

SOME SPECIES OF *UVIGERINA* AND THEIR STRATIGRAPHIC OCCURRENCES IN THE NADAURA DISTRICT OF THE TOYAMA TERTIARY BASIN, JAPAN.*

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Introduction

During the past several years, the writer has been studying the foraminiferal fauna and the microbiostratigraphy of the Tertiary formations in the Toyama Basin, central part of the Japan Sea coast. One of the results of these studies is the finding of some diagnostic assemblages of species of *Uvigerina*, in the Neogene of the northwestern part of this basin. Each assemblage is restricted to one of the different stratigraphic horizons.

Of some species of *Uvigerina*, it has been suggested that they are useful as the stratigraphic key species in the Japanese Neogene. ASANO (1938) studied the Japanese species of *Uvigerina* and its allied genera, and reported that in Japan *Uvigerina yabei* ASANO, *U. substriata* ASANO and *U. cf. peregrina* CUSHMAN occur only in the Pliocene. Furthermore, he stated that *Uvigerina subperegrina* CUSHMAN et KLEINPELL is a good key species of the Miocene in Japan.

In some oil fields of the Japan Sea coast, such as Akita—, Yamagata—, and Niigata—oil field, many zones and subzones are recognized in the Neogene formations on the basis of foraminiferal assemblages. It seems that some species of *Uvigerina* are useful as guide species in these areas, according to the results of the investigation by the Petroleum Resources Exploitation Co., Japan.

Recently, ASANO (1958) erected a new subspecies, *Uvigerina peregrina shiwoensis*, with which the above mentioned *Uvigerina cf. peregrina* was synonymized by ASANO (1950). He reported this subspecies from the recent marine deposits, in 154—687 m. depth of the sea surrounding Japan, under the warm Kuroshio waters. It occurs also in the Pliocene. In northeastern parts of the Japan Sea coast, however, its stratigraphic range is restricted to the Pliocene, for it has been unknown in the sediments under the cold Oyashio Waters.

Thus, *Uvigerina* is an important genus in the biostratigraphy of the Japanese Neogene.

The purpose of this paper is to describe some species of *Uvigerina*, collected from the late Miocene and Pliocene formations in the Nadaura district, northwestern part of the Toyama Tertiary Basin and to discuss their stratigraphic occurrences.

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Stratigraphy and localities

The materials on which the present work is based, were collected from the Miocene and Pliocene formations of the Nadaura district in the northwestern part of the Toyama Basin, which occupies the main part of the Hokuriku Sedimentary Province (IKEBE, 1957) of the Japanese Neogene.

According to IKEBE and others (see MATSUMOTO et al. 1958, p.81 and table 1), the stratigraphy of the Neogene formations of the Toyama Basin can be summarized as follows (table 1 a) :

Strata		Age * Symbol	Epoch
Alluvial and terrace sediments (Unconformity)		K	Recent
Kurehayama Group (Disconformity)		I ₁	Plio-Pleistocene
Himi Subgroup (Partial disconformity)		H ₂	Pliocene
Kaetsu Supergroup Yatsuo Group (s.l.) Yatsuo Group proper	Otokawa Formation (Partial disconformity)	H ₁ G	Mio-Pliocene
	Higashibessyo Formation Kurosedani and Iwozen Formation (Quasiconformity at several place)		
	Iwaine Formation	F ₃	Miocene
	Nirehara Formation		
	(Unconformity)		
Hutomiyama Group			
(Unconformity)		F ₁	
Basements			

Yowawa ** Subgroup in the NW part.

Table 1 a ; Stratigraphy of the Neogene formation in the Toyama Basin. (Afer MATSUMOTO et al. 1958)

* by IKEBE (1954)

** Yokawa Subgroup was hitherto regarded as distinct group. The name Yokawa Subgroup was suggested by Prof. N. IKEBE (personal communication).

Strata containing *Urigerina* are found in the Himi Subgroup (H₂, Late Pliocene) and the Yokawa Subgroup (F₃-H₁, Middle Miocene to Early Pliocene) in the Nadaura district.

Recently, KASENO and others(1957) divided the Neogene of Nadaura district into the following members(table 1 b) :

Member Name	(N)	Lithologic facies	(S)	Age symbol	Epoch
Yabuta M.		"Natsukawa" siltstone		H ₂	Pliocene
Oozakai M.*		glauc. ss.		H ₁	
Sugata M.		massive mudstone	shale, intercalating ss. glauc. ss. shale	G	Miocene
Nakata M.		pumiceous tf.	tuffite	F ₃	
Nakanami M.		shale or hard shale			
Oodomari M.		tuff and sandy tuff			
Taniguchi M.		<i>Miogypsina</i> ss. mudstone, sandstone, conglomerate			
"Volcanics"		andesite		F ₂	
"Conglomeratic ss."		ss. & cogl. ss.			

Table 1 b; Stratigraphy and facies change of the Neogene formation in the Nadaura district. (After KASENO etc. 1957.)

Among them, from the Taniguchi Member to the Oozakai Member belong to the Yokawa Subgroup, whereas the uppermost member, namely the Yabuta Member belongs to the Himi Subgroup.

