

The Geological Map and Stratigraphic Relationship of the Upper Devonian Ainosawa Formation in the Sōma District, Fukushima Prefecture, Japan

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In this paper the author deals with the geological map of Upper Devonian deposits in the Sōma district, Fukushima Prefecture, and also with the geological relationships between Devonian and other strata. Since the writer investigated and reported in 1960 and 1961, some studies have been done by other authors (I. HARA 1972, A. IWAMATSU 1971, Y. KURODA 1960, 1963, Y. ONUKI 1962, 1969). But the author has not changed his opinion that their original geologic relation was unconformable. For that reason, the main purpose of this paper is to publish the geological map of Devonian deposits in the Soma Paleozoic system, which has been unpublished up to this time.

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1 Outline of stratigraphy

The formation containing Upper Devonian fossils is distributed only halfway up Ainosawa Valley as far as the author has investigated. The lower part of this formation is in contact with the Matsugadaira group which was weakly metamorphosed. The upper part of this formation is in some area in contact with the Lower Permian Uwano (Uwagaya) formation and in other area in contact with the Upper Viséan Tateishi formation. They seem to have unconformable relationship each other. The following is the simplified and precisely stratigraphy of the Devonian and Lower Carboniferous.

Early Carboniferous

Tateishi formation; black limestone predominating. About 150m. in thickness.

Many fossils of Upper Viséan fauna are contained. (T. SATŌ, 1956)

Mano formation; chiefly of a thin bedded alternation of sandstone and slate.

About 130m. thick. Important fossils, *Leptaena* cf. *analoga*, *Sizophoria respinata*, *Syringothyris* spp., *Spiriferina* cf. *transversa*, *Spirifer* sp., *Lophophyllidium* sp., etc. (T. SATŌ, 1956, 1960, 1961)

Late Devonian

Ainosawa formation; predominantly of gray hard shale and greenish slates,
 More than 70m. thick. *Sinospirifer sinensis*, *Cyrtospirifer*, *Chonetes*, etc..
 (T. SATŌ, 1956, 1960, I. HAYASAKA & M. MINATO, 1956)

Pre-Late Devonian

Matsugadaira group; mainly of greenish semischist and greenish sandstone with
 abundant quartz veins, schistosity remarkably develops locally, where the
 rocks alterate chlorite and sericite schists.

2 Rock sequence of the Upper Devonian Ainosawa formation

The Ainosawa formation was found and named by the auther (1956), and its
 fauna was studied by I. HAYASAKA and M. MINTO (1956). This strata had been
 erroneously regarded as the base of Lower Permian deposits till that time. This
 formation is typically distributed in Ainosawa Valley. (Fig. 1)

