THE ORIGIN OF SOUTHAMPTON WATER.

WITH SOME ACCOUNT OF ITS EARLIEST NAVIGATORS.

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I do not propose in this Paper to discuss the commercial advantages of Southampton Water or its great capabilities as a trade channel, or to enlarge upon its natural beauties; but I wish to describe the origin of this remarkable estuary, and the geological conditions connected with it; and as I cannot fully describe its origin without some references to early man, I must also give a brief account of the primitive inhabitants of this neighbourhood, some of whom were here before Southampton Water existed, while others probably witnessed its formation, and were its earliest navigators.

Again, the historical events connected with this estuary are of great interest, and form part of our national history, but they do not come within the scope of this Paper.

I intend to deal as simply as I can, apart from geological technicalities, with far earlier circumstances than those which history records, viz., with those geological conditions which led to the origin of this remarkable estuary, as proved by modern engineering work, and by scientific observation, seeing that these circumstances and events must be regarded as the remote cause of all the maritime facilities of Southampton, and of all the great commercial possibilities in the future which its situation on this estuary may have in store for it. What Southampton was as a great port in the Middle Ages, what it is now, or what it may become in the future, is due for the most part to those geological conditions by which this great estuary, part of Hampshire's lowest valley, was formed.

The geological formations I shall have to mention, and the order of super-position in which they occur, are as follows:—

SUPERFICIAL BEDS—consisting of alluvial mud, peat, sand, and gravel.

BRACKLESHAM BEDS—consisting of loamy clay, and sand.

LOWER BAGSHOT BEDS—consisting of sand, and loam.

LONDON CLAY—of a firm brown, bluish, or slate coloured clay.

READING BEDS—consisting of softer clay, loams, and sand.

CHALK.

First, I have to ask you to bear in mind that Southampton Water is part of a valley—part of the long valley of the Test, and of the valley of the Itchen, which merge into each other, near this town. If you follow up the valley of the Test, it will lead you to the extreme north-west boundary of Hampshire, to Combe Hill, or Inkpen Beacon, 970 feet above the sea, the highest point of the chief watershed of the county. If you follow up the valley of the Itchen it will lead you to another part of that watershed near Basingstoke, 600 feet above the sea, and eastward, near Petersfield, 700 feet.

Next, I ask you to bear in mind that Southampton Water has had remarkable human associations, extending back to the very earliest periods in which we have any trace of man's existence in this part of Europe. As far as we know, it has not changed much, except in the matter of artificial reclamations of the land, within the range of English history. Along its banks have been found the relics of races far older than those with which the Romans had to do. Abundant remains of the conquering Roman people have been found on its shores or embedded in its mudlands. Here came the Roman ships, and here also came the ships of those ancient Greek merchants whose commerce with South Britain was carried on across the Channel and Bay of Biscay to the coasts of Gaul, up the Seine and Loire, and across central France overland to their stations on the Rhone, down which river their merchandise was conveyed to Marseilles, the chief emporium of their trade with western

Europe—a marvellous old trade route. These ancient Greeks were the commercial rivals of the Phœnicians, and amongst the commodities that they carried from Southampton Water was tin, which was in great demand in the eastern civilised countries for the manufacture of bronze, so largely used in the ancient world at that time. Here, in later ages, came also the ships of the Saxons, Jutes, and Danes, who all formed settlements in the county. The Ages of these latter Teutonic races, remote as they are from our day, are certainly nearer to our time than they were to the Ages of the much more ancient Iberian and Celtic peoples, who penetrated into Hampshire up the valley of Southampton Water.

We can observe with both scientific and commercial interest the flow of the tide up this estuary; but there was a time when the valley of Southampton Water existed as a water channel, but was too high above the sea level to have any tide at all. The double tide was probably caused through the destruction by the sea, or submergence, of the neck of land which formerly connected the Isle of Wight with Dorsetshire, by which the western approach to Southampton Water was made. Here, I may remark that we have a reference to this double tide about 1,200 years ago, for Bede, who wrote in the early Saxon period, mentions it as a remarkable phenomenon in his day.

That Southampton Water is the end of a valley may be easily seen by anyone standing on the higher ground on either side of it, and taking a general survey of the country on both sides. The country on the east bears a strong resemblance to that on the west. There is the same sloping foreshore, similar growths of timber near the shore, and similar great heaths existing on the higher ground a mile or two from the water on either side. The elevation of these heaths is much the same, being from 100 to 130 feet on both Netley Common and on Beaulieu Heath. The tidal estuary fills up the bottom of the hollow between the country on both sides: the water flows and ebbs through a valley.

The formation of the Hampshire valleys is one of the most interesting subjects connected with the physical geology of the county. The examination of their origin carries us back to the study of the effects of the forces of

Nature on the land, for the whole period during which what is now called Hampshire, has been above the sea, and it is also to the valleys that we must look for the traces of the earliest settlements of man. Every Hampshire valley is a waterway, but every waterway is not a valley. The water in some instances flows above the ground down gentle inclines in rivulets and streams, but in other instances its flow is first into a stratum more or less vertically, and afterwards through underground channels. There are consequently waterways which we can see and waterways which we cannot see.[1]

Southampton Water is very visible, and it is Hampshire's greatest waterway, apart from its tidal flow. There was a time, as I shall proceed to show, when the valley we now call by this name not only had no double tide, but had no tide at all. At that time, however, it was, as it is now, the greatest waterway in this county for the rain which falls upon it.

