MEMOIRS

OF THE

SCIENCE DEPARTMENT,

UNIVERSITY OF TOKIO, JAPAN.

VOLUME I. PART I.

SHELL MOUNDS OF OMORI.

BY

EDWARD S. MORSE.
Professor of Zoölogy, University of Tokio, Japan.

PUBLISHED BY THE UNIVERSITY.
TOKIO, JAPAN.
NISSHUSHA PRINTING OFFICE.
2539 (1879.)

U. S. NATIONAL MUSEUM.

The Rau Library of Archæology.

No. 1288

DR. CHARLES RAU was born in Belgium in 1826. He came to the United States in 1848, and was engaged as teacher at Belleville, Illinois, and in New York. In 1875 he accepted an invitation from the Smithsonian Institution to prepare an Ethnological Exhibit to be displayed at the Centennial Exhibition, and subsequently was appointed Curator of the department of Archæology in the National Museum, which position he held at the time of his death, July 25, 1887. He bequeathed his Archæologic collections and library to the U. S. National Museum.

大森介墟古物編

SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

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PREFACE.

During the preparation of this Memoir on the Shell Mounds of Omori, I have examined, in company with others whose names are mentioned below, deposits of a similar nature at Otaru, on the western Coast of Yezo, Hakodate, a number within the city limits of Tokio, and one of enormous extent and depth in the Province of Higo, Island of Kiushiu.

From all these places large collections have been made, and are now in the Archæological Museum of the University of Tokio.

As the Omori Mounds have proved so rich in material, it was thought best to limit this first contribution to an exhaustive illustration of the various forms and ornamentations there occurring, thus making it the basis for future comparisons when the other deposits shall have been worked up. In Yamagata Ken, for example, as well as in the Tokio Deposits, fragments of pottery are met with, bearing so close a resemblance to the Omori forms that a reference to them may be made without further illustration, while only new forms need be figured and described. For these reasons, the attempt has been made to figure every typical form of shape and ornamentation. In many cases, also, the varietal modification in shape and design has been given, as with the rims on Plate VIII. and the knobs on Plates XI. and XII.

It may be stated that many of the other forms figured, are represented by a number of varieties which are contained in the Museum of the University.

Professional duties at the University, connected with instruction and the arranging of the Museum, prevented my giving that supervision over the plates necessary to secure the uniformity which they lack. When it is considered however, that the drawing (with the exception of the last plate) and lithographing have been done entirely by Japanese artists,—the art of drawing in foreign style, and the art of lithography being still new to them,—some allowances may be made for the imperfections they present.

On the other hand, it may be said with truth that all the outlines are correct, and that full reliance may be placed on the figures. The same excuse may be made with reference to the composition and press work, as these labors have been done in a Japanese office, the compositors not being able to speak a word of English. With some pride, it may be said that the paper on which the book has been printed is of Japanese manufacture, so that from composition to binding, the mechanical production is entirely Japanese. As a Japanese version has been issued, the plates have been lettered for that edition also.

To the intelligent and cordial interest displayed by Mr. Kato, the Director of the University, and Mr. Hamao, the Vice Director, archæologists are indebted for this contribution toward a knowledge of the prehistoric pottery of Japan.

It is not too much to say that there is no other country in the world where so great a number of gentlemen interested in archæology can be found as in Japan. A native Archæological Society holds its meetings regularly in Tokio, and many of the contributions are of great value.

In the preparation of this work I have been greatly aided by the sympathy and practical assistance of a large number of Japanese scholars.

My thanks are especially due to Mr. Kanda, Mr. Kato, Mr. Hamao, Mr. Hattori, Mr. Ninagawa, Mr. Takamine, Prof. Yokoyama, Prof. Yatabe and Prof. Toyama, for many favors. To my special students, Mr. Sasaki, Mr. Iijima, Mr. Iwakawa and Mr. Fujitani, I am under many obligations for various translations which they havemade for me, and for other favors.

To my assistant Mr. Taneda who has copied all my manuscript for the printer, and who has assisted me in various ways, my thanks are also due.

To Prof. T. C. Mendenhall, of the University, my thanks are specially due for the reduction and averages of over a thousand measurements of Omori shells. I must also express my indebtedness to Prof. F. F. Jewett for a number of chemical analyses.

To Mr. E. H. House, Proprietor of the Tokio Times, for much assistance and advice I am also exceedingly grateful.

Acknowledgments are also due to Mr. Kimura the artist, Mr. Matsuda the lithographer, and the Nisshusha Printing Office, for the efforts they have made in securing accuracy in their respective lines of work.

The collecting of the material illustrated in this first part has been done mainly by Mr. Sasaki and the lamented Mr. Matsura.

Part II. will present the pottery of the Shell Mounds of Yezo, Tokio and Higo.

E. S. M.

Tokio, Japan.

July 16th, 1879.

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THE SHELL MOUNDS OF OMORI, JAPAN.

BY EDWARD S. MORSE.

Since the appearance of Darwin's great work on the Origin of Species, and the subsequent revolution in the minds of thinking men regarding the origin of man and animals below him, a new impulse has been given to the investigations of man's early history; a new science, in fact, has sprang into activity, and Societies and Journals of Anthropology, Archæology and Ethnology are the results of this wonderful awakening.

With the idea so long dominant that man had been specially created at a certain time to be measured by years, only those documents and those evidences were scanned which came within the prescribed time limits. Thirty years ago it seemed as useless a task to study the evidences of man's existence before these dates, as it would be for one to study the evidences of the Spanish occupation of America before the year 1492.

In fact so apathetic were men's minds on this matter, or rather so throughly was incorporated the idea of man's recent origin, that many valuable evidences have been neglected, or lost through this lamentable condition of things. Observations on the high antiquity of man made by Dr. Schmerling, Mr. Mac Enery, Mr. Godwin Austen and others attracted but little attention. Indeed they were received with incredulity, and the memoir of Mr. Vivian read before the Geological Society was considered too improbable for publication.* Yet the labors and discoveries of these men have been repeatedly confirmed by subsequent investigations.

Difficult indeed is it to restore the past history of mankind from the fragmentary remains found buried in the earth. Their life history must be made up entirely from the imperishable objects which have been preserved in caves, burial places, the refuse piles of their villages, and similar places. They left no written record, no hieroglyphics to decipher, because they had none.

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* Lubbock's Pre-historic Man.

It seems at first sight impossible to build up any idea of their habits and comparative states of savagery from the few objects which have survived the corroding influences of time.

Were we to apply the same methods to the study of civilized races to day, very little could be gathered of our life by an examination of the refuse piles of our dwellings. All the delicate works of art, wood carving, embroidery, books, models, etc. would disappear in the time that has elapsed since the earlier ages of man, and we should only have left the glass, porcelain, and stone fragments which would survive. From the refinement and delicacy of these objects, however, we would have a right to infer the progress and condition of the race, and would be justified in the assumption that in their perishable art the same refinement had been manifested.

It is true these deposits do not give us their textile fabrics, if they had any, or their wood work or more perishable art; but judging the ancient savage by the modern one, the sites of their villages, or contents of their refuse heaps, give us a very fair indication of what they possessed. The imprint of matting or cloth upon their pottery tells us at once the texture and kind of fabric used. An arrow head presupposes a wooden shaft. Knowing how scantily supplied with objects the hut of a low savage is to day, we have every reason to believe that the primitive savage was no better provided in these respects.

The importance of studying deposits of the nature of the Omori Mounds has been fully realized, since the investigations of the Danish shell mounds brought to light so many facts bearing on the habits of the primitive races of Denmark. Of such importance was an examination of the Danish deposits considered, that the Government appointed a commission consisting of three men highly eminent in science to make exhaustive explorations. And now so jealously does she guard her treasures that laws have been enacted prohibiting the exportation of archæological specimens or antiquities of any kind from the country. With the existence of an Archæological Society in Tokio, consisting exclusively of Japanese, who hold their meetings regularly, and the fact that there have already been a number of works published by native archæologists who have figured with more or less accuracy the stone implements, ancient vessels, inscriptions and the liket it seems proper and just that Government should follow the example of Greece, Italy and Denmark in passing laws to prevent these treasures from going ou, of the country. May the Government not only prevent the exportation of specimens, but may it jealously guard its ancient temples, monuments, gate ways and idols. I can not refrain from quoting at this point the words of an accomplished English archæologist, Mr. Borlase, who expresses a hope "that the liberal views which have hitherto prompted the Mikado's Government in all that relates to science and art, may be extended to that *chef d'œuvre* of their country (which is indeed unmatched in the world) and that authors may yet have to record the graceful act, on the part of the present Administration, which has saved from destruction the most beautiful relic of 'Old Japan'—the tombs of the Shoguns." *

Besides the investigations of Steenstrup in Denmark, we have the valuable memoirs of Wyman on the shell mounds of Florida and New England. Deposits of a similar nature have been recorded or described as occurring in England, Scotland, Ireland, France, the Eastern coast of the United States, the valley of the Mississippi, on the west coast from California to Behring Strait, Brazil, the Gulf of Guayaquil, Australia, Tasmania, and the Malay Archipelago; and doubtless they will be found scattered all over the world.

That these deposits are not all of the same age is certain; for just as the stone age exists in certain parts of the world to-day, so these deposits are in process of formation both among savage and civilized people. While the shell heaps of New England have the same essential features as those of Denmark, it can not be safely assumed they were made long before the advent of the European; for the natives were then living in the stone age, as it were, and were still forming deposits of shell in precisely the same way. It is true that many of these deposits when first observed by the earliest settlers were covered with a heavy growth of forest trees, and the presence of a molar tooth of the polar bear, and the abundance of the remains of the great auk now supposed to be extinct, lead us to believe that the New England deposits have some antiquity.

In Japan, however, the case is quite different; for with its ancient civilization and history, running back for fifteen hundred and perhaps two thousand years, and the fidelity of its records, we have as it were a longer time measurement by which to estimate the age of the shell deposits here. For this reason a much greater importance attaches to the minute and faithful exploration of such deposits in Japan.

Having for years studied these deposits in Maine and Massachusetts in company with Prof. Jeffries Wyman and Prof. F. W. Putnam, I felt prepared to undertake a similar investigation in this country and therefore at the outset kept a sharp look out for evidences of their occurrence. A few days after my arrival in the country I fortunately discovered a large and extensive shell mound on the immediate line of the railway a few miles from Tokio. A series of explorations was made in company with my special students, Mr. Matsura and Mr. Sasaki, and, in the first excavations Prof. Yatabe, Prof. Toyama, Mr. Matsumura, Mr. Fukuyo, Dr. David Murray, and Prof. Parson participated. The collections from Omori are now arranged in the Archæological Museum of the Tokio Daigaku. Most of the specimens have been collected by Mr. Sasaki and the lamented Mr. Matsura, who were indefatigable in their efforts to make the series as complete as possible.

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* Niphon and its Antiquities.

GENERAL CHARACTERS OF THE OMORI MOUNDS.

The Omori Shell Mounds lie on the western side of the Imperial railway between Yokohama and Tokio, at a distance of nearly six miles from Tokio. They may be seen from the car windows just after leaving Omori Station in going toward Tokio.

The railway has indeed passed through a large portion of the mounds, as in the field beyond the track the ground is strewn with the fragments of pottery and the shells formerly composing the deposit. The length of the deposit along the embankment is about eightynine meters. Its depth in the thickest part is four meters. Another exposure of considerable thickness is seen, back from the track at a distance of ninetyfive meters, but whether it is a continuation of the first deposit I have not been able to determine.

The fields to the south show that in their cultivation another deposit has been removed.

The mounds are nearly half a mile from the shores of the Bay of Yedo.

As deposits of this nature are always made along the immediate shore, whether they be upon the banks of a river, or on the coast, the occurrence of these deposits inland may be looked upon as an evidence that the land has been elevated since they were made. And when they occur inland, geological, and often historical evidences are not wanting to support this view.

The shell mounds along the Baltic are in many cases far removed from the coast line. They also contain species of shells not found in the Baltic, in consequence of the freshening of the water resulting from the geological changes that have taken place in that water basin.

Along the eastern coast of the United States, the ocean has been encroaching upon the land, and shell mounds in Casco Bay, Maine, are in process of being washed away by the waves.

Rev. James Fowler, in the Smithsonian Report for 1870, comments upon the absence of these deposits along the New Brunswick coast, and offers this as one of the evidences that the sea is encroaching upon the land, and calls attention to the fact that buildings which stood at some distance from the shore, fifty years ago, have since been washed away.

Geological evidences show that marked changes have taken place in the shore line of the Bay of Yedo. A portion of these changes are recorded historically on ancient maps of Yedo.

Shell mounds discovered by Mr. Kanda and Prof. Yatabe in the Botanical Garden, and others discovered by Prof. Chaplin and Mr. Ishikawa in Oji, show a recedence of the waters of the Bay of Yedo of from five to seven miles.

In every case these mounds are on ground slightly elevated above the surrounding country, and in indicating their various positions on a map of Tokio, the coincidence between the shaded line of an embankment, and the position of the deposit is at once seen.

SPECIAL CHARACTERISTICS OF THE OMORI DEPOSITS.

The shell mounds, or deposits, in various parts of the world have many features in common. They also have their distinguishing peculiarities. Their similarity arises from the fact that they are the refuse piles of savage races who came to the shore at certain times of the year, or who occupied the shore permanently and there availed themselves of the food so easily secured from the water, in the shape of mollusks and fishes. That they were hunters as well as fishermen is attested by the presence of the bones of wild animals, such as the deer, bear, and wild boar, as well as the bones of certain birds. The bones being in nearly every case broken into fragments, show that they did this to secure the marrow, or to more conveniently get them into their cooking pots. That they cooked their food in clay vessels, is evident from the carbonized remains of the food found on certain fragments of pottery. In all these deposits various primitive implements are found, fabricated out of either bone, horn, stone or shell.

The horn, bone and shell implements are generally in the shape of gouges, bodkins, needles and other pointed instruments. The stone implements are usually of the rudest kind, and consist of hammers, celts, axes, arrows, and spear points. The pottery is rude, and in all parts of the world bears the impression of the well known cord mark. Beside this ornamentation, if indeed it was intended for that purpose, there are often rude designs, (rarely, if ever imitative of natural objects) made by incised lines in the soft clay, or impressed upon the clay by stamps. While these features are common in deposits of this nature, even in those most widely removed, the deposits of each country and region seem to have their distinguishing peculiarities, so that one familiar with the description of them might tell with considerable accuracy the place of each deposit by an examination of a mass of material from it. The Danish deposits contain a great many flint chips and rude flint implements. The pottery does not appear to be common, and is of the simplest description. No evidences of cannibalism have been noticed. The New England deposits resemble greatly the Danish deposits in the character of the animal remains. The stone implements are very much fewer however, and the pottery is not common.

Simple horn and bone implements occur in both. In the New England deposits, Prof. Wyman found a few evidences of cannibalism. In the Florida mounds, as studied by Prof. Wyman, the pottery is again very rude, and besides the cord mark and incised lines, presents an ornamentation produced by stamps with definite designs upon them. Rude arrow heads and spear points were met with, and more rarely bone implements. These are made from the bones of the deer, and Wyman observes that the bones are broken, rather than split, as is the case with the old world deposits. Beside the stamped pottery, another marked peculiarity of the Florida mounds consists in the presence of gouges, chisels and other implements worked out of shell, generally the columella or axis of the large Strombus and Fasciolaria being used. Widely distributed evidences of cannibalism also occur.

The Omori deposits are also specialized. First: by the presence of enormous quantities of pottery, of many different shapes, and of an almost infinite variety of ornamentation. Second: by the great scarcity of stone implements, and the absence of arrow heads, spear points and other pointed implements of stone. Not a single arrow head, flake or chip has been found by the various parties who have been there in the interests of the University; and the combined time spent there, if represented by a single individual, would equal over eighty days work of seven hours each. The men of the Omori period were also cannibals, the evidences of which will be presented further on. Peculiar clay tablets or amulets, to be described elsewhere in this memoir are also unique. The Omori deposits are not only peculiar for what they possess, but for what they do not possess.

The following list presents the objects thus far found at Omori, and in another column is also given a list of objects characteristic of shell mounds generally, not yet found there.

OBJECTS FOUND AT OMORI.

EARTHEN.

Cooking vessels.
Hand vessels.
Ornamental jars.
Ornamental bead.
Tablets.
Spindle whorl —(?)
Disk, shaped from fragment of pottery.

STONE.

Hammers.
Celts.
Rollers.
Skin dresser —(?)

Stone mortar.

HORN.

