

# *Bevahites* (Cretaceous ammonite) from Shikoku

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## Introductory Notes

This is a report of an ammonite collected by a school boy, Yuji Fukuda, on 21st January 1957 from Hotokezaki, Saijo city, Ehime Prefecture, Shikoku. The specimen was sent to us by courtesy of Mr. Matsuichi Kondo of Nakahagi Primary School, Niihama, and Dr. Hiroshi Ozaki of National Science Museum and is now on deposit in the Department of Palaeontology, National Science Museum (abbreviated NSM.), Tokyo. Another specimen showing the external mould of the same ammonite has recently been sent to one of us (T.M.) by courtesy of Dr. Kozo Nagai and Michitoshi Miyahisa of the University of Ehime and is now preserved in the Department of Geology, Kyushu University (abbr. GK.), Fukuoka.

The geological setting of the locality, Hotokezaki, was briefly described by M. Kondo (1960). According to him, the fossiliferous sandstone and shale exposed at Hotokezaki on the coast between the industrial cities of Niihama and Saijo, rest on the basal conglomerate in the lowest part of the Upper Cretaceous (mainly Hetonaian) Izumi Group (Fig. 1). In addition to the ammonite here reported, other ammonites (heteromorpha), *Inoceramus* sp. cf. *I. balticus* and some other bivalves and gastropods have been obtained from the same bed.

## Palaeontologic Description

Family Collignoniceratidae

Subfamily Texanitinae

Genus *Bevahites* Collignon, 1948

*Type-species.*—*Bevahites quadratus* Collignon, 1948, by original designation.

*Diagnosis.*—Whorls are rather evolute, with wide or moderate umbilicus, quadrate to compressed in section, and provided with rather subdued ventral keel. In addition to the primary ribs on the sides there are bifurcated and inserted secondary ribs of the ventrolateral part, the latter being twice to three times as numerous as the former. Each primary rib has an umbilical, a weak or variably strong lateral, and two, close-set ventrolateral tubercles, of which the inner one is prominent. The secondary rib terminates at the ventral tubercle which is close to the keel. The primary ribs are mostly simple and rectiradiate, but may be bifurcated at or near the umbilical tubercle. The suture is similar to that of *Texanites*.

*Remarks.*—*Bevahites* is probably a descendant from *Paratexanites*, with the multiplication of outer ornaments. *Parabevahites* is better included in *Paratexanites*, rather than in *Bevahites*, as a subgenus (see Matsumoto, 1955, p. 40;

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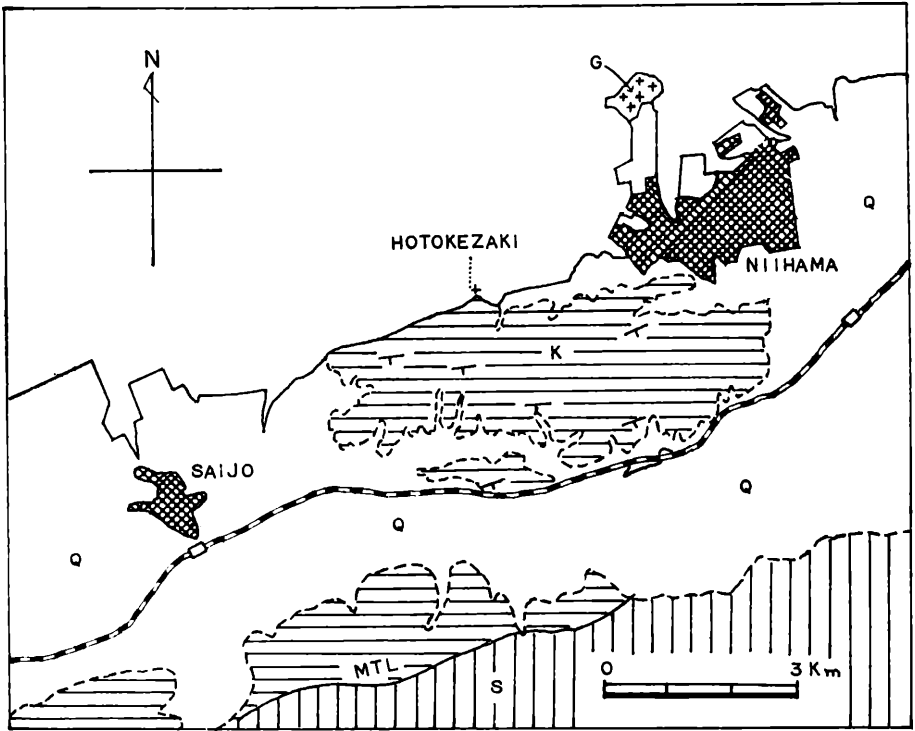


