A Public symposium: Is the Earth a Living Organism? Dates: August 1-6, 1985. University of Massachusetts at Amherst, Amherst, Massachusetts. Principal Sponsor: The National Audubon Society Expedition Institute.

"The Gaia Hypothesis, Glaciation and Climate Cycles: How can Humankind Develop a Shared Coevolutionary Relationship with the Biosphere?"

Abstract of Paper presented by Fred Bernard Wood on August 1,1985.

Why are computer simulation studies of the impact of rising carbon dioxide in the atmosphere predicting warming of our planet, while meteorological records and the deterioration of the citrus industry in Florida indicate a cooling? Perhaps climate researchers have neglected the effects of the trees on the land and the microorganisms in the ocean that add important feedback loops to the Biospheric system. Use of the GAIA hypothesis should help the climatologists find the missing elements in their models.

Both scientists and citizens need to develop a geophysical or tectonic-biospherical-atmospheric consciousness to understand the evolution of the biosphere. For two million years we have been in an Ice Age which has subcycles of 70,000 to 120,000 year glacial periods followed by 10,000 to 12,500 year interglacial warm periods. We are near the end of the present interglacial period.

During the last glacial period the Neanderthal Man disappeared after 90,000 years of a 120K year glacial period. The Cro-Magnon Man moved south and survived longer. Modern Man developed closer to the equator and repopulated the rest of the planet at the end of the glacial period.

Steps are being taken to organize the International Geosphere- Biosphere Program (IGBP) to facilitate study of these problems by international teams of scientists. It is estimated that the IGBP will be fully organized by 1990 and substantial research results will be obtained by the year 2000. The U.S Department of Energy is conducting a research program on Carbon Dioxide and Climate, and expects to complete an assessment of the impact of CO/2 by about 1990. The most comprehensive thesis on how the Biosphere functions is the Hamaker Thesis published in 1982, which predicted that 1984 was the last chance for humankind to stop the present shift to glaciation, with severe crop damage by 1990, and few people left alive by 1995.

If the Hamaker Thesis is correct, both the DOE assessment and the IGBP will have tested the thesis too late to do anything about it. During World War II American scientists reorganized to focus on the crises threatening civilization. In the shadow of an impending transition into a glacial period, we need to reorganize our work on climate problems into five separate but cooperating parts to facilitate the development of a coevolutionary relationship with the Biosphere: SCIENCE research in climatology, forestry, soil science, tectonics, et cetera; ENGINEERING and general systems development of conceptual models and computer models of the glacial and climate cycles; PHILOSOPHICAL studies to review the approach of the scientists and engineers for completeness; EDUCATIONAL projects to develop materials to educate the public on climate issues; and POLICY studies to make assessments of the risks involved in alternative policies. An on-line magazine has been set up on a computer bulletin board (408) 269-7045 to make available notes on what is happening in the five different areas.

"The Gaia Hypothesis, Glaciation and Climate Cycles: How can Humankind Develop a Shared Coevolutionary Relationship with the Biosphere?"

Fred Bernard Wood

Why are computer simulation studies of the impact of rising carbo dioxide in the atmosphere predicting warming of our planet (1,2) while meteorological records and the deterioration of the citru industry in Florida indicate a cooling (3)? Perhaps climat researchers have neglected the effects of the trees on the land an the microorganisms in the ocean that add important feedback loops t the Biospheric system. Examination of the processes in the Biospher that contribute to climate change indicate that about twenty-fiv fields of science are involved. It may be that scientists working o climate problems are having difficulty in establishing linkage between the twenty five fields of science.

Use of general systems theory may help the scientists focus on th appropriate fields of science necessary to get a more complete pictur of climate change processes (4,5,6). Miller and Miller have made study of the earth as a system (7), in which they consider the eart as a mixed living and nonliving system. Their analysis brough together many of the pieces from the twenty-five fields of science but still missed some important inter-relationships between phenomen in different fields of science. Some action linkage is require between scientists in the different subfields. Use of the GAI hypothesis (8) in addition to using a general systems philosoph should help the climatologists find the missing elements in thei models and to establish the necessary action linkage (9).

Both scientists and citizens need to develop a geophysical o tectonic-biospherical-atmospheric consciousness to understand th evolution of the biosphere. Much of the current literature on climat change talks about the carbon dioxide levels in the atomoshere for range of 100 years or the current century. We need to be conscious o the history of carbon dioxide on our planet back to 4.5 billion year to put present changes in perspective. The percentage of carbo dioxide in the atmosphere is plotted in Figure 1 from 4.5 billio years before present to now (10).

