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Guide to the Crystal Palace and its park und gardens

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Part III. The exterior.

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PART III.

THE EXTERIOR.

NOTE.—The arrangement of the following Division assumes the visitor to enter the Garden from the Central Transept, whence he proceeds to inspect the *Terraces* and the *Italian Garden*. Passing down the central steps from the second Terrace, and round the *Great Circular Fountain*, he proceeds to the left, and continuing the path, explores the *English Landscape Garden*, and the *Archery Ground*, beyond which is the *Park*, the *Cricketing Ground*, from which, proceeding half round the basin of one of the *Great Fountains*, he reaches the *Grand Plateau*, and examines the *Geological Restorations and the Extinct Animals on the Islands in the Lake*. Leaving the *Plateau*, he skirts the basin of the second *Great Fountain*, and proceeding by the *Rosary*, completes the circuit of the grounds. An account of the *Great Water Towers*, in connection with the system of *Fountains*, and of the *Artesian Well* and the *Water Supply* is then added.

The Park and Gardens.

THE SITE.

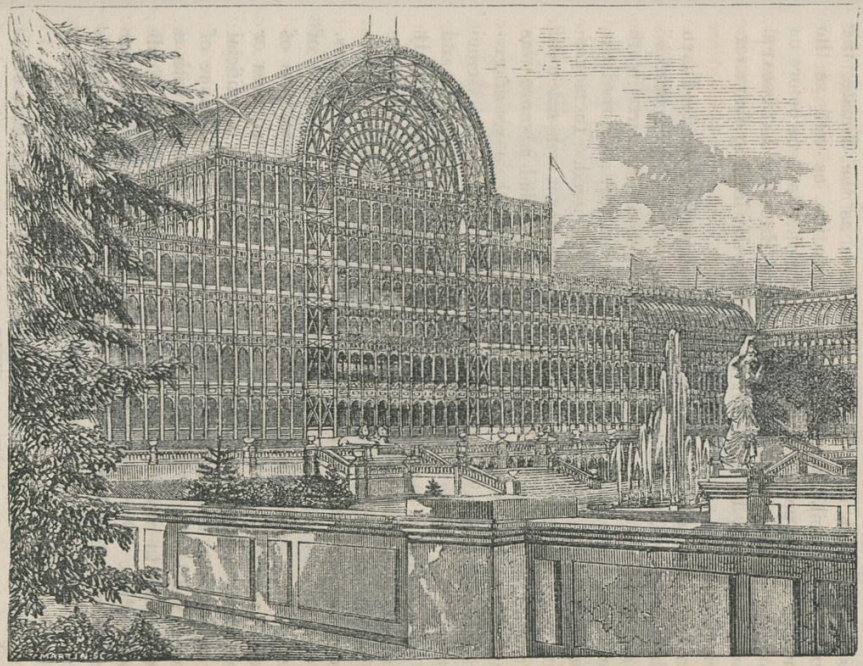
The Crystal Palace stands in the county of Surrey, immediately on the confines of Kent, bordered on one side by Sydenham, and on the other by Norwood and Anerley, whilst Penge lies at the foot of the hill, and Dulwich Wood at the top. No particular topographical or historical facts are associated with these places. Sydenham, however, is invested with some literary interest as having been the residence of the poet Campbell, the author of the "Pleasures of Hope," who passed, as he says in one of his letters, the happiest years of his life in this suburban village, and who wrote here the whole of "Gertrude of Wyoming."

THE PARK AND GARDENS.

The Crystal Palace and its grounds occupy two hundred acres, and it is of importance to note that, in the formation of the

gardens, the same uniformity of parts is adhered to as in the building itself; that is to say, the width of the walks, the width and length of the basins of the fountains, the length of the terraces, the breadth of the steps, are all multiples and sub-multiples of the one primary number of eight. By this symmetrical arrangement perfect harmony prevails, unconsciously to the looker-on, in the structure and in the grounds.

As the visitor quits the building from the Central Transept, let him pause at the top of the broad flight of steps leading to the first terrace, and notice the prospect before him. At his feet are the upper and lower terraces, bordered by stone balustrades, the long lines of which are broken by steps and projecting bastions. Along these balustrades, at intervals, the eye is attracted by the statues that surmount them. Straight before him runs the broad central walk, and, on either side of it, on the second terrace, the ground is covered with green turf, now relieved by beds filled with gay-coloured flowers, and further heightened in effect by fountains which throw water high up into the air. As a side boundary to the foreground of this picture, the wings of the building stretch out in their blue colouring, their cheerful, light aspect harmonising with the rest of the scene. Looking straight forward, below the level of the second terrace, we see the large circular fountain, surrounded by white marble statues, which stand out sharp and clear against the dark landscape beyond. On either side, on a yet lower level, a glimpse is caught of the glistening waters in the two largest fountains, backed by embankments of turf; and beyond these again, if we could only lift our vision over the plateau, we should see the waters of the large lake, whose islands are peopled by monsters that inhabited the earth when the world was young. To the right and to the left, in the grounds, are pleasant sloping lawns, dotted here and there with trees, and thickly planted shrubs; and then, beyond the Palace precincts, stretching away into the far distance, is visible the great garden of Nature herself, a picture of rural loveliness, almost unmatched by any scene so close as this to the great London city. Undulating scenery prevails: here it is rich with bright verdure, there dark with thick wood: here, the grass field; there, the grey soil, which, in the spring time, is covered with the delicate green of young wheat; and, in the autumn, waves thick with golden corn. Across the fields run long lines of hedgerows, telling plainly of the country in which they are found; and in the very heart of all, the village church spire shoots through the trees, surrounded by clusters of cottages, whose



VIEW OF GREAT TRANSEPT.

