42. *Recent Changes in Area of the Base Line Rhombus at Mitaka.*

By Chûji TSUBOI,

Earthquake Research Institute.

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In the compound of the Tokyo Astronomical Observatory at Mitaka, there is a special set of five geodetic base lines, which are each very nearly 100 m in length and which are so arranged as to form a rhombus consisting of two equilateral triangles NES and NSW with one side NS common to both. (Fig. 1.) This was laid down in 1916 by the Imperial Japanese Geodetic Commission with the object in view to measure the horizontal dilatation or contraction, if any, of the earth's crust near Mitaka. As the writer has already pointed out in previous papers of his,[1] precise measurements of the lengths of these base lines, which have since 1916 been made once a year on the average, showed that the base lines have not remained constant in length, resulting in the increase or decrease of the areas of the two triangles NES and NSW. As the continuation of the previous papers, the results of the length measurements of the base lines that were made twice in 1934 by experts of the Military Land Survey and were placed at the writer's disposal recently will be discussed in the present paper.

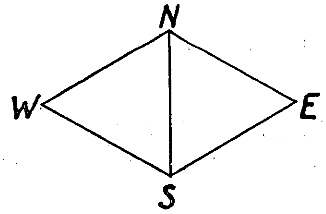

Fig. 1. The base line rhombus.

The lengths of the base lines in February and December of 1934 are as follows:

	NE	ES	NS	SW	NW
	m mm				
Feb. 1934.	100+1·76	100+0·53	100+3·29	100+1·72	100+1·33
Dec. 1934.	100+1·59	100+0·15	100+3·12	100+1·63	100+1·06

Utilising the successive changes in length of the base lines, the specific changes in area of the triangles can be calculated in the fol-

1) C. TSUBOI, *Proc. Imp. Acad.*, **6** (1930), 367; **7** (1931), 155; *Bull. Earthq. Res. Inst.*, **8** (1930), 384; *Jap. Journ. Astr. Geophys.*, **10** (1933), 93.

lowing manner.

The area S of a triangle of which the sides are a, b, and c is given by

$$S=\sqrt{s(s-a)(s-b)(s-c)}\,,$$

where $$s=\frac{1}{2}(a+b+c).$$

We have then

$$\frac{dS}{S}=\frac{1}{2}\left(\frac{ds}{s}+\frac{ds-da}{s-a}+\frac{ds-db}{s-b}+\frac{ds-dc}{s-c}\right).$$

For an equilateral triangle

$$a=b=c,$$

whence $$\frac{dS}{S}=\left(\frac{ds}{s}+\frac{ds}{s-a}\right).$$

As $s=150$ m and $a=b=c=100$ m in the present case, we have

$$\frac{dS}{S}=\frac{ds}{75{,}000}$$

ds being expressed in mm.

The recent changes in area of the triangles thus calculated are as follows:

	ΔNES	ΔNSW
Oct. 1931.		
Feb. 1934.	$-0{\cdot}22\times10^{-5}$	$-0{\cdot}89\times10^{-5}$
Dec. 1934.	$-0{\cdot}48$	$-0{\cdot}35$

They are all negative and indicate the horizontal contraction of the earth's crust. The continuous observation by R. Takahasi[2] of the length change of the earth's surface crust at Komaba, about 13 km E of Mitaka, also indicates the contraction recently.

The changes in area of the triangles since the first measurement in 1916 are given in Table I and are graphically shown in Fig. 2. It is to be noted that the triangles have undergone specific changes in area of the order of 10^{-5}.

2) R. TAKAHASI, *Bull. Earthq. Res. Inst.*, **12** (1934), 760.

Table I. Changes in Area of the Triangles NES and NSW of the Base Line Rhombus in 10^{-5}.

