EXPLANATORY TEXT
OF THE
QUATERNARY TECTONIC MAP
OF JAPAN

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Explanatory Text of the Quaternary Tectonic Map of Japan

By

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Abstract

The Quaternary Tectonic Map of Japan, compiled by the Research Group for Quaternary Tectonic Map and published by the National Research Center for Disaster Prevention in August 1969, consists of the following six sheets.

No. 1. Vertical displacements estimated with geomorphological method.
No. 2. Vertical displacements estimated with geological method.
No. 3. Vertical displacements compiled from the maps Nos. 1 and 2.
No. 4. Distribution of faults.
No. 5. Distribution of folds.
No. 6. Gipfelflur.

The Map No. 1 shows the present heights of the erosion flat surfaces formed during the latest Tertiary or the earliest Quaternary age. In producing this map, it is assumed that the erosion surfaces were formed not far from the sea level. The map No. 2 shows the present altitudes and the depths of the locations where upper Pliocene to lower Pleistocene marine sedimentary formations crop out or are buried. The amounts of vertical displacement estimated by geological method are considered to represent the total amounts of the crustal movement from the beginning of the Quaternary to the present. Errors which are derived from the assumptions that the sedimentation occured at shallow depths are neglected because of the next reasons.

It is not always possible to determine exactly the Plio-Pleistocene boundary in the sediments and it is often obliged to take the depositional surfaces or the erosion surfaces which may have considerable time gaps.

In the map No. 1, the amount of uplift can be traced regionally, but the amount of subsidence can not be known. In the map No. 2, both the amounts of uplift and subsidence can be known but they can be determined only locally. Taking advantage of the two mehtods, the authors synthesized the map No. 3, which is one of the conclusions of this work.

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Both of the fault distribution map (No. 4) and the fold distribution map (No. 5) are drawn for such faultings and foldings that have deformed sedimentary beds and terrace surfaces since the upper Pliocene age. Faults more than 1 km in length and folds 500 m to 30 km in wavelength are selected.

Generally speaking, mountain districts have been uplifted, while lowlands have subsided. The maximum uplift of about 1700 m is found in the Central Mountains and the maximum subsidence of about 1400 m in the Kanto Plain (No. 3). It is concluded that the present relief of the Japanese Islands is largely due to the Quaternary tectonic movements. The regional trend of fold-axes and strikes of faults shows a characteristic pattern (Nos. 4 and 5). The Japanese Islands may be divided into some tectonic provinces by the intensity and nature of the Quaternary tectonic movements.

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1. Introduction

The Japanese Islands belong to the circum-Pacific orogenic zone and have experienced severe tectonic movements since the beginning of the Miocene Epoch, especially during the Quaternary Period. The mode and intensity of the Quaternary tectonic movement have recently been elucidated, but not yet been compiled as a whole. On the other hand, some of Quaternary tectonic movements have been revealed to show the mode similar to that of the remarkable crustal deformation associated with great earthquakes in historical and recent times in the same areas. This fact suggests that the studies on Quaternary tectonic movement will be useful for us to detect the history of seismic activity and may contribute to the fundamental research on prediction of earthquakes.

From this point of view, the Research Group for Quaternary Tectonic Map was organized in 1963, in order to compile Quaternary tectonic maps of Japan which consist of distribution maps of vertical displacement, faultings and foldings in the Quaternary. The final goal of the Research Group is to compile maps of these kinds for different terms of 10^3, 10^4, 10^5, and 10^6 years in the order and to analyse the historical processes and their regional characteristics of tectonic movement throughout the Quaternary by comparing these maps. It will be also interesting to find the relationships between recent seismic activities and Quaternary tectonic movement and between the characters of tectonic activities of the Quaternary and pre-Quaternary.

First of all, the Research Group tried to complete the distribution maps for the whole Quaternary. The first report with the preliminary tectonic maps was presented in 1964 to the National Symposium for CRCM and was published in the Journal of Geodetic Society of Japan, Vol. 10, 1965. These maps have been revised and supplemented by recently obtained data. The second report was presented to the 7th International Congress of the International Union for Quaternary Research in 1965 and was published in Quaternaria, Vol. 8, 1966. The Quaternary tectonic maps published by the National Research Center for Disaster Prevention in 1969 consist of six sheets and are considerably revised and supplemented as compared with the former two reports. The present report is the final for the whole Quaternary and is attached to the maps of 1969.

Among these six sheets, the "Gipfelflur" of Japan was formerly prepared by Dr. Toshio Okayama, Professor of Meiji University, but has not yet been published in a complete form. The "Gipfelflur" will be useful for comparing the magnitude and mode of Quaternary tectonic movement with the present landforms of the Japanese Islands. We thank Dr. T. Okayama for his kindness on this occasion.

2. Quaternary vertical displacement

Amounts of vertical displacement for the whole Quaternary were estimated by geomorphological and geological methods separately (Maps Nos. 1 and 2). Then, a synthesized map of vertical displacement (Map No. 3) was compiled from these two maps, comparing and examining every amount in them.

2.1. Amounts of vertical displacement geomorphologically estimated

2.1.1. Method

Erosion surfaces, which are inferred as formed in the late Pliocene or early Pleistocene, are distributed at different altitudes in various regions of Japan, though most of them are generally scattered. As it is considered that they were originally formed at levels not very high above sea level, their present altitudes above sea level approximately represent the net amounts of vertical displacement since the beginning of Quaternary. Strictly speaking, altitudes above sea level at which the erosion surfaces were initially formed should be subtracted from the present altitudes to obtain exact amounts of vertical displacement, but those can hardly be estimated without any assumption. Moreover, those must have been probably not so large, because extensively distributed erosion surfaces with low relief are presumed to have been formed by rivers of which the gradients were not so high.

There are several regions in Japan where the geomorphic development has been intensively studied and the ages of erosion surfaces have been stratigraphically determined. In these regions, erosion surfaces formed in the late Pliocene or early Pleistocene were extracted so as to estimate Quaternary vertical displacement. Then, erosion surfaces correlated with these were successively traced in their surrounding regions, using topographical and geological maps, together with the "Gipfelflur". In the process of tracing the simultaneously formed erosion surfaces from one region to another, it was examined in every well-known region, whether or not the erosion surfaces had been correctly traced from one to another. It can not always be expected that erosion surfaces were formed in the late Pliocene or early Pleistocene and have been preserved until the present in every region of Japan. From this reason, erosion surfaces formed in ages nearer to the above-mentioned were used in some regions for estimating the amounts of Quaternary vertical displacement. For example, erosion surfaces extensively bevelling the upper Miocene formations were considered to have been formed in the period from late Pliocene to early Pleistocene, because the extensive erosion surfaces must have been completed in a considerably long duration of geological time. Amounts of vertical displacement estimated by this method, therefore, are not exactly for the Quaternary, but for a term of $n \times 10^6$ years, n being a certain number from one to two or three. Moreover, they can be obtained only in uplifted regions, because in remarkably subsiding regions the erosion surfaces have presumably been buried under younger formations.

Heights of these erosion surfaces were read at about four points in each quadrangle of topographical map on a scale of 1:50,000, and then the heights were plotted in a map of Japan on a scale of 1:2,000,000. Isobases in the Map No. 1 were drawn at intervals of 100 or 200 meters based on these heights.

2.1.2. Examples

a. *Tohoku District*

Erosion surfaces are extended on the outer side of the arc of Northeast Japan where the Kitakami and Abukuma Mountains are located.

(i) *The Kitakami Mountains* are mainly composed of the intensely folded Palaeozoic and Mesozoic formations together with plutonic and metamorphic complexes. The erosion surfaces of the Mountains are classified into three levels. The upper surfaces are 1000 to 1200 m high above sea level and are preserved as flat-topped ridges in the central part of the Mountains. The middle surfaces are extensively distributed around the upper surfaces, and their heights are 800 to 900 m high above sea level. Along the margin of the Mountains, the lower surfaces are distributed at the heights of 500 to 600 m, bevelling the middle or lower Pliocene in some places. As the middle Pleistocene marine terraces are developed along the eastern side of the Mountains at an altitude of about 300 m, the lower surfaces are presumed to have been formed at the end of Pliocene or the beginning of Pleistocene. There is no evidence of marine invasion into the main part of the Mountains throughout the younger Tertiary period. Any evidence of marked inflow of coarse clastic materials into the Miocene and Pliocene deposits adjacent to the Mountains is not recognized. Consequently, it is likely that both the altitude and relief of the Kitakami Mountains remained very low during the Tertiary period (Chinzei, 1966). Since a tendency of increasing grain diameters can be recognized in the last stage of the Pliocene deposition, the upheaval of the Kitakami Mountains is presumed to have taken place mainly during the Quaternary.

(ii) *The Abukuma Mountains* are mainly composed of granitic rocks which intruded mostly in the Mesozoic. The Mountains border on the Pacific coast by a steep scarp (Futaba fault scarp) running from north to south with relative heights of more than 400 m, and seem to be inclined westwards. Erosion surfaces are widely developed at altitudes 400 to 600 m high above sea level in the northern half of the Mountains.

Isolated flat-topped peaks stand out on the erosion surfaces. Their heights range from 800 to 1000 m above sea level. Some of these peaks in the northern part of the Mountains are standing in areas consisting of the middle Miocene volcanic rocks. Erosion surfaces with lower relief less than 50 m are recognized at six levels in the northwestern part of the Abukuma Mountains; namely the Tokiwa, Funehiki, Kumagami, Miharu, Upper Moki and Lower Moki erosion surfaces in a descending order (Koike, 1969; see Fig. 2-1). These erosion surfaces, successively stepping down westwards by 30 to 60 m, extend from the south to the north like piedmont benchlands. They were formed on the western back slope of the Abukuma tilted block by intermittent upheaval accompanying westward tilting. Six levels of erosion surfaces, except the Miharu surface, mainly extend in areas consisting of deeply weathered older granodiorite. Soon after the lower Moki erosion surfaces were formed, the Shirakawa dacitic welded-tuffs flowed and partly covered the erosion surfaces lower than the Kumagami surface. The eruption age of the Shirakawa dacitic welded-tuffs is not certainly known, but it is estimated to be the latest Pliocene or early Pleistocene. The lower Pliocene deposits which are distributed along the eastern foot of the Futaba fault scarp were deformed by the activity of the Futaba fault. As the

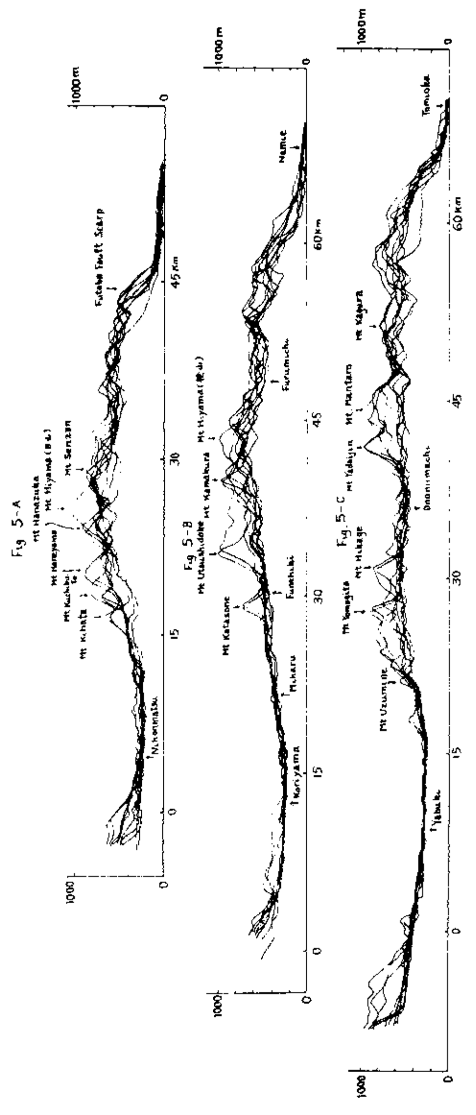

Fig. 2-1. Projected profile of W-E direction of the northern part of the Abukuma Mountains Koike, 1969).
5-A; Northern profile, 5-B; Central profile, 5-C; Southern profile

above-mentioned intermittent upheaval accompanying westward tilting of the Mountains is estimated to have a relation to the activity of the Futaba fault, the upheaval of the Abukuma Mountains is presumed to have taken place mainly during the Quaternary.

(iii) In Uetsu area, erosion surfaces are recognized at four levels, though most of them are generally scattered. This region is located in the Green-Tuff region, a young mobile region which has been developed since the beginning of the Miocene. As the boundaries of erosion surfaces are intricated, they are considered to be formed in different ages. The highest erosion surfaces are mainly flat-topped ridges at altitudes of 1000 to 1200 m above sea level and are distributed in areas composed of pre-Tertiary basements and lower Miocene deposits. The second erosion surfaces bevelling the folded middle Miocene are distributed in places at altitudes of 600 to 800 m above sea level. In Southwest Hokkaido, the second surfaces bevel the lower Pliocene in some places. Lower third and forth erosion surfaces are distributed mainly along the present valleys and in the basins. Their altitudes are in general lower than 300 m above sea level. After the deposition of middle or upper Pliocene, many basins on the inner side of Northeast Japan are formed by differential vertical movements, and lacustrine formations of the lower Pleistocene were deposited in accordance with the subsidence of the basins (Naito, 1963, 1970; Nakagawa, et al., 1971). Then, lower erosion surfaces were formed by bevelling the Pliocene and lower Pleistocene. It is, therefore, inferred that the displacement of the second erosion surfaces occurred after the late Pliocene, probably during the Quaternary.

b. *Chubu District*

(i) *Uonuma district* near the southern end of the inner side of Northeast Japan has experienced active crustal movements in the Quaternary. After the deposition of marine upper Pliocene, the marine and fluvial deposits of Plio-Pleistocene or lower Pleistocene, Uonuma Group, were thickly accumulated in accordance with the subsidence of this region. This region was not yet differentiated into basins and hills in the first half of the Uonuma stage, when the Echigo Mountains located to the east supplied sediments to form an extensive depositional plain. In the latter half of the Uonuma stage, this region was divided into basins and hills and was turned into upheaval (Naito, 1965). It is therefore inferred that erosion surfaces of the Echigo Mountains and depositional surfaces of the Uonuma Hills were displaced mainly after the early Pleistocene. The altitudes of erosion surfaces of the Echigo Mountains are 900 to 1200 m above sea level.

(ii) *Northern part of Nagano Prefecture.* In the northern part of Nagano Prefecture, erosion surfaces are recognized at four levels and are distributed at altitudes of 2000 m, 1700 m, 1400 m, and 1000 – 800 m above sea level in a descending order (Kobayashi, 1953). The erosion surfaces 1000 to 800 m high are referred to as the "Omine erosion surfaces". The Omine erosion surfaces are distributed mainly in areas composed of the Tertiary rocks, and peaks standing on the erosion surfaces, are considered to be Härtling. Fluviatile boulders are found in some places of the Omine erosion surfaces. These boulders are composed mainly of granitic rocks, some of them being three meters in diameter. It is therefore considered that the boulders were derived from the Hida Ranges located to the west of the northern Fossa Magna and were deposited at the latest stage of the formation of the Omine erosion surfaces. The Hida Ranges border a steep scarp (Hida fault scarp) running from north to south with a relative height of about 2000 m (Tsujimura, 1926). In the eastern part of the Hida Ranges, erosion surfaces are recognized at altitudes of 2700 m, 2400 m, 2200 – 2000 m, and 1800 – 1600 m above sea level (Kobayashi and Hirabayashi, 1955). The erosion surfaces 1800 – 1600 m high on the Hida Ranges are considered to be correlative with the Omine erosion surfaces. The deposition of boulders on the Omine erosion surfaces indicates the rejuvenation of the upper drainage of the rivers and an increase in stream gradient, and therefore it might suggest the upheaval of the Hida Ranges. The Omine erosion surfaces bevel the Plio-Pleistocene or lower Pleistocene marine formations. The lava flows which are correlated to the above-mentioned marine formations are mostly reversed in magnetic direction, suggesting that they are referable to the Matsuyama reversed epoch in age

(Momose, 1963; Research Group on the Quaternary of Japan, 1969). It is therefore inferred that the Omine erosion surfaces were formed during the early to middle Pleistocene and that the rapid upheaval of the Hida Ranges occurred after the early Pleistocene.

(iii) *The Mikawa Highland* composed of mainly granitic rocks occupies the southeastern part of the area shown in Fig. 2-2. This highland is bordered on the northwest by the straight steep scarp, "Byobusan fault scarp", which is running southwestward from the Ena Mountains. This low-relief highland generally decreases its altitude southwestward, and also towards the Yahagi River which flows through the central part of this highland.

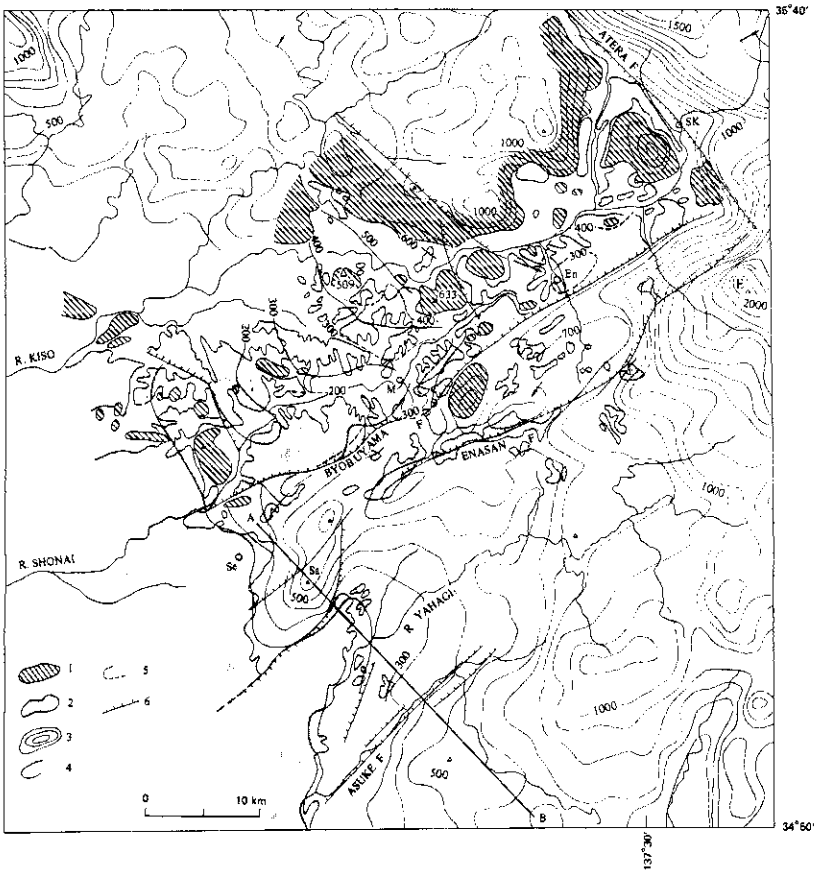

Fig. 2-2. Geomorphic map of the southern part of the Chubu district (Kaizuka *et al.*, 1964)

1: Bedrock mountains rising above the depositional surface of the Seto Group in the area along the Rivers Kiso and Toki.
2: Distribution of the Seto Group, containing the area covered with the younger deposits.
3: Contours of the Gipfelflur. In the area along the Rivers Kiso and Yahagi, contours are drawn in the part higher than 700 m, and in other areas in the part higher than 300 m.
4: Contours of the depositional surface of the Seto Group.
5: Bedrock contours under the Seto Group.
6: Fault scarps. Most of them have been dislocated after the deposition of the Seto Group.

Erosion surfaces of various levels are developed in this highland. Although the higher two erosion surfaces, 1100 – 1000 m and 900 – 700 m high above sea level, show only their relatively limited distribution near the top of the mountains, an erosion surface lower than 600 m is very extensively developed. This surface is called the Mikawa erosion surface and is subdivided into two levels, the Mikawa higher (600 – 400 m) and the Mikawa lower (300 – 100 m) surfaces. Figs. 2-2 and 2-3 show the horizontal and vertical relations between the Mikawa lower surface and the Plio-Pleistocene Seto Group which is widely distributed in this area. It can be seen from these figures that the Mikawa lower surface is continuous to the basal surface of the Seto Group which shows also the low-relief topography. Moreover, the Mikawa lower surface extends northward, bevelling the middle Miocene Mizunami Group. Accordingly, it is most probable that this surface was formed in the early Pliocene (Ota *et al.*, 1963). Therefore, the heights of this surface were adopted to estimate the Quaternary vertical displacement.

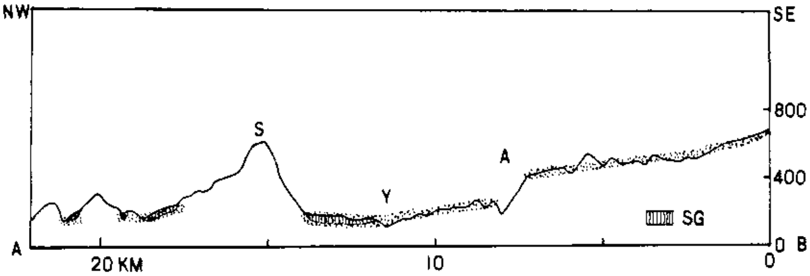

Fig. 2-3. Profile of NW-SE direction of the Mikawa Highland (Ota *et al.*, 1963). Dotted zone represents the Mikawa low erosion surface an the depositional surface of the Seto Group. The former has been dislocated along the Asuke fault. Location of the cross line is shown in Fig. 2-2.

The Seto Group is subdivided into two formations representing the different depositional environments and ages. The lower formation of it consists of very fine-grained sediments derived from the weathered materials of granitic rocks. On the other hand, in the upper formation which overlies the lower unconformably, coarse sand and gravels are dominant. These facts suggest that in the early stage of the deposition of the Seto Group, the Mikawa Highland was very low in relief, representing the Mikawa lower surfaces, and was the source area of fine-grained sediments, and that afterwards the Mikawa Highland was uplifted to lie intensively dissected and to supply a great amount of coarse sediments. In connection with the uplift of the Mikawa Highland area, the Yahagi River basin has been down-warped since the Pliocene, with an axis of NE-SW trend accompanying the faults with the same direction along its both sides.

The mountainland located northwestward from the Byobusan fault scarp is divided into three mountains: *the Atera* in the northeast, *the Futatsumori* in the middle and *the Kengyo* in the southwest, by the Atera and Akagawa fault scarps which run with NW-SE trend (Fig. 2-2). In these mountains, the higher and lower erosion surfaces and the depositional surface of the Plio-Pleistocene Seto Group are developed in the descending order (Kiso, 1963; Kaizuka *et al.*, 1963; Kaizuka *et al.*, 1964). The lower surfaces in these mountainlands are continuous to the basal plane of the Seto Group and bevel the Miocene series. Accordingly, it is possible that the lower surfaces were formed in the early Pliocene and are correlated with the Mikawa lower surface in the Mikawa Highland. Although there is no evidence to show the age of the formation of the higher erosion surface, probably it was formed in the pre-Miocene, judging from the relation between the distribution of this surface and the Miocene series.

Therefore, the heights of the lower erosion surface were adopted to draw the Quaternary tectonic map. In addition, the deposition surface of the Seto Group is also used in this area. Consequently, the geomorphic surfaces which are used for the estimation of Quaternary vertical displacement in this area were formed in a fairly longer term.

The heights of these geomorphic surfaces are represented in Table 2-1. The difference of the heights in the same surface among the three mountains has been caused by the differential uplift with the faults shown in Fig. 2-2. Some of these faults contributing to the differentiation of the mountains are still active. Especially, the Atera fault is a very typical active fault dislocating the recent fluvial terraces.

Table 2-1. Heights of the erosion surfaces in the southwestern area of the Chubu District

	Mikawa Highland	Atera Mts.	Futatsumori Mts.	Kengyo Mts.
Upper surface	1000–1100 m 700–900 m	1400–1700 m	800–1000 m	700–800 m
Lower surface (Mikawa surface)	400–600 m 100–300 m	900–1200 m	500–700 m	100–300 m

c. *Kinki District*

In the inner zone of Kinki District, several mountains with N-S trend are distributed in parallel, and among these mountains there are located the basins such as Iga Basin and Nara Basin bordered with fault scarps. In these mountains, remnants of former erosion surfaces are preserved in accordance with summit levels, especially very widely in the Nunobiki Mountains situated in the east. The age of the formation of erosion surfaces was discussed by Nakano (1944), analysing the relation between the erosion surface and the Cenozoic strata.

(i) The erosion surface on the top of *the Nunobiki Mountains* is at altitudes ranging from 600 to 700 m, and is intersecting the basal surface of the Miocene Isshi Group. Hence it can be said that this surface was formed in the post-Miocene.

(ii) In *the Yamato Highland* situated to the west of the Nunobiki Mountains beyond the Iga Basin, an erosion surface about 500 m high was possibly formed also in the post-Miocene, because it bevels the Miocene strata.

(iii) On the top of *the Rokko Mountains* in the most western part of Kinki District, the erosion surface at an altitude of about 800 m is developed. On the fault step bordering the southern side of the Rokko Mountains, there is an erosion surface covered with a thin sand and gravel bed which is the lowest member of the Plio-Pleistocene Osaka Group. Huzita (1962) regarded this basal surface to be correlative to the erosion surface on the top of the mountains and to have been formed during the Miocene-Pliocene. This surface, therefore, is correlated with the erosion surfaces in the Yamato Highland and Nunobiki Mountains.

The Miocene series in the inner zone of Kinki District generally show the zonal distribution from east to west including the both areas of mountains and basins. On the other hand, the distribution of the Plio-Pleistocene series is restricted to basin areas or coastal areas. From the above-mentioned facts and the distribution of erosion surfaces, historical development of this area is assumed as follows. In the early Miocene the subsiding zone with E-W trend was formed, and the subsequent transgression caused the deposition of Miocene marine strata in this zone and buried the relief of the mountains. Then, in the late Miocene this zone was uplifted and the erosion surfaces bevelling the Miocene series were extensively formed by subaerial erosion. In the early Pliocene again the subsiding zone with E-W trend was formed to deposit the lacustrine sediments in inland areas. Since then, this subsiding region has been uplifted and differentiated into the mountains and basins, accompanying the thrust faults with N-S trend.

d. *Chugoku District*

Chugoku ditrict is one of the most typical areas where the erosion surfaces with low relief are extensively developed (for example, see Fig. 2-4). This district is known as the area where the concept of the uplifted peneplain, on the basis of the cyclic theory of erosion, has been applied for the first time in Japan (Koto, 1908).

The erosion surfaces of this district are classified into three levels, the Dogosan surface, the Kibikogen surface and the Setouchi surface in the descending order (Nishimura, 1963). The Dogosan surface is preserved on the tops of the Chugoku Mountains about 1000 m high. The Kibikogen surface ranging from 400 to 600 m high above sea level is developed in the area surrounding the

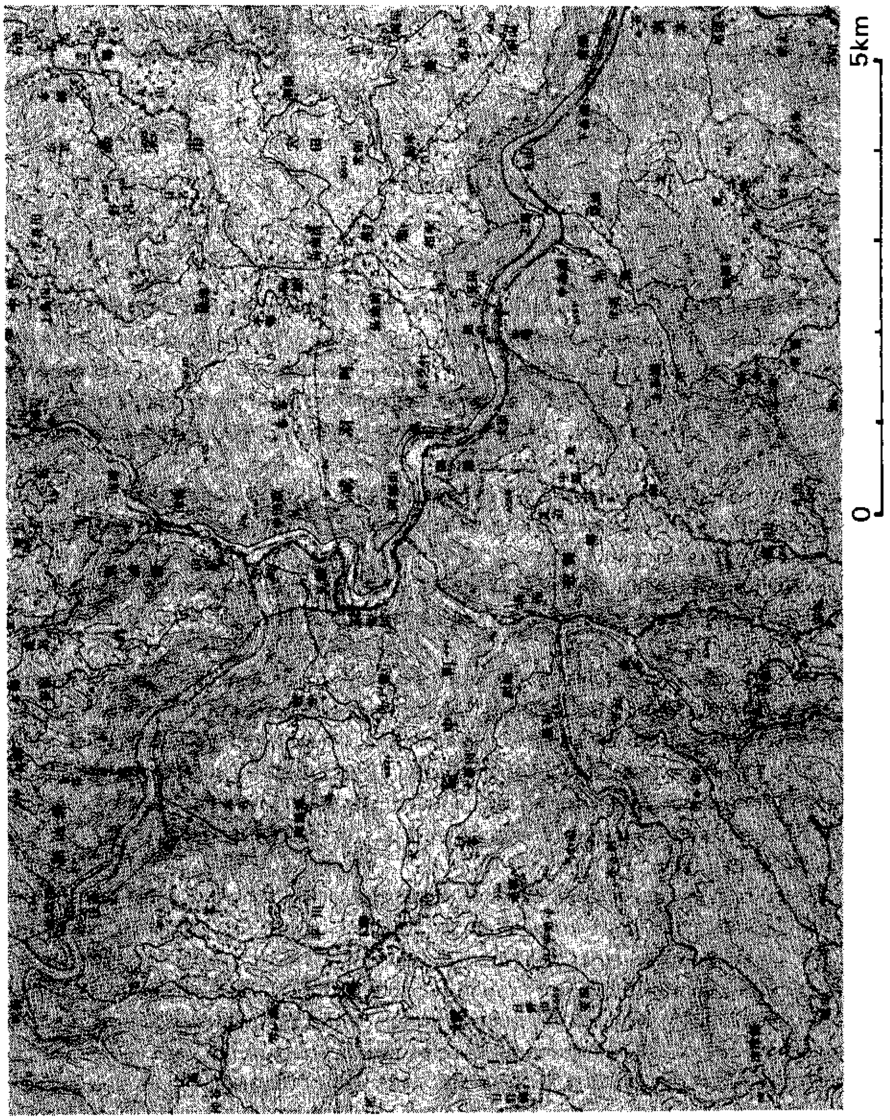

Fig. 2-4. Topographical map of the typical erosion surfaces in the Chugoku district, southwestern Japan.

Dogosan surface, and especially on its south side. The Setouchi surface less than 200 m high is located to the south of the Kibikogen surface, facing the Seto Inland Sea.

In Chugoku district, the relation between the distributions of erosion surfaces and the Cenozoic strata has been explained as follows. The Miocene series are distributed mainly in the area of the Kibikogen surface, partly invading along the valleys into the Dogosan surface. The upper limit of distribution of the Miocene series is about 800 m high, higher than that of the Kibikogen surface. In the valleys dissecting the Kibikogen surface, the lower Pleistocene series is formed. From the above-mentioned facts, it is inferred as to the age of the erosion surfaces as follows (Otuka, 1937). The Dogosan surface was formed in the pre-Miocene, probably in post-Cretaceous age, and the Kibikogen surface in the Pliocene, then the Setouchi surface in the latest Pliocene or early Pleistocene. To estimate Quaternary vertical displacement in this area, the height of the Kibikogen surface was used. The mode of the crustal movement of this district in the Quaternary was of an up-warping with a long axis running from east to west, accompanied by faults, especially on the southern side.

e. *Kyushu District*

The dissected lava plateau extends in *the northwestern part of Kyushu*. The surface of the plateau gradually lowers from east to west. The Kunimi-yama (777 m high above sea level) is the highest part in the eastern margin of the plateau. The thickness of the basalt lava is generally about 300 m, and the basal plane of basalts is generally flat and parallel with the surface of the plateau. The basement of the basalt lava is composed mainly of the folded Miocene, and the conglomerates partly overlie the basal surfaces (Fig. 2-5). The occurrence of the conglomerates is not continuous and its

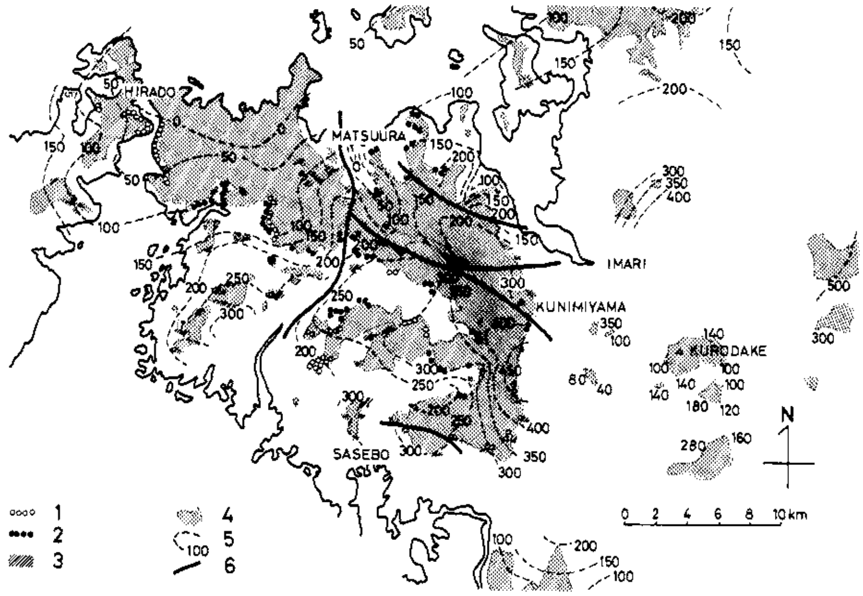

Fig. 2-5. Distribution of the Kita-matsuura basalts and the conglomerates and the heights of the basal plane of the basalts (Imai *et al.*, 1958).

1: Upper conglomerate.
2: Lower conglomerate.
3: The position of the outcrop with direct contact between the Tertiary strata and the basalt lave flows.
4: Distribution of the Kita-matsuura basalts.
5: Contour line showing the basal plane of the basalts.
6: Main faults.

thickness varies from several decimeters to one meter. The altitude of its distribution is also variable, from 460 m high above sea level near the Kunimi-yama in the east to 0 m high in the west (Imai *et al.*, 1958). As a result of the palaeomagnetic investigation, the basaltic activities are considered to have lasted for a long period, probably from the middle Pliocene to the Pleistocene (Kurasawa, 1967). It is inferred that the conglomerates might have been deposited during or immediately after the formation of the flat basal plane of basalts, and therefore that the plane might have been formed in the middle of the Pliocene.

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2.2. Amounts of vertical displacement geologically estimated

2.2.1. Method

Height and depth of boundary horizons between the marine Pliocene and Pleistocene formations approximately represent the net amounts of vertical displacement during the whole Quaternary. In this case, too, it is necessary to correct these values in order to estimate exact amounts of Quaternary vertical displacement, because these boundary horizons must have been originally located more or less deep below sea level. But it is hardly possible, without any assumption, to estimate the depth at which these formations were initially deposited. In the present work, therefore, no correction was done to estimate the amounts of Quaternary vertical displacement by a geological method.

In uplifted areas, boundary horizons between the marine Pliocene and Pleistocene formations are usually located above sea level at present, and it is rarely possible to find such boundary horizons in sedimentary succession from the Pliocene to the Pleistocene, because Pliocene formations have been generally denuded and have not been overlain by younger ones at most places. From this reason, heights of the highest points of upper Pliocene marine formations were used to estimate approximate amounts of Quaternary vertical displacement. Strictly speaking, as result of denudation these heights do not represent heights of the original deposition surfaces of these formations, which are more appropriate for the present work. The highest points of lower Pleistocene formations were also adopted for the same purpose in the present work.

Some convenient methods were used in areas where formations of the above-mentioned ages are not distributed. That is, assuming that the rates of tectonic movement have been uniform since the beginning of the Pliocene, the height of "lower" Pliocene formations is estimated at twice as large as, and that of "middle" Pleistocene formation at one third as large as the amount of vertical displacement for the whole Quaternary. These amounts are shown in the Map No. 2 with special symbols. The absolute ages of these formations and of the beginning of the Quaternary have not yet definitely been determined, and it is problematical whether the above assumption is correct or not. These estimations, therefore, were applied only to such cases as any other data could not be obtained for extensive areas.

In subsiding areas, data of deep drillings were used, because the said horizons are usually located under alluvial plains, basin floors, coastal plains, or submarine bottoms at present. There are, however, only a few areas where the said horizons have definitely been determined. In other subsiding areas, some convenient processes such as adopted in uplifted areas were applied. In these cases also, amounts of vertical displacement were not corrected by using the depths below sea level at which the Plio-Pleistocene formations had initially been deposited.

The upper Pliocene formations of Japan are shown in the correlation table of the Neogene formations in the "Geologic Developments of the Japanese Islands" (1965). Ages of locally distributed Pliocene formations which are not contained in this table were determined on the basis of their geomorphological and stratigraphical relations to the formations contained in the table. Therefore, the formations adopted as the upper Pliocene in this work may not always be of the same age, but must have been deposited during a short period from the Pliocene to the Pleistocene.

Data of height or depth of these formations were obtained from geological maps of various scales published by the Geological Survey of Japan, geological maps of each prefecture, and scientific papers and reports. In principle, amounts of Quaternary vertical displacement were estimated in each quadrangle of topographical map of 1:50,000 at one point, where the said formations are located highest in uplifted areas and lowest in subsiding areas. Then, these amounts were plotted in a map of Japan on a scale of 1:2,000,000. Isobases in the Map No. 2 were drawn at intervals of 100 or 200 meters by the interpolation method.

2.2.2. Examples

a. *Uplifted areas.*

(i) *Teshio area* (Figs. 2-6 and 2-7)

Upper Pliocene lying in this area is Sarapetsu formation corresponding to Setana formation. Sarapetsu formation has the thickness of 200–350 m, composed of alternating strata and considered as formation of lagoon origin. Accordingly, the development of this formation can be assumed to represent the levels which were extremely near to the sea level of those days. This formation, together with Yuchi formation (200 m thick) and Koetoi formation (300 m thick) (both being of marine origin and belonging to the Lower Pliocene) which conformably lie under Sarapetsu formation, composes the hills of heights less than 200 m in the whole neighborhood of Teshio, showing gentle flexure. Accordingly, it can be said that the heights of hills in this area well reflect the approximate shapes of Quaternary ground uplifting of this area.

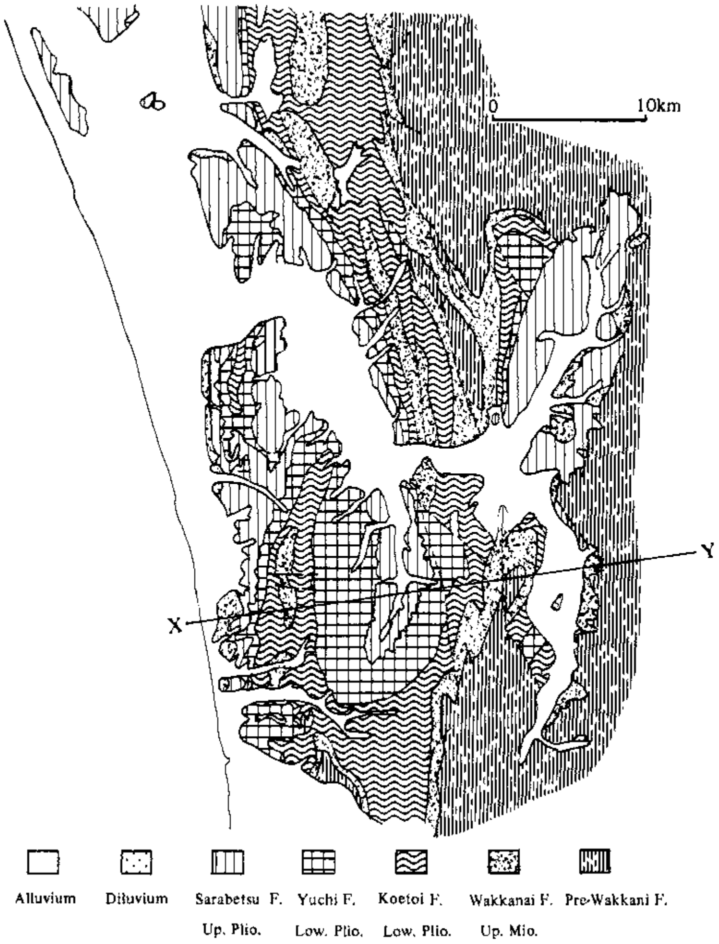

Fig. 2-6. Geological map of Teshio area.

Fig. 2-7. Geologic profile of Teshio area.

In the eastern part of Horonobe area along the River Teshio, the axis of anticline extends north-south in the Miocene formation. Having gone across this axis, on the east side there is seen the distribution of Sarapetsu formation, centering around Toikanbetsu. Therefore, the sedimentary domain of Sarapetsu formation can be considered to have extended across the Miocene anticlinal axis, and the distribution of Sarapetsu formation is estimated to have developed over this anticlinal axis. But the thickness of Sarapetsu formation thus estimated, and those of the formation Yuchi and Koetoi also are not clearly known. There may be some possibility that in the case where these formations were thin over the anticlinal axis, the height of Sarapetsu formation over the axial part only slightly surpassed the present heights of the Miocene formations. However, as these formations are widely distributed on the both sides of anticlinal axis in this area, it would be appropriate to consider that these formations were deposited over the anticlinal axis also, though being made somewhat thinner. From such consideration, the maximum amount of upheaval is estimated to be over 400 m.

(ii) *Boso area*

The Boso Peninsula is one of the standard regions in Japan for the discussion of the boundary between the Tertiary and the Quaternary. In the Boso Peninsula, there are developed marine deposits of the period from Miocene to Pleistocene, several thousand meters thick, almost making one continuous series, and tilting toward the north. A sequence of strata along the River Yôrô streaming northward in the central part of the peninsula is regarded as a stratigraphic standard, and it is shown in Figs. 2-8, 2-9 and 2-10.

It is supposed that in the middle part of Umegase formation there lies the Plio-Pleistocene boundary. This boundary was presumed on the basis of the study of Asano (1957) on planktonic foraminifera. According to him, at a position upper than the middle part of Umegase formation, there became conspicuous the existence of a cold sea species *Globigerina borealis*, and this was regarded as what indicates the "first cold climate" and as the commencement of Quaternary. This concept was afterwards supported by the study on plant fossil of Kokawa (1969) and also by the palaeogeomagnetic study of Nakagawa *et al.* (1969). Umegase formation is an alternation of strata rich in sand with a pyroplastic key bed U6. The sedimentary formation of U6 horizon, which is designated as Plio-Pleistocene boundary, has the molluscan assemblage which indicates the sedimentary environment of lower neritic sea zone–half abyssal zone generally under the influence of ocean waters. We may be able to say that the U6 horizon was deposited at original depths of 300–500 m for most of the peninsula and at original depths of 200–300 m for the western part of the peninsula.

In the western part of the peninsula the maximum value of the height of outcrop of U6 horizon is 200 m, and if its depositional depth be 300 m, the total quantity of upheaval in this case will be 500 m. However, U6 horizon must have its extension on the southern side of its surface outcrop before denudation. If the general slope of 10° N in the vicinity of this place were reversely extended, the upheaval amount on the southern side ought to have a pretty large value. Presuning from the circumstances that the general dip on the southern side becomes gradually steeper and shows values of more than 60° N beneath Kurotaki unconformity (base of Takeoka tuff) and that these beds including U6 horizon are rather oceanic so that any land area is not conceivable at a distance very close to them, the maximum amount of upheaval would be not less than 500 m even if reduction of depositional depth should be done.

Further, Mt. Kanosan on the northern side of the area where U6 horizon is developed has a height of 350 m above sea level, and this value is the maximum height of Ichijuku sand bed which immediately overlies the U6 horizon. As Ichijuku sand bed is the sediment in upper neritic sea zone or delta, its sedimentary depth is considered to be nearly 0 m. Accordingly, the upheaval amount of Ichijuku sand bed can be said to have reached 300 m at least.

Therefore, it is not an overestimation to consider the upheaval amount of the lower Pleistocene to be more than 500 m. And the beds of the Boso Peninsula which are developed in east-west direction, including U6 horizon, can be regarded as those that show the pattern of upheaval corresponding to the geologic structure of northward sloping.

As the development of this structure was formed by gradual transposition of the sedimentary basin, it cannot be expected that a formation, e.g. Umegase formation, will maintain its bed thickness for a long distance on the southern side of its present surface distribution. Therefore, the upheaval amount of U6 horizon, though it evidently surpasses 500 m, cannot maintain the value in the southward direction.

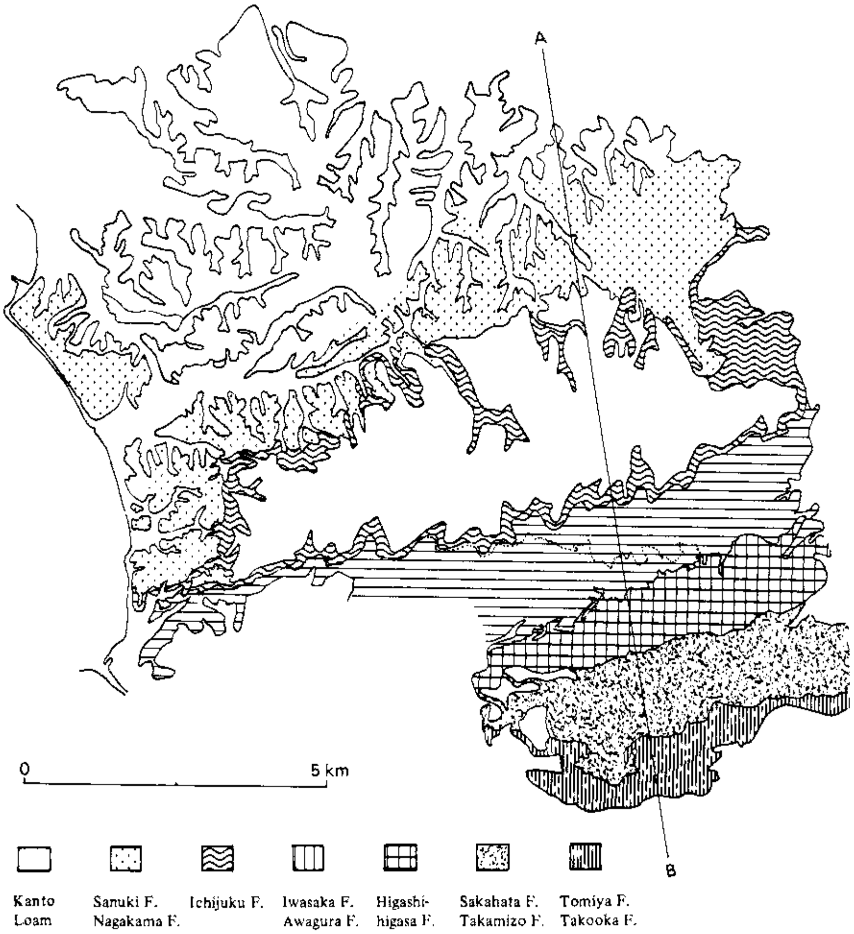

Fig. 2-8. Geological map of Boso area.

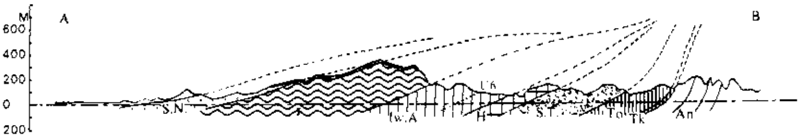

Fig. 2-9. Geologic profile of Boso area.

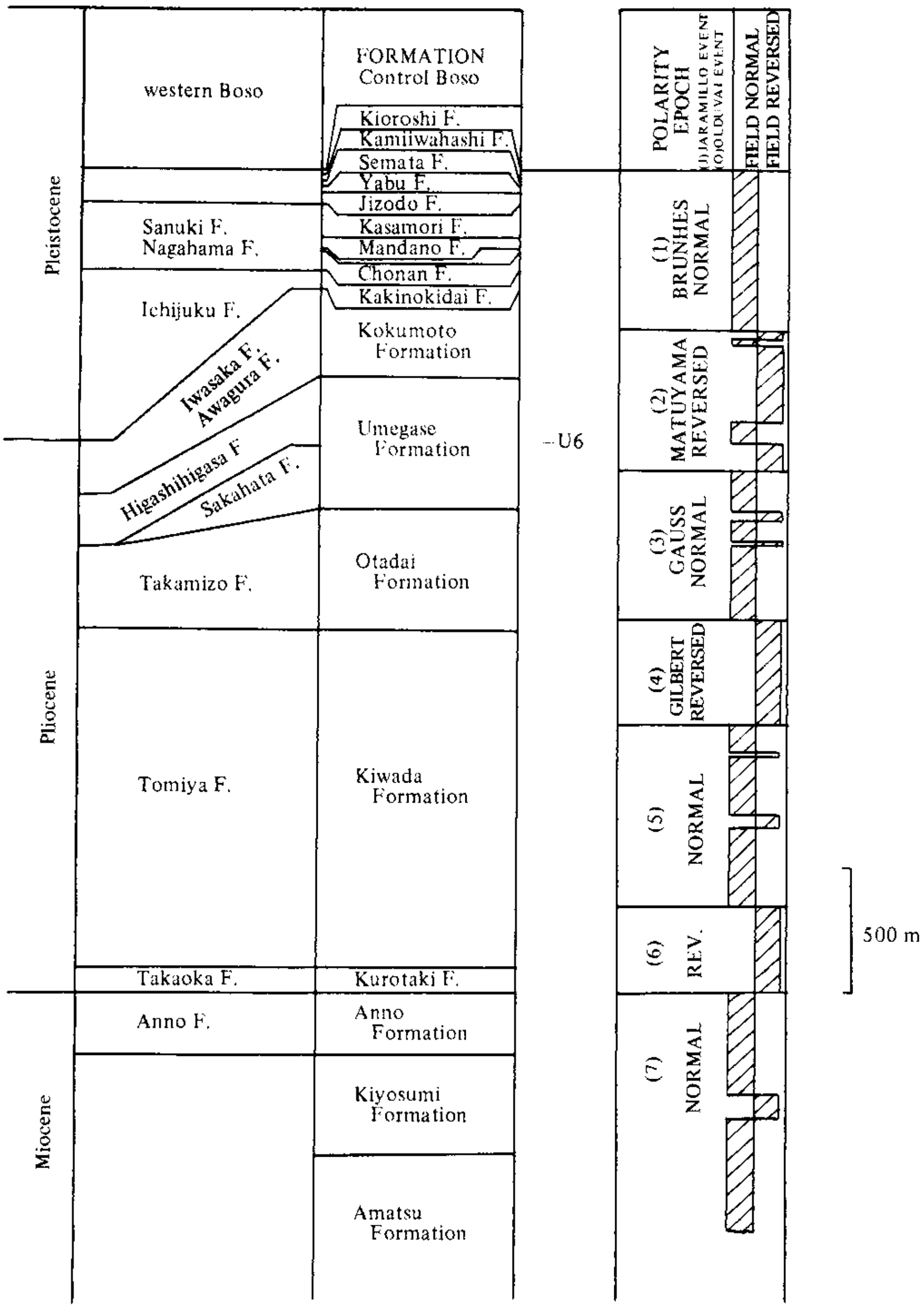

Fig. 2-10. Succession of the geological formations and polarity epoch in the Boso Peninsula.

