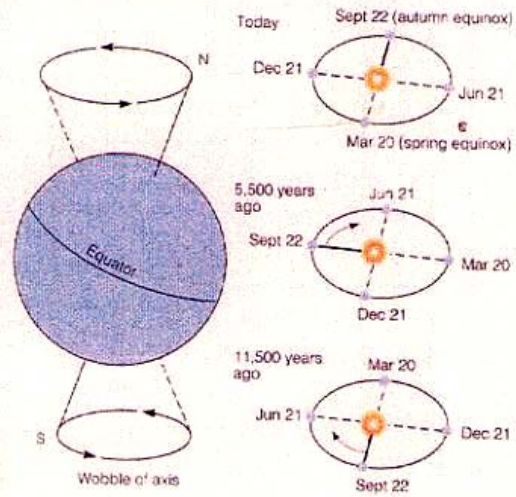
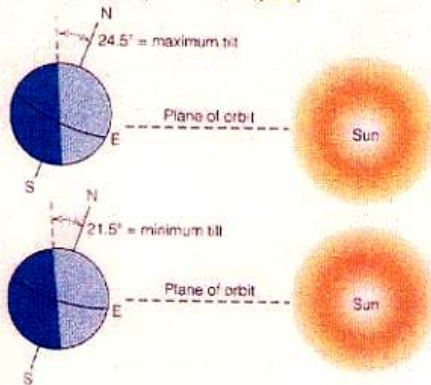


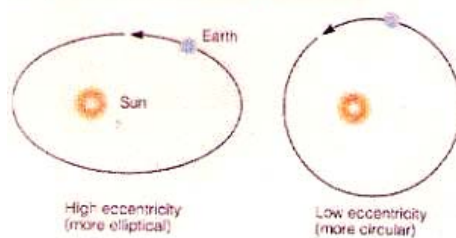
A. Precession of the equinoxes (period = 23,000 years)



B. Tilt of the axis (period = 41,000 years)



C. Eccentricity (dominant period = 100,000 years)



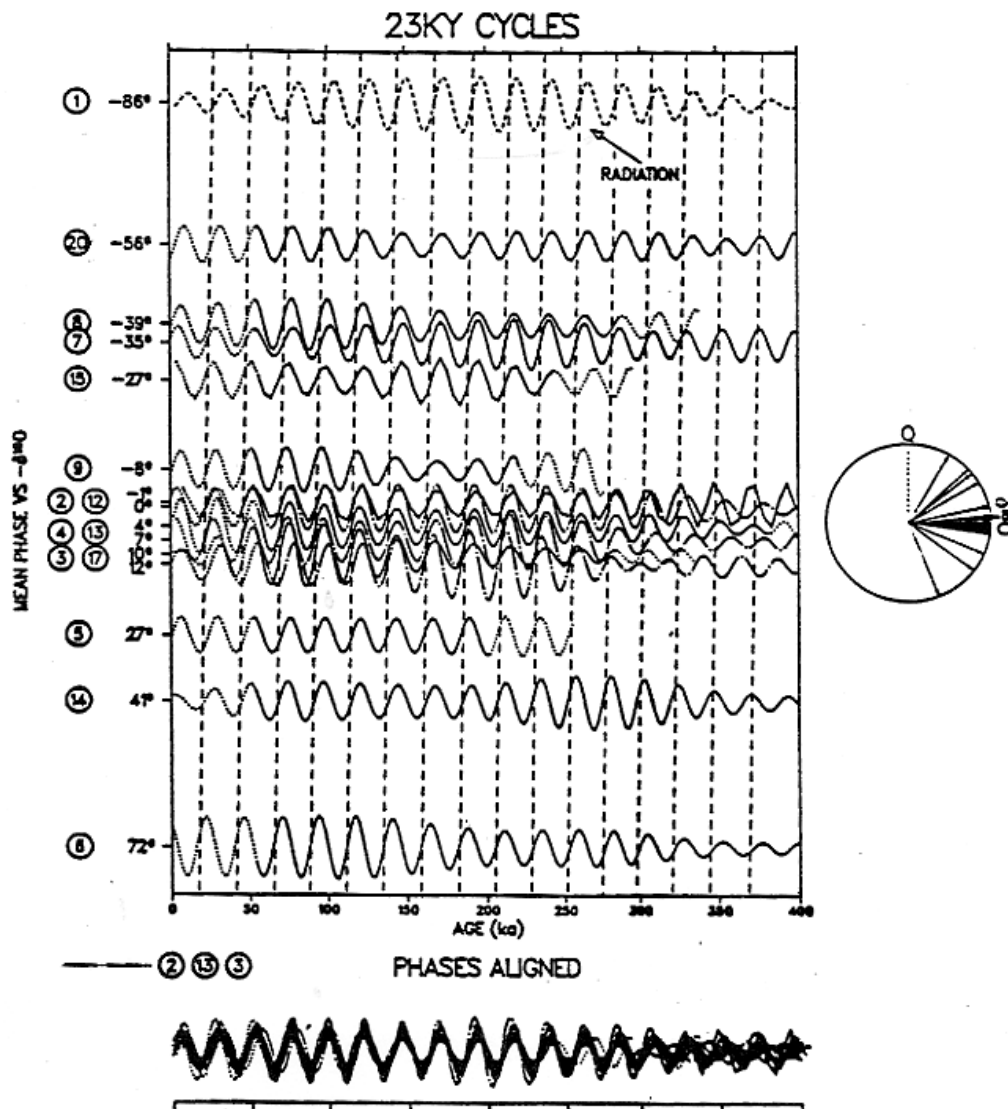


Fig. 9a. The 23-kyr climate cycles. The 23-kyr component of each time series is extracted with the bandpass filter described in