



ACADEMIA NACIONAL DE CIENCIAS

***9º CONGRESO ARGENTINO  
DE PALEONTOLOGÍA Y  
BIOESTRATIGRAFÍA***

***RESÚMENES***

*Córdoba, 18 al 22 de Septiembre, 2006 - Argentina*

1549781  
23/10/06

## Cladistic analysis of Conulariidae Walcott (Cnidaria)

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A cladistic analysis for Conulariidae, a major extinct (Eocambrian-Triassic) group of scyphozoan cnidarians (Kiderlen, 1937; Bischoff, 1978; Moore and Harrington, 1956; Van Iten, 1991, 1992a, b; Marques and Collins, 2004; Van Iten *et al.*, 2006), is presented. The analysis seeks to test whether the classical suprageneric groups proposed in the "Treatise on Invertebrate Paleontology" (TIP) are phylogenetically retrieved. The study is based on a comprehensive review of the skeletal anatomy of conulariid specimens ranging in age from Cambrian to Permian deposited in scientific collections from North and South America, Europe, and Australia. The main goals are: (1) to propose relationships within members of conulariids and (2) to discuss the implications of data so far gathered on the systematics of Conulariidae. A total of 17 characters were scored for the external and internal thecae morphology of 16 ingroup taxa (*Vendoconularia*, *Teresconularia*, *Conularina*, *Eoconularia*, *Archaeoconularia*, *Baccaconularia*, *Conularia*, *Ctenoconularia*, *Glyptoconularia*, *Metaconularia*, *Pseudoconularia*, *Notoconularia*, *Climacococonus*, *Paraconularia*, *Reticulaconularia*, and *Conulariella*). From this, six genera (*Vendoconularia*, *Teresconularia*, *Baccaconularia*, *Notoconularia*, *Reticulaconularia*, and *Glyptoconularia*) were erected after the publication of the TIP. Cubozoa, Stauromedusae, Coronatae and Semaostomeae were used as outgroups. Unweighted analysis of the data matrix yielded 1057 trees. Successive weighting analysis resulted in one tree, representing one of the 1057 original trees founded. Some optimization issues (ACCTRAN vs DELTRAN) came out in the successive weighting tree – the clades (*Vendoconularia* (*Teresconularia* (*Conularina*, *Eoconularia*))), and (*Archaeoconularia*, *Baccaconularia*, *Conularia*, *Ctenoconularia*, *Glyptoconularia*, *Metaconularia*, *Pseudoconularia* (*Notoconularia* (*Climacococonus* (*Paraconularia*, *Reticulaconularia*)))) were collapsed, generating a polytomy. The data shows Conulariidae as monophyletic, supported by the quadrate geometry of the oral portion of the theca and by the presence of a mineralized (phosphatic) periderm. Two inclusive groups came out. The clade (*Vendoconularia*, *Teresconularia*, *Conularina*, *Eoconularia*) is supported by the sinusoidal longitudinal geometry of the external ornamentation, and the clade (*Archaeoconularia*, *Baccaconularia*, *Conularia*, *Ctenoconularia*, *Glyptoconularia*, *Metaconularia*, *Pseudoconularia* (*Notoconularia* (*Climacococonus* (*Paraconularia*, *Reticulaconularia*)))) is supported by the tuberculate external thecae ornamentation. In contrast, many of other characters appear as homoplastic in a number of distinct groups. Once the distribution of character states through phylogeny is more elucidated by the present analysis, these data could contribute to understanding that some characters which have typically been used in differentiating groups of conulariids are, actually, non informative for these groups. Therefore, homology hypotheses can be re-evaluated. Conulariidae (subfamilies Conulariinae, Paraconulariinae and Ctenoconulariinae) and Conulariellidae, recognized in the TIP, are not monophyletic groups, being supported by symplesiomorphies (continuation of the transverse ornament across the corner sulcus), homoplasies (presence of septa and carinae) and characters susceptible to taphonomic modification (geometry of the transverse cross section). Finally, conulariid genera were classified within the Phylum Cnidaria, Class Scyphozoa, Order Conulariida and Family Conulariidae.

(Financially supported by FAPESP and CNPq)

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