In the vicinities of the southeast end of South Kanto District, the above-mentioned tendency of "south-high" similar to the Boso Peninsula is recognized in the Miura Peninsula and Oiso Hills also, and this is called Tanzawa-Mineoka upheaval belt. This crustal movement continued from the late Miocene to the Quaternary.

(iii) *The Rokko Mountains* (Fig. 2-11)

The Rokko Mountains situated west of Osaka City has the maximum height of 932 m, and divides the basins of Osaka and Harima which are developed on the east and west sides of the mountains. In the both basins there are developed beds of Osaka Group which is Plio-Pleistocene series, and especially the outcrops from the east foot of Mt. Rokko as far as Senriyama Hills, Osaka Prefecture, give the standard stratigraphy of the Osaka Group.

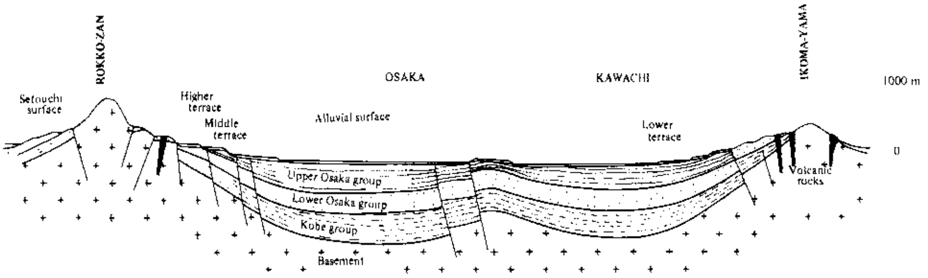

Fig. 2-11. Diagrammatic profile of Osaka Basin.
(Modified from the diagram by Itihara, 1966).

The Osaka Group developed in the area of Senriyama Hills is, according to Itihara (1961), a group of beds which can be divided into two parts, upper and lower, the upper part being 80 m thick, the lower 200 m, and respectively composed of alternation of strata of sand, mud and gravel of brackish water sediment and of freshwater sediment. In the upper part there are interposed beds of marine mudstone of Ma 2–Ma 8, and in the lower those of Ma 0–Ma 1.

According to the palaeomagnetic stratigraphic study of Ishida, Maenaka and Yokoyama (1969), the horizon of Olduvai event to be regarded as the Plio-Pleistocene boundary lies under Ma 0 and near the Kono tuff, namely in the middle of the lower part of Osaka Group.

Huzita and Kasama (1965) indicate, in their general view of the structural development of Cenozoic strata including Rokko Mountains and Osaka Basin, that the uplift of Mt. Rokko and the subsidence of Osaka Basin by the Rokko movements proceeded in correspondence to each other. From the facts that the lower part of Osaka Group clearly participates in these movements, and that higher terraces (corresponding to the mid-Pleistocene Tama terrace in Kanto District) also are displaced in relation to the movements, Huzita *et al.* (1965) recognized that the Rokko movements began from the lower part of Osaka Group (late Tertiary), had their climax age rather in the latter half of Quaternary (including the mid-Pleistocene), and even now are proceeding.

The foot part of Mt. Rokko lying between the Rokko Mountains side of uplifting nature and the Osaka Basin side of subsiding nature indicates strong gradients between uplifting and subsidence, and there are formed not only flexures of beds, but also several lines of faults. Within the area of Rokko Mountains also there remains the lower part of Osaka Group, much of the part is truncated by erosion. Considering from the movements of Mt. Rokko and from the state of the development of Osaka Group at east and west piedmonts, it is of course expected that formerly the erosion surface developed over the present summit part of Mt. Rokko with the height of 600 m.

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b. *Subsiding areas*

(i) *Kanto Plain* (Fig. 2-12)

(1) *Outline of the sedimentary basin*

The Kanto Plain has subsided since the earliest Neogene period, and the thick Neogene to Quaternary deposits have been deposited there. Especially, middle and southern parts of the Kanto Plain have uninterruptedly subsided, forming "the Kanto Tectonic Basin" since the Pliocene time, and is an area of negative gravity anomaly lower than –30 mgal (Tsuboi, 1954) owing to the marine formations more than 3000 m thick.

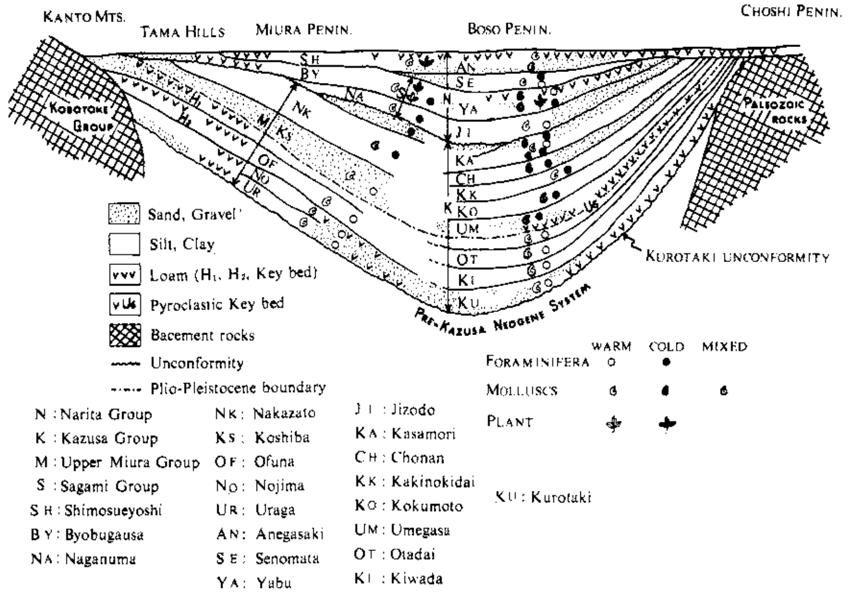

Fig. 2-12. Stratigraphic section of Kanto Basin.

The marine Pliocene-Pleistocene formations of which the Kanto tectonic basin consists are named the Kazusa and the Narita Groups. The lowest part of the Kazusa Group in the Boso Peninsula is tuffaceous conglomerates overlying the Kurotaki unconformity, which are succeeded by the alternation of sandstone and siltstone of varying thickness frequently with intercalated volcanic ash layers; and the uppermost part of the group is the massive muddy sand formation. Biofacies of the group are bathyal in the lower and middle parts, while becoming neritic in the upper. Center of the tectonic basin was once located in the east part of the Boso Peninsula through the deposition of the lower half of the group, and was later removed to the northwest. Towards the end of the deposition of the Kazusa Group, crustal disturbance occurred in the whole area of the Kanto Plain and consequently the "Paleo-Tokyo Bay" appeared. The Narita Group composed of sandy sediments was deposited in the Paleo-Tokyo Bay in the middle to upper Pleistocene. The group contains abundant fossil molluscs of neritic to littoral speices, and is overlain by the aeolian Kanto Loam (volcanic ash) formation.

(2) *Pliocene-Pleistocene boundary*

Because the Kazusa Group is a typical marine sedimentary succession from the Pliocene to the lower Pleistocene in Japan and yields abundant marine fossils together with the fossil mammals (*Palelephas proximus, Parastegodon* cf. *aurorae, Stegodon orientalis*, etc.), various opinions have arisen concerning the Pliocene-Pleistocene boundary in this group, though they have not yet agreed with each other. Asano *et al.* (Bôsô Research Group, 1957; Bôsô-Miura Research Group, 1958) studied the planktonic Foraminifera in the Neogene succession of the Boso Peninsula and found that the first drop (intensive lowering) of water temperature through the succession was recognized at the middle horizon of the Umegase formation which is characterized by cold water species, *Globigerina borealis* (= *G. Pachyderma*). These authors maintained that this horizon might correspond to the Pliocene-Pleistocene boundary as defined in the 18th International Geological Congress. This horizon, on the ohter hand, is placed near the pyroclastic key bed U6 by Mitsunashi *et al.* (1959). Recently Nakagawa *et al.* (1969) carried out the measurement of paleomagnetism of the Neogene to Quaternary muddy rocks above the base of the Amatsu formation (middle Miocene), and correlated a normal period found in the middle part of the Umegase formation (near U6) to the Olduvai event in the Matuyama reversed epoch (Fig. 2-13). From the above-mentioned evidence we can conclude that the Pliocene-Pleistocene boundary of the region is in the middle part or near U6-tuff of the Umegase formation.

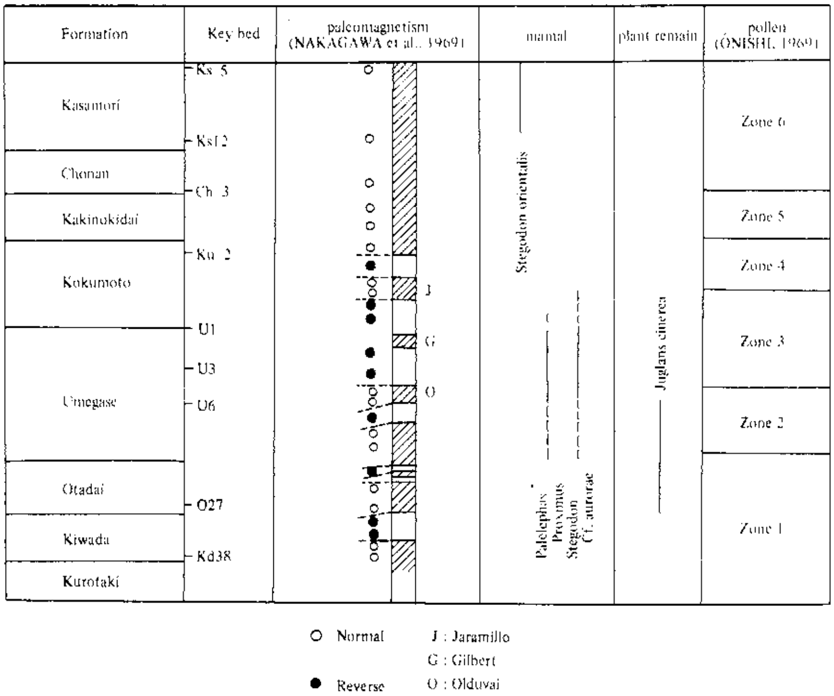

Fig. 2-13. Paleomagnetic and paleontological chronology of Kazusa Group.

(3) *Distribution of the depth of the Pliocene-Pleistocene boundary*

According to Ishiwada's studies on benthonic foraminiferal assemblage in the above sedimentary succession, the upper horizon of the Umegase formation is characterized by the assemblage of *Uvigerina akitaensis* of bathyal facies, and the base of this fossil zone is placed near the horizon of U6-tuff (Kanehara *et al.*, 1958). The *Uvigerina akitaensis* zone has been recognized at many test-wells for exploitation of the South Kanto natural gas field, east of Chiba City in the Boso Peninsula. West of Chiba City, the above fossil zone is not clearly recognized because the neritic dwellers appear from the lower horizon, but the base of the Kokumoto formation or the top of the Umegase formation is well-marked by the lower limit of the warm water foraminiferal assemblage such as *Globorotalia inflata* and *G. crassaformis* etc. (Higuchi & Kikuchi, 1964).

In the Kanto Plain the occurrence of the fossil zone in the upper to middle horizons of the Kazusa Group including the Umegase formation was confirmed by the fossil foraminiferal assemblage at a depth of more than 600 m below sea level in a test-well at Kasukabe (Fukuta and Ishiwada, 1964). In northern Kanto the base of the upper part of the Kazusa Group or the Umegase horizon is found to be 595 m deep in a test-well at Fujioka (Fukuta, 1964). In the central part of the Kanto Plain, we have no drilling that reached the Umegase horizon, but the Tama Loam, i.e. the lower horizon of the Narita Group, was found at several drilling cores. Assuming that the rate of subsidence has been uniform, we regarded tentatively [the depth of the Tama Loam] x 5 as the basal depth of the Quaternary system.

(4) *Amount and rate of subsidence during the Quaternary*

Based on the depth of the middle horizon of the Umegase formation mentioned in the preceding section, we can estimate the amount of the subsidence of the Kanto tectonic basin during the Quaternary. The Umegase formation in the Boso Peninsula, however, is not composed of neritic sediments, but of bathyal ones, so the above-mentioned depth does not indicate the amount of subsidence of the area. It is necessary to subtract the original depth of the formation from the present one. But the depth ranges detected from fossil records are generally wide, and moreover, the data useful for estimating the original depth of sedimentation are little in the area excluding the Boso Peninsula. No correction, therefore, was made in estimating the amounts of subsidence from the depth of the above sedimentary horizon.

Table 2-2 shows the rates of subsidence for different terms since the late Miocene in the Kanto basin which were inferred from the thickness and absolute age of the formations (Naruse, 1968). In these estimations the compaction of strata was neglected, and moreover, the original depth of the Umegase formation was tentatively assumed to be 500 m below sea level (Naruse, 1971). In this table it is evident that the rate of subsidence became higher since the middle Pleistocene than before.

(ii) *Osaka Plain* (Fig. 2-11)

(1) *Outline of the sedimentary basin*

In the Kinki District there are several fault basins, that is, the Osaka Plain, the Kyoto Basin, the Nara Basin, etc., which border mountains or hilly lands with thrusts. The hilly lands are usually composed of the Osaka Group and its equivalents of the upper Pliocene to lower Pleistocene. These strata are also distributed under the basins and plains overlying the Neogene formations or the granitic and Paleozoic basement. The correlatives of the Narita Group in the Kanto Plain are sporadically distributed as terrace deposits covering the Osaka Group.

The lower part of the Osaka Group is composed of the alternation of sandy gravel and clay of fluvial or lacustrine origin, while the upper part consists of frequent alternations of lacustrine gravel or clay and marine clay (Ma 0 – Ma 10) or sand. A large number of volcanic ash layers are intercalated, and mammalian bones, molluscs, plant remains, pollen and diatoms are also abundantly contained. Intensive studies have been done concerning the climatic changes and marine transgression and regression during the deposition of the Osaka Group and its correlative groups (Itihara, 1961, 1966; Kinki Group, 1969). Only a few deep wells were drilled in the central part of the plain. The

Table 2-2. Rate of crustal movements in the Kanto Tectonic Basin since upper Miocene (Naruse, 1968).

Horizon	Time span ($\times 10^4$ y.)	Vertical displacement (m)	Rate (m/10^3 y.)	Literature
Base of the Kiyosumi F.– Top of the Anno F.	1,000	1,000	0.1	Koike, 1948
Base of the Kurotaki F. – Umegase F.	500	2,000	0.4	Mitsunashi *et al.*, 1959
Top of the Umegase F.	200	1,000	0.5	
Base of the Narita Group	50	600	1.2	Kawai, 1965
Top of the Narita Group	10	130	1.3	Kaizuka *et al.*, 1963
Yurakucho F.	0.62	7	1.1	Sugimura, 1967

deep drilling OD-1 in Osaka City revealed the base of the Osaka Group to be about 660 m deep (Ikebe and Takenaka, 1969). This fact shows remarkable subsidence of the plain since the late Pliocene time.

(2) *Pliocene-Pleistocene boundary* (Fig. 2-14)

As the Osaka Group yields many fossil elephants and plant remains from various horizons, the Pliocene-Pleistocene boundary can be defined by using megafossils. Itihara (1961) considered that the Pliocene-Pleistocene boundary was drawn between the lowest part of the Osaka Group which was the flourishing stage of the *Metasequoia* flora (*Metasequoia, Sequoia, Glyptostrobus, Juglance cinerea*, etc.) and the lower part of the group which yielded plant remains of cold climate such as *Pinus koraiensis, Menyanthes*, etc. and indicated extinction of *Metasequoia* flora. His view is mainly based upon the striking resemblance in floral change between the Osaka Group and Italian sedimentary succession, that is to say, the *Metasequoia* flora flourished in the Plaisancian-Astian stage, while the indicators of cold climate such as *Abies, Picea, Pinus, Fagus*, etc. appeared in the Calabrian-Villafranchian series (Itihara, 1961). On the other hand, based on the fossil elephants, the Pliocene-Pleistocene boundary is drawn between the flourishing stage of *Stegodon akashiensis* and *St. sugiyamai* and the appearance of *Elephas shigensis* (Itihara, 1966).

Recently paleomagnetic measurements have been carried out for a number of volcanic ash layers in the Osaka and Kobiwako Groups, etc. (Ishida *et al.*, 1969). As a result three horizons, i.e. "Pink-", "Naka-" and "Kono-II" ash layers, were correlated to the Jaramillo, Gilsa and Olduvai events in the paleomagnetic chronology, respectively. According to Ishida *et al.*, (1969), the distribution of "Kono-II" ash layer is recognized only in the Kobiwako Group, but "Pumice" -ash layer immediately below the "Kono-II" is interbedded in both the Osaka and Kobiwako Groups. If so, the Pliocene-Pleistocene boundary can be drawn directly above the "Pumice" -ash layer of the Osaka Group. This horizon nearly corresponds to the lowest horizon yielding plant remains of cold climate in the group (Ibaraki Research Group, 1966). Moreover, it is very favourable that the "Pumice" -ash layer or its correlative horizon is well pursued in the Osaka Plain and in the Nara Basin (Kinki Group, 1969).

(3) *The basal depth of the Osaka Group and the amount of subsidence in the Quaternary*

The horizon of the Pliocene-Pleistocene boundary is well recognized in the hilly lands around the Osaka Plain, but it is difficult to confirm the boundary in the Osaka Group buried under the

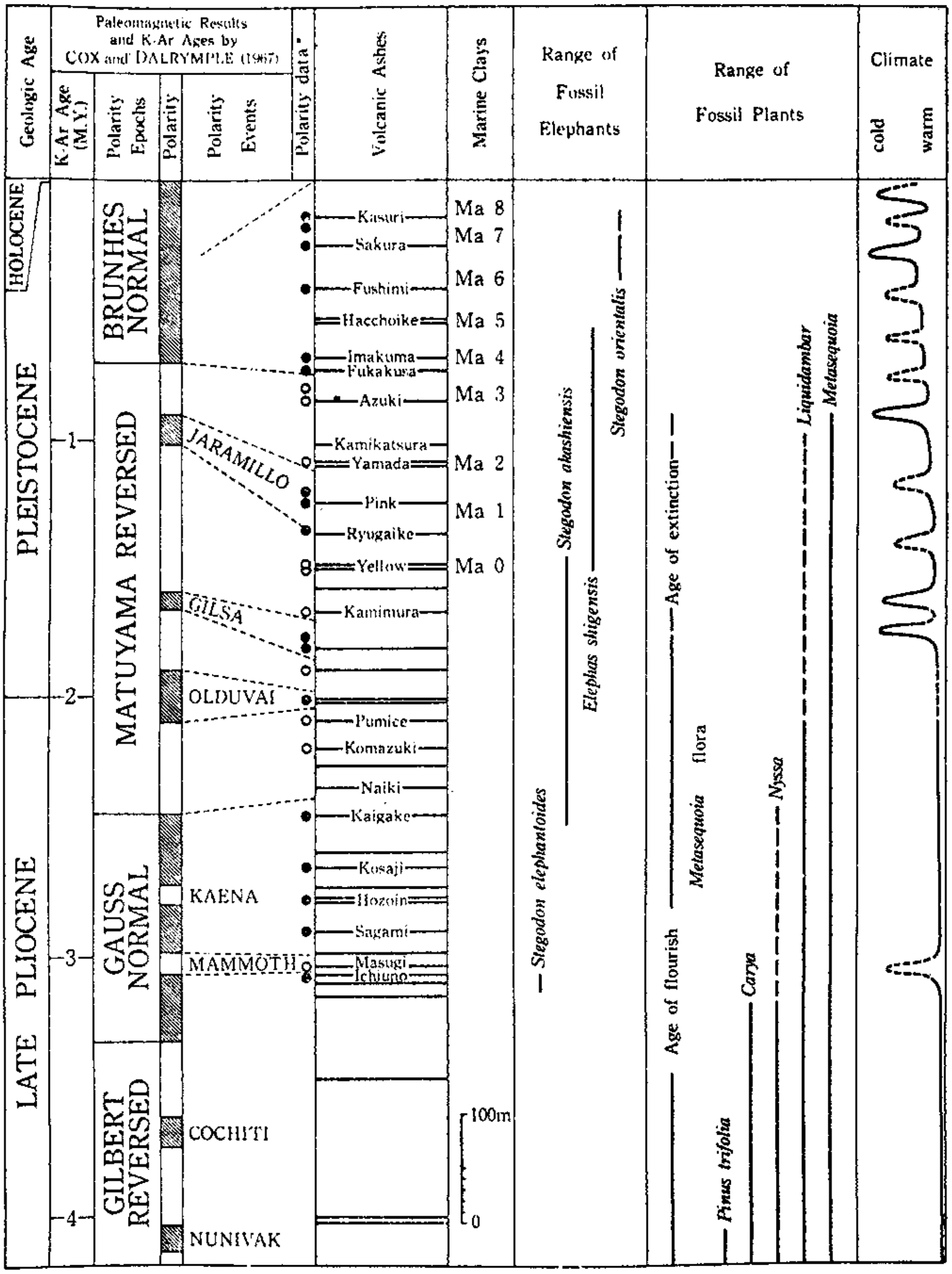

Fig. 2-14. Correlation of paleomagnetic chronology, biostratigraphy and climatic changes of the Osaka Group (Ishida *et al.*, 1969)

*● normal ○ reversed Sk: Shinkori warm age,
M: Manchidani cold age, G: Gokenya cold age,
K_{II}: Kamimura II cold age, K_I: Kamimura I cold age,
S: Sennan warm age, T: Terasho cold age.

plain. Therefore, we adopted the depth of the base of the Osaka Group as approximate amount of subsidence of the Osaka Plain in the Quaternary. As to the original depth of the deposition, it can be estimated at about 0 m, and so any correction was not made.

In the Osaka Bay area, the amount of subsidence in the Quaternary boundary planes between the basement and the Osaka Group or the "upper Pleistocene deposits" was revealed by sonic prospecting (Huzita and Kamata, 1964).

(iii) *Nobi Plain* (Fig. 2–15)

(1) *Outline of the sedimentary basin*

The Nobi Plain is a fault-angle basin bordered by the Yôrô fault on the west. The Plio-Pleistocene Agé Group is distributed in the hilly lands to the southwest of the plain, while the Seto Group of the same age is distributed in the eastern hills. These groups were deposited in the "Tokai Lake" which existed in the second stage of "Palaeo-Seto Inland Sea", where the Osaka and Kobiwako Groups also were deposited. In the Nobi Plain the Agé and Seto Groups are distibuted under the ground, and the stratigraphic relation between them is not fully known because of the deficiency of deep drillings.

The Agé Group is composed of alternation of non-marine clay, sand and gravel, frequently intervened by layers of lignite and volcanic ash. In its uppermost part the gravel facies predominates. *Metasequoia* flora is contained throughout the whole succession, while fossil elephants are sporadic. Total thickness of the Agé Group attains some 600 m in the northern part of the hills.

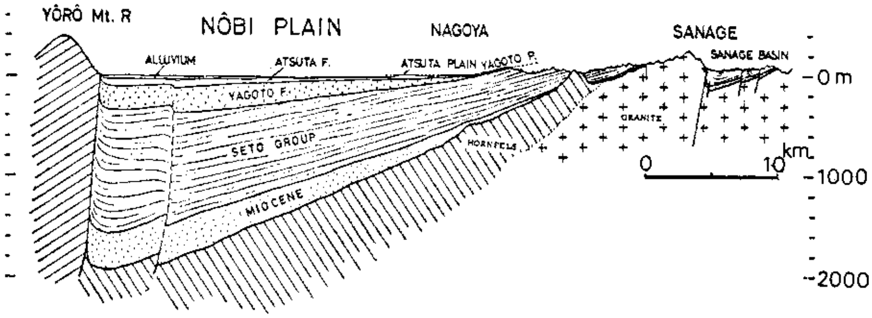

Fig. 2-15. Profile of Nobi tilting block (Kuwahara, 1968).

The Seto Group consists of terrestrial deposits composed of gravel, sand and clay intervened by lignite seams. It is divided into two formations, the lower being the Seto Porcelain Clay, and the upper the Yatagawa formation, both of them exhibiting deltaic facies. The Yatagawa formation with very varied sedimentary facies extends as far as under the Nobi Plain and is overlain by the Karayama formation. The thickness of the Yatagawa formation is about 250 m in the eastern hilly area (Matsuzawa *et al.*, 1960), becomes thicker towards the plain, and exceeds 500 m. This fact suggests that westward tilting of the basement had already begun at the time of the deposition of the Yatagawa formation. After the deposition of the Karayama formation, the Nobi Plain proper has subsided until the present (Kuwahara, 1968).

(2) *Pliocene-Pleistocene boundary*

As the Age Group yields *Stegodon elephantoides* from the lower part, and *St. akashiensis* from the upper (Takehara, 1961), the Pliocene-Pleistocene boundary is assumed to be at the upper horizon of the group (the lower part of the Oizumi formation) from the palaeontological point of view. On the other hand, *Pinus trifolia* flora, an indicator of the Pliocene age, is reported from the lower horizon of the Seto Group (the Seto Porcelain Clay).

Recently the "Pumice"-ash layer which is interbedded in the lower part of the Osaka group was reported from both the Age and Seto Groups (Ishida *et al.*, 1969). Based upon the former discussion in (ii) (2), we can draw the Pliocene-Pleistocene boundary either near the base of the Oizumi formation or in the Owari coaly facies of the upper part of the Seto Group. Though the base of the Oizumi formation is considered to be 500 m deep at the Nagashima R-3 well (Research Group for Lowland Geology, 1966), little is known about the Pliocene-Pleistocene boundary under the Nobi Plain. There is an opinion that the boundary may be drawn between the Karayama formation and the Seto Group in the vicinity of Nagoya based upon the pollen analysis (Nagoya Group, 1969).

(3) *The horizon adopted as bases of the Pleistocene formations in the Map*

As stated above, the Pliocene-Pleistocene boundary can be drawn at the upper part of the Age Group (and the Seto Group) in the hills and is not evident under the Nobi Plain. As it was pointed out that the Karayama formation unconformably overlies the Age Group (Kuwahara, 1968), a part of the formations near the horizon of the Pliocene-Pleistocene boundary may be eroded out.

On the other hand, if we adopt the bases of the Age and Seto Groups, these are lower than the base of the Osaka Group and their age may date back to the middle Pliocene time. Therefore, we considered that the base of the Karayama formation is a stratigraphically well-defined horizon of the Pliocene-Pleistocene boundary, and regarded its depth as the amount of Quaternary subsidence.

(4) *Depth of the base of the Karayama formation*

As the data concerning deep drilling in the Nobi Plain are so poor that we inferred the basal depth of the Karayama formation from the depth of its upper horizon, except a few drillings penetrating the base of the Karayama formation. The method of the inference is as follows. Sugisaki & Shibata (1961) classified the gravel beds under the Nobi Plain into six horizons and figured the isobases of the second gravel bed (G2) over the whole extent of the Plain. Comparing the Sugisaki & Shibata's classification with that of the "Foundation Map of the North Ise Bay" (1962), we correlated the G2 gravel bed to the uppermost one of the Yagoto formation and the G6 gravel bed to the Karayama formation. As the depth of G6 is about 3.5 times that of G2, we regarded (the depth of G2) x 3.5 as the depth of the Karayama formation.

(iv) *Niigata Plain*

(1) *Outline of the sedimentary basin*

Many drillings have been done in the Niigata Plain and its surroundings for exploiting natural gas and oil fields. But the opinions are different concerning the stratigraphic relation between the subsurface formations in the central part of the plain and the geologic succession in the surrounding hills. The Pliocene-Pleistocene deposits in this district are named the Uonuma Group which overlies the Chuetsu Group with partial unconformity and is 500 to 1000 meters thick (Ikebe, 1968). The lower half of the Group (the Tsukayama formation) is mainly composed of alternation of sand and clay intervened by gravel beds, and yields fossils of brackish to neritic molluscs. The upper half of the Group (the Oguni formation) is deposits in brackish to freshwater condition and consists of alternation of clay, sand and gravel frequently intervened by lignite seams. The Uonuma Group was deposited on a sedimentary basin of tectonic orgin after the deposition of oil-bearing Tertiary system. Severe folding occurred after the deposition of the Uonuma Group and is now continuting.

(2) *Pliocene-Pleistocene boundary*

Lower half of the Uonuma Group yields *Stegodon akashiensis* together with *Metasequoia* flora and has been considered to belong to the upper Pliocene to lower Pleistocene age (Ikebe, 1968). According to the study on the plant remains of the Uonuma Group in the Oguni area (Mizushima *et al.*, 1970), the Pliocene-Pleistocene boundary may be drawn between the Uonuma Group and the underlying Wanazu formation. Recent paleomagnetic study by Nitobe & Niitsuma for the Uonuma Group in the same area elucidated that the lowest part of the group can be correlated to the Gilsa event in the Matsuyama reversed epoch (Yamanoi *et al.*, 1970). In this case, the horizon of the Olduvai event may be placed in the Haizume or Nishiyama formation of the Chuetsu Group below the Uonuma Group.

On the other hand, pollen analysis (Yamanoi, 1969), palaeomagnetic measurements (Nitobe & Yamanoi, 1970), and fission track dating (Suzuki & Yamanoi, 1970) were carried out for the Uonuma Group near Tokamachi City. According to these studies, pollens of *Metasequoia* are frequently contained below the mud-flow 2 (mf-2) or at the top of the lower part of the Uonuma Group, while mf-2 horizon is correlated to the palaeomagnetic boundary between the Matsuyama reversed epoch and the Gauss normal epoch. Therefore, the Olduvai normal event is assumed to be at the horizon slightly below mf-3 in the middle part of the group, and the fission-track age of Surigoma tuff above Mf-3 is 1.90 ± 0.15 m.y. Accordingly, the Pliocene-Pleistocene boundary is drawn in the middle part of the Uonuma Group in the Tokamachi area.

On the other hand, seven gravel beds, G0 – G6, have been discerned as the natural gas-producing beds extending under the Niigata Plain. However, as to the basal horizon of the Quaternary system under the plain, opinions are various and the base of the Quaternary has been considered to be at G4, G5 or G6 horizon.

(3) *Amount of subsidence during the Quaternary*

Though, as is mentioned above, several stratigraphic problems such as the definition and subdivision of the Uonuma Group and the correlation between the group and subsurface gravel beds in the Niigata Plain are unsolved, we figured the isobases of the G4 bed in the Map, according to the opinions of Ida (1955) and Niigata Prefecture (1957) who correlated the G4 bed with the boundary horizon between the Tsukayama and Wanazu formations. Recently, Nishida (1969) discussed about the Pliocene-Pleistocene boundary in the Niigata natural gas field, whereas our Maps were already published. After his opinion, the base of the Uonuma Group is considered to be considerably deeper than the G6 bed, and the Pliocene-Pleistocene boundary is assumed to be at a horizon between the G5 bed (500 m deep) and the base of the Uonuma Group (800 m deep). As the depth of the G4 bed is 340 m deep, we must add some 200 m or 400 m to the isobases in the Niigata Plain. The base of the Tsukayama formationis far deeper than 1000 m in its thick area after Ikebe's geological profile of the Niigata Plain.

(v) *Ishikari and Kushiro Plains*

The Quaternary deposits in Hokkaido are well developed in the Ishikari Lowland region in the west and the Kushiro Plain in the east, but very little is known about the Pliocene-Pleistocene boundary. We adopted the bases of the so-called lower Pleistocene formations as the Pliocene-Pleistocene boundary in the Map.

In the Ishikari Plain the base of the Pleistocene deposits is considered to be at the base of the Nopporo formation which composes the Nopporo hills to the southeast of Sapporo. The Nopporo formation consists of alternation of sand and clay in the lower part, marine facies in the middle part, and of fluvial gravel, sand and clay in the upper part. It becomes thicker under the Ishikari Plain, exceeding 500 m at the maximum (Yamaguchi *et al.*, 1964).

In the Kushiro Plain, the Kushiro group of the so-called lower to middle Pleistocene is mainly composed of marine deposits partly intervened by non-marine facies, and is more than 500 m thick at the maximum (Hokkaido Group, 1969).

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2.3. Synthesized map of vertical displacement

It is found by a comparison of the amounts of Quaternary vertical displacement estimated by geomorphological method with those estimated by geological method that the regional distributions of these amounts generally show similar modes in two maps. There are, however, some regions where the amounts and the modes of their distribution are quite different in each of the two maps, because the amounts estimated either geomorphologically or geologically were obtained from uncertain data. In general, the amounts geomorphologically estimated tend to be by 200 to 300 meters larger than those estimated by geological method. This is reasonable, because most of the amounts geologically estimated are based on the upper Pliocene marine formations which were initially deposited on the surfaces lower than contemporaneous subaerial erosion surfaces and have been much denuded in mountain areas.

Considering the limits of these two methods and the above-mentioned differences of the amounts in the two maps, the Map No. 3 was synthesized from the Maps Nos. 1 and 2. In this map, degrees of vertical movement were classified into ten zones of iso-displacement, six being uplifted areas divided with 250-m, 500-m, 750-m, 1000-m, and 1500-m isopleths, and four zones being subsiding areas divided with 250-m, 500-m and 1000-m isopleths.

In areas where the amounts estimated by the two methods belong to different iso-displacement zones, it was examined for the initial data which of them were based on more certain proofs. And further, in mountain areas the amounts geomorphologically estimated were generally used, because erosion surfaces extensively extend and Pliocene or Pleistocene formations are poorly distributed there. On the countrary, the amounts geologically estimated were applied to piedmonts and hills, because extensively distributed Pliocene and Pleistocene formations have not been denuded so much and poorly distributed erosion surfaces have frequently been dislocated by faulting there. In remarkably subsiding areas, amounts of subsidence could be estimated only by geological method.

Erosion surfaces formed in the late Pliocene or early Pleistocene are not distributed in the central parts but only in the marginal parts of the Kitakami, Kii and Shikoku Mountains and others. In the central parts of these mountains, however, older erosion surfaces can be found. The amounts of Quaternary vertical displacement for the central parts were estimated by assuming an imaginary extension of the late Pliocene or early Pleistocene erosion surfaces in the marginal parts parallel to the older erosion surfaces.

2.4. Regional characteristics of Quaternary vertical displacement

(1) Uplifts throughout the Quaternary are most remarkable in Central Japan where the Japanese alps are located and the maximum value of the uplift attains 1700 meters in the Hida Range. Amounts of uplift rapidly decrease in the marginal part of Central Japan.

(2) Uplift in the Quaternary amounts to 1000 meters in the Hidaka, Yubari and Echigo Ranges and in the Uonuma, Kii, Shikoku and Kyushu Mountains, but the amounts are less than 750

meters in the Kitakami, Abukuma and Chugoku Mountains and in the northern part of Hokkaido.

(3) Throughout the Japanese Islands the amounts of uplift in the Quaternary exceed half the present height of mountains and in some regions reach even about two thirds of the latter. The present altitudes of the Japanese Islands, therefore, are mostly due to Quaternary crustal movement.

(4) Large plains in Japan such as Kanto, Nobi, Osaka, Niigata and Ishikari Plains are subsiding regions and amounts of subsidence in the Quaternary attain 1400 meters in Kanto Plain, 700 meters in Osaka Plain, 600 meters in Ishikari Plain and 500 meters in Niigata Plain. These subsiding regions are structural basins, of which marginal parts have high gradients of Quaternary vertical displacement, rapidly descending from uplifted regions to subsiding ones.

(5) Amounts and modes of Quaternary vertical displacement are remarkably different between the northeastern and southwestern parts of Japan divided by a line from Ise Bay to Wakasa Bay. In Southwest Japan, amounts of vertical displacement are much larger in the Outer Zone than in the Inner Zone and rapidly decrease northwards along the Median Tectonic Line, by which the Inner and Outer Zones are divided and along which faulting has occurred in the Quaternary at several locations. In Northeast Japan, however, the difference of vertical displacement between its eastern and western parts are not so remarkable as in Southwest Japan.

(6) In Northeast Japan, volcanoes are generally distributed in arcuate zones parallel to the island arcs, where the heights of mountains and the amounts of Quaternary vertical displacement are larger, and the axes of uplifted areas in the Quaternary are located a little west of the eastern margins of the volcanic zones.

(7) Amounts of vertical displacemnet do not generally vary so much in small extents which are surrounded by marginal zones with high gradients, though they are remarkably different in various regions of Japan. From this fact it is possible to divide the Japanese Islands into some tectonic regions according to Quaternary tectonic activities. These tectonic regions have probably a close relation with regional characteristics of recent seismic activities, as will be mentioned later.

3. Quaternary faults and folds

In the maps of Quaternary vertical displacement, linear or arcuate parts of high gradient may have resulted from Quaternary faulting or flexure, but small Quaternary faults are not generally expressed in these maps. On the other hand, up- and down-warping with long wavelength are shown in these maps as uplifted and subsiding areas, respectively. Small folds with short wavelengths and small amplitudes, however, are not found in these maps.

Many faults and folds which have been more or less active in the Quaternary have been discovered in various regions of Japan and a close relationship between their distribution and recent seismic activities has been recognized. That is, regions where faults were active in the Quaternary but any great earthquake has not occurred in the recent time have a higher probability of outbreak of a destructive earthquake in near future than those where it occurred recently. From this reason it has been considered that distribution maps of Quaternary faults and folds are very useful and indispensable for finding out the regions where great earthquakes may occur in near future and, accordingly, various observations of present seismic activities should be carried out for prediction of earthquakes.

From this point of view, the Research Group for Quaternary Tectionic Map has collected data on Quaternary faults and folds in Japan and compiled these separately in two distribution maps on a scale of 1:2,000,000 (Maps Nos. 4 and 5).

3.1 Quaternary faults

3.1.1. Method

Quaternay faults as defined in this paper are those which have dislocated upper Pliocene or younger formations and geomorphic surfaces, and have caused seismic faults more than 1 km long. Such faults were picked up over the Japanese Islands, using geological maps of various scales published by the Geological Survey of Japan and other organizations, and geological and geomorphological maps contained in scientific papers. 558 Quaternary faults were picked up in the abovementioned processes, were listed up as shown in the appendix, and were numbered in every quadrangle of the topographical map on a scale of 1:2,000,000. Among them, 132 faults were plotted in the Map No. 4, excluding those less than 10 km long and those which have not been ascertained but only inferred, because the scale of the distribution map was too small to contain all the Quaternary faults picked up.

In regions where fault nets are very complicated, parallel faults more than two were represented by one main fault and at some places those less than 15 km long were excluded in the map. In a part of Boso Peninsula where there develop many parallel faults trending from north to south and dipping either eastwards or westwards, the group of these faults was expressed by a hatched area. And further, the faults which mainly dislocate vertically are expressed with comb-like marks, and those which mainly dislocate horizontally with arrows.

3.1.2. Examples

a. *Atera fault*

(i) *Atera fault scarp*

Fig. 3-1 shows the Gipfelfur map of a part of Central Japan, the area being situated 70 km

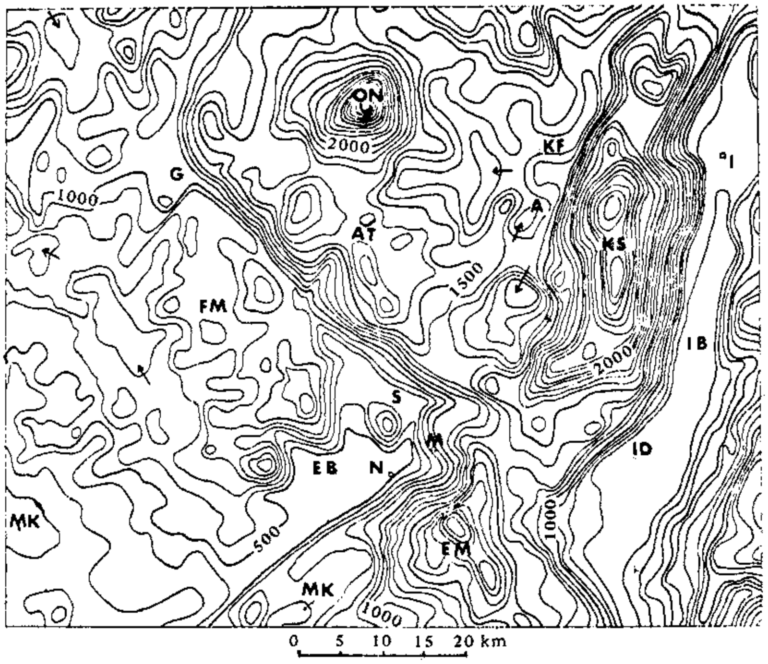

Fig. 3-1. Gipfelflur map of the Kiso River valley.

KF: Kiso-Fukushima
I: Ina
A: Agematsu
G: Gero
S: Sakashita
Id: Îda
M: Magome
N: Nakatsugawa

MK: Mino-Kamo
On: Ontakesan
Ks: Kiso Mountains
At: Atera Mountains
EB: Ena Basin
EM: Ena Mountains
Mk: Mikawa Plateau
FM: Futatsumori Mountains

northeast of Nagoya. In the middle of the map, a fairly flat topography slopes down to the southwest, and reappears in a lower level beyond the steep slope. This slope has been called the Atera fault scarp by some geomorphologists (Tsujimura, 1929; Okayama, 1930; Ito, 1941; Kaizuka *et al.*, 1963). A series of fault valleys, separated by several in-valley divides, run at the base of the fault scarp. At several places stream channels are offset, suggesting that the area northeast of the fualt has moved relatively by 7–10 kilometers to the northwest in respect to the southwest block.

The Atera fault is expressed also geologically (Geological Survey of Japan, 1961). A conspicuous fault zone is observed along the fault scarp in the late Cretaceous rhyolitic welded tuff. The fault zone consists of fractured rock more than 10 m wide with a central zone crushed into sand grains.

(ii) *Sakashita fault scarplet* (Fig. 3-1)

Near the southeastern end of the Atera fault, at Sakashita, the Kiso River crosses the fault line, and several river terraces have been formed. These terraces are cut by the fault and a fault scarplet is observed. Sugimura & Matsuda (1965) measured the vertical and horizontal displacements of the fault, from the offset of the terrace surfaces and scarps (Fig. 3-2). Five displacement vectors were calculated in the fault plane. They show that (1) the horizontal displacement is about five times as large as the vertical; that (2) the faulting, to date, has been persistently left lateral; and that (3) the rate of faulting seems to be about 5 meters/ 1000 years on the basis of radiocarbon dating for the VIIIth terrace, 27,000 years B. P.

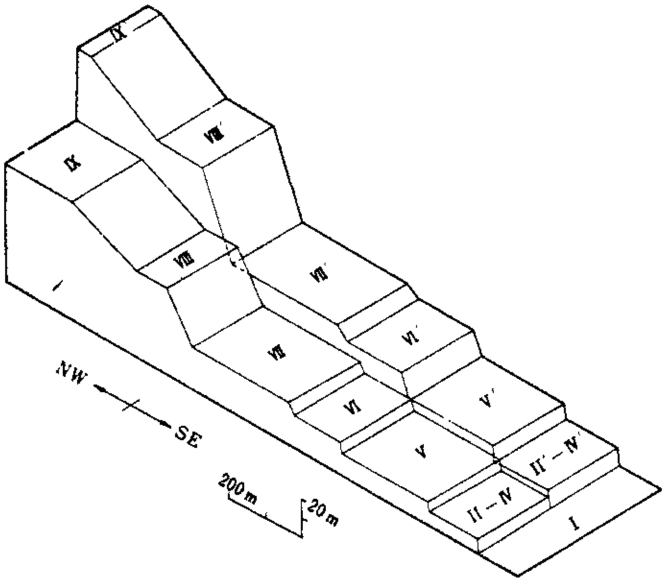

Fig. 3-2. Diagram showing that Atera fault cuts seven steps of river terraces at Sakashita (Revised from Sugimura & Matsuda, 1965).
The Roman numerals indicate the numbers of terraces.
The vertical scale is exaggerated five times.

(iii) *Strike-slip fault system*

Ten or more strike-slip faults have been formed during earthquakes in Japan (Arabic numerals in Fig. 3-3) and show clearly that (1) all horizontal displacements are larger than the vertical ones in the same fault; that (2) there is no regularity in the sense of vertical separation of the upthrown block; and that (3) north-south and northwest-southeast trending faults (nos. 3, 5, 6, 7, 8 and 10 in

Fig. 3-3) are exclusively left-slip, whereas the east-west and northeast-southwest ones (nos. 1, 2, 4 and 9 in Fig. 3-3) are exclusively right-lateral.

Quaternary active faults (Roman numerals in Fig. 3-3) including the Atera fault (no. V in Fig. 3-3) show the same characteristics as those of the earthquake faults. It seems to us that these faults form a conjugate set of two different shear planes, which may be derived from the west-northwest or east-southeast trending compressional stress.

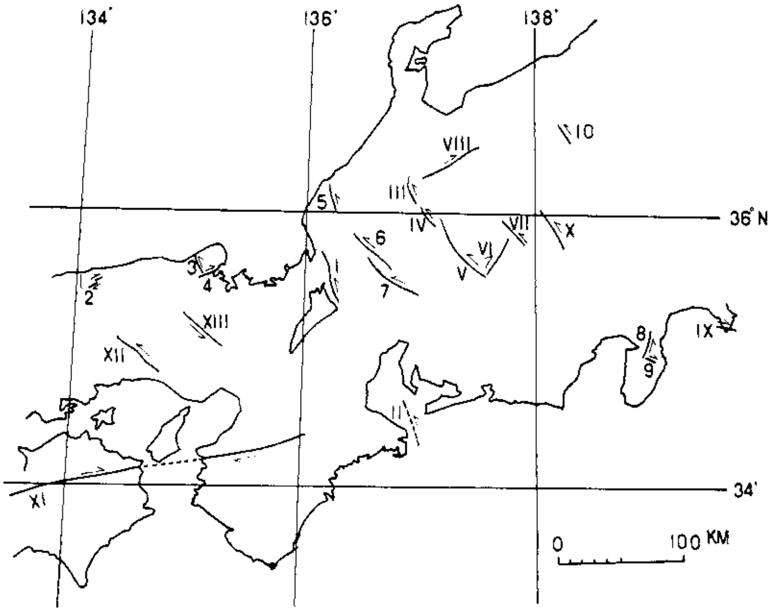

Fig. 3-3. Strike-slip fault system in central Japan. Arabic numerals indicate scientifically observed faults associated with major earthquakes; Roman numerals indicate Quaternary active faults.

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b. *Mobara–Otaki area*

(i) *Introduction*

The eastern part of the Bôsô Peninsula is, in general, rich in small faults and joints. The small faults of this area are divided into the following series:

Younger east-west normal fault series,

Younger north-south normal fault series,
Reverse fault series,
Older east-west normal fault series,
Older north-south normal fault series.

(ii) *Geology*

The Boso Peninsula has in its central part a horst-like structure, which consists of strata of Miocene and older series distributed in an approximately east-west direction, and cut by many faults with east-west strike. Younger strata are distributed on the south and north sides of the "horst". As to the north side, there are strata with east-west and northeast-southwest strikes, and the following strata with north dip lie one upon another in the order from below: Miura Group (the middle and upper Miocene), Kazusa Group (Pliocene), Sagami Group (Pliocene-Pleistocene) and Narita Group (Pleistocene).

(iii) *Fault System*

The older north-south normal fault series are the oldest among the above-mentioned series, and their properties are not yet clarified. The older east-west normal fault series are distributed in the southern part of the Boso Peninsula, and the reverse fault series are formed during the younger and older periods, and also developed in the southern part of the peninsula. Both the fault groups are inferred to have a relation with the uplift movement of Mineoka–Hayama zone in the central part of the Boso Peninsula, and to be formed in the middle Pliocene epoch and in the period from late Pliocene to early Pleistocene, respectively.

The faults in Mobara and Otaki natural gas fields (Fault No. 66-1) shown on the Quaternary Tectonic Map are those belonging to the younger epoch and a part of them is shown in Fig. 3-4. As this area belongs to the Mobara and Otaki natural gas field regions, geological features have been studied in detail. All the strata belong to Kazusa Group, and are chiefly composed of alternations of snad and silt, with many thin layers of tuff between them. Strike is here in the direction of NE-SW, showing the dip of a few degrees to ten-odd degrees to northwest. As is seen on the map, younger north-south normal faults are developed the average interval being 200 m. Faults with subsiding sides on the east are predoninating and occupy more than 80%, the dip angles being steep and over 60° The throws are hardly over 1 m, but those belonging to this series are larger than those of other series, and are more than 20 m at the maximum. Most of the fault lines are of sharp straight line type, and are generally accompanied by lens-shaped fault gouge composed of pulverized fine particles of both sides. The faults are of dip-slip type. They cut the Kazusa Group probably in the early and middle Pleistocene epoch and seem to be related with the regional uplift in the South Kanto district.

In addition, the faults belonging to the younger east-west fault series, which are formed more recently than the above series, are often observed in coastal zones of the eastern part of the area shown on the map. The strikes of faults are nearly parallel to those of strata, and most of the fault planes are either open or accompanied by fracture zones. The throws are generally less than 1 m, and less than 2–3 m at the most. It seems that these faults are formed at the end of Pleistocene and may be related with the development of the uplift parts in the periphery of the Kanto structural basin.