Hampshire has an area of 1,621 square miles, and the average annual rainfall is about 33 inches. This rainfall enables us to realise what a vast volume of water is annually poured over this county. Thirty-three inches of water over an area of 1,621 square miles are equal to 330 inches of water, over an area of 162 square miles, or equal to a cubic volume of water 16 miles long by 10 miles wide, and 27½ feet deep. Part of this water is evaporated from the surface of the land, part goes to supply the wants of plants and animals, including man, but the larger part either sinks into the earth and flows out again at a lower level where springs occur, or flows away over the surface. It reaches the sea somehow, by courses more or less circuitous.

There are, however, only two directions by which it can flow away. Part of it—that which falls on the northern slope of the watershed—finds its way into the streams which act as feeders to the Thames and so reaches the sea through the Thames valley. The greater part, however, flows southward into the streams flowing in that direction, and as the area of the combined river basins of the Test and the

[1] See Paper on The Springs and Streams of Hampshire by T. W. Shore, Hampshire Field Club Papers and Proceedings. Vol. II. pp. 33—58.

Itchen is greater than the Hampshire area which drains into any other stream, it thus happens that, apart from any tidal flow, Southampton Water is the greatest waterway in this county, and that by it a greater volume of the water which falls as rain over Hampshire returns to the sea than by any other channel.

I have mentioned the chief watershed of the county, the great water parting that, by the way in which it has directed the water towards the sea, has been much concerned in the formation of the Hampshire valleys, and consequently of Southampton Water. This watershed is at the present time a line of country, more or less elevated, extending through the county, from the neighbourhood of Petersfield and Alton, to Coombe Hill in the north western corner. Its elevation varies from 970 feet at Coombe Hill to only 370 feet west of Basingstoke, rising again to 700 feet near Medsted, and 700 feet near Petersfield.

This watershed marks the line of the main axis of elevation, by which what is now called Hampshire was raised above the sea. It was the line along which it may be said that the upheaving force acted with the greatest power. This watershed, as it exists at present, bears a faint resemblance only to the much more elevated ridge of country which far back in the later Tertiary geological period, was raised up by this force of upheaval. Several other axes of elevation may also be recognised in this county, viz., that which extends from the eastward past Winchester, that which passes along the line of the Portsdown Hill westward to Dean Hill on the Wiltshire border, and that which passes through the Isle of Wight. What is now called Hampshire, therefore as it was finally left above the sea after a series of geological changes, was an area with a main axis of elevation, and other axes to the south of it, having on the whole a slope to the southwards, and a slope to the northward and eastward, with trough-like hollows between the ridges. The trough-like hollow between the Portsdown ridge and the ridge of the Isle of Wight is that now covered by the Solent. We can recognise the remains of these ridges and trough valleys at the present day in other physical features of the county.

I now wish specially to draw your attention to one part of Nature's elevating work in the South of Hampshire which has had a most important influence on its physical features, and also on its history. The elevation marked by the chief watershed of the county, is, except in the neighbourhood of Basingstoke, fairly uniform. The elevation along the southern watershed, which passes a little northwards of Southampton, varies greatly in height, and it is lowest close to, and north of, this town. The chalk on Portsdown Hill at the present time is several hundred feet above the sea, and that on Dean Hill is 480 feet above the sea. The chalk beneath Southampton Common lies at a depth of 540 feet, and as the Common is elevated 150 feet, it may be said to be situated there at a level of about 400 feet below the sea. The upthrow to the north of Southampton along the southern line of elevation was small. As you stand on Middenbury Hill, near Bitterne, you can see a ridge extending from the east past Westend. The valley has been cut through it, but the ridge re-appears again across the Itchen, and extends past Chilworth and Rownhams, overlooking the Test. It re-appears again across the valley of the Test, and extends westward, rising to a height of 480 feet at Dean Hill, on the western border of the county.

The degree of this depression of the Portsdown and Dean axis in the neighbourhood of Southampton may be considered in another way. The London clay, which is found on both the north and the south of Portsdown Hill, extended over it also at the time of its elevation, the beds on the north being thus naturally connected with the beds on the south. As these beds are several hundred feet thick, and as the Reading beds lie beneath them, and above the chalk, the London clay must have existed at an elevation of 500 feet at least on Portsdown. It occurs at Swathling a few feet above the Ordnance datum, and it occurs in the bed of the Itchen at St. Denys below the sea level. There was thus, when Hampshire finally became dry land, a great depression in this east and west ridge, a short distance to the north of Southampton. This was a main contributory cause of the formation of Southampton Water, for it was across this depression that the water of the Itchen ultimately found its

way to the sea, instead of by some more circuitous route. There was, and is, a similar depression, as shown by similar geological conditions in the same ridge of elevation near Romsey. This was another main contributory cause of the formation of Southampton Water, for across this depression the water of the Test was ultimately able to find its way to the sea.