The sampling of the materials was done by K. NAKASEKO and the writer during the autumn of 1956. The materials were collected from the Taniguchi Member, the Oodomari Member, the Nakanami Member, the Sugata Member, the Oozakai Member and the Yabuta Member. The localities are as follows (Locality list and map) :

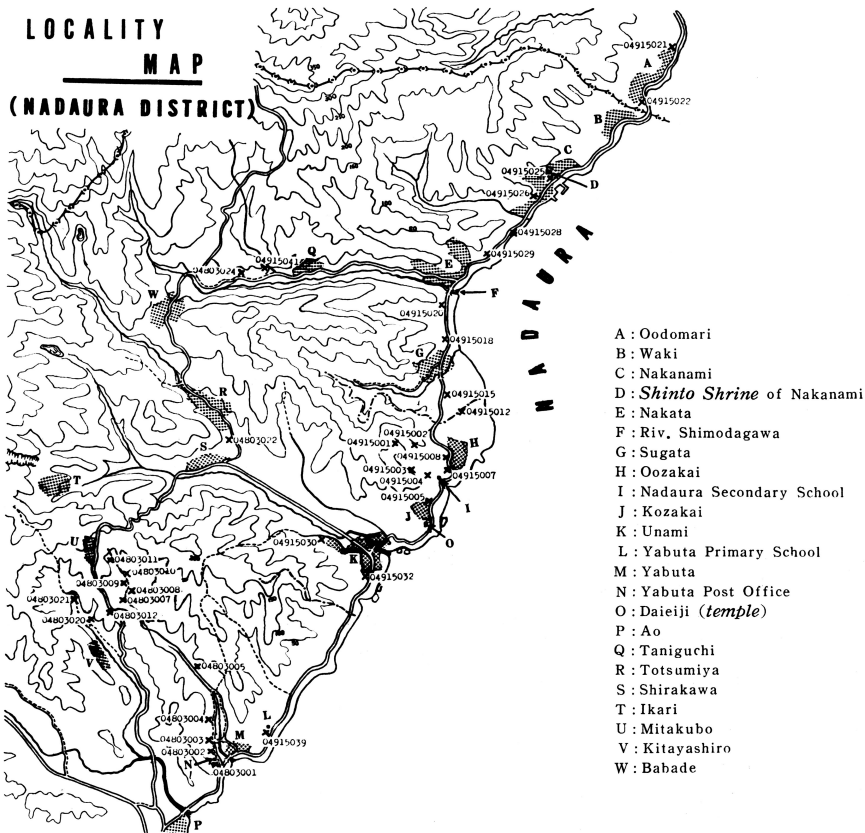
* KASENO etc. (1957) regarded this glauconitic sandstone as the uppermost submember of the Sugata Member.

Table 2 ; List of localities

Loc. No.*	Localities and Remarks
04915001-A	650 m. NW from the Nadaura Sec. School, along a small valley. Just below the Oozakai glauconitic ss. Oozakai, Himi-shi, Toyama Pref. Uppermost part of the Sugata Member.
04915001-B	ditto. Oozakai Member.
04915001-C	ditto. Lowermost part of the Yabuta Member.
04915002	500 m. NW from the Nadaura Sec. School, along a small valley, south side of the valley. Oozakai, Himi-shi, Toyama Pref. Yabuta Member.
04915003	350 m. NW from the Nadaura Sec. School, along a small valley, south side of the valley. Oozakai, Himi-shi Toyama Pref. Yabuta Member.
04915004	150 m. NW from the Nadaura Sec. School, along a small valley, south side of the valley. Oozakai, Himi-shi, Toyama Pref. Yabuta Member.
04915005	Bluff, 400 m. N from the Daieiji (<i>Temple</i>), along the road, Kozakai, Himi-shi, Toyama Pref. Yabuta Member.
04915007	Cliff, road side, 300 m. N from Loc. 04915005, along the road. Oozakai, Himi-shi, Toyama Pref. Yabuta Member.
04915008	Cliff, road side, 120 m. N from Loc. 04915007, along the road. Oozakai, Himi-shi, Toyama Pref. Yabuta Member.
04915012-A	350 m. W from the shore line, south side of the small valley, along the boundary-line between Unami and Mera. Just below the Oozakai glauconitic ss. Oozakai, Himi-shi, Toyama Pref. Sugata Member.
04915012-B	ditto. In the Oozakai glauconitic ss. Oozakai Member.
04915012-C	ditto. Just above the Oozakai glauconitic ss. Yabuta Member.
04915015	Ciff, 150 m. S from the bridge at the entrance of the Sugata-buraku, along the road; eastern side of the road. Sugata, Himi-shi, Toyama Pref. Sugata Member.
04915018	Bluff, 300 m. N from the crossing of roads in the Sugata-buraku. Sugata, Himi-shi, Toyama Pref. Type locality of the Sugata Member.
04915020	Bluff, 200 m. S from the bridge over the Riv. Shimodagawa, in the Nakata-buraku. Nakata, Himi-shi, Toyama Pref. Sugata Member.
04915021-A	Cliff, just behind the monument, at Oodamari, Nanao-shi, Ishikawa, Prefecture. Just below the Oodamari tuff. Shaly part of the uppermost part of the Taniguchi Member.
04915021-B	ditto. Coarse ss. of the uppermost part of the Taniguchi Member.
04915022	Cliff, 150 m. NW from the boundary-line between Ishikawa and Toyama Prefectures; behind a house. Oodamari, Nanao-shi, Ishikawa Pref. Lowermost part of the Nakanami Member.
04915025	Entrance of the <i>Shinto Shrine</i> in the Nakanami-buraku, Himi-shi, Toyama Pref. Near the type locality of the Nakanami Member. Nakanami Member.
04915026	Cliff,, 400 m. SW from the type locality of the Nakanami Member, along the road. Nakanami, Himi-shi, Toyama Pref. Nakanami Member.
04915028	Bluff, 420 m. SW from loc. 04915026, along the road; just below the Nakata tuff. Nakanami, Himi-shi, Toyama pref. Uppermost part of the Nakanami Member.

