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The migration of volcanic Centers in the South Hangai volcanic area (Mongolia) in Late Mesozoic–Cenozoic

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The South Hangai volcanic area spans Southern and Central Mongolia. It is the most protracted intraplate magmatic area in Central and East Asia. The volcanic fields of the area extend from the southern boundary of Mongolia to the Hangai highland and its nearest surrounding.

Systematic geochronological, paleovolcanological, and isotopic-geochemical studies of sequences of different age in different parts of this area allow to reconstruct the volcanic evolution of this region. It was established that volcanic activity occurred in several pulses separated by short time intervals, with systematic migration of its volcanic centers. The following stages of volcanic activity were distinguished: end of the Jurassic to beginning of the Early Cretaceous (150-135 Ma), beginning to middle of the Early Cretaceous (135-120 Ma), middle to the end of the Early Cretaceous (120-115 Ma), end of the Early Cretaceous (115-102 Ma), end of the Early Cretaceous to the beginning of the Late Cretaceous (102-90 Ma), end of the Late Cretaceous (88-71 Ma), Paleocene-Early Eocene (62-47 Ma), Early Oligocene (38-31 Ma), Late Oligocene-Early Miocene (30-22 Ma), Middle Miocene (17-12 Ma), Late Miocene-Pliocene (10-2.1 Ma), Pleistocene (1.25-0.2 Ma), and Holocene (<0.01 Ma). Each stage, in turn, was subdivided into individual volcanic pulses responsible for the formation of individual volcanic fields or their groups.

Thus, the history of the area is traced beginning from the Late Jurassic to the present time. Asynchronous volcanic pulses are typically spatially separated, which is related to the migration of magma conduits in the course of formation of volcanic area. A loop-like chain of volcanic fields more than 800 km long was detected. An observed shift in volcanic centers is considered as a trace of the South Hangai hot spot, which was expressed in the structure of lithosphere as the latter moved over the mantle plume.

The volcanic rocks of the area comprise basanites, trachybasalts, predominant trachybasaltic andesites, as well as more rare phonotephrites, basalts, nephelinites, and carbonatites; trachyandesites, trachytes, and trachyrhyolites occur only in the Late Mesozoic. All rocks are characterized by distinctly expressed K specifics.

Geochemical data indicate that main volcanic rocks of all age groups have similar abundance of incompatible trace elements. Their distribution patterns are close to that of OIB basalts, but differ in more fractionated REE pattern, higher LILE contents (Rb, Ba, Sr), and lower contents of such elements as Th, U, HREE (with the exception of Late Mesozoic rocks having higher HREE). All except the Late Mesozoic rocks display a prominent Ta-Nb maximum.

In the Sr-Nd isotopic diagram, the rocks of the area define two trends. One trend involves the oldest Late Mesozoic rocks of the area. It strikes from EM-II type field to the PREMA. Cenozoic rocks fall between fields of PREMA and EM-I type.

Geological (intracontinental) position of this volcanism and OIB-like composition of the volcanic products of the South Hangai area testify that its geodynamic setting was controlled by mantle plumes. This suggestion is consistent with paleomagnetic data, as well as with results of gravimetric and seismological studies, which revealed that the base of lithosphere is locally penetrated by asthenospheric fingers, which reach the crust bottom at a depth of about 50 km (Zorin et al., 2003). Thus, these fingers of hot mantle (asthenosphere) presumably controlled the volcanic activity of the region.

Zorin Yu.A., Turutanov E.Kh., Mordvinova V.V. et al. The Baikal rift zone: the effect of mantle plumes on older structure // Tectonophysics. 2003. V. 371. P. 153-173.