Morphology of Senmaya Hills in the Southern Part of the Kitakami Mountains

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Hill morphology seems to have a specific character, compared to mountainland, terrace landform, and lowland plains, in such points as that hills consist of gentle or steep slopes with narrow flat surfaces on their tops, develop usually in areas of low relief, and cut several rocks, mainly of Neogene Tertiary. In Japan, hilly landforms develop between mountains and lowlands, or sometimes between river terraces and alluvial plains. In any case, hills include some interesting problems whether hill formation is merely a product of a transitional stage in the erosional process, or it is resulted from a somewhat specific way like the influence of an entire alternation of denudational agency. The writer is going to discuss the denudation that hills were formed under a different environment from the present manner of dissection.

The writer's concern is, furthermore, to ascertain a geomorphological meaning of the fact that two different types of landforms coexist especially in hill-land in Japan. To approach to this problem, the writer would classify the topography of an area into some large groups and would point out a few valley levels, for the purpose of understanding relief structure. On the way of the work in the last few years, an interesting topography was found. It is, after the writer's naming, "high-level valley", which was found at first in the Nonodake Hills, Miyagi Prefecture, and later in the Kakuda and the Sasamori Hills (Nakamura 1963b, 1964b, 1966a). Judging from the distribution pattern, high-level valleys have a key to clarify the relationship between denudation surface forming and relief forming in the hills. Thus the present paper keeps the emphasis on the morphological description about high-level valleys and their related landforms. Of course, relief distribution and morphological development of the area, and correlation to the neighboring regions must be significant for this study.

The hill-land here studied (the Senmaya Hills in following chapters) is a favorable field to the subject, because it is situated at the piedmont of the Kitakami Mountains adjacent to the table land in the Kitakami Valley, on which morphological studies have been already accumulated.

1. Outline of geology and topography; problem setting

The Senmaya Hills chiefly consist of Permian slate (Toyoma Formation) and granitic rocks (so called "Senmaya Granite") intruding the lower Cretaceous strata (Hanzawa 1954). In detail, quartz diorite, quartz monzonite, and diabase are exposed at several places as resistant rocks. Conglomerate, sandstone, and limestone belonging to Paleozoic are scattered in the Toyoma slate formation area. As the geological constitution of the hills is very similar to that of the main part of the Kitakami Mountains, the hills are surely a part of the mountains, represented by pre-Tertiary sedimentary rocks and granitic rocks. Of the Tertiary sediments developing along the Kitakami Valley, only the Mataki Formation (mudstone with lignite beds) is found in patches, related with dissected tablelands. Concerning the geological structure, there are remarkable foldings of Permian in N-S direction accompanied with some rectangular systems of fault lines (Iwate Pref. 1954 and 1956).

The courses of the four tributaries of the Kitakami River, the Satetsu, the Senmaya, the Kinomi, and the Futamata Rivers, display the geological structure; the former three have incised meandering courses in their middle reaches, where remarkable gorges or rapids are formed, for examples the famous scenic spot, the "Geibikei" gorge in an area of limestone. And all of them have almost straight courses with valley plains about 1 km wide, joining the Kitakami River accordantly (Fig. 1). These valley plains mean the lowest regional base level of erosion for the hills, and the gorges in the middle reaches separate the lower level from the inner part of the hills with distinct knickpoint. Only the Futamata River has no knickpoint, so the valley plain has an almost graded profile in its drainage basin. As this stepped feature of the valley plains is due to geological structure, valley plains in the inner part of the hills are also based on the lowest level of erosion, in spite of their higher elevations (80–120 m). High-level valleys are situated much higher or in their upper reaches, near the valley heads of many branching streams.

Hilly landforms similar to the Senmaya Hills are found at the northwestern foot of Mt. Tabashine, but topographically, they have been included in mountain areas because of the lack of broad terraces, or of difficult correlation within scattered and dissected surfaces. On the topographical division of the Mizusawa Quadrangle (Fujiwara and Nakamura 1963) the hills, some of which are included into the basin of the Satetsu River, are classified into the western margin of the Kitakami Mountains, but regarding the subdivision and detailed descriptions they are treated as hills and dissected terraces (Tashiro Hills, Yanomori Hills, etc.). To the north the hilly area gradually rises beyond some intermontane basins (Surisawa, Ohara, Yôkamachi, etc.), reaching the core area of the Kitakami Mountains about

