Hydrography and Irrigation System in the Yonezawa Basin

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Topography of the Yonezawa Basin, viewed from the Tectonic Movement in the Surrounding Hill-lands

Kenzō FUJIIWARA

Introduction

Some basins belonging to the Median Groove in the Tōhoku Region are considerably distant from the Japan Sea, but their floors are scarcely dissected, because they are not situated much higher above sea level. On the other hand, the eastern half of their floors is extensively covered with fans spreading out on them. The activity of the faulting, causing the formation of these fans, can be conceivable through the researches of Dr. Otsuka and others, who confirmed the activity in fold structure, without depending upon the writer’s description mentioned before. Therefore, on the geomorphological considerations of the basins belonging to the Median Groove, the study of fans, especially from the viewpoint that the fans are the products of the active tectonic movement, attracts the writer’s interest as an important theme. And the relationship between the mode of the movement in faulting and the distribution of pre-tertiary rocks dotted on the tertiary rocks in this region is another interesting theme. This paper is a consideration, from such stand-points, of the Yonezawa Basin situated in the south of the Median Groove.

The writer wishes to express his hearty thanks to Prof. Yoshiro Tomita and Assit. Prof. Ken-ichi Tanabe under whom he has carried out his researches.

General Features

The Yonezawa Basin measures 23 km in length from north to south and 14 km at its widest in the north, and it doesn’t show clearly the feature of a fault basin as the other basins belonging to the Median Groove do in general (Fig. 1). Its floor is approximately 200 m above sea level even at the lowest part, in which the outlet of its floor lies, in the northwest corner of

4) In the paper (the recent earth movement viewed in the east side of the Yokote Basin. Ann. Tohoku Geogr. Assoc., Vol. 7, No. 2, 1954), the writer pointed out that the movement in faulting still progressed in repetition and its mode affected on the formation of fans considerably. At the same time, he said that its mode seemed to be restricted by the distribution of palaeozoic rocks and granodiorite.
5) ibid. 2)
its floor, and is much higher than the other basins. But the Matsukawa River, which is the up-stream of the Mogami River and the only draining stream of the basin, has not dissected its floor so much because of the harder rocks of the gorge (the Matsukawa gorge) at its outlet.

Though the basin floor definitely indicates a unit in morphology, it is nothing but a part of the broader unit including its both outer areas in structure. The eastern hill-land which is contiguous to the east part of its floor is distinguished by a steep scarp from the Backbone Range, which is composed of granodiorite and has a flat plane, assumed peneplain remnants, on top. This area is included in the same structural unit as that of the basin floor, for the reason why this is a depressed area. On the other hand, the western hill-land, which is extensively distributed with the soft rocks (upper pliocene), presents the wave-like feature having very gentle slope. And its western margin accords with the southern extension line of the Hayama fault scarp which borders the western side of the Nagai Basin, and accordingly this area is also distinguished from the Asahi-Iide Mountain-lands and is a structural unit similar to the basin floor. Therefore, it is certain that the topography of the basin floor is closely related with the mode of the tectonic movement occurring in its outer areas. This is the reason why the writer takes up its both outer areas for the geomorphological consideration of the Yonezawa Basin.

The Synclinal Feature of the Tamaniwa Hill-land and the Sasanoyama Fault Scarp (Western Part of the Basin)

1. The relationship between the hill-land and its geological structure.

As a foresaid, the western hill-land is a wave-like land, lying 300 m to 500 m above sea level and having gentle slope, and its north-eastern part is cut off by the Sasanoyama fault scarp. The Sasanoyama fault scarp has the most distinct feature near Sasanoyama mount (660 m above sea level), rising southwest of Yonezawa City, and its scarp is 300 m in height (Fig. 2) there. But towards the north-north-west, its scarp decreases
gradually in relative height, until at last it becomes so obscure as not to be traced. However, in the up-stream of the Nogawa River, flowing from the Asahi Mountain land into the Nagai Basin, there is a clear fault scarp (the Nogawa fault scarp) facing northwesterly. According to the summit level, these fault scarps seem to belong to the same fault, but there are not the positive data indicating the fact.

