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ANALYSIS OF COMPLEX GEODYNAMIC INTERACTIONS IN THE EASTERN PART OF CENTRAL GONDWANA AND EURASIA

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Summary. The eastern part of Central Gondwana and Eurasia is a tectonically complex region where several large tectonic plates interact – Eurasian, African, Arabian, Aegean-Anatolian, Iranian, and Sinai. However, consideration of only these plate interactions is insufficient. In addition to this interface, other regional geodynamic factors exist: the mantle rotating counterclockwise structure (MRCS), the Ural-African geoid anomaly, and the critical Earth latitude 35°. The Eurasia-Gondwana boundary divides the western part – the Aegean-Anatolian Plate and Mesozoic Terrane Belt (MTB) associated with the comparatively young Neoproterozoic Belt – and the eastern part, the Iranian Plate, whose terranes are fragments of the Archean-Early Proterozoic Arabian craton. The Iranian lithospheric plate, a key player at the boundary between Eurasia and Gondwana, holds significant implications in the tectonic-geodynamic context. It tectonically influenced the South Caspian Basin (SCB) and recently revealed MTB. Novel tectonic, satellite-derived gravity, and magnetic maps of the Iranian Plate have been developed. Geodynamically, the considered tectonic units are located above the central and eastern parts of the MRCS. The Iranian Plate is above the eastern (periclinal) zone of the MRCS and, under its influence, moves northward. The movement of the western part and complex form of the Iranian Plate force the clockwise rotation of the SCB. A complex geodynamic-geophysical interaction of the central tectonic-geodynamic units in the region is shown. The influence of the recent geodynamic event – Akchagylian hydrospheric maximum on the ancient hominin dispersal in the region is exhibited. The carried analysis is essential to understand the role of the complex geodynamic interface in a transition zone between Eurasia and Gondwana.

1. Introduction

The status and history of the formation of the Iranian lithospheric plate have been considered mainly at a narrow regional level. Therefore, its classification validity (legitimacy) as a supra-regional structure is not a generally accepted factor in the plate tectonics and geodynamics of the transition zone between Eurasia and Gondwana. Based on these positions, we propose analyzing the available data on plate tectonics of this large region, deep geophysics, and geodynamics, as indicated in Figure 1.

Figure 1 clearly shows that the vast Eurasian plate to the south relates to a complex of different-sized, differentially elongated lithospheric plates of Gondwana, oriented in either the latitudinal or meridional direction: Anatolian (Aegean-Anatolian), Iranian, Sinai, Nubian, Victorian, Somalian, Arabian, and Indian. The boundaries between the lithospheric plates belong to geodynamically heterogeneous zones and correspond to manifestations of collision, spreading, transform shears, and rotation. GPS data, paleomagnetic patterns, and geodynamic reconstructions reflect the latter phenomena. However, consideration of only these plate interfaces is insufficient. In this region there are other significant regional geodynamic factors: the mantle rotating counterclockwise structure (MRCS), the Ural-African geoid anomaly, and the critical Earth latitude 35°.

The discovery of a mantle rotating counterclockwise structure (MRCS) (Eppelbaum et al., 2021) based on multifactor geophysical data (GPS, gravity, magnetic, paleomagnetic, seismotomographic, etc.) caused the need to reconsider geodynamic evolution of this region. It is necessary to underline that earlier, Le Pichon and Gauler (1988) distinguished the rotation of Arabia and the Levant fault system only based on the tectonic-structural data.

Geodynamically, the Iranian Plate (Motaghi et al., 2015) is considered to occur above the eastern part of the MRCS (Eppelbaum et al., 2021). The lithosphere blocks above the MRCS eastern branch rotation initiate northern displacement of the Iranian Plate. The maps and schemes are based on the previous comprehensive regional geophysical, geodynamic, and paleobiogeographic studies (Alizadeh et al., 2016; Eppelbaum et al., 2018, 2021; 2024a, 2024b; Kadirov et al., 2024).

It is seen that the high magnitude seismogenic zone (Figure 1) is under the MRCS influence (the structure long-term rotation initiates a stress in the above lithosphere) and is nearly such geodynamic factors as the Eastern Anatolian Fault (EAF), distal part of the Mesozoic Terrane Belt (MTB), Ural-African tectonic step, Earth's critical latitude, and the western ending of the Iranian Plate. Besides this, the seismogenic zone is at the boundary between the MTB and Alpine-Himalayan tectonic belt (Eppelbaum et al., 2024a).

The regional scheme presented in Figure 1 allows considering combination of geodynamic elements of Gondwana several larger radial zones in this complex associated with the features of the historical development of this supercontinent: (1) Western Gondwana, located to the rear of the spreading zone of the Red Sea and East Africa, (2) Central Gondwana – lying on the eastern side of the East African – the Red Sea spreading zone, and (3) Eastern Gondwana, articulated with the Central Gondwana by a deep shear zone and represented in the extreme east of the region as a fragment of the Indian lithospheric plate.

The given tectonic-geophysical analysis is essential for assessing and understanding the role of the sublatitudinal lithospheric plates – the Iranian and Aegean-Anatolian—as transition zones between Eurasia and Gondwana. The complex tectonic-geodynamic and geophysical peculiarities of the region under study required the examination of works by numerous authors (see Section 2 below). A combined examination of literature sources and analyses of developed gravity, magnetic, tectonic-geodynamic, and topography/bathymetry maps allowed extending our geodynamic knowledge of the region.

For example, the multidimensional statistical analysis applied to the satellite-derived gravity data (Figure 2) (after Eppelbaum et al., 2018) indicates two significant anomalies (in arbitrary units): to the west of the Afar triangle and inside the central part of the Iranian Plate. This fact indicates the plate's geodynamic significance of the plate.

2. Materials and Methods

Such an investigation requires the acquisition of various geophysical and geological data. The satellite-derived gravity and topographic (bathymetry) data for this study were acquired from the World Gravity Database as retracked from the Geosat and European Remote Sensing (ERS) missions (Sandwell and Smith, 2009). Initial ΔZ magnetic data recalculated to one ordinary level of 2.5 km above the mean sea level (msl) were acquired from https://geomag.colorado.edu/magnetic-field-model-mf7.htm. Several independent works were examined for the GPS data analysis (e.g., Reilinger et al., 2006; Khorrami et al., 2019; Kadirov et al., 2015; 2024). In addition, various seismic (e.g., Ben-Avraham, 2002; Abdullayev et al., 2017; Teknik et al., 2019; Mousavi and Fullea, 2020; Alizadeh et al., 2024; Teknik, 2024; Corchete, 2025), thermal (e.g., Eppelbaum and Pilchin, 2006; Goutorbe et al., 2011; Mukhtarov, 2018; Mousavi and Andestani, 2023; Teknik, 2024), gravity (Kadirov, 2000; Ben-Avraham et al., 2002; Kadirov and Gadirov, 2014; Eppelbaum et al., 2018, 2021; Kadirov et al., 2023; Teknik, 2024), paleomagnetic (Issayeva and Khalafli, 2006; Mattei et al., 2019; Eppelbaum et al., 2021; Mousavi and Andestani, 2023), and magnetic (Eppelbaum and Katz, 2015; Eppelbaum et al., 2023, 2024a; Eppelbaum, 2024) data sources were analyzed. The following works were examined in the paleobiogeographical studies: Arkell, 1956; James and Wynd, 1965; Makridin et al., 1968; Ализаде, 1972; Ализаде и др., 1983; Feldman, 1987; Hirsch, 1988; Hirsch and Picard, 1988; Cooper, 1989; Kazmer, 1993; Hall et al., 2005; Alizadeh et al., 2016.

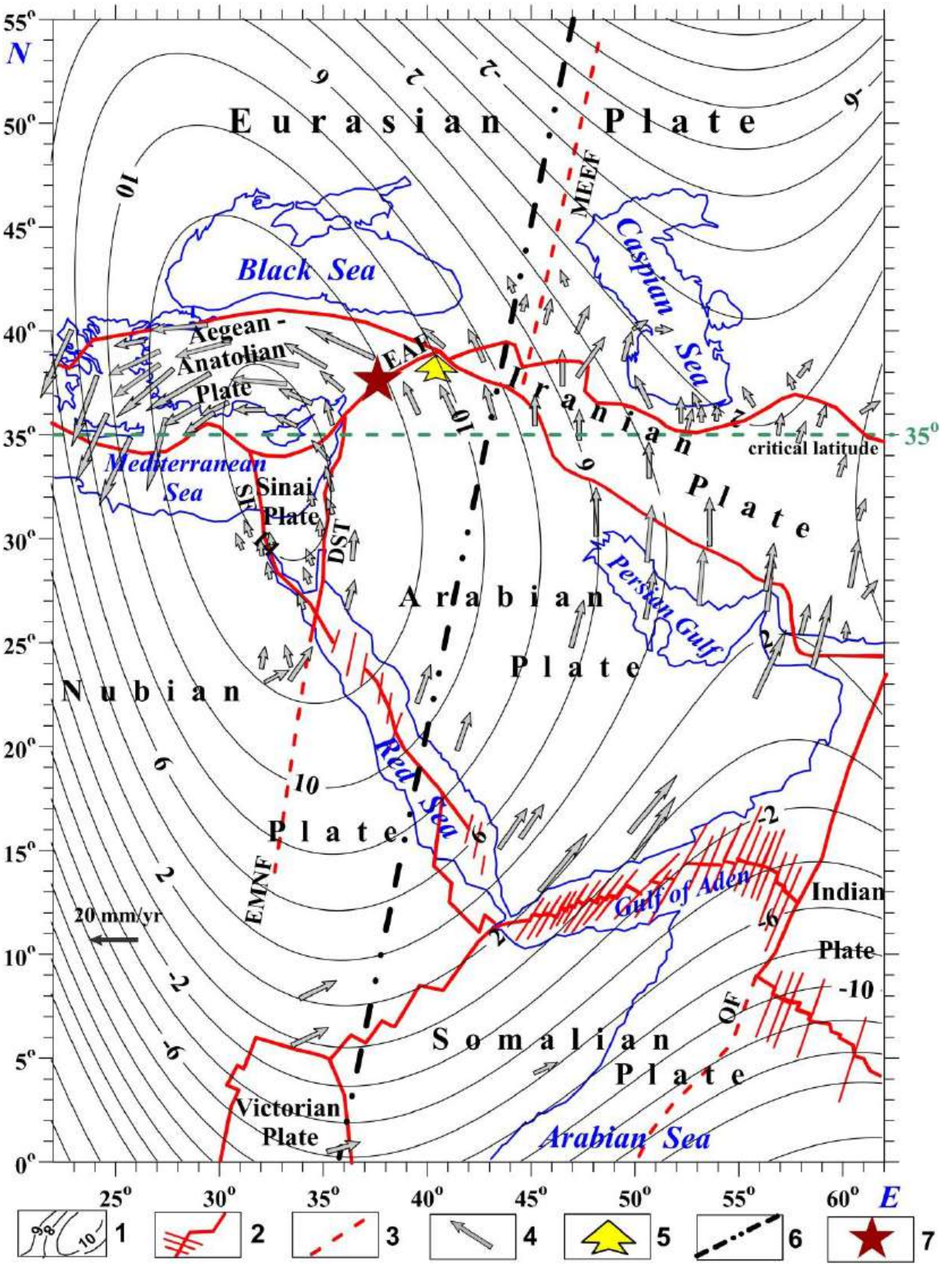

Fig. 1. Geophysical-geodynamic map of the area under study.
(1) isolines of the residual satellite-derived gravity field, (2) main interplate faults, (3) main intraplate faults, (4) GPS vector behavior (mainly after Reilinger et al., 2006; Khorrami et al., 2019; Kadirov et al., 2024), (5) a distal part of the Mesozoic Terrane Belt, (6) averaged position of the Ural-African tectonic step, (7) high-magnitude seismogenic zone in Eastern Turkey (February 06, 2023). SF, Sinai Fault; DST, Dead Sea Transform; MEEF, Main Eastern European Fault; EMNB, Eastern Mediterranean Nubian Belt; OF, Owen Fault

Among the analyzed tectonic-geodynamic sources, we can mention the following works: Le Pichon and Gauler, 1988; Tselentis and Drakopoulos, 1990; Ben-Avraham and Ginzburg, 1990; Scotese, 1991; Alavi, 1994; Ismail-Zade, 1996; Mangino and Priestley, 1998; Ben-Avraham et al., 2002; Nalbant et al., 2002; Stampfli and Borel, 2002; Brunet et al., 2003; Hall et al., 2005; Хаин, 2005; Şengör et al., 2005; Jimenez-Munt et al., 2006; Artyushkov, 2007; Zakariadze et al., 2007; Гулиев и др., 2009; Леонов и др., 2010; Goutorbe et al., 2011; Kaz'min and Verzhbitskii, 2011; Vergés et al., 2011; Eppelbaum and Katz, 2012; Eppelbaum et al., 2014; Moghadam and Stern, 2014; Kadirov et al., 2015; Motaghi et al., 2015; Alizadeh et al., 2016; Abdullayev et al., 2017, 2024; Eppelbaum and Katz, 2017; Mattei et al., 2017, 2019; Eppelbaum et al., 2018; Malekzade, 2018; Le Pichon et al., 2019; Tugend et al., 2019; Bagheri and Gol, 2020; Trifonov et al., 2020; Eppelbaum and Katz, 2021; Eppelbaum et al., 2021, 2024a, 2024b; Rashidi et al., 2022; Mousavi and Ardestani, 2023; Alizadeh et al., 2024; Koshnaw et al., 2024; Nouri et al., 2024; Teknik, 2024; Eppelbaum et al., 2025**.**

The investigation methods are based on integration of geophysical, tectonic-structural, and paleobiogeographical data (including anthropological materials).

