

Note on the Bivalves of the Olive-group, Salt-range; by Oberbergrath
Prof. Dr. W. WAAGEN.

When I came first to the Salt-range in 1871, the sequence of the beds exposed in this region had been made out in a satisfactory manner by Mr. Wynne, according to the data then available, and though in consequence of later discoveries some changes were unavoidable with regard to Mr. Wynne's original views, yet for the time Mr. Wynne's work was the best that had been executed up to then on the Salt-range. This is the best testimonial that can be attributed to a scientific work, as it cannot be expected of a man to anticipate everything that during further studies of eighteen years may be discovered. All human knowledge is attained by degrees, and thus every scientific work can only be expected to be absolutely correct for the time at which it is written, and any author cannot be blamed for not having discovered everything at once, because time is a very great factor in the human power of perception.¹

At the time of which I am writing, Mr. Wynne had, among other rock groups, also distinguished one to which he had given the name "*Olive-group*" on account of the prevalence of olive-coloured sandstones within this group at certain parts of the range. Fossils were but very little known to exist in this group, except a few bivalves of uncertain affinities.

In the first excursions I made with Mr. Wynne to the range, we soon found that the beds in which *Terebratula flemingi*, Dav., occurred belonged to this Olive-group, and this furnished the first clue towards considering these beds as upper mesozoic, probably upper cretaceous. The large bivalves that had formerly been found at other localities by Mr. Wynne appeared not contradictory to such a supposition, as on a superficial inspection they showed forms much resembling the species of *Unio* found in certain mesozoic beds (Laramie and Jurassic) in North America. So, I myself suggested to Mr. Wynne; on the strength of the data then available, that the Olive-group might perhaps best be considered as topmost cretaceous, and this suggestion was published by Mr. Wynne in his Salt-range Report.

When the Salt-range materials came afterwards into my hands for description, it was absolutely impossible to work up all the materials at once; hence I had to divide them according to the different volumes into which I had proposed to divide the whole work: thus the Olive-group bivalves came among the lot that was destined to be described in vol. iii, and were packed away without any close examination.

¹ Dr. Waagen seems unable to divest himself of the idea that he must needs be Mr. Wynne's apologist. There can be little doubt that Mr. Wynne is quite willing to admit that subsequent research has and must continue to alter or otherwise effect some of the conclusions given in his Memoir on the Salt-range. The recent discoveries tell somewhat against each author in his own line of work, but the facts remain, and on these the geology of the range must rest, not on *apologia*. Certainly, Mr. Wynne's work or writings have little, if any, direct bearing on the main point of the present paper which is really the story of the working out and recognition of the bivalves which have so long baffled Dr. Waagen's research.—ED.

In 1885, however, Dr. Warth made a most important discovery in the Salt-range, which was apt to suggest another view to be taken with regard to the Olive-group. He found in the boulder beds at the base of the group a number of nodules, as well as pebbles, in which palæozoic fossils were contained; and I myself have shown in vol. xix of the Records, that these fossils exhibited a great affinity to Australian carboniferous species.

The green sandstones in which the bivalves occur, and which follow immediately above the boulder bed, I considered yet of probably mesozoic age; whilst others, before all Mr. Wynne, took also the boulder beds as of a similar age, because the "Conularia-pebbles" were considered by them as in a secondary position, and not fit to determine the age of the bed in which they were found.

Dr. Warth, however, was of a different opinion. In a paper published in vol. xx of the Records, he not only identified the boulder bed of the Olive-group with similar beds at the base of the Speckled Sandstone in the western parts of the range, as had been done formerly also by myself; but he also put the green sandstones with the bivalves on a parallel with green sandstone beds of the Speckled Sandstone, and yet higher following red sandstones, with similar rocks of the same western group.

With this paper of Dr. Warth's, the whole question was put in a new light, and I now proceeded to inspect those bivalves, which all of a sudden appeared as of the greatest geological importance.