The valleys in this area can be classified into two types by their directions and their forms. Namely, i) open valley—broad and shallow valleys having the direction N20°–30°E (the Kurokawa, the up-stream of the Inukawa River), ii) valley in valley—complex valleys in which a open valley is newly dissected and which have the direction N80°E (the Kotaru River). In the former, as its river terrace is not formed at all and its bottom is scarcely dissected at present, so its cross profile presents a smooth concave curve made by the gradual connection of valley bottom and valley walls. In the latter there are a few steps of excellent terraces formed by cutting down an old open valley. Accordingly, it must be assumed that there was once the revival of erosion which happened in the latter alone.

The writer, then, will examine the valley head of the Kurokawa River a little. The Kurokawa valley branches into two in its up-stream, which run in parallel to each other and become the extremely lower and wider passes at their ends, which open on the north wall of the Kotaru valley (Fig. 1, 4), and are very unsuitable being compared with scale of the present stream in height and width. Near the passes, furthermore, some rounded gravels can be found. According to the above facts, it should be understood that the ancient Kurokawa River was pirated by the Kotaru River and lost both of its up-streams from these passes upward.

According to the summit level of this area (Fig. 3), it seems that the neighborhood of the Kurokawa valley is the lowest ground of this area and consequently is thought to be the axis, taking the direction N30°E, of a synclinal feature, which the feature of this area presents as a whole. In this area, the margin grounds surrounding from west to south are composed of some old and hard formations, and the recent formation occupies a greater part of the area covering the center and the northeast part. That is to say, in the margin, the alternative layers of gray hard shale and tuffaceous shale are distributed, and in a inner margin, the alternative layers of soft tuffaceous shale and sandstone are arranged, and in the more inside, namely in the center, the softest layers of conglomerate and conglomeratic sandstone lie broadly. And the geological structure of this area exhibits, as a whole, the synclinal

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structure having the axis of the direction N30°E near the Kurokawa valley. Therefore, it seems that the feature of the summit level expresses not only the mode of the tectonic movement in this area, but its geological structure and then the fact that the Kurokawa “open valley” corresponds to a synclined valley.

Fig. 3 Map of the summit level. Curves of altitude with 50 m equidistance. Coarse hatches present the depressed grounds and fine hatches show the slender troughs.

In the end, it can be concluded as follows. In the Tamaniwa hill-land, there was an ancient valley system which was consequently grown at the oldest time. Thereupon the rejuvenation of the Otaru River retreating from the direction ENE pirated their courses and then formed the new valley system adding the direction N80°E component, which is the direction of the older (or higher) valley in “valley in valley” and perhaps is brought due to the activity of the Sasanoyama fault. Furthermore, the later faulting formed a few river terraces in the valleys of the direction N80°E alone.

2. Some features viewed on the river terraces and the river longitudinal profiles. The writer classified the topographic planes of the valley bottoms in this hill-land into three, i.e. higher, middle and lower planes (Fig. 4). The higher plane is composed of loamy subsoil covering the upper.
part considerably thickly, and of underlying gravels, grains of which are usually decomposed by weathering. It is able to be well observed in the valleys of the Omono, the Inukawa and the Shirakawa Rivers. It has different features at the different places. For example, at one place it is a most gentle slope connecting gradually with its valley walls, and at another it shows a modified uneven surface. The eminences located at the mouth of the Shirakawa River and in the eastern outskirts of Imaizumi Town are examples of

Fig. 4 Map showing the geological conditions and the topographic planes. 1. pre-miocene rocks (granodiorite and Sekirae rocks), 2. miocene formations composed with agglomeratic tuff, pumiceous tuff breccia in general, 3. pliocene formation composed with the softest layers of conglomerate and conglomeratic sandstone, 4. higher plane, 5. middle plane—The lower plane has not done to draw in this map, 6. waste-filled land form, inlet-like valley, 7. detrital cone and fan, 8. dissected fan, which is correlated to the middle plane, 9. growing fan. In the granodiorite area in the northern hill-land, the direction of the most predominant valleys is presented.
the latter, where a heavy, thick clay layer (2m at the Shirakawa, 6m at Imaizumi), which seems to be lacustrine deposits because it contains some remains of plants and laminae of fine sand, lie under the loamy subsoil. Furthermore this surface is distributed near Isazawa settlement and Miyauchi Town along the northern margin of the basin floor and near Ayukai and Arato Towns in the north of the Nagai Basin also. Therefore, it seems that in the period of this surface a lake and swamp existed to a large extent from the north of the Yonezawa Basin to the whole Nagai Basin, and that some rivers pouring into them formed “open valleys” having very gentle gradient.

