

Following the splitting of the old Ponerinae, Bolton (6) placed *B. clavata* in its own monotypic subfamily (Brownimeciinae), observing that the species did not easily fit into any recognized subfamilies. *B. clavata* has falcate, edentate mandibles, unusual for ants and often associated with dulotic behavior (6). Unlike the armaniids and sphecomyrmines, and more like crown-group ants, *B. clavata* possesses a relatively elongate scape (41). Another interesting morphological feature of *B. clavata* is the presence of clubbed antennae, which, although not uncommon among modern ants, is the only known instance among Cretaceous ants (6).

Two other Cretaceous amber deposits (Burmese and Canadian) are of particular recent interest because they contain, in addition to sphecomyrmines, several fossils that very likely belong to the ant crown group. A possible aneuretine, *Burmomyrma rossi* (22), and a possible myrmeciine (although considered incertae sedis), *Myanmyrma gracilis* (35), from 99 myo Burmese amber have been described. The single known specimen of *B. rossi* is a headless alate. Dlussky (22) considered its general morphology and wing venation to be consistent with the crown-group subfamily Aneuretinae. Another fossil from younger Cretaceous Canadian amber (Campanian, ca. 78 myo), *Cananeuretus occidentalis*, has also been tentatively placed within the Aneuretinae (35). The subfamily Aneuretinae is represented today by a single, presumably relict species, *Aneuretus simoni*, found only on the island of Sri Lanka. Engel & Grimaldi (35) considered *Myanmyrma gracilis* either to be within the poneroid grade or to belong to the Myrmeciinae. The species possesses a gastral constriction, which places it within the poneroid grade, but it shares several other morphological features with the myrmeciines (35). Archibald et al. (1) thought that given the lack of character support and poor specimen preservation, *M. gracilis* was likely not a myrmeciine. They also observed that the short scapes are known only in stem-group ants; however, the strong constriction between abdominal segments III and IV is not known from any stem-group ant.

Discovered in Charentese amber (ca. 100 myo), *Gerontoformica cretacea* is of uncertain taxonomic placement due to the high distortion of the specimen (77), although it is likely a crown-group ant. Nel et al. (77) suggested it is reminiscent of either the Dolichoderinae or the Formicinae on the basis of general habitus. The specimen does have a relatively long scape and the antenna is not clubbed, which suggests it is not a sphecomyrmine or a brownimeciine.

Two other fossils have been assigned to the crown-group ants, *Afropone* to the Ponerinae and *Afromyrma* to the Myrmicinae, on the basis of imprints from Orapa, Botswana (26). The specimens are in poor condition and their assignment to an ant crown group has been questioned (1, 116).

## CENOZOIC ANT FOSSILS

The end of the Mesozoic 65 mya, marked by a well-known mass extinction event, also may have brought about the end of both the armaniids and sphecomyrmines—although the times of their extinctions remain unclear. The last armaniids occur about 91 mya in the Turonian of Botswana; however, insect-rich rock deposits are desperately lacking between 55 and 90 mya. Similarly, the last occurrence of sphecomyrmines is from the Campanian Canadian amber, but insect amber deposits are lacking in the Maastrichtian and Paleocene, so the possibility that sphecomyrmines survived until the Paleocene cannot be excluded. This is unlikely, however, given that the only known early Cenozoic deposit contains clearly identifiable and diverse crown-group ant fossils, and no sphecomyrmines. Dlussky (21) studied Sakhalin amber and found that, as in Cretaceous deposits, ants are rare (just 9 specimens), composing only 1.2% of all insect fossils, and belong to extinct genera from modern subfamilies (Dolichoderinae, Aneuretinae, Formicinae, and Ponerinae). Sakhalin amber finds do, however, demonstrate that Paleocene ants occupied various levels in the ecosystem, perhaps the beginnings of the various niches occupied by modern ants (28). For example, based on their morphology, *Aneuretellus* and *Protopone* likely lived in soil or leaf litter