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Research paper

The Black Sea basins structure and history: New model based on new deep penetration regional seismic data. Part 2: Tectonic history and paleogeography

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ABSTRACT

A new lithostratigraphy scheme has been compiled for the Western Black Sea Basin and a new geological history scheme from Middle Jurassic till Neogene is suggested for the entire Black Sea Region. Continental rifting manifested itself from the Late Barremian to the Albian while the time of opening of the basins with oceanic crust was from Cenomanian till mid Santonian; origination of the Western and Eastern Black Sea Basins took place almost simultaneously. During Cenozoic time, numerous compressional and transpressional structures were formed in different part of the Black Sea Basins. It is shown that in Pleistocene-Quaternary time, turbidities, mass-transport deposits and leveed channels were being formed in the distal part of the Danube Delta.

1. Introduction

In the first paper, we presented and discussed the new seismic data for the Black Sea, which allowed us to clarify the sequences of the basins and improve our models for the paleogeography and tectonic history of the region. In this second paper, we discuss the seismic stratigraphy of the Black Sea, largely through the Western Black Sea Basin. On the basis of this revised version of the stratigraphy and new tectonic reconstructions, we attempt to reconstruct the paleotectonic and paleogeographic history of the Black Sea Region. This article is largely based on our fieldwork in Turkey, the Crimea and in the Greater Caucasus but we also incorporate field geology studies in Georgia, Romania and Bulgaria. Basement topography and key structural elements for the Black Sea Basins are shown on Figure 1 (for details see Paper 1).

2. Seismostratigraphic model for the Black Sea

Stratigraphic schemes for the Black Sea have already been presented in numerous publications (Tugolesov et al., 1985; Finetti et al., 1988; Robinson et al., 1996; Dinu et al., 2005; Afanasenkov et al., 2007; Shillington et al., 2008; Rangin et al., 2002; Khriachtchevskaia et al., 2009, 2010; Munteanu et al., 2011; Menlikli et al., 2009; Stovba et al., 2009; Tari et al., 2009; Stuart et al., 2011; Nikishin et al., 2009, 2010, 2012; Mityukov et al., 2012; Almendinger et al., 2011; Georgiev, 2012; TPAO/BP Eastern Black Sea Project Study Group, 1997; Gozhik et al., 2010). Based on the interpretation of new seismic data, we are suggesting a revised stratigraphic scheme for the pre-Oligocene section. Our scheme is an updated version of older works (Nikishin et al., 2003, 2009, 2012; Afanasenkov et al., 2007), grounded on the analysis of

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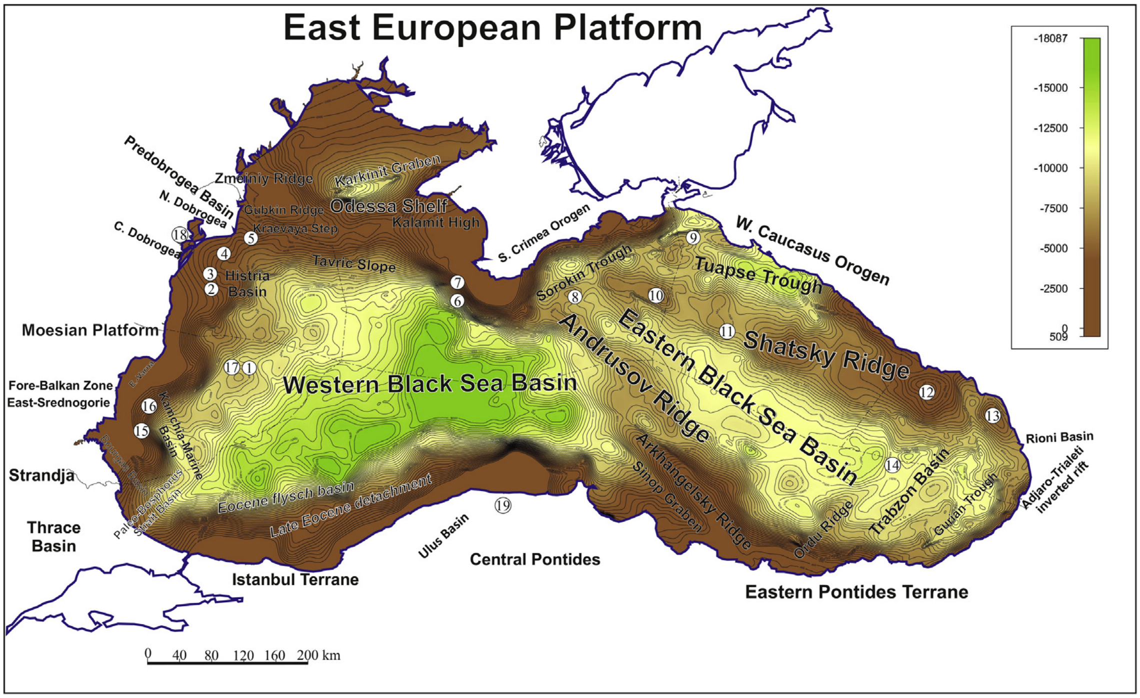