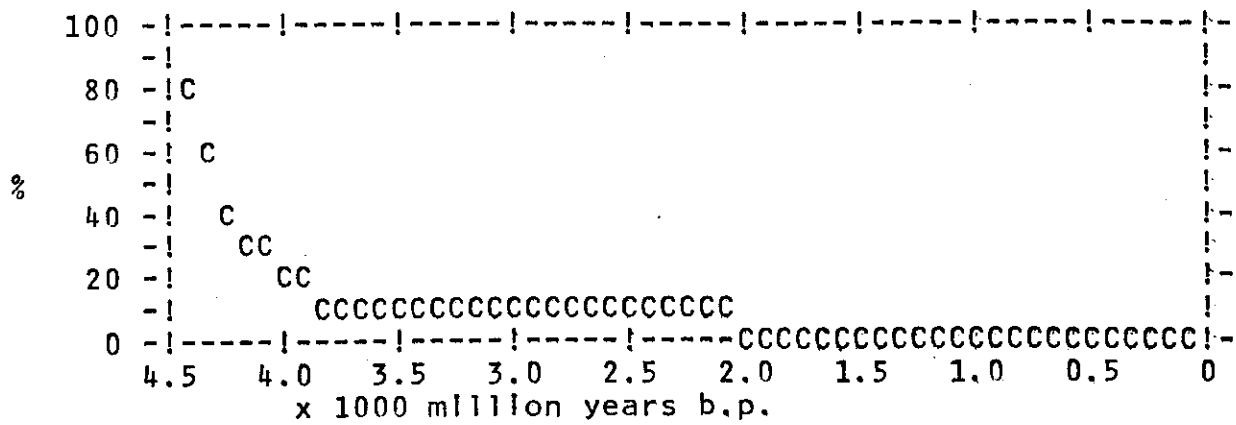


Fig. 1. Per cent atomospheric carbon dioxide.

For two million years we have been in an Ice Age which has subcycles of 70,000; to 120,000 year glacial periods followed by 10,000 to 12,500 year interglacial warm periods. We are near the end of the present interglacial period. Seventeen cycles of glaciation have been identified in the period of two million years before present to now. The last three cycles of glaciation are shown in Figure 2. A first approximation theoretical curve is shown by "A"s (11) and the experimental curve determined by paleoclimatological research in shown by "E"s (12). Tracing the "A"s in Fig. 2, one can see interglacial periods of approximately 10,000 years with the global ice volume at slightly more than 30 million cubic kilometers, starting at 250,000 years b.p., 130,000, and 10,000. In the approximate theory the ice volume rises gradually over the 70,000 to 120,000 glacial periods and drops abruptly at the change to interglacial.

