



FRESH WATER PEARLS, Tennessee.  
*2 Diameters.*



GRAY AND BLACK PEARLS, Lower California.  
*Natural size.*



BLACK PEARLS, Lower California.  
*2 Diameters.*



CLAM PEARLS, Long Island Sound.  
*2 Diameters.*

## 46.—ON PEARLS, AND THE UTILIZATION AND APPLICATION OF THE SHELLS IN WHICH THEY ARE FOUND IN THE ORNAMENTAL ARTS, AS SHOWN AT THE WORLD'S COLUMBIAN EXPOSITION.

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In these pages I have sought to bring together a series of notes from the World's Columbian Exposition, regarding the exhibits of pearls and pearl-bearing shells to be seen there, and the various ways in which these beautiful materials have been or may be employed in jewelry proper and in other of the decorative arts, such as inlaying, cameo work, and the like. With these are included some notes upon the use of pearls by the mound-builders of prehistoric America.

Before proceeding to describe any of these exhibits in detail, it may be well to take a general view of the subject of pearls and pearl shells.

The term pearly is applied strictly only to those shells that are iridescent or nacreous. These are of several families, especially the *Aviculidæ*, to which belongs the true pearl oyster, *Meleagrina*, in its several varieties mentioned further on, and the *Unionidæ*, or fresh-water mussels, found in all countries of the globe, but especially abundant in the interior river system of North America. These two latter groups furnish the greater part of the pearls of commerce while most of the mother-of-pearl is from the shells of the first-named family. Other pearly shells, more or less employed for ornamental work, are the *Nautilus*, the *Turbo* family, the *Trigonia*, and particularly the *Haliotis* family, or abalone shells, which furnish the green mother-of-pearl used with such fine effect for inlaying, etc., in connection with the usual white variety.

Other groups of shells also yield pearl-like concretions or are used in the ornamental arts; but not being iridescent or nacreous, they are not properly pearly, and their beauty is that of color effects simply. Such are in particular the large marine univalves commonly known as conchs. Of these, the pink conch of the West Indies, *Strombus gigas*, is used to a small extent for cameo work, and largely for the beautiful pink jewelry carved out of pieces of the shell, to form brooches, earrings, etc., and cut into bead forms in imitation of the rose-colored pearl. The cameo-shell proper, or king-conch, *Cassis cornuta*, is of a wholly different family and its white and brown layers afford the finest material for shell cameos. All these and various other colored shells are used also in marble work.

I shall take up the subject of the Columbian exhibits in about the following order: (1) Pearls and pearl jewelry, with further notes upon fresh-water pearls, and also upon ornamental articles of which pearls form a part, as shown in the German section; (2) pearls from the prehistoric mounds of the Mississippi Valley; (3) shell carvings, cameos, and inlayings, in many forms; and lastly, remarks on the Union shells of our

own and other countries, as exhibited at Chicago, and their actual and possible uses for ornamental work.

At the Tiffany Pavilion in the Manufactures Building there was a collection illustrating the occurrence of pearls and the various pearl-bearing shells and mollusks—notably a series of several thousand odd-shaped and curiously-formed pearls, pearl blisters, and hinge pearls, from the Unios of Wisconsin, Texas, Tennessee, and Ohio. In this collection are found round, oval, oblong, and mallet-shaped Unio pearls; two pearls ingrown into one another; pearls consisting of scarcely more than a blister, others formed of a single nacreous layer, with a central arc of clay, and other curious and abnormal growths, of interest to the naturalist, but of little commercial value (see Pl. 31). A silver tea-pot incrustated with fresh water pearls (see Pl. 28). A specimen of the fresh-water mussel *Margaritana margaritifera*, from the Botova River in Bohemia, carefully prepared and injected, showing a pearl in place between the mantle and the shell (see Pl. 41). A series of Unios from the Sugar River, Wisconsin (see Pls. 35 and 36), and from Texas, Tennessee, and Kentucky, remarkably large; a heart-shaped pearl, very nearly an inch in length (see Pl. 31), from the true pearl oyster of Ceylon, interesting as being hollow throughout. (This type has been frequently observed, notably in a collection of this kind presented by Mr. M. Lowensten to the Imperial School of Mines at St. Petersburg.) A pearl oyster was shown with a parasitic fish, *Fierasfer*, from Lower California (see Pl. 32); a pair of pearl-oyster shells remarkable for their size, weighing 151.35 ounces (see Pl. 37), from the west coast of Australia; a pearl-oyster shell from Tahiti, having attached to it three forms of coral, one of them a group 8 inches in height and 8 inches in width; the mollusk had lived, notwithstanding this great burden, although one of the corals at the side had very nearly suffocated it by closing the shell of the animal at the time when it was captured (see Pl. 29). A shell found on the coast of New Guinea had on it a cup-shaped coral over 8 inches in diameter and 6 inches in height. (For a series of similar specimens, see Pl. 30.)

There are also other examples where pearls are imbedded in the shells themselves, and some (see Pl. 34) where pearls had been imbedded and dropped out; also abnormally large growths in the shell (see Pl. 33), some of them more than an inch in diameter and an inch in height. These forms are frequently cut over and used as baroque pearls. Another form is a curious inclusion at the point of the shell, where the muscles are attached to the valves. This has the appearance (see Pl. 33) of the eyes and mouth of an ape's head. A small piece of the true mother-of-pearl shell two-fifths of an inch in length, which broke while undergoing the operation of being made into a button, revealing a small inclosed crab (see Pl. 32) immediately below the blister; a collection of pearl blisters assuming imitative shapes; and a large pearl-oyster showing the perforations of some marine borer which the mollusk has covered (see Pl. 39).

Other exhibits in this series were a group of four pearls united in a heart-shaped form (Pl. 31, E); several hundred pearls from the abalone shell, *Haliotis rufescens*, from the Gulf of California; a collection of various species of *Haliotis*, one containing an immense interior growth resembling a camel's head (see Pl. 38), due to some external injury (measuring  $2\frac{1}{2}$  by 2 inches); a collection of fine pearls from the large pink conch of the Bahamas, *Strombus gigas*, varying from deep pink to almost pure white, one of the pearls measuring nearly an inch in length; one small conch pearl and the shell in which it was found, from the coast of Florida; pearls from the Unios of Weymouth, Nova

Scotia; seven of the pearls from the original find made in 1856 at Notch Brook, near Paterson, N. J. (these were from the collection of Prof. D. S. Martin, of New York, where they had been since a short time after the discovery); a small quantity of pearls taken from the altar of the Turner group of mounds, Little Miami Valley, Ohio (these were from the original find of Prof. F. W. Putnam, who obtained several bushels of them, resembling strikingly those found by Warren K. Moorehead at points to be noted further on); a round white pearl, measuring four-fifths of an inch in diameter, from the giant oyster, *Ostrea singaporica*; about thirty pearls varying from white to pink, brown, purple, and almost a deep black, from the common clam, *Venus mercenaria*, from Long Island Sound and Chesapeake Bay; eight pearls from the common oyster, *Ostrea virginica*, from Long Island Sound and the Connecticut coast, one of them over half an inch in diameter and remarkable for its resemblance to the human eye; also the shell and pearls of *Venus fluctifraga*, San Diego, Cal., and *Pachyderma crassatelloides*, and shells and pearls of *Trigonia pectinata*, from Australia.

The most remarkable exhibit of pearl jewelry that was ever seen in this country is that in the four necklaces displayed by Messrs. Tiffany & Co., which for their purity of color, fine orient, even form, and careful selection are unsurpassed—notably a necklace of 3 strands consisting of 159 pearls, weighing 2,038 grains, and a single strand of 44 pearls, weighing 946½ grains; these strands represent \$100,000 each. Possibly more remarkable still for their great size were the strand of 38 pearls, weighing 1,064 grains, valued at \$200,000, and the one of 52 pearls, weighing 1,145½ grains, valued at \$80,000.

A remarkable illustration of the delicate manner in which pearls can be set is a watch case so thickly incrustated with Tennessee pearls that scarcely any mounting is visible.

Two great French jewelers had very interesting displays; the first, Vever, had several fine necklaces of pearls, notably one 5-strand necklace, valued at about \$100,000, and some very large single pearls and various others; the second, Boucheron, had two magnificent black-pearl earrings, weighing about 80 grains each, and several strands of fine white pearls of very large size.

In the French section were also some very fine exhibits of imitation pearls, notably that of Rutan, who had many strings, etc., of them. Constant Vales, of Paris, imitated the necklace of black and white pearls that belonged to the Empress Josephine and the 5-strand necklace of the Princess of Wales. Passeau-Feil, of Paris, had many imitations of both black and white pearls, notably a new kind produced by coating beads made of true mother-of-pearl shell with silver, giving them almost the same specific gravity and the silver simulating the luster of the gray pearl.

Schurman, of Frankfort, in the German section, exhibited a fairly good drop pearl of 105 grains; a remarkable Nautilus shell, mounted in a silver goblet; an ivory figure holding a mother-of-pearl shell; some pearl earrings, of from 25 to 40 grains each, and a quaint brooch, containing a pink, a yellow, a gray, a dark-gray, and a black pearl. Messrs. C. Heitel and Sohn, Hanau, showed a marvelous display of large oriental pearls of great size and fanciful forms. These were baroque pearls, artistically mounted, forming the principal features of figures, paperweights, brooches, pins, coupes, vases, cups, etc., as described hereafter (see Plate 19). Among these was a group of historical and other figures of fine artistic finish and original design, made in the style of those of Dinglinger in the Green Vaults at Dresden. The mounting of the figures is

in sterling silver, partly gilded and enameled, all on marble or lapis-lazuli bases, with the exception of the first two, which had bases of sterling silver gilt. Some of these were—

A negro king, with white waistcoat formed of a monstrous oriental pearl of good white color, 37 mm.  $\times$  29 mm, somewhat pointed on the upper part issuing from the neck and ornamented with 3 rose diamonds; the coat is of blue and yellow enamel, ornamented with 6 more rose diamonds and *en cabochon* rubies. The lower part of the negro's body and head are formed by one large baroque pearl, with the arms and legs of variously colored enamel.

A negress, with bust of one enormous pearl of 20  $\times$  17 mm., narrowing toward the waist, valued at \$145.

A dancing girl, the upper part of whose body is formed by a black pearl 25  $\times$  10 mm. The figure stands on a slab of rose onyx resting on a base which is richly ornamented with gold, silver and enamel.

Mercury, after Giovanni di Bologna. The body and upper parts of the legs of this figure are formed of an oriental baroque pearl, 24  $\times$  24 mm., going all around the body. One foot stands on a rock, an oriental pearl 22  $\times$  17 mm., and this again rests on a jeweled stone pedestal.

Don Quixote, Falstaff, a monk, and a hall porter, conceived in artistic mountings, rivaling in delicate workmanship the prototypes of Dinglinger, and not inferior in skilled technical execution.

A goblet with boar's head; the latter, at the end of the horn-shaped goblet, is an oriental pearl of extraordinary dimensions, being over 45 mm. in length and width.

A paperweight; an amourette riding on a dolphin, formed of an oriental pearl 65 mm. in length and 45 mm. in width, pointed at its end.

A sheet of water formed by a very flat pearl 65 mm. in length and 50 mm. in breadth.

Other fanciful conceits, all unique in form, as brooches, dogs' heads, spiders, beetles, pigs, ducks, pheasants, peacocks, etc., the special feature always an irregular pearl. These mounted objects ranged in value from \$135 to \$1,700.

The firm of Michel Piscione, in the Italian section, had a quantity of the small shells of *Trigonia pectinata* mounted in brooches, as single valves or two single valves together, generally with a fresh-water pearl set in them; and in the Japanese building was a collection of pearls from the abalone shell and various other shells and shell work.

The great family of fossil shells known as the ammonites, and their allies, which are very closely related to the modern pearly Nautilus, were, like the latter, highly nacreous, and in many cases retain this feature very beautifully in their present fossilized state. If the outer layers have been removed by partial decomposition, the pearly layers are exposed as is done artificially by means of acids in "cleaning" Nautilus shells for ornament. Some of the ammonites and baculites of the Cretaceous deposits of Dakota and elsewhere are gorgeous and glowing in their nacreous coloring, in some cases resembling masses of opal, and more rich than any other pearly material known. Specimens of these are not uncommon in geological collections, and some fine examples were shown in the South Dakota State building at the World's Fair.

In this connection may be mentioned some remarkable specimens of *lumachelle* (fire marble) from Bleiberg, Carinthia. One of the finest examples of this beautiful marble was that in the National Museum collection in the Government building; one of the finest-worked specimens was an eighteenth century snuff-box in the Tiffany

Pavilion. This rare and elegant material, nearly all found during the latter part of the eighteenth century, is a limestone filled with fossilized shells, in which the colors have become so splendidly intensified that it is frequently difficult to decide at a glance whether a cut specimen is a fire opal from Mexico or *lumachelle* marble.

Pearls were used in large quantities by the prehistoric tribes of America, and have been found in great numbers in the tumuli of the Scioto and Miami valleys in Ohio. Prof. F. W. Putnam, of the Peabody Museum, Cambridge, Mass., and Mr. Warren K. Moorehead, of Xenia, Ohio, have made extensive explorations in these mounds, some of the results of which were shown at the World's Fair. The former had investigated particularly the Turner group of mounds in the Little Miami Valley, the latter the Hopewell group in Ross County, near Chillicothe, on the North Fork of Paint Creek.

In the Anthropological building was shown the great "find" of pearls made by Mr. Moorehead in the Effigy mound of the Hopewell group. Here more than a gallon of pearls was obtained with two skeletons. They ranged from the size of a small millet-seed to a diameter of two-thirds of an inch, or even more. In shape they were usually irregular, though many were round or nearly so; but the absence of the elongated and hinge pearls is remarkable. All have been drilled, with holes varying from 1 to fully 3 mm. in diameter, but generally the larger size, made with a heated copper wire, in the manner described by early travelers as common among the Indians. This drilling was undoubtedly for the purpose of attaching them to clothing or belts, as shown by the fact that four or five hundred had been originally sewed upon a rough cloth shirt extending from the waist to the knees of a skeleton. Copper plates on the hips had preserved traces of the cloth, and several dozen beads were found with cloth fiber still extending through the perforation. Pearls were usually placed at the wrists, on the ankles, around the neck, or in the mouth. In the Porter mounds at Frankfort, Ross County, several hundred were on copper plates. Nearly all, however, are found loose, although some are imbedded in a hard, rock-like mass of clay, cemented either by a calcareous solution from the weathering of the pearls or by an iron oxide produced by the decomposition of the meteoric iron ornaments that were found in such quantities in the Hopewell group of mounds. These, like all the pearls found in mounds in the Ohio and adjacent valleys, were undoubtedly from the Unios, which were evidently very plentiful at the time these were collected. Very few of the pearls have retained any of the original orient, although it is possible that by peeling them some good unaltered pearl surfaces could be obtained; but it is more likely that either heat or burial in the ground, where they have undoubtedly lain for centuries, has destroyed them by infiltration of surface waters through the earth in which they were imbedded.

In the explorations in which Mr. Moorehead has been engaged, he has found over forty bear's teeth in which pearls had been set, lying near skeletons. The settings were in the side or near the base (root) of the tooth. Skeletons accompanied by a large number of pearls always have other relics associated with them, such as native copper articles, mica, obsidian, galena, hematite, ocean shells, bad-land fossils, and other foreign objects. This fact would indicate clearly that the remains thus distinguished must have been those of prominent persons.

From the altars or "hearths" in mounds have been taken thousands of spherical pearls. For instance, at the Turner group in the Little Miami Valley, Prof. Putnam, exploring for the Peabody Museum, secured half a bushel, nearly every one blackened

by heat, some cracked, and all impaired in luster. Mr. Moorehead took from two hearths upward of 100,000 pearls.

In an altar, or "hearth," of the Effigy mound were found a number of bears' teeth and several quarts of pearls, many of which had several successive layers flaked off. Some of these pearls measured two-thirds of an inch in diameter. In this remarkable altar were found hundreds of obsidian knives and spears, of exquisite workmanship, measuring from a few inches up to 8 inches in length. With these were several hundred earrings made of native copper coated with meteoric iron.

From their manner of occurrence in connection with the skeletons, the archæologist is led to see that the use of pearls, although so many are found, was confined to a few individuals.

A remarkable fact in this connection is that pearls have never been found in isolated mounds, nor out of the great mound groups. The hill mounds, the villages of the small streams, and the tumuli of northern Ohio have yielded none. They seem to have been used by the more cultured tribes, and are an evidence of extensive trade and barter.