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- 04915029 Bluff, 400 m. SW from loc. 04915028, and 650m. NE from the bridge over the Riv. Shimodagawa in Nakata, Himi-shi, Toyama Pref. Lowermost part of the **Sugata Member**.
- 04915030-A Cliff, 400 m. S from the Unami Primary School, and 650 m. NWW from the crossing of roads, along the pass from Unami to Taira. Just below the Oozakai glauconitic ss. Unami, Himi-shi, Toyama Pref. The uppermost part of the **Sugata Member**.
- 04915030-B ditto. In the Oozakai glauconitic ss. **Oozakai Member**.
- 04915030-C ditto. Just above of the Oozakai glauconitic ss. The lowermost part of the **Yabuta Member**.
- 04915032 Bluff, 280 m. S from the crossing of roads, along the road. Unami Himi-shi, Toyama Pref. **Yabuta Member**.
- 04915039 Cliff, just S side of the Yabuta Primary School, Yabuta, Himi-shi, Toyama Pref. Type locality of the **Yabuta Member**.
- 04915041 Cliff, road side, from Taniguchi to Hirasawa, 160 m. NW from the the crossing of roads. Taniguchi, Himi-shi, Toyama Pref. **Taniguchi Member**.
- 04803001 Cliff about 100 m. S from the Yabuta Post Office, Yabuta, Himi-shi Toyama Pref. **Yabuta Member**.
- 04803002 Cliff, about 130 m. E from the Yabuta Post Office, Yabuta, Himi-shi, Toyama Pref. **Yabuta Member**.
- 04803003 Cliff, 350 m. NW of the Yabuta Post Office, western side of the valley. Yabuta, Himi-shi, Toyama Pref. **Yabuta Member**.
- 04803004 Cliff, 220 m. N from loc. 04803003, western side of the valley. Yabuta, Himi-shi Toyama Pref. Uppermost part of the **Sugata Member**.
- 04803005 Cliff, 800 m. N from loc. 04803004, along the road from Yabuta to Mitakubo, southern side of the valley. Yabuta, Himi-shi, Toyama Pref. **Sugata Member**.
- 04803007 Cliff, just western side of the pond, located about 900m. NW from loc. 04803005. Mitakubo, Himi-shi, Toyama Pref. **Sugata Member**.
- 04803008 Cliff, eastern side of the valley, 150 m. N from loc. 04803007. Mitakubo, Himi-shi, Toyama Pref. **Sugata Member**.
- 04803009 Cliff, the pass side, 110 m. N from loc. 04803008. Mitakubo, Himi-shi, Toyama Pref. **Sugata Member**.
- 04803010 Cliff, the pass side, 90 m. NNW from loc. 04803009. Mitakubo, Himi-shi, Toyama Pref. **Sugata Member**.
- 04803011 Cliff, the pass side, 200 m. NNW from loc. 04803010. Mitakubo, Himi-shi, Toyama Pref. **Sugata Member**.
- 04803012 Cliff, at the crossing of roads, from Mitakubo to Yabuta, and to Ao. Mitakubo, Himi-shi, Toyama Pref. **Sugata Member**.
- 04803021 Cliff, northwestern side of the valley, 500 m. NW from the crossing of roads, from Ao to Mitakubo, and to Ikari. Kitayashiro, Himi-shi, Toyama Pref. **Sugata Member**.
- 04803021 Cliff, 450 m. NW from loc. 04803020, road side. Kitayashiro, Himi-shi, Toyama Pref. **Sugata Member**.
- 04803022 Cliff, 500 m. N from the crossing of roads, from Shirakawa to Totsumiya, and to Unami; road side. Shirakawa, Himi-shi, Toyama Pref. Lowermost Part of the **Sugata Member**.
- 04803024 Cliff, road side, 550m. E. from the crossing of roads in Babade, Himi-shi, Toyama Pref. **Taniguchi Member**.
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Foraminiferal fauna

Taniguchi Member

A layer of the *Miogypsina* sandstone, which is composed of the very coarse sands or granules and a lot of *Miogypsina kotoi* HANZAWA, is intercalated in the uppermost horizon of this member at Oodomari, Nanao-shi. From this sandstone, the writer found a few specimens of *Robulus nikobarensis* SCHWAGER, and very rarely *Amphistegina* sp., *Eponides nipponicus* HUSEZIMA et MARUHASI, *Eponides umbonatus* REUSS, *Uvigerina schwageri* BRADY, *Vaginulina yoshihamaensis* INOUE et NAKASEKO together with abundant *Miogypsina*.

No examination of the materials from the type locality of this member has been made, but some samples from this member, in the neighbourhood of the type locality, are studied. The fossil foraminifers such as *Martinottiella communis* (d'ORBIGNY), *Cyclamina pusira* BRADY, *Bathysiphon?* sp., *Sigmoilina* sp. 1, are frequently found in this member.

Oodomari Member

Miogypsina kotoi HANZAWA is rarely found from the lowest part of this member at the type locality, the bluff at Odomari. Two thin layers of sandstone in which *Miogypsina kotoi* HANZAWA is concentrated, are found in the lower part of this member at Ooma, Himi-shi, near the type locality. Other fossil foraminifers are not found from this member, by the writer.

Nakanami Member

Bathysiphon sp., *Arenosiphon?* sp., *Cibicides lobatulus* (WALKER et JACOB), *Epistominella japonica* (ASANO), *Lagenonodosaria pauciloculata* (CUSHMAN), *Nodosaria longicosta* d'ORBIGNY, *Robulus nikobarensis* SCHWAGER, and *Uvigerina proboscidea* SCHWAGER are found commonly in this member at the type locality, the cliff in front of the Nakanami Primary School, Nakanami, Himi-shi.

Nakata Member

This member is variable in its lithological facies; it is composed of pumiceous tuffs in the northern area and of pumiceous sandstones in the central area. In the southern area, it is the compact tuffite composed of fine ashes.

The fossil foraminifers have not been found from this member.

Sugata Member

Uvigerina subperegrina CUSHMAN et KLEINPELL, and *Uvigerina proboscidea* SCHWAGER are dominant in this member at the type locality, the bluff of Sugata, Himi-shi, and its neighbourhood. This fauna is accompanied by relatively abundant *Epistominella japonica* (ASANO), *Eponides umbonatus* REUSS, *Nodogenerina lepidula* SCHWAGER, and *Pseudononion* sp. 1. At other localities, also in the massive muddy part of this member, however, the fossil foraminifers are generally poor in numbers. *Martinottiella communis* (d'ORBIGNY) is rarely found from this facies.

