SOUTHERN CAVE-BEETLE FAUNA IN PERSPECTIVE

by

Barry P. Moore

Troglobitic beetles have excited the interests of entomologists and others ever since the first completely blind species were described from Europe over a century ago. In the intervening years northern cave systems have been extensively explored and more and more such species have been discovered in both the Old and New Worlds, so that by now a fairly clear picture of their biology, distribution and evolution has emerged. But not surprisingly, perhaps, comparable work on southern cave faunas has lagged far behind. The first concerted survey here was started in New Zealand some 15 years ago and a rich troglobitic fauna soon came to light, with several species of trechine Carabidae, in particular, attaining levels of morphological development fully comparable with those of the most adapted European forms.

Similar discoveries were hardly to be expected from the dry caves of mainland Australia but those of Tasmania appeared altogether more promising, both on grounds of present wet condition and of past climatic history, and they had, in fact, already produced our only troglobitic beetle in *Idacarabus troglodytes* Lea (Carabidae: Zolinae).

Recent explorations by both local and visitng cavers have fully justified these expectations and we now have quite an impressive list of troglobites from the island state. These additions culminated in the discovery at Ida Bay, some two years ago, of the first completely blind species (a trechine carabid) to be detected in our region—a veritable milestone in southern biospeleology. It therefore seems opportune and most appropriate to attempt to draw a new perspective of our cave-beetle fauna at this Congress in Hobart.

Studies on northern faunas soon established a number of general principles concerning the evolution of cave faunas. Most notable was the fact that troglobites (obligate cavernicoles) attain their greatest diversity in caves of the temperate regions and their present distributions reflect, rather closely, the maximal extensions of glaciation during the Pleistocene period. In effect, the favoured region dovetails with our conception of the Pleistocene periglacial zone, where caves apparently offered a refuge for stenothermic animals from the climatic vicissitudes of those unstable times. The known distribution of troglobitic carabids of the genus *Pseudanophthalmus* (Fig. 1) illustrates this principle particularly well, although many other examples could be cited from either side of the Atlantic ocean.

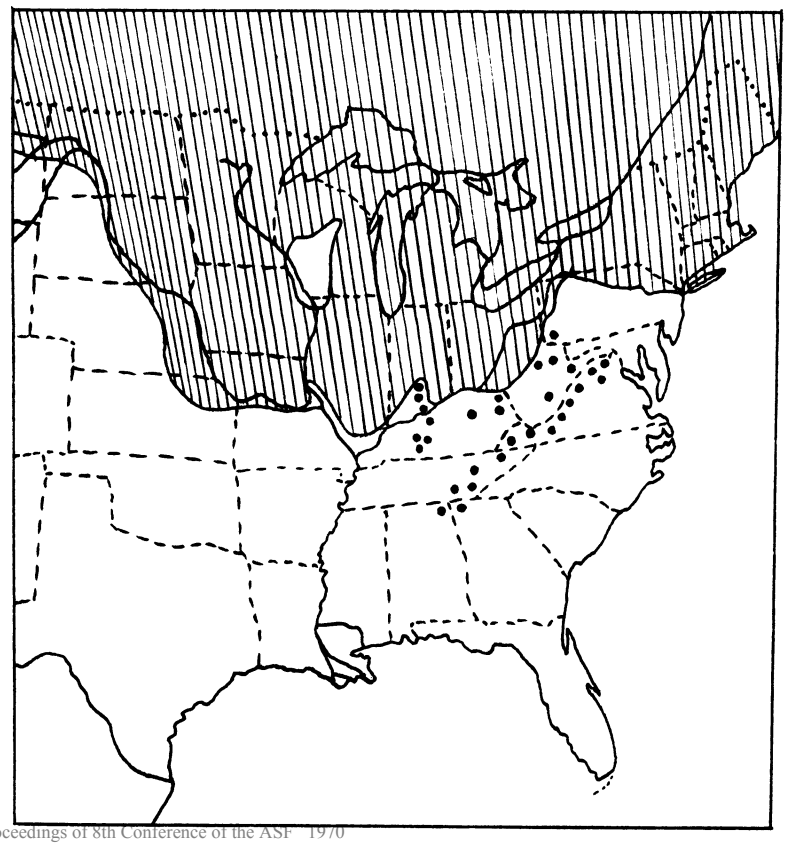


Figure 1:

The approximate distribution of troglobitic carabid beetles of the genus *Pseudanophthalmus* in N. America. The hatched area indicates the limits of glaciation in the Pleistocene. (After Jeannel, 1943, with additions).

