# Institute of Arctic and Alpine Research

2003–2004 Biennial Report

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## Cover Picture

Icy Shore.– a painting ment to subtly convey the menace
of the 80–90% of an iceburg that lies below the ocean surface
Painting by Mark F. Meier.
acrylic on canvas, 30"x24", 2004

This publication is printed on recycled stock.

# Biennial Report 2003–2004

*Institute of Arctic and Alpine Research*
*University of Colorado at Boulder*

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# INSTAAR: An Earth and Environmental Systems Institute

## University of Colorado at Boulder

The Institute of Arctic and Alpine Research (INSTAAR) develops scientific knowledge of natural and anthropogenic physical and biogeochemical environmental processes at local, regional and global scales, and applies this knowledge to improve society's awareness and understanding of environmental change. The world's high-altitude and high-latitude regions are the Institute's traditional focus, but the pursuit of understanding of these regions has led INSTAAR to a geographically wide range of interdisciplinary studies of Quaternary and modern environments, which include research in geochronology, human and ecosystem ecology, hydrology, oceanography, landscape evolution, biogeochemistry, and climate. INSTAAR's national and international research leadership in these areas is augmented by exceptional strength in graduate education and exposure of undergraduates to the research process, as well as by outreach to the public both locally and nationally.

INSTAAR's *Research Activities* integrate field studies, state-of- the-art laboratory experiments, field and laboratory data analysis, and numerical and laboratory modeling. INSTAAR, both historically and currently, emphasizes three themes of research.

The *Ecosystems Group* focuses on ecosystem dynamics, biogeochemical processes of terrestrial and aquatic systems, biodiversity, ecosystem disturbance and recovery, modeling of biotic pattern distribution, and ecological assessments. *Long-Term Ecological Research* (LTER) studies in alpine and polar regions are emphasized, involving populations and communities, biogeochemistry, and ecophysiology. Modern tools include geographic information systems (GIS), remote sensing, and ecosystem modeling. The *Mountain Research Station* offers a world-class complex of laboratory and field facilities to support these year-round research efforts.

The *Geophysics Group* applies quantitative field and numerical methods to discover the properties and dynamics of snow, ice, water, and sediments in the world's oceans, glaciers, and land areas. Methods of analysis include theoretical and numerical development, remote sensing, land, airborne, and ship-borne field experiments, all applied to problems in hydrology, glaciology, frozen-ground studies, paleoclimatology, physical oceanography, and marine geology. To facilitate these interests, the *Environmental Computation and Imaging Facility* provides researchers with supercomputer power and global connections to geophysical databases.

The *Past Global Change Group* focuses on the reconstruction of the dynamics of paleoenvironments and past climate variability to enhance our understanding of the interactions between all components of the earth system, including atmosphere, ocean, land, ice, the biosphere and including human ecology. Integration of a variety of records from a global network of sites, from polar ice caps to continental alpine regions and to the world's oceans, provides the capability to test conceptual and predictive global change models, to facilitate the differentiation between natural and human-induced change and to study the human impacts of changes. To facilitate these interests, the *Center for Geochemical Analysis of the Global Environment* (GAGE) promotes fundamental research in the development and application of analytical methods that reveal past and present changes in Earth's climate, its land surface, and major biogeochemical cycles.

INSTAAR's *Teaching Mission* is directed toward fostering an appreciation and understanding of the biological, chemical, and physical processes operating in continental and ocean environments. The Mountain Research Station and other study sites in the mountains of Colorado aid the educational efforts of the Institute. INSTAAR supports the University of Colorado's educational mission and provides interdisciplinary graduate and undergraduate classes and research opportunities. Our teaching mission includes international educational experiences for University of Colorado students, training of foreign students, and volunteer outreach to community schools and various other external constituencies.

INSTAAR's *Societal Mission* consists of activities in research, education, and science leadership. These activities address critical concerns involving issues such as ecosystem stability, biodiversity, water resources, agriculture, national security, and resources in sites ranging from the alpine areas of the Rocky Mountains to the remote regions of the world. Our expertise is applied to predictive understanding of environmental processes, including the maintenance of water quality and anticipating and responding to long-term environmental alterations. Changes and disturbance in high-latitude regions not only affect the lives of the indigenous residents but also have a bearing on the lives of people everywhere, through global teleconnections.

Information regarding the Institute of Arctic and Alpine Research, the Niwot Ridge Long-Term Ecological Research (LTER) Program, the Mountain Research Station, and the journal *Arctic, Antarctic, and Alpine Research* is available on the World Wide Web at, respectively:

instaar.colorado.edu
culter.colorado.edu:1030/
www.colorado.edu/mrs/
instaar.colorado.edu/AAAR/

# The State of the Institute

## A Message from the Director

Institute Director
James P. M. Syvitski

*What are we?* The INSTAAR is an Earth and Environmental Systems Institute, with facilities and labs located in the Boulder, Colorado, region. INSTAAR develops scientific knowledge of natural and anthropogenic physical and biogeochemical environmental processes at local, regional, and global scales, and applies this knowledge to improve society's awareness and understanding of environmental change. The world's high-altitude and high-latitude regions are the Institute's traditional focus, but the pursuit of understanding of these regions has led INSTAAR to a geographically wide range of interdisciplinary studies of Quaternary and modern environments, which include research in geochronology, human and ecosystem ecology, hydrology, oceanography, landscape evolution, biogeochemistry, and climate. INSTAAR's national and international research leadership in these areas is augmented by exceptional strength in graduate education and exposure of undergraduates to the research process, as well as by outreach to the public both locally and nationally. INSTAAR is a major contributor to teaching and research in two of the three areas of excellence identified in CU's *Quality for Colorado* program, namely in "*Environmental Sciences*" and studies of "*the American West*."

*Who are we?* At the end of 2004, the governing body (Directorate) comprised 35 Fellows and Research Scientists led by the Director, an Associate Director, and an Executive Committee. The Directorate consisted of 15 teaching faculty (3: Biology; 3: Geography; 4.5: Geology; 2: Civil, Architectural and Environmental Engineering; 1.5: Environmental Studies; 1: Anthropology), 5 Fellow/Professor-Emeriti, 2 Research Professors, 3 federal Research Scientists (NOAA, USGS), and 9 Research Faculty. The Directorate receives support from 40 professional scientists, 7 post-doctoral scientists, and 60 graduate students. Other Ph.D.-level Institute scientists include 37 Research Affiliates (USGS, NCAR, NOAA, other Universities, private companies) and 5 Visiting Scientists. The Institute supported the research experience of 92 undergraduate research assistants. Institute members are loosely subdivided into three research groups: Ecosystem Science, Geophysics, and Past Global Change. Staff and faculty within our Center for *Geochemical Analysis of the Global Environment* are included in these groups. Our Mountain Research Station has a staff of 16 including instructors. The Institute's administrative staff of 11 includes an Information Officer; the Managing Editor of *Arctic, Antarctic and Alpine Research;* the Chief Finance Officer; the Director's Executive Assistant; a Systems Administrator; and 6 accountant technicians and clerks; to support the activities of our 287-member institute (for details, see http://instaar.colorado.edu/people/).

*Research is expensive:* The majority of our $17.5M revenue for 2003 and 2004 came from federal agencies (65%), followed by the state of Colorado (CU: 17%), auxiliary lab operations (11%), and non-federal sources (7%). Of the federal agencies, NSF remains the largest source of revenue, followed by the Departments of Commerce, Defense, and Interior. INSTAAR research involves about 220 contracts, grants, and gifts. The total operating expenditures for 2003–2004 were of $17.4M, 51% as salaries (including student aid), 17% as operating expenses, 14% as recharges and indirect cost recovery by CU, 12% for equipment, 4% in travel, and 3% for other expenses and subcontracts.

*Honors, awards, and recognition:*

- Mort Turner was awarded the American Polar Society Special Award, the first of its kind, which recognizes Mort's tremendous service over the years on polar research, administration, and management.
- Patrick Bourgeron received the Chaire Blaise Pascal, an international visiting research chair to support his research into the interrelationships between global change, rapid demographic pressure, land use patterns, and sustainability of heavily populated areas.
- Diane McKnight was elected a fellow of the American Geophysical Union for her outstanding contributions to the understanding of the biogeochemistry associated with transport metals and organic substances in streams and lakes.
- Kathleen Salzberg was awarded the 2004 CU-Boulder University Medal for her internationally renowned work on INSTAAR's Journal *Arctic, Antarctic, and Alpine Research.* She was managing editor for 35 years and retired in October 2002.
- John T. Andrews was appointed Special Professor at the University of Nottingham, England. John also became the Distinguished Foreign Lecturer at the University of Durham, UK, for 2005.
- David M. Anderson received the Department of Commerce Sustained Superior Performance Award and NOAA Administrator's Award for excellence in scientific research. David also received the T. M. Harris Award for outstanding scientific paper, from the Institute for Paleobotany in Lucknow (with A. K. Gupta and J. T. Overpeck).
- John C. Behrendt was awarded Fellow of the American Association for the Advancement of Science at the 2003 Denver meeting, for distinguished contributions to the understanding of crustal controls on the Antarctic Ice Sheet and for efforts to protect and manage Antarctica for the scientific benefit of all nations.
- Wesley E. LeMasurier received the University of Colorado at Denver, Career Teaching Excellence Award.
- Mark B. Dyurgerov received a certificate of recognition for research contributions made through the 2004 NASA Faculty Fellowship Program, Jet Propulsion Laboratory, Pasadena, California.
- James W. C. White became a Member of the ISI Highly Cited scientists in geoscience by being in the top 250 (0.5%) cited authors in the field of geoscience. Dr. White becomes one of the 25 ISI Highly Cited authors on the CU-Boulder campus.

- Alan R. Townsend was named to the Ecological Society of America Rapid Response Team—a small group of scientists who provide rapid feedback to congressional staff and other policy makers on legislation and other policy issues with environmental implications.
- Astrid E. Ogilvie was appointed to the faculty of Hunter College, the City University of New York, as Adjunct Research Professor of Anthropology, an honorary position.
- Daniel Grossman, INSTAAR Affiliate, received the 2004 AIBS Media Award for Broadcast Journalism for his "Penguin Barometer" story broadcast on "The Research File" of Radio Netherlands.

*Books/special issues:* With great effort and dedication, INSTAARs published a series of well-reviewed books and special journal issues over the last two years. These include:

- Hoffecker, John F. 2005: *A Prehistory of the North: Human Settlement of the Higher Latitudes.* New Brunswick: Rutgers University Press.
- Liu Chaohai, Dyurgerov, M. B., Xie Zichu, 2002: *Tien-Shan Glaciation.* Beijing: "Science" Press, 226 pp. (Chinese)
- Syvitski, J.P.M. (ed.) 2003: The supply and flux of sediment along hydrological pathways: Anthropogenic influences at the global scale. *Global and Planetary Change,* 39(1/2): 199 pp.
- Syvitski, J.P.M., Weaver, P.P.E., Berné, S., Nittrouer, C.A., Trincardi, F., Canals, M., (eds.) 2004: Strata formation on European margins: A tribute to EU-NA cooperation on marine geology. *Oceanography,* 17(4): 165 pp.

*Interesting 2003–2004 research headlines:*

- James Dixon was interviewed for a *Nature* news feature on the paradigm shift toward finding physical traces of early human migrants along the Pacific Coast.
- Anil Gupta (IIT), David Anderson (INSTAAR and NOAA Paleoclimatology), and Jonathan Overpeck (University of Arizona) developed a new centennial-scale proxy record of the southwestern monsoon winds spanning the Holocene period (last ~11,000 years), showing direct links to conditions in the North Atlantic Ocean.
- James Dixon was interviewed widely about his research with William Manley on the potential of melting glaciers and permafrost to reveal archaeological treasures (National Public Radio, LA *Times,* Vancouver *Sun,* Miami *Herald,* Charlotte *Observer,* and Seattle *Times*).
- Journal Editor Mark Williams published the first full-text online issue of the periodical *Arctic, Antarctic, and Alpine Research.* All issues starting from 2003 will be available in both electronic and paper formats.
- Alan Townsend and colleagues discussed how human-induced changes to the global nitrogen cycle affect our health. Humans now convert more nitrogen to reactive forms than all natural processes combined. While beneficial for increasing crop growth, human-induced changes appear to pose a growing health risk.
- A new study of Niwot Ridge tundra soils by Schadt and colleagues has revealed the presence of whole new orders of previously undocumented microorganisms (mostly fungi) and the discovery that these organisms are more active in winter than in summer. The study facilitated by the Niwot Ridge Long-Term Ecological Research program has implications for carbon dioxide levels in Earth's atmosphere.
- Mark Dyurgerov helped compile an online database of the world's glaciers. Accelerated glacier melting over the last two decades has contributed to rising sea levels and to stressed water resources.
- Diane McKnight and colleagues have found that the ability of several of Colorado's prime ski areas to respond to winter drought is constrained by acidic runoff from abandoned mines.
- Konrad Hughen (WHOI, INSTAAR alum), Scott Lehman, and colleagues constructed a new high-resolution calibration of the radiocarbon time scale back to 50,000 years before the present.
- Meredith Knauf, Mark Williams, Nel Caine, and colleagues have discovered surprising evidence of microbial activity in a rock glacier high above treeline in the Rocky Mountains, a barren environment previously thought to be devoid of life. The microbial "signature" discovered by the team is similar to that found recently in semi-frozen lakes in the Dry Valleys of Antarctica.
- Tim Seastedt, Bill Bowman, Nel Caine, Diane McKnight, Alan Townsend, and Mark Williams (Niwot Ridge LTER PI's) have developed a new model for high elevation ecosystems, which suggests that high-elevation lakes and treeline, which functions as a windbreak and collects snow, particulates, and nutrients, are the locations that experience the first negative impacts of anthropogenic materials scavenged from the atmosphere.
- Tiffany Fourment, a local environmental educator, completed a new children's book, *My Water Comes from the Mountains.* Fourment began the project during a summer field course taught by Diane McKnight at the Mountain Research Station. The book introduces children to their local watershed, and narrates the path of water from alpine to plains ecosystems.
- James White and colleagues are part of a team of international researchers working on the North Greenland Ice Core Project that recently recovered plant remnants nearly two miles below the surface between the bottom of the glacial ice and the bedrock. The plant material is thought to date to several million years ago before the Pleistocene epoch smothered Greenland with ice. The ice cores allowed the researchers to decipher climate history during the past 123,000 years. The older part of the record shows that the Eemian period prior to the last glacial period was slightly warmer than the present day.