Awls.
Handle.
Prongs of deers' antlers.
Other implements —(use unknown.)

BONE.

Fish spine needles.
Bird bone with two holes in side.
Cube from metatarsal of deer.
Os calcis of deer probably used as handle.

MISCELLANEOUS.

Arrow point from boars, canine.
Shells used as paint cups.

OBJECTS NOT FOUND AT OMORI.

Flint or obscidian implements.
Arrow heads.
Spear points.
Scrapers.
Skinning knives.
Mortars or pestles—(?)
Drilling stones.
Ornamental stones.
Stone net sinkers.
Pipes.
Worked shell.
Wampum.
Stone beads.

POTTERY.

A great many earthen vessels, more or less perfect, and thousands of fragments, were collected in the Omori deposits.

The material of which the vessels is composed is coarse, and the vessels are in many cases, unevenly baked.

The pottery with few exceptions is quite thin, averaging 6 mm. in thickness; the surfaces are in many cases smooth. The rims of the vessels are either straight, undulating, notched, or projecting at intervals into points, or into variously formed knobs.

In some cases loops take the place of knobs. The borders of the vessels are often ribbed within, and sometimes marked with one or more parallel lines outside, the lines often enclosing a row of rude dots.

The lines marking the surfaces of the vessels are either roughly incised in wet clay, or smoothed out of wet clay, or carved in dry clay before baking.

The designs are infinitely varied; generally areas partially or wholly enclosed by curved lines, the area within or without the lines being cord marked, the other area being smooth. Deep pits or grooves often join the areas, and these may be repeated in regular succession round the vessel.

A common mode of ornamentation is a band of oblique lines running in one direction round the vessel, followed by a band of oblique lines running in an opposite direction. Somtimes these lines cross each other.

In many cases wreaths of clay, pinched into scallops by the fingers, border the vessel in one or more bands, either straight or undulating. These wreaths frequently separate from the vessel, showing that they were put on after the vessel was made.

Dr. Wilson in his work on Pre-Historic Man has mentioned the absence of imitative figures in the pre-historic pottery of Europe. He says; "In no single case is any attempt made to imitate leaf or flower, bird, beast or any natural object." His words would apply with equal truth to the Omori pottery for in no case can any form or design be construed into representing any natural object.

More curious still is the absence of legs or knobs of any description for the support of the vessel from below. A feature so common in the ancient pottery of Peru and Central America, is entirely absent in the ancient pottery of Omori.

On the contrary the Omori pottery presents knobs and loops of an infinity of form projecting from the rim of the vessel. In this respect the Omori pottery resembles the pre-historic pottery from Brazil and Porto Rico, though these forms often represent the heads of animals.

Some of the knobs from the shell mounds of the Amazon discovered by Prof. Hartt bear a remarkable resemblance to the commonest types of knobs from Omori.

The earthen vessels may be grouped as follows:—

Cooking vessels answering to pots, stewpans, etc. Hand vessels such as bowls and cups. Vessels with constricted necks, used as water bottles, possibly, and a few vessels of various forms which may be designated as ornamental jars and bowls.

The cooking vessels are of the following kinds: Deep vessels with slightly bulging sides and flaring rims, ornamented, walls thin. Plain deep vessels with bulging sides and slightly flaring rims, bottoms smooth, or marked with matting impressions. These are the most common forms of all. Straight sided deep vessels, thick walls, roughly made. Large shallow bowl shaped vessels. The hand vessels present the following varieties. Shallow bowl shaped vessels with incurved rims; generally ornamented. Shallow saucer shaped vessels, plain. Very shallow bowl shaped vessels with flaring rims, plainly ornamented.

The vessels with constricted necks are very imperfect, the necks and portions of the bodies only being found. Most of these are dry carved before baking.

The ornamental jars and vessels are figured on plate I. with accompanying descriptions in the explanation of the plate. Two of the larger ones are gracefully formed, though they may have been used for cooking.

One has four handles united above, the knobs on the handles perforated for the passage of a cord, the handles deeply grooved in a line with the perforations. Another one has a widely flaring margin projecting in four lobes with thickened border.

The most extraordinary one of all has two apertures, and recalls some of the unique features seen in the ancient Peruvian pottery.

Of fifty vessels more or less complete, five are bowl-shaped cups, three are large bowls, seven are cups with flaring rims, two are shallow saucer-shaped vessels, two are ornamental bowls with flaring rims, five are deep sided pots with slightly bulging sides, the bottoms of which generally have matting impressions, ten are cooking pots, eight have constricted necks, and eight are diversified in form and ornamentation. Among these vessels, thirty-seven are ornamented as follows: twenty-four have smoothed depressed lines, one has wide shallow lines, four have rough incised lines, two have dry carved lines, one has uneven rough lines, and four are plain.

Of the thirty-seven, also, twenty have the cord marked impressions, eighs have the surface smooth, and the remainder have rough surfaces.

Of the same number, nineteen have straight rims, and the remaining onet have the rims knobbed, or notched in various ways.

Several of the vessels are painted with mercury sulphide, but in no case is an attempt made to produce designs or patterns, except that in some instances the color is applied to interspaces between lines, or areas already marked upon the vessel. Reference is made to these in the explanation of plates.

Many of the vessels at first sight appear remarkable for their symmetry, and yet measurements show that they vary in their diameters, and the walls of the vessels vary greatly in their thickness. No trace of lathe work is found.

The economy of the makers of this pottery may be seen by the careful way in which they bored holes in the fractured edges of their vessels for the purpose of mending them. In some cases the hole was commenced too near the edge and the edge breaking away, a new hole was made, further removed from the edge.

The holes are always bored from the two sides, being smaller in diameter in the centre, showing that the boring instrument was rude, and probably consisted of a fragment of rock or bone.

Many fragments were finally matched and joined, by bringing together all fragments having perforations in them.

The economy of these people is again illustrated by the broken base of a vessel which has had its fractured margin smoothly ground down. That such an article as the broken bottom of one of the commonest forms of pots should be treated in this way, is an indication of the difficulty experienced in making these objects.

The pottery is found in such great abundance, and with such an infinite variety of form and ornamentation, that one would think that here at least was the site of some ancient manufacture; but thus far no unfinished vessels, or masses of potters clay have been met with. The shell mounds of Tokio show an equal abundance of pottery, and in many cases forms and designs similar to those found at Omori.

ORNAMENTS.

In the remains of the work of pre-historic races in various parts of the world, there are commonly found objects of stone, shell, bone and horn, which were evidently intended for personal adornment.

The entire absence of objects of this nature in the Omori remains, with one exception, may be looked upon as somewhat extraordinary. Considering also the highly ornamental and extremely diversified character of the pottery, the absence of these objects must be regarded with interest.

In various parts of Japan there are found many kinds of stone beads known under the name of Cha-usu-ishi, Mikawa-kuda-kara, Juto-tama, Ruri-tama, etc.—some long and cylindrical, others globular, and the Ruri-tama shaped more like the shell beads of the United States. The well known Maga-tama also, must have been an object of personal ornament. These various ornaments, as well as many others, are associated with the polished stone age, which seems well marked in Japan. Old accounts of the Ainos represent their wearing beads and ornaments of various kinds, and whenever these are found, they are regarded by the Japanese as personal ornaments. In fact the Japanese antiquarian regards objects of this nature as of the highest antiquity.

Nothing of the kind, however, so far as I am aware, has been met with in the Omori shell mounds, nor in the shell mounds in Tokio. In fact I have examined many shell heaps from the west coast of Yezo to the southern portions of Kiushiu, without meeting with a single example of those objects above mentioned.

It may be suggested that the clay tablets, to be described further on, were objects of this nature, but I am inclined to believe that they were not intended for this purpose.

The clay bead which is figured, natural size, on plate XV., is made of coarse slate-colored clay. It is dead black on the outside, and has a surface resembling many of the ornamented vessels.

The markings, consisting of curved lines and deep incisions and punctures, are arranged in graceful designs which are repeated three times round the circumference. The hole is eight and a half millimeters in diameter, is straight, and of the same diameter throughout. Within the hole, light spiral lines are plainly seen, indicating that the bead was fashioned and wrought on a round stick, and that the stick was afterward withdrawn, and twisted several times in the act of withdrawing,—this act being performed while the clay was yet soft.

Mr. Taneda has found at Omori, too late for illustration, a fragment of pottery which has been broken into an irregular oval shape and the rough edges partially ground or worn down. Its longest diameter is 75 mm. with a width of 65 mm. and a thickness of 9 mm. In a line with the longest diameter the edges are deeply and smoothly notched. A narrow and deeper channel at the base of the notches suggests the idea that the object has been tied, or bound by a cord which passed through these notches.

The fragment is much worn. It is impossible to suggest its use, though it is described under this head for want of a more appropriate place.

TABLETS.

I have designated these curious clay objects as Tablets, for want of a better name. Five tablets have thus far been found; four of them have the same general proportions, as will be seen by reference to plate XV., where they are all figured, natural size. The fifth one is smaller than the others, though nearly as thick.

The designs are widely different in each one, though a surface of one of the larger specimens is similar in design to that made on the smaller specimen. Two of them have designs in relief with depressed areas. The designs on the others are produced by the figures being cut out on a flat surface, and one, fig. 1, has a hole through one of its corners.

While differing so much in design, they possess some characters in common. They are all made of the finest clay, the material being much finer than that used in most of the vessels. They are all light colored, two of them being a light brick red. There is no blackening upon the surface, neither is there a trace of the red paint.

The designs are all carved, or wrought out of dry clay before baking, in the same manner as a certain class of pottery found with them. With the exception of the largest one, they all appear to be more or less worn. One of them has the design almost wholly effaced.

For such solid and well made objects, it is curious that they are all broken.

It is difficult to conjecture their use. The fact that they are ornamented on both sides, some of the figures being in high relief, and in some instances the design being carried over the margins, excludes the idea that they were used as stamps to impress designs upon cloth, if the fabricators possessed such material. It is impossible that they could have been used for weapons, or implements of any kind.

That they were considered choice, is evident from the fine material of which they are made, and the care and skill bestowed on their ornamentation.

That they were used as personal ornaments seems out of the question, because, excepting in one instance there seems to be no arrangement for suspending them about the person. Their pottery so often presents knobs, loops or holes, for the purpose of suspending their vessels, that such conveniences might be looked for in the tablets if they had been designed for personal ornaments.

That they were household idols, or objects of veneration, seems an equally untenable supposition, for they are much worn ; and this would not be the case if they had been at all protected, or cared for in their huts.

We can hardly conceive of their being weights, because the weighing of things in traffic is an advance we should hardly expect in a people of so primitive a character as these appear to have been. They certainly were not objects to be buried with their dead, from the fact that they appear to have been much used.

It is hardly possible that they represent substitutes for coin, for we should expect to find more variation in their size ; and judging these people by other primitive races, we might suppose that wampum, or some other small objects would have been adopted for such a currency.

We may hazard some conjectures regarding their use. *First :* they might have been used in some game, like quoit, in which the object is pitched, or thrown at a mark ; their being worn, and broken, and the convenient size the larger ones have for grasping, and tossing, suggest this idea. *Second :* they may represent insignia of authority in which case they would be carried about the person. *Third :* they may represent amulets, or the charms, possibly, of some medicine man, in either case to be carried, or worn about the person.

So far as we know, they are unique. We can only compare them to the famous Cincinnati Tablet, to which they bear some resemblance, in the incurving sides and general proportions.

The Cicinnati Tablet † was found in a mound at Cicinnati, Ohio, in the year 1841. This tablet " is made of a fine grained compact limestone of a light brown color. It measures five inches in length, three in breadth, and two and six tenths inches in the middle, and is about half an inch in thickness." One side is wrought into curious figures in low relief, quite symmetrically disposed on each side of a median line. The figures are in the shape of scrolls, and curves, not unlike the conventional designs of leaves on wall paper.

The obverse side of the tablets is flat, having three longitudinal diverging grooves. Mr. Squier was inclined to believe that this tablet resembled peculiar stamps made of burnt clay, which occur in the Mississipi mounds, and in Mexico. These stamps, have fanciful or imitative figures upon them in low relief, and were used to imprint ornamental figures upon the cloth, or prepared skins, of the people. Dr. Daniel Wilson in his " Prehistoric Man. " questions Squier's interpretation of its use, and suggests its being some standard of measurement, from the occurrence of two series of lines, bordering each end of the tablet.

It does not seem that Dr. Wilson is justified in this opinion, for the larger lines vary in their distance from each other, and the smaller spaces vary even more than the larger ones in proportion. A workman capable of duplicating so closely, in bilateral symmetry, the difficult and odd shaped designs upon the tablet would have found it the simplest thing to have made equidistant spaces.

IMPLEMENTS OF HORN AND BONE.

While the shell heaps of Denmark, Florida, and New England, present a number of implements made of bone, and a few made of horn, those of the Omori mounds are mostly made of horn, —or more correctly, the antlers of the deer. Wyman figures, in his article on the shell heaps of New England twelve implements made of bone, and one made of horn. Three of these are awl shaped implements ; the others are variously notched or barbed at the ends. One has a notched edge like a saw, another has a blunt pointed extremity with seven notches on one side and eight on the other. Another one has two notches on one side and three on the other. One is barbed on one side, others are bluntly pointed, and one looks like an ivory tooth-pick. A tooth is also represented, ground down on one side to a cutting edge. The implements of horn are chisel, or gouge shaped, and rude.

The Florida mounds also yielded implements of bone, every one of them pointed. One is in the shape of a long slender bodkin ; another one is worked from a longitudinal fragment of bone. Not one of these show a notch, or con-

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† In 1872 Col. Charles Whittlesey pronounced this a forgery. Robert Clarke Esq., of Cincinnati, has completely vindicated its genuineness in a pamphlet published in 1876, entitled " Prehistoric Remains of Cincinnati, Ohio."

striction, or barb at the point. Of twelve bone implements figured by Wyman from the New England shell heaps, five only are similar to the Florida specimens.

Of ten horn implements figured from Omori only two may be considered as identical with the Florida forms, and these are bodkins. These two also bear a slight resemblance to one or two figured from New England. The remaining ones are quite unlike the Florida, or the New England specimens. This marked difference in implements of so primitive a nature is worthy of attention, and particularly so, since the relation these are supposed to bear to the Aino ought also in turn resemble the New England specimens, which bear such a resemblance to the horn and bone implements in use among the Esquimaux and Aleutians. The implements of this nature in the Omori Mounds are, with few exceptions, made of fragments of deer's antlers. The common use of this material is shown by the frequency with which fragments of deers antlers cut at one or both ends, were met with. These fragments were cut off by making a circular groove round the antler, and then breaking the piece away. No examples of diagonal cutting from each side, were met with, such as Wyman figures from the New England mounds, though the circular groove method of cutting occurs in the New England and Florida mounds. The natural prongs, much worn by use, are common.

The incisor teeth of the deer, and the canine teeth of the wild boar, are met with in comparative abundance, and they all show marks of use. A very characteristic horn handle is figured on Plate XVI Fig. 4. This was deeply and smoothly perforated at one end, and a deer's incisor so nicely fitted into the cavity, that the kind of tool held by this handle was evident enough. An exquisitely wrought arrow point or fish lance point was found, made from a boar's canine. The natural layer of enamel forming one face of it. Its shape is peculiar, one side appearing to be broken away, making the outline unsymetrical, but as this face is polished it is evidently intentional. In the museum of the Kaitakushi, there is a silicious specimen of almost precisely the shape is the one above described, and that it was intended for a similar purpose is unquestionable. Dr. A. O. C. Geerts in his valuable work entitled "*Les Produits de la Nature Japonaise et Chinoise*" figures it on plate VIII., fig 3.

The bone cube made from the end of a deer's metatarsal is an odd shaped piece; the surfaces have been evenly ground down, and its use may possibly be surmised by associating it with some game.

A well defined hook made from a deer's antler is unique. A bird's bone having two perforations is another object of interest. An irregular fragment of bone has one end ground down to a cutting edge. A great many fish spines were collected, which in many cases bear marks of considerable use. They probably served as needles. The *so calcis* of the deer occur in great numbers and nearly all of them show indications of wear.

Wyman found the *olecranon* of the deer, used as an implement of some kind by the builders of the Florida mounds. It is difficult to conjecture the use that was made of the *os calcis,* unless it answered for a handle, — its irregular articular faces perhaps offering certain facilities for binding an instrument to it.

