Mesozoic tectonics of the Arctic: New constraints from provenance studies of Triassuc and Jurassic sandstone in Taimyr, Russia

Xiaojing Zhang * Victoria Pease
Stockholm University, * xiaojinng.zhang@geo.su.se

Why?

The formation of the Amerasia Basin, one of the major Arctic basins, has long been debated. Lack of information on the timing, structure, and geochemistry of geological units around the Amerasia Basin limits our ability to understand its development. One model suggests that the Amerasia Basin opened by the counterclockwise rotation of the Arctic Alaska-Chukotka microplate (AACM) in late Jurassic time. However, an increasing body of evidence suggests that AACM was probably not a unified fragment in the early Mesozoic. This study aims to add insight to the Mesozoic tectonics of the Arctic from provenance investigation of Triassic and Jurassic sandstone since they record the latest stage of deformation and deposition prior to the onset of Amerasia Basin opening.

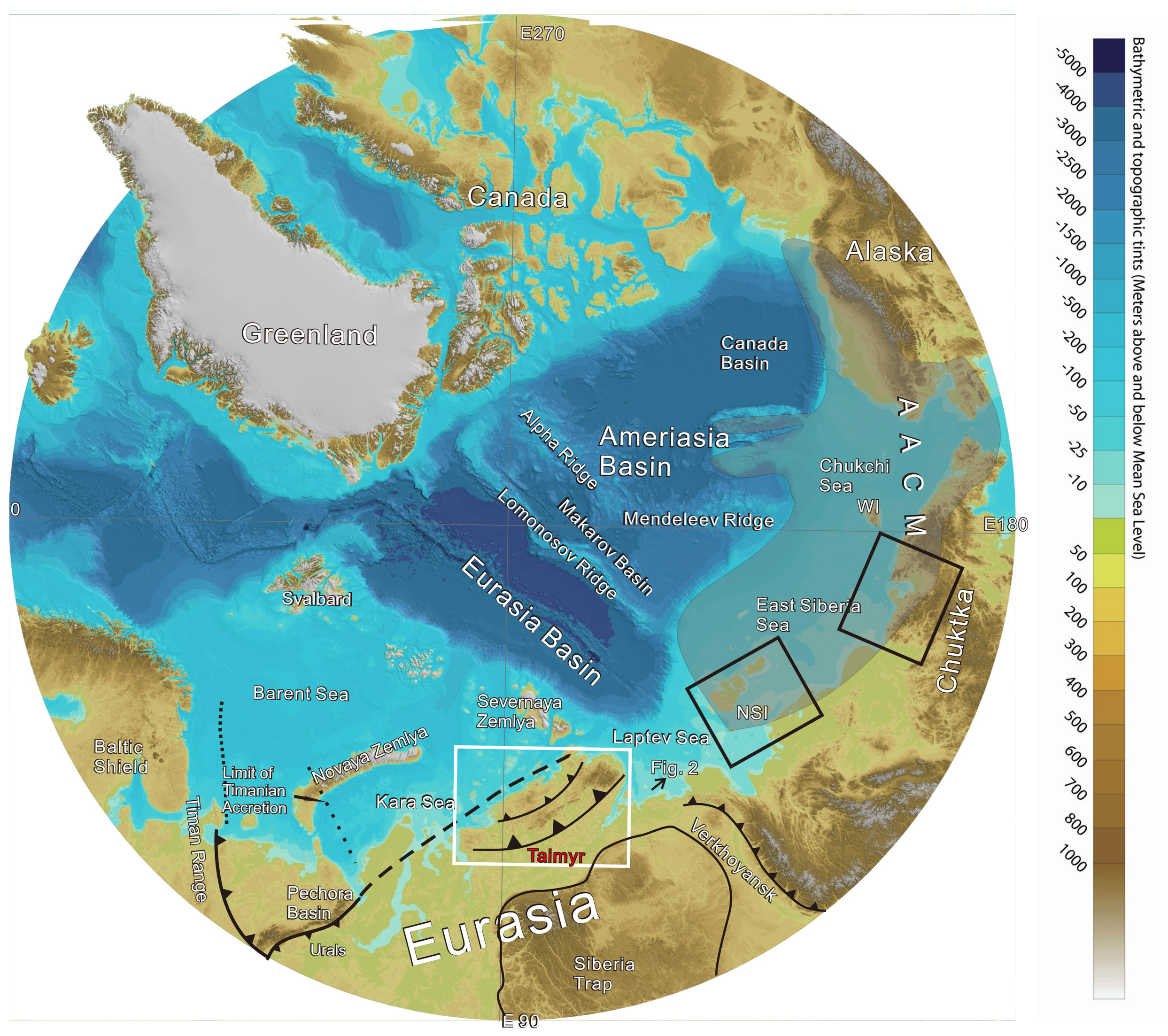


Fig.1 Circum-Arctic map showing the the main tectonic features of the Arctic related to this study. Bathymetry is from the IBCAO Arctic Bathymetry database. White box shows the location of Fig. 2. Black boxes indicate the location of Verkhoyansk foldbelt foreland basin sediment. New Siberia Islands (NSI) and Wrangel Islands (WI) are shown on this map.