Fig. 1. Outline geologic map near Saijo [adapted from Geologic Map of Ehime Prefecture, scale 1:100,000, 1962]. Q: Alluvium and Diluvium, K: Upper Cretaceous Izumi Group, G: Pre-Izumi granitic bodies, S: Sambagawa Metamorphic Group, MTL: Median tectonic line.

Wright in Moore [Ed.], 1957, p. L 432). *Mortoniceras umkwelanensis* Crick (1907, p. 228, pl. 15, fig. 9, 9a), from South Africa, is not a *Bevahites*, as Collignon (1948, p. 110) thought, but an example which shows a transitional feature from *Paratexanites* (*s. s.*) to *P.* (*Paravevahites*), as one of us (Matsumoto, 1955, p. 41) has already discussed.

*Occurrence.*—Upper Santonian to Middle Campanian of Madagascar, Texas and Japan.

*Bevahites* sp. aff. *B. lapparenti* Collignon

Pl. 61, fig. a-e

*Compare.*—1948. *Bevahites lapparenti* Collignon, *Ann. géol. serv. Mines*, fasc. n° 13, p. 88, pl. 14 [8], fig. 1, 1a, 1b.

*Material.*—NSM. 5254, an internal mould, and GK.H 6400, an external mould of the same specimen, in both of which the test is not preserved. They are somewhat deformed.

*Description.*—NSM. 5254 is about 100 mm in diameter but is fully septate; a still outer whorl, though fragmentary, is impressed on GK. H 6400. At the diameter of 100 mm the whorl-height is 36 mm and the whorl-breadth is estimated at about 30 mm, although the other flank is not preserved; the umbilicus is

about 37 mm (37% of diam.). The inner whorl is in a very unfavourable preservation. The involution is little. The whorl is apparently subquadrate in section, with low but steep umbilical wall and flat and parallel flanks, but this may have been modified by secondary deformation.

The whorl is ornamented with fairly strong, rectiradiate ribs, which are about 11 on a half volution and are separated by interspaces nearly as broad as or a little broader than the ribs themselves. Each rib is provided with an umbilical tubercle, which is pointed above the umbilical shoulder but is bullate in general outline, a weak and small lateral tubercle, very prominent submarginal and weaker, clavate, marginal tubercles, the last two of which are united at the base on the ventrolateral shoulder. There the ribs are bifurcated and a secondary rib may be inserted. These short ribs are somewhat projected and end at the ventral tubercles, which are small and more than twice as numerous as the umbilical tubercles.

The keel is not very prominent on the internal mould, being separated by narrow but flat spaces from the rows of ventral tubercles.

The suture is only partly exposed, which is of texanitime type.

*Remarks.*—All the observed characters evidently show that this ammonite is referred to *Bevahites* Collignon, 1948. In the ornamentation of the shell it is allied to *Bevahites lapparenti* Collignon (1948, p. 88, pl. 14 [8], fig. 1, 1a, 1b), from the Campanian (base of Middle Campanian or top of Lower Campanian) of Madagascar, but the specimen from Shikoku has somewhat more distant and coarser ribs and seems to be more compressed than that Madagascar species. It may represent a new species, but its preservation is not so good as to enable us to establish the new species.

