

Tectonic Uplift and Climate Change

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Edited by

William F. Ruddiman

University of Virginia
Charlottesville, Virginia

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Contributors

Michael A. Arthur • Department of Geosciences and Earth System Science Center, Pennsylvania State University, University Park, Pennsylvania 16802.

Elizabeth K. Berner • Department of Geology and Geophysics, Yale University, New Haven, Connecticut 06520-8109.

Robert A. Berner • Department of Geology and Geophysics, Yale University, New Haven, Connecticut 06520-8109.

Joel D. Blum • Earth, Ecosystem and Ecological Sciences Program, Earth Sciences Department, Dartmouth College, Hanover, New Hampshire 03755.

Anthony J. Broccoli • Geophysical Fluid Dynamics Laboratory/NOAA, Princeton University, Princeton, New Jersey 08542.

Thure E. Cerling • Department of Geology and Geophysics, University of Utah, Salt Lake City, Utah 84112.

Peter Copeland • Department of Geosciences, University of Houston, Houston, Texas 77204-5503.

Donald J. DePaolo • Center for Isotope Geochemistry, Department of Geology and Geophysics, University of California at Berkeley, Berkeley, California 94720-4767

Louis A. Derry • Department of Geological Sciences, Cornell University, Ithaca, New York 14853-1504.

John M. Edmond • Department of Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139.

Johan P. Erikson • Department of Geology, University of California at Davis, Davis, California 95616.

Christian France-Lanord • Centre de Recherches Petrographiques et Geo-chimiques-CNRS, BP20 54501, Vandoeuvre-les-Nancy, France.

Youngsook Huh • Department of Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139.

Teresa E. Jordan • Department of Geological Sciences, Cornell University, Ithaca, New York 14853-1504.

Lee R. Kump • Department of Geosciences and Earth System Science Center, Pennsylvania State University, University Park, Pennsylvania 16802.

John E. Kutzbach • Center for Climatic Research, University of Wisconsin-Madison, Madison, Wisconsin 53706.

Syukuro Manabe • Geophysical Fluid Dynamics Laboratory/NOAA, Princeton University, Princeton, New Jersey 08542.

Sean E. McCauley • Center for Isotope Geochemistry, Department of Geology and Geophysics, University of California at Berkeley, Berkeley, California 94720-4767.

John D. Milliman • School of Marine Science, College of William and Mary, Gloucester Point, Virginia 23062.

Timothy C. Partridge • Climatology Research Group, University of the Witwatersrand, WITS 2050, Johannesburg, South Africa.

William J. Pegram • Department of Geology and Geophysics, Yale University, New Haven, Connecticut 06520-8109.

Warren L. Prell • Department of Geological Sciences, Brown University, Providence, Rhode Island 02912.

I. Colin Prentice • School of Ecology, Lund University, 223 62 Lund, Sweden.

Maureen E. Raymo • Department of Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139.

James H. Reynolds III • Department of Geosciences and Anthropology, Western Carolina University, Cullowhee, North Carolina 28723.

David Rind • Goddard Space Flight Center, Institute for Space Studies, New York, New York 10025.

Gary Russell • Goddard Space Flight Center, Institute for Space Studies, New York, New York 10025.

William F. Ruddiman • Department of Environmental Sciences, University of Virginia, Charlottesville, Virginia 22903.

Karl K. Turekian • Department of Geology and Geophysics, Yale University, New Haven, Connecticut 06520-8109.

Preface

Plenum's initial inquiry two years ago about a volume on tectonics and climate came at just the right time. Although Plenum had in mind a broad overview treatment of this subject, I felt there was good reason to put together a volume focused entirely on one such connection, the link between plateau–mountain uplift and global climate over the last 50 million years. A series of papers published in the middle–late 1980s had proposed several linkages between uplift and climate, and these hypotheses had been subjected for almost a decade to the usual critical scrutiny by the scientific community. It was my not unbiased sense that the original hypotheses had emerged from this scrutiny largely intact (though, of course, not entirely), and that their scope had in fact been expanded by the subsequent addition of new concepts. If these earlier phases represented the “thesis” and “antithesis” phases of the dialectical method of science, the time now seemed ripe for an attempt at a “synthesis.” This seemed particularly desirable because the many publications on this topic lay scattered among disciplinary journals, and there was no central source to provide a complete overview. This volume attempts to fill that need.

Although focused on a single set of hypotheses, this volume is far from narrow in scope. Indeed, it encompasses most of the massive and dramatic transformations of the Earth's surface in recent geologic history. These include: the collision of continents, the uplift of massive plateaus and mountain belts, changes in the position of the jet stream and westerly winds, the creation of monsoon circulations that focus heavy rainfall on uplifted terrain, rapid and intense physical weathering of rocks in plateaus and mountain belts, runoff of sediment-laden rivers to the ocean, chemical weathering of rock and slow removal of CO₂ from the atmosphere, gradual cooling of global climate, formation of permanent ice sheets over Antarctica and Greenland, development of sea-ice cover in the Arctic Ocean, expansion of tundra and boreal forest southward from the Arctic margins of Asia and North America, replacement of tree and shrub vegetation by grassland in the subtropics, and, finally, the onset of periodic fluctuations of massive ice sheets over North America and Eurasia. A story that begins with tectonic uplift in the tropics and subtropics thus ends with glaciation of the polar regions.

For teaching-related purposes, this volume is unique in combining a broad interdisciplinary scope with a close focus on a single central issue (the uplift–

climate connection). It will probably prove most useful in graduate or advanced undergraduate seminars or in combined lecture–seminar courses. Many of the individual chapters could be the basis for a detailed investigation of the methods used and results obtained from specific Earth Sciences disciplines (such as geochemistry, atmosphere and ocean modeling, tectonophysics, and paleobotany). Yet the results from each chapter fit into a larger picture that will expand the breadth of vision of students who are too often focused only on one method or disciplinary area. This approach is well matched to an ongoing trend evident in most research universities, which are creating or encouraging new alignments among component departments in the Earth and Environmental Sciences in an effort to stimulate interdisciplinary research. I believe this volume represents a highly successful example of the kind of research that could emerge from such efforts.

The value of this volume as a reference source for researchers is obvious. All the chapters are current to the very end of 1996, and all the authors are recognized experts in their fields. It was my choice to pick the best people and give them the freedom of a nonrefereed volume, both to encourage cross-disciplinary thinking (and even speculation) and to speed the volume toward timely publication. The most obvious omission in the book is the absence of chapters on the timing of uplift in North America; these were solicited early, but fell through too late in the process for me to be able to obtain others.

I thank the following people for help and encouragement in seeing this project through to rapid completion: the authors, who all did their job in a timely way; Ken Howell, who nudged and nagged at about the right level of frequency and intensity; long-term colleagues Maureen Raymo, John Kutzbach, and Warren Prell, for past and present scholarly collaboration that has been both educational and enjoyable; and both Ginger and Debra Angelo, for literally making this volume possible.

W. F. Ruddiman
Charlottesville

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