

An Occurrence of *Turritella (Hataiella) sagai* in Alaska: Implications for the Age of the Bear Lake Formation

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Abstract The gastropod *Turritella (Hataiella) sagai* KOTAKA, 1951, previously known only from Miocene faunas of Japan, occurs in the Bear Lake Formation of the Alaska Peninsula in southwestern Alaska, U. S. A. Planktonic-microfossil and radiometric dates available for some of the Japanese occurrences indicate an age-range for this species of about 15–16 Ma, within the earliest middle Miocene. The presence of *T. (H.) sagai* provides the first reliable evidence for an age as great as earliest middle Miocene for strata in the Bear Lake Formation.

Introduction

The gastropod *Turritella (Hataiella) sagai* KOTAKA, 1951, is well known in Japan, where it occurs within a relatively narrow stratigraphic interval in formations of Miocene age (KOTAKA, 1959, 1982). Until the present study, this species had not been reported outside of Japan. However, *T. (H.) sagai* has now been discovered in southwestern Alaska, U. S. A., and it provides new insight into the age of the Bear Lake Formation, the principal Miocene marine unit of the Alaska Peninsula (Fig. 1).

All previous records of this species are from the Pacific side of Honshu, where KOTAKA (1959) listed occurrences in six Miocene stratigraphic units he referred to as the Akebihara, Kamiyasaku, Mitsuno, Moriya, Shimamori, and Togari. Three of these units have been placed in a modern chronostratigraphic context and are useful in assigning an exact age range for *T. (H.) sagai*.

Modern Ages of *Turritella sagai* Occurrences in Japan

The “Togari” of the Mizunami area in Gifu Prefecture includes the type locality of *T. (H.) sagai*, and is now assigned to the Togari Member of the Akeyo Formation (ITOIGAWA, 1979; TSUCHI and others, 1979). This formation has been dated using planktonic microfossils and radiometric techniques and assigned to the upper half of planktonic zone N8 (TSUCHI and others, 1979). This dating indicates an age range of about 15–16 Ma for the Togari Member, within the earliest middle Miocene (TSUCHI and others, 1981).

