38. *Contraction of the Japanese Islands since the Middle Neogene (advance paper).*

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It was long unknown what kind of structural characteristics are exposed in the Japanese Tertiary strata. Recently however our knowledge of Tertiary geologic structures has been greatly enriched, thanks to the studies of a number of Japanese investigators, especially in Northeast Japan by such oil-geologists as Prof. T. Iki, I. Ômura, Y. Chitani, Y. Iizuka and others, and also in Southwest Japan by Prof. J. Makiyama, the members of the Imperial Geological Survey, and the writer. Yet in spite of all this increased knowledge, the question as to how the Japanese Tertiary strata had contracted or shrunk since their deposition remained unanswered. Under these circumstances the writer tried to ascertain to what extent the Middle Neogene strata had contracted during the late Tertiary disturbances in Japan—information indispensable to the study of Japanese post-Miocene tectonic history. So the writer has measured and drawn a map showing how the contractions are distributed in the Middle Neogene strata as deduced from available data. The extent of the Middle Neogene strata that had deformed since the Middle Neogene was measured by referring to the geologic maps and sections contained in twenty-five selected papers consulted in this study and listed at the end of this paper.

It will be seen from fig. 1, that the Fossa Magna divides the Japanese arc into two parts, Northeast and Southwest Japan. The contraction is much greater in the western half of Northeast Japan and in the Fossa Magna than in Southwest Japan.

As will be seen from Fig. 2, which shows the contraction along the Japanese arc, the contraction in Northeast Japan is small, while the Fossa Magna is a very contracted region, as previously inferred by the writer[1]. Fig. 3 shows however that in the western half of Northeast Japan the contraction is large and in the eastern half small.

1) Y. ÔTUKA, *Bull. Earthq. Res. Inst.*, 9 (1931), 340-352.

As shown in Fig. 1, the small contractions are limited to the old land masses like Southwest Japan, and the Kitakami and Abukuma mountainlands. The contractions are found mostly in the zone from the west half of Northeast Japan to the Fossa Magna. This characteristic distribution of large contractions shows that in post-Middle Neogene this zone was more plastic than the other old land masses just mentioned.

It was held until now that the present general configuration of the Japanese arc had practically been formed by late Tertiary movements. But as will be seen from these figures, the general trend of structural lines and that of lines of equal $\frac{F-L}{F}$ and $\frac{F-L}{F}\cdot\cos\alpha$ do not coincide with the trend of the Japanese arc. It may then be said that the structural characteristics of the Middle Neogene Tertiary strata, which were deformed during the late Tertiary crustal movements, are quite independent of the present configuration of the Japanese arc. The Japanese arc must then have been formed after the Tertiary probably during Pleistocene. The late Tertiary movement was only a prelude to the formation of the Japanese arc.

The following is the way in which the writer did the calculating and mapping:

1. Made the geologic structural map.

2. Determined the general trend of structural lines of the Japanese Neogene Tertiary.

3. Drew the geologic sections at right angles to the general trend of the structural lines.

4. Measured horizontal length (L) of the geologic section.

5. Measured length (F) of the middle Neogene strata along the folded structure along the length of the geologic section.

6. Calculated $\frac{F-L}{F}$ for each geologic section. Fig. 1 shows the distribution of $\frac{F-L}{F}$.

7. Determined the center of the Japanese arc (C) after N. Kumagai,[2] joining "C" and the middle point (Mn.) of every geologic section with straight lines.

8. Measured angle α between line C-Mn and the general trend line of the structural lines.

9. Calculated $\frac{F-L}{F}\cdot\cos\alpha$ and $\frac{F-L}{F}\cdot\sin\alpha$.

2) N. Kumagai, Tigaku Ronsô, (1930), 471-502.

Figs. 2 and 3 show the distribution of these two values. The following table gives the numerical value of each reference.