The middle plane is in general composed of gravels which are covered with black soil (40–50 cm in thickness) and which are scarcely decomposed, and it is a river terrace just as the lower plane is, which is lower than the former and a little bit higher than the flood plain. And the former corresponds in forming age with the dissected fan situated on the basin floor near the valley mouth, the latter connects with the growing fan. Concerning the three planes, it is noticeable that their distribution and their form present some very important problems. That is, the Kurokawa valley has no topographic planes in it, while the valleys of the Omono, Shirakawa and Inukawa Rivers existing on both sides of Kurokawa, have some; especially they are well developed in the former two.

Fig. 5-(A) is the longitudinal profiles of the four rivers stated above, and the profiles of the three planes in addition. The heights of the terrace scarps shown in this figure are values obtained with hand-level. As indicated in this figure, the profiles of the higher plane are the curves having the gentlest gradient, and according with those of the middle at the up-stream. The gentle gradient of the higher explains that the rivers took the form of grad-

![Fig. 5 Longitudinal profiles of four rivers in the Tamazawa hill-land area (A), and a profile showing approximately the mode of displacements along the Sasanoyama fault (B).](image)
ed courses each in that period, as it is already understood through the con-
sideration of their forms and their composed materials. In the Omono and
the Shirakawa, the profiles of the middle and the lower exhibit such curves
as those of the flood plains, but in the upper part of the Inukawa, they ac-
cord with those of the flood plains, there being no higher plane in the upper
part than the point. A most remarkable knick-point exists at the mouth of
the Omono. And it is sure that a knick-point consists in the mouth of the
Inukawa also, the gradient of which is gentler than that of the Omono. But
the longitudinal profile of the Kurokawa draws a very smooth curve lacking
a knick-point and even any bending part between the valley bottom and the
basin floor.

3. The mode of the movement in the western hill-land and the Sas no-
yama fault scarp. As it being previously expected by the above consider-
ation, it can be supposed that the feature of valleys is closely related to the
mode of the tectonic movement in this hill-land. To make it simple, firstly
the writer considers the Inukawa, the Kurokawa and the Omono Rivers, and
does not the Shirakawa River in a different river system. These three streams
flow directly from the hill-land into the basin floor, in which they join the
Matsukawa River. Thus, it can be understood that the rejuvenation from
the Mogami River scarcely extends to them after the period of the higher
plane so their river terraces are formed by some other causes. But only with
the resistance of rocks against corrosion and the scale of their drainages,
cannot be explained the valley feature stated above. For example, the drain-
age areas of the Inukawa and the Kurotectonic are geologically composed of
some rocks almost similar to each other, and the Omono River being the
largest in drainage area has the most steep gradient. Thus, for the forming
cause of the river terraces, the tectonic movement should be taken up, that is,
the relative displacement between the hill-land and the basin floor, which
give shape in the Sasanoyama fault scarp. The above can be corroborated by
the displacement of the higher plane at the mouth of the Omono River and
by the agreement of the knick-point with the fault line.

Next, lets the writer consider the Shirakawa River excepted above. In
the valley of this stream there are some well growing terraces. But they dis-
appear suddenly at the mouth (near Uzentsubaki), below which a fan is form-
ed instead of them, so that they are not connected with the terraces of the
down-stream, at which a terrace is formed by the rejuvenation of the Mogami
River. Thus, it seems that they are formed due to the relative displacement
of the upper- and lowerparts adjoining at Uzentsubaki. Uzentsubaki is situat-
ed at the northwestern extension of the Sasanoyama fault and seems to be
the southeast end of the Nogawa fault line and otherwise to be the south
part of the Hayama fault line. Therefore, there is no doubt that the terraces in the valley of the Shirakawa are largely caused on the tectonic movement of the whole Tamaniwa hill-land in forming.

If the forming cause of the terraces depends almost upon the activity of the Sasanoyama and the Nogawa faults, their mode ought to be generally understood through the geomorphological features of terraces. Fig. 5-(B) shows the heights of terrace scarps imaged on the fault line from data which are gained at each mouth of rivers in Fig. 5-(A). As understood by this figure, it follows that in the western hill-land, the displacement of the fault was always excessive near the Omono and the Shirakawa Rivers which were the wings of the synclinal structure, and that it was the smallest at the Kuro-kawa, which was the axis. And the lacking of terraces and fans in the latter suggests that the displacement did not take place (stillness) or did toward minus (sinking). It can be said that such displacements in faulting were repeated three times after the period of the higher plane and that each time is a phase of the geomorphological development in the western hill-land.