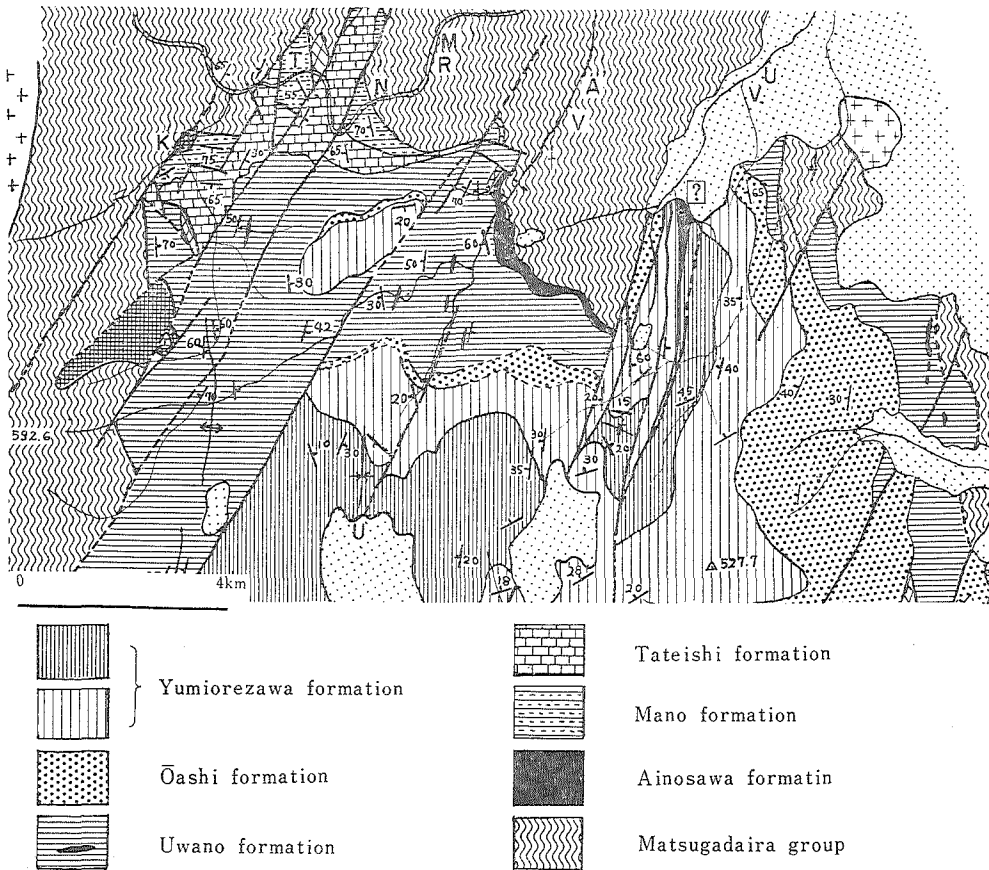


Fig. 1 Distribution of the Upper Devonian Ainosawa formation.

AV : Ainosawa Valley MR : Mano River UV : Uenohata Valley
 T : Tateishi N : Nagaoka U : Uwano (Uwagaya) K : Kawasaki

In general, the upper part of the Ainosawa formation consists of gray slate or sandy slate, while the Lower part is composed of greenish colored slate and porphyritic tuff. Gray slate and gray sandy slate which comprise many minute fragments of carbon substance constitute the upper part of the Ainosawa formation, while tuff in the lower part may be not always intercalated in the whole of the lower part.

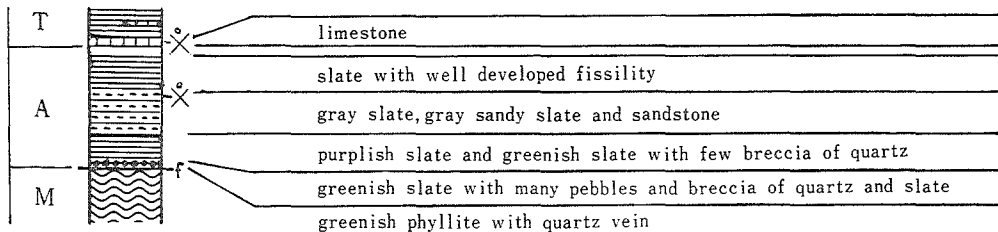


Fig. 2 Columnar section along the tributary I of Ainosawa Valley.

T : Tateishi formation A : Ainosawa f. M : Matsugadaira group

Stratigraphical sequence of the Ainosawa formation is shown in the following columnar section (Fig. 2). The basal part or lower part of the present formation consists of greenish and purplish slates, being observed at the tributary I of Ainosawa Valley, where the rocks contain conglomerates of quartz and slate. The author is here of opinion that the conglomerate may not represent basal one but fault breccia. However, it is presumed, as discussed in the latter, that the original stratigraphical relationship between both formations was unconformable. The facts of other outcrops show that both formations are in contact with each other by fault, or intruded by dykes of basic rock.

3 Stratigraphical relationship between the Matsugadaira group and Ainosawa formation

3.1 The relationship between the Matsugadaira group and Ainosawa formation is observable at several points along the tributary I and IV of Ainosawa Valley where formation outcrops at A, B, C and D. Among these outcrops, the most important and problematical one is observable at the "A" point. (A in the geological map of the Ainosawa formation) The facts of other outcrops show that both formations are in contact with each other by fault (e.g. "B" point).