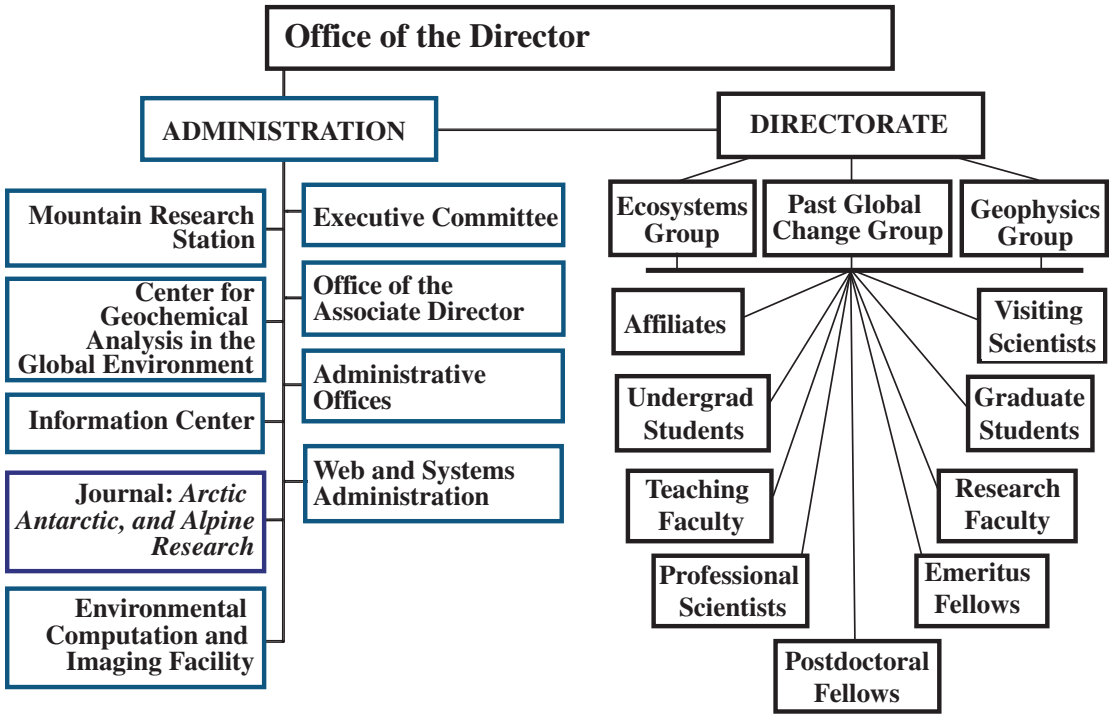
- Mark Williams and colleagues demonstrated that high-altitude aquifers honeycomb parts of the Colorado Rockies, and temporarily trap snowmelt. Geochemical and water isotope studies show that a considerable amount of the annual snowmelt flowing to the base of mountains arrives as "old groundwater" that had been stored in these subterranean mountain catchments for years or decades.
- Bill Bowman was interviewed for the Earth & Sky radio program broadcast daily by 688 radio stations to help listeners better understand the science of biodiversity studies and the consequences of its loss in mountain areas. Bowman and colleagues organized a symposium on this topic last summer at the meeting of the Ecological Society of America.

*$1 Million facility completed at Mountain Research Station:* The University of Colorado at Boulder has completed a million-dollar facility at the Mountain Research Station west of Boulder, providing researchers, students, and visitors with comfortable, year-round living and teaching quarters. The Moores-Collins Family Lodge, the first major construction project at the station in 30 years, replaces the original Fireweed Hostel at the site. Considered by scientists to be one of the premier alpine field stations in the world, the Mountain Research Station is located 25 miles west of Boulder at an altitude of 9,500 feet and is administered by INSTAAR. The new two-story, 3,200-square-foot lodge includes meeting facilities for up to 70 people, a full kitchen, three bathrooms, and winterized sleeping areas for up to 32 people. The station is adjacent to Niwot Ridge, which rises in elevation to 13,500 feet and is the site of one of 26 Long-Term Ecological Research sites in North America funded by the National Science Foundation and the only one in a sub-alpine environment. Featuring tundra, talus slopes, forests, glacial lakes and wetlands, the site is managed for NSF and the U.S. Forest Service by INSTAAR.

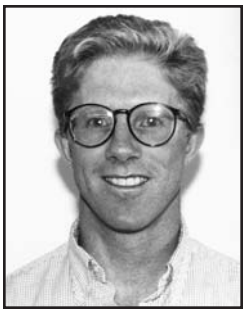
*Fond farewells:* Mortimer D. "Mort" Turner, prominent polar geologist, died of natural causes Saturday, May 1, 2004, in Boulder Colorado. He was 83. "He was the one who grew the Antarctic earth sciences program following the International Geophysical Year 1957–59," according to Guy Guthridge, Manager of Antarctic Information in the NSF's Office of Polar Programs. "Mort was gracious, generous, dignified, and knowledgeable, and he seemed mostly unfazed by the short-fuse panics that occasionally dominated our work." In 1984 he retired from NSF to conduct research on Early Man in Colorado, Montana, and China. In 1987 he moved to Boulder to join INSTAAR as a Fellow Emeritus where he continued his research jointly with his wife JoAnne. He also taught geology courses at CU-Denver. Dr. Turner received many honors, including the American Polar Society's Career Service Award. Turner Hills in Antarctica, the mineral turnerite, a fossil plesiosaur, and a prehistoric fossil sea mammal are all named after him. Professor Vera Markgraf retired from the Directorate as a Fellow Emeritus. Her illustrious career included a term as Chair of the IGBP Past Global Change program, one of the highest positions held in her field. Her research involved high resolution, multi-proxy paleoclimate analysis, using pollen (vegetation history), charcoal (fire history), and stable isotopes (temperature history) from late-Quaternary lake and bog sediments in southern South America.

*Hearty hellos:* While we say goodbye to old friends, we welcome new members to the institute with equal enthusiasm. Larry Bowlds joined the Institute in 2004 as the new Managing Editor of the AAAR journal. Robert S. Anderson joined the Directorate in 2003 as an Associate Professor in Geological Sciences. Bob received his Ph.D. in 1986 from the University of Washington, and joins the Institute from the University of California, Santa Cruz, where he was a faculty member. Bob's academic interests focus on the processes that drive landscape evolution, studied through monitoring of modern systems, numerical modeling, and geochronology, including the formation of alpine landscapes, and the glaciers and rivers that carve them. Suzanne Prestrud Anderson joined the Directorate in 2003 as a Research Scientist II, and then as an Assistant Professor of Geography in the fall of 2004. Suzanne received her Ph.D. in 1995 from the University of California, Berkeley, and joins the Institute from the University of California, Santa Cruz, where she was a research faculty member. Suzanne's specialty is field-based mechanistic understanding of the chemical and physical processes that shape the Earth's surface and control chemical denudation rates. Wesley E. LeMasurier joins the Directorate as a Senior Fellow in 2004. Wes received his Ph.D. in 1965 from Stanford University, and joins the Institute from the University of Colorado at Denver where he was a Professor of Geology. Wes brings to INSTAAR his expertise in Antarctic geology and volcanology. Irina Overeem joined the Directorate in 2004 as a Research Scientist II. Irina received her Ph.D. in 2002 from the Delft University of Technology, The Netherlands, where she was also a member of the faculty. Her specialties include stratigraphy, numerical modeling of fluvio-deltaic processes including an understanding of the uncertainty in geological prediction. Diana R. Nemergut joins the Directorate as an Assistant Professor in Environmental Studies, after she completes her post-doctoral research at Rutgers University. Diana received her Ph.D. in 2004 from the University of Colorado, where she completed her thesis on horizontal gene transfer in microbial communities. She is currently looking at the role of integrons in genetic exchange in soil and aquatic environments, and the types of genes that can be exchanged. Our INSTAAR family will continue to grow in both quality and quantity. We wish them all the best success while at INSTAAR.

## INSTAAR organization chart as of January 2005



# INSTAAR Directorate Members



### David M. Anderson

Fellow of INSTAAR; Adjoint Associate Professor of Geological Sciences, University of Colorado at Boulder; Director, World Data Center for Paleoclimatology and Chief of Paleoclimatology Branch of the National Climatic Data Center, U.S. Department of Commerce, National Oceanographic and Atmospheric Administration. PhD: 1991, Brown University.

**Specialty:** Paleoceanography, marine geology, quantitative paleoenvironmental reconstruction.

**Research Interests:** Research on the marine geologic record of climate change, with emphasis on quantitative estimates of past ocean temperature and ocean upwelling/productivity. Projects include reconstructions of ocean carbonate ion concentration related to the ocean's role in the global carbon cycle, reconstruction of long term trends in the Asian summer monsoon, and projects to reconstruct the coastal ocean currents in the eastern Pacific and their influence of the climates of North and South America.

### Robert S. Anderson

Fellow of INSTAAR; Associate Professor of Geological Sciences, University of Colorado at Boulder. PhD: 1986, University of Washington.

**Specialty:** Geomorphology, mechanics and timing of landscape evolution.

**Research Interests:** My academic interests focus on the processes that drive landscape evolution, studied through monitoring of modern systems, numerical modeling of these systems constrained by modern rates, and establishment of a chronology that constrains the longer term pace of landscape evolution. Recent research has focused on alpine landscapes, and the glaciers and rivers that carve them.

### Suzanne Prestrud Anderson

Research Scientist of INSTAAR; Assistant Professor of Geography. PhD: 1995, University of California, Berkeley.

**Specialty:** Geomorphology, weathering, hydrology, glaciology.

**Research Interests:** Field-based mechanistic understanding of the chemical and physical processes that shape the Earth's surface and control chemical denudation rates. Current focuses including studying the effect of glaciers on chemical weathering rates and the global carbon cycle, the linkage between glacier dynamics and subglacial hydrology, glacier outburst floods (jökulhlaups), and catchment-scale hydrology and hydrochemistry. Specializes in collection of detailed field observations to constrain models of geomorphic systems.

### John T. Andrews

Fellow of INSTAAR; Professor of Geological Sciences, University of Colorado at Boulder; Fellow of Norwegian Academy of Science and Letters. PhD 1965; DSc 1978, University of Nottingham, UK.

**Specialty:** Glacial and marine sedimentology and chronologies, high-resolution marine studies.

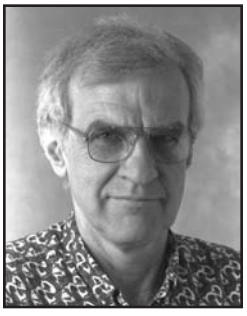
**Research Interests:** Late Quaternary history of ice sheet/ocean interactions and abrupt climate change during the last 10,000 to 40,000 yrs. Identification of iceberg rafting events. Detailed study of the paleoceanography of the East Greenland and Iceland margins on Holocene time scales.

### Martha Andrews

Former Librarian (Retired 2003). MA: 1964, McGill University; MA, 1973, University of Denver.

**Specialty:** Organization and dissemination of polar regions information.

**Research Interests:** Networking polar regions information; conversion of print information to electronic format; development of electronic databases.



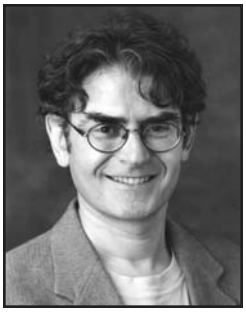
### John C. Behrendt

Fellow of INSTAAR. PhD: 1961, University of Wisconsin, Madison.

**Specialty:** Antarctic and marine geophysics, glaciology.

**Research Interests:** Presently studying lithospheric controls on the behavior of the West Antarctic Ice Sheet. Also investigating the tectonics of the West Antarctic rift

system including the continental margin. Deep crustal seismic investigations of continental rifts and rifted continental margins. Charleston, S.C. earthquake studies. Atlantic continental margins of U.S. and West Africa. Use of gravity and aeromagnetic surveys to investigate continental tectonics.



### Patrick S. Bourgeron

Fellow of INSTAAR. PhD.: 1978, Université Denis Diderot (formerly Paris 7), Paris, France.
**Specialty:** Ecosystem, landscape, and plant ecology; statistical and numerical modeling; biological diversity.
**Research Interests:** Structure of hierarchically organized ecosystems; analysis and modeling of species distributions; multi-scale mapping of biophysical and biotic patterns; selection of regional systems of conservation networks; land use change; integration of new technologies for ecological studies, ecological assessments, and conservation

### William D. Bowman

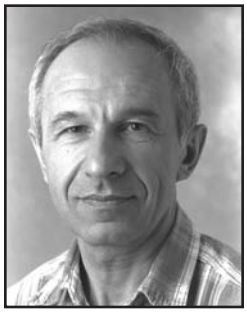
Fellow and Director of the Mountain Research Station of INSTAAR; Professor of Ecology and Evolutionary Biology, University of Colorado at Boulder. PhD: 1987, Duke University.
**Specialty:** Plant ecology.
**Research Interests:** Biotic control over community and ecosystem properties, resource use by plants, alpine ecology.

### T. Nelson Caine

Fellow of INSTAAR; Professor of Geography, University of Colorado at Boulder. PhD: 1966, Australian National University.
**Specialty:** Geomorphology and hydrology.
**Research Interests:** Present-day processes of erosion and sedimentation in mountain environments. This includes studies of snow hydrology, streamflow generation, and sediment transport. It incorporates work on periglacial processes, mountain permafrost, and hillslope processes.

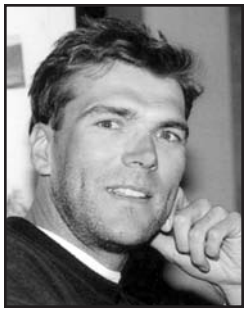
### E. James Dixon

Fellow of INSTAAR; Professor of Anthropology; Curator of Museum and Field Studies, University of Colorado at Boulder. PhD: 1979, Brown University.
**Specialty:** Archeology.
**Research Interests:** High latitude/high altitude human adaptations, circumpolar and paleoindian archeology, Quaternary science and geoarcheology.



### Mark B. Dyurgerov

Fellow of INSTAAR; Senior Scientist and Professor of Institute of Geography, Russian Academy of Science. PhD: 1974, Moscow State University; Doctor of Science: 1990, Institute of Geography, Russian Academy of Sciences.
**Specialty:** Glaciology and terrestrial hydrology.
**Research Interests:** Mountain glaciers and ice caps in relation to climate change and the global-water cycle, glacier mass balance monitoring, spatial and temporal distribution of glacier properties, measurement methods for glacier mass balance and runoff, all aspects of glacier regime and meltwater production worldwide, with particular emphasis in the Arctic, Alaska, and Central Asia.



### Detlev Helmig

Fellow of INSTAAR; Associate Research Professor of INSTAAR and the Program in Atmospheric and Oceanic Sciences (PAOS), University of Colorado at Boulder. Ph.D. 1989, University of Duisburg, Germany.
**Specialty:** Surface-atmosphere interactions, atmospheric chemistry and transport, atmospheric measurement techniques.
**Research Interests:** Biosphere-atmosphere trace gas fluxes and their environmental controls, in particular emissions of organic compounds from vegetation; atmospheric transport; deposition processes and atmospheric chemistry; Polar snow-atmosphere gas exchange processes; development, testing and application of analytical tools for field research. Current capabilities include GC, GC/MS, direct-inlet ion trap MS, eddy correlation techniques and meteorological and chemical instrumentation for flux measurements and boundary layer profiling from tethered balloon platforms.

### Mervi Hjelmroos-Koski

Fellow of INSTAAR; Research Scientist, Environmental Health Sciences, School of Public Health, University of California, Berkeley, CA. PhD: 1981, University of Lund, Sweden; DSc: 1989, University of Stockholm, Sweden.

**Specialty:** Palynology, pollen transport and deposition, pollination biology, long-distance transport of biological material, airborne fungal spores.

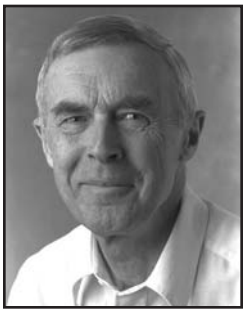
**Research Interests:** (1) annual pollen deposition and pollen-climate calibrations in the Colorado Front Range, to better understand pollen-vegetation relationships and vegetation responses to climate change, (2) composition of atmospheric organic carbon with special reference to pollen grains and fungal spores, and (3) native vegetation responses to invasive pollinators.

### John F. Hoffecker

Fellow of INSTAAR. PhD: 1986, University of Chicago.

