

# THE RESTORATION OF THE FOUNDATIONS OF THE PHILÆ TEMPLES.

BY OUR LONDON CORRESPONDENT.

When the designs for the Aswan dam, situated 600 miles above Cairo, and formally opened on December 10 last, were first prepared, the contemplated high level of the water thus held back would have submerged the greater part of the ruined temples on the historic island of Philæ, which is situated just above the point where the barrage has been erected. Egyptologists and archaeologists raised a great outcry against what was termed an unwarrantable act of vandalism, and the result of their agitation was that it was decided to lower the maximum level of the water to be stored up, to R. L. 106, and thus spare the temples. But even at this amended level the greater number of the temples on Philæ Island, with the solitary exception of the Temple of Isis, are covered when the reservoir is full, with water varying from two to four meters in depth.

To preserve the buildings against the head of water it was decided to underpin them and thus insure their stability, and a comprehensive exploratory survey as to the best means of accomplishing this object and its probable extent was carried out. The engineers in charge of the survey were cognizant of the fact that the Temple of Isis was founded on rock, and that the great pylons were on massive foundations sunk into the silt of the Nile to the depth of R. L. 101.5; but their knowledge of the rock depths, nature and extent of the foundations of the numerous buildings on Philæ Island was vague. A special grant was thereupon voted by the Egyptian government, to carry out a thorough exploration of the foundations, and the task was commenced in April, 1901.

Fifty-six shafts were sunk, and a number of trenches and headings were excavated, and all exposures of the foundations and levels were duly recorded.

Owing to the limited knowledge possessed by the engineers as to the stability of the ruins, this survey work had to be conducted with extreme care. The trenches, headings, and shafts were very strongly timbered, and the superstructures were shored up. Approximately three months were occupied in this examination, during which time 690 cubic meters of excavations were completed. The shafts sunk varied from 1 to 1.30 meters in diameter, and were continued down for the most part to a depth of 13 meters before the bedrock was reached. When sufficient excavations had been made to supply all the information required concerning the extent of the underpinning, the excavations were untimbered and filled in.

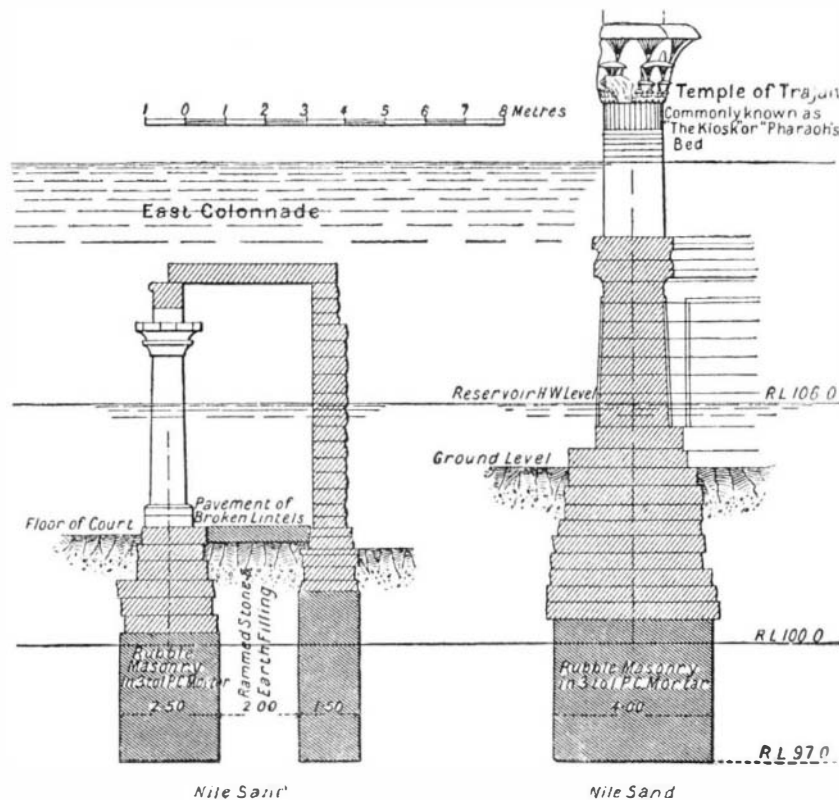
The results of the explorations showed that the necessary underpinning to preserve the ruins would be more extensive than was at first anticipated. In fact, it practically demonstrated that nearly the whole island would have to be provided with a new foundation.