It is of interest to archæologists to note further that they are not found in any quantity outside of the Miami and Scioto valleys, and that they invariably were kept in large and prosperous communities; that the pearls were deposited with the remains of persons held in especial distinction; while the enormous numbers found indicate that the yield of Unio pearls must have been far greater in the remote past than it has been at any time since the whites have occupied the country.

From Taylor's mound, Oregonia, Warren County, Ohio, there were four Unio shells in which a hole two-thirds of an inch in diameter has been drilled, either for the purpose of extracting a piece of the shell to make a bead from, or else to allow the shell to be used as an ornament. From this same mound were shown decorated disks made of Unio shells, and a long Unio from which the corner nearest the lip has been either ground down or cut off, evidently to adapt it for use as a scraper or a tool of some kind.

In the Ayer collection from Alaska was a large cloak of buckskin decorated with about one hundred pendants of abalone shell (*Haliotis kamchatkana*), the exterior of the shells being almost a brick red, the interior showing a brilliant iridescence of green, red, and yellow, the combined colors making a pleasing contrast with the dark-brown buckskin. The pieces are pear-shaped or elongated, frequently with a square lower end, occasionally having a notched edge, and varying in length from 1 to 4 inches.

One of the most striking objects in this collection was an ornament made of walrus bone, beautifully inlaid with green abalone shell. The shape is that of a capital letter H, laid down horizontally, the sides being concave and curving gracefully. The length is about 5 inches and the breadth  $1\frac{1}{4}$  inches at the middle and nearly 2 inches at the ends. The whole is adorned with elaborate inlays of abalone, oval, semioval, ring-shaped, etc., producing a delightful combination of color in contrast to the yellowish-white bone.

The decoration of various wooden dishes, bowls, boxes, and chests with pieces of abalone shell, is striking. Many of these are remarkably beautiful; and when it is considered that they were used as household utensils, one can not but admit that these savage tribes possess more natural artistic taste than nine-tenths of our American people. They also used circular pendants, either plain or with serrated edges, and in

several instances engraved with a human eye, the outlines being filled in with a red mineral color. Abalone or *Haliotis* shell is also skillfully used in the decoration of their horn spoons, the handles, quaintly-carved, being inlaid with abalone and *Unio* shell.

In the Emmons and Terry collections in the anthropological gallery of the American Museum of Natural History, at New York, are some remarkable specimens of pearl work from the aboriginal tribes of Northwest America. Among these may be noted some of the grotesque masks of the shamans, or medicine men, of the tribes of British Columbia, in which the face is surrounded with large inlaid pieces of *Haliotis* (abalone) shell. Another exhibit shows the whole process of making pearl fishhooks, among some of the Pacific coast Indians. Pearly shells are cut into rude disks of about 2 inches diameter; these are then perforated and the perforation gradually enlarged until the disk is reduced to a flattish oval ring; this ring is then cut through on one side, and worked into the shape of a letter C, and the completed hook is soon attained. Another consists of several hundred ring-shaped and discoid pieces of pearl, averaging from 1 to 2 inches across, which were found together in a grave in California. These are further drilled with small holes on opposite edges, evidently for sewing them to a garment, doubtless a splendid pearl-covered mantle worn by some distinguished person and buried with his remains.

The South American exhibits presented many interesting uses of pearly shells, both for inlaying and in various forms of personal adornment. Both these modes of application seem to have been carried very far among some of the native tribes of this continent, as indicated by the articles here described, nearly all of which are now in the Field Columbian Museum.

In the Amazon basin the *Unio* family is well developed, but is largely represented by two genera not found elsewhere, *Castalia* and *Hyria*. These are characteristic South American types, and while differing from the *Unios* and *Anodons* of North America and the Old World, are equally suitable for ornamental uses, from their pearly character. Probably many of the objects here described were made from these shells.

In the Paraguay collection were a number of necklaces made of oblong squares of *Unio* shell, connected by means of a fiber drawn through two drilled holes at the upper end, while the lower ends are decorated with three small circular drillings which do not entirely perforate the shell. Another necklace consisted of small joints of hollow reed or bamboo, about an inch in length, between which were blue-glass beads, and pendent from each of these a small brilliant *Unio* shell, pure white, with a slight iridescence, and remarkably beautiful. Still another necklace was made entirely of *Unio* shells, not very iridescent, with the dark-brown epidermis remaining on the exterior. Internally the drilling was either near one of the ends or toward the center of the shell. These were strung by a thin vegetable fiber so as to hang pendent about 3 inches from the fiber necklace, and were evidently intended to serve for a rattle or noise-producing ornament. In the same exhibit were a large number of pendants, consisting of small pieces or large sections of *Unio* shells, beautifully iridescent, varying in form from oval to disk-shaped, and in length from 1 to 4 inches. In another necklace *Unios* were strung indiscriminately with hoofs of some small animal.

The use of shells as ornaments is very pronounced among these people. In addition to those mentioned, Bullas and land shells were strung in a similar manner. These were white, gray, yellow, frequently with pink-tinted tips. An

interesting necklace consisted of operculums, 2 inches in length, of some large shell, attached by a fiber decorated with yellow feathers.

From Peru, life-size models of the Zaperos and Jiveros Indians, residing on the Montaña of Peru, were shown fully attired with their ornaments. These tribes decorate their headdresses, shoulder bands, and breasts with a profusion of circular, diamond-shaped, and pear-shaped pieces of a brilliant Anodon shell. These they arrange to form stars and other patterns, by sewing a number of them to the fabric, generally by means of perforations, and frequently have them swinging as pendants from the dress. They also use small Unio shells, the wing-cases of beetles, white and red dried seeds, teeth of animals, etc.

A woven necklace on which are sewed square sections of some fresh-water shells, and hanging from it oblong pendants; also three shells of the Spondylus, a pendant ornament, the red color of the latter shell adding a very striking feature.

From Peru, was shown an immense mother-of-pearl casket measuring 30 inches in length, 17 inches in width, and 18 inches in height, ornamented with large silver clasps and handles, and decorated with scrolls filled with a black pitchy substance, probably asphalt, Spanish work dating from the sixteenth and seventeenth centuries.

In the collection made by Dr. O. Finsch, of Hamburg, Germany, from the islands of the Pacific, are a number of shell articles, naturally much used among a people whose choice of materials is so limited and whose life is so much upon the sea and beach. Among these may be mentioned: Fishhooks and scrapers of mother-of-pearl, from the Caroline Islands; armlets from cross sections of *Trochus* shells, from New Britain; similar armlets from New Guinea, decorated on the exterior with characteristic carvings; also nose ornaments, tassels for earrings, etc. The nose rings were in shape long-elliptical, about 3 inches by  $\frac{3}{4}$  of an inch, with a piece cut out from the middle of one side, about  $\frac{1}{2}$  inch in length. This interrupted ring could then be put on the lower part of the nose, and would remain there by clasping it, much as we attach our spring eyeglasses above. Some of them were carved and some plain.

Another New Guinea ornament was a sort of plate or gorget, oval in form and about 3 inches by 2, perforated at the middle of one side, to be suspended and worn. This was cut so thin as to be almost transparent.

A somewhat similar mother-of-pearl gorget, from New Britain, about the same size, has the form of a semi-ellipse, with the upper edge cut somewhat concave, so as to give the whole a lunate shape. At the middle of the concave side are two drilled holes near together, to suspend it.

In the Orient articles of personal adornment made of shell have been used and valued among the East Indians time out of mind; particularly, bracelets made from large univalves, such as *Turbinella rapa*, have been regarded as indispensable by Hindoo women, and worn as a badge of ceremonial purity by every wife. They are given to the bride by her father at her marriage, and a brief religious form is gone through before putting them on.

In making them, the shell was cut into thin slices, as it were, across the body-whorl of, e. g., a large *Turbinella*, and these were then easily wrought into rings of a suitable size for bracelets. They were then variously ornamented by gilding and

coloring, or attaching beads, etc. Their use, however, is gradually becoming less general. Many varieties are made, distinguished by different native names, and a series was shown in the Indian Department of the International Exhibition at Glasgow, in 1888. The prices are very moderate, ranging from an average of half a rupee to a rupee for a pair.

Fuller references may be found in "The Art Manufactures of India," by T. M. Mukhauji, Calcutta, 1888, p. 265.

#### SHELLWORK AND MOTHER-OF-PEARL IN FURNITURE AND JEWELRY.

Some excellent examples of Damascus inlaid pearl work were those shown by Lockwood DeForest in the Manufactures building (*see* Pl. 23). These consisted of chests, some of which dated from the early part of the century, in which diamond-shaped pieces of mother-of-pearl were set in carved brown wood; also some very fine examples with floral and arabesque designs in mother-of-pearl work. They form a very pleasing contrast when inlaid in the dark-brown wood used throughout the East in making settees, chairs, and other objects of Oriental furniture. These are now regular articles of commerce, and are quite extensively imported into the United States.

Pearl-inlaid musical instruments are not infrequently seen. A number are exhibited in the Metropolitan Museum of Art, New York City, in the Brown and Drexel collections. Among these may be mentioned Turkish and Persian tambouras, etc., inlaid with pearl in dark-brown wood, in the favorite Oriental style—the pearl pieces being mainly lozenge-shaped or in simple geometrical forms. More elaborate patterns are seen in Italian work, particularly in several mandolins of the eighteenth century, in which both bowl and stem are richly inlaid in somewhat peculiar and characteristic forms.

A unique piece of American pearl-work is a mandolin exhibited at the World's Fair, by the makers, Lyon & Healy of Chicago (*see* Pl. 22), which was purchased by the proprietor of the Kimball Opera Comique Company as a present for Corinne. It was entirely covered with inlaid work, four kinds of pearl being employed, of different shades and tints, inlaid in metal. More than 2,000 pieces of the several materials were used, and 255 days' labor expended in making it, in cutting, fitting, and polishing the pieces of pearl. It was valued at \$1,500.

Some years ago there was shown in New York City—probably at the old Crystal Palace exhibition—a piano in which the entire keyboard was of pearl, the body of the keys being of ordinary white mother-of-pearl, and the flats and sharps of green abalone (*Haliotis*), producing an extremely rich and pleasing effect.

One of the most remarkable examples of American pearl inlaying was a grand piano made by Cottier & Company, of New York city, which is a study of the old Spanish method of inlaying mother-of-pearl with tortoise shell and colored woods in a hard wood. Plate 26 represents what is probably the most remarkable example of inlaying of woodwork ever made in the United States. This is only one of a number of pieces, all varying in design, marking, coloring and workmanship, that this leading firm of woodworkers and decorators have produced from time to time.

Another exposition piece—an electrolier designed by Mr. Louis O. Tiffany—is inlaid with flowers, each petal formed by one of the natural segments of the chambers

of the pearly nautilus (*Nautilus pompilius*), while the background is inlaid with bits of abalone shell.

There may also be mentioned a table in the same exhibit, where the flowers, forming part of a decorative border upon the top of the table, are made of pearl-oyster shell.

Some fine specimens of inlaying in furniture were shown in the Italian section by Ferdinando Pogiani, where mother-of-pearl is used in diamond-shaped and hexagonal forms, in the Oriental manner, as well as for entire figures inlaid with ivory and ebony, as a decoration in connection with his fine furniture.

Among many striking applications of pearl-bearing shells to decoration and furniture may be noted, in particular, some shown by the Tiffany Glass and Decorating Company in the Manufactures Building. One of these, a specimen of high art, is an ecclesiastical table. Beneath the edge of the mensa, or top of the altar, which consists of a single slab of Carrara marble, is a design of four circles, each containing one of the Apocalyptic emblems of the four evangelists. On the altar frontal, on either side of the center, are two larger circles, each containing a monogram of the Holy Name imbedded in a background of rosary beads made from the Fiji Island pearl shell. The monogram is further enriched by inlays of gold and precious stones, and made to appear iridescent by the addition of the green Japanese mother-of-pearl (abalone shell). (See Pls. 22 and 24.)

A tabernacle door is beautifully ornamented with several kinds of pearl shell from South Africa and from Terra del Fuego and Japan.

On the walls of the chapel, containing part of the above-named exhibit, the green abalone shells were made to simulate peacock's feathers with wonderful success.

Tiffany & Co. exhibited a very fine piece of work in the dial of a large astronomical clock. This dial measures 20 by 30 inches. The shells are arranged in such a manner as to give sky and sea effects. Inlays of mother-of-pearl shells were also used in elaborate scrolls on some boxes made of shark skin from Long Island Sound and Java, the shark skin being stained green, yellow, and other colors, and polished.

One of the most interesting objects of pearl inlay was a small round earthenware pot in the collection in the Cliff Dwellers' exhibit, immediately west of the Anthropological Building. In this earthen pot, irregular squares of *Unio* shell (fresh-water mussel) have been inlaid in hard clay in regular layers, the clay between the pieces of pearl being about the width of the pieces themselves, and producing the effect of mosaic. This is the only object so decorated that has ever been found.

Pearl-shell has also been utilized in the beautifying of church vestments. Two varieties have been specially used; one form, employed in the decoration of a miter, is peculiarly adapted to the embroiderer's art, as the protuberances on the true pearl oyster, sawn out and pierced, or mounted in a metal border and pierced, can readily be fastened to the embroidery with silk or wire. The other form is beads made from the Fiji Island pearl shell, which have been successfully used in the decoration of a chasuble. The natural surface of the shell is not ground down; only the sides are shaped, thus giving a more pearly appearance than if the whole were polished. In Russia, for centuries, this method of embellishing ecclesiastical garments has been practiced with wonderful success. The treasury of the Metropolitans in the Kremlin at Moscow contains an immense number. These applications seem a curious "reversion" to the Indian pearl-covered mantle referred to previously, as indicated by the cut pieces of mother-of-pearl in the American Museum of Natural History.

Some of the finest known examples of inlaid pearl work are in the canopies of the tombs at Allahabad, India. These date from the sixteenth century, the pearl work being a thin veneer set in black wood, and the ornamentation consisting of elaborate Persian designs.

In the Siamese pavilion were numerous examples of inlays, minute diamond-shaped pieces of abalone shell set in a black, pitch-like lacquer. This is similar to the lacquer work that the same people make, in which they use tiny bits of looking-glass made of remarkably thin glass with a coating of mercury on one side.

In the Chinese section there were some fine specimens of what Jacquemart, in his "Histoire de la Porcelaine Chinoise," describes as *lacque burgandée*, belonging to the reign of Kong Hi, in the seventeenth century, and made in the porcelain works at Ching-te-chew. They consist of an application of black lacquer on a specially prepared unglazed porcelain, the lacquer inlaid with thin flakes of pink and other iridescent colors of mother-of-pearl. Thin leaves of gold and silver are inlaid and introduced as parts of the decoration. Through time the silver has generally become black. This method of inlaying is now carried on at Canton and in Cochin China, forming quite an industry, wooden vessels and dishes being used instead of the unglazed porcelain.

The embellishing of ironwood, teak, and other wood at Canton forms quite an industry, the shell being set in wood in the form of leaves, flowers, and arabesque designs blending with the carved and plain surfaces of the chairs, settees, and other objects in which the shell work is inlaid.

The Japanese have added to the inlaying process the painting of mother-of-pearl work with lacquers. This work dates from the time of Kovin and Ritzui, the greatest artists in this line, who, although they did not create the art, founded quite a school for this style of ornamentation. The abalone shell is used to represent hawthorn or other floral designs, and the lacquer is brought close to the pearl work, the two blending one with the other, and the pearl itself occasionally exquisitely lacquered. Another form of ornamentation consists in inlaying, into the lacquer, squares of mother-of-pearl, so minute as to form an unbroken iridescence; also microscopic petal-like bits arranged as flowers in transparent lacquers. Beautiful examples of such Japanese work, in various styles, may be seen at the Metropolitan Museum of Art in New York City. In the Moore collection, for instance, is a casket with butterflies in abalone on gold lacquer; another with leaves and flowers in mother-of-pearl, also on gold lacquer; and some small pieces so closely inlaid with pearl that nothing else appears, and the most exquisite effects are produced by the different kinds employed, the ground being a sort of mosaic of the brightest green abalone, and the patterns inlaid in rich pinkish and lilac-tinted mother-of-pearl.