The Goshiyama Fault Scarp and the Fore-mountain Hill-land under it (Eastern Part of the Basin).

The eastern hill-land consists of hills having at least 500 m above sea level and of small hollows sitting in the lower part, and it can be named “fore-mountain hill land”, because it is very low in height against the Backbone Range 1,000 m to 1,300 m above sea level (Fig. 3). The steep scarp which divides this area from the Backbone Range and is tentatively named “the Gōshi-yama fault scarp” is maturely dissected by numerous ravines, and no, or very slight visage of the fault scarp.

There is only one, among the hollows, which resembles a basin in landform. It is the Wada Basin, which was already named “a kettle-like basin (a kettle-depression basin)”, and the others exhibit some features which seem to be eroded valleys having no relation structurally each other. But considering the summit level, it should be noticed that the Yashiro valley is included among the broader depressed ground (the Takahata depressed ground) which extend over the areas of Takahata Town and of Nijuku- and Yashiro-mura. Likewise, the Azusa valley is included in the same unit (the Manze depressed ground) together with the Kariyasu valley, and even the Wada Basin is nothing but a part of the broader ground (the Wada depressed ground) which contains its western low hills. Furthermore, it is known that the three similar depressed grounds are arranged at the foot of the Gōshi-yama fault scarp.

Between the depressed grounds, some hill-lands, approximately 500 m in
height, jut out westward from the Backbone Range. And a slender trough connects the two depressed grounds by cutting off the neck of the hill-land and pierces the Manze depressed ground to the Kaminoyama Basin with N–S direction tending more or less eastward. Furthermore, a chain of depressed ground containing both the Nakayama and the Nakagawa Basins extends north-northwest from Akayu Town which exists in a depressed ground (the Ōyachi depressed ground). In the still more western part some valleys of north-northeastern direction arrange in great numbers to the Nagai Basin. Here, it should be remarked that all the above depressed grounds and valleys lie in parallel to each other.

The writer will consider a bit the features as stated above, though some obtained data are still inadequate for the explanation of them. The Backbone Range around Mt. Gōshiyama (1022 m in height) is composed of granodiorite (pre-miocene) in core, and in its western part, the formations (miocene) of agglomeratic tuff and plagioliparite are arranged. In the still more western area than the outcrops of plagioliparite, formations of massive tuff breccia (miocene) lie almost as broad as the whole fore-mountain hill-land area. A syncline axis running from Manze through Akayu to Nakayama was expected by Mr. Minakawa⁴, because he observed the outcrops of plagioliparite and granodiorite on the west side of the tuff breccia. The fault exposure, making the tuff breccia immediately contact with the older rocks (Sekine old rock, granodiorite, etc.) and the western side of which slipped down, was observed by Mr. Minakawa at the Akahama settlement sitting on the east of Manze-mura. And, in the neighborhood of the Niijuku Pass situating east of Takahata Town, the fractured zone of fault having N20°E in direction and 1.5 km in width was found by Mr. Fujita⁵, who explained that it had been formed at the geologic period from late miocene to quaternary. Though the two fault exposures observed by the geologists are a little different in the character of fracture, but they resemble closely each other in the fact that they have the strike of north by east and the foot wall on the west side. And both the exposures are situated on an extended line in general. Therefore, as was stated by Mr. Fujita, they must undoubtedly contain the supposed same fault system of a width.

The Backbone Range diminishes abruptly in height on its west side, which corresponds to the Gōshiyama fault scarp. Further, it seems that the net-slip of the fault system in the north is smaller than in the south, and that in the north the fault gradually transforms into the flexure. This chang