	$\frac{F-L}{F}$	α	$\frac{F-L}{F}\cdot\sin\alpha$	$\frac{F-L}{F}\cdot\cos\alpha$
1) Daisyaka (Daishaka)	·133	19°	·044	·128
2) Kosaka	·102	18	·032	·089
3) Kitahukuoka	·015	5	·001	·015
4) Gozyônome	·102	20	·036	·088
5) Iwayadô	·015	3	·001	·015
6) Honzyô	·082	18	·026	·079
7) Yamagata	·080	13	·017	·075
8) Zyôban (Jôban)	·035	25·5	·015	·032
9) Niitu	·297	14	·071	·287
10) Maki	·339	12	·071	·330
11) Tyôsi (Chôshi)	·015	19	·005	·014
12) Takasaki	·062	66	·054	·024
13) Atuki	·035	55	·029	·020
14) Bôsô	·015	35	·009	·012
15) Bôsô	·355	42	·237	364
16) Sinano (Shinano)	·285	37	·172	·228
17) Sinano	·211	67	·196	·087
18) Asigara	·615	47	·450	·420
19) Noto	·030	3	·008	·030
20) Mino	·015	?	·015	·015
21) Enasan	·035	?	·035	·035
22) Enasan	·035	?	·035	·035
23) Husimi (Fushimi)	·035	15	·009	·034
24) Tuyama	·015	?	·015	·015
25) Tosa	·015	44	·010	·011
26) Hyûga	·015	61	·013	·007
27) Kakegawa	·035	67	·032	·014

1929 Y. IIZUKA: Geol. Topog. Map Oil Fiel. Jap. Emp., "Daishaka" sheet.
1930 K. KINOSHITA: 1:75,000 Geol. Sheet Map, "Kosaka" sheet.
1833 Y. OTUKA: Geology nr. Kitahukuoka etc. Jour. Geol. Soc. Tokyo, 40, 475.
1919–17 R. ODA: Geol. Top. Map Oil Fiel. Jap. Emp., "Gojonome, Akita" sheets.
1928 F. SAITO: Tert. Form. West. Marg. Kitakami Plateau, Jour. Goegr. 39, 462.
1921 Y. CHITANI: Geol. Top. Map. Oil. Fiel. Jap. Emp., "Honjo, Akita" sheet.
1928 Y. IIZUKA: Geol. Top. Map Oil Fiel. Jap. Emp. "Sinjo. Yamagata" sheet.
1928 K. WATANABE: Spec. Geol. Map., Joban Coal Fiel. sec. 11.
1904 S. OTSUKA: Geol. Top. Map. Oil Fiel. Jap. Emp., "Niitsu, Echigo" sheet.
1931 I. OOMURA: "Oil Geology," Iwanami Koza.
1926 S. YAMANE: 1:75,000 Geol. Sheet. Map, "Choshi" sheet.
1932 T. MURAKOSHI: Geology nr. Takasaki, Ms.
1932 K. SUZUKI: Pliocene nr. Atuki, Kanagawa Prf. Jour. Geol. Soc. Tokyo, 39, 461.
1933 Y. OTUKA: Geology nr. Kururi, Ms.
1933 Y. OTUKA: Geology nr. Kiyosumi, Ms.

1931 Y. ÔTUKA: Early Pliocene etc. Bull. Earthq. Res. Inst. 9, 3.
1931 F. HOMMA: Geology of Mid. Sinano, Geologic Map.
1933 T. ONOYAMA: Tertiary nr. Kanazawa City and Isurugi. Chikyu, 19, 4.
1927 N. KIYONO and K. ISHII: 1:75,000., Geol. Sheet. Map, "Tajimi" sheet.
1929 K. ISHII: 1:75,000, Geol. Sheet. Map, "Enasan" sheet.
1931 K. ISHII: 1:75,000, Geol. Sheet. Map, "Fushimi" sheet.
1929 T. SUZUKI: 1:75,000, Geol. Sheet. Map, "Muroto" sheet.
1930 T. SUZUKI: 1:75,000, Geol. Sheet. Map, "Kochi" sheet.
1930 Y. ÔTUKA: Geologic Problems nr. the Town of Takanabe etc. Geogr. Rev. Japan, 6, 7.
1931 J. MAKIYAMA: Stratigraphy of the Kakegawa Pliocenes etc. Mem. Col. Sci. Kyoto Imp. Univ. ser. B, VII, 1.