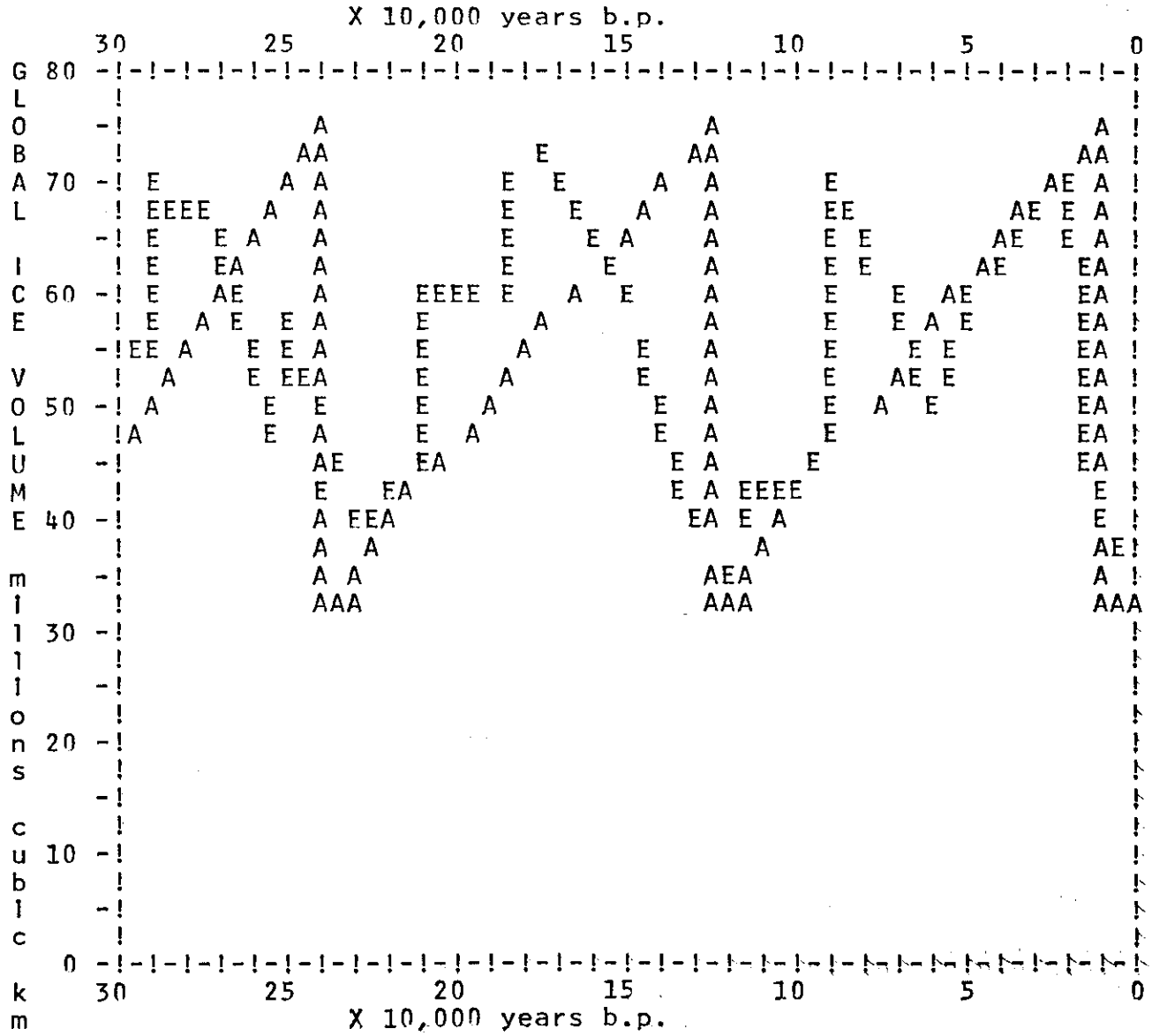


Fig. 2. Approximate Global Ice Volume(A) and Experimentaly Determined Global Ice Volume (E).

During the last glacial period the Neanderthal Man disappeared after 90,000 years of a 120K year glacial period. The Cro-Magnon Man moved south and survived longer. Modern Man developed closer to the equator and repopulated the rest of the planet at the end of the glacial period. Are we moving into the next glacial period? Unless something is changing compared to previous cycles, the projection of the curves of Fig. 2 would indicate we are moving into the next glacial period soon. Scientists do not agree on exactly how or when the next glacial period will start.

There appears to be a functional relationship between the percentage of carbon dioxide in the atmosphere, the glacial ice volume on our planet, and the mid latitude air temperature. These values are plotted in Figures 3, 4, and 5. Details on the processes involved and a bibliography on the carbon dioxide curve of Fig. 3 are available in a report of the Earth Regeneration Society (13). The recent part of the carbon dioxide curve is plotted in Figure 6. This exponential rise of the carbon dioxide is attributed to the exponentially rising burning of fossil fuels and the increasing destructon of the world's forests.

For a comprehensive study of climate histcry and a summary of present problems, see the book by Stephen H. Schneider and Randi Loner (14). N. N. Moiseev of the Academy of Sciences of the U.S.S.R. has proposed that mankind develop a deeper understanding of how the biosphere functions, so that we can work with nature in determining the future evolution of the biosphere -- i.e., coevolution (15). John Hamaker, a mechanical engineer, has developed a comprehensive thesis on how the major components of the glacial cycle function and a plan for action to save civilization (16,17), but no test of Hamaker's thesis has been published by the scientific community.

Hamaker's thesis consists of the following parts:

> Part A: Danger to civilization due to soil demineralization, deforestation, rising carbon dioxide from fossil fuel burning and loss of forests, starting of glaciation for next 90,000 year glacial period, climate changes at beginning of the glacial period, loss of temperate zone crop growing season length, severe crop failures, and widespread starvation.
> Part B: The Money Crisis: Investment money is rising exponentially in a way that money is reinvested to make more money, instead of supporting a sound economy and social order.
> Part C: World population has far outstripped resources.

Figures 7A and 7B show a block diagram for use in explaining the basis for Part A of the Hamaker Thesis. This diagram is an extension of one developed by Charles Francois of Buenos Aires, Argentina. Reports are available from the Earth Regeneration Society containing an expanded version of this diagram with more details (18).

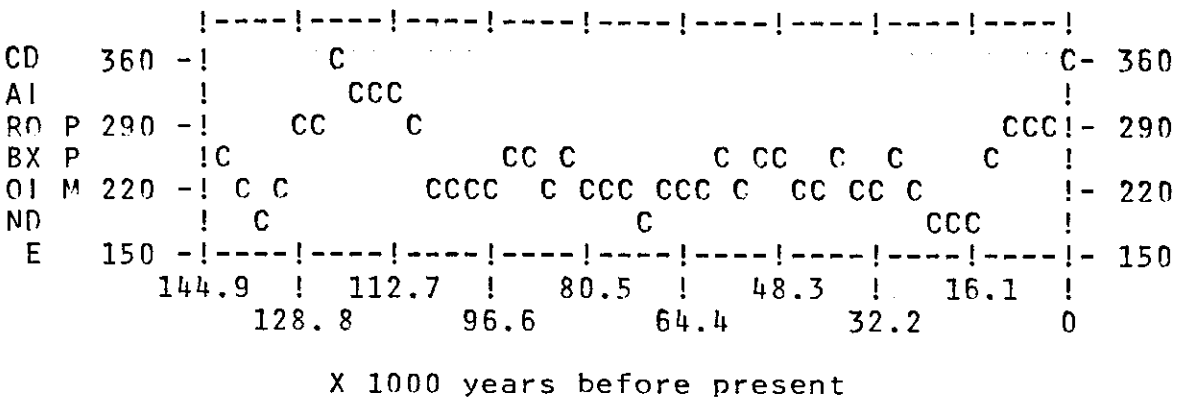


Fig. 3. Atmospheric Carbon Dioxide (parts per million).

