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BIOGRAPHICAL NOTICES OF EMINENT YORKSHIRE GEOLOGISTS.

I. "JOHN PHILLIPS." BY THE EDITOR.

MY personal knowledge of Professor John Phillips dates no further back than the meeting of the British Association at Bradford, in 1873, only one year before his death. My recollection is very fresh of his kind and genial face, his winning and encouraging smile, the ever-ready and wise words with which he brightened and enlivened the most perplexing questions, and the deep knowledge and great experience which lay below and prompted all his observations. This comparatively slight personal knowledge, however, has served to give life and vigour, an actuality which otherwise might have been impossible, to the study of the works of the veteran geologist. Within the short period of the life of John Phillips, the history of geology as a science has had its birth, has been nurtured and grown, and before his death, its interesting ramifications had encircled the whole crust of the earth. The germs of truth gathered and elucidated by Professor Phillips and his uncle, William Smith, have served as the basis on which the whole superstructure of geological science has been erected.

Before the advent of the present century, a correct knowledge of the composition of the crust of the earth had no existence. The whole aggregation of the rocks was generally imputed to the action of the deluge as defined by the Mosaic description, and the occasional discovery of the embedded fossil remains of some plant or animal was considered due to a freak of nature, an accidental representation of some living form. Such were the theories of Tertullian and Pliny in the early part of the christian era, who, accepting the results of the labours of Aristotle and his school, considered that all fossil remains were due to a plastic virtue latent in the earth, or that the slime of rivers or the mud of the earth had power to originate the animals whose forms became entombed in the rocks. It is true, that even before the time of Aristotle, there were at rare intervals philosophers, as for instance, Zenophanes (500 B.C.), and Herodotus (450 B.C.), who attributed the presence of fossil fish and shells in the quarries far away from the sea, to the fact that the rocks containing them must at some previous time have formed the bed of the sea, and that the fish and molluses died and were entombed in the soft mud. Such theories were, however, generally ridiculed. After the time of Pliny (*b.* 23 A.D.), who learnt much from the researches of the early Greeks, intervened some fourteen or fifteen centuries of almost universal darkness, during which time all knowledge suffered from the general dearth of intellect in Europe; science, art and literature being alike retrogressive and no development appearing to have been possible. During the 15th, 16th and 17th centuries, greater interest was taken in the collection of fossils, and several interesting books were written, largely illustrated with plates of specimens. This newly awakened interest was liveliest in Italy, but in this country Dr. Martin Lister contributed several articles to the Philosophical Transactions printed in the volumes for 1674 and succeeding years. He described certain stones figured like plants which he considered to be plants petrified. He also figured fossil and recent shells side by side, so that the close resemblance between the two at once became apparent, and

supported his theory, that the fossils were once living animals. Altogether his work conduced much to produce a true knowledge of fossil remains. A belief gradually grew in the minds of intelligent people that the fossils represented animals which had lived at some former period, but the erroneous conviction now entertained was, that they were all carried and left in the position where they were found, by the Noachian deluge. Quite to the beginning of the nineteenth century, and even much later, the belief existed in the Mosaic account of the creation of the world in six literal days, and that the whole earth was subjected to an universal deluge by which every living thing was destroyed, except Noah and those with him in the ark. Entertaining these opinions, it is not very remarkable that all fossil remains should be identified with the flood, and that all the literature relating to geological subjects published about this time should be saturated with this belief. One or two instances of the prevalence of these opinions may be interesting :—Buffon, a natural historian of much merit, published his “Theory of the Earth” in 1749. In this work he discussed many important geological questions, touching the action of natural causes in wearing down the land, and the gradual interchange of position between sea and land. Soon after the appearance of his work he received a polite intimation from the Faculty of Theology, in Paris, that there were several propositions in his book which were reprehensible and contrary to the creed of the Church ; he was invited to present himself and recant. Not feeling in any way bound to suffer as a martyr to science he drew up the following declaration, which he was required to publish. “ I declare that I had no intention to contradict the text of Scripture ; that I believe most firmly all therein related about the creation, both as to order of time and matter of fact ; and I abandon everything in my book respecting the formation of the earth, and, generally, all which may be contrary to the narration of Moses.”

