

PALEOMAGNETIC DIRECTIONS FROM HAWAIIAN LAVA FLOWS,
1840-1960

By

R. L. DuBois

Department of Geology, University of Arizona

Paleomagnetic investigations of historic lava flows from the Hawaiian Islands provide an opportunity to study the relationships between paleomagnetic data and measured values of the magnetic field of the earth. The problems of consistency of measurements and of reversals of the earth's magnetic field can also be studied. The results presented here are a preliminary report of magnetic measurements made on 44 oriented specimens collected from dated flows. Measurements of remanent magnetism were completed on an astatic magnetometer. Further studies giving information on the paleointensity of the geomagnetic field are in progress. The information presented here adds to that given by Doell and Cox (1961) and is in accord.

The measurements are given in table 1 and the directions of remanent magnetism of all measured specimens are plotted in figure 1 as a stereograph with solid circles plotted on the lower hemisphere. The flows from which the specimens were collected range in age from 1840 through 1960 and are on the island of Hawaii. The intensity of magnetism ranges from 172×10^{-5} emu/cm³ to 861×10^{-5} and there is some suggestion of a cyclic variation of magnetic intensity caused by possibly small changes in rock characteristics or intensity of the magnetic field. The declination of the remanent magnetism varies within a range of 19° and is symmetrical about a direction slightly east of north. Inclination, exclusive of one specimen, is downward and varies from 26° to 38°. The exception is from a 1907 flow and has an upward inclination of 30°. The other specimens measured from this same flow gave normal readings and therefore the upward inclination is not considered significant. It is not a reversal as the direction is to the north and not southward.

TABLE 1
MAGNETIC MEASUREMENTS ON HAWAIIAN LAVAS

Date of flow	Declination	Inclination	Geomagnetic Pole Position	Intensity $\times 10^{-5}$ emu/cm ³
1840	12	+38	79N, 71W	172
1855	11	+38	79N, 72W	632
1868	6	+29	82N, 28W	377
1881	12	+33	78N, 55W	433
1907	353	+26	80N, 65E	568
1919	8	+33	82N, 48W	861
1955	8	+34	82N, 52W	366
1960	356	+34	86N, 82E	383
Average	7	+34	83N, 48W	488

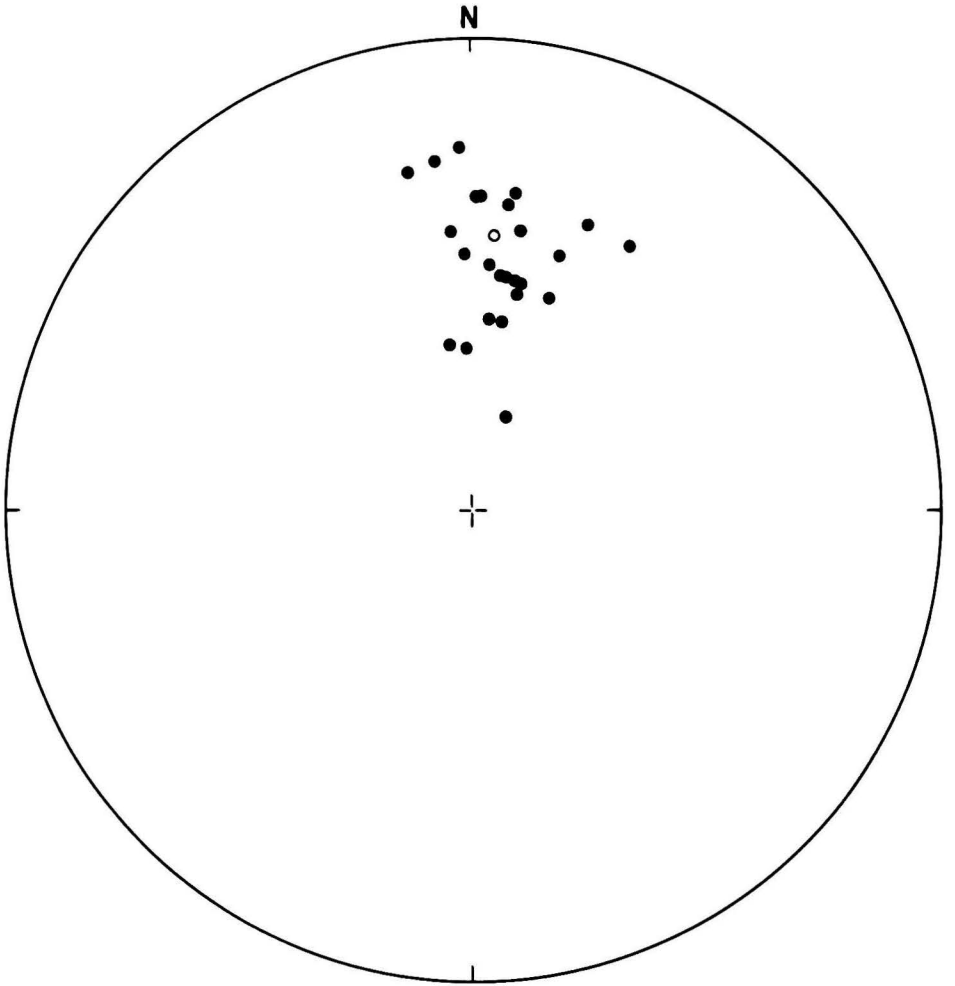


Figure 1. --Direction of remanent magnetism of specimens from Hawaiian lava flows, 1840-1960.

