ON THE TAGA GROUP IN THE YOTSUKURA DISTRICT OF THE JOBAN COAL-FIELD, FUKUSHIMA PREFECTURE

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Introduction

The so-called Taga Group (SUGAI and MATSUI, 1957) is distributed in the Joban coal-field, extending from southeastern Fukushima to north-eastern Ibaraki Prefectures. The Taga Group had been considered to be Miocene in age by some authors and as Pliocene by others, and it had been thought that no unconformity exists within the Taga Group. For example, SUGAI and MATSUI (1957) described that the Taga Group can be subdivided into the Hirono (Miocene) and Tomioka (Miocene ?—Pliocene) Formations in upward succession and that the stratigraphic relationship between them is a conformity. MITSUI (1971) stated that the Izumi Group (MITSUI, 1971; the Taga Group of SUGAI and MATSUI (1953, 1957)) distributed in the Izumi-Ueda district can be subdivided into the Nakosono-seki and Kurosuno Formations and that there is no unconformity between those formations. He thought that the geological age of the Izumi Group (MITSUI, 1971) ranges from Miocene to Pliocene.

However, recently, when MITSUI and OUCHI investigated the so-called Taga Group distributed in the Izumi-Ueda district, they recognized the presence of an unconformity (MITSUI and OUCHI, 1971), and later (MITSUI and OUCHI, 1972) pointed that it marks the Miocene-Pliocene boundary in the Joban coal-field. They also emphasized the necessity for review of the problems related with the so-called Taga Group. MITSUI and OUCHI (1972) stated that the Kurosuno and Nagisa Formations of the so-called Taga Group (SUGAI and MATSUI, 1957) in the Izumi-Ueda district are separated by an unconformity. Further, they described that the geological age of the Kurosuno Formation is Miocene based upon the planktonic foraminifera and diatoms, and that the age of the Nagisa is Pliocene according to the mol-

luses and diatoms. From the paleontological evidence, they considered that the unconformity plane between the two formations marks the Miocene-Pliocene boundary in the Joban coal-field.

Lately, the writer recognized from new outcrops that there is an unconformity in the so-called Taga Group (SUGAI and MATSUI, 1957) distributed in the Yotsukura Area of the Joban coal-field, Fukushima Prefecture. The purpose of the present paper is to interpret the stratigraphic significance of the so-called Taga Group distributed in the Yotsukura district and to outline paleontological data of the Group in the Yotsukura region. Detailed discussions will be reserved for another opportunity.

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Stratigraphy

As pointed out by MITSUI and OUCHI (1972),

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Fig. 1. Index map of the area investigated.

the "Taga Group" in this paper can be correlated with the Taga Group of SUGAI and MATSUI (1953, 1957).

The Taga Group in the surveyed area of Yotsukura district, Iwaki City, Fukushima Prefecture (Fig. 1), was called by HIRAYAMA (1952) the Yotsukura Formation. The Taga Group lies on the Shiramizu and Yunagaya Groups with unconformity and is superposed by the Quaternary Sodeyamayama Formation.

HIRAYAMA (1952) stated that the Yotsukura Formation is subdivided into four members from lithology, namely, the Nakano Conglomerate Member, the Toda Sandstone and Sandy Shale Member, the Minamimachi Mudstone Member and the Toda Sandstone Member. He considered the four members to have been deposited as irregular sediments, because of the remarkable changes in lithofacies both laterally and vertically, and he stated that no unconformity exists in the Yotsukura Formation. SUGAI and MATSUI (1957) named the Taga Group in the Yotsukura district as the Hirono Formation, and MITSUI (1971) named it the Kurosuno Formation. Those authors claimed that no unconformity exists in the formations.

However, new outcrops reveal that an unconformity exists in the Taga Group in the investigated area, just as in the same Group in the Izumi-Ueda district (MITSUI and OUCHI, 1971, 1972). From paleontological and stratigraphic evidences, it is

AGE	FORMATION	COLUMN	TH.	ROCK FACIES
PLIO. ?	TODA FORMATION		20 m	sandy mudstone and muddy sandstone medium to coarse grained sandstone mudstone including shale cob. or boulder
	YOTSUKURA FORMATION		150 m	medium to coarse grained sandstone sandy mudstone and muddy sandstone peb. to cob. size conglomerate med. to c. grained sandstone fine to med. grained sandstone

Fig. 2. Generalized stratigraphic sequence of the Yotsukura district, Iwaki City, Fukushima Prefecture.

considered that the Taga Group in the surveyed area extends from Miocene to Pliocene in geological age, and, therefore, the writer refrains from using the name of Taga Group to avoid confusion. And in this paper the writer uses the name of Yotsukura and Toda Formations for the strata below and above the unconformity, respectively (Fig. 2).