The East Colonnade rested on an almost continuous masonry foundation, approximately 2½ meters wide, and descended to the average depth of R. L. 100.60, but the wall behind it, supporting the last end of the lintels, was much shallower, reaching to only R. L. 101.60. At no point were the colonnade and wall touching the solid bedrock, the level of which varies from R. L. 91.50 at the north end to R. L. 98 at the south end. The space between the bottom of the masonry foundations of the monument and the solid bedrock was filled with Nile silt, muddy at the top but gradually passing into fine clear sand as the bedrock was approached.

The West Colonnade, however, was found to be quite differently and much more solidly constructed. Counterforts 1.80 meters thick were found to project eastward from the quay wall, at intervals of about 3 meters, and in each case they were carried down to a great depth, and in some places even to the solid bedrock. The colonnade is supported on these counterforts by stone beams, but in the majority

of cases it was found that the safety of the colonnade was seriously affected, owing to the majority of the stone beams having been fractured, due to two reasons: the tremendous weight of the structure, and the gradual undermining of the ground between the counterforts.

The foundations of the Temple of Trajan, familiar-



UNDERPINNING OF THE SUBMERGED BUILDINGS OF THE ISLAND OF PHILÆ.

ly known as the "Kiosk" or "Pharaoh's bed," were found to descend to R. L. 100.60, and for the most part were 4 meters in breadth. The bedrock of the river at this point is at R. L. 90 in the front of the building, rising slowly to the maximum of R. L. 95.10. When the exploratory shafts were sunk at this point, some ancient foundation walls were unearthed, which are supposed to be the foundations of a site that was subsequently abandoned.

The Temple of Nectanebo was found to be constructed in a curious manner. The foundation walls were carried down to the bedrock, but the superstructure is placed askew to the foundation walls, being supported upon heavy stone beams, which, however, as in the

West Colonnade, had for the most part broken under the combined influences of heavy top weight and subsidence of the subso.

Other temples on the island were carefully examined, but they were not found to be in such a precarious and unstable condition as the foregoing, though it was eventually decided to strengthen their foundations and supports to a sufficient extent to prevent collapse. A section of the Coptic village was also revealed, and a quantity of sandstone of good quality, suitable for being utilized in the underpinning work, was found. The discovery upon this island of this masonry, which was for the most part in roughly-hewn square blocks, was of immense value, since it saved the expense, time, and trouble of conveying the requisite stone from the mainland to the island. The Egyptian government, upon the report of this exploratory survey, granted the sum of £22,000 for the work of restoring the valuable monuments, and a comprehensive scheme of underpinning was commenced. In addition it was decided to clear the whole of the Coptic village, and to carry out a thorough system of drainage and investment of the terraces. In compiling the scheme of underpinning, it was considered that the earth and sand below the existing saturation level would not subside any more.

The sectional drawings accompanying this article will afford a comprehensive idea of the scope of the operations and the principle of underpinning which was adopted throughout with slight variations according to the nature of the buildings treated. The West Colonnade was the first upon which operations were commenced. The ground was opened along the east face outside the colonnade proper, in widths corresponding to the intervals between the counterforts. Beneath the fractured stone beams, rolled steel girders 14 inches deep by 6 inches wide, and weighing 54 pounds per lineal foot, were laid in pairs, their ends resting in seats cut into the existing counterforts. These girders were surrounded with rubble masonry in 3 to 1 p. c. mortar, care being taken that they were well grouted, so that all possibility of the water gaining access to the steel, and thus corroding it, was absolutely removed. The total depth of the masonry is practically 5 feet 3 inches, so that this superstructure now rests upon a substantial and solid foundation. A similar scheme of underpinning was adopted with the Temple

of Isis. With regard to "Pharaoh's bed" a much more elaborate scheme was necessary. Although old foundation walls were discovered beneath this famous ruin, it was found that they did not afford much resistance to the underpinning action constantly in progress. Beneath the original foundations of the building, which extended to R. L. 100.60, a new solid rubble masonry foundation was built right down to R. L. 97. The ground was opened inside the building. The diameter of the shaft was 1.20 meters, and it was sunk to a total depth of 7.45 meters. The shaft was well timbered up with 1½-inch boards in one meter lengths, with 9 x 3 walings and struts at intervals. By this means the engineers were able to excavate right beneath the structure. The original foundations of the temple were supported upon pitch pine head trees 12 x 8, securely wedged and packed, and side trees 10 x 7. The rubble masonry is 3 to 1 p. c. mortar, 4 meters in thickness, carried down for a depth of 3.40 meters, so that now the old building rests upon a solid masonry foundation, which rests in turn upon the Nile sand at saturation level.