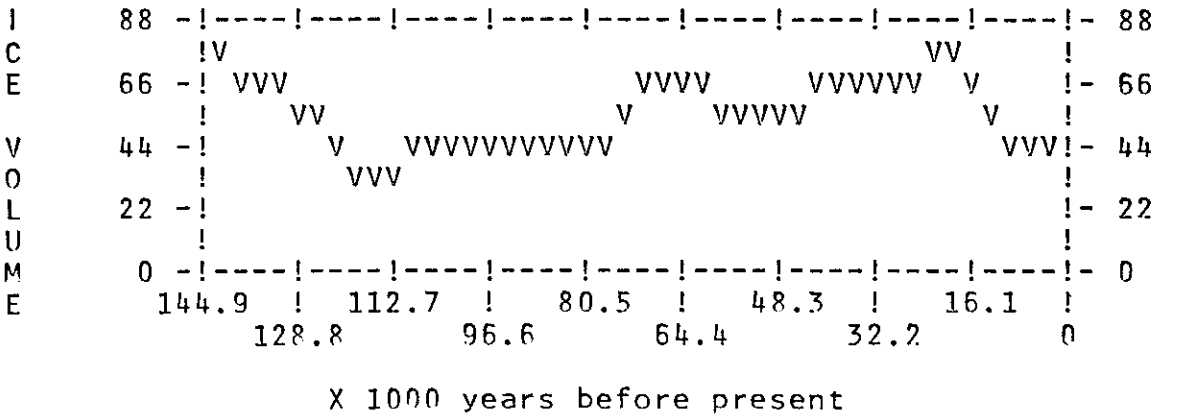


Fig. 4. Global Ice Volume (millions of cubic kilometers).

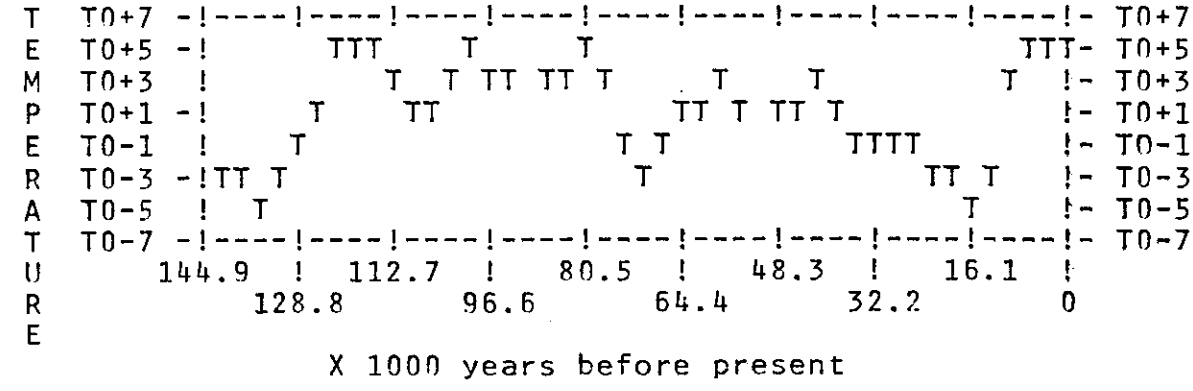


Fig. 5. Mid Latitude Air Temperature (relative degrees centigrade)