Observation at the "A" point. Basal part of the Ainosawa formation can be observed at this point where the outcrops are continuously developed. Rocks of the I in Fig. 3 are composed mainly of quartz, chlorite and partly of greenish phyllite with abundant quartz veins. From the feature, they are regarded as belonging to the Matsugadaira group. These rocks are overlain by the II in Fig. 3 which are composed mainly of greenish slate and comprise granules, pebbles or breccia of quartzite and pelitic rocks. The bed? of the II is about less than 1m.

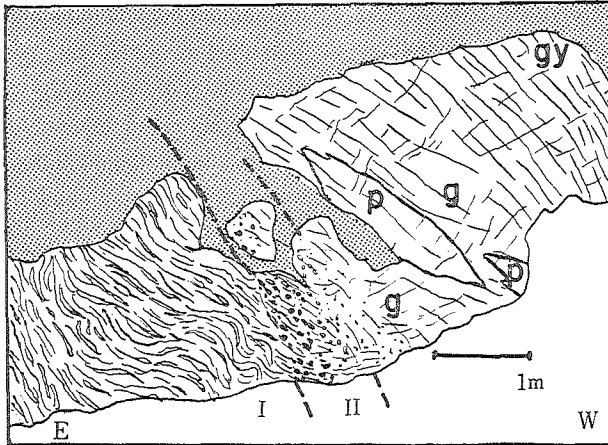


Fig. 3 Outcrop "A" in the tributary I of Ainosawa Valley.
g : greenish slate, p : purplish slate, gy : gray slate

in thickness, grading upward greenish slate in which pebbles and breccia of quartz or pelitic rocks are scarcely comprised. This greenish slate, in part, shows reddish or purplish color owing to much haematite producing in this rocks.

Microscopic observations for slices of the present breccia do not necessarily verify that they were basal conglomerates. It may be interpreted that segregated quartz veins and other rocks of the Matsugadaira and also the rocks of the Ainosawa were destroyed by fault movement which had took place along the base of the Ainosawa formation.

3.2 In this area the general trend of cleavage or schistosity of the Mastugadaira group near the contact of both rocks is within NS to N30°W, and dips vertically, or toward west or east. Variable strikes of bedding plane are within N20°E to N45°W. While general trend of the strikes of the Ainosawa formation is within the range of NS to N10°W, and that of the dips is presumably about 40°W, that is to say, the latter forms angles of more than 40 degrees in average with the former.

3.3 The following became clear after the investigation on the deformation and destoration, fault system, foldings, and metamorphism. The gross synclinerium of Sōma Paleozoic deposits may be divided into four structural units, and these structural elements are different from each other in its geological age as described below. The outline of these synclinerium and basin structure will be mentioned in ascending order.

OY-basin structure consists of the Upper Permian Ōashi and Yumioreszawa formation. (T.SATŌ, 1961, 1973)

U-synclinerium consists of only the Lower Permian Uwagaya formation. (ibid.)