In the shaly part of this member, which is gradually increasing in thickness toward the southern area of this district, a conspicuous fauna is found. In this fauna, *Cassidulina laevigata* d'ORBIGNY, *Eponides umbonatus* REUSS, *Lagenonodosaria pauciloculata* (CUSHMAN), and *Uvigerina subperegrina* CUSHMAN et KLEINPELL are predominant species; fairly abundant are *Elphidium bartletti* CUSHMAN, *Martinottiella communis* (d'ORBIGNY), *Nonion scaphum* (FICHEL et MOLL), *Pullenia salisburyi* R. E. et K. C. STEWART and *Sigmolilina* sp. 2., *Uvigerina proboscidea* SCHWAGER, *Sigmomorphina notoensis* ASANO, and *Plectofrondicularia miocenica* CUSHMAN are contained in most samples from the shaly part, but is few in number.

Oozakai Member

A very conspicuous fauna which consists of *Uvigerina akitaensis* ASANO and *Uvigerina wakimotoensis* (ASANO) accompanied by the smaller numbers of *Martinotiella communis* (d'ORBIGNY) is frequently found in this member.

Yabuta Member

Elphidium bartletti CUSHMAN, *Cassidulina kasiwazakiensis* HUSEZIMA et MARUHASI, *Cassidulina sagamiensis* ASANO et NAKAMURA, *Cassidulina subglobosa depressa* ASANO et NAKAMURA, etc. are predominant; *Elphidium subgranulosum* ASANO, *Elphidium subarcticum* CUSHMAN, *Angulogerina kokozuraensis* ASANO, *Bolivina decussata* BRADY, *Bolivina pseudoplicata* HERON-ALLEN et EARLAND, *Buccella frigida* (CUSHMAN), *Buliminella elegantissima tenuis* CUSHMAN et McCULLOCH, *Cassidulina orientale* CUSHMAN, *Cassidulina subglobosa* BRADY, *Discopulvinulina bradyi* CUSHMAN, *Discopulvinulina* cf. *nitida* (WILLIAMSON), *Epistominella japonica* (ASANO), *Eponides nipponicus* HUSEZIMA et MARUHASI, *Nonion pompilioides* (FICHEL et MOLL), *Pseudononion japonicum* ASANO, etc. are found abundantly. *Uvigerina akitaensis* ASANO is frequently found, mainly in the lower part of this member.

The Yabuta Member contains *Pecten kurosawaensis* and other "Onma—Manganjian" molluscan fauna and can be, therefore, referred to the Upper Pliocene (H₂).

The Upper Pliocene formations with rich foraminifers are relatively widely distributed in sedimentary basins along the Japan Sea coast. The foraminifer fauna of these formations has the common characteristic, and grouped into one "Onma—Manganjian" fauna as is the fossil molluscan fauna. The Yabuta foraminifer fauna is somewhat different from this fauna in the constitution, suggesting a deeper facies.

Occurrence of *Uvigerina*

Nine species of *Uvigerina* are recognized in the Neogene formations of this district (table 3).

Among these species, *Uvigerina akitaensis* ASANO, *Uvigerina proboscidea*, SCHWAGER, and *Uvigerina schwageri* BRADY are found also in the Recent deposits, in the sea surrounding Japan. *Uvigerina akitaensis* ASANO, *Uvigerina proboscidea* SCHWAGER, *Uvigerina subperegrina* CUSHMAN et KLEINPELL, and *Uvigerina wakimotoensis* (ASANO) are the predominant species in the formations of this district.

As shown in the table 3, the most remarkable faunal change of *Uvigerina* exists at the horizon between the Sugata Member and the Oozakai Member in the northern part of this district. The Oozakai glauconitic sandstone, which was regarded by KASENO and others (1957) as the topmost submember of the Sugata Member, is not dis-