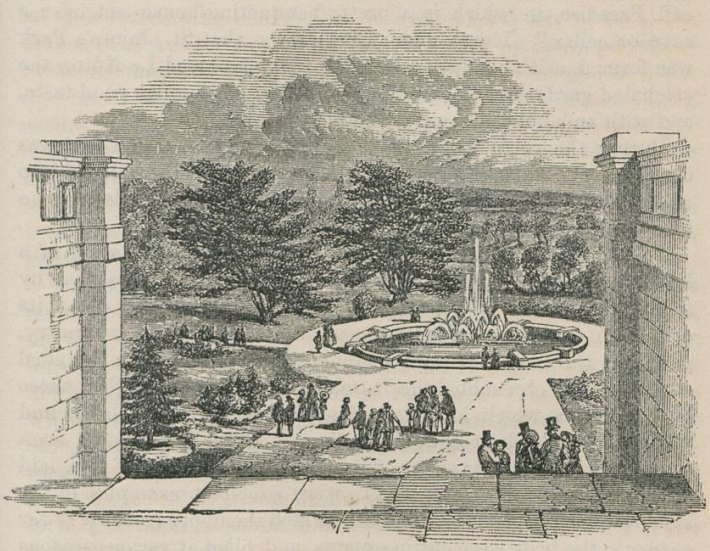
modest forms are almost hidden by the dark foliage in which they are nestled. The exquisite scene is completed by a long line of blue hills that ranges at the back of all.

Gardening, as an art, has flourished in all countries, and has possessed in each such distinctive features as the climate, the nature of the soil, and its physical formation, as well as the character of the people, have created. In the Gardens before us two styles are seen, THE ITALIAN and THE ENGLISH LANDSCAPE. A few words may be sufficient to describe the leading characteristics of both.

In Italy, during the middle ages, internal warfare confined men to their fortresses, and no gardens existed save those "pleasaunces" cultivated within the castle's quadrangle. When times grew more peaceful, men became more trustful, ventured forth, enjoyed the pleasures of a country life, and gardening prospered. In monasteries especially, the art received attention; but it was not until the beginning of the 16th century that a decided advance was manifest, and then we have to note a return to the style of gardening that flourished in ancient Rome itself. Lorenzo de' Medici possessed a garden laid out in the revived classical manner, and this style, which is recognised as the Italian, has existed in Italy with certain modifications ever since. Its chief features are the profuse use of architectural ornaments—the grounds being subdivided into terraces, and adorned with temples, statuary, urns, and vases, beds cut with mathematical precision, formal alleys of trees, straight walks, hedges cut into fantastic devices, jets of water, elaborate rock-work, and fish-ponds dug into squares or other geometrical forms. Everything in these gardens is artificial in the extreme, and in set opposition to the wild luxuriance of nature; and although the trees and shrubs are planted with a great regard to precision, they are too frequently devoid of all artistic effect. During the last century, the Italian style became blended with English landscape-gardening, but without much success; for the formality of the original style clings to all Italian gardening at the present day.

English gardening does not seem to have been regularly cultivated until the reign of Henry VIII.; although previously to his time, parks and gardens had been laid out. Bluff King Hal formed the gardens of Nonsuch Palace in Surrey on a most magnificent scale, decking them out with many wonderful and curious contrivances, including a pyramid of marble with concealed holes, which spirted water upon all who came within reach,—a practical

joke which our forefathers seem to have relished highly, for the ingenious engine was imitated in other gardens after that period. In this reign also were first laid out by Cardinal Wolsey the Hampton Court Gardens, containing the labyrinth, at that period an indispensable device of a large garden. The artificial style in



View from the Terrace.

James I.'s time called forth the indignation of the great Lord Bacon, who, although content to retain well-trimmed hedges and trees, pleaded strongly in the interest of nature. He insisted that beyond the highly dressed and embellished parts of the garden, should ever lie a portion sacred from the hand of man—a fragment of wild nature! He calls it "the heath, or desert." During Charles II.'s reign, landscape-gardening received an impulse. It was in his time that Chatsworth was laid out, and that buildings were introduced into gardens. During his reign, too, lived Evelyn —a spirit devoted to the service of the rural genius. In his Diary, Evelyn makes mention of several noblemen and gentlemen's gardens which he visited, and some of which indeed he himself devised. His remarks convey an idea of the state of gardening

during the reign of the merry monarch. "Hampton Park, Middlesex," he says, "was formerly a flat, naked piece of ground, now planted with sweet rows of lime trees, and the canal for water now near perfected; also the hare park. In the garden is a rich and noble fountain, with syrens, statues, &c., cast in copper by Fanelli, but no plenty of water. There is a parterre which they call Paradise, in which is a pretty banqueting-house set over a cave or cellar." It was under Charles, too, that St. James's Park was formed, a labour upon which the king employed Le Nôtre, the celebated gardener of Versailles,—an artist of singular good taste, and with an admirable eye for the picturesque.

During the reign of William and Mary, Hampton Court was considerably improved. Some Dutch features were introduced into gardening, and vegetable sculpture and parterres in lace came into vogue.

To the Dutch must be conceded the earliest manifestation of a love for gardening in Northern Europe—a feeling possessed by them even before the thirteenth century. The taste owed its origin, no doubt, partly to the general monotony of their country, partly to the wealth of their merchants, and partly to an extended commerce, which enabled the Dutch to import from the East those bulbous roots which have long been cultivated in Holland, and were once valued at fabulous prices. Dutch gardening soon acquired a peculiar character of its own. The gardens of Loo, laid out in the time of William III., were excellent examples of the symmetrical Dutch style; a canal divided the upper from the lower garden; the beds were cut in squares, and filled at various seasons of the year with tulips, hyacinths, poppies, sun-flowers, &c.; straight walks intersected the grounds, which were adorned with numerous statues, grotto-work, and fountains, some exceedingly whimsical and curious; the trees and shrubs were cut into devices, principally in pyramidal forms, whilst hedges separated the different parts of the garden, and were not allowed to grow above a certain height. Straight rows and double rows of trees constitute another characteristic of the Dutch style, and elaborate lace-like patterns for parterres were much in vogue during the latter part of the seventeenth century. The influence of this style upon English gardens may still be perceived in the clipped hedgerows and trees, green terraces, and now only prim, now magnificent avenues, so frequent in our country.

It would appear that from William down to George II., gardening in England suffered sad deterioration as an art. Formality pre-

vailed to the most deadening and oppressive extent. The shapes of men and animals were cut in trees, and the land was threatened with a vast and hideous collection of verdant sculpture. Pope and Addison came to the rescue of nature, and ridiculed the monstrous fashion. Pope, in one of his papers in "The Guardian," details an imaginary set of plants for sale, including a "St. George, in box, his arm scarce long enough, but will be in condition to stick the dragon next April;" and a "quickset hog shot up into a porcupine by being forgot a week in rainy weather." Addison, in "The Spectator," says, "Our British gardeners, instead of humouring nature, love to deviate from it as much as possible. Our trees rise in cones, globes, and pyramids. We see the marks of the scissors upon every plant and bush." Pope himself laid out his grounds in his villa at Twickenham; and his gardens there, which still bear the impress of his taste, attest to his practical skill as a gardener.