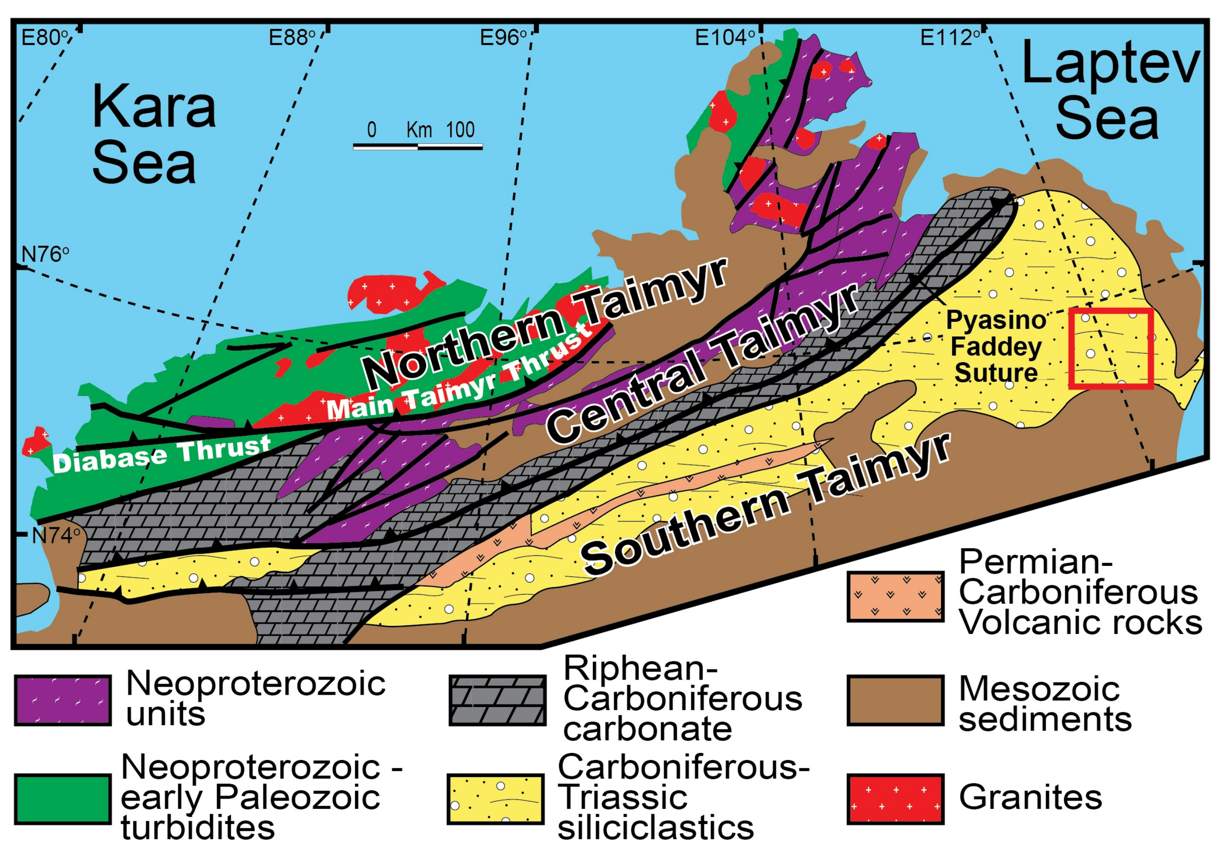


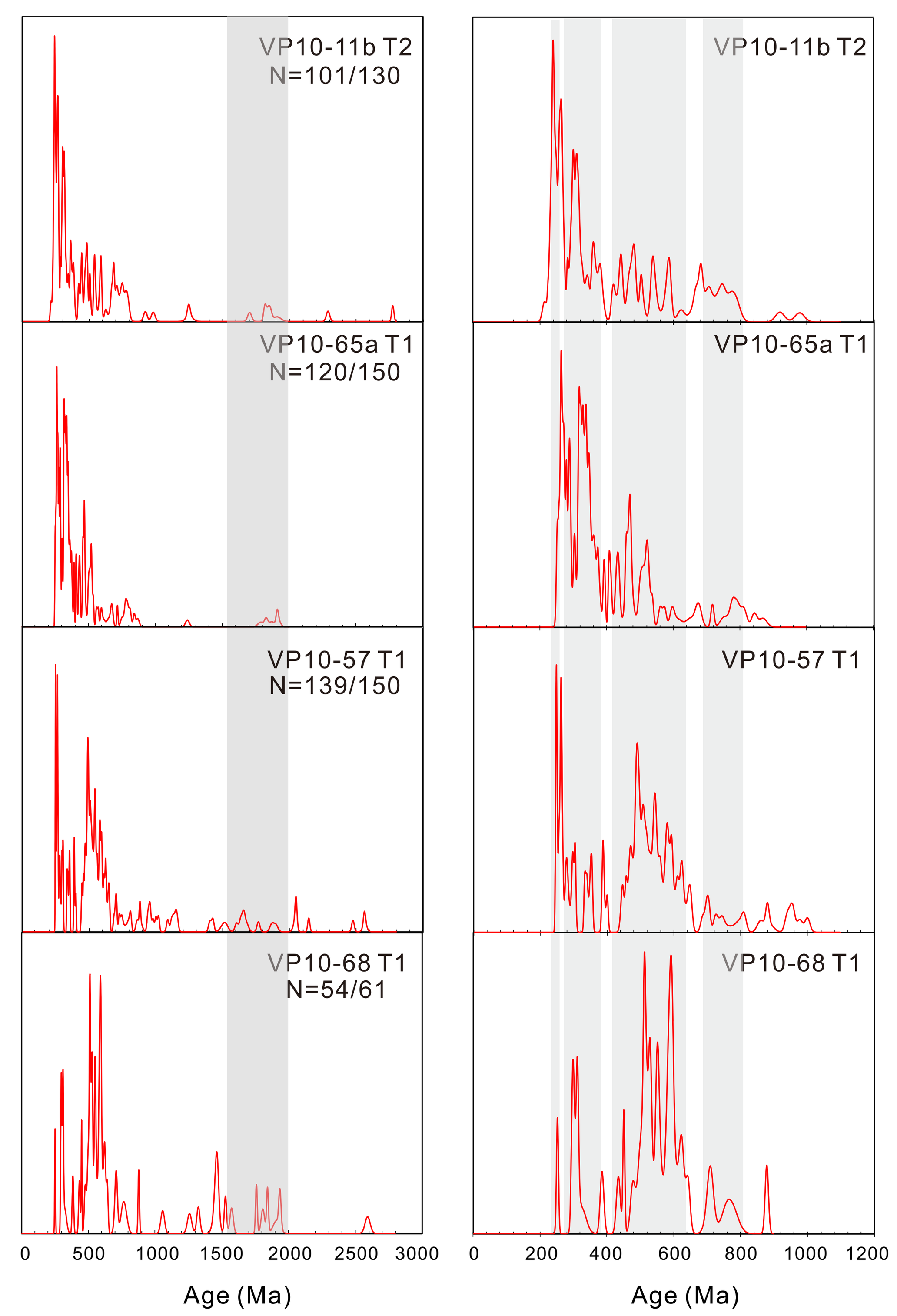
Fig. 2 Simplified geological map of the Taimyr Peninsula. Sample location is indicated by red box.