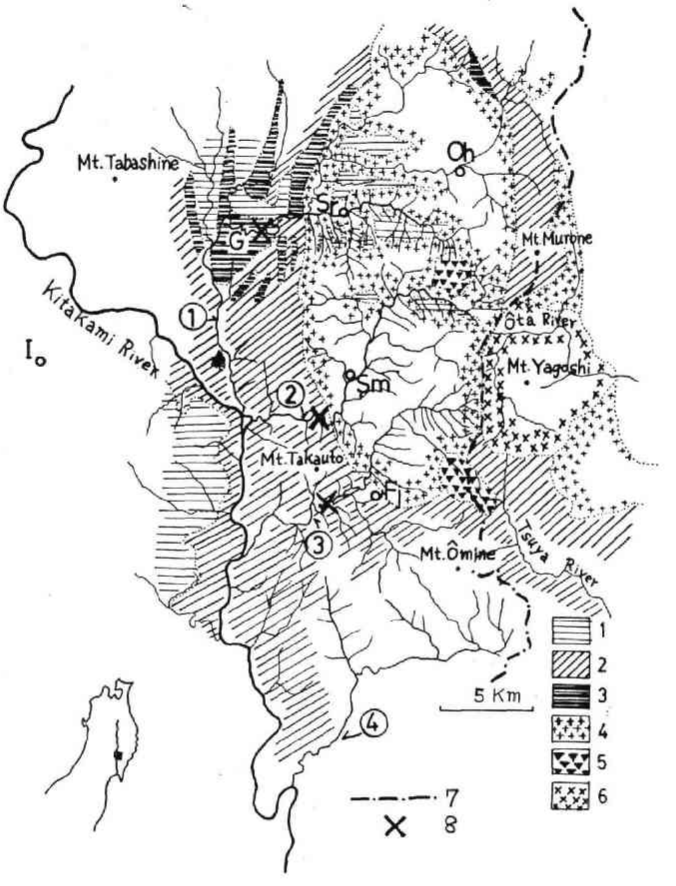

Fig. 1 Drainage system and geological background

1: Neogene Tertiary 2: Permian (slate, conglomerate etc.)
3: Permian (limestone) 4: Granitic rocks
5: Diorite 6: Monzonite
7: Watershed between the Sanriku Coast and the Kitakami Valley
8: Distinctive knickpoint (george)
① the Satetsu River ② the Senmaya River ③ the Kinomi River
④ the Futamata River
Fj: Fujisawa G: Geibikei Gorge I: Ichinoseki
Oh: Ohara Sm: Senmaya Sr: Surisawa

30 km northwards. The Kitakami River flowing through the Kozenji gorge (Tanabe 1952) makes the western boundary of the hills.

Roughly speaking, there are two elements that determine the quantity of relief everywhere in the hills; four geomorphic surfaces or planes and two valley

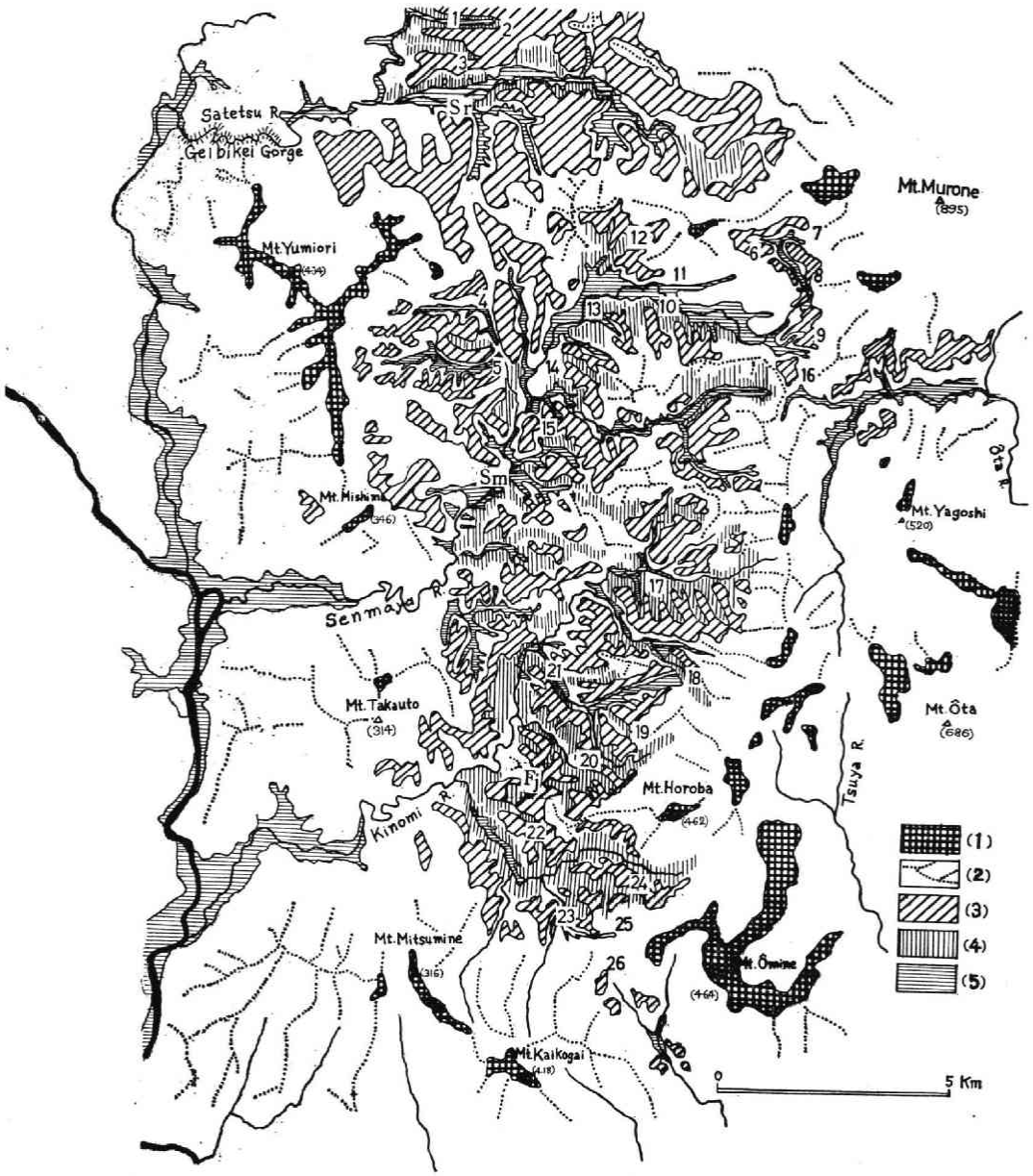

Fig. 2 Topographical map of the Senmaya Hills

(1) Horoba Plane (2) Neyama Plane, almost ridge in accordant height

(3) Fujisawa Plane (4) Konashi Terrace (5) Valley Plains

Undrawned space means steep slopes.