The pressures of climatic change were, of course, much less testing in the tropics and it is not surprising, therefore, that cave faunas at those latitudes include very few troglobites. Troglophiles (facultative cavernicoles), on the other hand, are abundant in tropical caves, where they exploit to the full the greatly augmented food supply.

For the most part, troglobitic beetles appear to have been derived from groups that were, in a sense, preadapted to life underground and in continual darkness; these were mainly inhabitants of the deep litter layer of cool, temperate, deciduous forests and many still occur in such habitats today. These beetles included primary detritus feeders belonging to the Anisotomidae and secondary predators of the Carabidae and these two families remain dominant in the northern cave faunas at the present time.

Troglobites have become so specialized that they are all but prisoners of their environment and are able to migrate only by means of subterranean fissures that may link, intermittently, their normally isolated retreats. Local variation is thus a striking feature of many troglobitic groups.

Troglophiles are more mobile and less restricted in their habits; they may persist for many generations underground if food supplies permit, but they are equally capable of subsisting upon surface sources and they not infrequently move from one habitat to the other. Guanophiles and other dung-feeders form a case in point: they are more or less polyphagous and their cave populations wax and wane with those of the bats and other mammals that provide their food.

Now, with our greatly increased knowledge of southern cave faunas (except, unfortunately, in S. America) we are much better able to assess the overall compositions and distributions in the light of the northern researches. The general parallelism in development is then, I believe, quite striking, although certain qualitative differences between the two hemispheres continue to exist. Thus, the Australasian troglobitic beetles so far known are all Carabidae and the great majority belong to the subfamily Trechinae, but their distribution patterns are closely concordant with our ideas of the extents of the southern Pleistocene periglacial zones. In New Zealand troglobitic beetles occur widely but they appear to reach their richest development in South Island (May, 1963); in Australia they are known only from Tasmania (*Idacarabus*, 2 species; *Goedetrechus*, 2 species; *Tasmanotrechus*, 1 species).

The extent of Pleistocene glaciation in Australia is not entirely settled but it certainly included upland Tasmania (Jennings and Banks, 1958) and a small area of the mainland centred about the Snowy Mountains. Thus the greater part of lowland Tasmania would have passed through at least one periglacial phase, and the distribution of our troglobitic beetles there is entirely accountable. On the same bases one might expect a similar occurrence in the higher mainland cave systems (Cooleman and Yarrangobilly) but to date no troglobite or indeed, any convincing troglophile has been discovered in this region. Possibly there may yet be such a species awaiting discovery, or perhaps the region was too circumscribed to retain a well developed cave fauna through the vicissitudes of post-Pleistocene Australia (Moore, 1964). In any event, the anomaly is a small one in the general context of troglobitic evolution here.