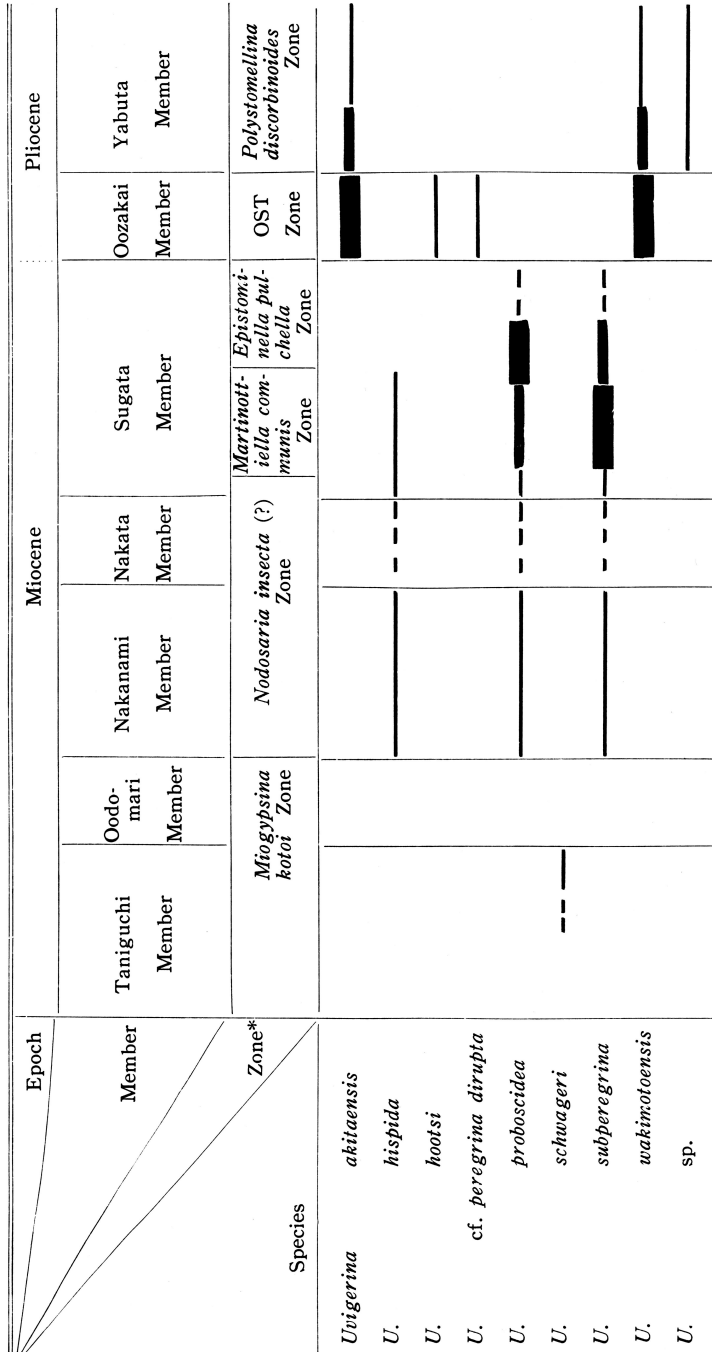


Table 3; Range chart of *Uvigerina* in the Nadaura district.

* This microbiostratigraphic classification was ever proposed by IKEBE et NAKASEKO (1949). As to this classification, however, more crucial studies seem to be necessary for the formation shown by the following three zones, *Martinottiella communis*, *Epistomiella pulchella*, and OST Zone.

tributed in the southern part of this district, where the Yabuta siltstone lies on the Sugata mudstone. In this southern part the faunal change, just mentioned, can be recognized at the transitional horizon from the Sugata Member to the Yabuta Member.

Uvigerina akitaensis ASANO and *Uvigerina wakimotoensis* (ASANO) are commonly found only in the members above this horizon, sometimes accompanied by the very small numbers of *Uvigerina* sp., while *Uvigerina proboscidea* SCHWAGER and *Uvigerina subperegrina* CUSHMAN et KLEINPELL are never found in this higher part. These two species are commonly distributed in the members below the Sugata Member (inclusive.)

Uvigerina akitaensis ASANO and *Uvigerina wakimotoensis* (ASANO), both species are very predominant, 20 to 40 percent in total, in the Oozakai Member and its equivalent horizon. *Uvigerina hootsi* RANKIN and *Uvigerina* cf. *peregrina dirupta* TODD are rarely found in this horizon.

In the Sugata Member, *Uvigerina subperegrina* CUSHMAN et KLEINPELL are abundantly distributed in the lower part, regardless of the change of facies. *Uvigerina proboscidea* SCHWAGER is predominant in the middle part of this member, in the northern area of this district. The mud facies of the upper part of this member in the northern area and the upper and middle part in the southern area are generally barren of foraminifers, except for a small number of the arenaceous forms such as *Martinottiella communis* d'ORBIGNY.

In the formations below the Nakata Member *Uvigerina* occurs rather rarely. The small numbers of *Uvigerina proboscidea* SCHWAGER, *Uvigerina subperegrina* CUSHMAN et KLEINPELL, and *Uvigerina hispida* SCHWAGER are sometimes found in the Nakanami Member. *Uvigerina schwager* BRADY is very rarely found in the uppermost part of the Taniguchi Member.

Description of species

Genus *UVIGERINA* d'ORBIGNY, 1826

Uvigerina akitaensis ASANO

pl. 7, fig. 1.

1950, *Uvigerina akitaensis* ASANO, Ill. Cat. Japan. small. Foram. Pt. 2, p. 14, figs 60 - 62.

1958, *Uvigerina akitaensis*, ASANO, Sci. Rep. Tohoku Univ. ser. 2, vol. 29, p. 33, pl. 6, figs. 9 - 13.

Description : Test free, elongate, nearly equal diameter throughout, distal end tapering, periphery lobulate; chamber inflated, gradually increasing in size, triserial throughout; sutures deeply incised; wall calcareous, finely perforated, ornamented by numerous longitudinal costae, not continuous across sutures; aperture at the end of a short

neck with a slight lip. *Measurement*: Specimen of fig. 1,—greatest diameter; 0.28 mm., length; up to 0.85 mm.

This species resembles *Uvigerina excellens* TODD (in CUSHMAN et McCULLOCH, 1948) and it is rather difficult to distinguish between them. It differs from *Uvigerina excellens* TODD in its more slender test and differs from *Uvigerina yabei* ASANO (1938) by its sharp lamellate costae.

Figured specimen (OMNH Reg. No. F1019F) is from locality 04915007*; unfigured specimens are recorded from localities 04915001-C, 04915001-B, 04915002, 04915004, 04915007, 04915008, 04915012-B, 04915030-C, 04915031, 04915039, 04803003-A.

Uvigerina hispida SCHWAGER

pl. 7, fig. 2.

1867, *Uvigerina hispida* SCHWAGER, Reise, Novara, Geol. Theil, 2, p. 249, pl. 7, fig. 95.

1938, *Uvigerina hispida*, KEINPLELL, Miocene Stratigraphy, Calif., p. 295, pl. 5, figs. 8, 16.

Description: Test free, fusiform, about twice as long as broad, periphery lobulate; chambers distinct, inflated; sutures distinct and depressed; wall calcareous, finely perforated; surface warty with numerous smaller knobs; aperture terminal with very short neck. *Measurement*: Specimen of fig. 2,—greatest diameter; 0.24 mm., length; up to 0.42 mm.

This form is commonly found in the Miocene of California. In the present district, it is rarely found from the late Miocene Sugata Member and Nakanami Member.

Figured specimen (OMNH Reg. No. F1020F) is from locality 04915025 and unfigured specimens from localities 04915025 and 04803021.