With the presence of so many shells of massive size, with thick and dense columellas, such as Rapana, it seems a little singular that not a single worked shell, either as an implement, utensil, or ornament has yet been found; particularly so, as objects useful and ornamental made from shell are frequently met with in the Florida mounds, and other parts of the Southern States and Mississipi Valley. Similar articles are also found in remains of this nature along the coast of California. Of the characteristic wampum,—that is little beads made of shell, so common in the American deposits, no trace was found in the Omori mounds.

IMPLEMENTS OF STONE.

It seems remarkable that a people capable of fabricating vessels of such symmetry in form, such variety in shape, and displaying such varied methods in ornamentation, should have left the few primitive, and ill-shapen implements, that have thus far been discovered in the Omori mounds. While thousands of fragments of pottery, a remarkable set of tablets, a bead of curious workmanship, and other objects have been found, only the few rude implements figured on Plate XVII. have thus far been met with ; and the few among these approaching to any symmetry in outline are made of soft stone, and easily worked.

The stone implements thus far discovered are as follows : three chisel like implements made of soft lava rock ; fragments of two rollers, one made from clay slate, and the other of some schistose rock, the latter bearing the marks of fire.

A portion of one, composed of talcose rock, is the best finished of the lot. It has two grooves transversely marking the blunt and smooth ends of one extremity. Two large and ill shapened implements have been worked out of jasper pebbles. One face is broken away, the other face shows the natural surface of the pebble. The constrictions have been chipped out, to accommodate a wooden handle, probably of twisted thorn. The evidence of wear is apparent in both. In the larger one, the rough edges are worn down in those places where the handle would naturally rub against them. The smaller one shows small surfaces in the same region, highly polished, and one of the worn surfaces shines like glass. I have supposed these to be hammers, from the manner in which one end is broken, as if by repeated blows. It is hardly probable that they were intended for net sinkers.

As so many finished stone implements of various kinds are found widely distributed in Japan, the absence in the Omori mounds of many groups of implements, and of common forms too, is remarkable, and lends additional evidence to the antiquity of the deposits.

Beside the stone implements, there were found many stones of irregular shape, but showing no marks of an artificial character. There were also found a few flat pieces of rock, having conical shaped holes bored into the flat sides. There was no evidence of design in the way the holes were arranged on the rock, nor did it appear that any attempt had been made to bore through the rock. These holes were 18 to 20 mm. in diameter, and 9 to 11 mm. deep. A fragment of a stone bowl with a heavy rim, 70 mm. thick in its widest part, and having a comparatively thin bottom was found in the deposits. The marks of wear on the inner surface, show that the fragment probably formed part of a mortar.

Two very symmetrically rounded stones were also found, but it was difficult to determine whether they had been rounded artificially, or not.

Large fragments of pumice were not uncommon in the mounds.

Implements of precisely the same character have been found in a number of the Tokio deposits.

REMAINS OF ANIMALS.

A great many bones of wild animals were found, mixed with the shells composing the deposits. These were all broken or split irregularly, and in this fragmentary condition it is difficult to identify them.

The remains of the following animals have thus far been recognized, :—Man, Monkey, Deer, Wild Boar, Wolf and Dog.

The bones of the Deer and Wild Boar are most numerous.

A few fragments of the vertebræ of a large cetacean, and also fragments of the ribs of a large Tortoise were found.

A few bones of the smaller mammals and birds, and many bones of fishes also occur, but their species have not yet been identified.

The antlers of the Deer are remarkable for their proportions, and the skulls of the Wild Boar indicate creatures of the largest size.

In ancient deposits in other parts of the world, the same difference in size and solidity of the bones, as compared to similar bones of recent species, have been noticed.

Beside the remains of the Japanese monkey, Macacus, I have detected the right lower jaw of what may prove to be a large baboon-like ape. It is certainly unlike anything found in Japan to-day. It may possibly be Cynopithicus, a species of which is found in the Philippine Islands and Celebes.

That this species existed in Japan during the historical period is not improbable, as the Japanese have long been familiar with accounts of monstrous apes, though the more intelligent among them have regarded these stories as mythical.

Mr. Ninagawa, the distinguished antiquarian, informs me that seven hundred years ago it was reported that a curious monster, supposed to be a large monkey, was seen near the Emperor's Palace at Kioto. Mr. Fujitani, a student in the Imperial University, has kindly collected a number of references in regard to this animal, and while many impossible things are told about it, yet some of the figures and descriptions recall an ape of large size, with long muzzle and protruding lips—features that ought well to accord with Cynopithicus.

Without specimens of the recent species to compare, it is of course impossible to state with certainty the character of the animal from the single fragment found at Omori.

CANNIBALISM. *

One of the most interesting discoveries connected with the Omori Mound is the evidence of cannibalism which it affords, this being the first indication of a race of anthropophagi in Japan. The human bones were found mixed with bones of the wild boar, deer and other animals. They were all fractured in a similar manner, either with the object of extracting the marrow or for convenience of cooking in vessels of too small dimensions to admit them at length. When discovered, they were entirely unrelated to each other. Some hopes were entertained that the place might have been used for purposes of burial, and special search was made for a continuous series of bones; but no proof was obtained in support of this supposition, and this is in accordance with the experience of those who have examined similar deposits in other parts of the world. The bones were mixed indiscriminately with other remains of feasts. Some of them are strongly marked with scratches and cuts, especially in those areas of muscular attachment where the muscles are separated from the bones with difficulty. The very mode of fracture in some cases is conspicuously artificial, and the surfaces for the attachment of muscles are strongly incised. These testimonials of cannibalism are of precisely the same nature as those educed by Professor Wyman in his memoir on the shell mounds of Florida. The accompanying passage is extracted from that memoir, page 68.

"The reasons derived from our own observations for believing that the ancient inhabitants of the St. John's were cannibals may be stated as follows:

1.—The bones, an account of which we have given, were not deposited in the shell heap at an ordinary burial of a dead body. In this case, after the decay of the flesh, there would have remained a certain order in the position of the parts of the skeleton, especially in the pelvis, the long bones of the limbs, the vertebral column and the head. The bones would be entire, as in other burials. In the cases here described, they were, on the contrary, scattered in a disorder-

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* Read before the Biological Society of the Imperial University, Tokio, Jan. 5. 1879. and originally published in the Tokio Times Jan. 18. 1879.

ly manner, broken into many fragments, and often some important portions were missing, as the head, at one of the mounds near Blue Spring, the bones of an arm and leg at another, and in other mounds a still larger number of bones. The fractures, as well as the disorder in which the bones were found, evidently existed at the time they were covered up, as is shown by the condition of the broken ends, which had the same discoloration as the natural surfaces.

2.—The bones were broken, as in the case of those of edible animals, as the deer, alligator, etc. This would be necessary to reduce the parts to a size corresponding with the vessels in which they were cooked, or suitable for roasting, or even for eating raw.

3.—The breaking up of the bones had a certain amount of method ; the heads of the humerus and femur were detached, as if to avoid the trouble, or from ignorance as to the way of disarticulating the joints. The shafts of these bones, as also those of the fore arm and leg, were regularly broken through the middle. The olecranon process of the ulna was in some cases detached in the same manner as the corresponding part of the deer."

Had this description referred especially to the Omori Mounds, there could not have been a more perfect accordance with the facts as they stand.

The evidence of cannibalism in the New England and Florida heaps was to have been expected, as history shows us that many tribes of North American Indians were eaters of human flesh, and tribes exist to-day, both in North and South America, who retain the habit. The evidence of cannibalism in Japan, however, has a different significance, because the minute and painstaking chronicles of her historians, running back with considerable accuracy for fifteen hundred years or more, give no trace of so monstrous a practice. Not only were the Japanese not cannibals, but there is no account of the tribes they encountered being addicted to tastes of this character, and so remarkable a trait would have found some acknowledgment in their records. The early historians speak of the Ainos as being of so mild and gentle a disposition that the art of murder was unknown among them. The failure of an adequate supply of food invariably drives even the highest of civilized races to this extremity, but no such necessity forced the people of the Omori period to so shocking an alternative. In this connection it would be interesting to know whether there are any records of the Japanese having been compelled by great exigency to subsist upon human flesh. There are many accounts of drifting Japanese junks given by Mr. Charles Walcott Brooks in the proceedings of the California Academy of Sciences. In these instances the survivors had prepared for burial those of their number who had perished from exposure and starvation.

The following is a list of the human bones thus far met with in the Omori Mounds :—

Right humerus ; leuth of fragment, 195 mm.; proximal end gone.

Left humerus ; length of fragment, 215 mm.; both ends gone.
Left humerus ; length of fragment, 160 mm.; both ends gone.
Right ulna ; length of fragment, 200 mm.; distal end gone.
Right ulna ; length of fragment, 180 mm.; both ends gone.
Right radius ; length of fragment, 80 mm.; upper portion only.
Right femur ; length of fragment, 150 mm.; proximal end and portion of shaft only.
Right femur ; length of fragment, 270 mm.; both ends gone.
Right femur ; length of fragment, 230 mm.; both ends gone.
Right femur ; length of fragment, 107 mm.; upper portion of shaft.
Right femur ; length of fragment, 304 mm.; articular surfaces broken ; child.
Left femur ; length of fragment, 160 mm.; shaft only.
Left femur ; length of fragment, 270 mm ; great trochanter and head and distal end gone ; child.
Left femur ; length of fragment, 85 mm.; lower portion only ; articular surface gone ; child.
Right tibia : length of fragment, 135 mm.; upper portion of shaft.
Right fibula : length of fragment, 205 mm.; both ends broken.
Fifth right metatarsal ; length, 65 mm.; distal articular surface partially gone.
Left lower maxillary.
Left parietal.

Of sixteen long bones of the arm and leg, nine are destitute of both extremities ; and of the remaining seven, three are destitute of the lower extremity, two of the upper extremity, and in two, the articular surfaces of both ends are gone. Nothing more clearly illustrates the indiscriminate way in which the bones were scattered about, than the fact that the eight femora found represented at least seven different individuals, four being adults and three either women or children. None of the human bones show marks of having been wrought, but this we should not expect, since most of the implements discovered are made of horn.

A recent examination of Shell Mounds in the southern portion of the Empire has disclosed the most abundant and unquestionable evidences of cannibalism.

FLATTENED TIBIA.

A special search was made for fragments of the human tibia, on account of the remarkable deviation the tibia of ancient man presents, in comparison with that of recent man.

This deviation consists in a lateral flattening of the shaft of the bone. So wide spread is this variation in primitive man that it has given rise to a new name in science, and tibia possessing this lateral flattening are known as Platycnemic tibia.

It has frequently been met with in ancient mounds and Cave explorations in Europe, and Prof. Wyman has observed platycnemic tibia in ancient mounds in Kentucky, Tennesee, California, Florida, Labrador and other places. Mr. Henry Gillman discovered, in mounds in Michigan, tibia that possessed a remarkable lateral flattening.

According to Prof. Wyman's observations, the flattening of the tibia is not a race character, but seems to be of common occurrence in all prehistoric races.

Our labors at Omori were fortunately rewarded by the discovery of a portion of the shaft of a tibia, associated with other human bones.

From the variation this bone presents in man, the single example here mentioned can have but little significance. It may be of interest, however, to give its proportionate measurements in contrast with corresponding measurements given by Wyman in his Florida mounds memoir.

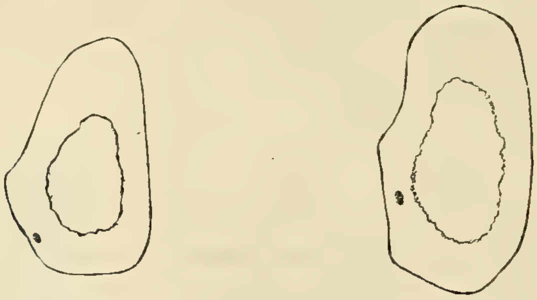

Fig. 1 Fig. 2

Transverse sections of Platycnemic Tibia.
Fig 1. Omori, Musashi. Fig. 2. Onomura, Higo.

The antero-posterior diameter being taken as 100, the transverse diameter in
Twelve, white race (recent), was 0.70 ;
Twelve, from the Florida Mounds, 0.64 ;
Seven, from the Kentucky Mounds, 0.63 ;
One, from the Omori Mound, 0.62.

There were others from the Florida mounds as low as 0.59, and Mr. Gillman discovered one in a mound on Rouge River, Michigan, with the excessive lateral flattening of 0.48. This latter tibia far exceeds the famous Cro Magnon tibia of Broca, which gave an index of 0.60. The Omori specimen, with its index of 0.62, may be looked upon as a fair platycnemic tibia. It has a remarkable lateral flattening in contrast with nine recent Japanese tibia, which were measured at random and which gave an index of 0.74 ;—the lowest index in the lot being 68.4.

This flattening of the tibia is peculiar to the higher apes also, but as Prof. Wyman properly remarks, it is not so much the lateral flattening, as the rounding of the angles, and the bending of the shaft forward, which gives to it a distinct ape like character. The Omori tibia possesses this character in a marked degree.

This peculiarity associated with its lateral flattening, gives greater importance to the bone, and may be looked upon as an evidence of considerable antiquity of the remains found associated with it.

Since writing the above, I have examined a shell mound of immense size in the province of Higo.

The bones of mammals were not numerous yet of forty fragments found, more than half were those of man. They were all broken, and were scattered promiscuously through the deposit. Fortunately, fragments of a number of tibia were found, and these were all platycnemic. One showed an excessive lateral flattening, giving an index of 50.2, this being one of the lowest ever recorded.

the human bones were remarkable for the roughness and prominence of the bony ridges for muscular attachments.

A description of this mound with its pottery, etc. will be given in a future memoir.

A COMPARISON BETWEEN THE ANCIENT AND MODERN MOLLUSCAN FAUNA OF OMORI.

Some interesting facts are revealed in studying the remains of the animals which form the bulk of these deposits in Denmark, New England, Florida and Omori.

These facts show the following :

First : that a change has taken place in the relative abundance of individuals of certain species.

Second : that a change has taken place in the relative size of certain species.

Third : that a change has taken place in the relative proportions of the shells of certain species.

Fourth : that a change has taken place in the extinction of certain species.

The modification in the relative size and proportions of certain species is profound, and would seem to indicate, either that species vary in a much shorter time than had been supposed, or else that deposits presenting these peculiarities have a much higher antiquity than had before been accorded them.

We quote the following from Lubbock's "Prehistoric Times" page 231, as bearing upon this subject. In the Danish Mounds the four most abundant species of mollusks are :

The oyster,	*Ostrea edulis L.*
The cockle,	*Cardium edule L.*
The mussel,	*Mytilus edulis L.*
The periwinkle,	*Litorina litorea L.*

All four of which are still used as food for man. Other species occur more rarely, namely,—

Nassa reticulata L.
Buccinum undatum L.
Venus pullastra, Mont.

And six other species of mollusks which he enumerates· He then says, "It is remarkable that the specimens of the first seven species are well developed, and decidedly larger than any now found in the neighborhood. This is especially the case with the *Cardium edule*, and *Litorina litorea*, while the oyster has entirely disappeared, and, even in the Kattegat, occurs only in a few places; a result which may, perhaps, be partly owing to the quantities caught by fishermen." And he concludes that "on the whole their disappearance, especially when taken in connection with the dwarfed size of other species, is evidently attributable in a great measure to the smaller proportion of salt in the water."

Among the birds occuring in the Danish shell heaps, is *Tetrao urogallus*, which feeds principally on the buds of the pine, showing that at the time the deposits were made, extensive pine forests once covered the region, a fact previously established by a study of the peat beds. Bones of the great auk, *Alca impennis*, also occur in the same deposits, and this bird is now probably extinct.

The shell mounds along the coast of Maine also indicate a marked change in the distribution of certain species. A number of species of mollusks occur in them, which are not found at present north of Cape Cod. Some of them present a remarkable solidity of form in comparison with recent specimens.

The bones of the great auk are likewise met with in many of the deposits, in such numbers as to show that it was then a common bird, and furnished an article of food. More curious still is the occurence of a molar tooth discovered by me in one of the deposits on the coast of Maine, which Prof. Wyman beieved to be the molar tooth of the polar bear, a species which is now confined to the Arctic regions.

In a paper published fifteen years ago on the occurrence of land snails in ancient deposits on one of the islands in Casco Bay, Maine,* I showed that at the time of their existence, a hard wood growth must have abounded. The island has been covered since the earliest memory of man with a dense spruce growth.

I have in preparation a paper on the changes in the character of certain species of Mollusca from the deposits in Massachusetts. In those I have measured and drawn, the differences between present existing species and their ancestors are constant.

