

due in a great measure to his advice. Need we wonder, then, even with youth in his favour, that at the early age of about thirty-seven, being yoked in such heavy double harness, he has died with it on, leaving a large amount of accomplished valuable work, which was waiting for a spare moment to prepare for the publisher.

For some time Dr. Scheffer had been suffering from defective digestive powers and frequent sleeplessness, but he neglected these warnings and the advice of his friends to take some rest. He was unfortunate in being surrounded by those who, with few exceptions, took little interest in his work, and by none to whom he thought he could entrust the work in which he was so hard and enthusiastic a worker, so he worked on. The fatal affection was inflammation of the liver. The seizure was very acute, and at an early stage danger was imminent; but at length he rallied. His medical attendants considered the crisis past, and recommended his removal to his own estate near Sindanglaya, to reach which a tedious climb of 4,500 feet over the Megameudoeng Pass had to be surmounted. He never reached his destination, expiring, on March 9, at the Sanatorium at Sindanglaya, where he now lies buried.

In his private life he was a man to be loved and esteemed; quiet, unassuming, very kind-hearted, ever ready to give whatever assistance he could, especially to scientific travellers. With him the Netherlands Indian Government has lost a valued public servant, to whom it will not be easy to find a successor, and botanical science has to deplore an earnest worker, a learned disciple, and a great helper.

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A SCOTTISH CRANNOG¹

BETWEEN geology and history there lies an intermediate sphere in which these sciences dovetail into one another. In this common territory or borderland lies the domain of prehistoric archæology, and to its most recent portion, or that which archæologists have designated the "Late Celtic Period," must be assigned the antiquarian remains I have here the pleasure of describing. During this period it appears that the Celtic races of Scotland and Ireland were in the habit of constructing artificial islands in marshes and shallow lakes to which, in troublous times, they resorted for safety. They were generally formed by the superposition of trunks of trees and brushwood mingled with stones strongly palisaded by stakes, and so situated as to be inaccessible except by means of causeways, or occasionally by a narrow gangway or mole. These island forts, or *crannogs*, as they have been called in the Irish annals, were very numerous in former times, but owing to the gradual rising of the level of the lakes, they appear to have been so completely lost sight of that their very existence was unknown to modern antiquaries, so that their discovery in the present century marks an important epoch in the history of archæology.

In October, 1878, I drew the attention of antiquaries, through the columns of NATURE, to the remains of an ancient lake-dwelling just then discovered on the farm of Lochlee, in the parish of Torbolton, Ayrshire. Since then a series of excavations have been made with the view of ascertaining the exact nature of this structure, in the course of which a large collection of most interesting relics has been made.

In the year 1839, while a small lake on this farm was being artificially dried up for agricultural purposes, the attention of the labourers was directed to a singular mound, in which, on cutting drains through it, they exposed some wrought wood-work; but their observations,

though freely talked of in the neighbourhood at the time, led to no further results till forty years later, when it was found necessary to re-drain the locality, and hence the present investigations. By a curious coincidence the early drainage at Lochlee was made in the same year that Sir W. R. Wilde discovered and examined the first Irish crannog, viz., that of Lagore in County Meath. The Irish discovery, however, owing to a general system of drainage that was then going on, led at once to the most brilliant results, so that it soon became apparent that crannogs existed very generally over the country. Up to the present time over a hundred have been examined, and have furnished the Irish museums with a vast collection of relics. In the year 1854 a great impetus was given to the study of these researches by the discovery of the remains of ancient lake villages in Switzerland, which have now become so famous and well known all over the continent of Europe; but it was not till 1857 that the subject began to attract the attention of Scottish archæologists. In this year Mr. Joseph Robertson read a paper to the Society of Antiquaries of Scotland, and in 1866 Dr. Stuart, who was then Secretary to this Society, collected and published all the scattered notices of Scottish crannogs known up to that date. Since the publication of Dr. Stuart's elaborate paper no further investigations on Scottish crannogs, with the exception of an occasional notice of a fresh discovery of the site of one, have been recorded.