(iv) *References*

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c. *Matsushiro Earthquake fault*

(i) *Introduction*

Matushiro Earthquake Swarm (1965–   ) occurred on the edge of the Central Belt

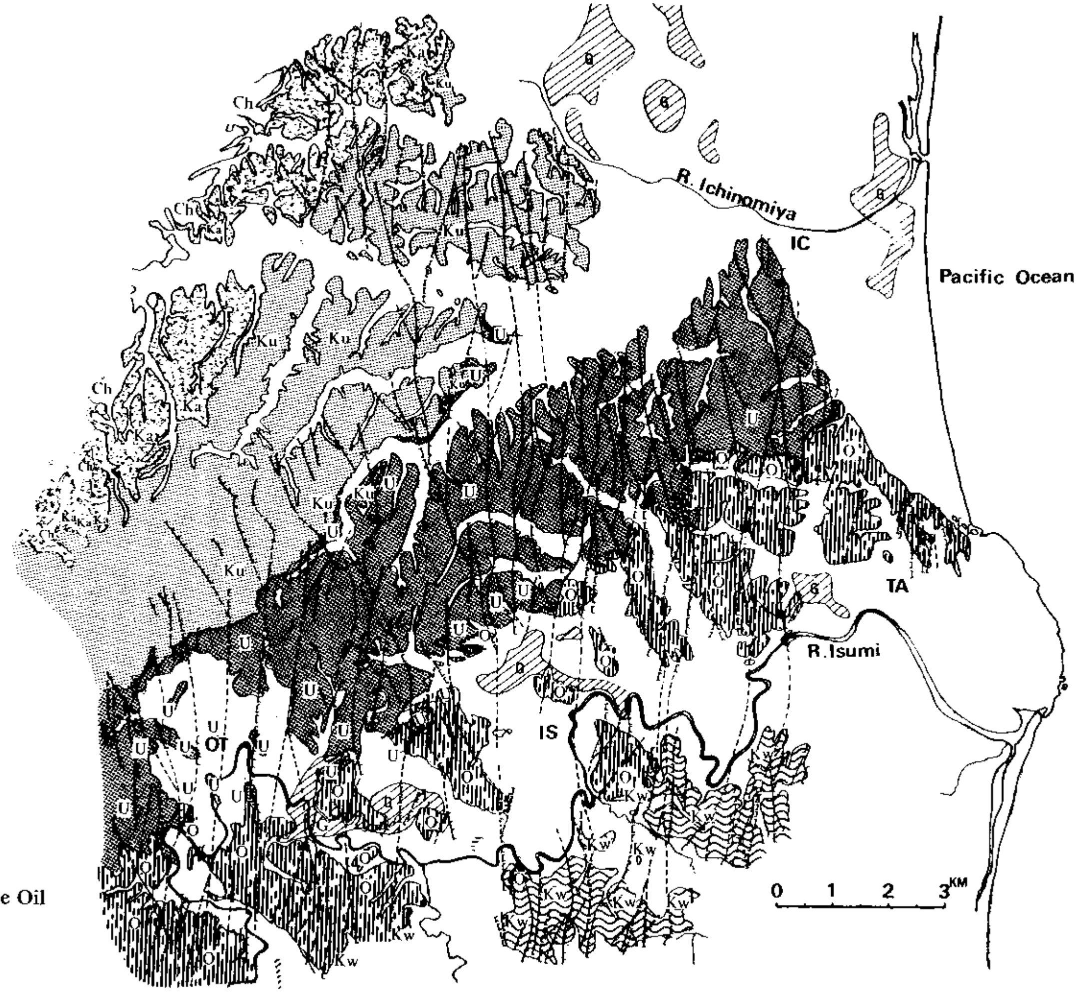

Fig. 3-4. Mobara, Geological Maps of the Oil and Gas Field of Japan.

of Uplift which had upheaved as the earliest of the belts in the Fossa Magna. The epicentral region is about 40 km in NE-SW direction and about 15 km in NW-SE direction. The hypocentral depths are shallow and concentrated mostly into the depths of 2–7 km. The number of felt earthquakes hitherto has reached more than 60,000. In the seismic activity of this earthquake swarm there were several periods of elevated activity. The seismic activity was most active in the 2nd period of activity (March–July 1966), over 600 earthquakes a day at the peak. Hypocentral region showed a tendency of decrease of hypocentral depth with the increase in the number of seismic activity pediods, namely, in the 3rd period of activity (August–December 1966), at Matsushiro Basin, the occurrence place of the earthquake, there occurred extraordinal crustal fluctuations such as up heavals, expansions, contractions, and tilting of the ground; plenty of ground cracks also occurred, and in the neighborhood of cracks there gushed out about ten million tons of ground water (hot springs). Some of the cracks formed horseshoe shape, and these cracks were due to landslides which occurred in relation with gushes of ground water. Other crakcs, independent of the topography, were regularly distributed, and they are considered to be expressions of the faults associated with earthquakes which occurred under the surface soil layer.

(ii) *Occurrence*

Ground cracks relating to earthquake faults form zones of fissures ranging *en echelon*. These fissures are related respectively to the left-lateral or to the right-lateral faults, the former occupying the greater part. A left-lateral fissured zone also is distributed *en echelon* in the range 0.5 km wide and 4 km long. Among these fissures the forerunning ones occurred at the peak of the second period of activity. And according to triangulations, in the blocks on the both sides of this fissured zone also there are shown the left-lateral and open movements the same as in the ground cracks. A large quantity of ground water gushed out in the ground crack zone, and on the extension line of the zone also there are some places where the gushing-out of ground water occurred. From these facts it is considered that this ground crack zone is the area of earthquake faults which have occurred in the basement. The principla geologic elements of this zone are considered to be as follows: strike of N 55° W, left-latral move of 500 m, extension of 7 km, vertical dip, subsidence of 15 cm on northern side, and opening amount of 30 cm.

According to the electro-optical distance measurement for the expansion and contraction of the ground, the same tendencies of east-west contraction and north-south extension are also clearly shown, and in the 3rd period of activity at the maximum, extension of more than 107 cm was observed for the distance of about 3 km in north-south direction which involves the above-mentioned fault.

(iii) *Tectonic setting*

The Matsushiro earthquake fault has occurred in the central part of the hypocentral region, with a direction nearly perpendicular to the direction of the long axis of the region. The earthquakes of Matsushiro Earthquake Swarm occurred extremely frequently in a limited area, and their earthquake mechanism is considered as follows: the principal pressure is of quadrant type of east-west direction, and its nodal line of the same direction as that of the fault. This earthquake mechanism shows the same tendency with those of the earthquakes in Central Japan. The Matsushiro fault also, as is mentioned above, is a left-lateral strike-slip fault, and this shows that the fault belongs to the geological system the same as that, to which the active faults in the Quaternary at the Chubu District belong (see Fig. 3-5). Furthermore, the ground water which gushed out in the ground crack zone became hot springs of $CaCl_2$-type; there are recrods of gushing-out in the past on the extension line of the fault; and there are also some places showing landslide topography similar to those recently made by the gushing-out. As it seems that earthquakes had occurred in this region in the past, so it is considered that the Matsushiro earthquake fault was active also formerly. However, geomorphologically speaking, the southern side of the fault seems to have subsided, unlike the recent displacement.

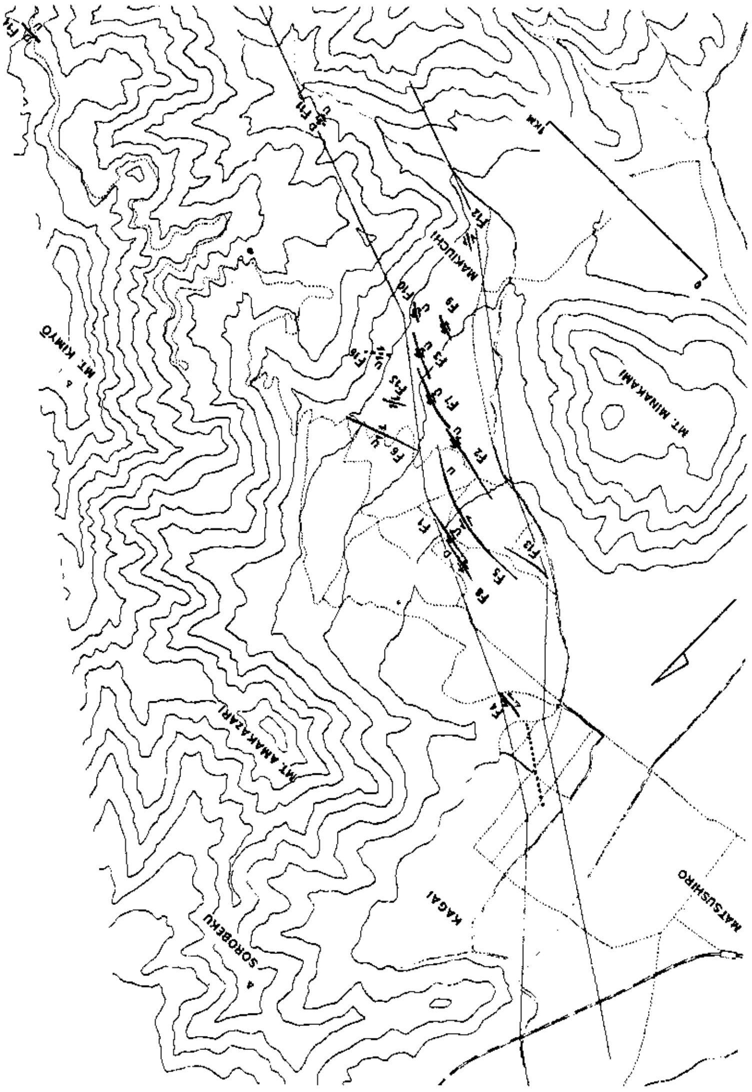

Fig. 3-5. Distribution of the fissure zones of probable fault origin or those which are unable to be attributed to landslide or the simple effect of gravity.

The belt defined by two thin lines shows probable location of left-lateral buried fault.

Broken lines indicate zones of doutful origin. Two types of termination of fissure zones are distinguished; one is gradual dying out and the other abrupt termination.

(iv) *References*

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3.2. Quaternary folds

3.2.1. Method

Quaternary folds as defined in this paper are those with wavelengths from 500 m to 30 km, deforming the upper Pliocene or younger formations and geomorphic surfaces. Such folds are investigated by using geological and geomorphological maps of various scales published by the Geological Survey of Japan and others or contributed scientific papers. Quaternary folds with wavelengths more than 30 km long are generally expressed as extensively uplifted or subsiding areas in the maps of Quaternary vertical displacement (Maps Nos. 1, 2 and 3). Holocene folds as well as geodetic folds revealed by precise levellings are not contained in the Map No. 5, because it is too difficult to discover all of them by the geological and geomorphological methods.

About 80 Quaternary folds selected in these processes are listed up as shown in the Appendix, and each one couple of anticline and syncline or groups of these couples in regions where exist so many folds are separately numbered in every quadrangle of the topographical map on a scale of 1:200,000. About one third of these folds were revealed with deformation of terrace surfaces. All of these folds are plotted in a map of Japan on a scale of 1:2,000,000 (Map No. 5).

3.2.2. Examples

As is above-mentioned, the Quaternary foldings shown in Map No. 5 were detected from the deformed upper Pliocene or Pleistocene formations and geomorphic surfaces. Strongly folded upper Pliocene or lower Pleistocene formations are generally expressed on some large-scale geologic maps. As for the upper Pleistocene fold, the deformation in the upper Pleistocene formation is, in general, too small to represent its folded structure by stratigraphic research. For the representation of folding in this case, it is useful to study the topographic expression of fold on geomorphic surface, especially on terrace surface.

In the following, three examples of Quaternary fold are illustrated, all of them having their topographic expressions. The localities of them are shown in Fig. 3-6.

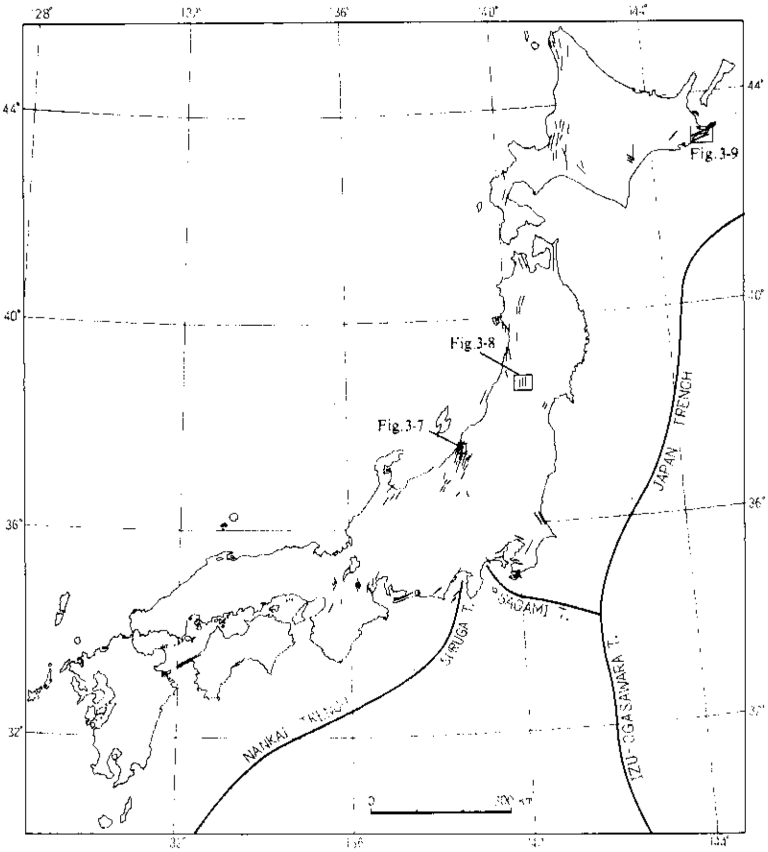

Fig. 3-6. Distribution of anticlinal axes of Quaternary folds in Japan, with localities of Figs. 3-7, 3-8, 3-9.

a. *Niigata area* (Fig. 3-7)

Niigata area has strongly folded Plio-Pleistocene strata and deformed terrace surfaces. In 1942 Otuka and Ikebe independently disclosed that the folding of this area is active at present, based on the evidences of deformed terraces and repeated leveling data. Thereafter, many works have been done for the active foldings of this area by geologic, geomorphologic and geodetic means.

The folded strata, making hilly land of the Niigata area, are the Plio-Pleistocene Uonuma Group, of which almost all anticlines and synclines show coincidence with ridges and valleys, respectively. River terraces in various upper Pleistocene ages have their deformed features as well. The landforms of these terraces are studied recently by Ota (1969), and are classified into eight levels (A–D). The deformed terrace surfaces are shown in Fig. 3-7 with restored contours. Cross sections of these deformed terraces and the underlying folded Uonuma Group are also presented in Fig. 3-7.

From these evidences, it was concluded that through the upper Pleistocene, the terrace surfaces have been deformed in the same mode with the folded structure of the Uonuma Group. In this area, some Quaternary foldings have been detected geomorphologically without any geologic evidence.

b. *Mogami area* (Fig. 3-8)

The Oguni River, a branch of the Mogami River, flows west from the backbone range of northern Honshu (the Oou Mts.) through the town of Funagata. This river crosses the hilly land of the Pliocene Funagata Group perpendicularly to its fold axes, and has many fluvial terraces. The terrace surfaces indicate remarkable deformation as shown in the middle section of Fig. 3-8 by projected profiles. The mode of the lower section, showing the folded structure of the Funagata Group, is succeeded by the mode of the terrace deformation, and even by that of the present deformation, which is shown in the upper section based on the repeated levellings in 1954 and 1964.

From the evidences and estimated years of the terraces, Sugimura (1967) obtained a hypothesis that the folding started at the beginning of the Quaternary and continued to the present with a nearly constant rate of deformation.

c. *The Nemuro Peninsula, eastern Hokkaido* (Fig. 3-9)

The land of the Nemuro Peninsula and its root is an uplifted abrasion platform, which is composed of the veneer of the marine Pleistocene, overlying monoclinal Cretaceous strata with clinounconformity. The form of the abrasion platform is shown in Fig. 3-9 by restored contours. Although there are three terrace surfaces of 30–50 m, 50–70 m, and 70–80 m high with indistinct scarp lines, the whole shape of the platform is of a reversed canoe. North of the abrasion platform, along the Furen River, there is a depressional zone, which is filled by the upper Pleistocene Nishi-shunbetsu Formation. From these evidences, the platform was supposed to show an anticlinal folding (Kaizuka, 1961).

3.2.3. Regional distribution

a. *Distribution of anticlinal axes*

Fig. 3-6, a simplified map of No. 5, shows the distribution of the anticlinal axes of the Quaternary folds. The Quaternary folds are distributed densely in northeastern Japan, especially along the Japan Sea coast of Tohoku, while they are sparse in southwestern Japan. When this map is compared with the map showing the distribution of Neogene and Pleistocene deposits (Fig. 3-10), it must be evident that the distribution of Quaternary folds coincides well with the distribution of Neogene and Pleistocene deposits.

This coincidence depends partly on the reason that a great number of Quaternary folds in Fig. 3-6 were derived from the folded structure of the upper Pliocene and Pleistocene strata. About one third of the folded axes in Fig. 3-6, however, were discovered from deformed marine and fluvial terrace surfaces. Therefore, the coincidence depends not only upon a superficial accordance between the distribution of the source material and that of the derived evidence from the same source, but also upon an essential reason, i.e., on the younger and more deformable rocks such as the Neogene-Plaistocene deposits, folding occurs more easily than on the older and more rigid rocks. This

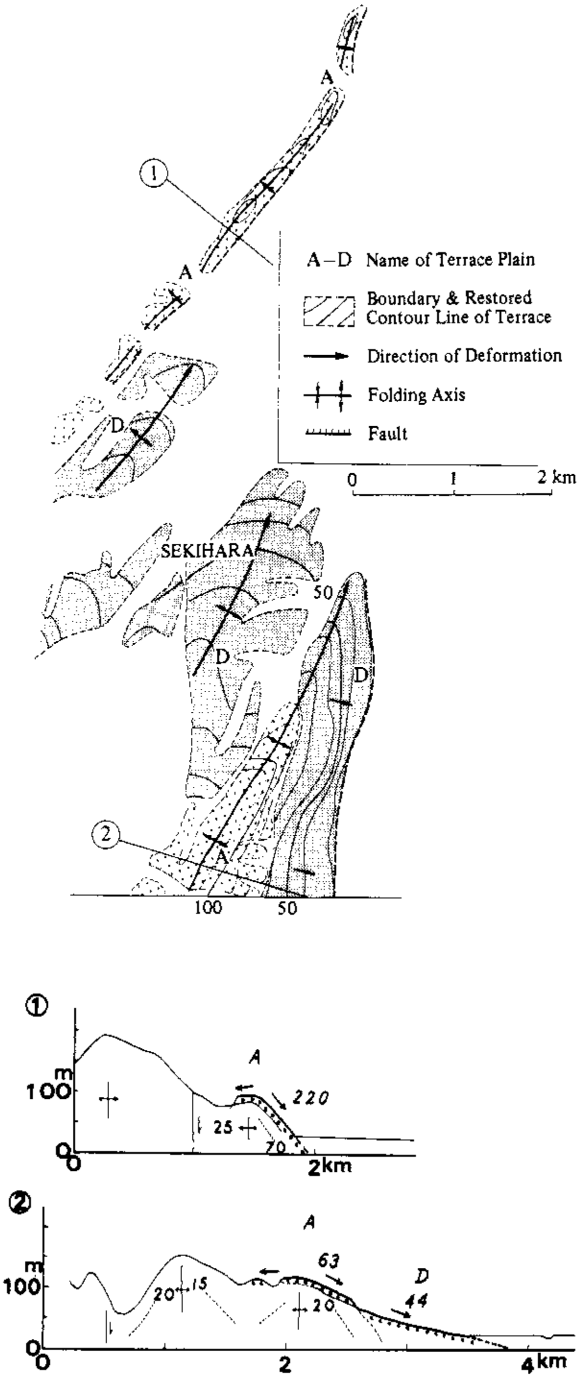

Fig. 3-7. Restored contour map of the folded river terraces and their cross sections in Niigata area, Central Japan.

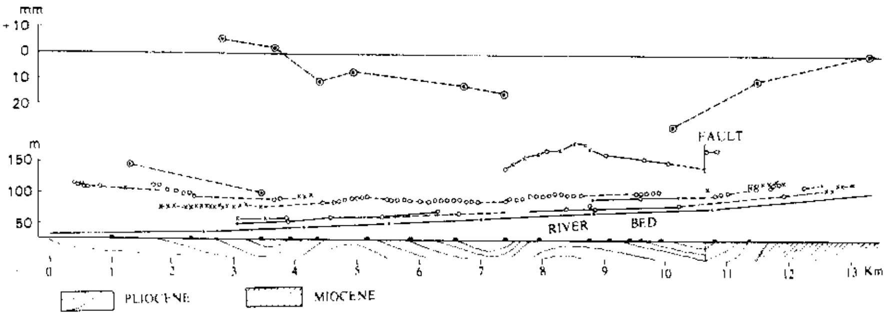

Fig. 3-8. Profiles of the terrace surface (middle), section of the geologic structure (lower), and the present vertical movements of 1954-1964 (upper) in Funagata, northwest of Sendai, northern Japan (Sugimura, 1967).
In the middle profiles, vertical scale is exaggerated 10 times; in the lower section there is no vertical exaggeration.

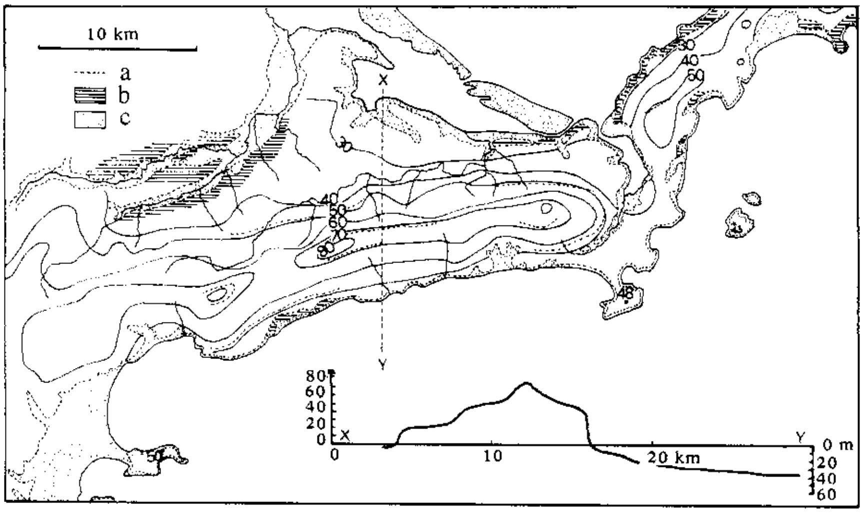

Fig. 3-9. Restored contour map of the folded coastal terraces and the cross section in Nemuro area, eastern Hokkaido (Kaizuka, 1961).
a: Boundary of terrace; b: Lower terrace; c: Recent coastal and alluvial plain.

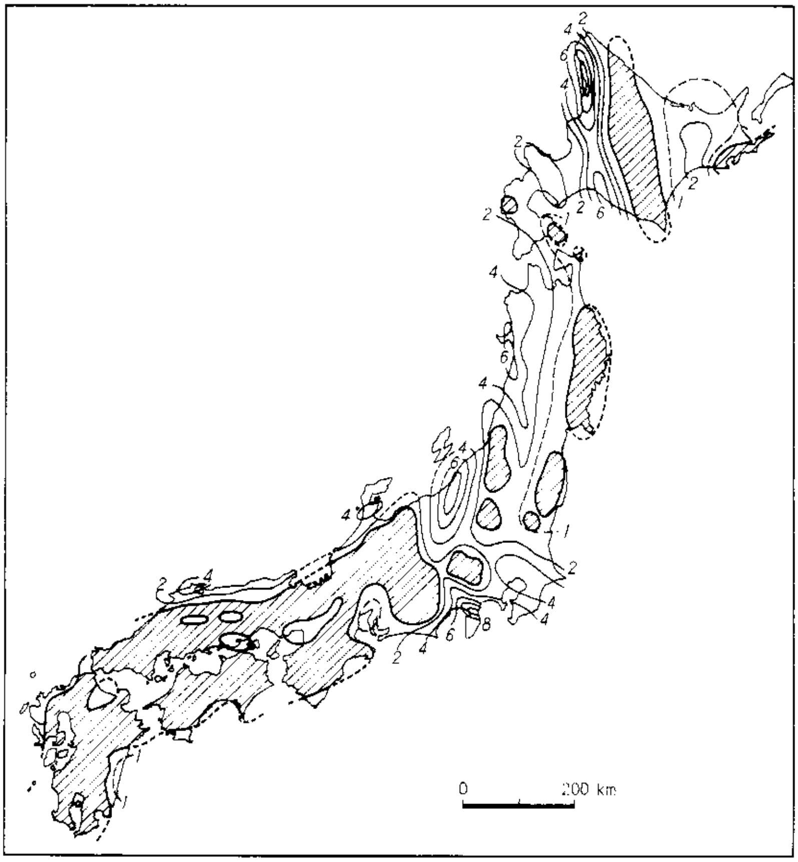

Fig. 3-10. Thickness contours of the Neogene and Pleistocene formations in Japan (compiled by Chinzei, 1968).
Contour interval: 2km
Oblique lines: nothing or very thin layer of the Neogene-Pleistocene.

will also be supported in the latter part of this report from other evidences.

b. *Relation between rate and wavelength*

The mean rate of folding is calculated by dividing G by T, T being the time duration from the age of the folded terrace surface or folded stratum to the present, and G the gradient of fold. The gradient G is obtained from either of the two equations: $G=2H/L$ or $G=\tan X$, where H is wave height, L wavelength, X angle of slope at a limb of the fold.

The relationship between thus obtained G/T (change of gradient or velocity gradient) and L is shown in Fig. 3-11. This diagram is essentially similar to the previously presented correlation diagram for some Japanese and foreign foldings (Kaizuka, 1967). Both diagrams indicate that the shorter the wavelength is, the more rapid is the rate of folding, and also indicate that the increase of wave height without any remarkable fault seems to have an upper limit of about 2 mm/year.

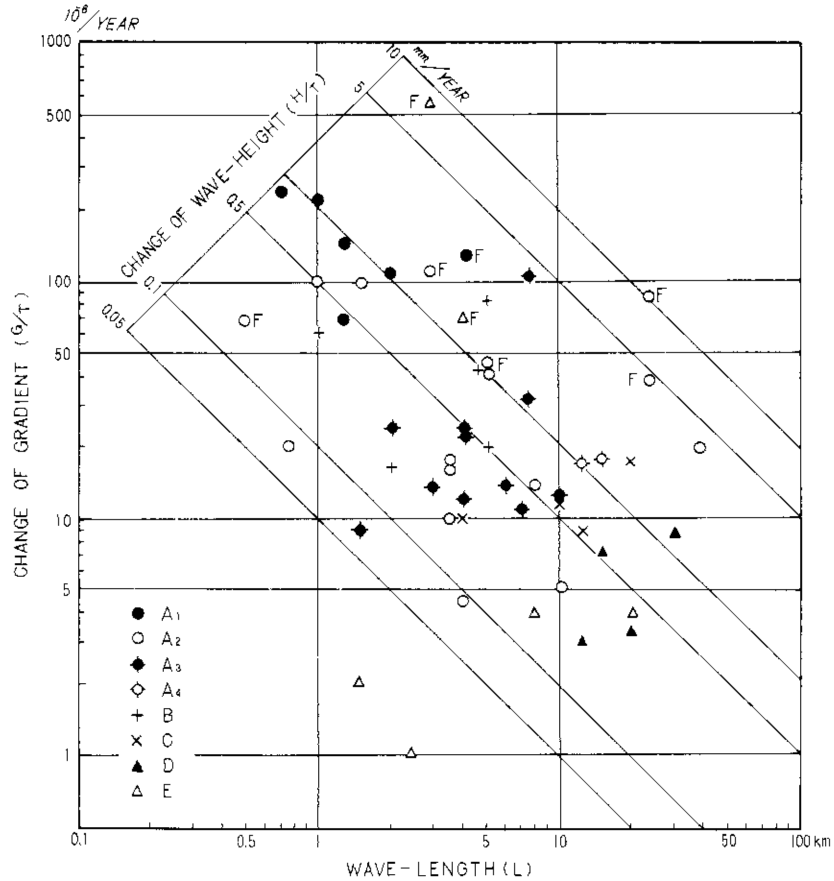

Fig. 3-11. Relation between change of gradient or wave height and wavelength of Quaternary fold in Japan.

A1:	Niigata Area	C:	East Hokkaido
A2:	Uetsu Area	D:	Kanto Area
A3:	Ishikari Area	E:	Kinki Area
A4:	Toyama Area	F:	Accompanied with remarkable fault
B:	South Fossa-Magna		

Fig. 3-11 also shows that the change of gradient is mostly less than 10^{-6} year. This value is much the same with the accumulating ratio of horizontal shear strain, calculated from re-triangulation data in the past 50–60 years in central and southwestern parts of Japan (Kasahara and Sugimura, 1964). In Fig. 3-11, however, there exists a rapid rate of folding, more than 10^{-6}/year in Niigata area.

c. *Geographical distribution of the rate and Quaternary folding areas*

Fig. 3-12 shows the distribution of the value *G/T*. Hereby, the regional difference of the rate of folding is evident, even though the calculation of *G/T* is only tentative. Based on this fact and also on the regional difference in axis-direction (Fig. 3-6) and wavelength (Fig. 3-11), Kaizuka (1968) attempted to classify the Quaternary folding areas in Japan as follows.

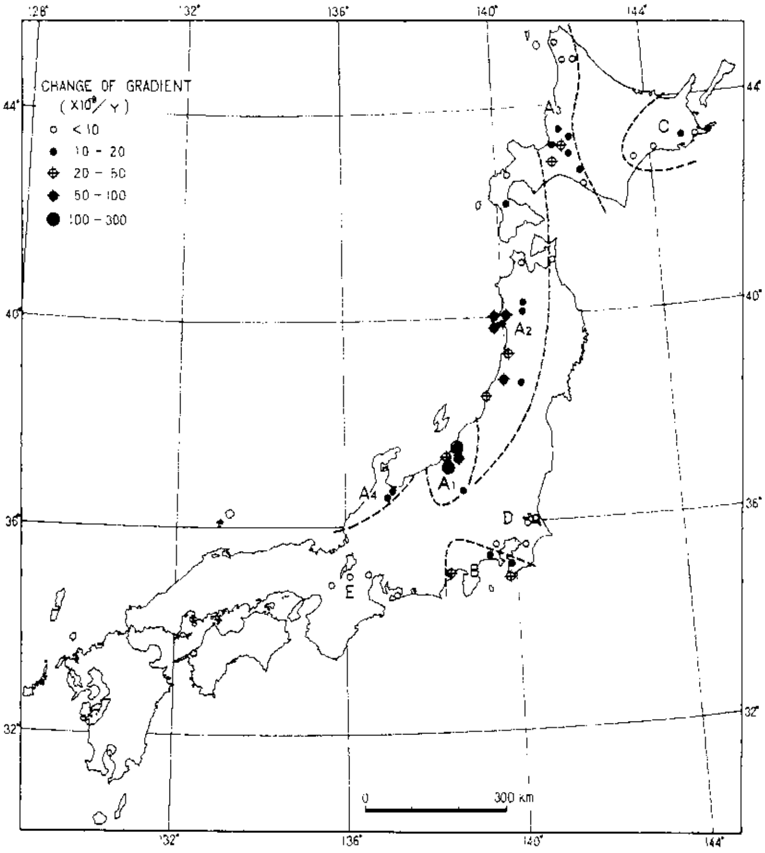

Fig. 3-12. Distribution of the rate (G/T) of Quaternary folding in Japan.

As indicated in Fig. 3-12, the following areas are classified provisionally (Table 3-1).

The areas, A_1, A_2, A_3 and A_4, are subdivisions of a nearly continuous fold zone, Ishikari–Uetsu–Toyama zone, in which the directions of fold axes are concordant with the direction of the Northern Japan Arc. In Fig. 3-11, each fold is given with a symbol of each fold area.

3.2.4. Disccusions on the formation of the Quaternary foldings

a. *Rate of foldings and thickness of sedimentary rocks*

It has been noted that the Quaternary foldings having shorther wavelengths and greater rates were formed on the thick Neogene or Neogene–Pleistocene formations, while those having longer wavelengths and smaller rates were on older and more rigid rocks than Neogene formations (Kaizuka, 1967). This regularity may also be found in a comparison of Fig. 3-10 with Fig. 3-12. The thicknesses of Neogene-Pleistocene formations in Fig. 3-12 are compiled by Chinzei in 1968. Quantitatively, a fold of more than 5×10^{-7}/year in rate is generally occurs when the Neogene–Pleistocene thickness is more than 4 km. The exceptions are the Kanto Area and the northern Ishikari Area, where the Neogene–Pleistocene formations seem to be too thick for such small rates of folding.

As main factors controlling the rate of folding, the following two may be counted; one is the

Table 3-1 Quaternary folding areas.

Area	Strike of axes	Wave-length (km)	Rate (G/T) (10^{-8}/year)	Remarks
A_1) Niigata	NNE-SSW	0.5- 5	300-50	the strongest fold area in Japan
A_2) Uetsu	parallel to the Japan Trench (NNE-SSW)	0.5-30	100- 5	the so-called Uetsu fold zone excluding A_1
A_3) Ishikari	nearly N-S	1-10	100-10	
A_4) Toyama	NE-SW	ca 10	ca 20	
B) South Fossa-Magna	concordant with the Sagami and the Suruga Trench	1-6	100-10	
C) East Hokkaido	parallel to the Kuril Arc (ENE-WSW)	4-20	20- 5	
D) Kanto	nearly parallel or perpendicular to the Sagami Trench	10-30	10- 1	weak fold in Neogene-Pleistocene formations
E) Kinki	nearly N-S	1-10	5- 1	weak fold in Plio-Pleisocene formations

nature of rocks for tectonic stress, the other is the state of the field of tectonic stress in the crust. The above-mentioned thickness of Neogene–Pleistocene deposits is concerned with the nature of the rock. As for the state of the stress field, information on the direction of the maximum compressive stress in the Quaternary and the present has been increased recently in Japan.

b. *Direction of fold axis and that of compressive stress*

From focal mechanism, seismologists have extensively examined the axis of maximum compressive stress (Honda, 1960; Ichikawa, 1965). Fig. 3-13 shows axes of maximum compressive stresses at hypocenters of very shallow earthquakes (earthquakes in the crust) in 1927–1966 (Honda *et al.*, 1967). It was known that the axes were nearly horizontal. As is shown in Fig. 3-13, the distribution of the directions of axes of maximum compressive stress are mostly systematic, namely, nearly perpendicular to the trend of Honshu in northeastern Japan, and nearly parallel to the trend of southwestern Japan, except in the South Fossa Magna, around Shikoku Island and at the Kii Peninsula. Comparing Fig. 3-13 with Fig. 3-6, it is obvious that there exists a close relationship between the directions of the fold axes and the stress system detected from very shallow earthquakes. That is, the pressure direction is almost perpendicular to the direction of the Quaternary fold axis, even in the above-mentioned exceptional regions of the South Fossa Magna, Shikoku and Kii.

The distribution of maximum compressive stress in the Quaternary was disclosed by Matsuda and Sugimura from the studies of conjugate sets of strike-slip faults in Central Japan (Fig. 3-14, reproduction from Matsuda, 1967). Thus the tendency of compressive stress direction in the Quaternary is in accord with that of the present Central Japan shown in Fig. 3-13.

Furthermore, Kasahara and Sugimura (1964) pointed out that the direction of the axis of minimum principal strain in western Japan, which was calculated from retriangulation data of the past 50–60 years, is generally in accord with the compressive axis direction deduced from the focal mechanism of very shallow earthquakes in the same area.

Thus, the above-mentioned four independent evidences, i.e., state of stress analyzed from present earthquakes and triangulations, Quaternary faults and folds, lead us to the conclusion that the

Quaternary foldings in Japan seem to be products of the stress system having been active during the Quaternary and even at present.

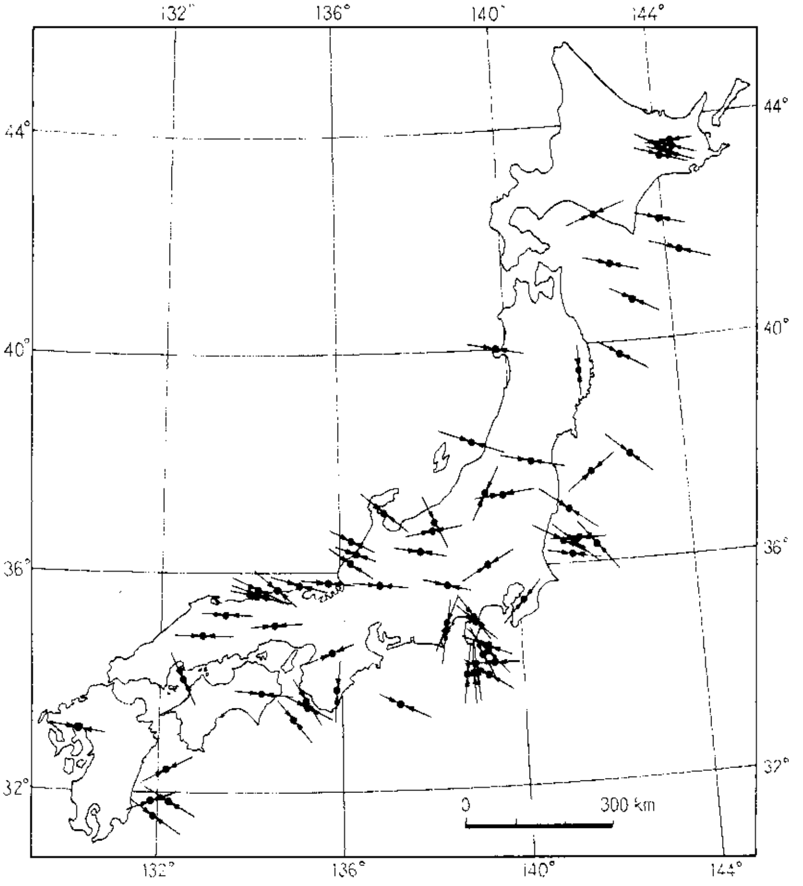

Fig. 3-13. Distribution of the direction of maximum compressive stress disclosed by focal mechanism of very shallow earthquakes during the period from 1927 to 1966 (Honda *et al.*, 1967).

3.2.5. References

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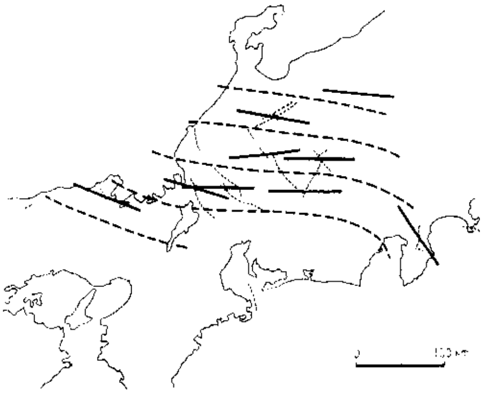

Fig. 3-14. Distribution of direction of maximum compressive stress estimated from active strike-slip faults (Matsuda, 1967).
Light dotted line: active strike-slip fault
Heavy solid line: local direction of maximum compressive stress
Heavy broken line: general direction of maximum compressive stress.

3.3. Regional characteristics of Quaternary faults and folds

Generally speaking, Quaternary faults and folds are more densely distributed in regions, where upper Pliocene formations are extensively developed, than in regions composed of formations of the other ages and igneous rocks. This fact does not represent any regional character of the intensity of Quaternary tectonic movement, but is a natural result of the above-mentioned processes of finding the Quaternary faults and folds. In general, faults and folds dislocating Pliocene formations are more intense than those dislocating Quaternary formations and less instense than those dislocating older formations, because the older formations had more frequently suffered faulting or folding. It is, however, usally very difficult to ascertain by the above-mentioned method whether or not faults in older formations have been active in the Quaternary. Therefore, in such older formations, there are not so many faults which were definitely proved with sound evidences of their activity in the Quaternary, even if they had been active in that age. Consequently, Quaternary faults and folds are more easily found by the above method in regions composed of upper Pliocene formations.

Accordingly, the distribution maps of Quaternary faults and folds, such as Nos. 4 and 5, do not seem to fit the present purpose, but it can be considered that these maps are, though not enough for, but necessary for development of fundamental research on the prediction of earthquake, because it will not be expected in near future to compile a map which contains all of Quaternary active faults and folds. From these considerations, it is concluded that regional characteristics of crustal activities in the Quaternary may be detected in these maps to some extent, though these maps do not exactly represent the intensity of crustal activities in a strict sense.

Quaternary folds are more densely distributed in Northeast Japan than in Southwest Japan. This fact is partly due to the extensive distribution of Neogene formations in Northeast Japan, but mainly it results from an essential relationship of the development of folding to the distribution of thick Neogene formations. That is, the development of folded structure is generally remarkable in regions composed of younger thick formations.

Strikes of faults and axes of folds, as criteria of inferring the regional character of tectonic activity, are regionally different. In the western part of Northeast Japan and Hokuriku District, strikes of both faults and folds are parallel to the Honshu island arc. On the other hand, in Central Japan, remarkable faults show strikes trending from ENE to WSW and from NNW to SSE, but such distinct trends are not found in strikes of folds. In Kinki District, faults trending from NNE to SSW are predominant, and active strike-slip faults are developed along the Median Tectonic Line in Kii and Shikoku Districts. The strike-slip faults developed in Central Japan, Kinki, Kii and Shikoku belong to one strain system caused by compressive stress trending E-W.

4. Gipfelflur Map

Gipfelflur as defined in this report is a descriptive delineation of the earth's surface, expressed by a surface touching the highest points of land masses selected according to certain criteria. The heights of the Gipfelflur approximately represent an integrated sum of crustal movement and the lowering of land surfaces by denudation in the recent geologic time. In such regions as Japan where crustal movement has been very active in the Quaternary, however, the heights of the Gipfelflur are considered to have been determined mainly by recent crustal movement.

From this point of view, the Gipfelflur map is very useful to obtain a general view of landforms and to estimate a role of recent tectonic movement in the geomorphic development of the Japanese Islands. Fortunately, a Gipfelflur map of 1:200,000 covering entire Japan has already been prepared by Prof. Okayama in order to clarify the modes of the manifestation of morphogenetic crustal movement as the first step for the morphostructural devision of the Japanese Islands.

As to the regions other than Central Japan, each sheet of topographical maps on a scale of 1:50,000 (15′ in longitude and 10′ in latitude) was divided into 80 meshes of 1.5′ in longitude and 1.25′ in latitude, and then, the highest point in every mesh was selected. These highest points were plotted on topographical maps of 1:200,000 and Gipfelflur contour lines were drawn with interpolation method, basing upon their heights.

As to Central Japan, all crests expressed by closed contour lines of isopleths of every 100 meters on topographical maps of 1:50,000 were picked up without selection, and the Gipfelflur contour lines were drawn using the heights of these crestes, though some of them were not used because of their discordance in height to neighbouring vrests. In some areas such as volcanoes, fault scarps and so on, convenient methods were used as far as they were considered to be appropriate for the present purpose.

The original Gipfelflur map of Japan prepared by Prof. Okayama was compiled by himself into three sheets on a scale of 1:800,000. The Research Group for Quaternary Tectonic Map synthesized the three sheets into one sheet on a scale of 1:1,000,000, and then, photographically reduced it to a scale of 1:2,000,000 (Map No. 6). In the Gipfelflur maps, original and complied contour lines were drawn at intervals of 100 meters, but in the Map No. 6 the contour lines are drawn at intervals of 200 meters.

5. Discussion

5.1. Tectonic setting of the Japanese Islands

5.1.1. Topographical and geophysical features

Fig. 5-1 was prepared for making a glance at the large-scale topography of island arc systems in Japan and its environs, on the basis of a map of the Maritime Safety Agency (1952). Land surface and sea floor shallower than 2500 m are shaded and mountain areas higher than 1500 m are blackened. Sea floors deeper than 6500 m are also blackened, but can be discriminated by inspecting whether the area is surrounded by a white part or not. The remaining areas of intermediate depths are left blank.

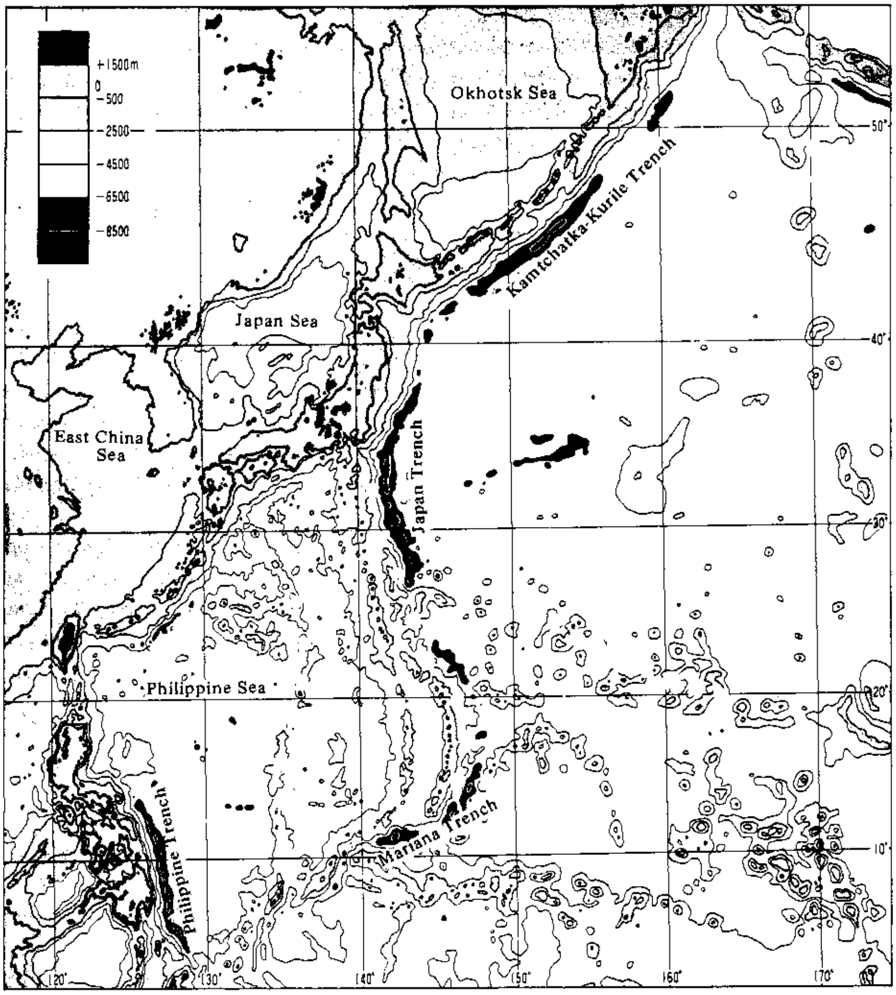

Fig. 5-1. Major topography of Japan and its environs.

The regions higher than −2500 m would nearly represent the surface of continental lithosphere, and those of the intermediate depths (white parts) the surface of oceanic lithosphere. Most of the deepest parts are the oceanic trenches and are thought to correspond to the surface of sinking oceanic lithosphere.

The subsidence of the Japan Trench, amounting to about 4000 m, is suggested to have taken place in the Quaternary period. Various sources of evidence may support this proposition. Iijima and Kagami (1961) found that a point, now at the 2200 m depth on the continental slope west of the Japan Trench, was on the shoreline in some age in the late Pliocene or early Pleistocene epoch. According to Ludwig *et al.* (1966), a succession of step faults that cut the soft sediments as well as the ocean floor, are observed along the Japan Trench by the reflection technique. This fact suggests that the process which formed the trench is still going on.

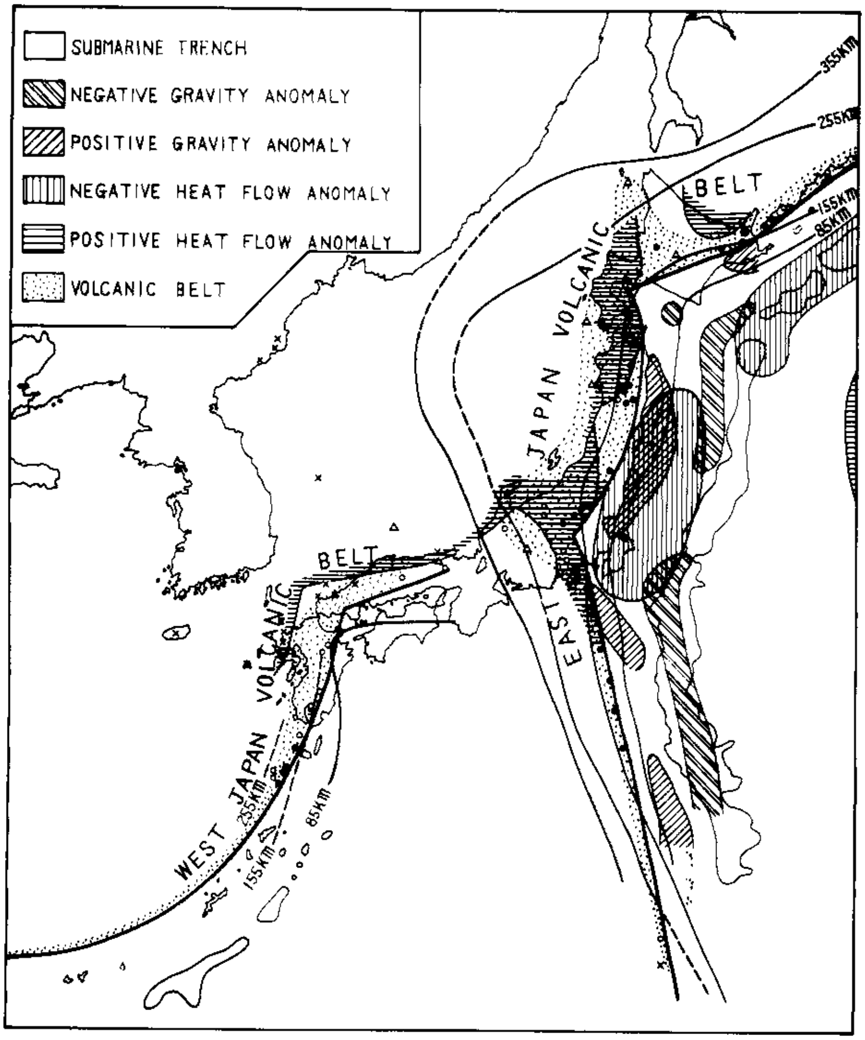

Fig. 5-2. Map of Japan showing island-arc zonality. For symboles, see the text.