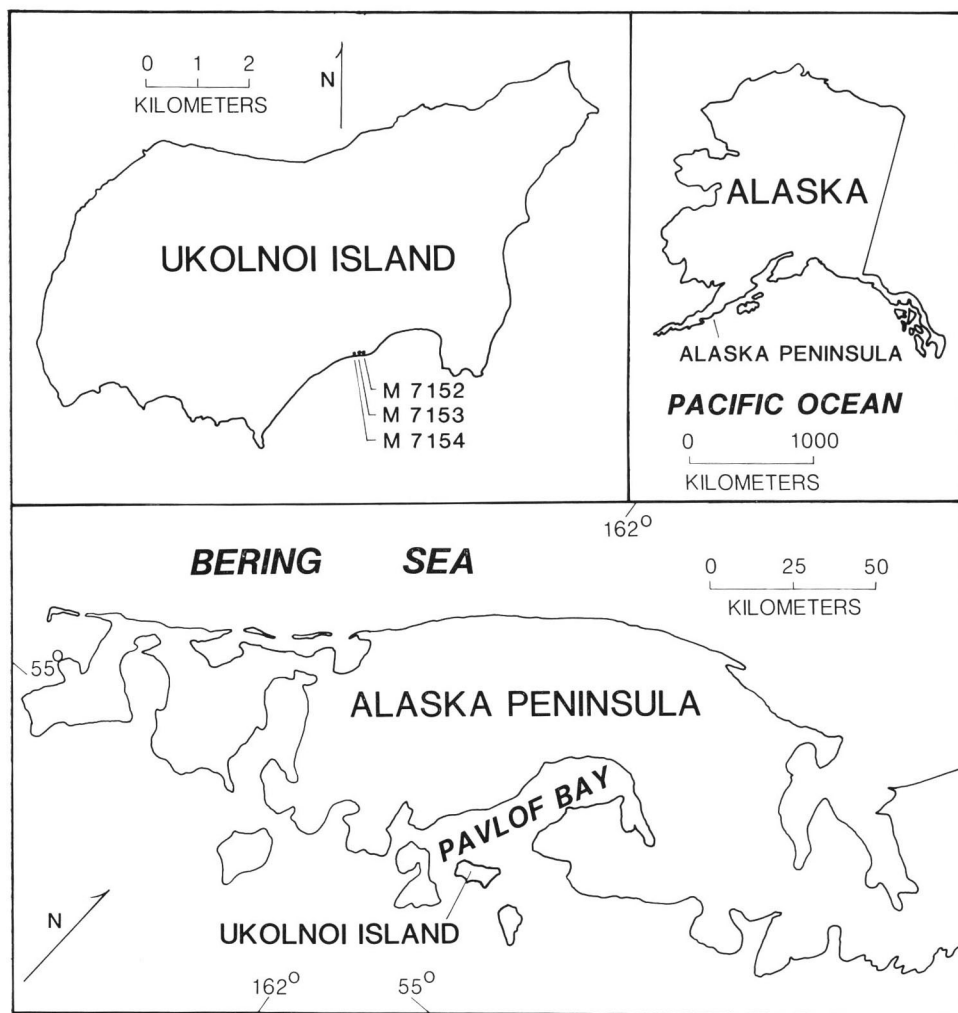


Fig. 1. Location of Ukolnoi Island and fossil localities.

The “Mitsuno” of the Kii Peninsula is assigned to the Mitsuno Formation of the Kumano Group (MIZUNO, 1953; KOTAKA, 1959). Both microfossil data and radiometric dating suggest an earliest middle Miocene age for the Mitsuno strata. IKEBE, CHIJU and MOROZUMI (1975) noted that the *Orbulina* datum at 15 ± 0.5 Ma occurs at the base of the Mitsuno Formation. In addition, the Mitsuno Formation is intruded and overlain by the Kumano Acidic Rocks, which have a potassium-argon age of 14 ± 1.0 Ma (IKEBE and others, 1972). Taken together, these data suggest an age range of about 15.0 to 15.5 Ma for the Mitsuno Formation.

KOTAKA (1959) noted the uncertainties in stratigraphic correlation of Miocene

rocks of the Joban Coal Field when he cited occurrences there for *T. (H.) sagai*. His "Kamiyasaku" Miocene occurrence may refer to the Kamiyasaku Mudstone Member of the Shimotakaku Formation, the stratigraphically highest formation within the Taga Group of the Joban Coal Field (HANZAWA, 1954). However, the Kamiyasaku Mudstone as currently defined is unfossiliferous, whereas the underlying Numanouchi Formation of the Taga Group contains foraminifers referred to planktonic zones N8 or N9 (KATO, 1980), within the earliest middle Miocene. Therefore, it is probable that KOTAKA's (1959) record is assignable to the early middle Miocene.

The sum of planktonic microfossil and radiometric dates for Japanese strata containing *T. (H.) sagai* suggests an age range for this species that is within the earliest middle Miocene, or about 15–16 Ma.

The Occurrence of *Turritella sagai* in Alaska

The presence of *T. (H.) sagai* in the Bear Lake Formation presents an opportunity to correlate across the North Pacific from well-dated faunas of Japan to a more poorly dated fauna in Alaska. The Bear Lake Formation consists of fossiliferous marine sandstone that crops out extensively but discontinuously on the distal half of the Alaska Peninsula. This formation is thought to be entirely of Miocene age (BURK, 1965), but its precise age range has not been determined. *Turritella (Hataiella) sagai* has been found in one faunule of the Bear Lake Formation, on Ukolnoi Island (Fig. 1). The sedimentary strata of Ukolnoi Island have not been intensively studied, but evidently consist of mostly nonmarine sediments (Robert DETTERMAN, oral communication, 1986), with one interval of undetermined thickness that contains marine fossils. Several mollusk species are present in the Ukolnoi Island faunule, but no other turritellid, and *T. (H.) sagai* occurs in large numbers. No *Turritella* species has been reported from any other outcrop of the Bear Lake Formation.

