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Chemosynthesis-based communities through time

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The discovery of chemosynthesis-based communities in late 1970s was probably one of the biggest surprises in the marine biology of 20th century. There are three basic types of locations where such communities may develop: hydrothermal vents, cold seeps, and vertebrate falls. Also sunken wood communities are partially chemosynthetically fueled. Reports of these unusual aggregation of benthic animals in the deep sea prompted a quest for their counterparts in the fossil record. Soon it has been revealed that a number of exotic carbonate rocks rich in fossils in otherwise siliciclastic deep water facies could easily be interpreted as a result of ancient cold seeps' activity. Later on also numerous hot vent, whale fall, and sunken wood associations have been described from the geological past. The earliest-known chemosynthesis-based association containing metazoan animals has been described from Silurian of Ural Mountains. This and the other Paleozoic chemosynthesis-based associations are dominated by worm tubes, mollusks (monoplacophorans, bivalves, and gastropods), and brachiopods. Nothing is known from the period encompassing Permian and Triassic and the Mesozoic record of chemosynthesis-based communities starts in Jurassic. The Lower Jurassic hydrothermal vent association from California consists of worm tubes, gastropods, and brachiopods which are not really comparable to their counterparts from Recent chemosynthesis-based communities. First associations composed of fossils recollecting animals from the Recent chemosynthesis-based communities appear in Late Jurassic. Oxfordian cold seep deposits from France are dominated by lucinid bivalves and similar deposits from Tithonian of Alexander Island in the Antarctic are known to contain lucinids and mass aggregations of hokkaidoconchids—extinct group of gastropods related to Recent Provannidae. Early Cretaceous is an epoch of rhynchonellide brachiopod *Peregrinella* which occurs worldwide abundantly at hydrocarbon seep sites where it is associated by lucinid and modiomorphid bivalves, hokkaidoconchids and gastropods which are not clearly related to any of the groups thriving nowadays in chemosynthesis-based communities. Earliest report of alleged neomphalid gastropod also comes from the same epoch. In the Late Cretaceous *Peregrinella* has disappeared while the bivalves started to dominate cold seep environments. Apart from large lucinids and still present modiomorphids also solemyids, thyasirids, and manzanellids became locally abundant. Several taxa of gastropods known also from Recent chemosynthesis-based communities have appeared at that time. It includes true provannids, acmaeid limpets, collonins, and cataegins. Also from the Late Cretaceous earliest-known sunken wood association containing xylophagainin ship worms has been described. Recently it has been shown that chemosynthesis-based communities could also develop on Late Cretaceous plesiosaur falls. Oligocene and Eocene chemosynthesis-based communities are known from numerous cold seep carbonates and wood and whale fall localities in North Pacific Region. Earliest occurrences of vesicomyids are known from Oligocene seep carbonates while earliest mytilids have been reported from from whale and wood falls from Eocene of the US Pacific Coast. Both groups dominate chemosynthesis-based communities from Miocene onward. Starting from Miocene the chemosynthesis-based associations have a modern composition although several groups of mollusks (e.g. majority of neomphalid gastropods and large symbiotic provannids) extremely common in Recent hydrothermal vents are still unknown from the fossil record.