The satire of these great writers contributed not a little to a revolution in English gardening. Bridgeman seems to have been the first to commence the wholesome work of destruction, and to introduce landscape gardening; and it is said that he was instigated to his labour by the very paper of Pope's, in "The Guardian," to which we have alluded. But Kent, at a later period, banished the old grotesque and ridiculous style, and established the new picturesque treatment. He laid out Kensington Gardens, and probably Claremont. Wright and Brown were also early artists in the new style, and deserve honourable mention for their exertions in the right direction. The former displayed his skill at Fonthill Abbey, the seat of Mr. Beckford; Brown was consulted at Blenheim, where he constructed the earliest artificial lake in the kingdom, —the work of a week. Nor must Shenstone, the poet, be forgotten. His attempt, towards 1750, to establish the rights of nature in his own ornamental farm at the Leasowes, places him fairly in the front rank of our rural reformers. Mathematical precision and the yoke of excessive art were thus cast off, and nature was allowed a larger extent of liberty and life. She was no longer tasked to imitate forms that detracted from her own beauty without giving grace to the imitation; but she was questioned as to the garb which it chiefly delighted her to wear, and answer being given, active steps were taken to comply with her will. Then came Knight and Price to carry out the goodly work of recovery and restoration. To them followed Mr. Humphrey Repton, the accomplished scholar, under whose eye the gardens of Cobham Hall were planned, and under

whose influence all the celebrated landscape-gardens of his time were fashioned. And as the result of the united labours of one and all, we have the irregularly-bounded pieces of water which delight the English eye, the shrubberies, the noble groups of trees, the winding walks, the gentle undulations, and pleasant slopes,—all which combined give a peculiar charm to our island landscapes, that is looked for in vain in fairer climates and on a more extended soil.

In the Crystal Palace Gardens, the Italian style has not been servilely copied, but rather adapted and appropriated. It has been taken, in fact, as the basis of a portion of our garden, and modified so as to suit English climate and English taste. Thus, we have the terraces and the architectural display, the long walks, the carefully cut beds, and the ornamental fountains; but the undulations of greensward, that bespeak the English soil, give a character to the borrowed elements which they do not find elsewhere. The violent juxtaposition of the two styles of gardening—the Italian and the English—it may readily be conceived, would produce a harsh and disagreeable effect. To avoid the collision, Sir Joseph Paxton has introduced, in the immediate vicinity of the terraces and the broad central walk, a mixed or transitional style, combining the formality of the one school with the freedom and natural grace of the other; and the former character is gradually diminished until, at the north side of the ground, it entirely disappears, and English landscape-gardening is looked upon in all its beauty.

THE TERRACES.

Descending the steps we reach the first terrace, on the parapet of which are placed twenty-six allegorical statues of the most important commercial and manufacturing countries in the world, and of the chief industrial cities of England and France. The length of the upper terrace is 1576 feet, and its width 48 feet; the terrace wall is of Bath-stone. The granite pedestals on each side of the steps, leading from the Great Transept, are 16 feet by 24 feet. The width of the central flight of steps is 96 feet; and this is also the width of the grand central walk. The lower terrace, along which are ranged the first six fountains of the upper series, is 1664 feet long between the wings of the building, or nearly one-third of a mile, and 512 feet wide, the basins for the fountains on this terrace being, in their measurements, as before

stated, all multiples of eight. The total length of the garden-front of the wall of this terrace, which is formed into alcoves, is 1896 feet. The length of the broad central gravel walk from the building to the end of the garden in a direct line is 2660 feet. Such are a few of the principal measurements connected with the Palace Gardens, as these are seen on the surface. But although the work that is above ground may be recognised and calculated with little trouble by the visitor, there is beneath the surface an amount of labour and capital expended, of which he can with difficulty form an accurate idea. Drain pipes spread under his feet like a net-work, and amount in length to several miles; he treads on thousands of bundles of faggots which have formed his path; he walks over ten miles of iron piping which supply the fountains for his amusement.

On each side of the great central staircase are statues representing Mulhouse, Glasgow, and Liverpool (to the right as we face the gardens), the two first by Calder Marshall, the third by Spence. On the left side are personifications of Paris, Lyons, and an allegorical statue of French art, the first by Etex.

The next bastion, on the Sydenham side, is surmounted by statues of Spain and Italy, admirably executed by Monti; the succeeding bastion forms a pedestal for the very characteristic figures of California and Australia, by Bell. The staircase at this end of the terrace is ornamented at the first angle with representations of South America, by Monti, and of Turkey and Greece by Baron Marochetti; the second group consists of India and Egypt, also by Marochetti, and of China, by Monti.

The first bastion, on the Norwood side of the central staircase, supports allegorical statues of Manchester, by Theed, and Belfast, by Legrew. On the succeeding one are placed those of Sheffield and Birmingham, by Bell.

On each side of the staircase, at this point, are very excellent representations of the Zollverein and Holland, by Monti, and of Belgium, by Geefs.

The last group consists of a fine allegorical statue of the United States, by Powers, and of Canada and Russia, by Launitz.

All these figurative subjects are more or less composed in the style of the modern Romantic school of sculpture, and afford excellent illustrations of the character, nature, and chief occupations of the countries and cities they represent.