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38. 新第三紀中期以來の日本島の收縮.

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文獻及び野外調査により日本の各地に發達する中部新第三系の地質構造を調べ，收縮度を求めた．先づ地質構造の一般走向と之に直角な方向に截つたと考へられるところの地質斷面圖とを求めた．そして水平長さ L の地質斷面圖中に於ける褶曲又は傾斜した中部新第三系の地層の元來の長さ F を水平層準に就いて測定し，$\frac{F-L}{F}$ を求めた．假に $\frac{F-L}{F}$ を收縮度と呼ぶ．收縮度の分布圖は第1圖a,bに示す通りで，東北日本の西部からフオツサマグナ地方へかけて，收縮度の大きい地域がある．

第2，3兩圖は日本の島弧に平行な方向と直角な方向とに收縮度を分けてみせた圖である．α は熊谷助教授の北海道を含めた日本島弧の中心と考へられたものを假に中心として，或る調査地と中心とを結ぶ半徑と一般走向とのなす角を示してゐる．

第2圖は日本島弧に沿へる收縮度を示すもので，東北日本と西南日本とがフオツサマグナ地方で境されてゐること，フオツサマグナの收縮度がかなり大きいのに，東北日本と西南日本とが極めて小さいことがわかる．之によると油田第三系は弧に沿うては餘り收縮してゐないこととなる．

第3圖は日本島弧を日本海側及び太平洋側から挾んで起るやうな收縮度を示してゐて，この圖によると東北日本の西半では收縮度が著しく大きい．殊に新潟地方では大きく．併しこの圖でも東北日本の東半，西南日本の收縮度は他地方に比して著しく小さい．

上記のやうに收縮度の小さいところは北上山地，阿武隈山地，西南日本と言ふ樣な古い地質系統からなつてゐる地方で，收縮度の大きい地方は之等の古い岩石からなる地域に比して遙に可塑性を持つてゐたらしい．

從來日本群島は第三紀末地殼運動でその概形が作られたと考へられてゐたが，之等の圖によつて日本島弧が全く新第三系の地質構造と無關係なことがわかつた．故に日本島弧の概形の形成は恐らく第四紀中に完成されたものであらうと考へることができる．