Prof. Wyman observed similar changes in the mollusks of the Florida deposits. He says, in his memoir on the Florida Mounds, that the Ampullariæ, and Paludinæ, are much larger than their living representatives. "The average size of the aperture in twenty large Ampullariæ from the mounds was, breadth 34.4 mm, and length 53.9 mm; while in the largest living shells we have found, the aperture did not exceed 30 mm. in breadth and 48 mm. in length, which would seem to indicate a greater vital activity in former days."

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* On the occurence of rare Helices in ancient shell heaps. Proceedings Portland Soc. Nat. Hist. Vol. 1 1863.

With these facts before me, I was impelled to examine the various species of shells found in the Omori Mounds, in comparison with similar species now living along the immediate shores of the Bay. The followings descriptions and measurements will show that changes more or less great have taken place since the ancestors of those now living along the shore formed the food of the savages who made the deposits.

As a preparation for these comparisons, a number of visits were made to the shores of Omori village, in which I was accompanied by a class of special students and others who had collected with me in Yezo.

A most searching exploration was made along the coast for a considerable distance, and many specimens of every species bearing upon the subject were obtained. A special search was made for those forms common in the Mounds. A similar number of visits was made to the Mounds, accompanied by the same corps of assistants, with directions to collect every species found there. In this way an immense amount of material was brought together, and from this material only mature and perfect specimens were selected for comparison. Besides this material, I had a large number of species collected at Yenoshima, year before last, as well as a large amount of material collected by the University Expedition at Otaru and Hakodate, in Yezo, Sendai Bay, and on the west coast at Funagawa, and Niigata. Use was also made of valuable collections made at Kishiu this winter by Prof. Yatabe and Mr. Sasaki. All of these collections were of use in showing the degree of variation between Northern and Southern forms of the same species. Collections of the edible mollusks in the Tokio markets, and at Shinagawa, were also considered in these comparisons. Measurelments were made in millimeters, and the tables of figures were submitted to Prof. T. C. Mendenhall, of the Tokio Daigaku, who kindly offered to compute the averages and proportions for me.

Every precaution has been taken to insure accuracy, and the results will certainly be of interest to those who recognize a change in species, coincident with change in time, and environment.

Arca subcrenata Lischke.

Specimens of this species were not uncommon in the Mounds, and were also found scattered along the shores of the Bay. Lischke gives the number of ribs as from 31 to 33. Twelve recent specimens from the shores of Omori averaged 33$^1/_4$ ribs, while 15 specimens from the Mounds averaged 30$^1/_2$ ribs. The hinge, or umbonal area in the recent specimens,—measuring the area of one valve transversely, gave an average of 5. 7 mm., while in the mound specimens the same area averaged 5.9 mm.

The following figures show that the ancient specimens are not only larger, but that the proportions of the shell are also different ;—the shell having increased in length, in proportion to its hight.

		Length.		Hight.
Average dimensions of ten largest specimens,	Recent,	61.8		50.4
	Mound,	65.7		52.
Assuming length to be 100, hight in,	30 Recent.		81.2	
	28 Mound.		79.1	
Dimensions of largest specimen,	Recent,	68.5		54.
	Mound,	80.5		69

These differences, though slight, appear to be constant, and indicate a change in the character of the shell, as to its relative size, number of ribs, size of hinge area, and proportionate diameters.

Arca inflata Reeve. Plate xviii. Fig. 5.

This species is comparatively rare in the Mounds though of common occurrence along the shores. It is a common edible mollusk in the markets of Tokio. The average number of ribs in the recent specimens from Omori is 41.2 Reeve gives 40 as the number in his description of the species, though Schrenck states that they average 42 to 43.

In the few specimens found in the Mounds the ribs averaged 39.6 This average, drawn from so few specimens, is of but little value, yet, taken in connection with the other species of Arca, wherein the ancient specimens exhibited a less number of ribs, it is of some interest.

In the dimensions of the hinge area, however, the most remarkable change is seen between the ancient and recent forms. The average width in nine recent specimens, measuring one valve, was 6.4, while in five ancient specimens it was 15. These dimensions in the recent specimens ranged as follows : 8, 5, 4, 7, 6, 6, 5, 6, 11 ; and in the ancient specimens, 17, 16, 13, 17, 12.

Arca granosa Linné.

This is one of the most abundant shells in the Mounds. I have never met with it in my collections made at Yenoshima, Yedo Bay, or Yezo. Takamine did not obtain it in his dredgings and shore collecting at Funagawa and Niigata, on the west coast. Sasaki did not find it at Sendai Bay. Prof. Yatabe and party made exhaustive collections by dredging, and shore collecting, at various points along the coast at Kishiu, yet failed to secure a single specimen.

Lischke in his great work, *Japanische Meeres Conchylien*, records examples from Nagasaki only. He gives the following localities: Tochi-fu, North China and Cochin China, *Debeaux ;* Philippine Islands, *Reeve ;* Ceram and Celebes, *Rumphius ;* Tranquebar and Nikobaren, *Chemnitz.* R. E. C. Stearns Esq. of the University of California says that the Mound specimens have a less number of ribs ;—the species at present having from 23 to 26 ribs, while the Mound specimens range in number of ribs from 18 to 20.

Mr. Stearns further remarks that the Mound specimens differ from the present form in being less equilateral, and in having the umbones less produced. He says it is at present a southern form, and belongs to a widely separated geographical province.

In the digging of wells in Tokio it is often brought up in a semi-fossil condition from considerable depths. I have also found it in great numbers in an ancient mound in Tokio proper, associated with pottery and rude stone implements, and Mr. Ishikawa has found it associated with cord marked pottery beyond Oji. From these evidences it must have been a common shell in past times, but has now become extinct in this and neighboring waters.

Lischke gives the following measurements of two specimens from Nagasaki, and one from Singapore.

	Length.	Hight.
Nagasaki,	54	40
,,	44	31
Singapore,	32	28
Largest specimen from the Mound	57	42
Average of ten largest specimens from the Mound,	52.9	41.1

It is interesting to observe that the two other species of *Arca* from the Mound possess a less number of ribs than the present species. In other words the three species of *Arca* at the present time differ in possessing a larger number of ribs than their ancestors, beside the other differences already recorded, as follows :

		Mound.	Recent.
Number of ribs in,	*Arca sub-crenata,*	30.5	33.3
	,, *inflata,*	39.6	41.2
	,, *granosa,*	18 to 20	23 to 26

Cyclina Chinensis Chemnitz. PLATE XVIII. FIG. 1.

This species is not common along the shores at Omori. Lischke records a single example from the Bay of Yedo, and thirteen from Nagasaki. I have a number of specimens from Omori village.

It is by no means an uncommon shell in the Mounds, and the larger size as compared with the recent form is seen at a glance.

		Length.	Hight.
Average dimensions of ten largest specimens,	Recent,	47.5	51.4
	Mound,	52.4	55.4

Assuming length to be 100, hight in	27 Recent specimens	105.7
	69 Mound ,,	104.2

		Length.	Hight.
Largest specimen,	Recent,	50.5	54.
	Mound,	57.5	62.5

Tapes sp. Plate xviii. Fig. 2.

This species is one of the most abundant forms in the Mounds, as well as one of the most common shells along the shore. It is a common edible mollusk in the markets. Not being able to refer to a description or figure of the species, I cannot give its specific name. It is sufficient to say that the living specimens collected for comparison are of the same species as those found in the Mounds.

The proportions of the shell have scarcely changed, though curiously enough the recent ones are somewhat longer than the ancient ones, and the umbones are more eroded.

		Length.	Hight.
Average dimensions of ten largest specimens,	Recent,	54.2	39.4
	Mound,	49.2	35.8

Assuming length to be 100, hight in	49	Recent,	72.3
	,,	Mound,	72.

		Length.	Hight.
Dimensions of largest specimen,	Recent,	58.	42.
	Mound,	50.5	35.

Dosinia Japonica Dunker. Plate xviii. Fig. 6.

This species is not common, either in the Mounds, or along the shores of the Bay. A comparison of the measurements shows a change in proportions, and indicates also that the ancient specimens were larger than the recent.

		Length.	Hight.
Average dimensions of ten largest specimens,	Recent,	65.6	61.5
	Mound,	69.8	65.7

Assuming length to be 100, hight in			
	10 specimens,	Recent,	93.9
	9 ,,	Mound,	95.2

Dimensions of largest specimen,		Length.	Hight.
	Recent,	68.	63.
	Mound,	77.5	73.

Mactra veneriformis Deshayes. Plate xviii. Fig. 3.

This species is very common in the Mounds, and along the shores of the Bay. It is also common in the markets of Tokio. Lischke gives the average size of the species as follows: length 38, hight 34.

He also gives the dimensions of a specimen from Kishiu as follows: length 48, hight 44.

The following are the dimensions of the Mound specimens in comparison with the recent at Omori.

Average dimensions of ten largest specimens,		Length.	Hight.
	Recent,	43.4	38.1
	Mound,	56.6	49.1

Assuming length to be 100, hight in			
	21	Recent,	88.3
	15	Mound,	86.6

Dimensions of largest specimen,		Length.	Hight.
	Recent,	48.5	43 5
	Mound,	59.	51.5

It will be seen by the above figures that the average hight of the Mound shell exceeds the length of recent specimens as given by Lischke, and is much longer than the shell as it exists to day at Omori. Its proportions have moreover changed.

Cytherea meretrix Linné. Plate xviii. Fig. 7.

Under this name Lischke probably refers to the species to be considered. It is one of the principal shells in the Mounds and appears equally common along the Omori shores.

The proportionate diameters vary but little, but the difference in size is noticeable at once, the Mound specimens being larger.

Average dimensions of ten largest specimens,		Length,	Hight,
	Recent,	85.8	66.1
	Mound,	97.3	75.1

Assuming length to be 100, hight in	18 Recent,	77.2
	18 Mound,	78.5

		Length.	Hight.
Dimensions of largest specimen	Recent,	95.	73.
	Mound,	106.5	81.5

Mya arenaria Linné. PLATE XVIII. FIG. 4.

Not an abundant shell in the Mounds nor common along the coast. It is often seen in the markets at Tokio, brought from Shinagawa.

It will be seen by the figures that the proportions have changed slightly, though the size remains nearly the same.

		Length.	Hight.
Average dimensions of ten largest specimens,	Recent,	98.5	62.1
	Mound,	98.2	59.9

Assuming length to be 100, hight in	17 Recent,	62.5
	17 Mound,	61.1

		Length.	Hight.
Dimensions of largest specimen,	Recent,	105.	62.5
	Mound,	112.	66.

The following species of Lamellibranchiates are present in the Deposits.

Arca subcrenata Lischke.
,, *inflata* Reeve.
,, *granosa* Linné.
Dosinia Troscheli Lischke.
Cyclina Chinensis Chemnitz.
Mactra veneriformis Deshayes.
Mya arenaria Linné.
Cytherea meretrix Linné.
Tapes sp.
Solen strictus Gould.
Lutraria Nuttalli Conrad.
Ostrea denslamellosa Lischke.
,, *sp.*

Those species whose dimensions have been given were represented by a suffiient number of specimens for the purposes of measurements and comparisons. Of the others, with the exception of *Ostrea*, only a few specimens were found, not enough to justify comparisons.

It will be seen by the foregoing measurements that the following species from the mounds are larger than their living representatives from the same locality:

Arca subcrenata, *Cyclina Chinensis*, *Cytherea meretrix*, *Mactra veneriformis* and *Dosinia Troscheli*. *Arca granosa* is much larger than any dimension given by Lischke.

Among the few gasteropods which occur in sufficient numbers for comparison, the differences in proportions between the Mound specimens and the recent ones are quite as conspicuous.

Eburna Japonica Lischke. Plate xviii. Fig. 9.

This is a very common shell in the deposits, and is also found scattered along the shores. It is very common further south in the Bay.

The differences between the ancient and recent shells are easily recognized without the aid of measurements.

The recent shell, though larger than the ancient one, is not so broad compared to its length, as in the ancient form. While both have the same average breadth, the recent form is nearly six millimeters longer. This gives the recent shell a more acute spire, while the ancient shell appears more robust.

A large number of recent and ancient specimens were brought together, and from these, the perfect and mature ones, for the purposes of measurement were selected.

The angle of the spire was measured in fifty specimens of the Mound and fifty specimens of the recent, and the difference is shown in the following diagram.

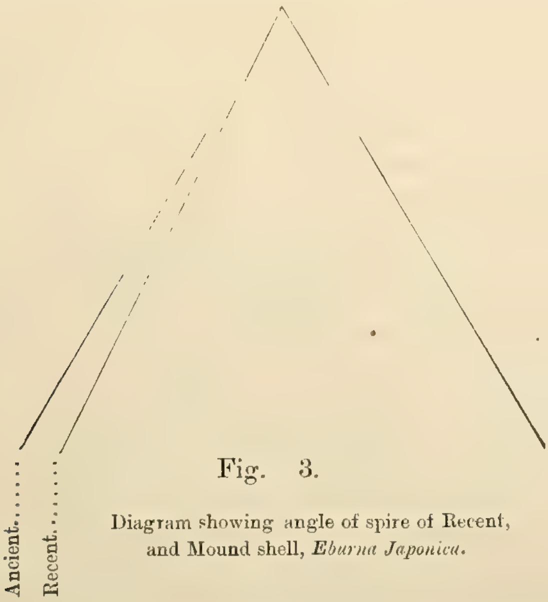


Fig. 3.

Diagram showing angle of spire of Recent, and Mound shell, *Eburna Japonica*.

The mean angle for the recent was 57°45′, and for the Mound, was 61°45′.

The following measurements will show the differences in the proportions between the recent and the Mound specimens.

		Breadth.	Length.
Average dimensions of ten largest specimens,	Recent,	41.8	67.9
	Mound,	40.7	63.1

Assuming length to be 100, breadth in { Recent was 63.
Mound „ 66.

Dimensions of largest specimen,	Recent,	47.	75.
	Mound,	45.	67.5

Purpura luteostoma Chemnitz.

The specimens referred to of this species from the Omori Mounds are so much larger than any Purpura found today in the Bay of Yedo that it is quite difficult to determine their affinities. At present, the species described under the names of *luteostoma* and *clavigera* can be pretty easily determined. In the Omori days the forms were not so well defined. The nearest resemblance to the Omori *Purpura* is the *Purpura luteostoma* from the west coast of Japan at Funagawa. *Purpura luteostoma* from Yenosima resembles somewhat *P. Bronni* Dunker as it occurs at Kishiu, while the *P. clavigera* Kuster from Kishiu resembles the variety described by Reeve under the name of *P. tumulosa.*

We searched in vain for an example of *Purpura* along the Omori shores.

The specimens from Yenosima are so small as to be worthless for comparison.

It is easy to believe that not long ago the various species of Purpura were once varieties of a single species, and that *P. Bronni, luteostoma, clavigera, tumulosa* and many others are modifications of a single form. Indeed I can recall as great a variation among examples of *Purpura lapillus* along the eastern coast of the United States as one sees among these so called species.

Lischke mentions the length of his largest specimen from Hakodate as 40 mm. The largest specimen from Omori measures 53 mm.

The following are the dimensions of the Omori specimens in comparison with those of Hakodate.

	Breadth.	Length.
10 largest specimens from Omori Mounds,	27.8	47.4
„ „ „ „ Hakodate,	23.9	35.4

Assuming length to be 100, breadth in { Omori shell is 58.
Hakodate, 67.

Natica Lamarckiana Duclos. PLATE XVIII. FIG. 8.

This is another common shell in the Omori Deposits, and is also one of the most common shells along the Omori shores.

The differences between the Mound specimens and the recent ones are so profound, that it may be recognized as a marked variety. The elevated spire, the heavy callosity almost concealing the umbilicus, and the marked differences in the proportions of the shell are noticeable at once, and distinguish it from its living representative.

The Omori Mound variety approaches nearer the form which occurs much further north at Hakodate.

The differences between this species and *Natica duplicata* Say, which occurs along the eastern coast of the United States, are very slight.

		Hight.	Breadth.
Average dimensions of ten largest specimens,	Recent,	60.2	68.4
	Mound,	62.	65.8

Assuming breadth to be 100, hight in { 10 largest Recent, 88.1
10 largest Mound, 94.2

		Hight.	Breadth.
Dimensions of largest specimen,	Recent,	68.	76.
	Mound,	66.	71.5

Turbo granulatus Chemnitz.

This is one of the most abundant shells in the Omori deposits, but the shores of Omori have been repeatedly searched without bringing to light a single specimen. Lischke records forty specimens from Nagasaki only. It is a common species at Hongkong and further south. Prof. Yatabe and Mr. Sasaki collected a very large and marked variety at the Bonin Islands, and also the ordinary form from Kishiu. Mr. Takamine met with it in abundance at Funagawa some distance north of Niigata, on the west Coast, and I have collected small specimens at Yenoshima.

