Magnetic fabric and flow directions in magmatic rocks of the Franz Josef Land, Arctic Ocean

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Here, we present the results of a study of the anisotropy of magnetic susceptibility (AMS) completed in the Early Cretaceous magmatic complexes from the Franz Josef Land (FJL). AMS was measured in the framework of paleomagnetic research as a leading indicator of the rock magnetic fabric to help in understanding the lava flow directions and forming mechanisms. The three types of magmatic bodies were available in these studies: dolerite sills, dykes and basaltic lava flows from several islands (Alexandra, Hall, Ziegler, Jackson and Heiss Islands) among FJL. During the experiments the different parameters of AMS ellipsoids were obtained which have a good correlation with the igneous body shapes and also could illustrate lava flows direction parameters. The degree of anisotropy P is 1.01-1.06 for most sites that is typical for the primary igneous magnetic fabric. The form factor T characterizing the shape of the AMS ellipsoids demonstrates both planar and linear magnetic fabric in studied magmatic bodies. What is remarkable the part of the dykes is characterized strictly oblate magnetic fabric and another dykes have the prolate AMS ellipsoids. The linear magnetic structure is also more typical for lava flows with the maximum axes K1 lying in the flow plane that is obviously could point to the flow direction. The part of the igneous bodies are characterized by the inverse type of magnetic fabric, when the principal axis K1 of the ellipsoid is oriented perpendicularly to the plane of the flow or the sill, that was likely caused by the effect of secondary processes. The previous studies (Abashev et al., 2019) demonstrated that the primary orientation of the AMS ellipsoid could be recovered after temperature demagnetization. Noticeable changes were revealed at heating up to ~450 deg C, which generally corresponds to deblocking temperatures of titanomagnetites identified in the rocks by rock-magnetic methods. The degree of anisotropy was decreased after heating in 2-3 times. The heating also resulted to the redistribution of magnetic axes and in several cases the axes becomes more grouped. Analysis of the AMS results from the basaltic lava flows of the Aleksandra Island defined the magma flow direction to be NW-SE. Similar behavior of the AMS ellipsoids and lava flow orientation is typical for Ziegler Island. Generally our results show that complex analysis of AMS data in basaltic rocks is promising for identifying magma flow direction and it can give more detailed information about forming mechanisms of the different magmatic bodies.

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