I. Yotsukura Formation

The Yotsukura Formation was originally named and defined by HIRAYAMA (1952), but from the existence of an unconformity in it, the name to be retained should be redefined and restricted for the strata underlying the unconformity. The type locality of the redefined formation is the environs of Yotsukura-machi, Iwaki City, Fukushima Prefecture.

Fig. 3. Geological map of the Yotsukura district, Iwaki City, Fukushima Prefecture.

The redefined Yotsukura Formation, distributed widely in the investigated area, lies with angular unconformity upon the Shiramizu and Yunagaya Groups, and is superposed with unconformity by the upper part of the Yotsukura Formation of HIRAYAMA (1952). The strikes of the Formation are varied, but the dips are generally 10° and 15° . The strata of the Yotsukura are gently undulated and differ distinctly from the structure of the Shiramizu and Yunagaya Groups. It forms a sedimentary basin (Fig. 3).

The Yotsukura Formation, about 150 meters in thickness, consists mainly of dark blue massive muddy sandstone and sandy mudstone, intercalated with layers of medium to coarse grained sandstone (max. 2—3 m), granule to pebble size conglomerate with sandstone layers (max. 2—3 m) and soft pebble conglomerate (max. 50 cm) in the middle part of the formation. In the upper part

of the formation there are layers of stratified and laminated, medium to coarse grained sandstone amounting to 2 to 10 meters in thickness (Fig. 4). The muddy rocks are diatomaceous and contain carbonaceous fragments, pumice, mica and *Makiyama* (= *Sagarites*). Mollusca, foraminifera, diatoms and radiolarians have been reported from this formation (SUGAI and MATSUI, 1957; IWAO and MATSUI, 1961).

II. Toda Formation

The Toda Formation almost correspond to the upper part of the Yotsukura Formation of HIRAYAMA (1952). From the existence of an unconformity within the Yotsukura Formation HIRAYAMA, 1952), the writer proposes to use the name of Toda Formation for the strata above the unconformity. The type locality is the outcrops northeast of the Sumitomo Cement Yotsukura

Fig. 4. Columnar section of the Yotsukura district, Iwaki City, Fukushima Prefecture. The legend refer to those in Figure 2.

Plant in Yotsukura-machi, Iwaki City, Fukushima Prefecture.

The name of Toda was formerly used by HIRAYAMA (1952) for the Sandstone and Sandy Shale Member of the Yotsukura Formation, and thus its usage in this paper may not be advisable, but the name is retained for following reasons, (1) the distributions of Toda Formation used in this paper is restricted and, (2) there is no other geographic name in the area distribution of the Formation.

The Toda Formation lies on the Yotsukura Formation with angular unconformity and is distributed in a small area in the northeast of the Sumitomo Cement Yotsukura Plant and of Toda.

The unconformity between the Yotsukura and Toda Formations can be observed at two localities, namely; (1) at the outcrop northeast of the Sumitomo Cement Yotsukura Plant, stratified and laminated, medium to coarse grained sand-

Fig. 5. Sketch showing the unconformity between the Yotsukura and Toda Formations. Locality: Northeast of the Sumitomo Cement Yotsukura Plant, Yotsukura-machi, Iwaki City.

Fig. 6. Sketch showing the unconformity between the Yotsukura and Toda Formations. Locality: Northeast of Toda, Yotsukura-cho, Iwaki City.

stone measuring 10 meters in thickness of the Yotsukura Formation is superposed by sandy mudstone, intercalated with thin layers of granule to pebble size conglomerate, or, partly with basal conglomerate of the Toda Formation with angular unconformity (Fig. 5). At this locality, the strike and dip of the Yotsukura Formation are E-W and of 15°S respectively, and those of the Toda Formation are N20°E and 10°E. (2) In outcrop northeast of Toda, sandy mudstone including shale cobble or boulder, derived from the Shirasaka Formation of the Shiramizu Group, of the Toda Formation lies with angular unconformity upon medium to coarse grained sandstone, intercalated with thin layers of pebble size conglomerate, of the Yotsukura Formation (Fig. 6). At this locality the Yotsukura Formation shows strike of N15°E and dips of 6°E, and the strike and dip of the Toda Formation are N60°E and 10°S.

The Toda Formation consists mainly of roughly

stratified sandy mudstone and muddy sandstone with carbonaceous fragments, pumice, mica, mollusca and diatoms, and is intercalated with layers of conglomeratic (pebble size) sandstone, fine to coarse grained sandstone and soft pebble conglomerate.

