Geology Group

Fossil Insects in the Australian Mesozoic

Report on talk given by Sarah Martin on 28 March 2007

Sarah's talk took us from the start of the Triassic through to the end of the Cretaceous. She explained the importance of this era as it was during this time that many major insect orders had their origins. These include butterflies, moths, flies, wasps, bees, ants, dragonflies, termites and fleas. At the same time many archaic orders became extinct, such as the giant dragonflies often featured in illustrations of Northern Hemisphere Carboniferous coal measure swamps; these were not closely related to our modern dragonflies. The Mesozoic era also has the first evidence of sociality in insects, e.g. termite nests, and also saw the evolution of many key insect-plant and insect-animal interactions, such as pollination and blood-sucking behaviours.

Tarwinia - Tarwinia australis, flea from Lower Cretaceous Koonwarra Fossil Bed, Gippsland Basin, Victoria. Picture sourced from Grimaldi & Engel 2005, p. 487, fig. 12.19

Hawkesbury Clatrotitan grimaldi - Titanopteran fore wing, Clatrotitan scullyi, from the Middle Triassic Hawkesbury Sandstone, Sydney Basin, New South Wales. Picture sourced from Grimaldi & Engel 2005, p.216, fig. 7.42

Our speaker commented that insect fossils are more common than one might expect with 17 Mesozoic sites in Australia. The first fossil insect to be described in Australia was from the Permian of NSW in 1870. However, there has not been a great deal published in recent years, the last major work being on the Koonwarra Fossil Bed in 1986. So we are fortunate that Sarah could give us such a comprehensive picture of the current state of our knowledge of fossil insects in Australia.

The Triassic period began 251 million years ago (Ma) with Australia part of the huge landmass Pangaea which meant that the insect fauna of Northern and Southern Hemispheres were similar. This global configuration continued through the Jurassic until the Cretaceous when Australia's separation from the rest of Gondwana began, with the final split from Antarctica about 38 Ma. Sarah remarked that Antarctica's insect fauna at that time was probably very similar to Australia's but became extinct as the polar icecap developed. There are 11 Triassic fossil insect localities in Australia.

The Early Triassic represents a recovery period from the Permian mass extinction but by the Mid Triassic (245-228 Ma) we have the first Australian occurrence of grasshoppers and primitive cockroaches, with beetles dominating the insect fauna. One fossil illustrated was a single 14 cm wing belonging to the predatory grasshopper-like titanopterans, which are also known from Russia. It has a stridulatory structure on its fore wing, a ridged area in the centre of the wing which produced sound when rubbed. This is one of the earliest groups of insects to show evidence of "singing". Insects had become very diverse by the Late Triassic with the first aquatic insects recorded in Australia (nymphs), the first appearance of flies and stick insects, and many bugs occurring, with Australia having one of the world's earliest examples of aphids.

Gondwanan fossil insect sites are rare in the Jurassic (200-146 Ma) but Australia has three interesting localities. One of these sites is the subject of Sarah's Ph.D.: the Lower Jurassic Cattamarra Coal Measures

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in Western Australia. Most of the insects in this assemblage are disarticulated and similar to those found in the Late Triassic. The toughest parts - beetle elytra (wing covers) and cockroach fore wings are preferentially preserved. The Late Jurassic Battle Camp Formation, Queensland has trace fossils considered to be the oldest leaf mines undoubtedly formed by insects worldwide.

There are three fossil insect sites of Cretaceous age (146-66 Ma) in Australia. But by far the most prolific and important is the Koonwarra Fossil Bed (118-115 Ma) of Victoria. This lens of mudstone within the sandstones of the Lower Cretaceous Eumeralla Formation represents a shallow lake deposit and was discovered during road widening on the South Gippsland Highway in the 1960s. It is famous for its fish and feather fossils but contains a rich, mainly aquatic, insect fauna with the nymphs of mayflies, dragonflies and damselflies common. Water beetles, caddisfly cases and water treaders also occur, the latter being virtually identical to present-day specimens. Terrestrial insects are less common but include the first fossil flea, *Tarwinia australis*, which like all modern fleas almost certainly was living as a vertebrate parasite. Although initially thought to be a mammal parasite, *Tarwinia*'s large body size (7 mm long) in relation to the small mammals known from this time makes this unlikely, with furry pterosaurs (flying reptile) instead considered a possible host. 80% of the fossil insect families that existed at the end of the Cretaceous are still with us today.

We would like to thank Sarah Martin for her presentation. Fossil insects are perhaps a neglected field but Sarah's enthusiasm, excellent illustrations, interesting explanations and depth of knowledge made this a fascinating talk.

References

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