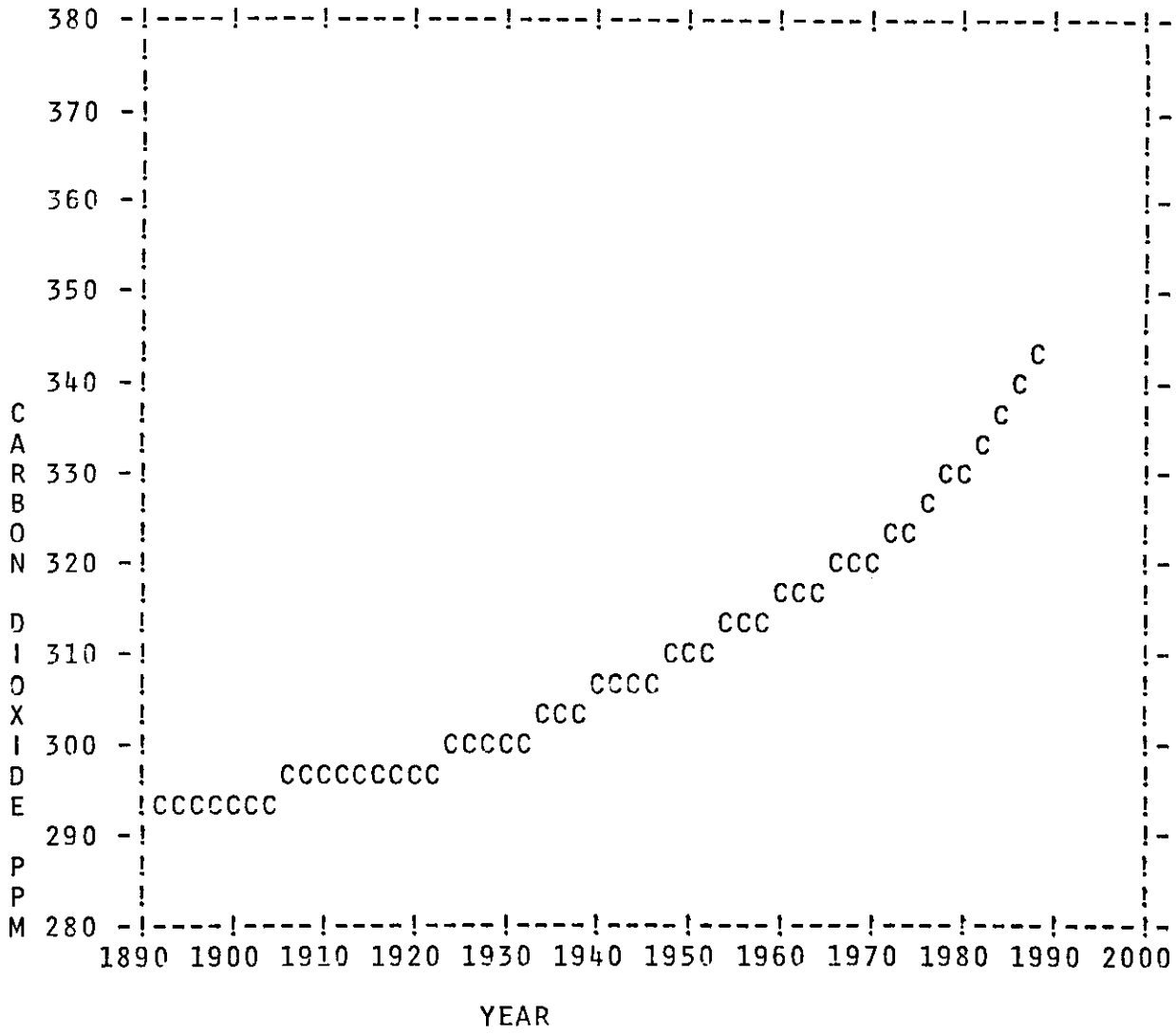
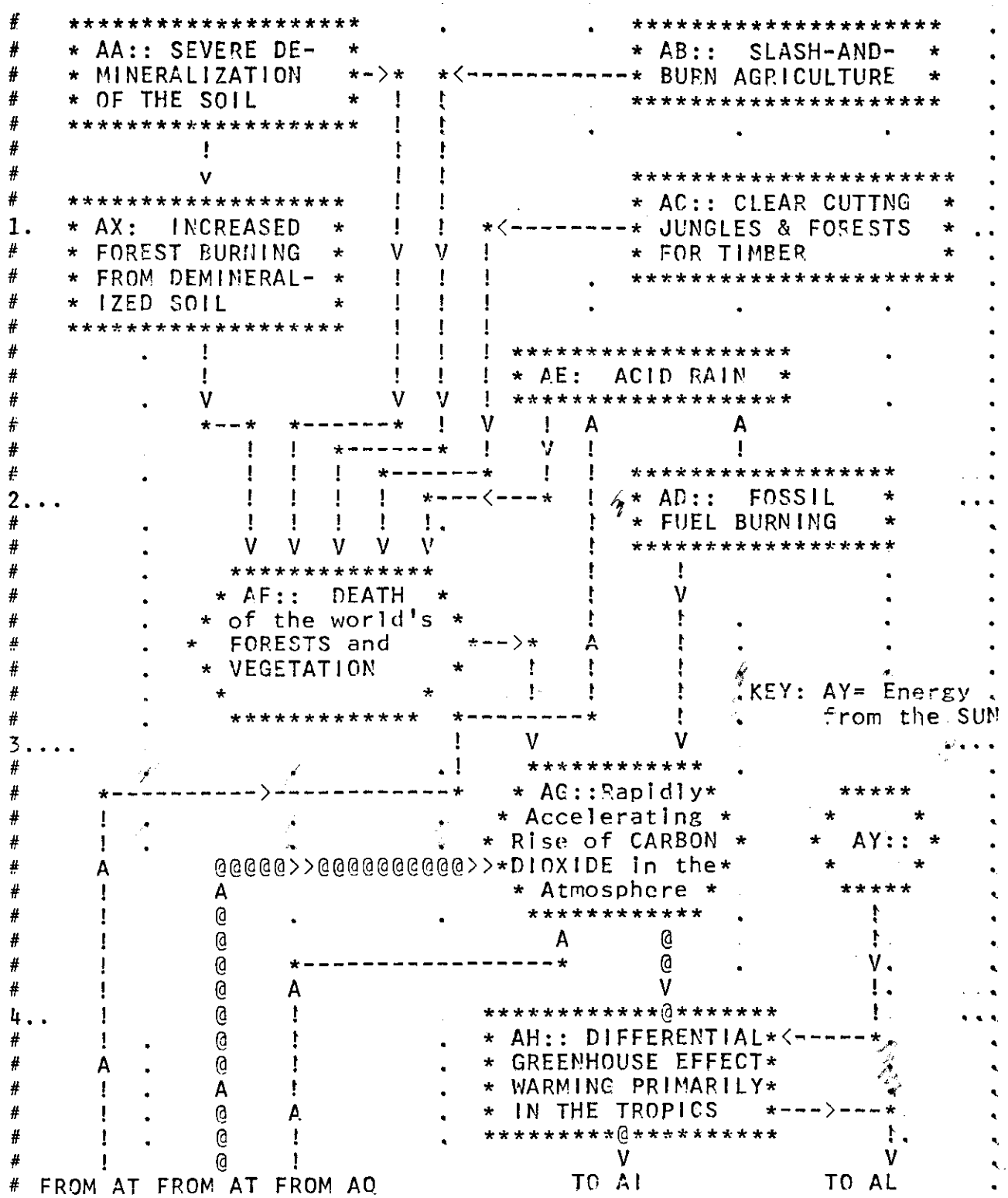