In 1731, Professor Scheuchzer, a Swiss naturalist, discovered some bones which he described as those of a child destroyed by the

deluge. He also found two vertebræ, which he attributed to another individual of gigantic size of the same race. The belief being thereby strengthened in the huge size as well as long life of our progenitors—both probably equally incorrect. Engravings of both these were subsequently given in the “Copper Bible.” Cuvier afterwards examined these interesting relics and pronounced the skeleton of the supposed child to be the remains of a gigantic salamander, and the two vertebræ to be those of an ichthyosaurus !

During the latter part of the eighteenth century and early in the present one, William Smith, uncle of John Phillips, made a series of distinct and remarkable discoveries, which served in a few years to revolutionize and place on a truly scientific basis the whole theory of geological knowledge.

William Smith was a land surveyor and engineer, and whilst engaged in his professional labours he had repeated opportunities of studying the surface of the land in various parts of the country. Having become well acquainted with the series of oolitic rocks in the neighbourhood of Bath, his native place, he discovered that each separate stratum of rock or clay had its peculiar system of fossils, many of which were quite characteristic of the bed in which they were found and did not extend to those above or below. After fully maturing his conception of this fact, business called him to Yorkshire, and here he had opportunities of observing that the same fossil shells, etc., which characterized the strata near Bath also occurred in similar beds of limestone or sandstone in this county, and are equally certain in their distribution. Repeated visits to various parts of the country convinced Smith that his generalizations applied to all parts ; and resulted, after many years of hard and patient labour, in a geological map of the strata of England and Wales, which was followed by more detailed maps of many of the counties. He also tabulated the whole series of strata occurring in England and Wales with the characteristic fossils of each section of the rocks. William Smith did immense service to the science by clearly demonstrating :—I. That the strata wherever

present always occupy the same relative position. II. That the strata have been deposited at successive periods beneath water ; and that the fossils found in them were the remains of organisms that lived in those waters, and were afterwards imbedded in the sand or mud and became fossil. III. That particular species of organic remains are limited to particular strata.

It is difficult at this day to realize the great importance of these discoveries. Before "Strata Smith," as he came to be familiarly known, had discovered by his painstaking and self-abnegating researches, that there was order and regularity in the arrangement of the strata composing the earth's surface, every phenomenon, whether with respect to the rocks or their fossil contents, was attributed to the action of the deluge. Scientific men of that day, as now, differed in matters of detail, but as regards the primary proposition, there were few instances where minds of strong calibre resisted the superstitious influence of the age, and made as in the instance of Buffon, even a few steps towards the great truth realized by William Smith. Practical miners and quarrymen certainly saw that there was an alternation of strata in the rocks through which they pierced, but that they were persistent over large areas, or that the strata were arranged in a regular consecutive order, were circumstances of which they had no conception. The work of Smith demonstrated all this, and laid a true basis for a correct knowledge of the principles which underlie all geological facts. He traced the extension of the oolites and lias from the Midland Counties into Yorkshire. The older rocks of the Welsh Mountains were found to be similar to those of Westmoreland and Scotland. The relations of the various coal fields, of the old red of Scotland and of Devonshire, and all the intermediate beds, were mapped and defined. In the short space of one man's life he mapped the whole of England, and published twenty-six county maps beside : forming a striking contrast to the amount of work done by the Geological Survey of the present day. The manufacturing and mining districts of the

West Riding have been surveyed for several years and still there are only about one half the sheets of the map of this important area issued at the present moment.