How?

FourTriassic and six Jurassic sandstone samples were collected for detrital zircon U-Pb dating via LA-ICP-MS. The Triassic data are compared with sandstone detrital zircon data from Chukotka and Wrangel Island (Miller et al., 2010). The Jurassic data are compared with detrital zircon data of syn-orogenic forelad basinn deposit in the Verkhoyansk foldbelt (Miller e al., 2008) (Fig.1).

Results and Conclusion

a). Triassic provenance



b). Jurrassic provenance

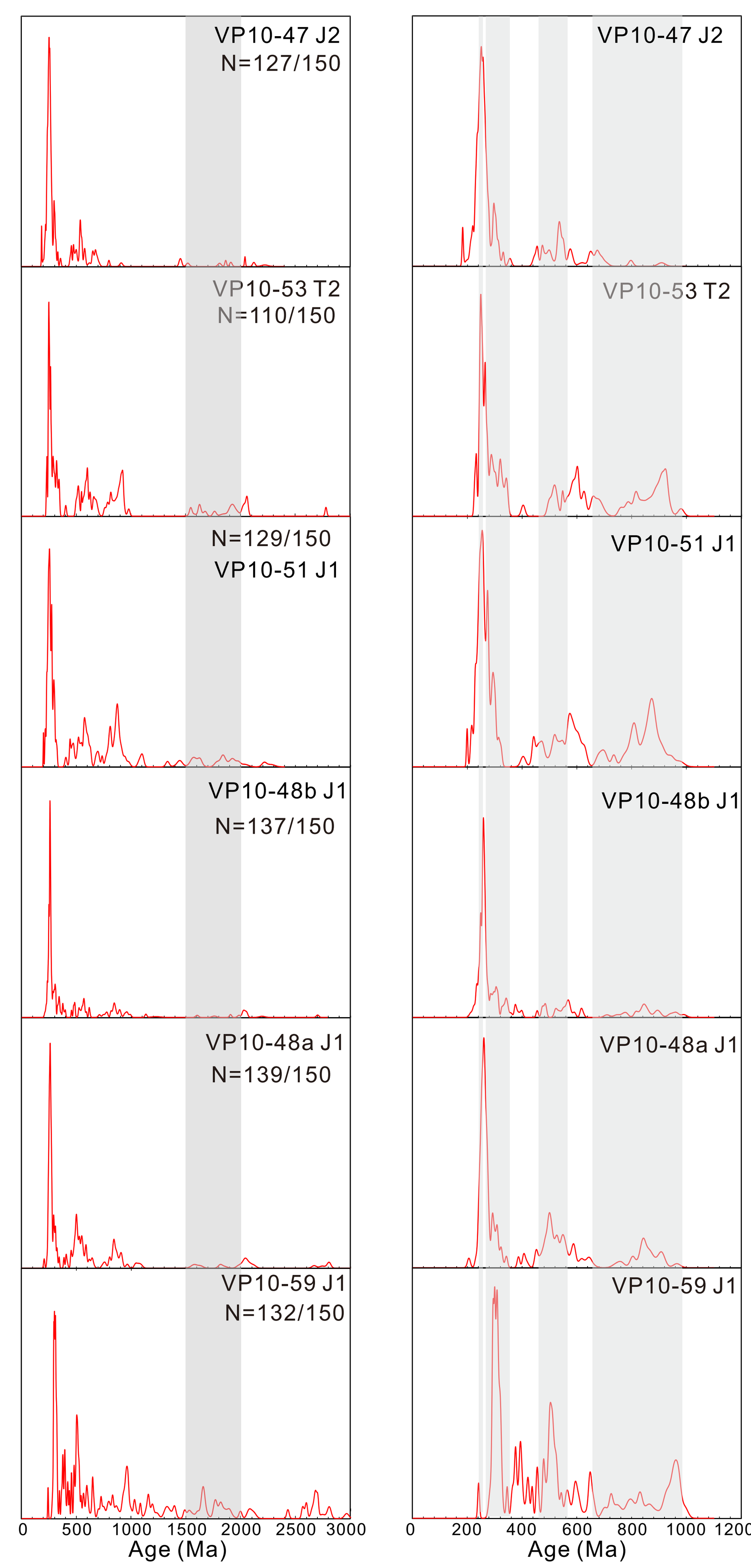


Fig. 3a and 3b. Relative probability density plots (0-3000 Ma and 0-1000 Ma) for U-Pb detrital zircon ages of Triassic and Jurassic sandstone from the Taimyr foldbelt. N denotes the number of analyses with 90-110% concordancy and less than 10% error relative to all analyses. Grey bars indicate similar age peaks in all samples.