As so little has appeared in the United States concerning the utilization of pearl shells of any kind in lacquer or similar industries, the following notes\* from the works of Prof. J. J. Rein, of the University of Berlin, and Prof. Christopher Dresser possess great interest:

*Ao-gai-nuri* or *ao-gai-togi-dashi*, mother-of-pearl lacquer, in which the coarsely or finely pulverized mother-of-pearl from varieties of *Trochus* and of *Haliotis* is used. If whole surfaces are to be evenly adorned, the process is like that in which metal powder is employed. If, on the contrary, definitely outlined decorations are intended,

\* See also article on "Lacquer," by Russell Sturgis, in Johnson's Universal Encyclopædia, vol. iv, New York, 1894.

stencil patterns of tin foil are pasted on the surface of the groundwork, and the open spaces are coated with rô-iro-urushi, and then sprinkled with ao-gai or mother-of-pearl powder. When dry the patterns are removed, and the whole is coated with a mixture of rô-iro and se-shime-urushi, and then the strewn mother-of-pearl is carefully rubbed with magnolia charcoal. A second coat of the same lacquer varnish follows, then a second rubbing, and finally the polishing. The same course is pursued in the simpler work of strewing the whole surface evenly with mother-of-pearl powder. The beautiful green and violet iridescence of small mother-of-pearl pieces on the lacquer wares decorated with it depends on its varying position toward the light and the uneven coating of the transparent lacquer varnish.

*Shari-nashi-ji*, i. e. *tin (dust) pearl ground*.—The tin dust (or bronze powder instead) is strewn with a little sieve, evenly or in stripes and figures, on the moist coat of naka-nuri and when dry covered with a coat of se-shime. With this it takes a brown color, like the scattered powder of a precious metal. The gold ground becomes lighter yellow and more lustrous with age, the scattered tin or bronze dust on the contrary grows darker and duller, as may be easily observed in many of the common Japanese lacquer wares. It is to be understood that the strewing of metal powder does not finish the work, but that a coat of transparent lacquer and the polishing process must follow.

*Simple lacquer wares, ornamented with inlaid work*.—I rank this group next to the preceding, because its execution, although demanding some skill, does not, any more than the foregoing, necessitate a real artistic talent. The precious metals also are either not at all, or only exceptionally, employed in this. The inlaid mother-of-pearl work, ao-gai-zaiku, as cabinets, boxes, dishes, etc., which are brought in such numbers to Europe and made chiefly at Nagasaki, belong principally to this class. It is customary to incrust even the finest lacquer wares with mother-of-pearl, ivory, and precious metals, and to form from them reliefs of flowers and other natural objects.

This branch of lacquer industry is already old, as articles in the Dutch, Dresden, and other collections testify. The common ao-gai comes from the inside of the shell of the *Haliotis*, each shell yielding only one thin plate. The finer or ma-gai ao-gai, i. e., ao-gai imitation, is the product of the large *Trochus*, and comes principally from the Riu-kiu islands. Both kinds (in *Trochus*, the last convolution) are scaled off in thin, transparent sheets, in a painstaking, primitive way.

The mother-of-pearl sheets are laid on the design, which is pricked through with India ink and brush. The colors (Prussian blue, gamboge, and a mixture of the two for green, also sienna, carmine, carthamine, etc.) are rubbed together with hot glue water and laid on with the brush according to the pattern, on the right places in the mother-of-pearl. When dry, the painted portions are covered with silver foil laid on with glue water and again dried. Then the mother-of-pearl is cut with a sharp chisel into the shapes designated on its opposite side (leaves, flowers, etc.), with their corresponding transparent colors. These are glued on the dull groundwork of vases, plates, cabinets, etc., and all the depressed intervals filled up with black lacquer. Then the whole surface, including the inlaid work, is covered with two coats of transparent varnish, and if necessary rubbed with charcoal and polished. The underlying silver foil is used to protect the colors on the under side of the mother-of-pearl from the lacquer, and to bring them out more clearly; but this is done only in the more valuable articles. Instead of mother-of-pearl, an inlay of tin is sometimes used, which is treated, of course, differently, and then never loses its color and polish.

*Ao-gai-zaïku, mother-of-pearl work.*—Pearls and mother-of-pearl consist of thin laminae of carbonate of lime with a little organic substance. But while they are found in concentric layers in the pearls, in the latter the laminae follow the direction or trend of the shell, yet in such a way that even in flat mussel and snail shells they lie somewhat inclined to the surface. The luster proceeds from the reflection of light and the iridescence or play of color from the interference of the rays reflected from the projecting edges of the thin laminae or blades and the somewhat deeper parts. (The color change or iridescence of mother-of-pearl, consequently, is a phenomenon of interference which inheres in the structure, and is analogous to the colors of diffraction spectra produced by ruling very fine lines upon glass plates, etc.)

Furniture inlaid with mother-of-pearl is very popular in Turkey and throughout the entire Orient, but particularly in farther India and China. In Japan it is used mainly for decorating lacquer wares. A product of the country, called *ao-gai* (*awogai*), used in thin sheets, is distinguished by its magnificent iridescence in all the colors of the rainbow, and is obtained mainly from the smooth inside of the larger varieties of ear shell (*Haliotis japonica* Reeve, *H. gigantea* Chemn.), called *awabi*. A still more valuable sort goes by the name of *ao-gai-magai*, *i. e.*, imitation *ao-gai*. It is formed of laminae scarcely 3 centimeters broad, and is said to come from the Riu-kiu islands, from a kind of *Nautilus*. The shell of the *Sazaye* (*Turbo cornutus* Chemn.) also yields mother-of-pearl.

The polishing of the mother-of-pearl, as observed in Nagasaki, is not scientifically conducted, since there is no facilitation of the work such as is afforded by the heavy grindstone, revolving vertically on its axis. The thick, curved outer edge of the *Haliotis* shell is first removed up to the row of holes, by means of pincers, hammer, and chisel; then the remaining part is ground on a fine-grained grindstone, sprinkled with water, till only a thin transparent lamina remains. It is a very wearisome work, and one man can polish only eighteen pieces a day. Each sheet costs from 2 to 6 *sen*, according to size and fineness. These thin sheets or plates, as well as the mother-of-pearl dust of various degrees of fineness, obtained from the waste, are now used by the *ao-gai-shi*, or mother-of-pearl workmen, for decorating lacquer wares.

The inlaying of pearl in lacquer\* is effected almost exactly as we inlay our papier-mache work, the process differing only in detail. The pieces of pearl from which the parts to be inlaid are cut are very thin, and can be used like tracing paper. Before a work of this kind is begun, a drawing of the pattern is made on a sheet of paper; this drawing is transferred to the box or tray upon which the pattern is to be wrought. Little sheets of pearl are now placed over those parts which are to appear in this lustrous material; the forms covered by the sheets of pearl are traced upon them, and then they are removed. With a curious chisel-like knife, the pearl is next cut into the desired shapes, and these are stuck by lacquer in their respective positions. After all are in place, the whole surface is covered with repeated coats of lacquer, by which the pearl is entirely hidden. By grinding, a smooth surface is then secured, and the pearl again appears, but is now level with the general surface. The pattern is again transferred to the surface, having been fitted to the bits of pearl so that they may take their right places.

Besides this *ra-den* or mosaic work with thin sheets of mother-of-pearl, thicker

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\* "Japan," by Prof. Christopher Dresser, page 362.

pieces are ground and engraved as a flower, an egg, or some other design, and made to serve, like ivory, as an inlay in raised gold lacquer work. The making of brooches out of this material, however, and turning buttons and other articles of jewelry on the lathe, are scarcely known.

An enterprising New York firm utilized in a novel way all the available pearl sheets, or leaves, as are termed the paper-like pieces of ear-shell, or *awabi*, as it is called in Japan, where, in preparing the abalone shell for export, they break off the thick edge, or "ear-piece," and reduce the rest almost to the thinness of paper, and then polish. These thin sheets, or leaves, were ingeniously inserted for windows or for sky effects on photographs made on glass, the plates being views of the World's Fair buildings, and were sold in great quantities.

#### SHELL CARVINGS AND COMEO WORK.

Among the most beautiful pearl work may be noted the high-relief cameos carved on mother-of-pearl shells, seen in the Italian section and elsewhere. Here advantage is taken of the difference of tint in the inner and outer portions of the dark variety (Tahitian pearl-shells) to cut cameos, where groups of carved figures 6 inches in diameter in white pearl are raised upon a background of darker pearl, producing a peculiarly elegant effect. Cameo work is also shown on the pink conch of the West Indies (*Strombus gigas*), where deeper and paler shades in the shell afford similar opportunity for relief designs. Some magnificent specimens of carved *Cassis cornuta* (queen conch) were in the exhibit of Rocco Morabito, of Naples, who, among other fine examples, had one immense group of figures on a conch, representing scenes in British history. This required two years' work.

The firm Decaro, of Naples, had many remarkably fine cameos, as well as carved shells representing Columbus, Diana, and Neptune. The firm Santa Maria (Rome and Florence) and Michel Piscione showed remarkably fine carved conch shells; and Leopoldo Pelissier had, among others, one depicting the Columbus caravels, another representing the landing of Columbus. The latter has been purchased by Gardiner G. Hubbard, of Washington, D. C. On the other side of the shell is a medallion head of Columbus (see Pls. 20 and 21). Throughout the entire Italian section could be seen many interesting examples of the utilization of the common conch and the queen conch, mother-of-pearl and other shells, into various beautiful articles representing industrial progress.

An interesting exhibit is that of M. Toledo, the work which he terms Massaniello, a lava-like material, surrounding which is a square frame made up of long pieces of the queen conch (*Cassis cornuta*), ornamented with elaborate, delicate, and intricate figures and scrolls in cameo work. This piece is of the highest artistic merit, and was one of the daintiest bits of carved shell work in the Exposition.

The utilization of mother-of-pearl for carving was also well illustrated in the exhibit of Dabdoub Brothers and by that in the Turkish Village. Here the polished mother-of-pearl shells are engraved with allegorical and ornamental designs and are known as Jerusalem shells, serving for trays, light screens, and similar objects. They are also cut into paper-knives, spoons, etc., and rounded into beads and strung to represent pearls, the beads being flat and the original nacreous surface being left

to give a more pearly effect. They are quaintly carved into brooches and bracelets. In the Manufactures Building was exhibited a fine crucifix several feet in height, and other interesting objects.

Leitner and Saloman showed a large quantity of mother-of-pearl shells and a series of works in engraved mother-of-pearl—handles, paper-cutters, and like objects—from Australia.

In the Anthropological Building, forming part of the Ward collection of mollusks, were fine examples of Pinnae from the various parts of the world; four specimens of the pearl oyster, *Avicula (Meleagrina) margaritifera* Linn., from the Indian Ocean, which are remarkable examples of carving by hand, and some beautifully carved examples of *Avicula macroptera* Lam., enriched with a circular disc-like ornamentation; also fine examples of *Avicula hirundo* and *Avicula sterna* Gould.

In the building of the French colony of New Caledonia were shown fine examples of engraving of mother-of-pearl shells, the relief being obtained by filling in the cutting with printers' ink. The subjects were in the style of steel engravings, the reproductions of famous paintings. The artist who made them was an unfortunate steel-plate engraver, who for some forgery was sent to New Caledonia, and when not pardoned as soon as he expected, took his own life. His pearl engraving was the finest that it has been my fortune to see anywhere.

Another mode of shell ornamentation, of a type related to cameo work, may here be referred to, viz, the carving of Nautilus shells by some of the Pacific Islanders. The outer colored layer is removed down to a surface of uniform dead white, somewhat creamy in tint. In this, patterns are cut down further to the pearly layers below, and when finished the entire shell is thus covered with elaborately carved designs, flowers, scroll work, arabesques, etc., raised in the cream-white upon a ground of pearl in a very beautiful manner. This is also frequently done by etching with acids.

One of the finest collections illustrating the utilization of the mother-of-pearl, abalone, and other shells, was an exhibit prepared by the Smithsonian Institution. Among these may be mentioned a series illustrating the evolution of pearl buttons, breastpins, earrings, inlaid cane-handles, umbrella handles, cardcases, and boxes, made of the shells of *Haliotis cracherodii*, and of the true mother-of-pearl shell, *Meleagrina margaritifera*, and of other shells.

An interesting exhibit illustrating the mother-of-pearl industry in Austria was that of Carl Storck's successor, at Vienna. This consisted of beautiful carved mother-of-pearl shells, among which may be mentioned a very interesting frame made of the mother-of-pearl and conch shell, and a large series of buttons and other carved ornaments. The Royal Imperial Austrian Museum of Arts and Industries, of Vienna, exhibited some remarkable shell objects, one a pearl casket, 13 by 10 by 10 inches, made of white and greenish-black mother-of-pearl, a superb piece of workmanship designed by Prof. J. Storck and executed by K. Krehan, of Vienna. Worthy of mention in the same exhibit were a collarette and brooch made of elongated and acorn-shaped beads of yellow-greenish-tinted mother-of-pearl, the necklace and brooch being of gold and silver, designed by Storck and made by Bacher & Son, of Vienna.

Probably the most superb piece of pearl work in the Fair was a platter, 20 by 15 inches and 4 inches deep, representing the Danube in silver gilt, and embellished with carved figures made of successive layers and pieces of mother-of-pearl, yellow, pink, and other colors of conch, abalone, etc. The central figure is the Danube, and

various busts representing the several provinces of the empire. The central group includes eight busts and eight fruit groups which embellish the dish, all the shellwork being placed on a background of lapis-lazuli. This was designed by Professors Storck, Karger, and Schwartz, and executed by Dorflinger & Brothers, Frankfort-on-the-Main.

Another design by Prof. Storck is a frame of Louis XVI style, inlaid entirely in gray, white, and black mother-of-pearl, and pink and yellow conch, 13 by 8 inches in size, executed by Rudolph Furtener, of Vienna. In the same exhibit were a collarette of four rows of mother-of-pearl beads with drops, set in silver and gold enamel; also a necklace and brooch, both designed by Prof. Storck. A collarette of five strands of sea pearls that alternate with panels of silver gilt was designed by Prof. Storck and executed by Bachner & Son, of Vienna. A casket 12 by 15 by 10 inches of ebony, mahogany, and olivewood, decorated with mother-of-pearl, was designed and made by Anton Michel of Vienna.

#### MISCELLANEOUS USES OF SHELL MATERIAL.

Great quantities of mother-of-pearl cat's-eyes were sold, mounted in silver or some other metal, and many people believed them to be true oriental cat's-eyes. These are generally made out of dark mother-of-pearl shells, abalone, or some other dark-colored species. By cutting across a thick layer of such shell and polishing the piece into a hemisphere the light condenses upon the dome into a band, giving a cat's-eye effect. A number of green *Trochus* shells were made into napkin rings by cutting oblique sections across the large diameter of the shell, leaving the apex or spire of the shell as well as the main whorl to receive the napkin.

With reference to the imitation cat's-eyes and the cutting of beads, etc., as also other peculiar uses, the following notes may have interest here. They are taken from a consular report on these pearl industries made by Mr. Edward Bedloe, U. S. consul at Amoy.

In the cutting of beads, buttons, studs, and other small articles from shells of a high luster, there are some fifty species utilized, of which the Chinese mussel and oyster are the most prominent. One variety gives a black, blue, or white button, similar to the cat's-eyes of Ceylon, and named after these, Amoy or Canton cat's-eyes. A second variety is of a pale fawn ranging to translucency, called white cat's-eyes. A third is half an inch in diameter and resembles light-brown onyx. The black and white cat's-eyes are used for bracelets, necklaces, ladies' dress buttons, and also as dress ornaments similar to pearls. The balls are strung and used as necklaces, bracelets, earrings, and rosaries. Though apparently fragile, they are really tough and very durable. Their price depends upon some inscrutable Chinese rule, and varies from half a cent to 5 cents apiece. When mounted as buttons the black cat's-eyes are a pleasing ornament when worn on a black-silk dress. The gradations of color are brought out into fine relief, and the suggestion of blue, which runs through the shell, gives a color to the somber silk, which is very pleasing. The best effect is when they are sewed closely together in a double line upon a vest or waist, when they seem to be a fine and brilliant stripe. A curious way of setting both cat's-eyes and onyx balls, practiced by the Chinese, consists in alternating them with small carved

fruit stones. It is rather attractive as an oddity, but the lack of color deprives it of any æsthetic value.