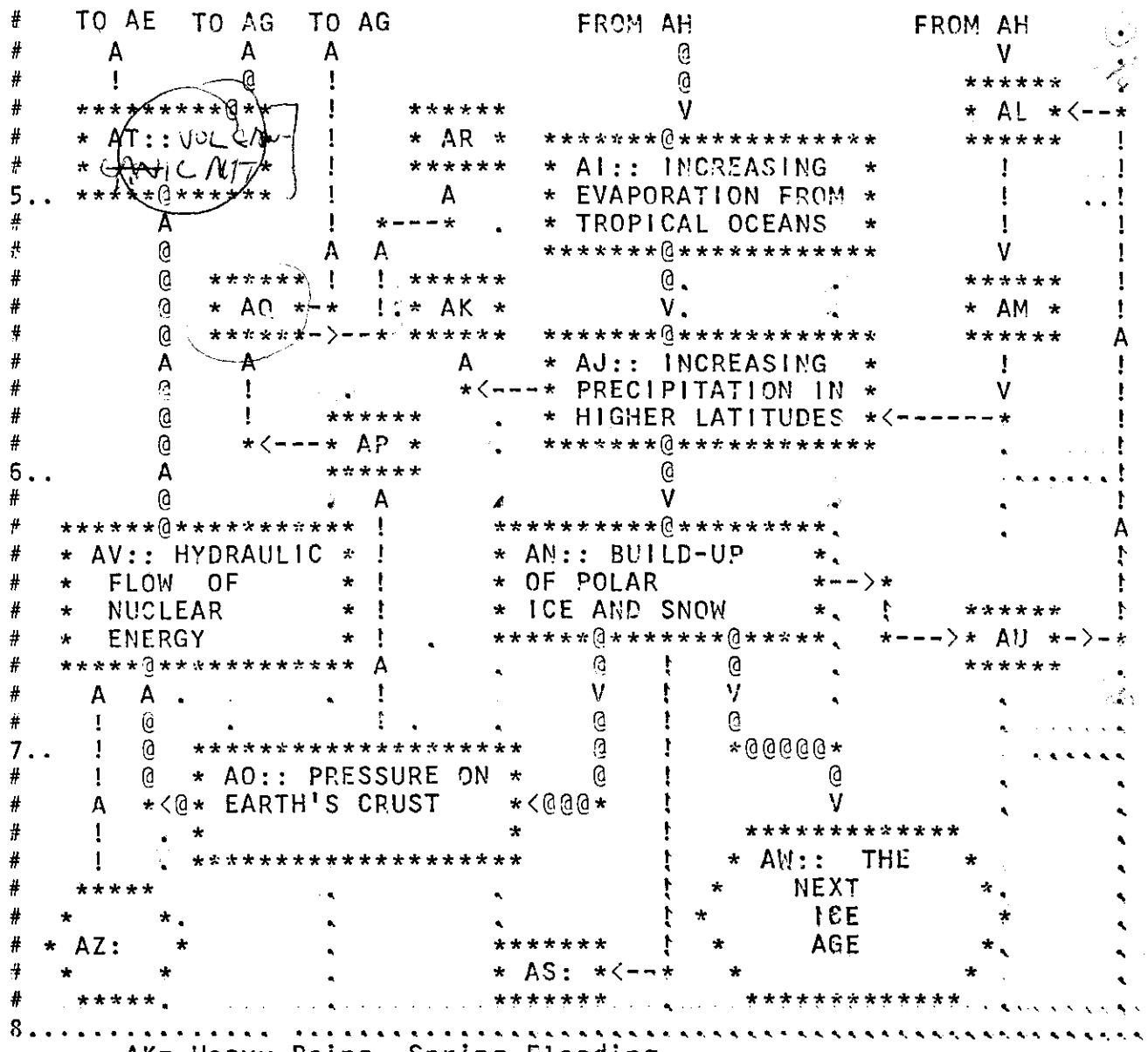
Fig. 6. Rise of Carbon Dioxide in Atmosphere (parts per million)

Fig. 7A. The Unstable Present Conditions.



AT:: VOLCANIC ACTIVITY

AT missing volcanic activity? (3?)