Figure 1. Basement topography of the Black Sea Basin (from Paper 1), and index map for the Black Sea Region. 1 – Polshkov Ridge, 2 – Tindala-Midia Ridge, 3 – Tomis Ridge, 4 – Lebada Ridge, 5 – Sf. Georg Ridge, 6 – Sevastopol Swell, 7 – Lomonosov Massif, 8 – Tetyaev Ridge, 9 – Anapa Swell, 10 – North Black Sea High, 11 – South-Doobskaya High, 12 – Gudauta High, 13 – Ochamchira High, 14 – Ordu-Pitsunda Flexure, 15 – Rezovo-Limankoy Folds, 16 – Kamchia Basin, 17 – East-Moesian Trough, 18 – Babadag Bassin, 19 – Küre Basin.

specific geological horizons and tectonostratigraphic units. Seismic data was discussed in Paper 1 where we presented 22 new regional seismic profiles. Here we analyze the main seismostratigraphic units and geological features along the three longest new regional seismic profiles (Figs. 2, 3, 4).

Corresponding to the fast drop of the sea level, the base Messinian erosional boundary can be clearly identified on most seismic lines (see Paper 1). In Neogene outcrop sections of the Taman region (Western part of the Great Caucasus), this event is dated as Middle Pontian (Rostovtseva, 2012), which approximately corresponds to the Late Messinian (Popov et al., 2006, 2010), or to the boundary between the Messinian and the Pliocene (Suc et al., 2011). The Messinian erosional event is detected on the Romanian Shelf as well, which is also dated as Mid Pontian (Suc et al., 2011; Munteanu et al., 2011, 2012).

On seismic lines, the top and bottom of the Maykop sequence are interpreted by different researchers as the bounding surfaces of a relatively monotonous package of sediments. Top and bottom of the Maykop sequence are dated by borehole data on the Ukrainian (Gozhik et al., 2010; Khriachtchevskaia et al., 2010) and Romanian (Dinu et al., 2005; Munteanu et al., 2011) shelves. Regionally, the upper boundary of the Maykop sequence corresponds to the end of

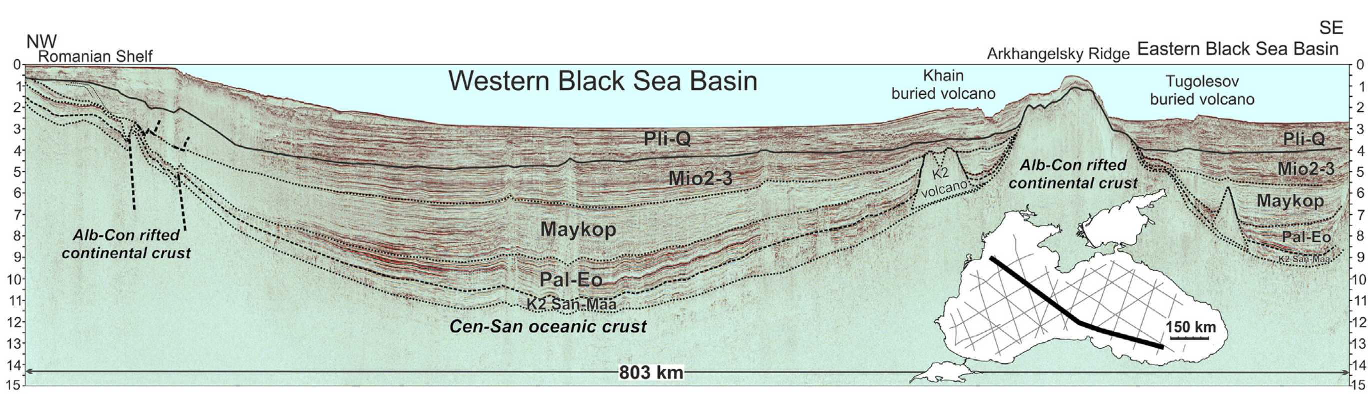

Figure 2. Geological interpretation of seismic line BS-160. This line is the longest in our project. The Arkhangelsky Ridge has no features of pre-Miocene sedimentary cover. Pre-Miocene levels could be composed of Cretaceous volcanics. Two big buried mountain-like highs could be recognized: Khain and Tugolesov. We propose a volcanic origin for these structures. The height of these structures is close to 2.5 s. They are covered by Maykopian deposits or even Mid Miocene deposits (the Khain structure). If these structures are volcanoes it means that till Early or Middle Miocene times the Black Sea was a deep-water basin with water depth in excess of 2 km. Abbreviations: K – Cretaceous, Apt – Aptian, San – Santonian, Maa – Maastrichtian, Pal – Paleocene, Eo – Eocene, Mio – Miocene, Pli – Pliocene, Q – Quaternary.