Among the quaint things shown by the Chinese\* are the cups, saucers, and spoons made from the larger types of tropical univalve shells. The finest specimens come from the southern Philippines and the next from Borneo, but good ones are found in the Pescadores and Formosa. It would seem as if the original idea was Malayan and that the other races of the Orient were merely imitators. In making cups and saucers the conchs are sawed through in about the same manner as coconuts are when intended for dippers. They are cleaned and polished, and the convex surface ground slightly so as to rest on a table without spilling or tilting. The spoons are made by sawing the round superior surface of the conch at such an angle as partially to intersect the spindle or major axis (columella), which becomes the handle of the completed spoon. According to the size of the shell, the result is a dessert-spoon, a tablespoon, or a ladle capable of containing a quart. The interior is of a rich sulphur, salmon, or orange color, or of a pearly luster. It has no angles where dirt can accumulate, and is about the handsomest natural spoon that I have ever seen. They stand heat and cold well, but are attacked by vinegar, lemon juice, and other acids. The best market in which to obtain them is Cebu, in the Philippine Islands.

#### FRESH-WATER PEARLS AND PEARL SHELLS OF THE UNITED STATES.

The abundance of the pearly shells of the family Unionidæ, commonly known as fresh-water mussels, in all the lakes, streams, and rivers of the United States, makes them quite important as a possible source of material in the ornamental arts. Reference has been made at various points in this article to fresh-water pearls and their use in jewelry, both in this country and Europe, and to the enormous numbers gathered in prehistoric times by some of the mound-builders of Ohio. As we possess so great a variety of these shells, so widely distributed over the country, it seems desirable to bring together here a general review of all the material of this kind shown at the World's Fair, and to lay stress on the value which it may have for decorative work, and the importance of preserving and utilizing the supply so freely bestowed upon our country and hitherto so little appreciated.

Included in the references above made to various exhibits of pearls and pearl shell are the following:

In the Tiffany exhibit in the Manufactures building: The prepared and injected specimen of *Margaritana margaritifera*, from Bohemia, showing a pearl in place between the mantle and the shell; Unio pearls from Nova Scotia; seven of those from near Paterson, N. J., gathered in the first river-pearl excitement in 1856; and some of the prehistoric pearls from the Turner mounds of Ohio.

There was also a large collection of various species of Unios, from the small shells to the magnificent valves measuring nearly 8 inches in length, in a series in which one valve of each specimen is polished and the other in its natural state, to show the commercial possibilities of these shells.

In the museum of the Brooklyn Institute of Arts and Sciences there is displayed, in their local collection of the mollusca of Long Island, a remarkable specimen of

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\* Report of U. S. Consul Edward Bedloe, at Amoy.

Anodon, with both valves polished and beautifully pearly, from the lake in Prospect Park in that city. The valves are about 6 inches long. A number of these splendid Anodons have lately been found in this lake, and the fact that they can thus occur shows how readily these mollusks could be propagated and their shells made an article of commercial value.

In the Swedish building, Augusta Mollenberg, the royal court jeweler, exhibited twelve fresh-water pearls, weighing from 4 to 10 grains each, eight mounted on a chalice and two on an ecclesiastical bowl. A Norwegian jeweler exhibited several dozen pearls, white and faintly pink, from Norwegian rivers.

In the English section of the Manufactures building Edmund Johnson, jeweler royal of Ireland, exhibited several fresh-water pearls, weighing over 10 grains each, from Irish rivers, mounted in a brooch in his collection of representations of Irish gold antiquities.

In the Mexican section, in the Fisheries building, from the district of Jederal, with a series of pearl shells from the west coast of Nueva Leon, was another of fresh-water Unios, some measuring nearly 10 inches in length.

In the southeastern gallery of the Anthropological building there were displayed about fifty specimens of Unios and mother-of-pearl shells, with one valve of each shell polished.

In the German section of the Manufactures building, and elsewhere, were shown Unio shells from the Elster, in Saxony, and the Bohemian rivers, frequently polished on both sides and made into beautiful little portmanteaus, satchels, etc. The shells are often ground very thin, so that colored photographs or designs may be shown through them.

A very interesting series of mounted fresh-water pearls was shown from Wisconsin, Tennessee, Ohio, and Texas. Among these are some absolutely white, pink, and brown pearls. All those from Wisconsin are very fine, possessing a marvelous metallic luster. The pearl fisheries of that State have produced at least \$250,000 worth of pearls since 1889.

In the Mining building, Bunde & Upmeyer, of Milwaukee, exhibited a case of several hundred Unio pearls, some of them very fine, of the various colors found in the rivers of Wisconsin.

The New York State exhibit, in the gallery of the Anthropological building, contained a superb collection of Unios, beautifully mounted and well labeled, belonging to the State cabinet. This collection embraces those of the Rev. John Walton, Shelly G. Crump, C. E. Beecher, and others. In the south gallery, forming a portion of the exhibit of Prof. Ward, of Rochester, were some magnificent specimens of Unios. Superb examples of *Dipsas plicatus* Lea, from Lake Riwa and from central China, containing pearl figures of Buddha and flat pearl-like disks, produced by inserting between the mantle and the shell of the mollusk small tin-foil figures of Buddha, or small hemispherical disks, which in time become coated by the pearly nacre, were shown in the folklore collection of G. F. Kunz and in the Ward collection in the south gallery (*see* Pl. 40), both now in the Field Columbian Museum.

This method of producing figures and symbols that could be used for ornaments is one that would recompense any American who would produce the same results in some of our richly colored and brilliantly lined Unios.

## CULTIVATION OF THE PEARL OYSTER.

In the Japanese section, K. Mikimoto, of Toba, Shima, Japan, made a remarkably interesting exhibit of pearl shells from the Bay of Ago, province of Shima, on the Pacific coast of central Japan, near the famous temple of Ise. The Bay of Ago is about 3 miles long and 2 miles broad, and, penetrating inland for some distance, its waters are always calm. The pearl oyster is abundant along its shores at a depth of from 1 to 6 fathoms, where the bottom is sandy, with a scant growth of seaweeds.

Little can be ascertained as to when the fishing of pearl oysters began in this bay. It is believed, however, to have commenced some three or four centuries ago.

In about 1880, pearl fishing in this bay was very actively carried on, and although pearls were comparatively cheap at that time, the annual yield amounted to \$10,000. But too great an activity on the part of fishermen led to a depletion of the fisheries, so that the yield gradually decreased until in 1885 the value of pearls obtained was less than \$1,000.

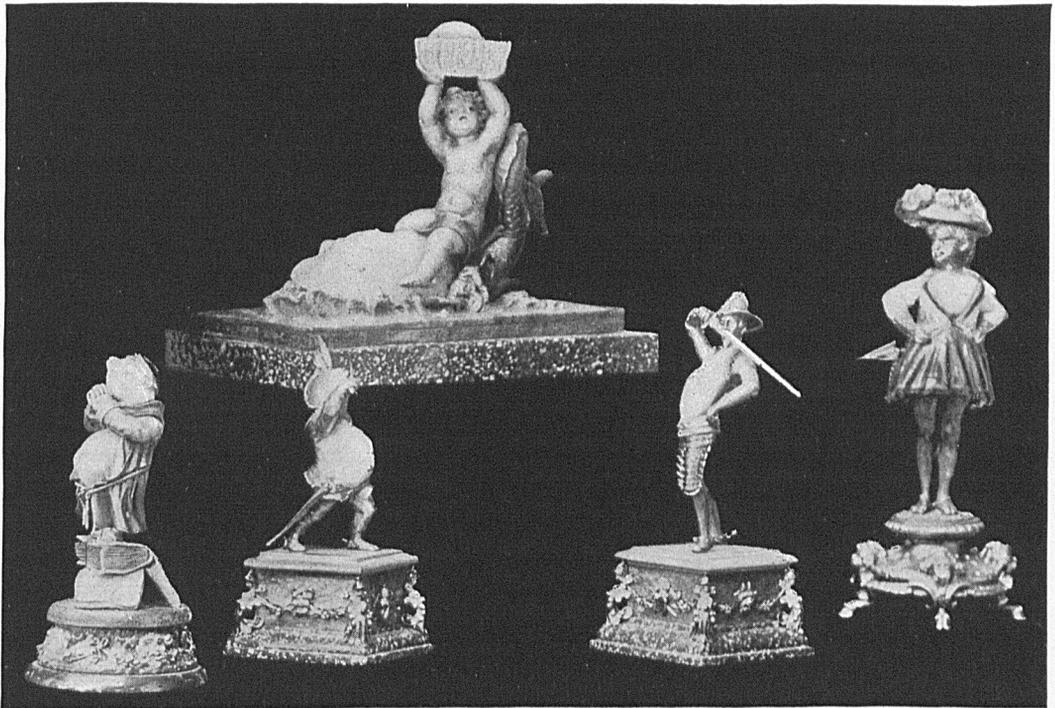
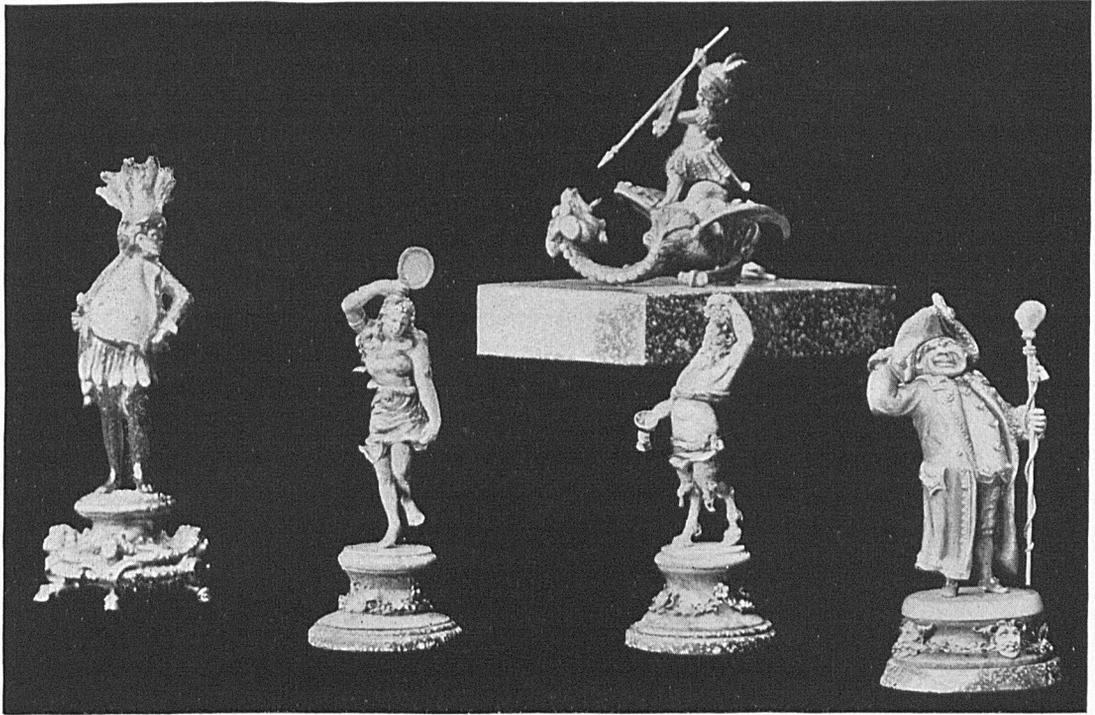
Fearing the extinction of this valuable shellfish, the Fisheries Association of the district took steps to restore the industry by establishing a closed season, etc., and, at the advice of the late Admiral Y. Yanagi, president of the Japan Fisheries Society, of Profs. K. Mitsukuri and C. Saraki, of the Imperial University, and of Kishinouye, the zoologist of the department of agriculture and commerce, tried with success the experiment of collecting and rearing the spat on tiles, stones, logs, ropes, etc. By the adoption of these various means the fishery has largely recovered its lost ground, and for the past two or three years the yield of pearls has been restored to the amount obtained at the active period of the industry. Mr. Mikimoto entertains every hope of greatly extending and promoting the industry in the future by systematic cultivation of this kind.

The chief source of pearls in Japan is the pearl oyster (*Avicula martensii*), but the mussel (*Mytilus crassitesta*), the oyster, the sea-ear or abalone (*Haliotis gigantea*), and the fresh-water pearl mussel (*Dipsas plicatus*) also produce their special pearls. In Japan, as in Europe, pearls from the pearl oyster are especially valued on account of their brilliant luster and pure color. Those with the silvery hue command higher prices than those of the golden hue. Pearls from the mussel, the pearl mussel, etc., are of various tints: those from the oyster are usually milky-white; while those from the sea-ear (*Haliotis*) and abalone shell have usually a golden tinge.

Mr. Mikimoto's exhibit illustrated the growth of pearl shells from one to nine years. This shellfish spawns from June to August; therefore some of the shells exhibited could not have been more than a few weeks old. These continue to grow until the following November, when the approach of the cold season checks them for a time. In March of the year following, growth again commences, and on this account February is considered the end of the "pearl-oyster year." In other words, young shells collected in the first season, up to and including the following February, are called first-year shells; those obtained from March of the second year to February of the third year are known as second-year shells, etc.

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NOTE.—Articles figured on plates 29, 30, 32, 33, 34, 35, 36, 37, 39 (see page 440) are in the Tiffany-Higinbotham Collection in the Field Columbian Museum, Chicago, Illinois.



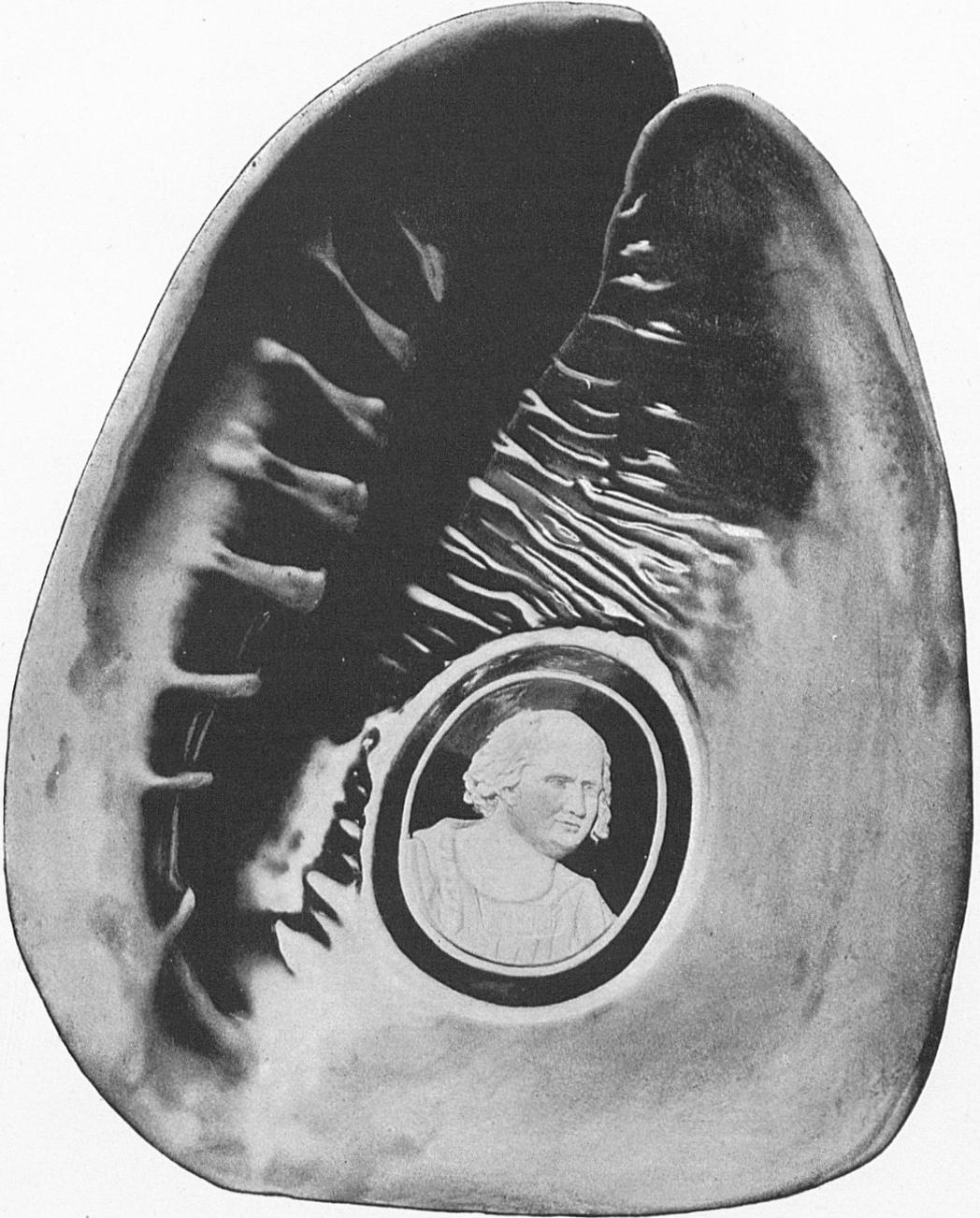
OBJECTS IN SILVER, IN WHICH SOME PART OF THE FIGURE IS MADE OF A LARGE ORIENTAL BAROQUE PEARL.

