

environment closely similar to that envisaged for Eighty-eight valley, Caroline Cutting, and other Kaihikuan assemblages outside the area of Torlesse rocks. There is little paleontological evidence supporting recognition of two distinct facies in Kaihikuan times.

Carbonaceous beds containing well-preserved fronds and stems occur at Tank Gully near Mt Potts and at three localities in the middle Waitaki valley (S117), in each case in the same general area as *Daonella*-brachiopod occurrences. Only two of these plant collections have been described, those from Tank Gully (Arber, 1917; S72/499) and Benmore Dam (Bell, Harrington, and McKellar, 1956; S117/469), and both were placed in the Rhaetian. Plant beds near the Otematata River (S117/516) are mapped by Mutch (1963) as ?Herangi Series (Lower Jurassic) on the grounds of their lower induration than the surrounding Middle Triassic sediments. However, detailed study of the area shows an apparently conformable sequence from *Daonella*-bearing sediments to siltstones and mudstones with plant remains (R. J. Ryburn, pers. comm.). The plant beds are not likely to be greatly different in age from *Daonella* and this raises the possibility of a Middle or early Upper Triassic age for Waitaki valley plant beds in general.

No section has been described so far in which *Atomodesma*-bearing rocks are shown to be in unfaulted sequence with Triassic beds. Permian and Triassic rocks are closely associated in the Waitaki valley, but available evidence suggests that the younger rocks are invariably preserved in fault-bounded blocks.

Upper Triassic Fossil Localities

At least three zones (*Halobia*, *Monotis*, and *Terebellina*) can be recognised in Upper Triassic (Balfour Series) rocks. McKay's (1890: 143) mapping of "Otapiri Series" in Canterbury (termed "Wharfdale beds" by Hector, 1884: xiv) is based on a single determination of *Trigonia* from the Mt Thomas Range (S67/19). Dr J. Marwick (pers. comm.) found the fossil to be indeterminable.

(a) *Halobia* Zone: The Upper Triassic indicator *Halobia* was discovered by G. M. Mason in 1955 in argillite in fan gravels at Blackford Station on the lower slopes of the Hutt Range, 4 miles upstream from the Rakaia Gorge bridge (S74/519, Plate 2). In spite of extended searching the source of these boulders is still unknown. Speight (1920: 106) very tentatively recorded "an occasional finer marking which may belong to *Halobia*" on fracture surfaces of tuffaceous beds at High Peak Saddle, about 9 miles east of Blackford Station. We have been unsuccessful in several attempts to find fossils on High Peak Saddle, or indeed in the neighbouring ranges.

Notwithstanding the unsatisfactory state of our knowledge of the occurrence of *Halobia*, it can be stated that some of the Torlesse Group sediments belong to the *Halobia* Zone, which is represented in the Hokonui Facies by the Oretian and Otamitan stages and is approximately equivalent to Carnian on the international time-scale.

Paleoneilo mundeni Fleming, described from the Waiheke River (S53/501), has close affinity with an Otamitan species from Nelson, but it is not so far known in association with other species in Torlesse rocks.

(b) *Monotis* Zone: The discovery of limestone containing *Monotis* in the Okuku Valley in 1874 (S67/22, Plate 4) led McKay to suspect that extensive areas of the high country of Canterbury were Triassic in age. Work in the succeeding ninety