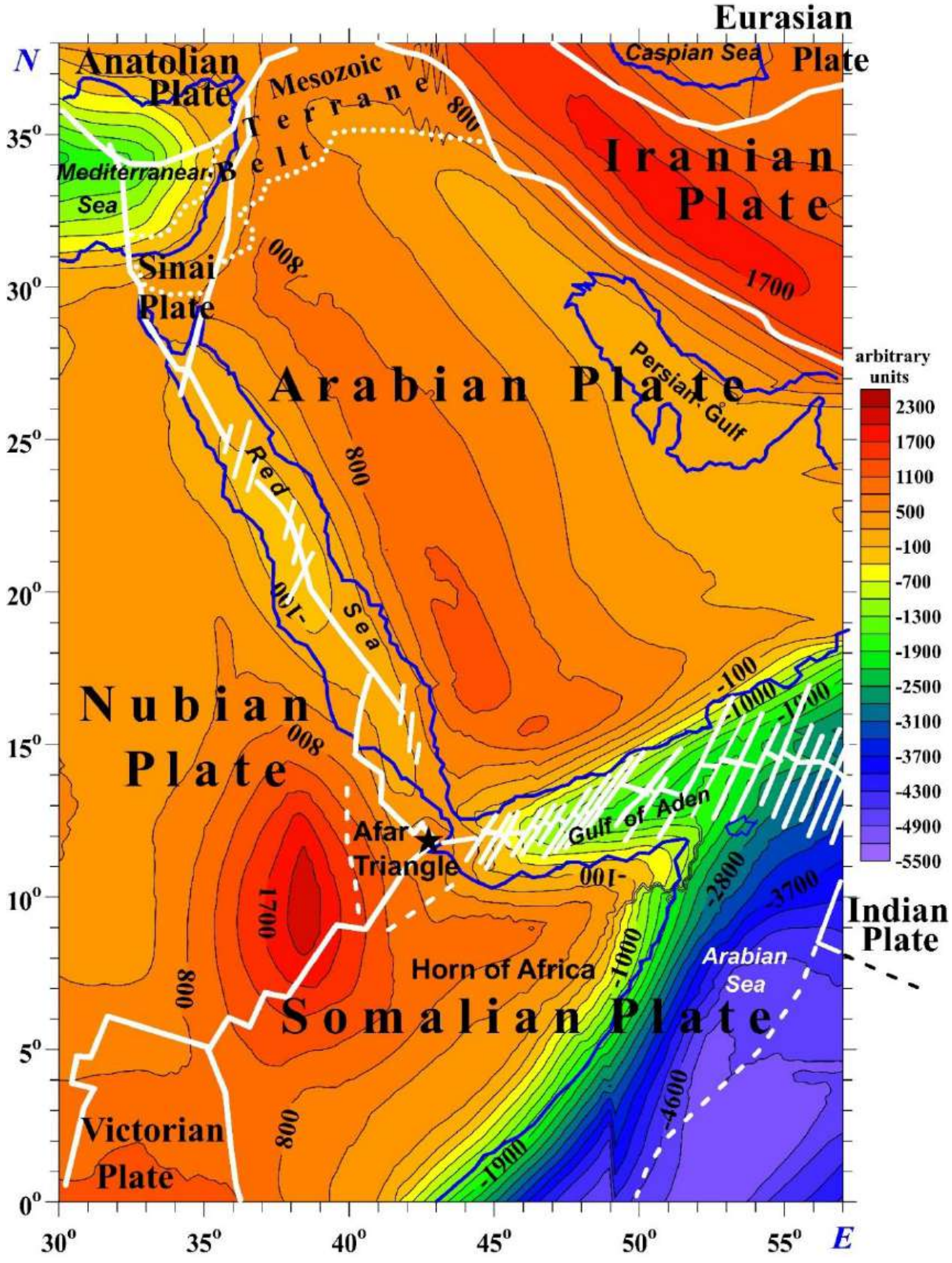

Fig. 2. The map of the satellite-derived gravity field transformed using multidimensional statistical analysis, accompanied by the main plate tectonics units. White lines indicate fault systems, and blue lines show boundaries between the land and marine areas; white points contour the Mesozoic Terrane Belt (supplemented and modified after Eppelbaum et al., 2018).

3. Geodynamic Interaction: A Brief Description

3.1. The Eastern Mediterranean giant mantle rotating structure

The first evidence of a giant mantle rotating counterclockwise structure (MRCS) in the Eastern Mediterranean was provided by Eppelbaum et al. (2021). The center of this structure is located under the island of Cyprus, at the Earth's critical latitude of 35°. The identification of this structure was demonstrated based on: (1) GPS data, (2) satellite gravity data recalculated to the sea/land surface (Figure 1), (3) Bouguer gravity anomalies were observed in the region, (4) geoid anomalies mostly coinciding with the GPS (Figure 3) and gravity anomalies, (5) numerous paleomagnetic data showing mostly counterclockwise rotation of tectonic blocks within the projection of the deep structure onto the surface, (6) primary analysis of paleobiogeographic data, (7) initial analysis of seismotomographic data, (8) tectonic-structural analysis, (9) petrological and mineralogical analysis. In the present paper, the results of the quantitative analysis of the residual satellite gravity anomaly are reinterpreted. Additional essential confirmation is provided by the circular pattern of anomalies of the regional magnetic field ΔZ recalculated to 2.5 km above the sea level (Eppelbaum et al., 2024a).

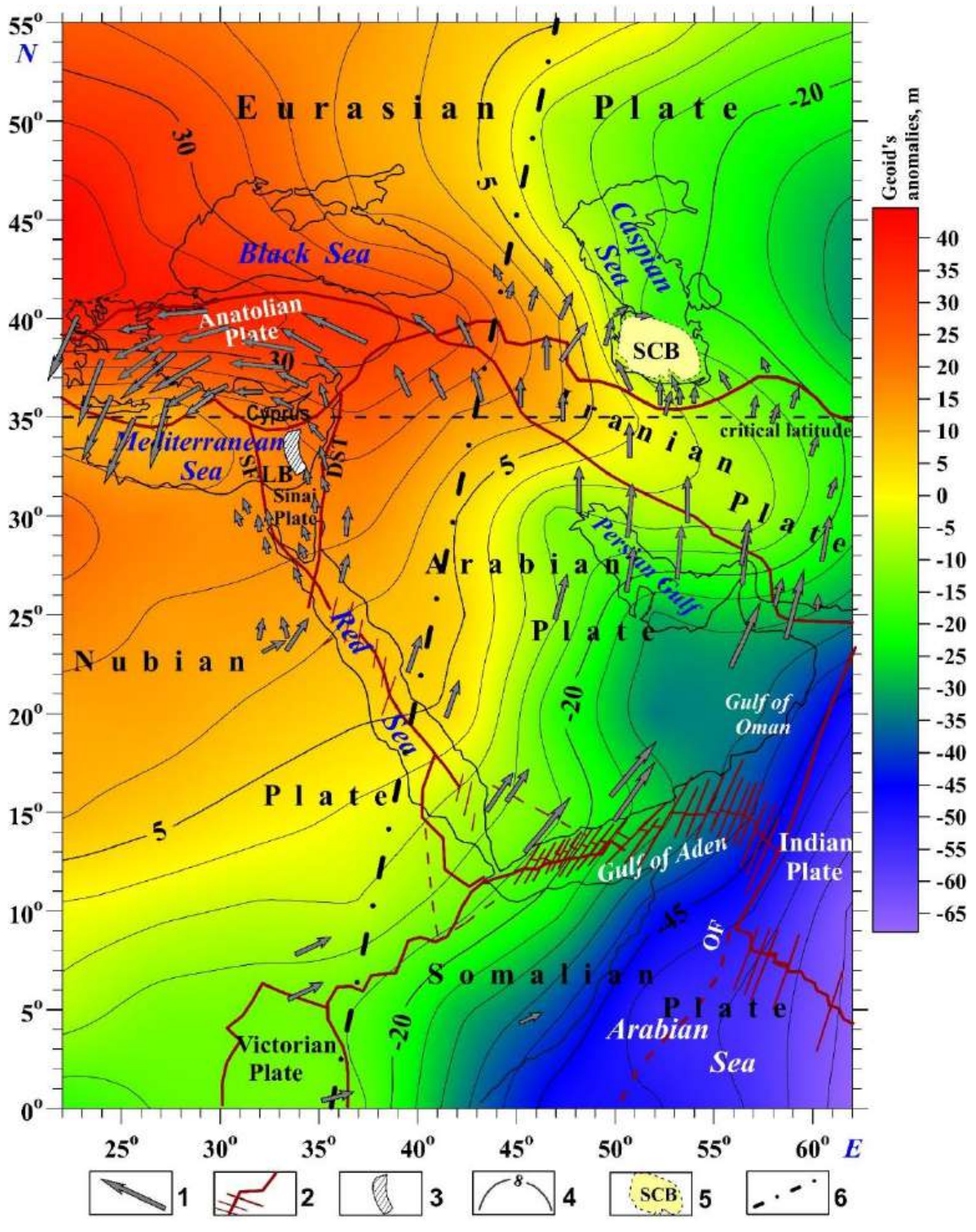

Fig. 3. Geoid map of the African-Arabian-Eurasian region with the tectonic-geodynamic features. (1) GPS vector distribution, (2) faults, (3) block of oceanic crust relating to the Kiama paleomagnetic hyperzone, (4) geoid's isolines, (5) South Caspian Basin, (6) average position of the Ural-African tectonic step. SF, Sinai Fault, DST, Dead Sea Transform, OF, Owen Fault, LB, Levant Basin, SCB, South Caspian Basin.

The synthesis of seismic tomography profiles enabled the construction of a seismic tomographic scheme for locating the deep structure, which aligns well with the results of other geophysical methods. The integrative combination of all these factors makes it unambiguously proven to detect an anomalous deep structure under the Eastern Mediterranean and surrounding regions. The first constructed paleobiogeographic map (Figure 4) clearly shows the displacement of the typical Ethiopian fauna to the northwest counterclockwise. The relationship between the rotating deep structure and the occurrence of rock stress before the catastrophic Turkish earthquakes (M = 7.9 and 7.8) that occurred on 06.02.2023 (the seismogenic zone, as shown in Figure 1, is at the crossing and nearly several significant tectonic and geodynamic features) (Eppelbaum et al., 2024a). Thus, MRCS is the leading profound geodynamic factor in the region under study.