But though traces of these crannogs have been found in almost every county of Scotland, there has been no systematic examination of them worthy of comparison with the investigations that have been made in other countries; nor, with the exception of a few articles found at Dowalton, is there any collection of relics which would enable archæologists to form an opinion with much certainty as to the purpose they served in the social economy of the period they represent; nor can their range in the dim vista of prehistoric times be determined with greater accuracy.

Before the Lochlee Lake was originally drained no one appears to have surmised that a small island (visible only in the summer time) which formed a safe habitation for gulls and other sea-birds during the breeding season, was formerly the residence of man. It was situated near the outlet of the lake-basin, and the nearest land, its southern bank, was about seventy-five yards distant. The general appearance which it presented when the present investigations were commenced was that of a grassy knoll, drier, firmer, and slightly more elevated than the surrounding field. Towards the circumference of this mound the tops of a few piles were observed barely projecting above the grass. Guided by these the workmen dug a deep circular trench, in which they exposed numerous piles and transverse beams having square-cut holes in their ends, through which the former projected about eighteen inches or two feet. In the course of further explorations it became apparent that these piles formed a series of stockades surrounding a somewhat circular space about fifty feet in diameter. Beyond this circle on the south side there were indications of other rows of uprights which appeared to unite into one on the north side. Here, instead of further rows of piles, the corresponding space was occupied by an intricate arrangement of woodwork, consisting of young trees and stout branches, mixed with slanting stakes and logs running in all directions, the whole forming a dense protective barrier. The diameter of the island was about 120 feet. The central area was about three feet lower than the surrounding stockades with their transverses, and had a flooring of prepared logs resembling railway sleepers. Near the centre of this log pavement were found four circular hearths placed one above the other with an interval between each of 18 inches to 2½ feet. These hearths were neatly constructed of flat stones of various

¹ A full report of the Lochlee Crannog is given in vol. xiii. of the *Proceedings of the Society of Antiquaries of Scotland*, and in vol. ii. of the *Collections of the Ayrshire and Wigtownshire Archæological Association*.

sizes, and had a raised rim round them, also formed of flat stones, but uniformly selected and set on edge. Each of them was imbedded in a thin layer of clay, which extended several feet beyond, and the intermediate strata consisted of ashes, charcoal, and small bits of burnt bones. The top of the upper hearth was 7 feet 9 inches above the log pavement, but only about one foot below the surface of the mound, so that the greatest depth of the accumulated rubbish since the log pavement was laid would be about $8\frac{1}{2}$ feet. The lowest or first fireplace was separated from the log pavement by a thick layer of turf and then a layer of clay.

On a level with the third hearth, counting from below, there were decayed portions of several massive stakes, with square-cut ends which appeared to have been the remains of a hut. One stake was found to have a small portion projecting from the centre of its base, which neatly mortised into a hole formed by a piece of wood, a flat stone, and some clay, and another had pressed down the portion of clay on which it rested nearly a foot. It was thus evident that the stakes were so formed as to prevent them as much as possible from sinking by pressure. Immediately below this level, all over the area of the log-pavement, but more particularly within a circle a few feet from the fireplace, most of the relics were found. Close to this hearth, but about two feet lower, we extracted the skeleton of an animal like that of a goat or sheep, the skull of which was entire, and had short horn-cores attached to it. The relic bed was made up of partially decomposed vegetable matters, and could be separated into thin layers; the common bracken, moss, parts of the stems of coarse grass, heather, and large quantities of the broken shells of hazel-nuts were frequently met with. One of the latter was found to have a hole gnawed in it, as if made by a squirrel.

