22. **The Geologic Significance of the Recent Mollusca from the Vicinity of Isinomaki, Rikuzen.**

By

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The shells comprising the present note were collected from the sand beach of Nagahama, stretching between Isinomaki at the west to Watanoha at the east, and bounded by the Kitakami-gawa, a large river at the former and by the inlet to Mangoku-ura at the latter; the length of the beach is about two and a half miles with a maximum breadth of about seven hundred yards or more.

This beach is free from muddy materials and rocky shores and consists of sand only. According to the sea chart No. 72, published by the Hydrographic Department of the Imperial Japanese Navy, the adjacent sea is a very shallow one and with a very gently sloping sea bottom. Sand continues to a depth of some 30–35 meters before grading into muddy material at a distance of about two miles from the shore line. Beyond the depth of 35–40 meters the sea bottom becomes rocky. Since no small river empty into this sand beach, and since it is free from muddy or rocky materials, the shell fauna is a small one. The geographic distribution of *Barnava dilatata*, *Raeta magnifica*, *Volosella hanleyi*, *Epitonium acuminatum* and *Lingula unguis* have been extended by the present collection. The total number of species collected are given below; those marked an asterisk indicate the abundant forms and those with two asterisks very few individual number.
The Geologic Significance of the Recent Mollusca from the Vicinity 890

Anomia cytraeum Gray
Arca boucardi Jousseaume**
A. inflata Reeve*
A. suberena Lischke
Barnea dilatata Souleyet*
Clementia vatheleti Mabille**
Cyclina sinensis Gmelin**
Dosinia japonica Reeve
Macoma incongrua Martens
M. tokyoensis Makiyama*
M. secta Conrad
M. vestaloides Yokoyama**
Mactra sachalinensis Schrenck*
M. sulcataria Reeve
M. veneriformis Reeve
Meretrix meretrix Linnaeus*
Mya arenaria Linnaeus*
Mytilus crassitera Lischke**
Paphia philippinarum Adams and Reeve*
Protothaca adamsii Reeve**
P. jedoensis Lischke**
Ostrea gigas Thunberg
Pecten nipponensis Kuroda**
Raeta magnifica Yokoyama
R. yokohamensis Pilsbry*
Sanguinolaria olivacea Jay*
Septifer virgatus Wiegmann
Siliqua pulchella Dunker
Solecurtus diversicus Lischke
Solen gouldii Conrad
S. krusensterni Schrenck
Tellina iridella Martens*
T. nitidula Dunker
Taras ustus Gould
Volsella hanleyei Dunker**

V. modiola Linnaeus*
Yoldia notabilis Yokoyama
Acmaea pallida Gould**
Argopecten oregonense Redfield**
Epitonium acuminatum Sowerby**
Haliotis kamtschatkana Jonas**
Littorina brevicula Philippi**
Monodonta labio Linnaeus**
Nassarius festivus Powys
Natica janthostoma Deshayes**
Turbo corenensis Recluz
Tegula basilirata Pilsbry**
T. rustica Gmelin
Olivella furcata Adams and Reeve

Purpura burnettii Adams and Reeve**
Polinices didymus Bolten*
Thais luteostoma Dillwyn
Tritonilis japonica Dunker**
Umbonium moniliferum Lamarck

Brachiopoda

Lingula unguis Linnaeus

Cirripedia

Balanus rosa Pilsbry**

Echinodermata

Asterias versicolor Sladen
Echinarchnus mirabilis Agassiz
Strongylocentrotus pulcherinus
A. Agassiz*

Land and Fresh-water shells

Ganesella species indet.**

Thiara libertina Gould**

Viviparus malleatus Reeve**

From the above list, it is interesting to find that there are a number of rock-inhabiting species intermingled among the sand loving forms, also the presence of those which thrive on a muddy or sandy-mud bottom in the collection is also of interest. True brackish water types of shells were not collected unless Cyclina sinensis (Gmelin) is considered to be one. The presence of land
mollusca or fresh-water shells is also a noteworthy feature of the present small collection.

The rock-inhabiting species were all collected from about 300 meters or slightly more from the eastern part of the beach where are found rocky shores of their original habitat. Prevailing wind and currents seem to be responsible for their presence on the sand beach where they do not normally live. There are some mud-loving species in the collection, but their number is a small one, being represented by either a single isolated valve, or by a few individuals, showing that the sand environment was unfavorable. The fresh-water and land shells seem to have been carried down to the sea by the Kitakami-gawa and brought to the beach by the agency of currents.

The varied fauna found on this beach is valuable in explaining or giving as examples the following statement by Twenhofel.

According to Twenhofel 1), "In any consideration of the environments of organisms, four phases of the individual organic history must be considered. These are the environments in which the organisms lived, the environments in which they died, the environments in which the dead bodies and appendages endured after death, and the environments in which the preservable remains were entombed."

Thus we find that the presence of rock-inhabiting species strewn on the sand beach apart from their original habitat is a good example. Consequently, the first phase of the rock-inhabiting species was the rocky-shore about 300 or slightly more meters apart from their point of discovery, the second phase was probably the shallow water adjacent to the rocky-shores, and the third phase is where they were found. Assuming that the fourth phase would be found, it would probably be in the sand beach or at a place near by.