Exhibited by Richard Horstman, of Berlin, for Messrs. Heitel & Sohn, Hanau.

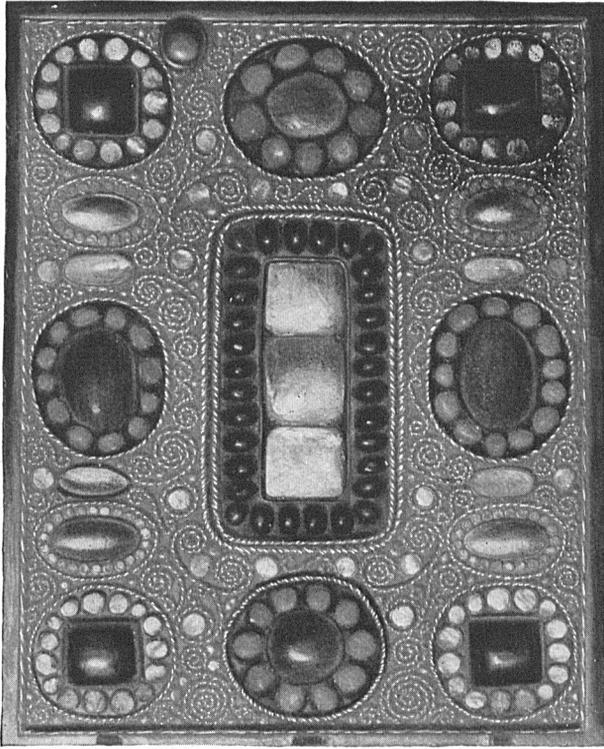


SARDONYX HELMET SHELL REPRESENTING THE LANDING OF COLUMBUS, A COPY OF THE BAS RELIEF ON THE MONUMENT TO CHRISTOPHER COLUMBUS IN NEW YORK.

Carved by E. Campi, of Rome, who obtained the award at Rome for this fine carved cameo-shell. This shell is unique, and will not be reproduced. Owned by Gardiner G. Hubbard, Esq., Washington, D. C.

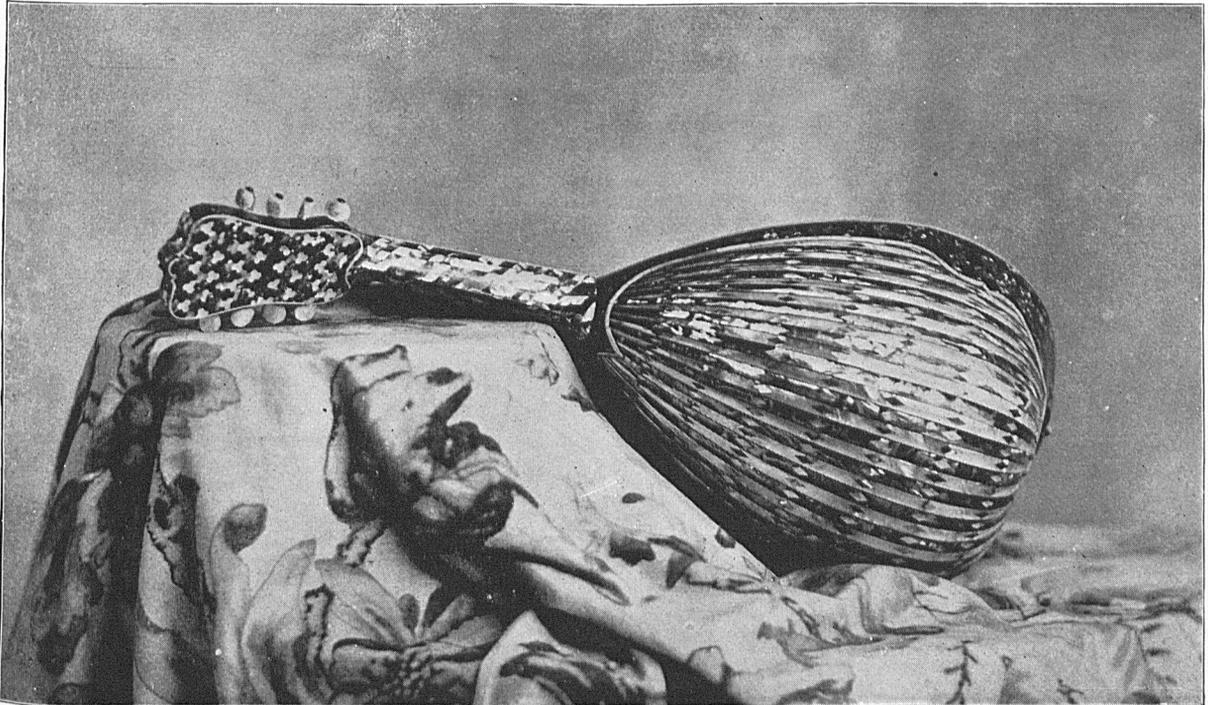


SARDONYX HELMET SHELL, REVERSE. PORTRAIT OF COLUMBUS.



TABERNACLE DOOR, TIFFANY GLASS AND DECORATING COMPANY.

Three center pieces in central ornament and four circles at each end, natural pearly pieces of mother-of-pearl; four oblong ornaments above and below circles, rounded *Nautilus pompilius*; four other circles with oblong or irregular centers, natural beach pebbles, used for translucent effect—an original use of natural objects.

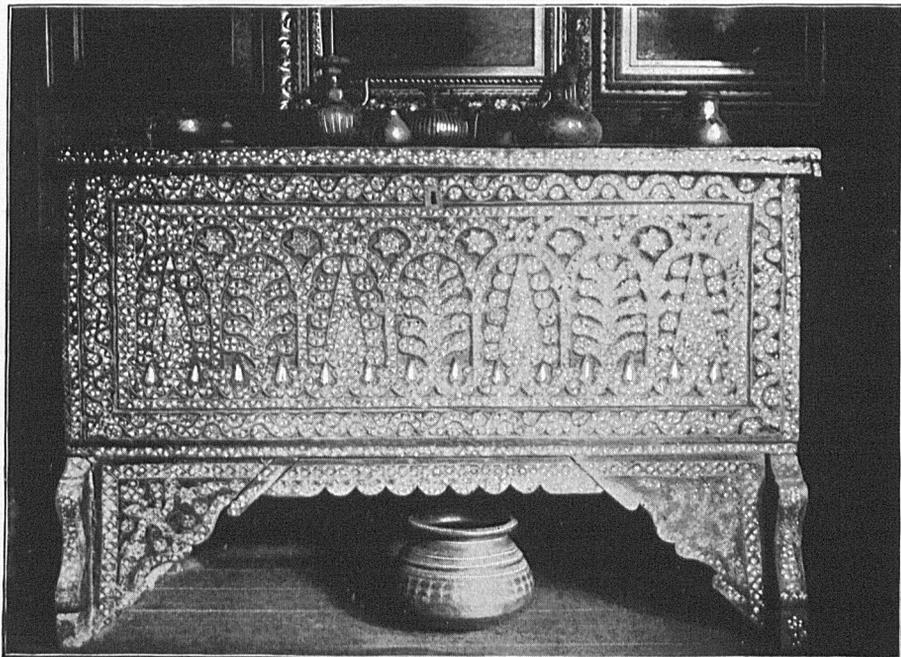


MANDOLIN, LYON & HEALY, CHICAGO.

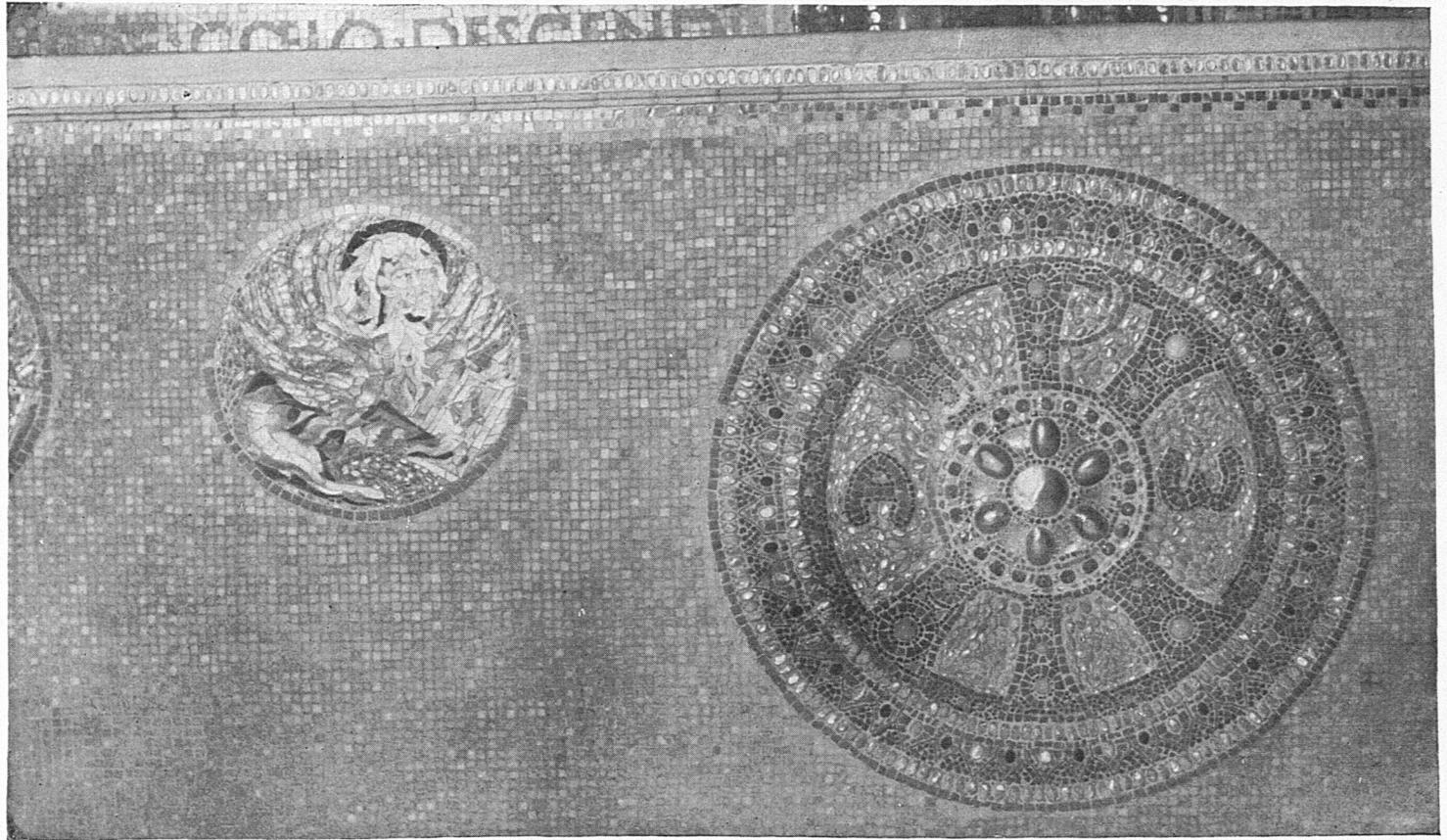
Made of two thousand separate pieces of various materials, including four distinct qualities of pearls, the effects being produced by the shading of the different pearls.



OAK SCREEN, INLAID WITH MOTHER-OF-PEARL, ONE-TENTH DIAMETER.  
Damascus work, made for World's Columbian Exposition by Lockwood De Forest, New York

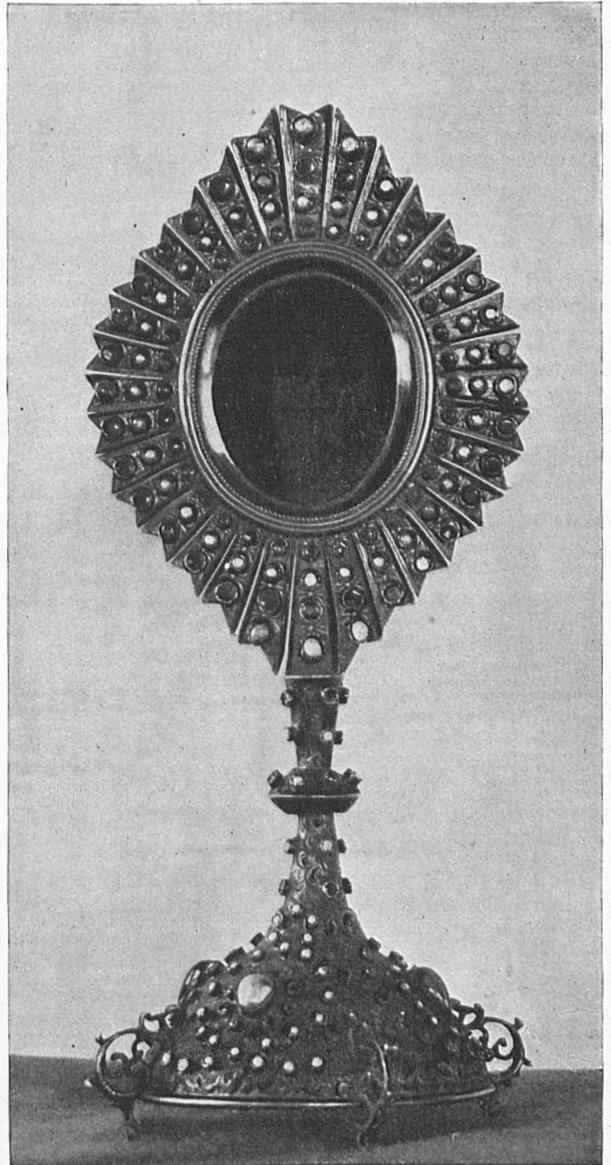
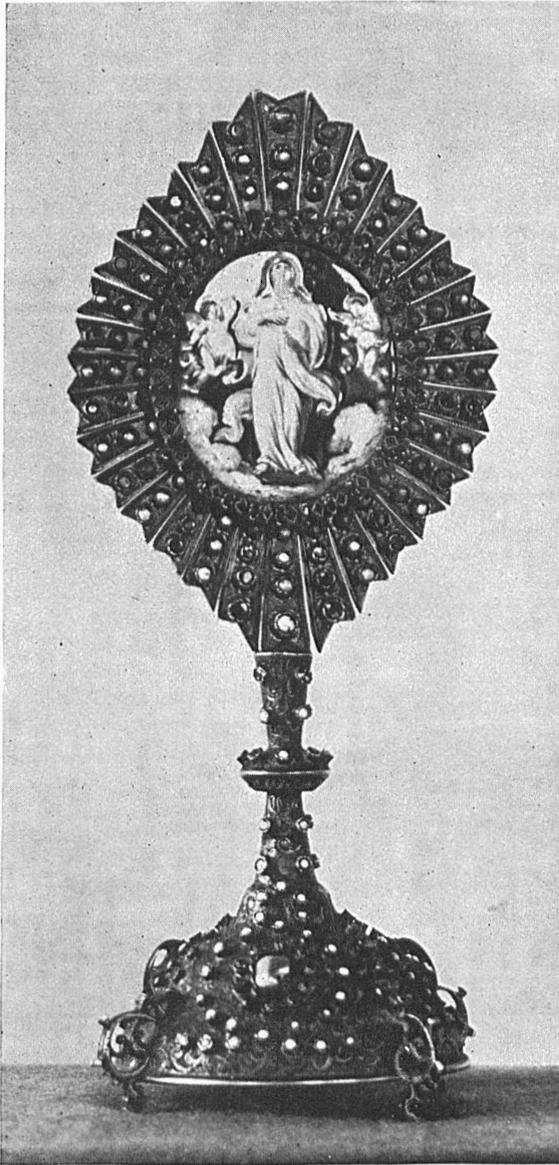


OLD WOOD CHEST, INLAID WITH MOTHER-OF-PEARL, ONE-NINTH DIAMETER.  
Damascus work, 75 years old Exhibited by Lockwood De Forest, New York