A similar rubble masonry foundation was built beneath the East Colonnade and its wall, and carried down to the same level. In carrying out this part of the work the shafts were sunk between the columns and the wall behind, headings being driven both ways from the central shafts. The masonry supporting the columns is 2.50 meters thick, and that of the wall behind 1.50 meters in thickness. The space between the foundations of the columns and walls, 2 meters



COLONNADE LOOKING SOUTH. READY FOR THE LAST LENGTH OF MASONRY. THE TRENCH IS PARTLY FILLED IN AT THE FARTHER END.

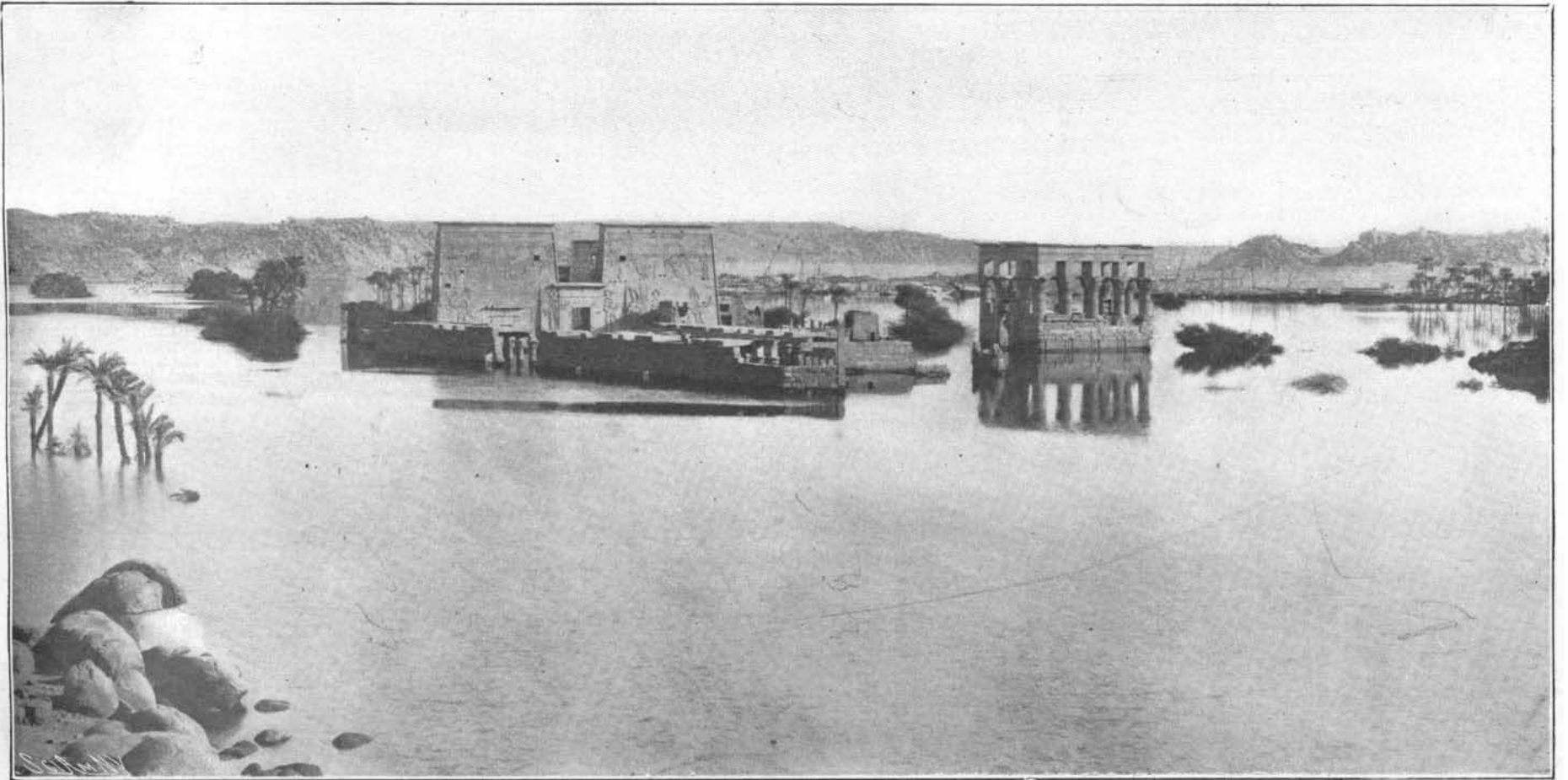
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General View of the Ruins of Philae, Showing the Island Completely Submerged, the Temples only being Visible.



