Trias–Jura?

By M. ONGLEY.

[*Read before the Wellington Branch, October 13, 1936; received by the Editor, October 10, 1939; issued separately, June, 1940.*]

IN New Zealand, if a greywacke formation is found that yields no evidence of its age, it is common practice to follow the usage initiated by Dr. Marshall and call it Trias-Jura. In the course of mapping Kaitangata Subdivision, the writer had to examine an area adjoining the " Trias-Jura " of Tuapeka Subdivision and to investigate this classification. Marshall (1918, *N.Z. Geol. Surv. Bull.*, 19) classed the Otago Schist and the 30 miles of greywacke south of it as far as Nugget Point and the Kaihiku Range in the early Mesozoic portion of his Trias-Jura formation. This formation was based on his work in Nelson, of which he wrote, in the *Handbuch der Regionalen Geologie, New Zealand,* the following: " In 1908 and 1909 the writer examined this district in great detail and was satisfied that the rocks from the Dun Mountain to the Waimea Plain constitute a conformable series, but they are much and sharply folded. The commonest fossils are the definite Triassic forms described by Zittel: *Monotis salinaria* var. *richmondiana* Zitt., *Halobia lomelli* Wissm. *Mytilus problematicus* Zitt., *Spirigera wreyi* Zitt. However in the lowest beds of the series a few specimens of *Trigonia* were obtained and *Gryphaea* was found to occur occasionally with the *Mytilus.* This certainly justifies the use of the term Trias-Jura. The original specimens on which Hector's identifications were based are not now available, and no subsequent collectors have obtained the types he mentions; no forms, in fact, that are different from Trias-Jura types in other parts of the country."

In spite of the fact that Marshall's examination of the district satisfied him that the beds constitute a normal conformable sequence, his ideas of the structure and sequence cannot be accepted. For instance conglomerate beds found almost continuously along a line for thirteen miles and reaching in places 500 feet thick were dismissed as indicating " local changes in the conditions of sedimentation." Further, his scepticism regarding McKay's finding of the Matai fossils (upper Palaeozoic) was shown as unjustified when Trechmann and Thomson, by following McKay's directions, recollected them as narrated by Trechmann (*Geol. Mag.*, dec. 6, vol. 4, p. 54, 1917): " In October, 1915, when I was in the Wairoa Gorge in company with Mr. F. Worley, of Nelson, we made careful inquiries where ' Martin's Saw-mill ' formerly stood, as it had disappeared since 1878. On returning two days later with Dr. A. Thomson we had the good fortune almost simultaneously to find the fossils at the place indicated. . . .

" Two days later I visited in Mr. Worley's company the Dun Mountain tramway line, and at Wooded Peak, again following closely the instructions of McKay's report, we found the large bivalves exactly as he had described."

To bring the Tuapeka Series, including the Otago Schist, into the Trias-Jura, Marshall set out this argument: " No fossil remains have yet been found in this (Tuapeka) series—at any rate, in the Tuapeka district. The nearest points at which fossils have been found are the Kaihiku Gorge and Nugget Point, twenty miles distant in a southerly direction. In these localities the rocks are greywackes, in which the grains of feldspar are perfectly fresh and unweathered. Petrologically the freshness of the feldspar alone distinguishes them from the rocks at Balclutha. So far as lithological evidence is concerned the rocks would reasonably be placed in the same series. Stratigraphically the rocks are highly inclined in both localities, but the strike is somewhat different. The importance of this should not be exaggerated, for the localities are twenty miles distant from each other, and the exact nature of the intervening country is not known. In fact, divergences of strike in one and the same rock-series are common throughout New Zealand. Stratigraphically there is no strong reason to separate the rocks at Balclutha from those at Nugget Point and they have previously been associated, notably by Hutton."

As Hutton had in 1875 divided these beds into five series, Wanaka, Kakanui, Kaikoura, Maitai, and Putataka, this reference to Hutton is misleading. The contention is of course invalid—steep beds, 20 miles apart, strikes divergent, intervening structure unknown. As for the statement that " stratigraphically there is no strong reason to separate the rocks . . ." there are his own statements that the structure of Otago is anticlinal and that the beds are steep and twenty miles apart. As this is on the south limb and across the strike, the beds according to these data are not the same but separated by 100,000 feet of strata.

In support of the Trias-Jura hypothesis Marshall made two other references to the Kaitangata Subdivision. He asserted: " In the Clutha Valley there are typical Trias-Jura rocks at Balclutha," and "A gradual change is to be seen along the coast from the Nugget Point to the Taieri Mouth." For the first assertion there is no evidence; and the second is incorrect, for from Nugget Point north along the coast for 20 miles there is not one outcrop of greywacke or schist.

What Marshall lumped into Trias-Jura had, as already stated. been classified in 1875 by Hutton in five series; and in the *N.Z. Geol. Surv. Bull.*, 38, 1939, it has had to be divided into eight, seven of which have distinctive faunas.

The Series recognised are:

Putataka Series, Lower Oolite, Bathonian-Oxfordian.

Bastion Series, Lower Oolite, Callovian.

Warepa Series, Noric.

Otamita Series, Upper and Middle Carnic.

Oreti Series, Lowest Carnic.

Kaihiku Series, Ladino-Carnic.

Clinton Series, Permian or older.

Tuapeka Series, pre-Clinton.

These occur in normal superposition; and older faunas do not overlie and are not mixed with younger so that Marshall's Trias-Jura formation containing *Trigonia* and *Gryphaea* along with *Mytilus* in the lowest beds has to be discarded.

There remains the difficulty of naming the unfossiliferous greywacke formations that crop out in many parts of New Zealand. Certainly they should not be called by the erroneous names of Trias-Jura. From the widespread continuous Triassic-Jurassic faunas examined in the South and North Islands the writer inclines to the working hypothesis that the unfossiliferous greywacke formations are not Mesozoic but Palaeozoic; but to assign an age name without evidence is unwarranted. The standard practice of naming a formation by giving it a binomial designation, the first part being geographic and the other lithologic, as " Balclutha Greywacke," should be followed.