The beds on Ukolnoi Island are the oldest paleontologically dated strata recognized in the Bear Lake Formation. Earlier reports of Bear Lake mollusks as old as early or middle Miocene were based on uncertain identifications or on the presence of mollusks that occurred in both Oligocene and Miocene North Pacific faunas (MACNEIL in BURK, 1965; MACNEIL, 1973). Most Bear Lake molluscan faunules appear to be of late Miocene age. *Turritella (Hataiella) sagai* is the first reliable evidence for an age as great as earliest middle Miocene for strata in the Bear Lake Formation.

The base of the Bear Lake Formation on Ukolnoi Island is not exposed (Robert DETTERMAN, oral communication, 1986), so an unknown thickness of this formation is older than the interval bearing *T. (H.) sagai*. This formation has been relatively well sampled for megafossils, so the single occurrence of lower middle Miocene strata noted here suggests that the oldest parts of the Bear Lake Formation have not been preserved or are not well exposed.

The Ukolnoi Island specimens of *T. (H.) sagai* (Fig. 2 A–E) are identical in size and sculpture to Japanese specimens figured by KOTAKA (1959) and examined by us

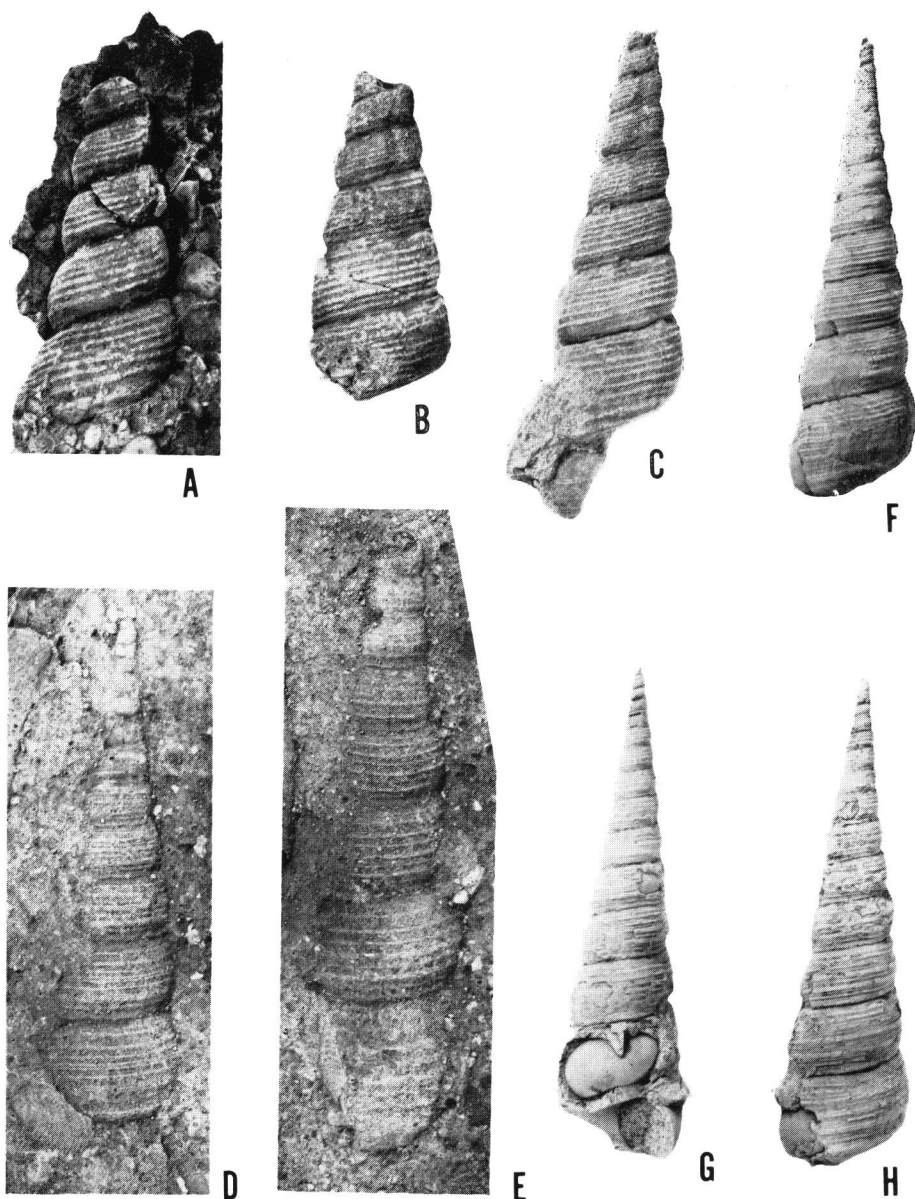


Fig. 2. A–E, *Turritella* (*Hataiella*) *sagai* KOTAKA, 1951 from the Bear Lake Formation, Ukolnoi Island, Alaska, A, USGS locality M7152, length 44.1 mm, diameter 16.7 mm, B, USGS locality M7152, length 43.1 mm, diameter 18.5 mm, C, USGS locality M7153, length 54.7 mm, diameter 17.1 mm, D, USGS locality M7152, length 66.2 mm, diameter 17.0 mm, E, USGS locality M7152, length 79.2 mm, diameter 16.8 mm. F–H, *Turritella* (*Hataiella*) *sagai* KOTAKA, 1951 from the Akebihara Sandstone, Shiga Prefecture, Japan, F, GIYU-130, length 60.9 mm, diameter 12.3 mm, G, H, GIYU-131, length 64.7 mm, diameter 18.1 mm.

in Japanese institutions (Fig. 2 F–H). The holotype and one paratype cited by KOTAKA (1959) have lengths of 48 mm and 88.2 mm, and diameters of 18 mm and 16.7 mm, respectively. The five best-preserved Alaskan specimens range from 47.9 mm to 80.1 mm in length and from 17.1 mm to 21.6 mm in diameter; numerous incomplete Ukolnoi Island specimens are also about the same size.