The most remarkable feature found in Fig. 5-1 is two pairs of each one island arc and one trench. One arc is followed along the western border of the North Pacific ocean basin, starting from Kamchatka and extending through the Kuriles and Northeast Japan to the Izu (Shichito)–Mariana arc. Another arc extends from Kyushu through the Ryukyu and Taiwan to the Philippines. These two island arc systems show remarkable endogenic features, especially active volcanoes and deep earthquake foci, as shown in Fig. 5-2.

Fig. 5-2 shows island-arc zonality in Japan. The submarine trenches are drawn at depths greater than 6000 m (Maritime Safety Agency, 1952); the belts of negative gravity anomaly have $\Delta g_0'' \leqq -100$ mgal, and the belts of positive gravity anomaly $\Delta g_0'' \geqq +100$ mgal (Sugimura, 1960); the belts of negative heat-flow anomaly have crustal heat fluxes $\leqq 1.0 \times 10^{-6}$ cal cm^{-2} sec^{-1}, and the positive heat-flow anomalies $\geqq 2{,}0 \times 10^{-6}$ cal cm^{-2} sec^{-1} (Uyeda and Horai, 1964). The heavy lines on the eastern edges of the Quaternary volcanic belts represent the volcanic fronts. The curves marked with 85 km, 155 km, etc. are isopleths of the mean hypocentral position of deep-focus earthquakes. The crosses represent volcanoes derived from strongly alkaline magma with $\theta \leqq 31$, the triangles those from weakly alkaline magma for which $31 < \theta \leqq 36$, the open circles those from high-alumina basalt magma $38 < \theta \leqq 40$, and the closed circles those from tholeiite magma with $40 < \theta$. (Concerning θ, see Sugimura (1968).)

Northeast Japan is illustraited in Fig. 5-2 as a typical island arc. Southwest Japan is the northeastern exitension of the Ryûkyû arc, but it lacks typical island-arc features. The Nankai trough off the Pacific coast of Southwest Japan has the deepest part of about 5000 m and could not be called a trench. Any clearly active volcano is not found and any earthquake focus deeper than 100 km has not been found there.

Consequently, the Japanese Islands can be divided into active Northeast Japan, very closely connected with the sinking Pacific Ocean lithosphere, and inactive Southwest Japan, only indirectly related to the endogenic disturbances.

5.1.2. Geological structure

For convenience of description of geologic structure, the main part of the Japanese Islands may be divided with two lines: a line provisionally called Sapporo–Tomakomai Line (S–T in Fig. 5-3) and a fault called Itoigawa–Shizuoka Line (I–S in Fig. 5-3), into three parts: Hokkaido, Northeast Japan and Southwest Japan.

The western zone (9, 10 and 11 in Fig. 5-3) of Northeast Japan is largely made up of folded late Cenozoic sediments overlain by Quaternary volcanic rocks, and underlain by Mesozoic and older rocks which crop out only in places between them. The southern continuation of it is the intensively deformed area east of the Itoigawa–Shizuoka Line. This area is customarily called Fossa Magna. The Itoigawa–Shizuoka fault crosses and cuts the structure of Southwest Japan, which was formed prior to early Miocene and reappears beyond Fossa Magna in some parts of Northeast Japan.

In the western zone of Northeast Japan and its extensions to the south to the Izu-Mariana arc and to the northeast to the Kurile arc, a series of orogenic events started at the beginning of the Miocene epoch. The trend of the late Cenozoic orogenic belt is discordant with those of Mesozoic orogenic belts. The younger orogeny seems to be genetically independent of the older ones, although the older structures have given some effects on the younger ones in Central Hokkaido and in southern Fossa Magna. The Mesozoic and older orgenic bels are distributed in the eastern zone of Northeast Japan, Southwest Japan, and Hokkaido.

The eastern zone of Northeast Japan consists of Kitakami Plateau, Abukuma Plateau, Kanto Range, and some other ranges. Paleogene and older rocks are distributed in these areas.

Southwest Japan is divided by the Median Tectonic Line (MTL in Fig. 5-3), which trends almost east–west, into two zones: i.e., the Outer Zone and the Inner Zone. The Median Tectonic Line has long been thought to be a thrust with which the Inner Zone overlies the Outer Zone, but the need of re-examination is arising because it was found recently that there occurred a right-lateral fault at least during Quaternary period (Okada, 1968). The western extension of this fault to Kyushu is made obscure by the cover of Cenozoic sediments and volcanic rocks.

The Inner Zone of the Southwest Japan consists of Paleozoic and Mesozoic sedimentary and metamorphic rocks as well as plutonic rocks intruding them, covered with Cenozoic sediments (4, 5, 6, 7, and 8 in Fig. 5-3). In the Outer Zone, there is an east-west trending zonal arrangement of tectonic provinces, in which the southernmost one is called Shimanto belt. The Shimanto belt consists largely of non-fossiliferous and partly fossiliferous Mesozoic and Paleogene sediments and is overlain unconformably by Neogene sediments (1 and 2 in Fig. 5-3).

Hokkaido contains a belt of metamorphic rocks called Hidaka orogenic belt in its middle area in a northerly direction pointing Sakhalin. A belt of deformed Jurassic strata with granitic and ultrabasic intrusives makes up the main part of the belt. A fold belt of Cretaceous, Paleogene and Miocene strata (12 in Fig. 5-3) is on the west next to the north–south trending metamorphic belt.

Down-faulted or down-warped basins, scattered over the Japanese Islands, trap the Quaternary System, which forms plains and neighboring terraces and hills. Kanto Plain is the largest of these basins (3 in Fig. 5-3).

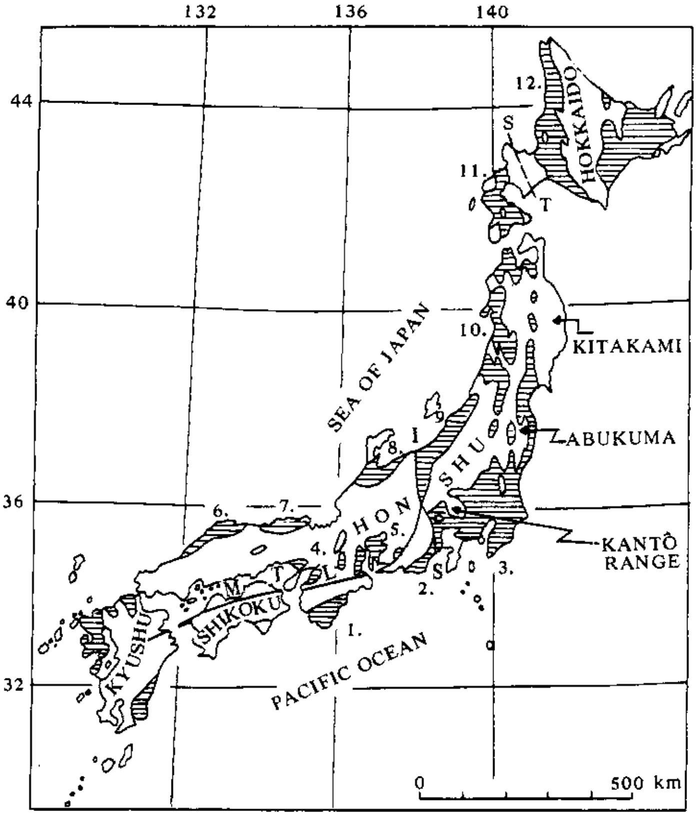

Fig. 5-3. Distribution of Cenozoic formations in Japan, with divisions of Neogene provinces (Ikebe and Chiji, 1969). For I-S, S-T, MTL and numbers, see the text.

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5.2. Comparison with Neogene tectonic movements

The late Cenozoic orogeny in the Japanese Islands was summarized by Matsuda *et al.*(1967), together with tectonic maps since the Miocene.

Using these maps and the Quaternary Tectonic Maps, Kaizuka and Murata (1969) constructed tectonic maps of Japan during the Neogene (from the beginning of Miocene to the end of Pliocene), and compared the crustal movements during the Neogene with those of the Quaternary. In the following a part of their paper is transcribed with some changes in expression.

5.2.1. Vertical displacement

Fig. 5-4 is a distribution map of vertical displacement since the beginning of the Miocene (Matsuda *et al.*, 1967). The total amount of vertical displacement was assumed to be represented by the present height of the basal unconformity of marine Miocene deposits.

In the Fig. 5-5, the distribution of vertical displacement during the whole Quaternary is reproduced from the Quaternary Tectonic Map No. 3.

Fig. 5-6 is a newly obtained map derived from Figs. 5-4 and 5-5. This shows the vertical displacement during the Neogene. The procedure for making this isopleth map was as follows: Figs. 5-4 and 5-5 were overlapped, and differences of the two isopleths were measured at each intersecting point, then isopleths were drawn. Thus Fig. 5-6 is only a rough approximation for the vertical displacement during the Neogene.

Through comparson between Figs. 5-5 and 5-6, the followings are indicated: (1) During about 25 million years of the Neogene, uplift of Southwest Japan was very small, especially in the Inner Zone, while during about 2 million years of the Quaternary, uplift of the same region was much greater and more rapid than in the Neogene. (2) During the Neogene, Northeast Japan subsided as a whole, especially in the following regions: Japan Sea coast of Northeast Honshu, Southern Fossa Magna, in the central part of which Mt. Fuji is situated today, and both sides of the Hidaka Range in central Hokkaido. On the contrary, during the Quaternary, Northeast Japan was uplifted extensively except in the Kanto, Niigata, and Ishikari areas. (3) Thus, the remarkable contrast in vertical displacement between Northeast Japan and Southwest Japan during the Neogene disappeared mostly in the Quaternary period.

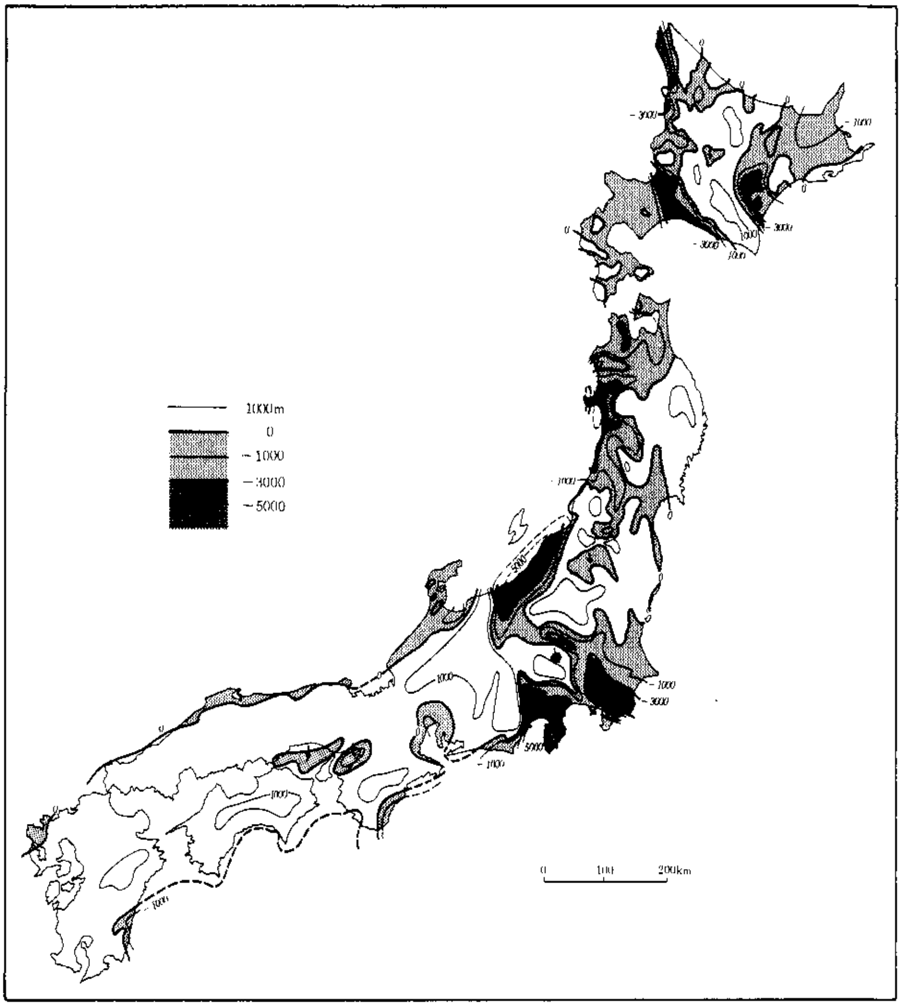

Fig. 5-4. Vertical displacement since the Miocene (Matsuda, Nakamura and Sugimura, 1967).

The origin of these major characteristics in the late Cenozoic orogeny of Japan must be explained in the future.

5.2.2. Folding or deformation of strata

Fig. 5-7 shows the distribution of a degree of deformation since the Miocene according to Matsuda *et al.*(1967). The degree of deformation was calculated from geological sections of Neogene rocks, and it was defined as $\Sigma\Delta H/L$, where $\Sigma\Delta H$ is the sum of the vertical component of folded Neogene strata and the throw of faulting, and L the length of the geological section.

In order to compare with Fig. 5-7, Fig. 5-8 showing the degree of deformation during the Quaternary was constructed from the data of Quaternary foldings (Appendix 4). The degree of deformation in the whole Quaternary is calculated by the following equation:

$$\Sigma\Delta H/L \text{ (during the Quaternary)} = R \times 2 \text{ million},$$

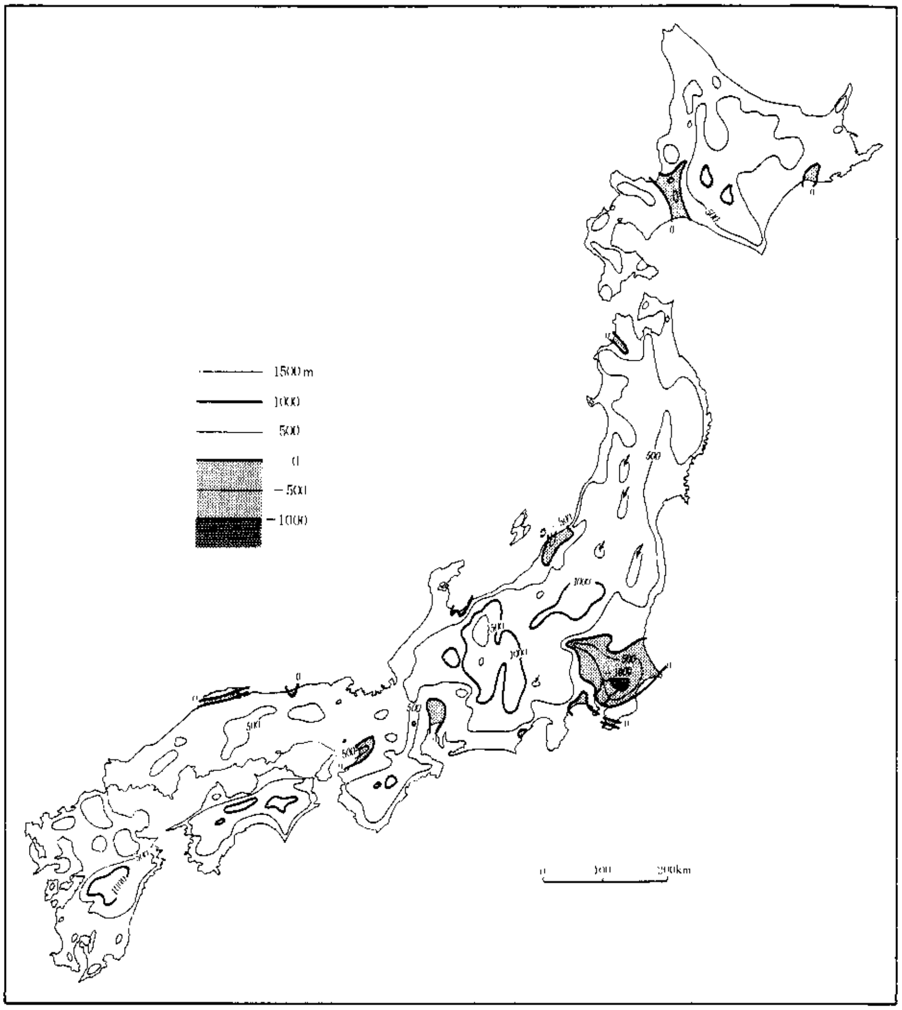

Fig. 5-5. Vertical displacement during the Quaternary (Research Group for Quaternary Tectonic Map, 1969).

where R is the rate of deformation or the velocity gradient presented in Appendix 4. This equation is based on an assumption that the rate of the degree in Fig. 5-7 is essentially the same as that of the rate of Quaternary folding presented in Fig. 5-10.

As shown in Fig. 5-8, the degree of deformation is greatest along the Japan Sea coast of Northeast Japan, in the "Uetsu Folded Zone". On the other hand, in Fig. 5-7 three deformed zones are recognized outside the Uetsu Folded Zone and the Southern Fossa Magna. The three zones are Ishikari (central Hoddaido), Japan Sea coast of Southwest Honshu, and Pacific coastal zone of Southwest Japan, where almost no folded Quaternary strata or geomorphic surfaces have been discovered as yet. Therefore, as mentioned by Otuka (1939), deformational process of these zones had mostly been completed before the Quaternary.

From Figs. 5-7 and 5-8, the map in Fig. 5-9 showing the degree of deformation during the

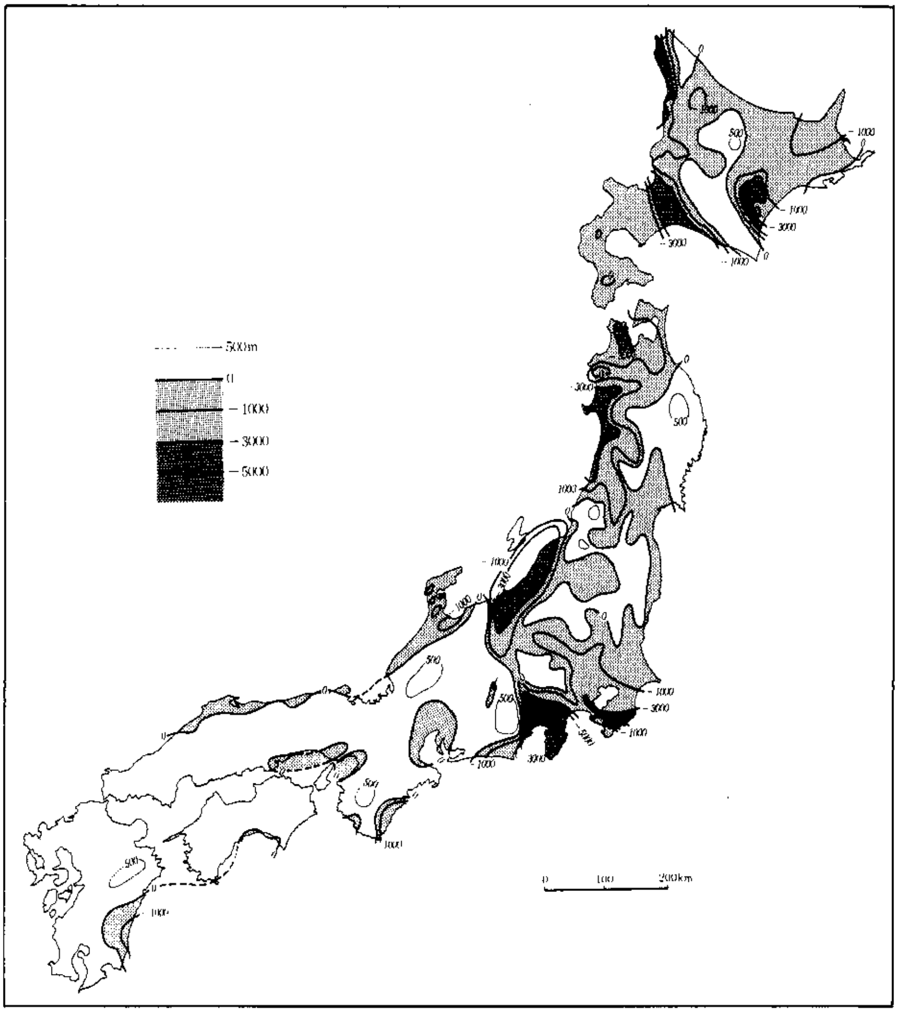

Fig. 5-6. Vertical displacement during the Neogene.

Neogene is obtained. Because only a small amount of data was taken from the same localities in Figs. 5-7 and 5-8, the calculated values of Fig. 5-9 are taken mostly from values of the nearest localities in both figures. Therefore, this map indicates only a rough sketch of the Neogene deformation.

In Fig. 5-9, a peculiarity is noted in the Uetsu Folded Zone, especially on its western side, where minus values predominate. This means that the deformation since the Miocene is less than that during the Quaternary. This discrepancy may have occurred because of the following reason: To calculate the degree of deformation in the Quaternary, $R \times 2$ million was used, based on the assumption that the rate of deformation was uniform throughout the whole Quaternary. This assumption is probably not correct in the region concerned, and it seems probable that the deformation began after the beginning of Quaternary (2 million years ago), or that the rate of deformation was accelerated at the end of Quaternary.

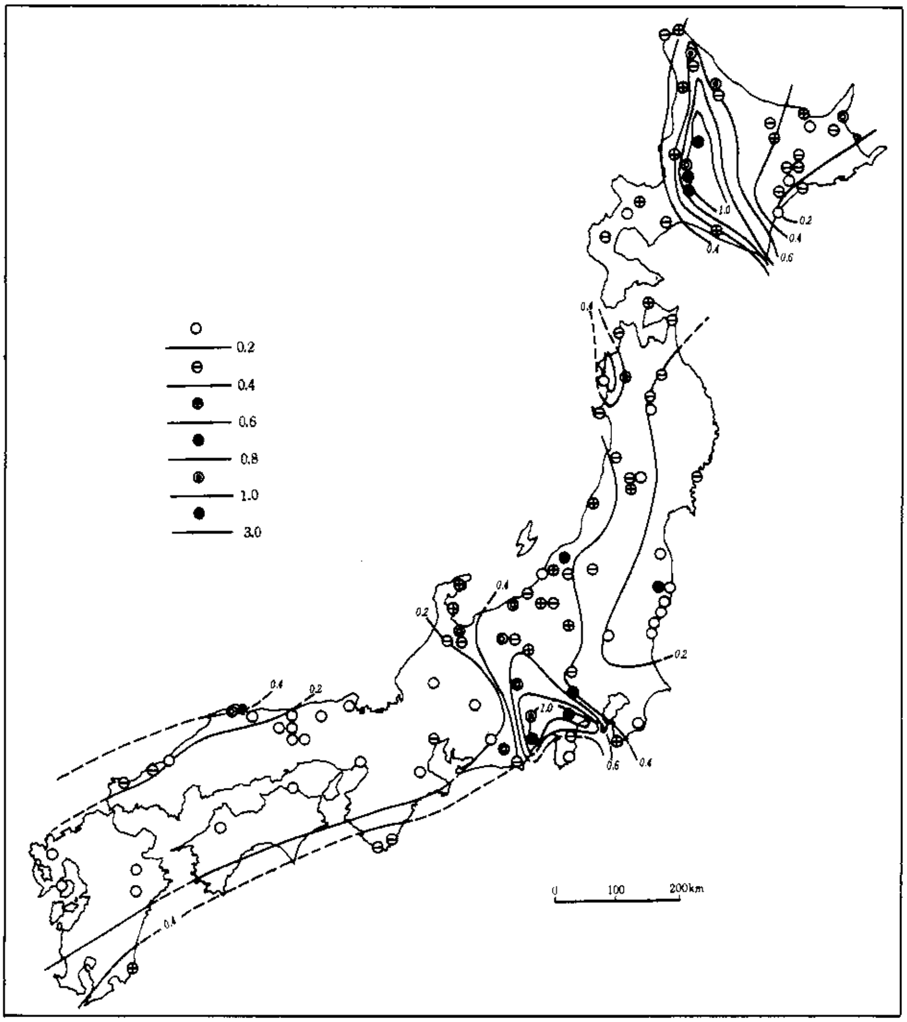

Fig. 5-7. Degree of deformation since the Miocene (Matsuda, Nakamura, and Sugimura, 1967).

5.2.3. Relief

Fig. 5-10 shows the present general relief of the Japanese Islands. This is a simplified map from the Gipfelflur of Japan (Quaternary Tectonic Map, No. 6). Based on this map and Fig. 5-5, Fig. 5-11 is newly obtained, which presents the relief of Japan at the end of Tertiary. The procedure for making this map is the same as in the case of Fig. 5-6. It is a matter of course that Quaternary volcanoes make no mountain in Fig. 5-11. Generally, the relief at the end of Tertiary is about half or even a quarter of the present relief. Low relief topography of the Japanese Islands at the end of Tertiary has been considered so far from evidences that there are the so-called "peneplain remants" of the late Tertiary in many regions and that facies of Pliocene strata indicate low relief environments.

5.2.4. Conclusional remarks

Looking over the maps presented above, it is noted that the character of Quaternary crustal

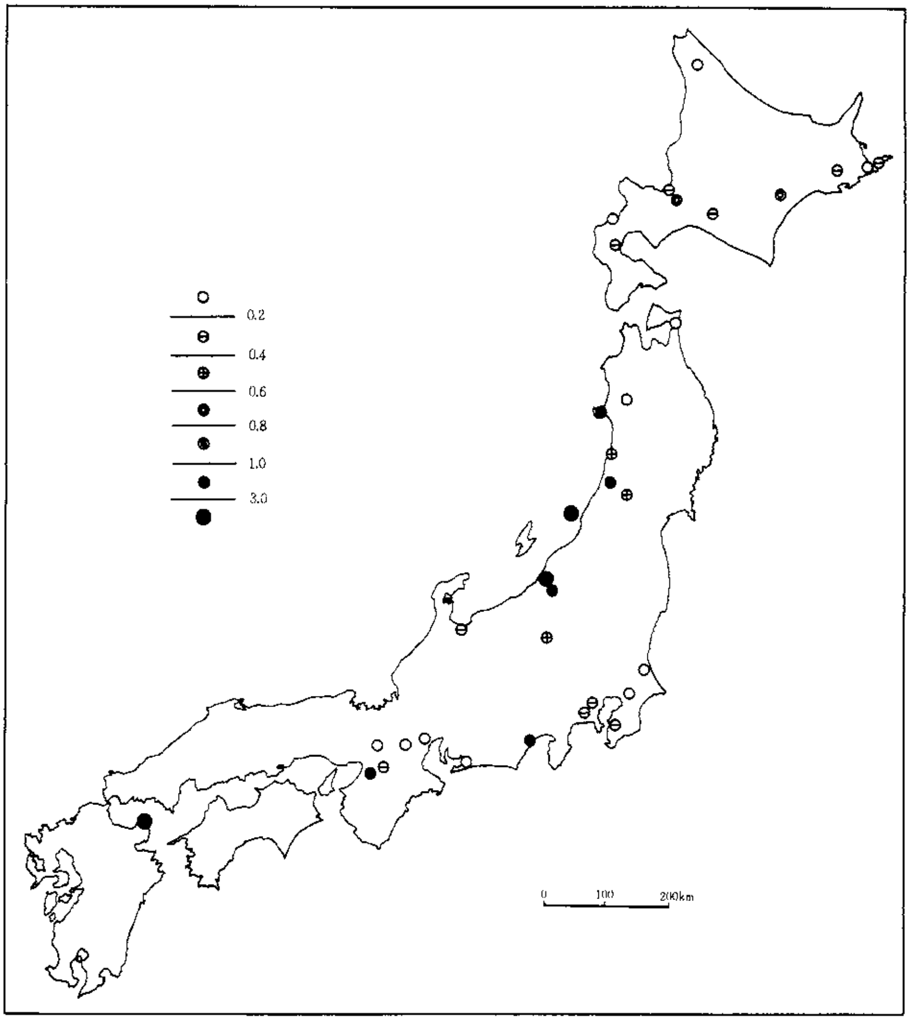

Fig. 5-8. Degree of folding during the Quaternary.

movements in Japan are much different from those of the Neogene. In Northeast Japan, subsidence which predominated during the Neogene, was replaced by uplifting in the Quaternary, accompanied by strong deformation of Neogene and Quaternary strata. In Southwest Japan, no remarkable vertical movements and foldings appeared during the Neogene, except for foldings of coastal belts of the Japan Sea and the Pacific. But the Quaternary vertical movements were not so different from those of Northeast Japan.

In other words, during the Neogene, the difference was very great between Northeast and Southwest Japan in the character of curstal movement. During the Quaternary, however, the difference was small, and nearly the same relief making movements took place in the entire Japanese Islands.

5.2.5. References

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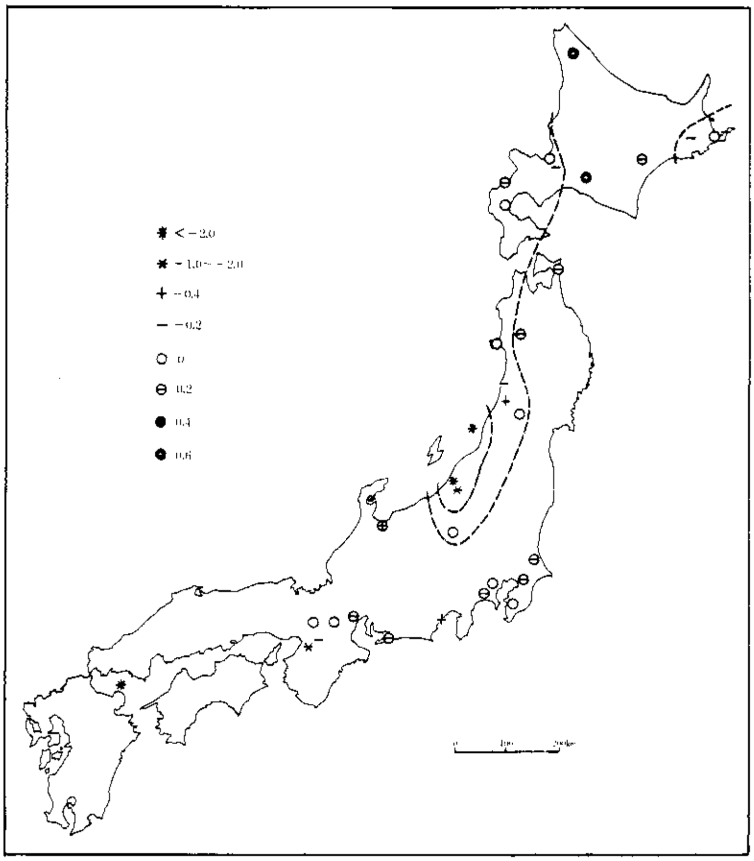

Fig. 5-9. Degree of deformation during the Neogene.

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5.3. Comparison with present seismic energy distribution

5.3.1. Introduction

Recent studies have revealed that in Japanese Island Arc there occurs frequently the crustal movement accompanied by great earthquakes of the present age in almost the same manner as the crustal movement in Quaternary, and that in many cases quantitatively also the latter is nearly equal to the integrated sum of the former (for example, Yoshikawa *et al.*, 1964). This indicates that a fairly large part of the crustal deformations in Quaternary may have been caused by the crustal movement

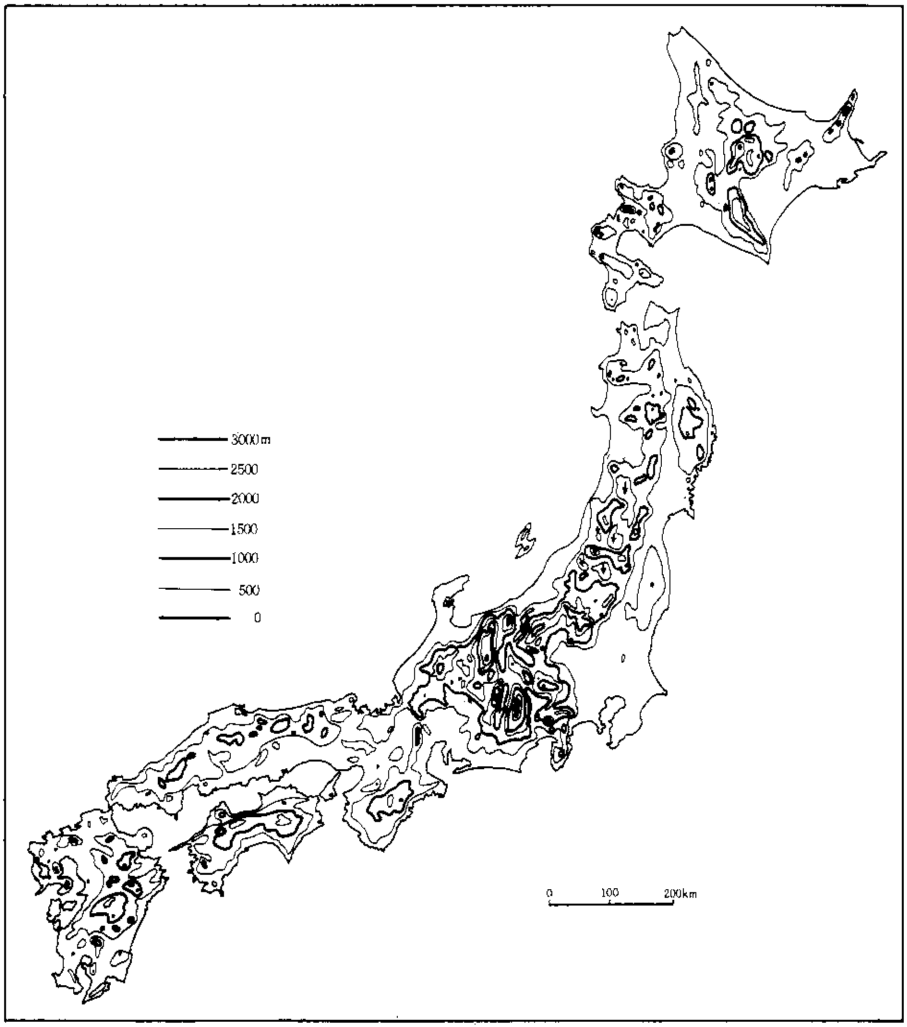

Fig. 5-10. Relief at the present.

accompanied with great earthquakes. Therefore, in order to know the mutual relations of these circumstances, study has been made on the status of the release of seismic energy in Japanese Island Arc in the historic age.

5.3.2. Method

As the scientific observation of earthquake has its history less than 100 years, the study on the seismic activity throughout the historic period is compelled to rely on ancient manuscripts. Fortunately, a Japanese year-book "Rika Nempyo" (Chronological Tables of Natural Sciences) contains tables by which we can know the epicenters and scales of principal earthquakes that had caused greater damage in the historic period, and according to this year-book the released energy of such earthquakes was calculated.

On the "Chronological Table of Greater Earthquakes in Japan and its Adjacent Regions" of the 1970 edition of the above year-book, there are described 519 earthquakes during the 1369 years from

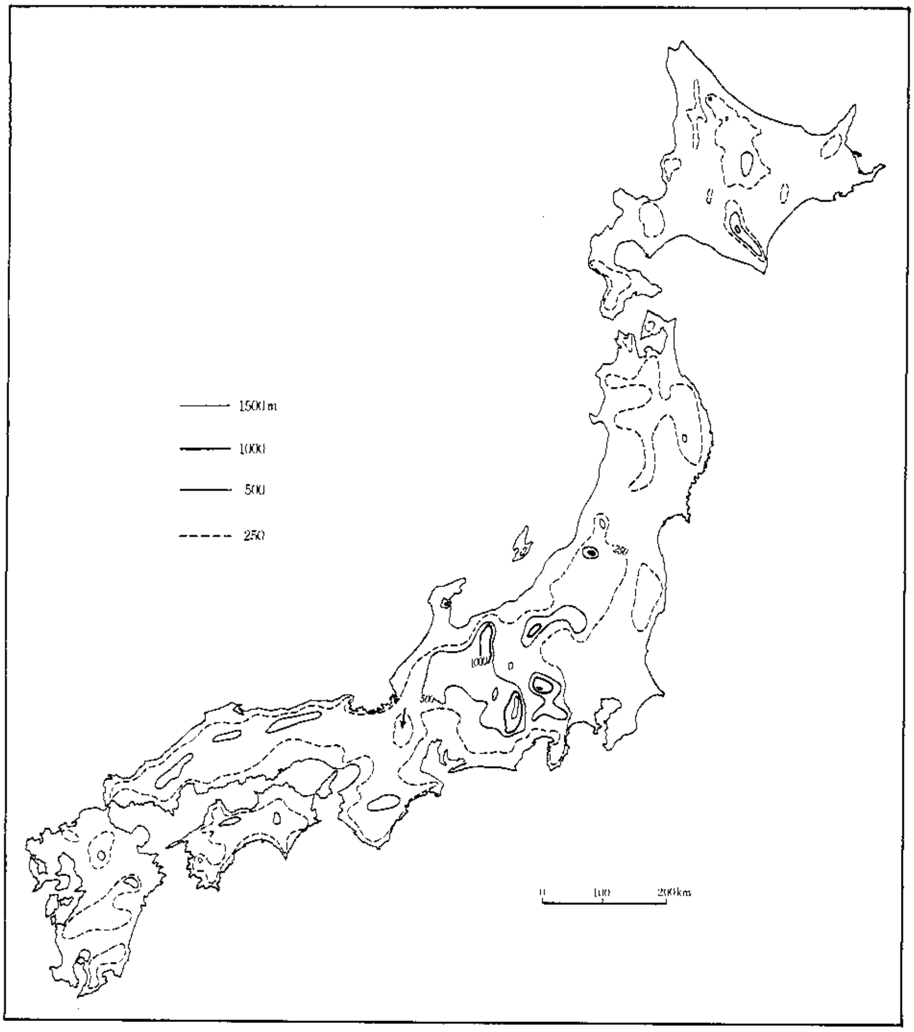

Fig. 5-11. Relief at the end of the Tertiary.

99 to 1968 A. D. Out of the 519 earthquakes, 167 are either earthquakes of unknown magnitude or earthquakes in regions of Korea, Formosa and Okinawa. Besides, it is considered that a large number of earthquakes of which the magnitudes are less than ca. 6 were omitted in the description of the Table. Therefore, excepting 35 eartuquakes with their magnitudes less than 5.9 and the above-mentioned 167, the released energy was calculated by the following equation:

$$\log E = 1.5\,M + 11.8,$$

where E is released energy, and M the magnitude.

As these earthquakes occurred on land and in sea areas within 250 km from the coast, the area of epicentral distribution is divided into meshes of each 0.5° in latitude and longitude (767 meshes), and the sum of released energy is calculated for each of the meshes. The distribution and the frequency of the sums are shown in Fig. 5-12 and Table 5-1.

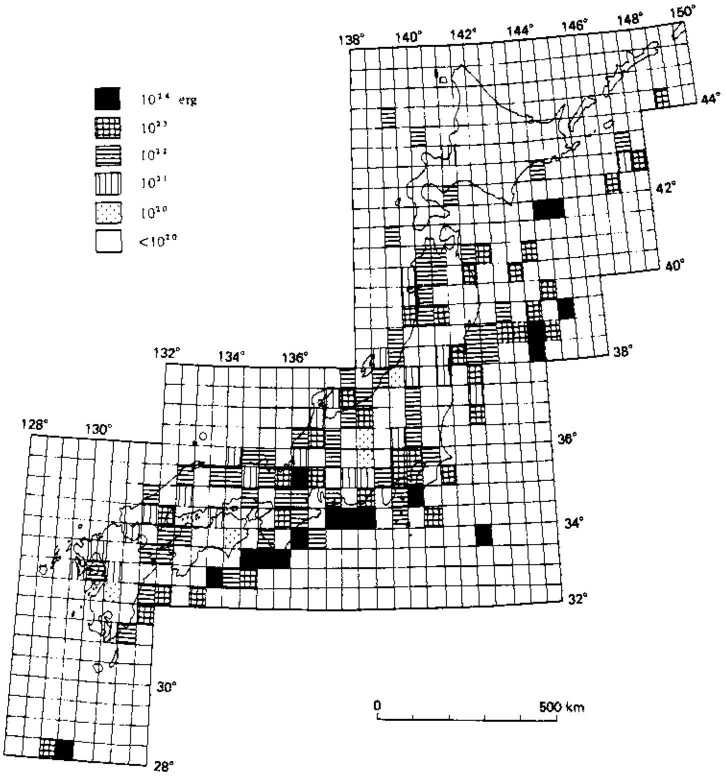

Fig. 5-12. Distribution of released energy by earthquakes in the historic period (0.5° meshes).

Table 5-1 Distribution of frequencies of magnitudes of released energy in the historic period (from Fig. 5-12).

Order of	10^{25} ergs	None of mesh
	10^{24} ergs	17 meshes
	10^{23} ergs	34 meshes
	10^{22} ergs	58 meshes
	10^{21} ergs	24* meshes
	10^{20} ergs and less	634 meshes

* As the earthquakes of $M \geq 6$ were adopted, the number is small. But if those of the order of $M = 5$ are also adopted, the number is larger.

According to Fig. 5-12, the maximum is 5.9×10^{24} ergs in the neighborhood of Shionomisaki, and otherwise, sums of more than 5×10^{24} ergs are found in the offings of Sanriku, Omaezaki and Shirahama (Kii), and places of the order of 10^{24} ergs are distributed continuously in the coastal areas on the Pacific Ocean side. The value of 5×10^{24} ergs corresponds to an earthquake of the magnitude of about 8.75, and it is noteworthy that the utmost maximum of released energy even in the period of a thousand and several hundreds years is of such a value. On the coast of the Japan Sea, the damage is not less than on the Pacific Ocean side, but the maximum released energy is 4×10^{23} (near Mt. Hakusan), and it is remarkable that the values are $10^{21} \sim 10^{22}$ ergs at most places. In addition, a conspicuous maximum in the inland regions is $10^{23} \sim 10^{24}$ ergs in the vicinity of Lake Biwa.

Areas of smaller amounts of the released energy are found in the inland part of Hokkaido, in Kitakami Mountains in areas of Yamagata Pref., in Abukima Mountains, in Ibaraki Pref., on the borders of Gunma and Niigata Prefectures, in Kanto Mountains, in the inland parts of Shikoku and Kyushu, etc.

By the way, concerning this distribution map, we must take account of the following facts: (1) that because ancient manuscripts were the source of this map, there was some unfairness such as more detailed description of the neighborhoods of administrative centers; (2) that there are not described such earthquakes as have caused rather light damage in spite of their large scales; and (3) that the assumption of hypocentral positions and scales can be erroneous, etc. In particular, it is considered that Hokkaido cannot be compared in the same rank with other regions becuase of extreme scantiness of the data.

Next, comparison of this energy distribution map with Quaternary Tectonic Map does not clearly reveal any correlation as is mentioned above. The reasons for this may be, other than the said problematic points, additionally shown as follows: (1) The absence of the correlation may have connection with the fact that the length of the historic period is less than 1/1000 of the period of the Quaternary, and this fact seems to be proved by the result of our study that the total sum of released energy even in the area of maximum release is corresponding to that of only one earthquake of the largest scale. (2) Another reason lies on the side of the Quaternary Tectonic Map. Namely, the situations of crustal movement under the sea surface, volcanic products and plain deposits can hardly be grasped, and so the precision of investigation cannot be uniform on such surfaces. Further, as the data for preparation of the maps were obtained by collection of existing research materials, the ununiformity of the precision may have been caused by such circumstances. As for the Quaternary Tectonic Map itself, the maps should be rather regarded as totalized maps which show roughly the properties of certain areas of some extension than used for finding out the correspondence in detail.

Therefore, merely aiming at the districts including land, Fig. 5-12 is redrawn into partial maps with meshes of each 1° (Fig. 5-13), and these are compared for knowing the distribution and amounts of uplifts, subsidences, faults and folds. The quadrangle of each 1° is 110 km long in north-south direction and about 80 – 95 km wide in east-west direction, and the size of this quadrangle seems to be too large for representing the topographic characteristics, but general tendencies on the whole are easier to see by this. Further, by the use of larger meshes, the influences of sea areas, volcanoes, plains, etc. become largely apparent, and properly speaking, such influences ought to be excluded, but as the methods of compensation are not clearly known, so the comparison has been made without any exclusion.

5.3.3. Comparison

On completing such arrangements, we can see, in regard to seismic activity, a belt of $10^{24} \sim 10^{25}$ ergs from the Boso Peninsula to Shikiku Island, and another belt of 10^{23} ergs from Akita Pref. to Tottori Pref. along the Japan Sea coast. Specially noticeable is the existence of the areas of $10^{23} \sim 10^{24}$ ergs in the land regions around Tokyo and from Gifu Perf. to Kyoto, Osaka and Kobe. Besides, meshes of 10^{23} ergs are also seen in the vicinity of Hiroshima. The relation between these and crustal movement is as follows.

First, as for faults and folds, the density of their distribution was taken as indices of crustal movement. The distribution density is indicated by various methods, but the density was represented with the number of lines of fault or fold within a mesh. In the case of fault, a falut line extending to another mesh was also counted as 1. In the case of fold, the number of the set of an anticline and a syncline was counted as 1, but in the case where either of the both was a fraction or missing, then also the number was counted as 1. The number of fault or fold having its extension of more than 50 km was also listed together. In the case of a fault with its extension of 50 km, according to Iida's formula: $M = 3.1 + 0.63 \log L$, the fault corresponds to what was caused by an earthquake of $M = 7.3$ approximately. Such faults were particularly counted, because they were considered to give some criteria, if they were to be activated on the occasions of great earthquakes in the past.

Comparison of the map of fault distribution density (Fig. 5-14) with Fig. 5-13 (in this comparison there are excluded the meshes for Hokkaido and islands only, and the same in the following) reveals that the areas, where there are many faults and the energy released by earthquakes is of the order of 10^{24} ergs are the southern part of Akita Pref., zones of Kanazawa – Lake Biwa – Osaka and Kobe, Boso Peninsula – Tokyo and Shonan, and the northern part of Nagano Prefecture. On the other hand, the area with a large quantity of released energy and with smaller densities of faults is Ibaraki Prefecture. Localities having lower seismic energy and smaller fault density are the Shimokita Peninsula and the central part of Shikoku. Furthermore, the comparatively high fault density in Kitakami Mountains and Abukuma Mountains are owing to the fact that the meshes include even the areas adjacent to the western part of the mountains. On the whole, most of the areas other than the above-mentioned also indicate a comparatively positive correspondence between seismic energy and fault density. A statistical review of the relation between the quantity of released energy and the fault density (Table 5-2, the meshes for Hokkaido or islands only being excluded, the same in the following) indicates that the meshes of more than 10^{22} ergs contain more numbers of fault, and especially such a mesh as contains two or three lines of faults of more than 50 km is not observed in areas of low energy. However, this feature is not very often seen in the areas of $10^{24}\sim10^{25}$ ergs, and this fact is considered to be largely effected by the situation that the areas where such meshes are distributed are mainly located on the coast of the Pacific Ocean and include pretty many sea areas.

As for folds (Fig. 5-15), areas with high distribution density of folds and with meshes of released energy of the order of 10^{24} ergs are region of Tokyo – Shonan, the southern part of Akita Pref., the neighborhood of Osaka and Kobe, and the northern part of Nagano Pref.: in the high energy zones on the coast of the Pacific Ocean the density of folds is small as well as that of fault. Low energy areas are the Shimokita Peninsula, Kitakami Mountains, Abukuma Mountains – Ibaraki Pref., and the central part of Shikoku; in these areas there are good agreements. Though the area of Lake Biwa is a high energy area, there is shown reversed correspondence. Due to the small number of lines of folds, the correspondence to the released energy in the fold is not so good as in the fault. In regard to the frequency distribution of energy quantity and the number of lines also, similar tendencies are seen in faults and folds (Table 5-2). Regarding both of fault and fold, the detection is difficult in places other than where there are distibuted the formations younger than Pliocene, and this difficulty also makes worse the correspondence to the energy released by earthquakes.

For the amounts of uplifted and subsidence, vertical displacements compiled from the Maps Nos. 1 and 2 (and the Quaternary Tectonic Map No. 3) were used, and the amounts of from the subsidences larger than 1000 m to the uplifts larger than 1500 m were divided into 10 ranks, respectively numbered with figures of 1 to 10, as indices. Namely, the largest quantity of uplift in a mesh was taken as uplift amount in the mesh, the maximum subsidence similarly as subsidence amount of the mesh, and the difference between the both amounts as index number of gradient. Thus, similarly to the case of faults, a map of vertical displacement distribution (Figs. 5-16, 5-17 and 5-18) and a table of correlation with energy (Table 5-3) are obtained.