*Occurrence.*—A solitary specimen from Hotokezaki,\* approximately 133°14' east long. and 33°56'30" north lat., about 5.5 km east-northeast from the center of Saijo city, Ehime Prefecture; fossiliferous bed near the basal part of the Izumi Group, immediately above the basal conglomerate.

### Concluding Remarks

Numerous species of *Bevahites* were described by Collignon (1948) from the Upper Cretaceous of Madagascar, but no example was reported from other areas. Recently Young (1963) has described two species of *Bevahites* from the Gulf Coast of the United States. Now the genus has proved to occur in Japan, too, and thus it seems to be considerably widespread.

In the Cretaceous sequence in Ménabe, Madagascar, *Bevahites* occur in the beds ranging from Upper Santonian to Middle Campanian (Collignon, 1948). In the Gulf Coast province, according to Young (1963, p. 95, 97), a species occurs in the basal Dessau Chalk (Upper Santonian) and another at the top of the Dessau Chalk (Lower Campanian). The fossiliferous bed at Hotokezaki, Shikoku, is referable to either Lower Hetonaiian or to Infracretaceous, i. e. Middle to Lower Campanian, for the reasons as described below.

The Izumi group is exposed from the central part of the Kinki region (south of Nara and Osaka) in the east to the western end of northern Shikoku (near

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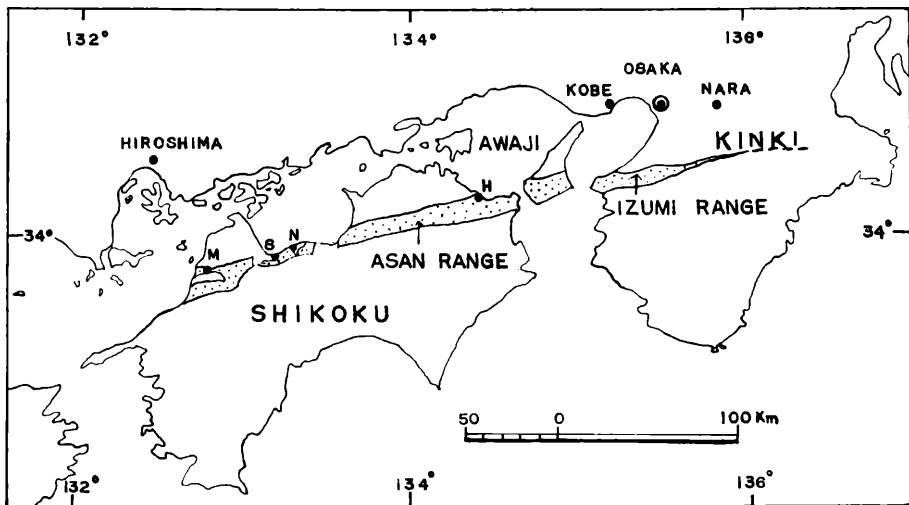


Fig. 2. Map showing the outcrop belt (dotted) of the Izumi Group, with indication of localities mentioned in the text:

H: Hiketa, M: Matsuyama, N: Niihama, S: Saijo.

Matsuyama) in the west, extending equatorially for about 400 km (Fig. 2). Whether or not the basal part of the group is of the same geological age everywhere in this long belt is a question to be settled.

Indeed fossiliferous member occurs above the basal conglomerate, but its fossil contents are not everywhere the same and its lithofacies also changes to some extent; either the basal conglomerate itself does not keep the same thickness. The dissimilarity in fossil contents between separated areas may be due either to the heterochroneity or to the dissimilarity in biofacies. The celebrated Minato shale in the island of Awaji, south of Kobe, for instance, contains *Praviloceras sigmoidale* Yabe, *Didymoceras awajiense* (Yabe), *Baculites occidentalis* Meek, *Baculites* cf. *inornatus* Meek, *Inoceramus balticus* Böhm, *Inoceramus orientalis* Sokolow, *Apiotrigonia minor* (Yabe and Nagao), *Apiotrigonia obsoleta* Nakano, *Apiotrigonia postonodosa* Nakano, etc., while the Azenotani shale in the Izumi range, south of Osaka, *Gaudryceras striatum paucistriatum* Matsumoto, *Pachydiscus kobayashii* Shimizu, *Baculites regina* Obata and Matsumoto, *Inoceramus* cf. *orientalis*, *Apiotrigonia minor*, etc. Nakagawa (1960) considered the Azenotani shale as being younger than the Minato, but the evidence was by no means satisfactory. The two assemblages of species mentioned above indicate commonly a Campanian age—probably rather lower part of the Campanian. Therefore we are inclined to regard the difference in the assemblage as probably due to some dissimilarity in biofacies, as we have already discussed in connection with *Baculites* (Matsumoto and Obata, 1962, p. 62; 1963, p. 95, 109).

