

the Graptolite. By this proof of the community of fossil types, as well as by a clear lithological passage of the beds, these Tremadoc slates are thus shown to be indissolubly connected with the Llandeilo and other Silurian formations above them; whilst, although they also pass down conformably into the *zone primordiale*, the latter is characterized by the linguloid shells (*Lingulella*, *Salter*) and by the genera *Olenus*, *Paradoxides*, and *Dikelocephalus*, which most characterize it in Britain as in other regions.*

I take this opportunity, however, of reiterating the opinion I have expressed in my work, "*Siluria*," that to whatever extent the primordial zone of Barrande be distinguished by peculiar fossils in any given tract from the prevalent Lower Silurian types, there exists no valid ground for differing from Barrande, de Verneuil, Logan, James Hall, and others, by separating this rudimentary fauna from that of the great Silurian series of life of which stratigraphically it constitutes the conformable base. And if in Europe but few genera be yet found which are common to this lower zone and the Llandeilo formation (though the *Agnostus* and *Orthis* are common to it and all the Silurian strata), we may not unreasonably attribute the circumstance to the fact, that the primordial zone of no one country contains more than a very limited number of distinct forms. May we not, therefore, infer that in the sequel other fossil links, similar to those which are now known to connect the Lower and Upper Silurian series—which I myself at one time supposed to be sharply separated by their organic remains—will be brought to light, and will then zoologically connect the primordial zone with the overlying strata into which it graduates? Let us recollect, that a few years only have elapsed since M. de Verneuil was criticised for inserting, in his table of the Palæozoic Fauna of North America, a number of species as being common to the Upper and Lower Silurian. But now the view of the eminent French Academician has been completely sustained, by the discovery in the strata of Anticosti, as worked out by Mr. Billings under the direction of Sir W. E. Logan, of a group of fossils intermediate in character between those of the Hudson River and Clinton formations, or in other words between Lower and Upper Silurian rocks. In like manner, a similar interlacing seems already to have been found, in North America, between the Quebec group, with its primordial fossils, and the Trenton deposits which are, as is well known, of the Llandeilo age.

I have thus spoken out upon the fitness of adhering to the classifications decided upon by Sir Henry De la Beche and his associates, long before I had any relation to the Geological Survey, and which places the whole of the *Lingula*-flags of Wales as the natural base of the Silurian rocks. For English geologists should remember that this arrangement is not merely the issue of the view I have long maintained, but is also the matured opinion of these geologists in foreign countries and in our colonies, who have not only zealously elaborated the necessary details, but who have also had the opportunities of making the widest comparisons.

* In the last edition of *Siluria* the distinction was drawn between the lower and upper *Lingula*-flags, but the fauna of the latter is now much enlarged.

On the continent of Europe, an interesting addition has been made to our acquaintance with the fauna of one of the older beds of the Lower Silurian rocks, or the Obolus green sand of St. Petersburg,* by our eminent associate, Ehrenberg. He has described and figured† four genera and ten species of microscopic Pteropods, one of which he names *Panderella Silurica*: the generic name being in honor of the distinguished Russian palæontologist, Pander, who collected them. It is well to remark, that as the very grains of this Lower Silurian green sand seem to be in great measure made up of these minute organisms, so we recognize, in one of the oldest strata in which animal life has been detected, organisms of the same nature as, and not less abundant than, those which constitute the deep sea bottoms of the existing Mediterranean and other seas.

Before I quit the consideration of the older palæozoic rocks, I must remind you that it is through the discovery, by Mr. C. Peach, of certain fossils of Lower Silurian age in the limestones of Sutherland, combined with the order of the strata, observed in the year 1827, by Professor Sedgwick and myself, that the true age of the largest and overlying masses of the crystalline rocks of the Highlands has been fixed. The fossils of the Sutherland limestone are not indeed strictly those of the Lower Silurian of England and Wales, but are analogous to those of the Calciferous sand-rock of North America. The *Macluria* is indeed known in the Silurian limestone of the south of Scotland; but the *Ophileta* and other forms are not found until we reach the horizon of North America. Now, these fossils refer the zone of the Highland limestone and associated quartz-rocks to that portion of the Lower Silurian which forms the natural base of the Trenton series of North America, or the lower part of the Llandeilo formation of Britain. The intermediate formation—the *Lingula*-flags or "*zone primordiale*" of Bohemia—having no representative in the north-western Highlands, these is necessarily a complete unconformity between the fossil-bearing crystalline limestones and quartz-rocks with the *Maclurea*, *Murchisonia*, *Ophileta*, *Orthis*, *Otheceratites*, &c., and those Cambrian rocks on which they rest.

A great revolution in the ideas of many an old geologist, including myself, has thus been effected. Strengthened and confirmed as my view has been by the concordant testimony of Ramsay, Harkness, Geikie, James, and others, I have had no hesitation in considering a very large portion of the crystalline strata of the Highlands to be of the same age as some of the older fossiliferous Silurian rocks, whether in the form of slates in Wales, or graywacke-schist in the southern counties of Scotland, or in the conditions of mud and sand at St. Petersburg. The conclusions as respects the correlation of all the older rocks of Scotland have now indeed been summed up by Mr. Geikie and myself in the Geological Sketch-Map of Scotland ‡ which we have just published, and a copy of which

* See "*Russia and the Ural Mountains*."

† *Monats-Bericht d. Königl. Akad. der Wiss.* Berlin, 18th April, 1861.

‡ This map is already on sale in Manchester.