Fj : Fujisawa Sm : Senmaya Sr : Surisawa

levels. Present complication of the hills is caused by multiplication of the surfaces with each valley level. It will be possible to disintegrate this complexity into a simple model combining some of the elements. The four surfaces are, described in the following chapter, the Horoba Plane, the Neyama Plane, the Fujisawa Plane, and the Konashi Terrace; the two levels are those of the high level valleys and of the valley plains.

From the application of this study, it is expected that following subjects may be more or less clarified; 1) correlation between the Kitakami and the Abukuma Mountains based on the fact that below the lower surface (lower peneplain) another level of much lower erosion surface is found, 2) correlation to the neighbouring areas, 3) distinctive separation of denudation and dissection periods, presented e.g. by Nagel (1965) for hill-land and by Meshcheryakov (1963) for platform plains, and 4) to pay attention not only to periglacial phenomena but also to arid climate in hill morphology, suggested by Dedkov (1965).

2. Observations on each landform

Now the landforms in the Senmaya Hills are divided as is shown in Fig. 2. The landforms shown here as planes are not always flat planes, but they are usually hill tops or interfluves with an accordant height, probably transformed from an initial flat erosion surfaces by various ways of dissection and denudation.

1) *The Horoba Plane* is represented by the Horoba Mountain (462 m), and is correlated to the Ohira surface in the central part of the Kitakami Mountains about 550 m in height (Nakamura 1963a). Mountains protruding above this level are considered as *Fernling* (for examples, Mt. Murone, Mt. Yagoshi, and Mt. Ota), which were isolated remnants of the upper peneplain of the Kitakami Mountains. The level of the Horoba Plane is continuously traced southward into the summit level of the Ojika Peninsula, descending to 400–300 m (Ishikawa 1964). Slopes surrounding these mountain flanks are smooth and concave, and not so much dissected. On some slopes, for instance at Yagoshiyama, few block streams are recognized (Matsumoto 1966), and these evidences tell us a process of dissection which occurs under the certain potential relief between the upper surface and the lower (base level of erosion in many cases), and under some climatic condition.

2) *The Neyama Plane* is 300–180 m in height, represented by many flat or rounded tops of hills at the eastern part, by interfluves in accordant height (220 m) at the central part, and by small peaks protruding above the lower surfaces at the western part (Photo 3). This plane is redarded as the descended part of the Horoba Plane by means of selective erosion, for the plane is found only on low-resistant rocks

such as weathered granitic rocks. Slopes bordering this plane from the next-lower plane have also smooth and concave form, but are sometimes broken by the lowest valley level with sharp knick on half way of slopes. In short, this plane is not an original landform but a partly transformed one of the Horoba Plane.

3) *The Fujisawa Plane* (240–140 m, Photo 1,5,6) is the most wide-spread, having a doublecurved (covex-concave downwards) vertical profile, covered with no fluvial deposits but with a veneer of rock fragments supplied from mass wasting of weathered bedrocks. Its summit level gently descends westwards without any influence of rock difference upon its height. Judging from these facts the plain is an erosion surface that once developed here, and to the west it continues to Iwai Tableland in altitude.

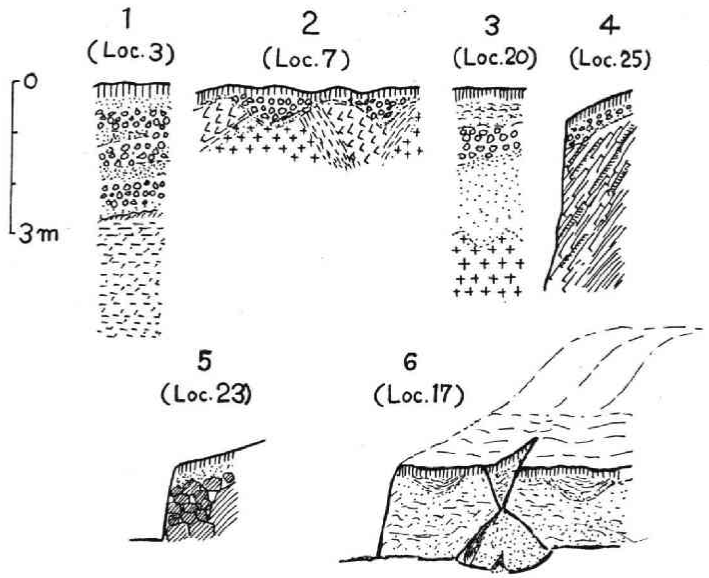

Fig. 3 Some sections of Fujisawa Plane (1–4) and Konashi Terrace (5, 6)

1: (upper to lower in each section) subround-gravel bed composed of slate, siltstone, and granitic rocks, with lenses of coarse sand; Pliocene mudstone (Mataki Formation)

2: angular fragments filled in ancient hollows; bedrock of granitic and andesitic rocks with metamorphosed parts

3: sandy clay; subangular boulders of granite and slate; weathered granite; unweathered granite

4: veneer of rock fragments; slate (Permian), N30°W in strike and 48°NE in dip, weathered along the stratification

5: veneer of coarse sand; decomposed bedrock of slate

6: clay and fine sand filled in ancient hollows; arkose sand with clay; terrace is dissected and small cone is formed in front of scarp.

