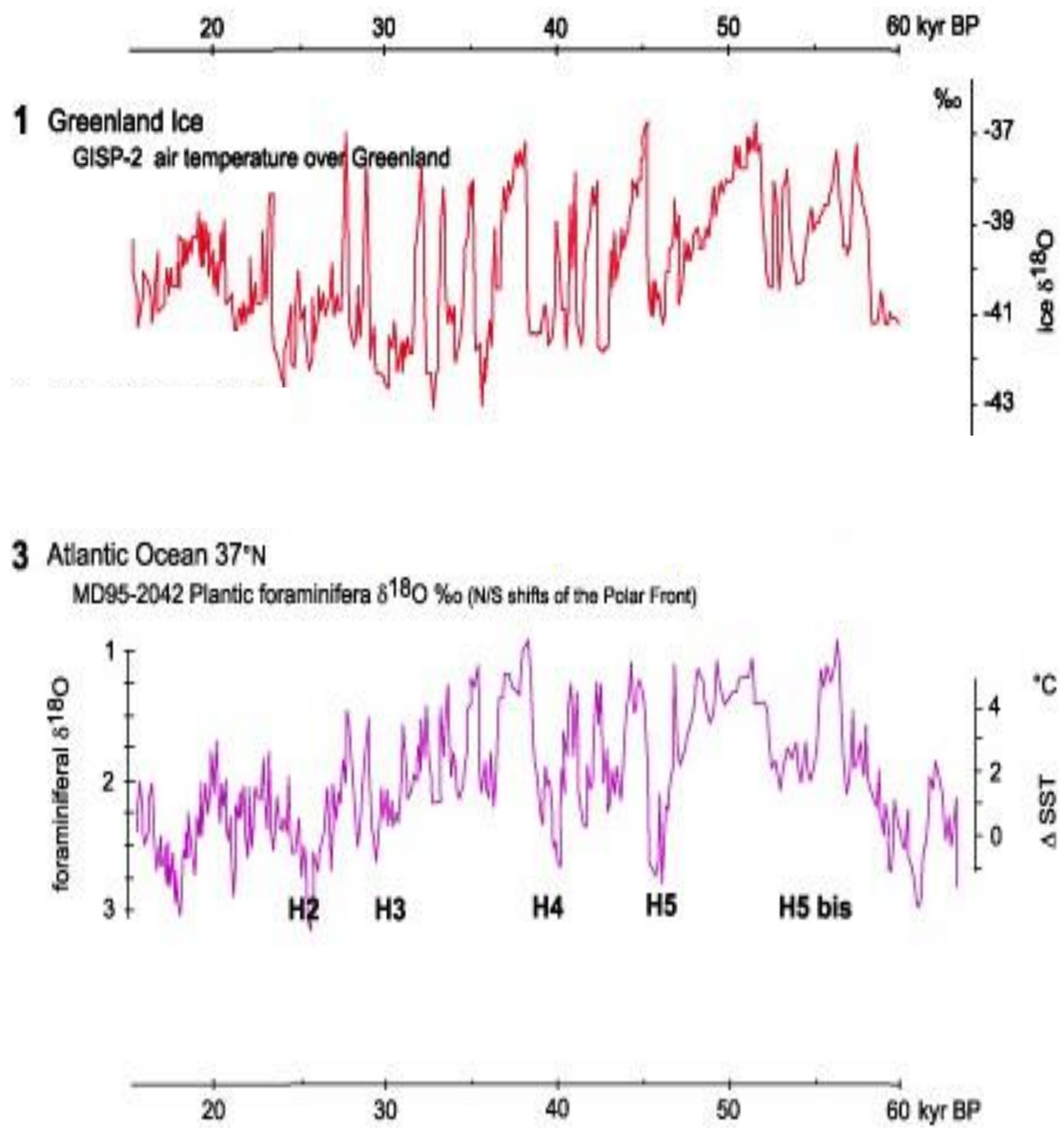
Isotopic composition of ancient oceans

Conclusions

The process which caused the change of isotopic composition from ancient oceans of an estimated value of 7 ‰ to 0 ‰ are not fully understood. They are most likely a result from a mixture of all three processes described below. Isotope measurements of marine sediments do not allow us to say exactly how the earth worked in the past.

Introduction

The isotopic composition of ancient oceans and how much they change over time is a question of great importance. The oceans contain huge amounts of oxygen and hydrogen. Such a reservoir can only be changed in its isotopic composition by a major geologic event; its measurement allows to gain information about earth history and temperature conditions of the past.



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Results

Marine sediments, consisting of iron formations, phosphorites, and limestones, provid information on how $\delta^{18}O$ values may have changed over time.

It has to be born in mind that reconstruction conditions in ancient oceans, using oxygen isotope ratios of marine sediments, are plagued with uncertainty because the examined sediments may not have retained their original isotopic ratios through time. Taking this into acount, all samples of marine sediments came up with the same result: $\delta^{18}O$ values of these sediments decrease with increasing age.

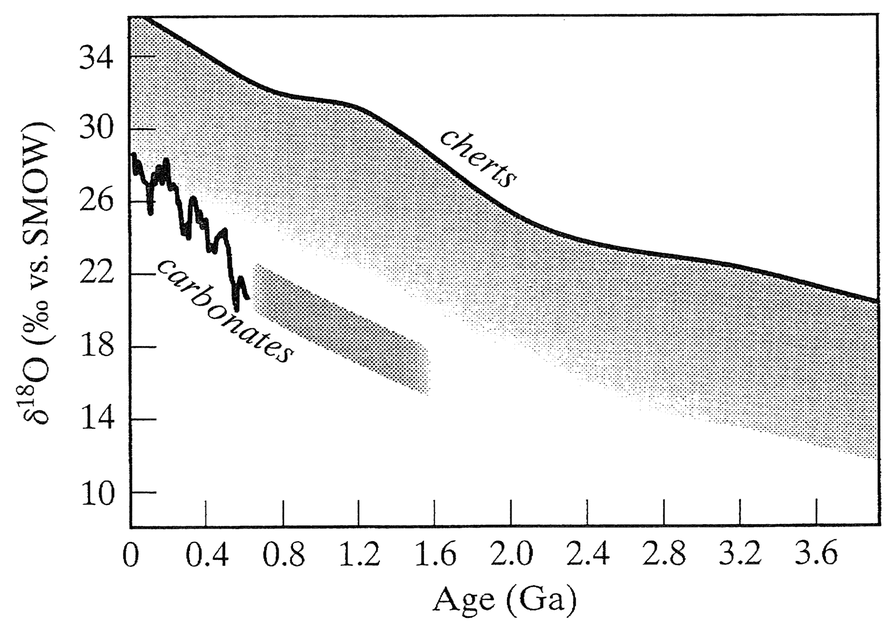

FIGURE 5.6: Schematic variation in the $\delta^{18}O$ values of cherts and carbonates.

Discussion

The results can be explained in three different ways:

1. $\delta^{18}O$ values of the ancient oceans were more negative; which is only possible if unidirectional plate tectonic processes occured.
2. Temperatures of ancient oceans were higher. Marine organisms would have to tolerate temperatures up to 70 °C. This was not accepted by the majority of biologists, but the argument is weakened by the discovery of thermophilic bacteria.
3. Sediments become lighter with time through diagenetic reactions. This is widely accepted, but there are some exeptions mentioned in literature.

References:

Z.Sharp: Principles of stable isotope geochemistry (2007), *Pearson prentice hall.*

K. Muehlenbachs: The isotopic composition of the oceans, sediments and the seafloor (1997). *Chemical Geology.* Vol. 145,p. 263- 273.

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