The upheaval of the land, which I have briefly described, was thus effected or accompanied by a bending of the strata into several arches and troughs. The crest of the main arch or ridge has since been much worn down, but is now represented by the main watershed of the county. This upheaval was not effected without a struggle, for, as the land was slowly lifted up, the waves attacked it, and layer after layer was planed off its top. We know this because patches of those layers are left. Thus for a long time, perhaps for a very long time, the struggle went on between the two forces, the force of upheaval and the denuding force of the waves. Finally the upheaving force overcame the action of the waves, and the land now known as Hampshire, arose above the sea, forming part of the series of geological arches and troughs which may be traced through England.

The chief part of Hampshire after the elevation of its strata must consequently have consisted of two inclined areas, having irregular surfaces which sloped from the crest of its main elevated ridge towards the line where the sea level now is on the south, and towards what is now the valley of the Thames on the north. This slope towards the south was, however, as I have described, obstructed by the Portsdown and Dean arch of elevation, and by that of the Isle of Wight, but not much obstructed in the neighbourhood of Southampton, and not much in the neighbourhood of Romsey.

The newly-elevated land was then attacked by rain, rivers, and floods. The inclined areas were planes no longer. The water as it fell on the land became collected into any hollow places and irregularities on its surface which could act as channels, and thus the earliest system of drainage began. As no continuous river courses yet existed, this drainage

formed streams flowing as best they could, some of them perhaps through lakes, in which the water was collected until it rose sufficiently high to pass over any obstruction or to break through it, and so flowing over one obstruction after another it found its way down the inclined surfaces into the great valley which is now the English Channel. Rain, rivers, and floods have been the forces which have scooped out the valleys of Hampshire, except a few, such as the Dean valley, which was originally a trough formed by the elevation of the Dean and Portsdown axis, and even these valleys rain, rivers, and floods have deepened or otherwise changed. Rain, rivers, and floods are the natural forces by which the lowest lying of all the Hampshire valleys, that now covered by Southampton Water, was originally formed.

I have mentioned the present annual rainfall as represented by a volume of water 16 miles long by 10 miles wide and 27½ feet deep; but this is small compared with the far greater rainfall of former ages. At one time a warmer climate certainly prevailed, when elephants and other wild animals now found only in semi-tropical countries roamed over the surface and through the forests of what is now called Hampshire, a much changed country indeed, but still the same area; the rivers now shrunken to the size of the modern Test and Itchen, their ancient river banks left high and dry and represented by the gravel terraces along their courses; the elephants all gone, and represented now only by their teeth, which are frequently found in the beds of gravel formed by the old rivers.

It was a great rainfall such as this I have referred to which fed the large rivers, such as the Test and Itchen undoubtedly were at one time. It was this rainfall which enabled them to deepen their valleys and widen them, and it was this which made it possible for the combined streams to cut out in their course to the sea that remarkable valley now known as Southampton Water. It was mainly this rainfall which widened the valley, through the rain wash forming innumerable rivulets, and so smoothing down its slopes. Notwithstanding the depression in the neighbourhood of Southampton, which enabled the water of the old Itchen to find

its way to the sea, that river had certainly to cut through some obstructions in its course. One example of this you may observe by noticing the Lower Bagshot sands and loams in the brickyard at Bitterne Park. These beds lie above the London clay which occurs along the banks and in the bed of the river. On the opposite side of the valley the Lower Bagshot beds may also be seen on Portswood Hill. They were once continuous, and the river has cut its way through them. Look at these beds of sand and sandy loam at Bitterne and Portswood, and consider how comparatively easy it would be for a great river when in flood to force its way through such loose material. It would first accumulate in a sheet of water above the obstruction and gradually rise until it was high enough to flow over the barrier, or the pressure of the water great enough to break it down, after which it would be a question of time only before the river, assisted by the rainwash down the slopes, made for itself a course such as the Itchen shows at the present day.

Water is one of the greatest forces in Nature. It shows its power most forcibly when obstructions oppose its rising force, as has been discovered by engineers, who have constructed reservoirs with embankments that have had insufficient resisting power.

As Goëthe says:

"Water, its living strength first shows,
When obstacles its course oppose."

The work connected with the extension of the Docks at Southampton during recent years has afforded opportunities for a geological investigation of the nature of the beds which lie beneath the mud in Southampton Water. The best opportunities of this kind occurred in the years 1887—88, when the excavation for the Empress Dock was being made, and again when the excavation for the Prince of Wales dry dock, and that for the later dry dock were made.

The largest work of this kind was that of the Empress Dock, the subsequent excavations for the Prince of Wales dry dock and for the later dry dock confirming the observations made during the progress of the Empress Dock. Previous work connected with dredging and lesser excavations for foundations on the reclaimed mudlands had

generally shown that the sequence of beds to be passed through in such work was mud, peat, gravel, sand, into beds of compact clay or loam. Apart from geological technicalities of any kind, I may say that the beds of clay or loam, with sand, which lie beneath the gravel, are those which were formed in the sea before the elevation of the land took place, and that the beds of gravel, peat, and mud have accumulated upon the clay and loam since the time when the beds were raised above the sea.