Proceeding in a northerly direction, we pass on until we reach a flight of steps, by which we gain the lower terrace, or Italian

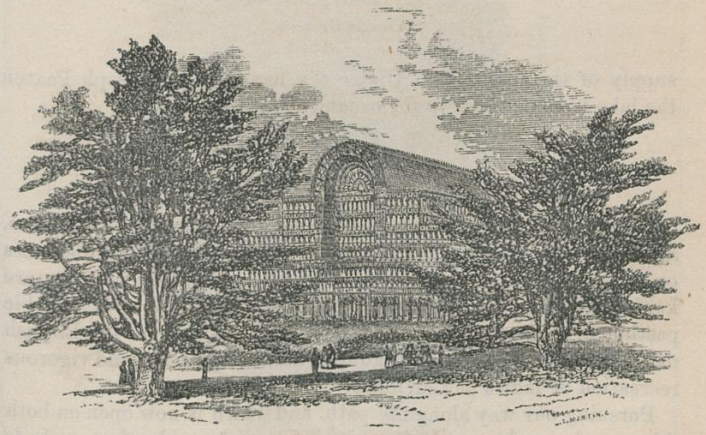
flower-garden. At the bottom of these steps are stone recesses, built under the terrace above, in which streams of water fall from dolphins' mouths into bronze basins. Crossing the terrace by the path facing the steps, the visitor turns to the right, examining the flowers and the fountains, until he arrives at the central steps leading to the circular basin, from which point a most admirable view of the whole crystal structure is obtained. The deep recesses in the transepts, the open galleries, the circular roof to the nave, the height of the Central Transept, the great length of the building, and the general aërial appearance of the whole crystal fabric, produce an effect which, for novelty and lightness, surpasses every other architectural elevation in the world. Turning his back upon the building, the visitor beholds on either side of him green undulating lawns, beds planted with rhododendrons and other flowers, and winding gravel walks. He now surveys the mixed garden, before mentioned, which extends throughout the south side. To the right is a mound, surrounded by an arcade of arabesque iron-work, around which innumerable roses are twined;

The Arcade and Rosary.

and, to the left, two spreading cedar trees—of a kind familiar to this neighbourhood—attract attention by their thick, spreading, sombre foliage. Descending the steps, and walking down the broad gravel path, the visitor reaches the large Circular Fountain.

Round the basin of the fountain are white marble statues, copies from the antique, and of works by Thorwaldsen and Canova. Amongst them will be found the celebrated Farnese Hercules, the free and graceful Mercury by Thorwaldsen, the Venus of Milo, and the Paris by Canova. On either hand, and a little below the Central Fountain, will be remarked two temples of beautiful iron-work, called the Temples of the Cascades, which, with the fountains, will be more fully described hereafter. Having made one half of the circle, the visitor, instead of proceeding down the central avenue, turns to the left, round the other side of the Central Fountain, and passing the first outlet, finds his way through the second, and descends the steps into a gently rising walk, which leads him to a smaller fountain.

Keeping to the left-hand side, we make half the circle of this smaller fountain, and then enter upon a pleasant path, on the right side of which stands one of the noble cedar-trees before mentioned. We are now quitting the mixed Italian and English gardens for the pure English landscape. Trees wave their long branches over our heads, the paths wind, and art recedes before



The Cedar Trees.

nature. Travelling for a short distance, we come to a junction of two roads. Selecting the left, we journey on through a path, still gently rising, bordered on one side by trees, and on the other by a lawn, until we approach a valley at the bottom of which is a

small piece of water, lying close to a thicket forming a pleasant summer shade. Leading out of this small piece of water is seen a large lake, which forms the second or intermediate reservoir for the

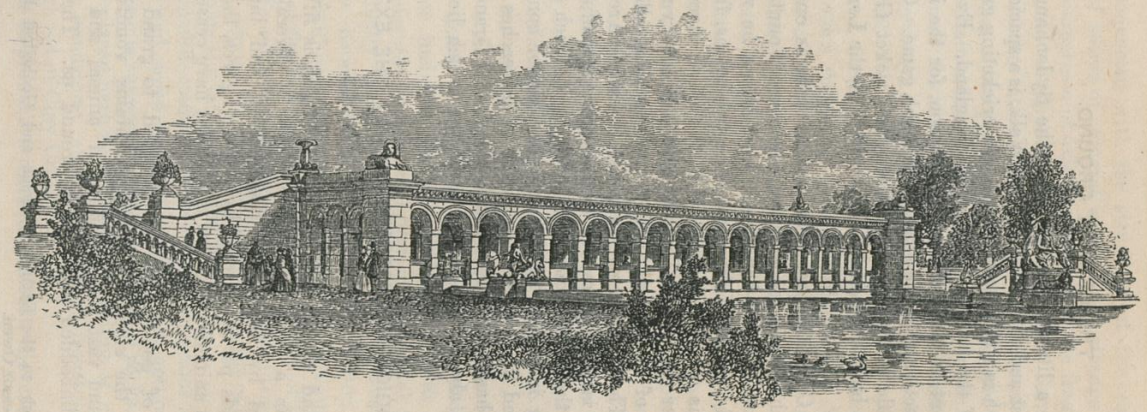
View in Grounds.

supply of the fountains. Under the hand of Sir Joseph Paxton the lake is made to serve for ornament as well as use.

THE ARCHERY GROUND.

On the slope, which is here picturesquely bordered with trees, is the Archery Ground. The targets are fixed at various distances on the lawn, and in a marquee, pitched in a proper position, are kept bows and arrows and all needful appliances of the noble pastime of archery—once the military stay and boast of the English nation, now, in these days of gunpowder, the pleasing and vigorous recreation of ladies and civilians.

Pursuing our way along the path, and which is now open on both sides, we descend towards the east, and on either side of us are beds filled with American rhododendrons. Our road takes us along the edge of the lake. Bearing to the right, we presently reach the junction of two paths. If the visitor turns to the left, he enters the Park, which occupies this side of the ground, and forms not one of the least agreeable features of the place.



THE STONE ARCADE.

THE CRICKET GROUND.

In the Park, a little to the right of the Sydenham entrance, and between that and the Great Central Walk, is a spacious level of green turf, which is specially laid out as a cricketing ground, and which is one of the best and largest in England. Every necessary arrangement is made, during the season, for the interesting matches and practice of this essentially English game. Close by is a gallery for Rifle practice, and between the Cricket Ground and the road are the butts erected for the practice of the London Rifle Brigade.

Quitting the Cricket Ground, the visitor returns on the same path by which he has approached, to the Great Fountain Basin, proceeding round the left-hand margin of which he will arrive where the broad Central Walk divides the two basins, from which point he obtains an excellent view of the stone Arcades, over which the water from the Temples and Cascades rushes in a glittering span of many feet, and forms splendid falls into the basins below. The pathway passes under the stone Arcades, and, when the water is pouring over, a curious and beautiful effect is noticeable from the open balustrade, in front of which the water passes. Having inspected the Arcades, the visitor continues his walk, partly round the next fountain basin, till he reaches a flight of steps on the left hand, passing up which he gains the Grand Plateau, which is 47 feet above the level of the Lake, which lies below.