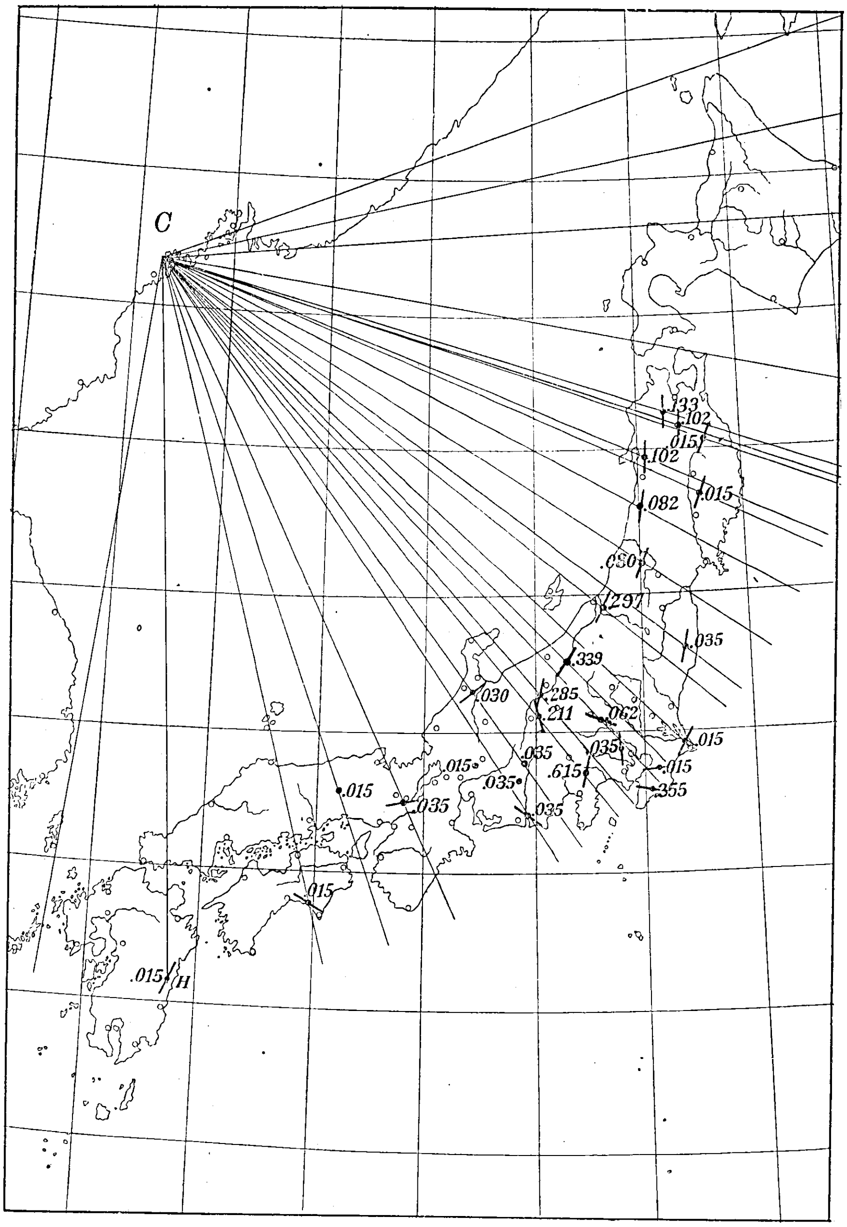

Fig. 1a. General trend of structural lines and $\frac{F-L}{F}$.