Figure 8, normalized, and placed on the y axis according to the mean phase difference ( $^{\circ}$ ) with respect to  $\delta^{18}O$  (variable 2). Lines drawn with a slope of  $360^{\circ}/23$  kyr show that the local climatic responses radiation progress systematically through the system with respect to the local changes in  $\delta^{18}O$  that are used align the records (Figure 5). When phase-aligned and superposed (bottom panel), this progressive wave is seen to be coherent with the forcing (Table 2). Dotted curves mark intervals where 10% or more of the cyclic convolution integral is based on extrapolated data. In the phase wheel (right), climate variables are plotted with respect to the maximum June radiation at  $65^{\circ}N$  (Q).

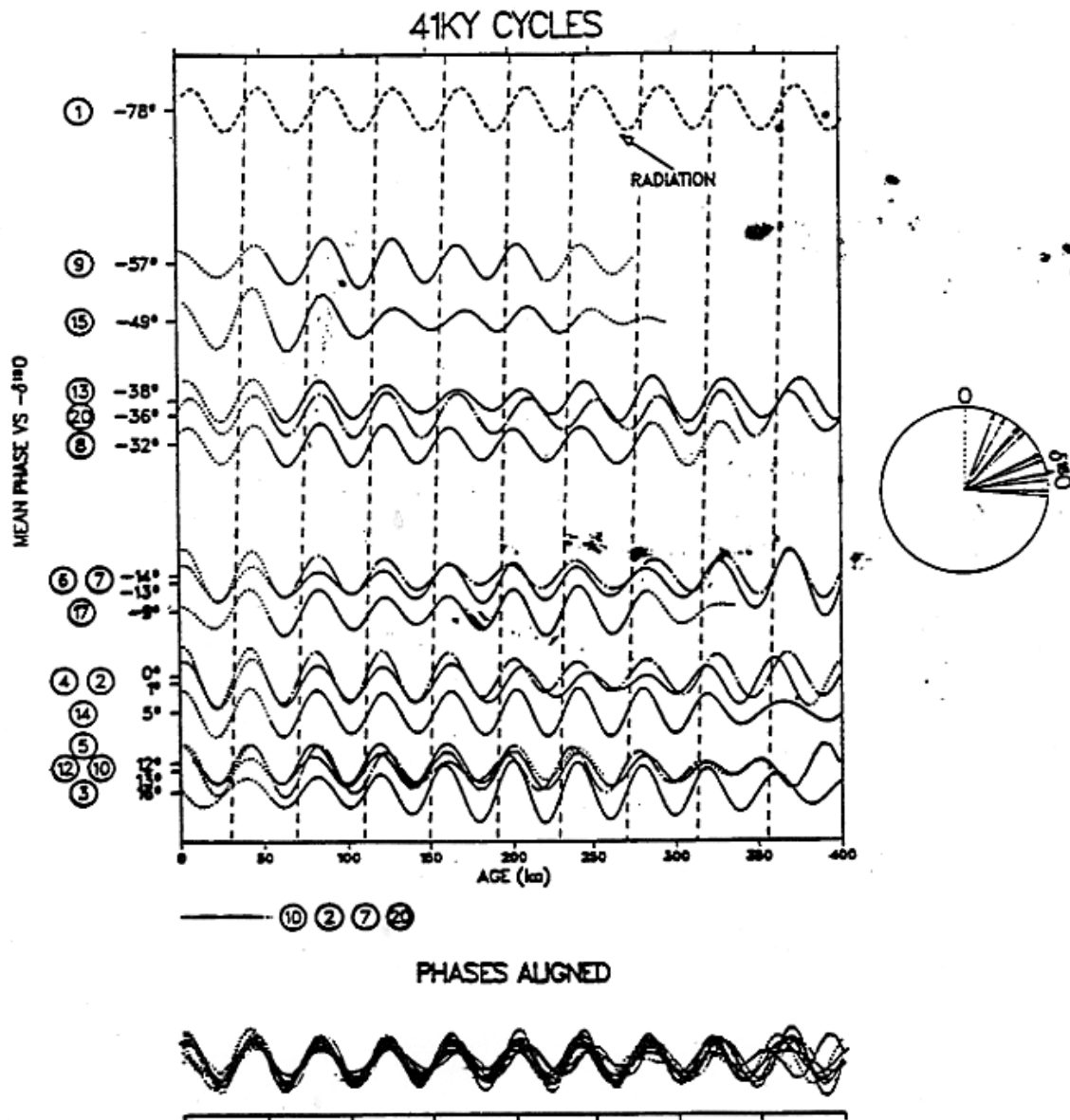
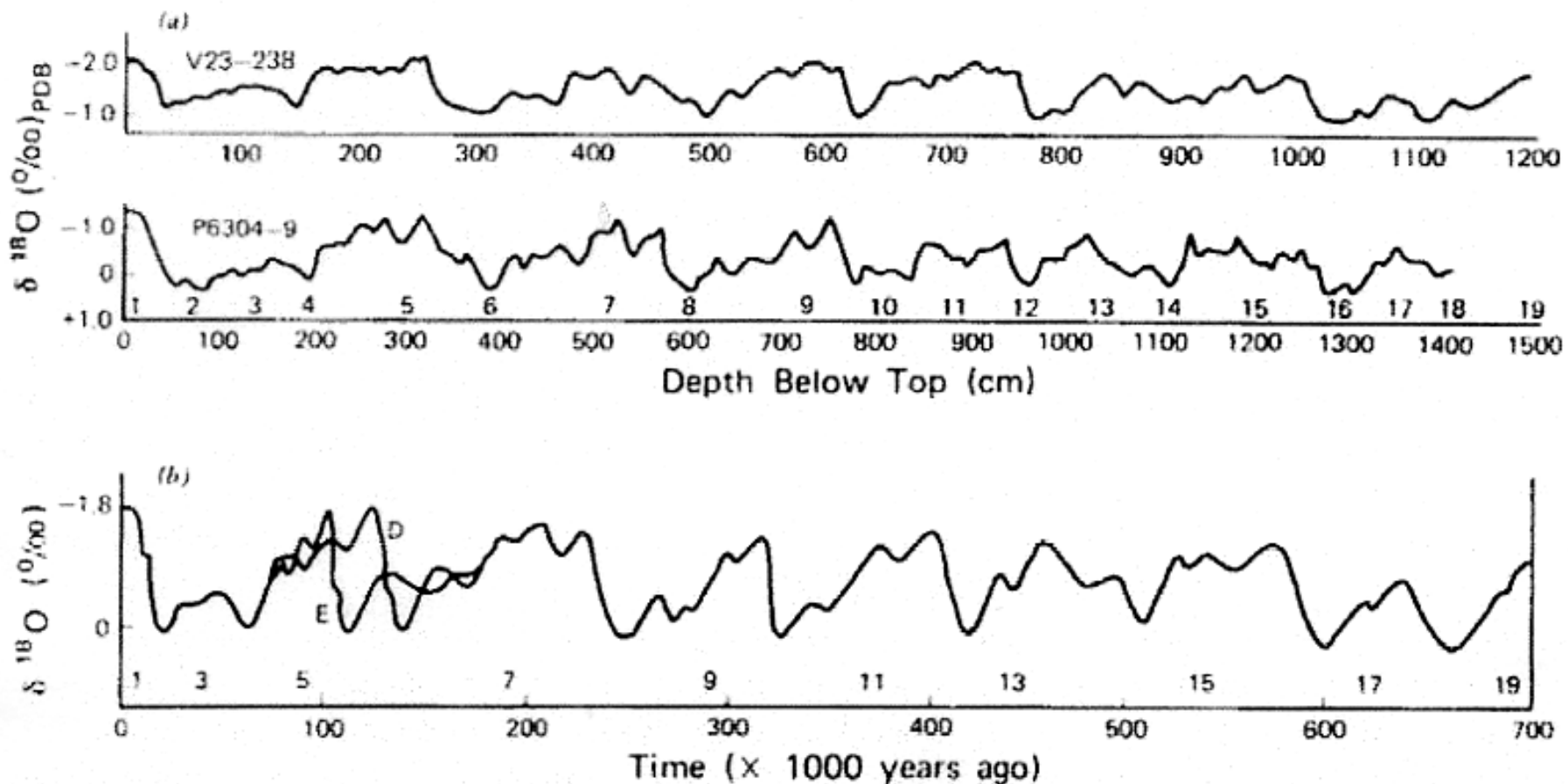
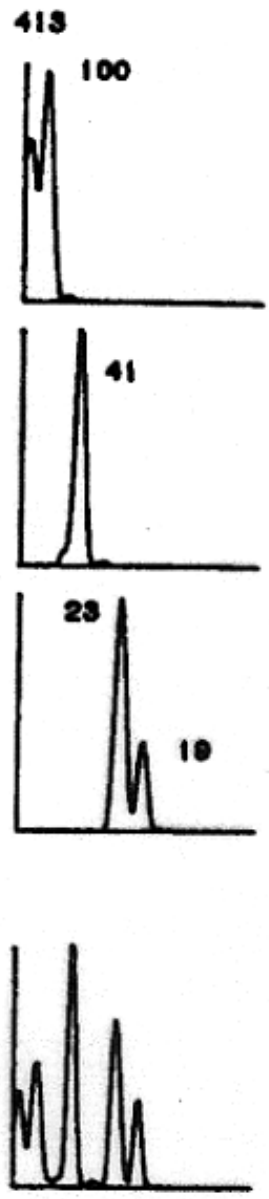
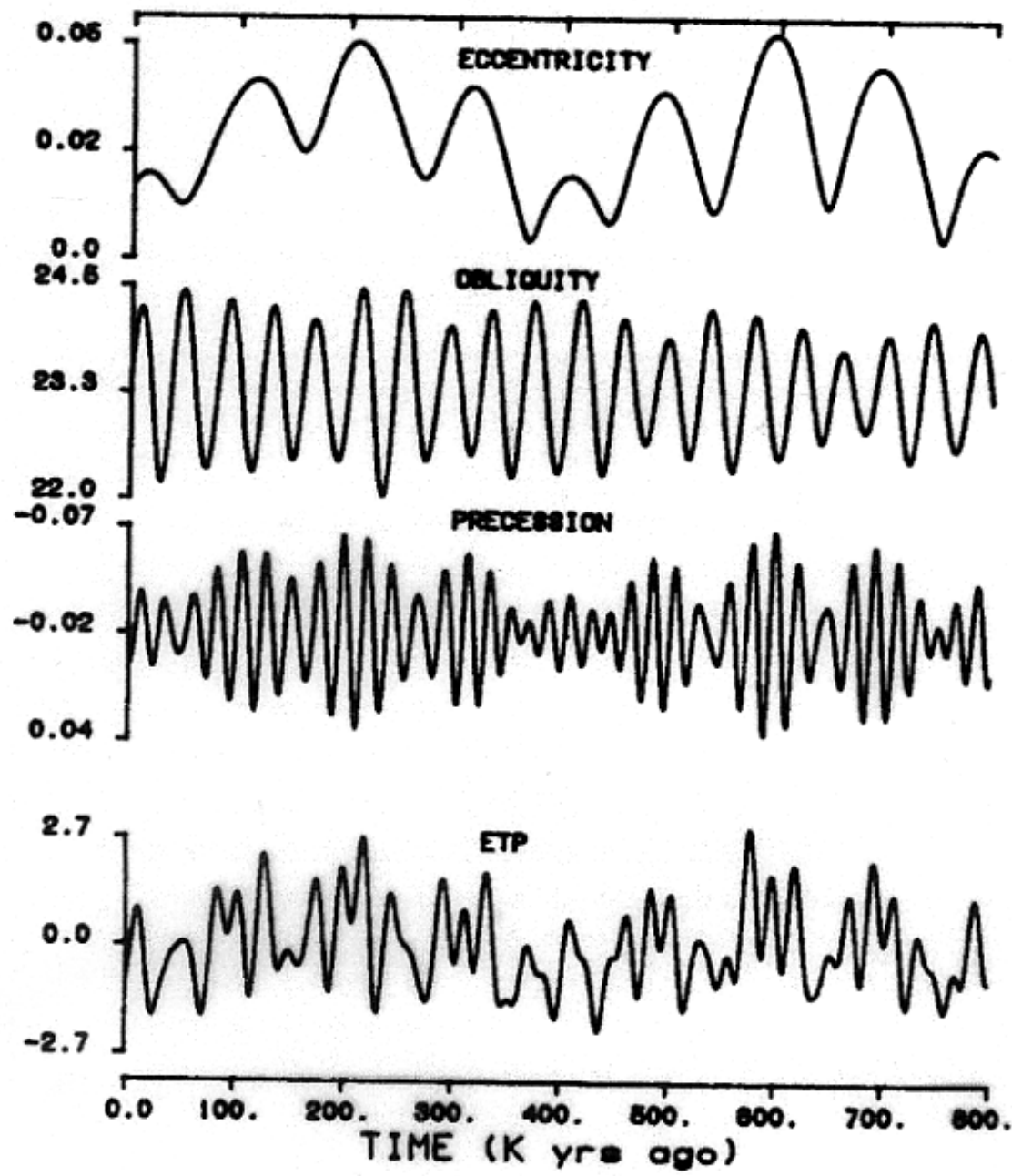
