U.S. DEPARTMENT OF THE INTERIOR
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Paleomagnetic data from basaltic lava flows of the northeast rift zone of Mauna Loa volcano, Hawaii

by

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The assessment of volcano hazards to the island of Hawaii from possible eruptions at Kilauea, Mauna Loa, Mauna Kea, and Hualalai volcanoes is a continuing responsibility of the Volcano Hazards Team of the U.S. Geological Survey. That assessment includes the collection of basic earth science information in the form of chemical, physical, and even biological data which are intended to facilitate the evaluation. A volcano hazards assessment revolves centrally around the detailed reconstruction of the history of eruptive activity, and the areal distribution of volcanic eruption products such as lava flows and ash. The list of information collected in this evaluation can include, but is not limited to, identification and mapping of lava flow contacts; geochemical data and petrographic data; geophysical data including gravity, magnetics, and paleomagnetics; absolute age data derived from the rocks (argon-dating, uranium-disequilibrium), from organic material charred or overridden by the flow or ash (^{14}C), and from surface exposure systems (^{36}Cl, ^{26}Al, ^{10}Be, ^{3}He, etc.); physical surface characteristics such as glass preservation, roughness, blockiness; degree of soil formation on the flow; and extent and nature of vegetative cover as the ecological system returns to preeruption conditions.

Paleomagnetic data are included in this list due to their utility both as the inherent characteristics of a specific lava flow and as a tool for assessing its age relative to other flows. When a basaltic lava flow erupts, moves downhill over the ground surface, and comes to rest and cools, it acquires a thermoremanent magnetization parallel to the geomagnetic field that exists at the time of the eruption. The geomagnetic field is not constant in direction, but instead has a secular variation over time periods of decades to millenia, producing different local magnetic directions that can vary by tens of degrees in both inclination and declination values. Thus, a particular lava flow, with its inherent remanent magnetic direction can be compared to another lava flow with its own remanent direction to see if they are similar. Dissimilar remanent directions are evidence that the compared lava flows are not of the same exact age, while similar directions, when included with other outcrop and geologic data, may indicate that lava flows are of the same age.

The paleomagnetic data shown in Table 1 have been collected from some of the lava flows of the northeast rift zone of Mauna Loa volcano over a period of 20 years.

References cited:

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Holcomb, R.T., 1980, Chronology and morphology of the surficial lava flows of Kilauea Volcano, Hawaii (PhD dissertation): Stanford University, Palo Alto, CA.

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Table 1. - Mauna Loa Volcano Northeast Rift Zone Paleomagnetic Data

Hilo quadrangle

Site	Lat.	Long.	N/No	Exp.	I	D	α95	k	R	Plat.	Plong.
8B433*	19.713°	204.882°	12/12	15	33.4°	4.5°	1.1°	1467	11.99250	85.5°	313.1°
9B037*	19.640°	204.949°	12/12	20	25.7°	357.8°	2.3°	361	11.96953	83.5°	44.4°
9B049*	19.684°	204.891°	12/12	20	18.9°	0.1°	1.6°	699	11.98425	80.1°	24.1°
2A419#	19.690°	204.877°	11/12	20	41.5°	6.2°	1.3°	1259	10.99206	82.9°	257.9°
2B115#	19.729°	204.935°	10/12	40	21.1°	359.9°	1.9°	682	9.98680	81.2°	25.4°
6A331#	19.715°	204.917°	10/10	20	37.2°	359.0°	2.3°	443	9.97970	88.6°	165.4°
6B001#	19.720°	204.880°	12/12	30+	23.5°	357.0°	1.3°	1082	11.98983	82.0°	46.7°
6B013	19.720°	204.892°	12/12	20	18.5°	358.7°	2.1°	432	11.97454	79.7°	32.2°
6B025	19.721°	204.875°	12/12	20+	22.8°	357.1°	1.2°	1397	11.99213	81.7°	44.7°
6B037	19.723°	204.876°	12/12	10	30.8°	354.7°	2.2°	406	11.97288	84.1°	84.0°
6B049	19.697°	204.877°	12/12	30	12.6°	350.1°	2.3°	364	11.96980	73.6°	62.0°
6B061	19.698°	204.875°	12/12	20	38.4°	7.0°	1.9°	505	11.97823	83.2°	277.1°
6B073	19.705°	204.883°	12/12	20	39.3°	2.7°	2.2°	381	11.97111	86.4°	249.6°
6B133	19.706°	204.914°	12/12	20	21.4°	0.6°	1.9°	516	11.97870	81.3°	21.2°
6B145	19.659°	204.899°	12/12	30	23.8°	4.2°	2.3°	358	11.96929	81.8°	355.1°
7B373#	19.665°	204.878°	12/12	20	16.6°	3.0°	1.4°	921	11.98806	78.5°	9.9°
7B385	19.665°	204.878°	10/12	20+	31.0°	0.3°	2.2°	477	9.98113	87.0°	20.2°
7B397#	19.680°	204.925°	12/12	10	32.5°	2.8°	2.1°	433	11.97462	86.7°	332.0°
7B409#	19.696°	204.955°	12/12	20	24.3°	1.4°	1.9°	514	11.97858	82.9°	13.9°
7B421#	19.738°	204.988°	12/12	20+	24.4°	2.8°	1.4°	912	11.98793	82.5°	3.3°
B1214	19.740°	204.986°	9/12	10+	22.1°	358.5°	2.2°	545	8.98531	81.6°	35.4°
B2378	19.636°	204.957°	13/13	20+	42.4°	14.6°	2.3°	326	12.96317	75.6°	272.4°
B3746	19.722°	204.894°	14/14	20+	38.2°	4.1°	1.8°	466	13.97210	85.8°	270.0°
B5432	19.723°	204.911°	12/13	10	42.1°	7.0°	1.5°	887	11.98759	82.1°	258.0°

