That something like this has taken place seems indicated by the film-like character of such specimens of wood as those we have referred to, in which cases the sulphuret of iron was probably deposited in the fine parting between the wood and the bark. Moreover, the casts of the teredo-holes are covered over with the same film of red oxide of iron, which has resulted from the decomposition at a subsequent period of the sulphuret.

Although we attempt not then to determine their family or genera, we are not doing bad service to science in drawing attention to these fossil cretaceous fruits. The very knowledge of their existence will stimulate other observers to seek for more illustrative examples. What one is defective in, another may possess, and so from one to the other we may gain a general knowledge of the whole organism long before any perfect specimen has been brought to light.

In the present case we submit our plates and figures of these fruits, and leave the honour of naming them open to him who can really tell us What they are.

ON THE INAPPLICABILITY OF THE NEW TERM "DYAS" TO THE "PERMIAN" GROUP OF ROCKS, AS PROPOSED BY DR. GEINITZ.

COMMUNICATED BY

SIR RODERICK IMPEY MURCHISON, F.R.S., D.C.L., LL.D., ETC.,

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In the year 1859, M. Marcou proposed to substitute the word "Dyas" for "Permian," and summed up his views by saying that he regarded "the New Red Sandstone, comprising the Dyas and Trias, as a great geologic period, equal in time and space to the Palæozoic epoch or the Greywacke (Silurian and Devonian), the Carboniferous (Mountain-limestone and Coal), the Mesozoic (Jurassic and Cretaceous), the Tertiary (Eocene, Miocene, and Pliocene), and the recent deposits (Quaternary and later)"!! *

As that author, who had not been in Russia, criticized the labours and inductions of my associates De Verneuil and Von Keyserling, and myself, in having proposed the word "Permian" for tracts in which he surmised that we had commingled with our Permian deposits much red rock of the age of the Trias, I briefly defended the views

* See 'Dyas et Trias de Marcou,' Bibliothèque Universelle de Genève, 1859.

I had further sustained by personal examination of the rocks of Permian age in various other countries of Europe.*

It was, indeed, evident that M. Marcou's proposed union of the so-called Dyas and Trias in one natural group could not for a moment be maintained, since there is no conclusion on which geologists and palæontologists are more agreed, than that the series composed of Roth-liegende, Kupfer-Schiefer, Zechstein, etc., forms the uppermost Palæozoic group, and is entirely distinct in all its fossils, animal and vegetable, from the overlying Trias, which forms the true base of the Mesozoic or Secondary rocks.

Owing to such a manifest confusion respecting the true palæontological value of the proposed "Dyas," we should probably never have heard more of the word, had not my distinguished friend, Dr. Geinitz, of Dresden, recently issued the first volume of his valuable palæontological work, entitled 'Dyas, oder die Zechstein-Formation und das Rothliegende.†' In borrowing the term "Dyas" from Marcou, Dr. Geinitz shows, however, that that author had been entirely mistaken in grouping the deposits so named with the Trias or the Lower Secondary rocks, and necessarily agrees with me in considering the group to be of Palæozoic age.

As there is no one of my younger contemporaries for whom I have a greater respect as a man of science, or more regard as a friend, than Dr. Geinitz, it is painful, in vindicating the propriety and usefulness of the word "Permian," to be under the necessity of pointing out the misuse and inapplicability of the word "Dyas."

The term "Permian" was proposed twenty years ago for the adoption of geologists, without any reference whatever to the lithological or mineral divisions of the group; for I well knew that a certain order of mineral succession of this group prevailed in one tract, which could not be followed out in another. After surveys, during the summers of 1840 and 1841, of extensive regions in Russia in Europe, in which fossil shells of the age of the Zechstein of Germany, and the Magnesian Limestone of England, were found to occur in several courses of limestone, interpolated in *one great series* of red sandstones, marls, pebble-beds, copper-ores, gypsum, etc., and seeing that these varied strata occupied an infinitely larger superficial area than their equivalents in Germany and other parts of Europe, I suggested to my associates, when we were at Moscow in October, 1851, that we should employ the term "Permian," as derived from the vast government of that name, over which and several adjacent governments we had traced these deposits.

In a letter addressed to the late venerable Dr. Fischer von Waldheim, then the leading naturalist of Moscow, I therefore proposed the term "Permian,"‡ to represent by one unambiguous geographical

* See 'American Journal of Science and Arts,' 2nd ser. vol. xxviii. p. 256,—the work of M. Marcou having attracted more attention in America than in England.