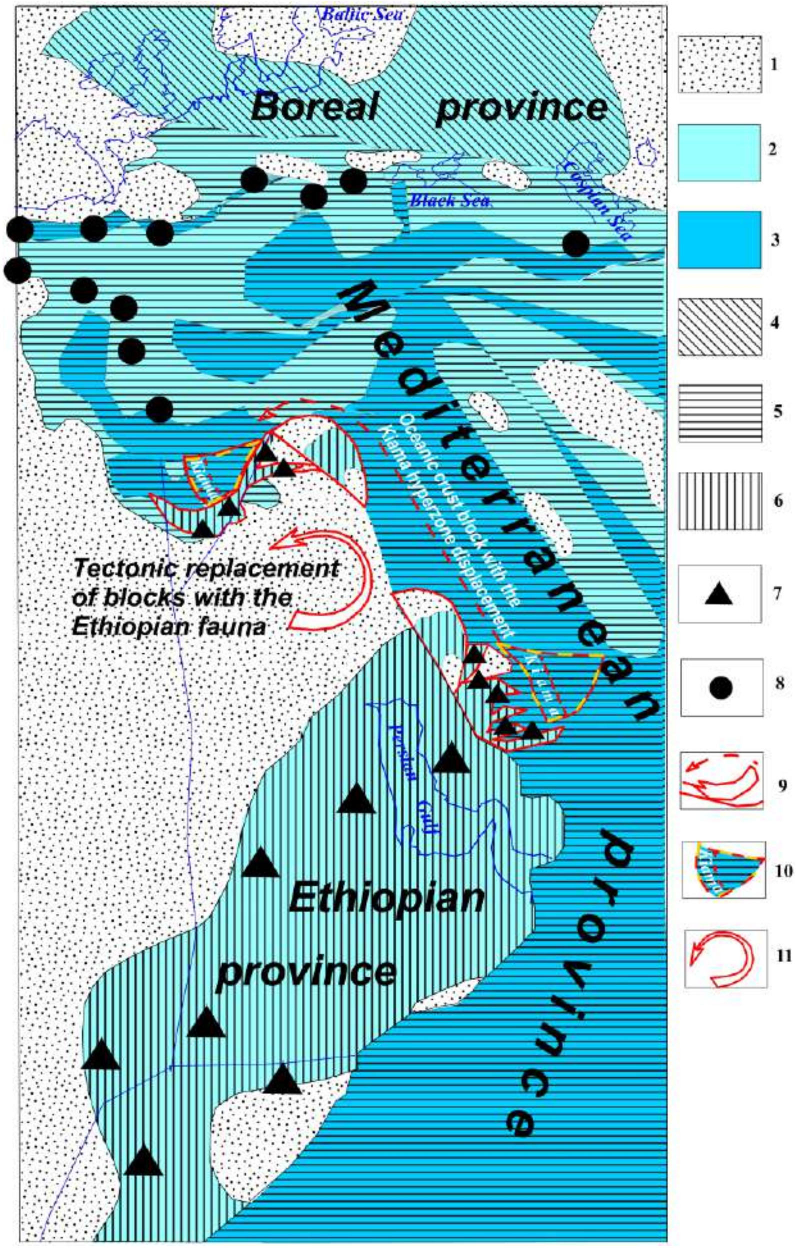

Fig. 4. The **s**chematic Late Jurassic paleobiogeographical map of the transitional region between Eurasia and Gondwana with elements of the subsequent Early Cretaceous geodynamics in the MTB. The blue lines show boundaries between the seas and land. For construction of this map paleobiogeographic data were used from (Arkell, 1956; James and Wynd, 1965; Макридин и др., 1968; Feldman, 1987; Hirsch, 1988; Hirsch and Picard, 1988; Cooper, 1989; Alizadeh et al., 2016; Eppelbaum et al., 2024b) and tectonic-geodynamic data from (Scotese, 1991; Hall et al., 2005; Stampfli and Kozur, 2006; Eppelbaum et al., 2021).

(1) land, (2) continental shields and arcs, (3) oceanic plateaus and rifts, (4) Boreal paleobiogeographic province, (5) Mediterranean paleobiogeographic province, (6) Ethiopian paleobiogeographic province, (7) points with the Ethiopian brachiopods Septirhynchia-Somalirhynchia, (8) location points with the Mediterranean brachiopods *Pygope*, (9) tectonic lines of the discordant paleobiogeographic replacements, (10) block of the oceanic crust with the Kiama hyperzone, (11) counterclockwise rotated tectonic blocks.

3.2. The Iranian lithospheric plate

A new generalized tectonic map of the Iranian lithospheric plate and surrounding regions has been developed (Figure 5). This map reflects the tectonic position of the Central Gondwana and the southern Eurasian plates. The most crucial element here is the boundary between the Iranian and Arabian lithospheric plates, as this collision zone corresponds to the once vast expanse of the Neotethys Ocean that existed in this region. This essential structural element has long been referred to as the Zagros zone. Our regional tectonic studies (Eppelbaum and Katz, 2017) have shown that the Zagros uplift (e.g., Alavi, 1994) is merely the easternmost block of the vast MTB.

The younger Alpine-Himalayan folded-block belt of the transition zone between Gondwana and Eurasia lies to the north of the MTB (formed in the middle of the Early Cretaceous), composed of a complex of continental and oceanic crust with the ancient Kiama paleomagnetic zone (Eppelbaum et al., 2014). The Iranian lithospheric plate is part of this extensive belt and occupies its southern and eastern parts on the map (Figure 5). The structure of this plate is asymmetric. To the southeast of the Caspian Basin meridian, submeridional block structures and belts are developed: Yazd, Tabas, Lut, and Afghanistan blocks. On the border with Kopet Dagh, sublatitudinal structures are concentrated north of these structures: the Central Iranian Massif and the Ala-Dagh and Binalud folded belts (Mattei et al., 2017). Elongated narrow sublatitudinal structures are developed in the south of the Iranian Plate, directly near the border with the Arabian Plate (Figure 5). Here, the plateau of Southern Iran stands out (Motaghi et al., 2015), composed of the Sanandaj-Sirjan zone (SS).

Fig. 5. The tectonic-geodynamic map of the region under study (based on Alavi, 1994; Zakariadze et al., 2007; Moghadam and Stern, 2014; Motaghi et al., 2015; Mattei et al., 2017; Eppelbaum et al., 2018; Malekzade, 2018; Bagheri and Gol, 2020; Trifonov et al., 2020; Eppelbaum et al., 2021, 2024b).

(1) Archean cratons, (2-4) folded belts: (2) Paleo-Mesoproterozoic, (3) Neoproterozoic, (4) Late Paleozoic (Hercynian), (5) Mesozoic Terrane Belt, (6) Alpine-Himalayan orogenic belt, (7) lithospheric plates boundaries, (8) folded belts and massifs boundaries, (9) boundary of the South Caspian Basin. Indexes of the structural zones: AD, Ala Dagh, Af, Afghanistan block, Al, Alborz Mts., BN, Binalud Mts., CI, Central Iran massif, EAC, Eastern Arabian craton, EI, Eastern Iranian orogen, EP-AT, Eastern Pontides-Adjaro-Trialet zone, G, Ga'ara belt, GC, Greater Caucasian belt, HR, Hall-Rutbah massif, KD, Kopet-Dagh Mts., L, Lut block, LC, Lesser Caucasus, Ma, Makran accretional zone, SCB, South Caspian Basin, SS, Sanandaj-Sirjan zone, T, Tabas block, TCM, Transcaucasian Massif, Tl, Talysh zone, UD, Urumieh-Dochtar Magmatic Arc, W, Widyah belt, Y, Yazd belt, Zg, Zagros Folded zone

To the east of this subduction zone, the Macran accretionary obduction zone, composed of the Mesozoic ophiolites, is developed. Geotectonically, these elongated belts mark the most intense zone, corresponding to the once vast absorbed space of the Neotethys Ocean. The northern boundary of the Iranian lithospheric plate is less contrasting. It reflects the process of less significant phenomena associated with tectonic collision, an important characteristic of terrane tectonics. In the west of the Iranian Plate, its elongated belts discordantly touch the structures of the Caucasian belt (Figure 5). According to the satellite-derived gravity map (Figure 6), the Eurasian Plate is sharply separated from the Iranian Plate by increased values of the gravity field within a vast belt stretching from the Lesser Caucasus to the Kopet-Dagh. In the western part, between the Black Sea and Caspian basins to the north of the Lesser Caucasus back island arc, the submerged belt of the Transcaucasian massif is developed with marks with reduced field values, and to the north of it – the folded structure of the Greater Caucasus with sharply increased marks of the gravity field values. Thus, the Eurasian Plate in the study area is characterized by sharp indicators of changes in gravity compared to the adjacent lithospheric plates.

The ΔZ magnetic map (Figure 7) clearly shows the dominant striped nature of the magnetic zones distribution, which partially levels out the structural plan of the region (Figure 5). Nevertheless, each of the three lithospheric plates (Eurasian, Iranian, and Arabian) has a specific distribution of magnetization indices in the form (topology) and the ΔZ amplitudes.

The Eurasian Plate differs sharply from the Iranian and Arabian plates in its striped spatial nature and in the contrast and intensity of the magnetic amplitudes. Unlike the gravity distribution stripes, the magnetic field stripes are not directly associated with the structural belts or stable zones that pass near them. Nevertheless, it should be noted that the ΔZ amplitudes differ within the western part of the Eurasian Plate, where the folded belts of the Caucasus are developed, from the eastern – Transcaspian part of the plate, where the epi-Hercynian stable plateau of the Turanian belt dominates.

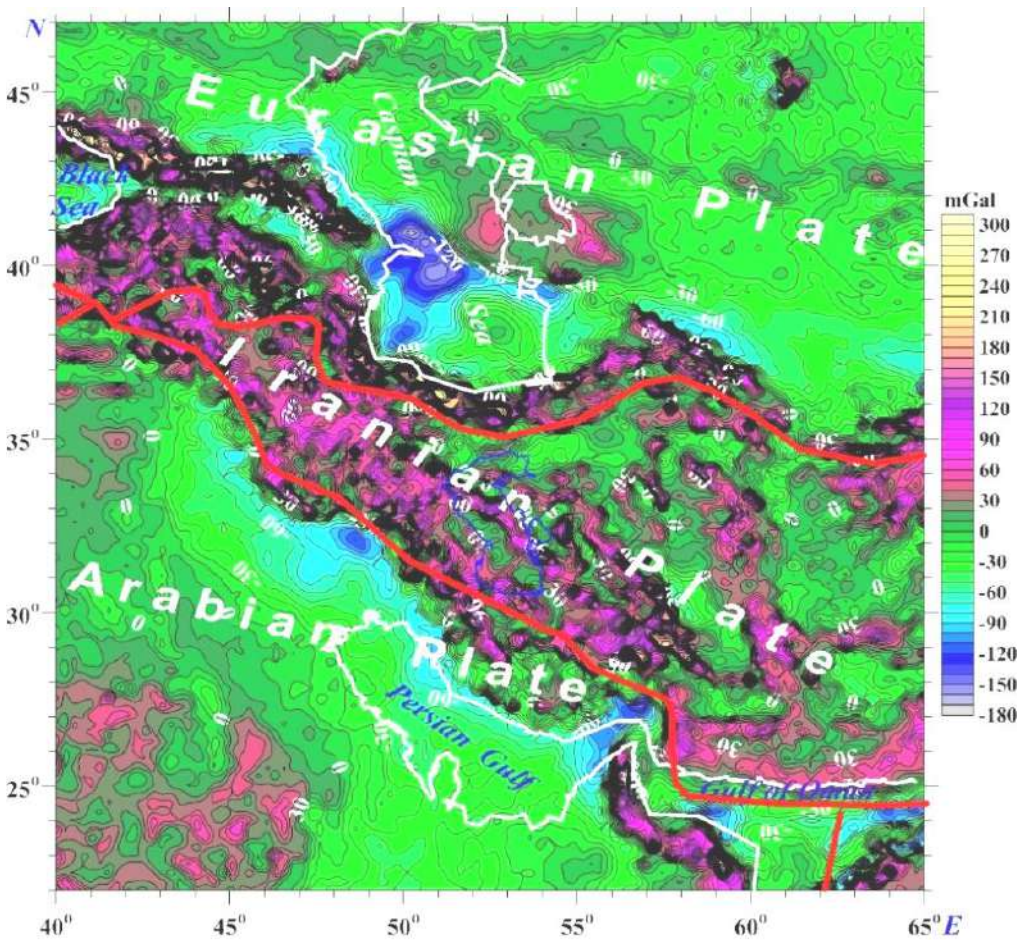

Fig. 6. Gravity satellite-derived map with the main tectonic elements. The bold red lines designate the plates' boundaries (based on Alavi, 1994; Zakariadze et al., 2007; Moghadam and Stern, 2014; Motaghi et al., 2015; Mattei et al., 2017; Eppelbaum et al., 2018; Malekzade, 2018; Bagheri and Gol, 2020; Trifonov et al., 2020; Eppelbaum et al., 2021, 2024b), and the white lines – the land-sea boundaries.

