Spatial and morphometric analyses of Anaun monogenetic volcanic field (Sredinny Range, Kamchatka)

Dmitry Melnikov, Anna Volynets

Institute of volcanology and seismology FEB RAS, Petropavlovsk-Kamchatsky 683006, Russia. dvm@kscnet.ru

Keywords: Kamchatka, morphometric analyses, spatial distribution

Monogenetic volcanic fields are frequently located in the faulted area and in clusters which are associated with the particular geometry of the magmatic chambers and structures of the magma plumbing system in the crust. The method of cluster analyses of the spatial distribution and morphometric characteristics of the cinder cones was used in our research of the conditions of origin and evolution of one of the largest monogenetic fields in Kamchatka back-arc – the Anaunsky Dol, or Anaun MVF. Kamchatka subduction system is located at the north-western part of the Pacific at the convergent boundary of the Okhotsk and Pacific plates. Today, Sredinny Range represents its back-arc part and is characterized by the wide distribution of the monogenetic volcanic fields: it has more than 1000 cinder cones, which deposits cover the area of about 8500 km2 (Laverov, 2005; Ogorodov et al., 1972) (Fig. 1). Sredinny Range has a complex structure with several volcanic provinces with different geological history and variable composition of products. Anaun monogenetic volcanic field occupies one of the lowest sections of the whole Sredinny Range. The youngest volcanism in this area (according to the geological map, it was formed in Quaternary times, although our geochemical research and isotopic dating shows its earlier age) is confined to the lowered block of basement rocks. Shield volcanoes, volcanic ridges, cinder and lava cones are located on a low-laying volcanic dale. We made an attempt to make a spatial analysis of distribution of the volcanic edifices and to quantitatively estimate the structural control of the magma plumbing channels. Based on a digital relief model (DEM SRTM, spatial resolution 30 m) we distinguished more than 100 morphometrically expressed cinder cones. For them, using semi-automatic mode, we estimated the morphometric characteristics: height, diameter of the basement, height/basement ratio, angle of the slope, volume of the edifice. With time, cinder cones change their shape due to the erosion processes. Therefore, finally the edifice height is decreased while the basement diameter increased. Determination of the morphometric parameters allowed us to compose a relative age scale for the cinder cones located in Anaun monogenetic volcanic field.

Spatial analysis has shown that cones tend to form series of clusters, which are associated with the systems of lineaments. Statistically significant patterns in the cinder cones distribution were then compared with the strike of lineaments to estimate possible location of the magma feeding channels.

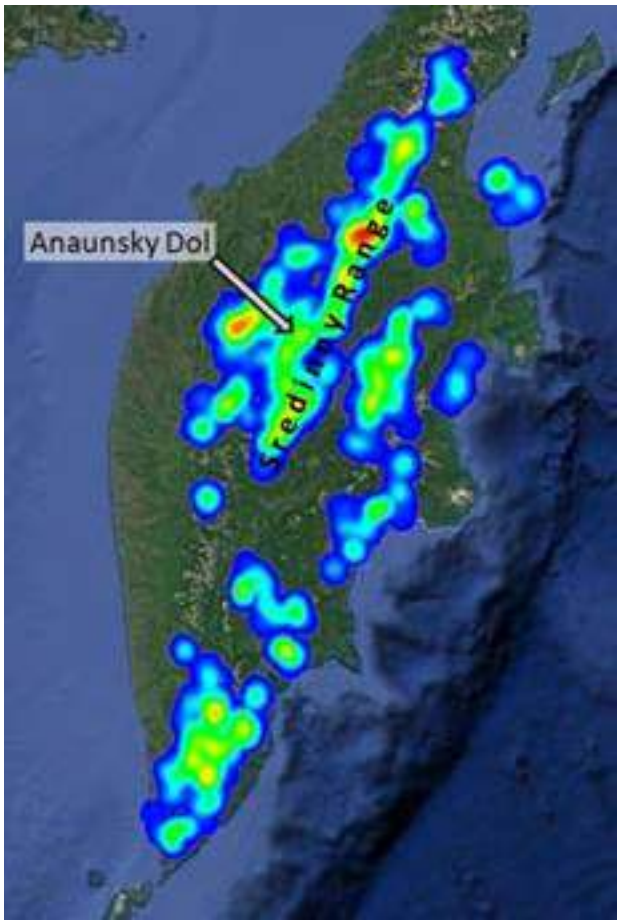

Fig. 1 – Scheme of the spatial distribution of the cinder cones in Kamchatka (HEAT-map), on a base of data from the database "Holocene volcanism of Kamchatka" (geoportal.kscnet.ru/volcanoes/geoservices/hvolc.php)

Acknowledgements

Financial support by RFBR grant #17-05-00112

References

Laverov, N.P. (ed.) 2005. Newest and contemporary volcanism in Russia. Moscow: Nauka: 604 p. In Russian.

Ogorodov, N.V., Kozhemiaka, N.N., Vazheevskaya, A.A., Ogorodova A.S. 1972. Volcanoes and quaternary volcanism of the Sredinny Range of Kamchatka. Moscow: Nauka. In Russian.