In the western part of the belt of the Izumi Group the fauna has not been precisely described, but the available data seems to show that the assemblage of species in the fossiliferous unit near the base is again somewhat different from those of Awaji and Izumi. At a locality (Aonami), about 8 km east from the center of the city of Matsuyama, *Inoceramus schmidtii* Michael, *Apiotrigonia crassoradiata* Nakano, *Steinmanella (Yeharella) japonica* (Yehara) and *Steinman-*

*nella* (*Yeharella*) *kimurai* (Tokunaga and Shimizu) have been reported from the basal conglomerate and sandstone (see Kobayashi and Amano, 1955; Nakano, 1957, 1960). Dr. Michitoshi Miyahisa of Ehime University has recently obtained and supplied for Kyushu University a specimen of *Apiotrigonia postonodosa* Nakano (identified by T. Matsumoto and M. Harada) from the basal conglomerate of Aonami. Further eastward at a locality (Kurotaki) about 15 km east of Matsuyama there is a *Glycymeris* bed near the base of the Izumi Group and from another locality about 20 km east of Matsuyama Mikihiko Harada, a student of Kyushu University, has recently found *Inoceramus schmidti* Michael in the upper part of the lower formation, but not at the base.

In the Asan range of Kagawa Prefecture, which occupies the central part of the entire belt, *Steinmanella* (*Yeharella*) *japonica* (Yehara), *Steinmanella* (*Yeharella*) *kimurai* (Tokunaga and Shimizu) and *Steinmanella* (*Setotrigonia*) *shinoharai* Kobayashi and Amano were reported to occur from the basal conglomerate and overlying sandstone (see Kobayashi and Amano, 1955). At Hiketa, near the eastern end of the Asan range, the assemblage of species is similar to that of the Minato shale.

Nakagawa (1961) has shown, through his precise mapping in the Asan range, that the sediments in the lower part abut the basement at one place but overstep it at another. This happens, however, within the lower part of the Izumi Group. Such a kind of minor heterochroneity at the base of a sedimentary group can well be expected in many cases, although the extraordinary thick and rapid accumulation of the sediments in the case of the Izumi Group may have exaggerated the feature.

Anyhow, on fossil evidence, all the above localities are referable to the stage which corresponds to the Lower Hetonian and probably also the Infracretanian [=Uppermost Urakawan] of Hokkaido, being probably an extension of the zones of *Inoceramus schmidti* and *Inoceramus orientalis*, which are to be correlated with Middle to Lower Campanian in terms of the international scale (Matsumoto, 1959). The change from place to place in the assemblage of species at or near the base of the Izumi Group can, thus, be largely ascribed to the facies change which reflects the variable environments, although a minor scale heterochroneity within the extent of the stage certainly exists, as is verified by the precise mapping with the aid of a key tuff bed and also well suggested by the mode of occurrence of *Inoceramus* species.

Now the locality of Hotokezaki is situated at the northern extremity (i. e. the basal part) of hills which consist of the Izumi Group. The hills are separated by alluvial sediments from the mountains near Matsuyama and also from the Asan range mentioned above. The faunule of Hotokezaki, however, does not seem to be an exception from the above stated general conclusion. Here pelecypods belonging to *Nanonavis*, *Pseudogrammatodon*, *Acila*, *Glycymeris* etc. predominate. It is interesting to note that an ornate ammonite *Bevahites* was found in the sediments of this kind of biofacies. Among the associated fossils one of us (T.M.) has identified *Inoceramus balticus* Böhm, *Inoceramus* sp. cf. *I. schmidti* Michael, *Submortonicerias* sp., *Baculites* sp. cf. *B. occidentalis* Meek, all Campanian species, and a peculiar nostoceratid.