Keaau Ranch quadrangle

Site	Lat.	Long.	N/No	Exp.	I	D	α95	k	R	Plat.	Plong.
B1201	19.648°	205.015°	11/12	10+	24.9°	359.3°	1.1°	1895	10.99472	83.4°	31.1°

Kulani quadrangle

Site	Lat.	Long.	N/No	Exp.	I	D	α95	k	R	Plat.	Plong.
8B829*	19.552°	204.698°	12/12	20	36.5°	7.6°	1.1°	1658	11.99336	82.8°	287.4°
9B085*	19.595°	204.644°	12/12	20	18.9°	1.9°	2.1°	411	11.97325	79.9°	13.7°
9B097*	19.581°	204.650°	11/12	20	17.2°	359.0°	2.2°	429	10.97669	79.2°	30.2°

Table 1. cont.

Kulani quadrangle

Site	Lat.	Long.	N/No	Exp.	I	D	α95	k	R	Plat.	Plong.
9B109*	19.564°	204.656°	12/12	20	18.2°	2.2°	2.2°	401	11.97256	79.6°	12.6°
1B704	19.538°	204.655°	11/12	30	21.0°	2.0°	1.7°	736	10.98641	81.1°	11.9°
1B716	19.544°	204.655°	10/12	30+	20.1°	3.2°	1.5°	1098	9.99180	80.3°	5.7°
1B728	19.533°	204.648°	10/12	30+	17.8°	355.5°	1.9°	679	9.98675	78.7°	48.2°
1B740	19.525°	204.657°	12/12	20+	39.1°	0.1°	1.4°	1029	11.98931	87.4°	206.3°
1B764	19.517°	204.657°	10/12	20	34.4°	2.0°	2.0°	585	9.98463	88.0°	312.3°
2A505	19.566°	204.720°	11/11	20	35.8°	7.0°	1.4°	1109	10.99099	83.4°	291.4°
2B079	19.595°	204.655°	12/12	20	42.0°	5.3°	2.0°	465	11.97632	83.2°	250.6°
2B091	19.572°	204.737°	12/12	20	35.8°	4.4°	1.6°	764	11.98560	85.9°	290.4°
2B103	19.566°	204.683°	12/12	20	18.5°	2.9°	1.3°	1084	11.98985	79.5°	8.7°
3A052	19.569°	204.696°	7/8	20	18.1°	4.1°	2.1°	854	6.99297	79.0°	3.1°
B1112	19.582°	204.737°	13/13	20+	39.6°	7.3°	2.0°	430	12.97213	82.6°	270.2°
B1125	19.583°	204.734°	11/12	15	37.0°	16.1°	1.5°	984	10.98984	74.9°	288.0°

Mountain View quadrangle

Site	Lat.	Long.	N/No	Exp.	I	D	α95	k	R	Plat.	Plong.
8B217*	19.582°	204.971°	10/12	30	36.4°	4.0°	1.2°	1550	9.99419	86.2°	284.5°
8B901*	19.543°	204.876°	12/12	20	33.6°	5.5°	1.5°	829	11.98673	84.6°	306.3°
9B889*	19.584°	204.969°	12/12	30	36.0°	0.3°	1.3°	1161	11.99052	89.5°	237.4°