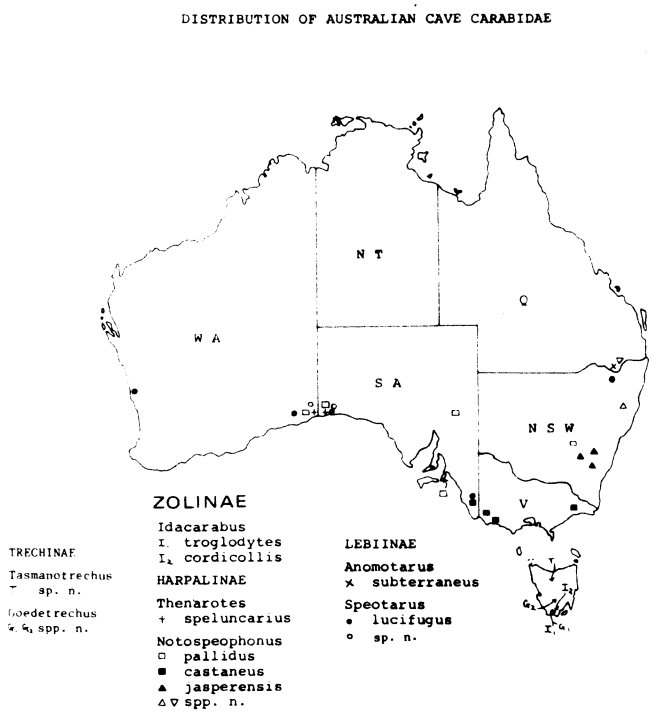
In composition also, our troglobitic beetle fauna shows some minor divergences from the northern pattern but these result from differences in early surface faunas rather than from differential evolution in the cave environment. Thus in our two *Idacarabus* species (*troglodytes* Lea and *cordicollis* Moore) we have the only known troglobitic Zolinae (Merizodinae) but this subfamily is entirely confined to the southern hemisphere. Then again, the lack of troglobitic Anisotomidae in southern caves, in marked contrast with the northern faunas, does no more than reflect the extreme paucity of this family in surface habitats in our area. Their role as detritus feeders in both types of habitat in Australasia must presumably be played by some other group of arthropods, possibly the Acari.

The rather numerous troglophiles of mainland Australia give the appearance of a somewhat attenuated tropical-type cave fauna and this is exactly what might be expected on grounds of palaeoclimate and present-day food supplies. The salient carabid genera are *Notospeophonus* (Harpalinae), with about five closely related species and *Speotarus* (Lebiinae) with two. Their known distributions are outlined in Figure 2. These beetles have fully developed eyes and wings and, although hardly ever found outside the cave environment, they apparently do migrate across the intervening open spaces. A specimen of *Speotarus* sp.n. taken by Mr G.W. Anderson at light a few years ago, on the Eyre Peninsula, S.A., and well away from any known cave system, gives the clue we needed. This same species, incidentally, is known from several of the Nullarbor caves.

Both *Notospeophonus* and *Speotarus* have numerous close relatives in the surface faunas, in *Lecanomerus* and *Anomatarus*, respectively, and isolated species of each of these predominantly surface genera are also known from caves. Therefore, although Harpalinae and Lebiinae are certainly atypical as cave dwellers overseas (they are known from caves elsewhere only from New Zealand and Africa, respectively), they are entirely in keeping with the surface fauna here.

Of the other families of beetles represented in our caves (15 are listed by Hamilton-Smith, 1967), none is specially noteworthy from the biospeleological viewpoint but a few are of interest on other grounds. The latter include the enigmatic family, Jacobsoniidae, represented by a new genus and species from bat guano in southern caves (Hamilton-Smith, 1967) and, in the Staphylinidae, the rat parasite *Myotyphlus jansoni* (Matth.) now also known to be free-living

Figure 2: Distribution of Australian Cave Carabidae



(Hamilton-Smith and Adams, 1966), and the Japanese *Philonthus parcus* Shp., established as a guanophile in several caves of New South Wales (Moore, 1968).

To sum up, then, we may say that the general characteristics of the Australasian cave beetle faunas are in keeping with the concept of a Pleistocene derivation for troglobites, and that such anomalies, in comparison with northern faunas, as still exist may be accounted for on the bases of differing ground faunas and divergences of palaeoclimate in Recent times.

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DISCUSSION

Q *For some reason at Yarrangobilly there aren't any of these troglobitic beetles. Is it possible that due to its altitude the area was glaciated?*

A There is a possibility. It is by no means at the top of the mountains and no two authorities agree exactly how far the glaciers came down. It could well be that it was a shade too close to the edge of the glaciers to be an effective harbour. The caves at the moment look very suitable for the sort of life we are looking for but obviously they haven't been in the past for some reason or other.

Q *In which case they'd be searched for at Cooleman?*

A We have been in Cooleman quite a lot but the Cooleman Caves are not terribly extensive and when you go in them you get the impression that it wouldn't have taken much of a dry period outside to dry them out. They don't look a firm enough refuge for really adapted cave fauna. We have a few troglophiles there but that is all.