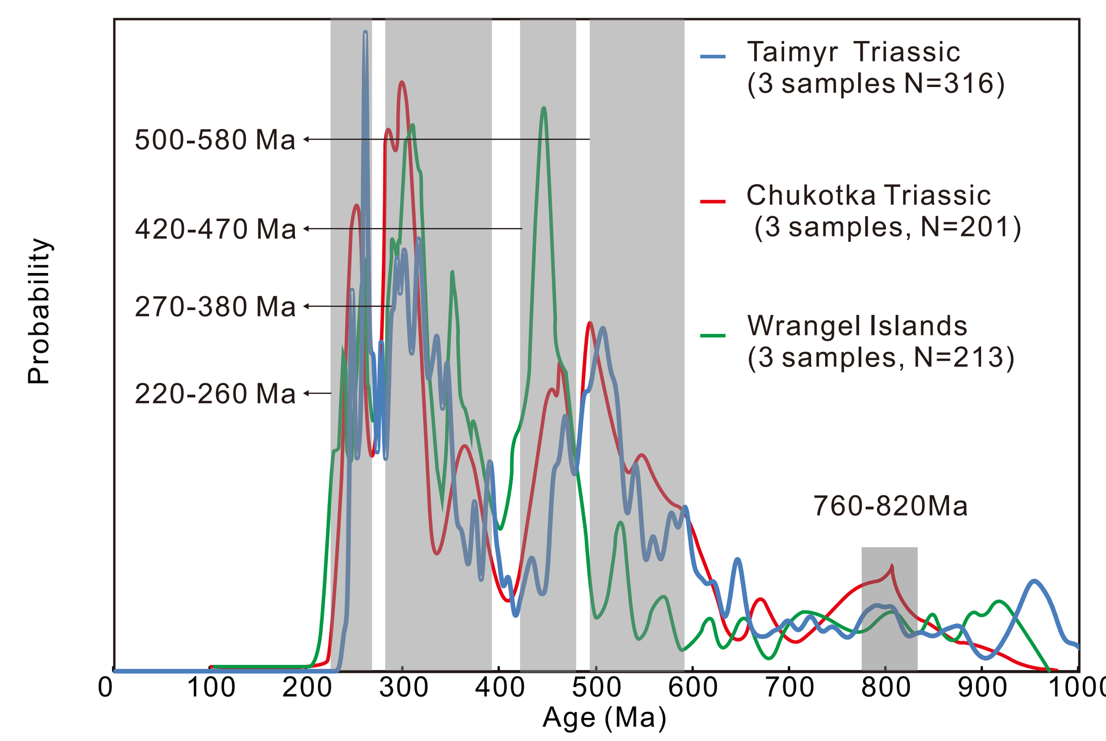


Fig.4 Comparison of younger than 1000 Ma relative age probability distributions of combined Triassic detrital zircon suites from Taimyr to combined data from Chukotka and Wrangel Island (Miller et al., 2010). Grey bars indicate the similar age peaks in all samples. Note that sample VP10-68 is excluded because of the small amount of data.

