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PREFECTURE

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**DISCOVERY OF MARINE FOSSILS FROM IMMEDIATELY
BELOW THE ATA PYROCLASTIC FLOW DEPOSITS,
ÔNÉJIMÉ-CHÔ, ÔSUMI PENINSULA,
KAGOSHIMA PREFECTURE**

By

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and

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Introduction and Acknowledgments

During the course of study on the geology of the southern part of the Ôsumi Peninsula, the junior writer found some marine fossils from a tuffaceous siltstone bed situated at the top of the Ata pumice fall and just below the superjacent Ata pyroclastic flow deposits. To date there had been no record of a siltstone bed at the said horizon and of any fossils from the present area. Underlying the aforementioned pumice fall deposit there had been known to occur the Ônéjimé sand and gravel bed (GÔHARA and KOMORI, 1961), of which the lower part consists of cobble to boulder sized gravels, the middle of sandstone and the upper of siltstone. Although the Ônéjimé sand and gravel bed is inferred to be of fluvial origin by ARAMAKI and UI (1966), there have been no direct evidence. Such being the case, the discovery of a siltstone bed bearing marine fossils from the uppermost part of the Ata pumice fall is of considerable interest.

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Geologic Setting

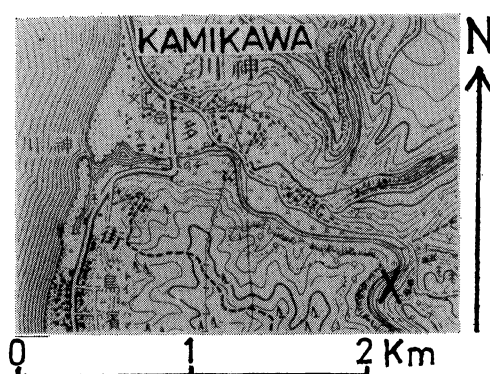
The geology of the Ôsumi Peninsula had been studied by several authors. Among them, GÔHARA and KOMORI (1961, 1962) and ARAMAKI and UI (1966) gave the standard columnar sections of the Ônéjimé area. The results of the stratigraphic study by the present writers agree with their conclusions with a few exceptions.

On the uneven surface of the basement rocks consisting of an alternation of sandstone

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and shale of unknown age and of lava flows and pyroclastic rocks of the Tertiary andesite, the Ônéjîmé sand and gravel bed is developed. The lower part of the Ônéjîmé is composed of well-rounded boulder to cobble sized gravels of andesite, sandstone and shale. The middle part consists of yellowish white, faintly stratified tuffaceous sands rich in quartz grains. This sand facies changes upward into massive tuffaceous siltstone of the upper part. The total thickness of the Ônéjîmé sand and gravel bed varies from zero to nearly ten meters. Unconformably overlapping the Ônéjîmé sand and gravel bed and the basement rocks is a pumice fall deposit of about two to ten meters in thickness. This has been called the Ata pumice fall by ARAMAKI and UI (1966) and is composed of well-sorted white pumice of about one to three centimeters in diameter. The uppermost part of the present pumice fall deposits partially changes upward into pumiceous and tuffaceous siltstone, in which the marine fossils treated here were discovered. Although the relation between the pumice fall and the tuffaceous siltstone seems to be conformable, the possibility is reserved of a blended unconformity. The massive, fossil-bearing siltstone is distributed in a rather narrow area along the Kamikawa River, Ônéjîmé-chô, and is merely about six meters in maximum thickness. The Ata pumice fall partially with siltstone lenses in its uppermost part is overlain by the Ata pyroclastic flow deposits. Although the stratigraphic relation between them had been regarded to be conformable by GÔHARA and KOMORI (1961, 1962) and Aramaki and Ui (1966), the present writers have come to the conclusion that the said relation should be considered to be unconformable based on the occurrence of marine fossils and field observation. Of the Ata pyroclastic flow deposits of about 60 meters in thickness, the lower 30 and the upper 10 meters are not welded but the remaining 20 meters thickness consists of the so-called "Ata welded tuff".



Text-fig. 1. Map showing the fossil locality.

Remarks on the Molluscan Fossils

The fossil locality from where the specimens treated in the present article were collected is a road side-cutting, three meters high, and situated at about 1.7 km southeast of Kamikawa village (Text-fig. 1). The tuffaceous siltstone is exposed along the road for a distance of about 50 meters. The fossils occur sporadically in the siltstone and most

of them scarcely preserve the original shell material.