The space immediately beyond and on the south side of the log pavement, extending between it and the outer circles of piles, was occupied by a refuse heap or midden, consisting of gritty ash, decayed bones, and vegetable matters. Its breadth was ten or twelve feet, and its length from east to west nearly double that. Its surface was three feet below that of the field, so that its average depth would be about four feet. Some important relics were found here, such as metal instruments and daggers, two fibulae, several wooden vessels, and a few bone implements. It is noteworthy that the metal objects were all comparatively near the surface of the midden, and also that no boars' tusks were found in it except at its very lowest stratum.

The probable existence of some kind of communication between the crannog and the shore of the lake was suggested at an early stage of the investigations by the discovery of a few oak piles in a drain outside the mound on its south side. Upon making excavations in the line thus indicated a very singular wooden structure was discovered, which I found no less difficult to comprehend than it now is to describe. The tops of upright stakes were first revealed, which seemed to conform to no regular arrangement, but by and by, in addition to single piles, groups of three, four, and five, here and there, were detected. The first horizontal beam was reached 7 feet below the surface of the field, which proved to be one of a complete network of similar beams lying in various directions. At a depth of 10 feet the workmen could find no more horizontal beams, and the lake silt became harder and more friable. The reason of grouping the piles now became apparent. The groups were placed in a somewhat zigzag fashion near the sides of the gangway, and from each there radiated a series of horizontal beams, the ends of which crossed each other and were kept in position by the uprights. One group was carefully inspected. The first or lowest beam was right across; the next lay lengthways, and of course at right angles to the former; then three or four spread out diagonally, like a

fan, and terminated in other groups at the opposite side of the gangway; and, lastly, one again lay lengthways. Thus each beam raised the level of the general structure the exact height of its thickness, though large lozenge-shaped spaces remained in the middle quite clear of any beams. The general breadth of the portion of this unique structure examined was about 10 feet, and its thickness varied from 3 to 4 feet. A large oak plank, 10 feet long, showing the marks of a sharp cutting instrument by which it was formed, was found lying on edge at its west side and beyond the line of piles, but otherwise no remains of a platform were seen. All the beams and stakes were made of oak, and so thoroughly bound together that, though not a single joint, mortise, or pin was discovered, the whole fabric was as firm as a rock. No relics were found in any of the excavations along the line of this gangway.

The thickness, composition, and mode of structure of the island itself was ascertained by sinking a shaft at the south end of the log pavement (*i.e.*, near the centre of the island). This shaft was rectangular in form, and large enough to allow three men to work in it together. After removing the three or four layers of oak planks which constituted the log pavement, we came upon a thin layer of brushwood, and then large trunks of trees laid in regular beds or layers, each layer having its logs lying parallel to each other, but transversely and sometimes obliquely to those of the layer immediately above or below it. At the west end of the trench, after removing the first and second layers of the log pavement, we found part of a small canoe hollowed out of an oak trunk. This portion was 5 feet long, 12 inches deep, and 14 inches broad at the stern, but widened towards the broken end, where its breadth was 19 inches. This was evidently part of an old worn-out canoe, thus economised and used instead of a prepared log. Much progress in this kind of excavation was by no means an easy task, as it was necessary to keep two men constantly pumping the water which copiously flowed from all directions into the trench and even then there always remained some at the bottom. As we advanced downwards we encountered layer upon layer of the trunks of trees with the branches closely chopped off, and so soft that the spade easily cut through them. Birch was the prevailing kind of wood, but occasionally beams of oak were found, with holes at their extremities, through which pins of oak penetrated into other holes in the logs beneath. One such pin, some 3 or 4 inches in diameter, was found to pass through no less than four beams in successive layers, and to terminate ultimately in a round trunk over 13 inches in diameter. One of the oak beams was extracted entire, and measured 8 feet 3 inches in length and 10 inches in breadth, and the holes in it were 5 feet apart. Others were found to have small round projections, which evidently fitted into mortised holes in adjacent beams. Down to a depth of about 4 feet the logs were rudely split, but below this they appeared to be round rough trunks, with the bark still adhering to them. Their average diameter would be from 6 inches to 1 foot, and amongst them were some curiously gnarled stems occasionally displaying large knotty protuberances. Of course the wood in the act of digging the trench was cut up into fragments, and, on being uncovered, its tissues had a natural and even fresh-like appearance, but in a few minutes after exposure to the air they became as black as ink. Amongst the *débris* thrown up from a depth of 6 feet below the log pavement I picked up the larger portion of a broken hammer-stone or polisher, which, from the worn appearance presented by its fractured edges, must have been used subsequently to its breakage. After a long and hard day's work we reached a depth of 7 feet 4 inches, but yet there were no indications of approaching the bottom of this subaqueous fabric. However, towards the close of the second day's labour, when the probability

