NOTES ON FUJIYAMA.

By WADA TSUNASHIRO.

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When travelling in Koshiu, in 1878, I was fortunate in obtaining some dates of the eruption of Fujisan at Shimo-Yoshida. These agree very well with the dates given by Klaproth in Humbolt's "Fragments of Geology and Climatology of Asia." Before giving these dates, I wish to make some remarks on the topography of Fujisan. Mr. O. Schütt has made a survey of the mountain, which will shortly be described in the Transactions of the German Asiatic Society. He has given profiles of the mountain from Subashiri, and from Kami Yoshida, to the summit. Between Subashiri which is 768 metres above the sea and Kenga Mine (the highest point on Fuji) which is 3,765 metres above the sea, he found the average angle of 13°. From Ichigome the angle is 21.5°. From Kami Yoshida the angle is only 11.5°, and from its Ichigome it is 18°.

Professor Mendenhall gives a collection of the observations about the height of Fuji. These are 12 in number. The observation of Mr. Rein, made seven years ago, Mr. Mendenhall does not mention. Mr. Schütt also measured

the height. Altgether we have therefore fourteen determinations :—

	Meters.		*Meters.*
1.	4,332 Allcock.	8.	3,772 Fenton.
2.	3,987 Fagan.	9.	3,768 Favre Brandt.
3.	3,266 Williams.	10.	3,823 Nakamura & Wada.
4.	3,518 Lepissier.	11.	3,793 Siebold.
5.	3,729 Knipping 1st calculation.	12.	3,745 Rein.
6.	3,829 „ 2nd „	13.	3,794 Schütt.
7.	3,769 Stewart.	14.	3,787 Chaplin.

The only determinations which are worthy of consideration are those founded on a great number of barometric observations ; *pro ex.* 5, 6, 10 and 13 ; or which, as number 7, are determined by an Omnimeter, or which are taken by trigonometrical observations, as number 14. The average of the six reliable determinations is 3,784 meters which agrees very satisfactorily with Chaplin's number of 3,787 meters, the latter being the most exact of all, according to the method applied. Therefore Chaplin's height must be accepted as the height until farther observations have been made.

The rock of Fuji has been called by Rein and by Dr. Naumann a Dolerite. Two analyses of it are printed. One is made by myself and Mr. Korschelt. It has been published by Mr. E. Kinch in Vol. VIII of the Transactions of the Asiatic Society, but it is hardly exact enough to be repeated The other is by Dr. Luedecke, who found,

Silica	52.6
Alumina	16.8
Ferrous oxide	13.0
Magnesia	2.0
Lime	14.6
Soda	.9
Phosphoric acid	trace.
Potash calculated by difference	.9
	100.0

I hardly think that this analysis of Dr. Luedecke is to be relied upon. The calculation of Potash by the difference,

and the exceedingly large quantity of Iron and small quantity of Alumina, are points where there may be some error. Luedecke found under the microscope that the rock is a normal Felspar Basalt, consisting of felspar which is Anorthite, Olivine and Augite. The glass basis is scarce. If the latter is the case, then the lime must be in the Anorthite and only in small quantity in the basis. But, as Anorthite contains at least 8 parts Alumina for 2 parts Lime, there would be necessary for 14.6 lime, 21.9 Alumina to form Anorthite, while Luedecke only found 16.8 of the latter. Also Olivine so rich in Iron, as the Olivine in the rock of Fuji would be, after Luedecke's analysis, is an Olivine which has not yet been observed by others. A third analysis of a specimen of the rock, taken by Mr. Schütt from the sides of the Crater, was anlysed under Mr. Korschelt's direction by Mr. Hida.

	A. A Rock from Fuji.	B. A Rock from Tonosawa.	C. The felspar of the Tonosawa Rock.	
Silica	49.77	48.97	44.16	
Alumina	20.57	22.91	31.87	
Ferric oxide	6.06	4.81	1.33	as Ferric oxide.
Ferrous ,,	5.11	4.02		
Manganous oxide	.20	0.08	—	
Lime	10.37	13.44	20.90	
Magnesia	5.00	3.78	0.53	
Potash	0.84	0.34	0.55	
Soda	1.08	1.29	0.32	
Water	.73	0.47	0.60	
Phosphoric acid	0.16	0.22	—	
	99.89	100.32	100.26	
Specific Gravity	2.642	2.805	—	

In a thin section I found:—

1st.—Felspar, with many slag enclosures and great angles of extinction. Generally in single twins.

2nd.—Olivine, in numerous small grains frequently with a black border of magnetite.

3.—Augite, but in small quantity.

4.—Magnetite, relatively much, but in small grains.

5.—Mica was not observed, although Luedecke saw it.

6.—A colourless basis but scarce.

Comparing the results of other analyses with the above, I conclude that the felspar is an Anorthite.