† Leipzig, 1861.

‡ See Leonhard's 'Jahrbuch' of 1842, p. 92; and the 'Philosophical Magazine,'

term a varied mineral group, which neither in Germany nor elsewhere had then received one collective name* adopted by geologists, albeit it was characterized by one typical group only of animal and vegetable remains. As the subdivisions of this group in Germany consisted, in ascending order, of Rothliegende, with its overlying strata of Weissliegende, Kupfer-Schiefer, and Lower and Upper Zechstein, and in England of Lower Red Sandstone and Magnesian Limestone, with other accompanying sands, marls, etc., so well described by Sedgwick,† the name of "Permian"—purposely designed to comprehend these various strata—was readily adopted, and has since been generally used. Even Geinitz himself, as well as his associate Gutbier, published a work under the name of the 'Permische System in Sachsen.'‡ Naumann has also used the term in reference to the group in other parts of Saxony; whilst Göppert has clearly shown that the rich Permian Flora is peculiar and characteristic of this supra-carboniferous deposit. In England, France, and America no other term in reference to this group has been used for the last fifteen years.

The chief reason assigned by Geinitz for the substitution of the word "Dyas" is, that in parts of Germany the group is divided into two essential parts only—the Rothliegende below, and the Zechstein above, the latter being separated abruptly from all overlying deposits.

Now, not doubting that this arrangement suits certain localities, I affirm that it is entirely inapplicable to many other tracts. For, in other regions besides Russia, the series of sands, pebbles, marls, gypseous, cupriferous, and calcareous deposits form but one great series. In short, the Permian deposits are for ever varying. Thus, in one district they constitute a *Monas* only, in others a *Dyas*, in a third a *Trias*, and in a fourth a *Tetras*.§

In this way many of the natural sections of the north of Germany differ essentially from those of Saxony; whilst those of Silesia differ still more from each other in their mineral subdivisions, as explained

vol. xix. p. 418, "Sketch of some of the Principal Results of a Geological Survey of Russia."

* It is true that the term Pénéen was formerly proposed by my eminent friend, M. d'Omalius d'Halloy; but as that name, meaning *sterile*, was taken from an insulated mass of conglomerate near Malmédy in Belgium, in which nothing organic was ever discovered, it was manifest that it could not be continued in use as applied to a group which was rich in animal and vegetable productions.

† Trans. Geol. Soc. London, New Series, vol. iii. p. 37.

‡ I may here note that the great Damuda formation of Bengal, with its fossil Flora and animal remains, including Saurians and Labyrinthodonts, described by Professor Huxley, has recently been referred (at least provisionally) to the Permian age, by Dr. Oldham, the Superintendent of the Geological Survey of India. In fact, Dr. Oldham actually cites the plant *Taniopteris*, of the "*Permian beds of Geinitz and Gutbier in Saxony*," in justification of his opinion. See 'Memoirs of the Geological Survey of India,' vol. iii. p. 204.

§ See 'Siluria,' 2nd edit., 1859, and 'Russia in Europe and the Ural Mountains,' 1845.

in 'Siluria,' 2nd edition, particularly at p. 342. Near the northern extremity of the Thüringerwald, for example, and especially in the environs of Eisenach, an enormous thickness of the Rothliegende, in itself exhibiting at least two great and distinct parts, is surmounted by the Zechstein, thus being even so far tripartite, whilst the Zechstein is seen to pass upwards to the east of the town, by nodular limestones, into greenish and red sandy marl and shale, the "Lower Bunter Schiefer" of the German geologists. The same ascending order is seen around the copper-mining tract near Reichelsdorf, as well as in numerous sections on the banks of the Fulda, between Rotheburg and Altmorschen, where the Zechstein crops out as a calcareous band in the middle of escarpments of red, white, and green sandstone.*

But in showing that in many parts of Germany, as well as in England, the Zechstein has a natural, conformable, and unbroken cover of red rock, I never proposed to abstract from the Trias any portion of the Bunter Sandstein or true base of the group, as related to the Muschelkalk by natural connection or by fossils. I simply classed as Permian a peculiar thin red band (Bunter Schiefer), into which I have in many localities traced an upward passage from the Zechstein, and in which no triassic shell or plant has ever been detected.

