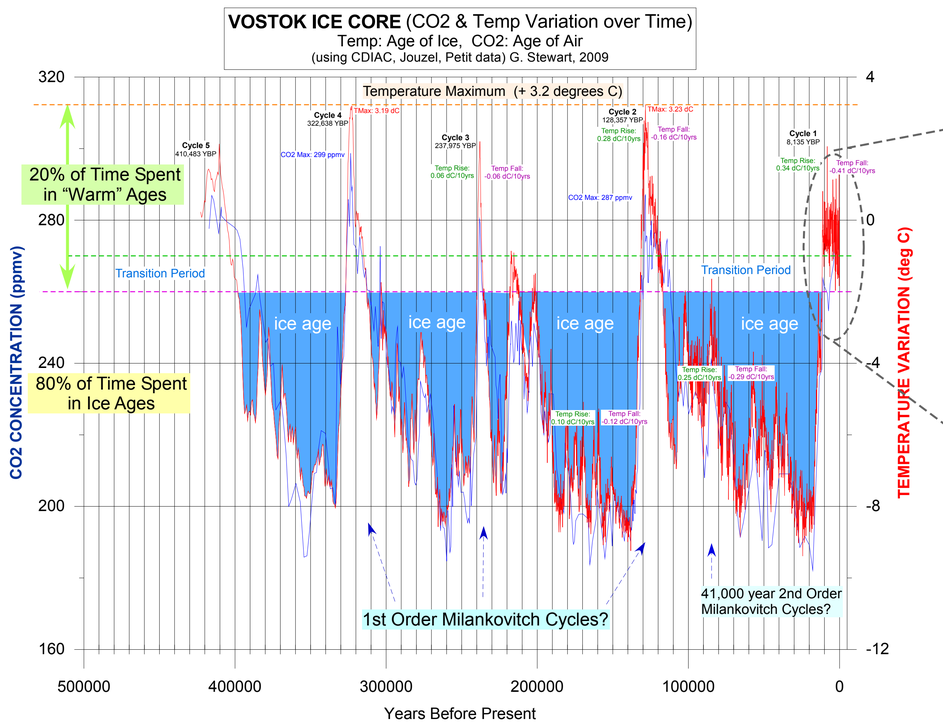
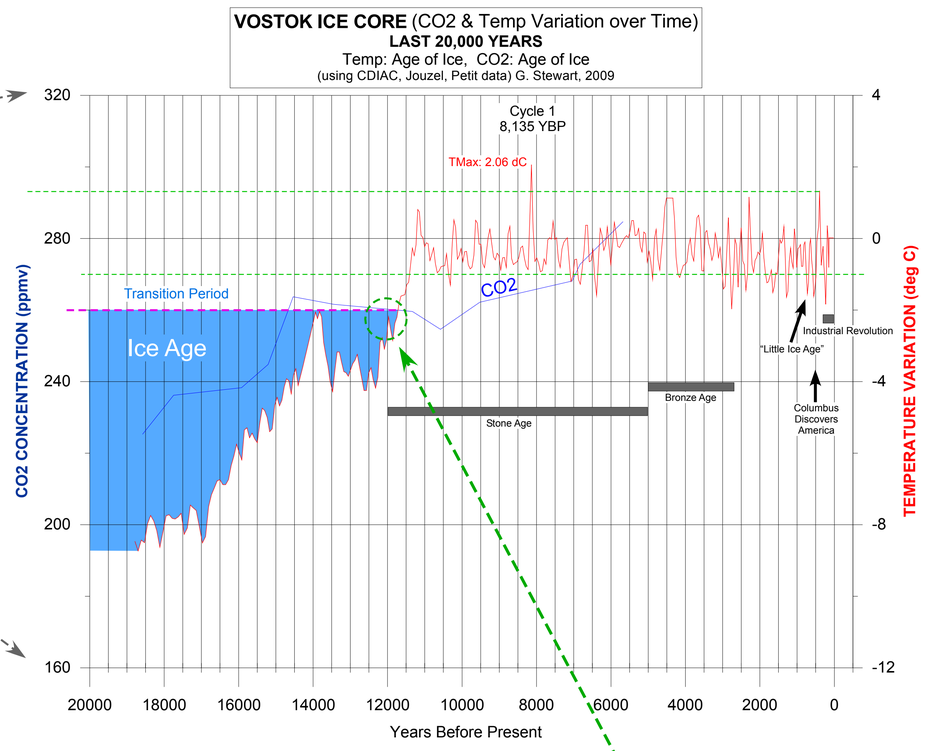
VOSTOK ICE CORE OBSERVATIONS

