

New Late Cretaceous and Early Cenozoic decapod crustaceans from California, USA: implications for the origination of taxa in the eastern North Pacific

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Abstract

Recent revision of Cretaceous and Paleocene brachyurans in the collections of the Natural History Museum of Los Angeles County has revealed the presence of several new species. Based upon these fossils and their ages, it is evident that they played a pivotal role in the origination and subsequent dispersal of decapod crustaceans within the eastern North Pacific.

Introduction

Prior to this report, diverse occurrences of fossil decapod crustaceans had been reported from California (Rathbun, 1926, 1932; Squires, 1980, 2001; Bishop, 1988; Tucker et al., 1994; Schweitzer & Feldmann, 2002). Furthermore, decapod crustaceans of Late Cretaceous and Early Cenozoic ages were believed to be quite rare in California (Schweitzer, 2001; Schweitzer & Feldmann, 2002). However, the species described herein and the known Eocene decapod faunas from California (Rathbun, 1926; Squires, 2001; Schweitzer & Feldmann, 2002) indicate that California is indeed a well-represented region for fossil decapod crustaceans.

Mesozoic crustaceans

The decapod fauna from the Maastrichtian Moreno Formation of Merced County, California, includes three species of brachyurans:

The first is *Raninoides* n. sp., representing the earliest occurrence of the genus both in California

and worldwide. The shape of the dorsal carapace, including the placement and lengths of the frontal spines, clearly justifies assignment to *Raninoides*. Well-preserved fossil material will allow a complete description of this new species and provide further insight into the evolution of the family Raninidae;

The second is *Archaeopus* n. sp., the second report of the genus from Upper Cretaceous rocks of California. The subquadrate carapace, long down turned front, relatively large orbits, and overall carapace shape allow confident assignment of this species to *Archaeopus*. Another species, *A. antennatus*, has been previously reported from an unnamed formation in the Upper Cretaceous of California (Rathbun, 1926). The new taxon differs in having a less subquadrate carapace and better defined regions than *A. antennatus*.

The third taxon is *Icriocarcinus xestos*, a species first reported from the late Campanian or early Maastrichtian Point Loma Formation of California (Bishop, 1988). This genus was originally placed in the Carcineretidae and subsequently reassigned to the Goneplacidae (Schweitzer et al., 2002). New material extends the geographic range of the genus northwards into central California. Currently, based upon very broad morphological characteristics, the genus *Icriocarcinus* is placed within the Goneplacidae (Schweitzer et al., 2002). With the many well-preserved and complete specimens available for study now, it is hoped that the genus can be confidently placed at the family level.

Cenozoic crustaceans

The Early Cenozoic occurrences of decapod crustaceans in California also are very significant. Decapod crustaceans from the middle to late Paleocene Coal Canyon Formation are the only specimens of this age known from the West Coast of North America. These specimens also are important because they indicate that certain Late Cretaceous decapod taxa persisted through the Cretaceous-Tertiary (K/T) extinction event and survived at least into the Paleocene. Five species have been recognized:

The first species is *Costacopluma* n. sp. within Paleocene rocks of California confirms that the genus was widespread after the K/T extinction event (Rémy, 1960; Collins & Rasmussen, 1992; Collins et al., 1994; Feldmann & Martins-Neto, 1995; Feldmann et al., 1995, 1997). A subrectangular carapace, narrow front, and angular cardiac region clearly allow placement of this species within the genus *Costacopluma*. Records of *Costacopluma* from the Mexcala Formation of the State of Guerrero, Mexico, suggest that this genus was present in America since Coniacian times (Vega & Feldmann, 1992) and is as old (or possibly older) than the purported first record of the genus from Africa (Collins & Morris, 1975). These findings indicate that the genus was well established in the eastern North Pacific region during its evolutionary span;

The second taxon is *Coeloma* n. sp., representing the earliest occurrence of the genus both in California and worldwide. The specimens referred here have a flat, trapezoidal carapace with a four-toothed front and four teeth along the anterolateral margin. These morphological characteristics clearly permit the placement of this species within the genus *Coeloma*. Previously, the genus was believed to have dispersed to North America from Europe after the early Eocene (Schweitzer et al., 2002). However, with more than a dozen well-preserved specimens currently available for study, the genus now appears to have had its first appearance in California and subsequently dispersed to Europe by the early Eocene. Another species, *Coeloma martinensis*, was described from the late Eocene Martinez Formation of California by Rathbun (1926). The new species differs from *C. martinensis*

in having a more distinct and projected front, more triangular anterolateral spines, and a less distinct medial frontal groove;

The third species is *Archaeopus* n. sp. is the first report of the genus in Paleocene rocks. The oldest occurrence is in Cretaceous strata of the west coast of North America (Rathbun, 1908; Schweitzer & Feldmann, 2001; Schweitzer et al., 2002, submitted). The youngest occurrence is in the late Eocene of British Columbia, Canada (Schweitzer et al., submitted). The genus is endemic to the North Pacific with all but one of the fossil occurrences along the west coast of North America; Nagao (1941) described *Archaeopus ezoensis* from Cretaceous rocks of Japan.

The fourth taxon of note is *Zanthopsis* n. sp. from the Paleocene of California clearly has the four-lobed front, vaulted carapace, and tubercles on the branchial region which justify placement of the new species within the genus *Zanthopsis*. With the reassignment of previous taxa referred to *Zanthopsis* (Beurlen, 1958; Bishop, 1988; Schweitzer et al., 2000), the present species is the earliest representative of the genus. Another species, *Zanthopsis sternbergi*, was reported from the Cretaceous of California (Rathbun, 1926), but it is only known from a questionable claw fragment and thus the occurrence of the species cannot be confirmed;

Finally, *Cyclocorystes aldersoni* also occurs in the Coal Canyon Formation, the species having been originally described by Squires (1980) on the basis of seventeen specimens collected from this formation. The only other species referred to this genus is the type species, *Cyclocorystes pulchellus* Bell, 1858, from the Eocene London Clay of England.

Discussion

The latest Cretaceous-earliest Cenozoic strata along the California coast of North America preserve a fairly robust record of the origination and evolution of fossil decapod crustaceans. Previously it had been postulated that southern latitude and Tethyan regions had a higher number of decapod taxa originations, with subsequent dispersals to the eastern North Pacific (Schweitzer, 2001; Schweitzer et al., 2002). However, with continued study of the deca-

pod faunas from this region as exemplified by the above descriptions, it is becoming clear that many of the taxa described from rocks of the West Coast of North America actually originated within the eastern North Pacific.

It has been reported (Schweitzer, 2001) that Cenozoic decapods from lower latitude regions, such as California, exhibit significant differences at the generic level from those occurring at higher latitude localities in Oregon, Washington, and British Columbia. Although there are only a few genera that can be found in every country and state from British Columbia to Mexico, there are actually many geographic overlaps along the margin of the continent. The genus *Costacopluma*, which is very common in the Upper Cretaceous of the eastern coast of Mexico (Vega & Perrilliat, 1991; Vega et al., 1994, 1995), now has been recognised in the Paleocene rocks of California and undescribed specimens are known from British Columbia (J. Fam, pers. comm.). It is interesting to note that *Costacopluma* was as widespread during Paleocene times as it was during the Late Cretaceous. *Archaeopus* is found in Alaska, British Columbia, California, and Mexico. *Ranina* and *Raninoides* are found all along the west coast of North America. We agree with Schweitzer (2001) that more collecting and additional taxonomic studies of fossil decapods of the west coast of North America are needed before a comprehensive understanding of the originations and dispersal patterns of this group can be confidently achieved for the eastern North Pacific.

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