of total discomfiture in reaching the bottom was freely talked of, our most energetic foreman announced, after cutting through a large flat trunk 14 inches thick, that underneath this he could find no trace of further woodwork. The substance removed from below the lowest logs consisted of a few twigs of hazel brushwood, imbedded in a dark, firm, but friable, and somewhat peaty soil, which we concluded to be the silt of the lake deposited before the foundations of the crannog were laid. The depth of this solid mass of woodwork, measuring from the surface of the log pavement, was 9 feet 10 inches, or about 16 feet from the surface of the field. Amongst the very last spadefuls pitched from this depth was found nearly one-half of a well-formed and polished ring made out of shale, the external and internal diameters of which were $3\frac{1}{2}$ and 2 inches respectively.

In all the trenches made at the margin and beyond the crannog the stuff dug up was of the same character and composition. First or uppermost there was a bed of fine clay rather more than 2 feet thick, and then a soft, dark substance formed of decomposed vegetable matters. The source of the latter was evident from the occurrence in its upper stratum of large quantities of leaves, stems, branches, and the roots of stunted trees apparently *in situ*. This uniformity in the composition of the silt forming the bed of the lake points to the fact that for centuries the increase was due principally to the decomposition of vegetable matters, while latterly it was caused more by a deposition of fine clay. A change so marked in the sediment can only be accounted for by a corresponding change in the surrounding scenery, and no explanation is more likely than that the primæval forests had given place to the inroads of agriculture, when some of the upturned virgin soil would be washed down, as it still is, by every trickling rill that finds its way into this lake basin.

The remains of human industry found during the excavations of the Lochlee Crannog, calculated to throw light on the civilisation and social economy of its occupiers, are very abundant. They comprise a large variety of objects, such as warlike weapons, industrial implements, and personal ornaments, made of stone, bone, horn, wood, metal, &c. In the following description of them I have adopted the principle of classification suggested by the materials of which they are composed:—

I.—Objects made of Stone

Hammer Stones.—A great many water-worn pebbles, of a similar character to those observed in the surrounding glacial drift and river courses, which were used as

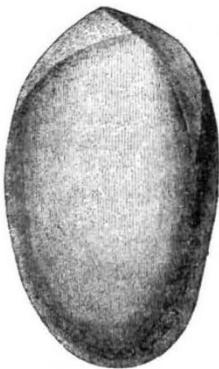


FIG. 1.—Hammer-Stone (Scale $\frac{1}{2}$).

hammers, pounders, or rubbers, were found in the *débris* all over the crannog, but more abundantly in the deeper layers of a small circular area surrounding the hearths. As typical specimens of such implements I have collected no less than nineteen. Of these fourteen are of a somewhat elongated oval shape, and were used at one or both ends (Fig. 1). They vary considerably in size, the major

diameter of the largest measuring 6 inches, and the rest graduating downwards to about the half of this. Two are flat and circular, and show friction markings all round, while other three were used on their flat surfaces only. One of these is divided into two portions, each of which was picked up separately, about a yard asunder, and found to fit exactly. It would thus appear that it was broken while being used on the crannog, and then pitched aside as useless.

