Integrated geological-geophysical study of the junction zone of Eurasia and Gondwana

Lev Eppelbaum\textsuperscript{1,2} and Youri Katz\textsuperscript{3}

\textsuperscript{1}School of Geosciences, Faculty of Exact Sciences, Tel Aviv University, Ramat Aviv 6997801, Tel Aviv, Israel (levap@tauex.tau.ac.il)
\textsuperscript{2}Azerbaijan State Oil and Industry University, Azadlig ave. 20, Baku AZ1010, Azerbaijan
\textsuperscript{3}Steinhardt Museum of Natural History & National Research Center, Faculty of Life Sciences, Tel Aviv University, Ramat Aviv 6997801, Tel Aviv, Israel

Tectonically the considered area of junction of four lithospheric plates (Nubian, Arabian, Aegean-Anatolian and Sinai) belongs to the Eastern Mediterranean, with its Cyprus-Levantine marine and Anatolian-Nubian-Arabian continental framing. The anomalousness of the region is manifested in the tectono-structural features of the mantle, lithosphere, hydrosphere and specifics of atmospheric, biospheric processes, and Hominid evolution.

The study region is distinguished by a complex junction of elements of the continental and oceanic crust. This intricate structure is caused by the simultaneous development of collision processes associated with the latitudinal zone of the Neotethys Ocean closure and manifestation of the initial stages of spreading of the Red Sea – Indian Ocean submeridional rift system. This area is characterized by presence of several geological-geophysical phenomena: (1) anomalous thickening of the mantle lithosphere in the Cyprus-Levantine zone, (2) development of the most ancient oceanic crust block with the Kiama paleomagnetic hyperzone, (3) presence of significant in size and amplitude gravitational and magnetic anomalies and lowest values of thermal flow, (4) presence of mantle diapirs, (5) high seismic activity, (5) development of a counterclockwise circular rotation of the GPS vectors, and (6) the location of the apical part of the oval structure occurring in the Earth's lower mantle. The study area is also distinguished by unique geomorphological and paleogeographic features. At present, the lowest elevations of the earth's surface relief developed here reach ~430 m on the Dead Sea coast, and the deepest zones of the Mediterranean Sea almost reach the ultra-abyssal depth of ~5267 m in the Calypso depression in the Ionian arc of Greece. In the epoch of the Mediterranean Sea drying out in the end of the Miocene (the Messinian crisis), the earth's surface marks (taking into account the hydro-isostatic effect) could reach 3000-4000 m below the hydrosphere level; this was probably the lowest land hypsometric minimum in the Earth geological history.

The aforementioned phenomena make it possible to conclude that this region is a giant geodynamic node formed in the northern hemisphere at the intersection of the latitudinal critical parallel (35°) in the Eurasia and Gondwana junction zone and the meridional step of the Ural-African geoid anomaly. The combined use of systematic data analysis, geodynamic constructions,
structural-tectonic zonation, and cyclic analysis enabled to clarify the history of geodynamic development and genesis of the tectono-physical formation of individual geological structures, and the region as a whole.

A special importance was paid to the satellite gravity data analysis with the subsequent modeling and transformation and identification of the heterogeneous structures in the Earth's crust, mantle lithosphere and lower mantle. Paleomagnetic mapping of the region indicates an increase of the frequency and diversity of magmatic complexes from the west to east. Obviously, this manifestation is due to the counterclockwise rotation of the Earth's crust relative to elongated axis of the discovered deep mantle structure (Eppelbaum et al., 2021).