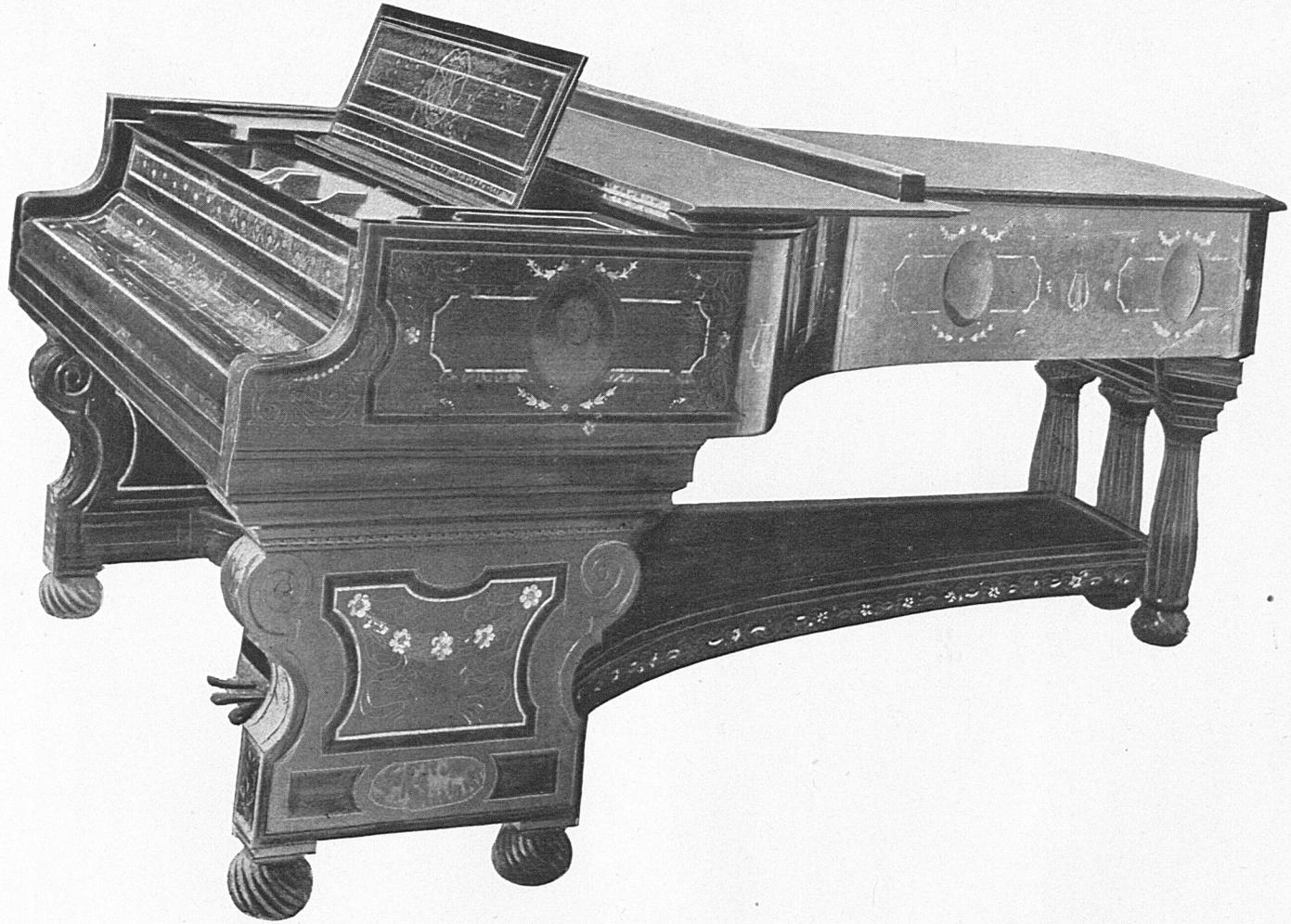
FRONT OF MENSA, TIFFANY GLASS AND DECORATING COMPANY.

Mother-of-pearl (natural, rounded, pearl-like surfaces) used in upper border-line and in circles on right. *Nautilus pompilius*, natural rounded pieces, used for central ornament of large circle. Groundwork, a mosaic of Mexican onyx, colored and aventurine glass. Chicago, 1893.



SILVER RELIQUAIRE.

Rococo style. Bohemian work of the seventeenth century, inlaid with Bohemian river pearls, garnets, and turquoises, Rock crystal cover over relic, Limoges enamel on reverse side.



GRAND PIANO, COTTIER & CO.

One of the most remarkable examples of American pearl inlaying; a study of the old Spanish method of inlaying mother-of-pearl with tortoise shell and colored woods in a hard wood.



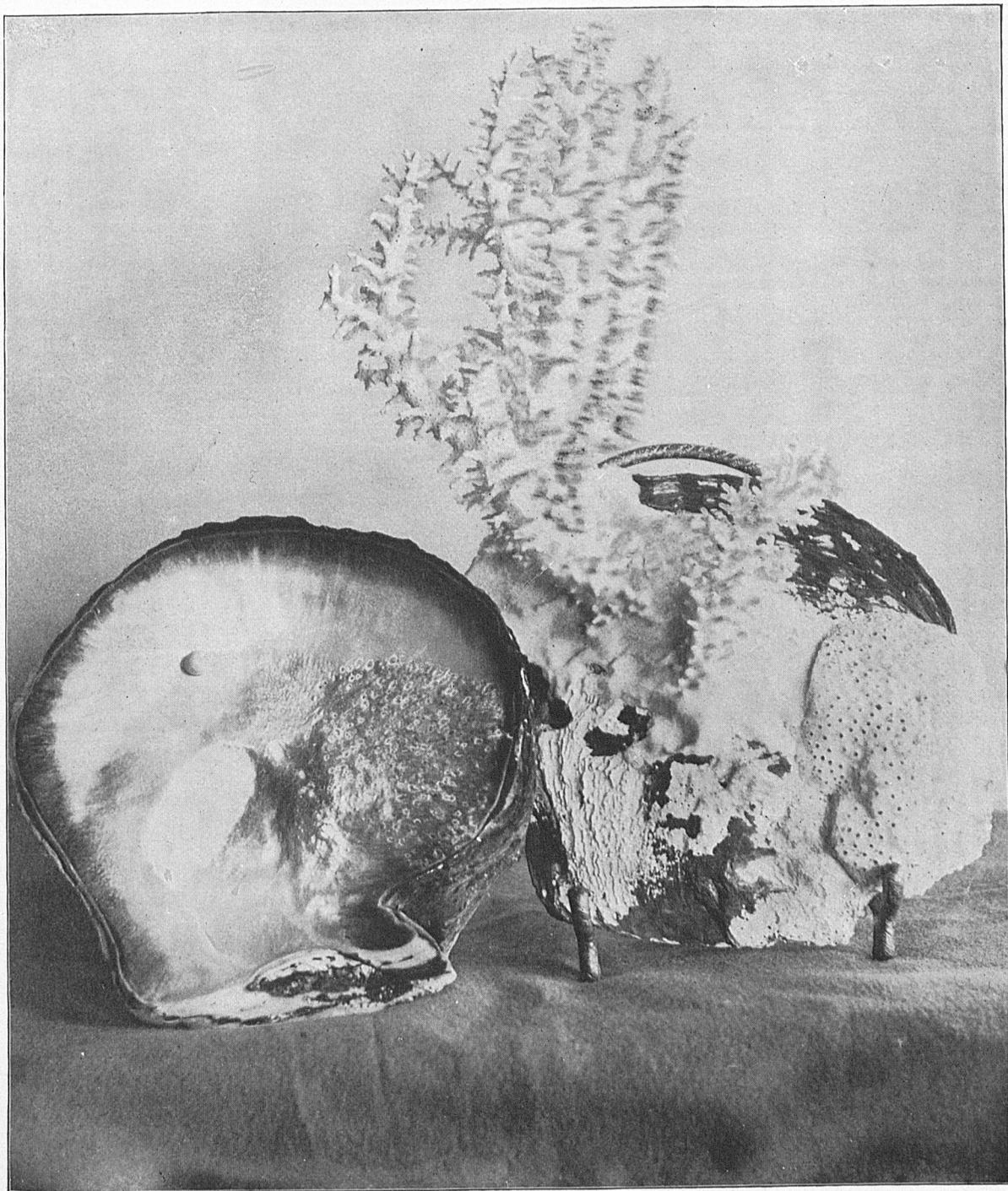
RUSSIAN ICON, TRYPHTICH OF VIRGIN AND CHILD.

Made about 1640, by a leading Russian artist, for one of the principal churches of Nijni Novgorod. The framework in silver gilt; the inlaying, river pearls, rubies, emeralds, etc. Brought from Nijni Novgorod by George F. Kunz; in the collection of the United States National Museum, Washington, D. C.

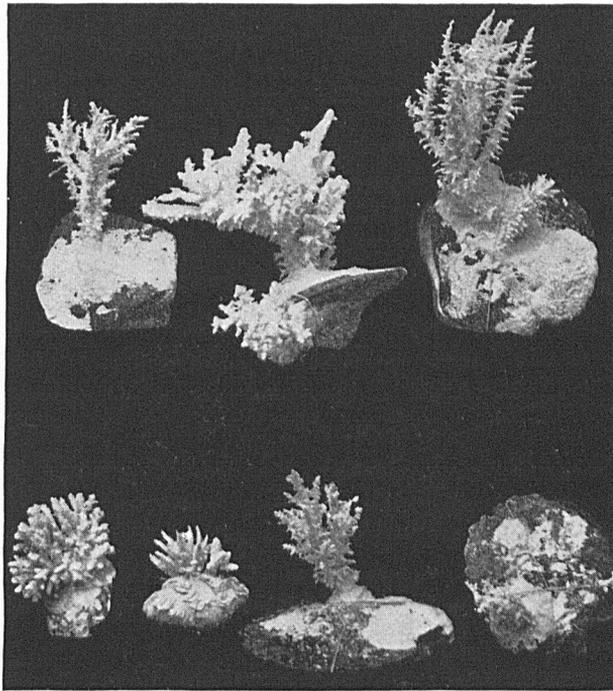


STERLING SILVER TEAPOT.

Gilt, encrusted with baroque pearls from the rivers of Tennessee. Made by Tiffany & Co.



PEARL OYSTER, *Meleagrina margaritifera*. OBLVERSE AND REVERSE, INNER AND OUTER VALVES.  
On the exterior are groups of three different species of coral. Size, valve with coral, 15 inches high, 7 inches wide.

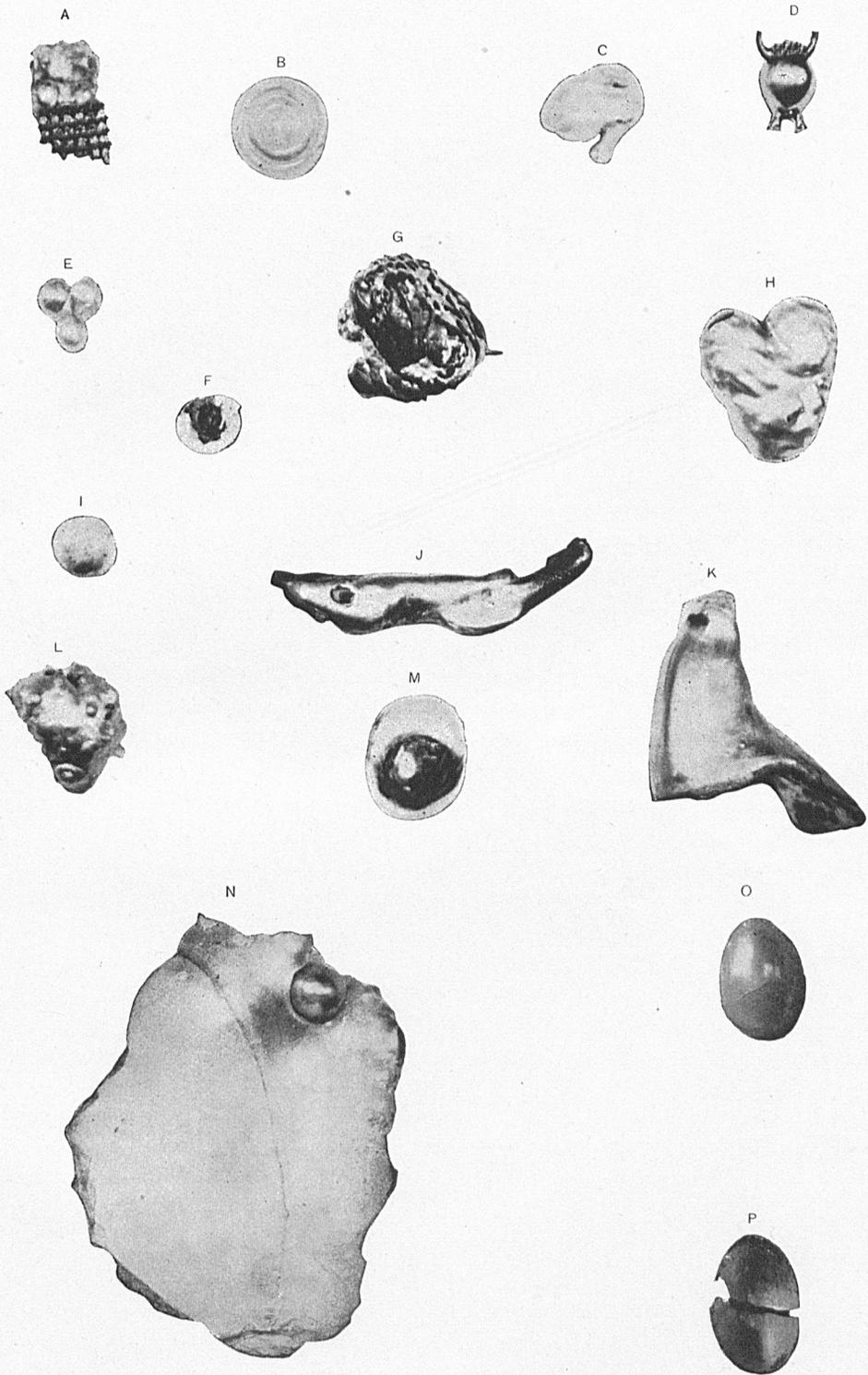


PEARL OYSTER SHELLS WITH CORAL GROWTHS.

One-tenth diameter, from Tahiti.



TRIGONIA PECTINATA. Australia. Natural size.

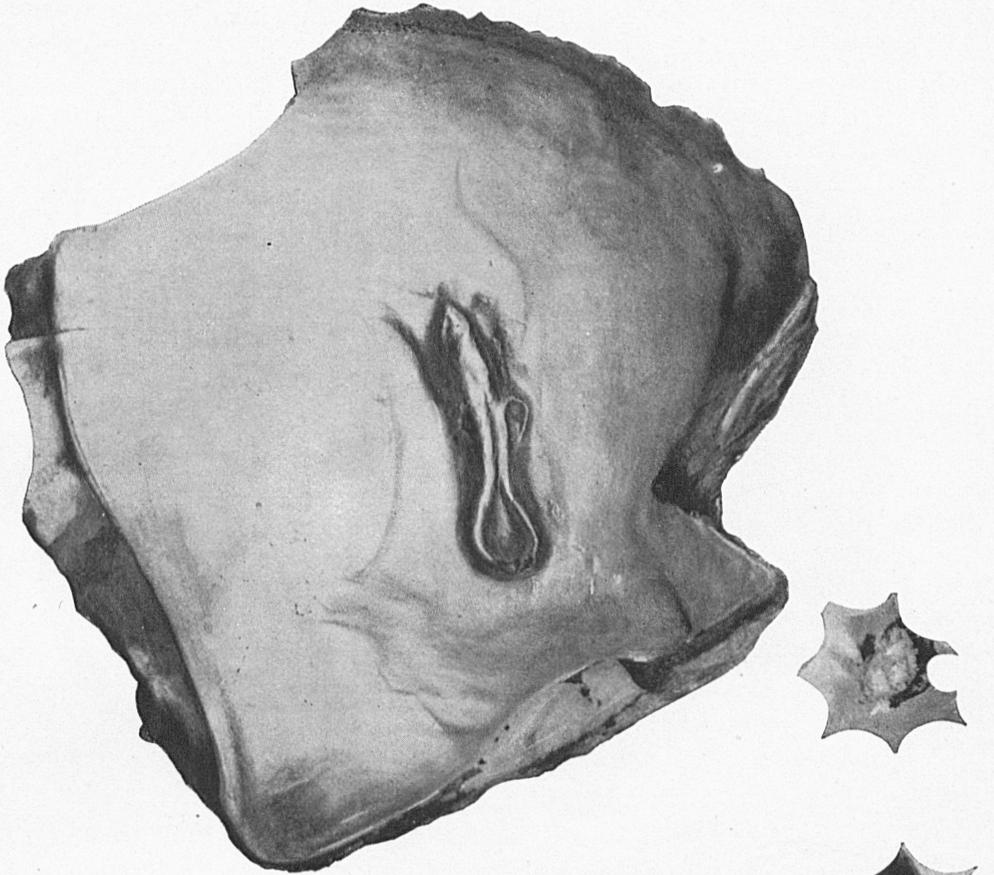


TIFFANY-HIGINBOTHAM COLLECTION.