Heating-Stones and Sling-Stones.—A large number of round stones, varying in size from half an inch to three inches in diameter, some having their surfaces roughened and cracked as if by fire, but others presenting no marks whatever, were met with. The former might have been used as heating-stones for boiling water in wooden vessels—the only ones found on the crannog—the latter as sling-stones or missiles.

Anvil.—About a foot below the surface, and a few feet to the north of the upper fireplace, a beautiful quartz pebble was found, which has the appearance of having been used as an anvil. It is of a circular shape, flat

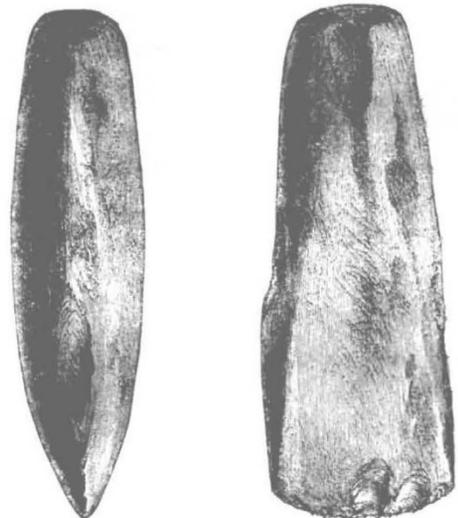


FIG. 2.—Stone Celt (Scale $\frac{1}{2}$).

below, somewhat rounded above, and measures 27 inches in circumference.

Sharpening-Stones or Whetstones.—Five whetstones were collected from various parts of the island. They are made of a hard, smooth claystone, one only being made of a fine-grained sandstone, and vary in length from 5 to 7 inches.

Polished Celt.—Only one polished stone celt was found. It is a wedge-shaped instrument $5\frac{1}{2}$ inches long and 2 broad along its cutting edge, which bears the evidence of having been well used, and tapers gently towards the other end, which is round and blunt. It is made of a hard mottled greenstone (Fig. 2).

Querns.—Five upper, and portions of several lower quern stones were disinterred at different periods, all of which, however, with the exception of a pair found over the log pavement, and an upper stone observed towards the west margin of the crannog, were imbedded in the *débris* not far from the site of the fireplaces. Some are made of granite, while others are of schist or hard whinstone.

Cup-marked Stones.—Two portions of red sandstone, having cup-shaped cavities about 1 inch deep and 3 inches in diameter, were found amongst the *débris*. One of them was lying underneath, and as if supporting one of the horizontal raised beams at the north side of the

crannog. The other, the position of which was not determined, has two circular grooves or rings round the cup, the outer of which is 9 inches in diameter (Fig. 3).



FIG. 3.—Cup Stone (Scale $\frac{1}{2}$).

Other Stone Relics.—Amongst a variety of other stone relics there is one peculiar implement manufactured out of a bit of hard trap-rock. It presents two flat surfaces 3 inches in diameter, with a round periphery, and is $1\frac{1}{8}$ inch thick.

Flint implements.—Only three flint implements were found on the crannog—a large knife flake 3 inches long and $1\frac{1}{2}$ inch broad; the posterior portion of another flake; and a beautifully-chipped horseshoe-shaped scraper here figured (Fig. 4).

Spindle whorls.—Three small circular objects, supposed to be spindle whorls, are here classed together. Two are made of clay, and were found in the relic bed near the fireplaces. The smaller of the two (Fig. 5) is



FIG. 4.—Flint Scraper (Scale $\frac{1}{2}$).



FIG. 5.—Clay Spindle Whorl (Scale $\frac{1}{2}$).

$1\frac{1}{2}$ inch in diameter, and has a small round hole in the centre; the other has a diameter of $1\frac{3}{4}$ inch, and is only partially perforated, just sufficiently to indicate that the act of perforation had been commenced, but not completed. The third object is a smooth, flat, circular bit of stone, $1\frac{1}{2}$ inch in diameter and $\frac{1}{2}$ inch thick, and is perforated in the centre like a large bead.