AK= Heavy Rains, Spring Flooding
KEYS:: AL= Increasing Pole-To-Tropics Temperature Differential
AM= High Winds, Hurricanes, Tornados
AP= Volcanic Heating of Ocean Floor
AQ= Decreased Absorption of CO/2 by Ocean
AR= Death of Marine Organisms
AS= Earthquakes
AU= Cooling of Poles
AT ~~AZ= Energy from Earth's Core~~ VOLCANIC ACTIVITY
CA = Ocean oxygen absorb CO2

Fig. 7B. The Unsatble Present Conditions.

AT=

AV V
AW V
AX V
AY
AZ V

Steps are being taken to organize the International Geosphere-Biosphere Program (IGBP) to facilitate study of these problems by international teams of scientists (19). It is estimated that the IGBP will be fully organized by 1990 and substantial research results will be obtained by the year 2000. The U.S Department of Energy is conducting a research program on Carbon Dioxide and Climate (20), and expects to complete an assessment of the impact of CO/2 by about 1990. The most comprehensive thesis on how the Biosphere functions is the Hamaker Thesis published in 1982, which predicted that 1984 was almost the last chance for humankind to stop the present shift to glaciation, with severe crop damage by 1990, and few people left alive by 1995. These dates are displayed on a time line in Figure 8 to illustrate how we may miss the last chance to do something about the glaciation and climate change if we wait for scientific certainty as to what is happening.

TIME LINE	IGBP International Geosphere-Biosphere Program	DOE U.S. Department of Energy, CO/2 Climate Research	Hamaker Thesis Predictions
1982		(continuation of earlier plans)	1982 Hamaker Thesis Published.
1983		1983 Research Plan	
1984			1984 Almost Last Chance to Stop Glaciation.
1985	1985 Program Proposed.	1985 State of the Art Papers.	
1986			
1987			
1988			
1989			
1990	1990 Program Organized.	1990 Assessment.	1990 Severe Crop Damage.
1991			
1992			
1993			
1994			
1995			1995 Few People Left Alive on Earth.
1996			
1997			
1998			
1999			
2000	2000 Analysis Completed.		

Fig. 8. Climate Research Time Lines and Worst Case Predictions.

SHARED by MEN & WOMEN		COEVOLUTION with the BIOSPHERE
( )	( )	SCIENTIFIC RESEARCH: It is important that the basic research in the approx. 25 fields of science involved in understanding the climate and glacial cycles be accelerated.
( )	( )	ENGINEERING SYNTHESIS: The development of an adequate theory of climate change requies a systhesis of concepts from over 25 fields of science and the development of conceptual models and computer mathematical models of the climate and glaciation processes. The philosophy of general systems theory can help organize the material from the different fields of science provided there is some action linkage between the specialists in the different fields and the generalists.
( )	( )	PHILOSOHICAL OVERSIGHT: The services of philosophy professors are needed to check the completeness and validity of methods used to verify the computer simulation models used in climate research. As a starter the procedures developed by the Society for Computer Simulation can be expanded to the climate models (21).
( )	( )	EDUCATIONAL DEVELOPMENT: To prepare the public and their representatves in Congress to deal wilth the glaciation cycles, we need to educate the public about the biosphere and its major components: the tectonic system, the oceans, the land, soil minerals, forest nutrition functions, photosynthesis, the atomosphere, the carbon cycle in the biosphere, and a general tectonic-biospheric-atmospheric consciousness.
( )	( )	DECISION FACILITATORS: We need to develop people with skills in aiding people to make decisions where incomplete data is avaliable such that estimates of the risk involved in waiting for complete scientific proof.

Fig. 9. Checklist of Functional Subdivisions of the Problem of Climate Change Related to the Glacial Cycle, Tectonic Actilvity, Soil Demineralization, Dying Forests, & Rising Carbon Dioxide in the Atmosphere.

If the Hamaker Thesis is correct, both the DOE assessment and the IGBP will have tested the thesis too late to do anything about it. During World War II American scientists reorganized to focus on the crises threatening civilization. In the shadow of an impending transition into a glacial period, we need to reorganize our work on climate problems into five separate but cooperating parts to facilitate the development of a coevolutionary relationship with the Biosphere: SCIENCE research in climatology, forestry, soil science, tectonics, et cetera; ENGINEERING and general systems development of conceptual models and computer models of the glacial and climate cycles; PHILOSOPHICAL studies to review the approach of the scientists and engineers for completeness; EDUCATIONAL projects to develop material to educate the public on climate issues; and POLICY studies to make assessments of the risks involved in alternative policies.

An on-line magazine is being set up on a computer bulletin board to make available notes on what is happening in the five different areas. To get later information from the computer bulletin board, dial-up 408/269-7045 at 300 baud with home computer or computer terminal. When you get carrier, send two carriage-returns and follow the instructions. If you need more detailed instructions issue the command "read help".

See the paper by Alden Bryant (22) for an emergency program to do what we can to reduce the CO/2 level without waiting for scientific validation of the Hamaker Thesis. If we wait for detailed scientifi validation, we may be exposing another billion people to starvation.

REFERENCES

1. National Research Council, *Changing Climate* Washington, D.C.: National Academy Press (1983), 496 pp.

2. U.S. Environmental Protection Agency, *Can We Delay A Greenhouse Warming?* Washington, D.C.: USGPO (Sept 1983).

3. Kenneth E.F. Watt, Zoology Dept., University of California, Davis, California, "The Effect of Local Influences on Perception of Climatic Trends", in process 7/27/85.