On my own part, I long ago expressed my dislike to the term Trias; for, in common with many practical geologists who had surveyed various countries where that group abounds, I knew that in numerous tracts the deposits of this age are frequently not divisible into three parts. In central Germany, where the Muschelkalk forms the central band of the group, with its subjacent Bunter Sandstein and the overlying Keuper, the name was indeed well used by Alberti, who first proposed it; but when the same group is followed to the west, the lower of the three divisions, even in Germany, is seen to expand into two bands, which are laid down as separate deposits on the geological maps of Ludwig and other authors. In these countries, therefore, the Trias of Alberti's tract has already become a Tetras. In Britain it parts entirely with its central or calcareous band, the Muschelkalk, and is no longer a Trias; but, consisting simply of Bunter Sandstein below, and Keuper above, it is therefore a Dyas; though here again the Geological Surveyors have divided the group into four and even into five parts, as the group is laid down upon the map—No. 62, 'Geographical Survey of Great Britain.'

The order of succession in the Permian group all along the western side of the Pennine chain or geographical axis of England proves the impossibility of applying to it the word "Dyas;" for over wide

* On two occasions (1853-4) Professor Morris accompanied me, and traced with me these relations of the strata; subsequently, when Mr. Rupert Jones (1857) was my companion, we saw other sections clearly exhibiting this upward transition which I have described. Since then, Professor Ramsay, when at Eisenach, convinced himself of the accuracy of the fact that the Zechstein passes up conformably into an overlying red cover. My note-books contains many additional evidences, which I have not thought it necessary to repeat.

areas in Shropshire and Staffordshire it is one great red arenaceous series, with a few subordinate courses of calcareous conglomerate. Following it to the north, Mr. Binney has demonstrated that the fossils of the Zechstein show themselves in the heart of red marls which occupy on the whole a superior part of such a red series; and in tracing these rocks northwards he has demonstrated that there are, besides, two great underlying masses, first of conglomerates and breccias, and next of soft red sandstones, the latter attaining, as he believes, a thickness of not less than 2000 feet. Here then the Permian may be considered a Trias. Professor Harkness, in a memoir he is preparing, estimates the thickness of these Lower Sandstones and conglomerates to the N.E. of West Ormside, in Cumberland, at 4000 to 5000 feet, and shows that they are surmounted by marl-slates bearing plants, thin-bedded red sandstone, grey shale, and sandstone and limestone, the latter—the representative of the Magnesian Limestone—being covered by red argillaceous shale.* Now in all these cases the Permian is a series divisible into three or more parts. But when we follow the same group into Scotland, it there parts with its calcareous feature, and, becoming one red sandstone of vast thickness, is again a *Monas*.

I have entered into this explanation because my friend Dr. Geinitz has seized upon one illustration in my work 'Siluria' which shows that in certain tracts, where the Zechstein or Magnesian Limestone is subordinate to an enveloping series of sandstones, the Permian of my classification is *there* as much a tripartite Palæozoic group as the Trias of Central Germany is a triple formation of Mesozoic age. Unless, therefore, the data to which my associates and self have appealed, in the work on 'Russia and the Ural Mountains,' and which I have further developed in Memoirs read before the Geological Society, and in my two editions of 'Siluria,' be shown to be inaccurate, I hold to the opinion that there are tracts in which the Zechstein is simply a fossiliferous zone in a great sandstone series, to which no division by numerals can be logically applied. Even if I do not appeal to the natural evidences in England, Russia, and parts of Germany, but refer to those tracts where the Zechstein or Magnesian Limestone has no natural red cover, I may well ask, does not the word "Permian," in the sense in which it was originally adopted, serve for every tract wherein the uppermost palæozoic fossil animals and plants are found, whether the strata of which the group is composed form, as in Russia and Silesia, one great series of alternations of plant-bearing sandstones and marls in parts containing bands of fossiliferous limestone, or whether, as in other tracts, the Zechstein stands alone (as near Saalfeld), or in others, again, where the group is tripartite, and even quadripartite? Quite

* The red clay or argillaceous shale which covers the limestone is surmounted at Hilton, in Cumberland, by five hundred feet of red sandstone, which, though perfectly conformable to the subjacent Permian rocks, he considers to belong to the Bunter Sandstein of the Trias. Here, then, as in Germany, the limestone may have a red cover, and yet the Bunter Sandstein be intact.

irrespective, however, of the question of whether there are or are not localities in Germany where the Zechstein passes upwards into a red rock, which forms no true part of the Bunter Sandstein of the Trias, we have only to look to the environs of Dresden, on the one hand, and to Lower Silesia on the other, to see the inapplicability of the word "Dyas" to this group.

