

**Paleomagnetism, Paleosecular Variation, Successive Reversals and Absolute Paleointensities Recorded in the Ko'olau and Wai'anae Volcanoes, O'ahu, Hawai'i**

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The island of Oahu is the third largest island in the Hawaiian group. It consists of primarily of two coalesced shield volcanoes, the Wai'anae and Ko'olau, each now deeply eroded. The Ko'olau volcano is the younger of the two and was active after the Wai'anae volcano had ceased to erupt. Both volcanoes have suffered mass wasting events that have shaped the two volcanoes leaving a highly dissected morphology with superbly exposed lavas suitable for paleomagnetic research. The offshore expression of the slid blocks from the Ko'olau volcano is an extensive rubbly field of debris extending approximately 230 km from the island across the Hawaiian Deep onto the Hawaiian Arch. We have studied the lavas of the Ko'olau Volcano as well as the deep-sea sediments on top of the detached blocks by means of magnetostratigraphy to investigate the volcanic evolution and the timing of the catastrophic events that denuded the volcano. Magnetostratigraphic results of the subaerial part of the Ko'olau complex indicate that at least on the normal Reunion Subchrons (ca. Reunion II 2.15 $\pm$ 0.04 to 2.11 $\pm$ 0.04 Ma) had been registered at two different locations. Deep-sea cores have recorded several reversals. The oldest one is the top of the Olduvai Subchron (ca. 1.78 Ma). The land and deep-sea paleomagnetic studies indicate that the timing of the main collapse of the Ko'olau Volcano that originated the detachment of the blocks had to occur between 2.1 to 1.78 million years ago based on the magnetostratigraphic evidence. Paleosecular variation studies conducted on 19 dated sites with ages between 33 and 700 ka from the Honolulu Volcanic Series (HVS) exposed on SE Oahu and 10 lava flows belonging to the Ko'olau Volcanic Series (KVS) ranging in age from 1.8 to 2.6 Ma yielded successful mean paleomagnetic directions. The average value of the site mean declinations is 359.6 $^{\circ}$  while the mean inclination of 34.5 $^{\circ}$  is 3.5 $^{\circ}$  lower than the value of the geocentric dipole at the site for the HVS. The mean declination obtained for the KVS is 177.7 $^{\circ}$  and the mean

1. Chapman Conference on  
Tiemscales of the Geomagnetic  
Field 2. CONTRIBUTED (oral  
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inclination is  $34.9^\circ$  ( $\alpha_{95} < 5^\circ$ ). The mean direction of magnetization obtained after correcting the site localities of the Matuyama KVS is perfectly antipodal to the mean directions of the Brunhes HVS. This agreement suggests that the time-averaged directions obtained for these two periods are reasonably representative of the mean geomagnetic field. The value of dispersion is consistent with the typical value of PSV at the site latitude. The declination does not significantly deviate from the N-S axis but there is a persistent offset by almost 4 degrees in inclination with respect to the expected value of GAD at the site latitude. The Waianae volcano lavas (3.8-2.4 Ma) located on the west part of the island of Oahu, Hawaii has provided a unique opportunity to document the geomagnetic field behavior over a relatively long period of time. This has been an ideal location to investigate the Earth's magnetic field because extensive and superbly well-exposed lava flows make up sequences that include at least three back-to-back reversals of the geomagnetic field (Gilbert-Gauss 3.57 Ma through the Upper Mammoth 3.22 Ma). Five thick sections appropriate for paleomagnetic sampling have been successfully studied. The geomagnetic results include the pre- and post-transitional directions with determinations of absolute paleointensity from the three successive reversal volcanic sequences. The dominant pattern of the directional changes is the presence of large inclination paleosecular changes with increasing amplitude and steep values during transitional periods. Our results indicate that there is no evidence for preferred longitudinal sectors or for clusters of directions that would be related to periods of standstill during reversals. In contrast, the presence of parallel records has demonstrated that clusters of directions are not reproducible between parallel sections and thus related to local eruption rates. Some recurring features could reflect characteristics inferred from studies of the secular variation in the Pacific. Absolute paleointensity experiments of 240 lava flows have been conducted on one sample per lava flow using a modified version of the Thellier-Coe technique. We obtained a 23 percent success rate for the paleointensity determinations of at least 4 samples per lava flow and indicate that there is a range between 3.5 and 88 uT. The paleofield was reduced to at least one tenth of the present-day value during transitions characterized by a mean paleointensity of 15 uT, whereas the field recovery depicts a mean paleointensity of 40 uT (normal polarity intervals) with severe paleointensity highs during the recovery periods.