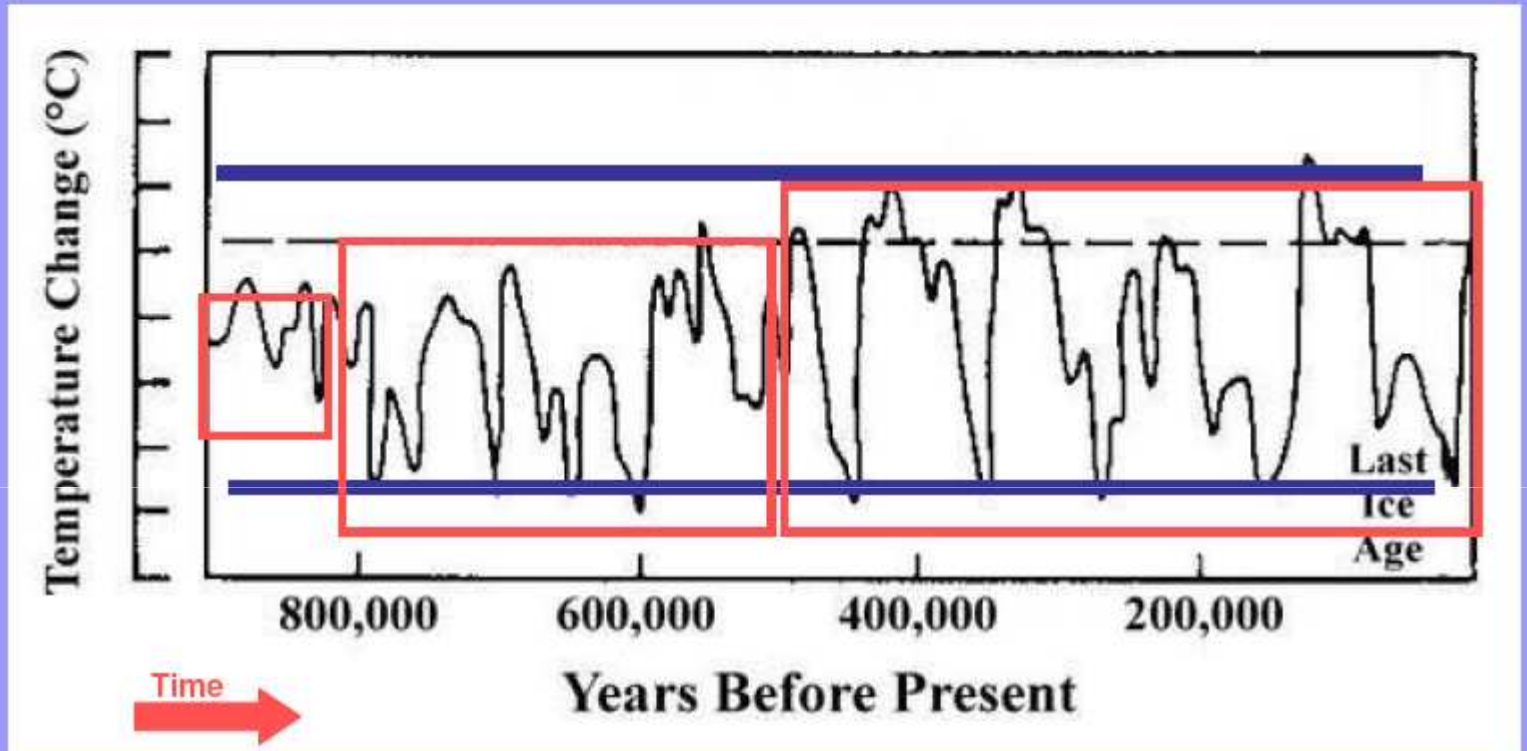
The last million of years



- About 700 ky ago there has been a variation in the duration of the ice sheet cycles: the period has changed from 40,000 to 100,000 years

Glaciers periods

- Last 700 Ka were marked by wide swings indicating a large shift in the land ice amount
- These swings had a characteristic interval of about 100 Ky between successive periods of maximum glaciation
- Glaciers advanced and retreated in both emispheres simultaneously
- Prior to about 700 Ky ago, the swings were more frequent and less extreme
- The dominant period of the glacial-interglacial swings in the early part of the record was about 41-43 Ky