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⁴ S. Minakawa: Read at the Meeting of the Tōhoku Branch of the Geological Society of Japan, 1951.
seems to relate to the height of the Backbone Range, of which the northern part is lower than the southern. In the valley bottoms in this area filled up with waste, it is usually very difficult to find the exposures of the valley floor basements. But, the writer observed that a few fracture existed conspicuously at some outcrops, especially along the margins of the depressed grounds (Fig. 6). Even if they are fractures of different kinds having cleft, fissure and miner fault, they can be generally classified into two types by the direction, i.e. the N-S direction and the E-W (trellis pattern). On the ground that they exist in great numbers only in the margins of the depressed grounds, it is supposed that they take a considerable part in the forming of the depressed grounds. Enough fractures are not to be observed to understand their occurrence-mechanism by their directions and their characters. They are mainly observed on the outcrops of tuff breccia and also at the outcrops of plagioclparite, and granodiorite. And the more distinct one (N-S direction) of the two fracture types runs approximately parallel to the direction of the Gōshiyama fault and of the stretch of the valleys in the northern hill-land. Therefore, between the fractures on the tuff breccia and on the granodiorite of its both sides, there must be some relationship in occurrence-mechanism. On the other hand, the fractures of granodiorite having the N-S direction are clearly observed not only in the Backbone Range and in the northern hill-land, but also in the north of the Asahi Range and others. Accordingly, it is sure that these fractures are not so much affected by the primary structure of granodiorite, as the product of the “tectonic movement” which is occurring over all the western zone of the Tōhoku Region. According to the above considerations, it is expected that during the progress of depression (faulting and flexure) of this area the structure of underlying baserock (granodiorite, etc.) had an effect on the deformation of miocene rocks (tuff breccia, etc.) producing the trellis-like fractures.

Summarizing the above discussion, the eastern hill-land area corresponds to the foot wall, or flexured down-side, of the Gōshiyama fault, and the area has the syncline structure composed of the miocene rocks jamming in the pre-miocence. The floor basement of this area is crushed like trellis.
this is especially found along the margins of the depressed grounds and shows such features as were brought about by the tectonic movement. Accordingly, the writer may think that the origin of the depressed grounds are attributed to strong and excessive slipping down the some parts of the trellis-like fracture, that is to the partial depression in the foot wall of the Gōshiyama fault. Further, getting the differential erosion, some of the crushed weak zones became many troughs.

Considering topographically the eastern hill-land, the writer can not find the higher plane, which distributed here and there in the western hill-land, yet observed merely some small-scale terraces in the valley bottoms of the Azusakawa and the Kariyasu Rivers in the south. The basins and the valleys in this area have deep inlet-like flat floors, which are filled up with wastes and presented a most typically near Takahata Town. What do these facts express? Because the harder rocks of the Matsukawa gorge checked the rejuvenation of the Mogami River toward the basin floor in the geologically recent time, it may be thought that this gorge decided locally a base-level of erosion for the drainage area. Hence, if the eastern area had been relatively uplifted with the gorge, such as the western hill-land, this area should have been dissected by the Matsukawa River and its tributaries, and some terraces should have been formed in this area. But, in fact, the present land forms are in contrast to this. Accordingly, it follows that the ground of this area suffered rather subsidence than upheaval comparing with the Matsukawa gorge in and after the period of the higher plane.

On the other hand, in this area some alluvial cones and fans spread out from the mouth of smaller tributaries on waste-filled valley floor. Especially they are most representatively observed south-east of Takahata Town and of the Wada Basin. The writer takes a great interest in why the deep inlet-like flat floors and the detrital cones and fans exist in a same valley. It can be found that the inlet-like floor is always distributed in the valley of the streams flowing south- and eastwards, and that the detrital cone and fan in the valleys running north- and westwards. These facts can be more clearly expressed by making each longitudinal profile of the valleys classified into four types by the flowing direction and then by adding to it the situation of the detrital cone and fan. That is to say, concerning the south- and eastward valleys each the curve shows easy grades in their entirety except at the valley head. But the profiles of the north- and westward valleys are steeper curves which have a marked convex curve exhibiting the existence of detrital cones. Furthermore, the fact that the ravines near the heads of the latter have been maturely dissected is as interesting as the existence of the detrital cones.
To sum up the above morphological considerations, it is as follows. This area all over depressed along the foot of the Backbone Range, the westward scarp of which has been maturely modified by numerous ravines, and some fans and cones have been produced only at the mouths of the ravines. But, at the same time, having partially depressed based on the trellis-like fractures, some ancient valley bottoms lowered down below the level of the Matsukawa gorge, and consequently some inlet-like valley floors were formed in the valleys or basins of the above depressed grounds.

The Landform of the Basin Floor.

As was already stated, because of the existence of the Matsukawa gorge, the Matsukawa River does not flow smoothly and so meanders in the north part of the basin floor. In the basin floor, the good growth of terraces can be hardly seen but the mouths of the Matsukawa, the Haguro and the Yoshino Rivers. Moreover, we can observe that some dissected fans having easy grade spread out from the above mouths toward the center of the basin floor. There are no definite and positive data which can explain the cause of their forming. But, their forms and their composed materials and their structural relations with surrounding mountains suggest that they were formed by the depression of the whole basin floor.