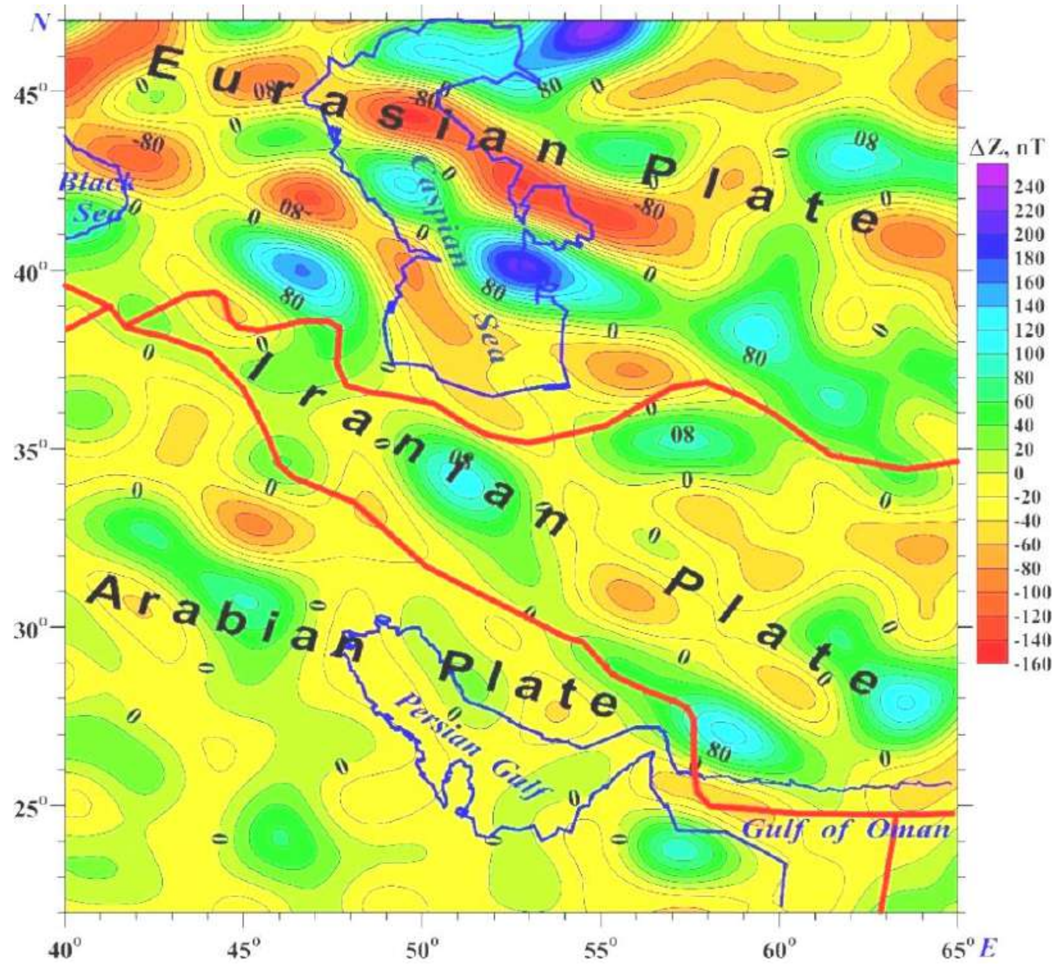

Fig. 7. Δ*Z* magnetic map (recalculated to 2.5 km above the Earth's surface) with the main tectonic elements. The bold red lines designate the plates' boundaries (based on Alavi, 1994; Zakariadze et al., 2007; Moghadam and Stern, 2014; Motaghi et al., 2015; Mattei et al., 2017; Eppelbaum et al., 2018; Malekzade, 2018; Bagheri and Gol, 2020; Trifonov et al., 2020; Eppelbaum et al., 2021, 2024b), and the blue lines – the land-sea boundaries

The Iranian lithospheric plate is characterized by a strident discordance of the junction of magnetization zones in the northern boundary (with the Eurasian Plate) and in the south (with the Arabian Plate) regarding the magnetic pattern. This peculiarity is of fundamental importance since both boundaries under consideration are zones of absorption for the Neotethys oceanic structures between Eurasia and Gondwana. On the other hand, the western part of the Iranian Plate differs from its eastern part by the Δ*Z* pattern due to tectonic and geodynamic differences in the region and the lithospheric plate itself.

The Arabian lithospheric plate differs significantly from the Eurasian and Iranian plates in terms of its high homogeneity and stability. The banded nature of the distribution of magnetic field zones is practically not manifested here, and the Δ*Z* amplitude fluctuates near the zero line.

Regional topography data also proved highly informative and productive in structural and geodynamic terms (Figure 8). A clear contrast was revealed at the boundary of the Arabian and Iranian lithospheric plates – the central subduction zone of the Neotethys Ocean. In addition, the topography map indicates the boundary of the northern Iranian Plate.

3.3. South Caspian Basin

The comprehensive seismic data suggest a fundamental compositional difference between the crust of the South Caspian Basin (SCB) and the surrounding region (Mangino and Priestley, 1998). The SCB has been sufficiently studied structurally and geodynamically based on drilling data, seismic profiling, gravity, thermal, magnetic, and paleomagnetic data, and remote sensing (Гулиев и др., 2009; Kadirov et al., 2015, 2024; Abdullayev et al., 2017, 2024; Alizadeh et al., 2024).

As a result, a structural-tectonic map was compiled (Artyushkov, 2007; Abdullayev et al., 2017), where the age and geodynamic type of various SCB zones were clearly defined. In this paper, this map was generally used as a basis (Figure 9) but slightly modified by incorporating data from adjacent areas of Turkmenistan and the eastern SCB area (Леонов и др., 2010; Nouri et al., 2024) and the latest geodynamic data based on GPS analysis (Kadirov et al., 2024). The presented structural-tectonic map (Figure 9) effectively reflects the deep structure of the SCB and its adjacent areas. According to the distribution of the thickness of the sedimentary cover, the difference between the SCB and the North Caspian Basin, which belong to tectonic zones of different ages, is sharply manifested. The first is part of the Alpine-Himalayan belt, and the second is the epi-Hercynian Scythian-Turanian belt. The SCB basin is sharply separated from the Hercynides and the adjacent Alpine structures by a system of deep faults. All this is emphasized by the anomalously high thickness of the SCB sedimentary layer, reaching a maximum (28.5 km) near the Absheron ridge. It is the boundary structure between the Hercynides and the Alpines (Хаин, 2005). The structural map indicates that the arcuately curved zone of high sedimentary rock thicknesses suggests a thrust of the space of its highest thicknesses under the Absheron Ridge fault system. The fault-displaced Jurassic trough system (Artyushkov, 2007; Abdullayev et al., 2017) confirms this tectonic-geodynamic model. The displaced southeastern part of the trough is not so contrasting geodynamically, and the thickness of the sedimentary layer here is 8-10 km less than in the north.

The eastern part of the SCB is characterized by sharply reduced sedimentary layer thicknesses, up to 8 km near the Caspian coastline. According to the distribution of isopachs, the basin itself forms a plateau, which is why it was called TST—Turkmenian Structural Terrace. Near the coastline (Figure 9), this terrace gives way to the GOS—Gorgan' dag—Okarem Step scarp (Леонов и др., 2010).

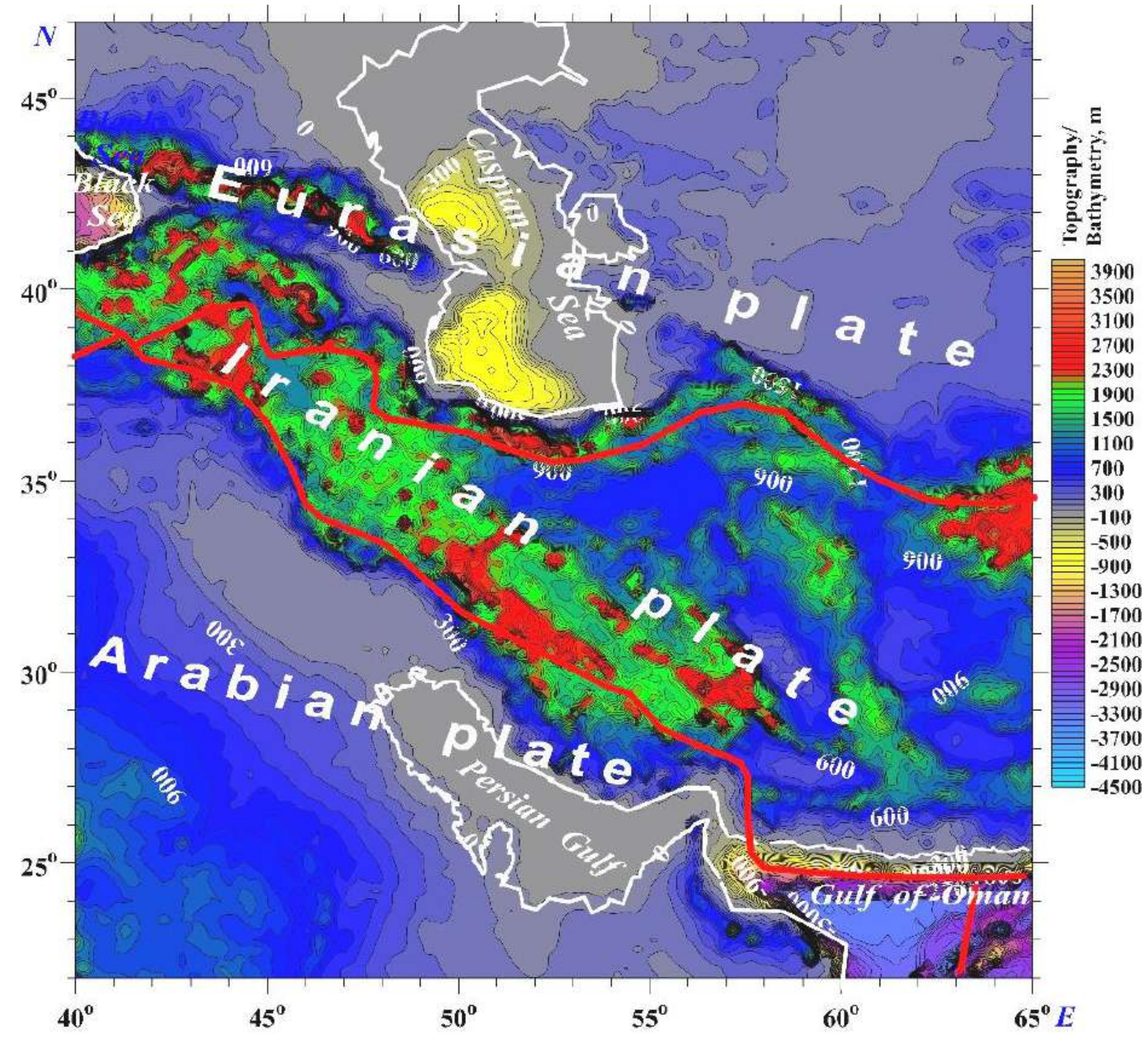

Fig. 8. Topography-bathymetric map with the main tectonic elements. The bold red lines designate the plates' boundaries (based on Alavi, 1994; Zakariadze et al., 2007; Moghadam and Stern, 2014; Motaghi et al., 2015; Mattei et al., 2017; Eppelbaum et al., 2018; Malekzade, 2018; Bagheri and Gol, 2020; Trifonov et al., 2020; Eppelbaum et al., 2021, 2024b), and the white lines – the land-sea boundaries