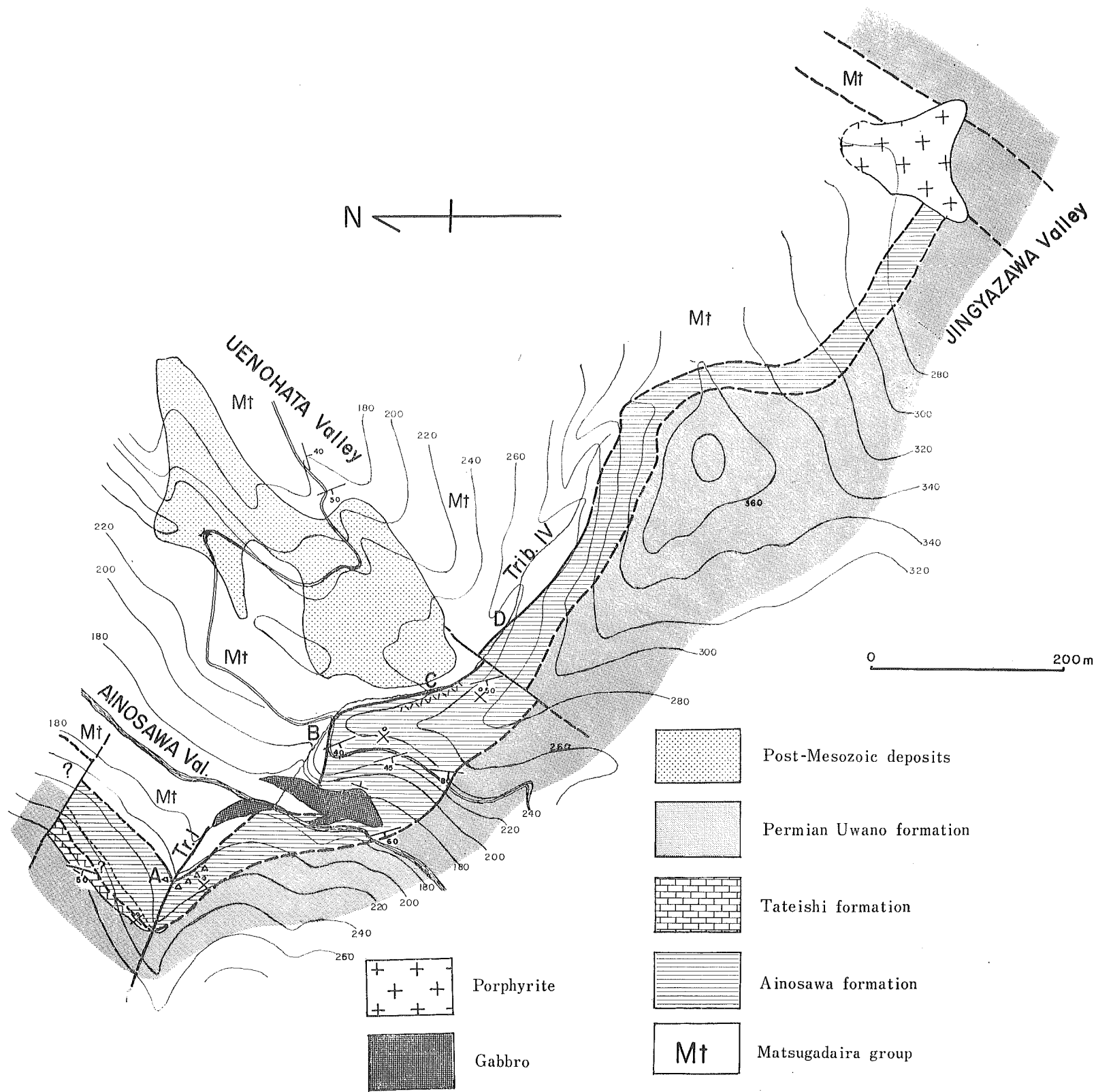


Fig. 4 Geological map of Ainosawa formation

AMT-synclinorium consists of the Lower Carboniferous Tateishi, Mano and Upper Devonian Ainosawa formation. (AMT; initial letters of Ainosawa, Mano and Tateishi) In comparison with the structural trend of the Matsugadaira group, the Upper Devonian formation shows remarkable difference in the structure, which is rather concordant with the synclinorium of the Lower Carboniferous among four units.

M-synclinorium consists of the Matsugadaira group. (M; Matsugadaira)

It is distinctly shown that these four structural units are different from each other in the degree of disturbance. In the M-synclinorium, the rocks are weakly metamorphosed by shearing stress and the other causes, having so much been disturbed by foldings and faults that it was not easy to reconstruct the structure formed by the original bedding plane. However, the general trend of the strikes of schistosity or cleavage of those rocks is N 30° E, and that of dips is usually within the range of 60 degree to 90. It forms synclinorium with axis of north-north-east trend. Such secondary structures resulting from weak metamorphism and deformation are distinctly different from those of the AMT.

Apparently the M-synclinorium is unconformably overlain by the AMT-synclinorium which had no influence of the weak metamorphism. The AMT-synclinorium is the compound one consisting of the Ainosawa, Mano and Tateishi formations, those of which are more or less different from each other in their tectonic feature. Judging from the results of detailed field researchs and analysis of tectogenetic movement on the AMT, it is to say that tectonic movement at two stages took place during the geologic times of the three formations. However, the structural differences among these three formations are not so remarkable that the author will treat three formations as one unit of synclinorium structure, that is to say, it may be regarded that they, on the whole, constitute one unit because of their similarity of characters of disturbance. The formations belonging to be the AMT-synclinorium are very thin in thickness. This fact seems to be the result of erosion of three formations during the time interval before the deposition of the Lower Carboniferous Mano formation, and before that of the Viséan Tateishi formation respectively.