In the northwest suburb of Yonezawa City, there are a large fan being grown by the Omono River and a dissected fan which remains only at the valley mouth and can be corresponded to the middle plane of the up-stream. At the mouth of the Enukawa also, there is an old dissected fan having a gentle surface, which connects with the middle plane of the up-stream and so can be corresponded to the dissected fan of the Omono River. There is no doubt that these fans were formed by the occurrence of the movement along the Sasanoyama fault. But at the Kurokawa no fan is to be found at all.

On the other hand, a waste-filled feature is conspicuous in the eastern half of the basin floor, especially in the north part of which the Hakuryu Lake-ko and some broad peat marshes lie to the east of Akayu (Fig. 7). In addition, there

Fig. 7 The waste-filled feature around the Hakuryu Lake which is buried yet. The buried hills and spurs are seen far away.
are more than 10 small isolated mounds here and there, which seem to be buried ancient hill tops.

Such topographical differences between the west and the east parts of the basin floor are closely related to the modes of the movement in the broader area which contains the surrounding hill-land. They are shown by the patterns and the profiles of the river courses. For example, in the basin floor some river courses having the direction of north, such as the Matsukawa River and the Haguro (northward) and the Yoshino (southward), are one-sided, i.e. eastward, and so are at their mouth. Furthermore, the longitudinal profiles of the river flowing into the basin floor show a conspicuous contrast between the east- and westward rivers (Fig. 8). That is to say, the profiles of the former show gentle curves having a marked knick-points. On the contrary the latter ones present peculiar curves taking a sudden turn from the steep declivity at the up-stream to the easy grade at the valley bottom and the basin floor. Still the intermediate character between the above is presented in the profiles of the north- and southward rivers.

![Fig 8 Longitudinal profiles of rivers flowing into the basin floor.](image)

From the above facts, it can be concluded that the land form of the basin floor, except that in the north and south, is represented by the fans on the west and with the inlet-like floor on the east. And then the former can be clearly explained by the relation with the upheaval in the western hill-land and with the movement of the Sasanoyma fault, and the latter can.
be generally understood, based on the relationship between the Gōshiyama fault scarp and the fore-mountain hill-land and on the trellis-like structure of the baserock of the foot wall. Furthermore, taking account of the existence of the Matsukawa gorge as the local base-level of erosion, the above considerations will, to some degree, contribute to the solution of the problem.

**Conclusion**

As one of the topographical similarities of many basins belonging to the Median Groove, it is said that in the east of the basin rise the Backbone Range having great height above sea level, and over the western area lie the tertiary hill-land having low relief. It makes us suppose that the grandiose fault scarps face to west along the eastern margin and the extensive fans spread out under their scarps, and that the western margin is lacking of them. But the writer has said in this paper that the Yonezawa Basin has many characters which are quite different from these suppositions. That is to say, though the topographical similarity is observed on the surrounding mountain lands, yet it is not found along the margins, especially not in the floor of the basin. Such singularity in this basin seems to be brought by the upheaval, forming the synclinal structure and continuing to the most recent time, of its western area (Tamaniwa hill-land)—that is the existence of the fault scarp having the clear form relatively and of fans being still in growth. But the singularity seems to decisively consists in the lack of fans in its eastern area, because the depression is insufficient in the foot wall (Fore-mountain hill-land) of the Gōshiyama fault and the fault is inactive along it. These facts mean that the Yonezawa Basin is more or less different from the others in the mechanism of formation.

On the problem of the tectonic movement in the western zone, which is contained in the Mizuho Fossa Magna Folded Zone proposed by Y. Ōtsuka, of the Tōhoku Region, there are various opinions; that is, one is the eastward lateral pressure of the Asiatic continent, and another is the deformation which transforms the tertiary formations, overlying on the baserock, by the separate movement of each block of baserock. But, even if it is caused only by the lateral pressure, the deformation of tertiary formation may be affected by the existence of the underlying baserocks such as palaeozoic rocks and granodiorite. Therefore, without distinction of its cause, the deformation, which takes part in the forming of the basins having the aforesaid characters, may be regarded to be not a little affected by the distribution of the underlying baserocks, and so in the Yonezawa Basin which is surrounded by the rocks. Therefore, the geomorphological characters of the Yonezawa Basin have to be grasped through the aforesaid geological condition.