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Structure and depositional environments of Permian-Triassic terrigeneous complex of the Barents Sea shelf

Daria Norina and Antonina Stoupakova
Lomonosov Moscow State University, Moscow, Russian Federation (daria.norina@gmail.com)

Permian-Triassic complex of the Barents Sea shelf composed of up to 8-12 km of clastic sediments has a great interest for geology as it contains hydrocarbon-bearing reservoirs and source rocks. It is drilled on shelf margins and structural highs; it outcrops in adjoining archipelagos. However within depositional centers like the South-Barents basin where Permian-Triassic reaches maximum thickness and burial, its structure can only be understood from seismic data.

We present an evaluation of structure, depositional environments and cyclicity of Permian-Triassic terrigeneous complex based on interpretation of 18 000 km of regional seismic profiles with record length of 10-12 s acquired by MAGE in 2007-09 in the south-east shelf. Transgressive-regressive sequences were identified and correlated using well log analysis for 17 wells, descriptions of well sections and outcrops in Franz Josef Land, Svalbard and Novaya Zemlya archipelagos.

Cooling of the climate throughout Sakmarian-Artinskian (Lower Permian), marine transgression, and Ural orogeny in the south-east had interrupted carbonate deposition and initiated the deposition of terrigeneous (East Barents) and spiculite, siliceous-carbonate, and siliciclastic (West Barents) sediments (Geological history, 2009). Triassic is represented by clastic lithologies all over the basin.

On seismic data lower boundary of Permian-Triassic complex is a high-amplitude reflector (Ia) and downlap surface corresponding to the top of Lower Permian carbonates. Upper boundary is related to Rhaetian erosional unconformity best pronounced in the pre-Novaya Zemlya foredeep, Kola monocline and Pechora Sea.

Permian is represented by 5 transgressive-regressive sequences with upward regressive trend and total thickness of 100-800 m. Low-angle clinoforms prograding from south-east (Ural provenance) and east were interpreted on seismic. Increasing thickness of Permian towards Novaya Zemlya is consistent with up to 4 km of sediments in the archipelago's outcrops and indicates Kara provenance. In the south-eastern basin margin Permian-Triassic boundary is well-traced due to its erosional origin and downlapping of overlaying Induan clinoforms.

Triassic sediments were formed in deltaic, shallow-marine to deep shelf environments in the large epicontinental basin with vast transgressions and significant lateral shift of the shoreline during sea level changes. Interpreted Triassic horizons correspond to Induan/Olenekian (top Havert), Lower/Upper Olenekian, Olenekian/Anisian (top Klappmyss) and Ladinian/Carnian boundaries. These relatively continuous reflectors were formed as transgressive shaly packages overlaid sequence boundaries.

During Induan clinoforms (height $\sim$100 s) had prograded to the north-west and west compensating the steady subsidence of the South- and North Barents depressions and pre-Novaya Zemlya foredeep. We traced migration of the clinoform break (platform margin) of several Induan prograding sequences across the South-Barents basin towards Norwegian Barents Sea, where the area of non-compensated deposition in deep shelf environments was delineated (Glorstad-Clark, 2010). During Olenekian and Middle Triassic the clinoform break persisted in the western shelf, thus no clinoforms are observed in the south-east of the Barents Sea where deltaic environments had prevailed. Late Triassic was characterized by shallowing of the basin, spreading of deltas and filling of previously non-compensated area in the north-west.

Maximum thickness of Triassic is related to Lower Triassic within South Barents basin and Lower-Middle Triassic within the pre-Novaya Zemlya foredeep.