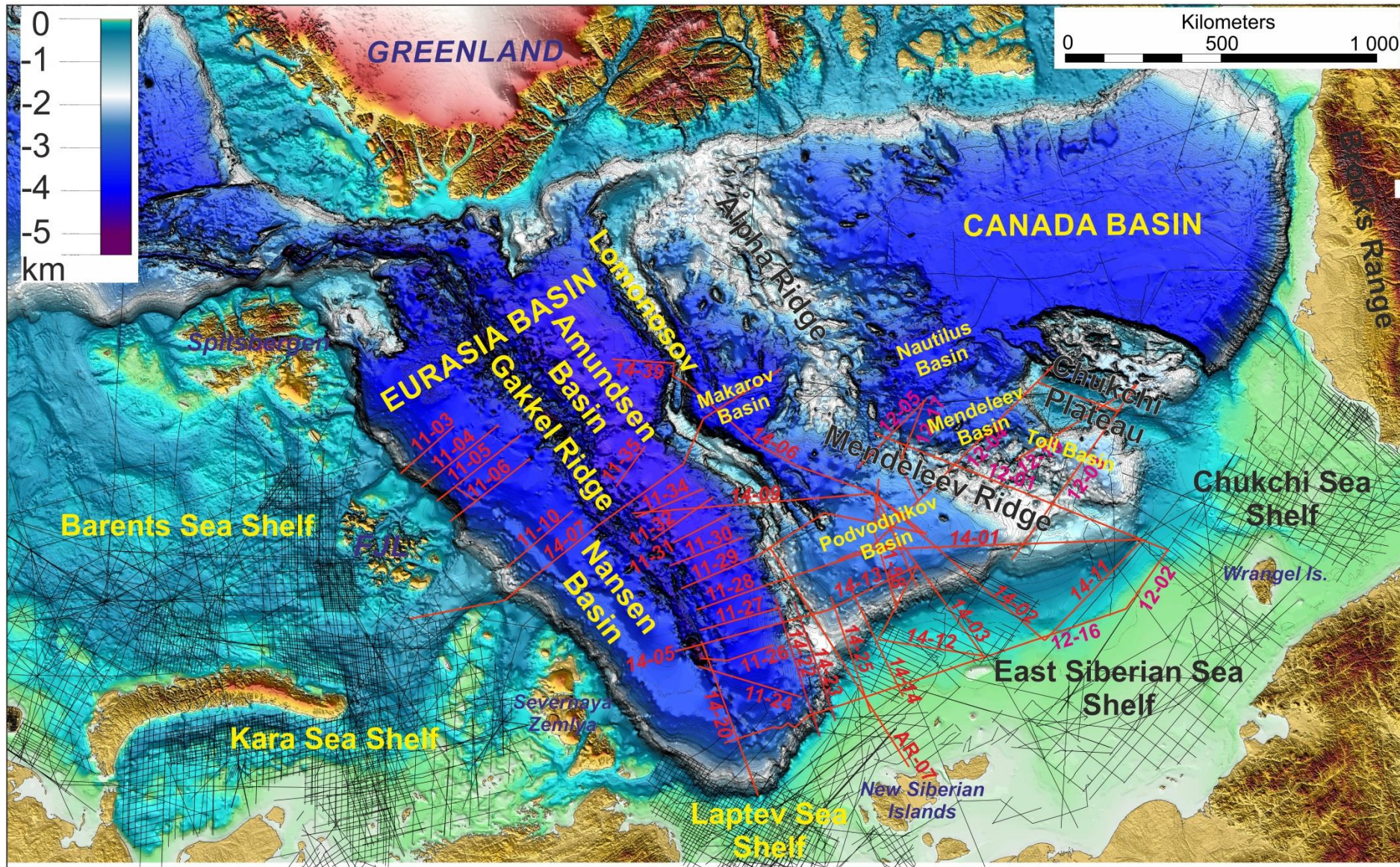


# Geographic map of the Arctic Ocean



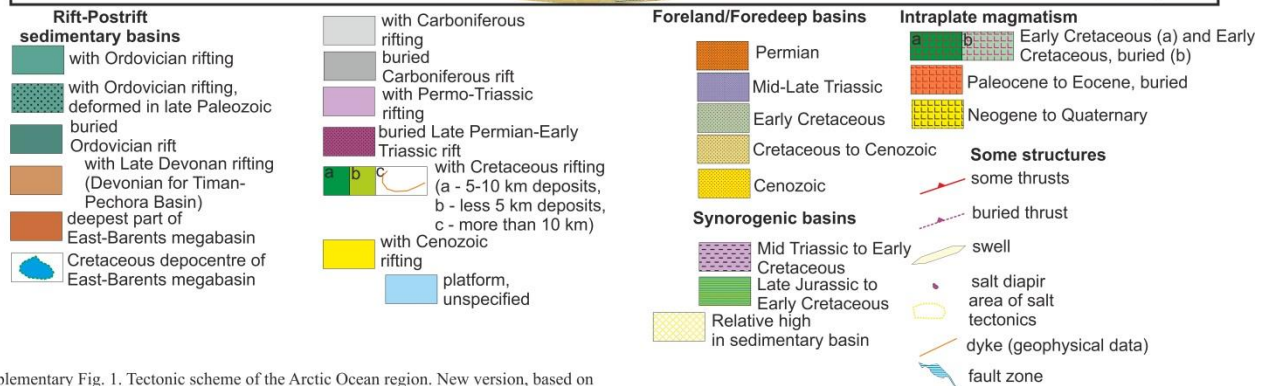
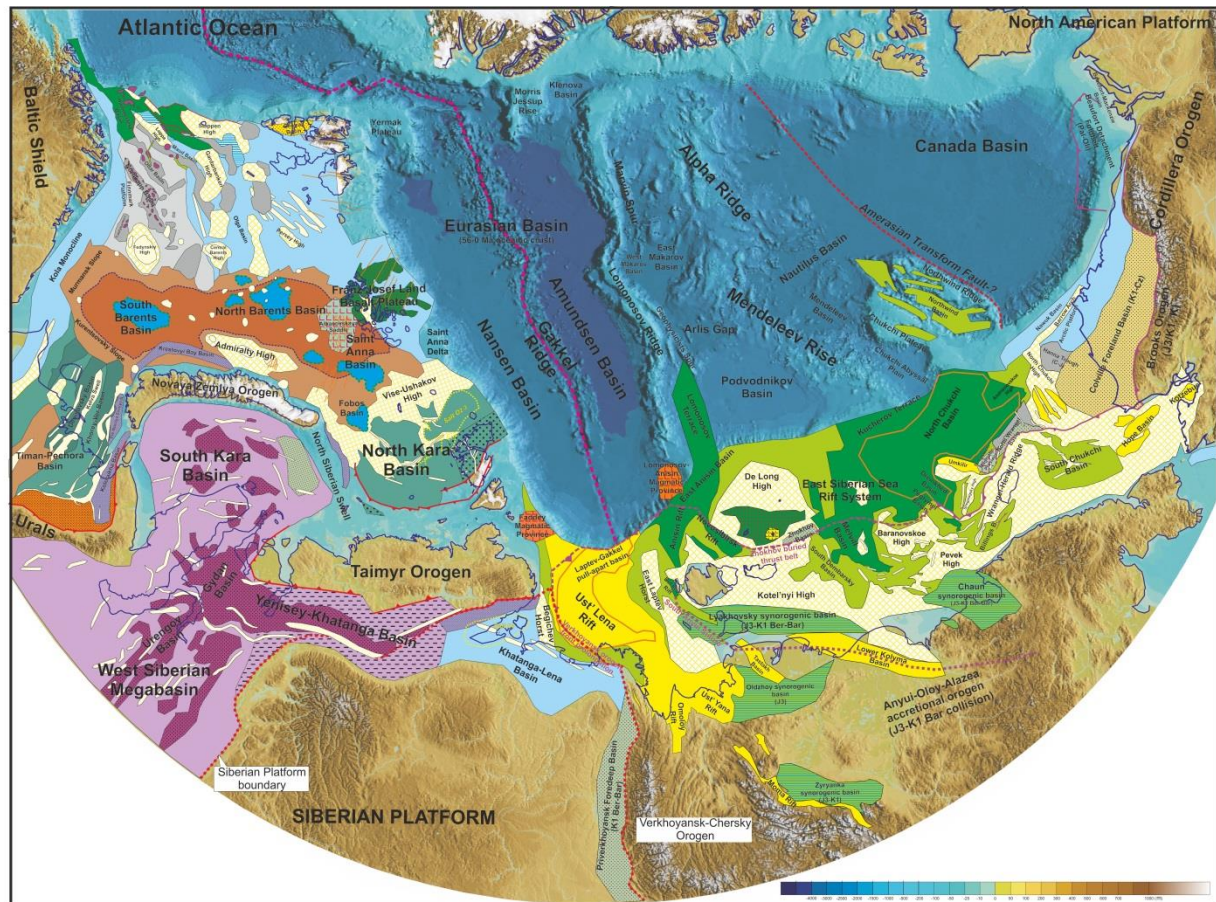