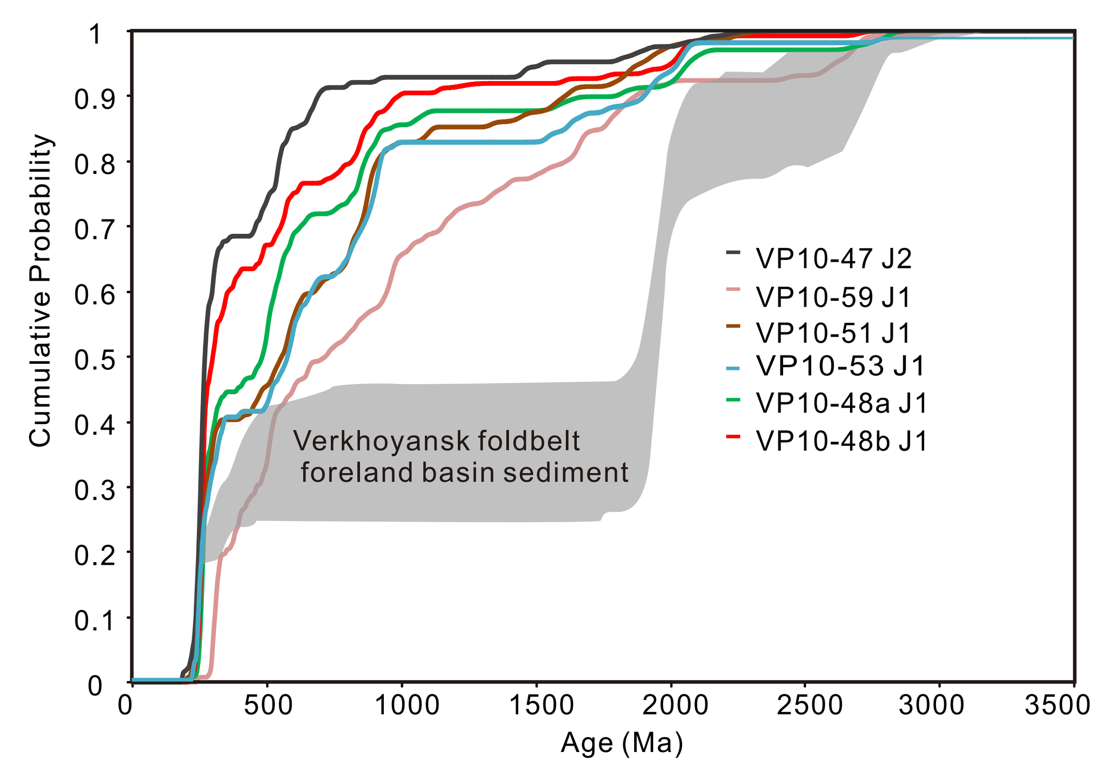


Fig.5 Cumulative probability plots of Jurassic zircon age data from Taimyr compared with Jurassic-Cretaceous detrital zircon ages from Verkhoyansk foldbelt foreland basin deposit (Miller et al., 2008)

The Triassic samples show great similarity in detrital zircon population with Triassic sandstone from Chukotka and Wrangel Island and the New Siberian Islands. Age peaks at 220-260Ma, 270-380 Ma, 420 - 580 Ma and 760-820 Ma suggest sources from Siberia Trap magmatism, the Ural Mountains of Arctic Russia and Taimyr. It is therefore likely that Taimyr, Chukotka and Wrangel Island which are separated at present were close to each other or belonged to the same large drainage system before the opening of the Amerasia Basin.

Detrital zircon age spectra of Taimyr Jurassic samples are not very different from Triassic samples. However, absence of early Paleozoic ages and no significant Precambrian grains distinguish the Taimyr Jurassic sandstone from Jurassic to Cretaceous sediment on the New Siberian Islands and Chukotka which are interpreted as foreland basin sediment of the Verkhoyansk foldbelt. In the Jurassic, detritus shed from Taimyr no longer reached to Chukotka and the New Siberian Islands. This change likely reflects tectonic processes, but has yet to be causally linked to specific event.

Ref: Miller, E., Gehrels, G., Pease, V., Sokolov, S., 2010. Stratigraphy and U-Pb detrital zircon geochronology of Wrangel Island, Russia: Implications for Arctic paleogeography. AAPG bulletin 94, 665.
Miller, E.L., Soloviev, A., Kuzmichev, A., Gehrels, G., Toro, J., Tuchkova, M., 2008. Jurassic and Cretaceous foreland basin deposits of the Russian Arctic: Separated by birth of the Makarov Basin? Norwegian Journal of Geology 88, 201-226.

This study is part of a large program to correlate circum Arctic geology (http://www.cale.geo.su.se/).