The most remarkable difference between the Fujisawa Plane and Iwai Tableland is that, the former was formed dissecting (or denuding) the preexisting mountainous landforms like Horoba and Neyama Planes, while the latter was formed cutting the Pliocene formations after their emergence (Fujiwara 1959).

4) *The Konashi Terrace* (the writer would call it a "terrace", because of its clearly "terraced" feature) develops typically at Minami-konashi, 5 km southeast of Senmaya. This is not a river terrace in ordinary meaning but is, in many cases, a feature like a gentle slope (Wako 1966). At Loc. 17, a road cutting shows a massive deposition of fine — coarse sand with coarse grains of quartz etc. derived from granitic rocks (Fig. 3-6). At Loc. 23 (Funaki) it is composed of only bedrock (more or less decomposed), and at Loc. 19 rounded gravels 0.5 m thick cover the surface of the terrace. Thus the constitution of the Konashi Terrace is so variable but its surface is always gently waved (Photo 4, 7, 8), and is cut with a steep scarp which makes a conspicuous abruption of the slope in the hills.

5) The present valley plains (called "Valley Plain" hereafter) are subdivided into the upper and the lower. The former develops along the small branches and the latter along major streams. Stream pattern of these valleys seems to be controlled by a geological structure of NNW-SSE direction (Fig. 1). Most of small branches join to large-scale tributary in discordance with low scarps (about 2 m). These discordant junctions occur very frequently in the hilly region, and is explained as a result of different erosive power within the large-scale stream and the smaller one. Under such a condition, there occurred many piracies between

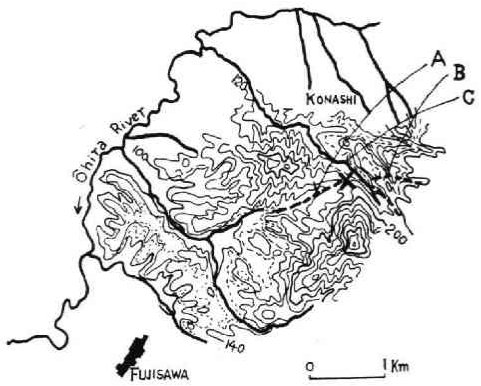

Fig. 4 Piracy at the upper branch (the Ohira River) of the Kinomi River (x in the figure)
A: beheaded stream (underfit river)
B: traced as terrace across the new drainage pattern, about 10m higher than new valley floor
C: headward extension of another branch stream

upper reaches of the streams of different scales (Fig. 4, Loc. 18). These are subsequent streams, and a piracy between adjacent two branches is considered as a result of the process of subsequent river formation. The writer pointed out the examples of piracies east of Tanagura, southwestern Abukuma Mountains, and at the Nonodake Hill, Miyagi Prefecture (1962, 63b).

Among these drainage basins there is a kind of parallel accordance to topographical units, despite of their variable scale, which include number of steps and velley levels. The same relation was reported on the Sasamori Hills where the Imogawa and the Takase basins have a same composition of terraces, erosion surfaces, incised meandering, and distinct knickpoints in gorges (Nakamura 1966a). This means that there occurred a change of erosional agency or altitudinal change of the base level of erosion after the drainage basins had been formed, and also that each basin has experienced a synoptic evolution notwithstanding altitudinal differentiation.

In such a topography there are some geomorphic problems. To point out such problems in which the present writer is concerned, such are the formation of a broad, flat erosion surfaces along the piedmont of the mountains, the formation of stepped pattern in erosion surfaces, and the process of dissection of these flat planes, or relief-forming process of the entire region.

The attention on the landform of "hills" hitherto has been much concentrated to their low relief and rounded feature as a whole, but according to the writer's observations more in detail, there are generally five elements in the so-called "hills"; that is, 1) accordant height of summits (frequently with flat surfaces), 2) a waving feature of upper part of hill slopes with shallow valleys of *Muldental* type,

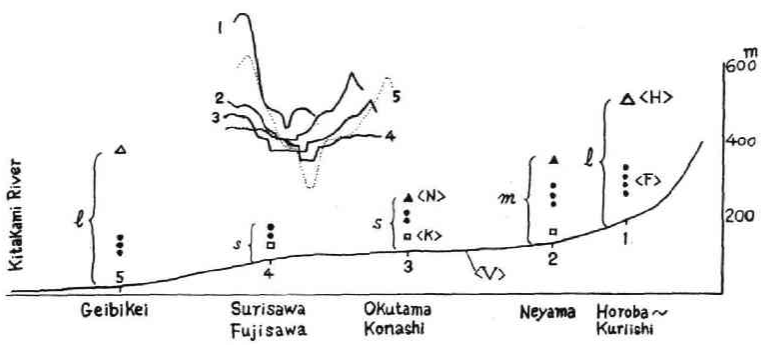

Fig. 5 Schematic profile and relief distribution
H: Horoba Plane N: Neyama Plane Fj: Fujisawa Plane
K: Konashi Terrace V: Valley Plain, represented by the Senmaya River
l: large relief (more than 250 m) *m*: moderate relieft (200 m±) *s*: small relief (less than 150 m)

3) breaks in slope gradient in the middle or lower part of hill slopes, 4) steep scarp or convex slope at the foot of hills, which plays an important role to represent a relief of the area, and 5) alluvial valley plain with high density and accompanied with discordant junctions of small branches.