**Specialty:** Archaeology and human paleoecology

**Research Interests:** The evolution of human adaptations to cold environments during the Quaternary period. Studies of archaeological sites in Eastern Europe and Alaska. Currently investigating the earliest modern human sites in Russia and the dispersal of modern humans into Eastern Europe (and related disappearance of local Neanderthals). Special focus on the role of technology in the dispersal process. Current research also includes interdisciplinary study of coastal middens in northern Alaska and the origins of modern Inuit culture with a focus on technological innovation.



### John T. Hollin

Fellow Emeritus of INSTAAR. PhD: 1972, Princeton University.

**Specialty:** Glaciology, Quaternary especially last interglacial history.

**Research Interests:** Glacier and ice-sheet profiles, empirical and theoretical. Sea-level evidence for Antarctic melting and/or surging. Gondwana ice surges and Carboniferous coal cyclothems.

### Anne E. Jennings

Fellow of INSTAAR; Associate Professor Attendant Rank of Geological Sciences, University of Colorado. PhD: 1989, University of Colorado at Boulder.

**Specialty:** Paleoceanography, glacial history, foraminifera.

**Research Interests:** Paleoceanography, glacial history, and climate change in high latitude regions, specifically Greenland, Baffin Island, Iceland, and Antarctica. Specializes in using foraminifera for interpreting paleoenvironments and chronology on high-latitude continental shelves.

### Scott J. Lehman

Fellow and Research Professor of INSTAAR. PhD: 1989, University of Colorado at Boulder.

**Specialty:** Paleoclimatology, paleoceanography, radiocarbon research.

**Research Interests:** The role of the oceans in climate change, cycling of heat, fresh water, and carbon by the oceans, paleotemperature applications of marine biomarkers and amino acids, dynamics and consequences of abrupt climate change, radiocarbon calibration, bomb 14C as a tracer in the recent carbon cycle.

### Wesley E. LeMasurier

Fellow of INSTAAR, Professor of Geology, University of Colorado at Denver. PhD: 1965, Stanford University.

**Specialty:** Volcanology and igneous petrology.

**Research Interests:** (1) Volcanoes of Marie Byrd Land, Antarctica: origin and evolution of basaltic and felsic rocks, (2) Relationship of volcanism in Antarctica (esp. Marie Byrd Land) to tectonic environment: West Antarctic rift system, Marie Byrd Land dome, (3) Volcanic record of Cenozoic glacial history in Marie Byrd Land, (4) Geology of hydrovolcanic rocks (hyaloclastites, pillow lavas), (5) Cenozoic volcanoes of Antarctica: distribution and petrologic character.

## David J. Lubinski

Research Scientist of INSTAAR. (in new role at INSTAAR starting 2004). PhD: 1998, University of Colorado at Boulder.
**Specialty:** Glacial geology, paleoceanography, and paleoclimatology of high northern latitudes.
**Research Interests:** Presently investigating (1) the Last Glacial Maximum to present glacier history of the Severnaya Zemlya Archipelago, Russian Arctic, 79°N. Additional projects that will be completed in the coming years are the (1) Late Quaternary glacial history of Vaygatch Island, Russian Arctic, 69°N and (2) several papers related to paleoceanography of the northern Barents and Kara seas.

## William F. Manley

Fellow of INSTAAR. PhD: 1995, University of Colorado at Boulder.
**Specialty:** Quaternary geology, GIS, paleoclimatology, and high-latitude environmental change.
**Research Interests:** Pleistocene glacier fluctuations and paleoclimate forcing for Alaska, through field research and data analysis, including spatial analysis with GIS. Spatial analysis of modern Alaskan glaciers, including links between equilibrium line altitudes and climate. Icefield archeology and remote sensing. Arctic coastal erosion and flooding.

## Tom Marchitto

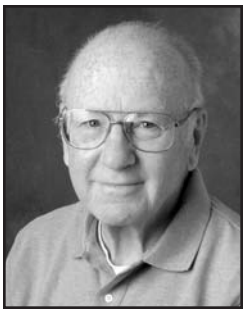
Research Scientist of INSTAAR; Assistant Professor of Geological Sciences, University of Colorado at Boulder. PhD: 1999, MIT/WHOI Joint Program.
**Specialty:** Quaternary paleoclimate, paleoceanography, and past ocean chemistry.
**Research Interests:** Rapid climate change during the late Quaternary, particularly large-scale changes in ocean circulation and chemistry. Specializing in the use the calcitic foraminifera as recorders of physical and chemical properties of seawater, including temperature, salinity, the isotopic composition of dissolved inorganic carbon, and the concentrations of various nutrients.

## Vera Markgraf

Fellow Emeritus of INSTAAR; Research Professor of Geography, University of Colorado at Boulder. PhD: 1968, Bern, Switzerland.
**Specialty:** South America and Southern Hemisphere paleoclimates and interhemispheric paleoclimate correlations.
**Research Interests:** High resolution, multi-proxy paleoclimate analysis, using pollen (vegetation history), charcoal (fire history), and stable isotopes (temperature history) from late-Quaternary lake and bog sediments in southern South America, in collaboration with J. W. C. White and E. Pendall (both INSTAAR) and INSTAAR graduate students. International cooperative research: Patagonian Lake Drilling Project (PATO), focusing on recovery and multi-proxy analysis of sediment cores from large, extra-Andean lakes. Editor of volume *Interhemispheric Climate Linkages,* published in 2000 by Academic Press, representing the outcome of the "Pole-Equator-Pole Paleoclimates of the Americas" (PEP 1) IGBP-PAGES research initiative, that I previously chaired. Co-editor with H.F. Diaz of the volume *El Niño and the Southern Oscillation: Multiscale Variability and Global and Regional Impacts,* published in 2000 by Cambridge University Press.

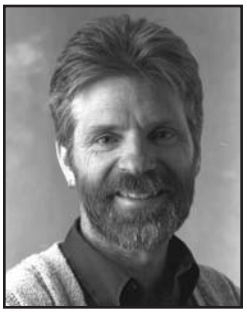
## Diane M. McKnight

Fellow of INSTAAR; Professor of Civil, Environmental and Architectural Engineering, University of Colorado at Boulder. PhD: 1979, Massachusetts Institute of Technology.
**Specialty:** Limnology, biogeochemistry of lakes and streams.
**Research Interests:** Research focuses on interactions between hydrologic, chemical and biological processes in controlling the dynamics in aquatic ecosystems. This research is carried out through field-scale experiments, modeling, and laboratory characterization of natural substrates. Main field sites are located in the Rocky Mountains and in the Transantarctic Mountains, and include pristine and stressed ecosystems, such as acid mine drainage influences on mountain streams. Conducts research focusing on interactions between freshwater biota, trace metals, and natural organic material in diverse freshwater environments, including lakes and streams in the Colorado Rocky Mountains, and in the McMurdo Dry Valleys in Antarctica. Develops interactions with state and local groups involved in mine drainage and watershed issues in the Rocky Mountains. A co-principal investigator in the McMurdo Dry Valley LTER and in the Niwot Ridge LTER.



### Mark F. Meier

Fellow Emeritus of INSTAAR; Professor Emeritus of Geological Sciences, University of Colorado at Boulder. PhD: 1957, California Institute of Technology.
**Specialty:** Glaciology, global change.
**Research Interests:** Glaciers in the Earth system, causes and projections of sea-level change, iceberg calving, surging and calving glaciers, climate change, and global change in general.



### Gifford H. Miller

Fellow of INSTAAR; Professor of Geological Sciences, University of Colorado at Boulder. PhD: 1975, University of Colorado at Boulder.
**Specialty:** Quaternary stratigraphy, geochronology, and paleoclimatology.
**Research Interests:** My primary scholarly interests focus on gaining an improved understanding of how the physical earth system operates. Toward this end, I am specifically interested in using the Quaternary as a means to reconstruct the coupled ocean/atmospheric/ice climate system. By reconstructing past environmental changes it is possible to get a better understanding of the rates and magnitude of natural climate variability, and the various feedback mechanisms in the global climate system. I am also interested in the role of humans in the modification of landscapes and ecosystem on Quaternary timescales.

### Diana R. Nemergut

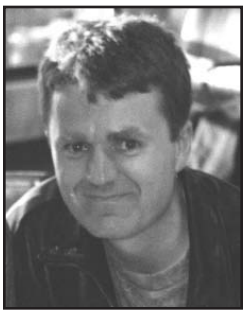
Research Scientist of INSTAAR; Assistant Professor of Environmental Studies, University of Colorado at Boulder. PhD, 2004, University of Colorado, Boulder.
**Specialty:** Microbial ecology and evolution.
**Research Interests:** Horizontal gene transfer in microbial communities. I am currently looking at the role of integrons in genetic exchange in soil and aquatic environments. I am interested in the types of genes that can be exchanged via integrons, as well as the phylogenetic diversity of the organisms that contain integrons.

### Astrid E. J. Ogilvie

Fellow of INSTAAR. PhD: 1982, University of East Anglia, Norwich, U.K.
**Specialty:** The transcription, analysis, and calibration of historical documentary climate records, in particular unpublished manuscript sources, in Icelandic, Danish, Norwegian and Swedish.
**Research Interests:** The environmental, social, and human history of countries bordering the North Atlantic regions, in particular Iceland, Greenland, Norway, and the United Kingdom; the past climate and sea-ice record of Iceland; human and social dynamics in the context of climatic and environmental changes; syntheses of proxy climate records; North Atlantic fisheries history; the Viking period; the Icelandic Sagas; the history and anthropology of wetlands in Iceland and Norway; history of science; constructions of images of the north, especially Iceland; also interdisciplinary research with colleagues in a variety of fields including archaeology and anthropology, in particular through NABO (the North Atlantic Biocultural Organization)—chair of climate working group—and climate history, especially as co-chair of EACH (European and Atlantic Climate Historians).

### Irina Overeem

Research Scientist of INSTAAR. PhD: 2002, Delft University of Technology, the Netherlands.
**Specialty:** Stratigraphy, numerical modeling of fluvio-deltaic processes, uncertainty prediction in sedimentary modeling.
**Research Interests:** My long-term research goal is to develop predictive sedimentary models, which form a tool to quantify responses of sedimentary systems to changing environmental conditions. I do have a keen interest in using field studies to critically assess model performance.



### Scott D. Peckham

Research Scientist of INSTAAR. PhD: 1995, University of Colorado
**Specialty:** Surface water hydrology, geomorphology, scaling analysis, and mathematical modeling
**Research Interests:** Physically-based mathematical and numerical modeling of watershed-scale hydrologic systems, source-to-sink sediment transport, scaling analysis, river networks, theoretical

geomorphology, grid-based computational methods, efficient computer algorithms and fluvial landscape evolution models.

### W. Tad Pfeffer

Fellow and Associate Director of INSTAAR; Associate Professor of Civil, Environmental, and Architectural Engineering, University of Colorado at Boulder. PhD: 1987, University of Washington.
**Specialty:** Glaciology, continuum mechanics, heat transfer.
**Research Interests:** Dynamics of present and past glaciers and ice sheets, through field observational methods and numerical modeling, with emphasis on analysis of stress, deformation and defracture, and iceberg calving and ice/ocean interaction. Also, heat and mass transfer in seasonal and perennial snowpacks and atmospheric and snowpack temperature measurement methods.

### Tim R. Seastedt

Fellow of INSTAAR.; Professor of Ecology and Evolutionary Biology, University of Colorado at Boulder. PhD: 1979, University of Georgia.
**Specialty:** Terrestrial ecosystems and biogeochemistry.
**Research Interests:** Biotic interactions with physical and chemical properties of the environment to control patterns of energy flow and material cycling. Emphasis is placed on soil phenomena, particularly those of grassland and tundra ecosystems.

### Robert F. Stallard

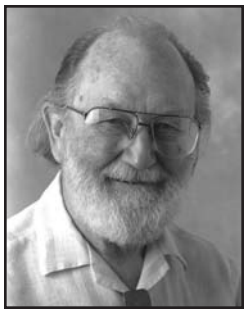
Fellow of INSTAAR; Research Hydrologist of U.S. Geological Survey. PhD: 1980, MIT-WHOI.
**Specialty:** Biogeochemistry, hydrology, and geomorphology.
**Research Interests:** My principal interest is the earth-surface environment and how it changes on human and geologic time scales. Currently, my focus is the study of climate and land-use changes and how these affect processes that control the composition and dispersal of dissolved and solid phases in rivers and trace gases in the atmosphere.

### James P. M. Syvitski

Fellow and Director of INSTAAR; Professor of Geological Sciences, University of Colorado at Boulder. PhD: 1978, University of British Columbia (1) Geological Sciences, 1st class, (2) Oceanography, 1st Class.
**Specialty:** Sedimentology, oceanography, hydrology, numerical modeling (climate-ice-water-sediment interactions), marine geophysics, slope instabilities, seafloor acoustics.
**Research Interests:** Presently investigating: (1) the discharge dynamics of global rivers and the sediment load they carry, (2) the morphology and deposits of continental margins, (3) the impact of high-energy weather events on our coastline; and (4) the impact of ice sheets on high-latitude shelves and slopes.

### Alan R. Townsend

Fellow of INSTAAR; Associate Professor of Ecology and Evolutionary Biology, University of Colorado at Boulder. PhD: 1994, Stanford University.
**Specialty:** Terrestrial biogeochemistry/ecosystem ecology.
**Research Interests:** Carbon and nitrogen dynamics at regional to global scales; phosphorus controls over C and N in moist tropical systems; nutrient controls over soil carbon storage; human health effects of a changing N cycle.



### Mort D. Turner

Fellow Emeritus of INSTAAR (deceased, 2004). PhD: 1972, University of Kansas.
**Specialty:** Glacial and archaeological geology.
**Research Interests:** Active research interests are (1) glacial geology and archaeological geology of southwestern Montana, (2) environment and archaeological geology of late Pleistocene ice-sheet margins in the U.S.A., (3) geology and mineral resources of Antarctica, (4) tectonic development of the Caribbean region, and (5) archaeological geology of early man in the Americas, China, and Russia.

## James W.C. White

Fellow of INSTAAR; Professor of Geological Sciences; Director of the Environmental Studies Program, University of Colorado at Boulder. PhD: 1983, Columbia University.
**Specialty:** Global change, paleoclimate dynamics, biogeochemistry.
**Research Interests:** Stable isotope laboratory: global scale climate and environmental dynamics, carbon dioxide concentrations and climate from stable hydrogen isotopes peats and other organics, climate from deuterium excess and hydrogen isotopes in ice cores; isotopes in general circulation models; modern carbon cycle dynamics via isotopes of carbon dioxide and methane.

## Mark W. Williams

Fellow of INSTAAR; Professor of Geography, University of Colorado at Boulder. PhD: 1991, University of California-Santa Barbara.
**Specialty:** Alpine biogeochemistry, hydrology, and snow hydrology.
**Research Interests:** The processes that determine the hydrochemistry and biogeochemistry of high-elevation basins including the storage and release of solutes from the snowpack, biogeochemical modifications of snowpack runoff, nutrient cycling, and hydrologic pathways and residence time. Current projects include the Rocky Mountains, Ecuadorian and Bolivian Andes, and Central Asian areas of Kazakhstan, Kirghizia, and China.

## Connie A. Woodhouse

Fellow of INSTAAR; Physical Scientist of Paleoclimatology Branch of the National Climatic Data Center, U.S. Department of Commerce, National Oceanographic and Atmospheric Administration. PhD: 1996, University of Arizona.
**Specialty:** Paleoclimatology, dendrochronology, climatology
**Research Interests:** Research has focused on the generation and interpretation of high-resolution records of climate for the past 2,000 years. Current research projects concern tree-ring reconstructions of drought for the Great Plains and Rocky Mountains, as well as investigations into the mechanisms of long terms drought and impacts on ecosystems and disturbance regimes. Other work addresses millennial length reconstructions of temperature and atmospheric circulation for the northern Rockies and western U.S.A.. Recent projects target ways to generate dendrohydrologic reconstructions that are more useful to water resource managers.