The molluscan fossils collected from the present locality and discriminated by the senior writer are shown in the following list. Besides these molluscs, fossils of fish otolith and fish scale were also collected, but these are reserved for another opportunity.

Table 1. List of molluscan fossils from Kamikawa, Ônéjimé-chô, Kagoshima Prefecture.

Species	Number of Specimens
<i>Limopsis</i> cf. <i>tokaiensis</i> YOKOYAMA	3
<i>Pecten albicans</i> (SCHRÖTER)	9
<i>Promantellum orientale</i> (ADAMS & REEVE)	1
<i>Joannisiella lunaris</i> (YOKOYAMA)	1
<i>Kellia porculus</i> PILSBRY	1
<i>Fulvia</i> cf. <i>hungerfordi</i> (SOWERBY)	1
<i>Pitar</i> (<i>Costellipitar</i>) <i>chordata</i> (RÖMER)	1
<i>Venus</i> (<i>Ventricola</i>) <i>foveolata</i> SOWERBY	2
<i>Paphia</i> cf. <i>amabilis</i> (PHILIPPI)	3
<i>Raeta</i> (<i>Raetellops</i>) <i>pulchella</i> (ADAMS & REEVE).	3
<i>Azorinus abbreviatus</i> (GOULD)	11
<i>Macoma</i> sp.	2
<i>Dentalium</i> sp.	1
<i>Nassarius</i> (<i>Niotha</i>) <i>livescens</i> (PHILIPPI)	3
<i>Ringicula</i> (<i>Ringiculina</i>) <i>doliaris</i> GOULD	1

Among the species listed above, *Azorinus abbreviatus* and *Pecten albicans* are most abundant in number of specimens. The subordinate species are *Limopsis* cf. *tokaiensis*, *Paphia* cf. *amabilis*, *Raeta pulchella* and *Nassarius livescens*; and the seven other species are represented by only a single specimen respectively.

Limopsis (s.s.) cf. *tokaiensis* YOKOYAMA [Pl. 1, fig. 1]

Three internal mold specimens are in the present collection. Although the features of the outer surface are not preserved, the present specimens are judged to most resemble the named species from their flat and oblique appearance and the characters of the hinge-teeth. The named species is known to live in the waters along the Pacific coast of the southwest Japan.

Pecten albicans (SCHRÖTER) [Pl. 1, figs. 2, 3, 4a-b, 5a-b.]

This species is represented by nine juvenile specimens: two left valves, one of which is slightly broken at the ventral portion, and four internal and three external molds of the right valves. Dimensions (in mm) of the largest specimen are 36 in length and 30 in height. The present species ranges from the Early Pliocene to the Recent, and is now living in areas with sandy bottom in the Euneritic fascia (OYAMA, 1952) in the Pacific (30°-42°N) and the Japan Sea (42°N).

Promantellum orientale (ADAMS & REEVE) [Pl. 1, fig. 6]

Only a single internal mold specimen is in the present collection. The present species is known to live in the Euneritic fascia of the Pacific (Central Honshu and southwards)

and the Japan Sea (42°N).

Joannisiella lunaris (YOKOYAMA)

A single right valve of a juvenile specimen is at hand. The present species has rather wide bathymetrical range (10–500 meters) in the Pacific (Sagami Bay and southwards to Kyushu) and in the Japan Sea (Nanao Bay).

Kellia porculus PILSBRY

This is represented by a single cast of a right valve showing the outer surface. The geographic distribution of the present species is from Tokyo Bay to Kyushu on the Pacific side and to the Noto Peninsula in the Japan Sea. The depth range of the present species is from the intertidal zone to about 20 meters (Tidal to Euneritic fascia).

Fulvia cf. *hungerfordi* (SOWERBY)

A single, rather small external mold specimen was compared with the named species. The named species ranges bathymetrically from the low tide line to about 10 meters (Euneritic fascia), and geographically from Central Honshu, Japan to the equatorial sea.

Pitar (*Costellipitar*) *chordata* (RÖMER) [Pl. 1, figs. 7a, b]

A single, very small right valve was examined. The present species is known to live in the sandy mud bottom of the seas of Sagami Bay (Pacific side) and Nanao Bay (Japan Sea side) and southwards.

Venus (*Ventricola*) *foveolata* SOWERBY [Pl. 1, fig. 8]

Two external mold specimens of right and left valves are in the collection. The characteristic features of the surface ornamentation and hinge dentition of the present specimens are identical with those of the named species. The present species lives in the water below the lower tide line (Euneritic fascia) both in the Pacific (31°–36°N) and the Japan Sea (40°N).

