b34 An orbital cycle < *I* >

Logic: "Contrariwise, if it was so it might be; and if it were so, it would be; but as it isn't, it ain't," explains Tweedledee in *Through the Looking Glass*.[1]

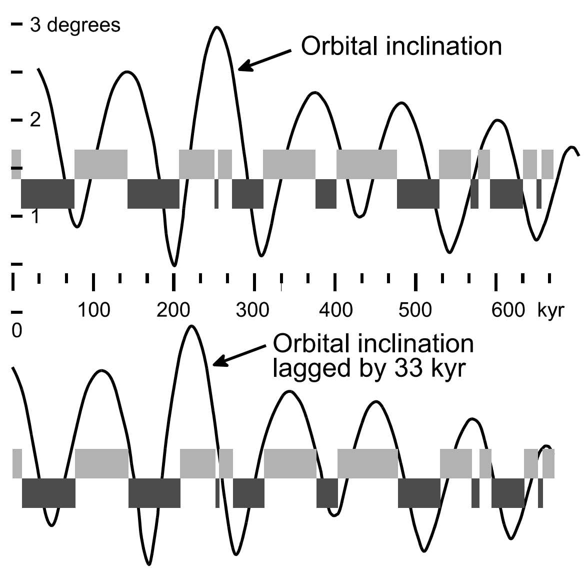
In 1997, **Maureen E. Raymo** wrote: "the excess ice characteristic of late Quaternary '100-kyr' [100,000 year] climate cycles typically accumulates when July insolation at 65°N has been unusually low for more than a full precessional cycle, or >21 kyr, and once established does not last beyond the next increase in summer insolation. Thus, the timing of the growth and decay of large 100-kyr ice sheets, as depicted in the deepsea δ^{18}O record, is strongly (and semi-predictably) influenced by eccentricity through its modulation of the orbital precession component of northern hemisphere summer insolation."[2] But a causality problem exists with the Milankovitch eccentricity explanation of the 100,000 year climatic cycle during the last 1 million years. The sudden terminations of the glacial cycles have been found to *precede* increases in insolation in the last 1 million years when the most extensive glaciations have occurred. Logic decrees that the 100,000 year cyclic insolation variation is irrelevant to their explanation. During earlier times, 1-3 million years ago, the dominant cycles of the ice ages centered on periods of 41,000 and 23,000 years,[3] as Milankovitch predicted.

Richard A. Muller proposed that a 100,000 year *orbital* inclination cycle, *I*, could be the true factor as this *leads* the climatic variation by 33,000 years (***Figure b34.1***).[4] However arguments that rely too strongly on the frequency analysis could be misleading as Raymo finds that ice ages do not end with a 100,000 years metronome beat. Instead, endings are 85,000 years apart or 125,000 years apart. Even so, a cyclic variation in accretion of meteoroids or dust by Earth can be expected.[5] Walter Alvarez has anticipated that this reality can be tested for by measuring ^{3}He (Helium-3) in glacial ice.[6]

Upon looking for actual cosmic dust in marine sediments, Franco Marcontonio and Kenneth (Ken) A. Farley in 1995, reported insignificant change of its arrival flux during past climatic cycles.[7] However, in 1997, Farley reported that the ^{3}He in marine sediments *does* fluctuate up and down by a factor of 3 to 5 over a 100,000-year-long cycle. Also, the amount of ^{3}He has been at today's accumulation levels (40,000 tons annually) for 1 million years and had climbed steeply to this high level beginning 2 million years ago. Farley suggests that upper-atmosphere dustiness has overwhelmed other insolation factors and accounts for the 10 glacials in the last 1 million years having been significantly larger and longer than the lesser ones before.[8] ❑

Figure b34.1 [9] Comparison of delta oxygen-18 climate data (gray-warm, black-cold) and orbital inclination, ***I***.

Actual



and showing a good fit when lagged by 33 kyr.