3. Some features of the hill morphology in this area

1) Correlation to the neighbouring areas

Height of the Fujisawa Plane is concordant to that of the East Iwai Tableland in the adjacent region (on both sides of the Kitakami River), 130–120 m high. The East Iwai Tableland is divided into two planes, the Yasakai Plane and the Tomisawa Plane (Fujiwara 1959), and the Fujisawa Plane could be correlated to the Yasakai Plane and the Konashi Terrace to the Tomisawa Plane respectively. About the geomorphological meaning of the Iwai Tableland, K. Fujiwara explained that an uplift of the tableland area caused a separation of the Kitakami Valley from the Senpoku alluvial lowland in Miyagi Prefecture (1959).

The Senmaya Hills, however, are geomorpho-historically different from the Iwai Tableland in following two points, that the Senmaya area was free from the tectonic disturbance which dislocated the erosion surfaces like an uplift of the tableland, and that the planes in this area were formed chiefly not by the stream erosion but by a kind of surface denudation. The writer suggests the probability that erosion surfaces in the Iwai Tableland could have been formed also by surface denudation and there may be preserved some high-level valleys.

In the neighbouring areas to the southeast, the Fujisawa Plane is partly traced to the upper reach where it disappears into a narrow gorge, and its relation to the coastal area is cut here. To the south, the Horoba Plane is recognzied intermittently preventing the Fujisawa Plane from wide development like a barrier massif.

2) Morphological development

In spite of many regional variations geomorphological development of the hills is constructed in the following sequence, 1) a vast erosion surface, the Horoba Plane, which is deduced from the existence of remnants of flat-topped ridges about 460 m high, was formed probably in Plio-Pleistocene age, associated with the later peneplanation of the Kitakami Mountains. Morphological details are not ascertained but apparently most part of the Horoba Plane had been eroded out to form the second erosion surface, the Fujisawa Plane, which developed at the cost of the upper plane. During this period, especially in areas of less resistant rocks, the Horoba Plane was disintegrated into lower interfluves (the Neyama Plane). In the period of the Fujisawa Plane forming, present drainage system was not

established yet and the valleys of *Muldental* type prevailed in the entire region. As the Iwai Tableland is covered with Pleistocene deposit (Nakayama Formation) and was formed in late Pleistocene (Fujiwara 1959), the Fujisawa Plane must have suffered subaerial denudation for a fairly long time. Afterwards the Fujisawa Plane was dissected by concave valleys which were preserved as high-level valleys. The bottom of these concave valleys, or lower parts of concave valley walls, are nothing but the surface of the Konashi Terrace.

When the valley plain developed in present form after the surface formation of the Konashi Terrace, lowering of erosion-base-level was not always necessary. Because, in the cross section, 1) the scarp is very low (usually 2–3 m), and 2) vertical profile of the Konashi Terrace has concave slope descending toward the center line of the valley, so the present feature could be produced only by the swinging of the stream courses or lateral erosion (Fig. 6) without the lowering of the base level.

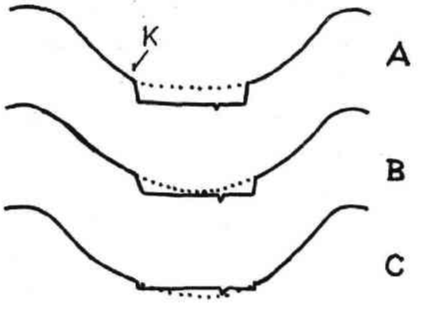

Fig. 6 Relationship between the Konashi Terrace (K) and Valley Plain is variable, not always necessary to assume a lowering of base level (B,C).

Furthermore, such form could also be introduced if the base level ascends a little. In any case, it is more important here that an agency by which the Konashi Terrace surface was formed seems to have changed its character. It worked to widen the flat-bottomed valley plains, and change of the base level, if at all, played a relatively subordinate part in the morphological evolution of the hills. As to the relationship between denudation surface and these valley plains, the former was evidently initiated prior to the development of the latter, but undissected part of the denudation surface is still in development, in very slow tempo keeping pace with widening of valley plains.

For the development of hill morphology of the present area, some favorable conditions are pointed out, 1) tectonically stable area, accompanied with relatively small-scale uplift offering small potential relief (Nakamura 1964a), 2) uniform or

simple structure of geology offered little variety of erodibility, and 3) remarkable knickpoints defend the most part of the hills (the upper reaches of dissecting valleys) from the more active erosion based on the level of the Kitakami River. The upstream areas of these tributaries have "not enough altitude" and this condition must be favorable to produce here a "mixed stage in Reliefenergie sequence" (Nishimura 1963), accompanied with small relief even at the maximum of relief development.

3) Breaks of hill slopes

Within the Senmaya Hills two types of landforms coexist as described above, *Muldental* type (including denudation surface, high-level valleys) and *Sohlen-kerbtal* type (*Kerbtal*, *Sohlental*, lower terraces). Boundary of these two types is recognized as a knickpoint or break of a slope in a vertical profile, and as a front line connecting knickpoints (Nakamura 1966b). This front line seemingly proceeds upstreamwards, but according to the previously mentioned fact the front line means a balanced location between the surface denudation of the upper slope and linear erosion (including lateral erosion, downcutting by stream erosion) of the lower slope. This idea was initially derived from relief analysis on the Kitakami Mountains (Nakamura 1963a) and later on the Sasamori Hills (1966a) and the hills around Sendai City (1966b).