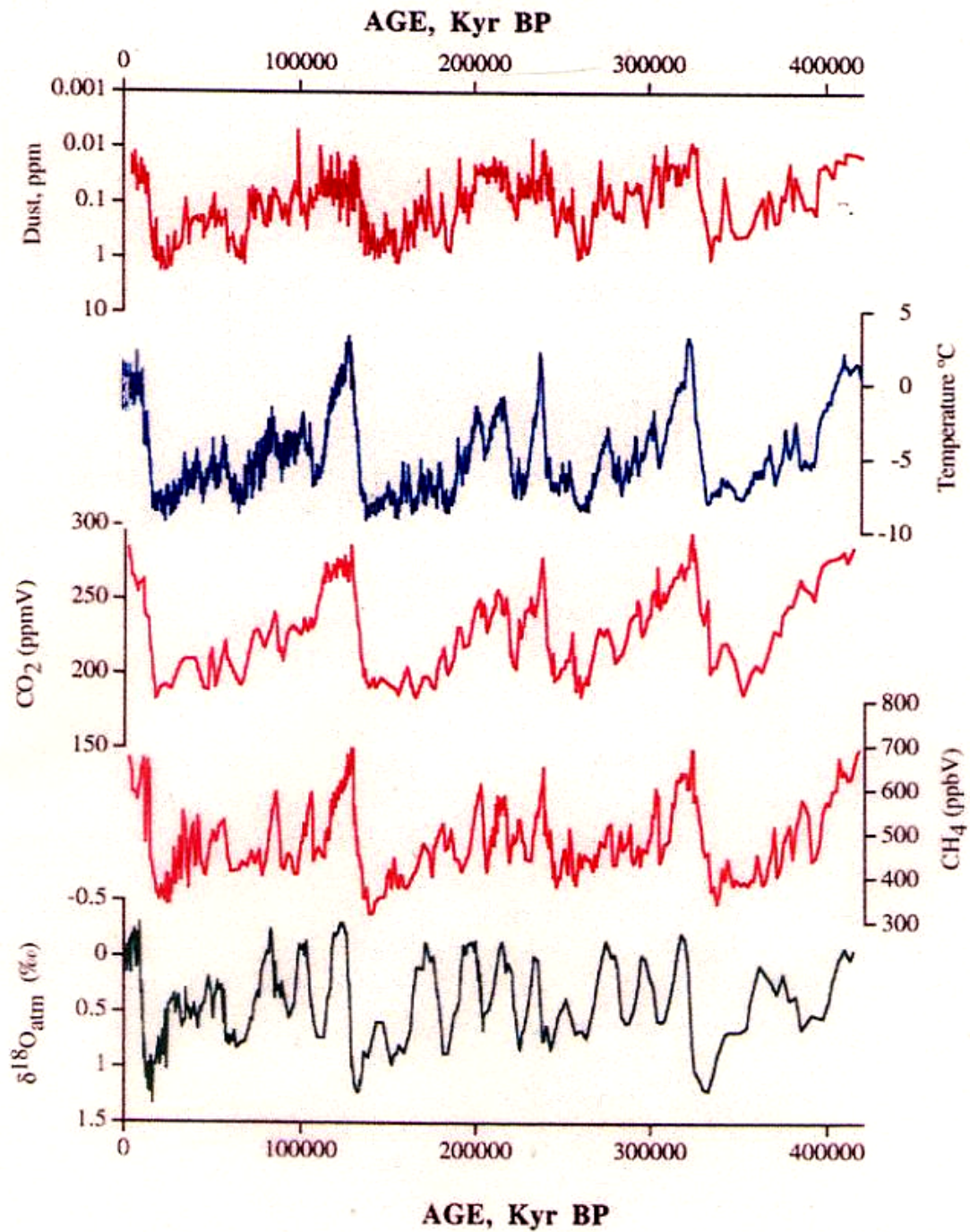


Fig. 9b. The 41-kyr climate cycles. The 41-kyr component of each time series is extracted with the band-pass filter described in Figure 8, normalized, and placed on the y axis according to the mean phase difference (degrees) with respect to  $\delta^{18}\text{O}$  (variable 2). Dashed lines have a slope of  $360^\circ/41$  kyr. Other features as in Figure 9a.



**Figure 24.10** (a)  $\delta^{18}\text{O}$  values (PDB scale) of tests of the foraminifer *Globigerinoides sacculifera* in cores V28-238 (western equatorial Pacific,  $1^{\circ}1'N$ ,  $160^{\circ}29'E$ ) and P6304-9 (Caribbean Sea,  $14^{\circ}57'N$ ,  $69^{\circ}20'W$ ) during the Brunhes epoch. The horizontal scale of core V28-238 has been adjusted to make the peak of stage 5 coincide with that of core P6304-9. The numbers above the abscissa identify deep-sea core stages. The systematic variations of  $\delta^{18}\text{O}$  are attributable to temperature fluctuations of surface water in the oceans during the Pleistocene epoch. (b) Generalized paleotemperature curve and time scales (D and E) of Emiliani and Shackleton (1974). (Reproduced from Figures 1 and 4 of Emiliani, C. and N. J. Shackleton, *Science*, vol. 183, No. 4124, 511-514, 1974. Copyright 1974 by the American Association for the Advancement of Science by permission of A.A.A.S.)