It is noteworthy that the axis of the M-synclinorium runs through near Tateishi in the direction of north-north-east, on the other hand that of the AMT is situated on near Nagaoka, parallel to the general trend of north-north-east, being about 1 kilometer distant from the former, and that the axis of the U-synclinorium runs eastward parallel to that of the AMT, being about 1.5 kilometer distant from that of the AMT.

As already reported (Y. KURODA, 1960 T. SATŌ, 1960,), two types of metamorphosed rocks are distributed in this area. One is the semischist and schist of

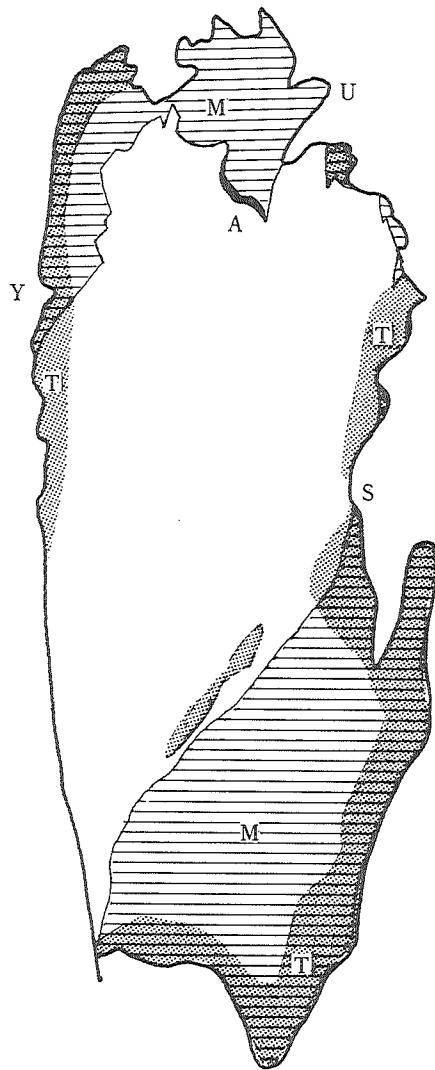


Fig. 5 Two types of metamorphosed rocks in Sōma Paleozoic deposits.

M : Matsugadaira group T : thermal metamorphic rocks

A : Ainosawa formation

Y : Yagisawa U : Uenohata S : Shajigami

the Matsugadaira group, and the other is thermal metamorphic rocks having produced by intrusion of the Cretaceous Younger granite and granodiorite around the Paleozoic sedimentary rocks. The boundaries of both metamorphosed rocks to non-metamorphosed one cross in several areas (Fig. 5). The fact that Devonian rocks in Ainosawa Valley had no influence of the younger thermal metamorphism is convenient for the purpose of analysis to original relationships between two formations under consideration. In this area, the rocks of the Ainosawa formation had no influence of the regional weak metamorphism, while those of the Matsugadaira were sheared, producing much quantity of quartz vein, sericite, chlorite and biotite by this metamorphism. This fact probably shows the existence of diastrophe before deposition of the Ainosawa formation in this area.

4 From the facts described above, the author may conclude that the Upper Devonian Ainosawa formation is in contact with the Matsugadaira group by means of fault at the present time. But judging from the facts mentioned above (3-1, 3-2, 3-3), the author comes to probable conclusion that the stratigraphic relationship between both rocks was originally unconformable and the Matsugadaira group had been disturbed and suffered regional weak metamorphism before the deposition in Late Devonian.

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Summary

- 1 In this paper, the auther publishes the geological map of Upper Devonian deposit in Sōma Paleozoic rocks, which has been unpublished up to this time.
- 2 The facts in the field show that, at present time, the Ainosawa formation is in contact with the Matsugadaira group by fault, but from the fact mentioned in 3-1, 3-2 and 3-3, original relationship between both rocks was probably unconformable and the Matsugadaira group had been suffered regional weak metamorphism before the deposition in Late Devonian.