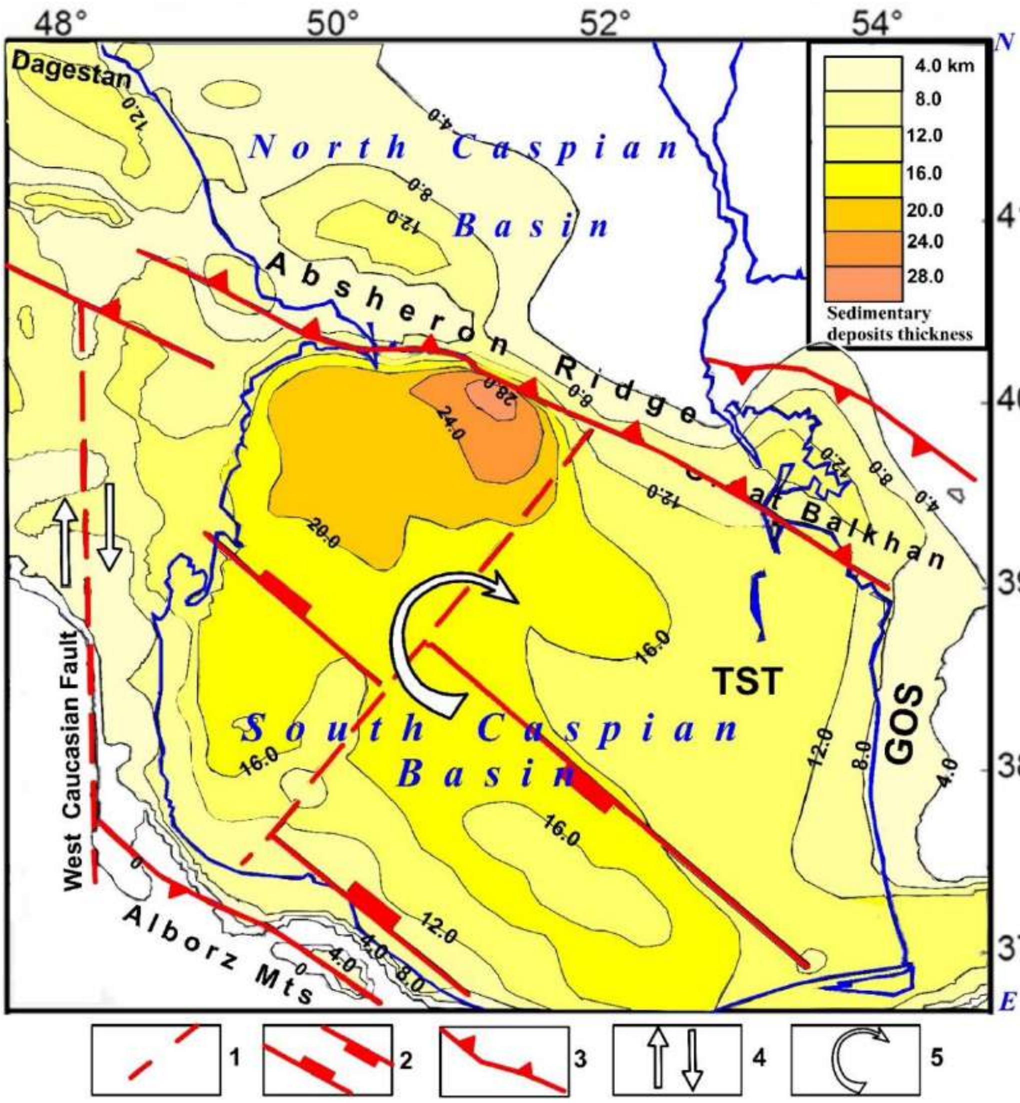

Fig. 9. Structural-geodynamic map of the SCB (after Леонов и др., 2010; Abdullayev et al., 2017; Trifonov et al., 2020; Abdullayev et al., 2024; Kadirov et al., 2024; Nouri et al., 2024).
(1) shear zones, (2) Jurassic rift zone, (3) thrust and underthrust zones, (4) direction of strike-slip displacement, (5) clockwise rotation of blocks.
Al, Alborz Mts, GC, Greater Caucasian belt, GOS, Gorgan'dag – Okerem Step, KD, Kopet-Dagh Mts, LC, Lesser Caucasus, TCM, Transcaucasian Massif, Tl, Talysh zone, TST, Turkmenian Structural Terrace. The black lines show boundaries between the land and sea

The distribution of the thickness of the sedimentary cover and fault systems indicates the geodynamic nature that created the complex structure of the SCB. The data suggests a clockwise rotation of the western part of this sedimentary basin. A more detailed analysis of this cartographically recorded phenomenon requires geophysical materials since seismic profiling and GPS analyses have been well-studied in this area (Kadirov et al., 2024).

The data from the gravity anomaly studies were used for the structural-geodynamic analysis of the SCB. First, the Bouguer gravity anomaly map is considered (Figure 10). It indicates the difference between the SCB and the adjacent structures of the Alpine-Himalayan belt and the epi-Hercynian Turanian belt. The Bouguer anomalies within the Alpine belt are characterized mainly by negative values (Kadirov and Gadirov, 2014; Kadirov et al., 2023).

At the same time, shallow values from -120 to -200 mGal are concentrated on the boundary of the Eurasian and Iranian lithospheric plates. Somewhat less extreme (from -100 to -120) are the negative Bouguer anomalies on the boundary between the Alpines of the Absheron Ridge and the Hercynides of the Turanian belt. The maximum values of the Bouguer anomalies (from about +40 to values over +60 mGal) are widely developed in the Kara-Bugaz arch of the Hercynides. In the Alpines, anomalies of this kind are created only to the west of the SCB – near the fault zone on the border with the Talysh uplift (e.g., Кадиров, 2000).

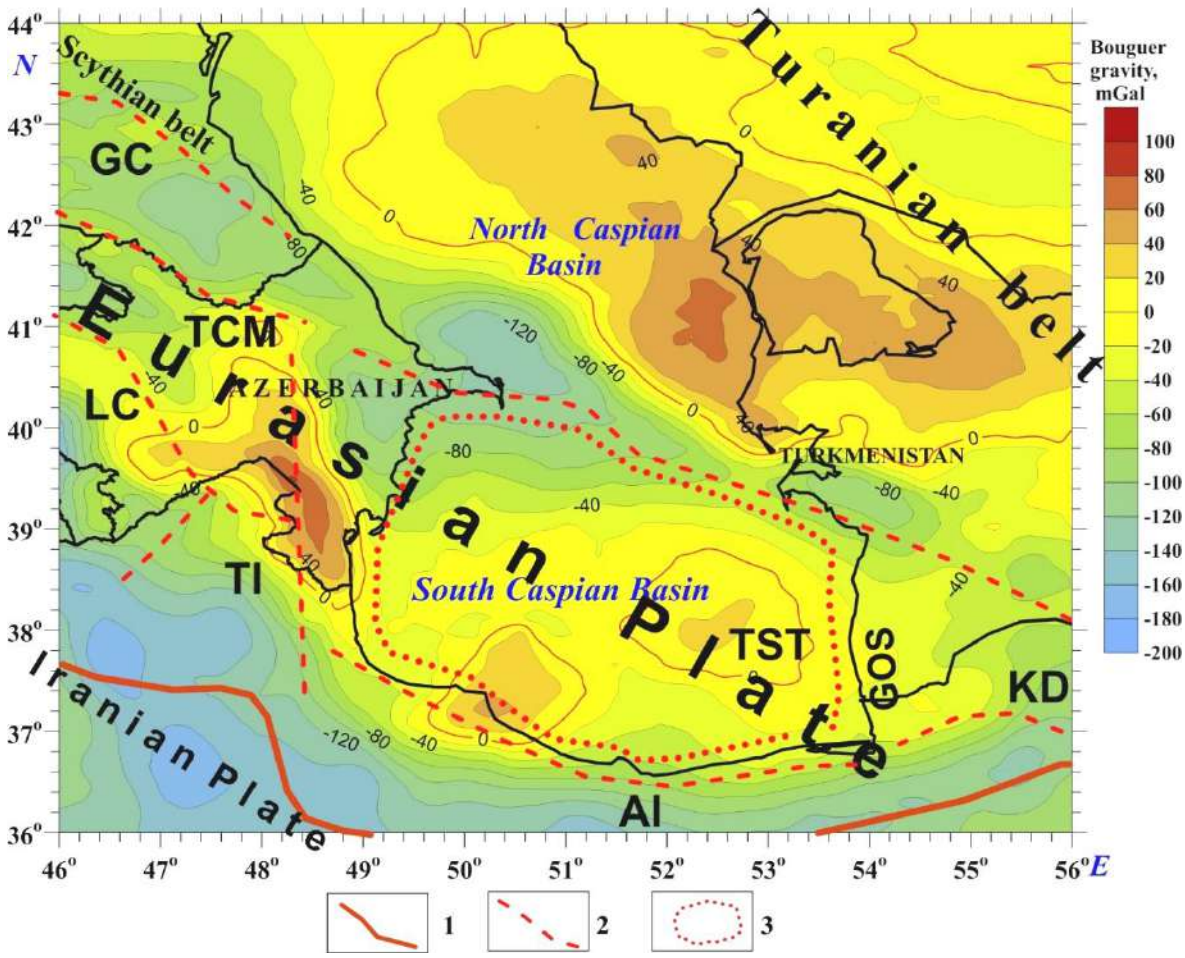

Fig. 10. A generalized Bouguer gravity map for the SCB and surrounding regions with the tectonic features (supplemented after Кадиров, 2000; Kadirov et al., 2023). (1) interplate faults, (2) intraplate faults, (3) SCB contour. Al, Alborz Mts, GC, Greater Caucasian belt, GOS, Gorgan'dag – Okerem Step, KD, Kopet-Dagh Mts, LC, Lesser Caucasus, TCM, Transcaucasian Massif, Tl, Talysh zone, TST, Turkmenian Structural Terrace. The black lines show the boundaries between the land and sea

The SCB differs from the adjacent Alpines by transitional values of the Bouguer anomalies, about -50 to +20 mGal. At the same time, the eastern section with reduced thicknesses of the sedimentary layer – TST (Turkmenian Structural Terrace) – is generally characterized by the most stable regime of Bouguer anomalies with values near the zero line. To the east of the transition of the Caspian Sea to the Kopet-Dag Alpine system, the Bouguer anomalies record the GOS tectonic scarp (Figure 10).

The calculated ΔZ magnetic map on 2.5 km above the sea level implies an expressed correlation between the significant negative magnetic anomaly and the location of most mud volcanoes in the South Caspian Basin (Eppelbaum, 2024). A preliminary analysis of this anomaly reveals its profound nature (extending dozens of kilometers). This indicates that mud volcanism is associated with the deep processes in the Earth's crust and lithosphere (possibly with the Iranian Plate pressure).

Notably, the geodynamic clockwise rotation of the SCB can be detected in the bathymetry map (Figure 11) and the map of the strike angles (Figure 12) calculated from the satellite-derived gravity data using the methodology presented in Klokočník et al. (2014).

3.4. Geodynamic aspects of the ancient hominin dispersal from Eastern Africa to the Levant and South Caspian Basin boundaries

The modern geodynamics of the Middle East and the Caucasus (within the region under study) is significantly influenced by various processes from past geological periods. In the late Cenozoic era, they determined the settlement process of the most ancient hominids (Figure 13). The presence of the Caucasian and Levant areas isolated from each other, along with the remote East African region, clearly links the confinement of the habitats of the most ancient hominids with the basin factor and with active geodynamics, which influenced the development of optimal landscapes and ecosystems in these areas (Eppelbaum and Katz, 2021). The paleogeographic map indicates that the Levant and Caucasian regions, where the most ancient hominids are found, are closely associated with the vast Neotethys-Mediterranean and Paratethys basins. The advance of ancient hominids from the distant East African range mostly coincided with the completion of the Akchagylian hydrospheric maximum (Eppelbaum and Katz, 2021, 2024), which manifested itself to the greatest extent in both the Levant and Caspian basins.