Paphia cf. *amabilis* (PHILIPPI)

Three imperfect internal molds of two right and one left valves of adult specimens are in the collection. Although the surface features are unknown, they are compared with the named species based on their shell outline. The geographic distribution of the present species is from central Honshu, Japan (Pacific side) to Formosa.

Raeta (*Raetellops*) *pulchella* (ADAMS & REEVE) [Pl. 1, fig. 9]

Two external and one internal molds of the left valves of the average sizes for the named species are in the collection. The present species is one of the diagnostic species of embayment environment in Japan (MIYADI *et al.*, 1954; OYAMA, 1952), and burrowing into the muddy bottom of the Euneritic fascia.

Azorinus abbreviatus (GOULD) [Pl. 1, figs. 10, 11]

Four conjoined specimens, one of which preserved the shell material, and seven internal mold specimens of four right and three left valves were examined. The present species lives in the water from the lower tide line to the depth of about ten meters in the Pacific (0–35°N) and in the Japan Sea (33°–37°N).

Macoma sp.

Two imperfect internal molds of the right valves are referable to *Macoma*. Owing to their unfavorable state of preservation, specific identification is reserved.

Dentalium sp.

Only a single, imperfect external mold specimen is in the collection.

Nassarius (Niotha) livescens (PHILIPPI) [Pl. 1, fig. 12]

Three specimens, only one with the original shell material, are in the collection. The present species lives on the sandy mud bottom of the shallow sea ranging from the lower tide line to about ten meters in depth in the Pacific (0–41°N) and in the Japan Sea (41°N).

Ringicula (Ringiculina) doliaris GOULD [Pl. 1, fig. 13]

Only a single, but well-preserved specimen is in the collection. The present species and *Raeta pulchella* have been regarded as elements of the "Asiatic Continental Fauna" (MIYADI *et al.*, 1954); they live on the muddy bottom of embayments on the coasts of northern, central and southwestern Japan and of the Chinese Continent.

Concluding Remarks

From the foregoing remarks on each species included in the present collection, the general biotic aspect of the fauna can be summarized as follows.

All the species determined specifically are known to live in the south Kyushu region, and most of them are known as the inhabitants of the sandy or muddy bottom of the normal marine water. It is noticeable, however, that two elements of the "Asiatic Continental Fauna" (MIYADI *et al.*, 1954) are contained in the present collection, namely, *Raeta pulchella* and *Ringicula doliaris*, both of which are muddy bottom dwellers of embayment environment. The depth at which the present fauna lived is inferred to have been shallower than 20 meters, probably about ten meters (Euneritic fascia), based on the bathymetric distribution of each species.

Although the number of species is insufficient for a thorough paleoecological analysis, it may be reasonable to say that the sedimentary environment of the fossil-bearing siltstone was a muddy bottom of normal marine shallow water (about ten meters) situated near the lower tidal line and neighbouring a brackish water bay.

We have no positive evidence for the precise correlation between the geology of Ôsumi Peninsula and of the Kagoshima City area. It can be roughly estimated, however, that the age of the famous fossil shell-bearing formations developed in and around the Kagoshima City area, such as the Yoshida, Kekura and the Kogashira formations (ÔKI and HAYASAKA, 1970) may be older than the collapse of the Ata caldera at the present day bay mouth area of Kagoshima bay. Considering the paleogeography of Kagoshima Prefecture at the time prior to the formation of the calderas, we must suppose the existence of an inland sea connecting the Pacific Ocean at the east with the East China Sea at the west. The discovery of a marine fauna from the present locality seems to have considerable importance to endorse the connection of the inland sea with the Pacific.

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Ata	阿 多	Kamikawa	神 川
Kekura	花 倉	Kogashira	河 頭
Ônéjimé	大根占	Ôsumi	大 隅
Yoshida	吉 田		