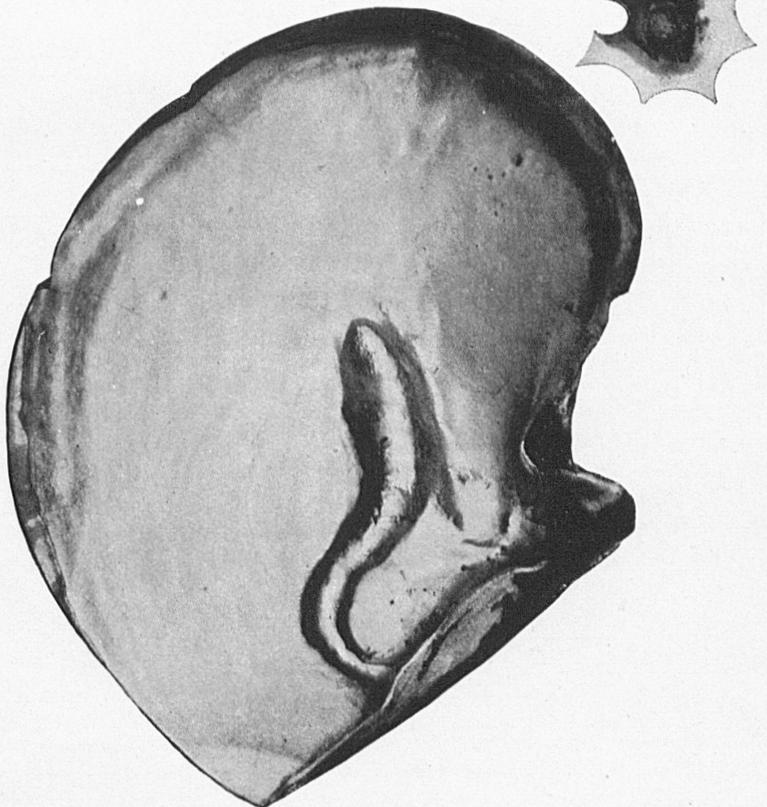
- (A) Fresh-water pearl, simulating Pan playing on pipes; pink.
- (B) Fresh-water pearl, showing concentric markings.
- (C) Fresh-water pearl, animal head; white.
- (D) Fresh-water pearl, ram's head; bronze color.
- (E) Four pearls united, representing head; from Tahiti.
- (F) *Ostrea borealis*, showing internal structure.
- (G) Fresh-water pearl, Spaniel Head, ruddy copper color.
- (H) Heart-shaped pearl.
- (I) *Ostrea borealis*.

- (J) Greenish pearl, *Haliotis rufescens*. Lower California.
- (K) Greenish pearl from a large species of *Trochus*. West coast of Mexico.
- (L) Pink *Unio* pearl. Tennessee.
- (M) *Ostrea borealis*, resembling human eye.
- (N) Fragment of *Unio* from Wisconsin; copper colored.
- (O) Oriental pearl; peeled. Exterior convex side.
- (P) Interior concave view.

*a*



*b*



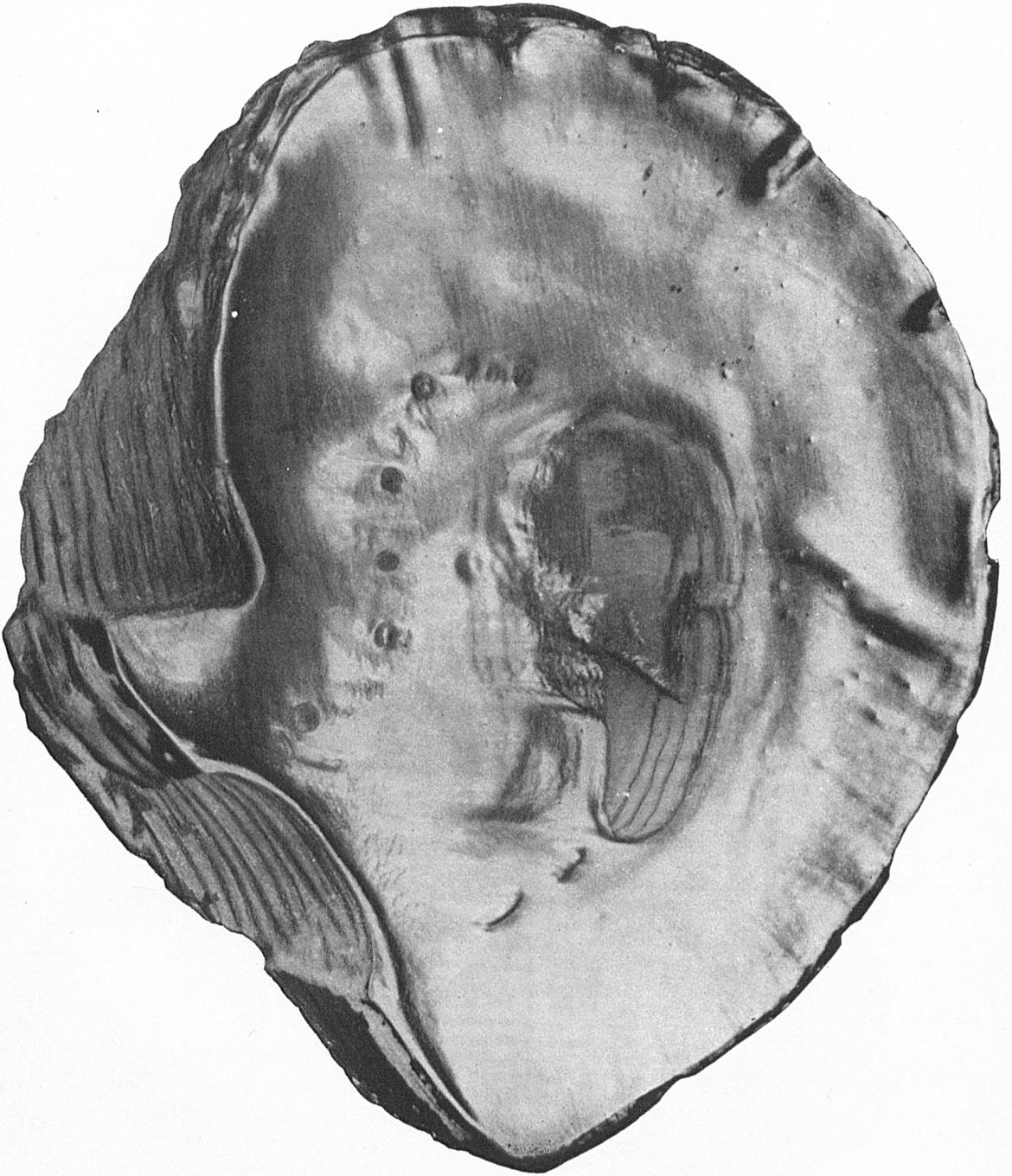
(*a*) MELEAGRINA MARGARITIFERA, WITH INCLUDED PARASITIC FISH. Lower California.  
(*b*) MELEAGRINA MARGARITIFERA, WITH INCLUDED PARASITIC FISH. Lower California.



PEARLY KNOB, *Meleagrina margaritifera*. Six by five and a half inches. Thursday Island, Tahiti.

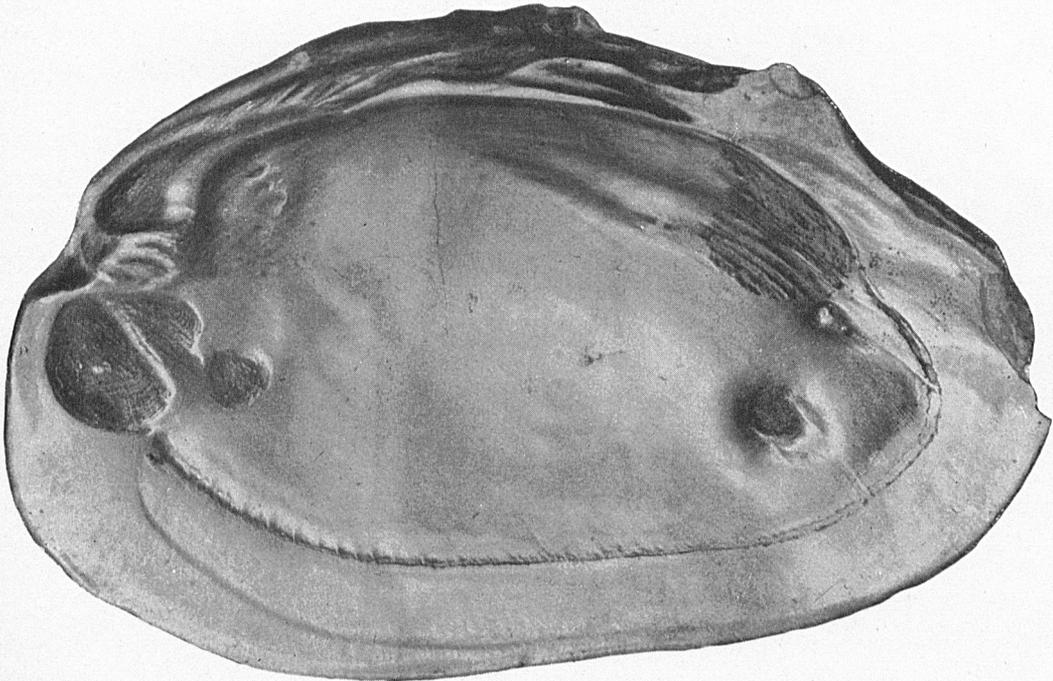


MOTHER-OF-PEARL SHELL WITH PEARLY KNOB WITH MONKEY-LIKE FACE.  
Four and a half by four and a half inches. Thursday Island, Tahiti.

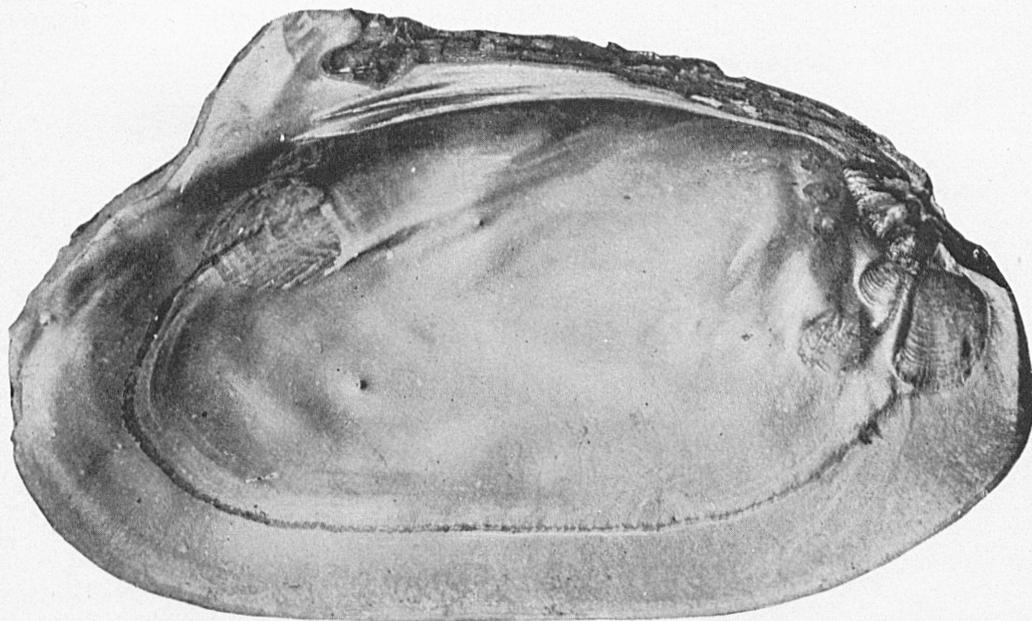
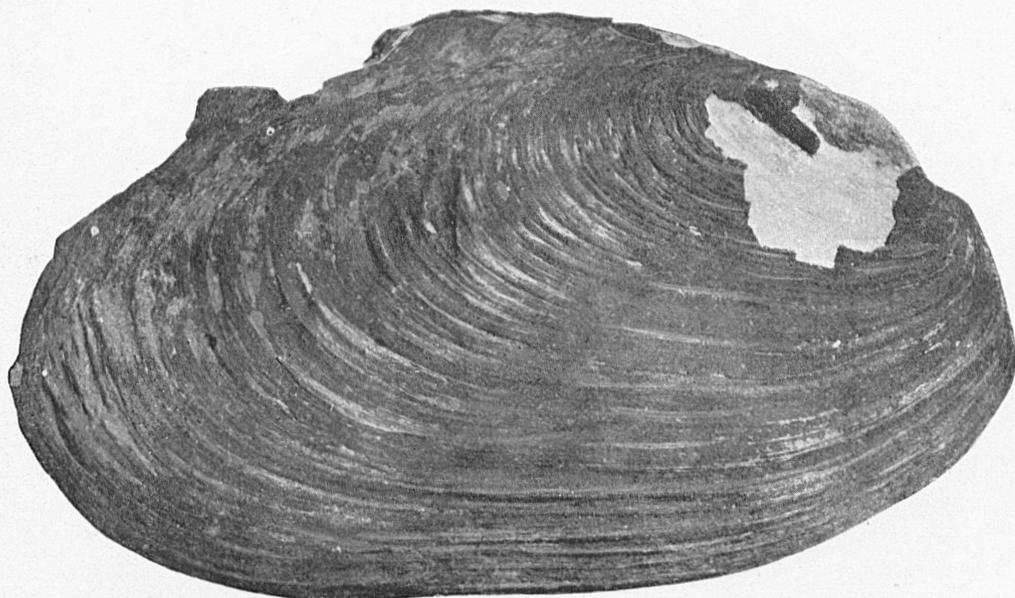


PEARL OYSTER.

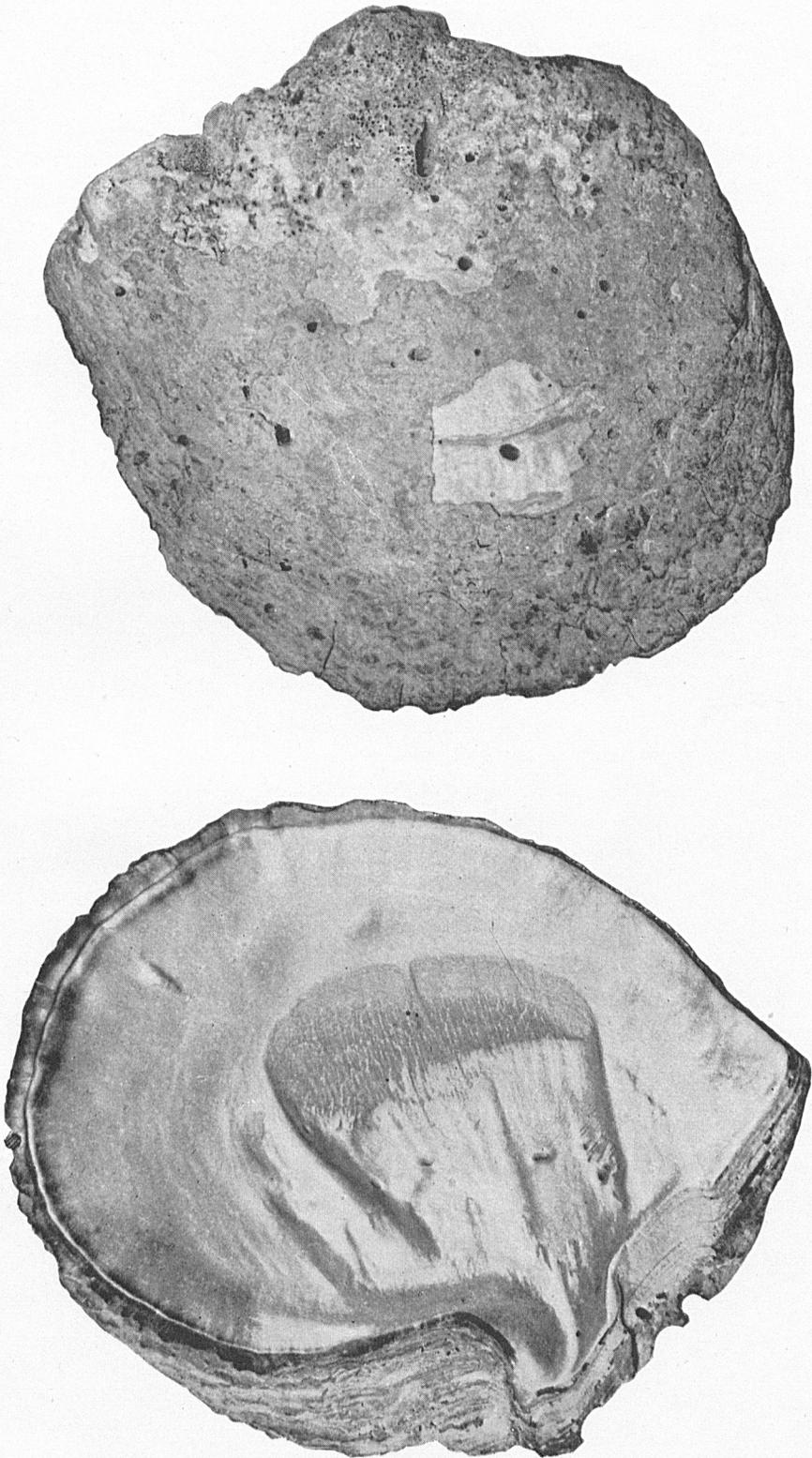
One valve showing two ingrowing pearls and four places where pearls had been attached and had fallen out. Coast of West Australia.