1. Last 400,000 Years



SEE ENLARGEMENT

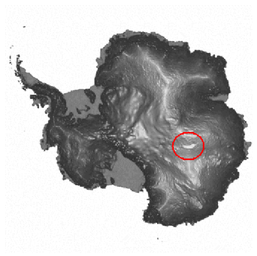
2. Last 20,000 Years



OBSERVATIONS:

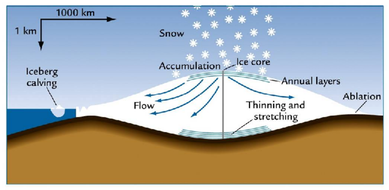
1. Temperature either rises or falls. Those are your only two choices. It never remains flat;
2. Temperature maximum for prior cycles were approximately 2 to 3 degrees Celsius higher than today;
3. Temperature curve is asymmetric, with rapid temperature rise out of the ice ages;
4. At the onset of temperature fall, temperature declines at the same rate as the related temperature rise;
5. The rate of temperature rise (calculated from these data) often exceeds the measured rate of rise from years 1980 to 2000;
6. Assuming the five temperature maximums are related to the 1st Order 100,000 year Milankovitch cycles, CO2 had little effect in maintaining the high temperatures. As seen in Cycle 4, even though CO2 levels were at maximum 299 ppmv CO2, temperature did not continue to increase, but actually made a abrupt reversal. Therefore it appears that the mechanical temperature rise & fall associated with 1st order Milankovitch cycles appear to overwhelm any warming effect associated with CO2, for CO2 levels below 299 ppmv;
7. A 3 degree C rise in temperature either did not release significant methane from gas hydrates, or if released, this methane appears to have had little effect on maintaining temperature maximum.
8. Temperature sampling frequency begins at less than 20 year intervals but exceeds over 600 year intervals at the bottom of the core.

LOCATION MAP

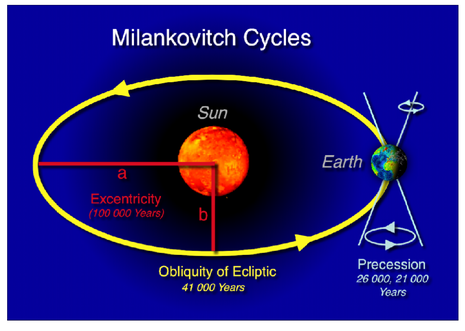


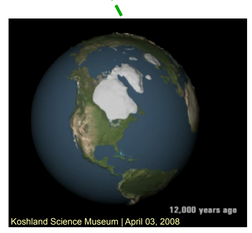
Antarctica with Lake Vostok Circled

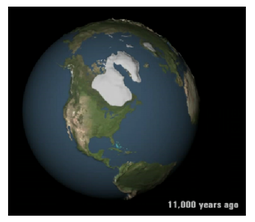
http://www.globalchange.umich.edu/globalchange1/current/labs/Lab9_ClimatePolicy/Vostok.htm