A group of INSTAAR Directorate members, February 2005. Photo: T. Pfeffer (INSTAAR).

### Other Directorate Members

**Yarrow Axford**
Representative, Graduate Students

**Nicole Barger**
Representative, Postdoctoral Research Scientists

**Larry Bowlds**
Managing Editor of *Arctic, Antarctic, and Alpine Research*

**Jason Briner**
Representative, Postdoctoral Research Scientists

**Julie Hughes**
Chief Financial Officer

**Dan Liptzin**
Representative, Graduate Students.

**Jeff Lukas**
Representative, Professional Scientists

**Vicky Nelson**
Assistant to the Director

**Connie Oehring**
Managing Editor of *Arctic, Antarctic, and Alpine Research* (departed 2004)

**Ursula Quillmann**
Representative, Graduate Students

**Shelly Sommer**
Manager of the INSTAAR Information Center

**Bruce Vaughn**
Laboratory Facilities

# INSTAAR Visiting Scientists

**Dr. Inge Aarseth**
Department of Geology,
University of Bergen.
Host: James Syvitski.

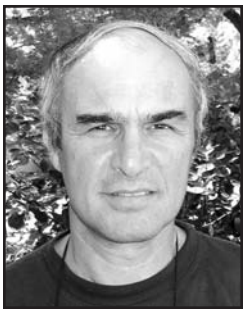
**Dr. Daekyo Cheong**
Kangwon National
University.
Host: Irina Overeem.

**Dr. Najat Bhiry**
Université Laval.
Host: James Syvitski.

**Dr. Snehalata Huzurbazar**
University of Wyoming.
Host: Tad Pfeffer.

**Dr. Yu'suke Kubo**
University of Tokyo.
Host: James Syvitski.

**Dr. Meredith Newman**
Chemistry and Geology, Hartwick College, Oneonta, New York.
Host: Mark Williams.



**Dr. Iggy Litaor**
Tel-Hai Academic College, Israel.
Host: Tim Seastedt.

**Dr. Lothar Schrott**
Geomorphological Research Unit, Department of Geography, University of Bonn.
Host: Nel Caine.

**Dr. Gaute Mikalsen**
University of Tromsø, Norway.
Host: Anne Jennings.

**Dr. Hans Petter Sejrup**
University of Bergen.
Hosts: John Andrews and Gifford Miller.

Three of INSTAAR's Visiting Scientists (Hans Petter Sejrup, Daekyo Cheong, and Yu'suke Kubo), February 2005.
Photo: T. Pfeffer (INSTAAR).

# INSTAAR Affiliates

## Ecosystems

**Richard Boyce**
Department of Biological Sciences, Northern Kentucky University. PhD: 1990, Yale University.
Plant physiological ecology.

**Paul Brooks**
Assistant Professor, Hydrology and Water Resources, University of Arizona. PhD: 1995, University of Colorado at Boulder.
Biogeochemical cycling of carbon and nutrients, hydrological linkages between terrestrial and aquatic systems, effects of disturbance on natural systems.

**Hector Galbraith**
CEO, Galbraith Environmental Sciences, Boulder, CO. PhD: 1986, Glasgow University.
Anthropogenic disturbances and arctic/alpine bird and plant communities.

**Stephen Jackson**
Assistant Professor, Botany, University of Wyoming. PhD: 1983, Indiana University.
Verification of the range of vegetation responses to environmental changes, and delineation of the relationships between modes of response and the magnitudes and rates of environmental forcing.

**Timothy Kittel**
Natural Resource Ecology Laboratory, Colorado State University. PhD: 1986, University of California, Davis.
Ecological response to climate variability at interannual through centennial time scales.

**Amy Miller**
Institute for Computational Earth Systems Science, UC – Santa Barbara. PhD: 2002 University of Colorado at Boulder.
Plant physiological ecology/ecosystem ecology, uptake of organic and inorganic nitrogen by alpine tundra plants.

### Cynthia Nevison
National Center for Atmospheric Research (NCAR). PhD: Stanford University.

Ocean nitrogen cycle, nitrous oxide budget, carbon-nitrogen biogeochemistry, stratosphere-troposphere interactions.

### Herman Sievering
Professor, Environmental Science Program & Physics Department, University of Colorado at Denver. PhD: 1971, University of Illinois.

Atmospheric physics and chemistry.

### Sarah Spaulding
Research Scientist, U.S. Geological Survey, Denver, Colorado. PhD: 1996, Colorado State University.

Environmental, geologic, and evolutionary change through paleoecology, systematics, and biogeography of freshwater diatoms.

### Heidi Steltzer
Postdoctoral Research Scientist, Department of Forest Sciences, Colorado State University. PhD: 1999, University of Colorado at Boulder.

Ecosystem development, nutrient retention, and scaling plant effects.

### Cathy Tate
Research Biologist, Water Resources Division, U.S. Geological Survey, Denver Federal Center. PhD: 1985, Kansas State University.

Ecology and biogeochemistry of temperate and Antarctic streams.

### Howard E. Taylor
Research Chemist and Project Chief, Environmental Analytical Chemistry and Water Quality Project, National Research Program, Water Resources Division, U.S. Geological Survey, Boulder, CO. PhD: 1970, Colorado State University.

Water chemistry and trace element analysis.

Vladimir Konovalov (Institute Geography, Moscow, and INSTAAR Affiliate) with colleagues after his lecture on modeling glacier runoff, Department of Geography, Trent University, Peterborough, Canada, September 2004. Left to right: C. McKenna-Neumann, V. Konovalov, G. Cogley, S. Admiral, J. Buttle, and P. Lafleur. Photo: V. Konovalov.

## Geophysics

### Edmund Andrews
Chief River Mechanics Project, National Research Program, U.S. Geological Survey, Denver Federal Center. PhD: 1977, University of California at Berkeley.

Sedimetation.

### David B. Bahr
Associate Professor, Regis University, Denver, Colorado. PhD: 1993, University of Colorado at Boulder.

Glaciology and computer science.

### Gary Clow
Chief, Cryospheric Studies Project, U.S. Geological Survey, Earth Surface Dynamics program, Denver Federal Center.

Climate observing systems, permafrost, borehole paleo-thermometry, climate modeling.

### Andrew G. Fountain
Professor, Department of Geology, Portland State University. PhD: 1992, University of Washington.

Glacier hydrology.

### Pierre Julien
Professor, Department of Civil Engineering, Colorado State University. PhD: 1983, Laval University.

Hydrology and sediment transport modeling.

### Vladimir G. Konovalov
Chief, Department of Regional Projects, Central Asian Regional Research, Hydrometeorological Institute, Republic of Uzbekistan. PhD: 1964, Leningrad State University, USSR; 1983, USSR Academy of Sciences, Irkutsk, USSR.

Glaciology and hydrometeorology.

### John Pitlick
Associate Professor, Department of Geography, University of Colorado at Boulder. PhD: 1988, Colorado State University.

Geomorphology and sediment transport modeling.

### Lincoln Pratson
Associate Professor, Division of Earth & Ocean Sciences, Duke University. PhD: 1993, Columbia University.

Marine geology and geophysics.

## Past Global Change

### Larry Benson
U.S. Geological Survey, Denver Federal Center. PhD: 1974, Brown University.

Quaternary fluctuations of closed basin lakes.

**Parker E. Calkin**
Emeritus Professor of Geology, State University of New York at Buffalo. PhD: 1963, Ohio State University.
Glacial Geology, Geomorphology, Quaternary Geology.

**Julia Cole**
Associate Professor, Department of Geosciences, University of Arizona. PhD: 1992, Columbia University.
Recent tropical climate variability, coral geochemical records, hydrologic cycle stable isotopes, North American drought.

**P. Thompson Davis**
Professor, Natural Sciences Department, Bentley College. PhD: 1980, University of Colorado at Boulder.
Glacial and Quaternary stratigraphy, cosmogenic exposure dating, lacustrine sedimentology, tephrochronology, palynology.

**Scott Elias**
Reader of Geography, Royal Holloway-University of London. PhD: 1980, University of Colorado at Boulder.
The paleoecological, paleoclimatic, zoogeographic, and evolutionary implications of insect fossil assemblages from the Quaternary period.

**Daniel Grossman**
Freelance Journalist. PhD: 1993, Massachusetts Institute of Technology.
Radio stories and magazine articles; working on climate change trade book.

**Richard F. Madole**
Scientist Emeritus, Earth Surface Processes Team, U.S. Geological Survey. PhD: 1963, Ohio State University.
Surficial geology, geomorphology, Quaternary stratigraphy and dating techniques, and the application of these disciplines to determining recurrence intervals of natural hazards.

**Gregory McCabe**
Physical Scientist, U.S. Geological Survey, Denver, CO. PhD: 1986, Louisiana State University.
Hydro-climatic processes and hazards.

**Daniel R. Muhs**
Research Geologist, Earth Surface Processes Team, U.S. Geological Survey. PhD: 1980, University of Colorado.
Quaternary geology and paleoclimatology, soils, geomorphology, geochronology.

**Alan R. Nelson**
Geologic Hazards Team, U.S. Geological Survey, Golden CO. PhD: 1978, University of Colorado at Boulder.
Paleoseismology and active faulting of U.S. Pacific Northwest, Holocene sea-level history applied to neotectonics, earthquake and tsunami hazards.

Gifford Miller (INSTAAR, right) and P. Thompson Davis (Bentley College and INSTAAR Affiliate, left) hunt for shells in exposed sediments to help date advances and retreats of the Laurentide Ice Sheet in the Aston Lowlands, northeastern Baffin Island, Canada, May 2003. Photo: J. Briner (INSTAAR).

The hunt is successful: a rich layer of shells that will help date advances and retreats of the Laurentide Ice Sheet in the Aston Lowlands, northeastern Baffin Island, Canada, May 2003. Photo: J. Briner (INSTAAR).

Neal Michelutti (University of Alberta) awaits a labeled sample bag from P. Thompson Davis (Bentley College and INSTAAR Affiliate) during the subsampling of a surface sediment core from a moraine-dammed lake near Perfection Pass, Inugsuin Fiord, northeastern Baffin Island, May 2003. Michelutti is using diatom assemblages and other proxies to monitor the effects of global warming in "pristine" arctic environments. Photo: J. Briner (INSTAAR).

### Mel Reasoner

Mountain Research Initiative Coordination Office, Bern, Switzerland. PhD: University of Alberta.

Paleoecology of alpine environments, pollen and macrofossil analysis and lake-coring techniques, target preparation for AMS dating.

### Richard Reynolds

U.S. Geological Survey, Denver Federal Center. PhD: 1975, University of Colorado at Boulder.

Geologic records of climate change; environmental magnetic studies.

### Eric J. Steig

Associate Professor, Geophysics/Quaternary Research Center, University of Washington, Seattle. PhD: 1996, University of Washington.

Isotope geochemistry, glaciology.

### Robert S. Thompson

Team Chief Scientist, Earth Surface Processes Team, U.S. Geological Survey. PhD: 1984, University of Arizona.

Paleoclimatology, palynology, plant macrofossil studies, plant-climate relations, vegetation change, and paleohydrology.

### Robert S. Webb

Physical Scientist, NOAA Climate Diagnostics Center, Boulder, Colorado. PhD: 1981, Brown University.

Paleoclimate research, past and future global change.

Reconstructing Late Quaternary climate change from the geologic record and using numerical models to investigate the mechanisms of the past climate and environmental change.

### Alexander P. Wolfe

Associate Professor, Department of Earth & Atmospheric Sciences, University of Alberta. PhD: 1994, Queen's University.

Paleolimnology, freshwater diatoms, environmental change as registered in the sediments of arctic and alpine lakes.

# Postdoctoral Research Scientists

**Lisa Barlow**
PhD: 1994, University of Colorado at Boulder. High resolution paleoclimatology, climate/societal interactions.

**Nichole Barger**
PhD: 2003, Colorado State University. Nutrient cycling in arid ecosystems and the use of dendrochronological techniques to examine pinyon-juniper woodland expansion in the western U.S.A.

**Jason Briner**
PhD: 2003, University of Colorado at Boulder. Quaternary paleoclimatology, glacial geology, cosmogenic isotope geochemistry, geochronology.

**Cory Cleveland**
PhD: 2001, University of Colorado at Boulder. Terrestrial biogeochemistry and microbial ecology.

**Dominic Ferretti**
PhD: 1999, Victoria University of Wellington, New Zealand. Experimental technique development and isotopic analysis of atmospheric trace gases as indicators of climate change.

**Jacqueline Flückiger**
PhD: 2003, University of Bern, Switzerland. Modeling the dynamics of glacial climate change.

**Hope Humphries**
PhD: 1993, Colorado State University. Landscape ecology, ecological modeling, conservation planning.

**Mark Kessler**
PhD: 2002, Scripps Institution of Oceanography–University of California, San Diego. Geomorphology, modeling pattern formation in natural systems

**Yusuke Kubo**
PhD: 2000, Kyoto University, Japan. Sedimentology, sediment transport processes in the deep sea.

**Helmut Mayer**
PhD: 1996, Eberhard-Karls-Universität, Tübingen, Germany. Quantitative stratigraphy, paleomagnetism, structural geology, glaciology, marine geology, geomathematics, and geophysics.

**John Miller**
PhD: 1999, University of Colorado at Boulder. Isotopic composition of radiative trace gases and biosphere atmosphere interactions.

**Katherine Nash Suding**
PhD: 1999, University of Michigan. Plant community ecology, plant species effects on ecosystem function.

**J. Scott Stewart**
PhD: 2000, University of Colorado at Boulder. Three-dimensional sediment modeling.

**Joseph Stoner**
PhD: 1995, Université du Québec à Montréal (UQAM). Quaternary paleoceanography, paleoclimatology and paleomagnetism; magnetic methods (paleo- and environmental magnetism) to date and interpret the Earth's past from Quaternary sediments.

Three of INSTAAR's Postdoctoral Research Scientists (Jacqueline Flückiger, Irina Overeem, and Nichole Barger). Photo: T. Pfeffer (INSTAAR).

# Senior Research and Professional Scientists and Research Support Personnel

## Senior Research Scientist

### Chris Jenkins
PhD, Cambridge, UK. *Research Interests:* Marine geosciences, seabed information processing and mapping, development of Geographic Information System (GIS) visualizations and rule-based GIS expert systems.

## Professional Scientists and Research Support Personnel

### Todd Ackerman
Primary Duties: LTER data and information management. *Research Interests:* Data management and information technology. *Supervisor:* Tim Seastedt.

### Henry Adams
*Primary Duties:* Tree-ring sample collection, preparation, dating, measurement, and quality-control analysis. *Research Interests:* Dendroecology, effects of climate change on forests, tree ecophysiology. *Supervisor:* Connie Woodhouse.

### Kathy Anderson
*Primary Duties:* Paleoclimatological studies on a continental scale in North America, using pollen, plant macrofossils, and modern vegetation to look at past and future climate and vegetation changes. *Supervisor:* Connie Woodhouse.

### Jon Arnarson
*Supervisor:* Wendy Roth.

### Vera Balaeva
*Supervisor:* Mark Dyurgerov.

### Heather Bechtold
*Primary Duties:* Lab and Field Manager. *Research Interests:* Plant-soil interactions, competitive strategy, and community dynamics. *Supervisor:* Tim Seastedt and Bill Bowman.

