Basin architecture and lithosphere structure of West- and East-Black Sea Basins from geophysical studies

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For a better understanding the basin architecture and lithosphere structure of two deep sub-basins – the West-Black Sea (WBS) and the East-Black Sea (EBS) – as well as operated tectonic processes, we made a comprehensive analysis of available geological and geophysical information. The analysis includes reinterpretation of a number of seismic refraction profiles, 3D gravity back-stripping analysis as well as reevaluation of seismological data and local seismic tomography. A ray-tracing modelling of seismic refraction data acquired in the 1960s has been undertaken on W-E seismic line along the north-western shelf (Profile 26) and on two N-S lines – Profile 25 in western part of the Black Sea and Profile 28/29 crossing the Azov Sea and central part of the Black Sea. The velocity model on Profile 25 shows two domains interpreted as thin (5 km) high-velocity oceanic crust below the WBS, covered by 12-13 km of sediments, and a 39-km thick continental domain of the Scythian Platform and southernmost part of the East European Platform. They are separated by a high-amplitude normal fault, interpreted as being related to the opening of the WBS during Late Cretaceous rifting. A specific feature of the velocity field of the north-western shelf (Profiles 26 and 25) is presence of a low-velocity zone in the basement, that might be indicative of the saturation of the basement by hydrocarbon fluids related most probably to the high oil and gas potential of the area. The velocity model on Profile 28/29 shows an oceanic crust on the north-western extremity of the EBS and thinned continental crust (Moho depths at 29 km) underlying the Mid-Black Sea Ridge. The basement of the latter an en echelon-like manner elevates southwards from a depth of 10-11 km beneath the Andrusov Ridge to 6 km on Arkhangelsky Ridge. An inclined seismic boundary at the Moho interface may be related to oblique rifting setting during the initial formation of the EBS. Local seismic tomography shows that WBS and EBS have different velocity structure of the lithosphere. High-velocity lithosphere of the WBS could be inferred from its origination on the basement of Moesian Platform due to rifting occurred along the Mesozoic sutures. The EBS is underlain by the lithopsphere of lower P-wave velocities that might be indicative on its origination on different (Trancaucasus) domain and/or on increased temperature regime of the upper mantle. Occurrence of two lithospheric blocks under the Black Sea corresponds to different character of observed seismicity. In the WBS the major seismogenic zone locates along the southern margin within the North-Anatolian seismic zone, while accumulated in the EBS strength is unloaded along the northern seismic zone, distinguished along the Crimea-Caucasus coast. The latter might be caused of active underthrusting of the EBS oceanic plate below the Scythian Platform and confirms the accretional origin of Sorokin and Kerch-Taman Troughs.