Climate Change and Microorganism Size

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Ocean drilling can reveal information about life and environmental conditions in the sea millions of years ago Core samples collected from DSDP and ODP ocean sites around the world were used to document the distribution of selected foraminifera during the past million years (m y) These foraminifera are single celled organisms that construct shells from calcite that can then be preserved in the fossil record The particular foraminiferal species chosen for analyses in this study lived in sea floor sediments in deep water environments (m water depths)

The largest exterior shell (known as a 'test') from each sample was measured and the diameter recorded and plotted Average values of the maximum test diameter for m y intervals show a general trend of increasing size which has doubled since Early Cretaceous time (c million years ago) The plot also showed fluctuations with six minima and six maxima the latter being to times greater than the former (see Figure a) These size fluctuations correspond to changes in global climate and in deep water dissolved oxygen conditions This latter synchronism indicates that the test size of deep sea foraminifera was likely controlled by fluctuations in the level of dissolved oxygen or related factors in the deep ocean which in turn were caused by global climatic changes (Kaiho)

All of the recognized minima in test size coincide with periods of climatic warming except for two of the periods for which there are inadequate data Two minima coincide with extinction events Maxima in test size coincide with periods of climatic cooling except for a period with sporadic data The maxima also coincide with periods of high dissolved oxygen as recorded among benthic foraminifera Initiation of increase in test size during several periods coincided with diversification of genera and/or species of calcareous trochospiral benthic foraminifera

Evidence was also presented for variations in test size over time of eight dominant lineages composed of ten genera of these types of foraminifera over the past m y (Kaiho) Variations in test size show the same trend and fluctuations described above Major global climatic changes have apparently controlled not only extinctions and diversifications but also test size of deep sea protists

References:
Kaiho K Global climatic forcing of deep sea benthic foraminiferal test size during the past m y *Geology*

Kaiho K Evolution in the test size of deep sea benthic foraminifera during the past m y Mar *Micropaleontol*

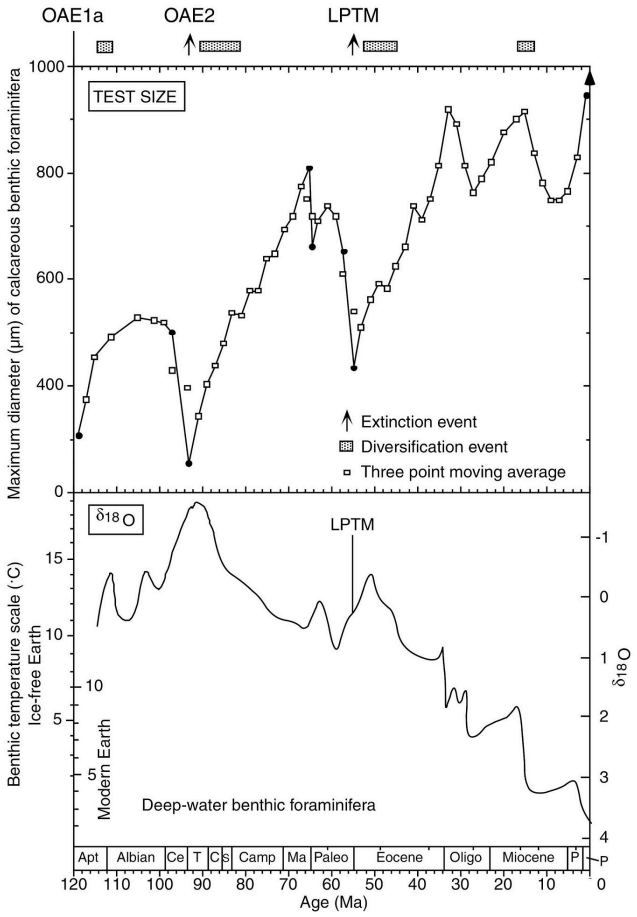

Figure A (Top) Maximum diameter of selected foraminiferal tests during the past million years

Figure B (Below) Temperature recorded by benthic foraminiferal oxygen isotope data during the past m y