But it may fairly be said that these beds of clay and loam are now beneath the sea level. They are beneath the sea over the Dock area, because some of their upper layers have been washed away, and they are there situated at a low level. They are known as the Bracklesham beds, and are continued under the whole of Southampton Water, appearing on both sides of it, and extending round Southampton in all directions. It is mainly from the loam of the Bracklesham beds that the bricks have been made of which this town has been built. It is these beds which form the bottom of the valley above which Southampton Water flows. It is the upper layers of these beds that have such a tendency to slip, as some engineers, insufficiently acquainted with the local geological conditions, have found to their cost. It was owing to the partial excavation of these beds by river and floods that the valley now covered by Southampton Water was formed, and it is upon this excavated surface that the beds of gravel, peat, and mud have accumulated.

The question arises—"How"? Let us consider this subject from the upper beds downwards, beginning with what we can see, that is treating of the mud first. As we look at the mudlands they appear at first sight to be areas devoid of interest. Most people are glad to see as little of them as possible, and welcome the returning tide which hides them from view. If, however, we observe these areas of mud more closely they will present to us a miniature geological picture, for they are not extents of perfectly flat mud, but are intersected by numerous channels, some of the largest of which, called by the local name of "lakes," are sufficiently deep to have water in them at ebb tide. There are also

smaller channels, which extend from the larger ones over the mud in all directions. These little channels are the courses by which, at the ebb of the tide, water drains off the surface of the mud, and by which the rain, when it falls upon them, also runs away.

The channels are formed by the erosive action of the streamlets on the soft mud, and they illustrate the same geological action as that which rain and rivers exert on all land surfaces. The differences is merely one of degree and time, for if the mudlands could be artificially levelled, the miniature valleys in them would again be formed by the streamlets after a few tides. Similarly the hills and land surfaces of the county have been gradually wearing away, and the valleys have been in process of formation or enlargement for as long a time as Hampshire has been above the sea.

The mud has been brought down by the Test and Itchen, the particles being suspended in the water in a fine state of subdivision. Fresh water, even with the fine sediment which it brings down, is lighter than salt water, and hence the discoloured water which the rivers bring down after heavy rain, instead of falling beneath the water into which it flows, and depositing the mud at the bottom, as it usually does in deep fresh water lakes, such as those of Switzerland, is spread over the mudbanks in calm weather, or carried seawards on the surface of the sea water.

In calm weather you may see this meeting of the waters near Redbridge and Millbrook, the flowing tide carrying the heavier salt water up the mid channel and the lighter fresh water being divided by it into two parts, which spread out over the mud.

Owing to the friction of the water on the mud, its outflow is not so rapid over the shallow mudlands as in the deep channels, and consequently, as the water stops longer over the banks, the sediment has more time to settle. The newly-deposited sediment is, however, subjected to the denuding action of rain while the mudlands are above the water and exposed to its effects, so that the fine sediment is not only being gradually deposited, but is being often removed and brought back by the tide to some other site.

This fine mud which the rivers bring down to the estuary has been derived from the same sources as the mud which the same rivers in the higher parts of their courses deposit when in flood, on the alluvial meadows and marshes through which they flow. It has been obtained from the waste of the softer parts of the surface of the land higher up, and the rivers have formed the alluvial meadows and marshes in much the same way as they have, aided by the tides, formed the mudlands.

Here let me remind you what a remarkable substance mud is. When we survey any of the Hampshire mudlands and other muddy alluviums we should remember that mud is not a useless but a very useful substance, for in the widest meaning of the word without mud there could be no support for human life. Vegetable food stuffs of nearly every kind are raised on soils which have been largely formed by mud. The soils of deltas and other deposits of river mud are the richest in the world. The Hampshire valleys contain many examples of such rich alluvial soils. It is only in Southampton Water and similar places, where the mud is washed by the sea, that it is of no value. Where no mud exists, or can be made to exist, there is a waste, as in the sandy and gravelly districts of the New Forest. Mud must, therefore, be recognised as a main cause in the formation of soils, and consequently of the fertility of the land. The mud produced by rainwash has been of far greater value to Hampshire than all the mineral substances which have ever been dug out of its strata. This rainwashed mud, assisted by other agencies concerned in the formation of soils, has been the making of Hampshire as an agricultural county. In the soils of the upper parts of the hill slopes of the county, we see muddy detritus in its first and highest resting-places. In the mudlands of Southampton Water we view it in its finer condition and in its last resting-place, until some unusually strong current, finally carries it away into the sea.[1]

1 See Paper on Hampshire Mudlands and other Alluviums, Hampshire Field Club Papers and Proceedings. Vol. II., pp. 181—200.

