ON THE ORIGIN OF CRUSTACEA

K. G. McKENZIE

Riverina College of Advanced Education,
Wagga Wagga, NSW, Australia

SUMMARY

Crustaceans are predominantly aquatic arthropods with a characteristic naupliar stage. Their known evolutionary history extends at least from the Early Cambrian. They display many features convergent with the chelicerates, uniramians and trilobites and formerly were classified with these groups in Arthropoda.

It seems more appropriate to study the origins of Crustacea by reference to their Cambrian representatives than by seeking to establish particular intuitions concerning early crustaceans based on a knowledge of living forms only.

Among Cambrian fossils, the lobopod *Aysheaia* is irrelevant to crustacean origins. Similarly, the living Tardigrada are best consigned to a separate phylum although they seem to be a related group with several primitive characters and are likely, on zoogeographic grounds, to have had a long evolutionary history.

Assuming that Crustacea are monophyletic, the existing fossil record dictates that the ancestral taxon possessed a complex of characters out of which evolved (during Cambrian times) at least: bradoriids and other primitive ostracode-like animals; *Canadaspis* and other phyllocarid-like forms; *Branchiocaris* and similar notostracan-like forms. Several other Cambrian taxa may be either true crustaceans or examples of convergence. Some show similarities to anostracans and conchostracans.

The diversity and complexity of the Cambrian fossils suggest that a basic crustacean facies was already established by the Late Precambrian (Ediacaran).

Introduction

Most crustaceans are aquatic invertebrates, inhabiting marine or continental athalassic and freshwater environments, although many terrestrial-adapted species are known. The total of crustacean species is not known definitively but has been conservatively reported at 40,000 (Gruner and Holthuis, 1967, cited in Moore, 1969, p. R59). This number is near the known species of Ostracoda alone (McKenzie, 1973). Probably, the total number of described crustacean species is nearer 100,000. This larger figure takes into account the rich fossil record of Crustacea which extends from the Early Cambrian to Recent, i.e. spans over 550 million years.

It is scarcely surprising that such a large pool of species embraces a remarkable diversity of forms. Nevertheless, the homogeneity of Crustaceans as a group has rarely been questioned. A particularly powerful argument in favour of the unity of Crustacea is adduced from embryology. Thus, ". . . the mode of development in Crustacea is based on spiral cleavage and a configuration of presumptive areas whose subsequent development is as a nauplius . . ." (Anderson, 1973, p. 471). The typical crustacean nauplius (metanauplius) is an ontogenetic stage which, embryologically at least, may be considered to possess a basic segmentation that includes antennular, antennal and mandibular segments (McKenzie, 1972, p. 172).

With some major exceptions (e.g. Ostracoda), most mature crustaceans possess three more or less well-defined tagmata—cephalon, thorax and abdomen—analogously with the non-related Trilobita. In general, cephalic features tend to be conservative among the several crustacean groups and typically include two pairs of antennary appendages. Behind these are segments which carry gnathobasic mandibles and up to two pairs of maxillae (in some groups one pair is interpreted as having been lost during evolution). The total possible number of cephalic segments is thus six but some or all may be fused.