Swath bathymetric investigations of the submarine Volcanologists Massif, Komandorsky Basin

Boris Baranov[1], Reinhart Werner[2], Nikolay Tsukanov[1], Karine Dozorova[1]
[1] IO RAS, P.P. Shirshov Institute of Oceanology RAS, Nakhimovsky prospekt 36, 117997 Moscow, Russia; email: bbaranov@ocean.ru
[2] IFM-GEOMAR, Leibniz-Institut für Meereswissenschaften, Gebäude Ostufer, Wischhofstrasse 1-3, 24148 Kiel, Germany

The most peculiar feature of the Komandorsky Basin (Western Bering Sea) floor is a huge volcanic massif located about 60 km to the north from the Komandorsky Islands. This structure called Volcanologists Massif was discovered in 1984 during RV Vulkanolog Cruise (Seliverstov et al., 1986). It has diameter of about 40 km and height more then 3.5 km. Up to beginning of 90-th Volcanologists Massif was investigated by different methods including single-beam echosounder mapping (Seliverstov, 1998).

For the first time the swath bathymetric investigations were conducted on this structure in autumn of 2009 during RV Sonne Cruise SO 201-2. This cruise was carried on in the frame of German-Russian project KALMAR (**K**urile-Kamchatka and **Al**eutian **M**arginal Sea – Island **Ar**c System).

Swath bathymetric surveys give us an opportunity to clarify the main structural features of the Volcanologists Massif area including its central part (Piip Volcano), Komandor Graben and Alpha Ridge. So, real idea was obtained about distribution of the normal fault scarps, which locate in western and eastern parts of the Volcanologists Massif and in the Komandor Graben. The strikes of the normal faults scarps suggest dextral strike-slip movements along the fracture zone associated with the Alpha Ridge.

In addition to many volcanic forms including flank cones, volcanic ridges and lava flows were detected in the Volcanologists Massif. The flank cones are the most peculiar features among them. 57 cones locate in Volcanologists Massif, besides about half of them (25 cones) are spaced at Piip volcano. The height of cones changes from 10 m up to 250 m and their diameters vary from 100 m up to 1,5 km. Main amount of the flank cones locates to the west from the Piip Volcano axis.

According to Nakamura (1977) the distribution of the flank cones will be elongated in the direction of the maximum horizontal compression (S_H) of the regional stress. To determine direction of the S_H we have used two parameters (Paulsen, Wilson, 2010): (1) flank cones alignments based on cone centers, and (2) flank cones alignments based on cone shapes. Two directions of the S_H were obtained, namely NW-SE and NNE-SSW (Fig. 1B, inset). First direction is weakly expressed and corresponds to direction of the maximum horizontal stress obtained on base of focal mechanism solutions (Heidbach et al., 2008). The second direction is determined by existence of feeder dikes, which trend parallel to the S_H direction and orthogonal to the minimum horizontal stress (S_h). S_h direction is roughly coincided with strikes of normal faults scarps, which are determined by regional extension existing in this part of the Komandorsky Basin.

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References

Heidbach O, Tingay M, Barth A, Reinecker J, Kurfeß D, and Müller B (2008) The World Stress Map database release 2008 doi:10.1594/GFZ.WSM.Rel2008

Nakamura K (1977) Volcanoes as possible indicators of tectonic stress orientation – principle and proposal. Journal of Volcanology and Geothermal Research 2:1-16

Paulsen TS, Wilson TJ (2010) New criteria for systematic mapping and reliability assessment of monogenetic volcanic vent alignments and elongate volcanic vents for crustal stress analyses. Tectonophysics 482: 16–28

Seliverstov NI, Avdeiko GP, Ivanenko AN, Shkira VA, Khabunaya SA (1986) New submarine volcano in the western Aleutian Arc. Volcanology and Seismology 5: 3-16 (in Russian)

Seliverstov NI (1998) Seafloor structure offshore the Kamchatka Peninsula and geodynamics of the junction of the Kurile-Kamchatka/Aleutian islands arcs. Scientific World, Moscow: 164 (in Russian)