In past times it must have been one of the most common shells along the shores at Omori, judging from the number that occur in the Mounds. It must have had a more northern range in past times, but like *Arca granosa* has retreated south.

The following measurements are given from ten largest specimens from the Omori Mounds, Kishiu, and Funagawa.

Average dimensions of ten largest specimens.

	Breadth.	Hight.	Proportion of hight to breadth.
Omori Mounds,	25.4	23.	90.5
Kishiu,	24.6	21.8	84.3
Funagawa,	23.2	22.1	95.2

Lischke's largest specimen from Nagasaki measured 25 millimeters in diameter.

As this species varies greatly with each locality, it would be unfair to make any comparisons between the Omori Mound specimens and those from Kishiu and Niigata. It will be observed however, that the average diameter of the Omori specimens, exceeds the largest diameter as given by Lischke, as well as those from Kishiu and Niigata.

Of the other species of mollusks found in the Mounds, no special comparisons have been made, owing either to the lack of a sufficient number of mature and perfect specimens, or of recent specimens with which to compare.

The following is a list of the gasteropods thus far found in the deposits.

Fusus inconstans Lischke.
Rapana bezoar Linné.
Hemifusus tuba Gmelin.
Purpura luteostoma Chemnitz.
Eburna Japonica Lischke.
Nassa sp.
Potamides sp.
Lampania sp.
Natica Lamarckiana Duclos.
Turbo granulatus Gmelin.
Rotella globosa Gould.

The few specimens of *Fusus inconstans* appears to be more robust than the species as it exists to day in the vicinity, and resembles the typical form as figured by Lischke, while the recent ones along the shore resembles his small varieties.

Rapana bezoar is exceedingly abundant, of large size, with massive shell. Many of the specimens have a portion of the body wall broken through, as if for the purpose of more conveniently extracting the flesh.

The Mound specimens of *Hemifusus tuba* were large, light, and the tubercles were prominent and acute. The recent specimens along the shore were about half the size, quite solid, with the tubercles obtuse.

The species of *Nassa* and *Lampania* were too small for edible mollusks, and were probably accidently introduced with the larger species. Only a few specimens of each species were collected, and these were too much eroded for comparison.

The following species were more or less common along the shores of Omori village, but have not yet been found in the Mounds.

Mactra, possibly *sulcataria.*
Cancellaria Spengleriana Lischke.
Soletellina olivacea Jay.
Liocardium sp.
Pecten sp.
Natica janthostoma Deshayes.

With the exception of the last species, these are all edible mollusks, and the *Mactra* is one of the most common mollusks in the Tokio markets. Their absence from the Deposits certainly indicates a change in the fauna.

In this respect the absence of *Haliotis* and *Pinna* from the Mounds is certainly of great interest, for it shows, either the lack of proper means for water transport, or a disinclination on the part of the people to go far from their abiding place in quest of food.

On the opposite side of the Bay, and also south of Yokohama, the *Haliotis* may be found, and large numbers of the shells are brought to Tokio for the pearl they afford. No trace of the large species, *Haliotis gigantea* or of the smaller species, *Haliotis Gruneri*, has as yet been met with in the Mounds.

A race of fishermen accustomed to venture far in their boats would certainly have left some trace of these species in their refuse piles.

In conclusion it may be said that a pronounced change has taken place in the molluscan fauna of the Bay of Yedo since the Omori deposits were made. The extinction of certain forms within comparatively recent times might be accounted for in considering the upheaval of the water basin, and the consequent narrowing of the Bay and shoaling of the waters, but the profound changes which have taken place in the size and contour of certain species demands time.

There are but few units of time that can be used to measure the interval required to effect such changes. One of two hundred and thirty years has presented itself to me in the removal of a portion of the Suruga-dai canal embankment. This canal was dug through Suruga-dai two hundred and thirty years ago. The earth was piled up in immense embankments on each side of the canal.

Recently at Misaki Cho, near the Suido Bashi, a portion of this embankment was removed in the construction of a new street. In the removal of this earth, a deposit of shells was exposed presumably as old as the embankment, which rested upon it.

The deposit was composed of the following species. *Placuanomia* sp, *Ostrea denslamellosa*, *Ostrea* sp., *Cytherea meretrix*, *Cyclina Chinensis*, *Mactra veneri-*

formis, Arca subcrenata, Tapes sp. *Rapana bezoar, Turbo spinosus, Turbo granulatus, and Lampania multiformis.*

The shells bore the marks of age, having that peculiar yellowish and chalky color and characteristic appearance of the nacreous portion, generally seen in shells long buried in the ground.

Not a single fragment of ancient pottery was found. On the contrary, fragments of tiles and a few pieces of glazed pottery and porcelain of Owari and Kioto, were met with.

The two species of *Ostrea* formed the bulk of the deposit.

Specimens of *Cyclina Chinensis* were very large. A single small specimen only of *Turbo granulatus* was met with. Special search, however, was made for *Purpura luteostoma* and particularly for *Arca granosa*, but no trace of either was found. *Arca inflata* had the same narrow hinge area that the species presents to-day. In fact no appreciable change has taken place between the species living two hundred and thirty years ago, and their descendants which live at the present time.

Another deposit of shells, somewhat old, judging from the appearance of the shells, was examined near Kameido, and no trace of *Arca granosa* was found-nor trace of pottery.

The occurrence of *Arca granosa*, in this region at least, may be looked upon as an evidence of the presence of ancient cord marked pottery.

* * *

EXPLANATION OF PLATES.

PLATE I.

Note. All figures drawn half size unless otherwise mentioned.

Fig. 1. 5 to 7 mm. in thickness, hight 242 mm., diameter across mouth 268 mm. Black above, reddish below, bottom with matting impression. 1^a top view of rim, natural size. 1^b section of rim, natural size. 1^c front view of rim, natural size.

Fig. 2. Margin 12 mm. thick, side 7 mm. thick, diameter of mouth, 100 mm. Black, bottom slightly concave and smooth. Design repeated four times. Inside of vessel stained with *ferric oxide.*

Fig. 3. 8 mm. thick Below, 5 mm. thick near rim, hight 200 mm., largest diameter 177 mm. Blackish, mouth triangular in shape. 3^a top view of rim, natural size.

Fig. 4. Wall 5 mm. thick, diameter of rim 150 mm. Black.

Fig. 5. Body 9 mm. thick, bottom 12 mm. thick, handle 10 mm. thick. Hight from bottom to top of handle 147 mm. Light Brick red, Handles grooved, and loops perforated for passage of cord.
Clay nearly dry before ornamenting.

Fig. 6. 7 mm. thick at margin, 4 mm. below, diameter 120 mm. Black, bottom flat.

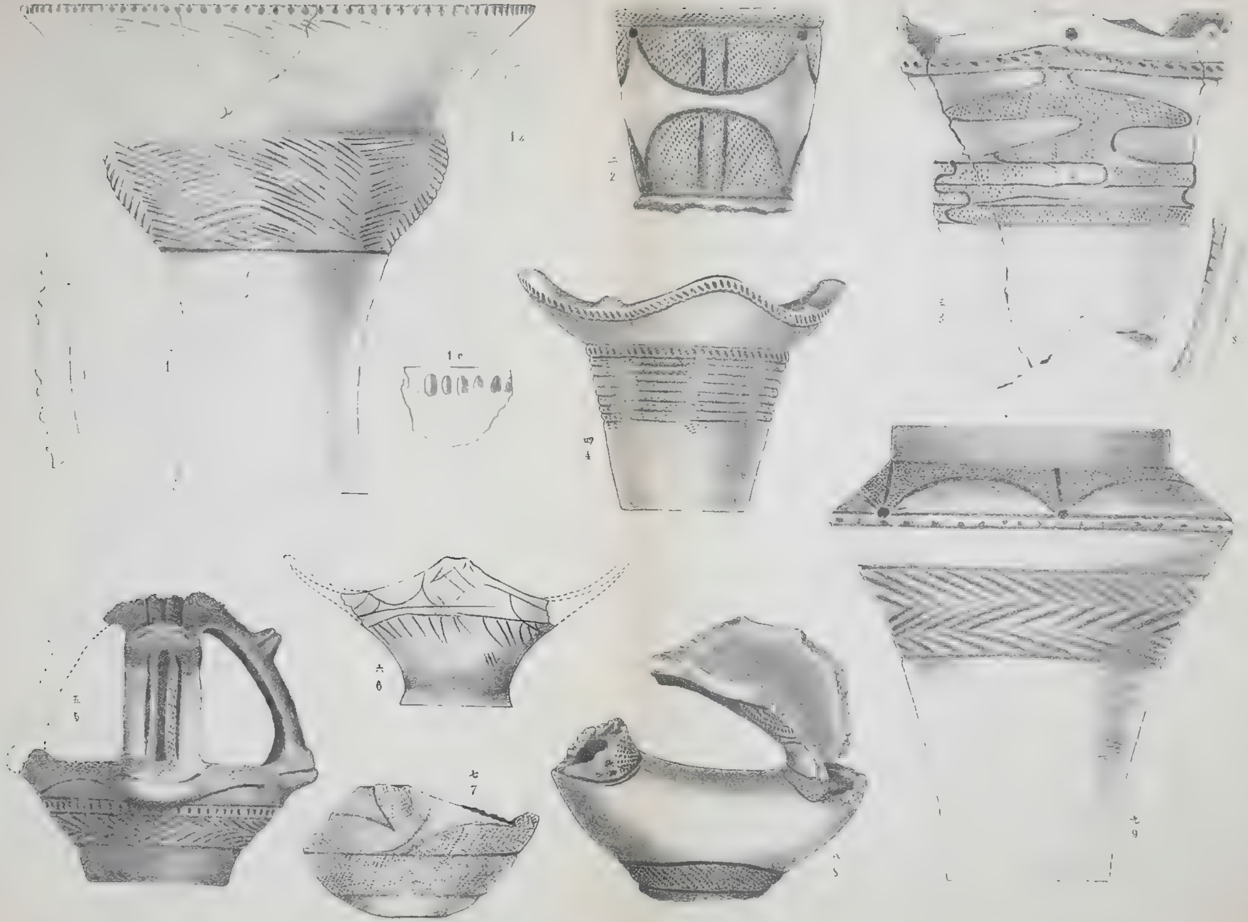
Fig. 7. 5 mm. thick, diameter 140 mm., bottom depressed, smooth areas depressed. Above first band of cord marks painted with *mercury sulphide.* Cord marked areas black, bottom smooth, olive brown color. Inside of vessel rough clay washed. Length 150 mm., hight 125 mm., breadth 71 mm.

Fig. 8. Varying from 5 to 13 mm. in thickness, black outside, bottom massive, greatly depressed, very roughly and coarsely made.

Fig. 9. Rim 6 mm. thick, body 5 mm. thick, mouth 144 mm. in diameter. Reddish, with signs of use over fire.
Many rims of vessels similar to this were found, one fragment showing a diameter of the perfect vessel of 354 mm.

大森介墟古物編　第一板

PLATE I



SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

PLATE II.

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Note. All figures drawn haf size unless otherwise mentioned.

Fig. 1. Bottom 4 to 7 mm. thick, bulge 3 to 4 mm., rim 7 mm. Black, rudely made.

Fig. 2. Restored from large fragment, bottom 10 mm., rim 4 mm., diameter 165 mm. Blackish.

Fig. 3. Bottom 7 mm. thick, margin 4 to 5 mm., diameter 120 mm. Clay colored, made of fine clay and very light.

Fig. 4. *One quarter natural size*, rim 9 mm., below 5 mm. Black.

Fig. 5. 5 mm. thick, diameter 60 mm. Light brick red, bottom with mat impression. Very nicely made.

Fig. 6. 6 mm. thick, red with black stains.

Fig. 7. Rim 5 mm. thick, body 7 mm., black. Bottom with mat impression. Incrusted within, like paint.

Fig. 8. Rim 4 mm. thick, bottom 10 mm. Black.

Fig. 9. 5 mm. thick, black with traces of red.

Fig. 10. 8 mm. thick, diameter 124 mm. Black, smooth, bottom with mat impression. The bottom has not been accurately represented by the lithographer.

Fig. 11. 6 mm. thick, diameter 190 mm. Dark colored bisquit, black within and without. Shining. This is the finest made vessel in the whole collection. It will be observed that the design on the bottom is repeated four times, while the rim has five undulations. A similar feature will be seen in the vessel figured on this plate, Fig. 1.

Fig. 12. Wall 5 mm. thick, bottom 8 mm., diameter 260 mm., red below, black above, smooth within.

大森介墟古物編 第二板

PLATE II


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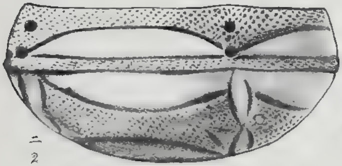
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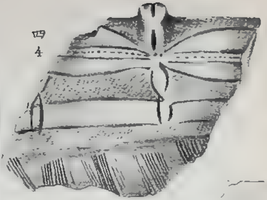
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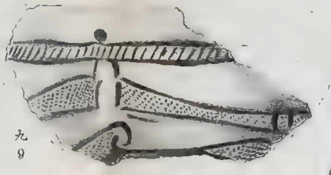
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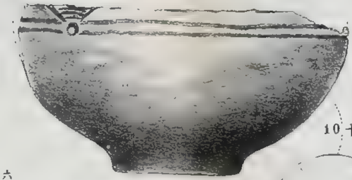

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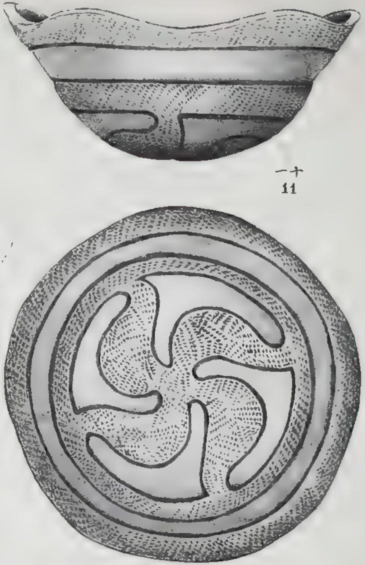
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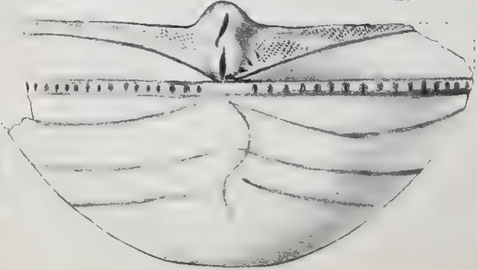
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SHELL MOUNDS of OMORI NEAR TOKIO, JAPAN.

PLATE III.

Note. All figures drawn half size unless otherwise mentioned.

Fig. 1. 5 mm. thick, diameter 100 mm., nearly black, smooth inside.
Fig. 2. 4 mm. thick, blackish, dry scratched.
Fig. 3. Margin 7 mm. thick, black, flat bottom, rough finish inside.
Fig. 4. Bottom 7 mm. thick, diameter 144 mm. thick, black.
Fig. 5. Upper edge 7 mm. thick, very coarse clay, roughly made, thickly painted with *mercury sulphide.* Dotted lines indicate contours of inside and bottom.
Fig. 6. 5 mm. thick, black. Restored from large fragment.
Fig. 7. 5 mm. thick, diameters across mouth 137 and 150 mm. Black, bottom flat, groove on inside of rim, faint mat impression on bottom, very uneven in shape.
Fig. 8. 4 mm. thick on side, light reddish, smooth finish within.
Fig. 9. 10 mm. thick, black, smooth inside.
Fig. 10. Lower edge 5 mm., thick, blackish.
Fig. 11. 7 to 10 mm. thick, clay colored.
Fig. 12. 6 mm. thick, diameter 160 mm.
Fig. 13. 6 to 8 mm. thick, slate color.
Fig. 14. 5 mm. thick near rim, diameter 177 mm., black, bottom rough.
Fig. 15. 5 mm. thick, light reddish colored, hight 77 mm., upper margin roughly rounded, lower rim broken, bottom flat.
Fig. 16. 8 mm. thick, diameter 154 mm., clay colored, unevenly made. Dotted lines indicate contours of inside and base.

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PLATE III

SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

PLATE IV.

Note. All figures drawn half size unless otherwise mentioned.