Apparently, the above-mentioned maps may give an impression different from that of usual distirubtion maps of fualts and folds. First, as to the uplift amounts, Fig. 5-16 shows that the areas, where the ranks over 9, namely the uplift amounts over 1000 m, are seen and there is observed the agreement with the order of 10^{24} ergs of released energy, are the reas near Lake Biwa and near Muroto. Agreement with the order of 10^{23} ergs of energy is also found in the northern part of Nagano Pref., near Kanazawa, near Osaka and Kobe. On the other hand, the very opposite tendency is seen on the Pacific coast, near Tokyo and near Hiroshima. The correspondence of low energy area with low-rank locality is very good in the Shimokita Peninsula, Kitakami Mountains, and Ibaraki Prefecture, but in the central part of Shikoku, etc., there is observed the perfectly opposite

Table 5-2. Relation between frequencies of the densities of faults and folds and the magnitude of released energy by earthquakes

Energy	Fault					Fold				
Erg / Frequency	10^{20}	10^{21}	10^{22}	10^{23}	10^{24}	10^{20}	10^{21}	10^{22}	10^{23}	10^{24}
0	3	1	3		1	5	7	10	7	3*
1	1	1	1	3	3*	1			1	2
2			2	2		2		1	1	2
3	$1_{(1)}$	$2_{(1)}$		2	1			1	1	
4			$3_{(1)}$		1		1		1	
5			1	$2_{(1)}$				2	2	
6	1							1	2	
7	$2_{(2)}$	2	$2_{(2)}$	1						
8		$1_{(1)}$								
9			$1_{(1)}$		$2_{(2\text{-}1)}$					
10										1
11				1						
12			$1_{(1)}$	1						
13				$1_{(1)}$				1		
16			1							
17			$1_{(2\text{-}1)}$							
25		1								
27				$1_{(3\text{-}1)}$						
many				1						
Total	$8_{(3)}$	$8_{(2)}$	$16_{\binom{5}{2\text{-}1}}$	$15_{\binom{2}{3\text{-}1}}$	8*	8	8	16	15	8*
Mean	3.0	6.8	5.6	6.6	3.5	0.6	0.5	2.4	2.1	2.0

Remarks:		
	*	including a case of 10^{25} ergs;
	( )	number of meshes including 1 line with an extension over 50 km;
	(2-) :	number of meshes including 2 of such lines;
	(3-) :	number of meshes including 3 of such lines.

Table 5-3. Relation between frequencies of maximum uplift amounts, maximum subsidence amounts and gradients and the magnitude of released energy by earthquakes.

(*including a case of 10^{25} ergs)

Uplift and Subsidence Amounts	Energy / Erg / Rank	(1) Maximum Uplift Amounts					(2) Maximum Subsidence Amounts					(3) Gradients (1) – (2)					(4) Corrected Maximum Subsidence Amounts					(5) Corrected Gradients (1) – (4)				
		$\leq 10^{20}$	10^{21}	10^{22}	10^{23}	10^{24}	$\leq 10^{20}$	10^{21}	10^{22}	10^{23}	10^{24}	$\leq 10^{20}$	10^{21}	10^{22}	10^{23}	10^{24}	$\leq 10^{20}$	10^{21}	10^{22}	10^{23}	10^{24}	$\leq 10^{20}$	10^{21}	10^{22}	10^{23}	10^{24}
> 1500 m	10			2																						
1500~> 1000 m	9	1		7	3	2																				2*
1000~> 750	8		4	2	3	2*								1									1	4		2
750~> 500	7	4	3	4	7	3								2	1	1						1	1	2	1	1
500~> 250	6	3	1	1	2	1				2	1			1	1	1				1		2		1	6	3
250~> 0	5						7	8	5	8	3			3	1				1					4	2	
0~> -250	4								6	1	1	2		4	2		4	5	5	4		1	4	1	2	
-250 ~> -500	3						1		2	1	2*		4	3	4	4*	1		2	2	1	2	2	4	4	
-500~> -1000	2								3	2	1	3	3	2	5	2	1	1	4	4		2				
-1000~> -2000	1									1		3	1				1	1	4	3	3					
-2000~> -3000	0														1		1			1	1					
-3000~> -4000	-1																	1			2*					
$\leq$ -4000	-2																				1					
	Total	8	8	16	15	8*	8	8	16	15	8*	8	8	16	15	8*	8	8	16	15	8*	8	8	16	15	8*
	Mean	6.9	7.4	8.3	7.5	7.5	4.8	5.0	3.8	4.3	4.0	2.1	2.4	4.0	3.2	3.6	2.8	2.8	2.7	2.7	0.3	4.1	4.6	5.5	4.5	6.9

correspondence. Considering the releation of the ranking numbers to the amounts of released energy (Table 5-3), the uplifts of ranks ≧ 9, namely more than 1000 m occur beginning with the order of 10^{22} ergs, but without any appearance of conspicuous features. In consideration of the relation with the amounts of subsidence (Fig. 5-17), areas where the values of $10^{23} \sim 10^{24}$ ergs of released energy correspond to rank 2 or 1 of subsidence amount are the Boso Peninsula – Tokyo – Shonan, and area on the north of Tokyo, and Osaka and Kobe; the correspondence to low energy areas is found in the Shimokita Peninsula, Kitakami Mountains, and the central part of Shikoku; and in the areas of 10^{21} ergs also there is seen good correspondence on the whole. On investigating the relatiionof theranking numbers of vertical displacement to the released energy amount (Table 5-3), the areas of subsidence (less than 0 m) are all areas of released energy larger than 10^{22} ergs, excluding only one example, and there is observed the correlation larger than in the case of uplift amount. As for the gradient, the areas of high energy and large gradient (ranks ≧ 7) are the district of Tokyo and Shonan and that of Osaka and Kobe, but low energy areas have low gradients. The relation between the gradient frequency and the released energy amount (Table 5-3) has a tendency that the rank is high in meshes of released energy larger than 10^{22} ergs. As is mentioned in the above discussion, the correlation between the amount of vertical displacement in the crust and the amount of energy released by seismic activity is considered to be not so clear as was expected. Various reasons may be considered for this, but the regions including sea areas are called into question. Around the Japanese Island Arcs there are developed such submarine topographies of large depth or gradient as cannot be explained without assuming them to be originated by the crustal movement. At such localities there have frequently occurred great earthquakes also.

The amount of subsidene as well as the water depth shows comparatively good correlation with the released energy from the ground surface on the Pacific coast west of the Boso Peninsula (Fig. 5-19). It goes well for the gradient of subsidence, too (Fig. 5-20). However, the correspondence to the localities of high energy in other coastal areas is not satisfactory.

5.3.4. Conclusion

As is shown above, the correlation of the elements of the crustal movement with the amount of released energy by earthquakes in the historic period is not so large. Namely, comparatively good agreements are observed in areas of Tokyo – Shonan and Osaka – Kobe (in regard to faults, folds, amount of maximum uplift, amount of maximum subsidence, and gradient), in Kanazawa district and the vicinity of Lake Biwa (for faults and quantity of maximum uplift), and in the Boso Peninsula (for faults, amount of maximum upheaval, and corrected gradient). Excepting these and other several examples, at many of the high-energy localities the agreement is not so good. Out of such areas, the Pacific coast west of the Boso Peninsula will become to have good agreement, if the depth of the trench be regarded as crustal subsidence, but in other areas it is not so.

There are areas where the crustal movement is comparatively large, but the energy released by earthquakes rather low, for example the Hida district. This seems to suggest that in the Hida district the active periods of Atotsugawa fault and Atera fault were longer than the historic time. Besides, concerning low energy areas also there are cases of agreement and disagreement. For the purpose of earthquake prediction, studies in these respects should be more and more promoted.

5.3.5. References

Yoshikawa *et al.* (1964): Crustal movement in the Quaternary revealed by coastal terraces on the southeast coast of Shikoku, Southwestern Japan. *J. Geodet. Soc. Japan, Vol. 10, pp. 116-122.*

5.4. Quaternary tectonic divisions of Japan

5.4.1. Method

Quaternary tectonic movement in Japan is regionally characteristic as shown in the maps of vertical displacement and the distribution of Quaternary faults and folds. Vertical displacement during the whole period of Quaternary attains to more than 1,500 meters in Central Japan and the Kanto Plain, but it is less than 750 meters in other extensive areas of the country. In Southwest Japan, it is

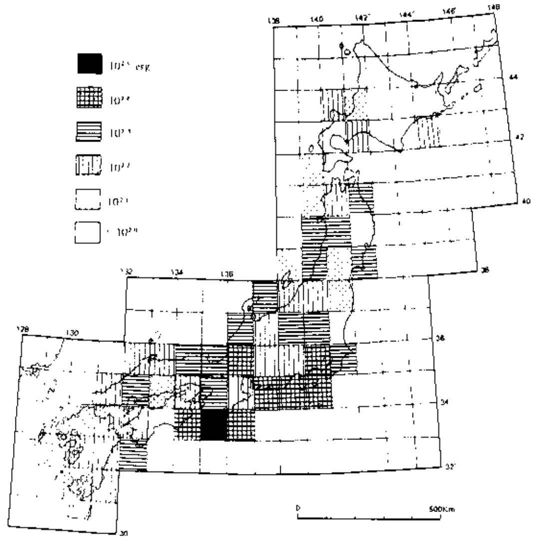

Fig. 5-13. Distribution of released energy by earthquakes in historic period (1° meshes).

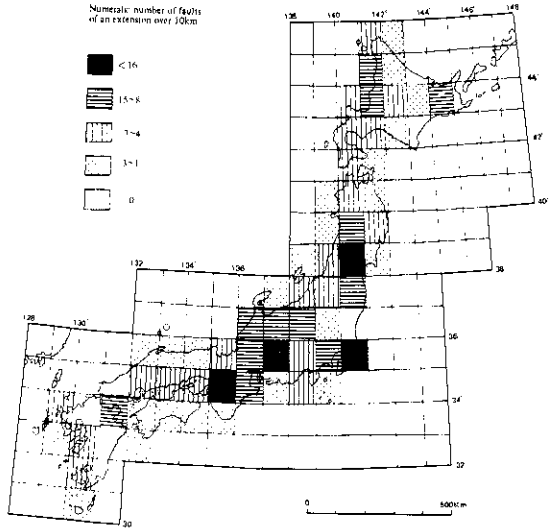

Fig. 5-14. Distribution of densities of faults (1° meshes).

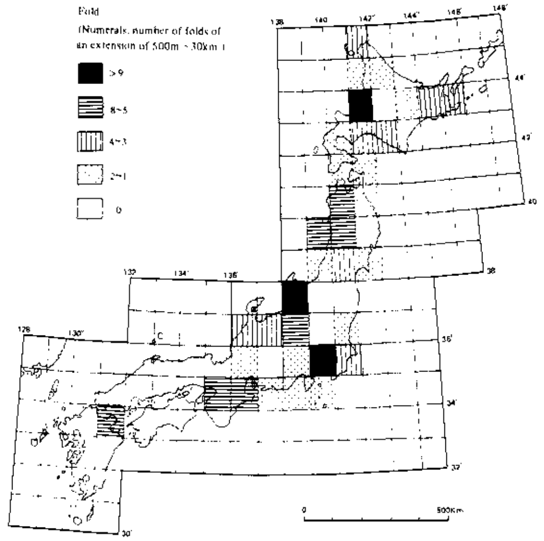

Fig. 5-15. Distribution of densities of folds (1° meshes).

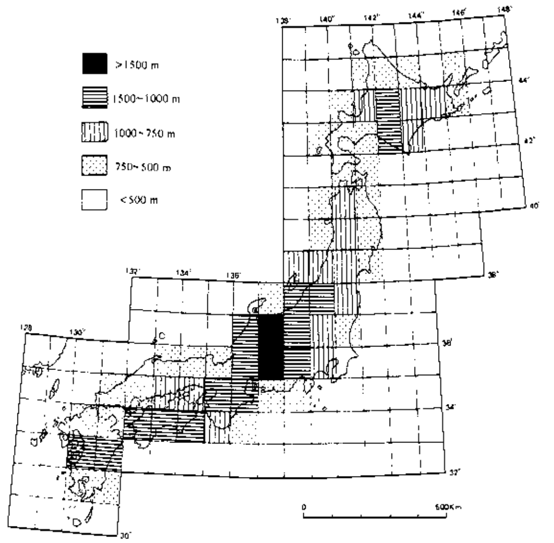

Fig. 5-16. Distribution of maximum uplift amounts (1° meshes).

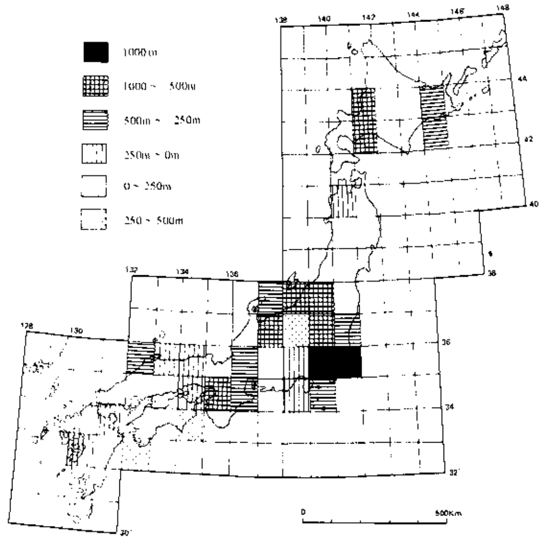

Fig. 5-17. Distribution of maximum subsidence amounts (1° meshes).

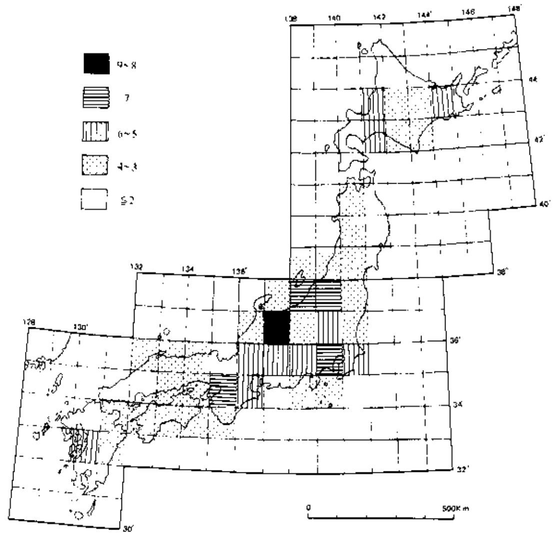

Fig. 5-18. Distribution of gradients (1° meshes).

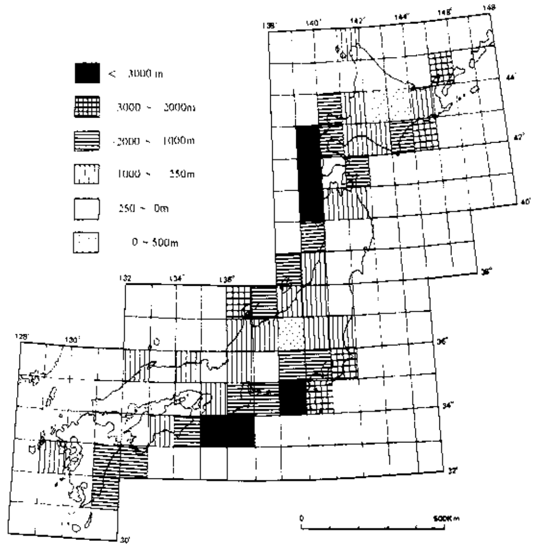

Fig. 5-19. Distribution of corrected maximum subsidence amounts (1° meshes).

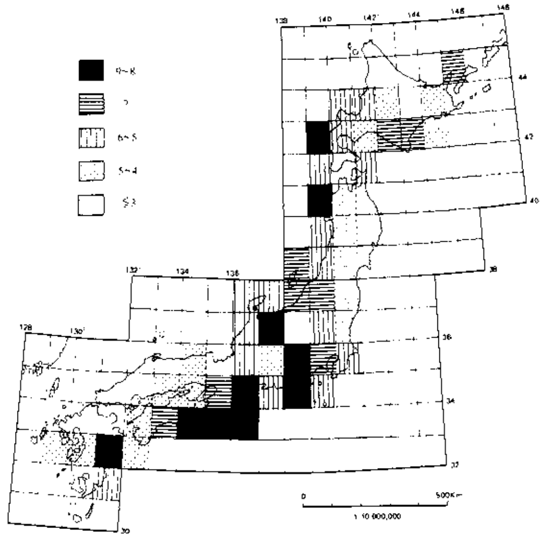

Fig. 5-20. Distribution of corrected gradients (1° meshes).

contrastively much less in the Inner Zone than in the Outer Zone. The inner side of Northeast Japan is characterized by the dense distribution of Quaternary folds, but the Kinki District by Quaternary faulting. The Japanese Islands, therefore, can be classified into several Quaternary tectonic divisions, according to the characteristics and intensities of Quaternary tectonic movement.

On the other hand, some interesting relationships have been found between the late Quaternary tectonic movement and the recent crustal deformation, especially seismic ones. In various regions of Japan, it was inferred that the late Quaternary tectonic movement had occured in the modes and areal dimensions similar to recent crustal deformation (Yoshikawa, 1970), and that the rates of tectonic movement had been uniform since the beginning of the Quaternary (Sugimura, 1967). Tectonic movement, however, has not always uniformly proceeded throughout the Quaternary period in every region of Japan. For example, in the inner side of Northeast Japan the mode of tectonic movement is considered to have been uniform since the beginning of the Quaternary, but it changed during the Pleistocene on the Pacific coast of Southwest Japan (Ota, 1968). Such a difference of the sequence of Quaternary tectonic movement may be ascribed to that of tectonic history between the above two regions. The historical development of tectonic movement and its regional characteristics during the Quaternary period should be further elucidated in every region of Japan in future. For this purpose, it is necessary to prepare also the late Quaternary tectonic maps for the period of the order of 10^4 to 10^5 years, together with the already published maps for the whole period of Quaternary. The Research Group for Quaternary Tectonic Map is now collecting data on late Quaternary tectonic movement to compile such maps, but it is a rahter laborious work to complete them.

From the above-mentioned it is considered that studies on Quaternary tectonic movement may be useful for investigating the historical backgrounds of recent seismic acitvities. Accordingly, the classification of Quaternary tectonic divisions will contribute to the arrangement of seismological observatories over the whole country for predicting the occurrence of future earthquakes, because it will indicate summary regional characteristics of tectonic movement in the recent geologic time.

From this point of view, the Research Group attempted to divide the Japanese Islands into Quaternary tectonic divisions and classify them as a conclusion of this report. This division and classification was made only according to characteristics and intensities of Quaternary tectonic movement, and character of seismic activities in recent and historic period in each division will be mentioned later in the regional description of Quaternary tectonic divisions.

In the classification of Quaternary tectonic divisions, it is important to give due consideration also to the regional differences in the gradient and amount of vertical displacement and in the mode of tectonic movement, because zones of high gradients of vertical displacement are usually accompanied with faulting which is considered to have close relation with seismic activities. The gradients of vertical displacement are obtained by measuring maximum differences of vertical displacement within squares of 15′ in longitude and 13⅓ in latitude (about 25 x 25 km) in Quaternary Tectonic Map Nos. 1 and 2. They are classified into 8 grades and are shown in a distribution map (Fig. 5-21). Then, the Japanese Islands are tentatively divided into 10 Quaternary tectonic divisions, judging from the regional differences of amounts and gradients of vertical displacement during the whole period of quaternary. Boundaries of the Quaternary tectonic divisions generally correspond to the significant tectonic lines or other discontinuities in geological and geomorphological structure (Fig. 5-22).

Another support for our division may be provided by Table 5-4. The activities of tectonic movement are represented by average absolute amount and gradient of vertical displacement during the whole period of Quaternary in every division. These values could be easily classified into three or four classes as shown in Table 5-4. It is very interesting that frequency distribution of absolute amounts and gradients of vertical displacement in every class or division is characteristic, which may be caused by the characters of Quaternary tectonic movement. This suggests that the above Quaternary tectonic division is proper.

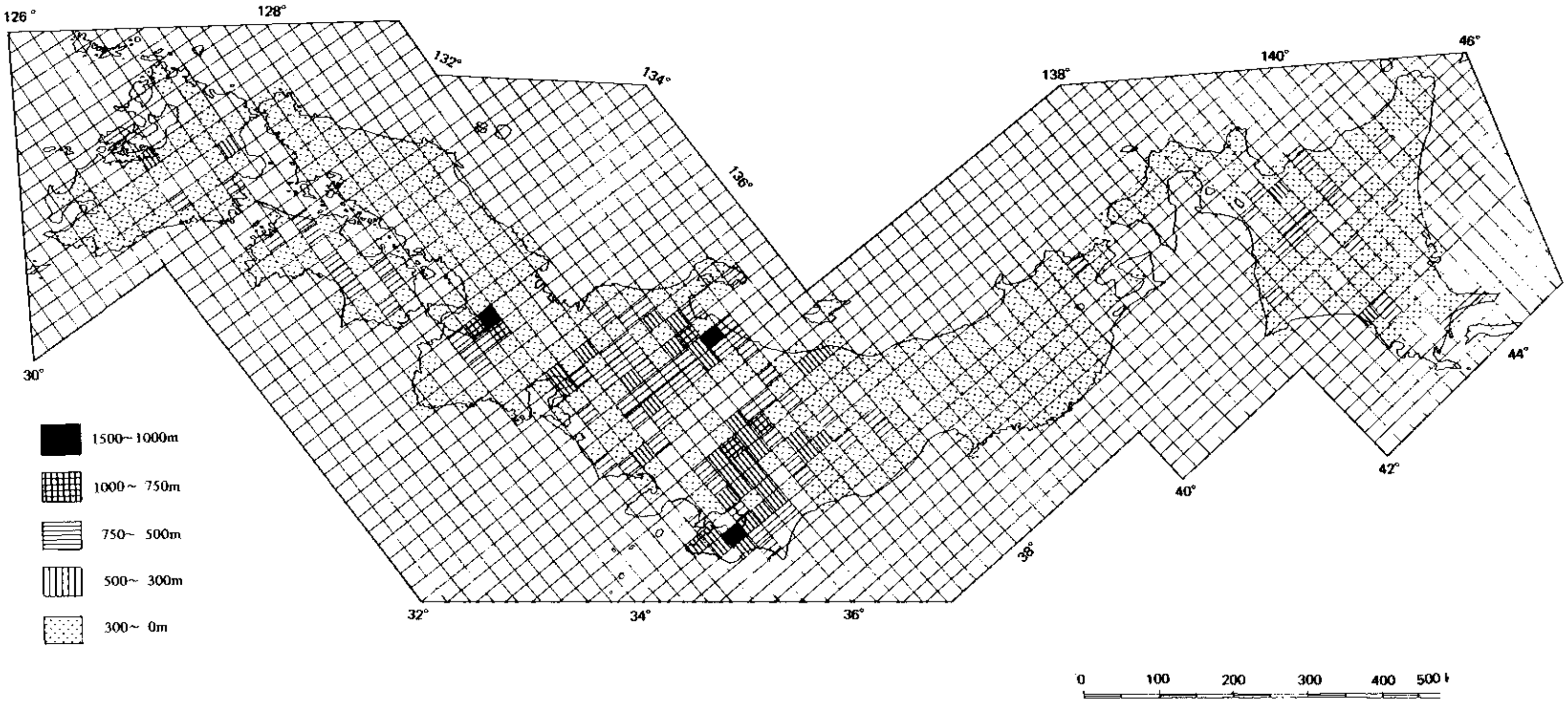

Fig. 5-21. Gradients of Quaternary vertical displacement.

The distribution of Quaternary faults and folds is very important for revealing the modes of Quaternary tectonic movement, and is considered to be closely related to recent seismicity. To represent densities of faults and folds, numbers of them within squares of 15′ in longitude by 13⅓′ in latitude were counted in Quaternary Tectonic Map Nos. 4 and 5, and then the squares where more than five faults or folds are distributed were defined as squares dense with faults or folds and the squares where four or three faults or folds are distributed were defined as fairly dense squares. The distribution of faults or folds in every division was judged from numbers of squares of these two kinds as shown in Table 5-4. In other words, divisions where faults or folds are densely distributed in certain limited areas were judged to be higher in their density than other divisions where they are evenly distibuted, when the total numbers of faults or folds were the same in each division.

The classification of Quaternary tectonic divisions was attempted for the purpose of contributing to the prediction of earthquakes. In classifying the divisions, therefore, particular attention was paid to the density of faults among the above three elements, because it was considered to have colse relation to seismicity. From this point of view, the gradient of veritcal displacement also is a very important element, because not all of Quaternary faults could be picked up in Quaternary Tectonic Map No. 4, and because zones of higher gradients in vertical displacement are usually accompanied with faults. After the above considerations, the Quaternary tectonic divisions of the Japanese Islands were classified into five classes as shown in Table 5-4, and emphatically considering gradients of vertical displacement and denstites of faults, divisions where both the values are higher than in others were expressed with the suffix "+" amoung divisions belonging to the same classes. Activities of Quaternary tectonic movement were more intense in the alphabetical order.

5.4.2. Regional description

The study on Quaternary tectonic movement by the Research Group of Quaternary Tectonic Map has not been extended on submarine bottoms around the Japanese Islands, and therefore, it was impossible to decide ocean-side boundaries of the Ouaternary tectonic divisions according to characters of tectonic movement on ocean bottoms. Seismic energy of recent earthquakes was calculated as shown in Fig. 5-12, but most of recent earthquakes in and around the Japanese Islands originated off the Pacific coast. From this reason, total amounts of energy released by recent earthquakes could not be estimated in individual tectonic divisions. It is, therefore, difficult to discuss on seismic energy of recent earthquakes in each division, and it is very urgent to corfirm the ocean-side, especially Pacific-side boundaries of the Quaternary tectonic divisions, where epicenters of most of recent earthquakes were located. Generally speaking, however, it is very interesting to recognize a tendency that the Kanto and Kinki – Nobi divisions have released more seismic energy, where gradients of vertical displacement are rather high compared with its absolute amounts.

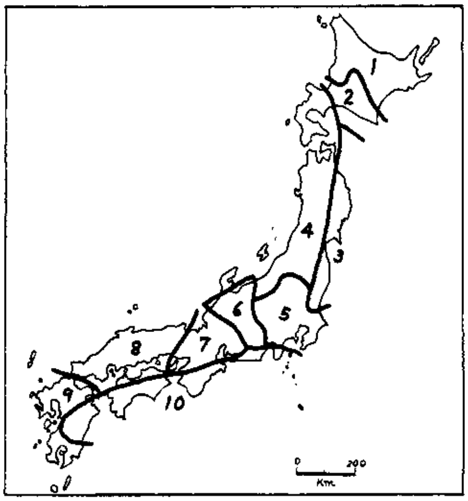

Fig. 5-22 Quaternary tectonic divisions of Japan. 1: Northern and Eastern Hokkaido, 2: Hidaka-Yubari, 3: Kitakami-Abukuma, 4: The Inner Side of Northeast Japan, 5: Kanto, 6: Central Mountains, 7: Kinki-Nobi, 8: Chugoku-Setouchi, 9: Kyushu, 10: The Outer Zone of Southwest Japan.

D: Northern and Eastern Hokkaido. In this division, hills mostly lower than 1,000 m extend and short rows of valcanoes are distributed 'en *echelon*, trending NE and extending east – northeastward to the Kurile Islands. The amounts of vertical displacement are rather small and its gradients are low. Quaternary folds and faults are recognized in the northern- and eastern-most parts of this division. Recent seismic activity is low and no remarkable seismic crustal deformation has been found in recent times.

B: Hidaka – Yubari. This division is composed of two NNW-trending mountain ranges and a depression which separates Hokkaido into the main and peninsular parts. The maximum amounts of uplift during the Quaternary exceed 1,000 m and those of subsidence exceed 500 m. Quaternary folds are rahter densely distributed, trending N-S in the western part of this division consisting of Tertiary formations. Seismic activity is very high off the south coast of this division, but any remarkable seismic crustal deformation has not been recognized on the land of the division. This division is very similar in such characteristics of seismic crustal deformation to the Kyushu Mountains located in the westernmost part of the Outer Zone of Southwest Japan.

E: Kitakami – Abukuma. This division consists of two isolated mountains, distributed *en echelon* on the Pacific coast. Both of these mountains mainly composed of Paleozoic and Mesozoic rocks and characterized by plateau-like features, because erosion surfaces extensively extend, and they are separated by narrows basins from the mountain ranges in the Inner Side of Northeast Japan. The boundary of these two divisions corresponds to the zone of high gradients in the distribution of Bouguer's anomalies of gravity. The amounts of uplift are mostly less than 500 m and its gradients are low. Recent seismicity is extremely active off the east coast of this division, where the deep Japan Trench extends nearly parallel to the coast, whereas it is very inactive in this division.

C: The Inner Side of Northeast Japan. This division is a Neogene fold zone and is characterized by successive activities of folding in the Quaternary, by which fluvial terrace surfaces and even alluvial plains have been gently deformed. This division, inclusive of the peninsular part of Hokkaido, consists of two parallel mountain ranges, small basins intervening the ranges and the lowlands on the coast of the Japan Sea. Many volcanoes are distributed along these mountain ranges. Vertical displacement is generally not so larger, and it si larger in its southern part. The maximum amounts of uplift is 1,000 m and those of subsidence 500 m in the Niigata Plain. In this division recent seismicity is rather active, and dip-slip faulting as well as active folding has been recognized at times of recent earthquakes.

A: Kanto. This division consists of the Kanto Plain and its surrounding mountains. The Kanto Plain is a tectonic basin having grown since the Miocene, and its central part has subsided by over 1,500 m since the beginning of the Quaternary. Upland surfaces extending in the plain have been gently undulatingly deformed since the late Quaternary. The frequency distribuiton of gradients of vertical displacement is bimodal, beccuse the marginal parts of the Kanto tectonic basin have been deformed with very high gradients, whereas the surrounding mountainous areas have been uplifted with rather low ones. Volcanic areas extend in the surrounding mountains and the western part of this division was subject to folds in the Neogene and since then has been uplifted. This division suffered extensive uplift and subsidence by recent earthquakes and is one of the most active regions in recent seismicity in Japan. Its southern part is very similar in features of seismic crustral deformation to the Outer Zone of Southwest Japan, and therefore, is considered to be the eastern extension of the latter from the viewpoint of the seismic division.

A^+: Central Mountains. This division occupies the highest part of the Japanese Islands and three high mountain ranges, the so-called Japan Alps, extend *en echelon*, trending NNE. The highest parts of the mountain ranges a little exceed the height of 3,000 m above sea level and the amounts of uplift during the whole period of Quaternary are mostly more than 1,000 m. Gradients of vertical displacement are generally very high, especially along the marginal parts of the mountain ranges which are bordered by huge fault-scarps or steep flexure-scarps. It is very curious and noticeable that this highly active division in Quaternary tectonic movement is very inactive in recent seismicity and has not suffered remarkable seismic crustal deformation in recent times.

C^+: Kinki – Nobi. This division is characterized by small tectonic ranges and basins. Erosion surfaces formed in the late Tertiary have been dislocated at various heights and partly preserved on tops of mountain ranges, and basin floors have subsided by more than 500 m in the Osaka and Nobi Plains. In genral, gradients of vertical displacement are not so high, but they are locally very high along Quaternary faults which are densely distributed, bordering the mountain ranges in this division. Some of the Quaternary faults have been dislocated horizontally as well as vertically. This division is very active in recent seismicity and it is very interesting that there are some strike-slip seismic faults at times of recent earthquakes in the division, which are very similar in mode to the Quaternary faults.

E: Chugoku – Setouchi. Plateau-like mountains 300 to 500 m high extend, and rahter isolated small mountain blocks a little higher than 1,000 m form a back-bone range trending ENE. The southern margin of the mountains gently descends down to the Setouchi inland sea depression, the southern margin of which is bordered by the Median Tectonic Line. In most parts of this division, amounts of uplift are less than 500 m and its gradients are lowest in Japan. Several Quaternary faults but no fold have been found in this division. Recently an earthquake occurred in a local area, but recent seismicity is rahter inactive and seismic crustal deformation also was very local.

D: Kyushu. This division consists of the remain of Kyushu Island excluding the Kyushu Mountains which belong to the Outer Zone of Southwest Japan. In the northern half of this division, small block mountains are distributed, intervened by lowlands, and low hilly lands in its western and southern parts are covered with lava flows. The southern half of this division, including Aso volcano, is characterized by the existence of gigantic calderas and the extensive distribution of uplands composed of pyroclastic sediments. Amounts of uplift are less than 700 m and its gradients are low. Recent seismicity is very inactive and no remarkable seismic crustal deformation has been recognized.

B: The Outer Zone of Southwest Japan. This division is bordered by the Median Tectonic Line along its northern margin, which has been dislocated horizontally as well as vertically in the late Quaternary. This division is separated into three main parts, that is, the Kii, Shikoku and Kyushu Mountains, by narrows straits. Amounts of uplift in these mountains during the Quaternary exceed 1,000 m, and it has been considered that this division have been undulatingly deformed with wavelengths of about 150 to 200 km since the beginning of the Quaternary. The easternmost part of this division is piedmont areas of the Central Mountains. Upland surfaces extending in this area have been gently undulatingly deformed with axes trending NE in the late Quaternary. Recent seismicity is very active off the Pacific coast of the division, and the division suffered characteristic seismic crustal deformation by recent earthquakes, which was considered to have very interesting relations with Quaternary tectonic movement. In the Kyshu Mountains, however, any remarkable seismic crustal movement has not been found, in spite of active seismicity off the coast east of the mountains.

In conclusion, there are a few interesting relations between recent seismic activities and Quaternary tectonic movement in each tectonic division. These relations, however, should be further examined, considering the historical sequences of tectonic movement in the Quaternary, which are to be solved for every Quaternary tectonic division in future. At the same time, it is very important to study the tectonic movement on submarine bottoms around the Japanese Islands, where the epicenters of most of recent earthquakes were located.

5.4.3. References

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Sugimura, A. (1967) Uniform rates and duration period of Quaternary earth movements in Japan. J. Geosci. Osaka City Univ, Vol. 10, Art. 1–4, pp. 25–35.

Yoshikawa, T. (1970) On the relations between Quaternary tectonic movement and seismic crustal deformation in Japan. Bull. Dept. Geogr. Univ. Tokyo, No. 2, pp. 1–24.

Table 5-4. Classification of the Quaternary tectonic divisions of the Japanese Islands.

Quaternary tectonic division (QTD)	Mean of absolute amounts of vertical displacement (1)	Mean of gradients of vertical displacement (2)	Fault	Fold	Class of (1)	Class of (2)	Class of QTD
Northern and Eastern Hokkaido	464 m	7×10^{-3}	fairly dense		c	c	D
Hidaka-Yubari	697	10			b	b	B
Kitakami-Abukuma	504	4			c	d	E
The Inner Side of Northeast Japan	620	6	fairly dense	dense	b	c	C
Kanto	745	17			b	a	A
Central Mountains	1,090	17	fairly dense		a	a	A^+
Kinki-Nobi	478	10	dense		c	b	C^+
Chugoku-Setouchi	448	4			c	d	E
Kyushu	479	6	fairly dense		c	c	D
The Outer Zone of Southwest Japan	648	9			b	b	B

6. Postscript

The work for compilation and publication of this volume was commenced in 1963 by the following 7 persons: K. Hatori, S. Kaizuka, Y. Naruse, Y. Ota, A. Sugimura, H. Takahashi and T. Yoshikawa.

Thereafter at present as of January 1973, the following 5 persons are added to the members for the work: R. Ishii, C. Komori, F. Shimizu, M. Takahashi, and N. Yonekura.

Partial charge of the work for preparation of Tectonic Map was assigned the person(s) named below, as follows:

1. Vertical displacement estimated by geomorphological method: Kaizuka, Ota, Yoshikawa, Yonekura.
2. Vertical displacement estimated by geological method: Hatori, Naruse, Ishii, Komori.
3. Vertical displacement compiled from the Maps Nos. 1 and 2: All members.
4. Distribution of faults: Sugimura, H. Takahashi.
5. Distribution of folds: Kaizuka.
6. The Gipfelflur Map prepared by Prof. T. Okayama was offered us by the courtesy of the author and was added as a part of the Tectonic Map.

Partial charge for the manuscripts of explanatory text is as follow:

1.	Yoshikawa.
2.1.1.	Yoshikawa.
2.1.2.	Ota, Yonekura, Yoshikawa.
2.2.1.	Yoshikawa.
2.2.2.	Hatori, Naruse.
2.3.	Yoshikawa.
2.4.	Yoshikawa.
3.1.1.	Yoshikawa.
3.1.2.	Sugimura, H. Takahashi.
3.2.1.	Yoshikawa.
3.2.2.–3.2.5.	Kaizuka.
3.3.	Yoshikawa.
4.	Yoshikawa.
5.1.	Sugimura.
5.2.	Kaizuka.
5.3.	H. Takahashi, M. Takahashi.
5.4.	Yoshikawa.
6.	Sugimura, H. Takahashi.
7.1.	Hatori, Shimizu.
7.2.	Naruse.
7.3.	Sugimura, H. Takahashi, Shimizu.
7.4.	Kaizuka.
7.5.	All members.

7. Appendices

7.1. List of the present heights of geologic formations.

1. Number (Quadrangle number and locality number).
2. Numeral on the map, which indicates the height of geologic formation (unit: 10 m)

sign on numeral	horizons of formations	coefficient for giving the amount of uplift during the Quaternary
signless	Up. Plio., Low Pleist.	X 1
[ ]	Low. Plio. occasionally Up. Mio.	X 1/2
( )	Mid. Pleist.	X 3
((( )))	Up. Pleist.	X 10
(( ))	Doubtful case	

3. Location (number of 1:200,000 topographic map and 1:50,000 topographic map).
4. Height of the geologic formation (in m).
5. Evidences (Formations and their age).
6. References (Descriptions are shown in the following order: author's name, year of publication.
   Refferred geological maps are indicated with the kinds of maps as follows:
   V: 1:50,000; VII: 1:75,000; XX: 1:200,000; L: 1:500,000).
7. Note.

1. Number	2. Numeral on the Map	3. Location	(m) 4. Height	5. Evidence	6. Reference	7. Note
1 - 1	[10]	NL-54-16 稚 内 - 4	100	追分層 (Oiwake Formation) (Miocene)	北海道地下資源調査所 (1957) X X (北海道)	
1 - 2	[5]	- 8	50	"	"	
1 - 3	[5]	-16	50	"	"	
2 - 1	10	NL-54-17 天 塩 - 1	100	瀬棚層 (Setana Formation)	"	
2 - 2	10	- 2	100	"	"	
2 - 3	10	- 3	100	"	"	
2 - 4	5	- 4	50	"	"	
2 - 5	5	- 5	50	"	"	
2 - 6	5	- 6	50	"	"	
2 - 7	[5]	- 9	50	追分層 (Oiwake Formation) (Miocene)	"	
3 - 1	(16)	NL-54-11 枝 幸 - 4	160	高位段丘 (堆積物の) 面高度 Neogene のオタルベシ Lava を不整合におおう (Miocence)	斎藤昌之他 (1959) V	
3 - 2	(16)	- 6	160	高位段丘面高度	酒匂純俊 (1961) V	
3 - 3	(2-5)	- 7	20 - 50	第 1 段丘面高度	小山内熙他 (1962) V	
3 - 4	(12-18)	- 8	120 - 180	第 1 段丘面高度，下にペンケ層 (Plio.) 有り．ペンケ層の Max．高度とほぼ同じ	酒匂純俊他 (1961) V	
3 - 5	[10]	-12	100	追分層 (Oiwake Formation) (Mio.)	北海道地下資源調査所 (1957) X X (北海道)	

1.Number	2. Numeral on the Map	3. Location	(m) 4.Height	5. Evidence	6. Reference	7. Note
3 - 6	15	-14	150	瀬棚層 (Setana F.) (Plio.)	"	
3 - 7	5	-15	50	"	"	
3 - 8	[20]	-16	200	追分層 (Oiwake F.) (Mio.)	"	
4 - 1	[10]	NL-54-18 羽 幌 - 1	100	"	"	
4 - 2	[25]	- 2	250	"	"	
4 - 3	[5]	- 6	50	"	"	
4 - 4	[10]	- 7	100	"	"	
4 - 5	[10]	- 8	100	"	"	
5 - 1	[10]	NL-54-12 名 寄 - 1	100	"	"	
5 - 2	[30]	- 2	300	"	"	
5 - 3	30	- 3	300	滝川層 (Takikawa F.) (Plio.)	"	
5 - 4	40	- 5	400	オシトツ層 (Oshitotsu F.) (Plio.) 上部の上幌内越層のMax.高度 この上に高位段丘堆積物有り	土居繁雄他 (1960) V	〔 〕をつけるかどうか問題．一応このまま
5 - 5	40	- 6	380 - 400	下川層群 (Shimokawa Group)	酒勾純俊他 (1960) V	
5 - 6	40	- 7	400	滝川層 (Takikawa F.) (Plio.)	北海道地下資源調査所 (1957) XX (北海道)	
5 - 7	[20]	- 9	200	追分層 (Oiwake F.) (Mio.)	"	

1. Number	2. Numeral on the Map	3. Location	4. Height (m)	5. Evidence	6. Reference	7. Note
5 - 8	25	-10	250	瀬棚層 (Setana F.) (Plio.)	"	
5 - 9	20	-11	200	瀬棚層 (Setana F.) (Plio.)	"	
5 -10	[40]	-13	400	追分層 (Oiwake F.) (Plio.)	"	
5 -11	[35]	-14	350	瀬棚層 (Setana F.) (Plio.)	"	〔 〕をとれ
5 -12	[30]	-16	300	滝川層 (Takikawa F.) (Plio.)	"	〔 〕をとれ
6 - 1	[5]	NL-54- 6 紋 別 - 4	50	高位段丘Ⅰの上位面 (Pleist.) 高度	黒田和男他 (1964) V	
6 - 2	[4]	- 7	40	高位段丘面高度	長尾捨一 (1962) V	
6 - 3	20	- 8	200	滝川層 (Takikawa F.) (Plio.)	北海道地下資源調査所 (1957) XX (北海道)	
6 - 4	[30]	-11	300	追分層 (Oiwake F.) (Mio.)	"	
6 - 5	40	-12	400	滝川層 (Takikawa F.) (Plio.)	"	
6 - 6	8	-13	80	御西層 (Onishi F.) (Plio.) 上を段丘堆積物（沢木層）がおおい 極めて平担.	斎藤昌之 (1964) V	(　)をつけよ
6 - 7	10	-15	100	滝川層 (Takikawa F.) (Plio.)	北海道地下資源調査所 (1957) XX (北海道)	
6 - 8	[50]	-16	500	追分層 (Oiwake F.) (Mio.)	北海道地下資源調査所 (1957) XX (北海道)	

1. Number	2. Numeral on the Map	3. Location	4. Height (m)	5. Evidence	6. Reference	7. Note
7 - 1	60	NL-55-36 網 走 - 4	600	宇登呂層 (Utora F.) (Plio.)	杉本良也・松下勝秀(1961) V	問題あるが、一応そのまま、本来は4の下段350mを採用すべきもの〔35〕に相当
7 - 2		〃	350	追分層 (Oiwake F.) (Mio.)	北海道地下資源調査所(1957) XX(北海道)	
7 - 3	10	-12	100	美幌層 (Bihoro F.) (Pleist.)	島田忠夫(1962) V	(　)をつけよ
7 - 4	15	-16	150	追分層 (Oiwake F.) (Mio.)	北海道地下資源調査所(1957) XX(北海道)	〔 〕をつけよ
8 - 1	[40]	NL-55-30 知床岬 -12	400	〃	〃	
8 - 2	30	-15	300	テッパンベツ集塊岩層 (Tepanbetsu agglomerate bed) (Plio.)	庄谷幸夫(1965) V	〔 〕をつけよ
8 - 3	[40]	-16	400	追分層 (Oiwake F.) (Mio.)	北海道地下資源調査所(1957) XX(北海道)	
9 - 1	10	NK-54-13 留 萌 - 1	100	追分～滝川層 (Oiwake - Takikawa F.)	〃	
9 - 2	[40]	- 2	400	〃	〃	
9 - 3	20	- 3	200	滝川層 (Takikawa F.) (Plio.)	〃	
9 - 4	20	- 4	200	〃	〃	
9 - 5	[10]	- 5	100	追分層 (Oiwake F.) (Mio.)	〃	
9 - 6	[40]	- 6	400	〃	〃	
9 - 7	[30]	- 7	300	追分層 (Oiwake F.) (Mio.)	北海道地下資源調査所(1957) XX(北海道)	

1.Number	2.Numeral on the Map	3.Location	(m) 4.Height	5.Evidence	6.Reference	7.Note
9 - 8	10	- 8	100	滝川層 (Takikawa F.) (Plio.)	北海道地下資源調査所 (1957) X X (北海道)	
9 - 9	[40]	-11	400	追分層 (Oiwake F.) (Mio.)	〃	
9 -10		-12	150	当別層 (Tobetsu F.) (Lower Plio.)	対島坤六他 (1956) V	〔15〕に相当
10 - 1	30	NK-54- 7 旭 川 -11	300	滝川層 (Takikawa F.) (Plio.)	北海道地下資源調査所 (1957) X X (北海道)	
10 - 2	((20))	-12	200	オチンノペ層 (Ochinnobe F.) (Neogene) 植物化石多し，海棲化石も有り	橋本 亘 (1955) V	
10 - 3	20	-13	200	滝川層 (Takikawa F.) (Plio.)	北海道地下資源調査所 (1957) X X (北海道)	
10 - 4		-14	150	追分～滝川層 (Oiwake - Takikawa F.) (Mio. - Plio.)	〃	15に相当
10 - 5	30	-15	300	滝川層 (Takikawa F.) (Plio.)	〃	
10 - 6	((70))	-16	700	川端層群 (Kawabata Group) (Mio.)	清水 勇他 (1954) V	
11 - 1	20	NK-54- 1 北 見 - 1	200	滝川層 (Takikawa F.) (Plio.)	北海道地下資源調査所 (1957) X X (北海道)	
11 - 2	[3]	- 2	300	追分層 (Oiwake F.) (Mio.)	〃	〔30〕が正しい
11 - 3	25	- 3	250	滝川層 (Takikawa F.) (Plio.)	〃	
11 - 4	[60]	- 4	600	追分層 (Oiwake F.) (Mio.)	〃	

1. Number	2. Numeral on the Map	3. Location	4. Height (m)	5. Evidence	6. Reference	7. Note
11 - 5	30	- 5	300	矢矧層 (Yahagi F.) (Plio.)	山田敬一他 (1963) V	
11 - 6	40	- 6	400	小松沢層 (Komatsuzawa F.) (Low. - Mid. Plio.) 非海成	沢村孝之助他 (1965) V	〔 〕をつけよ
11 - 7	40	- 7	400	本別層 (Honbetsu F.) (Lower Tokachi Group) (Upper Plio.)	鈴木 守他 (1963) V	
11 - 8	50	- 8	550	滝川層 (Takikawa F.) (Plio.)	北海道地下資源調査所 (1957) X X (北海道)	
11 - 9		-10	600	滝の湯層 (Takinoyu F.) (Plio.)	酒匂純俊他 (1964) V	60 に相当
11 -10	50	-12	500	滝川層 (Takikawa F.) (Plio.)	北海道地下資源調査所 (1957) X X (北海道)	
11 -11	50	-13	500	幌加湧別層 (Horokayubetsu F.) (Plio.). 湖成層.	国府谷盛明他 (1964) V	
11 -12	80	-14	800	白滝層 (Shirataki F.) (Pleist.) この上に第1段丘堆積物がのる.	長谷川潔他 (1961) V	
11 -13	80	-15	800	瀬棚層 (Setana F.) (Plio.)	北海道地下資源調査所 (1957) X X (北海道)	
12 - 1	15	NK-55-31 斜里 - 1	150	知布泊層 (Chipudomari F.) (Mio.? - Plio.)	杉本良也他 (1959) V	〔 〕をつけよ
12 - 2	40	- 2	400	崎無異川集塊岩層 (Sakinaigawa agglomerate bed) (Plio.?)	"	〔 〕をつけよ
12 - 3	(10)	- 5	100	止別砂礫層 (Shibetsu gravel bed) (Pleist.)	松下勝秀 (1960) V	

1.Number	2.Numeral on the Map	3.Location	(m) 4.Height	5.Evidence	6.Reference	7.Note
12 - 4	(10)	- 6	100	札鶴層 (Sattsuru F.)(「小清水」図巾の美幌層に対比)	杉本良也他(1959) V	
12 - 5	20	- 8	200	滝川層 (Takikawa F.) (Plio.)	北海道地下資源調査所 (1957) XX(北海道)	
12 - 6	(10)	- 9	100	美幌層 (Bihoro F.) (下末吉？) 非海成	島田忠夫他(1959)	
12 - 7	7	-10	70	東藻琴層 (Higashimokota F.) (Neogene).この上を屈斜路火山噴出物が広くおおう.	勝井義雄他(1963) V	
12 - 8	20	-12	200	釧路層群堆積面 (Kushiro Group depositional surface) (Shiranuka terrace surface)	岡崎由夫(MS)	私信による
12 - 9	5	-13	50	追分層 (Oiwake F.) (Mio.)	北海道地下資源調査所 (1957) XX(北海道)	〔 〕をつけよ
12 -10	50	-16	500	滝川層 (Takikawa F.) (Plio.)	"	
13 - 1	0	NK-55-25 標 津 -13	100	幾品層 (Ikushina F.) (Plio.)	三谷勝利他(1963) V	〔10〕であるが，実質は0である
13 - 2	[50]	-13	500	追分層 (Oiwake F.) (Mio.)	北海道地下資源調査所 (1957) XX(北海道)	
13 - 3	9	-14	90	薫別層 (Kunbetsu F.) (Pleist.)	松井公平(1961) V	
13 - 4	50	-15	500	追分層 (Oiwake F.) (Mio.)	北海道地下資源調査所 XX(北海道)	〔 〕をつけよ
14 - 1	[10]	NK-54-20 岩 内 - 1	100	"	"	
14 - 2	[70]	- 2	700	"	"	