## Location of seismic profiles we used in our report





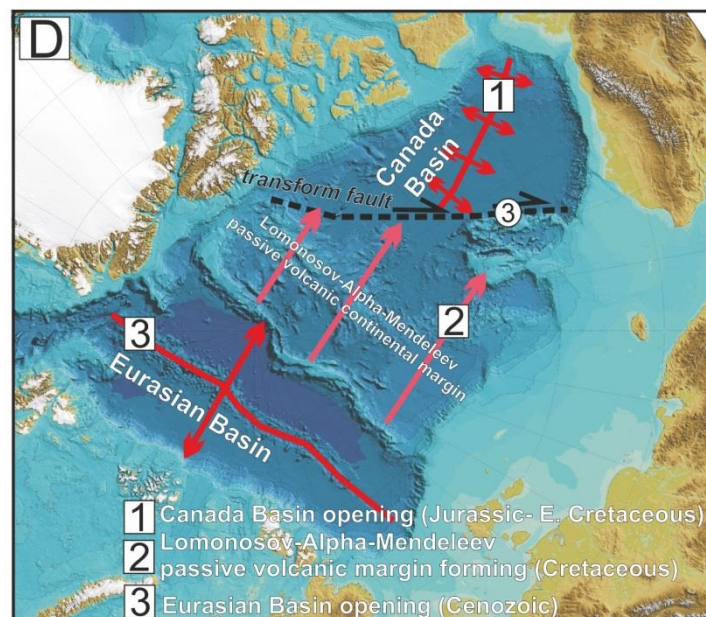
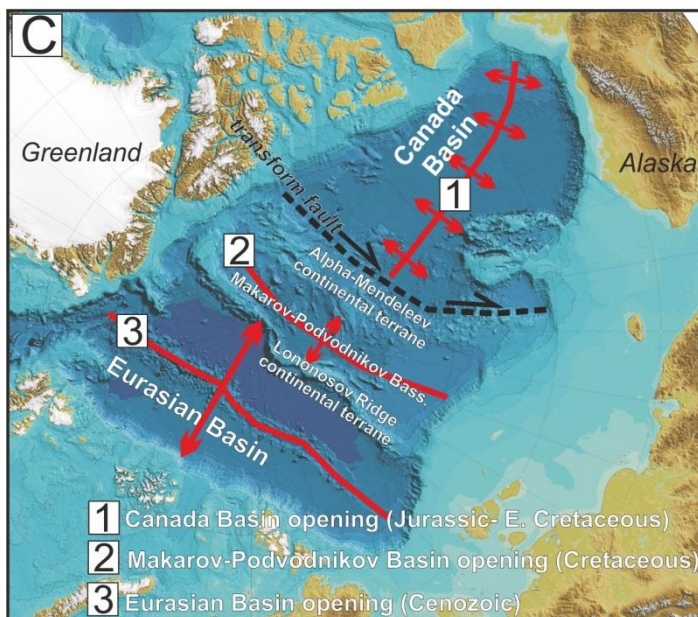
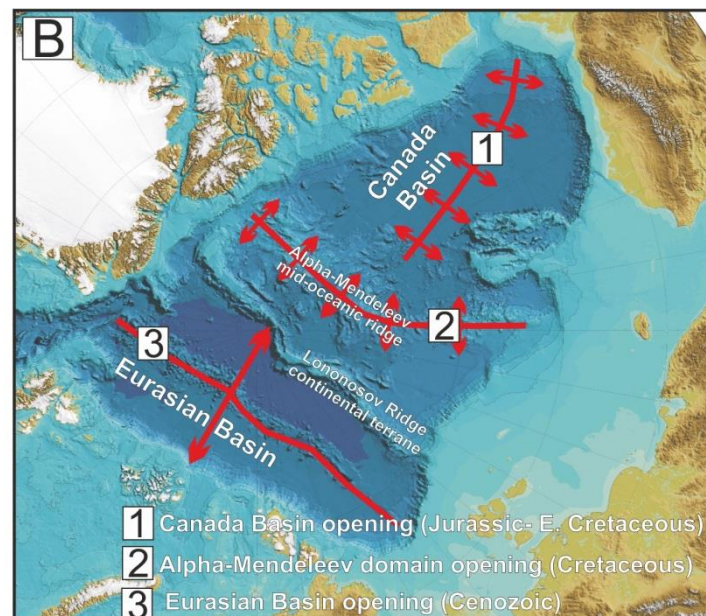
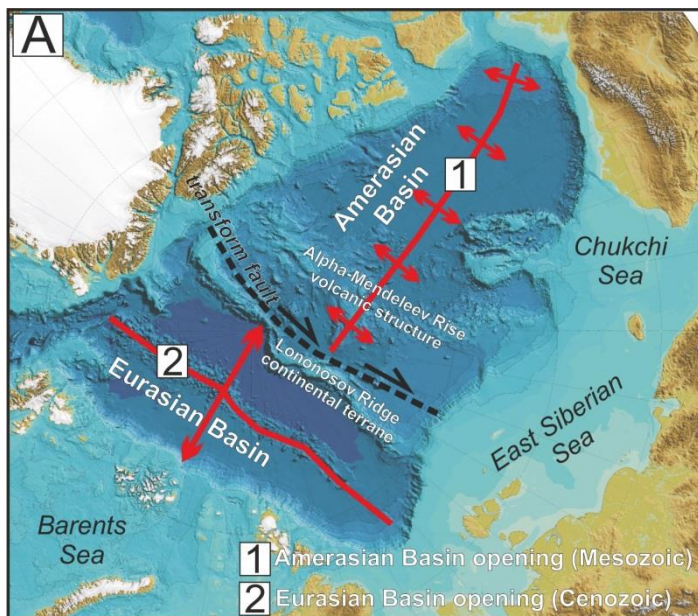
# Tectonic scheme of the Arctic region