The vast work of Smith was readily appreciated by his brethren of the hammer. In 1807 the Geological Society of London was formed and took a position, which it maintains still, of the foremost organization in the world for the cultivation, recognition and dissemination of geological knowledge. Amongst the founders and early members of the Society were, Buckland, who investigated the Kirkdale Caves, in Yorkshire; Adam Sedgwick, who was born at Dent, and a thorough Yorkshireman; Vernon Harcourt—Charles Lyell, Phillips, Murchison, and many others whose names are revered as the pioneers in the science, though they have passed away. These *savans*, heartily recognizing the truth of the discoveries of Smith, advanced them, not only in this country but quickly bore them over the continent of Europe and to Asia and America. Everywhere the same evidence was afforded that the rocks composing the whole surface of the earth are the result of ever-acting causes, that the ordinary and common denuding agencies of rain, frost, and ice, gradually but incessantly grind down the surface of the earth, the disintegrated material being borne by rivers to the sea, there again to be deposited and in time raise up new lands. Such were the forces found to be now at work, and to be those on which a reasonable basis could be laid to explain long past accumulations of stratified rocks.

Fortunately, an account of Professor Phillips' early life written by his own hand, has been preserved in the "Athenæum" newspaper for May 2nd, 1874. From it we learn that he was born on Christmas Day, 1800, at Marden, in Wiltshire. His father, the youngest son of a Welsh family settled for many generations on their own property at Blaen-y-ddol, in Carmarthenshire, was trained for the Church in which some of his relatives had place; but this plan was not carried out. "He came to England, was appointed an officer of Excise, and married the sister of dear old

William Smith, of Churchill, in Oxfordshire. His father died when Phillips was seven years old, his mother soon after ; and from that time he was under the charge of his uncle, a civil engineer in full practise, known as " Strata Smith."

At ten years of age, John Phillips was at a school at Holt-Spa, in Wiltshire, where a small microscope was given to him, and he speaks of the delight with which all natural objects were scrutinized by its magnifiers; he appears also to have been fond of athletic exercises, for he says, " When you see me now (*χαλεπὸς βαδίζων*) tired with the ascent of Geo Fell and the rough path of the Zmutt Glacier, you will hardly credit me as the winner of many a race, and the first in many a desperate leap. My work at this school was incessant for five years. I took the greatest delight in latin, french and mathematics, and had the usual lessons in drawing. We were required to write a good deal of latin, especially our Sunday theme ; of such, I wrote many for my idle associates. I worked through Mole's algebra and Simson's Euclid, the first two books completely, and selections from the others. The French master was a charming old Abbé, a refugee, whose patience and good nature and perseverance were quite above praise. We spoke and wrote french in abundance. Of greek I learned merely the rudiments, to be expanded in after life. I did not work at german until some years later ; italian I merely looked at."

On leaving school, Phillips accepted a twelve months invitation to the home of his ever-honoured friend, the Rev. Benjamin Richardson, of Farleigh Castle, " One of the best naturalists in the West of England, a man of excellent education, and a certain generosity of mind, very rare and very precious. Educated in Christ Church, he retained much of the indefinable air of a gentleman of old Oxford ; but mixed with this, there was a singular attachment to rural life and farming operations. Looking back through the vista of half a century, among the ranks of many kind and accomplished friends, I find no such man ; and to my daily and hourly intercourse with him, to his talk on plants, shells and

fossils, to his curiously rich old library, and sympathy with all good knowledge I may justly attribute whatever may be thought to have been my own success in following pursuits which he opened to my mind."

From the rectory of Farleigh, John Phillips returned to his uncle Smith, whose house overlooked the Thames from Buckingham Street. William Smith at this time was in the exercise of a lucrative and honourable profession ; he had for many years been at work on his great " Map of the Strata of England and Wales," which was published in 1815. " His home was full of maps, sections, models and collections of fossils ; and his hourly talk was of the laws of stratification, the succession of organic life, the practical value of geology ; its importance in agriculture, engineering and commerce ; its connection with physical geography, the occupations of different people, and the distribution of different races. In this happy dream of the future expansion of geology, his actual professional work was forgotten, until at length he had thrown into the gulf of the strata all his little patrimony and all his little gains, and he gave up his London residence, and wandered at his own sweet will among those rocks which had been so fatal to his prosperity, though so favourable to his renown." In all the pursuits and cares of his uncle, John Phillips had his share ; they were never separated in act or thought, and so his mind came to be moulded on that of his uncle.