Uvigerina hootsi RANKIN

pl. 7, fig. 3.

1948, *Uvigerina hootsi*, CUSHMAN et McCULLOCH, Rep. Allan Hancock Exp., vol. 6, No. 5, p. 259, pl. 33, figs. 33a, b.

Description: Test free, elongate, which a grape bunch like shape, greatest diameter across the last whorl of chambers, about three times as long as broad; chambers distinct, inflated, relatively compactly arranged, rapidly attaining the adult size; sutures distinct and deeply incised; wall calcareous, finely perforated, surface of the almost whole portion of the test smooth, very weak costae in earliest portion; aperture terminal with a short neck and slight lip. *Measurement*: Specimen of fig. 3,—greatest diameter; 0.21 mm., length; up to 0.60 mm.

ASANO (1950, p. 15, figs. 67, 68) reported *Uvigerina* cf. *hootsi* RANKIN from the Pliocene Haizume Formation of Niigata Prefecture. It differs from the present form

in its broader test and in having a smaller number of chambers.

Figured specimen (OMNH Reg. No. F1021F) and unfigured specimens are from locality 04803003-A, in the transitional part between the Sugata Member and the Yabuta Member.

Uvigerina cf. peregrina dirupta TODD

pl. 7, fig. 4.

cf. 1948, *Uvigerina peregrina dirupta* TODD in CUSHMAN et McCULLOCH, Allan Hancock Exp., vol. 6, no. 5, p. 267, pl. 34, fig. 3.

Description: Test free, fusiform, periphery moderately lobulate; chambers distinct; sutures deeply incised; wall calcareous, finely perforated, ornamented with prominent plate like costae, toward the apertural end breaking up into spines; aperture small, opening at the end of a short neck. *Measurement*: Specimen of fig. 4—greatest diameter; 0.20 mm., length; up to 0.45 mm.

This form somewhat differs from typical *Uvigerina peregrina dirupta* TODD in having rather weak serrate costae. It is rarely found in the Yabuta Member in this area. *Uvigerina peregrina dirupta* in ASANO (1950, p. 16, figs. 71, 72) which was reported from the Pliocene Kiwada Formation of the Pacific coast and the Pliocene Wakimoto Formation of the Japan Sea coast, and was lately referred to *Uvigerina peregrina shiwoensis* ASANO (1958, p. 35, pl. 6, figs. 5-7) is not similar to the present form in having the spinose projection on each costa.

Figured specimen (OMNH Reg. No. F1022F) is from locality 04803003-A, unfigured specimens from localities 04915012-C and 04803003-A.

Uvigerina proboscidea SCHWAGER

pl. 7, fig. 5.

1867, *Uvigerina proboscidea* SCHWAGER, Reise, Novara, Geol. Theil, 2, p. 250, pl. 7, fig. 96.

1939, *Uvigerina proboscidea*, CUSHMAN, Jour Geol. Soc. Japan, vol. 46., no. 546, p. 151, pl. 10, fig. 13.

1942, *Uvigerina proboscidea*, CUSHMAN, U.S. Nat. Mus., Bull. 161, p. 49, pl. 14, figs. 1-4.

1948, *Uvigerina proboscidea*, CUSHMAN et McCULLOCH, Rep. Allan Hancock, Exp. vol. 6, no. 5, p. 267, pl. 34, fig. 4.

1950, *Uvigerina proboscidea*, ASANO, Ill. Cat. Japan. Tert. small. Foram., Pt. 2, p. 16, fig. 73.

1953, *Uvigerina proboscidea*, ASANO, Short Paper, Inst. Geol. Paleont. Tohoku Univ. no. 5, table 2, pl. 2, figs. 29-31.

1958, *Uvigerina proboscidea*, ASANO, Sci. Rep. Tohoku Univ. ser. 2, vol. 29, p. 35 (here a more complete synonymic list), pl. 6, figs. 14-16.

Description: Test free, fusiform, widest in the middle portion of the test, periphery

lobulate; chambers distinct and inflated, early portion compact, later portion attenuate; sutures depressed; wall calcareous, finely perforated, thin, translucent, ornamented by numerous very slender and very short projections, which seem to be arranged somewhat longitudinally; aperture small, at the top of cylindrical short neck. *Measurement*: Specimen of fig. 5,—greatest diameter; 0.15 mm., length; up to 0.30 mm.

In Japan, this form was reported by ASANO from the Pliocene Haizume Formation of Niigata Prefecture, Japan Sea coast and the Pleistocene Naganuma Formation of Kanagawa Prefecture, Pacific coast of Japan. In the Hokuriku Province, it has been found from the Miocene Najimi and Higashiinnai Formation of Noto Peninsula and is now discovered from the Miocene Sugata and Nakanami Members of the Yokawa Subgroup in the Nadaura district, but is, remarkably enough, not found from the Pliocene Yabuta Member in this district. In recent sediments, it occurs under the warm Kuroshio waters.

Figured specimen (OMNH Reg. No. F1023F) is from locality 04915025, and unfigured specimens are from localities 04915018, 04915025, 04803008, 04803010, 04803011, 04803021.

Uvigerina schwageri BRADY

pl. 7, fig. 6.

- 1884, *Uvigerina schwageri* BRADY, Rep. Voy. Challenger, Zool., vol. 9, p. 475, pl. 74, figs. 8-10.
1936, *Uvigerina schwageri*, ASANO, Jour. Geol. Soc. Japan., vol. 45, no. 538, p. 612, pl. 17, figs. 3-5.
1950, *Uvigerina schwageri*, ASANO, Ill. Cat. Japan. Tert. small. Foram., pt. 2, p. 17, figs. 76, 77.
1958, *Uvigerina schwageri*, ASANO, Sci. Rep. Tohoku Univ. ser. 2, vol. 29, p. 38 (here a more complete synonymic list), pl. 6, figs. 1, 2,

Description: Test free, fusiform, one half or two times as long as broad, periphery lobulate; chambers inflated, early portion compact, early chambers often obscured by ornamentation; sutures depressed, indistinct; wall calcareous, finely perforated with a few somewhat bluntly raised costae, continuous across sutures, becoming obscure on the last chamber; aperture terminal with a short neck and slight lip. *Measurement*: Specimen of fig. 6,—greatest diameter; 0.30 mm., length; up to 0.50 mm.

