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AN ABRUPT UPPER MIDDLE CAMBRIAN FAUNAL CHANGE, CHRISTMAS HILLS, TASMANIA, AUSTRALIA

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(with two text figures)

ABSTRACT

Sediments containing two almost entirely different Upper Middle Cambrian faunas are in direct contact near Christmas Hills, Tasmania. Two reasons are advanced in explanation for this faunal change, (a) that there is a disconformity at the position of the faunal change, or (b) that the younger fauna replaced the older fauna due to a change in environment.

INTRODUCTION

A Cambrian sedimentary succession of unknown thickness occurs in the Christmas Hills area of far north-western Tasmania (fig. 1). Much of this area is covered by thick vegetation and all the sediments are deeply weathered, with exposure being limited to occasional outcrops in stream beds and road cuttings. The most common lithologies are siltstones and tuffs (or reworked tuffs) with minor occurrences of sandstone, greywacke and conglomerate. The available dips and strikes indicate that the Cambrian rocks of this area are strongly folded in places, although in the section discussed below the sediments have shallow dips (fig. 1). The only measured section is about 160 metres thick, but the entire sequence is probably much thicker. Within this measured section, well preserved Upper Middle Cambrian fossils were discovered by Gulline (1959) in a road cutting about 2.4 km. south of the Christmas Hills Post Office. Other localities have since been found. Banks (1962, p. 134) noted a 1959 personal communication from Öpik in which Öpik identified some of the trilobites, and stated that these indicated an age in the Late Middle Cambrian *Lejopyge laevigata II* Zone of the Queensland Middle Cambrian as listed by Öpik (1960, fig. 14). However, no mention of two separate faunas is made in Banks (1962).

THE FAUNAS

There are two principal faunas at the locality 2.4 km. south of the Christmas Hills Post Office. The lower fauna contains great numbers of a species of a possible new genus cf. *Oidalagnostus,* and species of *Clavagnostus,* other agnostids, *Nepea,* and other polymerid trilobites including very rare examples of *Dorypyge.* Inarticulate brachiopods, hyolithids and rare hydroids are also present. The upper fauna includes species of *Centropleura, Amphoton,* and other polymerids, *Ptychagnostus (Goniagnostus), Ptychagnostus* cf. *aculeatus* (Angelin), *Diplagnostus, Hypagnostus* cf. *brevifrons* (Angelin) *Oidalagnostus* and other agnostids, inarticulate brachiopods, dendroids, hyolithids and sponge spicules. The hydroids and dendroids are being described by P. Quilty and the trilobites by J. Jago.

The lower fauna is contained within about 20 metres of well sorted, buff coloured, slightly micaceous siltstone, with the frequency of most fossil species increasing up the section. *Nepea* is not known from near the base of the succession. The basal part of the overlying fauna is found in a pale buff-coloured laminated siltstone which generally becomes harder and greyer up the succession. The fossil content decreases rapidly after the first two or three metres. The density of occurrence of fossils in the lower is generally greater than that of the upper fauna. However, the proportion of complete or partially complete trilobites in the upper fauna is much greater than in the lower fauna.

The two faunas are almost entirely different with only *Clavagnostus, Peronopsis,* and cf. *Oidalagnostus* being common genera. Only part of a single pygidium of *Clavagnostus* is known from the upper fauna and cf. *Oidalagnostus* is also much rarer there than in the lower fauna. The species of *Clavagnostus* present in the upper fauna is different from that in the lower fauna. However, the same species of cf. *Oidalagnostus* occurs in both faunas. The species of *Peronopsis* in the upper fauna is probably the same as that in the lower fauna, but it is much rarer in the upper fauna than within the lower fauna.

The presence of *Centropleura, Ptychagnostus* cf. *aculeatus* and *Hypagnostus cf. brevifrons* in the upper fauna suggests that the age of this fauna is either that of the *Lejopyge laevigata II* Zone or the *L. laevigata I* Zone of Öpik (1961). The age of the lower fauna is not known precisely. Its general aspect indicates that it can only be a little older than the upper fauna and the presence of *Clavagnostus* suggests that the lower fauna is probably not older than the *L. laevigata I* Zone. One rather odd feature of the lower fauna is the absence of *Ptychagnostus,* a genus usually found in the Upper Middle Cambrian agnostid faunas.