4. F. B. Wood, "The Social Responsibility of Engineers and Scientists," pamphlet, 1960, Society for Social Responsibility in Science.

5. Fred Bernard Wood, "A General Systems View of Agriculture, Climate and Glaciation," manuscript, 3/18/84, 4 pp.

6. Fred Bernard Wood, "Specifications for Developing a Computer Simulation of the Earth's 100-thousand cycle of Carbon Dioxide, Climate and Glaciation." Baden-Baden, August 1984, 8 pp.

7. James Grier Miller and Jessie L. Miller, "The Earth as a System," *Behavioral Science*, v. 27, n. 4, Oct 1982, pp. 303-322.

8. J. E. Lovelock, *GAIA A new look at life on Earth* Oxford: Oxford Univ. Press (1979), 157 pp.

9. Fred Bernard Wood, "Geophysical Global Consciousness," manuscript,

2/9/85, 5 pp.

10. David G. Smith, *The Cambridge Encyclopedia of Earth Sciences*, Cambridge: Cambridge University Press (1982), 496 pp., CO/2 data at p. 276.

11. The "A" curve of approximate global ice volume is derived from an exhibit explaining the glacial cycles in a museum of ethnography in Rome, Italy.

12. John Gribbin, *What's Wrong With Our Weather,* (1979) NY: Scribners's, p. 33.

13. Earth Regeneration Society, Berkeley, California, "Historic Effects of CO/2 Changes on Air Tempe. & Ice Volume," 7/13/84, 5 pp.

14. Stephen H. Schneider and Randi Londer, *The Coevolution of Climate &Life*, San Franciso: Sierra Club Books (1984), 563 pp.

15. N. N. Moiseev (Academy of Sciences U.S.S.R.), "Coevolution: Some Propositions," Seminar, Erice, Italy, August 19-24, 1984, 8 pp.

16. John Hamaker, *The Survival of Civilization*, Burlingame, CA: Hamaker-Weaver Publications (1982) 218 pp.

17. John Hamaker, "Automatic Phase of Glaciation" in Solar Age or Ice Age? Bulletin No. 4-5, Dec 1983, ed. by Don Weaver, Hamaker-Weaver Publications, Box 1961, Burlingame, CA 94010, Page 61.

18. ERS Publications: 411A & 413A & 41A, Description of CO/2 Charts, long form, 12-8-83, rev. 1-31-84, 11pp.; 412, Description of CO/2 Charts, short form, 12:8-83, 2pp.

20. "CO/2 Climate Research Plan", prepared by Michael R. Riches, Carbon Dioxide Research Division, Office of bassic Energy Sciences, U. S. Department of Energy, Washingto, D.C. 20545, Dec 1983, 22 pp., with technical assistance during preparation provided by Michael C. MacCracken and Frederick M. Luther, Lawrence Livermore National Laboratory.

21. John McLeod, "Computer Modelling and Simulation: Principles of Good Practice," 1982, San Diego: The Society for Computer Simulation, Simulation Series No. SS-10-2, 178 pp.

22. Alden Bryant, "The Meaning of Earth Regeneration," paper at National Audubon Society Expedition Institute, Aug 1-6, 1985, Including U.S. Employment Plan - Earth Regeneration Program, 9 pp.

BIOGRAPHY

Fred Bernard Wood: B.S, M.S., Ph.D from University of California Berkeley, Electrical Engineering. Five Years at M.I.T. Radiatio Laboratory on RADAR test equipment. Twenty-seven years at IBM Corp on computer-communications systems. Five years volunteer consultin for community and environmental groups.

INFORMATION SOURCES

For more information on the theoretical developments and computer simulation work write to: Computer Social Impact Research Institute, Inc.(non-profit), P.O. Box 5583, San Jose, California 95150. Tel: 408/269-9327
Or from your computer terminal dial-up our computer bulletin board at 408/269-7045 (300 baud, 2 carriage returns to start).

For more information on the overall program and next practical steps write to: Earth Regeneration Society, Inc. (non-profit), 470 Vassar Ave., Berkeley, California 94708, Tel: 415/525-4877

For information on the Hamaker Thesis and subsequent bulletins write to: Hamaker-Weaver Publishers, Box 1961, Burlingame, California 94010, Tel: 415/342-0329
- Book: The Survival of Civilization, $12 postpaid.
- Bulletin: Solar Age or Ice Age? Bulletin, $5.00 per issue (large size and/or double issues).

Page, Figure and Computer File Checklist:

I		TSE.GAIA.CLIMATE.I
1	1	AUDU.AA
2	2	AUDU.BA, AUDU.C
2A		AUDU.FA
3	3-5	AUDU.DEF
4	6	AUDU.G
5	7A	AUDU.J
6	7B	AUDU.K
7	8	AUDU.H, AUDU.HD
8	9	AUDU.M
9-10		AUDU.IN
11		AUDU.O

AUDUFORMAT
CTCH.IV3A--AUDU-- A-775-L 08/01/85 Rev 08/28/85 Rev 09/22/85