The abundant presence of the Japanese species *T. (H.) sagai* within a narrow stratigraphic interval of an Alaskan formation otherwise devoid of turritellids suggests the occurrence of a unique biogeographic event. The earliest middle Miocene (15–16 Ma) range of *T. (H.) sagai* coincides with the warmest interval of the Miocene (SAVIN and others, 1981). Temperatures of northern high-latitude surface waters evidently were such that veligers of the warm-temperate to subtropical *T. (H.) sagai* traversed the North Pacific and successfully established themselves in southwestern Alaska. Based on this single known occurrence on Ukolnoi Island, the interval during which *T. (H.) sagai* maintained itself in the northeastern Pacific may have been brief and perhaps coincided only with the very peak of the earliest middle Miocene climatic optimum.

Other mollusks that probably originated in Asia are present in many Bear Lake Formation faunules. Further study of these taxa will aid in deciphering the complete age range of this formation.

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Locality Information

All collections from Alaska were made in July 1977 by Louie MARINCOVICH, Jr., and are housed at the United States Geological Survey, Menlo Park, California, U. S. A. The specimens from the Akebihara Sandstone were collected in August 1971 by Tadasu YAMASHITA and Kimihiko OZAKI and housed at the Geological Institute, Yokohama National University, Yokohama, Japan.

M7152. Shoreline exposure on south shore of Ukolnoi Island, about 120 meters north and 240 meters west of the southeast corner of Section 29, T. 57 S., R. 81 W., Port Moller (A-5) quadrangle; latitude 55°12.5'N, longitude 161°35.8'W; Alaska Peninsula, U. S. A.

M7153. Same general locality as M7152, but 60 to 120 meters farther to the southwest along shoreline.

M7154. Same general locality as M7153, but 60 to 120 meters farther to the southwest along shoreline.

NSM-PCL11-42-1. Creekbank about 750 meters west-southwest of Akebihara; latitude 34°54'50'' N, longitude 136°20'50''E; Tsuchiyama-cho, Kouga-gun, Shiga Prefecture, Japan.

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