Fig. 1. 7 mm. thick, black with reddish tinge, bands finger squeezed and put on after pot was shaped.

Fig. 2. 4 mm. thick, nearly black, smooth inside.

Fig. 3. 5 mm. thick, rim thicker, reddish.

Fig. 4. 6 mm. thick, reddish.

Fig. 5. *One quarter natural size.* 7 mm. thick, black. Inside are fine parallel lines, two to a millimeter; these are partially obliterated by a vertical smoothing motion of some implement.

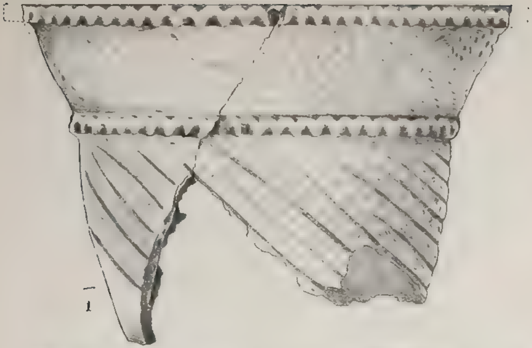
Fig. 6. 7 mm. thick, dark red, smooth.

Fig. 7. *One quarter natural size.* 6 mm. thick, clay colored.

Fig. 8. 5 mm. thick, margin thicker and grooved above. Diameter of vessel about 190 mm. Central design repeated eight times round, reddish, smooth. Numbers of fragments of this vessel were found.

Fig. 9. 6 mm. thick, reddish, diameter about 200 mm.

Fig. 10. *One quarter natural size.* 8 mm. thick, diameter of vessel 245 mm. Black, coarsely made.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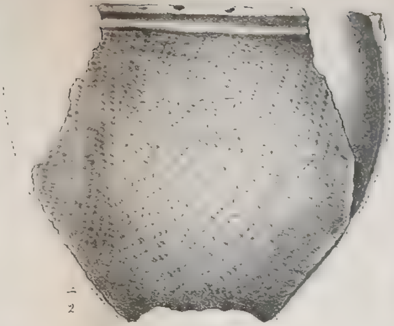
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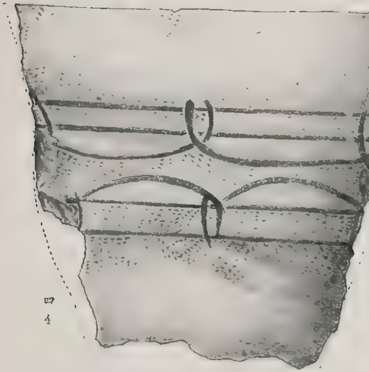
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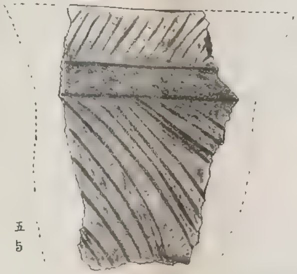
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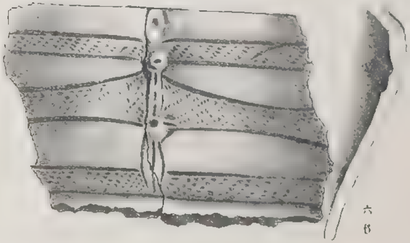
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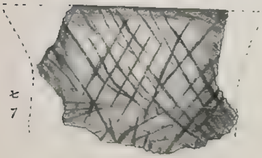
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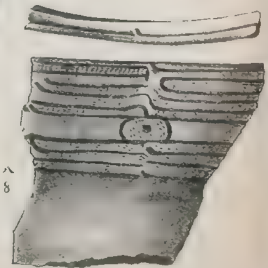
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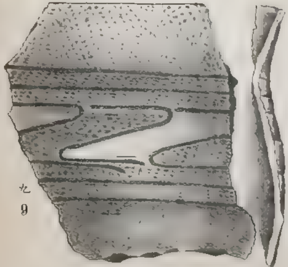
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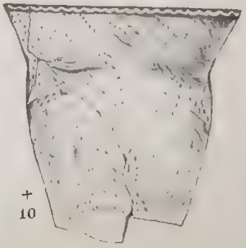
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SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

PLATE V.

Note. All figures drawn half size unless otherwise mentioned.

Fig. 1. The broken portions of pots of this nature are the most common forms in the mounds. Varying from 5 to 10 mm. in thickness. Nearly half show the mat impression, and these impressions show a variety in the mode of braiding the mat. The color of the fragments are generally reddish.

Fig. 2. 3 mm. thick, black, very delicate walls and very fine mat impression.

Fig. 3. 10 mm. thick, light reddish. This specimen has had its fractured edge ground down, probably for the purpose of utilizing it as a cup.

Fig. 4. 7 mm. thick, black, with areas of brick red, bowl shaped bottom within.

Fig. 5. 6 mm. thick, black with areas of brick red, smooth bottom, rough inside.

Fig. 6. Light clay colored.

Fig. 7. 7 mm. thick, black.

Fig. 8. 6 mm. thick, black.

Fig. 9. Above 10 mm. thick, below 7 mm. thick, black. One groove inside twenty millmeters below rim and parallel to it.

Fig. 10. Rim 10 mm. thick, lower edge of fragment 5 mm. thick, reddish colored, rough surface.

Fig. 11. 8 mm. thick, hight 140 mm. thick, rim with five rude knobs around periphery; roughly made. A few rounded pebbles mixed with bisquit; burnt mud color.

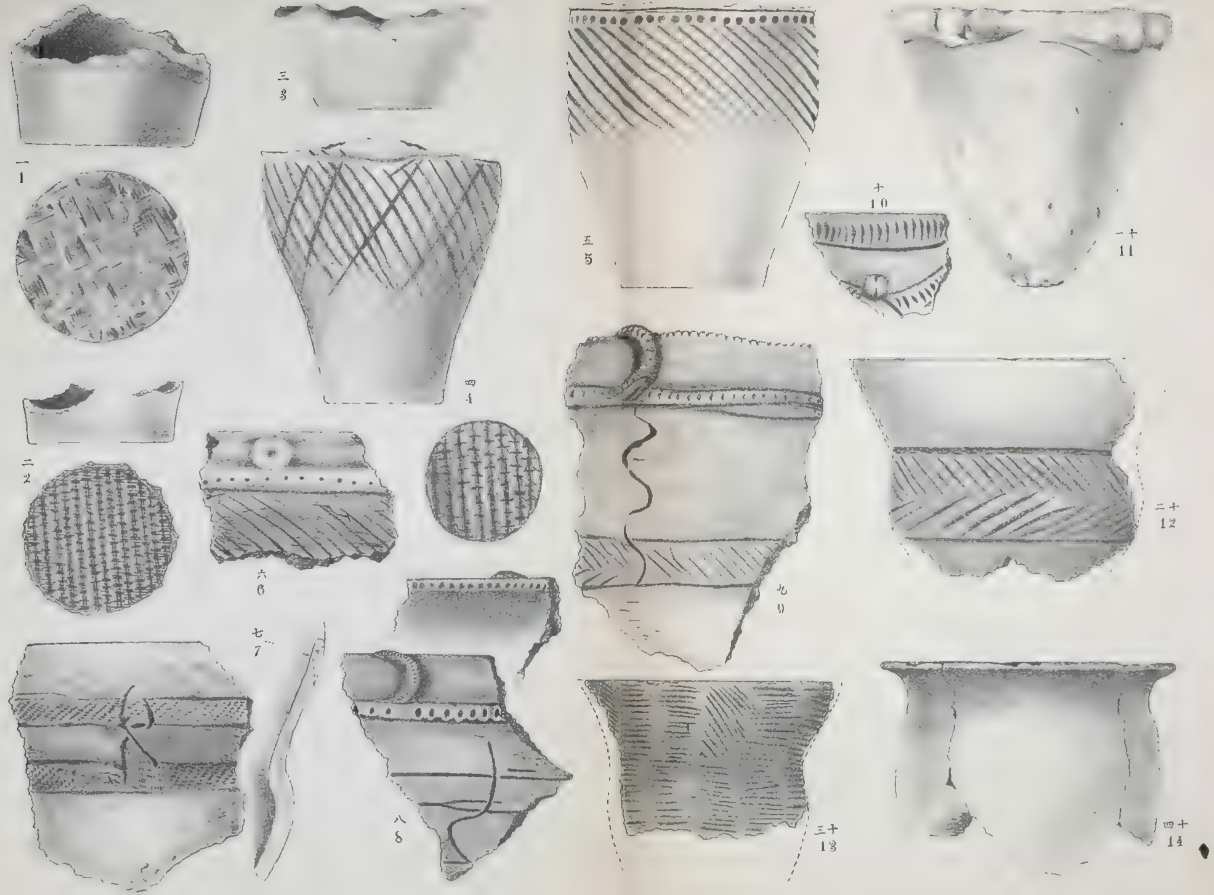
Fig. 12. 5 to 6 mm. thick, light brick red, well made.

Fig. 13. *One quarter natural size.* 5 mm. thick, black.

Fig. 14 4 to 5 mm. thick, 155 mm. in diameter, light brick red.

大森介墟古物編　第五板

PLATE V



SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

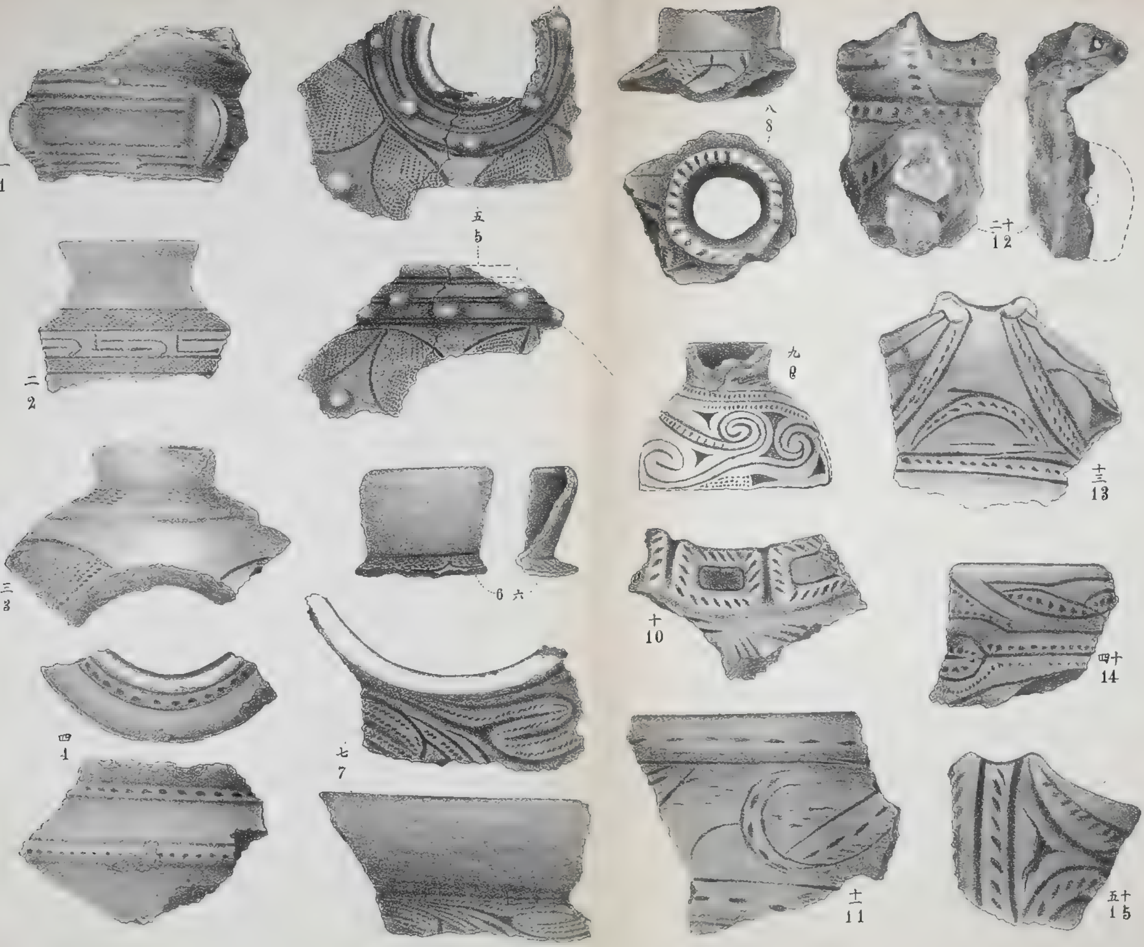
PLATE VI.

Note. All figures drawn half size unless otherwise mentioned.

Fig. 1. *Natural size.* 4 to 5 mm. thick, black, outside polished, inside rough.
Fig. 2. 6 mm. thick, light brick red, neck joined to body in making.
Fig. 3. *Natural size.* 8 mm. thick, black.
Fig. 4. 7 mm. thick, reddish black. Rim put on spirally, and very roughly joined inside.
Fig. 5. 3 mm. thick near margin, 8 mm. thick below, black, with here and there spots of *mercury sulphide* ; rough inside.
Fig. 6. 5 mm. thick, blackish red, smooth inside.
Fig. 7. Rim 9 mm. thick, body 7 mm. thick, light reddish, neck nearly at right angle with body, dry carving.
Fig. 8. *Natural size.* 5 mm. thick, red clay, black surface with spots of *mercury sulphide* ; dry carving.
Fig. 9. 5 mm. thick, light brick red, rough within, dry carving.
Fig. 10. Body 6 mm. thick, broad rim thickened, black.
Fig. 11. Rim 11 mm. thick, body 7 mm. thick, light brick red, dry carving. Evidently not used.
Fig. 12. *Natural size.* 8 mm. thick, thickly painted with *mercury sulphide* outside, and inside to bottom of rim, neck put on separately, and roughly joined ; dotted line shows where loop had been.
Fig. 13. Rim 8 mm. thick, body 6 mm. thick, clay colored, red inside, dry carving.
Fig. 14. 6 mm. thick, light clay colored and blackish in spots, dry carving.
Fig. 15. 6 to 7 mm. thick, very light clay colored, dry carving.

大森介墟古物編　第六板

PLATE VI



SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

PLATE VII.

Note. All figures drawn half size unless otherwise mentioned.

All the specimens figured on this plate have wreaths of clay put on in bands, and ornamented with finger squeezings, the impression of finger nails and papillæ of the flesh being plainly visible.

Fig. 1. 9 mm. thick, reddish, lines made with groove pointed stick, or possibly the end of a hollow reed or bone. Hole at side made for mending, the hole being commenced in two places.

Fig. 2. 7 mm. thick, black.

Fig. 3. 8 mm. thick, nail marks plainly seen.

Fig. 4. 9 mm. thick, groove within just below rim, very coarsely made.

Fig. 5. 6 mm. thick, reddish, deep groove within, below rim.

Fig. 6. 10 mm. thick, very coarsely made, rough inside.

Fig. 7. 7 mm. thick, reddish.

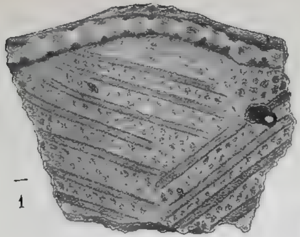
Fig. 8. 8 mm. thick, light clay color, deep groove within, below rim.

Fig. 9. 9 mm. thick, reddish.

Fig. 10. 7 mm. thick, reddish.

Fig. 11. *One quarter natural size.* 6 mm. thick, reddish, rough.