Supplementary Fig. 1. Tectonic scheme of the Arctic Ocean region. New version, based on Nikishin et al. (2014, 2017), and new data. Background map is the topography and bathymetry of the Arctic region (Jakobsson et al., 2012)

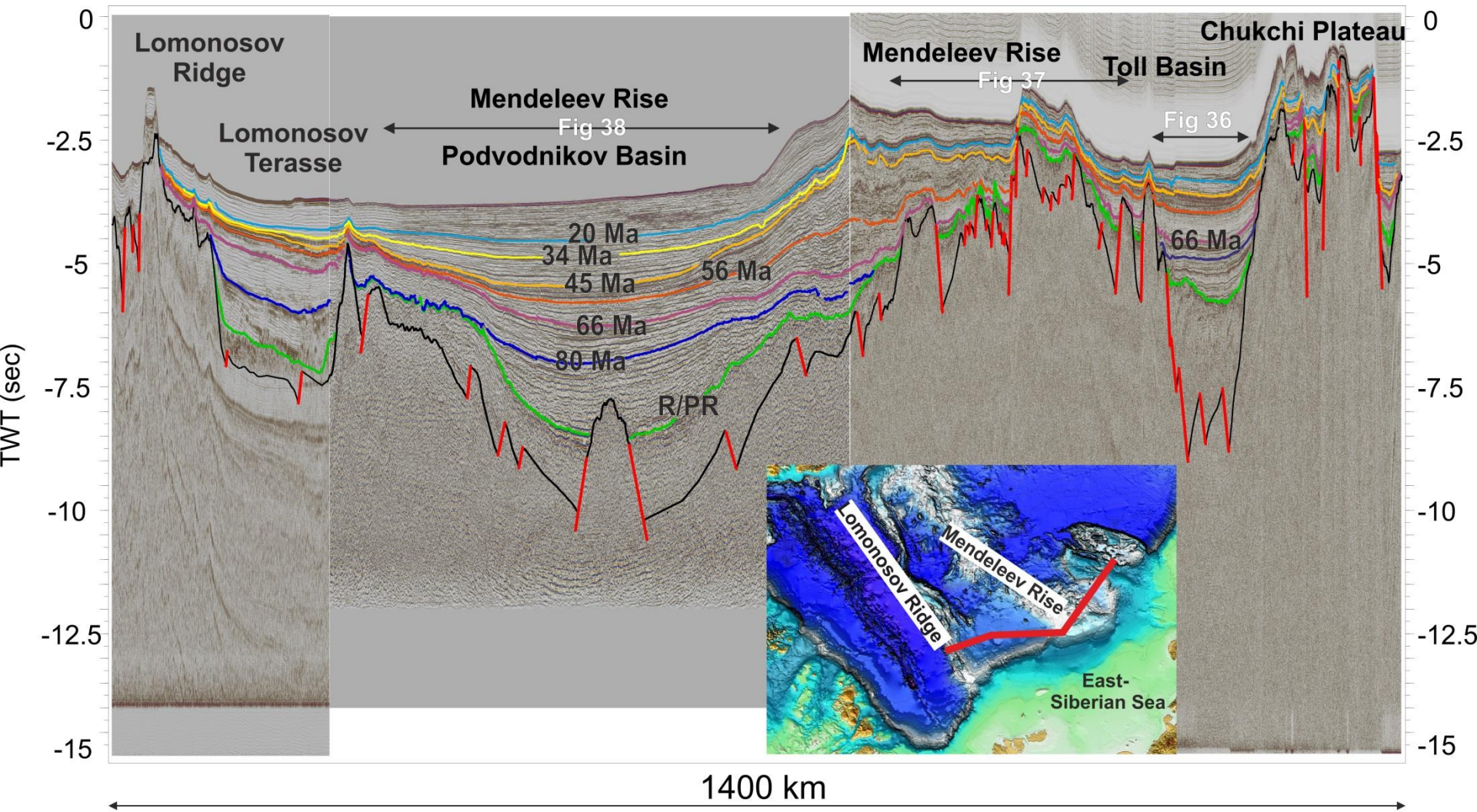


# Different current models of the Arctic Ocean opening





## Interpretation of seismic data



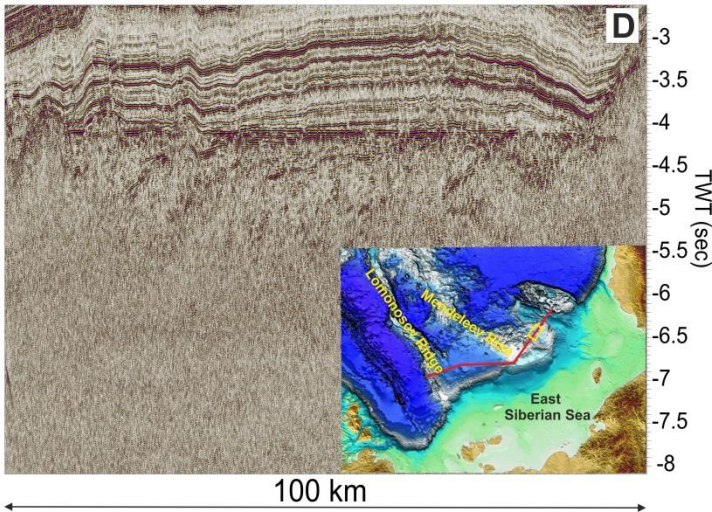
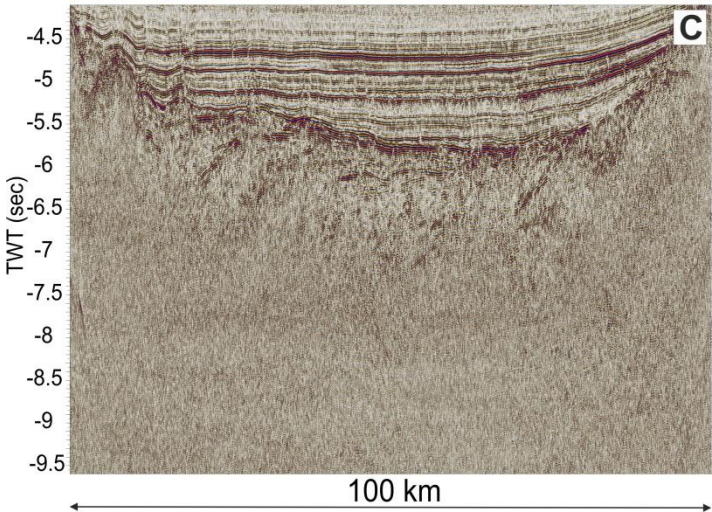