4) Coexistence of two kinds of landform groups, and an alternation of erosive agency

If a thin debris cover was removed, wideopen valleys with concave cross profiles must have been formed, dissecting the Fujisawa Plane to transform it into a gently waving surface. Coexisting two landform types are separated morphologically by conspicuous breaks of slopes. This means that in the foregoing period landform evolution was carried on by the way of surface denudation under certain climatic condition. The writer assumes a rather arid climate in that period, deduced from such facts as thin veneer of rock fragments on the surfaces, and development (or preservation) of *Muldental*-type valleys which prevail in arid zones at the present (Louis 1960). However, along the Sarugaishi River, in the neighbouring section to the north, T. Wako pointed out a cryopediment built under periglacial condition (1963). In any way, denudation worked rather strongly, to transform the interfluves into lower and rounded mounds (like the Neyama Plane). Dissection of the Fujisawa Plane was also chiefly performed in such a way, and valley bottom or a part of downslope was terraced by the cutting of intensified stream erosion in the later period, which was introduced by an alternation of erosive condition.

Surface denduation (or down wearing) reduces a divide and finally diminishes

it, otherwise, linear erosion makes a divide develop and distinct. Consequently after the initial surface has been more or less uplifted, and if linear erosion acts to produce a valley system with *Kerbtal* type with high density, the surface would be finely separated into narrow and branching interfluves, and thus the once separated interfluves would receive surface denudation instead of linear erosion that gradually weakens owing to decreased supply of water. In this way erosive agency could alternate without any climatic change but according to an evolutional consequence. Nevertheless there still remains a question when and why such an alternation of erosive agency occurred. Was it a necessary result in old stage of normal erosion, or was it an abruption of erosion cycle caused by a climatic change (humid — arid — humid)?

Where linear erosion had overcome surface denudation gradually from downstream to upstream, a great number of small tributaries dissected the upper areas, by means of linear erosion, both deepening and widening of valley bottoms. Thus stream density increased in the low-level area according to the retreat of the upper-level area.

Lack of vegetation and deep weathering, on the other hand, reported by Matsumoto (1966) on the Shirayamadôyama and Yagoshiyama, suggests the existence of an arid climate, rather than cold or periglacial condition. Granitic rocks covered with gruss are easily weathered into respectable depth (Wahrhaftig 1965). For gruss production, big changes of temperature are favorable. Although periglacial and arid climates are both favorable for it, stability or no movement of gruss is necessary for deep weathering. A wide flat plain in a low-relief region like Kitakami Peneplain (especially the lower part) could favorably hold the gruss on the surface. In addition, the present hills are situated far (about 100 km) from the southern limit of periglacial landform at low level in the last ice age (Suzuki 1962), and this would support hypothesis that erosive agency was affected not by a periglacial but another (different from the present climate), maybe more arid climate.

4. High-level valleys

Up to the present, a term "foregoing landform (or valley)" is used for this kind of topography. However, foregoing forms are not always this kind of topography; and landforms built in a certain period in the past have a specific character described before, e.g. in higher situation, developing near the watershed, with concave profile, etc. (Photo 2). Here the writer would propose a definition of a high-level valley that it is a kind of a valley initiated in the previous cycle of erosion, accompanied with concave slope on both sides, in the uppermost reaches of an arbitrary valley, and discordantly joined into the present (or of later period)