FRESH-WATER MUSSEL, UNIO, WITH DEEP PURPLISH-RED INTERIOR.  
Eight inches long. From Sugar River, Wisconsin.



FRESH-WATER MUSSEL, UNIO, DEEP PURPLISH-RED INTERIOR.  
Eight inches in length. Sugar River, Wisconsin.

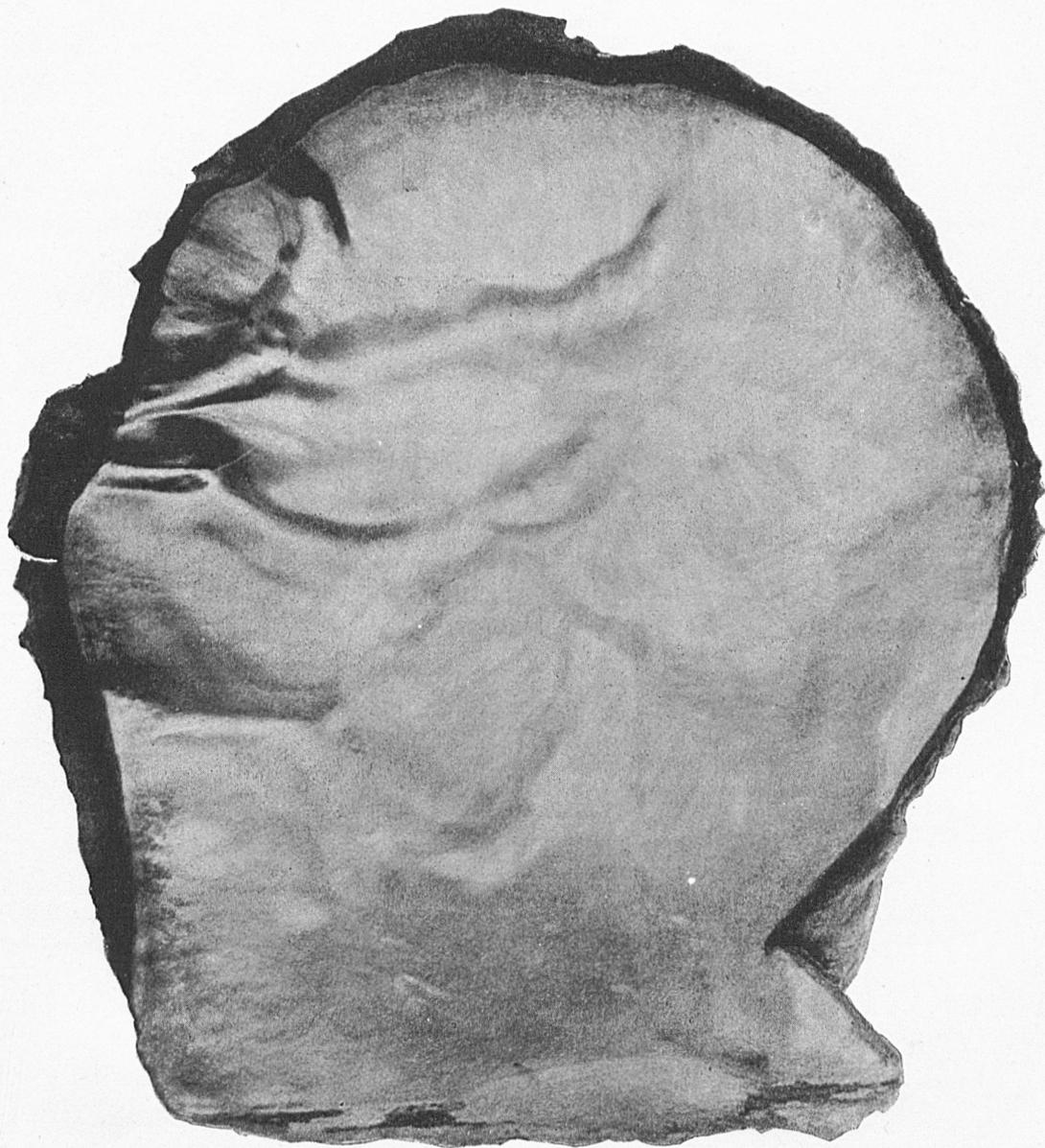


PAIR OF LARGE SHELLS, *Meleagrina margaritifera*, MOTHER-OF-PEARL.  
Weight, 155½ ounces, each valve being 11½ inches across.

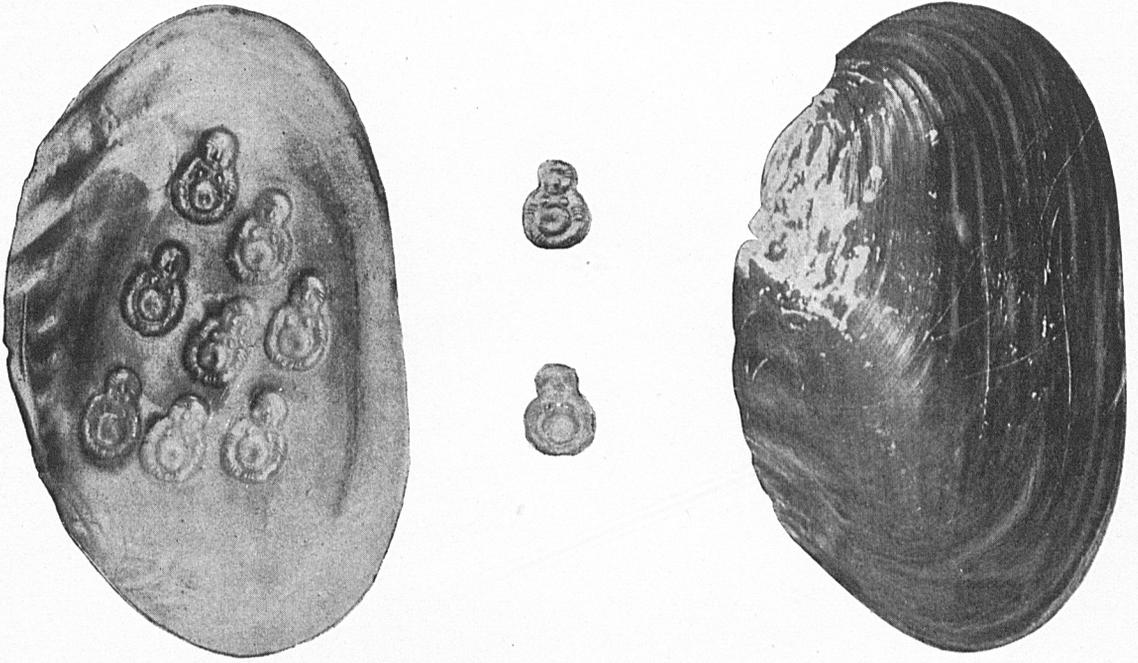


ABALONE SHELL, *Haliotis rufescens*, WITH PEARLY GROWTH RESEMBLING CAMEL'S HEAD, AND NEARLY TWO INCHES IN DIAMETER.

From coast near San Diego County, California.

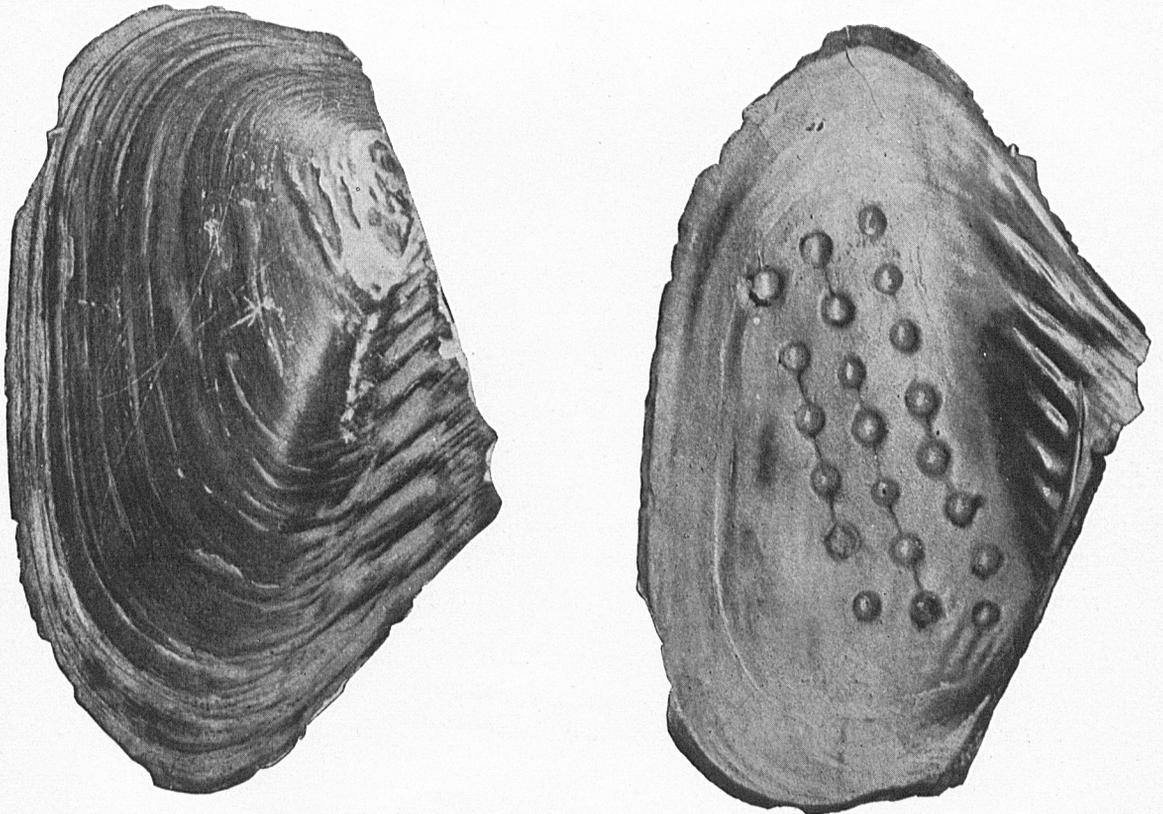


PEARL OYSTER, *Meleagrina margaritifera*, SHOWING BORINGS WHICH THE SHELL HAS COVERED.  
Six by five inches. Tahiti.



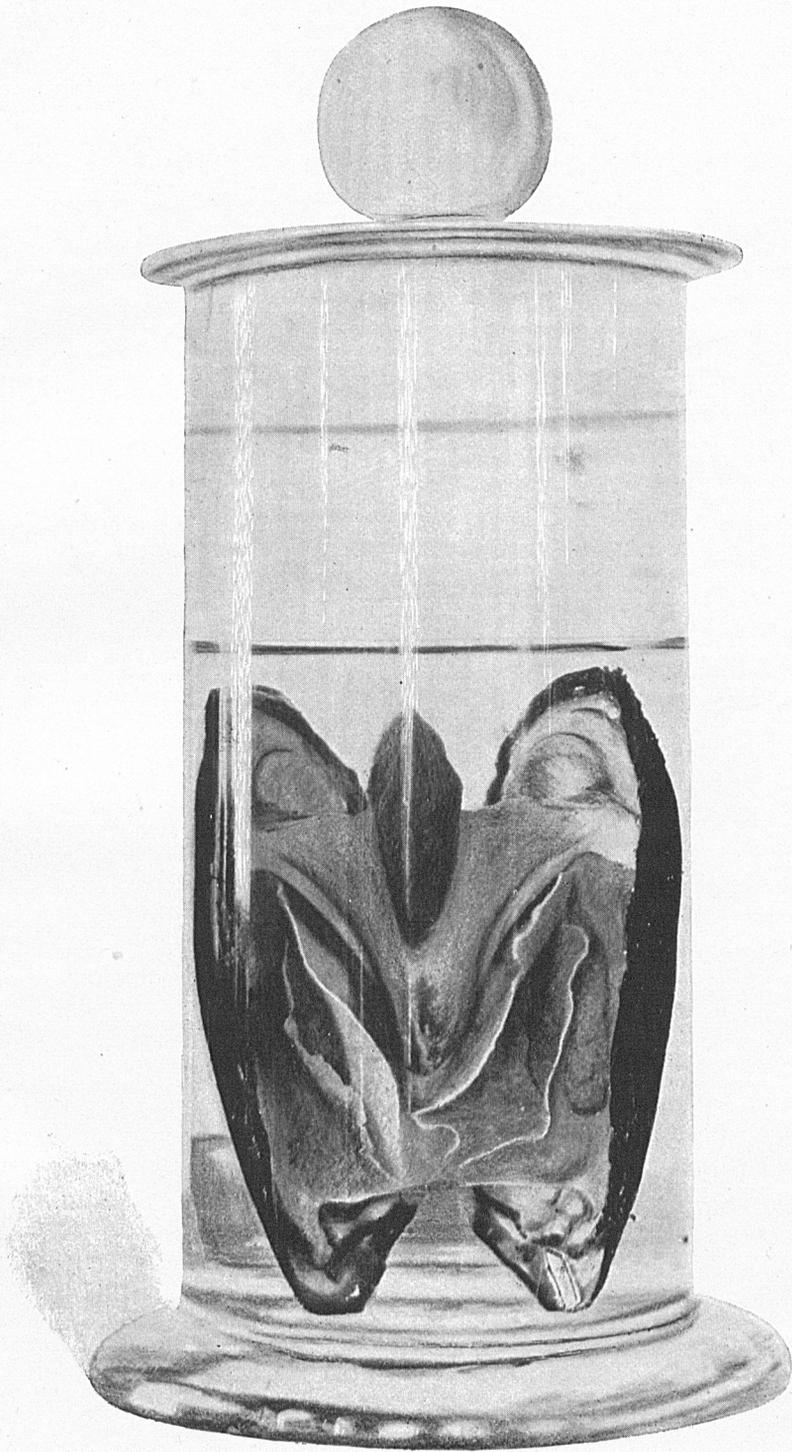
DIPSAS PLICATUS, INTERIOR AND EXTERIOR, INTERIOR CONTAINING TINFOIL FIGURES OF BUDDHA.

Four inches long. Pearl-coated figure of Buddha, obverse and reverse, showing concave depression originally filled with tinfoil or wax.



DIPSAS PLICATUS, CONTAINING THREE STRINGS OF BEADS WITH A PEARLY COATING.

Both from temples in Souchow, China.



FRESH WATER MUSSEL, *Margaritana margaritifera*, SHOWING PEARL INCLUDED BETWEEN MANTLE AND SHELL, IN THE LOWER RIGHT-HAND CORNER.

Specimen prepared by V. Fric, of Prague. From Botova River, Bohemia.