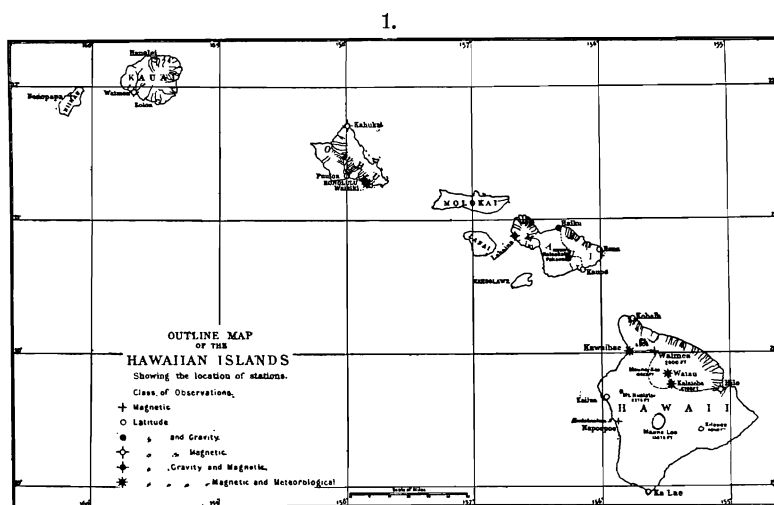ART. XXII.—*Disturbances in the direction of the Plumb-line in the Hawaiian Islands ;* by E. D. PRESTON.

PROFESSOR ALEXANDER, Surveyor General of Hawaii has made a comparison of the astronomical and geodetic latitudes on the three principal islands of the group. In addition to this, since the observed latitudes at Kawaihae, Hilo, and Waiau (Mauna Kea) are consistent with one another the latter has been adopted as a standard and a comparison has been made between the observed latitudes and the Mauna Kea standard. This brings out some interesting deflections of the plumb-line. See Fig. 1.

1.

OUTLINE MAP
OF THE
HAWAIIAN ISLANDS
Showing the location of stations.
Class of Observations.
+ Magnetic
O Latitude
● ,, and Gravity.
✧ ,, ,, Magnetic.
✛ ,, ,, Gravity and Magnetic.
✳ ,, ,, ,, Magnetic and Meteorological

Scale 100 miles to one inch.

There appears to be a disturbance of more than a minute in the direction of gravity at the south point of Hawaii (Ka Lae). At Kohala the plumb-line is deflected half a minute towards the south and at Kalaieha nearly as much towards the north, the disturbance being in both cases towards the mountain. The enormous deflection at Ka Lae (67″) is also to the north-ward. This is evidently caused by the great mass of Mauna Loa,* which adds its effect to that of Mauna Kea and more-over is comparatively near to the astronomical station.

On Maui the same phenomenon appears. At Haiku there is a deflection towards the south and at Kaupo there is one to the north, and as before the astronomical latitude determined

* Both Mauna Kea and Mauna Loa are nearly 14,000 feet high.

on the top of Haleakala (10,000 feet elevation) at Pakaoao appears to be a normal one for that island. Judging by analogy there seems to be no reasonable doubt that Oahu would have shown the same thing had a station been made on the summit between Kahuku and Puuloa.

The mean deflection for each of the islands (leaving out Ka Lae on the island of Hawaii) is:—

$$\begin{array}{ll}\text{Hawaii} & 27'' \\ \text{Maui} & 29 \\ \text{Oahu} & 26\end{array}$$

When we come to compare the mean latitudes for each island with one another we find that Maui is too small whether judged by the Hawaii or the Oahu standard. The amount is nearly the same in either case so that the most probable assumption is that there is a preponderance of matter deflecting the plumb-line to the northward at all the Maui stations. This supposition has been made by Professor Alexander and seems to be the most rational interpretation of the results. The following table has been furnished by him and is inserted here with his permission.

Hawaiian Latitudes.

STATIONS.	ASTRONOMICAL.	GEODETIC.	DIFF.	MAUNA KEA STANDARD.	DIFF.
Oahu					
Kahuku	21° 43′ 06″·1	21° 42′ 16″·1	+50″·0	21° 42′ 43″·2	+22″·9
Puuloa	21 19 15 ·6	21 19 11 ·8	+ 3 ·8	21 19 38 ·9	−23 ·3
Honolulu	21 18 02 ·5	21 18 02 ·3	+ 0 ·2	21 18 29 ·6	−27 ·1
Waikiki	21 16 24 ·5	21 16 26 ·8	− 2 ·3	21 16 53 ·9	−29 ·4
Maui					
Lahaina	20 52 22 ·8	20 52 53 ·2	−30 ·4	20 52 34 ·5	−11 ·7
Haiku	20 56 02 ·6	20 56 04 ·0	− 1 ·4	20 55 45 ·3	+17 ·3
Pakaoao	20 42 51 ·0	20 43 21 ·6	−30 ·6	20 43 02 ·9	−11 ·9
Kaupo	20 36 40 ·8	20 37 41 ·0	−60 ·2	20 37 22 ·3	−41 ·5
Hana	20 45 38 ·9	20 45 47 ·5	− 8 ·6	20 45 28 ·8	+10 ·1
Hawaii					
Kohala	20 15 29 ·3	20 15 17 ·7	+11 ·6	20 14 59 ·0	+30· 3
Kawaihae	20 02 05 ·9	20 02 25 ·1	−19 ·2	20 02 06 ·4	−00· 5
Mauna Kea	19 48 52 ·0	19 49 10 ·7	−18 ·7	19 48 52 ·0	±00· 0
Kalaieha	19 42 02 ·6	19 42 33 ·5	−30 ·9	19 42 14 ·8	−12· 2
Hilo	19 43 11 ·2	19 43 30 ·4	−19 ·2	19 43 11 7	−00· 5
Kailua	19 38 20 ·9	19 39 03 ·8	−42 ·9	19 38 45 ·1	−24· 2
Ka Lae	18 53 51 ·7	18 55 17 ·7	−86 ·0	18 54 59 ·0	−67· 3

The astronomical latitudes were determined by myself in 1883, 1887 and 1891–'92, using the method of equal zenith distances. The average probable error of a result for each station was ±0″·10. For the details of this work see Appendix, No. 14, U. S. Coast and Geodetic Survey Report for 1888. Determinations of Latitude and Gravity for the Hawaiian Government.