Geological Age

From the muddy rocks of the Yotsukura Formation at the west of the Sumitomo Cement Yotsukura Plant, the planktonic foraminifera *Orbulina universa* and *Globorotalia tumida* were reported by IWA0 and MATSUI (1961), and, when these planktonic foraminifera are plotted in the range chart of BLOW (1969), the Yotsukura Formation is considered to be younger than Late Miocene in age. The following benthonic foraminifera were reported by IWA0 and MATSUI (1962); *Robulus limbosus*, *R. pseudorotulatus*, *Nodosaria insecta*, *Lagena globosa*, *L. striata*, *Nonion pompiloides*, *Uvigerina subperegrina*, *Epistomina elegans*, *Pullenia bulloides*, and *Sphaerocidina austriaca*. IWA0 and MATSUI (1961) described that a large size *Robulus* is dominant and that the benthonic foraminifera from the Yotsukura Formation closely resemble those of the Kokozura Formation (ASANO, 1949).

On the other hand, from the muddy rocks of the type Kokozura Formation (IWAI, 1950), the following planktonic foraminifera were recorded and reported by SAITO (1963); *Globigerina bulloides*, *G. foliata*, *Globigerinoides ruber*, *Sphaeroidinellopsis subdehiscens*, *Globoquadrina dehiscens*, *G. obesa*, *Globorotalia minutissima*, etc. SAITO (1963) pointed out that the formation corresponds to a position ranges from the *Sphaeroinella seminulina* zone to the *Globorotalia menardii*/*Globigerina nepenthes* zone and therefore may be Tortonian to Sarmatian in age. When these planktonic foraminifera, described by SAITO (1963), are plotted in the range chart of BLOW (1969), the Kokozura Formation can be correlated within the range from N16 to the middle part of N18 and is thus Late Miocene in age.

Hence, according to IWA0 and MATSUI (1961), SAITO (1963) and BLOW (1969), the geological age of the Yotsukura Formation is Late Miocene.

On the other hand, because no fossils available for determination of the geological age were discovered from the Toda Formation, its age could not be determined. But, from the stratigraphic correlation with the Taga Group in the Izumi-Ueda district by MITSUI and OUCHI (1972), as described in the next paragraph, the Toda Formation may be Pliocene in age.

Correlation

In this section the correlation between the Taga

AGE	FORMATION	COLUMN	ROCK FACIES
PLIOCENE	NAGISA FORMATION		stratified sandy mudstone with sandstone thin layers conglomeratic (soft pebble) fine to medium grained sandstone soft peb. conglomerate
	KUROSUNO FORMATION		pumice tuff dark blue sandy mudstone and muddy sandstone
MIOCENE	YOKOYAMA SANDSTONE MEMBER		medium to coarse grained sandstone conglomeratic coarse grained sandstone

Fig. 7. Generalized stratigraphic sequence of the Izumi-Ueda district, Iwaki City, Fukushima Prefecture (after MITSUI and OUCHI, 1972).

Group distributed in the Yotsukura district and that in the Izumi-Ueda district by MITSUI and OUCHI (1972) is outlined.

The Kurosuno Formation (MITSUI and OUCHI, 1971) in the Izumi-Ueda district consists mainly of dark blue massive muddy sandstone and sandy mudstone intercalated with thin layers (50—20 cm) of soft pebble conglomerate, fine to coarse grained tuffaceous sandstone and pumiceous sandstone. The muddy rocks are diatomaceous and contain carbonaceous fragments, pumice, mica and *Makiyama* (= *Sagarites*). Mollusca, foraminifera and diatoms occurred from this formation. In the upper part of the formation there are layers of rhyolitic tuff or pumiceous sandstone. The Yokoyama Sandstone Member (MITSUI and OUCHI, 1971) occupies the lower part of the formation (Fig. 7). In lithology and stratigraphic section, the Kurosuno Formation almost coincides with the Yotsukura Formation, except for having layers of rhyolitic tuff and pumiceous sandstone and containing the Yokoyama Sandstone Member.

On the one hand, from the mudstone of the Kurosuno Formation, the following planktonic foraminifera were reported by MITSUI and OUCHI (1972); *Globigerina bulloides bulloides*, *G. bulloides concinna*, *G. foliata*, *G. parabulloides*, *G. venezuelana*, *G. sp.*, *Globigerinoides quardrilobatus immaturs*, *G. quardrilobatus sacculifer*, *G. quardrilobatus trilobus*, *Globigerinita glutinata*, *Sphaeroidinellopsis seminulina*, *S. subdehiscens*, and *Globoquadrina dehiscens dehiscens*. These planktonic foraminifera from the range chart of BLOW (1969) suggest that the Kurosuno Formation can be correlated within the range from N16 to the middle part of N18 and is thus Late Miocene in age. From the diatom fossils, OUCHI (1972 MS) pointed out that the Kurosuno Formation is Miocene in age.