Piihonua quadrangle

Site	Lat.	Long.	N/No	Exp.	I	D	α95	k	R	Plat.	Plong.
9B061*	19.642°	204.873°	11/12	30	40.2°	5.1°	1.8°	684	10.98537	84.2°	259.7°
1A854	19.684°	204.853°	18/18	30	42.4°	1.8°	1.7°	407	17.95823	84.9°	222.9°
2A431	19.678°	204.815°	7/15	20	32.7°	5.8°	2.8°	460	6.98696	84.2°	312.8°
2A469	19.698°	204.863°	12/12	30+	12.6°	347.2°	2.0°	454	11.97579	71.8°	69.7°
2A481	19.715°	204.846°	14/14	30	35.9°	5.4°	1.3°	895	13.98547	85.0°	291.9°
2A495	19.701°	204.829°	10/10	20	33.1°	6.1°	1.6°	960	9.99063	84.0°	309.4°
6A308#	19.663°	204.862°	10/11	20	25.7°	0.6°	1.6°	869	9.98965	83.8°	19.4°
6A319#	19.650°	204.873°	12/12	20	37.9°	19.3°	1.5°	800	11.98625	71.8°	286.4°
6B085	19.692°	204.847°	12/12	20	42.0°	1.2°	2.7°	262	11.95804	85.4°	218.3°
6B097	19.718°	204.862°	12/12	10+	35.9°	5.6°	1.9°	553	11.98011	84.7°	291.9°
6B109	19.661°	204.872°	12/12	20	38.0°	357.3°	1.2°	1388	11.99207	87.0°	149.5°
6B121	19.661°	204.873°	12/12	20+	34.5°	7.2°	1.8°	618	11.98221	83.1°	299.5°

Table 1. cont.

Piihonua quadrangle

Site	Lat.	Long.	N/No	Exp.	I	D	α95	k	R	Plat.	Plong.
6B157	19.654°	204.861°	12/12	20	23.5°	338.4°	1.2°	1334	11.99176	68.0°	98.5°
6B169	19.655°	204.862°	12/12	20	21.0°	359.3°	2.6°	288	11.96183	81.2°	29.7°
6B181	19.655°	204.861°	12/12	20	41.0°	350.9°	1.6°	697	11.98423	80.7°	140.8°

Puu Makaala quadrangle

Site	Lat.	Long.	N/No	Exp.	I	D	α95	k	R	Plat.	Plong.
9B013*	19.598°	204.853°	11/12	20	22.2°	359.3°	1.1°	1749	10.99428	81.9°	29.9°
9B025*	19.571°	204.769°	12/12	30	20.5°	348.0°	3.1°	199	11.94461	75.3°	78.7°
2A410	19.597°	204.783°	9/9	20	35.5°	3.8°	1.0°	2798	8.99714	86.4°	293.6°
2B067	19.593°	204.787°	12/12	20	41.3°	6.9°	1.6°	723	11.98479	82.4°	260.7°
B8266	19.570°	204.829°	12/13	10	39.8°	14.5°	1.3°	1056	11.98959	76.2°	279.5°
B3011	19.509°	204.830°	13/13	10	35.3°	11.0°	1.8°	554	12.97835	79.7°	293.3°
B3024	19.554°	204.859°	11/11	10+	33.6°	9.1°	1.7°	726	10.98623	81.3°	301.3°

Puu Ulaula quadrangle

Site	Lat.	Long.	N/No	Exp.	I	D	α95	k	R	Plat.	Plong.
2A516	19.531°	204.537°	12/12	30	30.7°	1.4°	2.6°	286	11.96150	86.8°	1.0°
2A529	19.533°	204.535°	7/10	30	31.1°	1.4°	3.5°	305	6.98031	87.0°	358.5°
7A358	19.531°	204.530°	13/13	20	42.5°	5.8°	1.2°	1196	12.98996	82.6°	250.4°
7A468	19.579°	204.511°	12/12	30+	31.2°	353.9°	2.3°	371	11.97034	83.6°	90.2°
B8230	19.575°	204.500°	11/12	20	31.7°	352.1°	2.8°	263	10.96194	82.1°	98.0°

Site is alphanumeric identifier of location; Lat./Long. are latitude and longitude in degrees north and east of the site location; N/No is the number of cores used compared with the number originally taken at the site; Exp. is the strength of the peak alternating field in milliTeslas; I and D are the remanent inclination and declination in degrees; α95 is the 95% confidence limit about the mean direction in degrees; k is the estimate of the Fisherian precision parameter; R is the length of the resultant vector; and Plat./Plong. is the location in degrees north and east of the virtual geomagnetic pole (VGP) calculated from the site mean direction. (*) denotes sites originally published in Holcomb(1980) and Holcomb et al. (1986); (#) denotes sites originally published in Buchanan-Banks (1993).