It is reasonable and natural that *Bevahites* sp. from Hotokezaki is allied to *B. lapparenti* Collignon, which came from the "basal Middle Campanian or top

of Lower Campanian" in Madagascar.

### Acknowledgements

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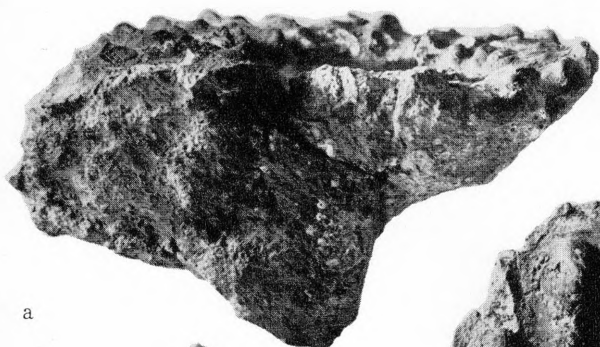
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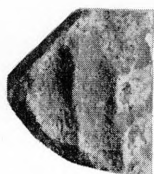
### Explanation of Plate 61

*Bevahites* sp. aff. *B. lapparenti* COLLIGNON (All figures of natural size)

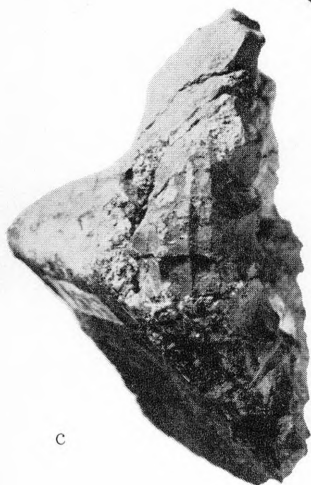
- a-d. NSM. 5254, a specimen from Hotokezaki, Saijo city, Ehime Prefecture, slightly above the base of the Izumi Group.
- a. Front view.
- b. Preserved last part of the venter, photographed from top side.
- c. Back view. A part of the deformed venter is shown.
- d. Lateral view.
- e. Plaster cast of GK. H6400, an external mould of the same specimen as NSM. 5254. Lateral view.



a



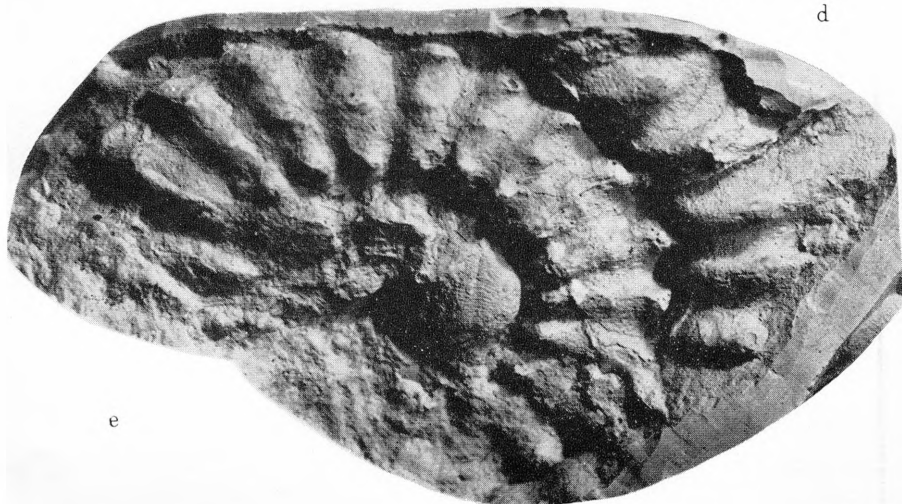
b



c



d



e