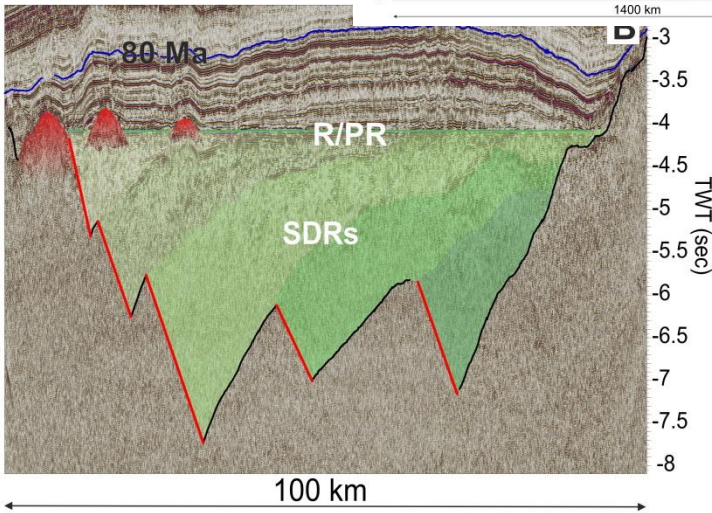
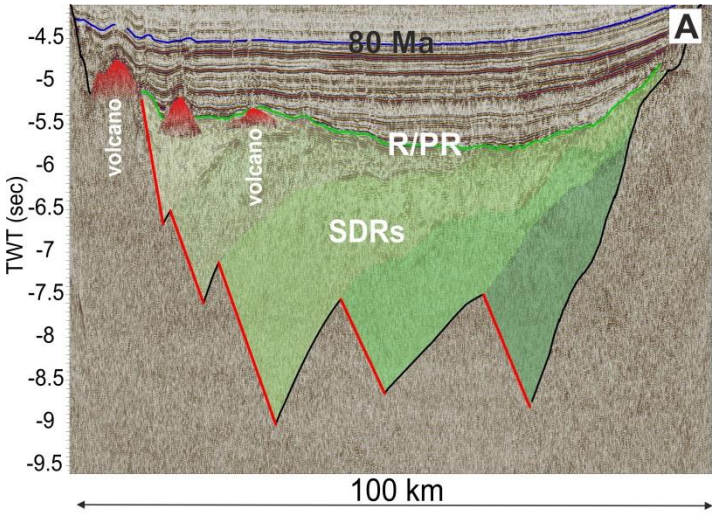
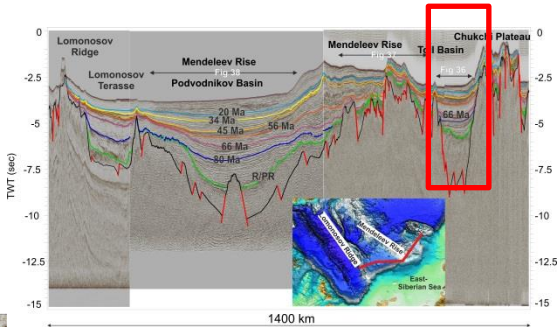
Interpretation of composite seismic profile for the region from Lomonosov Ridge to Chukchi Plateau. Different color lines are seismic horizons and corresponding ages (Ma), R/PR – rift/postrift boundary.



A. Interpretation of a fragment of seismic profile for the region from Toll Basin. SDR complexes and volcanoes on a top of SDRs are interpretation.