Hence, from the stratigraphic and paleonto-

logical consideration, it is considered that the Yotsukura Formation is a correlative of the Kurosuno Formation.

For the following reasons, it is thought that the Toda Formation can be correlated with the Nagisa Formation (MITSUI and OUCHI, 1971) distributed in the Izumi-Ueda district; that is to say, (1) muddy rocks form the main part of both formations, and are diatomaceous and contain carbonaceous fragments, pumice, mica mollusca and diatoms. (2) The Toda Formation lies on the Yotsukura Formation with angular unconformity and the Nagisa Formation lies with angular unconformity upon the Kurosuno Formation, the latter of which is considered to be a correlative of the Yotsukura Formation. Both the Toda and Nagisa Formation are superposed by the Quaternary Sodedamayama Formation (SUGAI and MATSUI, 1957) with angular unconformity. (3) The only unconformity recognized in the so-called Taga Group in the Yotsukura and Izumi-Ueda districts is that between the Formations stated above.

Turritella nipponica YOKOYAMA, which is an index fossil of the pliocene age, was discovered from the Nagisa Formation, hence the geological age is inferred to be Pliocene. The Pliocene age is also upheld from the occurrence of such diatoms as; *Denticulina kamtchatica*, *Thalassiosira autigua*, *T. nidulus*, *T. usatchvii*+*zabelina* (OUCHI, 1972 MS). From this data, OUCHI (1972 MS) states that the Nagisa Formation can be correlated with the Tatsunokuchi Formation of the Sendai Group in the Sendai district, Miyagi Prefecture (HANZAWA, *et al.*, 1953), which is Early Pliocene in age. Accordingly, the geological age of the Nagisa Formation is Pliocene. Since the Toda Formation is inferred to be a correlative of the Nagisa Formation, as stated before, the geological age of the Toda Formation is also Pliocene.

Stratigraphic Significance

From the considerations given above, the geological age of the Yotsukura Formation is Miocene and that of the Nagisa Formation is Pliocene. As stated before, the Yotsukura Formation is superposed with angular unconformity by the Toda Formation. From the evidence presented already it can be said that the plane between the two formations is the Miocene-Pliocene boundary in the investigated area or in the Joban coal-field, and that between the Kurosuno and Nagisa Formations in the Izumi-Ueda district as pointed by MITSUI and OUCHI (1972) also form the said chronological boundary.

Summary

The results of the present study can be summarized as follows.

1. The so-called Taga Group (SUGAI and MATSUI, 1957) in the Yotsukura district can be subdivided into the Yotsukura and Toda Formations, and the stratigraphic relation between them is an unconformity.

2. It is considered that the geological age of the Yotsukura Formation is Late Miocene and that of the Toda is Early Pliocene. Hence, the plane between the two formations marks the Miocene-Pliocene boundary in the surveyed area or in the Joban coal-field.

3. The Yotsukura Formation is correlated with the Kurosuno Formation in the Izumi-Ueda district (MITSUI and OUCHI, 1972), and, the Toda Formation with the Nagisa Formation in the Izumi-Ueda district.

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常磐炭田四倉地域における多賀層群について

三 井 忍

(要 旨)

この論文の目的は、常磐炭田四倉地域に分布する“多賀層群”(須貝・松井, 1957) 中に不整合現象が見い出された事にもとづき、同層群の層位学的意義ならびに時代論について予察的に論じる事にある。

今回の研究の結果を要約すると、次の通りである。

- 1) 四倉地域に分布する“多賀層群”は四倉層および戸田層に区分され、両者の層位学的関係は不整合である。
- 2) 四倉層は後期中新世、戸田層は前期鮮新世と考えられる。したがって、両層間に存在する不整合面は四倉地域、ひいては、常磐炭田における中新世—鮮新世の境界を示すことになる。
- 3) 常磐炭田泉—植田地域に分布する“多賀層群”(Mitsui and Ouchi, 1972) に対比を試みると、四倉層は黒須野層(後期中新世)に、戸田層は渚層(前期鮮新

世) に対比される。

地 名		地 名	
Iwaki City	いわき市	Izumi	泉
Ueda	植田	Yotsukura	四倉
層 名		層 名	
Hirono Formation		広野層	
Kokozura Formation		九面層	
Kurosuno Formation		黒須野層	
Nagisa Formation		渚層	
Nakosonoseki Formation		勿来ノ関層	
Sodetamayama Formation		袖玉山層	
Toda Formation		戸田層	
Tomioka Formation		富岡層	