Harmonic Analysis

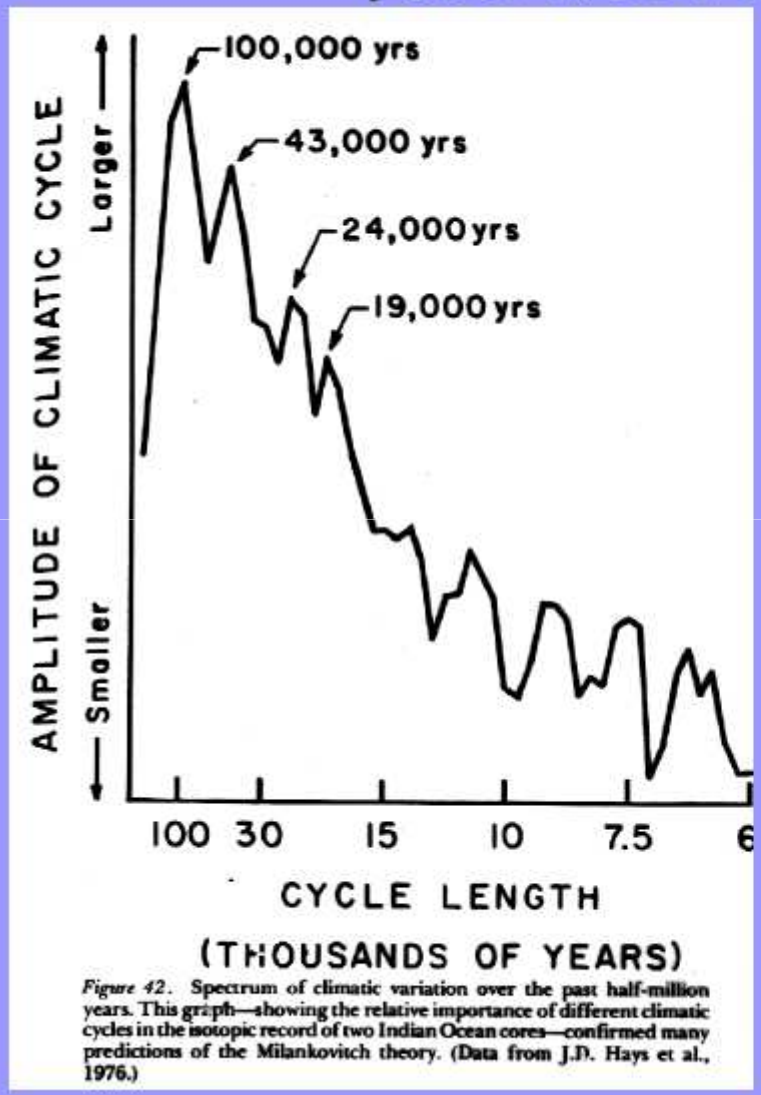


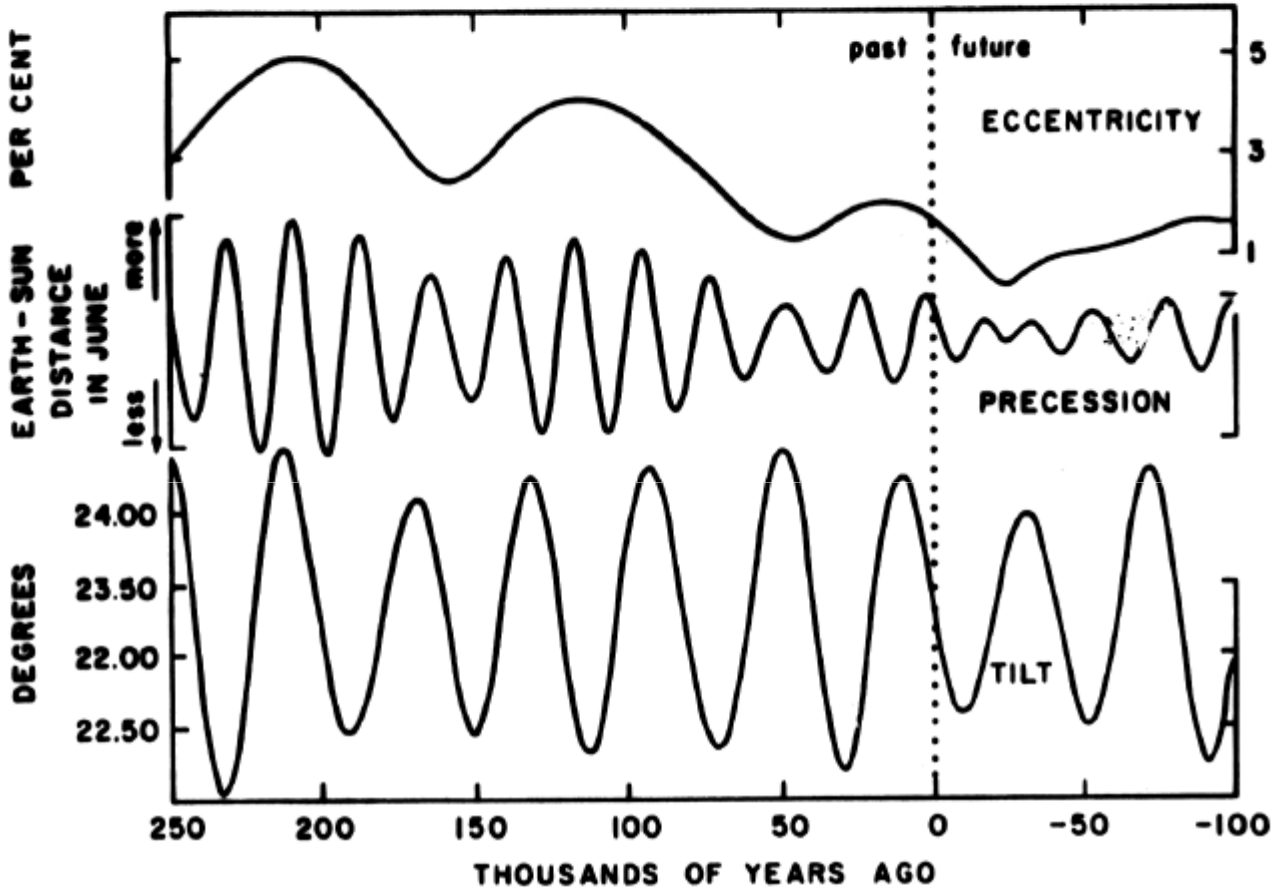
Figure 42. Spectrum of climatic variation over the past half-million years. This graph—showing the relative importance of different climatic cycles in the isotopic record of two Indian Ocean cores—confirmed many predictions of the Milankovitch theory. (Data from J.D. Hays et al., 1976.)