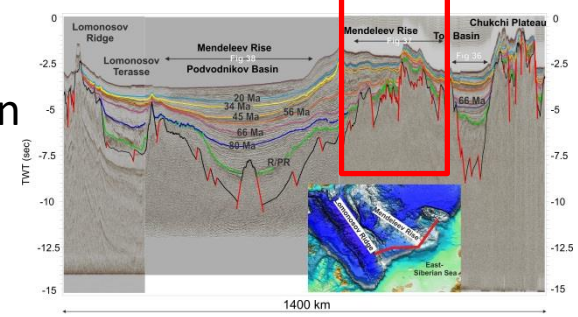
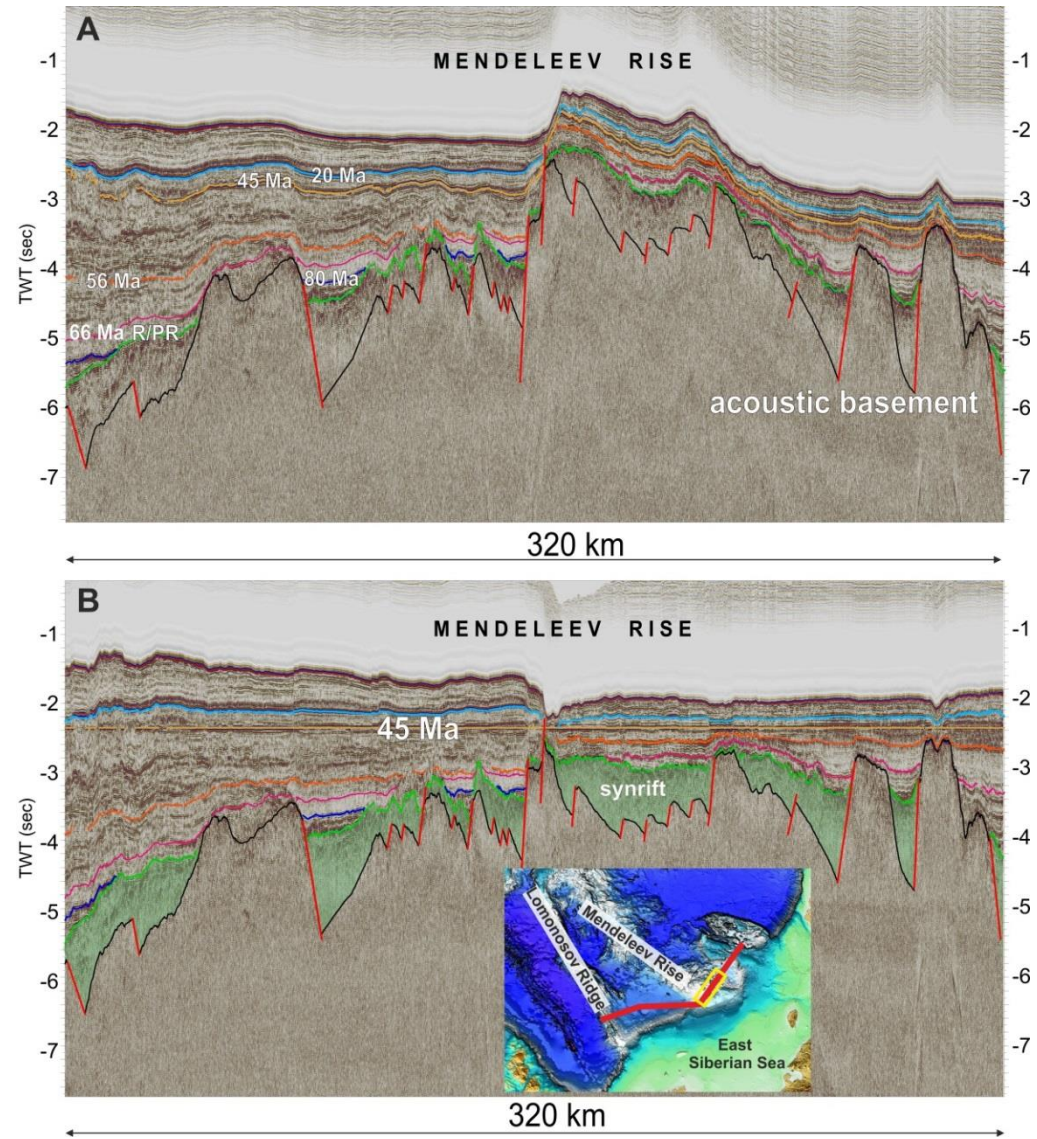
B. Flattening on the rift/postrift boundary.

C and D – profiles without interpretation.



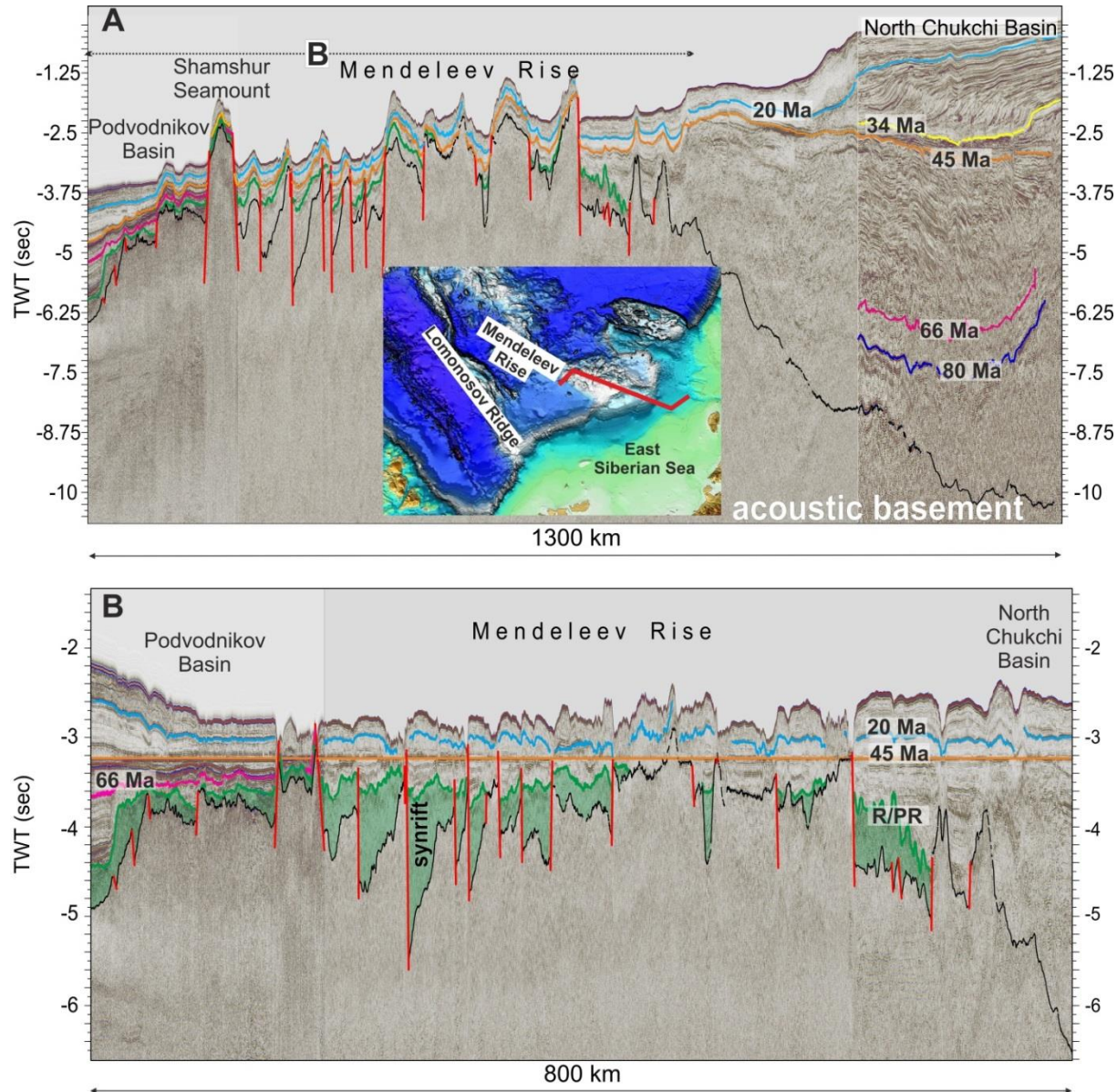


A. Fragment of seismic profile for the Mendeleev Rise. B. Flattening on the 45 Ma horizon. Horst/graben structure on Mendeleev Rise acoustic basement can be observed.