I have said that the Test and the Itchen must have formerly been much greater streams. The work they have done in excavating their valleys shows this. They are now, geologically speaking, old rivers—so old that their age baffles all exact chronology. They are streams which have experienced, and have caused, many changes. In the fragmentary gravel terraces, along their courses, we may see the remains of the more or less continuous terraces of gravel formed by them during the heyday of their youth and prime, which terraces have long since been themselves almost washed away. The Test and the Itchen have played havoc with the chalk strata higher up the county, and have sculptured the hills they have left. The remains of the Saxons and Romans which have been found along their courses are but of recent date compared with the age of the rivers themselves. The men of the Bronze and Newer Stone periods did not see these rivers in their prime. For that time we must go back to the Early Stone Age, when the river drift men, whose weapons we find in the river gravel beds, and the elephants, whose teeth we find in these same beds, were contemporary inhabitants of the country along their courses, and that was the age when the valley now partly covered by Southampton Water was formed.

When we consider that the ancient Test and Itchen have with their branches and the contemporary rainwash, cut out for themselves in the higher parts of their courses, valleys which are at least 200 or 300 feet deep, we shall not be surprised that their combined waterflow cut out the valley about 130 feet deep, the bottom of which is now covered by Southampton Water. If these streams have not removed mountains they have at least carried away a vast mass of material from between the hills, and they have given their shapes to those hills which they have left.

Rivers perform the chief part of their excavating work in the heyday of their youth and in the vigour of their prime. When they become geologically old, and have cut down their channels, they become less active as geological agents. They then form alluvial plains along their courses, such as you may see along those rivers above the tidal limits, and

near their mouths they commonly form sand banks, or mudbanks, such as you may see in the Southampton mudlands.[1]

Let us next consider the origin of the peat which lies here and there beneath the mud along both sides of the mid-channel of Southampton Water. This peat is not a deposit, but a growth. It was not brought there by a flow of the water as the mud was, but it was formed by plants which grew under the influence of the sun's heat and light. It must have been formed above the water, for the remains of the plants of which it is composed are remains of land plants similar to those now growing in the boggy parts of the New Forest, where beds of peat are in the process of formation.

During the time when the Empress Dock was being constructed the peat found beneath the mud was carefully examined, and although the plant—remains in it were much decomposed, the bulrush, the common sedge, the bog myrtle, heaths, and the bracken fern were identified, all of which are at the present day growing in the New Forest. The peat also contained the trunks of trees lying as they fell, with roots passing down into the loam beneath. There were abundant remains of the beech and hazel, much oak, and some parts of the birch and pine, together with abundance of hazel nuts, and plenty of fir cones in a good state of preservation.[2]

These observations show that the peat beneath the mud in Southampton Water was formed under somewhat similar conditions to those under which peat is now being formed in the New Forest. There bogs exist in which cattle are frequently mired, as the animals were whose bones were found in the peat, nearly forty feet below the surface of the tide—washed mud on the site of the Empress Dock. This peat beneath the mud was formed under precisely similar conditions to those under which it was formed higher up the

[1] See Paper on The Springs and Streams of Hampshire, by T. W. Shore, Hampshire Field Club. Papers and Proceedings Vol. II. pp. 33—58.

[2] See Paper on The New Dock Excavation at Southampton by T. W. Shore and J. W. Elwes. Hampshire Field Club. Papers and Proceedings. Vol. I., Part III., pp. 43—56.

valleys of the Test and the Itchen. Where excavations are made in the alluvial marshes along the higher courses of these streams, the muddy soil has first to be dug through, then peat is often met with, then gravel, resting on the loam, chalk, or other material through which the primitive stream cut its valley. The same beds commonly occur, and in the same order as in Southampton Water, mud or surface clay, peat, and gravel. In some of the higher parts of the valleys, such as near Bishopstoke, and near Stockbridge, peat was extensively dug centuries ago for use as fuel.

Geological observations have shown that a subsidence occurred after the growth of the peat, and that this was not confined to Southampton, but extended up the county. It also extended along the coast, for peat beneath the mud is found along the north bank of the Solent westward of Calshot, near Bournemouth, and along parts of the south coasts of the Isle of Wight. The subsidence probably did not occur all at once. The encroachments of the sea on the Hampshire coasts by such changes are well-known. In the middle of the fourteenth century a great area of land was submerged near Hayling Island. Previously the sea submerged a large area of land near Alverstoke and Portsmouth, and these later submergences are recorded in historical documents. These circumstances prove conclusively that there have been considerable subsidences of the surface of the earth in this part of England, since the time when the peat now lying beneath the mud was formed. At the time when the peat plants were growing in the valley, Southampton Water was a fresh water channel only, with marshy or boggy ground extending along its sides; and it was certainly above the limit of the tidal flow. The sea at that time must have been many miles away, the old shore line being probably somewhere out in the English Channel.