Submergence of the Island of Philae by the Dam at Aswan.

THE RESTORATION OF THE FOUNDATIONS OF THE PHILAE TEMPLES.—[See page 194.]



in width, was filled with rammed stone and earth. The other monuments underpinned were the Mam-museum, the openings to which were sunk outside the building so as not to disturb the paved floor, the Temple of Hathor, and colonnade and rooms of the Isis forecourt, the masonry in each case being carried down to R. L. 97. Furthermore, the gateways of Hadrian and Adelpheos respectively were strengthened.

The Coptic village, which comprised for the most part a collection of mud-brick dwellings in an advanced state of ruin, and constituted an eyesore, was almost entirely cleared away, and the sandstone contained therein was washed and used for the new masonry. Two Coptic churches and a few of the better houses, however, were left untouched.

During the excavations several stones and tablets freely inscribed with hieroglyphics were discovered, and these were carefully preserved for the Antiquities Department, to be subsequently deciphered.

The work was carried out by 300 native laborers and 26 Italian timber men and masons, under the supervision of four English inspectors. The work of underpinning was attended with constant and considerable danger, since the masonry of the buildings as already described had failed, owing to the undermining of the foundations, and was not able to withstand any further subsidence, such as might have ensued while the excavations were in progress. It was only by skillful shoring up and timbering, and constant vigilance, that the task was successfully completed without even an accident to either the laborers or monuments. With the extensive new foundations which have been supplied to these remaining valuable relics of the epoch of the Pharaohs, a new lease of life has been imparted to Philæ, sufficient to preserve the famous ruins indefinitely. In fact, the structures now rest upon a more substantial and solid foundation than they have at any time during their prolonged existence.