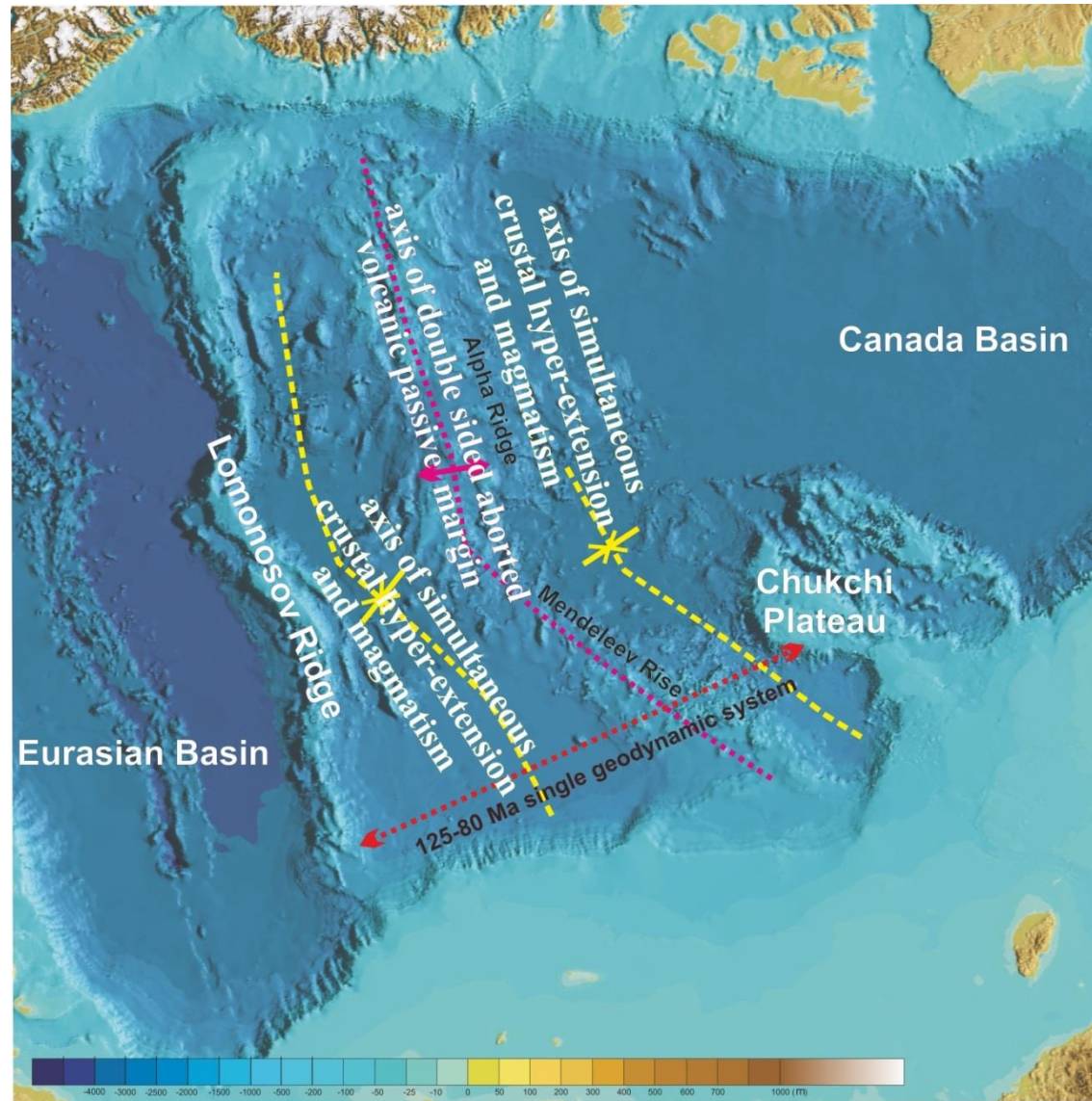


A. Interpretation of composite seismic profile for the region from the North Chukchi Basin and along the Mendeleev Rise.  
 B. Flattening on the 45 Ma horizon. Horst/graben structure on the Mendeleev Rise acoustic basement can be observed.



