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# GEODYNAMIC EVOLUTION OF THE SOUTH CASPIAN BASIN

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Mysterious powerful and extended mountain chains covering the continents on the Earth are just subordinate elements on the tectonic layout of the geodynamic of folded regions. It is certainly possible to study and describe in detail the geology of some mountainous region or inland sea basin etc, but it is impossible to scientifically explain them in general, without considering their interrelations with adjacent regions and relative to location of oceanic and continental plates in the geological past. From this very position we consider the origin of abyssal South Caspian Depression (SCD) with its so-called “oceanic crust”. Time and way of generation of this crust has been the cause for debates which resulted in six different points of view. It is obvious that according to seismic parameters, in the abyssal SCD under the 20 km thick sedimentary series, there is a “oceanic-type crust”. But according to the structure it differs from oceanic and continental crust. To discover the reasons for this fact and restore the sequence of historical and geological formation of SCD a number of geodynamic maps of the Caspian region were made up as a part of the Mediterrenaen belt (MB) central segment. The map was made up by separate time sections beginning with the Cambrian critical stage.

For each stage, geodynamic models of evolution of Paleotethys and Mesotethys were created with two geotraverses. On making up the map and models we followed the concept that in each tectonic cycle (Baikalian, Hercynian, Alpine) in this MB basin formation of mature continental crust was completed which is indicated by granitoid intrusions and molasse deposists. Existence of allegedly permanent 4,000-5,000 km wide oceanic basin in the central segment of MB since the Early Paleozoic (terrain hypthesis) was not confirmed by complex geological data. Geoynclinal systems of Paleotethys and Mesotethys with oceanic and suboceanic zone are newly formed structures of MB, and they emerged as a result of rifting. Subsequently, rifting was followed by spreading of structural-geomorphological elements or tectonic zones in each system.
In the geodynamic evolution, replacement of processes of spreading and subduction eventually resulted in final closing at the zones with oceanic crust in $C_2$-$C_3$-Paleothetis and $K_2$-Mesothetis. After these phases, MB began its evolution in the collision geodynamics.

The South Caspian area in the Hercynian cycle was situated between geosynclinal systems of Paleotethys as a continental plate-Trauscaucasian-South Caspian (TSC). The geodynamics of this plate is conditioned by emergence and evolution of oceanic zones: Trauscaucasian-Pre-Albors in the south and Pre-Caucasian-Tuarkyr in the north. Even in early Paleozoic and most distinctly in Cambrian, the boundary of epicontinental carbonate shelf of Gondwana and uplift and erosion in the north are observed across the northern Albros. In the Ordovician-Silurian period in uplifted zone rifting and spreading of oceanic crust occur, which was foleowed by subduction in Devonian accompanied by island-arc volcanism at the active margins of the SCD plate. It is interesting for the Caspian oil problem that in the northern part of the SCD plate, sedimentary basin of marginal sea is formed beginning from Devonian, with continuous sedimentation up tothe Upper Triassic, mainly by terrigenic facies under conditions of continental slope. Their fragments with thickness of up to 7 km are outcropped in Svanetia on the Southern slope of Great Caucasus and in Aghdarband to the south-west of Kopetdag. A similar basin with Devonian-Triassic deposits of primarly carbonate facies was formed on the continental slope of Gondwana along Albors and south of Lesser Caucasus. In the process of closure of southern branch of Paleotethys ($C_2$-$C_3$) and intrusion of massive granitoids at the active margins of collision zone, SCD plate is attached to Gondwana and after molasse depositing and local taphrogenic volcanism ($C_3$) is converted to marginal continental rise embracing northern Albros. A broad Permian transgression on the Gondwana shelf begins.

The circumstances are quite different in the northern part of SCD plate under similar processes and collision of systems of island arcs. The marginal basin in the northern slope of SCD plate is extended, deepened and transformed into deep water basin of neo-Paleotethys with thinned suboceanic crust in its axial zone. Here periodically basaltoid volcanism and introduction of subvolcanic intrusions occur. At this period the subduction zone is relocated to the southern edge of Scyhtian-Turanian plate, volcano-platonic association P-T is manifestated on the Karabogaz arc and others. In the north, heavier crust intensively submerges and folded metamorphic foundation $Pz_2$ is covered with P-T molasse sequence (8 km). All this proceeds in collisional settings which completely atternates, $T_3$, prior to early Kimmerian orogenesis. In the latter, in new tectonic plan, geosynclinal systems of Mesotethis originated.