This is a common Neogene and Recent Indo-pacific species. In Japan, it is reported from the Pliocene Kiwada Formation of Chiba Prefecture and the Pliocene Hosoya Formation of Shizuoka Prefecture by ASANO (1950). The writer obtained only one specimen from the Pliocene Oozakai Member of the Nadaura district.

Figured specimen (OMNH Reg. No. F1024F) is from locality 04915012-B.

Uvigerina subperegrina CUSHMAN et KLEINPELL

pl. 7, figs 7, 8.

- 1934, *Uvigerina subperegrina* CUSHMAN et KLEINPELL, Contr., Cushman Lab. Foram. Res. 10, p. 12, pl. 2, figs. 9-11. (in Cat. Foram).
 1948, *Uvigerina subperegrina*, CUSHMAN et McCULLOCH, Rep. Allan Hancock Exp., vol. 6, no. 5, p. 270, pl. 34, fig. 10.
 1950, *Uvigerina subperegrina*, ASANO, Ill. Cat. Japan. Tert. small. Foram., pt. 2, p. 18, figs. 80-82.

Description: Test free, fusiform, somewhat slender, periphery lobulate; chambers distinct, inflated, ordinarily triserial throughout but sometimes becoming biserial in later portion; sutures incised, gently curved; wall calcareous, finely perforated, thin, translucent, ornamented with numerous longitudinal costae, not continuous across sutures, obsolete and serrate, rather becoming smooth in later portion of test; aperture small, located at the end of the cylindrical short neck. *Measurement*: Specimen of fig. 7,—greatest diameter; 0.20 mm., length; up to 0.40 mm., and specimen of fig. 8—greatest diameter; 0.20 mm., length; up to 0.50 mm.

The present forms are generally smaller than the type specimens originally described. It is found that the extent of the indistinctly costated portion is variable among the present specimens. *Uvigerina subperegrina* CUSHMAN et KLEINPELL was recorded from the Miocene of California. In Japan, it is abundant in the Miocene formations of Niigata and Miyazaki Prefecture and is rarely found in the Pliocene formations of Akita and Niigata Prefecture. In the Nadaura district, it occurs from the Miocene Sugata and Nakanami Members.

Specimen of fig. 7 (OMNH Reg. No. F1025F) is from locality 04803008 and specimen of fig. 8 (OMNH Reg. No. F1026F), from locality 04803011. Unfigured specimens are from localities 04915039, 04803008, 04803009, 04803010, 04803011.

Uvigerina wakimotoensis (ASANO)

pl. 7, figs 9, 10.

- 1950, *Hopkinsina wakimotoensis* ASANO, Ill. Cat. Japan. Tert. small. Foram., pt. 2, p. 19, figs. 88-90.

Description: Test free, slender, 2.5 to 3.5 times as long as broad, tapering toward distal end, periphery lobulate; chambers distinct, inflated, triserial, sometimes becoming biserial in later portion; sutures deeply incised; wall calcareous, finely perforated, ornamented with widely spaced longitudinal costae which are serrate, the later ones somewhat obsolete and breaking up into rows of small spines; aperture small, at the end of the cylindrical short neck with the slight lip. *Measurement*: Specimen of

fig. 9,—greatest diameter; 0.22 mm., length; up to 0.70 mm., and specimen of fig. 10,—greatest diameter; 0.30 mm., length; up to 0.75 mm.

The forms, similar to ASANO's type specimens, are found among the present specimens but the individual number of that typical form is very small. The majority of the present specimens has not the biserial portion and shows the characteristic of typical *Uvigerina*. It is frequently found that the biserial arrangement sometimes appears in the late adult stage, in some species of *Uvigerina*. *Hopkinsina* has, on the other hand, no triserial arrangement, in the adult stage, as shown in the original description of *Hopkinsina danvillensis* HOW et WALLACE, the type-species of *Hopkinsina*. Therefore, it is believed that ASANO's *Hopkinsina wakimotoensis* belongs to the genus *Uvigerina*. This species differs from *Uvigerina peregrina dirupta* TODD in its more elongate shape and in having smaller and weaker spines in the later chambers.

ASANO(1950, p. 19) reported that this species is characteristically common in the Pliocene Wakimoto Formation and is rarely found in the Miocene? Kitaura Formation of Akita Prefecture. In the present district, it is abundantly found in the Oozakai Member just below the Yabuta Member, and occurs also from the Late Pliocene Yabuta Member.

Specimen of fig. 9(OMNH Reg. No. F1027F) is from locality 04803003-A, and specimen of fig. 10(OMNH Reg. No. F1028F), from locality 04915032. Unfigured specimens are from localities 04915001-C, 04915003, 04915007, 04915012-B, 04915012-C, 04915018, 04915032, 04915039, 04803003-A.

Uvigerina sp. indet.

pl. 7, fig. 11.

Description: Test elongate, fusiform, greatest diameter at the upper portion of the test, periphery lobulate; chambers compact, relatively inflated; sutures incised, rather indistinct; wall calcareous, finely perforated, surface rather smooth; aperture small, terminal with a short neck. *Measurement*: Specimen of fig. 11,—greatest diameter; 0.14 mm., length; up to 0.30 mm.

This form somewhat resembles *Uvigerina* cf. *hootsi* in ASANO(1950, p. 15, figs. 67, 68) from the Pliocene Haizume Formation of Niigata Prefecture. It is rarely found from the Yabuta Member in the present district.