In 1824, they accepted an invitation to give a course of lectures on geology at York, and from that time Phillips was constantly engaged in Yorkshire to give lectures and arrange museums, and many valuable friendships were created in its several towns ; thus " the great county, in which thirty thoughtful years were afterwards passed, became known to me as probably to no others. The generous Yorkshire people gave no stinted remuneration for my efforts to be useful ; and I employed freely all the funds which came to my hands in acquiring new and strengthening old knowledge, so as to be able to offer instruction in



almost any department of nature, but especially in zoology and geology." At York he became associated with Mr. W. V. Harcourt, the first president of the Yorkshire Philosophical Society, and they along with Brewster, Forbes, Johnson, Murchison and Daubeny, were the principal means of organizing the British Association for the Advancement of Science. Professor Phillips concludes his short autobiography with the following sentence.—“ Educated in no college, I have professed geology in three Universities, and in each have found this branch of science firmly supported by scholars, philosophers and divines.”

We have considered, however briefly, the state of knowledge of the earth's crust anterior to the commencement of the present century. The exploded belief in the all-powerful energy and widely ranging results of the deluge gave place to an earnest endeavour by all scientists to collect and chronicle the fossil contents of the various strata. Cuvier did immense service in the tertiary beds of the Paris basin amongst the higher forms of animal life, and was worthily followed by his pupil Louis Agassiz, whose knowledge of recent and fossil fishes led him to perceive a succession in the forms deposited in the earliest rocks and ranging up to the present time, which bears some correspondence to the developmental stages of modern fishes. Professor Agassiz in this country found a fellow-worker amongst the fossil fishes, in Sir Philip Egerton, whose ichthyological contributions to scientific literature have been both important and extensive. Sowerby, Owen, Morris, Forbes and many others were collecting and describing fossils from the British rocks. John Phillips was not idle, in addition to his many other published works about this period, and all his lecturing and arranging museums, he published (1829—1836) his “ Illustrations of the Geology of Yorkshire,” in two quarto volumes, which beside the stratigraphical descriptions of the northern and eastern divisions of the county, contained descriptions and figures of hundreds of species of fossils, ranging over the whole series of the animal kingdom comprised in the strata between the silurian rocks

of Howgill Fells and the secondary and tertiary series on the south eastern coast. In connection with the Geological Survey, he also produced in 1843, his work on the "Palæozoic Fossils of Cornwall, Devonshire and West Somerset," which contained an equal or larger amount of original matter in connection with fossil remains. The result of all this activity in every part of the world was very great ; more than 30,000 species of fossils were named, described, and in many cases figured. The fossils were found to be far larger in number than the living forms, and many of them were ascertained to be without any living representative ; others, found almost in the earliest rocks have existed through the untold ages since their first appearance and are still represented in the seas of the present day.

The varied picture presented to a careful and enquiring mind by the consideration of this subject is one of profound and awe-inspiring interest. It opens up a large field for speculation ; and its bearing on the past history of the globe and its inhabitants is of the utmost importance.

Geology, as a science, is pre-eminently one of facts, and unless its truths are treasured and adhered to, speculations and generalizations, which of necessity must be interwoven with those facts, may prove not only misleading, but injurious. So long, however, as the imagination is chained down to a basis of truth, and a solid foundation of indubitable and thoroughly well digested knowledge serves to leaven the edifice, the superstructure of inference and deduction may be both correct, pleasing and highly instructive. Without the use of the imagination to fill in the pictures presented by a study of the fossils found in the rocks, of ages and periods long past, whose similitudes can never recur, geological as well as other science, would only prove barren and abortive. For example :—the fossil remains of some fish, or shell, or plant are found imbedded in the shales of the coal measures ; the whole of the original matter composing the bones of the fish or the tissues of the plant have been removed, and in their place is a wonderfully