THE GEOLOGICAL ILLUSTRATIONS AND THE EXTINCT ANIMALS.*

From our stand on the Grand Plateau, which is fifty feet in width, we obtain a general view of a tract of several acres of ground occupied by Geological illustrations, and including a number of islands partly covered by strange figures, the restored forms of various animals which for many ages have ceased to exist as living tribes.

The wonders of geology are not confined to grand mountain chains piercing the clouds, burning mountains vomiting steam and hot ashes, and vast accumulations of animal and vegetable remains found imbedded everywhere around us. They extend

* See "Handbook to the Extinct Animals and Geological Illustrations described," by Professor Owen.

to facts connected with the structure of the earth's crust, the existence of stores of mineral wealth, and strange results derived from the comparison of existing races with the fragments of other races formerly occupying the surface. The form of the surface depends on the internal structure; the scenery is due to the circumstances of the prevailing rock and soil; and the sea-cliff and naked mountain side are the places where nature teaches her first great lesson of the natural history of the Mineral Kingdom. To illustrate geology, it was necessary to perform the same kind of task as that which has been so successfully performed in the Architectural Courts, and the result is now before the visitor, as he looks down from this plateau and prepares to enter on the new course of investigation open to him. The ground forming the cliffs, shores, banks, and islands in this part of the Park are so constructed as to give, in a series of views, a number of practical lessons in geology, tending to make the essential facts of the science easily understood, while, at the same time, they add to the picturesque beauty of the scenery. The plan may be recognised in the fine expanse of cliff now at our feet; to do justice to which we must descend and place ourselves on the tongue of land below, or on the rustic bridge a little to the left. From hence may be seen the full length of the present cliff, and a few words of explanation will be sufficient to indicate the succession of rocks and the geological phenomena.

On this cliff, the part immediately facing the bridge represents a section nearly vertical of part of a coal-field, all the beds *dipping* (or inclining) at a moderate angle to the right-hand, so that those to the left are lower in geological position, though they gradually become higher in point of actual elevation, and at a little distance further to the left overtop the coal itself. Besides this illustration, we also see in the same equal part of the cliff instances of *faults* or *troubles*, throwing a part of the coal-measures into a different position from the rest, and lifting up portions of a series of deposits. In the case before us, the older rocks are also thrown up on the left side of the fault.

The coal-cliff consists of two beds or seams of coal, two of ironstone, and some sandstone. The part not consisting of projecting stone is supposed to represent softer rocks, clays, or shales. There are placed here about twenty-five tons of coal, twenty tons of grit or sandstone, and five tons of ironstone, all from the neighbourhood of Clay Cross.

In order to produce a marked contrast, the carboniferous lime-

stone is placed next in order, and as if brought up to its position by a considerable fault. The millstone grit, appearing on the top of the plateau above the limestone, would have occupied naturally, and without disturbance, a position below the lowest part of the coal measures. The fault is therefore called, technically, an upthrow or upcast to the south. The millstone grit consists of about 30 tons of rock from Crick, near Matlock, and from Bramley Fall quarries, in Yorkshire. The carboniferous limestone (of which there is 100 tons) is from the neighbourhood of Matlock, and is placed nearly in its natural position.

In this cliff of carboniferous limestone the bedding may be very distinctly traced, and systems of fissures, or *joints*, may also be observed. One of these fissures, wider than the rest and communicating with several smaller ones, is partly filled with spar, and has an opening into a cavern constructed behind the cliff. The main fissure represents a *mineral vein* or *lode*, and the smaller ones are *strings* or *feeders*. Within the cavern the spectator sees some of the peculiar and interesting appearances of natural limestone grottoes.

Coming out below the limestone, hard beds of the *old red sandstone* are seen. These have the same dip as the limestones, and are seen at intervals further to the left towards the railway. It is intended to continue the series of older and altered rocks in this direction. The old red sandstone on the ground consists of about twenty tons from near Bristol.

Overlying this whole series of old (or palæozoic) rocks, which are inclined to the north, is a horizontal, and therefore unconformable capping of *new red sandstone*. This also is from near Bristol, and the quantity provided was fifty tons.

The new red sandstone, thus capping the old rock on the high ground of the plateau, re-appears at the extremity of the nearest of the adjacent islands at a much lower level, and having a different mechanical position.

It is right to mention that these geological sketches are the result of careful consideration, and have not been effected without much constructive ingenuity. The original plan of the whole was suggested by Professor Ansted, and arranged with Sir Joseph Paxton at an early period of the laying out of the grounds; and as soon as the state of affairs permitted and the actual earthworks of the Plateau were in progress, a model of the intended structure was completed and coloured geologically by Professor Ansted. The works have been ably constructed from this model by Mr.

James Campbell, who also procured the stone and other minerals from different parts of the country.

Let us now return to the Plateau, from whence we can obtain the best view of the islands and their singular tenants. Before

The Labyrinthodons.

describing them, however, we will remind the visitor that the lowest or oldest rocks, which we have shown him, were the old red sandstone; next above them were the carboniferous limestone, the millstone grit, the coal-measures, and then the new red sandstone. It is with this last formation that the restorations of the extinct animals commence. Before that period fossil remains indicate that fish inhabited the waters of the earth, but there are no traces of the existence of any reptiles or higher animals. Reptiles first appear in the new red sandstone, and as the extreme right of the islands is arranged to represent this formation, it is there that we shall find the Labyrinthodon and the Dicynodon, of each of which there are two species. The strata which overlie the new red sandstone will be now mentioned in the order of their super-position, each successive formation bringing us nearer to the forms of animal life which are at present living upon the earth.

Next above the new red sandstone comes the lias, the general

direction of the inclination of the beds being the same as in the coal-cliff, and the newer beds covering up the old ones as we advance in the direction of the larger islands. The lias animals are here represented by three very dissimilar forms; there are three species of *Ichthyosaurus*, or Fish Lizard; three species of *Plesiosaurus*, or Serpent Lizard, and a crocodilian beast called *Teleosaurus*, which much resembles the fish-eating Gavial of the river Ganges. This crocodile and the fish lizards formerly inhabited the neighbourhood of Whitby in Yorkshire, where their remains are found in good condition. Dr. Buckland describes the *Plesiosaurus* as the most singular and monstrous of the relics of the former world, having the head of a lizard, the teeth of a crocodile, a neck like the body of a serpent, the trunk and tail of an ordinary quadruped, the ribs of a chameleon, and the paddles of a whale.