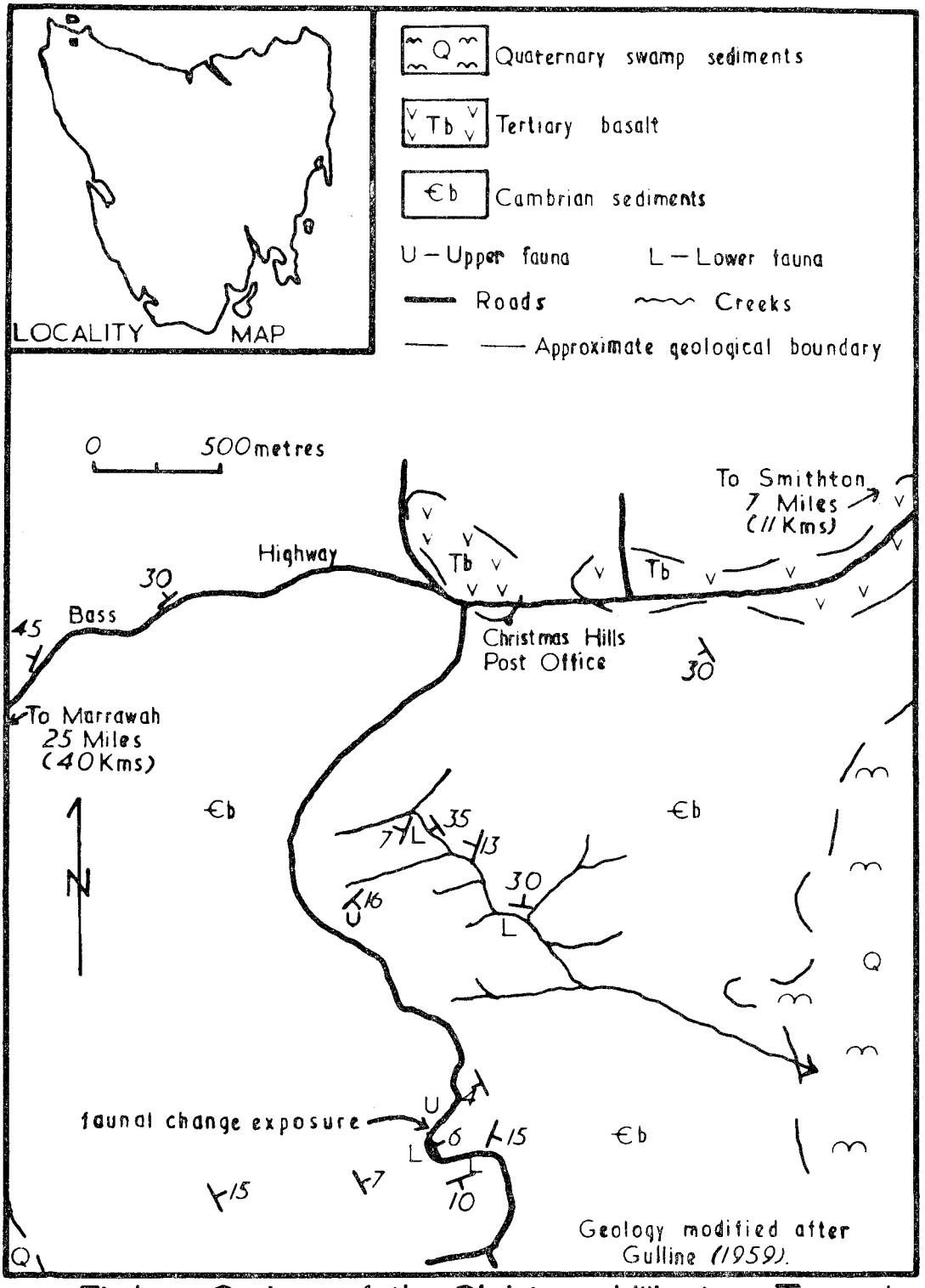

Fig. 1 — Geology of the Christmas Hills Area, Tasmania.

THE ABRUPT FAUNAL CHANGE

Prior to 1967 the boundary between the sediments containing the two faunas was unknown. In late December 1967 the authors dug out the boundary, with the results described below and summarized in fig. 2.