第七板　　大森介墟古物編　　**PLATE VII**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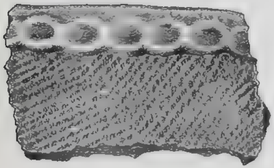
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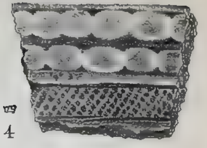
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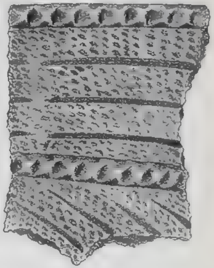
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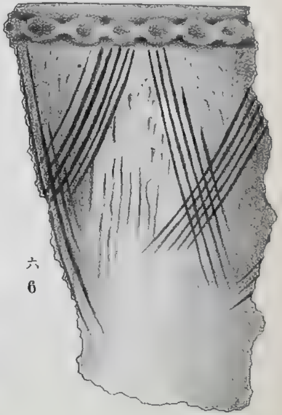
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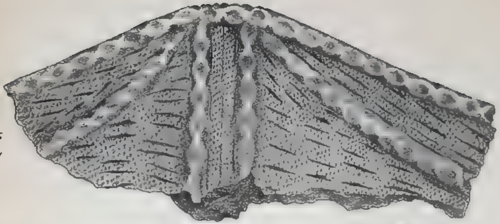
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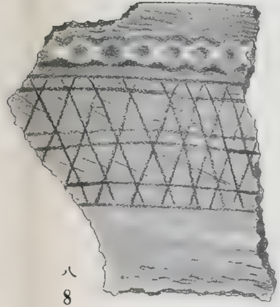
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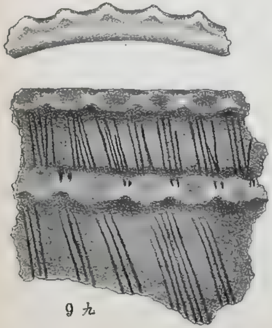
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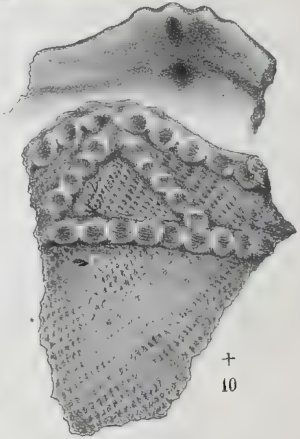
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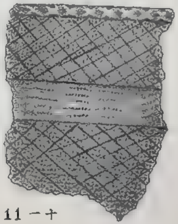
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SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

PLATE VIII.

Note. All figures drawn half size unless otherwise mentioned.

Fig. 1. 5 mm. thick, black.
Fig. 2. 5 mm. thick, reddish black, groove within 28 mm. below margin.
Fig. 3. 4 mm. thick, black.
Fig. 4. 6 mm. thick, black, notches in rim pressed down while clay was yet soft.
Fig. 5. 7 mm. thick, black.
Fig. 6. 7 mm. thick, black, notches cut while clay was soft and then rounded down.
Fig. 7. 6 mm. thick, black.
Fig. 8. 6 mm. thick, groove within below rim.
Fig. 9. 6 to 7 mm. thick, reddish, rough.
Fig. 10. 6 mm. thick, black.
Fig. 11. 6 mm. thick, black.
Fig. 12. 6 mm. thick, reddish, grooves and punctures inside as shown in upper figure.
Fig. 13. 5 mm. thick, black within, reddish.
Fig. 14. *Natural size.* 5 mm. thick, reddish.
Fig. 15. 8 mm. thick, reddish. Figs. 13, 14 and 15 have the inner surface ornamented. Fragments of this nature were of rare occurrence in the deposits. The fragments indicated shallow bowls or plates of smooth and delicate finish. Fig. 15 was rough on the outside but the finish within was of extreme delicacy.

It will be observed that in Figures 12 and 15 the upper figures represent the inner surface, while in Figures 13 and 14 the lower figures represent the inner surface.

大森介墟古物編 第八板 PLATE VIII

SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

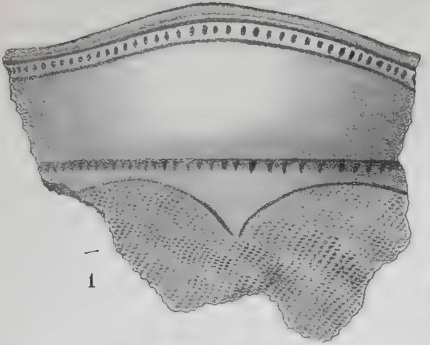
PLATE IX.

Note. All figures drawn half size unless otherwise mentioned.

Fig. 1. 7 mm. thick, black, rim flaring.
Fig. 2. 7 mm. thick above, 5 mm. below, black.
Fig. 3. 8 mm. thick, black.
Fig. 4. 6 mm. thick, black.
Fig. 5. 6 mm. thick, black, flaring rim, cooking vessel.
Fig. 6. 5 mm. thick, red, flaring rim.
Fig. 7. *One quarter natural size.* 6 mm. thick, flaring rim outside, bright red with black discolorations from uneven baking. Inside bright red. Never used.
Fig. 8. *One quarter natural size.* Rim 7 mm. thick, body 6 mm. thick, reddish, smooth within.
Fig. 9. 4 to 5 mm. thick, black throughout.
Fig. 10. 6 mm. thick, black. Cooking vessel.
Fig. 11. 8 mm. thick, dark clay. Evidently fragment of shallow flat bottomed basin.
Fig. 12. 7 mm. thick, black, deep groove within below rim.
Fig. 13. 6 mm. thick, black.
Fig. 14. 4 mm. thick, rim thicker, black, roughly made. Cooking vessel.
Fig. 15. 7 mm. thick, black. Most if not all of these are cooking vessels. Those designated as such, have charred remains of food encrusted within.

大森介墟古物編　第九板

PLATE IX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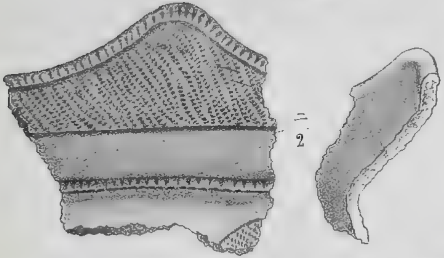
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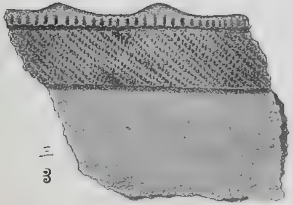
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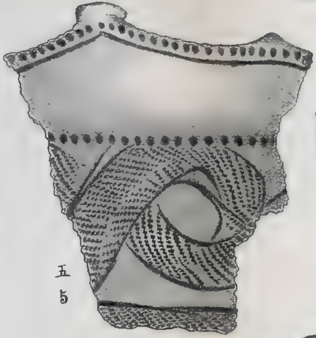
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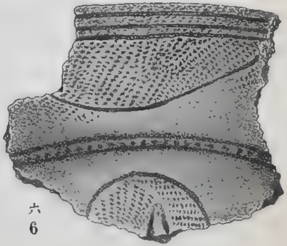
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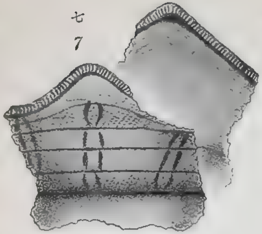
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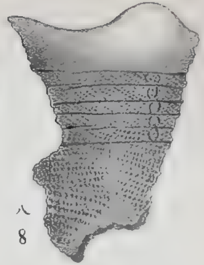
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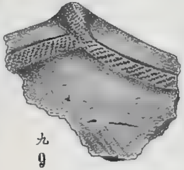
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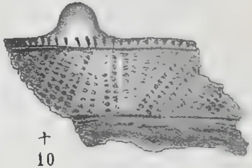
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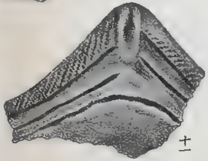
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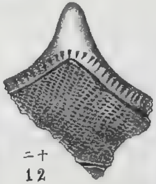
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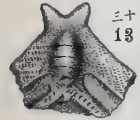
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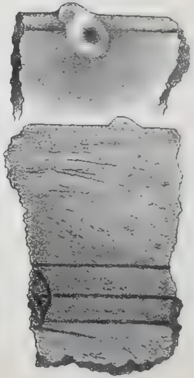
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SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

PLATE X.

Note. All figures drawn half size unless otherwise mentioned.

Fig. 1. 5. mm. thick, black, outside rough, inside smooth. A series of grooves within.

Fig. 2. 10 mm. thick above, 8 mm. thick below, reddish, very coarsely made.

Fig. 3. 3 mm. thick, black.

Fig. 4. 10 mm. thick, black, very coarsely made.

Fig. 5. 7 mm. thick, reddish black, very smooth. This vessel is unlike anything else found in the deposits, and may be of a different age.

Fig. 6. Thinner portion 10 mm. thick. Possibly the base, or else a projecting knob from the side of some vessel. Clay color, very rough, finger marks within.

Fig. 7. 4 to 6 mm. thick, black, lines deeply and sharply incised.

Fig. 8. 6 mm. thick, clay colored, very irregular in shape.

Fig. 9. 6 to 7 mm. thick, black.

Fig. 10. 5 to 6 mm. thick, reddish, dry carved.

Fig. 11. 4 mm. thick, black throughout.

Fig. 12. *Natural size.* 5 mm. thick, black, painted with *mercury sulphide*, hole in nozzle straight, 7 mm. in diameter throughout.

Fig. 13. 8 mm. thick, black, hole in nozzle 7 mm. in diameter at tip, dilating toward vessel, where it is 14 mm. in diameter.

Fig. 14. *Natural size.* 8 mm. thick, black. Hole 12 mm. in diameter at both ends and perfectly straight. Within are seen oblique spiral lines, showing that the nozzle was made round a stick and the stick was afterwards withdrawn with a spiral motion.

Fig. 15. 5 to 6 mm. in diameter, red, hole 11 mm. in diameter, irregular in size, nozzle rudely made.

Fig. 16. Coarse reddish baked clay, roughly made. Probably a spindle whorl.

第十板　　大森介墟古物編　　PLATE X

SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

PLATE XI.

Note. All figures drawn half size unless otherwise mentioned.

The following measurements refer to the body wall and not to the thickened knob.

Fig. 1. 7 mm. thick, black, rim thin.
Fig. 2. 6 mm. thick, black, rough.
Fig. 3. 10 mm. thick, brick red, three grooves diverging within.
Fig. 4. 8 mm. thick, black, rim sharp, incurving.
Fig. 5. 5 mm. thick, black. Two semilunar grooves within.
Fig. 6. 6 mm. thick, brick red, delicately made.
Fig. 7. 5 mm. thick, blackish.
Fig. 8. 5 mm. thick, black, corresponding circular depression within.
Fig. 9. 5 mm. thick, black. Broad flat rim, incurving edge.
Fig. 10. 5 mm. thick, black, deep circular depression within, incurving rim.
Fig. 11. 7 mm. thick, light brick red.
Fig. 12. 5 mm. thick, black.
Fig. 13. 7 mm. thick, blackish red, incurving rim.
Fig. 14. 9 mm. thick, bright red inside, dull red without, incurving rim.
Fig. 15. 6 mm. thick, black, incurving rim.
Fig. 16. 6 mm. thick, black, double groove within, rim thin.
Fig. 17. 7 mm. thick, black, vertical depression within, smaller one near tip.
Fig. 18. 5 mm. thick, reddish and clay color, knob perforated.
Fig. 19. 7 mm. thick, red outside, black within, round depression within.
Fig. 20. 6 mm. thick, black, groove within.
Fig. 21. 8 mm. thick, brick red, knob projecting.
Fig. 22. 6 mm. thick, reddish, incurving rim.
Fig. 23. 4 mm. thick, black, knob perforated; thimble shaped depression above, 21 mm. deep, and 22 mm. in diameter.
Fig. 24. 7 mm. thick, black, rim incurving.
Fig. 25. 7 mm. thick, black, reddish within, knob perforated, incurving rim.
Fig. 26. 5 mm. thick, black, roughly wrought.
Fig. 27. 8 mm. thick, black.
Fig. 28. 6 mm. thick, reddish black, deep groove within, knob perforated.

第十一板　　大森介墟古物編　　PLATE XI

SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

PLATE. XII.

Note. All figures drawn half size unless otherwise mentioned.

Fig. 1. Reddish black, rough and irregular.
Fig. 2. 7 mm. thick, reddish black.
Fig. 3. 7 mm. thick, black.
Fig. 4. 6 mm. thick, black.
Fig. 5. 5 mm. thick, black, deep depression within, corresponding to one outside.
Fig. 6. 7 mm. thick, black, rough.
Fig. 7. 7 mm. thick, black, flaring with rim incurving, double groove within.
Fig. 8. 7 mm. thick, clay black, rough.
Fig. 9. Black, ridged inside, deep circular depression within with border slightly raised.
Fig. 10. 5 to 8 mm. thick, black.
Fig. 11. 5 to 8 mm. thick.
Fig. 12. 5 mm. thick, black, reddish within.
Fig. 13. 7 mm. thick, reddish black, very rough inside.
Fig. 14. 7 mm. thick, black, very rough inside, perforated ear.
Fig. 15. 5 mm. thick, black.
Fig. 16. 4 mm. thick, light brick red, soft clay, minute perforation passing into loop from below at place marked *o*. Figures 4 to 12 are the most common forms in the deposits. Figures 13 to 16 are unique.

第十二板　　大森介墟古物編　　PLATE XII

SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

PLATE XIII.

Note. All figures drawn half size unless otherwise mentioned.

Fig. 1. *Natural size.* 2 mm thick, handle moulded from wall, bent over and welded.

Fig. 2. 7 mm. thick, reddish black, rim slightly flaring, hole made in wall while clay was yet soft.

Fig. 3. 6 mm. thick near rim, 4 mm. thick below, brick red.

Fig. 4. 8 mm. thick, pale red, double groove within 20 mm. below rim.

Fig. 5. 8 mm. thick, dark clay.

Fig. 6. 8 mm. thick, black, smooth within.

Fig. 7. *Natural size.* Black grooves and smooth areas heavily painted with *mercury sulphide.*

Fig. 8. 7 mm. thick, reddish.

Fig. 9. 5 mm. thick, reddish.

Fig. 10. 5 to 7 mm. thick, black, carbonized remains of food encrusted within.

Fig. 11. 5 mm. thick, black.

Fig. 12. 4 mm. thick, black.

Fig. 13. 5 mm. thick, rim 8 mm. thick, black.

Fig. 14. 6 mm. thick, black, rim rounded and thicker.

Fig. 15. 6 mm. thick, nearly black.

Fig. 16. 7 mm. thick, reddish.

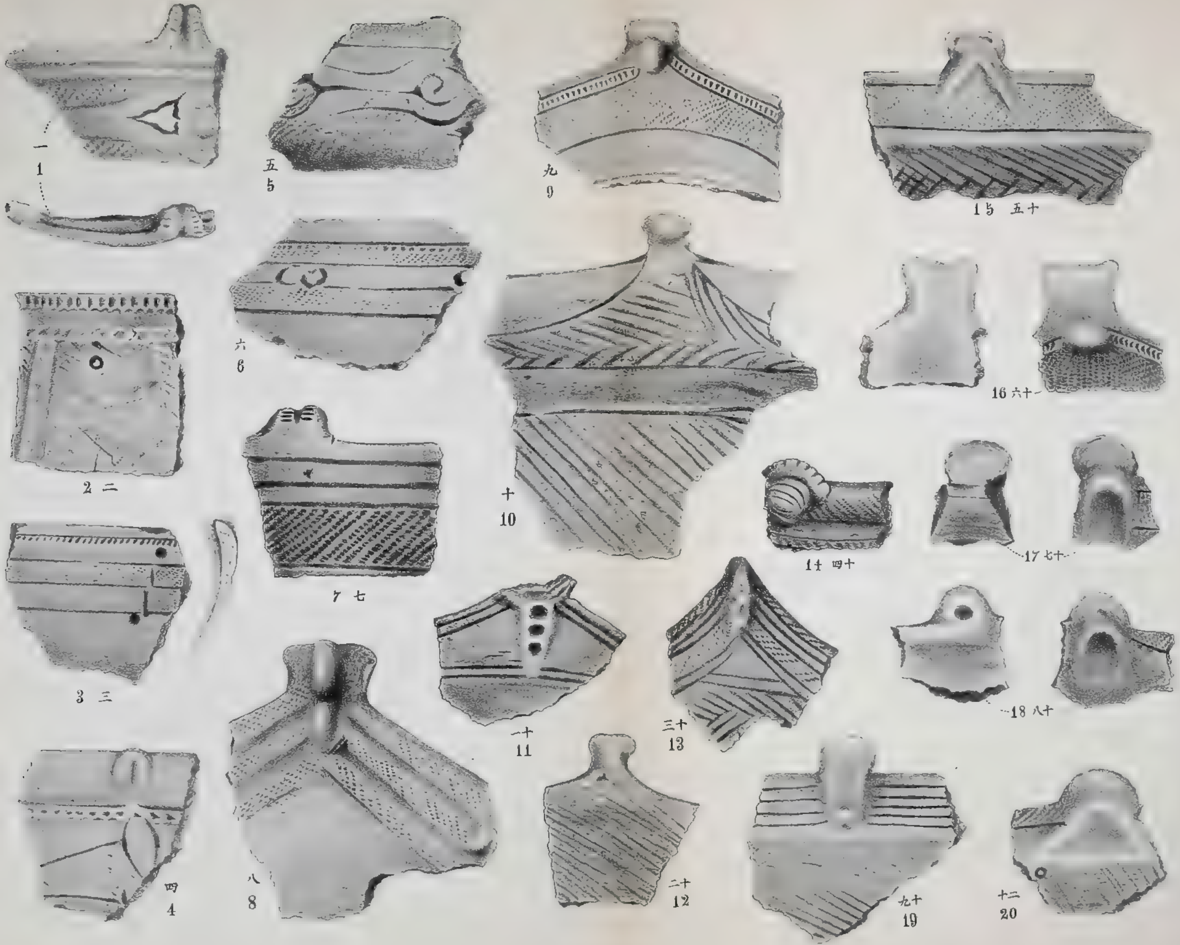
Fig. 17. 9 mm. thick, black. Ears projecting from side of vessel.