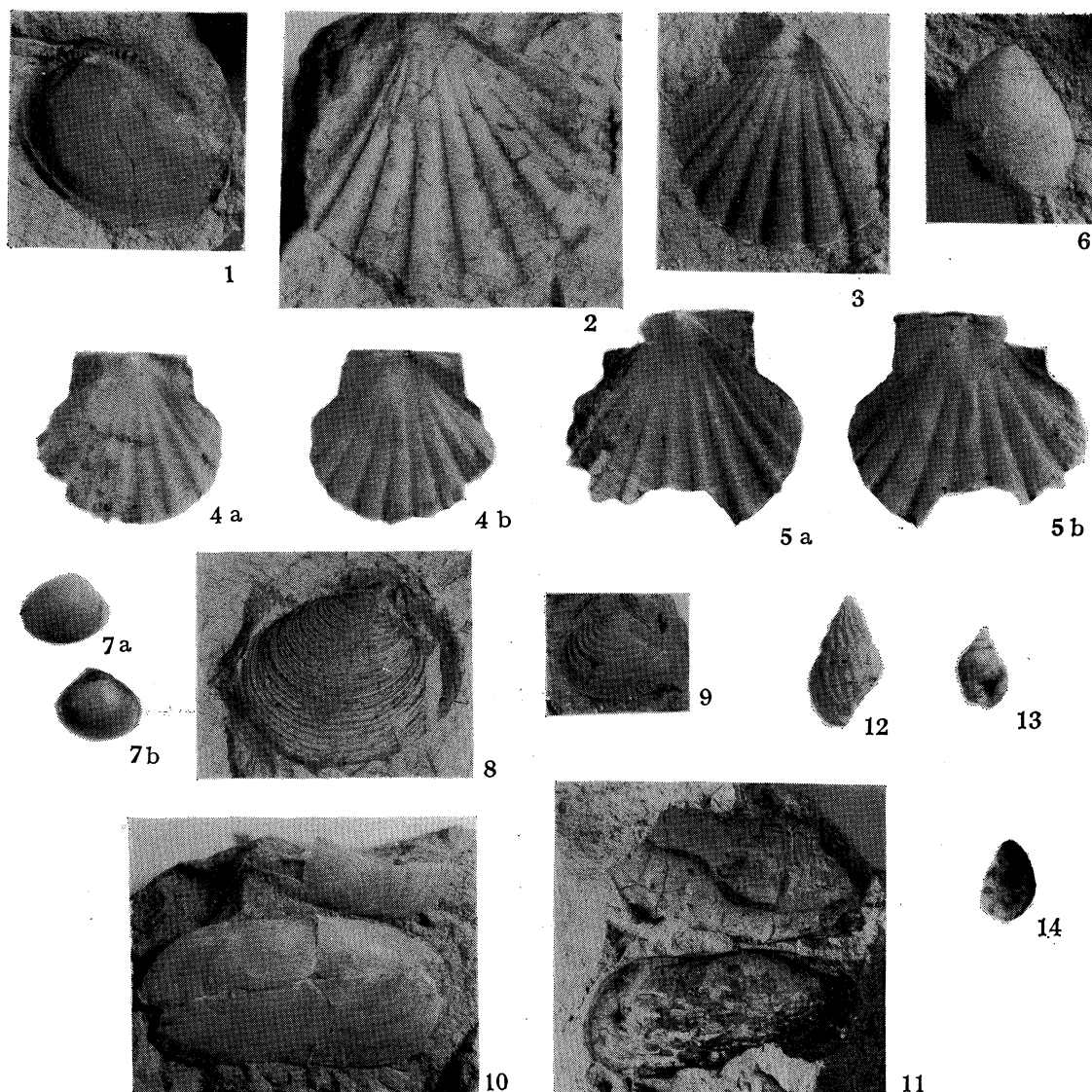


Fig. 1. *Limopsis* cf. *tokaiensis* YOKOYAMA. An internal mold of left valve. $\times 1$

figs. 2-5. *Pecten albicans* (SCHRÖTER). 2, 3, external molds of left valves; 4, 5, left valves, a, external view, b, internal view. $\times 1$

Fig. 6. *Promantellum orientale* (ADAMS & REEVE). An internal mold of right valve. $\times 1$

Fig. 7. *Pitar* (*Costellipitar*) *chordata* (RÖMER). a, external view, b, internal view. $\times 1.5$

Fig. 8. *Venus* (*Ventricola*) *foveolata* SOWERBY. An external mold of left valve with an internal mold of hinge plate of right valve. $\times 1$

Fig. 9. *Raeta* (*Raetellops*) *pulchella* (ADAMS & REEVE). An internal mold of left valve. $\times 1$

Figs. 10, 11. *Azorinus abbreviatus* (GOULD). Conjoined valves. 11, internal mold. $\times 1$

Fig. 12. *Nassarius* (*Niotha*) *livescens* (PHILIPPI). $\times 1.5$

Fig. 13. *Ringicula* (*Ringiculina*) *doliaris* GOULD. $\times 1.5$

Fig. 14. Fish otolith.