### Florence Bocquet
*Primary Duties:* Assistant Laboratory Manager of the Atmospheric Research Laboratory. Development, testing and application of analytical tools for field measurements. *Research Interests:* Arctic/Antarctic snow-atmosphere gas exchange. *Supervisor:* Detlev Helmig.

### Kurt Chowanski
*Primary Duties:* Maintaining and operating instruments measuring total dissolved nitrogen and carbon. *Research Interests:* Dissolved organic matter. *Supervisor:* Mark Williams.

### Valerie Claymore
*Primary Duties:* Operating and maintaining mass spectrometers, analyzing air samples for stable isotopes in collaboration with NOAA. *Research Interests:* Carbon cycling through all systems. *Supervisor:* Bruce Vaughn.

### Briana Christine Constance
*Primary Duties:* Manage Terrestrial Biogeochemistry Lab. *Research Interests:* Soil biogeochemistry. *Supervisor:* Alan Townsend.

### Andrew Crotwell
*Primary Duties:* Laboratory Manager, Sediment Geochemistry Lab. *Research Interests:* Climate reconstruction using alkenone-derived sea-surface temperatures. *Supervisor:* Scott Lehman.

### Stephen DeVogel
*Primary Duties:* Laboratory Manager, Amino Acid Lab. *Supervisor:* Gifford Miller.

### Mark Dreier
*Primary Duties:* Assistant Laboratory Manager in Stable Isotope Laboratory. Provide technical expertise with the hardware, develop new systems, maintain old systems, and rebuild mass spectrometers and vacuum pumps. *Supervisor:* Bruce Vaughn.

### Sylvia Englund
*Primary Duties:* Isotopic analysis in greenhouse gases. *Research Interests:* Stable isotopes in atmospheric carbon dioxide and methane. Changes in biogeochemical cycles caused by invasive species. *Supervisor:* Bruce Vaughn.

### Greg Estep
*Primary Duties:* Operating and maintaining mass spectrometers for oxygen and deuterium isotopes in water samples primarily from arctic ice cores. *Research Interests:* Ice core paleoclimatology and its implications for global climate change. *Supervisor:* Bruce Vaughn.

### Charles Hart
*Primary Duties:* Data collection, information management for the Amino Acid Geochronology Laboratory, Center for Geochronological Research. *Supervisor:* Giff Miller.

### Jacques Hueber
*Primary Duties:* Development of instrumentation for atmospheric measurements. Maintenance of existing instruments. *Supervisor:* Detlev Helmig.

### Eric Hutton
*Primary Duties:* Maintain and develop numerical models that predict the spatial and temporal distribution of marine sediments. *Research Interests:* Sediment transport, computational fluid dynamics, and geophysics. *Supervisor:* Scott Peckham.

### Chris Jaros
*Supervisor:* Diane McKnight.

### Albert Kettner
*Primary Duties:* Develop numerical code of hydrological process model HYDROTREND, develop and maintain web-based GIS applications, collect paleoclimate data for scenario modeling. *Research Interests:* Programming and GIS applied to earth-science issues. *Supervisor:* James Syvitski.

### Richard Kraemer
*Primary Duties:* Stable isotopes in atmospheric methane. *Research Interests:* Stable isotopes in atmospheric methane and the biological sources. *Supervisor:* James White.

### Julia Larson
*Supervisor:* Tim Seastedt.

### Mark Losleben
*Primary Duties:* Long-term climatic database management, atmospheric and precipitation measurements. *Research Interests:* Long-term climatic trends and related processes effecting Niwot Ridge. *Supervisor:* Bill Bowman.

### Jeff Lukas
*Primary Duties:* Tree-ring sample collection, dating, measuring, and data analysis. *Research Interests:* Climate variability in the interior West and its effects on human activities and ecosystems. *Supervisor:* Connie Woodhouse.

### David Mixon
*Primary Duties:* Develop terrain analysis techniques to calculate and visualize long-term coastal sedimentation trends using existing numerical models. *Research Interests:* Application of geographic information systems (GIS) to problems relating to erosion and sediment movement. Specifically: Sedimentation in man-made reservoirs, post-wildfire erosion processes, and the effects of climate and land-use change on erosion and sedimentation. *Supervisor:* James Syvitski.

### Curtis Nepstad-Thornberry
*Primary Duties:* Tree-ring preparation, dating, measuring, and chronology compilation. *Research Interests:* Settlement ecology, New World paleobotany, Geographic Information Systems, quantitative methods. *Supervisor:* Connie Woodhouse.

### Sean Pack
*Primary Duties:* Stable isotope techniques, design and development of instrumentation, paleoclimatology. *Research Interests:* Designing, building, and maintaining instrumentation for stable isotopes; application of stable isotopes in paleoclimatology and archaeology. *Supervisor:* Bruce Vaughn.

### Andy O'Reilly
*Primary Duties:* LTER Field Technician. *Research Interests:* Snow science, mountain climatology, structural geology, glaciology, DC power systems. *Supervisor:* Tim Seastedt.

### Eric Parrish
*Primary Duties:* Create graphics and GIS based products, information and image management, scientific illustration, and support. *Research Interests:* Scientific illustration, ArcGIS, remote sensing and graphic software applications. *Supervisor:* E. James Dixon.

### Jan Pollmann
*Primary Duties:* Quantification of anthropogenic and biogenic volatile organic compounds using gas chromatography techniques . *Research Interests:* Anthropogenic and biogenic trace gas sources and their measurement. *Supervisor:* Detlev Helmig.

### Christine Seibold
*Primary Duties:* Environmental Chemistry Laboratory Manager. *Research Interests:* Long-term ecological research chemistries. *Supervisor:* Tim Seastedt.

### Steve Seibold
*Primary Duties:* Manager Mountain Research Station. *Supervisor:* Bill Bowman.

### Jocelyn Turnbull
*Primary Duties:* Manages Laboratory for AMS Radiocarbon Preparation and Research which provides radiocarbon dating services to the NSF-ESH community as well as in house research. *Research Interests:* improved radiocarbon dating techniques. *Supervisor:* Scott Lehman.

### Joanne Turner
*Primary Duties:* Geoarchaeological Assistant. *Research Interests:* Earliest peopling of the Americas and sources of raw materials for stone tools. *Supervisor:* James Syvitski.

**Erin van Matre**
*Supervisor:* Diane McKnight.

**Bruce Vaughn**
*Primary Duties:* Oversees the operation of the Stable Isotope Lab that performs isotopic analyses on atmospheric CO2, CH4, polar ice cores, water, and organic materials. The facility is comprised of several labs, and houses multiple prep systems, off line extraction systems, computing facilities, and six mass spectrometers. *Research Interests:* Collaborative isotopic studies in ice cores, glaciers, atmospheric gases, and global change in general. *Supervisor:* Jim White.

**Megan Walsh**
*Supervisor:* Tim Seastedt.

**Nancy Weiner**
*Primary Duties:* Micropaleontology Laboratory Technician, supervises students and conducts foraminiferal analysis. *Research Interests:* Micropaleontology. *Supervisor:* Anne Jennings.

**Kris White**
*Primary Duties:* Research assistant providing support to Townsend and White for the Carbon, Climate, and Society Initiative IGERT Program. *Supervisor:* Alan Townsend.

**Chad Wolak**
*Primary Duties:* Laboratory Manager, Sediment Geochemistry Lab. *Research Interests:* Climate reconstruction using alkenone-derived sea-surface temperatures. *Supervisor:* Scott Lehman.

**Chi Yang**
*Primary Duties:* Data Manager for McMurdo Dry Valleys Long-Term Ecological Research (MCMLTER). *Supervisor:* Diane McKnight.

**Melanie Zauscher**
*Supervisor:* Bruce Vaughn.

A group of INSTAAR Professional Scientists and Research Support Personnel, February 2005. Front row from left: David Mixon, Todd Ackerman, Bruce Vaughn, Valerie Claymore, and Sylvia Englund. Back row: Eric Parrish, Albert Kettner, Sean Pack, and Richard Kraemer. Photo: T. Pfeffer (INSTAAR).

# Administrative, Classified, Computer, Editorial, and Library Staff

**Larry Bowlds**
Managing Editor of INSTAAR's interdisciplinary journal: *Arctic, Antarctic, and Alpine Research* (AAAR).

**Kathryn Clegg**
Accounting Technician III, provides grants and contract management.

**Mary Fentress**
Accounting Technician III, provides grants and contract management.

**Sedrick Frazier**
Accounting Technician III, provides grants and contract management.

**Jenifer Hall-Bowman**
Administrative Assistant II, provides assistance for Journal and Information Center.

**Julie Hughes**
Chief Financial Officer, acts as main financial officer for the institute and its faculty.

**Martha LaForge**
Administrative Assistant I, provides administrative support for the Institute.

**David Lubinski**
Webmaster (part-time).

**Wesley Mendez**
Accounting Technician III, provides grants and contract management.

**Vicky Nelson**
Assistant to Director, provides administrative support to the Director of the Institute, the Chief Financial Officer, Institute Committees, and Institute Members.

**Connie Oehring**
Managing editor of INSTAAR's interdisciplinary journal: *Arctic, Antarctic, and Alpine Research* (AAAR) (departed in 2004).

**Wendy (Freeman) Roth**
Sediment Lab Coordinator.

**Shelly Sommer**
Manager of INSTAAR's Information Center.

**Chad Stoffel**
System/Network Administrator (full-time).

**James Syvitski**
Director.

A group of INSTAAR staff, February 2005. Front row from left: Julie Hughes, Mary Fentress, Kathryn Clegg, Shelly Sommer, and Martha LaForge. Back row: Sedrick Frazier, Wesley Mendez, Chad Stoffel, and Larry Bowlds. Photo: T. Pfeffer (INSTAAR).

# Students

Graduate and undergraduate students are an integral part of INSTAAR, and they play important roles in the research conducted by the institute and its members. INSTAAR students are registered for degree programs in an appropriate department and college. The graduate students have a weekly seminar series at INSTAAR, fostering contacts between the students in different departments. An annual retreat at the Mountain Research Station for incoming students and teaching faculty, and a senior student mentorship program, have been established to facilitate integration into INSTAAR. Financial support is available for INSTAAR graduate students as research assistants employed on research grants. Undergraduate support is available through special programs sponsored by INSTAAR, the university, industry, and agencies such as the National Science Foundation and are designed to encourage undergraduate participation in research. They include the Summer Undergraduate Research Program (SURE), Summer Undergraduate Research Fellowships (SURF), Summer Minority Access Research Training (SMART), Undergraduate Research Opportunities (UROP), University Mentoring Program (UMP), and Research Experience for Undergraduates (REU). Undergraduate research may lead to honors theses and internships. These programs have contributed greatly to the feasibility of including undergraduate students in INSTAAR research and to encouraging undergraduate students to continue to advanced degrees. Prospective graduate students should contact the department that they wish to enter and apply for admission to the University of Colorado. Suitable departments include CEA Engineering, EPO Biology, Geography, Geological Sciences, and Program in Atmospheric and Oceanic Sciences (PAOS). Applications forms are available from the Graduate School, 30 UCB, University of Colorado, Boulder, CO 80309-0030. For specific INSTAAR-related questions, send email to instaar-info@instaar.colorado.edu or contact individual INSTAAR professors directly (see the INSTAAR website at http://instaar.colorado.edu). Martha Laforge is the liason for graduate students and departments (Martha.LaForge@Colorado.edu).

## INSTAAR Graduate Students 2003-2004

*Student Name, Degree, Department, Advisor. Approximate thesis topic or title.*

Craig Anderson, MS, Geography, Mark Williams. Thesis combines snow hydrology, GIS, and remote sensing.

A group of INSTAAR Graduate Students, February 2005. From left: Saedis Olafsdottir, Ursula Quillmann, Hrafnhildur Hannesdottir, Greta Bjork Kristjansdottir, Jan Pollmann, Ken Mack, Maureen Mason, and Craig Lee.
Photo: T. Pfeffer (INSTAAR).

Paul Abood, MS, Geography, Mark Williams. Thesis relates to the analysis of deposition data for PRIMENet National Parks.

Craig Anderson, MS, Geography, Mark Williams. Thesis combines snow hydrology, GIS, and remote sensing.

Marcella Appel, MS, Civil, Environmental and Architectural Engineering, Diane McKnight. "Photochemical Effects on the Copper Binding Capacity of Stream and Wetland Humic Substances in the Colorado Rocky Mountains."

Nataly Ascarrunz, PhD, Ecology and Evolutionary Biology, Tim Seastedt. Dissertation relates to carbon cycling and changes in land use.

Rebecca Atkinson, MS, Geological Sciences, Gifford Miller. Theses topic involves Arctic Holocene climate change on Baffin Island.

Yarrow Axford, PhD, Geological Sciences, Gifford Miller. "Lacustrine Oxygen-Isotopic Records of Climate Change in Northern Iceland."

Carleton Bern, PhD, Ecology and Evolutionary Biology, Alan Townsend. Dissertation focuses on nutrient cation cycling in tropical forests.

Jessica Black, PhD, Geological Sciences, Gifford Miller. "Investigating the Holocene Thermal Maximum at Hvitarvatn, Iceland."

Florence Bocquet, PhD, Program of Atmospheric and Oceanic Sciences (PAOS), Detlev Helmig. "Ozone Fluxes in the Boundary Layer at Summit, Greenland and Snowpack Ozone at Niwot Ridge, CO."

Nehalem Breiter, MA, Ecology and Evolutionary Biology, Tim Seastedt. "Host Specificity of Biological Control Agents."

Jason Briner, PhD, Geological Sciences, Gifford Miller. "The Last Glaciation of the Clyde Region, Northeastern Baffin Island, Arctic Canada."

Cynthia Cacy, PhD, Environmental Studies, Suzanne Anderson. "Chemical Weathering in Glacial Environments."

Karie Cherwin, PhD, Ecology and Evolutionary Biology, Tim Seastedt. Dissertation relates to invasive plants in grassland ecosystems; restoration and ecosystem ecology.

Lana Cohen, MS, Program in Atmospheric and Oceanic Sciences, Detlev Helmig. Thesis relates to atmospheric boundary layer conditions at Summit, Greenland.

Daniel Cordalis, MS, Geography, Mark Williams. Thesis relates to alpine hydrology and flowpaths.

Rose Cory, PhD, Civil, Environmental and Architectural Engineering, Diane McKnight. "Effect of Dissolved Organic Matter on the Photolytis of Persistent Organic Pollutants in Arctic Surface Waters."

Yarrow Axford (INSTAAR) subsampling a core of lake sediment, Langavatn, Skagi Peninsula, north Iceland, July 2003. Axford is using subfossil chironomid assemblages and light stable isotopes in their chitin to reconstruct the summer temperature history of Iceland during the Holocene. Photo: J. Briner (INSTAAR).

Yarrow Axford (INSTAAR) and Donna Francis (Univ. of Massachusetts) use a small boat to sample lacustrine surface sediments, Litlasjosver, south central Iceland, July, 2003. Photo: J. Briner (INSTAAR).

Roy Coulthard, MS, Geological Sciences, Gifford Miller. "The Glacial and Sea Level History of the Aston Lowlands, East-Central Baffin Island, Nunavut, Canada."

Karen Cozzetto, PhD, Civil, Environmental and Architectural Engineering, Diane McKnight. Dissertation relates to hydrology in the Dry Valleys, Antarctica.

Tiffany Duhl, Program in Atmospheric and Oceanic Sciences, Detlev Helmig.

Gita Dunhill, PhD, Geological Sciences, James Syvitski and Anne Jennings. "Greenland and Iceland Margins: A Comparison of Depositional Processes under Different Glaciologic and Oceanographic Settings".