(To be continued.)

NOTES

THE Royal Society of Edinburgh has awarded the Keith Medal for the biennial period 1877-79 to Prof. Fleeming Jenkin for his paper on the application of graphic methods to the determination of the efficiency of machinery.

PROF. HENRY J. S. SMITH, F.R.S., Savilian Professor of Geometry in the University of Oxford, has been made a Corresponding Member of the Academy of Science of Berlin.

ON the 16th inst. the International Congress of Meteorology will meet at Vienna.

THE honorary degree of LL.D. has been conferred by the University of Glasgow on Mr. Edward John Routh, M.A., F.R.S., and Dr. Michael Foster, F.R.S.

PROF. W. H. FLOWER, LL.D., F.R.S., will give a discourse at the Royal Institution, on Fashion in Deformity, at the evening meeting on Friday, May 7.

PROF. HUXLEY will deliver the inaugural address at the opening of the Science College at Birmingham on October 1.

SIR WILLIAM THOMSON will preside at the meeting of the Physical Society on Saturday afternoon, and will make some brief communications to the Society.

PROF. HENRY TANNER, F.C.S., Senior Member of the Royal Agricultural College, and Examiner in the Principles of Agriculture under the Government Department of Science, has been appointed Professor of the Principles of Agriculture in the Royal Agricultural College, Cirencester.

THE fifty-first anniversary meeting of the Zoological Society was held last week. The report of the council was read by Mr. Selater, F.R.S., the secretary. It stated that the number of Fellows on December 31, 1879, was 3,364 against 3,415 at the same date of the previous year, 145 new Fellows having been elected, and 189 removed by death or other causes during the year. In consequence of the bad weather, which had seriously affected the garden receipts, and of the general depression in business which had prevailed in 1879, the income of the society showed a falling off as compared with that of 1878, but not to any serious amount; the total receipts having been 26,463*l.* in place of 27,944*l.* in 1878. The total assets of the society on December 31 last were estimated at 28,051*l.*, and the liabilities at 9,960*l.* The number of visitors to the gardens in 1879 had been 643,000, against 706,713 in 1878.

THE general meeting of the German Geometrical Society will be held at Cassel on July 4-7 next.

IN the last week of April an extraordinary fact was observed at Montsouris. We have stated already that the electrical observations are taken eight times daily with a Thomson electrometer and recorded; out of the eight readings registered on April 28 not less than six were negative, and on the following day seven were of the same sign. The occurrence is so extraordinary that it has been referred to in the papers as a fair characteristic of the season.

A LARGE and influential committee of shipbuilders and marine engineers has been formed in Glasgow for the purpose of promoting an exhibition of naval and marine engineering models in Glasgow. It is proposed that the exhibition shall be opened in the Corporation Galleries in November and remain open for six months. Mr. James Paton, the Superintendent of the Glasgow Museum and Galleries, has been appointed Secretary to the Committee.

AT the next meeting of the Society of Telegraph Engineers Dr. Siemens is going to bring forward his latest development of his dynamo machine, and of the influence of the electric light on vegetation.

THE Whit-Monday excursion of the Geologists' Association will be to Oxford, under the direction of Prof. Prestwich and Mr. James Parker. It will last over two days. The long excursion of the Association will be to Bristol on August 2 and following days.

FROM the Report of the New York Central Park Menagerie we learn that that establishment has now 423 mammals, representing 55 genera and 98 species; 753 birds, of 102 genera, 134 species; 30 reptiles, of 8 genera and 10 species; or 1,205 animals in all. The additions in 1879 numbered 668.

HEYWOOD of Manchester has issued, for the small price of sixpence, the eleventh series of the Manchester Science Lectures for the People, containing lectures on "Islands," by Mr. A. R. Wallace; "The Age of Dragons," by Mr. B. W. Hawkins; "Palestine in its Physical Aspects," by Canon Tristram; and