AGE, Kyr BP

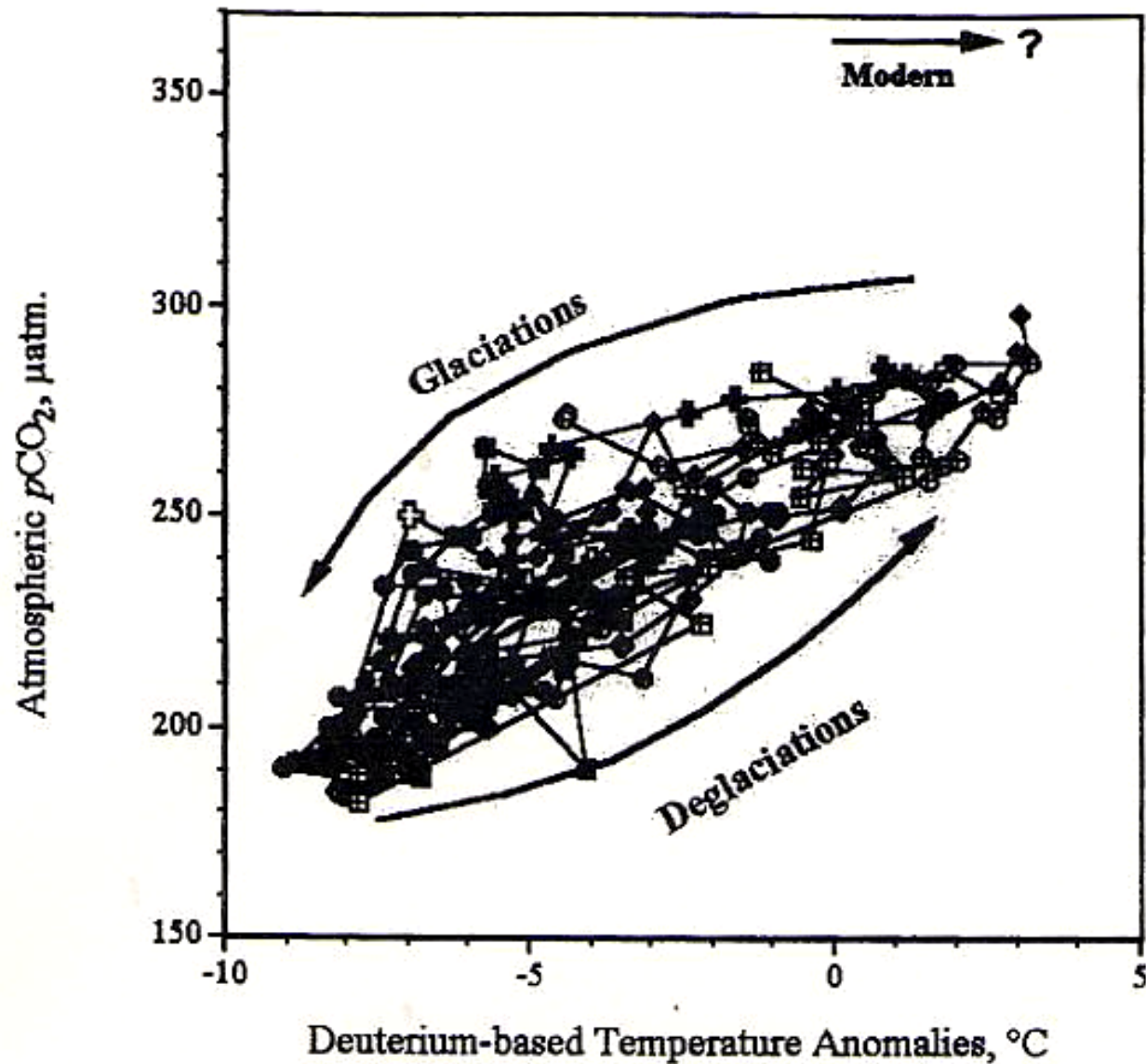


Figure 3. The relationship between atmospheric  $\text{CO}_2$  and the temperature anomaly at Vostok during the past 420,000 years and its relationship to present conditions.