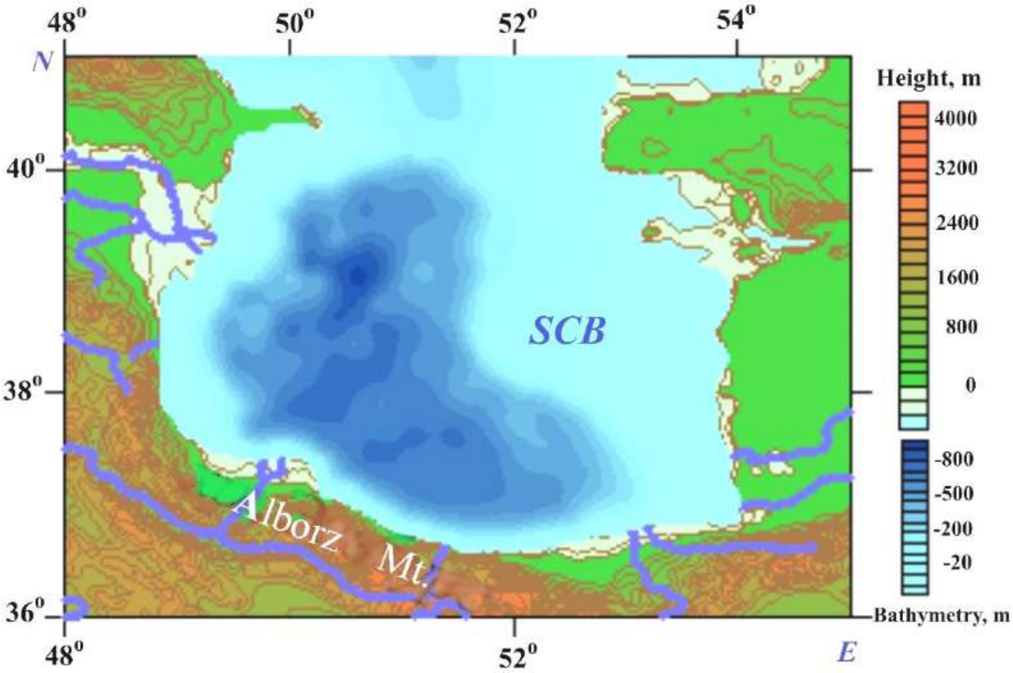

Fig. 11. Bathymetric map of the South Caspian Basin (SCB) (modified after the Caucasian Database)

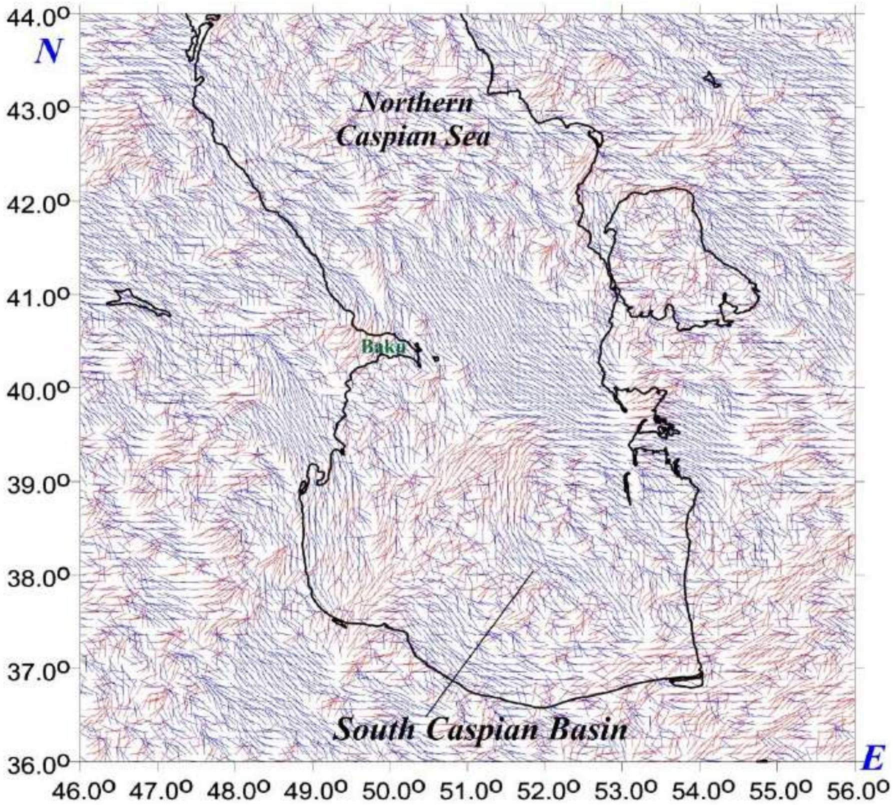

Fig. 12. Map of the strike angles (the main direction of the tensor Γ (Klokočník et al., 2014)) (revised after Kadirov et al., 2023)

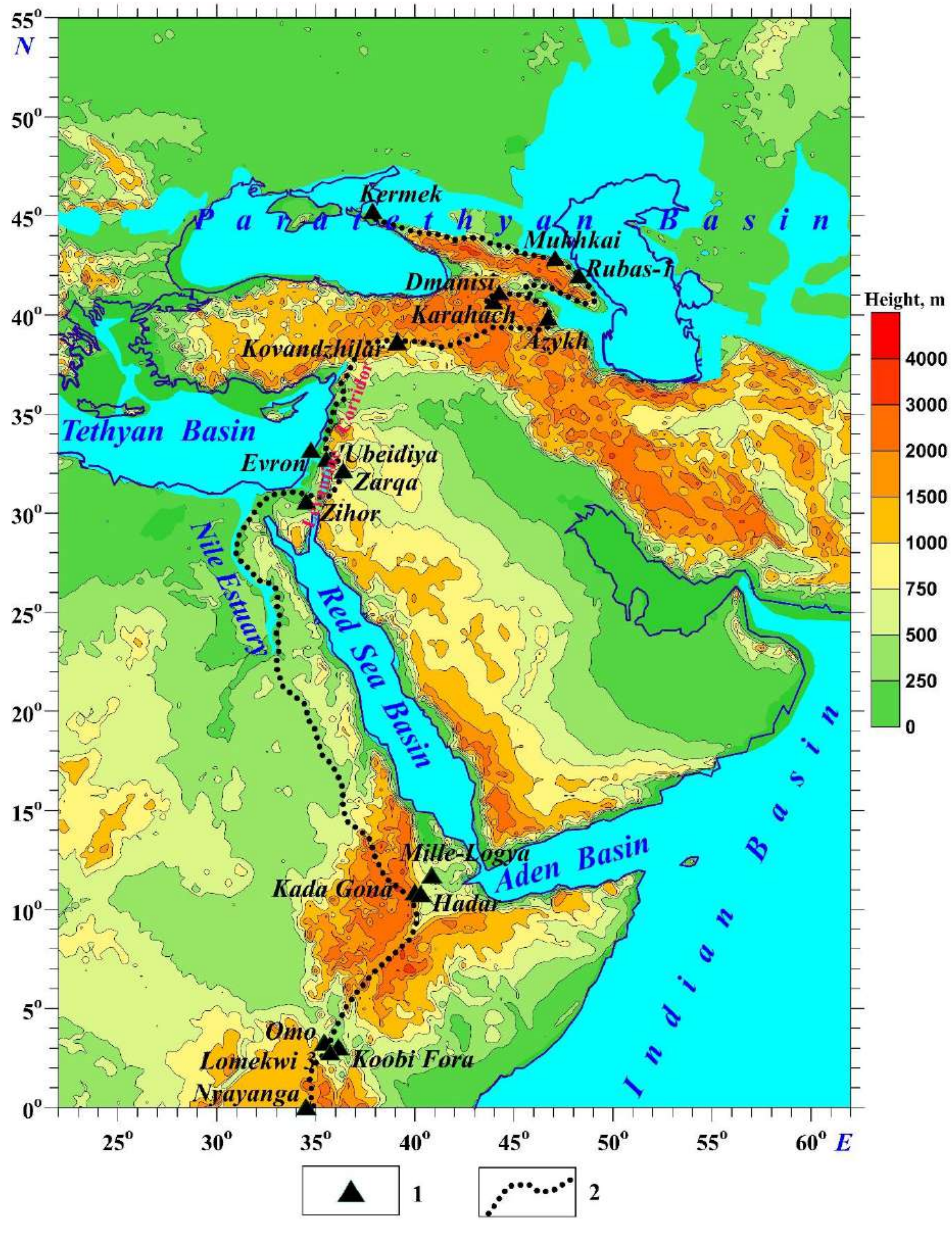

Fig. 13. Paleogeographic-anthropological map of the ancient man dispersal (based on the modern topography map) from Eastern Africa to the Levantine Corridor and the South Caspian Basin and Caucasus.

(1) ancient hominin sites of 3.3 – 1.85 Ma, (2) reconstructed ancient hominin's way from Africa to Eurasia (revised and supplemented after Eppelbaum and Katz, 2024).

The age (in Ma) of anthropological sites is taken from: Nyayanga (3.03-2.58, Plummer et al., 2023), Lomekwi (3.3, Harmand et al., 2015), Koobi Fora (2.1-1.6, Grine et al., 2019), Omo (2.4-2.3, McDougall et al., 2008), Hadar (2.4-2.3, Johanson, 2017), Kada Gona (2.6-2.0, Semaw et al., 2005), Mille-Logia (2.42-2.1, Alemseged et al., 2020), Zihor (1.95-1.78, Larrasoaña et al., 2020), Zarqa (2.5-1.95, Scardia et al., 2019), 'Ubeidiya (1.6-2.6, Eppelbaum and Katz, 2024), Kovandzhilar (2.0-1.7, Ожерельев и др., 2020), Azykh (2.1-1.9, Veliyev et al., 2010), Karahach (1.85-1.78, Беляева, 2020), Dmanisi (1.85-1.77, Lordkipanidze et al., 2007), Rubas-1 (2.2-2.3, Деревянко и др., 2015), Mukhkai (2.1-1.77, Амирханов, 2020), Kermek (2.1-1.95, Щелинский, 2021).

The hydrospheric phenomena of these two basins were associated with their location near the Earth's critical latitude of 35°, which separated the zones of conjugate deformation of the ellipsoid of rotation and the development of the extended estuaries of the Volga and Nile rivers. On the other hand, the South Caspian and Levant basins (as shown in Figure 1) were located near different zones of the deep mantle rotating structure, whose active geodynamics influenced the troughs of the South Caspian, Levant, and related structures.

4. Discussion

The simplified geodynamic scheme (Figure 14) indicates the complex interaction of the MRCS, Iranian Plate, and SCB. The essence of this scheme is to display that the counterclockwise MRCS rotation caused a northward displacement of the complex-constructed western part of the Iranian Plate, which, in turn, caused the SCB clockwise rotation. An essential factor is the decrease of the corresponding rotation and displacement velocities. In the MRCS contour and its interaction with the Iranian Plate, the GPS velocity consists of 10-20 mm/year (Figure 1), in the western part of the Iranian Plate, this northward velocity consists of 8-14 mm/year, and finally, SCB clockwise rotation is about 3-5 mm/year (Figure 1). It can be explained by the simple physical law of decreasing movement impulse by transferring from one target to another. This ensemble interaction includes an influence of the Earth's critical northern latitude of 35° and the Ural-African tectonic step (zone between the positive and negative geoid anomalies) (Figure 3).

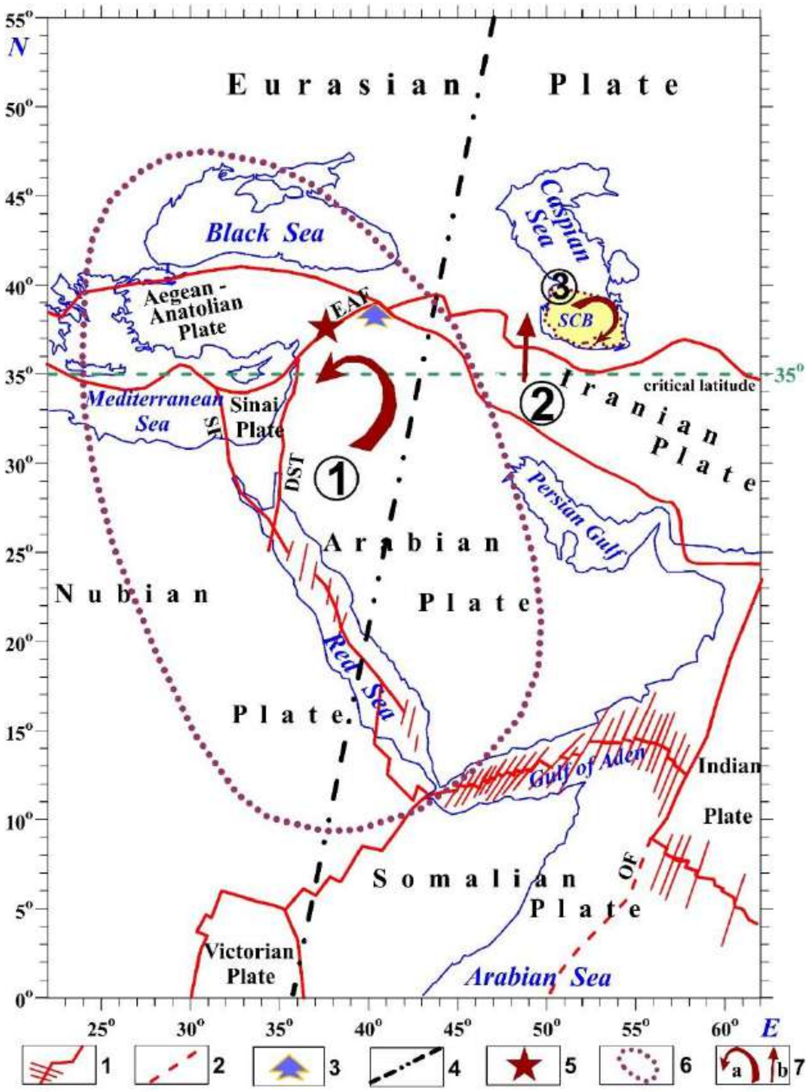

Fig. 14. Simplified geodynamic scheme of the area under study.
(1) main interplate faults, (2) main intraplate faults, (3) a distal part of the Mesozoic Terrane Belt, (4) averaged position of the Ural-African tectonic step, (5) high-magnitude seismogenic zone in Eastern Turkey (February 06, 2023), (6) average projection of the mantle rotating counterclockwise structure, (7) tectonic movements: (a) rotation, (b) north and north-northeast displacement. Numbers in circles: 1 – mantle rotating counterclockwise structure, 2 – Iranian Plate, 3 – South Caspian Basin. SCB, South Caspian Basin, SF, Sinai Fault; DST, Dead Sea Transform; OF, Owen Fault

The geophysical evidence to discover the oceanic crust in the Easternmost Mediterranean is based on a comprehensive analysis of seismic, gravitational, magnetic, and thermal data (Ben-Avraham et al., 2002). The most significant evidence was the absence of a granite crustal layer in the Easternmost Mediterranean (approximately 40-80 km from the Israeli coast), a very low thermal regime (15-30 mW/m^2), and crustal (basaltic) blocks with reverse magnetization. It should be noted that seismic, magnetic, and gravity data analysis and advanced 3D magnetic-gravity modeling were carried out simultaneously on three intersecting profiles. This work laid the foundations for the later discovery of the oldest block of oceanic crust (see Kiama block location in Figures 1 and 2).