After seeing these specimens again after so many years had elapsed, I was again struck by the similarity they exhibited to an inflated species of *Unio*. In none of the specimens was the hinge visible, and the material was of the brittlest kind imaginable, the rocks being generally considerably harder than the specimens. For nearly a year I tried every method imaginable to arrive at a clear view of the hinge, but for a long time quite in vain. At last I succeeded in cleaning the greater part of the hinge of both valves, and now the very strange result came to light that there existed no similarity whatever to *Unio* or any allied genus, but that the shells had to be rather approached to *Mytilus*, *Avicula*, or something of that kind, though the affinity still seemed to be a very doubtful and conflicting one.

I looked up all kinds of manuals and all sorts of books, without finding anything similar, except, perhaps, the genus *Modiomorpha* of Hall, but also here a very remote similarity only existed. At last I took the shells to Vienna, and showed them to everybody there, but without a better result.

After this I put them aside, disgusted, hoping that in the future the riddle might be solved, and began to write down the description of the contents of the Conularia nodules for vol. iv of the Salt-range fossils. For this purpose I got also Strzelecki's Physical Description of New South Wales to hand, and there all of a sudden I found a shell figured under the name of *Eurydesma* which was extremely similar to the Salt-range bivalves. The genus, I now found, was mentioned in all Hand-books, but, according to Dr. Stoliczka's views, was placed generally in the family *Tridacnida*, whilst all my observations on these shells pointed to a relation with the *Aviculida*.

After the spell had thus been broken, it was not difficult to follow the clue obtained; further, I now soon found that one of the species occurring in the Salt-range could be identified with all possible certainty with *Eurydesma globosum*,

Dana, from Illawara, and this is an identification of such geological importance that I thought it worthy of giving a notice of it in the Records.

Now at last we know for certain that Dr. Warth's views in the matter were correct, and that the green sandstones, with bivalves, that formerly had been attributed to the Olive group, form in reality part of the carboniferous period. There is now also no need for further discussion about the question, whether the *Conularia* nodules were found *in situ* or not, as the *Conulariæ* occur either (in most cases) in a lower position than the bivalves, or (exceptionally) they are to be met with in thin seams between the beds of bivalve sandstone. The *Conularia* nodules, as well as the bivalve sandstones, both have now been found to contain species identical with such of the Australian carboniferous; and with regard to the latter there has never existed the slightest doubt as to their occurring *in situ*.

I accept therefore the sub divisions of the Speckled Sandstone, as proposed by Dr. Warth, and the sequence of beds within this rock group is now the following:—

- (6), Green and dark sandstones, with some limestone bands (Lower *Productus* Limestone).
- (5), Red and purple clays (Lavender clays).
- (4), Red sandstones (Speckled Sandstone properly speaking).
- (3), Green sandstones.
- (2), Darker shales.
- (1), Crystalline-boulder conglomerate.

It can now no longer be doubted that the boulder-beds throughout the Salt-range belong to one and the same geological horizon, and are of upper carboniferous age; as in the eastern parts of the range their geological position can be demonstrated by the identity of the fossils with Australian carboniferous species, and in the western parts by their sequence below permian and uppermost carboniferous strata.

From the beginning, I have compared these boulder-beds with those of the Talchirs of peninsular India, but now that it has been proved that the green sandstones above belong to the same group of rocks, and that both rest unconformably on Cambrian beds, which, with some probability, can be put on a parallel with the Vindhians of peninsular India; the points of similarity have augmented to such a degree that even sceptic minds will admit that the divisions 1, 2 and 3 of the Speckled Sandstone will probably have to be placed on a level with the Talchirs. To this comes yet another point of importance. Now that it has been proved that the Australian carboniferous species occurring in the Salt-range are *in situ*, and not in a secondary position; the identity of the Australian and the Salt-range strata containing the same species cannot be doubted any longer. In Australia, glacial deposits have been detected in these beds by Mr. R. D. Oldham; and for this reason they were also placed on a level with the Talchirs.

Thus, from all sides come in proofs for the identity of the lower part of the Speckled Sandstone with the Talchirs; and in such a manner a distinct horizon is fixed, from which to start for the comparison of other beds of peninsular India with the marine deposits of the Salt-range.