Near the capital of Saxony, Dr. Geinitz himself pointed out to me that the Rothliegende is there divided into two very dissimilar parts; and these, if added to the limestone which is there interpolated, or to the true Zechstein of other places, constitute a Trias. Again, Beyrich, in his Map of Lower Silesia,* has divided the vast Rothliegende of those mountains into Lower and Upper, the two embracing *eight* subdivisions according to that author.

In repeating, then, that the word "Permian" was not originally proposed with the view of affixing to this natural group any number of component parts, but simply as a convenient short term to define the Uppermost Palæozoic group, I refer all geologists to the very words I used in the year 1841, when the name was first suggested. In speaking of the structure of Russia, I thus wrote:—"The Carboniferous system is surmounted to the east of the Volga by a vast series of beds of marls, schists, limestones, sandstones, and conglomerates, to which I propose to give the name of 'Permian System,' because, although this series represents *as a whole* the Lower New Red Sandstone (Rothe-todte-liegende) and the Magnesian Limestone or Zechstein, yet it cannot be classed exactly, whether by the succession of the strata or their contents, with either of the German or British subdivisions of this age."†

After pointing to the governments of Russia over which such Permian rocks ranged, I added:—"Of the fossils of this system, some undescribed species of *Producti* might seem to connect the Permian with the Carboniferous era; and other shells, together with fishes and saurians, link it more closely to the period of the Zechstein, whilst its peculiar plants appear to constitute a Flora of a type intermediate between the epochs of the New Red Sandstone or Trias and the Coal-measures. Hence it is that I have ventured to consider this series as worthy of being regarded as a system."‡

In subsequent years, having personally examined this group in the typical tracts of Germany as well as of Britain, I felt more than ever assured that, from the great local variations of mineral succession of the group, the word "Permian," which might apply to any number of mineral subdivisions, was the most comprehensive and best term which could be used, the more so as it was in harmony with the principle on which the term Silurian had been adopted.

Apart from the question of the substitution of the new word

* See also 'Siluria,' 2nd edit. p. 343.

† Phil. Mag. xix. p. 419.

‡ In my last edition of 'Siluria' I have spoken of the Permian as the uppermost Palæozoic *group*, but have not deemed it a *system* by comparison with the vast deposits of Carboniferous, Devonian, and Silurian age.

"Dyas" for the older name "Permian," I take this opportunity of expressing my regret that some German geologists are returning to the use of the term "Grauwacke Formation," as if years of hard labour had not been successfully bestowed in elaborating and establishing the different Palæozoic groups, all of which, even including the Lower Carboniferous deposits, were formerly confusedly grouped under the one lithological term of the "Grauwacke Formation."

Respecting as I do the labours of the German geologists who have distinguished themselves in describing the order of the strata and the fossil contents of the group under consideration, I claim no other merit on this point for my colleagues De Verneuil and Von Keyserling, and myself, than that of having propounded twenty years ago the name of "Permian" to embrace in one natural series those sub-formations for which no collective name had been adopted. Independently therefore of the reasons above given, which show the inapplicability of the word "Dyas," I trust that, in accordance with those rules of priority which guide naturalists, the word "Permian" will be maintained in geological classification.

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THE GEOLOGICAL AND CHRONOLOGICAL DISTRIBUTION OF THE DEVONIAN FOSSILS OF DEVON AND CORNWALL.

By W. PENGELLY, F.G.S.

The limestones, slates, and associated sandstones of North and South Devon and Cornwall have, as is well known, caused much perplexity as to their real place in the chronological series of the geologist. Thanks, however, to the labours of Professor Sedgwick, Sir R. I. Murchison, Mr. Lonsdale, and others, the problem is now generally admitted to be solved; the rocks in question are the representatives or equivalents of the Old Red Sandstone of Scotland and elsewhere; they belong to what is known as the *Devonian* age of the world. Some little difficulty, however, exists—or rather once existed—in the way of the full acceptance of this chronology. The rocks of Devonshire are crowded with the remains of invertebrate animals, especially shells, corals, and sponges; whilst the supposed contemporary deposits in Scotland and the adjacent islets are so rich in fossil fish that, in the language of the late Hugh Miller, "Orkney, were the trade once opened up, could supply with ichthyolites, by the ton and the shipload, the museums of the world."* But the fossils characteristic of either of these districts are not found in the other; there are no organic links connecting the two localities.

* 'Footprints of the Creator,' p. 2.