Sabre Duren, MS, Civil, Environmental and Architectural Engineering, Diane McKnight. "Spatial and Temporal Variation of Iron and Zinc in a Mountain Stream Receiving Multiple Sources of Acid Rock Drainage."

Erika Engelhaupt, PhD, Ecology and Evolutionary Biology, Alan Townsend. Dissertation relates to soil biogeochemistry and ecosystem processes.

Tyler Erickson, PhD, Geography, Mark Williams. "Development and Application of Geostatistical Methods to Modeling Spatial Variation in Snowpack Properties, Front Range, Colorado."

Erick Robert Erwin, MA, Anthropology, James Dixon. Thesis topic to be determined.

Beth Bartel (UNAVCO) and Justin Joslin (INSTAAR) help with a tracer experiment studying stream thermal processes, McMurdo Dry Valleys, Antarctica, January 2004. Photo: K. Cozzetto (INSTAAR).

Colleen Flanagan, MS, Environmental Studies, Diane McKnight. Thesis relates to alpine aquatic ecosystems.

Eileen Gardner, MA, Ecology and Evolutionary Biology, Diane McKnight and William Lewis. "Effects of Nutrient Enrichment on Phytoplankton in an Alpine Lake, Colorado, U.S.A."

Zack Guido, MS, Geological Sciences, Robert Anderson. Thesis relates to the Last Glacial Maximum in the San Juan Mountains, Colorado.

Anne Hickey, PhD, Environmental Studies, Diane McKnight. Dissertation relates to remote sensing and Alaskan North Slope hydrology and climate change.

Nancy Hoalst-Pullen, PhD, Geography, Robert Stallard. "Effects of Soil-borne Resources on the Structure and Dynamics of Lowland Tropical Forests."

Keri Holland, PhD, Ecology and Evolutionary Biology, Alan Townsend. "The Fate of Excess Nitrogen in Alpine Tundra."

Eric W. H. Hutton, PhD, Geophysics, James Syvitski. "Modeling Sediment Delivery and Dispersion within the Coastal Ocean: Scaling across Space and Time."

Jason Janke, PhD, Geography, Nel Caine. "Rock Glaciers in the Front Range: an Analysis of Topoclimatic Variables, Permafrost Distribution, and Long-term Flow Rates."

Justin Joslin, MS, Civil, Environmental and Architectural Engineering, Diane McKnight. Thesis relates to streamwater chemistry in the McMurdo Dry Valleys LTER, Antarctica.

David Kinner, PhD, Geological Sciences, James Syvitski. "Multi-scale Estimation of Erosion and Deposition in the Mississippi River Basin."

Meredith Knauf, MS, Geography, Mark Williams. "Rock Glaciers as Contributors to Water Quality in Alpine Catchments: Green Lakes Valley, Colorado, USA."

Greta Bjork Kristjansdottir, PhD, Geological Sciences, John T. Andrews. Dissertation relates to reconstructing Late Quaternary paleoclimatic variations on the Iceland shelf with Mg/Ca and ‰18O in foraminifera.

Anthony Lane, MS, James White.

Julia Larson, PhD, Ecology and Evolutionary Biology, Bill Bowman. "Plant Species Effects on Microbial Resource Limitations in the Alpine Moist Meadow."

Brian Lazar, MS, Civil, Environmental and Architectural Engineering, Tad Pfeffer. "Relationship between Water Storage and Sliding in a Temperate Valley Glacier."

Craig Lee, PhD, Anthropology, James Dixon. Dissertation relates to the early human occupation of southeastern Alaska.

Isabelle Lheritier, MS, Civil, Environmental and Architectural Engineering, Diane McKnight. Thesis relates to climate-induced alterations in dissolved organic matter on metal toxicity and UV radiation in Rocky Mountain streams.

Dan Liptzin, PhD, Ecology and Evolutionary Biology, Tim Seastedt. "Biotic Constraints on Regional Biogeochemistry at the Forest-tundra Ecotone".

Fengjing Liu, PhD, Geography, Mark Williams. "Hydrological Controls on Stream Water Chemistry in Alpine Catchments, Colorado Front Range, U.S.A."

Nathaniel Logar, PhD, Environmental Sciences, Jim White. Dissertation topic relates to stable isotopes, the carbon cycle, and climate change.

Ken Mack, PhD, Geological Sciences, Jim White. "System Construction and Method Development for High Spatial and Temporal Resolution Measurements of the Deuterium of Atmospheric Methane."

Maureen Mason, MS, Geological Sciences, Robert S. Anderson. Thesis relates to knickpoint migration and landscape evolution on the Roan Plateau, western Colorado.

Hans-Peter Marshall, PhD, Civil, Environmental and Architectural Engineering, Tad Pfeffer. "Snow Slope Stability: Modeling and Investigations using FMCW Radar and Finite Elements."

Courtney Meier, PhD, Ecology and Evolutionary Biology, Bill Bowman. Dissertation relates to feedbacks between plant secondary chemicals and soil microbial communities.

Allen Meyer, PhD, Ecology and Evolutionary Biology, Bill Bowman. Dissertation relates to alpine eukaryotic microbial diversity and role in biogeochemistry.

Elisa Miller, PhD, Ecology and Evolutionary Biology, Tim Seastedt. "Manipulating the Physical and Chemical Properties of Soil to Inhibit Exotic Species Invasions in Thinned Montane Forest."

Matthew P Miller, MS, Civil, Environmental and Architectural Engineering, Diane McKnight. "Effects of Hyporheic Zone Interaction on the Biogeochemistry of a Headwater Stream, Green Lakes Valley, Colorado Front Range, United States."

Trevor Popp (INSTAAR) takes a break in the science trench at the NorthGRIP drilling site (North Greenland Ice core Project), Greenland Ice Sheet, July 2004. Photo: J. White (INSTAAR).

Natalie Mladenov, PhD, Civil, Environmental and Architectural Engineering, Diane McKnight. "Science and Tourism in the Okavango Delta of Botswana: Aquatic Organic Matter Dynamics and Ecosystem Valuation of a Southern African Wetland."

Laura Mujica-Crapanzano, PhD, Ecology and Evolutionary Biology, Tom Ranker and Patrick Bourgeron, "Landscape Analysis of Vegetation and Diversity Patterns at Niwot Ridge, Colorado."

Leora Nanus, PhD, Geography, Mark Williams. Dissertation focuses on sensitivity criteria for atmospheric pollution to lakes in the national parks of the Rocky Mountains.

Shad O'Neel, PhD, Geological Sciences (Geophysics), Tad Pfeffer. "Seismological Investigation of Columbia Glacier Calving Mechanics."

John Ortega, PhD, Program in Atmospheric and Oceanic Sciences, Detlev Helmig. "Flux Measurements of Biogenic Volatile Organic Compounds Using Disjunct Eddy Sampling and Ion Trap Mass Spectrometry."

Trevor Popp, PhD, IGERT, Geological Sciences, James White. Dissertation relates to paleoclimate via stable isotopes in ice cores.

Sarah Principato, PhD, Geological Sciences, John Andrews, "The Late Quaternary History of the Eastern Isafjardardjup and Strandir Areas of the Northwest Peninsula, Iceland, Using Terrestrial and Marine Evidence."

Ursula Quillmann, MS, Geological Sciences, John Andrews and Anne Jennings. Thesis relates to high-resolution reconstruction of Holocene marine environment in Isafjardardjup, northwest Iceland, based on faunal assemblages and isotopic compositions of foraminifera.

Kim Raby (INSTAAR) collects water quality samples in Cunningham Gulch outside of Silverton, Colorado, August 2004. An EPA study used water quality as an indicator of ecosystem health, with data subsequently fed into a scientifically based decision support tool for county land-use planners and resource managers. Photo: S. Padgett (CU Denver).

Kim Raby, MS, Environmental Studies, Mark Williams. Thesis relates to evaluating water quality and sensitive areas in high alpine catchments.

Adina Racoviteanu, MS, IGERT, Geography, Mark Williams. "GIS for High-altitude Inca Sanctuaries in the Peruvian Andes."

Heather Reed, PhD, Ecology and Evolutionary Biology, Tim Seastedt. "Soil Biodiversity and Ecosystem Function."

Sasha Reed, PhD, Ecology and Evolutionary Biology, Alan Townsend/Steve Schmidt. "Biogeochemical Cycling and Microbiological Communities of Soils."

Ursula Rick, PhD, Program in Atmospheric and Oceanic Sciences, Tad Pfeffer. "Meltwater Flow Through the Percolation Facies of Arctic Ice Caps."

Annalisa Schilla, PhD, Geological Sciences, Jim White. Dissertation topic relates to the stable isotopic measurements of ice from the Siple Dome ice core and implications for global climatic reconstruction.

Brianna Shanklin, Diane McKnight.

Alexandra Sinclair, PhD, Geological Sciences (Geophysics), James Syvitski. Dissertation relates to sediment transport in a coastal ocean environment.

Sarah Stapleton, PhD, Environmental Studies, Diane McKnight and Subhrendu Gangophadyay. Dissertation relates to streamflow forecasting and climate change effects on salmon mortality in Pacific Northwest and forecasting effects of climate change on the Rio Grande de Manati aquifer in Puerto Rico.

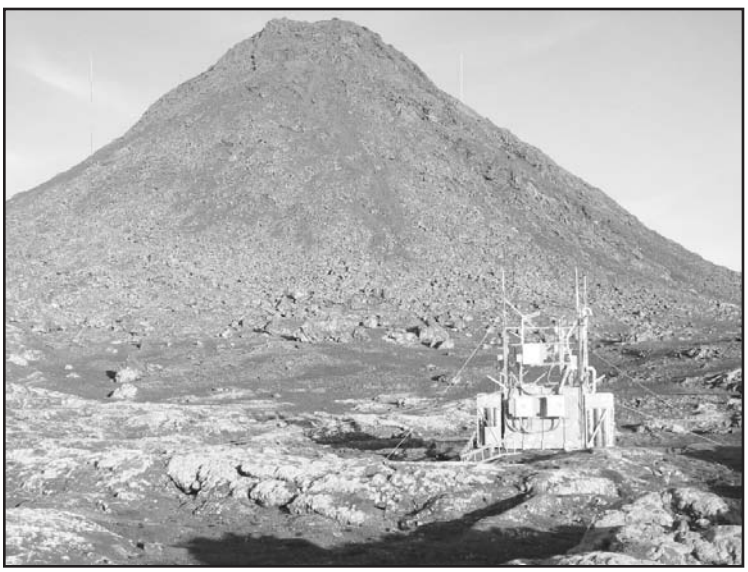
David Tanner, MS, Mechanical Engineering, Detlev Helmig. "Non-methane Hydrocarbon Measurements for Long-range Transport Studies at Pico Mountain, Azores, Portugal."

Andrew Todd, PhD, IGERT, Civil, Environmental and Architectural Engineering, Diane McKnight, "Mining Legacies in the Snake River Basin: Implications for River Restoration."

Jocelyn Turnbull, PhD, Geological Sciences, Scott Lehman. "Environmental Measurements of Atmospheric 14CO2: Development and Applications."

Tim Tomaszewski, PhD, Environmental Studies, Herman Sievering. Dissertation relates to nitrogen deposition at subalpine forests.

The Pico International Chemical Observatory at 2242 m above sea level, Pico Mountain, Azores, April 2004. INSTAAR's Atmospheric Research Lab is performing a one-year experiment with non-methane hydrocarbon measurements to investigate the transport of air pollution across the Atlantic Ocean. Photo: D. Helmig (INSTAAR).



David Tanner (INSTAAR) taking a well deserved break during the installation of a new non-methane hydrocarbon instrument in the International Chemical Observatory (ICO) on top of Pico Mountain, Azores, April 2004. Photo: D. Helmig (INSTAAR).

Ryan Vachon, PhD, Geological Sciences, James White. "The Distribution of Stable Isotopes of Precipitation across the United States."

Dylan Ward, PhD, Geological Sciences, Robert Anderson. "Tectonic and Geomorphic Processes of Exhumation and Uplift in the Alaska Range."

Jeff Wong, Civil, Environmental and Architectural Engineering, Diane McKnight.

Chi Yang, MS, Civil, Environmental and Architectural Engineering, Diane McKnight. "Effect of Acid Mine Drainage on Success of Tree Swallow Nesting in Snake River, Colorado."

## Visiting Graduate Students 2003–2004

*Student Name, Country, Advisor.*

Maria Hag, Denmark. Supervisor: Tad Pfeffer.
Hrafnhildur Hannesdottir, Iceland. Supervisor: Gifford Miller.
Jacques Hueber, France, Detlev Helmig.
Wim Lekens, Norway. Supervisor: Hans Petter Sejrup.
Saedis Olafsdottir, Iceland. Supervisor: Gifford Miller.
Jan Pollmann, Germany, Detlev Helmig.
Kari-Lise Rorvik, Norway, Anne Jennings.

## Non-INSTAAR Graduate Students Advised by INSTAAR Faculty 2003-2004

*Student Name, Degree, Department, Advisor. Approximate thesis topic or title.*

Eric Metzger, MA, Anthropology, University of Colorado at Denver, James Dixon. Thesis involves analysis of lithic debitage from archaeological site 49-PET-408 in southeast Alaska.

Heather Mrzlack, MA, Anthropology, University of Colorado at Denver, James Dixon. Thesis topic involves PIXE analysis of ocher recovered from archaeological site 49-PET-408 in southeast Alaska.

## INSTAAR Undergraduate Students 2003–2004

*Student Name—Advisor*

Kaylee Acuff—Woodhouse
Joe Alfieri—Helmig
Michael Ardison—C. Seibold
Valerie Bakeman—Miller
Jacob Bauer—Marchitto
Rodney Beall—Seastedt
Ian Brown—Helmig/Vaughn
Patrick Cappa—Lehman
Dan Carlson—Helmig
Paul Carpenter—Seastedt
Tara Chesley—Andrews
Kristin Chiniaeff—Vaughn
Brian Clarke—Manley
Michael Cox—McKnight
Sara Desplaines—Bowman
Christine Dolliver—Helmig
Tiffany Duhl—Helmig
Timothy Fazekas—Seastedt
Christopher Florian—Miller
Allison Forrest—Roth
Kristy Freeman—Lehman/Turnbull
Marybeth Garmoe—Seastedt
Dawn Heigele—Seastedt
Shannon Horn—McKnight
Keith Hoyt—Briner
Doug Hultstrand—Helmig
Thomas Ingersoll—Seastedt
Ali Jaffri—Jennings
Kathryn Jahnke—C. Seibold
Jolie Johnson—Andrews
Erik Jorgensen—McKnight
Lindsey Kruckenberg—C. Seibold
Michael Krymis—Lehman
John Kyzer—Manley
Carrie Lahr—Roth
Kristina Larson—Lehman
Patrick Lawler—Losleben
Colin Leibold—Seastedt
David Leopold—McKnight
Colin Mann—Seastedt
Emily Mathis—Seastedt
Matt Mayernick—Spaulding
Keith Mitchell—Vaughn

Dan Carlson, Jacques Hueber and Florence Bocquet (all INSTAAR) after visiting two snowpack field sites in the Niwot Ridge LTER area, near Ward Colorado, January 2005. INSTAAR's Atmospheric Research Lab is investigating gas transfer through the snowpack by drawing and analyzing air from several depths. Photo: D. Helmig (INSTAAR).

Students in the NSF-sponsored Research Experiences for Undergraduates program on a hike from the INSTAAR Mountain Research Station to the Niwot Ridge LTER area, Colorado, July, 2004. Photo: W. Bowman (INSTAAR).

