



Arthropod predators in the Early Cambrian pelagic food-chain

J. Vannier (1), S.-X. Hu (2) and A.-L. Chen (3)

(1) UMR 5125 PEPS, CNRS, Université Lyon 1, Campus de la Doua, Bâtiment Géode, 69622 Villeurbanne Cedex, France, (2) Yunnan Institute of Geological Science, 87 Dongfeng Lane, Dongfeng Donglu, Kunming 650051, Yunnan Province, China, (3) Chengjiang Fauna National Geopark of China, Fengxiang Street, Chengjiang, Yunnan Province, China
(jean.vannier@univ-lyon1.fr)

Present-day pelagic ecosystems are inhabited by an extraordinary variety of organisms from picoplankton to large fishes and mammals. All of them interact via a complex food chain and a cascade of trophic levels with autotrophic primary producers (phytoplankton such as dinoflagellates and cyanobacteria) as the first level, heterotrophic consumers such as herbivores (e.g. crustacean copepods) as the second, and carnivores (e.g. chaetognaths) as a third. Zooplankton play a central role in the pelagic food web both in terms of biomass and energy fluxes. The origin and construction of this highly complex pelagic ecosystem, crucial to the functioning of the biosphere, is still an enigma. Was the animal invasion of the water column concomitant with the Cambrian radiation of major animal phyla or, on the contrary, occurred later on in the Phanerozoic ? What was its main trigger ? Recent studies of the Chengjiang biota show that Early Cambrian animals that lived off-bottom were probably nektonic swimmers and drifters such as ctenophores, eldoniids resembling jellyfish, arthropods (bivalved forms, anomalocaridids), vetulicolids, and possibly some streamlined fish-like chordates. Their presumed lifestyle is largely based on their functional morphology and comparisons with Recent forms, but considerable uncertainties remain concerning their exact habitat and dynamics within the water column. Whether true zooplankton- i.e. organisms by definition smaller than 20mm and unable to overcome the dispersive effect of water current- was present or not in the Early Cambrian oceans is still an open issue. However, chaetognaths and small arthropods (bivalved and sup-

posed filter-feeding forms) do appear as potential early zooplankters. New fossil specimens from the ca. 520 million year old Chengjiang fauna indicate that the world-wide distributed bivalved arthropod *Isoxys* was a pelagic arthropod that lived permanently within the water column and used predation as a feeding strategy. Evidence comes from the functional morphology of its head and trunk appendages, visual organs and carapace design. Large spherical stalked eyes adjacent to a pair of prehensile appendages formed a frontal cephalic unit that is likely to have played a key-role in prey recognition and subsequent capture of swimming or drifting pelagic small prey. The uniform series of trunk limbs and the unique pair of grasping head appendages suggest that *Isoxys* belonged to the stem-line Chelicerata as numerous Early Cambrian arthropods with a comparable bauplan. However, contrasting with them, *Isoxys* was a swimmer powered by multiple setose appendages that possibly functioned in the same way as crustacean pleopods. *Isoxys* brings convincing evidence for the colonization of pelagic niches by arthropods in the Early Cambrian. This event most probably took place as a response to the invasion of the water column by zooplanktonic animals (larval stages or adults) and was one of the important events that triggered the build-up of the first pelagic food-chain.