Then came the last, and the most important, of the geological changes which led to the formation of this estuary, for the subsidence occurred, a gradual subsidence probably, but certainly such as depressed the bottom of the valley that formed the common outlet for the water of both the Test and the Itchen, and as a result of this sinking of the

land the tide flowed in and out, the water increased greatly in depth, and Southampton Water became an arm of the sea. That geological occurrence by which the lowest part of the Test and Itchen valley became depressed beneath the sea level must be regarded as the ultimate natural cause of all the maritime advantages of Southampton. The outlet of the Test and Itchen was more depressed by this sinking of the land than the outlet of the Avon at Christchurch. If the lower part of the Avon valley had been submerged as that of the Test and Itchen was, Christchurch, or some other place near its site would possess maritime facilities which might rival those of Southampton at the present day. Nature was kinder in this respect to the neighbourhood of Southampton than she was to the neighbourhood of Christchurch.

Next, let us consider briefly the geological history of the gravel which occurs beneath the peat in Southampton Water and in many of the higher parts of the valleys. In conjunction with it we must consider also the gravel patches and terraces which lie along the courses of the streams, though now above the surfaces of the streams, even when flowing in their greatest flood. Some of the gravel beds are older than the peat, some later, and some are now being formed. This gravel has all been brought down by the river from the country higher up, and derived from the waste of older gravel beds on the hills, or, from waste of the flints in the chalk beds. The oldest of these gravel beds are those which lie highest above the level of the streams, for they were formed when the rivers were larger and flowed at higher levels. The occurrence of these river gravel beds points to the destruction of some other beds. A great thickness of chalk has been removed by rain, rainwash, frost, floods, and rivers from the surface of the chalk country in the course of ages. The softer parts were easily removed and for the most part carried out to sea, particle by particle, either in solution or in suspension as fine chalky mud in the river water. The flints, being much harder, remain, and in the course of ages have become broken up into gravel, generally stained by oxide of iron. The gravel beneath the peat in Southampton Water points to the destruction by water and frost of some of the Hampshire chalk beds in that

remote age which preceded the growth of the peat. It rests on the excavated surface of the beds of clay and loam, the upper parts of which were destroyed when the ancient rivers and their floods cut out the valley now covered up by the gravel, peat, mud, and tidal water. The forces of nature have been engaged more or less actively in these processes of destruction since the time when the land emerged above the level of the sea.

Let us now consider some of the remains of those races of man who where the earliest inhabitants of this part of the country, and the earliest navigators of Southampton Water, the consideration of their remains will assist us in determining relatively the date of that pre-historic Age during which the valley itself was formed, and also of that during which the submergence of what is now Southampton Water probably took place.

The earliest race of all, of whom we find remains in the neighbourhood, is that of the Early Stone Age, the River Drift men. The remains they have left in this county consist of roughly shaped stone implements of various shapes. You may see a collection of them in the Hartley College Museum, all found locally within the last thirty years, and all derived from beds of drift gravel. These stone weapons bear unmistakable marks of design. They have been made by chipping flints with great care, so as to form such flints into the shape of spear heads, clubs, or other implements convenient for use.

The men of the Early Stone Age lived in this neighbourhood before the country had assumed its present diversified appearance of hill and valleys. They lived here before the valley of Southampton Water was cut, for we find their implements imbedded in the gravel bed which caps the cliffs along the south-east of this water, and further eastward along the north of the Solent. Walk along the shingle beach at the base of these cliffs, between Hook and Hill Head, or eastward to Lee-on-the-Solent, and perhaps Fortune may favour you as she favoured me, and you may find one or more of these ancient stone weapons which have been washed out of the gravel at the top of the cliff. The bed of gravel has been cut back by the action of the water, and it now forms

the top of a cliff. It is quite clear, therefore, that the drift water or floods which brought down the gravel, and with it the stone implements of the River Drift men, must have flowed much above the present level of Southampton Water, and that when the men who used these implements roamed about this part of the country the valley now covered by the tidal estuary did not exist. The drift water must have flowed at a much higher level. It was an immense drift of flood water of some kind, for it covered the area now occupied by Southampton itself, and deposited some of these stone implements in the gravel beds on Southampton Common, at Highfield, and other parts of this neighbourhood, 100 feet above the level of the sea. Near Hill Head the great drift stream must have flowed 50 feet above the sea. Primitive man in this neighbourhood either saw this great drift of water or preceded it in point of time, for his weapons are found in these gravel deposits. That race of men lived here so long ago that he would be a bold man who would venture to assign a date to his period of life here. I have said that elephants' teeth are found in the same gravel beds. A collection of these, and parts of them discovered in this neighbourhood, are in the Hartley College Museum.

No remains of the men of the Early Stone Age except their stone implements, which are different from those of the Newer Stone Age have been found either along the shores of Southampton Water or elsewhere in this part of Europe.

When we consider the relics of the men of the later or Newer Stone Age, we find remains along the shores of Southampton Water and the valleys opening into it of a more varied character. Their stone implements are of a different shape, and are not found in the older gravel beds. During the Empress Dock excavation, a site was discovered where a Neolithic flint worker had shaped his stone implements, for many flint flakes were found lying together in the peat.

These men have left not only their stone weapons, but also their burial mounds, their skeletons, some of their domestic implements, and, I think, a trace of their language in one of the pre-historic water names of the county. Their

skeletons show that they were a race of somewhat short stature with long-headed skulls, that is, with skulls considerably longer than they were broad. They buried their dead in the most ancient form of burial known in this part of the world, drawing the body up into a contracted form, and restoring it to their great Mother earth in the same position, as nearly as could be, in which the mother nourished it, a burial custom, I doubt not, of reverence and religious symbolism which we cannot but regard with respect.