well-preserved *fac-simile*, in all probability composed of the same material as the surrounding masses of shale. The structure which characterized the objects when living is retained with exquisite perfection, and the highest powers of the microscope only serve to expose the infinite exactness of this mineral reproduction. These are the facts: the inferences to be drawn from them are many. They call into operation a wonderful play of the highest powers of the human mind. All kinds of collateral sciences are brought to bear in the elucidation of the problems suggested by these facts. Zoology, by comparison with existing forms, enables us to ascertain, with more or less correctness, the nature and habits of the fossil fish, the shape and character of its teeth, its covering of dermal armature and the presence or absence of external means of offence, thus affording data on which may be based assumptions as to the character of its food and the necessity or otherwise for protection against powerful foes. The changes undergone by the fossil since it first sank to the mud at the bottom of the water, call in the aid of chemistry and mineralogy. Possibly the structure of the fish may give valuable insight into its habitat when living, as to whether it was a denizen of salt, estuarine, or fresh water, and thus, much knowledge may be gained as to the physical geography of the land and sea, and the method of aggregation of the strata deposited during that period of the world's history. A similar course of reasoning may also be applied to the fossil shell or plant.

The great accumulation of geological and palæontological facts, led a few years later on, to a number of theoretical generalizations which exercised the greatest scientific minds of this or probably any previous age. The stratagraphical knowledge accumulated by William Smith and his followers not only laid the foundation for geological science in this country, but the influence of their labours spread over a great part of the civilized world, the methods of research and the nomenclature used by British geologists having been adopted in every other country as a foundation whereon to base local and minor designations. Philosophers speedily collated their knowledge

and proceeded to adapt it to already existing theories, or new ones were originated to account rationally for the phenomena of nature during the long past ages. Professor Phillips wrote in 1837,\* "From a mass of crude speculations fitted to inaccurate observations, it (*i.e.* geology) has gradually grown up to a system of sound, though limited inferences, connected by some very probable generalizations, and supported by independent mathematical reasoning. The *laws of phenomena* are unfolded to a considerable extent, and in the opinion of eminent men of science, the time is at hand for effectual researches into the *laws of causation*. Not that the labours of observation should, for an instant, be suspended; *they* are the most important of all the means of advancing geology; on the contrary, they ought to be continually excited by new impulses, and turned into more profitable directions by the first, however rude, indications of theory. The state of geology is so prosperous, that its numerous cultivators may well agree to divide their forces so as to accomplish combined movements; to advance on the one hand, the mass of generalized phenomena, and on the other, to multiply the points of contact between dynamical, chemical and vital laws and the results of geological inquiry."

It would be impossible within the limits of this paper to trace the various theories which have finally resulted in the great work of Darwin on the Development of Species by Natural Selection. It is a little more than twenty-one years since the "Origin of Species" was issued from the press, and in that short period the work has created a complete revolution in all modern scientific thought. It is not to be supposed that the origin of this great discovery rested solely with Darwin: many minds had been working at the problem. It was the natural outcome of all the accumulated thought for years previously, and solved the problem which was the great stumbling-block to all advance. The belief in "special creations" had long been undermined by well established facts, and many naturalists

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\* Treatise on Geology, by John Phillips, F.R.S., &c., 1837.

were convinced that development or evolution was the true explanation of the origin of all the multitude of species which do now, and have in times past, peopled the earth ; but to Darwin was reserved the grand discovery of natural selection and descent with modification. The many and important results of these researches may be briefly stated as follows. That all life is the result of development from pre-existing forms, and adaptation to the circumstances under which it exists ; and, as Mr. Spencer has aptly termed it, "the survival of the fittest." A most important result of the theory is the present widely extended belief in the antiquity of man. The limited period of 6,000 years is now proved to be totally inadequate. The remains of man have been repeatedly found in association with extinct animals, both in Yorkshire and in all parts of the world. In the gravels of the Somme Valley, the Kjekkenmoeding of Denmark and Sweden and the Lake dwellings of Switzerland, the worked and carved tools of the old inhabitants have been found. It is possible, nay probable, that man was in existence prior to the last so-called glacial epoch and descends even to the tertiary strata ; if this be so, the age of man on the earth will of necessity be carried back much further than the few thousands of years assigned to him.