The paleomagnetic pole positions calculated from the data are given in table 1 and plotted in figure 2. The positions of the poles, exclusive of two values, plot as a tight group with an elongate shape. The dispersion is easily explained by the variance in inclination of remanent magnetism which could be in part a sampling error. The group essentially coincides with the plotted position of the present geomagnetic pole. The geomagnetic pole is the position of intersection of the projected axis of a theoretical dipole which characterizes the earth's magnetic field, with the earth's surface. The pole positions are some distance from the geographic pole and from the magnetic pole. The location of the paleomagnetic poles does deviate some from the present geomagnetic pole. The older flows are nearly coincident whereas the later flows, 1881-1955, give poles which group around a point further east.

The data presented clearly indicate the validity of the use of magnetic measurements of rocks to locate paleomagnetic poles. It shows that where consistency of measurements should be expected it is present—a close correlation of data determined from rocks with known geomagnetic conditions. The data suggest some differences that may be significant and if so will require an explanation. It further suggests a method whereby additional parameters of the earth's paleomagnetic field might be determined which will help test any theories set forth on the origin of the magnetic field.

REFERENCES

- Doell, R. R., and Cox, A., 1961, Paleomagnetism of Hawaiian Lava Flows: *Nature*, 192, p. 645-646.

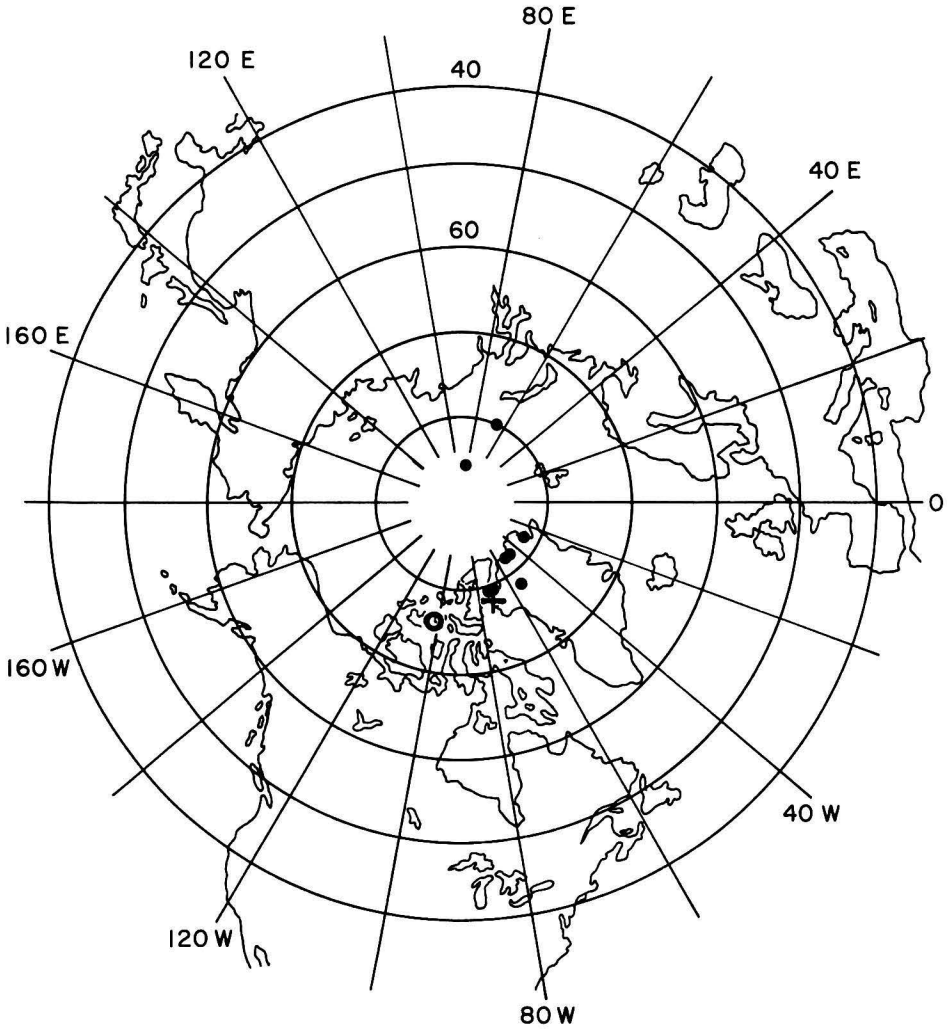


Figure 2.--Geomagnetic pole positions for Hawaiian lava flows, 1840-1960. ● Calculated geomagnetic pole, ○ present magnetic pole, + present geomagnetic pole.