Their burial grounds consist of masses of earth heaped up in an elongated shape, and they are known as long barrows. Many of them have been destroyed in the course of time, but some may be seen in various parts of the county, for example a good specimen exists on Beaulieu Heath, between Hythe and Beaulieu. In places where they could obtain large stones they commonly placed their dead in a sitting or contracted position beneath a dolmen, a structure made of two large stones placed in the ground vertically, and another large stone placed so as to rest upon them horizontally like a table. Where they could not obtain such large stones they made holes or cists in the earth, and placed their dead therein. Over these dolmens or burial cists they heaped up long barrows.

Many of these most ancient funeral monuments have become worn down, and are now almost or quite obliterated; but when examined, some remains of contracted skeletons or long-headed skulls have commonly been found. This was the case on Chattis Hill, near Stockbridge, where, a few years ago I saw a depressed long barrow excavated, the skulls and bones of the contracted skeletons found being now in the Hartley College Museum.

These people made stone axes, hammers, arrowheads, and other weapons for their common use, and the surfaces of many of them they rubbed smooth and polished. They also made articles of bone for domestic purposes, such as the bodkin for use in sewing skins, found during the excavation for the Empress Dock.

None of their remains have been found in the Old river gravel beds in which we find the implements of the men of the Early Stone Age. These men of the Newer Stone Age, or Neolithic people lived here long after the time when the river gravel beds had been deposited. They may have picked up from these beds some of the rougher made stone weapons of their remote predecessors, but they made their own stone implements of a different shape, as you may see by examining the specimens in the Hartley Museum. They were acquainted with some of the arts of life, and some early mechanical appliances. They must have had some rotary instruments, such as are now used by people in some uncivilised parts of the world, who are now passing through their Stone Age, as the people here were thousands of years ago. The smooth stone hammer head of a circular shape, with a large hole drilled through the middle, like that exhibited in the Hartley Museum and found during the Dock excavations, show that they must have used a drill of some kind. It was probably a drill worked by a string or thong of leather or skin, such as is used still in many parts of the world for drilling holes, smoothing rough surfaces, and obtaining fire by friction. It was by such means that the people of the Newer Stone Age, or Neolithic men, no doubt obtained fire.

The stone implements of these people are found on the surface of the land or very near its surface. Fine examples of such specimens, found at Freemantle and Botley, are shown in the Hartley Museum.

The chief racial characteristics connected with these people were—(1) Their long-headed skulls, known as dolicocephalic. (2) Their burial customs. These characteristics show that the people of the Newer Stone Age who lived along the shores of Southampton Water were not an isolated clan or tribe, but part of a great race. I have mentioned their custom of building dolmens, beneath which they placed their dead. Dolmens have been found in many parts of England. The remains of some exist on the chalk downs of neighbouring counties, and there are references in Saxon documents to dolmens and places of heathen burial in this county. Many have no doubt been destroyed. The

remains of dolmens are more numerous in France, and increase in number towards the south. They are still more numerous in Spain, and in North Africa they are still more abundant, hundreds of these old characteristic burial places being found within areas of a few square miles. These circumstances point to a great migration of an ancient race of men, of whom the people of the Newer Stone Age who settled in Hampshire were part. They are also known as the Iberian race, owing to their ancient migration from Spain, the Iberian peninsula. North Africa was, however, their orignal home, and they were impelled to migrate, no doubt, by similar causes to those which cause emigration at the present day—the pressure of population and food necessities. It is an interesting circumstance that they appear to have followed the same course as that taken by our swallows in their annual northward flight.

That these ancient Iberians settled in Hampshire possessed some articles which they brought from a great distance, or at least acquired articles by barter which must have come from some far distant country, was shown by an implement I obtained for the Hartley collection about twelve years ago. Part of it had been broken off, but it is a weapon of the usual Neolithic or Iberian type, and was found near Hordle. It is made of jade or nephrite, a mineral substance not found in Britain or at the present time in Europe. You may see it in the Hartley College Museum. Most of the implements of these people which have been found in this neighbourhood are made of native stones, chiefly flint, but this weapon is made of jade, a rare substance, now mainly obtained from parts of Asia. Geologists have no knowledge of jade having ever been found among any of the British rocks, but in ancient time some may have been obtained from South Europe. The jade weapon in the Hartley College Museum certainly travelled a great distance before it was thrown away in a broken condition near the Hampshire coast. These people probably crossed the Channel in its narrowest part, and penetrated into this county up the valleys of the Test and Itchen, in the higher parts of which, as well as the lower parts, their remains have been found. They probably

fortified hill sites as their successors certainly did after them, such as the camp which you may see on St. Catherine's Hill.

How long the people of the Neolithic or Newer Stone Age lived here we cannot say, but we do know approximately when their conquest by people of the Celtic race, who used bronze weapons and implements, took place.