1. Number	2. Numeral on the Map	3. Location	4. Height (m)	5. Evidence	6. Reference	7. Note
14 - 3	25	- 3	250	無沢層 (Nashizawa F.) (Lower Plio.)	土居繁雄他 (1956) V	
14 - 4		- 4	360	三の原層(Sannohara F.) (Plio.)	斎藤昌之他 (1956) V	36に相当
14 - 5	40	- 5	400	追分層 (Oiwake F.) (Mio.)	北海道地下資源調査所 (1957) XX (北海道)	〔 〕をつけよ
14 - 6	[60]	- 6	600	"	"	
14 - 7	[20]	- 7	200	"	"	
14 - 8	20	- 8	200	瀬棚層 (Setana F.) (Plio.)	"	
14 - 9	[30]	- 9	300	追分層 (Oiwake F.) (Mio.)	"	
14 -10	[40]	-11	400	"	"	
14 -11	20	-12	200	瀬棚層 (Setana F.) (Plio.)	"	
14 -12	5	-16	50	"	"	
15 - 1		NK-54-14 札幌 - 1	100	峰延層 (Minenobu F.) (Plio.)	松野久也他 (1964) V	10に相当
15 - 2	10	- 2	100	清真布層 (Kiyomappu F.) (Plio.),層厚 250 ~ 300 m	佐々保雄他 (1965) V	
15 - 3	10	- 3	100	追分層 (Oiwake F.) (Mio.)	北海道地下資源調査所 (1957) XX (北海道)	〔 〕をつけよ
15 - 4	[20]	- 4	242	"	"	
15 - 5	[20]	- 5	200	当別層 (Tobetsu F.) (Low. Plio.). 付近に材木沢層 (層厚 400 m) 有り	垣見俊弘他 (1956) V	

1. Number	2. Numeral on the Map	3. Location	4. Height (m)	5. Evidence	6. Reference	7. Note
15 - 6	20	- 9	200	当別層 (Tobetsu F.) (Low. Plio.). 付近に材木沢層有り.	垣見俊弘他 (1958) V	〔 〕をつけよ
15 - 7	[40]	-11	400	追分層 (Oiwake F.) (Mio.)	北海道地下資源調査所 (1957) X X (北海道)	
15 - 8	[30]	-12	300	"	"	
16 - 1	20	NK-54- 8 夕張岳 - 2	200	滝川層 (Takikawa F.) (Plio.)	"	
16 - 2	10	- 3	150	"	"	
16 - 3		-10	800	ニニウ層群 (Niniu Group) (Neogene) Kawabata G. に対比. 一部 Horonai F. に対比.	小山内熙他 (1958) V	〔80〕に相当
16 - 4		-14	700	板垣沢層群 (Itagakizawa G.) (Neogene)	長尾捨一他 (1954) V	〔70〕に相当
16 - 5	27	-16	275	滝川層 (Takikawa F.) (Plio.)	北海道地下資源調査所 (1957) X X (北海道)	
17 - 1	[20]	NK-54- 2 帯 広 - 2	200	追分層 (Oiwake F.) (Mio.)	"	
17 - 2	10	- 3	100	滝川層 (Takikawa F.) (Plio.)	"	
17 - 3	[40]	- 4	400	追分層 (Oiwake F.) (Mio.)	"	
17 - 4	40	- 5	400	滝川層 (Takikawa F.) (Plio.)	"	
17 - 5	30	- 6	300	十勝層群 (Tokachi Group) (Plio. - Pleist.)	三谷勝利他 (1958) X X (北海道)	

1.Number	2.Numeral on the Map	3.Location	(m) 4.Height	5.Evidence	6.Reference	7.Note
17 - 6	20	- 7	200	滝川層(Takikawa F.) (Plio.)	北海道地下資源調査所 (1957) X X (北海道)	
17 - 7	20	- 8	200	滝川層(Takikawa F.) (Plio.)	"	
17 - 8	40	- 9	400	"	"	
17 - 9	20	-10	200	"	"	
17 -10	20	-11	200	"	"	
17 -11	10	-12	100	"	"	
17 -12	70	-13	700	"	"	
17 -13	20	-14	200	"	"	
17 -14	10	-15	100	"	"	
17 -15	30	-16	300	"	"	
18 - 1	10	NK-55-32 釧 路 - 5	100	"	"	
18 - 2	10	- 6	100	"	"	
18 - 3	20	- 9	200	"	"	
18 - 4	50	-13	500	"	"	
18 - 5	20	-14	200	"	"	
18 - 6	25	-15	250	"	"	
20 - 1	6	NK-54-27 久 遠 - 2	60	瀬棚層(Setana F.) (Plio.)	"	

1.Number	2.Numeral on the Map	3.Location	4.Height (m)	5.Evidence	6.Reference	7.Note
20 - 2	[20]	- 3	200	追分層 (Oiwake F.) (Mio.)	北海道地下資源調査所 (1957) XX（北海道）	
20 - 3	[5]	- 4	50	"	"	
20 - 4	[5]	- 6	50	"	"	
21 - 1	[10]	NK-54-21 室 蘭	80	室蘭層 (Muroran F.) (Plio.)	村山正郎他 (1955) V	
21 - 2		- 3	200	"	小山内熙他 (1953) V	〔20〕に相当
21 - 3	[10]	- 5	100	追分層 (Oiwake F.) (Mio.)	北海道地下資源調査所 (1957) XX（北海道）	
21 - 4	[30]	- 8	300	"	"	
21 - 5	20	- 9	200	瀬棚層 (Setana F.) (Plio.)	"	
21 - 6	5	-10	50	"	"	
21 - 7	20	-11	200	"	"	
21 - 8	[30]	-12	300	追分層 (Oiwake F.) (Mio.)	"	
21 - 9	10	-14	100	瀬棚層 (Setana F.) (Plio.)	"	
21 -10	20	-15	200	"	"	
21 -11	[3]	-16	300	追分層 (Oiwake F.) (Mio.)	"	〔30〕が正しい。
22 - 1	[20]	NK-54-15 苫小牧	200	萠別層 (Moebetsu F.) (Lower Plio.)	山口昇一 (1960) V	

1.Number	2.Numeral on the Map	3.Location	(m) 4.Height	5.Evidence	6.Reference	7.Note
22 - 2	[40]	- 9	400	別々川層 (Betsubetsugawa F.) (Plio.)	土居繁雄(1953) V	
22 - 3	[30]	-14	200	室蘭層 (Muroran F.) (Plio.)	斉藤昌之(1953) V	
23 - 1	20	NK-54- 9 浦 河 - 7	249	滝川層 (Takikawa F.) (Plio.)	北海道地下資源調査所(1957) XX(北海道)	
23 - 2	30 26	-10	297	"	"	
23 - 3	25	-13	258	"	"	
23 - 4	16	-14	160	厚賀層 (Atsuga F.) (Low. Plio.) 付近に滝川層(層厚100 m)有り. これを加えれば260 mになる.	山口昇一他(1958) V	〔 〕をつけよ。
24 - 1	10	NK-54- 3 広 尾 - 5	100	瀬棚層 (Setana F.) (Plio.)	北海道地下資源調査所(1957) XX(北海道)	
24 - 2	[10]	- 9	100	追分層 (Oiwake F.) (Mio.)	"	
24 - 3		-10	50	"	"	
24 - 4	[2]	-11	200	"	"	〔20〕が正しい。
24 - 5	[30]	-14	300	"	"	
26 - 1	(5)	NK-54-22 函 館 - 4	50	高位段丘 (Upper Terrace) (多摩?)	上村不二雄(1962) V	
26 - 2	(8)	- 4	80	"	"	
26 - 3	20	- 5	200	富川層 (Tomikawa F.) (Plio.)	三谷勝利他(1966) V	

1.Number	2.Numeral on the Map	3.Location	(m) 4.Height	5.Evidence	6.Reference	7.Note
26 - 4	13	- 6	130	富川層(Tomikawa F.) (Plio.)	三谷勝利他(1966) V	
26 - 5	20	- 9	200	追分層(Oiwake F.) (Mio.)	北海道地下資源調査所(1957) XX(北海道)	〔 〕をつけよ。
26 - 6	[3]	-10	300	"	"	〔30〕が正しい。
26 - 7	[2]	-11	200	"	"	〔20〕が正しい。
26 - 8	10	-13	100	瀬棚層(Setana F.) (Plio.)	"	
26 - 9	[5]	-14	50	追分層(Oiwake F.) (Mio.)	"	
27 - 1	2	NK-54-16 尻屋崎 -16	20	野辺地層(Noheji F.) (Plio.?)	上村不二雄・斉藤正次(1957) V	
28 - 1	21	NK-54-23 青 森 - 5	210	蟹田層(Kanita F.) (Plio.) 瀬棚層に対比.	"	
28 - 2	36	- 6	360	"	上村不二雄(1959) V	
28 - 3	26	- 7	260	天田内川層 (Amadanaigawa F.)	青森県(1962) XX(青森)	
28 - 4	[16]	- 8	160	土筆森山層 (Tsukushimoriyama F.) (Low. Plio.)	"	
28 - 5	10	- 9	100	蟹田層(Kanita F.) (Plio.)	"	
28 - 6	27	-10	270	蟹田層(Kanita F.) (Plio.).瀬棚層に対比.	対島坤六・上村不二雄(1959) V	
28 - 7	10	-12	100	鳴沢層(Narusawa F.) (Low. Plio.)	青森県(1962) XX(青森)	
29 - 1	16	NK-54-17 野辺地 - 9	160	田名部累層 (Tanabe F.) (Pleist.)	今井 功(1961) V	

1. Number	2. Numeral on the Map	3. Location	4. Height (m)	5. Evidence	6. Reference	7. Note
29 - 2	[8]	-15	80	石浜層 (Ishihama F.) (Low. Plio.)	青森県 (1962) X X (青森)	
29 - 3	21	-16	210	"	"	〔 〕をつけよ。
30 - 1	(18)	NK-54-30 深 浦	180	海岸段丘 (Coastal Tenace) (多摩 ?)	大沢 穠 (1963) V	資料不足
31 - 1	34	NK-54-24 弘 前	340	東目屋層 (Higashimeya F.) (Plio.)	大沢 穠 (1962) V	
31 - 2	17	-11	170	前山川層 (Maeyamakawa F.) (Plio.)	平山次郎・角 清愛 (1963) V	
31 - 3	15	-12	150	鮪川層 (Shibikawa F.) (Plio.)	秋田県 (1957) X X (秋田)	
31 - 4	15	-15	150	"	"	
32 - 1	(28)	NK-54-18 八 戸 - 4	280	高位段丘堆積物のbase (Base of Upper Terrace deposit) (多摩 ?)	島津光夫・寺岡易司 (1962) V	
32 - 2	8	-10	80	久保累層 (Kubo F.), 舌崎累層 (Shitazaki F.) (Low. - Mid. Plio.)	青森県 (1962) X X (青森)	
32 - 3	20	-11	200	"	"	
32 - 4	[14]	-14	140	斗川累層 (Togawa F.) (Late Plio.)	"	
32 - 5	28	-15	280	斗川累層 (Togawa F.) (Mid. Plio.)	青森県 (1962) X X (青森)	〔 〕をつけよ。
33 - 1	10 5	NJ-54-25 男 鹿 - 1	100	鮪川層 (Shibikawa F.) (Late Plio.)	藤岡一男 (1959) V	
33 - 2	10	- 5	100	戸賀軽石層 (Toga Pumice bed) (=Shibikawa F.?)	"	

1.Number	2.Numeral on the Map	3.Location	(m) 4.Height	5.Evidence	6.Reference	7.Note
34 - 1	64	NJ-54-19 秋 田 - 1	640	北又川層 (Kitamatagawa F.) (Plio.) 海成？	河野義礼・上村不二雄(1964) V	《 》をつけよ。資料少い。
34 - 2	21	- 8	210	鮪川層 (Shibikawa F.) (Plio.)	秋田県 (1957) X X (秋田) (秋田県地質鉱産図)	
34 - 3	10	-11	100	"	大沢 穠他 (1958) X X	
34 - 4	6	-13	160	"	三梨 昂他 (1963) (油田ガス田図 1.5万)	16 が正しい。
34 - 5	10	-15	100	"	大沢 穠他 (1958) X X	
34 - 6	14	-16	140	"	秋田県 (1957) X X (秋田県地質鉱産図)	
35 - 1	22	NJ-54-13 盛 岡 -11	220	玉里層 (Tamazasa F.) (Upper Plio.)	広川 治・吉田 尚 (1955) V	《 》をつけよ。
35 - 2	15	-16	150	真滝夾炭層 (Mataki coal-bearing F) (Plio.) (Tamazato F.相当)	岩手県土木部 (1954) X (岩手)	《 》をつけよ。
36 - 1	30	NJ-54-26 酒 田 - 2	300	常禅寺層 (Jozenji F.) (Plio.)	山形県鉱産課 (1960) X X (山形)	
36 - 2	30	- 3	300	"	"	
36 - 3	30	- 4	300	"	"	
37 - 1	[60]	NJ-54-20 新 庄 - 1	600	大平層 (Ohira F.) (Low Plio.)	岩手県土木部 (1954) X (岩手)	
37 - 2	44	- 2	440	"	北村 信 (1960) V	
37 - 3	30	- 3	300	八木山層 (Yagiyama F.) (Up.Plio.)	宮城県 (1962) X X (宮城)	
37 - 4	20	- 4	200	"	"	

1.Number	2.Numeral on the Map	3.Location	4.Height (m)	5.Evidence	6.Reference	7.Note
37 - 5	30	- 5	300	鮪川層(Shibikawa F.) (Plio.)	秋田県(1957) X X (秋田県地質鉱産図)	
37 - 6	[18]	-11	180	高沢砂岩層 (Takazawa sandstone bed) (Low. Plio.)	大沢 穠・角 清愛(1961) V	
37 - 8	15	-13	150	鮪川層(Shibikawa F.) (Plio.)	秋田県(1957) X X (秋田地質鉱産図)	
37 - 9	50	-14	500	常禅寺層 (Jozenji F.) (Plio.)	山形県鉱産課(1960) X X (山形)	
37 -10	30	-15	300	"	"	
38 - 1	8	NJ-54-14 一 関 - 7	80	松崎層(Matsuzaki F.) (Pleist. Aobayama F. 相当)	神戸信和・島津光夫(1961) V	(　)をつけよ。
38 - 2	((17))	- 9	170	玉里層(Tamazasa F.) (Upper Plio.)	広川 治・吉田 尚(1954) V	
38 - 3	13	-15	130	八木山層 (Yagiyama F.) (Up. Plio.)	宮城県(1962) X X (宮城)	
38 - 4	10	-16	100	真滝夾炭層 (Mataki coalbeating Formation)	岩手県土木部(1954) X (岩手)	
39 - 1	10	NJ-54-33 相 川 -12	120	灰爪層(Haizume F.) (Plio.)	新潟県(1962) X X (新潟)	
40 - 1	110	NJ-54-27 村 上	1100	常禅寺層 (Jozenji F.) (Plio.)	山形県鉱産課(1960) X X(山形)	
40 - 2	20	- 8	200	西山層(Nishiyama F.) (Plio.)	新潟県 (1962) X X (新潟)	
40 - 3		-12	200	"	"	
41 - 1	20 30	NJ-54-21 仙 台 - 1	200	小野川層 (Onogawa F.) (Plio.)	宮城県(1962) X X (宮城)	

1.Number	2.Numeral on the Map	3.Location	(m) 4.Height	5.Evidence	6.Reference	7.Note
41 - 2	17	- 2		小野川層(Onogawa F.) (Plio.)	宮城県(1962) XX (宮城)	
41 - 3	24	- 3	240	青葉山層(Aobayama F.) (Pleist.)	〃	(　)をつけよ。
41 - 4	40	- 5	400	本砂金礫層 (Motoisago Gravel bed.) (Pleist.)	中川久夫他(1960)第四紀研究 Vol. 1 pp.219～227	(　)をつけよ。
41 - 5	50	- 6		〃	〃	
41 - 6		- 9	110	舟形層(Funakata F.) (Plio.)	徳永重元 (1958) V	[11]に相当
41 - 7	110	-13	1100	常禅寺層(Jozenji F.) (Plio.)	山形県鉱産課(1960) XX(山形)	[　]をつけよ。
41 - 8	40	-16	400	中山層(Nakayama F.) (Plio. - Pleist.)	〃	
42 - 1	20	NJ-54-15　石　巻 -13	200	広淵層(Hirobuchi F.) (Plio.)	岩手県(1959) XX (岩手)	
42 - 2	10	-14	100	〃	〃	
42 - 3	10	-15	100	下馬層(Geba F.) (Plio.)	〃	
44 - 1	15	NJ-54-34　長　岡 - 3	150	魚沼層群 (Uonuma Group) (Plio. - Pleist.)	新潟県(1955) XX (新潟)	
44 - 2	25	- 4	250	〃	〃	
44 - 3	20	- 7	200	〃	〃	
44 - 4	25	- 8	250	〃	〃	
45 - 1	41	NJ-54-28　新　潟 - 2	410	山都層群 (Yamato Group) (Plio.)	新潟県(1962) XX (新潟)	

1. Number	2. Numeral on the Map	3. Location	4. Height (m)	5. Evidence	6. Reference	7. Note
45 - 2	54	- 4	540	山都層群 (Yamato Group) (Plio.)	新潟県 (1962) X X (新潟)	
45 - 3	18	- 9	180	西山層 (Nishiyama F.) (Plio.)	"	
45 - 4	13	-14	130	"	"	
45 - 5	20	-15	200	"	"	
45 - 6	51	-16	510	"	"	
46 - 1	25	NJ-54-22　福　島 - 1	250	富岡層 (Tomioka F.) (Plio.)	福島県 (1955) X X (福島)	
46 - 2	16	- 3	160	"	"	
46 - 3	50	- 5	500	山都層群 (Yamato F.) (Plio.)	"	
46 - 4	42	-10	420	"	"	
46 - 5	34	-12	340	"	"	
46 - 6	100	-15	1000	"	"	
47 - 1	17	NJ-53-11　七　尾 - 1	170	中部洪積層 (Mid. Pleist)および 未区分洪積層	富山県 (1967) X X (富山)	(　　) をつけよ。
47 - 2	3	- 2	30	氷見層(Himi Formation) (Plio.)	"	
47 - 3	10	- 3	30	"	"	数字を 3 になおせ。
47 - 4	20	- 3	100	氷見層群 (Himi Group) (Plio.)	富山県 (1957) X X (富山)	数字を 10 になおせ。
47 - 5	20	- 4	200	"	"	

1.Number	2.Numeral on the Map	3.Location	4.Height (m)	5.Evidence	6.Reference	7.Note
47 - 6	15	- 5	150	下部洪積層 (Lower Pleist.)	富山県（1967）ＸＸ（富山）	(　)をつけよ。
47 - 7	10	- 6	100	"	"	(　)をつけよ。
47 - 8		- 8	60	埴生層(Hanyu F.) (Pleist.)	"	6に相当
48 - 1	[20]	NJ-53- 5 富 山 -11	200	下部洪積層 (Lower Pleist.)	"	
48 - 2	10	-12	100	氷見層(Himi F.) (Plio.)	"	
48 - 3	20	-13	200	中部洪積層 (Mid. Pleist.) および未区分洪積層（九戸面？）	"	(　)をつける。
48 - 4	30	-14	300	下部氷見層 (Low. Himi F.) (Plio.)	絈野義夫（1965）“能登半島の地質”	〔 〕をつけよ。
48 - 5	20	-15	200	氷見層(Himi F.) (Plio.)	富山県（1957）ＸＸ（富山）	
48 - 6	10	-16	100	"	富山県（1967）ＸＸ（富山）	
49 - 1	50	NJ-54-35 高 田 - 1	500	魚沼層群 (Uonuma Group)	新潟県（1955）ＸＸ（新潟）	
49 - 2	100	- 2	1000	"	"	
49 - 3	40	- 6	400	"	"	
49 - 4	70	- 7	700	"	"	
49 - 5	90	-11	900	柵層群上部 (Upper Shigarami Group) (Plio.)	長野県（1957）ＸＸ（長野）	〔 〕をつけよ。
49 - 6		-12	600	"	"	60に相当

1.Number	2.Numeral on the Map	3.Location	(m) 4.Height	5.Evidence	6.Reference	7.Note
49 - 7	60	-15	600	魚沼層群 (Uonuma Group) (Plio. - Pleist.)	長野県 (1957) X X (長野)	
49 - 8		-16	1000	柵層群上部 (Upper Shigarami Group) (Plio.)	"	100に相当
50 - 1	80	NJ-54-29 日 光 - 1	800	山都層群 (Yamato Group) (Plio.)	福島県 (1955) X X (福島)	
50 - 2	95	- 3	950	新第三系上部(Upper Neogene)	栃木県 (1963) X X (栃木)	[ ]をつけよ。
50 - 3		- 4	500	"	"	[50]に相当
50 - 4	90	- 5	900	山都層群 (Yamato Group) (Plio.)	福島県 (1955) X X (福島)	
50 - 5	100	- 6	1000	"	"	
51 - 1	10	NJ-54-23 白 河 - 2	100	袖玉山層 (Sodetamayama F.) (Pleist.)	岩生周一・松井 寛 (1961) V	
51 - 2	85	-10	350	山都層群 (Yamato Group) (Plio.)	福島県 (1955) X X (福島)	35に訂正
51 - 3		-16	300	喜連川層 (Kizuregawa F.) (Mid. Plio.)	栃木県 (1963) X X (栃木)	(30) に相当
53 - 1	20	NJ-53-12 金 沢 - 1	200	氷見層 (Himi F.) (Plio.)	富山県 (1957) X X (富山)	
54 - 1	110	NJ-53- 6 高 山 - 1	1050	猿丸砂岩礫岩層 (Sarumaru sandstone conglomerate bed) (Plio. - Pleist.)	長野県 (1962) X X (長野)	
54 - 2	80	- 2	800	高萩砂岩礫岩層 (Takahagi sandstone conglomerate bed) (Plio.)	"	

1. Number	2. Numeral on the Map	3. Location	(m) 4. Height	5. Evidence	6. Reference	7. Note
55 - 1	((110))	NJ-54-36 長 野 - 5	1060	門貝層(Kadokai F.) (Neogene - Pleist.)	太田良平(1957) V	
55 - 2	((140))	- 7	1400	兜岩層(Kabutoiwa F.) (Plio.)	長野県(1962) X X (長野)	
55 - 3	90	-11	900	小諸層群(Komoro Group) (Plio.?)	"	
55 - 4	((250))	-12	2500	兜岩層相当層 (Upper Mio.)	"	
55 - 5	80	-13	800	高府泥岩層 (Takafu mudstone bed) (柵層群 Plio.)	"	
56 - 1	18	NJ-54-30 宇都宮 - 1	180	新第三系上部 (Upper Neogene) (Plio.?)	栃木県(1963) X X (栃木)	
56 - 2	2	- 4	20	成田層(Narita F.) (Pleist.)	茨城県(1962) X X (茨城)	【 】をつけよ。
56 - 3	33	- 5	330	新第三系上部 (Upper Neogene) (Plio.?)	栃木県(1963) X X (栃木)	
56 - 4	((110))	- 9	1100	舟石層(Funaishi F.) (Pleist.)	河田春雄・大沢 穠(1955) V	
56 - 5	50	-13	380	沼田湖成層 (Numata lacustrine bed) (Pleist.)	新井房夫(1962) X X (群馬)	(38) にせよ。
57 - 1	10	NJ-54-24 水 戸 - 5	100	久米層群(Kume Group) (Plio.)	茨城県(1962) X X (茨城)	
57 - 2	3	- 6	30	"	"	
57 - 3	10	- 9	100	"	"	
57 - 4	3	-10		"	"	

1. Number	2. Numeral on the Map	3. Location	(m) 4. Height	5. Evidence	6. Reference	7. Note
57 - 5		-13	180	新第三系上部 (Upper Neogene) (Plio.?)	栃木県(1963) X X (栃木)	18 に相当
57 - 6	18	-14	100	"	"	10 にせよ。
57 - 7	(6)	-15	60	成田層(Narita F.) (Pleist.)	茨城県(1962) X X (茨城)	
59 - 1	8	NI-53-25 松 江 - 4	80	駄経寺礫岩 (Dakyoji Conglomerate)	村山正邦・大沢 穠(1961) V	
62 - 1		NI-53- 7 岐 阜 -12	400	古琵琶湖層群 (Kobiwako Group) (Plio. - Pleist.)	滋賀県(1954) X X (滋賀)	40 に相当
62 - 2		-12	180	古琵琶湖層群 (Kobiwako Group) (Plio. - Pleist.)	礒見 博(1957) V	18 に相当
62 - 3		-16	100	"	滋賀県(1954) X X (滋賀)	10 に相当
63 - 1		NI-53- 1 飯 田 - 3	140	伊那層(Ina F.) (Plio.)	河田清雄(1958) V	〔14〕に相当
63 - 2	80	- 4	800	"	地質調査所(1961) X X	〔 〕をつけよ。
63 - 3		- 7	400	瀬戸層群上部 (Upper Set. Group) (Upper Plio.) (非海域であるが, そのまま使用する)	山田直利他(1958) V	40 に相当
63 - 4	90	- 8	900	瀬戸層群 (Seto Group) (Upper Plio.)	地質調査所(1961) X X	
63 - 5	50	-11	500	"	"	
63 - 6	90	-12	900	"	"	
63 - 7	50	-15	500	"	"	
63 - 8	50	-16	500	"	"	
64 - 1	40	NI-54-31 甲 府 - 7	400	曽根層群 (Sone Group) (Pleist.)	片田正人(1956) V	

1. Number	2. Numeral on the Map	3. Location	4. Height (m)	5. Evidence	6. Reference	7. Note
64 - 2	[70]	-12	700	静川累層 (Shizukawa F.) (Mid. - Low. Plio.)	山梨県治山協会 (1962) X V	
65 - 1	10	NI-54-25 東 京 - 7	100	三浦層群上部 (Upper Miura Group) (Plio. - Pleist.)	羽鳥謙三・寿円晋吾 (1958)	
65 - 2	20	- 8	160+	小柴層 (Koshiba F.) (Miura G. Plio. - Pleist.)	〃	
65 - 3	20	- 9	180+	飯能礫層 (Hanno Gravel bed) (Plio. - Pleist.)	羽鳥謙二・寿円晋吉 (1958)	
65 - 4	40	-10	360+	大荷田礫層 (Onida Gravel bed) (Plio. - Pleist.)	〃	
65 - 5	20	-11	200	三浦層群中部 (Mid. Miura Group) (Plio.)	〃	
65 - 6	40	-16	400	駿河礫層 (Suruga Gravel bed) (Plio. - Pleist.)	静岡県 (1956) X X (静岡)	
66 - 1		NI-54-19 千 葉 -12	80	梅ケ瀬層中部 (Mid. Umegase F.)	陶山国男 成瀬 洋 (1959) X X (千葉)	《 8 》に相当
68 - 1	35	NI-53-32 浜 田 - 4	360	甲立礫層 (Koutachi Gravel bed) (Plio. - Pleist.)	広島県 (1963) X X (広島)	
68 - 2	30	- 8	300	〃	〃	
68 - 3	20	-10	250-	都野津層 (Tsunozu F.) (Plio. - Pleist.)	三位秀夫 (M. S.)	
68 - 4	5	-15	50	〃	〃	
69 - 1	70	NI-53-26 高 梁 - 1	700	人形峠層 (Ningyotoge F.) (Plio.)	山田直利 (1961) V	〔 〕をつけよ。
69 - 2	30	- 3	300	山砂利層 (Mountain Gravels) (Pleist.)	岡山県 (1963) X X (岡山)	《 》をつけよ。

1.Number	2.Numeral on the Map	3.Location	(m) 4.Height	5.Evidence	6.Reference	7.Note
69 - 3	5	- 4	50	"	"	《 》をつけよ。
69 - 4	30	- 8	300	"	"	《 》をつけよ。
69 - 5	40	-12	400	"	"	《 》をつけよ。
70 - 1	15	NI-53-20 - 3	130	大阪層群下部 (Lower Osaka Group) (Upper Plio.)	兵庫県(1951) XX(兵庫)	
70 - 2	10	- 4	100	"	"	
70 - 3	30	-10	300	佐用礫層 (Sayo Gravel bed) (Plio. - Pleist.) クサリ礫	神戸信和・広川 治(1963) V	
70 - 4	20	-14	200	山砂利層 (Mountain Gravels) (Pleist.)	岡山県(1963) XX(岡山)	《 》をつけよ。
70 - 5	25	-15	250	準平原形成以前の礫層 (Mio.)	光野千春・大和尚秦(1965) V	《 》をつけよ。
70 - 6	10	-16	100	山砂利層 (Mountain Gravels) (Pleist.)	岡山県(1963) XX(岡山)	《 》をつけよ。
71 - 1	80	NI-53-14 - 1	800	Plio. - Pleist.?	滋賀県(1954) XX(滋賀)	《 》をつけよ。
71 - 2	15	- 2	150	"	京都府(1970) XX(京都)	
71 - 3	30	- 3	300	"	"	
71 - 4	30	- 4	300	"	"	
71 - 5	20	- 6	200	"	"	
71 - 6	20	- 7	200	"	"	
71 - 7	40	-11	400	大阪層群下部 (Lower Osaka Group) (Plio. - Pleist.)	兵庫県(1951) XX(兵庫)	

1. Number	2. Numeral on the Map	3. Location	4. Height (m)	5. Evidence	6. Reference	7. Note
71 - 8	40	-12	400	大阪層群下部 (Lower Osaka Group) (Plio. - Pleist.)	兵庫県 (1951) X X (兵庫)	
71 - 9	20	-15	190	"	"	
71 -10	20	-16	200	"	"	
72 - 1	10	NI-53- 8 名古屋 - 2	60+	常滑層群 (Tokoname Group) (Plio.)	深田 糸魚川淳二 (1962) X X (愛知)	
72 - 2	10	- 3	90	"	"	
72 - 3	10	- 4	60+	"	"	
72 - 4		- 9	500	奄芸層群上部 (Upper Agei Group) (Plio. - Pleist.)	竹原平一 (1961), 槇山次郎教授記念論文集	50 に相当
72 - 5	30	- 9	300	古琵琶湖層 (Kobiwako F.) (Plio. - Pleist.)	滋賀県 (1954) X X (滋賀)	
72 - 6		-10	400	奄芸層群上部 (Upper Agei Group) (Plio. - Pleist.)	竹原平一 (1961), 槇山次郎教授記念論文集	40 に相当
72 - 7	30	-10	300	古琵琶湖層 (Kobiwako F.) (Plio. - Pleist.)	滋賀県 (1954) X X (滋賀)	
72 - 8		-11	200	奄芸層群上部 (Upper Agei Group) (Plio. - Pleist.)	竹原平一 (1961), 槇山次郎教授記念論文集	20 に相当
72 - 9	45	-11	450	古琵琶湖層 (Kobiwako F.) (Plio. - Pleist.)	滋賀県 (1954) X X (滋賀)	
72 -10	10	-14	100	"	"	
72 -11	30	-15	300	"	"	
73 - 1	20	NI-53- 2 豊 橋 - 3	200	掛川層群 (Kakegawa Group) (Plio.)	静岡県 (1956) X X (静岡)	

1. Number	2. Numeral on the Map	3. Location	4. Height (m)	5. Evidence	6. Reference	7. Note
73 - 2	10	- 4	100	掛川層群 (Kakegawa Group) (Plio.)	静岡県 (1956) XX (静岡)	
73 - 3	20	-11	190	瀬戸層群 (Seto Group) (Plio.)	深田 糸魚川淳二 (1962) XX (愛知)	
73 - 4	40	-13	330+	"	"	
73 - 5	20	-14	140	"	"	
73 - 6	20	-15	140	"	"	
74 - 1	20	NI-54-32 静 岡 - 2	200	城層(Iki Formation) (Plio. - Pleist.)	静岡県 (1956) XX (静岡)	
74 - 2	40	- 3	400	"	"	
74 - 3	30	- 5	300	鷺ノ田礫層 (Saginota Gravel bed) (Pleist.)	"	(　)をつけよ。
74 - 4	40	- 6	400	"	"	(　)をつけよ。
74 - 5	30	-10	300	波田内川礫層 (Hatanaigawa Gravel bed) (Plio. - Pleist.)	"	
74 - 6	20	-11	200	曽我層群 (Soga Group) (Plio. - Pleist.)	静岡県 (1956) XX (静岡)	
74 - 8		-11	300	久能山礫層 (Kunozan Gravel bed) (Plio. - Pleist.)	"	(30)に相当
74 - 9	20	-16	200	掛川層群 (Kakegawa Group) (Plio.)	"	
75 - 1	20	NI-54-26 横須賀 - 1	150	梅ケ瀬層中部 (Mid. Umegase F.) (Plio. - Pleist boundary)	陶山国男 成瀬　洋 (1959) XX (千葉)	

1. Number	2. Numeral on the Map	3. Location	4. Height (m)	5. Evidence	6. Reference	7. Note
75 - 2	10	- 2	110	豊房層(Toyofusa F.) (Plio.)	陶山国男 成瀬　洋 (1959) XX(千葉)	
75 - 3		- 3	140-	"	"	10に相当
75 - 4	20	- 5	140	三浦層群中部 (Mid. Miura Group) （伝御～野島層くらい） (Plio.)		〔　〕をつけよ。
76 - 1	10 10	NI-54-20　大多喜 - 9	80	梅ヶ瀬層中部 (Mid. Umegase Formation) (Plio. - Pleist. boundary)	"	
62 - 2	30	-13	250	"	"	
80 - 1	40	NI-53-33　広　島 - 1	400	甲立礫層 (Koutachi Gravel bed) (Plio. - Pleist.)	広島県(1963) XX(広島)	
80 - 2	25	- 6	250	西条層(Saijo Formation) (Mid. Pleist.)	"	(　)をつけよ。
80 - 3	20	- 7	200	"	"	(　)をつけよ。
80 - 4	30	-10	300	甲立礫層 (Koutachi Gravel bed) (Plio. - Pleist.)		
81 - 1	5	NI-53-27　岡山及丸亀 - 1	50	山砂利層 (Mountain Gravels) (Pleist.)	岡山県(1963) XX(岡山)	《　》をつけよ。
81 - 2	20	- 4	200	三豊累層 (Mitoyo F.) メタセコイア含有(断層北側)	香川県(1962) X(香川)	
81 - 3		- 5	50	山砂利層 (Mountain Gravels) (Pleist.)	岡山県(1963) XX(岡山)	
81 - 4	10	- 8	100	三豊累層 (Mitoyo F.) メタセコイア含有(断層北側)	香川県(1962) X(香川)	
81 - 5		- 9	50	未区分礫層 (Plio. - Pleist.)	広島県(1963) XX(広島)	《5》に相当

1.Number	2.Numeral on the Map	3.Location	(m) 4.Height	5.Evidence	6.Reference	7.Note
81 - 6		-10	100	未区分礫層 (Plio. - Pleist.)	広島県（1963）X X（広島）	《10》に相当
81 - 7	50	-13	500	甲立礫層 (Koutachi Gravel bed) (Plio. - Pleist.)	"	
81 - 8	30	-14	300	未区分礫層 (Plio. - Pleist.)	"	《　》をつける
82 - 1	20	NI-53-21 徳 島 - 2	200	大阪層群下部 (Lower Osaka Group) (Plio. - Pleist.)	兵庫県（1951）X X（兵庫）	
82 - 2	10	- 3	100	"	"	
82 - 3	28	-14	280	屋島頂面堆積物 (Plio. - Pleist.)淡水成	斉藤　実（1960),地質雑	
83 - 1	27	NI-53-15 和歌山 - 6	272	大阪層群下部 (Lower Osaka Group) (Plio.)	藤田和夫 石田志朗他 （1963),地球科学 66	
83 - 2		- 7	250	出塔層 (Deto F.) (未詳の Plio. - Pleist.)	"	25に相当
83 - 3	20	-10	200	大阪層群下部 (Lower Osaka Group) (Plio.)	藤田和夫 石田志朗他 （1963),地球科学 66	
83 - 4		-13	120	明石層群 (Akashi Group) (Plio. - Pleist.)	"	12に相当
86 - 1		NI-54-33 御前崎 - 1	60	未詳のPlio. - Pleist.	角　清愛（1958）V	6に相当
86 - 2	10	-13	100	掛川層群 (Kakegawa Group) (Plio.)	静岡県（1956）XX（静岡）	
88 - 1	0	NI-52-16 唐 津 - 2	0	壱岐層上部 (Upper Iki F.) (Upper Plio.),陸成薄層	松井和典（1958）V	

1.Number	2.Numeral on the Map	3.Location	(m) 4.Height	5.Evidence	6.Reference	7.Note
88 - 2		- 3	0	未詳洪積層 (陸成薄層で玄武岩におおわれる)	小林勇・今井功・松井和典 (1955) V	数字 0 が落ちた
88 - 3	15	- 4	150	"	小林勇・今井功・松井和典 (1956) V	《　》をつけよ
88 - 4	9	- 6	90	壱岐層上部 (Upper Iki F.) (Upper Plio.　陸成薄層　)	松井和典(1958) V	
88 - 5	5	- 8	50	田助夾亜炭凝灰質岩層(Tasuke lignite - bearing tuffceus bed.) (Plio.) 厚さ 30 m, 陸成	沢村孝之助・今井　功他(1955)	
89 - 1	((10))	NI-52-10　福　岡 - 2	100	洪積層 (Pleist.) 多摩面？北に傾斜	福岡県(1963) XX (福岡)	
89 - 2	(((6))) ((50))	- 3	60	"	"	(((5))) になおせ
89 - 3	((60)) ((70))	- 4	60 70	"	"	(((6))) になおせ (((7))) になおせ
89 - 4	(((4))) (((4)))	- 6	40	"	"	
89 - 5	(((8)))	- 8	80	"	"	
89 - 6		-11	60	"	"	(((6))) に相当
89 - 7	(((6)))	-15	60	洪積層 (Pleist.) 多摩面？	福岡県(1963) XX (福岡)	
90 - 1	35	NI-52- 4　中　津 - 7	350	大分層群 (Oita Group) (Plio.)	首藤次男(1953)	
90 - 2	34	- 8	340	"	"	
90 - 3		- 9	50	海岸段丘 (下末吉～多摩？)	河野迪也(1956) V	(((5))) に相当
90 - 4	30	-11	300	大分層群 (Oita Group)	首藤次男(1953)	

1. Number	2. Numeral on the Map	3. Location	4. Height (m)	5. Evidence	6. Reference	7. Note
90 - 5	50	-12	500	駅館川層中部 (Mid. Yakkangawa F.)	首藤次男 (1953)	
90 - 6	1	-13	10	琴崎層 (Kotozaki F.) 海成 層厚 20 m	清原清人 (1956)	(　) をつけよ
90 - 7	20	-15	200	大分層群 (Oita Group)	首藤次男 (1953)	
90 - 8	70	-16	700	"	"	
91 - 1	((25))	NI-53-34 松 山 - 4	250	鮮新, 洪積統, 植物有り	愛媛県 (1962) X (愛媛)	
91 - 2	10	- 5	100	鮮新統	"	
91 - 3	10	- 6	100	"	"	
92 - 1		NI-53-28 高 知 - 3	60	穴内層 (Ananai F.) (= 唐の浜層群 Karanohama G.) (Plio.)	高知県 (1960) XX (高知)	6に相当
92 - 2	6	- 4	60	"	"	
92 - 3	10	-13	100	鮮新統, 植物化石有り	愛媛県 (1962) X (愛媛)	
92 - 4		-13	60	鮮新統, 植物化石有り	愛媛県 (1962) X (愛媛)	
97 - 1	((30))	NI-52-17 長 崎 - 1	300	鮮新統, 玄武岩	佐賀県 (1966) X (佐賀)	
97 - 2	((30))	- 2	300	"	長崎県 (1960) XX (長崎)	
97 - 3	((30))	- 3	300	"	"	
97 - 4	((25))	- 4	250	"	"	
97 - 5	((40)) ((20))	- 9	400 200	平戸層 (Hirado F.) (Plio.) 鮮新統玄武岩		

1.Number	2.Numeral on the Map	3.Location	(m) 4.Height	5.Evidence	6.Reference	7.Note
98 - 1	((80))	NI-52-11 熊 本 - 1	800	鮮新統または中新統	大分県（1958）XX（大分）	
98 - 2	50 ((80))	- 2	500 800	鮮新統（薄層） 鮮新統	熊本県（1963）XX（熊本）	
98 - 3	10	- 3	100	筑紫溶岩 (Chikushi lava) この境に砂混り粘土層有り	隈府温泉資料 （橋本光男提供）	《　》をつけよ
98 - 4	20	- 4	200	洪積層 (Pleist.)	熊本県（1963）XX（熊本）	《(　)》をつけよ
98 - 5		- 5	70	洪積層 (Pleist.)　（多摩面）	福岡県（1963）XX（福岡）	(7)に相当
98 - 6	20	- 8	200	鮮新一更新統	熊本県（1963）XX（熊本）	
98 - 7	20	-13	200	筑紫火山岩類中の両輝石安山岩質火山砕屑岩	首藤次男（1962),地質雑 松本達郎・野田光雄・宮久三千年（1962)日本地方地質誌（九州地方）	《　》をつけよ
98 - 8	((50))	-14	500	筑紫火山岩類中の両輝石安山岩質火山砕屑岩	首藤次男（1962),地質雑 松本達郎・野田光雄・宮久三千年（1962)日本地方地質誌（九州地方）	
98 - 9	((40)) ((20))	-15	400 200	"	"	
98 -10	((20))	-16	200	"	"	
99 - 1	15	NI-52- 5 大 分 - 1	150	碩南～大分層群 (Sekinan - Oita G.)	首藤次男（1953）地質雑	
99 - 2	25	- 5	100 200	滝尾層 (Takio F.)	"　(1953) "　(1962)	10に相当 20になおせ
99 - 3	25	- 6	250	碩南～大分層群 (Sekinan - Oita G.)	"　(1953)	
99 - 4	30	- 7	300	"	"　(1953)	
99 - 5	((50))	- 9	500	田中礫層 (Tanaka Gravel bed) (Plio.　陸成）	小野晃二（1963）V	

1. Number	2. Numeral on the Map	3. Location	4. Height (m)	5. Evidence	6. Reference	7. Note
99 - 6	((60))	-10	600	田中礫層 (Tanaka Gravel bed) (Plio. 陸成)	小野晃二 (1963) V	
99 - 7	35	-13	350	鮮新統	熊本県 (1963) XX (熊本)	《40》に訂正
99 - 8	((70))	-14	700	"	成瀬 洋私信による	
100 - 1	((25))	NI-53-35 宇和島 - 1		越層 (Koshi F.) (唐の浜層群 Tonohama G.) (Plio.)	大塚彌之助 (1931)	
100 - 2	8	- 4	80	越層 (Koshi F.) (唐の浜層群 Tonohama G.) (Plio.)	"	
104 - 1	20	NI-52-12 八 代 - 3	200	鮮新～更新統 (Plio. - Pleist.)	熊本県 (1963) XX (熊本)	
104 - 2	((30))	- 4	300	国分層 (Kokubu F.) (Plio. - Pleist.)	鹿児島県 (1961) XX (鹿児島)	
104 - 3	((30))	- 4	300	加久藤層群 (Kakuto Group) 陸成おそらく湖成, Plio. とあるが, 面形態から Mid.~Upper Pleist.	"	
104 - 4	20	- 7	200	鮮新～更新統	熊本県 (1963) XX (熊本)	
104 - 5		- 9	80	"	"	
104 - 6	20	-13	200	口之津層 (Kuchinotsu F.)	長崎県 (1960) XX (長崎)	
104 - 7	9	-14	90	鮮新～更新統	熊本県 (1963) XX (熊本)	
104 - 8	((15))	-15	150	国分層 (Kokubu F.) (Plio. - Pleist.)	鹿児島県 (1961) XX (鹿児島)	
105 - 1	2	NI-52- 6 延 岡 - 6	20	富高層 (Tomitaka Formation) 下末吉？ 海成薄層	野沢保・木野義人 (1966) V	(( )) をつけよ
105 - 2	2	- 7	20	通山浜層 (Toriyamahama F.) (Low. Pleist.) 厚さ 50 m	Tsuchi, R. (1961) Japan, J. Geol. Geogr.	( ) をつけよ

1.Number	2.Numeral on the Map	3.Location	4.Height (m)	5.Evidence	6.Reference	7.Note
105 - 3	(15) (15)	-12	140 140	茶臼原層上部 (Upper Chausubaru F.)	Tsuchi, R.(1961) Japan J.Geol. Geogr.,	
107 - 1	5	NH-52- 7 鹿児島 - 2	50	国分層 (Kokubu F.)	鹿児島県 (1961) X X (鹿児島)	
107 - 2	30	- 5	300	"	"	
107 - 3	10	- 6	100	"	"	
107 - 4	0	- 7	0	国分層 (Kokubu F.)	鹿児島県 (1961) X X (鹿児島)	
107 - 5	20	-10	200	"	"	
107 - 6	10	-16	100	"	"	
108 - 1	(20)	NH-52- 1 宮 崎 - 9	200	通山浜層 (Toriyamahama F.) (= Chausubaru F.)	大塚彌之助 (1932) 地理評 8 巻 P. 85 ~ 95	
108 - 2		-10	140	梅谷層(Umetani F.) (不詳，非海成洪積層)	木野義人 (1959) V	《14》に相当
108 - 3	(25)	-13	230	通山浜層 (Toriyamahama F.) 相当層 (= Chausubaru F.)	大塚彌之助 (1932) 地理評 8 巻 P. 81 ~ 95	
110 - 1	25	NH-52- 8 開聞岳 - 5	250	国分層(Kokubu F.)	鹿児島県 (1961) X X (鹿児島)	

7.2. List of drilling.

1. Number (Quadrangle number and drilling number).
2. Number of place (drilling point) and drilling well number.
3. Location (number of 1:200,000 topographic map and 1:50,000 topographic map).
4. Depth (in m).
5. Remarks.
6. References (Descriptions are shown in the following order: author's name, year of publication, name of the book or periodical in which the scientific paper appeared).

1. Number	2. Name of ;lece (Drilling point)	3. Location	4. Depth (m)	5. Remarks	6. Reference
9- 1	奈井江 Naie	NK-54-13 留 萠 - 4	50	Base of the Noppro F.	山口久之助 et.al., (1964) 北海道水理地質図説明書（札幌）第 8 号（北海道地下資源調）
15- 1	長 都 Osatsu	NK-54-14 札 幌 - 7	500+	"	"
15- 2	"	"	ca. 300	"	木下浩二（1965） 第四紀研究 Vol. 4, 59～68.
15- 3	幌 内 Horomui	- 6	310	"	山口久之助 et.al., (1964)
15- 4	対 雁 Tsuishikari	- 6	0	"	木下浩二（1965）
15- 5	発 寒 ～ 手 稲 Hassamu Teine	-10	50	"	山口久之助 et.al., (1964)
15- 6	茨 戸 Barato	"	50～70	"	"
15- 7	米 里 Yonesato	-10	100+	"	小山内熙 et.al, (1956) V（札幌）
15- 8	丘 珠 Okasu	"	108	"	木下浩二（1965）
15- 9	金 沢 Kanazawa	- 5	135	"	"
15-10	当 別 Tobetsu	"	ca. 600	"	"
15-11	千 歳 Chitose	- 8	ca. 250	"	"
15-12	美 々 Bibi	"	ca. 150	"	"
18- 1	大楽毛 Otanoshike	NK-55-32 釧 路 -10	400+	Base of the Kushiro Group	水野篤行 et.al., (1963) V（阿寒）

1. Number	2. Name of place (drilling point)		3. Location	4. Depth (m)	5. Remarks	6. Reference
18- 2	釧　路 Kushiro		-11	120	"	鈴木泰輔（1958） V（白糖）
22- 1	勇　払 Yufutsu		NK-54-15 苫小牧 - 5	ca.100	Base of the Nopporo F.	木下浩二（1965）
44- 1	長　岡 Nagaoka	No. 1	NJ-54-35 長　岡 - 4	300	Base of the G4 bed	新潟県（1957） 天然ガス調査報告
44- 2	燕 Tsubakuro	新潟No.1	- 3	470	"	"
44- 3	内　野 Uchino	帝石No.2	- 1	520	"	"
44- 4	赤　塚 Akatsuka	帝石No.1	- 2	500	"	"
45- 1	新　潟 Niigata	R-61	NJ-54-28 新　潟 -13	300	"	石和田靖章・本島公司（1958） 地調月報 Vol. 9, 117～122.
45- 2	舞　潟 Maigata	R-1	"	400	"	"
45- 3	加治川 Kajikawa	No. 1	"	450	"	石和田靖章 et.al. (1957) 石油技協誌 Vol. 22, 16～20.
45- 4	新　潟 Niigata	NGm-10	"	350	"	須貝貫二 et.al., (1964) 地質ニュース No. 120, p. 4.
45- 5	梅ノ木 Umenoki	帝石No.1	-14	320	"	新潟県（1957）
56- 1	藤　岡 Fujioka	GS-1	NJ-54-30 宇都宮 -15	524	Base of the upper half of the Kazusa Group at -595m in depth. altitude: +71.21m	福田　理（1964） 地質ニュース No. 114, 1～10.
56- 2	古　河 Koga		- 7	80 × 5	Tama Loam	河井興三（1961） 石油技協誌 Vol. 26, 212～266.