- Fourier spectra of isotopic record of ice volume (500 Ky)
- Most of the "power" is in variations with periods of 100 Ky, 43 Ky, and 24 Ky
- These periods correspond to periodicity of orbital changes

Orbital Theory of Ice Ages

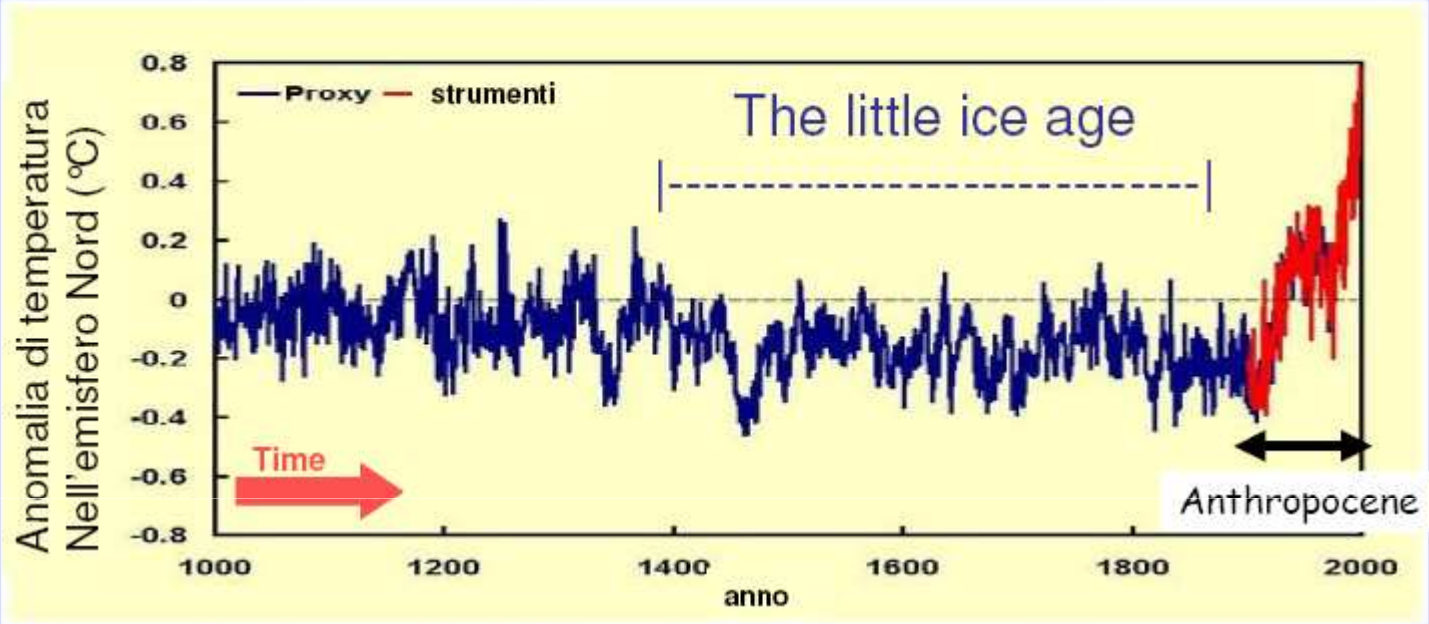
- Regular changes in shape of Earth's orbit and Earth-sun geometry as the "timekeeper" of ice ages
- First suggested in mid 19th Century by Adhemar and (later) LeVerrier and James Croll
- Quantified by Serbian mathematician Milutin Milankovitch in early 20th Century
- Hard to support with paleoclimate evidence of the day, fell out of favor until mid-1960's
- Modern paleoclimatic data in 1970's strongly supported Milankovitch theory

Periodicities in Orbital Parameters



Variations in last 250 Ky and in next 100 Ky of the main parameters

The last millennium



- Cooling of about 1.5°C with respect to the medieval age, greater in the Northern emisphere and during wintertime
  - Glacier progress
  - problems of agricultural productivity
  - migrations (Greenland)
- Hypoteses
  - < solar activity (-0.25%, Maunder minimum), > vulcanic activity