#### Lloyd's Wreck Returns.

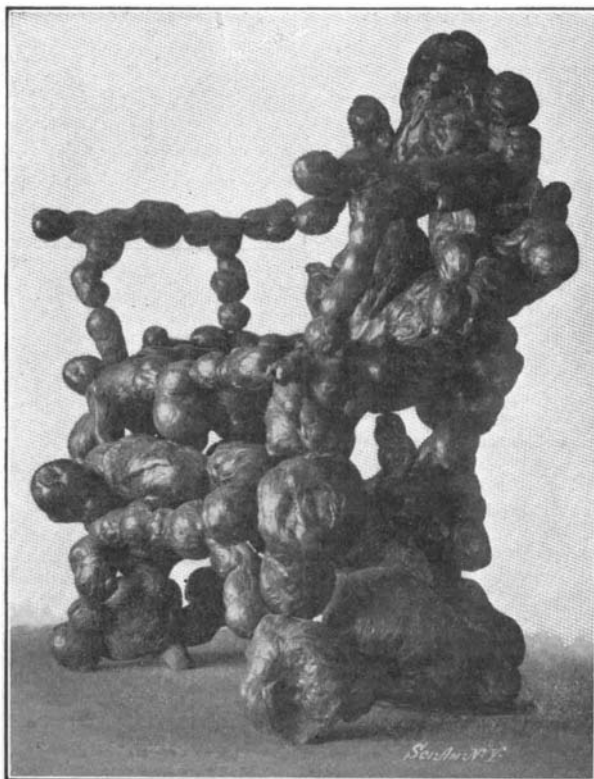
The returns of vessels totally lost, condemned, etc., during the quarter ended June 30, 1902, have just been issued by Lloyd's Register. These give particulars in reference to 45 steamers, aggregating 67,581 gross tons, and 89 sailing vessels, unitedly equal to 50,827 tons. Among the steamers the heaviest loss, 45 ships of 42,109 tons, comes under the head of "Wrecked;" while under that even more terrible heading "Missing" comes the second heaviest loss, viz., 3 ships of 10,135 tons. Collisions provide the next most serious item in these returns, 10 steamers, of 9,017 tons, figuring under this head. It is, on the other hand, satisfactory to find that no steamer was abandoned at sea in the quarter referred to. Among the sailing vessels the greatest losses were also due to wrecks, 43 ships of 20,946 tons being entered under this head alone. Four sailers, aggregating 5,258 tons, were burnt, and 10, of 6,612 tons, met their end by collision, while 6, of 5,105 tons, are reported missing. In apportioning the losses it is to be observed that the French nation had the lowest ratio in regard to their steamers, their figures being 1 ship of 559 gross tons, or 0.05 per cent of their total steam tonnage. The British Colonies were the worst sufferers in this class, their 4 steamers, of 4,332 tons, representing 0.57 per cent of their tonnage. The losses of British-owned steamers were 16 in number, their tonnage, 24,593 gross, equaling 0.19 per cent of our holding. In the matter of sailing vessels, France was also the most favored nation, her 7 sailers, of 1,405 tons, which appear in these returns representing but 0.34 per cent of her holding. The heaviest losers were the Dutch with 3.24 per cent of their total. Of British sailing tonnage exactly one-half per cent was lost, this being made up of 7 ships and 7,736 tons gross.

#### New French Submarine Boat.

The French Admiralty have decided upon the construction of a new submarine boat which will exceed in dimensions and displacement any yet attempted. Hitherto the largest submarine in that navy has been the "Gustave Zédé," of 266 tons, but this new vessel is to be of 350 tons. It will measure 160 feet 9 inches in length by approximately 9 feet draught. The boat will be driven by a single screw, and will have a surface speed of 11 knots. The torpedo armament will comprise four tubes. It is estimated that the cost of this vessel will amount of \$250,000, which is about a third more than the cost of the most expensive submarine yet built for the French navy. It is intended to be an offensive arm, being sufficiently large to attack an enemy's ports, and to cruise along the commercial routes.

#### AN ARMCHAIR FORMED BY NATURAL GROWTH.

The armchair pictured in the accompanying illustration may be said to have partly grown out of the ground, although its shape was furnished by twisting and turning a vine out of which most of its framework was formed. It was brought to the United States by a sea captain who saw it in a Korean city. The chair is studded or ornamented with seeds of the ginkgo tree of various sizes, which have actually grown to the fiber of the vine. A Korean gardener, familiar with the adhesiveness of the seed, took



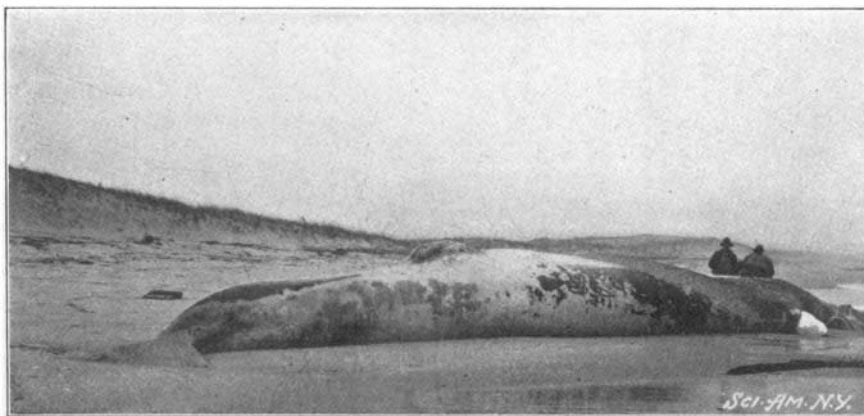
#### AN ARMCHAIR FORMED BY NATURAL GROWTH.

a native vine, noted for its toughness, and rudely made it into the form of a chair, holding it in place with branches of small trees. The seeds fresh from the tree were bound to the vine until they had firmly fastened themselves to it, the vine being allowed to grow in the meantime. After the seeds and boughs had become attached, the vine was cut from the roots, and this natural chair exposed to the sunlight until the sap had dried from the fiber and all of the material had hardened into a substance as solid as oak. It was then polished until its surface glistened like mahogany. Although but three feet four inches in height and twenty-five inches in width, the weight of this curiosity is over a hundred pounds, on account of the hardness of the material of which it is composed.