1. Number	2. Name of place (Drilling point)	3. Location	4. Depth (m)	5. Remarks	6. Reference
56- 3	栗 橋 ～ 鷲 宮 Kurihashi ～ Washinomiya	- 8	180 ×	"	河井興三 (1961) 石油技協誌 Vol. 26,212～266
56- 4	不動岡 Fudooka	- 8	180 × 5	Marine shell bed at -110m ±	Otuka, Y. (1936) Bull. Earthq. Res. Inst. Tokyo Imp. Univ., Vol.14. 75～82.
56- 5	小 山 Oyama	- 3	50	Marine shell bed between 40～85m in depth. altitude: +35m	阿久津純 (1964) 宇都宮大・学芸・研究論集 No. 15, pt. 2, 30～46.
65- 1	江 東 Koto R-7	NI-54-25 東 京 - 2	700	Base of the *Uvigerina akitasensis* Zone	金原均二 et. al., (1958) 天然ガス—調査と方法— 361 p. (朝倉)
65- 2	上 野 Ueno R-1	"	600	Bulimina *Uvigerina akitaensis* Zone	"
65- 3	船 橋 Funabashi FR-18	"	1000	Top of the Umegase F. at -1000m	樋口 雄・菊地良樹 (1964) 石油技協誌 Vol. 29,22～28.
65- 4	草 加 Soka R-1	"	800	" at -757m	"
65- 5	春日部 Kasukabe GS-1	- 5	600	Foraminiferal assemblage is resemble to that of the Koshiba F. (Umegase horizon)	福田 理・石和田靖章 (1964) 石油技協誌 Vol. 29,3～21.
66- 1	八幡宿 Yawatajuku K-5	NI-54-19 千 葉 -15	1300+	Top of the Umegase F. at -1300m	河井興三 (1961) 石油技協誌 Vol. 26,212～266.
66- 2	千 葉 Chiba TR-2	-15	1200～1300	Middle to lower part of the Umegase F. at -1300m	金原均二 et.al., (1958)
66- 3	横 芝 Yokoshiba R-1	-11	420 ± 10	U6 horizon	石和田靖章・品田芳二郎 (1959) 地調月報 Vol. 10,563～540.
66- 4	東 金 Togane R-1	"	530	"	石和田靖章・品川芳二郎 (1956) 石油技協誌 Vol. 21,13～21.

1. Number	2. Name of place (Drilling point)	3. Location	4. Depth (m)	5. Remarks	6. Reference
66- 5	飯 岡 Iioka R-1	- 6	70～80	U6 horizon	石和田靖章・品田芳二郎 (1959) 地調月報 Vol. 10,536～540.
66- 6	習志野 Narashino R-1	-14	1200	Kokumoto F. at -1115m	河井興三(1961)
66- 7	成 田 Narita R-1	-10	700+	*Uvigerina akitaensis* Zone between -700～-850m	"
66- 8	小見川 Omigawa R-1	- 5	400+	Top of the Umegase Formation at ca -400m	"
66- 9	竜ヶ崎 Ryugasaki R-1	-13	600～700	Abundant Zone of *Uvigerina akitaensis*	石和田靖章(1957) 有孔虫 Vol. 8, 43－48
71- 1	鴫 野 Shigino	NI-53-14 京都及大阪 - 8	400	Base of the Osaka Group	藤田和夫・鎌田清吉(1964) "大阪湾の地質"大阪湾音波探査委員 62 p
71- 2	都 島 Miyakojima OD－2	"	300	"	池辺展生・竹中準之助(1969) "Rep. on land subsidencd in Osaka" Editional committee for technical report on Osaka land subsidence, 40～88.
71- 3	住 道 Suminodo	"	600+	Ma 1 at -400m	"
71- 4	尼 崎 Amagasaki	-12	ca. 700	Ma 6 at -300m	"
72- 1	善太川下流 NS－6 Lower course of the Zenta River	NI-53-8 名古屋 -2	300+	Top of the Karayama F. at -270m	建設省計画局・愛知県・三重県編(1961) 伊勢湾北部臨海地帯の地盤. 都市地盤調査報告書 第1巻
72- 2	蟹 江 Kanie	"	400	Base of the G2 bed at -130m	杉崎隆一・柴田賢(1961) 地質雑 Vol. 67, 335～345
72- 3	熱田駅 NS－2 Atsuta Station	"	120～130	Top of the Yatagawa F.	建設省計画局・愛知県・三重県(1962)
72- 4	蟹 江 Kanie R－1	-2	341	Top of the Karayama F.	平野地質グループ濃尾平野班(1966) 地質ニュース No.143, 18 － 27.

1. Number	2. Name of place (Drilling point)	3. Location	4. Depth (m)	5. Remarks	6. Reference
72- 5	長 島 Nagashima R－1	"	267	"	〃
83- 9	大阪市港区田中本町 OD－1 Tanaka-motomachi	NI-53-14 京都及大阪 - 9	ca.660	Base of the Osaka Group	池辺展生・竹中準之助（1969）

7.3. List of fault.

1. Number (Quadrangle number and fault number).
2. Name of fault or place.
3. Location (number of 1:200,000 topographic map and 1:50,000 topographic map).
4. Length (in km).
5. Strike.
6. Displacement.
    ?: direction of throw unknown.
    E nd: east throw, quantity unknown.
    S 100: south throw, 100 m.
    E 120*: (* : horizontal slip, estimated at 0).
    E nd R: east throw; throw unknown; right horizontal slip.
    $N \leqq 0.75$ $R \leqq 1.5$: north throw 0.75 km and less; right slip, 1.5 km and less.
    W nd Th: west throw; throw unknown; reverse fault.
    $S < 500$ $R < 5000$: south throw; throw, less than 500 m; right slip, less than 500 m.
    NW nd dip: 50NW: northwest throw; throw unknown; dip 50° NW.
    L nd: left slip; quantity unknown.
7. Evidences.
8. References (Descriptions are shown in the following order: author's name, year of publication.
    Re~~f~~ferred geological maps are indicated with the kinds of maps as follows:
    V: 1:50,000, VII: 1:75,000, XX: 1:200,000, L: 1:500,000).
    p. c.: abbreviation of "Personal Communication".
9. Reference number of abstract.

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
2-1	樺岡北東方 Kabaoka	NL-54-17 天 塩 -1	2	N30E	nd.	Pliocene bed displaced	秦 光男 (1964) L	
2-2	"	"	2	N55E	nd.	"	"	
2-3	"	"	2	N55E	nd.	"	"	
2-4	"	"	5	N55E	N nd.	"	"	
2-5	"	"	4	N40W - NS	nd.	"	"	
2-6	沼川南方 Numakawa	"	4	N60E	S nd.	"	"	
2-7	上勇知 Kamiyuchi	-5, -1	8	N15W	E nd.	"	"	
2-8	"	-1	3	N60E	S nd.	"	"	
2-9	"	"	3	N60E	S nd.	"	"	
2-10	豊幌 Toyohoro	-1, -2	17	N25W	W nd.	"	"	
2-11	上幌延 Kamihoronobe	-2, -3	22	N25W	W nd.	"	"	
2-12	豊富温泉－雄信内 Toyotomi Hot Spring - Obunai	-2, -3, -4	38	N25W	W nd.	"	"	
2-13	南更岸東方 Minamisarakishi	-4	5	N80W	N nd.	"	"	
2-14	"	"	5	N80W	S nd.	"	"	
2-15	中央北東方 Chuo		3	N				
2-16	中央南東 Chuo	-4, NL-54-18 -1	4	N30W	nd.	"	"	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
3-1	ウエンナイ川上流 Uennai R.	NL-54-11 枝幸 -7	3	N20W	E nd. R	Pliocene bed displaced	小山内熙他(1963) V	
3-2	中頓別東方 Nakatonbetsu	-11	4.5	N10W	nd.	"	"	
3-3	"	-11	10	NS	W nd.	"	"	
3-4	毛登別附近 Ketobetsu	-11, -12	12.5	N60 - N5W	W175*	"	小山内熙他(1963) V 長谷川潔他(1962) V	
3-5	上頓別－音戒富士 Kamitonbetsu - Mt. Otoi Fuji	-12	10	NS	W nd.	"	長谷川潔他(1962) V	
3-6	咲来峠附近 Sakkuru Pass	-12	3	N10E	E nd.	"	"	
3-7	"	-12	11	N60E	N nd.	"	"	
3-8	ツネオナイ川上流 Tsuneonai R.	-12	>6	N60E	N nd.	"	"	
3-9	十六線西方 Jurokusen	-14	6	N25W	E360*	"	田中啓策(1950) V	
4-1	初山別断層 Shosanbetsu ft.	NL-54-18 羽幌 -1, -2	28	N45W	SW nd. Th, dip 45 - 50°	"	秦 光男他(1961) V 松野久也他(1960) V	
4-2	筑別背斜断層 Chikubetsu anticl. ft.	-1, -2, -3	28	N30W	SW nd. Th.	"	秦 光男他(1961) V 松野久也他(1960) V 山口昇一他(1963) V	
4-3	羽幌背斜断層 Haboro anticl. ft.	-2, -3,	25	N30W	SW nd. Th	Pliocene bed displaced	松野久也他(1960) V 山口昇一他(1963) V	
4-4	三毛別断層 Sankebetsu ft.	-7, -3, -4	10	N30W	E250*, R 1800*	Quaternary bed displaced	対島坤六他(1954) V 秦 光男(1964) V	
4-5	真砂トンネル断層 Masago Tonnel ft.	-8	7.2	N40W	E1500*	Pliocene bed displaced	対島坤六他(1954) V	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
4-6	武蔵水道 Musashi Channel	-10			nd.	Neogene bed could be disllaced.	秦　光男(1960) V	
5-1	中幌内西方 Nakahoronai	NL-54-12 名　寄 -5	2	EW	S nd.	Pliocene bed displaced	土居繁雄他(1960) V	
5-2	上幌内西方 Kamihoronai	-5, -6	3	N45E	E nd.	〃	〃　V 酒勾純俊(1960) V	
5-3	オロウェン幌内川 Orouenhoronai R.	-6	3.3	N20W	W nd.	〃	酒勾純俊(1960) V	
5-4	矢文山 Mt. Yabumi	-6	4	N35E	nd.	〃	〃	
5-5	政和西方 Seiwa	-15, -16	8.5	N15E - N60W	E nd.	〃	猪木幸男他(1958) V(幌加内)	
9-1	小豆沢断層 Shozuzawa ft.	NK-54-13 留　萠 -2	14	N10 - 30E	E nd.	Pliocene bed displaced	秦　光男(1965) L	
9-2	川上附近 Kawakami	-2	5	N10W	E nd.	〃	〃	
9-3	尾白利加－上徳富 Oshirorika - Kamitoppu	-3	6	N15E	E nd.	〃	〃	
9-4	砂金沢 Sakinzawa	-3	4	N55E	S nd.	〃	〃	
9-5	総富地附近 Sofuchi	-3	6	N65 - 30E	SE20 TH.	abrupt change in height of a terrace	松井　寛他(1965) V (砂川)	
9-6	浦臼断層 Urausu ft.	-3, -4	10	N65 - 30E	E20 TH.	〃	〃	
9-7	浦臼沢 Urausuzawa	-4	5	N60W	N10 TH.	〃	〃	
9-8	豊平断層 Toyohira ft.	-4	10	NS - N20E	W nd. Th.	Pliocene bed displaced		

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
9-*9*	札的沢断層 Sattekizawa ft.	-4	6	NS - N35E	W nd. Th.	"	"	
9-*10*	留萠南東方 Rumoi	-5	12	N40W	N nd.	"	対島坤六(1954) V	
9-*11*	"	-5	6	N10 - 35W	N nd.	"	"	
9-12	"	-5	3	N50W	nd.	"	"	
9-13	"	-5	2.5	N40E	E nd.	"	"	
9-14	大別苅一暑寒沢附近 Obekkari - Shokanzawa	-10, -6	5.5	N35 - 85W	nd.	"	佐藤博之他(1963) V " (1964) V	
9-*15*	黄金岳南西方 Mt. Kogane	-11	2.5	N55W	N50*	"	秦　光男他(1957) V	
9-16	察来山南西方 Mt. Sakkuru	-7	5	NS	W80*	"	"	
9-17	当別断層 Tobetsu ft.	-8, NK-54-14 札幌 -5	12	NS	E nd.	"	垣見俊弘他(1958) V " (1956) V	
9-18	別狩岳衝上 Bekkari-dake thrust ft.	-8	6.5	NS	E nd. Th.	"	垣見俊弘他(1958) V	
9-19	二番川 Niban R.	-8	2	N50W	N nd.	"	"	
9-20	二番川一青山中央 Niban R. - Aoyama-Chuo	-8	5	N25E	W nd.	"	"	
9-21	青山中央東方 Aoyama-chuo	-8	3	N5W	W nd.	Pliocene bed displaced	垣見俊弘(1958) V	
9-22	青山中央西方 Aoyama-chuo	-8	3	N25E	E nd.	"	"	
9-23	四号沢一ヤバチ沢 Yongozawa - Yabachizawa	-8	8	N25 - 40E	W nd.	"	"	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
9-24	須部津川 Subetsu R.	-8	7	N50E	W nd.	"	"	
9-25	"	-8	7	N50E	W nd.	"	"	
9-26	"	-8	4	N40E	S nd.	"	"	
10-1	美瑛川 Biei R.	NK-54-7 旭 川 -11, -7, -8	16	N45W	SW50	Lava flows(Pleistocene) displaced	勝井義雄他(1963) V(十勝岳)	
10-2	"	-8	7.5	N60E	SE100-200	Pleistocene bed displaced	"	
10-3	"	-8	2	N30E	nd.	"	"	
10-4	オプタテシケ山 Mt. Oputateshike	-8	4	N45W	nd.	"	"	
10-5	美瑛温泉 Hot Spring Biei	-8	6	N30W	nd.	"	"	
10-6	ベルルイ川 Berurui R.	-8	10	N80E - N30W	nd.	"	"	
10-7	十勝川上流 Tokachi R.	-8	11	N50E	nd.	"	"	
10-8	内大部断層 Naidaibe ft.	-14, -15	16	N50 - 20W	W nd.	Pliocene bed displaced	鈴木 醇(1953) V(深川) 河野義礼他(1956) V(歌志内)	
10-9	神居断層 Kamui ft.	-15	>7.5	N20W	W nd.		河野義礼他(1956) V(歌志内)	
11-1	螺湾伏在断層 Rawan ft.	NK-54-1 北 見 -8	>20	N10W	W nd.	Pliocene bed displaced	三谷勝利他(1960) V	
11-2	川向から北 Kawamukai	-8	> 5	N15W	W nd.	Pliocene bed displaced	三谷勝利他(1960) V	
11-3	陸別附近 Rikubetsu	-8	> 3	NS - N50E	nd.	"	"	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
11-4	ポントマム川 Pontomamu R.	-8	> 7	N50W	S nd.	"	"	
11-5	大誉地－新トマム Oyochi - Shintomamu	-8	>14	N30W	W nd.	"	"	
11-6	パンケトプシ川上流－大誉地 Panketobushi R. - Oyochi	-8	10	N45W - EW	W nd.	"	"	
11-7	斗満附近 Tomamu	-8	4	N60E	S nd.	"	"	
11-8	上斗満南西方 Kamitomamu	-8	5	N35E	S nd.	"	"	
11-9	大誉地南西方 Oyochi	-8	6	N25E	E nd.	"	"	
11-10	塩幌川上流－トメルシベ沢 Shihoro R. - Tomerushibezawa	-8	10	N35E - EW	nd.	"	"	
11-11	トメルシベ沢上流 Tomerushibezawa	-8	4	N50E	nd.	"	"	
11-12	上利別西方 Kamitoshibetsu	-8	4.5	N40 - 80E	N nd.	"	"	
11-13	上利別東方 Kamitoshibetsu	-8	> 3	N60 - 30E	W nd.	"	"	
11-14	"	-8	>1.5	N30W	E nd.	"	"	
11-15	大誉地南東方 Kamitoshibetsu	-8	3	N70W	nd.	"	"	
11-16	大誉地南東方 Oyochi	-8	4	N50E	nd.	"	"	
11-17	"	-8	> 1	N80W	nd.	"	"	
11-18	三国山東方 Mt. Mikuni	-15	2.5	N30E	W nd.	"	斉藤昌之他（1960）V	
12-1	丸山東方 Mt. Maru	NK-55-31 斜　里 -2	2.5	N60E	nd.	displacement Recent pumice deposit	杉本良也（1960）V	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
12-2	根室鉱山付近 Nemuro Mine	-2	13	N35E	E nd.	Pliocene bed displaced	"	
12-3	"	-2	1.7	N65E	S nd.	"	"	
12-4	藻琴山 Mt. Mokoto	-10	3	N80E	S nd.	Pleistocene bed displaced	勝井義雄他 (1962) V	
12-5	"	-10	4	N70E	S nd.	"	"	
12-6	屈斜路地震断層 Kutcharo earthq. ft.	-14, -15, -11, -12	35	N40W	NE nd.	formed at Kutcharo Earthquake (1938)	"　（屈斜路湖）	
12-7	美幌峠 Bihoro Pass	-14	1.7	N60E	S nd.	Pleistocene bed displaced	"	
12-8	阿寒断層 Akan ft.	-16	17	N50E	W nd.	"	佐藤博之 (1965) V	
12-9	ペンケトー東方 Penketo	-16	≥ 3	N30W	W nd.	"	"	
12-10	ペンケトー南方 Panketo	-16	4	N80E	nd.	Pliocene bed displaced	"	
12-11	瓢簞沼 Hyotan-numa	-16	3	N80E	nd.	"	"	
12-12	阿寒川２号断層 Akan-gawa II ft.	NK-55-32 釧 路 -13, -16	10	N20E	nd.	"	佐藤博之 (1965) V 水野篤行他 (1960) V	
12-13	北陽断層 Hokuyo ft.	Nk-55-32 釧 路 -13	15	N40E	S 100	"	"	
14-1	余市町 Yoichi	NK-54-20 岩 内 -1	2.5	NS	W nd.	Pliocene bed displaced	猪木幸男他 (1954) V	
14-2	余市－仁木 Yoichi - Niki	-1, -2,	≥8.5	N25 - 40E	E nd.	"	猪木幸男他 (1954) V 太田良平 (1954) V	
14-3	登川沿い Nobori R.	-2	4	NS	W nd.	"	太田良平他 (1954) V 根本忠寛他 (1955) V	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
14-4	泥の木山附近 Mt. Doronoki	-5	5	N20E	nd.	Pliocene bad displaced	根本忠寛他（1955）V	
14-5	"	-5	4	N60E	N nd.	"	"	
14-6	美国川 Bikuni R.	-5	4	N45E	E nd.	"	"	
14-7	古平川 Furubira R.	-5	3.5	N30E	nd.	"	"	
14-8	"	-5	>1.5	N30E	nd.	"	"	
14-9	天狗嶽 Tengu-dake	-5	2	N15E	nd.	"	"	
14-10	岩内平野北東辺 Pl. Iwanai	-6, -7	12	N35E	SW nd.	topographically estimated	斎藤正次他（1952）V	S.24
14-11	無　沢 Nashizawa	-7	4	N45E	S nd.	Pliocene bed displaced	広川　治他（1955）V 国府谷盛明他（1961）V	
14-12	昆布川 Kombu R.	-8	10	N20E - 20W	E nd.	"		
14-13	"	-8	3	N65E	N nd.	"	"	
18-1	飽別断層 Akubetsu ft.	NK-55-32 釧　路 -13	6	N70W	S 200	Pliocene bed displaced	水野篤行他（1960）V	
18-2	苔樋沢断層 Koketoizawa ft.	"	10	N50E	N 60	"	"	
18-3	舌辛川断層 Shitakara ft.	-13, -14 NK-54-2 帯　広 -2　-2	30	N20 - 45E	E 20	"	水野篤行他（1960）V 佐藤　茂（1961）V	
18-4	オクヨンナイ断層 Okuyonnai ft.	-13	2	N50E	N nd.	"	水野篤行他（1960）V	
18-5	知茶布1号断層 Chichappu No.1 ft.	-13, -14	12	N35 - 60W	E 120*	"	水野篤行他（1963）V	
18-6	知茶布1号断層 Chichappu No.3 ft.	-14	4	N10E	W nd.	"	水野篤行他（1963）V	
18-7	トマリベツ川 Tomaribetsu R.	-14	2	N40W	W 120*	"	"	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
18-8	"	-14	5	N40 - 80E	S nd.	"	"	
21-1	洞爺湖附近 L. Toyo	NK-54-21 室 蘭 -1	4.5	N45E	S nd.	Pliocene bed displaced	太田良平他(1956) V	
21-2	"	-1	6.5	N60W - N85E	S nd.	"	"	
21-3	"	-1	7	N55E	N nd.	"	"	
21-4	"	-1	4	N35E	N nd.	"	"	
21-5	"	-1	5.5	N55W	S nd.	Pliocene bed displaced	太田良平(1956) V	
21-6	"	-1	2.2	N35W	nd.	"	"	
21-7	"	-1	2.7	N20W	W nd.	"	"	
22-1	ホロホロ山附近 Mt. Horohoro	NK-54-15 苫小牧 -13	4.5	EW - N60W	nd.	Lava flows of Horohoro Volcano displaced	太田良平(1954) V	
22-2	"	-13	6.5	N50E	nd.	"	"	
22-3	厚真断層 Azuma ft.	-1 NK-54-14 札 幌 -5	23	N60 - 10W	W nd. Th.	Pliocene bed displaced	山口昇一(1960) V 松野久也他(1960) V	
22-4	二の宮断層 Ninomiya ft.	-1	6.5	N35W	W nd. Th.	"	山口昇一(1960) V	
22-5	白老滝附近 Shiraoi fall	-13	3	N85W	S nd.	Lava flows of Horohoro Volcano displaced	太田良平(1954) V	
22-6	"	-13	2.5	N50E	N nd.	"	"	
23-1	三石断層 Mitsuishi ft.	NK-54-9 浦 河 -10, -11	>20	N10E - N50W	E nd.	Pliocene bed displaced	松野久也他(1957) V 佐藤博之他(1960) V(春立)	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
23-2	平取断層 Biratori ft.	-10, -14, -13, NK-54-8 夕張岳 -16 NK-54-14 札 幌 -4, -3	58	N30 - 50W	W nd. Th.	"	松野久也他（1957）V（静内） 山口昇一 （1958）V（内別） 今井 功他（1958）V（富川） 松野久也他（1960）V（早来） 〃 （〃）V（追分）	
24-1	広尾地方 T. Hiroo	NK-54-3 広 尾 -11	3.5	N40E - N70W	E nd.	Pliocene bed displaced	橋本誠二他（1960）V	
26-1	二股岳附近 Futamata-dake	NK-54-22 函 館 -5	7	N35W	nd.	Pliocene bed displaced	広川 治他（1960）L	
26-2	梯子岳附近 Hashigo-dake	-10	7	N50 - 30W	nd.	"	"	
26-3	"	-10	4	N15W	nd.	"	"	
26-4	"	-10	4.5	N15W	nd.	"	"	
26-5	"	-10	3	N15E	nd.	"	"	
27-1	下風呂附近 Shimoburo	NK-54-16 -16	1.7	N20E	W nd.	Pliocene bed displaced	上村不二雄他（1957）V	
27-2	甲崎附近 Kabuto-zaki	-16	4.2	N50E	E nd.	"	"	
27-3	易国間川上流 Ikokuma R.	-16 NK-54-22 函 館 -4	2.5	N80W	S nd.	"	上村不二雄（1957）V " （1962）V	
28-1	八幡嶽附近 Hachiman-dake	NK-54-23 青 森 -4	1.5	N30E	nd.	Plio.-Pleistocene bed displaced.	広川 治他（1960）L	
28-2	母衣月附近 Horozuki	-5	2.5	N10W	W nd.	Pliocene bed displaced	斉藤正次（1957）V（母衣月）	
28-3	横岳附近 Yokodake	-6	1.8	NS	nd.	"	上村不二雄他（1959）V	
28-4	大平－小国峠附近 Odai-Oguni Pass	-6	6.5	N5E	nd.	"	"	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
28-5	津軽断層 Tsugaru ft.	-9, -10, -6, -7, -8	51	NS - N30 W - NS	W nd.	〃	太田良平他（1957）V（三厩） 対島坤六（1957）　（小泊） 上村不二雄他（1959）V(蟹田) 対島坤六（1961）XX 〃　（〃）	
28-6	内真部川上流 Uchimappe R.	-7	4.5	N5W	E nd.	Pliocene bed displaced	対島坤六（1961）XX	
28-7	小田川ダム Kodagawa-dam	-7	3.5	N20W	W nd.	〃	〃	
28-8	田沢森山ー土筆森山附近 Mt. Tazawamori - Tsukusimoriyama	-7, -8	6.5	N20E	E nd.	〃	〃	
28-9	小泊東方 Kodomari	-10	3.5	N20W	W nd.	〃	〃	
28-10	八景森附近 Hakkeimori	-16	5	NS	W nd.	〃	広川　治他（1960）L	
28-11	〃	-16	5	N60E	nd.	〃	〃	
29-1	砂子又附近 Sunakomata	NK-54-17 野辺地 -9	8	N25W	W nd.	Pliocene bed displaced	今井　功（1961）	
29-2	〃	-9	5	N25E	E nd. Th.	〃	〃	
30-1	陸奥岩崎附近 Mutsu Iwasaki	Nk-54-30 深浦 -1	1.5	N50E	S nd.	Pliocene bed displaced	広川　治他（1960）L	
31-1	坊沢断層 Bozawa ft.	NK-54-24 弘前 -11	14	N25E	E 200*	flexure of river terrace (Quaternary)	平山次郎他（1963）V	S.40
31-2	前山断層 Maeyama ft.	-11	15	N15E	E nd.	Pliocene bed displaced	〃	
31-3	長場内西方 Osabanai	-15	1.5	N70E	nd.	〃	広川　治他（1960）L	
31-4	鶴形ー森岳 Tsurugata - Moritake	-15, -16	4	N20E	W nd.	〃	〃	
32-1	折爪断層 Oritsume ft.	NK-54-18 入戸 -10, -11	2.1	N25W	Northern part:E70	displacement of Kindaichi Plain (Tama age)	K. Chinzei (1966)	S.108

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
33-*1*	男鹿中断層 Oganaka ft.	NJ-54-25 男鹿半島 -1	8.5	N25W	E nd.	Pliocene bed displaced	藤岡一男	
33-2	申川断層 Sarukawa ft.	-1	3.5	N5W	nd.	"	"	
34-*1*	螢宿温泉附近 Oshuku Hot Spring	NJ-54-19 秋田 -2, -3	16	NS - N25W	E nd.	Pliocene bed displaced	平山次郎他（1959）L	
34-2	須賀倉山附近 Mt. Sugakura	-3	2	N10W	W nd.	"	"	
34-*3*	"	-3	3.5	N30W	E nd.	"	"	
34-*4*	千屋地震断層 Senya Earthquake ft.	-7, -8	20	NS	W nd.	formed at Rikuu Earthquake (1896)	藤原健蔵（1954）	K.1
34-*5*	真昼岳附近より南 Mahirudake	-8	10	NS	E nd.	Pliocene bed displaced	平山次郎他（1959）L	
34-*6*	割倉山断層 （川舟地震断層） Warikurayama ft.	-8 NK-54-20 新庄 -5	26	N25 - 30E	E nd.	Pleistocene bed displaced. displacement of Pliocene S. (extension of Kawafune Earthq. ft. <1896>)	大沢　穠他（1960）X X 大沢　穠他（1964）X X 平山次郎他（1959）L	
34-*7*	狙山西方 Mt. Manaita	-13	5	NS	W nd.	Pliocene bed displaced	平山次郎他（1959）L	
35-*1*	南晶山断層 Nanshozan ft.	NJ-54-13 盛岡 -14, -15	16	N45W - NS	E nd. Th.	Pleistocene bed displaced. fresh scarp	平山次郎他（1959）L 金子史朗（1955）	0.24
35-*2*	上平断層 Kamihira ft.	-15, -16	10	NS - N15E	E nd. Th.	Pleistocene bed displaced	"	0.24

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
35-3	草井山断層 Kusaiyama ft.	-16, JK-54-19 秋田 -4	18	N20 - 85E	E nd. Th.	Pleistocene bed displaced	平山次郎他（1959）L 金子史朗他（1959）L	).24
35-4	志戸平温泉付近 Shidodaira Hot Spring	-16, JK-54-19 秋田 -4	7	N45W	N nd.	pliocene bed displaced	平山次郎他（1959）L	
35-5	須賀倉山附近 Mt. Sugakura	-15, JK-54-19 秋田 -3	10	N65E	S nd.	"	"	
35-6	山王海ダム附近 Sannokai Dam	-15, -16	11	NS - N65W	W nd.	"	"	
35-7	台山附近 Mt. Dai	-15, -16	4	N30E	S nd.	"	"	
36-1	平沢町附近 Hirasawa T.	NJ-54-26 酒田 -1	8	N20W	nd.	Pliocene bed displaced	大沢 穠(1964) X X	
36-2	鷹尾山附近 Mt. Takao	-2, -3	10	N5E	nd.	"	"	
36-3	"	-3	10	NS	nd.	"	"	
37-1	石渕ダム附近 Ishibuchi Dam	NJ-54-20 新庄 -2	12	N10E - 35W	nd.	Plio-Pleistocene bed displaced	平山次郎（1959）L	
37-2	沼ノ森附近 Numanomori	-3	6	N20E	W nd.	"	片山信夫（1958）Ⅷ（鬼首）	
37-3	"	-3	4	N30E	E nd.	"	"	
37-4	"	-3	6	N60E	N nd.	"	"	
37-5	"	-3	5	N35E	nd.	"	"	
37-6	栗駒山東 Mt. Kurikoma	-3	7	N5W	E nd.	Plio-Pleistocene bed displaced	片山信夫（1958）Ⅷ(鬼首）	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
37-7	栗駒ダム附近 Kurikoma Dam	-3	10	NS - N10E	W nd.	Plio-Pleistocene bed displaced	片山信夫他(1958)Ⅶ（鬼首）	
37-8	"	-3, -4	13	N5E - NS	nd.	"	"	
37-9	"	-3	7	N20E	E nd.	"	"	
37-10	猫ケ森 Nekogamori	-3	12	N30E	E nd.	"	"	
37-11	松倉 Matsukura	-3	5	N50W	S nd.	"	"	
37-12	高玉 Takadama	-3, -4	4	N50W	N nd.	"	"	
37-13	湯ノ倉温泉附近 Yunokura Hot Spring	-3	3	N10W	nd.	"	"	
37-14	天狗森附近 Tengumori	-3, -7	14	EW	nd.	Pliocene bed displaced	"	
37-15	草木沢附近 Kusakizawa	-4	2	N10E	nd.	Plio-Pleistocene bed displaced	"	
37-16	荒雄岳周辺 Araodake	-7, -8	13	N40E	W nd.	Pliocene bed displaced	"	
37-17	"	-7	3.5	EW	S nd.	Plio-Pleistocene bed displaced	"	
37-18	"	-7	3.5	N45E	E nd.	Pliocene bed displaced	"	
37-19	"	-7, -8	6	N20E	W nd.	Plio-Pleistocene bed displaced	"	
37-20	"	-7	5	EW(波状)	N nd.	"	"	
37-21	"	-8	4	NS	E nd.	"	"	
37-22	"	-8	5.5	N15W	W nd.	"	"	
37-23	"	-8	4.5	N45W - 10E	S nd.	"	"	
37-24	"	-8	7	EW	nd.	"	"	
37-25	"	-8	≥ 2	N20W	nd.	"	"	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
37-26	"	-8	5	N35W	W nd.	Pliocene bed displaced	平山次郎 (1959) L	
37-27	鬼首峠附近 Onikobe Pass	-7	7	N25W	E nd.	Pliocene bed displaced	平山次郎他 (1959) L	
37-28	吹突岳周辺 Futtsukidake	-7	10.5	EW	N nd.	"	片山信夫 (1958) Ⅷ	
37-29	吹突岳周辺 Futtsukidake	-7	4	N70E	N nd.	Pliocene bed displaced	平山次郎他 (1959) L	
37-30	"	-6, -7	5	N30E	W nd.	"	"	
37-31	"	-6, -7	18	N40W	E nd.	"	"	
37-32	足倉山附近 Mt. Ashikura	-6	18	N10 - 65W	W nd.	"	"	
37-33	"	-6	4	N55W	N nd.	"	"	
37-34	経壇原断層 Kyodambara ft.	-12	18	NS	W 15	Pleistocene bed displaced River tenaces displaced	大沢 穠他 (1964) XX 杉村 新 (1952)	S.54
37-35	田郎附近 Taro	-15	4	N5W	E nd.	Pliocene bed displaced	平山次郎他 (1959) L	
37-36	"	-11, -15	9	N35 - 70E	E nd.	"	"	
37-37	升田－清川 Masuda - Kiyokawa	-14, -15, -16	29	N5E	W nd.	"	平山次郎他 (1959) L 大沢 穠他 (1964) XX	
37-38	松山断層 Matsuyama ft.	-16	5	NS	W nd. Th, dip: low	topographically estimated	杉村 新 (1952)	S.54
38-1	胆沢－油島撓曲線 Isawa-Yushima flexure	NJ-54-14 一関 -14, -15, -16	40	N5W	E nd.	flexure in Pliocene bed and river terrace surface steeply formed	平山次郎 (1959) L 中川久夫 (1963)	S.93
39-1	大佐渡山地 Osado Mts.	NJ-54-33 相川 -12	15	N35E	E nd.	Pliocene bed displaced	福田 理他 (1958) L	
39-2	"	-12	3	N60W	S nd.	"	"	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
39-*3*	大佐渡山地 Osado Mts.	-12 NJ-54-43 長岡 -9	7	N10E	E nd.	Pliocene bed displaced	福田 理他 (1958) L	
40-*1*	野川断層 Nogawa ft.	NJ-54-27 村上 -3, -4	18	N20W	E nd.	fresh scarp	Fujiwara, K. (1956)	H.16
40-*2*	櫛形山脈東麓 Kushigata Mts.	NJ-54-28 新潟 -9	21	N20E	E nd.	Pliocene bed displaced	福田 理他 (1958) L	
40-3	牟礼山 Mt. Mure	-8	> 7	NS	nd.	"	平山次郎他 (1959) L	
40-*4*	S_3 （粟島南方） Niigata Earthquake ft.	-15	3	N30E	E nd.	formed at Niigata Earthquake (1964)	茂木昭夫他 (1965)	
41-1	富谷南西方 Tomiya	NJ-54-21 仙台 -2	2	N55W	E nd.	Pliocene bed displaced	平山次郎他 (1959) L	
41-2	"	-2	1.5	N40E	E nd.	"	"	
41-3	"	-2	1	N45W	E nd.	"	"	
41-4	"	-2	3	N45E	E nd.	"	"	
41-5	"	-2	1.5	N30W	E nd.	"	"	
41-*6*	"	-2	6	N45E	W nd.	"	"	
41-7	"	-2	4	N35W	W nd.	"	"	
41-*8*	長町－利府線 Nagamachi- Rifu tectonic line	-3, -2, NJ-54-15 石巻 -14	27	N40 - 60E	S nd.	displacement of Aobayama formation (Pleistocene)	生出慶司 中川久夫他 (1961) 神戸信和 (1959) X X	S.53 S.56
41-*9*	C撓曲線 C flexure line	-3	5	N55W	N nd.	flexure of Aobayama tenace	中川久夫他 (1961)	S.56
41-*10*	D撓曲線 D flexure line	-3	5	N55W	N nd.	"	"	S.56

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
41-*11*	鈎取線 Kagitori tectonic line	-3	6	N50W	N nd.	Higher terrace deposit and Aobayama formation displaced	田山利三郎 (1934) 生出慶司 (1961)	K.15 S.52, 53,56
41-*12*	鈎取線延長 Extension of Kagitori tectonic line	-3, -7, -2	14	N20E - 75W arc.	E nd.	"	生出慶司 (1961)	S.52
41-*13*	大倉ダム Okura Dam	-6, -7	7	N30W	W nd.	Pliocene bed displaced	平山次郎他 (1959) L	
41-*14*	作並地方 Sakunami	-6, -7	9	NS	E nd.	"	"	
41-*15*	村田町北方 Murata	-8, -4	8	N60E	S nd.	"	"	
41-16	引竜ダム Hikiryu Dam	-10	3	N60W	N140*	"	別所文吉 (1962) V (山形北西部)	
41-17	間沢附近 Mazawa	-14	3	N50W	N nd.	"	"	
41-18	宮宿附近 Miyajuku	-15	6.5	N10W	E 120*	"	"	
41-*19*	送橋附近 Okurihashi	-14, -15	8.5	NS	E nd.	"	"	
41-20	"	-15	3.5	N25E	W nd.	"	"	
41-21	"	-15	2	N45E	S nd.	"	"	
41-22	三郷附近 Sango	-14	4	N55E	S nd.	"	"	
41-23	"	-14	2	NS	E nd.	"	"	
41-24	"	-15	2.5	N65E	nd.	"	"	
41-25	上反田附近 Kamisorida	-15	2.5	N10W	nd.	"	"	
41-*26*	荒砥町北東 Arato	-15, -16	23	N30W	W nd.	"	平山次郎他 (1959) L	
41-*27*	葉山断層 Hayama ft.	-15, -16, NJ-54-27 村 上 -4	28	N30E - NS	E nd.	fresh scarp	Fujiwara, K. (1956)	H.16

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
44-1	魚沼丘陵 Uonuma Hill	NJ-54-34 長 岡 -4, NJ-54-35 高 田 -1	17	N10E	E nd.	Pliocene bed displaced	福田 理他 (1958) L	
44-2	出雲崎町南方 Izumozaki	-7, -8	10	N50E	Northeast part: E nd. Southwest part: W nd.	" "	"	
44-3	"	-7, -8	9	N30E	E nd.	"	"	
45-1	東山温泉附近 Higashiyama Hot Spring	NJ-54-28 新 潟 -4	2	N40E	NW nd. dip: 50 NW	Yukawa river terrace deposit (Pleistocene) displaced	小林 学 (1943)	S.70
45-2	赤崩山南 Mt. Akakuzure	-2, -3, 7	19	N10E	E nd.	Pliocene bed displaced	福田 理他 (1958) L	
45-3	野沢町附近 Nozawa	-6, -7, -8	34	N5E	W nd.	"	"	
45-4	滝谷附近 Takiya	-7, -8	15	N30W - NS	E nd.	"	"	
45-5	鹿瀬附近 Kanose	-6, -10, -11	26	N40E	S nd.	"	"	
45-6	加茂附近 Kamo	-14, -15	22	N40E	E nd.	"	"	
46-1	双葉断層 Futaba ft.	NJ-54-22 福 島 -2, -3, -4, NJ-54-23 白 河 -1	75	N15W	E nd. Th.	Pliocene bed displaced	福田 理他 (1958) L 岩生周一他 (1961) V (井出, 川前)	
46-2	桑折附近 Koori	-5, -9, -10	6	N40E	E 12	Alluvial fan displaced topographically estimated	Fujiwara, K. (1958)	K.4
46-3	吾妻山麓 Mt. Azuma	-10	19	N45W - NS -N45E (arc.)	E 15	"	"	K.4

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
46-4	豪士山断層 Goshiyama ft.	-13, -14, NJ-54-21 仙 台 -1	31	N10W	W 500	fresh scarp	Fujiwara, K. (1958)	H.16
46-5	笹野山断層 Sasanoyama ft.	-13, NJ-54-21 仙 台 -16	11	N20 - 50W	E 300	"	" (1956)	H.16
46-6	檜原湖附近 Hibara L.	-13, -14	24	N10W	W nd.	Pliocene bed displaced	福田 理他 (1958) L	
47-1	飯山一藪田線 Iiyama - Yabuta tectonic line	NJ-53-11 七 尾 -3	2	EW	S nd.	"	今井 功 (1967) V	
47-2	邑知潟地溝南側急斜帯 Steepdip zone of Ochigata depression southern side	-3	8	N35E	N nd.	Himi formation (Pleistocene) steeply displaced	"	
47-3	三千防山附近 Mt. Sanzenbo	-4	7	N80W	S nd.	Pliocene bed displaced	" XX	
47-4	"	-4	3	N30E	nd.	"	"	
47-5	"	-4	6	N60E	nd.	"	"	
47-6	"	-4, NJ-53-5 富山	5	N40E	S nd.	"	"	
47-7	津幡町北方 Tsubata	-4, -8 , -16	5	N30E	E nd.	"	"	
47-8	津幡町北方 Tsubata	-4, -8	9	N80E	nd.	Pliocene bed displaced	今井 功他 (1967) XX	
47-9	"	-8	3	N30E	W nd.	"	"	
48-1	小谷断層 Otari ft.	NJ-53-5 富 山 -3, -4, NJ-53-6 高 山 -1	26	N25E - NS	E nd.	Pleistocene bed displaced "	姫川団研グループ (1958)	N.18
48-2	姫川断層 Himekawa ft.	-4	17	N20E	E nd.	"	"	N.18

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
48-3	中山附近 Nakayama	-7, -10, -11	7	N30E	W nd.	base of fan deposits displaced	角　靖夫 (1967) V (三日市)	
48-4	前沢附近 Maezawa	-11	1	N30E	W nd.	"	"	
48-4'	"	-11	0.5	N30E	W nd.	"	"	
48-5	小口瀬戸北方 Koguchiseto	-14	1.2	N30W	W nd.	Pliocene bed displaced	今井　功 (1965) V	
48-6	"	-14	2.5	N35 - 20E	E nd.	"	"	
48-7	谷内 Yachi	-14	2	N25E	W nd.	"	"	
48-*8*	柏戸断層 Kayado ft.	-14	8	N10E	W nd.	"	"	
48-9	海老坂断層（東断層） Ebisaka ft. (east ft.)	-16	3	N5E	W nd.	"	坂本　享 (1963) V	
48-10	海老坂断層（中断層） Ebisaka ft. (middle ft.)	-16	1.5	N5E	W nd.	"	"	
48-11	北小谷附近 Kitaotari	-3, -4	4.5	N25W	nd.	"	磯見　博他 (1958) L	
48-12	島尻－室山附近 Shimajiri - Moriyama	-12	6	N30E	W nd.	extension of 3.	今井　功 (1967) XX	
50-*1*	弥五島 Yagoshima	NJ-54-29 日　光 -1	8	N20W	W nd.	Pliocene bed displaced	福田　理他 (1958) L	
50-*2*	関谷構造線 Sekiya tectonic line	-2, -3	14	N20E	E 40	Kawasaki group (byobugaura stage?) and Nasuno sand and gravel member displaced	阿久津　純 (1962)	H.15
51-*1*	二ッ箭断層 Futatsuya ft.	NJ-54-23 白　河 -1, -2	17	N55W	S ≤ 500, R < 4000-5000	Pleistocene bed displaced	岩生周一他 (1961) V (平)	S.32

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
51-2	湯ノ岳断層 Yunotake ft.	-2	>6.5	N50W	S > 200, R > 7000	Pliocene bed displaced	岩生周一他 (1961) V	
53-1	倶利加羅峠附近 Kurikara Pass	NJ-53-12 金沢 -1	9	N35E - NS	nd.	Pliocene bed displaced	井上正昭他 (1964) V	
53-2	竹又断層 (及延長) Takemata ft.	-1	14	N45 - 10E	W nd.	"	"	
53-3	桑山附近 Kurayama	-1	8	N40E	nd.	"	"	
53-4	法林寺断層 Horinji ft.	-1	7	N40E	E nd.	"	"	
53-5	森本撓曲 Morimoto flexure	-5	18	N55E	W nd.	Pleistocene bed displaced	今井 功 (1959) V	
53-6	福井断層 Fukui ft.	-15, -16, -12	20	N15W	W nd. L	formed at Fukui earthquake (1948)	村松郁栄他 (1964)	S.94
54-1	中山断層 Nakayama ft.	NJ-53-6 高山 -1, -2, NJ-53-5 -4	40	N5W - 35E	E nd.	Pleistocene bed displaced	姫川団研グループ (1958) 磯見 博他 (1958) L	N.18
54-2	飛弾山断層崖 Hidasan fault scrap	-2, -3	30	NS - N30W	E 200 (height of fault scarp)	fresh scarp	小林国夫・平林照夫 (1955) 小林国夫 (1951)	S.55, 81 N.8, 0.25
54-3	五福寺断層 Gofukuji ft.	-3, NJ-54-36 長野 -15, -16	4.8	N30W	L nd.	fault scarp	地団研松本支部 (1966) 金子史朗	S.88
54-4	小野附近 Ono	-4, NJ-54-36 長野 -16	10	N75E	N nd.	Pliocene bed displaced	片田正人他 (1964) V (塩尻)	
54-5	奈良井断層 Narai ft.	-4, NI-53-1 飯田 -1	24	N65 - 45E	N nd.	"	" (1964) V (塩尻) " (1962) V (塩尻)	
54-6	山田川沿い Yamada R.	-13	13.5	N25E	W 100*	"	坂本 享他 (1960) V	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
54-*7*	跡津川断層 Atotsugawa ft.	-5, -9, -10, -14, -15, NJ-53-12 金沢 -3	>60	N60E	S<1000, R 3000, dip : 90	Quaternary river terrace deposit displaced	松田時彦(1966)	
55-*1*	菅 峰 Kampo	NJ-54-36 長野 -5	7	N45W	S nd.	Pliocene bed displaced	太田良平(1957) V	
55-*2*		-5	9	N50E	N nd.	"	"	
55-*3*	高間山附近 Mt. Takama	-5	5.5	N45W	nd.	"	"	
55-4	"	-5	4	N75W	S nd.	"	"	
55-*5*	"	-5	9	N70E	S nd.	"	"	
55-*6*	花敷温泉附近 Hanashiki Hot Spring	-5	7.5	N75E	S nd.	"	"	
55-*7*	"	-5	18	N7E	W nd.	"	"	
55-8	"	-5	2.7	N15E	nd.	"	"	
55-9	"	-5	2.3	N15W	E nd.	"	"	
55-*10*	諏訪湖南 L. Suwa	-16	13	N45W	nd.	"	沢村孝之助他(1953) V	
55-*11*	高ボッチ附近 Mt. Takabocchi	-16	9	N10E	nd.	"	"	
55-*12*	"	-16	4	N70W	S nd.	"	"	
55-13	"	-16	4	N5W	W nd.	"	"	
55-14	萩倉附近 Hagikura	-16	3	N20E	nd.	"	"	
55-*15*	大 平 Oodaira	-16	9	N30W - 15E	E nd.	Pleistocene bed displaced	"	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
55-*16*	松代地震断層 Matsushiro Earthquake ft.	-13	4.5	N55W	NE.10 - 20, dip: 90	formed at Matsushiro Earthquake swarms (1966)	Nakamura, & Y. Tsuneishi (1967)	
59-1	鉢伏山附近 Mr. Hachibuse	NI-53-25 松江 -4	3	N15E	nd.	Pliocene bed displaced	村山正郎他 (1961) V	
59-*2*	弥山－孝霊山構造線 Misen - Koreizan tectonic line	-12, -8, NI-53-26 高梁 -5	30	N35W - EW	NE>200	base of Daisen Volcano displaced	太田良平 (1962) V (大山)	
59-3	溝口町附近 Mizoguchi	-12	2.5	EW	nd.	Pliocene bed displaced	太田良平 (1962) V	
60-*1*	吉岡断層 Yoshioka ft.	NI-53-19 鳥取 -16	9	EW	N≦0.5, R≦0.9	formed at Tottori Earthquake (1943)	築地 明 (1947) " (1944) 村山正郎他 (1963) " (1962) V	0.11 0.65
60-*2*	鹿野断層 Shikano ft.	-16	15	N75E	N≦0.75, R≦1.5, dip : 60N	"	"	0.11 0.65 S.39
61-1	蒲入附近 Kamanyu	NI-53-13 宮津 -10	1	N50W	E nd.	Pliocene bed displaced	広川 治他 (1958) V	
61-2	本庄浜附近 Honjohama	-10	1	N30W	S nd.	"	"	
61-*3*	久僧－日ケ谷 Kuso - Higatani	-14	11	N40W	E nd.	"	磯見 博他 (1958) L	
61-*4*	小脇附近 Kowaki	-14	10	N70E	N nd.	"	"	
61-*5*	郷村断層 Gomura ft.	-14, -15	18	N30W	E 0.57, L 0.25	formed at Tango Earthquake (1927)	磯見 博他 (1960) V (宮津)	
61-*6*	山田断層 Yamada ft.	-15	8.5	N55E	S 0.4, R 0.8	"	"	
62-*1*	秋生断層 Akyu ft.	NI-53-7 岐阜 -1, -5, -6	20	N70E - EW	N nd., dip: 90 - 75N	fault valley	河合正虎 (1964) V (根尾)	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
62-2	温見谷－下大須線 Nukumidani-Shimoosu tectonic line	-6, -10	30	N55W	S nd., L 2000, dip: 60 - 65S	river terrace displaced	河合正虎（1964）V	
62-3	黒津－温見断層 Kurozu - Nukumi ft.	-6, -10	12	N50W	SW 5, L 3	formed at Nobi Earthquake (1891)	村松郁栄（1964）V	S.94
62-4	根尾谷断層 Neodani ft.	-6, -7, -3, -4	60	N50W	SW 6, L 8	"	"	S.94
62-5	能郷白山－天神堂線 Nogohakusan - Tenjindo tectonic line	-6	7	N35W	nd., L nd.	extension of Neodani fault	河合正虎（1964 ）V	
62-5	"	-6		N10W	nd	"	"	
62-6	柳ヶ瀬断層 Yanagase ft.	-14, -15, -16, -12, -8	55	N5 - 85W	L nd.	Pleistocene bed displaced (Makita formation)	杉村　新（1963） 磯見　博（1956）V （近江長浜）	K.11 S.11 S.27
62-7	関ヶ原町 Sekigahara	-12	0.6	N80W	S nd.	Pleistacene bed displaced	磯見　博（1956）V （近江長浜）	
63-1	神谷断層 Kamiya ft.	NI-53-1 飯田 -1	20	N30W		Narai fault displaced	片田正人・磯見　博（1962） V（伊那）	
63-2	伊那北－赤穂西方 Inakita - Akaho	-1, -2	16	N20 - 5E		Plio. - Pleist. displaced	"	
63-91	留々川断層 Tadomegawa ft.	-4	1-2	N50E	SE nd.	Tsukueyama bed (upper Pliocene) displaced	有井琢磨（1956）	S.76
63-92	川路－竜岡断層 Kawaji - Tatsuoka ft.	-4	8	N20E	E nd.	"	"　(1958)	0.59
63-3	親田断層 Shinden ft.	-4	1-2	N45W	NE20, dip: SW	talus and terrace deposit displaced	"　(1956) "　(1958)	S.76 0.59