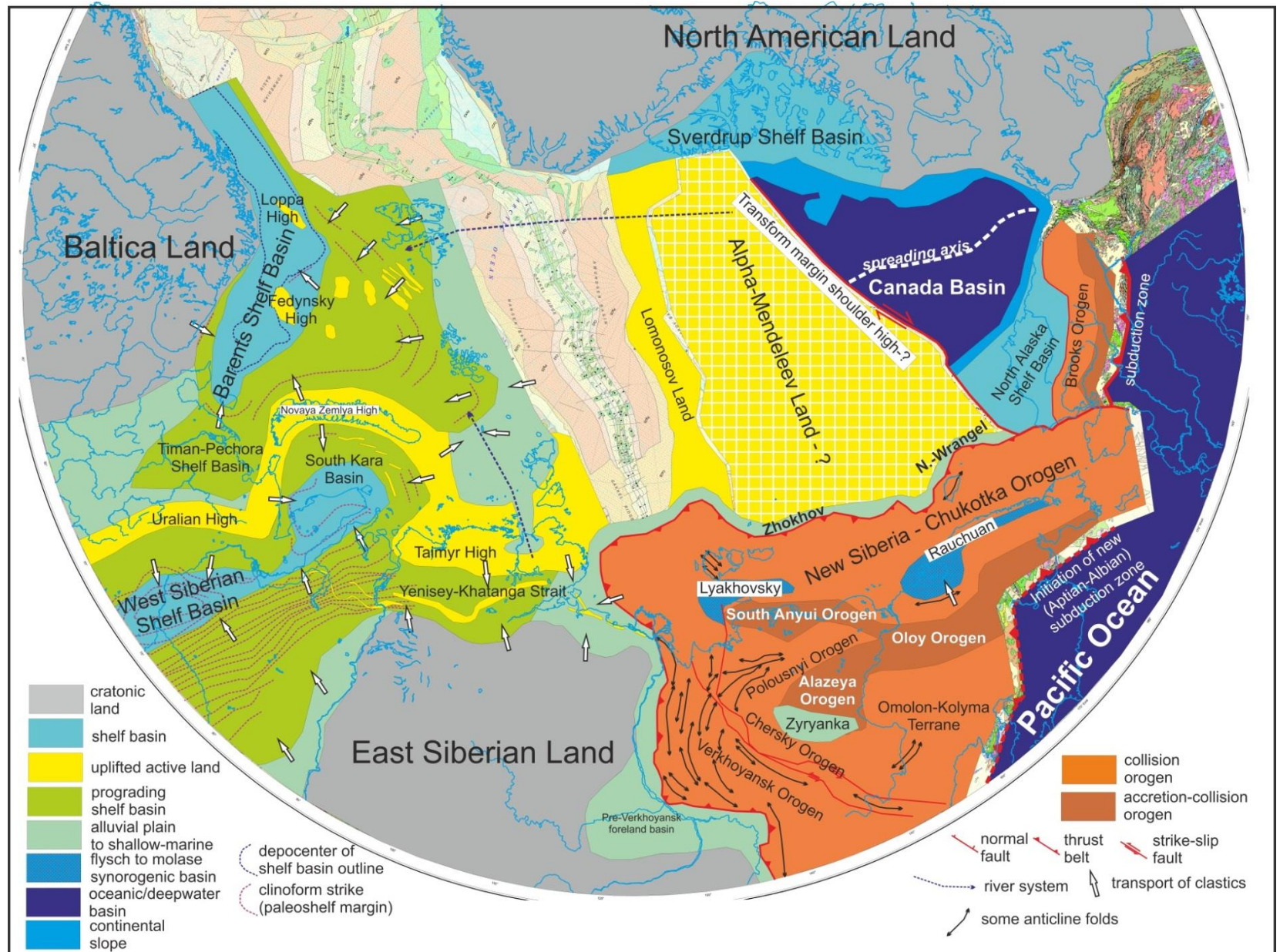


We propose that Alpha-Mendeleev Rise is a Eurasian aborted double-sided volcanic passive continental margin with stretched and hyper-extended continental crust intruded by basalts.





Paleogeographic map of the Arctic for the Early Cretaceous, Berriasian to Barremian (145–125 Ma),  
on the present-day geographic framework



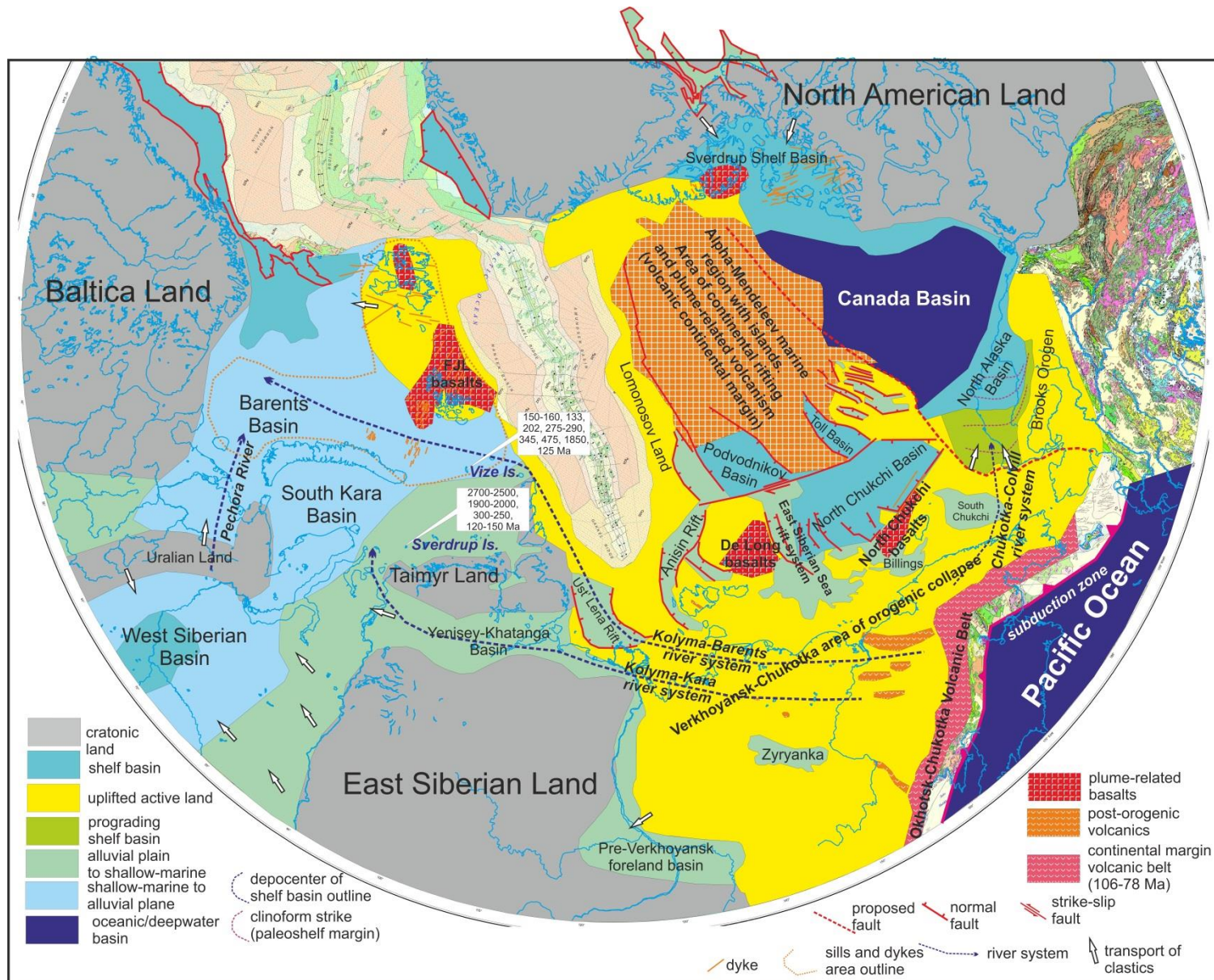


Tectonic restoration of the Arctic region for the Early Cretaceous, Berriasian to Barremian (145–125 Ma).  
Kinematic restoration for the 128 Ma. Restoration was performed using GPlates programme



