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Geodynamic development of the Black Sea basin

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Kinematics of plate motion in the Black Sea—Caucasus region are determined by the convergence of Arabian and Eurasian plates with a velocity of about 30 mm/year. The area of the maximal compression including the Great and Lesser Caucasus and East Anatolia is located just opposite to the ledge of the Arabian plate. In this area, a considerable lateral contraction of the Earth crust is expressed as reversed faults and nappes in the Great Caucasus and Transcaucasian areas and as a lateral push away of blocks in the East Anatolia and north-western Iran. So, the East Anatolian sub-plate is pushed to the west from the zone of maximal compression, while other blocks move to the east towards the South Caspian Basin.

The eastern part of the Black Sea is suggested to represent a block or sub-plate that moves to the Northeast. This conclusion is important for estimation of seismic and related geological hazards in the study area. It is ascertained that deformations and seismicity are mainly confined to the East Black Sea sub-plate margins, while the seismic activity is considerably lower in its inner part.

In the West Black Sea Basin, the seismic activity is confined to the front of Balkanids and Pontids, while the northern and north-western passive margins show low seismic activity or are aseismic, thus demonstrating current calm tectonic regime. The West Black Sea Basin comprises about 50 thousand $km^2$of shelf located mainly within the Ukrainian economic zone. The water depth over the majority of shelf is less than 100 m. The Odessa Bay represents a confirmed province of gas bursts with one exploited gas deposit and six deposits in the stage of preparation to the exploitation or development. The total surveyed resources of gas amount are 1.5 trillion m^3.

Gas bursts take place within the continental slope of the West Basin. The basin filled

with Cenozoic sediments, more than 14 km thick, is located southward of the slope. Judging by results of the deep seismic profiling, they overlay basaltic basement, whereas Mesozoic (Cretaceous) deposits are distinguished only at the base of the continental slope.

The Cenozoic cross-section includes: Pliocene-Eocene carbonate deposits (2-3 km thick); the Oligocene—Upper Miocene clay with rare sandstone and siltstone interbeds (Maikop series, 2-4 km thick); the Middle-Upper Miocene and Pliocene carbonate-terrigenous sesediments variable in their composition (2.5-4.0 km thick); Quaternary terrigenous sediments of the Danube River delta (2.5-4.0 km thick). The lower part of the Maikop series is considered as a potentially oil-bearing rock mass with the organic carbon content up to 8 kg/t.

Within the faulted continental slope, lower layers of the Cenozoic sequence wedge out, and upper layers are thinning. Minimal thickness of Cenozoic deposits is fixed within the Kalamitsk Rise extending parallel to the brow of the continental slope. The Karkinit Basin northward of the rise is filled with thick Cretaceous to Cenozoic deposits. The basin commenced to form with Albian and Aptian—Albian rifting and infilling of the rift system with clay-sand synrift deposits, up to 1-2 km thick. The wide basin was formed during the Cretaceous to Paleogene, as a result of post-rift subsidence. It was filled with sediments up to 4 km thick.

At the end of the Eocene, the basin underwent slight inversion accompanied by formation of reversed faults, probably along the plains of previous normal faults. Reversed faults and conjugate anticlines developed on both slopes of the Kalamitsk Rise which likely uplifted during the compression phase. Some reversed faults were active also later, up to the Pliocene.

The Karkinitsk Basin includes several gas deposits with total explored recourses of 1.5 trillion m^3. Reservoirs are confined to the Aptian, Pliocene, and Oligocene coarse-grained sandstone overlain by the Upper Cretaceous to Eocene marl and Oligocene clay. Anticlines formed during the Late Eocene and later compression phases represent the main type of traps.