## INSTAAR High School Student Employees 2003–2004

*Student Name—Advisor*

Harold Cooper—Peckham
Laurie Cornell—Seastedt
Danette Fentress—Hughes
Krystle Fentress—Hughes

# Moores-Collins Family Lodge

Construction of the Moores-Collins Family Lodge was completed in summer of 2004, and officially dedicated in September. The facility provides the first year-round housing and teaching/ conference space at the Mountain Research Station (MRS), the field station of the University of Colorado, operated by INSTAAR. Located at 9500 feet (2900 meters), the MRS provides logistical support for research and educational opportunities in mountain environmental studies. The new 3200 square foot lodge has sleeping rooms that accommodate 32 people, a "great room" for presentations and dining space, 2 lounges, a full kitchen, and 3 bathroom facilities.

The building was initially started in 1997, to replace the Fireweed Hostel, adjacent to the venerable Dining Hall, built in 1921. Funding for the initial phase of construction was provided by the National Science Foundation, the CU Graduate School, the MRS, INSTAAR, the CU Global Change and Environmental Quality Program, and students from the Department of Environmental Population, and Organismic Biology. Rising construction costs prohibited completion of the project in 1998. Fund raising efforts by the CU Foundation provided the resources needed to complete the building. The major donors included the Moores-Collins family, including Anthony and Lisbeth Moores and their children Melissa Moores and Mack and Maggie Collins, who contributed $300,000. Several INSTAAR and MRS alumni also made significant contributions to help complete the building. The final construction cost was just short of $1 million.

A major focus for the Lodge will be K-12 education. This was one of the motivations for the Moores-Collins family, who were anxious to provide a venue for environmental education for school children. This winter the building has been used by middle school students from the Boulder Valley School District to learn more about winter ecology and environmental research at the MRS. Several K-12 groups have booked the Lodge for the spring and summer, includ-

*Below left:* The Moores-Collins Family Lodge at the Mountain Research Station, near Ward, Colorado. Photo: W. Bowman (INSTAAR).

*Below right:* The Moores-Collins family in front of the new lodge at the INSTAAR Mountain Research Station named in honor of them, near Ward, Colorado, September 2004. In front, from right to left, are Mack Collins and Lisbeth and Anthony Moores; standing are Melissa Moores and Maggie Collins. Thanks to a generous contribution from the family, the new lodge was completed in the summer of 2004. Photo: C.A. Cass (University of Colorado).

ing the Science Discovery Program run through CU and the Wild Bear Science School from Nederland, CO.

Another motivation for construction of the building was to provide a "bridge" to CU academic-year programs from the Boulder campus. Course and departmental retreats during the October to May period when the rest of camp is closed have provided an important service to the broader CU community. The MRS is running a Winter Ecology course in February and March, using the building as the classroom and living space. In addition, Universities from Ohio, Nebraska, Colorado (non-CU), England, and Austria are bringing courses to the MRS that will use the Lodge. Several private groups involved in environmental science education (e.g. Nature Conservancy) have inquired about use of the Lodge for retreats as well.

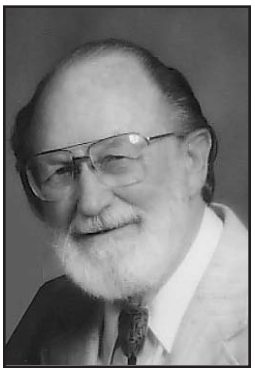
The Moores-Collins family cuts the "ribbon" attached to two aspen trees, marking the official opening of the lodge named in their honor at the INSTAAR Mountain Research Station, near Ward, Colorado, September 2004. Doing the honors are Mack Collins (left), Maggie Collins (center), and Melissa Moores (right), while parents Anthony and Lisbeth Moores look on. Photo C.A. Cass (University of Colorado).

Celebrating the opening of the Moores-Collins Family Lodge at the Mountain Research Station, near Ward, Colorado, September 2004. Maggie Collins in front, Bill Bowman, Lisbeth Moores, Anthony Moores, and James Syvitski (left to right), with Mack Collins and Melissa Moores standing in back. Photo: C.A. Cass (University of Colorado).

The Moores-Collins Family Lodge during the dedication ceremony, INSTAAR Mountain Research Station, near Ward, Colorado, September 2004. The new lodge will provide year-round housing, classroom, and conference facilities. The Lodge will facilitate education of mountain environmental science for K-12 students, as well as courses from the Boulder campus during the regular academic year. Photo: C.A. Cass (University of Colorado).

Carol Lynch, outgoing Dean of the Graduate School, addresses the audience at the dedication ceremony for the Moores-Collins Family Lodge at the INSTAAR Mountain Research Station, while MRS Director Bill Bowman looks on, near Ward, Colorado, September 2004. Photo: C.A. Cass (University of Colorado).

# Mortimer D. "Mort" Turner, prominent polar geologist, dies at 83



Dr. Mort Turner
October 24, 1920–May 1, 2004

Mortimer D. "Mort" Turner died of natural causes on Saturday, May 1, 2004, in Boulder Colorado. He was 83. A celebration of Dr. Turner's life was held at 4:30 p.m. Thursday, May 6, at INSTAAR.

The son of Clarence E. Turner and Satia Darling Turner, he was born October 24, 1920, in Greeley, Colorado. He married Laura Perez Mendez on January 20, 1945, in Aberdeen, Maryland. She died in April 1965. He married JoAnne Church on December 5, 1965, in Kensington, Md.

Dr. Turner studied at the University of California-Berkeley and earned a bachelor's degree in geological engineering while in the Army. He was assigned to Aberdeen Proving Ground in Maryland and worked on missiles under Edwin Hubble. He served in the Army from 1943 until 1945.

Dr. Turner worked for the California Bureau of Mines and Geology from 1948 to 1954. While there, he received a master's degree in geology from UC-Berkeley. He then set up the first Geological Survey of Puerto Rico. In 1959 he was recruited by the National Science Foundation (NSF) in Washington, DC, to help manage the U.S. Antarctica Research Program, making 27 trips to the Antarctic and traveling also to Europe, Japan, India, Nepal, Chile, and China. He received a doctorate from the University of Kansas in 1972. As NSF program officer for Polar Earth Sciences, Dr. Turner mentored, funded, and led field programs that made new discoveries in paleontology, geology, and geophysics on the Antarctic continent.

"He began this leadership in 1959, at a time when Antarctic research was just emerging from a period of geographic exploration to its present status of multi-disciplinary and multi-national scientific achievement of importance to understanding global climate change, earth structure, and the evolution of life," said Mark F. Meier, former Director of INSTAAR.

"He was the one who grew the Antarctic earth sciences program following the International Geophysical Year 1957–59," according to Guy Guthridge, Manager of Antarctic Information in the NSF's Office of Polar Programs. "Mort was gracious, generous, dignified, and knowledgeable, and he seemed mostly unfazed by the short-fuse panics that occasionally dominated our work."

Wesley E. Le Masurier, retired professor of geology at CU-Denver, says of Turner's accomplishments, "His tenure saw the initiation of major ice drilling, sediment drilling, and meteorite collecting programs which continue to this day in much expanded and diversified forms. With his support, the Antarctic ice sheet was first penetrated to its base in 1968, and sediments in the Dry Valleys of Antarctica were penetrated in the early 1970s. Numerous subsequent drilling programs of this kind form the data base upon which much of our knowledge of climate change is based."

In 1984 he retired from NSF to do research in geology and early man in Colorado, Montana, and China. In 1987 he moved to Boulder to join INSTAAR as a Fellow Emeritus where he continued his research jointly with his wife. He also taught geology courses at CU-Denver.

Dr. Turner received a number of honors, including the American Polar Society's Career Service Award. Turner Hills in Antarctica, the mineral turnerite, a fossil plesiosaur, and a prehistoric fossil sea mammal are all named after him.

"He was a loving husband and partner, and a wonderful father and grandfather. We will all miss him very much," his family said. Survivors include his wife, JoAnne Turner of Boulder; two daughters, Satia Goff of Monticello, Minnesota, and Ylla Romdall of Bellingham, Washington; a son, Robert Turner of Bakersfield, California; a stepson, Christopher Dort of Spotsylvania, Virginia; six grandchildren; and three great-grandchildren. He was preceded in death by a brother, Robert Turner.

His body was donated to the University Medical Center in Denver for research. Contributions may be made to a scholarship in Dr. Turner's name to the CU Foundation, P.O. Box 1140, Boulder, CO 80306.

An article, "Remembering Mort Turner 1920–2004", written by Jo Ann Harris, Anne Stanaway, Tina (Ylla) Romdall, Robson Bonnichsen, and Mary Beatty was published in *The Mammoth Trumpet Newsletter,* vol. 19, no. 4, September 2004. The article includes an overview of his career and a series of memories of him by colleagues and family members. The newsletter is available from the Center for the Study of the First Americans, Department of Anthropology at Texas A&M University (http://csfa.tamu.edu/mammoth/issues/vol19/4_contents.htm).

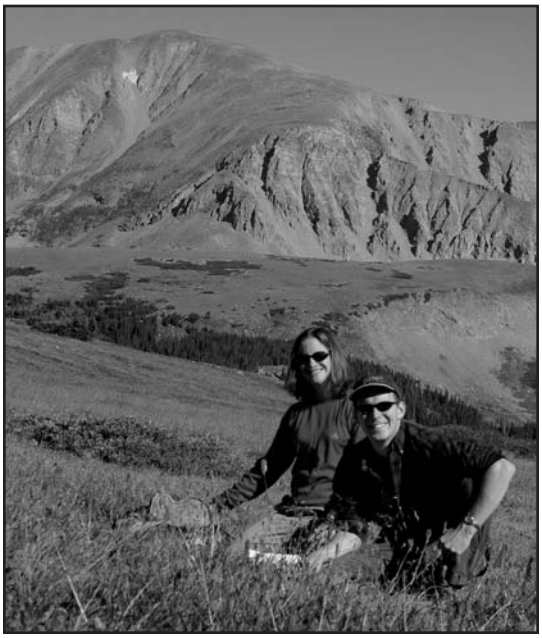
# Mountain Research Station

The Mountain Research Station (MRS), located near Nederland, 25 miles from Boulder, is an interdisciplinary research facility of the University of Colorado, run by INSTAAR, devoted to the advancement of study of mountain ecosystems. Its mission is to facilitate research and education to better understand the unique patterns and processes of biological and physical systems in mountains, and how environmental changes may affect these processes.

The MRS was established in 1921 and has continued to serve as an outstanding facility in field education and research. Research on nearby Niwot Ridge has contributed substantially to our understanding of the environmental science of mountain systems and is recognized internationally for its excellence. Approximately 40 researchers per year use the MRS as a base of operations, including faculty and students from CU and many other universities and federal laboratories in the United States and around the world. The Niwot Ridge Long-Term Ecological Research program continues to have the largest presence at the MRS, and funding for this program was recently renewed by the National Science Foundation through 2010. The C1 eddy flux tower site has also been a major focus for research, thanks to a recent NSF Biocomplexity grant received by Russ Monson at CU and others at NCAR. Three new 40-m towers were erected during the summer of 2004 as part of a program to better understand the uptake of CO2 by montane forests in complex terrain.

The station's teaching mission includes formal undergraduate field courses, which have been offered at the MRS for over eight decades and have become an integral part of the academic experience of many college students. The MRS is used regularly by course programs from other universities in the U.S. and Europe. Several K–12 courses also use the MRS as a site to introduce students to field environmental science.

Forty-meter eddy-flux correlation tower near the INSTAAR Mountain Research Station's C1 climate station, erected in the summer of 2004 as part of an NSF Biocomplexity Project headed by Russ Monson (Ecology and Evolutionary Biology and CIRES) and Dave Schimel (NCAR) to study CO2 uptake by forest canopies in complex mountain terrain, near Ward, Colorado, September 2004. Photo: W. Bowman (INSTAAR).



Kim Lohnas and Courtney Meier (INSTAAR and Ecology and Evolutionary Biology) clip biomass in experimental plots above the INSTAAR Mountain Research Station in the Niwot Ridge LTER area, Colorado, September 2004. Mount Audubon is in the background. Photo: W. Bowman (INSTAAR).

The MRS participates in educational experiences for the general public aimed at policy decisions that affect our environment. Through formal interactions with U.S. federal agencies such as the Forest Service, the Environmental Protection Agency, and the National Park Service, the MRS has provided expertise to help regulatory agencies make informed decisions about minimizing human impacts on mountain ecosystems. The Director of the MRS is involved in international mountain research programs (IGBP Mountain Research Initiative, Global Mountain Biodiversity Assessment) that help shape the direction of mountain environmental research. The MRS also provides summer seminars open to all on subjects of interest to both scientists and nonscientists. The MRS is a popular site for symposia and workshops aimed at decision-making and information sharing as well as CU departmental retreats and national scientific meetings.

Completion of the new Moores-Collins Lodge will facilitate year-round use of the MRS, including academic year educational opportunities and research during the winter (see cover story).

Fourth-grade students in the CU Science Discovery Program on a hike led by Deb Kulcsar, INSTAAR Mountain Research Station, Niwot Ridge LTER area, Colorado, July 2004. Photo: W. Bowman (INSTAAR).

# Science Spotlights

Science Spotlights are examples of INSTAAR research, education, and societal outreach. Web links are available for each spotlight at http://instaar.colorado.edu/research/science_spotlights_2001.html.

## 2003

***Contaminated Water from Abandoned Mines Constrains Colorado Ski Areas.*** Andrew Todd, Diane McKnight, and colleague Lane Wyatt (Northwest Council of Governments) found that the ability of several of Colorado's prime ski areas to respond to winter drought is constrained by acidic runoff from abandoned mines. Waterways that are contaminated with acid-rock drainage, such as the Snake River, are less desirable for snowmaking than pristine streams. When the snow melts, the water can run into streams not previously polluted, further spreading the contamination. Published in the September 23 issue of *EOS* (American Geophysical Union).

***Patrick Bourgeron Awarded the Prestigious French Chaire Blaise Pascal.*** Patrick Bourgeron received the Chaire Blaise Pascal, an international visiting research chair that funds collaboration for one year with members of a number of French and European Commission research and teaching institutions. His activities as Chair fit under the umbrella of the International, U.S., and European Long Term Ecological Networks, funded respectively by the National Science Foundation and the European Commission. Activities included research into the interrelationships between global change, rapid demographic pressure, land use patterns, and sustainability of heavily populated areas. Bourgeron also presented a series of lectures, developed new proposals, and guided visits of students and senior scientists to the collaborative French and U.S. institutions. Taken from a press release by the Ecology Lab ("Biodiversité et fonctionnement des ecosystèmes") of the Ecole Normale Supérieure.

***Sediment along Hydrological Pathways: Anthropogenic Influences.*** James Syvitski edited a special journal issue entitled "The supply and flux of sediment along hydrological pathways: Anthropogenic influences at the global scale." The issue investigated the increasing human impact on sediment in the global water system. More than 25 scientists contributed 11 papers to the issue, which was sponsored by IGBP, LOICZ, PAGES, and BAHC. The issue played an important contributing role in starting the Global Water Systems Project (GWSP). Published in *Global and Planetary Change*, 39(1/2): 1–200.

***Artifacts in Melting Glaciers.*** E. James Dixon, William Manley, Craig Lee, and colleagues continued their search in southeast Alaska to pinpoint rapidly melting glaciers and ice fields that hold prehistoric human artifacts before exposure triggers their decomposition. As global warming continues to melt glaciers and ice fields at a rapid rate, discarded or lost tools that were frozen in glaciers are being released from the ice. Among their most significant finds this season were wooden arrow shafts, one with red ochre paint, and a stone point still lashed to its wooden shaft. They also found a birch bark container or basket recently thawed from the ice.