During the year following the publication of Darwin's "Origin of Species," Professor Phillips wrote his book, entitled "Life on the Earth, its origin and succession," in which he attempted to show the fallacy of Darwin's investigations. His arguments were derived principally from want of distinct evidence of the actual transmission of some peculiarity in the fossil forms. The several animals or plants existing fossilized in the rocks certainly exhibited great advances in structure and organization over those found in strata of greater antiquity, but the connecting links had not been discovered, and Professor Phillips, like most other people, was much inclined to consider all the several forms as independent creations. After reviewing in detail the difficulties attendant on the development of a higher form from a lower, Professor Phillips

continues,\* “ If it is not possible in the existing ocean, among the innumerable and variable radiated, amorphozoan and foraminiferous animals, to construct one chain of easily graduated life, from the fertile cell to the prolific ovarium and digestive stomach, it must be quite vain to look for such evidence in the fossil state. In the face of the assumption requisite to imagine such a chain, we cannot venture to adopt it as a probable hypothesis, and thus the idea of one general oceanic germ of life, whether we like it or not, must be abandoned. Reasoning of the same kind will convince us that to derive by any probable steps any one great division of the animal kingdom from another, involves too much hazardous assumption to be adopted by a prudent inquirer.”

From this extract it is clear that to the mind of Professor Phillips, in 1860, the difficulties in connection with the acceptance of Darwin's theory of evolution quite outweighed the simplicity and beauty of the conception, and he felt bound to reject it. But in the short space of a dozen years, the labours of many naturalists, in most cases equally unbelieving, had produced such a mass of confirmatory evidence, that the theory is now generally accepted by the scientific workers of every country.

The researches of Professor Huxley have demonstrated the close relationship between birds and reptiles. American palæontologists have discovered a series of fossil remains of animals which exhibit, in a no less clear than marvellous manner, the history of the ancestry of the horse from an animal little larger than a dog; this little animal, in some respects very different in structure to the horse, is found to have been slowly changed, step by step, through the successive stages of later geological time, until the noble quadruped, so useful, nay, indispensable to man, has been the result. The feline animals have also been shown to have had distant relations, during the tertiary period in the carnivorous animals, *e.g.* *Dinictis*, *Machærodus* and others, whose remains are found buried in those deposits. Much has been learnt respecting the ancestry of living fishes and of

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\* Life on the Earth, p. 211. 1860.

many of the, so-called, lower forms of life. Space will not permit that these instances should be more than alluded to at present. But they serve to illustrate one of the brightest characteristics of a mind trained to scientific methods, and pre-eminently such an one was that of John Phillips. A year or two after the publication of his friend Darwin's work, he had, after mature reflection opposed the whole theory; but in 1873, at the meeting of the British Association at Bradford, the ever-increasing mass of evidence in favour of natural selection and development had produced their natural result, and we find the Professor in his presidential address to the geological section discoursing as follows\* :—“ But concurrently with the apparent perpetuity of similar forms and ways of life another general idea comes into notice. No two plants are more than alike; no two men have more than a family resemblance; the offspring is not in all respects an exact copy of the parent. A general reference to some earlier type accompanied by special diversity in every case (‘descent with modification’) is recognised in the case of every living being.

“ Similitude, not identity, is the effect of natural agencies in the continuation of life forms, the small differences from identity being due to limited physical conditions, in harmony with the general law that organic structures are adapted to the exigencies of being. Moreover, the structures are adaptable to new conditions; if the conditions change, the structures change also, but not suddenly; the plant or animal may survive in presence of slowly altered circumstances, but must perish under critical inversions. These adaptations, so necessary to the preservation of a race; are they restricted within narrow limits? or is it possible that in the course of long-enduring time, step by step and grain by grain, one form of life can be changed, and has been changed to another, and adapted to fulfil quite different functions? Is it thus that innumerable forms of plants and animals have been ‘developed’ in the course of ages upon ages from a few original types?

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\* Brit. Assoc. Report, 1873. Trans. of the Sections, pp. 73, 74.

“This question of development might be safely left to the prudent researches of physiology and anatomy, were it not the case that palæontology furnishes a vast range of evidence on the real succession in time of organic structures, which on the whole indicate more and more variety and adaptation, and in certain aspects a growing advance in the energies of life. Thus at first only invertebrate animals appear in the catalogues of the inhabitants of the sea ; then fishes are added, and reptiles and the higher vertebrata succeed ; man comes at last to contemplate and in some degree to govern the whole.