This supposition is strengthened if analyses B and C given by Mr. Korschelt are taken into account. B is an analysis of a large grained rock from Tonosawa near Hakone, and C an analysis of the felspar contained in that rock. This felspar is without doubt Anorthite. Because analyses of the Tonosawa and Fuji rock agree so well, and the external appearance of the Fuji rock is the same as that of the Hakone rock, when the latter is fine grained through cooling, the conclusion is justified that the felspar of Fuji is also Anorthite. However, not all the lime is in the Anorthite, nor is the whole of the Magnesia, because otherwise the glass basis would become far too acidic. Hence the rock of Fujiyama is an Anorthite Basalt.

The following eruptions are known in Shimo-Yoshida (partly taken from an old manuscript in the possession of Mr. Watanabe).

1. In the year A.D. 798 (Yureki, 18th year) from the 14th of 3rd to the 16th of the 4th months.

2. In 799 (Yureki 19th year) 3rd month, (all the rivers became red.)

3. In 801 (Yureki 21st year) 3rd month.

4. „ 863 (Tekuwan 6th year) 1st of 5th month—25th of the 5th.

5. In 937 (Shohei 7th year).

6. „ 1330 (Genko 1st year) 7th day 7th month.

7. „ 1561 (Yikoku 3rd year).

8. „ 1707 (Hoyei 4th year) 3rd day 11th month.

The lava stream of the 1st eruption came down to Saruhashi along the Katsuragawa. The place where it stopped is still called Shogimba (Pure locality) because the pilgrims at the time of the eruption could not go up the mountain, and therefore prayed at that place. The length of this stream is from 8 to 9 ri. Another lava stream came as far as Otsuki, 1 ri nearer to Fuji than Saruhashi; but people do not know to what eruption it belongs. At this place there is now a temple, called San-no-Miya.

At the 4th eruption (863) a lava stream came between Kami and Shimo-Yoshida, where now the cemetery, common to the two places, is situated. The village Yoshida existed in the period Yureki.

In Landgrebe's "Volcanoes," Klaproth's remarks, above mentioned, are as follows:

"In the year 799 Fuji had a violent eruption. It lasted from the 14th of the 3rd to the 18th of the 4th. The ash thrown out covered the whole foot of the mountain and all the steams in the neighbourhood became red.

"Before the eruption of 800, there was no preceding earthquake, while those of the 6th month of 863 and of the 5th month of 864 were preceded by earthquakes. This latter eruption was very violent. The mountain burned in a space of two geographical square miles on all sides. The flames rose 12 *toises*, and were accompanied by fearful thunder. The earthquakes were repeated three times, and the mountain stood in flames for 10 days. Finally the foot of the mountain broke up; and a shower of stones and ash came out and fell partially in a lake N.W, of the mountain and heated the water to boiling. All the fish died in consequence. The devastation extended a length of 30 *lieues* and the lava flowed 3 to 4 *lieues* in the direction of Kai.

"In the year 1707 on the night of the 23rd Nov. there were two strong shocks. Fuji opened, threw out flames, and

ash came to the bridge Kasubatsu near Okabe in the province of Suruga, a distance of 10 *lieues*. Next morning the eruption became less. However it was renewed with still greater violence on the 25th and 26th of the same month. Enormous quantities of blocks of stone, red hot ash and sand covered the neighbouring plain. In Yoshiwara it was five or six feet high; and it even reached Yedo, where it accumulated several inches in thickness. At the place of the eruption a wide gulf was formed. Near to it a mountain rose which received the name of Fooyeyama" (Hoyeisan).

The eruptions of 937, 1330 and 1561 are not mentioned by Landgrebe. The eruption of 801 Landgrebe gives as 800 and that of 863 he gives as 864. Besides he mentions one of 863. These interchanges may be due to the calculation. The eruptions, Nos. 1 to 3, are perhaps identical as they occurred all in the 3rd month. Be it as it may, the number of the eruptions of Fuji in historical time is remarkably small. Only the oldest eruptions have had lava streams, all of which run North and West; but the formation of Hoyeisan in 1707 took place without eruption of lava. Dr. Naumann in the Transactions of the German Asiatic Society, Part V., has described this eruption in detail from Japanese sources.

The lakes lying at the North foot were formerly without doubt united, and one can see distinctly how they have become separated by lava streams flowing down from Fuji. The three lakes on the West side have exactly the same height of 905 meters. The level of the water in them changes simultaneously, in consequence of which the inhabitants have the idea that these lakes are united underground, which idea I share. The East and South of Fuji is formed of volcanic rocks; the mountains on the West, on the left shore of the Fujikawa, are syenitic in their highest parts. The mountains to the North of the three

lakes are granite on their Northern slope. On their Southern, that is on the Fuji side, the granite is overlaid with old green tufa *(Diabase tufa)*. The North-East mountain range separating Kai from Suruga and Sagami is also granite. This range extends very nearly to Fuji, where it is overlaid by the scoria of the mountain. A continuation of the ridge of these mountains would pass to the top of Fuji. Consequently it is probable that Fuji has been built up over granite.