MAGNETIC ANISOTROPY, ROCK MAGNETIC AND PALEOMAGNETIC STUDIES OF DIKES EMPLACED IN THE WAI'ANAE VOLCANO, O'AHU, HAWAI'I, USA

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The Wai'anae Volcano is the older of two shield volcanoes that make up the island of O'ahu. Previous age determinations suggest that the subaerial portion of the edifice erupted between approximately 3.7 and 2.7 Ma. The eroded Wai'anae Volcano had a well-developed caldera centered near the back of its two most prominent valleys, and two major rift zones: a prominent north-west rift zone, well defined by a complex of sub-parallel dikes trending approximately N52W, and a more diffuse south rift zone, trending between S20W to due south. In order to investigate the volcanic evolution, the plumbing and the triggering mechanisms of the catastrophic mass wasting occurred in the volcano we have undertaken a paleomagnetic and AMS study of 7 dikes from the volcano. We drilled the dikes paying special attention to the chilled margins were we recovered a minimum of 8 and up to 23 samples per margin. The width of the dikes ranges between 0.5 to 4 m. In terms of the paleomagnetic results at least 20 samples per intrusive were stepwise demagnetized by a.f. from 5 to 100mT. Companion specimens from the same core were demagnetized at 15 temperature steps. In both cases demagnetization diagrams obtained with each technique showed a stable Characteristic direction of remanence (ChRM) determined with no ambiguity. The ChRM was calculated using principal component analysis for the demagnetization diagrams with a well-defined component trending to the origin. In addition, low field susceptibility vs temperature (k-T) and SIRM experiments were able to identify magnetite (575 degrees C) and a low temperature mineral phase at about 250-300 degrees C which probably reflects the presence of titanomagnetite. The determined directions of the intrusives resulted in normal and reversed polarities indicating that such dikes were emplaced at different periods of time covering a gap of 350 kyrs. Magnetic fabric studies of the dikes along a NW-SE section across the present southwestern part of the Waianae volcano have been conducted. The flow direction was studied using the imbrication angle between the dike walls and the magnetic foliation (e.g. Geoffroy et al., 2002). At the dike scale, the magnetic zone axis, which underlines the intersection of the magnetic foliation from the two borders of the dike (i.e. a direction perpendicular to flow), has yielded a precise orientation in three of the sites studied. The flow direction has been obtained in the seven studied dikes. For the majority of the cases, the maximum axis K1 appears to be perpendicular to the flow direction and in some cases with a partial axes permutation with respect to the intermediate axis K2 or even with respect to the minimum axis K3. In addition, in one of the sites studied, the minimum axis K3 is very close to the flow direction. In all the cases, the magma flowed along a direction with a moderate plunge. For six of the dikes, the interpreted flow was from the internal part of the volcano towards the volcano border and corresponds probably to the inflation phase of the volcano. In two cases (dikes located on the northwestern side of the volcano), the flow is slightly downwards, possibly related to the distal extension due to inflation of the central part of the volcano. The seventh dike is located closer to center of the volcano and is characterized by a slightly different orientation with respect to the other six dikes, and also revealed a downward flow that could correspond to another magma pulse that resulted from a flow-back during distension due to the collapsing of the Waianae volcano.

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