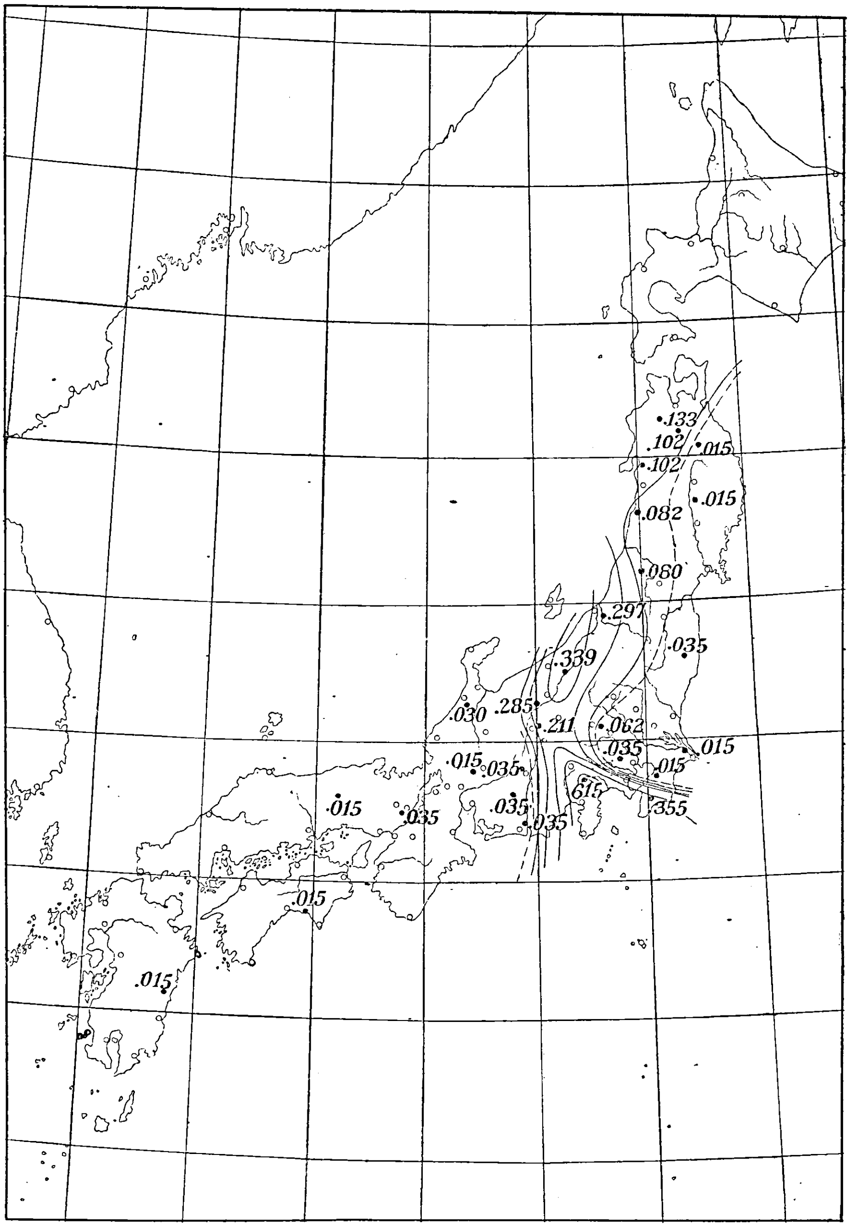

Fig. 1b. Lines of Equal $\frac{F-L}{F}$.