It was found that the faunal change is abrupt and that there are distinctly different siltstones on either side of the boundary. The uppermost 60 cm. of the lower fauna is contained within sediment that is much more weathered than the sediments above and below. The boundary between the sediments containing the two faunas occurs at the top of a 2.5 cm. band of ferruginous purple siltstone. Immediately above this purple siltstone is a 5 cm. layer of siltstone and ferruginous siltstone, which is overlain by well bedded pale siltstone containing the upper fauna. At this level the fauna includes *Hypagnostus* cf. *brevifrons* cf. *Oidalagnostus* and *Amphoton*. At the present the lowest known example of the upper fauna comes from about 9 cm. above the purple siltstone. The lowest *Centropleura* found to date is about 43 cm. above the boundary.

Immediately below the ferruginous purple siltstone is a 20 cm. thickness of clay and deeply weathered siltstone, which contains *Nepea* and other members of the lower fauna within 2 cm. of the purple siltstone. Beneath this is a slightly ferruginous siltstone 1-2 cm. thick underlain by 7.5 cm. of deeply weathered, whitish clay, which overlies 5 cm. of purple silt and ferruginous material. Below this are 19 cm. of deeply weathered siltstone and clay, which is underlain by well bedded siltstone, which contains abundant well preserved representatives of the lower fauna.

The above description indicates that there is a maximum of about 13 cm. between the lowest known member of the upper fauna and the highest known member of the lower fauna. With further collecting and excavation of the trench from which the above section was described this distance will probably decrease.

The marked change in faunas across the boundary, the different sediment types containing the faunas, and the highly weathered nature of these sediments may indicate a disconformity at this level. A second explanation for the abrupt faunal change is that there is no disconformity, but rather that the upper fauna represents an incoming fauna which displaced the original fauna due to a change in environment.

It is probable that the sediments containing the upper fauna were deposited in quieter waters than the sediments which contain the lower fauna. This is substantiated by the laminated nature of the sediments containing the upper fauna, and the greater proportion of complete trilobites in the upper fauna as compared to the lower fauna. The presence of sponge spicules and the preservation of dendroids in the upper fauna also implies quiet bottom conditions. The cause of this environmental difference is unknown, although it is possible that the upper fauna is a deeper water fauna than the lower fauna.

The lower fauna is seen at two other localities in the vicinity of Christmas Hills and the upper fauna is seen at one other place (see fig. 1). However, the nature of the outcrops at these localities does not allow the stratigraphic relationships between the sediments containing the two faunas to be determined. Thus at the present the faunal change can be inspected in the excavated section whose lateral extent is only about 60 cms. Until the field relationships are known in much more detail no firm explanation can be given.

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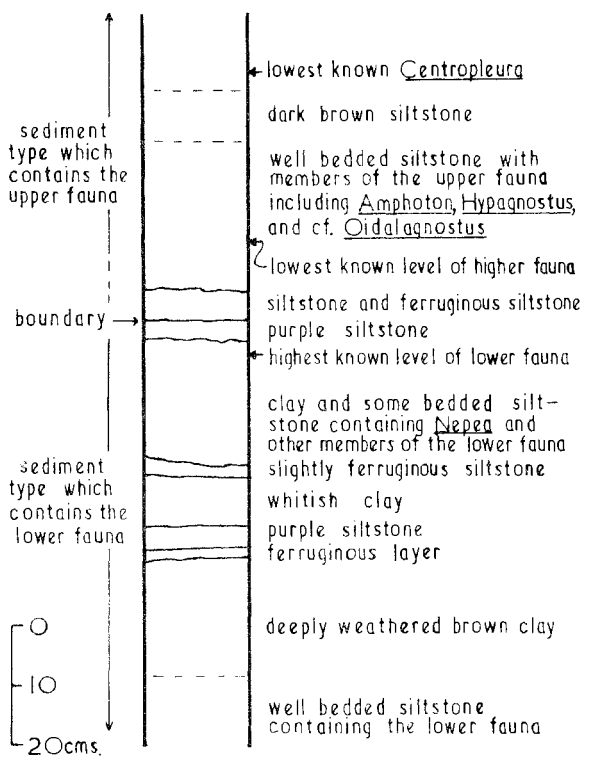

Fig.2 —— Section through the faunal change, Christmas Hills, Tasmania.