“The various hypothetical threads by which many good naturalists hoped to unite the countless facts of biological change into a harmonious system have culminated in Darwinism, which takes for its basis the facts already stated, and proposes to explain the analogies of organic structures by reference to a common origin, and their differences to small, mostly congenital, modifications which are integrated in particular directions by external physical conditions, involving a ‘struggle for existence.’ Geology is interested in the question of development, and in the particular exposition of it by the great naturalist whose name it bears, because it alone possesses the history of the development *in time*, and it is to inconceivably long periods of time, and to the accumulated effect of small but almost infinitely numerous changes in certain directions, that the full effect of the transformations is attributed.

“For us therefore, at present it is to collect with fidelity the evidence which our researches must certainly yield, to trace the relation of forms to time generally, and physical conditions locally, to determine the life periods of species, genera and families in different regions, to consider the cases of temporary interruption and occasional recurrence of races, and how far by uniting the results obtained in different regions the alleged ‘imperfection of the geological record’ can be remedied.”

I have, perhaps, dwelt longer on the important question of Darwinism than the nature of my subject will warrant, but it is



one of such vital importance to the success of all future work in the natural history of living or fossil animals and plants, that I trust I shall be excused; and the experience of Professor Phillips may serve a very useful purpose if it teaches us the lesson of patience and forbearance in passing judgment on what may, in the first instance, be thought extraordinary or even ridiculous theories, but which may eventually be proved to be founded on just and right principles, the result of life-long thought and experiment.

In 1828, John Phillips was elected a Fellow of the Geological Society, and six years later, when 34 years of age, he was chosen as the Professor of Geology at King's College, London, and also a Fellow of the Royal Society. Ten years later again, in 1844, he became the Professor of Geology at Trinity College, Dublin. During this period he was working at several branches of science in addition to geology. He made very valuable observations in meteorology, a science at that time little understood or appreciated. Astronomy also received some attention, and several papers on the planet Mars and other subjects are printed in the Proceedings of the Royal Society. As already stated, Phillips played an important part in organizing and managing the British Association; for many years he was the secretary, and the first twenty-seven volumes of its proceedings were produced under his editorship. In 1859 and '60, he was president of the Geological Society, and in 1865 of the British Association. Meanwhile he had taken the place of Dr. Buckland as Professor of Geology at Oxford, a position which he held during the remainder of his life.

Professor Phillips was an indefatigable worker. He never tired in his efforts to spread abroad that love of nature which so thoroughly imbued his own existence. By example and teaching, whether orally or with the pen, his single aim was the advancement of those branches of knowledge which had proved so ennobling to his own existence. Never married, he was wedded to his science, and in all his labours, whether as an original

investigator, an organizer of the means for encouragement and assistance of his fellow-workers, or more important than either, as an inculcator of a true knowledge and love of scientific method in the youthful minds of those entrusted to his care at the college or elsewhere,—he was always earnest and sincere.

No one would endorse more heartily than Phillips the noble words of a recent speaker, with which I will conclude this sketch, with the substitution of one word; they are as follows:—"The benefit to the student of *science* flows from the improvement of his own mind; from the exercise and expansion of his power to perceive and to reflect; from the formation of habits of attention and application; from a bias given to character in favour of cultivating intelligence for its own sake, as well as for the sake of the direct advantages it brings. The advantages lie in the far future, and do not administer to the feverish excitement which are of necessity in the various degrees incidental to the pursuits of the modern commercial world. The habits of mind formed by *Scientific pursuits* are founded on sobriety and tranquility; they help to settle the spirits of a man, fixing them upon the centre of gravity; they tend to self-command, self-government, and that genuine self-respect which has nothing in it of self-worship. It is one thing to plough and sow with the expectation of the harvest in due season when the year shall have come round; it is another to ransack the ground in a gold-field with the heated hope and craving for vast returns to-morrow or to-day. All honour then to *Science*, because, while it prepares young men in the most useful manner for the practical purposes of life, it embodies a protest against the excessive dominion of craving appetites, and supplies a powerful agency for neutralizing the specific dangers of this age."

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