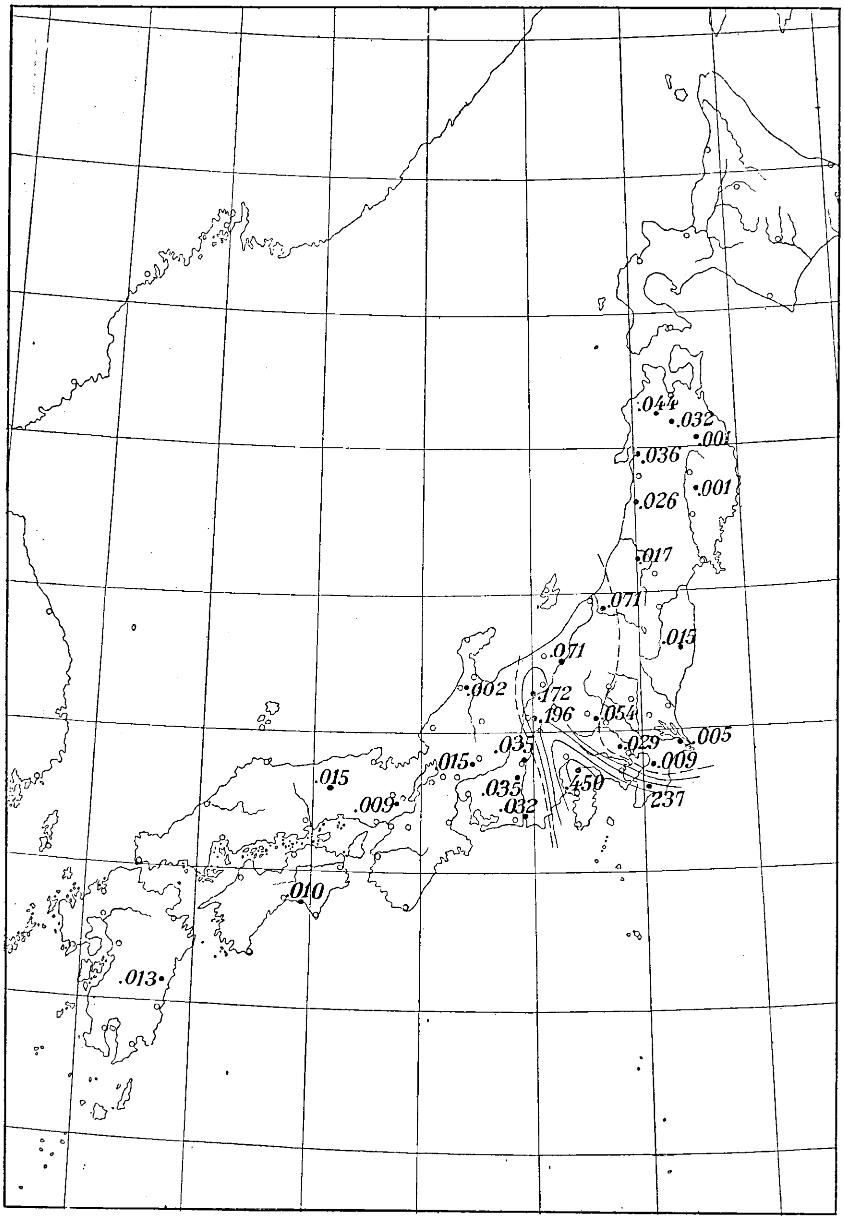

Fig. 2. Lines of Equal $\frac{F-L}{F}\cdot\sin\alpha$

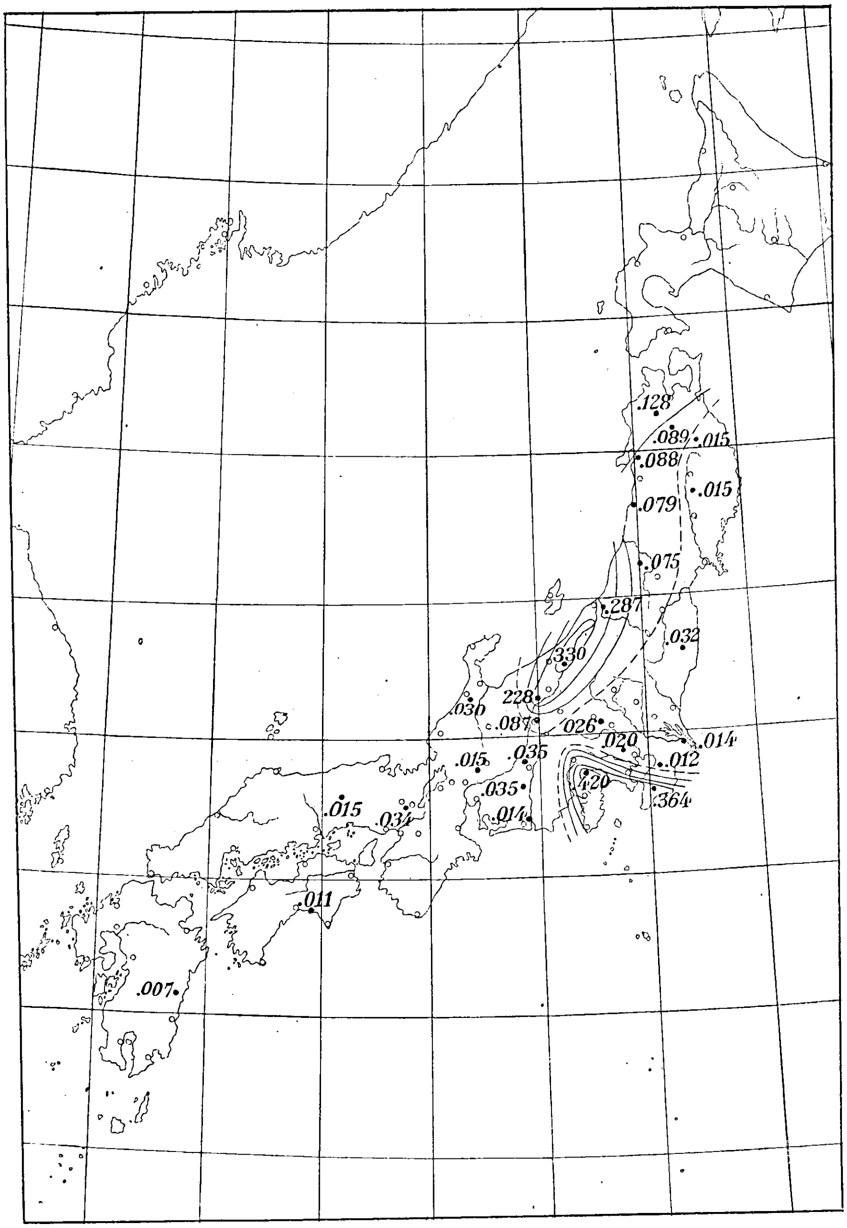

Fig. 3. Lines of Equal $\frac{F-L}{F}.\cos\alpha$