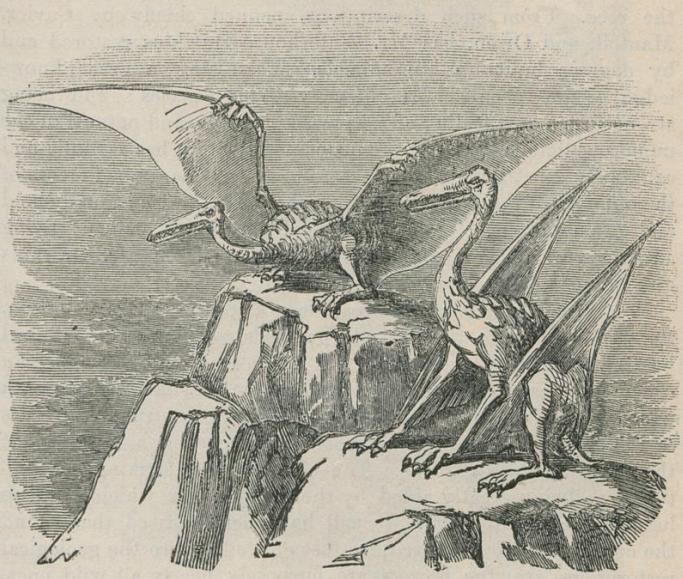
The next formation in ascending order is the oolite. To this stratum, as well as to the succeeding one, belongs the *Megalosaurus*, or Gigantic Lizard, which measures 39 feet from snout to top of tail, and 22 feet 6 inches round the body, and the smaller Pterodactyles.

Still proceeding to the left, we pass next to the Wealden formation so well known in Kent, Surrey, and Sussex. Here we see the gigantic *Iguanodons*, and the *Hylæosaurus*, or Great Spiny Lizard of the Wealden. It is with these creatures that the name of the late distinguished palæontologist, Dr. Mantell, will ever be connected, since to his labours in Tilgate Forest and other parts we are indebted for our knowledge of these animals.

Above the Wealden formation come those of the lower greensand and the chalk. Both of these also contain fragments of singular reptiles of large size, the *Mosasaurus* and great Pterodactyles (most probably the fabled dragon of old) restored from Mr. Bowerbank's specimens.

With these we quit the Secondary Island, and may next turn our attention to the island beyond, which contains the principal forms characterising the strata belonging to the tertiary period. Hitherto we have shown the visitor nothing but reptiles—now, upon the Tertiary Island, he will find a higher order of animal life, and meet with forms more nearly resembling our living animals. Next in procession are the animals restored by Baron Cuvier from fragments found in the Gypsum beds of the Paris basin: the *Palæotherium*, or Ancient Beast, might be justly called the first triumph of comparative anatomy, as from a few

detached pieces of bone Cuvier was enabled to construct the entire animal, which, by his drawings, appears to have resembled the Tapir of the present day. After these come the more elegant pachydermatous animal called the *Anoplotherium commune* and



Great Pterodactyles.

the *Anoplotherium gracilis*, and not far off we see the *Megatherium*, or Gigantic Sloth, in the act of pulling down a tree to obtain the leaves, upon which it was accustomed to feed, as its smaller analogies do at the present day. These, with the Irish Elks, first found in the Isle of Man, are grouped upon this island, and present a scene equally remarkable and instructive to all those who are interested in the natural history of the earlier periods of the earth.

No one can look upon all these singular and bulky productions, so unlike the comparatively familiar forms of even the rarer living animals, and yet with so much appearance of reality, without at once becoming sensible that a series of illustrations is before him, of a nature altogether different from any he has been accustomed to.

The footmarks, the bones, the very skin in some cases, of animals long since extinct, have been preserved by being buried in mud which has afterwards been converted into solid rock. From these obscure guides, the comparative anatomist has ventured to describe the general form, the habits, and the peculiarities of the race. From such descriptions, penned chiefly by Cuvier, Mantell, and Owen, has Mr. Waterhouse Hawkins restored and by degrees built up the animals. Possessing a great knowledge of the peculiarities of many living species; and being strong in his own feeling of what was probable and natural in the numerous details that required consideration, he has skilfully and cautiously constructed these restorations, and his embodiments of the opinions of the greatest palæontologists are indeed equally bold and conscientious. Professor Owen, the most eminent living authority upon these subjects, has kindly rendered Mr. Hawkins every assistance in his undertaking.

Re-descending from the Plateau once more to the large fountain, the visitor turns to the left, and proceeds round its margin until he arrives at the further end of the basin, where he will notice an ornamental cataract is contrived. On the left-hand of the path which winds from this point, is a high bank constructed of roots of the trees which grew in the woods once covering a great part of the Crystal Palace gardens. The effect is very striking and picturesque, being greatly aided by the wild flowers which grow so luxuriantly on all parts. It will have been noticed that round the confines of the lake we have just quitted, where the geological restorations are, the flowers are purposely nearly all wild ones, and they give a singularly natural and fit appearance to this interesting district. It must be mentioned that the whole of the Crystal Palace Exterior Gardens are under the personal superintendence of Mr. Gordon, and it will be confessed their beautiful condition answers to his assiduous care. A few steps further, and the visitor arrives at the junction of two roads. Selecting that to the left, he will speedily gain the foot of the Rosary, and the mound, at the top of which is an ornamental arabesque arcade designed by Mr. Owen Jones. He will here find roses of every variety, besides other plants which climb the sides and around the roof of the arcade.

Proceeding round the Rosary to the right, we quit the mound at the second outlet, and journey along a path, on either side of which are flower-beds and groups of Rhododendrons and Azaleas. Bearing to the right we reach the basin of a fountain. Choosing

The Secondary Island.

1. Mosasaurus.
2 & 3. Pterodactyles.
4 & 5. Iguanodons.
6. The Hylæosaurus.
7. The Megalosaurus.
8 & 9. The Teleosauri.
10. The Ichthyosaurus Communis.
11. The Ichthyosaurus Platydon.
12. Plesiosaurus Macrocephalus.
13. The Labyrinthodon Salamandroides.
14 & 15. Dycynodons.
16. Labyrinthodon Pachygnathus.

the left-hand side of this basin, we turn into the broad walk which leads us by means of a flight of steps to the second terrace, crossing which we make our way by the steps to the upper terrace.

