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Georgian-Caucasian Lithosphere: Geological Past and Current State

Geology is the scientific study of the earth. Geological investigations indicate that the earth is changing because of internal and surficial processes. Although the earth is changing constantly, the rates of change are generally slow by human standards.

The age of the earth is commonly regarded as about 5,0-4,5 billion years. (Soviet geologists think that 6 billion years is a better estimate). The oldest rocks found on earth are from northwestern Canada and have been dated at about 3,964 billion years old.

The evidence from geophysics suggests that the earth is divided into there major parts – the crust on the earth's surface, the rocky mantle beneath the crust, and the metallic core at the center of the earth. The study of plate tectonics has shown that the crust and uppermost mantle can be conveniently divided into the brittle lithosphere and the plastic astenosphere.

According to the theory of plate tectonics, the earth's rigid outer shell is broken into a series of plates. Adjoining plates may slide past, move away from, or collide with one another. Plates generally move from 1 to 10 centimeters a year. The basic idea of plate tectonics is that the earth's surface is divided into a few large, thick plates that move slowly and change in size. Intense geologic activity occurs at plate boundaries where plates move away from one another, past one another, or toward one another.The theory of plate tectonics describes the movement of plates and the forces acting between them. The concept explains the distribution of many large-scale geologic features – mountain chains, structures on the seafloor, volcanoes, and earthquakes.

The tectonics and geological evolution of Georgia and the Caucasus, on the whole, are largely determined by its position between the still-converging Eurasian and Africa-Arabian lithosphere plates, within the wide zone of a continent-continent collision and deformations. The region during the Late Proterozoic-Early Cenozoic –last 700Ma - belonged to the now-vanished Tethys Ocean and its Eurasian and Africa-Arabian margins. Within this convergence zone, there existed a system of island arcs, back-arc basins characteristic of the pre-collisional stage of evolution in the region. During the syn-collisional (˜ 30-10 Ma ago) and post-collisional (recent 10 Ma) stages back-arc basins were inverted to form fold-thrust mountain belts in the Great and Lesser Caucasus and the Transcaucasian intermontane lowland in between.

Starting from the Late Miocene (˜ 9-7Ma ago) to the end of the Pleistocene-Holocene, volcanic eruptions in subaerial conditions occurred. High geodynamic activity of the region is conditioned by convergence of lithospheric plates and northward propagation of the Afro-Arabian continent at a rate of several cm/y. The post-collisional sub-horizontal shortening of the Caucasus caused by the northward propagation of the Africa-Arabian plate is estimated at approximately hundreds of km. This considerable shortening of the lithosphere has been realized in the region in different ways: crustal deformation with wide development of compressional structures; warping and displacement of the crustal blocks themselves as they uplift; subsidence; underthrusting beneath each other and lateral escaping.

Several different geodynamic models have been proposed for the genesis of collision-related magmatism of continental collision zones. Some of them may be relevant to the Caucasian Late Cenozoic collision zone – for example, the *Detachment model* of the last piece of subduced oceanic lithosphere to explain the Late Miocene-Quaternary calk-alkaline and sub-alkaline volcanism of South Georgia, and the *Lithosphere Delamination model* for an explanation of the Pleistocene-Holocene volcanism of the Great Caucasus.