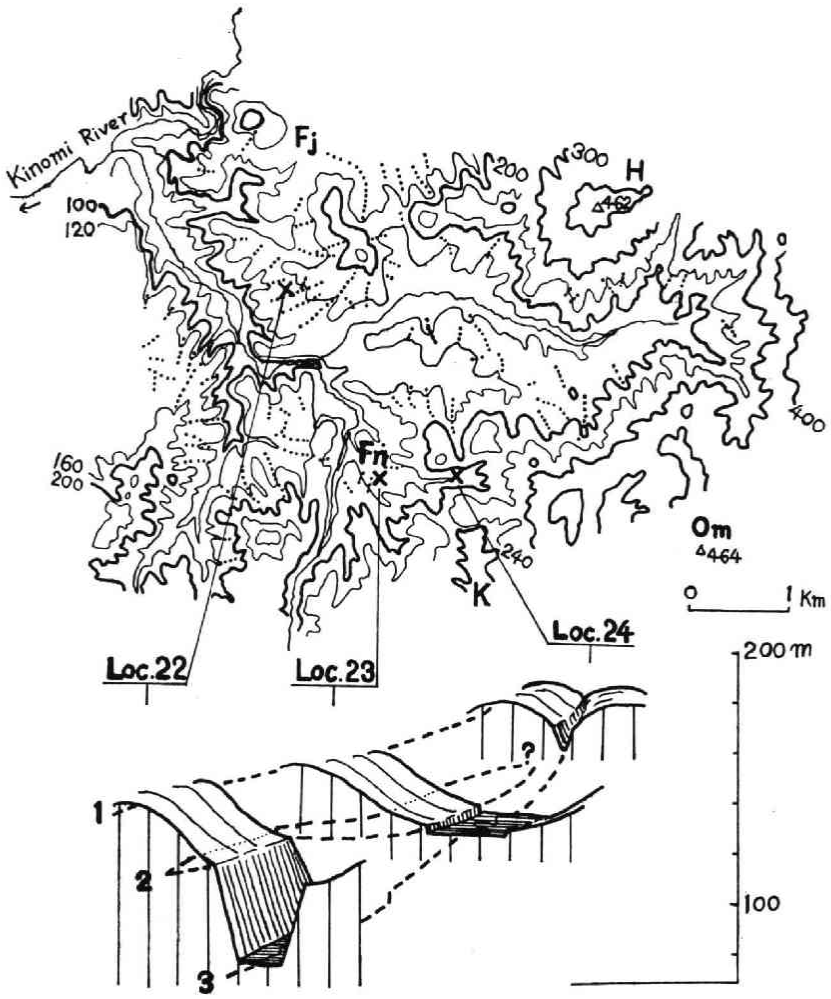

Fig. 7 High-level valleys (dotted line) near Fujisawa, and their regional variety of preservation along the Kinomi River
1: Fujisawa Plane 2: Konashi Terrace 3: Valley Plains (upper and lower)
Fj: Fujisawa Fn: Funaki H: Mt. Horoba K: Konashi Om: Mt. Omine

valley plain. Judging from its distribution near the divides, and from the fact that there are no large-scale ones, the development of high-level valleys is limited around the core area of flat erosion surface (intial surface, in another word). This is remarkably contrasting to the distribution of *Kerbtal*-type (including *Sohlen-kerbtal*-type) valleys, which develop near the large stream that representing the regional base level of erosion.

In the distribution pattern of high-level valleys there is an accordance with the present drainage system (Fig. 7), and this means that high-level valleys belonged to the ancient drainage system with low stream density within each basin, and that the present system is composed of the inherited streams, which have preserved high-level valleys at their heads.

Rate of shifting (retreat or advance) of the breaks on slopes, significant of the lower limit of high-level valleys, varies due to erosive power controlled by local conditions (Nakamura 1966a). Generally, however, the smaller the tributary is, the better the high-level valleys are preserved. That is to say, they could develop with little supply of the water, but the *Kerbtal* type valleys can not develop under such a condition. Now arises a question whether this valley form indicates so-

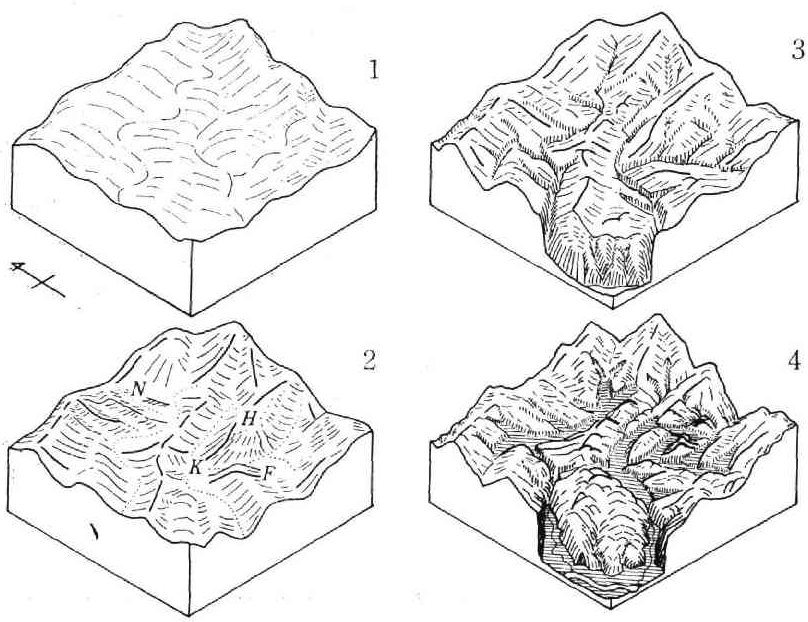

Fig. 8 Geomorphological development of the Senmaya Hills
1: widespread erosion surface (the lowe peneplain of the Kitakami Mountains)
2: After certain uplift of the area, the erosion surface was dissected to Horoba (H) and Neyama (N) Planes. Fujisawa Plane (F) and Konashi Terrace (K) were later formed under surface denudation with *Muldental* type valleys. Main drainage system was then established.
3: *Kerbtal* type valleys developed caused by a change of erosive agency, and gorges or knickpoints were fixed on hard rocks. Rolling surfaces formed in previous ages were transformed into many separated interfluves, preserving high-level valleys.
4: Valley plains (*Sohlen-kerbtal* type) developed, and were differentiated into two parts owing to knickpoints.

called old stage in Davis' theory, or it supports an assumption of some paleolcimate. The writer supposes that there was an arid condition concerned with its valley profile. "*Flachmuldental*" type (Louis 1960) is seemingly different from the type of high-level valleys, but if *Flachmuldental* is entirely dissected, its preserved part would be like the latter.

5. Conclusions

1) The Senmaya Hills are classified into five topographical units. Those are: a) the Horoba Plane (460–320 m), remnant of the lower Kitakami Peneplain. b) The Neyama Plane (300–180 m), dissected and descended from the Horoba Plane, transitional form of former dissection. c) The Fujisawa Plane (240–140 m), wide spread erosion surface, wavy transformed by concave valleys (high-level valleys). d) The Konashi Terrace, lower part of concave hill slope, cut to steep scarp on its foot, formed as terrace-like feature but not a fluvial terrace. e) Valley Plains of *Sohlen-kerbtal* type, separated by distinct knickpoint into the upper and the lower parts, and the upper is subdivided into two types, main valley and small tributaries discordantly jointed to main valley.

