TROPHIC STRUCTURE OF THE LOWER OXFORD CLAY

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Conventional palaeontological methodology over the last one hundred years has revealed a complex and intricate food web in the Jurassic Lower Oxford Clay of central England; we are able to identify the top carnivores (pliosaurs) down to the primary producers (coccolithophoroids) within the water column. In some cases it is even possible to identify individual prey preferences for different taxa.

What conventional palaeontology cannot do satisfactorily is determine the quantities of food processed through the food web, the source of the nutrients, and how much and where recycling of nutrients took place. Consequently we here combine the results of extensive fossil collecting, begun in the 1890s, with data obtained from organic geochemical analysis and isotopic analysis of Oxford Clay sediment and its preserved biota (shells and bones). Examples follow:

Palaeotemperatures derived from vertebrates show that ichthyosaurs, plesiosaurs and crocodiles were calcifying in waters with temperatures in the range (19o - 22o). In addition, the giant filter feeding fish Leedsichthys also yields palaeotemperatures in this range, suggesting that it was a pelagic filter feeder exploiting a rich surface plankton source.

Direct evidence for tetrapod diet in the form of preserved stomach contents indicates that hookleted cephalopods formed an important food source for macrovertebrates (Martill 1986). Isotopic data indicate that belemnites (believed to have been hookleted) were living in the lower water column (T = 15o). We suggest that perhaps belemnites migrated to surface waters for feeding (probably at night) where they were predated upon by marine reptiles.

Duff (1978) suggested that the bivalves Bositra and Meleagrinella lived attached to seaweed rather than living directly on a dysoxic, probably soupy, sea floor. Isotopic data gives palaeotemperatures from these bivalves in the range 16-18 C, comparable with the range 15-18 C derived from the definitely benthic bivalve Gryphaea. Clearly if Meleagrinella and Bositra lived attached to seaweed then the bottom of the Oxford Clay Sea lay within the photic zone. Organic geochemical analysis indicates high nutrient input, and this is reflected in an extremely high abundance, and diversity peak, for Boreal Jurassic nannofossils.