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
63-4	下伊那竜西断層 Shimoina-Ryusei ft.	-4	15	N30E	E nd., dip: 18 - 70W	terrace deposit displaced	〃 (1956) 〃 (1958) 〃 (1963)	S.76 0.59 S.90
63-5	毛賀沢断層 Kegasawa ft.	-4	5	N55W	N10, dip: 60W	Tsukueyama bed (upper Pliocene) displaced	三野与吉 (1951)	0.53
63-6	駒場断層 Komaba ft.	-4, -8	9	N35E	E nd.	Holocene talus displaced	有井琢磨 (1956) 〃 (1958) 〃 (1964)	S.76 0.59 S.90
63-7	清内路峠断層 Seinaiji-toge ft.	-7, -8	35	N5E	W nd.	fault valley	山田直利他 (1958) V (妻籠) 片田正人他 (1961) XX	
63-8	馬籠峠断層 Magome-toge ft.	-7	7.5	N15E	W nd.	〃	山田直利他 (1958) V	
63-9	阿寺断層 Atera ft.	-7, -11, -10, -4, -13	66	N45 - 5W	W30, L140 (terrace, dyiorit, topography) W500 - 800, L 8000	Takabe Surface (27,000 y. B.P.) displaced	Sugimura, A. et al., (1965) 山田直利他 (1958) V (妻籠) 河田清雄 (1961) V (付知) 山田直利 (1961) V (加子母) 片田正人他 (1961) XX 木曾敏行 (1963) 木曾谷研究グループ (1964) 小林国夫 (1962)	S.79 0.5 H.11 S.73
63-10	屏風山断層 Byobuyama ft.	-7, -8, -12 NI-53-2 豊橋 -9, -13	50	N60E	N500 - 600 Th	Toki gravel bed (Pleistocene) displaced	木曾敏行 (1959) 小林国夫 (1962)	0.4 S.73 A.1 0.5
63-11	恵那山断層崖 Enasan ft.	-8, NI-53-2 豊橋 -9	15	N70E	N nd.	fault scarp, Toki gravel bed (Pleistocene) displaced	貝塚爽平 (1964)	A.1 0.3
63-12	赤河断層 Akagawa ft.	-15, -11, -12	25	N55W	N nd.	〃	木曾敏行 (1959) 〃 (1963)	0.4 0.5

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
63-*13*	権現山断層 Gongenyama ft.	-12	9	N25W	E nd.	"	" (1963)	O.5 A.1
63-*14*	華立断層崖 Hanatate ft.	-6 NI-53-2 豊橋 -13	14	N60 - 20W	N nd.	"	木曾敏行 (1963) 片田正人 (1963) X X	O.5
64-1	下円井断層 Shimotsuburai ft.	NI-54-31 甲府 -10	4.7	N30W	E nd. Th, dip: 20W	lower terrace deposit (Pleistocene) displaced	大塚弥之助 (1941)	
65-*1*	越生町附近 Ogose	NI-54-25 東京 -9	5	NS	W nd.	Pliocene bed displaced	福田　理他 (1956) L	
65-2	北鎌倉 Kitakamakura	-8	2	N20W	W nd.	"	"	
65-*3*	川越－川口線 Kawagoe - Kawaguchi tectonic line	-9, -5, -6	30	N50W	Terrace: NE10 - 20, Strata: NE60	Change in height of Shimosueyoshi-age terraces	貝塚爽平 (1964)	S.68
65-*4*	渋沢断層崖 Shibusawa fault scarp	-16	7	EW	N nd.	Hakone pumice flow (Musashino-age) displaced	町田　洋・森山昭雄 (1968)	S.107
66-*1*	茂原－大多喜天然ガス田 Mobara - Otaki area gas field	NI-54-19 千葉 -12, NI-54-20 大多喜 -19, -13	25	NS - N10E	A group of about 100 faults, most of which E nd.	Kazusa group (Plio-Pleistocene) displaced	石和田靖章 (1960) 三梨　昂 (1962)	
68-*1*	船佐衝上 Hunasa thrust	NI-53-32 浜田 -8	6	EW	S nd., dip: 40 - 50N	Kotachi gravel bed (Plio-Pleistocene) displaced	多井義郎 (1964)	S.104

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
68-2	山ノ内衝上 Yamanouchi thrust	-3, -4	13	N45E	SE nd.	"	"	S.104
68-3	毛無山断層 Kenashiyama ft.	-2, -3	15	N20E	W nd.	Pleistocene basalts displaced	小島丈児・今村外治(1964)	S.105
69-1	人形峠 Ningyo Pass	NI-53-26 高梁 -1	0.5	N80W	nd.	Pliocene bed displaced	山田直利(1961) V	
69-2	"	-1	0.5	N35W	nd.	"	"	
69-3	日応寺断層 Nichioji ft.	-4	3	N50E	SE nd., dip: 40 - 85°NW	Parallel to Funasa, Yamanouchi, Fukuyama thrust	今村外治(1966)	S.106
70-1	山崎断層 Yamasaki ft.	NI-53-20 姫路 -6, -7, -8	32	N70W	L nd.	river courses and ridges offset	Huzita, K. (1969)	
71-1	比良山地西麓 Hira Mts.	NI-53-14 京都及大阪 -1, -2, -3 NI-53-13 宮津 -4	60	N20E	Northern part: E nd. Southern part: W nd.	Plio-Pleistocene bed displaced	L.	
71-2	石山寺西方 Ishiyamadera	-3	3	N30E	E nd.	"	L.	
71-3	五雲峰～郷之口附近 Gounpo-gonoguchi	-3	10	N15W	nd.	"	L.	
71-4	鷲峰山南部 Mt. Jubu	-4	7.5	N45E	S nd.	"	L.	
71-5	"	-4	6	NS - N30E	nd.	"	L.	
71-6	大柳生断層 Oyagyu ft.	-4	7	N15E	W nd.	lower Pleistocene bed dragged	帷子二郎(1961)	S.92
71-7	樫原構造線 Katahihara tectonic line	-7	5.5	N15W	E>0.8	flexure scarp, gravel bed (Quaternary) displaced	水山高幸(1953)	0.42
71-8	高畑構造線 Takahata tectonic line	-7	6	N45W	N nd.	"	"	0.42

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
71-9	金ケ原構造線 Kanegahara tectonic line	-7	6	N45W	N nd.	fault scarp. gravel bed (Quaternary) displaced	水山高幸(1953)	O.42
71-10	ポンポン山附近 Mt. Ponpon	-7	4	N20W	E nd.	Pliocene bed displaced	L.	
71-11	"	-7	11	N20W	E nd.	"	L.	
71-12	竜田川沿い Tatsuta R.	-8 NI-53-15 和歌山 -5	11	N5W	W nd.	Pliocene displaced	L.	
71-13	小野原断層 Onohara ft.	-8, -12	11	EW - N60E	N20 - 50 Th.	Osaka Group displaced	市原　実他(1955) L	N.11
71-14	仏念寺山断層 Butsunenjiyama ft.	-12	6	N20E	W160	"	"	N.11
71-15	六甲スラスト Rokko thrust	-12	>7	N75E	N300 Th.	"	藤田和夫(1961)	H.12
71-16	五助橋スラスト—仮屋断層 Gosukebashi Thrust - Kariya ft.	-12, -16, NI-53-15 和歌山 -13 NI-53-21 徳　島 -1, -2, -3	85	N60E - NS - N35W	E250 - 300 Th.	"	" (1961) " (1966) 早川正己他(1964)	A.2 S.48
	五助橋スラスト Gosukebashi Thrust	-12	12	N60E	S250 Th.	"	藤田和夫(1961)	H.12
	六甲山麓沿い Rokko Piedmont	-12, -16	13			"	"	A.2
	仮屋断層 Kariya ft.	NI-53-15 和歌山 -13 NI-53-21 徳　島 -1, -2, -3	60	N45E - NS - N35W	E nd.	"	早川正己他(1964) 藤田和夫(1966)	S.48 S.85
71-17	芦屋スラスト Ashiya Thrust	-12	10	N40E	SE270 - 300 Th.	"	藤田和夫(1961)	H.12 N.27
71-18	会下山断層 Egeyama ft.	-16	4	N50E	N nd.	"	" (1965)	S.89
71-19	沖ノ瀬甲陽断層 Okinose Koyo ft.	-12, NI-53-15 和歌山 -13, -14	53	N45 - 25E	SE200	"	" (1961) " (1966) 早川正己他(1964)	H.12 S.48 S.85

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
	甲陽断層 Koyo ft.	-12	8	N45E	SE200	"	藤田和夫（1961）	H.12
	沖ノ瀬甲陽断層 Okinose Koyo ft.	-12, -16 NI-53-15 和歌山 -13, -14	45	N45 - 25E	SE nd.	"	早川正己他（1961） 藤田和夫（1966）	S.48 S.85
71-*20*	木見－垂水 Komi - Tarumi	-16, NI-53-15 和歌山 -13	12	N5W - N25E	W nd.	Plio-Pleistocene bed displaced	L.	
71-*21*	摩耶山－雌岡山 Mt. Maya - Mt. Mekko	-16	19	EW	S nd.	Plio-Pleistocene bed displaced	"	
71-22	三峠断層 Mitoke ft.	-9	6	N70W	L nd.	river courses and ridges offset	Fujita, K. (1969)	
72-*1*	養老山地東麓 Yoro Mts. east Piedmont	NI-53-8 名古屋 -5, -6	30	N25W	E 1,600 m +	Plio-Pleistocene Seto group displaced	桑原 徹（1968）	A.6
72-2	桑名市街西 Kuwana	-6	2	NS	W dip: 50°W	flexure of Pleistocene gravel bed	"	O.17
72-*3*	鈴鹿山脈東麓 Suzuka Mts. east Piedmont	-9, -10, -11	53	NS	E nd.	Pleistocene bed displaced	地調編図課（1955） L,XX 嘉藤良次郎（1957）	N.15
72-4	西明寺 Saimyozi	-10	4	N35E	W nd.	"	地調編図課（1955） XX	
72-*5*	平 子 Hirako	-11	4	N20W	E nd.	Plio-Pleistocene bed displaced	"	
72-*6*	沓 掛 Kutsukake	-11, -12	5	NS	E nd.	Pleistocene bed displaced	"	
72-*7*	経が峰 Kyogamine	-12	6.5	N70W - N85E	S nd.	"	"	
72-*8*	土山町－柘植－名張 Tuchiyama - Tsuge - Nabari	-11, -12, 16, NI-53-9 伊 勢 -13	46	N15W - N55E	W nd.	Plio-Pleistocene bed displaced	" L,XX	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
72-9	喰 代 Hojiro	-16	3	N15E	W nd.	"	" L.	
72-*10*	友 生 Tomono	-16	6	N45W	nd.	pliocene bed displaced	" L,XX	
72-*11*	我山断層崖 Wagayama fault scarp	-16	5	N55E	nd.	"	帷子次郎(1961)	S.92
72-*12*	上野断層 Ueno ft.	-16	11	N70E	S nd.	"	多田文男(1929)	K.12
72-*13*	島が原断層 Shimagahara ft.	-16, NI-53-14京都及大阪 -4	21	N45 - 70E	S nd.	"	"	K.12
72-*14*	花ノ木断層 Hananoki ft.	-16	10	N70E	S nd.	lower Pleistocene bed dragged	帷子次郎(1961) 多田文男(1929)	K.12 S.92
73-*1*	宇刈撓曲構造 Ukari flexure	NI-53-2 豊 橋 -4	3	N15E	nd.	Pliocene Kakegawa group gently bent	槇山次郎・坂本 亨(1957) V (見付)	
73-*2*	山梨町－森町 Yamanashi-mori	-4, -3	4.6	N25E	nd.	Pliocene bed displaced	"	
73-*3*	"	-4	4.6	N40E	W nd.	"	"	
73-*4*	足助断層 Asuke ft.	-10, -14	20	N45E	N50 - 100	Mikawa erosion surface displaced	貝塚爽平他(1964) 太田陽子他(1963)	A.3 0.3,4
73-*5*	中金－古瀬間 Nakagane - Kosema	-14	9	N20E	W70	"	貝塚爽平他(1964)	0.14 0.3
73-*6*	猿投境川断層 Sanage-Sakaigawa ft.	-13, -14	18	N5 - 40E	E nd.	Seto Group (Pleistocene) displaced	"	0.14 0.3
74-*1*	丹那地震断層 Tanna Earthquake ft.	NI-54-32 静 岡 -3	8	N15E	W nd.	formed at Tanna Earthquake (1930)	沢村孝之助(1955) V	
74-2	"	-3	3	N10W	W nd.	"	"	
74-3	"	-3	4	N80W	S nd.	"	"	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
74-4	"	-3	3	N80 - 30E	N nd.	Pliocene bed displaced	"	
74-5	天子火山北方 Tenshi Volcano	-3	7	N55E	S nd.	Pleistocene bed displaced	"	
74-6	"	-3	5	N55E	S nd.	"	"	
74-7	沢水加－上平川 Sabaka - Kamihirakawa	-16	10.5	N30E	N nd.	Pliocene bed displaced	槇山次郎(1963) V	
74-8	掛川北東方 Kakegawa	-16	2.3	EW	N nd.	"	"	
74-9	仁王辻の東 Niotsuhi	-16	2	N45W	S7, dip: 60SW	gravel bed (Pleistocene) displaced	井口正男(1954)	O.21
74-10	入山衝上断層 Iriyama thrust ft.	-5, -6	12	N5E	E nd. Th, dip: 60 - 70	Saginota gravel bed (Pleistocene) displaced	大塚弥之助(1938)	S.101
74-11	水沼断層 Mizunuma ft.	-5	1.3	N5E	E nd., dip: 90	"	"	"
74-12	中山衝上断層 Nakayama ft.	-6	2.6	N40E	W nd. Th, dip: 70 - 80	"	"	"
75-1	那古船形から東方 Nako Funakata	NI-54-26 横須賀 -2	12	EW	S nd.	Pliocene bed displaced	福田 理他(1956) L	
75-2	仁我浦 Nigaura	-2, NI-54-20 大多喜 -14	4	N80W	N nd.	"	"	
75-3	館山市南 Tateyama	-3	4.5	N35E	S nd.	"	"	
75-4	鎌倉附近 Kamakura	-4	1.5	N5E	W nd.	"	"	
75-5	"	-4	2.5	N10E	W nd.	"	"	
75-6	"	-4	2.5	N10E	W nd.	"	"	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
75-*7*	武山断層 Takeyama ft.	-4	8	N60W	S nd. R.	Pleistocene bed displaced	"	
75-*8*	南下浦断層 Minamishitaura ft.	-4	4	N80W	N nd. (dip slip)	Pleistocene bed displaced	福田　理（1956）L	
75-*9*	松田～国府津断層 Matsuda - Kozu ft.	-13	9	N45W	SW100 - 200	Hakone pumice flow (50,000 years B.P.) displaced	町田　洋・森山昭雄（1968)	S.107
75-*10*	丹那地震断層 Tanna Earthquake ft.	-13, -14	20	NS	E100, L1000	formed at Tanna Earthquake (1930)	Kuno, H. (1936)	K.17 S.79
80-*1*	冠山断層 Kammuriyama ft.	NI-53-33 広　島 -13, -14	23	N50E	SE nd.	Takinosawa gravel bed (Plio-Pleistocene) displaced	小島丈児・今村外治（1964)	S.105
80-*2*	上根断層 Kamine ft.	-5	21	N30E	NW nd.	talus displaced	"	S.105
81-*1*	中央構造線（三野町） Mediam Tectonic line (Mino T.)	NI-53-27 岡山及丸亀 -4	7	N85E	S nd, R nd, dip: 25 - 35 N	terrace deposit displaced	中川　典他（1957) 岡田篤正（1968, 1969)	S.57
81-*2*	財田附近 Saida	-4	6	N70E	N nd Th.	Mitoyo formation (Plio-Pleistocene) displaced	斉藤　実他（1962)	S.97
81-*3*	"	-4, -8	7	N70E	N nd Th.	"	"	
81-*4*	三原断層 Mihara ft.	-14	11	N30E	SE nd.	Saijo gravel bed (Holocene) displaced	小島丈児・今村外治（1964)	S.105
81-*5*	福山衝上 Fukuyama thrust	-9, -10	14	N70E	S nd, dip: 35 - 70 N	Pleistocene gravel bed displaced	今村外治他（1967)	S.103
82-*1*	灘 Nada	NI-53-21徳　島 -3	4	N50E	SE nd, dip: 50 - 60 N	Pleistocene bed displaced	東中秀雄他（1960)	S.63

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
82-2	中央構造線(吉野川) Median Tectonic Line (Yoshino R.)	-12, -16	40	N80E	R100 - 200	Holocene terrace scarp offset	Kaneko, S. (1966)	
83-1	田原断層 Tawara ft.	NI-53-15 和歌山 -1	5	N5E	W nd.	lower Pleistocene bed dragged	帷子二郎(1961)	S.92
83-2	春日断層 Kasuga ft.	-1 NI-53-14 京都及大阪 -4	17	NS	W nd Th.	lower Osaka group displaced	坂本 亨(1955) 帷子二郎(1961) L	N.9 S.92
83-3	天理撓曲 Tenri flexure	-1	3	NS	W nd Th.	Kokuzoyama gravel bed displaced	坂本 亨(1955)	N.9
83-4	千股衝上 Chimata thrust	-2, -6	28	EW	S nd, dip: 20 - 30 N	Oyodo formation (Pleistocene) displaced	中野尊正(1946) 平山 健他(1957) 〃 (1957) V(吉野山)	Y.4 S.29
83-5	長野断層 Nagano ft.	-6	6	N20E	W nd.	Osaka group displaced	岡 義記(1961)	O.9
83-6	泉佐野推定断層 Izumisano ft. (estimate)	-5, -9, -10, -14, -15	60	N10 - 75E	W nd.	〃	藤田和夫他(1964) 〃 (1966) 早川正己他(1966)	N.66 S.85 S.48
83-7	中央構造線(紀の川) Median Tectonic Line (Kinokawa)	-6, -7, -11, -15	50	N80E	R nd.	river courses offset	Kaneko, S. (1966)	
84-1	名張断層 Nabari ft.	NI-53-9 伊 勢 -13	8	N45E	S nd.	lower Pleistocene bed dragged	帷子二郎(1961)	S.92
84-2	関町－松阪－小俣町－一志断層 Seki - Matsuzaka - Obata - Ichishi ft.	-5, -9, NI-53-8 名古屋 -12, -11	60	NS - EW	NE nd.	Pleistocene bed displaced	嘉藤良次郎(1957)	N.15

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
86-1	入　間 Irima	NI-54-33 御前崎 -1	6	N30E	E nd.	Pliocene bed displaced	角　清愛（1958）V	
86-2	田牛附近 Toji	-1	2.5	N50W	W nd.	"	"	
86-3	"	-1	2.5	N20W	E nd.	"	"	
88-1	鷹島南部 Taka I.	NI-52-16 唐　津 -8	3.5	N20E	nd.	Pleistocene bed, basalt displaced (estimated)	沢田秀穂他（1955）V	
88-2	"	-8	2	N40W	S nd.	"	"	
88-3	"	-8	2.5	N45W	S nd.	"	"	
88-4	鷹島南部 Taka I.	-8	3.5	N60W	S nd.	Pleistocene bed, basalt displaced (estimated)	沢田秀穂他（1955）V	
88-5	志佐南西 Shisa	-8	2	N75W	S nd.	"	"	
88-6	"	-8	1.5	N85W	N nd.	"	"	
90-1	姫　島 Hime I.	NI-52-4 中　津 -6	1.5	NS	W nd.	Karato formation (Plio-Pleistocene) displaced	笠間太郎他（1955）	N.10 N.5
90-2	安心院盆地とその南 Ajimu basin	-12	3	N70W	N nd.	Pleistocene bed displaced	首藤次男（1953）	N.5
90-3	"	-12	4.5	N70W	N nd.	"	"	"
90-4	"	-12	5	EW	N nd.	"	"	"
90-5	"	-12	8	N80W	N nd.	"	"	"
90-6	"	-12	5	N75W	N nd.	"	"	"
90-7	"	-12	7.5	N80W	N nd.	"	"	"

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
90-8	"	-12	4	N70W	N nd.	Pliocene bed displaced	L.	
91-1	中央構造線 Médian tectonic line (near Matsuyama)	NI-53-34 松 山 -6, -2	20	N50E	R nd.	river courses and ridges offset	（杉村新による） P.C. 岡田篤正（1970）	B.5
91-2	"	-2, NI-53-28 高 知 -13	28	N70E	R nd.	"	P.C. "	B.5
92-1	中央構造線 Median tectonic line (near Niihama)	NI-53-28 高 知 -13, -9	28	N60W	R nd.	river courses and ridges offset	岡田篤正（1970）	B.5
92-2	"	-5, -9, -13 NI-53-27 岡山及丸亀 -8, -4	75	N75E	R nd.	"	"	"
93-1	室 戸 Muroto	NI-53-22 剣 山 -17	10	N65E	S50	Shimosueyoshi terraces displaced	吉川虎雄（1964）	0.86
94-1	三段壁 Sandanbeki	NI-53-16 田 辺 -11	1.5	EW	S13	Shimosueyoshi terraces displaced	P.c. 太田陽子による	B.14
97-1	楠久断層 Kusuku ft.	NI-52-17 長 崎 -1, -5	10	N60W	S60	basalt (Pleistocene) displaced	今井 功他（1958） （ 〃 ）X X	S.32
97-2	長浜断層 Nagahama ft.	-1	7	N85E	N100	"	"	S.32
97-3	国見山断層 Kunimiyama ft.	-1, -5	17	N55W	N40	Pliocene bed displaced	"	S.32
97-4	賞観断層 Shokan ft.	-1, -5	8	N70W	N70	basalt (Pleistocene) displaced	"	S.32
97-5	佐々川・呼子の瀬戸断層 Sasagawa-Yobuko-no-Seto ft.	-5, -6, -7, NI-52-16 唐 津 -8	60	N35E - NS	E50 - 70	basalt (Pleistocene) displaced, extension of Sasagawa ft.	沢田秀穂他（1958） 長浜春夫（1962）X X	S.51 S.83

1. Number	2. Name of fault or place	3 Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
	佐々川断層 Sasagawa ft.	-5, -6, -7, NI-52-16 唐 津 -8	20	N30E	E50 - 70, dip: 60W	basalt (Pleistocene) displaced, terrace displaced	沢田秀穂(1958)	S.51
	呼子の瀬戸断層 Yobuko-no-Seto ft.	-6, -7	20 (+10)	NS	nd.	Pliocene bed displaced extension of Sasagawa ft.	長浜春夫(1962) 今井　功他(1965) X X	S.83
97-6	平野断層 Hirano ft.	-5	2	N20E	E nd.	Pleistocene basalt dyke displaced	沢田秀穂(1958)	S.51
97-7	猪調（イノツキ）断層 Inotsuki ft.	-5	10	N20E	E nd.	"	"	S.51
97-8	江迎断層 Emukai ft.	-5	7	NS	nd.	lower basalt displaced (?)	今井　功他(1965) X X	
97-9	山野田断層 Yamanoda ft.	-5	3	N60E	nd.			
97-10	川内浦附近 Kawachiura	-6	1.5	N80W	N nd.	Pleistocene tuff breccia displaced (estimated)	長浜春夫他(1965)	
97-11	太田和附近 Otawa	-6	2	EW	N nd.	lower and middle basalt displaced	長浜春夫他(1958) 今井　功他(1965) X X	S.31
97-12	船石岳附近 Funaishi-Dake	-4	3	N30W	nd.	Pliocene bed displaced	今井　功他(1965) X X	
97-13	船石岳付近 Hunaishi-Dake	-4	5.5	N15W	nd.	Pliocene bed displaced	今井　功他(1965) X X	
97-14	"	-4	4	N15W	nd.	"	"	
97-15	"	-4	2	N70W	nd.	"	"	
99-1	川添一坂の市断層 Kawazoe-Sakanoich ft.	NI-52-5 大 分 -1, -5	14	N45 - 65E	N nd.	Pleistocene bed displaced	首藤次男　(1953)	N.5
99-2	大野川断層 Onogawa ft.	-5, -6	18	N15E	nd.	Plio-Pleistocene bed displaced	"	"

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
99-*3*	平原－門前断層 Hirahara-Monzen ft.	-5, -6	9	N50E	nd.	Plio-Pleistocene bed displaced		"
99-*4*	竹　中 Takenaka	-6	5	N45W	N nd.	Pliocene bed displaced	対島坤六 (1958) L X X	
99-5	霊山付近 Ryozen	-6	1	N70W	N nd.	"	"	
99-*6*	"	-5, -6	12	N30 - 50E	W nd.	"	"	
99-7	"	-5, -6	2	N60W	N nd.	"	"	
99-*8*	七瀬川断層 Nanasegawa ft.	-5, -6	16	N10 - 60E	W nd.	" (estimated)	首藤次男 (1953) 対島坤六 (1958) L X X	N.5
99-9	大分市 Oita City	-5	4	N75W	N 80 - 100	"	対島坤六 (1958) L X X 首藤次男 (1953)	N.5
99-*10*	向　原 Mukainohara	-5, -9	7	N85E	N 80 - 100	"	首藤次男 (1953)	"
99-*11*	"	-5, -9	4.5	N80E	N 80 - 100	"	"	"
99-12	野津原付近 Notsuhara	-6	2	N75E	nd.	"	L.	
99-13	塚原ダム Tsukawara Dam	-9	2.5	N85E	S nd.	Holocene bed displaced	対島坤六 (1958) X X	
99-14	立石山西麓 Mt. Tateishi	-9	0.8	N70E	nd.	Holocene bed displaced	対島坤六 (1958) X X	
99-*15*	湯布院盆地南縁 Yuhuin	-9	8	N70E	N nd.	Pliocene bed displaced	"	
99-*16*	花牟礼山北西 Mt. Hanamure	-10	5.5	N70E	S nd.	"	"	
99-17	"	-10	4.2	N55E	N nd.	"	"	
99-18	花牟礼山東方 Mt. Hanamure	-10	3.5	N55W	W nd.	"	"	
99-*19*	花牟礼山南東方 Mt. Hanamure	-10	6	N65E	N nd.	"	"	
99-20	小野屋附近 Onoya	-10	0.8	N85E	N nd.	"	小野晃司 (1963) V	
99-21	"	-10	1	NS	E nd.	"	"	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
99-22	"	-10	1.8	N80W	nd.	"	"	
99-23	"	-10	3	N70E	nd.	"	"	
99-24	長湯附近 Nagayu	-10	19	N45 - 65E	N nd.	" (estimated)	"	
100-1	中村市東方 Nakamura City	NI-53-35 宇和島 -3, NI-53-28 高知 -15	3	N50E	SE5	Shimosueyoshi terrace displaced	p. c. 太田陽子による	B.3
100-2	"	-15	3	N40E	SE5	"	p. c. "	B.3
104-1	日奈久断層 Hinagu ft.	NI-52-12 八代 -5, -6	40	N45E	W270 - 360	Aso welded tuff displaced	松本達郎他(1964) V	
104-2	口之津 Kuchinotsu	-13	4	EW	nd	Pliocene bed displaced	L	
104-3	有馬川沿い Arima R.	-13, -9	7	N80W	nd.	"	L	
104-4	加津佐町附近 Kazusa	-13	6	N45E	nd.	"	L	
107-1	国分北方の撓曲 Kokubu (flexure)	NH-52-7 鹿児島 -2	6	N25E	W nd.	Kokubu group (Plio-Pleistocene) displaced	沢村孝之助(1956) V	S.28
107-2	国見岳北斜面 Kunimidake	-5	6	N40 - 80E	S nd.	Upper Neogene bed displaced	L.	
107-3	"	-5	6	N40 - 80E	nd	"	L.	
107-4	国見岳南斜面 Kunimidake	-5	2	EW	nd.	"	L.	
107-5	"	-5	6	N80W	nd.	"	L.	
107-6	"	-5	4	EW	S nd.	"	L.	

1. Number	2. Name of fault or place	3. Location	4. Length in Km	5. Strike	6. Displacement	7. Evidence	8. Reference	9. Reference Number of abstract
107-7	国見岳南斜面 Kunimidake	-5	1.5	N15E	W nd.	Upper Neogene bed displaced	L.	
107-8	求名地方 Gumyo	-5	3	N35 - 75W	N nd	"	L.	
107-9	北方附近 Kitagata	-5	3	N40W	nd.	"	L.	
107-*10*	南方附近 Minamikata	-5	5	N30W	E nd.	"	L.	
107-11	下平南方 Shimobira	-5, -9	3	N80W	S nd.	"	L.	
107-*12*	藺牟田附近 Imuta	-6	4	N45 - 10W	W nd.	"	L.	
107-13	"	-6, -10	3	N70E	N nd.	"	L.	
107-*14*	"	-6, -10	4	N45W	W nd.	"	L.	
108-1	宮崎市北 Miyazaki City	NH-52-1 宮 崎 -9	3	N65E	N nd.	Pliocene bed displaced	L.	
111-*1*	南種子 Minami-tane	NH-52-9 屋久島 -2	12	N, S	W nd.	Pleistocene bed displaced	L.	

7.4. List of fold.

1. Number (Quadrangle number and fold number).
2. Name of fold or place.
3. Location (number of 1:200,000 topographic map and 1:50,000 topographic map).
4. Name of folded stratum or geomorphic surface and the geologic age and environment of its formation.

Tc:	Tachikawa age (late last glacial).
M:	Musashino age (early last glacial).
S:	Shimosueyoshi age (last interglacial).
T:	Tama age (penultimate interglacial).
Ld:	Lower Pleistocene.
D:	Pleistocene.
Pd:	Plio-Pleistocene.
UP:	Upper Pliocene.
P:	Pliocene.
m:	marine.
f:	fluvial.

5. Strike and length (in km) of axis.
6. Wave length (in km); "F": accompanied with fault.
7. Angle of slope on a lib of fold (in tangent and degree); "F": accompanied with fault.
8. Rate of deformation or velocity gradient (tan. $10^{-5}/10^3$ years); "F": accompanied with fault. Calculation is based on the following estimation of absolute age.

Geologic age	Absolute age	Geologic age	Absolute age
Tc	2.5×10^4 years	Ld	1×10^6 years
M	5×10^4	Pd	2×10^6
S	9×10^4	UP	4×10^6
T	25×10^4	P	7×10^6

9. References (Descriptions are shown in the following order: author's name, year of publication. Referred geological maps are indicated with the kinds of maps as follows:
V: 1:50,000, VII: 1:75,000, XX' 1:200,000, L: 1:500,000).
10. Reference number of abstract.

1	2	3	4	5	6	7	8	9	10
2-1	天 塩 Teshio	NL-54-17 天 塩 1～6	瀬棚層(UP) Setana Formation	N 5～50	5～10	—	—	北海道地下資源調査所(1957) XX (1963) L	
3-1	上猿払 Kamisarufutsu	NL-54-11 枝 幸 14, 15	更別層(UP) Sarabetsu Formation	NEN 5+	1.5	0.18～0.36 (10～20°)	4～9	田中啓策(1960) V 猪木幸男(1959) V	S.71 S.72
9-1	西徳富 Nishitoppu	NK-54-13 留 萌 7	深川層群(P) Fukagawa Group	N 15	6	0.36～1.0 (20～45°)	5～14	秦 光男他(1963) V	
9-2	尾白利加向斜 OshirorikaSyncl. 津川背斜 Tsugawa Anticl.	NK-54-13 留 萌 3	〃	NEN 10	10	0.36～0.84 (20～40°)	5～12	小林 勇他(1956) V	
9-3	赤 平 Akabira	NK-54-13 留 萌 4	〃	N 3	4 F	0.36～0.84 (20～40°) 0.58～1.7F (30～60°F)	5～12 8～24F	小林 勇他(1956) V 松井 寛他(1965) V	
9-4	当 別 Tobetsu	NK-54-13 留 萌 8 NK-54-14 札 幌 5	当別層(P) Tobetsu Formation	N,NE 10+	2～6	0.36～1.7 (20～60°)	5～24	垣見俊弘他(1958) V 〃 (1957) V	
9-5	砂 川 Sunakawa	NK-54-13 留 萌 4	〃	NE 10+	5+ F	0.84～2.8F (40～70°F)	12～40F	松井 寛他(1965) V	
14-1	清畠向斜 Kiyohata Syncl.	NK-54-9 浦 河 14	厚賀層(P) Atsuga Formation	WHW 10+	10+?	0.36～0.58 (20～30°)	5～8	山口昇一他(1958) V	
15-1	石 狩 Ishikari	NK-54-14 札 幌 9	段 丘(S, m) Terrace	NE 15+	7	0.01 (35')	11	垣見俊弘(1958)	S.25
15-2	野 幌 Nopporo	NK-54-14 札 幌 6, 10	野幌段丘(S, m) Nopporo Terrace	N 15+	5～10	0.03 (1°45')	33	貝塚爽平(1961) 石狩低地グループ(1965)	
			野幌層(T) Nopporo Formation	N 15+	5～10	0.12～0.27 (7～15°)	48～108	山口久之助他(1964)	N.45 K.20 N.64
15-3	志文向斜 Sibumi Syncl. 岩見沢背斜 Iwamizawa Anticl.	NK-54-14 札 幌 1	峯延層(P) Minenobu Formation	N 10+	1.5	—	—	松野久也他(1964) V	

1	2	3	4	5	6	7	8	9	10
16-*1*	豊 田 Toyota	NK-54-8 夕張岳 16	滝川層(UP) Takikawa Formation	NWN 20	3	0.58 (30°)	14	北海道地下資源調査所(1954) X X	
17-*1*	池 田 Ikeda	NK-54-2 帯 広 6, 7	池田層(UP) Ikeda Formation	N,NW 2～17	3～4	0.09～0.47 (5～25°)	2.2～12	〃 (1958) X X	
18-1	標 茶 Shibecha	NK-55-32 釧 路 5, 6	釧路層(Ld) Kushiro Formation	NE 15	20	0.18 (10°)	18	斉藤・北川(1963) 水野・百石(1960)	S.14 S.15
18-2	釧 路 Kushiro	NK-55-32 釧 路 6, 10	釧路層(Ld) Kushiro Formation	NE 40	20	—	—	水野・佐藤・角(1963) 岡崎由夫(1960) 水野篤行他(1963)	0.1 S.13
18-3	トマリベツ向斜 Tomaribetsu Syncl.	NK-55-32 釧 路 14	阿寒層群(P) Akan Group	NE 5+	3～5	0.18～0.7 (10～35°)	2～10	水野篤行他(1963)	S.13
19-1	厚 床 Attoko	NK-55-26 根 室 9	中位段丘(S, m) Middle Terrace	ENE 40	10～15	0.008 (28')	9	貝塚爽平(1961)	N.45
19-2	根 室 Nemuro	NK-55-26 根 室 5	低位段丘(M, m) Lower Terrace	NE 20	10	0.006 (20')	12	〃 (1961)	N.45
21-*1*	八 雲 Yakumo	NK-54-21 室 蘭 11 11	瀬棚層(UP) Setana Formation	NEN 8	8	0.9～0.58 (16～30°)	7～14	北海道地下資源調査所(1954) X X	
23-1	寿 都 Suttsu	NK-54-20 岩 内 16	〃	N 8	4	0.18 (10°)	4.5	〃	
28-*1*	津軽半島 Tsugaru Pen.	NK-54-23 青 森 5, 6, 7	蟹田層(P) Kanita Formation	NWN 15～20	10	0.18～0.36 (10～20°)	2.6～ 5.1	青森県(1961) X X 上村不二雄(1959) V	
29-1	下北半島 Shimokita Pen.	NK-54-17 野辺地 9	第4段丘(S, m) 4th Terrace	N 40	20	0.005 (17')	5.5	大矢・市瀬(1956)資源研報	
			田中部層(Ld) Tanabu Formation	N 40	20	0.017～0.07 (1～4°)	1.7～7	桑野幸夫(1956) 今井 功(1961)	N.46 S.37
31-*1*	阿仁川 Ani Riber	NK-54-24 弘 前 12	第Ⅲ段丘(Tc, f) 3rd Terrace	N	4～5	0.0015～ 0.005 (5～17')	5～17	杉村 新(1952) 平山, 角(1963)	S.54 S.40
			第Ⅳ段丘(M, f) 4th Terrace	N	4～5	0.0025～ 0.005 (9～17')	5～10		

1	2	3	4	5	6	7	8	9	10
31-2	鷹　巣 Takanosu	NK-54-24 弘　前 8	前山川層（P） Maeyamakawa F.	N,NEN 5～10	1～3 F	0.36～1.7F (20～60°F)	5～24F	平山次郎他（1963）V	S.40
33-1	女川向斜 Onnagawa Syncl.	NJ-54-25 男　鹿 1	Terrace (M, m)	NS 3	1	0.03～0.05 (2～3°)	60～100	太田陽子（MS）	
33-2	湯ノ尻背斜 Yunojiri Anticl.	NJ-54-25 男　鹿 1	"　(M, m)	NS 3	1.5	0.03～0.05 (2～3°)	60～100	〃	
33-3	申川背斜 Sarukawa Anticl.	NJ-54-25 男　鹿 1	"　(S, m)	NS 3	3 F	0.07～ 0.1+,F (4～6°+)	80～110 +F	〃	
33-4	男鹿半島 Oga Pen.	NJ-54-25 男　鹿 1	鮪川層(UP) Shibikawa F.	N 2～3	0.5～1	0.36～0.84 (20～40°)	9～21	大沢　穣（1960）XX 藤岡一男（1959）V	
34-1	秋　田 Akita	NJ-54-19 秋　田 11, 13～15 NJ-54-25 男　鹿 1	鮪川層（UP） Shibikawa F. 笹岡層（UP） Sasaoka F.	N～NWN 5～20	3～4	—	—	大沢　穣（1960）XX	
36-1	酒　田 Sakata	NJ-54-26 酒　田 4	鮪川層（UP） Shibikawa F.	N 5+	0.5 F	0.84～2.8F (40～70°F)	21～70F	大沢　穣（1964）XX 村山賢一（1934）VII	
37-1	小国川 Oguni River	NJ-54-20 新　圧 9	高位段丘（S, f） Higher Terrace	N	3～4	0.026 (1°30')	17.6	杉村　新（1952） 〃　（1967） 村山賢一（1964）XX	S.54
37-2	花山向斜 Hanayama Syncl.	NJ-54-20 新　圧 5	芳沢層（D） Yoshizawa F.	N 8+	3?	—	—	大沢　穣（1964）XX	
37-3	本　庄 Honjo	NJ-54-20 新　圧 13	鮪川層（UP） Shibikawa F.	N 5+	5 F	0.09～1.7F (5～60°F)	2.2～ 42F	大沢　穣（1964）XX 〃　（〃）XX 村山賢一（1934）VII	
40-1	粟　島 Awashima	NJ-54-27 村　上 14	牧平段丘（S, m） Makidaira Terrace	NE 20+	24 F?	0.03 (1°40')	39F?	中村ほか（1964） 中村・松田（1965）	K.21 N.83
			海底段丘（1×10^{4}Y, m） Submarine terrace	NE 20+	24	0.004～ 0.009 (15～30')	44～87		

1	2	3	4	5	6	7	8	9	10
41-1	仙　台 Sendai	NJ-54-21 仙　台 3	青葉山面（T，f） Aobayama Surface	NE 4～6	1.0	—	—	中川久夫他（1961）	S.56
44-1	七日市 Nanokaichi	NJ-54-34 長　岡	A段丘（S，f） A Terrace	NEN 4	0.7	0.22 (12°)	240	太田陽子（1967） Ota, Y.（1969）	K.22
44-2	関　原 Sekihara	NJ-54-34 長　岡 8	B段丘（S，f） B Terrace	NEN 2+	1.0	0.066 (3°50')	220	太田陽子（1967） Ota, Y.（1969）	K.22
44-3	上富岡 Kamitomioka	NJ-54-34 長　岡 8	A段丘（S，f） A Terrace	N 3	1.2	0.063 (3°40')	70	〃	K.22
			D段丘（Tc，f） D Terrace	N 3	1.2	0.044 (2°30')	147		
44-4	三　条 Sanjo	NJ-54-34 長　岡 3	魚沼層（Pd） Uonuma Formation	NNE 2～10	0.5～1 F	—	—	新潟県（1955）XX 〃　（1962）XX	
48-1	呉羽山 Kurehayama	NJ-53-5 富　山 16 NJ-54-35 高　田 13	呉羽山礫層（Ld） Kurehayama Gravel Bed	NNE 15	10～20	0.17 (10°)	18	坂本　享他（1959） 坂本，野沢（1960） 坂本　享（1963）	S.50 S.35 S.42
49-1$_a$	二ノ宮向斜 Ninomiya Syncl. 丸山背斜 Maruyama Anticl.	NJ-54-35 高　田 1	山屋層（Pd） Yamaya Formation	N 15+	5	0.58～0.84 (30～40°)	29～42	中村一明（1957）（MS）	
49-1$_b$	八　島 Yashima	NJ-54-35 高　田 1	A段丘（S，f） A Terrace	NEN	4.2 F	0.15F (9°)	130F	太田陽子（1967） Ota, Y.（1969）J.J.Geol.Geogr.	K.22
49-2	魚野川 Uono River	NJ-54-35 高　田 1	第1段丘（S，f） 1st Terrace	NEN	2	0.1 (6°)	110	白井哲之（1967）	K.19
49-3	大鹿村 Ooshika Mura	NJ-54-35 高　田 11	魚沼層（Pd） Uonuma Formation	NNE 5～10	2～3	—	—	新潟県（1955）XX 〃　（1962）XX	
49-4	豊　野 Toyono	NJ-54-35 高　田 12, 16	柵　層（P） Shigarami F. 豊野層（P） Toyono F.	NE～NEN 1～3	1 F	—	—	長野県地学会（1957）XX	

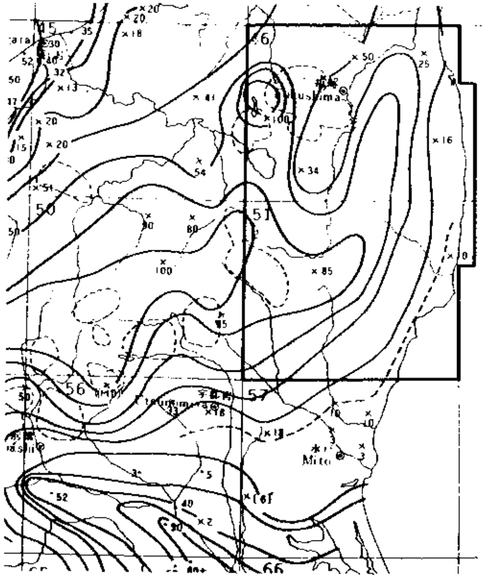
1	2	3	4	5	6	7	8	9	10
53-1	金沢～氷見 Kanazawa-Himi	NJ-53-12 金沢 1	埴生累層・氷見累層（P） Hanyu & Himi F.	NE 10～25	5～20	0.18～1.2 (10～50°)	2.6～17	井上正昭他（1964）V	
55-1	門　貝 Kadokai	NJ-54-36 長野 5	門貝層（P） Kadokai F.	NE 8	2～3	—	—	守屋以智雄（1966）	0.84
55-2	吾妻川 Agatsuma River	NJ-54-36 長野 1	中之条 I 面（Tc，f） Nakanojo I Terrace		40	0.006 (20')	20	〃	0.84
			伊勢町 I 面（1×10^{4}Y，f） Isemachi I Terrace		40	0.002 (7')	20		
57-1	鹿島・行方 Kashima & Namekata	NJ-54-24 水戸 8，12	下末吉段丘（S，m） Shimosueyoshi Terrace	N 40	10～15	0.003 (10')	3	貝塚爽平（1961）	N.45
65-1	相模野南部 Southern Sagamino	NI-54-25 東京 12	相模原面（M，f） Sagamihara Terrace	E 30	5	0.01 (35')	20	成瀬　洋（1952） 成瀬・戸谷（1957） 貝塚爽平（1961）	N.3 N.14 N.45
65-2	富岡向斜 Tomioka Syncl.	NI-54-25 東京 8	杉田累層（Ld） Sugita Formation	NW 5+	5	—	—	神奈川県（1955）	
65-3	星川背斜 Hoshikawa Anticl.	NI-54-25 東京 8	上星川層（Ld） Kamihoshikawa Formation	WNW 15+	10～20	—	—	徳永他（1949）資源研報 神奈川県（1955）	
65-4	溝口向斜 Mizonokuchi Syncl.	NI-54-25 東京 7	高津層（Ld） Takatsu Formation	ENE 10+	10～20	0.035～0.07 (2～4°)	3.5～7	神奈川県（1955）	
65-5	武蔵野北東部 Northeastern Musashino	NI-54-25 東京 5，6	武蔵野面（M，f） Musashino Surface	NW 15	—	—	—	貝塚爽平（1957），第四紀研究	
66-1	下総西部 Western Shimofusa	NI-54-19 千葉 14	下末吉面（S，m） Shimosueyoshi Terrace	WNW 30	20	0.003 (10')	3.3	貝塚爽平（1961）	N.45
66-2	房総半島北部 Northern Boso Pen.	NI-54-19 千葉 15，16	下末吉面（S，m） Shimosueyoshi Terrace	NE 60+	30	0.008 (28')	8.8	〃	

1	2	3	4	5	6	7	8	9	10
71-1	西　山 Nishiyama	NI-53-14 京都及 7 大　阪	大阪層群（Pd） Osaka Group	6 NW 1.5～4	1～2	0.02～0.04 (1°10' ～ 2°20')	1～2	西山団研（1967）	N.97
72-1	桑名背斜 Kuwana Anticl.	NI-53-8　名古屋 6, 7	蓮花寺層（T） Rengeiji Formation	NEN 10	8	0.01 (35')	4	嘉藤良次郎（1957）	N.15
72-2	甲　南 Konan	NI-53-8　名古屋 15	古琵琶湖層群（UP） Kobiwako Group	NW 2～6	2～6	0.02～0.04 (1°10'～ 2°20')	0.5～1	横山他（1968），地質雑.	
72-3	四日市 Yokkaichi	NI-53-8　名古屋 7	奄芸層群（Ld） Age Group	N 15	5	—	—	三重県（1964）XX	
72-4	津 Tsu	NI-53-8　名古屋 7, 8	"	N～NW 15F	2	—	—	〃	
74-1	久能山 Kunosan	NI-54-32 静　岡 11	久能山面（T, f） Kunosan Surface	NE 8+	5	0.11 (6°20')	44	土　隆一（1960）	N.23 S.80
			日本平面（S, f） Nihondaira Surface	NE 8+	5	0.076 (4°20')	84	〃　（1961）	
74-2	小笠山 Ogasayama	NI-54-32 静　岡 16	小笠山面（T, f） Ogasayama Surface	NE 20	—	—	—	土　隆一（1961） 〃　（1966）	S.80 S.82
75-1	湊　川 Minatogawa	NI-54-26 横須賀 1	黄和田層（Ld） Kiwada Formation	E 5	2	0.12～0.33 (7～18°)	6～16	千葉県（1959）XX 三梨　昂他（1961）V	
75-2	佐　貫 Sanuki	NI-54-26 横須賀 1	岩坂層・長浜層（Ld） Iwasaka & Nagahama Formation	E 3	2	—	—	三梨　昂他（1961）V	
75-3	房総半島南部 Southern Boso Pen.	NI-54-26 横須賀 3	豊房累層（Pd） Toyohusa Formation	ENE 1～10	0.5～2	0.18～1.2 (10～50°)	9～60	成瀬　洋他（1951）	N.96
75-4	曾我山 Sogayama	NI-54-26 横須賀 13	土沢層（T） Tsuchizawa Formation	NW 10	3+	—	—	〃　（1960），第四紀研究	
83-1	富田林 Tondabayashi	NI-53-15 和歌山 5, 6	大阪層群（Ld） Osaka Group	NE 12	3～5	0.7F (35°F)	70F	岡　義記（1961） 中世古幸次郎（MS），地質図の書き方	0.9

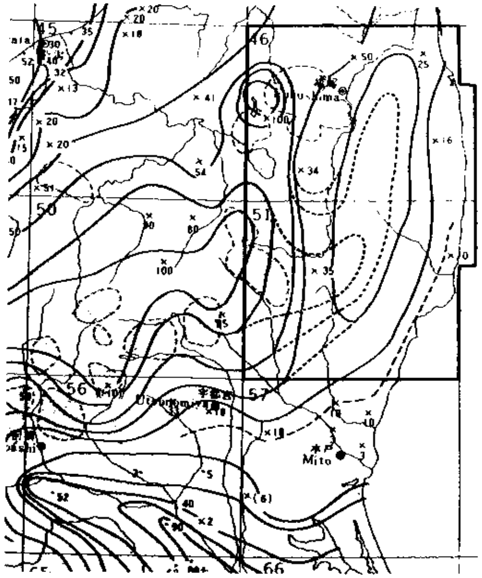
1	2	3	4	5	6	7	8	9	10
83-2	白川池背斜 Shirakawaike Anticl.	NI-53-15 和歌山 1	白川池累層(UP) Shirakawaike F.	N	—	0.36～0.58F (20～30°F)	9 ~14F	坂本　享(1955)	N.9
85-1	渥美半島 Atsumi Pen.	NI-53-2 豊　橋 12	天伯原面(T, m) Tenpakuhara Surface	ENE 30	20	0.01 (35')	4	土　隆一(1960) 貝塚爽平(1961) 黒田啓介(1966) 太田・石川(1967), 第四紀研究	H.5 N.45 K.26
		NI-53-3 伊良湖岬 9	福江面 Fukue Surface	ENE	20	—	—		
90-1	姫　島 Himeshima	NI-52-4 中　津 6	姫島累層(Ld) Himeshima Formation	N 2+	3	0.36～5.7F (20～80°F)	36 ~570 F	笠間・藤田(1955)	N.10
99-*1*	鶴　崎 Tsurusaki	NI-52-5 大　分 5	鶴崎層(Ld) Tsurusaki Formation	NWN～N 1～2	0.5	—	—	首藤次男(1953)	N.5

Errata of the map "No. 2 Vertical displacements estimated with geological method."

error



correct



□ corrected area

×85 → ×35

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