These early races of men were not isolated tribes or islanders who had no affinity to a parent stock, or had no traffic by barter with people allied to them in blood on the Continent. We know by such discoveries as that of the jade weapon that even the Iberians or Neolithic people must have had such communications.

We know from archæological research that the ancient Iberians occupied at one time the greater part of France, and that they were gradually driven southwards by the advance of the Celts from the north-west and west. These ancient Celts were the people of the Bronze Age in Western Europe.

Bronze weapons and implements were made after prevailing fashions, which changed in the course of centuries, the South of Europe being more advanced in the art of its manufacture than the north. The shapes and artistic decoration of these implements made in the South of Europe can be assigned approximately to relative periods, and as Britain was not wholly isolated from intercouse with the Mediterranean area, its arts were influenced by the arts of Southern Europe. The period from about 1400 B.C., to 1200 B.C., has, after most careful examination of bronze implements in all parts of Europe, been assigned as the approximate period when the manufacture of bronze was introduced into England. That manufacture came in with the Celtic conquest. The Iberic people were probably nomadic in their habits, wandering over the open parts of the country with their herds of cattle and flocks of goats, while the Celts were a typical branch of the great group of nations known as Arians, who tilled the land and consequently were more stationary. With the aid of fire they would be able to begin the systematic clearings in the primeval forests, an undertaking probably beyond the power of the Iberians, who had nothing but stone axes, very liable to fracture in such work.

If not at first, yet soon after their conquest, the Celts adopted cremation as the method for disposal of their dead. They constructed no dolmen mounds or long barrows, but buried the ashes of their departed chieftains under round tumuli of various shapes. These round tumuli exist on both sides of Southampton Water, particularly on the heaths round Beaulieu. Wherever they have been examined in Hampshire they have been found to contain some evidences of cremation. The earlier, such as some whose excavation I directed in Hampshire, are usually found to contain remains of burnt bones and charcoal, mixed with the loose earth, but no urns.

Those of later date, such as those found near the northern watershed of the Itchen, contain urns full of ashes and remains of bones, placed in the ground in an inverted position. I took part in the removal of eleven of these urns in 1888, of which one is shown in the Hartley College Museum, which also contains another from Westend, and others from near Chandler's Ford.

Bronze implements have been discovered in various places near Southampton. Eight were found on the east side of Cobden Bridge in 1894, in a small patch of peat on the hillside, where a spring probably at one time existed. They have often been found in peat, which in some cases, as at Bitterne, has grown over the place where they were lost, or deposited. Some years ago, my co-Secretary, Mr. Dale, obtained about 20 found on a boggy spot near Pear Tree Green, but after inquiries extending back many years, I have not been able to learn that a bronze implement has ever been found in the submerged peat beneath Southampton Water. A polished stone hammer head, with flint flakes, a bone bodkin, and other articles of the Neolithic or Newer Stone Age, were, however found, in the submerged peat.

These circumstances are very important, and assist us in determining the relative date of that subsidence by which the valley now called Southampton Water was submerged. Such subsidences along the Hampshire coast are not

unknown to history. Historical documents tell us, as I have mentioned, of the submergence of areas of land at Hayling Island and Alverstoke in the thirteenth and fourteenth centuries, and the implements of the people of the Iberian or Newer Stone Age found in the submerged peat where the Empress Dock now is, together with the absence of bronze implements in this peat, point to the Newer Stone Age, the Neolithic, or Iberian period, as the time when the earlier and greater subsidence of the Hampshire coast took place.

The remaining evidence which I have to mention in support of this view, is of some interest. The peat beneath the mud in Southampton Water contains patches of tufa, a fresh water calcareous formation. This substance is composed of shells and other remains of animals, such as inhabit the fresh water pools in peaty marshes, higher up the valleys of the Test and Itchen. The polished stone hammer-head I have mentioned was found in a patch of tufa in the peat, and when brought to me had the calcareous matter of the tufa adhering to it. It was no doubt lost in the pool by one of the Iberic inhabitants of this neighbourhood, on what was then a river marsh near the junction of the two rivers, and this pool afterwards became filled up with fresh water calcareous accumulations and a growth of peat. It is clear that the subsidence must have occurred after the loss of the stone hammer-head, and the accumulations of tufa and peat over it.

These circumstances point to about the close of the Neolithic or Newer Stone age as the probable time when the great subsidence occurred. Let me remind you that the close of the Stone Age in Britain, as I have mentioned, has been assigned, after much research, to about 1400 B.C., when bronze was introduced. At that time Egypt was the most civilized, and, perhaps, the most powerful State of the then known world. Assyria and Babylonia, the great ancient Empires of the east were in their infancy. The Etruscans and Phœnicians were races in the early stages of their national

development, and the chief commerce of the world was carried on between ancient ports on the Mediterranean Sea, and in Asiatic waters.

It is to this ara of the world's history that the scientific evidence obtained points as the period when Southampton Water was formed, and it is the Hampshire people of the Newer Stone and Bronze Ages, the Iberians, who buried their dead in a sitting posture, and the Celts, who cremated their dead, to whom this evidence points as its earliest navigators.