Schematic Diagram Showing Ice Movement

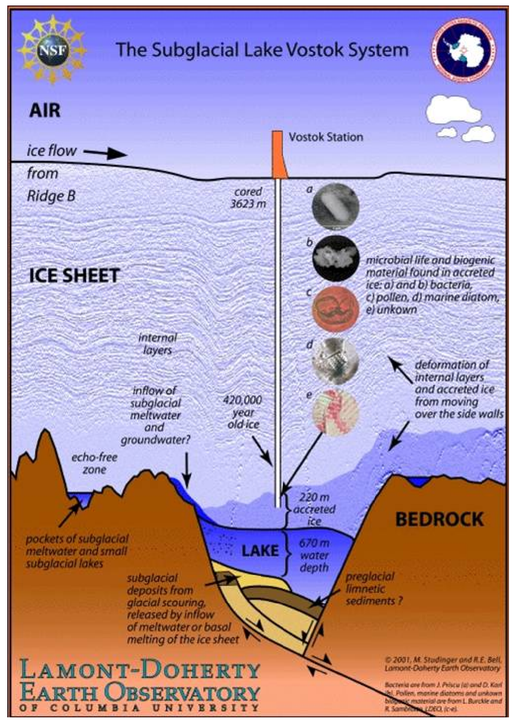






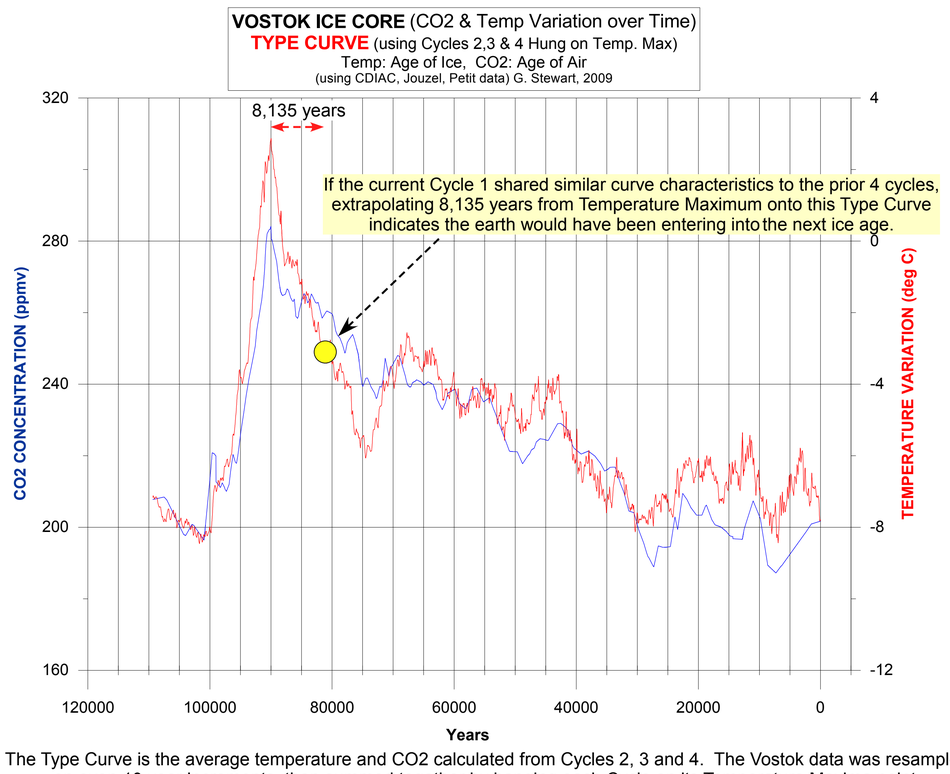
At 12,000 YBP, 2/3rds of Canada was covered with ice.

http://www.youtube.com/user/KoshlandSciMuseum#p/a/u/2/GoVPRJbvg1w



Vostok team photo with unprocessed ice cores.

3. Type Curve



The Type Curve is the average temperature and CO2 calculated from Cycles 2, 3 and 4. The Vostok data was resampled on even 10 year increments, then summed together by hanging each Cycle on its Temperature Maxima point.

Please cite the following work when using these data::

Jouzel, J., C. Lorius, J.R. Petit, C. Genthon, N.I. Barkov, V.M. Kotlyakov, and V.M. Petrov. 1987. Vostok ice core: a continuous isotope temperature record over the last climatic cycle (160,000 years). Nature 329:403-8.

Jouzel, J., N.I. Barkov, J.M. Barnola, M. Bender, J. Chappellaz, C. Genthon, V.M. Kotlyakov, V. Lipenkov, C. Lorius, J.R. Petit, D. Raynaud, G. Raisbeck, C. Ritz, T. Sowers, M. Stievenard, F. Yiou, and P. Yiou. 1993. Extending the Vostok ice-core record of palaeoclimate to the penultimate glacial period. Nature 364:407-12.

Jouzel, J., C. Waelbroeck, B. Malaize, M. Bender, J.R. Petit, M. Stievenard, N.I. Barkov, J.M. Barnola, T. King, V.M. Kotlyakov, V. Lipenkov, C. Lorius, D. Raynaud, C. Ritz, and T. Sowers. 1996. Climatic interpretation of the recently extended Vostok ice records. Climate Dynamics 12:513-521.

Petit, J.R., J. Jouzel, D. Raynaud, N.I. Barkov, J.-M. Barnola, I. Basile, M. Bender, J. Chappellaz, M. Davis, G. Delayque, M. Delmotte, V.M. Kotlyakov, M. Legrand, V.Y. Lipenkov, C. Lorius, L. Pepin, C. Ritz, E. Saltzman, and M. Stievenard. 1999. Climate and atmospheric history of the past 420,000 years from the Vostok ice core, Antarctica. Nature 399: 429-436.

Stewart, G.C., 2009 Denver Climate Group, Unpublished

ftp://cdiac.ornl.gov/pub/trends/co2/vostok.icecore.co2

DATING CORES

Shallow cores, or the upper parts of cores in high-accumulation areas, can be dated exactly by counting individual layers, each representing a year. Deeper into the core the layers thin out due to ice flow and eventually individual years cannot be distinguished. It may be possible to identify events - atom bomb test radioisotope layers in the upper levels; ash layers corresponding to known volcanic eruptions. Lower down the ages are reconstructed by modelling accumulation rate variations and ice flow.

MELANGE INTERNATIONAL, LLC
475 17th St., Suite 540 Denver, CO 80202

VOSTOK ICE CORE OBSERVATIONS (Part 1 of 2)

For
Denver Climate Study Group

Gary Stewart, 2009
gary@eMelange.com