2) The Senmaya Hills make a key for the correlation of the Kitakami Mountains with the Abukuma Mountains, because the Fujisawa Plane is traced westwards to the Iwai Table-land, and possibly further southwards to hilly land along the eastern piedmont of the Abukuma Mountains.

3) There is a series of breaks of hill slopes at a certain elevation, which suggests an alternation of process for hill-formation, probably from surface denudation with valley development of *Muldental*-type into linear erosion which produced steep scarp and flat alluvial plain (*Sohlen-kerbtal* type).

4) In the process of morphological evolution (Fig. 8), a specific landform "high-level valley" was formed under several conditions that included surface denduation, low potential relief, stable base level of erosion, and somewhat arid climate that favored mechanical weathering of bedrocks and mass wasting.

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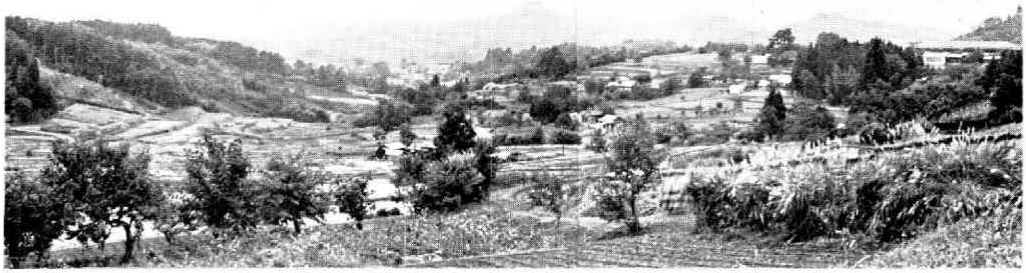

Photo 1 Fujisawa Plane; dissecting valley is *Muldental* at the head and *Sohlenkerbtal* at the downstream, 1km south of Fujisawa.

Photo 2 A concave profile of "high-level valley," viewed from the head to downstreamward, Loc. 22.

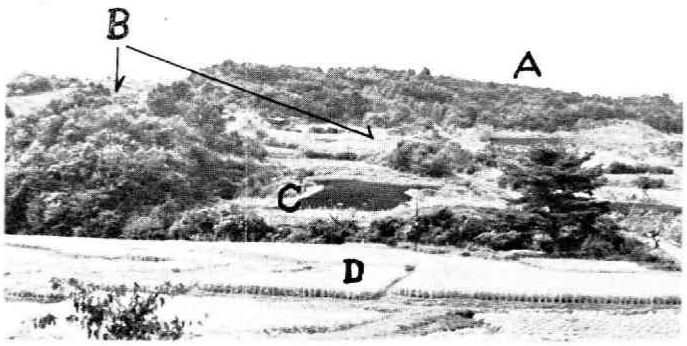

Photo 3 Neyama Plane on ridge top (A), Fujisawa Plane on the flanks of hill slope (B), Konashi Terrace (C), and valley plain (D) at Neyama (Loc. 6).

Photo 4 Fujisawa Plane on narrow ridge tops, Konashi Terrace, and valley plain at Sakainosawa (Loc. 1).

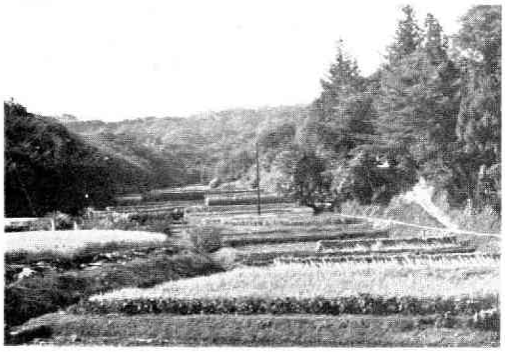

Photo 5 *Shollen-kerbtal* dissecting Fujisawa Plane, which is indicated by ridge-top level, at Loc. 4.

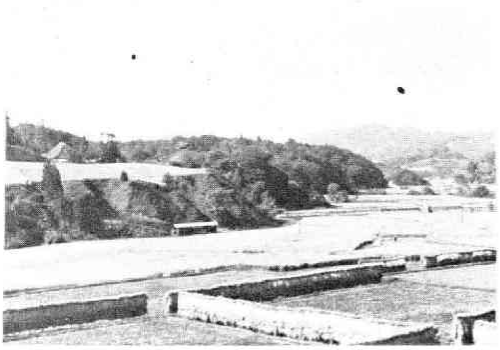

Photo 6 Fujisawa Plane without Konashi Terrace, dissected by *Sohlen-kerbtal*, at Loc. 5.

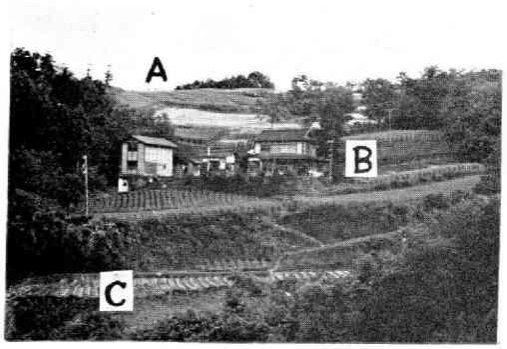

Photo 7 Fujisawa Plane on round-ridge top (A), Konashi Terrace with concave slope as "high-level valley" (B), and narrow valley plain (C) at Loc. 2.

Photo 8 Konashi Terrace, waving a little, and valley plain, at Loc. 16.