Fig. 18. 6 mm. thick, dark reddish.

Fig. 19. 4 mm. thick, rim 8 mm. thick, reddish.

Fig. 20. 5 mm. thick, very light clay. The hole is countersunk from both sides. A first attempt was made too near the fractured edge.

大森介墟古物編



SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

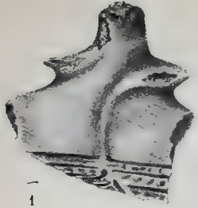
PLATE XIV.

Note: All figures drawn half size unless otherwise mentioned.

Fig. 1. 8 mm. thick, black, knob thick and massive.
Fig. 2. 5 mm. thick, black
Fig. 3. 7 mm. thick, black.
Fig. 4. 7 mm. thick, red ; nicely and squarely finished on rim.
Fig. 5. 6 mm. thick, black.
Fig. 6. 7 mm. thick, black, end of knob continued up, and bent down in making.
Fig. 7. 7 mm. thick, black, nicely finished.
Fig. 8. *One quarter natural size.* 8 mm. thick, black, massive, symetrically finished.
Fig. 9. 6 mm. thick, black, rim flat, 13 mm. in width, very smooth.
Fig. 10. 6 mm. thick, nearly black.
Fig. 11. 12 mm. thick in middle, black and smooth.
Fig. 12. *Natural size.* Fine reddish clay, bottom depressed.
Fig. 13. 8 mm. thick, reddish.
Fig. 14. *Natural size.* Light brick red, very roughly made. On three sides grooved in a similar way. Evidently a handle.
Fig. 15. *Natural size.* 8 mm. thick, reddish inside, black outside. This may be a rim knob of a vessel.
Fig. 16. *Natural size.* 10 mm. thick, black, inside rough. Evidently a handle.
Fig. 17. Light brick red, very coarse. Possibly a rim knob.

It is difficult to suggest the use of the objects represented by Figs. 10, 11, 12 and 15.

第十四板 大森介墟古物編 PLATE XIV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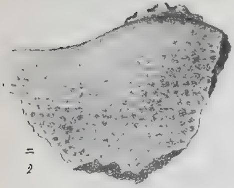
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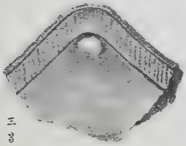
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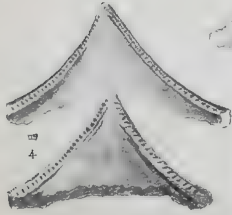
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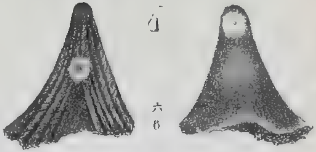
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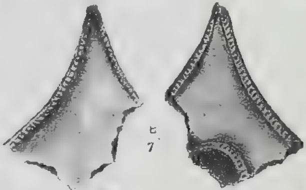
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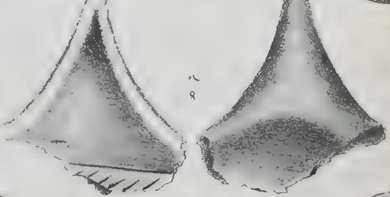
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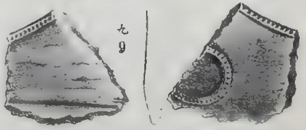
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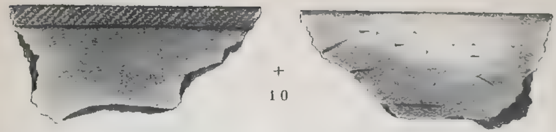
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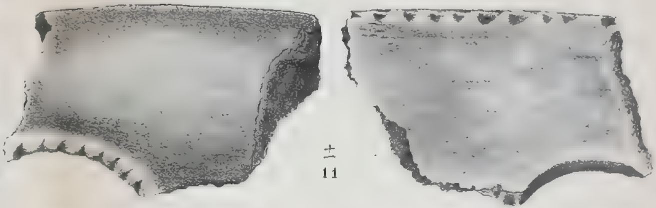
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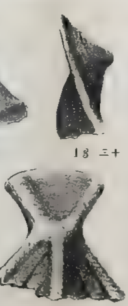
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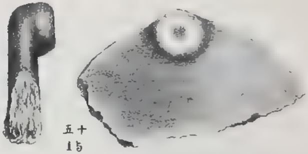
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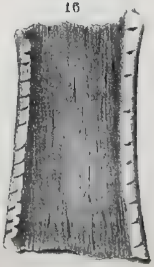
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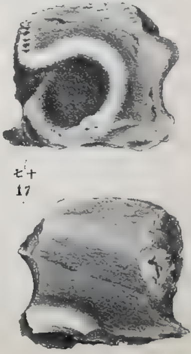
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SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

PLATE XV.

Note. All figures on this plate are drawn natural size.

Fig. 1. Center 18 mm. thick, clay color with a pale reddish tinge. The dark spot in one corner represents a hole which passes through the tablet.

Fig. 2. Light clay color, much worn.

Fig. 3. Bright brick red.

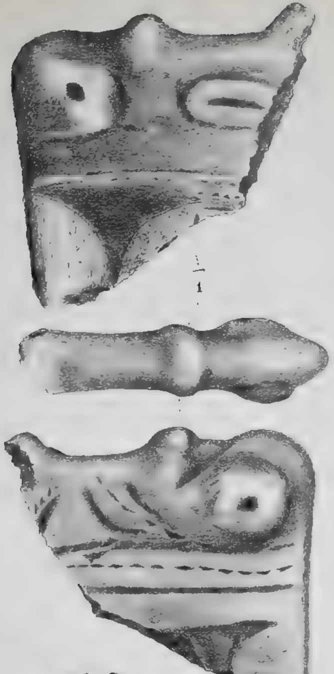
Fig. 4. Clay color, light reddish tinge.

Fig. 5. Light brick red, very much worn.

Fig. 6. Black outside, within clay colored. Central design repeated three times round circumference. Hole straight. $8\frac{1}{2}$ mm. in diameter. Light spiral lines are seen on the walls of the hole showing that it was made on a round stick, and the stick was twisted in the act of withdrawing.

The tablets are made of the finest clay. They are all deeply, wrought and this was done after the clay was dry and before baking.

第十五板 大森介墟古物編 PLATE XV



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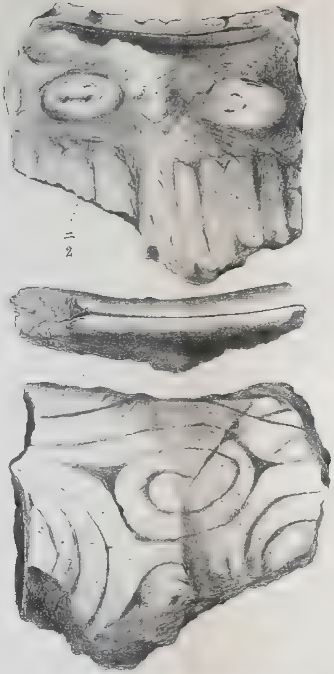

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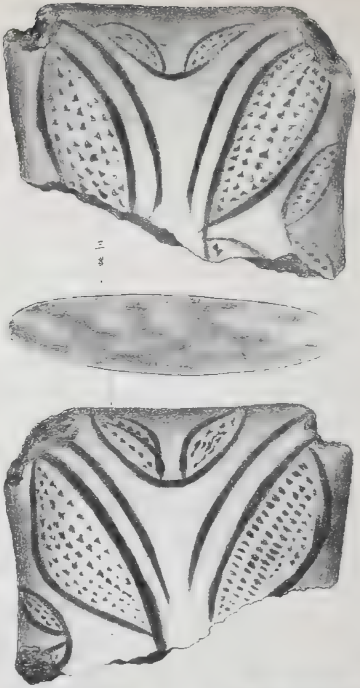

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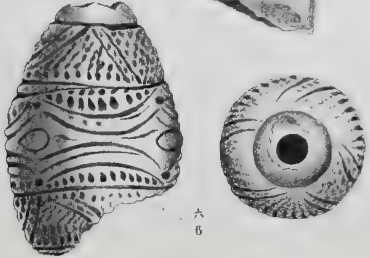

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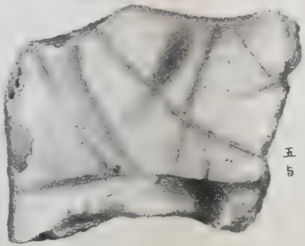

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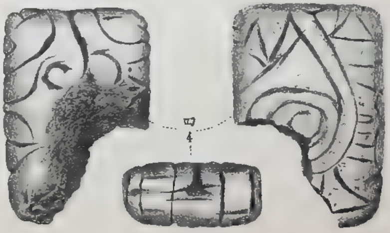

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SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

PLATE XVI.

Note. All figures on this plate are drawn natural size.

Fig. 1. Prong of deer's antler, much worn by use. The detached prongs bearing evidences of much use, are common in the Deposits.

Fig. 2. Portion of deer's antler showing rude cutting.

Fig. 3. Similar to Fig. 1.

Fig. 4. Handle made out of deer's antler. The incisor tooth of a deer is figured as the probable tool for which the handle was intended.

Fig. 5. Fragment of deer's antler cut at both ends.

Fig. 6. Hook made of deer's antler.

Fig. 7 and 8. Bodkins made of deer's antler.

Fig. 9. Fragment of bone with lower edge ground down.

Fig. 10. Arrow point made from the canine tooth of a boar.

Fig. 11. Bird's bone with two perforations.

Fig. 12. Cube made from metatarsal bone of deer.

Fig. 13. Dorsal spine of fish used as a needle.

Fig. 14. Mammalian claw, with lower surface cut away.

Fig. 15. 16, 17, 18, 19 and 20 are implements of various and unknown use, worked from deer's antlers.

Fig. 21, 22, and 23. Dorsal spines of fish used as needles.

第十六板 大森介墟古物編 PLATE XVI

SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

PLATE XVII.

Note. All figures in this plate are drawn natural size.

Fig. 1. Jasper pebble, one side clipped away.
Fig. 2. Jasper pebble, one side clipped away.
Fig. 3. Shistose rock, burnt.
Fig. 4. Clay slate.
Fig. 5. Lava rock.
Fig. 6. Lava rock.
Fig. 7. Talcose slate.
Fig. 8. Lava rock.
Fig. 9. ?

The first two implements are probably hammers, as the lower ends are fractured as if from use. Figs. 3 and 4 are rollers. Figs. 5, 6 and 8 are rude adzes. Fig. 7 represents a portion only of some implement. Fig. 9 is a of a mortar.

第十七板　　大森介 古物編　　PLATE XVII


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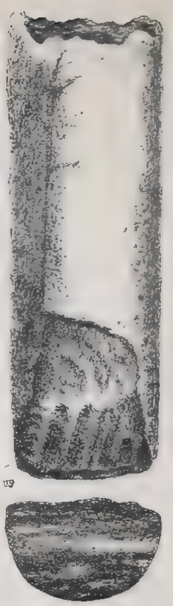
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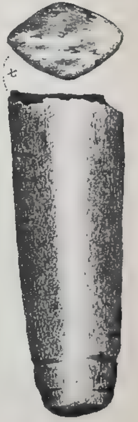
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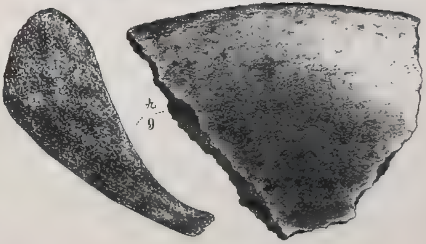
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SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.

PLATE XVIII.

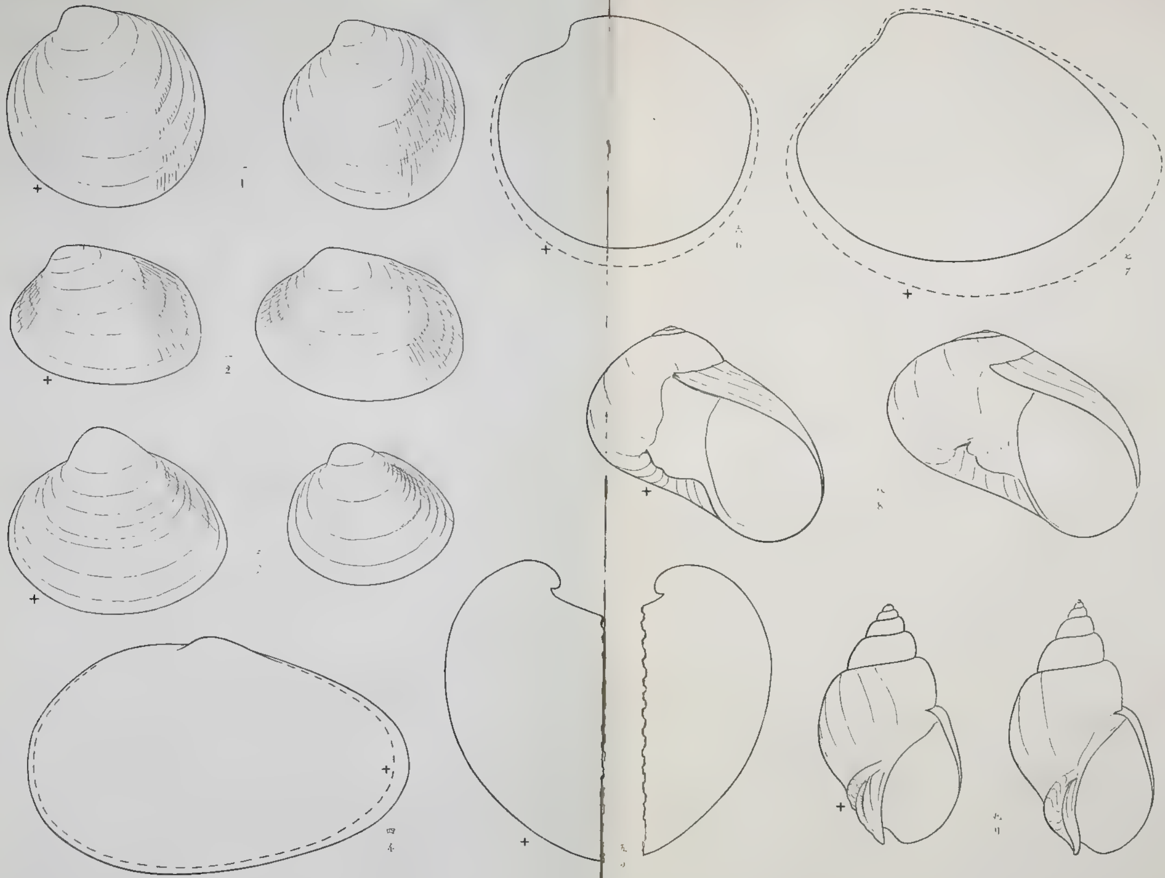
Note. All figures on this plate are drawn natural size.

When two figures occur side by side, the left hand figure represents the ancient form from the Omori Mounds. The right hand figure represents the recent form from the Omori shore.

When an outline and a dotted line occur together, the dotted line represents the ancient form. The figures marked by a cross also indicate the ancient form.

Fig. 1. Cyclina Chinensis Chemnitz.
Fig. 2. Tapes sp.
Fig. 3. Mactra venerformis Deshay.
Fig. 4. Mya arenaria Linné.
Fig. 5. Arca inflata Reeve.
Fig. 6. Dosinia Japonica Lischke.
Fig. 7. Cytherea meretrix Linné.
Fig. 8. Natica Lamarckiana Duclos.
Fig. 9. Eburna Japonica Lischke.

第十八版　　大森介墟古物編　　PLATE XVIII



SHELL MOUNDS OF OMORI NEAR TOKIO, JAPAN.