The armchair may well be regarded as a striking example of the gardening skill of the Far East.



Cutting Up the Whale for the Whalebone



The Dead Whale on the Beach.  
THE LARGEST FINBACK WHALE.

#### THE LARGEST FINBACK WHALE.

BY WALTER L. BEASLEY.

The American Museum of Natural History has recently secured for its department of mammalogy a mighty leviathan of the deep, in the shape of a huge female finback whale, considered the largest specimen so far obtained, as it measures 68½ feet in length. The full-grown right whale averages from 45 to 50 feet in length only. This new specimen is a noteworthy contribution to science, and when mounted will form a striking exhibit of marine life seldom seen save by whalers and voyagers in the Arctic regions. The great creature was found stranded on the beach near Forked River, N. J., the latter part of November. Before the body came ashore it was first sighted a mile or so out on the shoals by the lookout of the life-saving station, from which point it appeared like an overturned schooner or craft of some sort. Acting on this supposition the life-savers launched their boat and pulled out to the assistance of a supposed wreck. On a near approach they discovered the true nature of the object, which was the great carcass of a dead whale. The pulling strength of the combined crew of ten men was not equal to moving this large, weighty animal from its stranded position, so all efforts in this direction were abandoned. The next day the heavy body was gradually pounded and pushed ashore by the incoming waves. On learning the news, Director H. C. Bumpus, Curator of the Department of Invertebrate Zoology, recognizing this as a favorable opportunity for securing a rare and splendid specimen, immediately sent Mr. George H. Sherwood, his assistant, and Mr. Figgins to investigate, and secure the body, if possible. Being first on the spot, they captured the prize ahead of other institutions. A number of local fishermen, however, had in the meantime laid claim to the big whale, but were induced to part with the same for a money consideration. A baby whale 16 feet long was also found near by.

The caudal fin or tail of the large whale measured 12 feet 4 inches from tip to tip, the body was 30 feet in circumference, and its estimated weight was about 75 tons. The length of the ponderous lower jaw was 14 feet 7 inches, and its open mouth could have more than taken in an average-sized horse. Her spacious interior, including mouth space, would more than shelter fifty men.

The specimen belongs to the group of whales known as genus *Balaenoptera*, which has a world-wide distribution. This particular species is named finner or finback by the whalers, who seldom hunt it, owing to the little amount of blubber and the small-sized whalebone it carries.

There were 375 plates two feet long on each side of the upper jaw of the whale. The right whale, the one regularly pursued for commercial purposes, has whalebone 12 feet long, and 25 to 50 barrels of blubber oil.

The color of the whale was slaty blue on the back, and white with some blue markings below. There were some eighty longitudinal folds and stripes on the ventral surface of the skin. The two bodies, after the measurements were taken, were buried in the sand to preserve their skeletons until spring, when they will be unearthed and taken to the museum for mounting in the near future.

The whale is highly prized by scientists for exhibition purposes, from the fact that it is one of the best examples known illustrating the influence of environment in the modification of structure. They are considered as descendants of terrestrial mammals which have assumed an aquatic existence—a change which has brought about very remarkable modifications in the structure of the animals. Some organs have become highly specialized, while others have completely degenerated. Teeth, for instance, which are a characteristic feature of land mammals, are entirely lacking in the adult finback, their place being taken in part by the whalebone. The fore limbs have ceased to be appendages of locomotion, and have become mainly balancing organs, and they still retain the structural plan of the mammalian fore limbs. The external fish-like form is perfectly adapted for swimming through the water, and the tail is not placed as in fishes, but horizontally. The hind limbs have disappeared entirely externally, and are represented by the rudiments of hind legs, which are found buried deep in the interior of the animal. These serve no practical purpose, but they serve to indicate its former life and habits as a land mammal and to show in a striking way the effect of environment.