At this point the visitor can either re-enter the Palace under the Central Transept, or by proceeding to the left-hand down the terrace, enter the south wing and pass down the colonnade to the Railway Station.

THE CRYSTAL TOWERS.

The high towers, of which there are two, one at each end of the building, have been erected for the purpose of raising the tanks from which the high jets of the great fountains in the lower basins are played, and are, with the exception of the tank and stays, constructed of cast iron.

The foundation upon which this enormous mass of material rests, is necessarily very strong, and consists, in the first place, of a ring of concrete, sixty feet in external diameter, and three feet deep; upon this is built a circular wall of brick-work, laid in cement, fifty-six feet in diameter, and eighteen feet deep. This forms the bed on which rests the base pieces of the columns.

The columns, 1 foot in diameter, and 24 in number, are placed in pairs, 4 feet apart, and are connected together by solid vertical girders or filling-in frames, each pair thus forming one continuous broad column, extending from the base to the bottom of the tank by which the tower is surmounted; the whole rising to a height of 202 feet. The space between each pair of columns (8 feet) is filled in with glazed sashes and face-work, corresponding with those in the building, and completing the shell of the tower. Behind these sashes, and spanning these spaces, extending from floor to floor, are series of round wrought-iron diagonal bracing, continued from the bottom to the top of the tower; and, under each of the ten landing-floors, is a strong horizontal bracing-plate, termed a diaphragm, forming, with the diagonal bracing above referred to, a system of vertical and horizontal trussing.

Up the centre of each tower is carried a perpendicular brick shaft (the internal diameter of which is 7 ft. 9 in.), resting upon a separate foundation, and serving the double purpose of carrying off the smoke from the heating apparatus, from the boilers connected with the Machinery Department, the upper engine-house, and kitchen, and forming the core or spiral staircase by which the various floors, and gallery at the top of the tower, are reached.

These floors arise at intervals of twenty feet from the level of the floor of the main building. The tank noticed above is of boiler-plate, and is formed of an inner and outer wall, the former of which encircles the chimney-shaft; the bottom, which is dome-shaped, is carried upon wrought-iron girders radiating from the chimney, and is secured to the tops of the external columns. This description will be more readily understood when the depths of the tank at its outer and inner walls are given. The former, or that resting upon the external columns, being 38 feet, while the latter, next the chimney-shaft, is about 26 feet. These tanks are calculated to hold, when filled, a body of water of the enormous weight of 1,576 tons, or a bulk of 57,228 cubic feet, equal to 357,675 gallons.

The supply is forced from the upper reservoir by the same engines that raise the water to the lower water-tanks and the building; and the same pipes form also the means of conveying the water to the fountains. They are arranged within the outer columns, forming an interior circle, apparently of columns, but rendering in reality no assistance towards the stability of the structure.

On a level with the base of the tank, projecting from the exterior of the tower, and carried on strong and elegant cast-iron brackets, is the gallery six feet in width, from the outer edge of which, on light iron columns, is carried the many-gabled conical Paxton roof which covers the tower. The total height of these stupendous edifices, from the ground line to the top ornaments on the roof, is 284 feet. From the same ground line to the floor of the projecting gallery is 214 feet, involving to the persevering visitor an ascent of no fewer than 400 steps, with only ten landings or rests on the floors previously mentioned. The reward in the prospect afforded will, however, amply repay the toil incurred, embracing as it does an horizon including part of six counties—viz., Middlesex, Kent, Essex, Bedfordshire, and Bucks—and including a panorama possessing, amongst other objects of interest, the Towers of London and Windsor, the woodlands of Essex, and the Downs of Epsom. The vision of the visitor from this height is also lifted over the grand plateau, or ridge, which separates the great lake with its antediluvian animals from the rest of the garden.

These magnificent towers, each of which contains 800 tons of iron, were designed by Mr. Brunel.

From the above simple statement it will be seen, that the

arrangements for supplying the fountains with water are at once simple, complete, and based upon the most economical principles. The engine power employed is that of three hundred and twenty horses; the water itself is conveyed to and from the reservoirs in pipes varying from three feet to one inch in diameter; and the total weight of piping may be set down at 4,000 tons, its length, roughly estimated, at ten miles.

THE ARTESIAN WELL, AND THE WATER SUPPLY.

In July, 1852, the supply of water for the fountains and other great works in connexion with the Crystal Palace, first seriously engaged the attention of the Directors. Various proposals were made, and suggestions offered: some were at once rejected; others, although not free from difficulties, were taken into consideration. The most feasible of these was that which involved the extension to Sydenham of the pipes of one of the nearest London water-work companies,—a measure that would at once secure a sufficient supply of tolerably good water. Against the proposition for sinking a well on the grounds, it was urged that the neighbourhood is almost destitute of water; that wells already excavated to the depth of two hundred feet had yielded but a small supply; and that even if a sufficient supply could be secured by digging, the water obtained could never be raised to the top of the hill.

Acting, however, upon sound advice, and after due consideration, the company commenced the sinking of an artesian well at the foot of the hill on which the Palace stands, and after proceeding to a depth of 250 feet, their efforts were rewarded.

In the present case, the water which appears in the well comes from a reservoir lying between the London clay and the greensand as its upper and lower envelopes. This reservoir is supplied by rain-water, which, percolating the London clay, sand, and chalk, and finding an impediment to its downward progress on reaching the greensand, flows into the space between the hard clay and greensand, as into a cistern. The process by which the reservoir is supplied is continuous, the water finding its way down to it as if by a series of small tubes, and pressing against the lower surface of the clay with a force which, if unresisted, would raise it to the level from which it descended. When the clay is pierced by the augur it is evident that this force is free to act, the resistance of the clay at the point where it is pierced being removed, and accordingly the water rises in the bore to the level from which it is

supplied, and will continue to do so as long as the percolation lasts. The chief difficulty to be overcome was the great thickness of the substratum of chalk, which extends, probably, to a depth of about 1000 feet. The well, now completed, is a brick shaft 8½ feet in diameter, 247 feet deep, from whence an Artesian bore descends 328 feet, making the entire depth 575 feet. It is situated at the bottom of the Garden, near the Cricket Ground.