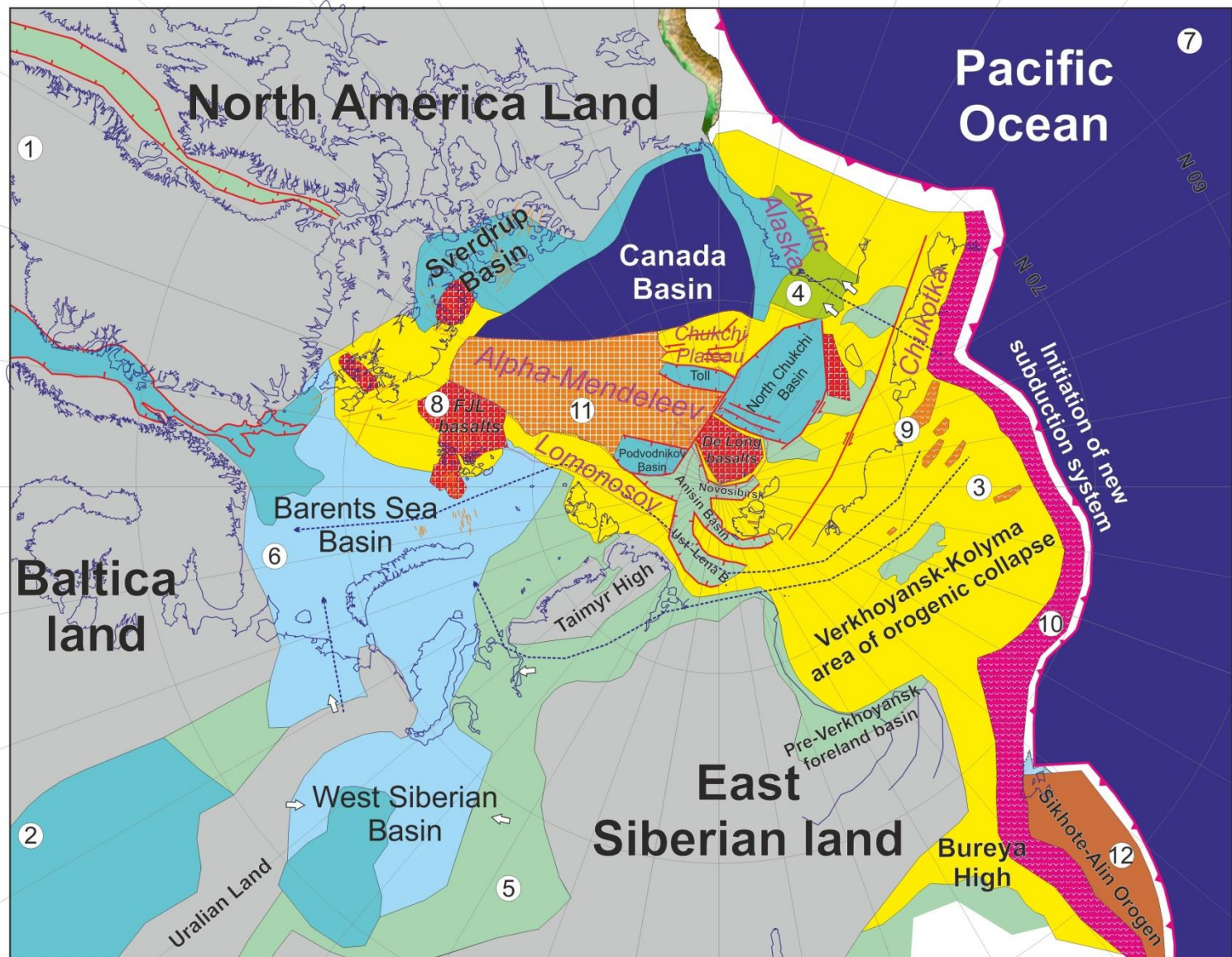


# Paleogeographic map of the Arctic for the Early Cretaceous, Aptian to Albian (125–100 Ma), on the present-day geographic framework





Tectonic restoration of the Arctic region for the Early Cretaceous, Aptian to Albian (125–100 Ma).  
Kinematic restoration for the 115 Ma. Restoration was performed using GPlates programme





## Conclusions:

1. The Mendeleev Rise together with the Podvodnikov and Toll basins compile a single geodynamic system with the same rift/postrift boundary
2. Alpha-Mendeleev Rise is a Eurasian aborted double-sided volcanic passive continental margin with stretched and hyper-extended continental crust intruded by basalts.



We report interpretations of regional seismic lines and new data of analyses of rocks from Alpha-Mendelev Rise. A new magmatic province is documented at the bottom of the North Chukchi Basin. Seismic data demonstrate synrift basalt sequences (half-grabens with bright reflectors) and a number of intrusions. The seismic stratigraphic age of the magmatism is ca. 125-100 Ma. Seismic data show evidence of magmatism in the area of De Long High. Basalts have isotopic ages on De Long islands of ca. 130-105 Ma. A huge magmatic province exists in the Barents Sea. Seismic data show a basalt province to the SE from Franz Josef Land. The two-way travel time of the basalt unit is 100 ms. The age of the basalts is ca. 125 Ma from correlation with borehole data. The area is enriched by intrusions of the same age. Similar magmatic provinces are known on Svalbard and the Canadian Archipelago. We recognize half-grabens and/or SDR complexes along the Mendelev Rise. The dip of SDRs is toward the Podvodnikov and Toll basins. The Mendelev Rise has an axial line which separates differently dipping SDRs. Half-grabens are filled with clastic rocks and basalts with ages ca. 127-110 Ma (Skolotnev et al. in preparation, and our correlations with seismic data). The Podvodnikov and Toll basins have SDR complexes also. The dipping of the SDRs is toward the axial lines of these basins, and the lines are parallel to the Mendelev Rise axial line. We propose that intraplate, ca. 125 Ma basalt magmatism started between the Eurasian continent (including the Lomonosov and Alpha-Mendelev terranes) and the Canada Basin (which formed before 125 Ma). This was followed by concentration of rifting and magmatism along Alpha-Mendelev Rise and the adjacent Podvodnikov, Nautilus and Toll basins. These processes were aborted at ca. 100 Ma as a result of plate kinematic reorganization. Additional intraplate magmatism took place at 90-80 Ma. We propose that Alpha-Mendelev Rise is a Eurasian aborted double-sided volcanic passive continental margin with stretched and hyper-extended continental crust intruded by basalts. This work was supported by RFBR grants (18-05-70011 and 18-05-00495).