	⊿NES	Integrated	⊿NSW	Integrated
June 1916				
Feb. 1917	−0·04	−0 04	−0·05	−0·05
Oct. 1917	+0·55	+0·51	+0·50	+0·45
Feb. 1918	−0·56	−0·05	−0·36	+0·09
Oct. 1918	−0·06	−0·11	−0·17	−0·08
Dec. 1919	+0·38	+0·27	+0·31	+0·23
Nov. 1920	+0·32	+0·59	+0·34	+0·57
Nov. 1921	+0·05	+0·64	+0·14	+0·71
Nov. 1922	−0·26	+0·38	−0·17	+0·54
Sept. 1923	+2·87	+3·25	+2·97	+3·51
Oct. 1923	−0·46	+2·79	−0·63	+2·88
Jan. 1924	−0·15	+2·64	−0·37	+2·51
Aug. 1924	−0·53	+2·11	−0·16	+2·35
Dec. 1925	+0·55	+2·66	+0·21	+2·56
Dec. 1927	+0·87	+3·53	+1·00	+3·56
March 1929	−0·25	+3·28	−0·14	+3·42
Feb. 1930	−0·41	+2·87	−0·53	+2·89
Oct. 1931	−0·11	+2·76	+0·83	+3·72
Feb. 1934	−0·22	+2·54	−0·89	+2·83
Dec. 1934	−0·48	+2·06	−0·35	+2·48

On the other hand, according to the mareographic observations at Aburatubo which is situated 60km S of Mitaka and at the top of Miura Peninsula, the height H of a bench-mark here above the mean sea level has undergone secular changes as shown in Fig. 2. Although the height of the annual mean sea level at a coastal station is affected more or less by meteorological conditions over the adjacent sea of the station in the corresponding year, at least some part of the observed change in the level is attributable to the absolute vertical displacement of the earth's crust near the station. The similarity of the two curves showing the changes in H and in

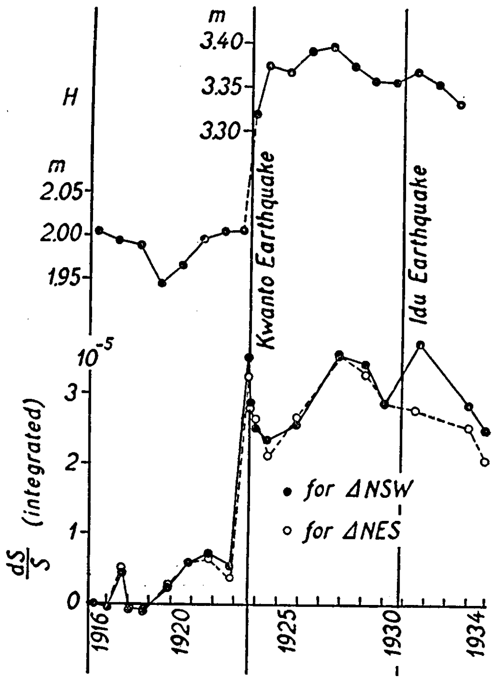

Fig. 2. dS/S ··· Changes in area of the triangles ⊿NES and ⊿NSW.
H ··· Height of the bench-mark at Aburatubo above the annual mean sea level.

area of the triangles is rather striking. The increase or decrease of the areas of the triangles respectively corresponds to the upheaval or depression of the earth's crust at Aburatubo.

It seems thus probable that the change in area of the Mitaka base line rhombus is not of a local character but is some or other manifestation of a larger crust deformation prevailing at least over the southern half of the Kwantô district.

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42. 三鷹基線菱形の最近の面積變化

地震研究所 坪井忠二

三鷹基線菱形の面積變化に就いては嘗て報告した事があるが，本文では昭和9年2月及び12月に得られた測定結果を材料として，其の後の變化を論じた．計算の結果によれば面積變化は次の通りである．

	⊿NES	⊿NSW
昭和6年10月 昭和9年2月	$-0{\cdot}22\times10^{-5}$	$-0{\cdot}89\times10^{-5}$
昭和9年2月 昭和9年12月	$-0{\cdot}48$	$-0{\cdot}35$

尙面積變化の模樣が油壺に於ける水準點の平均海水面上の高さの變化の模樣と類似して居るのは著しい事で，これは上述の面積變化が三鷹局部的のものでなく，少くとも關東地方の南半分に起つて居る地殼變動のあらはれである事を暗示する．