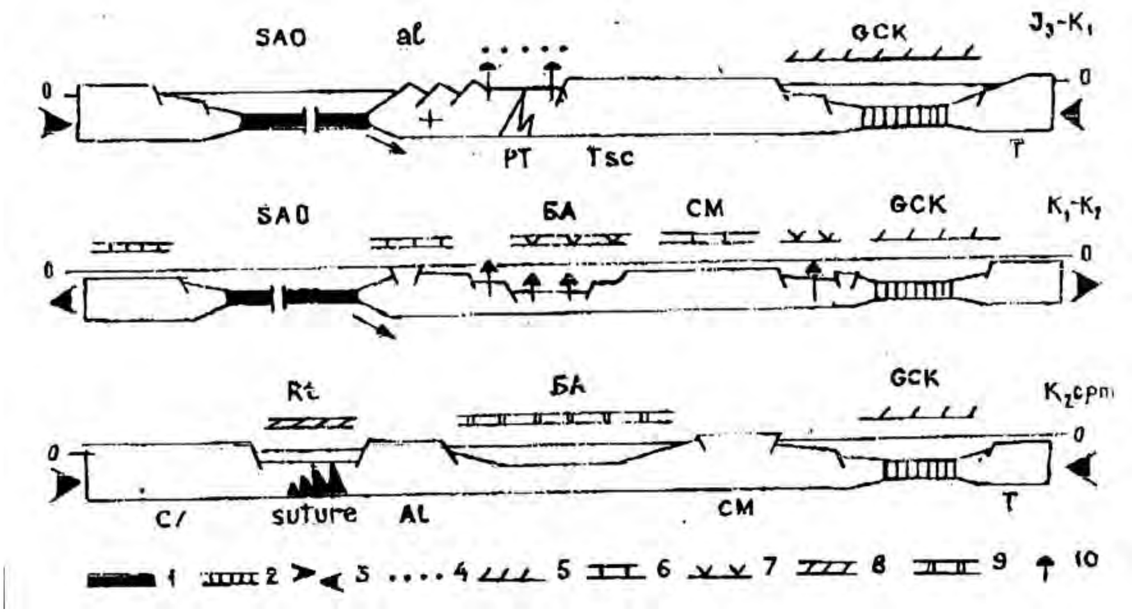
During Mesotethis evolution of South Caspian region was determination by emergence and separation of Great Caucasus basin in the north Early Jurassic and oceanic basin of southern Albors and correspondingly of active margin of Albors zone in Iran which to in the north borders with the area of the South Caspian plate of epihercinian consolidation and suture of Paleotethys. The Late Kimmerian orogenesis is marked with completion of the first stage of evolution of these systems and preservation of epicontinental circumstances ofthe South Caspian massif. With deformation and uplift of axial zone of the Great Caucasus basin and its dislocation to the south with emergence ($I_3$) of facial flysch zones and barrier reefs, the Albors zone is freed from marine settings due to compression and intrusion of granitoids. This is accompanied by sedimentation of evaporitic-redstone series with melaphyres ($J_3$-$K_1$) in near-fracture grabens of the north Albors and on its border with South Caspian massif.

The second stage begins after Neocamian with regeneration of marine conditions under geodynanic circumstance of regional extension and submergence of the whole MB: Subsidence of the flysch zone increases and as result causing submergence of the northern edge os SCD plate, and in places of activation of non-meridional and north-eastern fractures, it breaks apart and becomes a place for riftogenic volcanism in Albian-Senomanian and Senonian. During this processes, Transcaucasian and South Caspian plates were separated and the “transverse folding zone” with growing subsidence becomes isolated. The Continental slopes of this zone underwent subsidence in relatively less degree. The formation of back-arc trough and volcanism manifestation started a little before in southern ending of this zone in front of Albors island arc. The new stage of spreading and subduction in the oceanic zone is accompanied by several phases of rear arc volcanism in the central and western Albors. Extensive basalt volcanism is fixed after sedimentation of orbitoline limestones in the Aptian-Senomanian, Senamonian-Turanian, Lower Senonian with northern polarity, which indicates formation of back-arc depression in the South Caspian with thick series of basalt volcanite of Cretaceous section. The foothill geology of Albors evidences replacement of volcanism with deposition of limestone sequence of $K_2$ sn-m.

In the third stage, the evolution of South Caspian region in new tectonic plan occurs in collisional geodynamics and permanent submergence, particularly intensively starting with Oligocene. In Neogene under syncompressional conditions the South Caspian basin underwent rapid subsidence on neotectonic phases (16.5-15; 12.4-9.7; 3.7-1.8 and 1.6-0 Ma). On the other hand, a rapid subsidence of the basin is genetically related with the processes of reworking of deep-water trough crust.

Subsidence of the deepwater depression and great thickness of the sedimentary cover (20 km) including limestone series and terrigenic deposits from Paleocene to modern, is explained from the point of view of geodynamics, law of isostatic balance and deep structure of lithosphere. At the same time, seismic velocity 6.6-6.8 km/sec does not characterize the surface of oceanic crust or basalt layer, but reflects the surface of Cretaceous volcanogenic series, overlaying modified crust with thickness of 15-20 km. By its thickness, structure and specific features of formation mechanism, it does not correspond to oceanic or continental type of the crust.

Thus, opinion of researchers on the time and origin of deep water South Caspian depression as well as on the nature of its foundation is not confirmed by analysis of regional complex data from geodynamic point of view.




1- The oceanic crust; 2- suboceanic crust; 3- global stiation of compression and extension; 4-molassa; 5- terrigenic-carbonaceous flysch and subflysch; 6- Orbitoline limestones; 7-volcanogenic deposits; 8- carbonaceous with flyschoids; 9- carbonates; 10- basaltoid volcanism; SAO-oceanic basin of the South Albars; al. Al-island arch of the Albors and microplate of the Albors; GCK-Great Caucasus-Kopetdag system; CI-Central Iranian plate; PT-Suture of Paleotethys; TSC-Trancaucasim-South Caspian plate; T-Turan; BT-backarch trough; SM-South-Caspian massif; RT-rezidual trough.