From the conventional point of view, the age of oceanic crust blocks should not exceed 160-180 million years (Wilson, 1966). Constant subduction explained this regularity, lowering oceanic crust blocks into the upper mantle with subsequent absorption of these blocks by the hot mantle. However, this general pattern, given the complexity of the structure of the Earth's crust, is not always observed. Several authors (e.g., Stampfli and Borel, 2002; Le Pichon et al., 2019; Tugend et al., 2019) earlier postulated the Permian age of the Eastern Mediterranean oceanic crust (one of the most significant factors is the very low heat flow in the region under study). A comprehensive geological-geophysical analysis conducted by Eppelbaum et al. (2014); Eppelbaum and Katz, 2015) showed that the identified block of oceanic crust (Figure 1) corresponds to the Kiama paleomagnetic hyperzone (~255-308 Ma, Upper-Lower Permian and Upper Carboniferous). We believe this oceanic block formed no more than 285 million years ago (Permian) north of the modern Persian Gulf. The depth of this block is 10-11 km, and its total volume is about 120,000 km^3 (Eppelbaum et al., 2023). It was then displaced along the transform faults to its current position, which has remained in place for more than 120 million years. Even the geometric location of this block within the Easternmost Mediterranean indicates its discordant position with the surrounding structures – the Anatolian Plate and the Mesozoic Terrane Belt. However, why was this block of oceanic crust not subducted? We proposed that the subduction is disallowed by the MRCS influence, whose counterclockwise rotation prevented this block from sinking into the upper mantle and preserved it until today.

Special attention is drawn to the anomalous biogeographic indicators (e.g., Arkell, 1956; James and Wynd, 1965; Макридин и др., 1968; Ализаде, 1972; Ализаде и др., 1983; Feldman, 1987; Hirsch, 1988; Cooper, 1989; Kazmer, 1993; Hall et al., 2005); particularly shell remains of giant brachiopods **Septirhynchia–Somalirhynchia** (see review in Eppelbaum et al., 2021) and Mediterranean brachiopods *Pygope* (see review in Eppelbaum et al., 2024b). Based on the analysis of numerous sources, three paleobiogeographical provinces were selected (Figure 4): (1) Boreal (Eurasian shelf), (2) Mediterranean (Mediterranean Basin), and (3) Ethiopian (Eastern Africa and Southern Arabia). The constructed paleobiogeographical map (Figure 4) shows the phenomenon (indicated by the red arrow rotating counterclockwise) of the geodynamic transfer of tectonic blocks with the remains of the Ethiopian fauna from the present position of the Persian Gulf to the Levant up to the Egyptian Eastern Desert. This fact demonstrates the counterclockwise movement of the eastern and central parts of near-surface projections of the anomalous deep structure in the Jurassic and Early Cretaceous periods.

Thus, the foreland sediments of Northern Arabia and Eastern Nubia are tectonically discordantly connected to the allochthonous Mesozoic Terrane Belt, which rotated counterclockwise in the direction of the paleocontinent Gondwana. This geodynamic feature makes it possible for the first time to explain the uniqueness of the biogeographically anomalous zone of terrane block attachment to the Gondwana paleocontinent in the Levantine phase of tectonic activity (Eppelbaum and Katz, 2015). To the north of this belt, within the marginal oceanic zone (along transform arc faults), an allochthonous block with the Kiama paleomagnetic hyperzone moved west to the current Levantine basin (Figure 4).

The multistatistical map transformed from the satellite-derived gravity field (Figure 2) highlights the critical role of the applied methodology for identifying the critical properties of deep regional geodynamics. The marginal plates of the northern part of Central Gondwana – Iranian, Sinai, and Aegean-Anatolian – are associated with collisional geodynamics. Here, a thick eastern (Arabian-Iranian) sector is developed with a complete absorption of the Neotethys oceanic crust with thickening of the crust and mantle lithosphere in the subduction zone (Vergés et al., 2011; Teknik et al., 2019; Corchete, 2025). In the western (Aegean-Anatolian-Sinai) sector, there is a zone of incomplete subduction with anomalously low values of the crustal and mantle lithosphere thicknesses, which is demonstrated both by the drop in the values in Figure 2 and by seismic data (e.g., Ben Avraham et al., 2002; Jimenes-Munt et al., 2006). Between these two zones, there is a protrusion of the Mesozoic Terrane Belt, penetrating the zone of wedging out of the Alpine associations of the Anatolian-Aegean and Iranian plates and manifesting itself in anomalously high seismicity caused by the rotational geodynamics of the MRCS (Eppelbaum et al., 2024a). A completely different type of geodynamics is developed within Central Gondwana and its eastern segment on the boundary with the Indian Plate. Here, according to the multistatistical analysis (Figure 2), the classical structures of spreading geodynamics are recorded – a triple junction with the formation of the Arabian, Nubian, and Somalian plates with an increase in the thickness of the mantle lithosphere (Eppelbaum and Katz, 2017; Eppelbaum et al., 2018, 2021) in the zones of ascending deep thermal inflow. The rift zones of the Red Sea and the Gulf of Aden themselves are characterized by reduced values of both the scale indicators in Figure 2 and the thickness of the crust and mantle lithosphere, which is due to the rotational processes of deep geodynamics (Eppelbaum et al., 2021).

Geophysical and hypsometric data (Figures 6-8) supported the analysis of tectonic-structural features of the studied region (see tectonic map in Figure 5). First, it is necessary to consider the satellite-derived gravity map recalculated to the Earth's surface (Figure 6). According to the presented data, we have revealed that the Iranian lithospheric plate manifests itself as an independent, geodynamically most stressed structure. This fact is prominently visible along the southern and northern borders of this plate.

The developed maps (Figures 6-8) are structurally consistent with the data of regional-tectonic zoning (Zakariadze et al., 2007; Trifonov et al., 2020; Malekzade, 2018; Eppelbaum et al., 2018) and elements of geodynamics (Eppelbaum and Katz, 2017; Rashidi et al., 2022), partially shown in Figures 1-3. The last-mentioned figures are compared with the satellite-derived gravity map (Figure 6), indicating that between the continental platforms of Eurasia and Gondwana, there is a tectonically unstable younger Alpine-Himalayan belt with increased values of the gravity field indicators. At the same time, each of the three lithospheric plates typologically differs in the gravity-structural characteristics of the latitudinal belts. On the other hand, within the lithospheric plates, the latitudinal indicators of gravity field changes are accompanied by the presence of submeridional heterogeneities. They are manifested in the meridian area of 50^{o} eastern longitude, passing through the Caspian and Persian Gulf basins. Here, troughs are developed, marked by the reduced gravitational anomaly values. Earlier, Eppelbaum and Katz (2017) discovered this phenomenon in the satellite-derived gravity field of larger areas (long-pass Gaussian-filtered gravity map). In subsequent work (Eppelbaum et al., 2018), this zone with lowered gravity field anomalies was compared with the geoid map of the African-Arabian region (the geoid map with the central tectonic units is shown in Figure 3). It should be noted that the Ural-African geoid step (Figures 1 and 3) is tectonically very active, and systems of deep faults are associated with it, producing numerous graben-like structures (Eppelbaum et al., 2024b) with the largest hydrocarbon deposits.

Regional geodynamic analysis, based on Figures 1-4 and examination of Alavi (1994), Ben-Avraham et al. (2002), Zakariadze et al. (2007), Moghadam and Stern (2014), Motaghi et al. (2015), Eppelbaum et al. (2018), Khorrami et al. (2019), Eppelbaum et al. (2021, 2024b), Mattei et al. (2017), Malekzade (2018), Bagheri and Gol (2020), Trifonov et al. (2020), indicates the intricate interaction of the lithospheric slabs in the region. The MRCS' eastern branch slab rotation initiates a northward movement of the Iranian Plate. On the other hand, the north (north-north-east) displacement of the Iranian Plate caused a clockwise rotation of the South Caspian Basin (Eppelbaum et al., 2025). The rotation and displacement of the lithospheric blocks caused by the above factors are (along with other geodynamic causes) sources of the seismological hazard in the region under consideration. Particularly illustrative are the two recent catastrophic earthquakes in eastern Turkey on 06.02.2023, where the long-term accumulated stress (e.g., Tselentis and Drakopoulos, 1990; Nalbant et al., 2002; Şengör et al., 2005) from a rotating deep structure (Eppelbaum et al., 2024a), along with other tectonic factors, resulted in a strong seismological shock.

The Iranian lithospheric plate is discordantly attached to the Eurasian Plate. Its narrowed western part is composed of the Sanandaj-Sirjan magmatic belt, marking a collisional suture in the absorption zone of the once-vast Neotethys Ocean. The extended eastern part of the Iranian Plate is characterized by significantly lower values of the gravity field indicators since vast massifs and blocks of continental crust dominate it.

The Arabian lithospheric plate is quite sharply delimited from the Iranian Plate, since elevated gravity field values characterize the Mesozoic Terrane Belt. To the south of this belt is a zone of decreasing gravity field marks (Figure 6). To the southwest, there is a stable zone of the Arabian Craton and Neoproterozoic Belt characterized by gravity field anomalies with average values. The increase in gravity field values in the extreme southwestern outskirts of the region is due to its proximity to the tectonically active rift zone of the Red Sea. The gravity map (Figure 6) coincides with the gravity transformation anomaly (Figure 2) and the recent publication of Teknik (2024), where the Iranian Plate is distinguished by thickening of the Earth's crust and lithosphere.

Analysis of the magnetic field (ΔZ) indicators (Figure 7) shows a less contrasting but distinct picture of the differences between the identified lithospheric plates. At the same time, the most significant structural contrast is manifested with the Eurasian lithospheric plate.

The topography data (Figure 8) and the gravity field (Figure 6) contrast the structures of the Iranian and Eurasian lithospheric plates. The topography map (reflecting important geodynamic features) is unique to study the relationships between the Arabian and Indian plates. It demonstrates a significant geodynamic contrast in the Gulf of Oman zone (Figure 8). Above and beyond, an analysis of numerous publications indicated an increase in the Earth's crust thickness (e.g., Teknik et al., 2019; Mousavi and Fullea, 2020; Teknik, 2024), and heightened thermal flow data (e.g., Goutorbe et al., 2011; Mousavi and Fullea, 2020; Mousavi and Ardestani, 2023) within the Iranian Plate.

Our previous investigations (Eppelbaum and Katz, 2017) indicate that in the post-Carboniferous, an uplift of the Zagros zone as an isolated tectonic feature of the Neotethys Ocean began to form. Geodynamic indicators reflect the isolation of the Zagros zone and suggest that it may have been a fragment of the MTB in the southern segment of the Neotethys Ocean (Vergés et al., 2011; Koshnaw et al., 2024).

The paper presents a historical-geodynamic analysis of Gondwana, demonstrating that its differentiation is linked to a submeridional fault system. Thus, the disintegration of the supercontinent was accompanied in parallel by an uneven process of closure (collision) of the Neotethys Ocean. We distinguish the Western Gondwana, where the remains of the oceanic crust – the Mediterranean – have been preserved (partially shown in Eppelbaum et al. (2014), Eppelbaum and Katz (2017), and Eppelbaum et al. (2024a). To the east, in Central Gondwana, on the boundary of the Arabian and Iranian lithospheric plates, the oceanic crust of the Neotethys was subducted. A narrow linear zone of the South Iranian Plateau, a belt of magmatic and metamorphic rocks of the marginal subduction zone, has remained from this process.