An abundant supply of water having been brought to the foot of the hill from the well, and the supplies of a neighbouring water-company, it was necessary not only to raise it to the top, on a level with the building, but also to elevate it to a sufficient height for obtaining the requisite pressure for fountains to throw up water to heights varying from 5 to 280 feet. The following is a brief outline of the arrangements by which these objects are effected:—

Three reservoirs have been formed at different levels in the grounds, the lowest one being on the same level as the largest basins placed nearly at the base of the hill; the second or intermediate reservoir is higher up, and in a line with the basin in the central walk; whilst the third or upper reservoir stands on the top of the hill immediately adjoining the north end of the building. Next to the Artesian Well, an engine is placed which raises the water required to be permanently maintained in the reservoirs and in the basins of the fountains, and which supply or keep up the water that is lost by waste and evaporation.

The reservoir on the summit of the hill contains the water required for the use of the building, and for the fountains throughout the grounds. Close to this reservoir is an engine-house, containing the steam-engines that raise part of the water into two large tanks erected on columns at the north end of the building close to the junction of the Sydenham and Dulwich roads. The columns, twenty-four in number, are of hollowed cast-iron, one foot in diameter. The central column, which is two feet in diameter, supporting a portion of the superincumbent weight, and making up the number, twenty-five, is the water-pipe, by which the tank is fed, and which forms also the conduit to the fountains in the building, and on the terraces. These two distinct actions of filling the tank and working the fountains proceed simultaneously through the same pipe. On the top of these columns are massive girders which support the plates, forming the bottom of the tank. The height from the stone curb of the reservoir to the bottom of the tank is 65 feet; the tanks are each 47 feet square by 15 feet

deep, and capable of containing 207,000 gallons, or about 900 tons of water. They supply also the water required in the building for the plants and kitchens, and charge the pipes provided against casualties from fire. The vast residue of the water in the great upper reservoir, in consequence of the sloping character of the ground, does not need any help from the engines, but flows direct to fountains on a lower level, and plays smaller jets. Through the same convenience, the waste water from the upper fountains is used a second time in the lower fountains.

The central or intermediate reservoir collects the waste water from the displays which take place on ordinary days, and which include all the fountains, save the two largest, and the cascades. Attached to this reservoir are also engines which pump the water back to the upper reservoir. The lowest reservoir collects similarly the waste water from the displays which take place in the two largest fountains on the days of great exhibition, and its engines return the water at once to the top level.

THE FOUNTAINS.

The great system of fountains in the grounds of the Crystal Palace, though the most stupendous that the world has ever seen, is designed with an unity which greatly enhances, or rather fully displays, its unrivalled magnificence. The whole system is divided into two series, the upper and the lower. The upper series, which consists of the six basins adorning the long extent of the second terrace, with the great circular fountain in the centre, and the smaller ones on either side of it, in all, nine fountains, constitutes the display on ordinary occasions. Beyond these, as we advance down the central path, are the iron Water Temples, from which the water rushes down a series of twelve cascades, extending for a distance of 600 feet, till it falls over the stone arcade in the great fountain basins, forming a glittering cataract 120 feet broad, with a fall of thirty feet. The Water Temples with their cascades and falls, and the two great fountains into the basins of which they discharge, constitute the lower series, which is played only on grand occasions; but all are part of one design, and each one ministers to its completeness.

Unlike most similar works, sculpture has not been used to enhance or obtain the effect desired. Under any circumstances, water, when thrown high into the air, assumes a graceful and beautiful appearance; no ungentle curves or distortions of form

mar its expression of a natural beauty, which, though it may be the roaring grandeur of a mighty stream, or the gentle grace of the smallest jet, bears with it an unspeakable charm. In the Crystal Palace Fountains the designs are carried out by the water alone, and the sculptural ornamentation is confined to the margins of the basins, and, down the sides of the cascades, to some small ornamental bronze fountains of secondary importance.

The first six fountains of the upper series which ornament the Italian Garden on the second terrace throw their highest jets to the height of 90 feet, the lower jets form graceful designs round the bases of these columns of water, and in other parts of the basins. It is so arranged that the waste water from these basins is again used for the lowest jets of the fountains which lie between these and the Water Temples, a rapid descent in the ground giving sufficient pressure for this purpose; the same is the case with the water flowing from these again, as it is once more used for the lower water designs in the great basins.

The great circular fountain, which occupies the central position below the terraces, is the principal one of the upper series. Its highest columns, which rise in an imposing mass from a gigantic cradle formed by the water, attain the altitude of 150 feet. Rising from the surface around this, are single upright streams which beautifully fill in the design, throwing their spray to almost an equal height. The whole is surrounded by a delicate trellis of water, in which the jets appear to interlace with one another. On the right and left of this, but in lower positions, are two smaller circular fountains of great beauty, which, with those already described, complete the upper series. The largest circular basin is 196 feet in diameter.

We now approach the two Water Temples which head the cascades on either side of the broad central walk. These Temples are octagonal in shape, with dome-shaped roofs, and are constructed of ornamental ironwork, gaily coloured and gilded. On the apex of each is a bronze figure, from beneath which the water, which is forced up the hollow columns, bursts in a glittering film till it falls over the roof and down the sides. The Temples are about 60 feet in height. The head or basin which surrounds each one, and from which the water flows down the cascades, is a parallelogram of 72 feet, with semicircular extensions in the two sides of 18 feet radius. Bronze fountains ornament each side of the cascades.

The great fountains are the crowning effect of the whole system, and are the largest in the world. The basins, which are designed

with a graceful and diversified outline, are 784 feet each in length, having a diameter in the semicircular centre portion of 468 feet. A great central column rises in each, streaming upward to the height of 280 feet when undisturbed by wind. These columns are each composed of 50 two-inch jets, which burst forth under a pressure on the mouth of the pipes of 262 lb. to the square inch. The design is carried out by an infinite variety of water display. The effect is gained by the water alone, which assumes many forms, from the giant and stately column, to the most delicate crystal tracery. When the whole system of fountains is displayed, no less than 11,788 jets are in operation, throwing 120,000 gallons per minute. A grand display usually consumes 6,000,000 gallons of water.

These stupendous and magnificent works were designed by Sir Joseph Paxton, the engineering operations being executed by Mr. W. Shields, the resident engineer of the Company.