Such examples are frequently met with and brought to our attention when collecting recent shells from the strand line. It also seems that more attention, than hitherto given, should be directed along such facts. Knowledge of such phenomena are important in interpreting the conditions under which the fossils

once lived. Further, we hope to give further examples in the future together with our views on other lines of interesting work or that which may be applied to the fossil fauna within the scope of our study. Without further studies on the various features of the recent molluscan fauna, a full interpretation of the fossil one is not to be expected and an attempt to do so, cannot be regarded as reasonable.

In order to bring about interesting results from a fossil fauna, the following points should be given consideration, those points are: (1) the kind of fauna common to the (a) tidal zone of sandy, muddy, gravelly or rocky environment, (b) subtidal zone of such habitats, (c) and zones of various depths of various habitats or environments, (2) the kind of fauna common to the (a) open sea, (b) areas near mouths of large rivers, (c) estuaries, (d) bays, and (e) promontories, (3) the kind of fauna common in habitats of high or low salinity, or, brackish waters, stagnant waters, and etc., (4) the kind of fauna common to rough water and that common to quiet water, (5) the influence of oceanic currents, prevailing winds and “Tsunami” on the living and dead fauna, and, (6) the four phases of environment stated by TWENHOEL. Also studies are needed along the lines of the distance a dead shell may be carried, either by oceanic currents, prevailing winds or other agencies. Further it is also necessary to make observations on the distance a dead shell may be carried from the shore sea-wards, from the sea landwards, from the beach up on the land.

**Shell-repair**

Among the numerous specimens of *Meretrix meretrix* Linnaeus collected from Nagahama beach, one was found to have a sort of shell-repair line extending from behind the beak to the postero-ventral margin of the right valve.

This groove extending from the beak to the postero-ventral margin is about 0.5mm. at the broadest point, and merely a line at the beak; the concentric growth lines do not appear to transverse this groove, but become very strong upon reaching it and all are directed upwards or dorsally on both sides of the groove, thereon laterally, they become obsolete as in the general case of the surface sculpture in the shells of this species. This groove
is not in the least indicated or found as traces on the inner side of the shell.

It is at present hard to decide whether this may be a case of shell-repair or a case of abnormality. However, it is interesting to find such a shell in the collection. It may also be stated that, it is generally regarded that shells showing traces of shell-repair are indicative of shallow water origin. Thus, in fossil state this datum may be found to be of importance in dealing with the depth of deposition of the strata yielding such interesting fossils.

**Recent Concretions**

In the collection from Nagahama was found a right valve belonging to *Meretrix meretrix* Linnaeus, in the process of becoming a concretion. The valve is not much worn, the teeth only are slightly abraded. Sand grains together with fragments of shells belonging to such genera as *Tellina*, *Mytilus*, *Raeula*, *Umbonium* and *Corbicula* are found adhering to the greater part of the inner surface and also to the sides of the exterior surface of the shell. The sand grains are compactly cemented to the shell, giving to it an aspect of a true fossil.

This shell was found on the strand line of Nagahama beach, not far distant from the small town of Watanoha.

Concretions, especially recent ones, are interesting in several respects, and their characteristics have been dealt with by Twenhofel. The process by which the present concretion had begun is hard to say, but it may be possible that decaying organic matter may have been one of the causes.

However, it appears that the time required for the making of a concretion not only differs according to the resulting size, but also to the kind of nuclei. In the present case it appears that very little time has elapsed to make the concretion in the view that only the teeth have been abraded regardless of the fact that other surfaces are exposed. Also the sand grains cemented on the shell are also slightly smoothed, probably by sand abrasion.

Another concretion specimen in the collection appears to have developed around the burrow tubes of certain marine annelids such as those belonging to *Arenicola*. At present there are several

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different species of encrusting Bryozoa occupying the upper and under surfaces and some also the inner part of the tubular holes. At several places are found fragments of molluscan shells embedded in the material making up the concretion. This concretion is made up of hardened fine clayey material. It is irregular in shape and with a boss at its middle, from which radially extend four rough branches with two having tubular holes throughout their length. The boss is apparently excavate.

This concretion unlike the one mentioned above, seems to have taken much more time for its development. Also it seems to have been subjected to weathering for a longer period than the other.

陸前石巻附近現生貝類の地質学的考察（摘要）

野村七平，畑井小虎

宮城県石巻渡波間の海岸に沿って波浪に打ち上げられた貝類の採集結果の概要をする。或物の個體数は極めて多量ではあるが種類は多くない。分布的に見て面白さななるもあがみ、筆者等の述べたいことは採集に気づいた地質的方面のことである。石巻渡波間は所謂白砂青松の海岸で北上川口と蕪石浦の出口に岩石の露出がある。北上川口を去る凡そ300メートルの地点の砂漬に岩石に附着して生活する貝，陸産，淡水産の貝が，砂中生活を営むものと一組に観察される一事は極めて興味深く感じた。陸産，淡水産の貝の存在は砂丘を越えて海岸に来たと考へるより，北上川によって一旦海に出ればこれから潮流で海辺に打ちあげられたと考察される権利的で是，岩石上に棲息するものは多分北上川口附近から風と波の力で遠々採集地點に連襲されたものと考へたい。生物によっては死ぬ場所も生きる場所も，死んで埋もれる場所も同じななるものもあるが，或物によっては大に異なるものがある。之等の事質より推論して化石を含む地層の沈澱相を従来より深く考へて観たい。