It was revealed that the bending arc of the Mesozoic Terrane Belt, which deviates sharply after the distal western end of the Iranian Plate to the southwest up to the south of the Sinai Plate, is associated with more ancient rotational movements along the forming deep mantle structure (Eppelbaum et al., 2021; 2024a). The collision of the Neotethys Ocean in Central Gondwana occurred later, in the middle of the Cenozoic, near the eastern branch of the deep mantle structure projection, outside the zone of influence of its rotational movements.

A general distribution of paleomagnetic vectors within the MRCS contour (mainly counterclockwise rotation) and without it (clockwise and alternating rotation) is shown in Eppelbaum et al. (2021, 2024a). A paleomagnetic direction map compiled for Azerbaijan and some surrounding areas (Figure 15) clearly shows the role of the MRCS, the Ural-African step, and the western part of the Iranian Plate in a complex form. The MRCS influence declines paleomagnetic directions counterclockwise, the African-Arabian step is an average boundary line, and the Iranian Plate impact declines paleomagnetic vector clockwise.

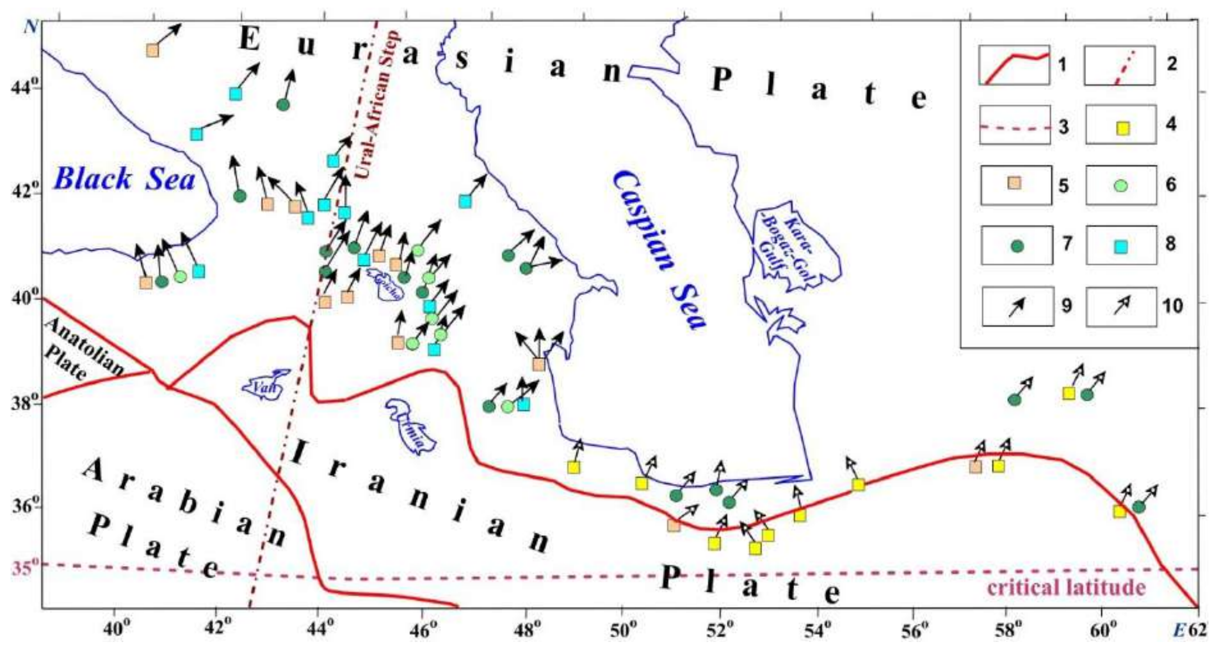

Fig. 15. Paleomagnetic-geodynamic scheme of the region at the boundary of the Iranian Plate and South Caspian Basin. (1) lithospheric plate boundaries, (2) Ural-African step, (3) Earth's critical latitude 35°, (4-10) paleomagnetic-geodynamical data: (4) for Neogene, (5) for Paleogene, (6) for Upper Cretaceous, (7) for Lower Cretaceous, (8) for Jurassic, (9) supplemented after Issayeva and Khalafli (2006), (10) modified after Mattei et al. (2019)

The geodynamic clockwise rotation over a long time must be reflected in the development of the SCB's bottom relief (see, for instance, Figure 11). This map displays the SCB's bottom relief rotation clockwise. Interestingly, the map of strike angles calculated by a complex transformation of the satellite-derived gravity data also demonstrates a circular vortex in the central part of the SCB (Figure 12). We must note that the present rapid decrease of the Caspian Sea's level can be associated not only with global warming and the diminution in the volume of the Volga runoff but also with the active near-surface tectonics in the sea caused by the instability of the regional geodynamic interaction.

The region under study (the eastern part of Central Gondwana and Eurasia) played an essential role in ancient hominin dispersal (e.g., Lordkipanidze et al., 2007; Veliyev et al., 2010; Scardia et al., 2019; Plummer et al., 2023). The examination of the recent geodynamics in the region indicates that the dissection of the coastal high plateau of the Eastern Mediterranean with the formation of optimal land landscapes for the habitation of ancient hominins began after regression at the end of the Middle Gelasian when the sea level dropped by more than 150 m (Eppelbaum and Katz, 2024). This paleogeographic effect had not previously been considered, which prevented its use in developing an archaeological research strategy. However, considering the diverse and complex aspects of hominin dispersal from Africa to Eurasia in this multifaceted region, the range must be broader. The comprehensive study of the Carmel area (northern coastal plain of Israel), displaced in the main direction of the Levantine Corridor (Figure 13) during the Pleistocene time, showed that this area was flooded during the early dispersal of hominins from Africa (Eppelbaum and Katz, 2021). We propose that the Levantine Corridor emerged after the end of the Akchagylian transgression and landscape forming in the Eastern Mediterranean. At the same time, it was evident from Figure 13 that the primary ancient hominin dispersal skirted the Iranian Plate due to its complex topography and tectonics.

Conclusions

The main results of the investigation performed are the following:

(1) The MRCS, Iranian Plate, and South Caspian Basin compose a single geodynamic ensemble in the eastern part of Central Gondwana and Eurasia,

(2) The MRSC leads in this ensemble since its eastern counterclockwise rotating branch pushes the Iranian Plate to move north. The MRCS influence is also affected by the Earth's critical latitude of 35^o and the Ural-African tectonic step.

(3) The complex configuration of the western part of the Iranian Plate, moving north and north-northeast, forces the South Caspian Basin to rotate clockwise,

(4) The western-central boundaries of the Iranian Plate were contoured by a combined analysis of gravity, magnetic, topographic, tectonic-structural, and some other features,

(5) The Iranian Plate comprises an intermediate zone between the Arabian and Eurasian plates,

(6) The recent geodynamic factors (together with the climatic, habitat, and food conditions) played a significant role in the dispersal of ancient hominins from Eastern Africa to the Levantine Corridor and further to the Caucasian region 2.5-2.0 million years ago.

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АНАЛИЗ СЛОЖНЫХ ГЕОДИНАМИЧЕСКИХ ВЗАИМОДЕЙСТВИЙ В ВОСТОЧНОЙ ЧАСТИ ЦЕНТРАЛЬНОЙ ГОНДВАНЫ И ЕВРАЗИИ

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Резюме. Восточная часть Центральной Гондваны и Евразии представляет собой тектонически сложный регион, где взаимодействует несколько крупных тектонических плит — Евразийская, Африканская, Аравийская, Эгейско-Анатолийская, Иранская и Синайская. Однако недостаточно изучения эффектов взаимодействий только этих плит. В дополнение к этому интерфейсу здесь воздействуют также следующие региональные геодинамические факторы: мантийная структура, вращающаяся против часовой стрелки, Урало-Африканская аномалия геоида и критическая широта Земли 35°. Граница Евразия-Гондвана разделяет западную часть — Эгейско-Анатолийскую плиту и Мезозойский Террейновый Пояс (МТП), связанный со сравнительно молодым Неопротерозойским Поясом, — и восточную часть – Иранскую плиту, террейны которой являются фрагментами архейско-раннепротерозойского Аравийского кратона. Иранская литосферная плита, ключевая структура на границе между Евразией и Гондваной, имеет существенное тектоно-геодинамическое воздействие на Южно-Каспийский бассейн (ЮКБ) и на восточную часть МТП. Разработаны новые тектоническая, магнитная, спутниковая гравитационная карты Иранской плиты. В геодинамическом отношении рассматриваемые тектонические объекты расположены над центральной и восточной частями вращающейся эллиптической мантийной структуры. Иранская плита находится над восточной погранично-краевой зоной вращающейся мантийной структуры и под ее влиянием перемещается на север. Это движение и сложная форма западной части Иранской плиты обуславливают вращение ЮКБ по часовой стрелке. Представлен комплексный геодинамическо-геофизический анализ основных тектонических структур региона и их взаимодействие между собой. Отдельно показано влияние недавнего геодинамического события – Акчагыльского гидросферного максимума – на миграцию древних людей. Проведенный анализ имеет важное значение для понимания роли сложного геодинамического взаимодействия в переходной зоне между Евразией и Гондваной.

Ключевые слова: *мантийная структура Восточного Средиземноморья, Иранская литосферная плита, Южно-Каспийский бассейн, граница Евразии и Гондваны, геодинамические вращение и смещение*

MƏRKƏZİ QONDVANANIN ŞƏRQİNDƏ VƏ AVRASİYADA MÜRƏKKƏB GEODİNAMİK QARŞILIQLI TƏSİRLƏRİN TƏHLİLİ

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Xülasə. Mərkəzi Qondvana və Avrasiyanın şərq hissəsi bir neçə böyük tektonik plitələrin - Avrasiya, Afrika, Ərəbistan, Egey-Anadolu, İran və Sinay plitələrinin qarşılıqlı əlaqədə olduğu, tektonik cəhətdən mürəkkəb bir bölgədir. Qeyd edək ki, yalnız bu plitələr arasındakı qarşılıqlı təsirlərin effektini öyrənmək kifayət deyil. Bu interfeysə əlavə olaraq, aşağıdakı regional geodinamik amillər də mövcuddur: saat əqrəbinin əksi istiqamətində fırlanan mantiya strukturu, Ural-Afrika geoid anomaliyası və Yerin 35° kritik eni dairəsi. Avrasiya-Qondvana sərhədi, Egey-Anadolu plitəsinin qərb hissəsini, nisbətən gənc Neoproterozoy qurşağı ilə əlaqəli Mezozoy Terreyn qurşağını (MTB) və terreynləri, Arxey-Erkən Proterozoya aid olan Ərəb kratonunun fraqmentini ehtiva edən İran plitəsinin şərq hissəsindən ayırır. Avrasiya ilə Qondvana arasındakı sərhəddə əsas struktur olan İran litosfer plitəsi Cənubi Xəzər hövzəsi (SCB) və Mezozoy Terreyn qurşağının (MTB) şərq hissəsinə əhəmiyyətli tektonik-geodinamik təsir göstərir. İran plitəsinin yeni tektonik, maqnit və peyk qravitasiya xəritələri hazırlanmışdır. Geodinamik baxımdan nəzərdən keçirilən tektonik obyektlər mantiya strukturunun mərkəzi və şərq hissəsindən yuxarıda yerləşir. İran plitəsi fırlanan mantiya strukturunun şərq sərhəd-marjinal zonasından yuxarıda yerləşir və onun təsiri altında şimala doğru hərəkət edir. Bu hərəkət və İran plitəsinin qərb hissəsinin mürəkkəb forması Cənubi Xəzər hövzəsinin (SCB-nin) saat əqrəbi istiqamətində dönməsinə səbəb olur. Məqalədə bölgənin əsas tektonik strukturları və onların qarşılıqlı əlaqələrinin hərtərəfli geodinamik-geofiziki təhlili təqdim olunur. Xüsusilə, son geodinamik hadisələrdən biri olan Ağçaqıl hidrosferik maksimumunun qədim insan miqrasiyalarına təsiri ayrıca araşdırılır. Aparılmış təhlillər, Avrasiya ilə Qondvana arasında yerləşən keçid zonasında baş verən mürəkkəb geodinamik qarşılıqlı təsirləri anlamaq baxımından mühüm əhəmiyyət daşıyır.

Açar sözlər: *Şərqi Aralıq dənizinin mantiya quruluşu, İran litosfer plitəsi, Cənubi Xəzər hövzəsi, Avrasiya-Qondvana sərhədi, geodinamik fırlanma və yerdəyişmə*