Figured specimen (OMNH Reg. No. F1029F) is from locality 04915030-C, and unfigured specimens from localities 04915030-C, and 04915039.

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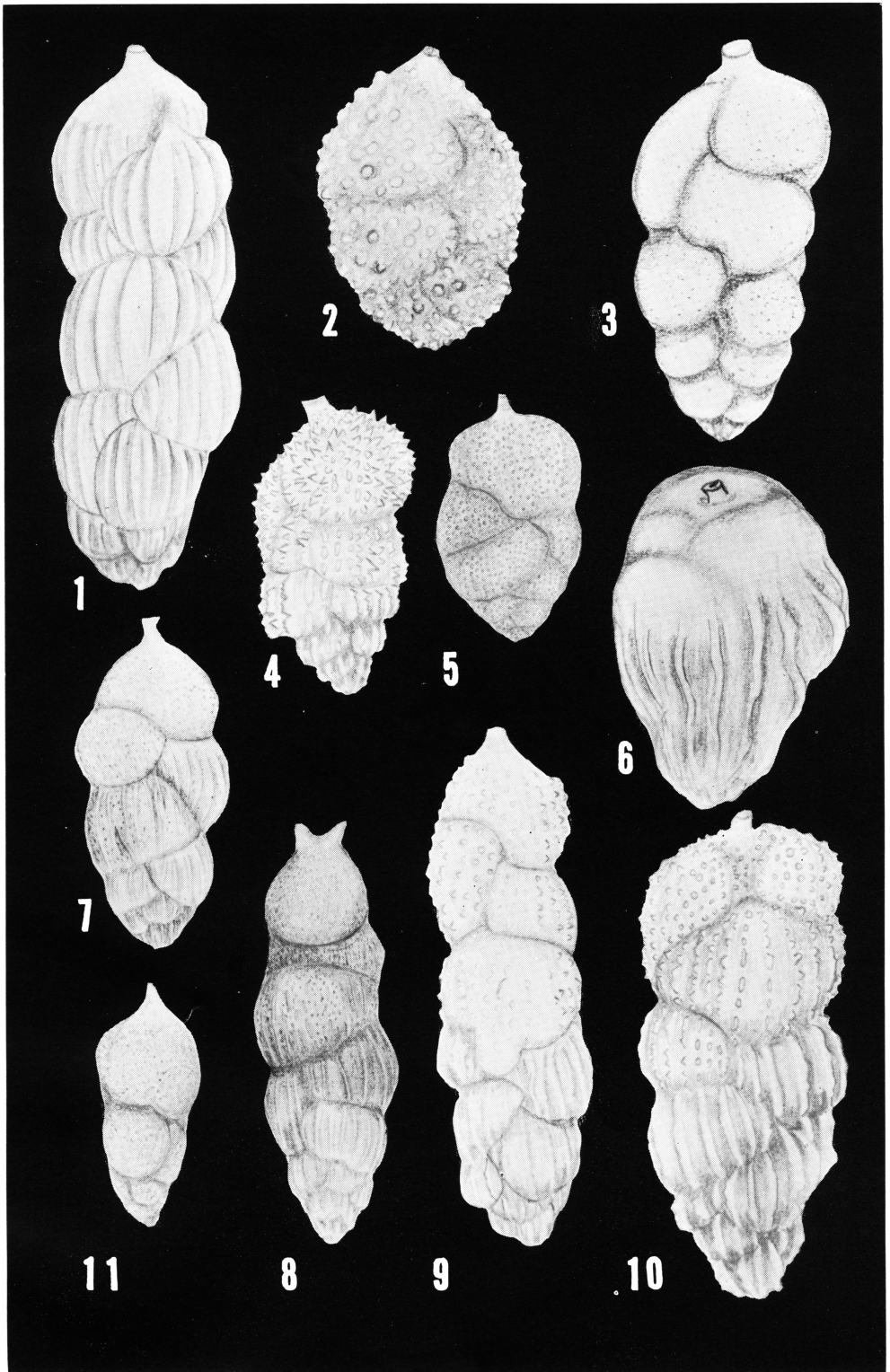
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Explanation of Plate 7

- Fig. 1, *Uvigerina akitaensis* ASANO, (OMNH Reg. No. F1019F), from locality 04915007. $\times 100$.
- Fig. 2, *Uvigerina hispida* SCHWAGER, (OMNH Reg. No. F1020F) from locality 04915007, $\times 100$.
- Fig. 3, *Uvigerina hootsi* RANKIN, (OMNH Reg. No. F1021F), from locality 04803003-A, $\times 100$.
- Fig. 4, *Uvigerina* cf. *peregrina dirupta* TODD, (OMNH Reg. No. F1022F), from locality 04803003-A, $\times 120$.
- Fig. 5, *Uvigerina proboscidea* SHWAGER, (OMNH Reg. F1023F), from locality 04915025. $\times 120$.
- Fig. 6, *Uvigerina schwageri* BRADY, (OMNH Reg. No. F1024F), from locality 04915012-B. $\times 100$.
- Fig. 7, *Uvigerina subperegrina* CUSHMAN et KLEINPELL, (OMNH Reg. No. F1025F), from locality 04803008. $\times 120$.
- Fig. 8, *Uvigerina subperegrina* CUSHMAN et KLEINPELL, (OMNH Reg. No. F1026F), from locality 04803011. $\times 120$.
- Fig. 9, *Uvigerina wakimotoensis* (ASANO), (OMNH Reg. No. F1027F), from locality 04803003-A. $\times 100$.
- Fig. 10, *Uvigerina wakimotoensis* (ASANO), (OMNH Reg. No. F1028F), from locality 04915032. $\times 100$.
- Fig. 11, *Uvigerina* sp. indet., (OMNH Reg. No. F1029F), from locality 04915030-C. $\times 120$.



М. СИЛИ: *Uvigerina*, Nadaura district, Toyama.