***Alan Townsend Penned Science Column.*** Alan Townsend wrote seven columns in 2003 about "The Changing World" for the Boulder *Daily Camera*. Townsend's column was focused on the environment, with topics ranging from the effects of fertilizer to developments in motor vehicle technology.

***Global Warming Threatens Alpine Plants.*** Vera Markgraf was an invited lecturer at a week-long international summer school concentrating on "Climate Change: Impacts on Terrestrial Ecosystems." Discussion included the past, present, and future effects of global warming on alpine vegetation, including European vegetation attempting to shift north-, east-, and upwards. The summer school provides young scientists with the opportunity to learn from some of the world's leading climate researchers. Seventy PhD students and Post-Docs from around the world are selected from applications. The school focuses on a different climate topic each year. The program is sponsored by the Swiss National Science Foundation.

***Mort Turner Received American Polar Society Special Award.*** Mort Turner was awarded the American Polar Society Special Award, the first of its kind. The award recognizes Turner's tremendous service over the years on polar research, administration, and management. The award ceremony took place during the American Polar Society Symposium 2003 at the Byrd Polar Research Center at Ohio State University.

***INSTAAR Contributing to New NASA-Funded CU-Boulder Study of Earth's Glacier Systems.*** Mark Dyurgerov is participating in a large CU-Boulder study—led by Richard Armstrong (National Snow and Ice Data Center)—to compile an online database of the world's glaciers. Accelerated glacier melting over the last two decades has contributed to rising sea levels and to stressed water resources. But global monitoring of the response of glaciers to climate change has

been difficult; in part because volume change measurements have been made on only a few hundred of the world's approximately 160,000 glaciers. The study will expand existing knowledge by combining historical data sets with new and existing high-resolution satellite imagery.

***INSTAAR Participates in New CU-Boulder Certificate Program for Science and Technology Policy.*** Diane McKnight is one of 17 CU-Boulder faculty members from a variety of departments participating in a new program offering a certificate in Science and Technology Policy. All CU-Boulder graduate students are eligible. The program addresses society's growing need for expertise when faced with decisions involving science and technology. Three proposed new courses are among the 18 hours of required coursework for the certificate: "Science and Technology Policy," "Science, Technology and Society," and "Methods of Policy Analysis and Research." Three more courses are selected from a list of approved electives. The certificate is coordinated by the university's Center for Science and Technology Policy Research.

***Fungal Metabolism in Tundra Soils at Niwot Ridge Higher in Winter Than Summer.*** A new study of Niwot Ridge tundra soils by Schadt et al. (CU-Boulder, San Diego State) revealed the presence of whole new orders of previously undocumented microorganisms (mostly fungi). These organisms were found to be more active in winter than in summer. The study has implications for carbon dioxide levels in Earth's atmosphere. The research is one of many projects facilitated by the Niwot Ridge Long-Term Ecological Research (NWT LTER) program, administered by INSTAAR's Mountain Research Station. Published in the September 5 issue of *Science*.

***Changing Global Nitrogen Cycle Impacting Human Health.*** Alan Townsend, Cory Cleveland and colleagues studied how human influence on the global nitrogen cycle affects our health. Humans now convert more nitrogen to reactive forms than all natural processes combined. While beneficial for increasing crop growth, human-induced changes appear to pose a growing health risk. The authors believe that the greatest net health benefits come from using nitrogen at moderate levels. Using nitrogen at higher levels does not lead to parallel increases in benefits, while greatly exacerbating health and environmental problems. Published in the June issue of *Frontiers in Ecology and the Environment*.

***INSTAAR Hosted Open House for 164 Middle School Students.*** Bill Manley, Bruce Vaughn, and Diane McKnight led an organizing committee that hosted the entire eighth grade class of Southern Hills Middle School on April 18. The students were divided into groups to participate in lab tours, lectures, and stream sampling activities. The students learned how materials such as bones and soils are radiocarbon dated, how to excavate an archaeology site in the Arctic, how climate is recorded in ice and sediment cores, and how greenhouse gases are affecting our atmosphere. They also learned how glaciers work by manipulating 10-foot-high 3-D digital images of Alaska's landscape. In addition, the students studied stream ecology by collecting water and insects while measuring streamflow. Other INSTAAR participants included Vicky Nelson, John Ortega, John Hoffecker, Astrid Ogilvie, Jason Briner, Wendy Roth, and a team of graduate students and professional scientists.

*Far left:* Andrew Todd and Erin Keeley (both INSTAAR) discuss aquatic invertebrates taken from Boulder Creek with an eighth grader during the INSTAAR Open House, Boulder, Colorado, April 2003. Photo: J. Briner (INSTAAR).

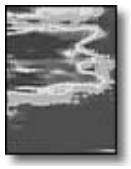
*Near left:* William Manley (INSTAAR), center, helps a group of eighth graders explore how glaciers work by "flying" through 10-foot-high 3-D digital images of Alaska's landscape, INSTAAR Open House, Boulder, Colorado, April 2003. Photo: J. Marbach (BP Center for Visualization, CU-Boulder).

***Gift from Moores Family Helped Complete Science Lodge.*** Anthony, Liz, and Melissa Moores donated $300,000+ to finish the Science Lodge at INSTAAR'S Mountain Research Station. This generous gift funded work on the interior, completing prior work on the building's shell, funded by the National Science Foundation. The Science Lodge now provides accommodations and conference space for 32 people throughout the year, even during the winter months when the Station was previously mostly unavailable to visitors. The Station has started reserving space for all the student groups and researchers who had to be turned away in recent years for lack of space. The Science Lodge will have many visitors including K-12 teachers, environmental classes, and think tanks on ecological and earth system research. INSTAAR sends a hearty "thank you" to the Moores family, Dean Carol B. Lynch, and all others involved!

***Diane McKnight Named Fellow of American Geophysical Union.*** Diane McKnight was elected a fellow of the American Geophysical Union for her outstanding contributions to the understanding of the biogeochemistry associated with transport metals and organic substances in streams and lakes. Fellowship is bestowed on only 0.1% of the total AGU membership of about 35,000 in any given year and recognizes scientists who have made significant contributions in the geophysical sciences.

Anne Hickey (INSTAAR) shows several eighth graders the results of their efforts to filter water from Boulder Creek, INSTAAR Open House, Boulder, Colorado, April 2003. Photo: J. Briner (INSTAAR).

***INSTAAR's AAAR Journal Goes Online.*** Journal Editor Mark Williams and Managing Editor Connie Oehring completed a project begun in 2002 by Kathleen Salzberg to publish the first full-text online issue of *Arctic, Antarctic, and Alpine Research* (AAAR). All issues starting from the first in 2003 are available in both electronic and paper formats. Our online host is BioOne, a nonprofit aggregation of high-impact bioscience research journals. If your institution or local library is a subscriber to BioOne (e.g., University of Colorado), then you should have access. Please take a look!



***Long-Term North Atlantic Oceanographic Variability and Solar Forcing.*** John Andrews led a six-person team to reconstruct a high-resolution paleoceanographic history off North Iceland for the past 12,000 years. Team members included INSTAAR's Joe Stoner and Gréta Björk Kristjánsdóttir, INSTAAR alumni Jorunn Hardadóttir (Iceland Energy Authority), Michael Mann (University of Virginia), and Nalân Koç (Norsk Polar Institute). The team found links between variations in grain-size, magnetic concentration, and solar forcing that appear to be controlled by changes in the relative advection of Atlantic and polar waters. This conclusion may have implications for global ocean circulation, in part because present advection changes on the north Iceland margin are associated with variations in deep convection in the Greenland and Iceland seas. Published in *Earth and Planetary Science Letters*, 210(3-4): 453–465.

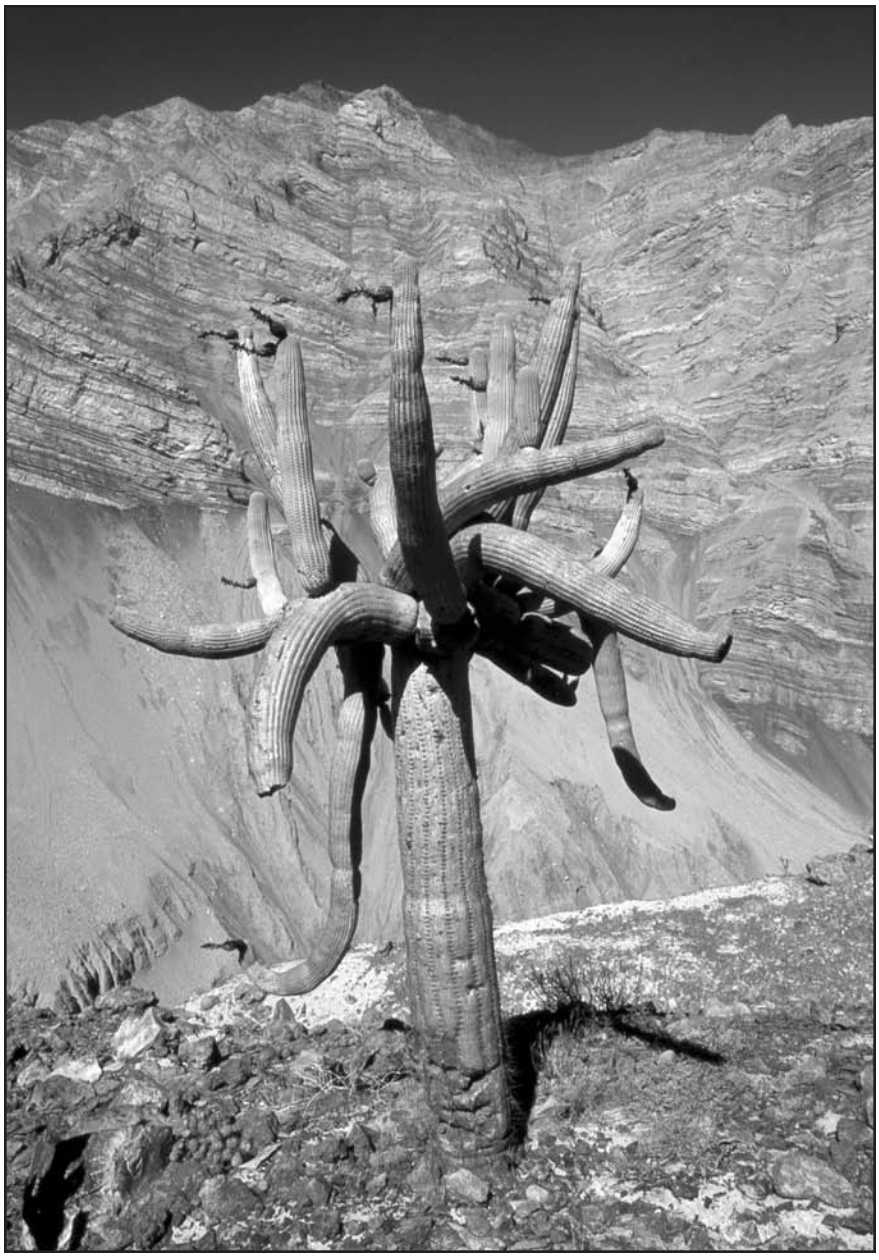
***John Behrendt Elected to AAAS.*** John Behrendt was elected a Fellow of the prestigious American Association for the Advancement of Science for 2002. He was cited for his distinguished contributions to the understanding of crustal controls in the Antarctic Ice Sheet and for efforts to protect and manage Antarctica for the scientific benefit of all nations. He was presented with an official certificate and a pin on February 15 at the Fellows Forum being held during the 2003 AAAS annual meeting in Denver.

***Melting Glaciers and Permafrost Hold Potential for Archaeological Discoveries.*** E. James Dixon recorded an interview with National Public Radio (NPR) in January about the research that he and William Manley are conducting on the archaeological potential of snow and ice. A small portion of that interview was broadcast on NPR's All Things Considered, discussing the fantastic preservation of artifacts recovered from frozen contexts. Dixon and Manley's research has recently come to the fore of public attention through front-page stories in major newspapers such as the LA *Times*, Vancouver *Sun*, Miami *Herald*, Charlotte *Observer*, and Seattle *Times*.

***Abrupt Changes in Asian Monsoon over Last 11,000 Years Linked to North Atlantic Climate.*** Anil Gupta (Indian Institute of Technology), David Anderson (INSTAAR and NOAA Paleoclimatology), and Jonathan Overpeck (University of Arizona) developed a new centennial-scale proxy record of the southwestern monsoon winds spanning the Holocene period (last ~11,000 years). The foraminifer-based record showed repeating intervals of weaker summer monsoon winds that coincide with cold periods documented in the North Atlantic region. Older records from the last ice age previously showed that the southwest monsoon exhibited abrupt changes that were closely correlated with millennial-scale climate events in the North Atlantic region. Thus, the link between these distant regions appears to be a persistent aspect of global climate on different timescales. The significance of this work lies in documenting a linkage between climate of high and low latitudes, and in revealing the amplitude of natural variability in monsoon climate. Published in the January 23 issue of *Nature*.

***Postglacial Flooding of the Bering Land Bridge: An Animation.*** William Manley used a Geographic Information System (GIS) to create a movie showing how the Bering Land Bridge evolved after the Last Glacial Maximum, about 21,000 years ago. Global sea level at that time was approximately 120 m (400 ft) lower than today. The Land Bridge existed as a vast tundra plain connecting Asia and North America. As the world's glaciers and ice sheets melted over the following thousands of years, rising sea level flooded the Land Bridge, blocking migration routes for animals and humans. The visualization was created in the INSTAAR Quaternary GIS lab and is based on the best available digital information; it reveals large-scale patterns of shifting coastlines and environments as the Land Bridge evolved.

***America's First Inhabitants May Have Used the Coastal Road.*** E. James Dixon was interviewed for a *Nature* News Feature on the explosion of interest in studying the climatic, environmental, and geological conditions that prevailed along the Pacific Coast during the past 35,000 years or so. In the article, Dixon notes an ongoing paradigm shift toward finding physical traces of early coastal migrants. Existing traces include a manmade tool that Dixon and colleagues have radiocarbon dated to about 10,300 years ago in a cave on Prince of Wales Island, southeast Alaska. Published in the March 6 issue of *Nature*.



Cactus, Valley of the Volcanoes, southern Peru, July 2004. In the background are highly kink-folded Mesozoic rocks that form the basement of the altiplano, exposed by the Colca River. This area was visited by Doug Burbank (University of California at Santa Barbara), Brian Clark (University of California at Santa Barbara, former INSTAAR), and Bob Anderson (INSTAAR) while on a pilot trip to assess the potential for determining rates of incision of the Colca and Cotahuasi Rivers, the structural evolution of the plateau, and the climate history embedded in the moraine complexes surrounding the major volcanoes on the altiplano. Photo: R.S. Anderson (INSTAAR).

# 2004

***First Evidence of Life in Rock Glaciers.*** Meredith Knauf, Mark Williams, Nel Caine, Rose Cory, and Fengjing Liu discovered surprising evidence of microbial activity in a rock glacier high above treeline in the Rocky Mountains, a barren environment previously thought to be devoid of life. Rock glaciers are large masses of rock debris interspersed with ice in the high mountains of temperate areas. Moving at speeds of just inches or a few feet a year, they require an extremely cold environment, large amounts of rock debris and enough of a slope to allow them to slide. The evidence included traces of dissolved organic material and high levels of nitrates in an intermittent stream draining from a rock glacier in the Green Lakes Valley watershed, Niwot Ridge Long-Term Ecological Research site. The high nitrate levels are believed to be a result of microbes metabolizing nitrogen within the glacier. The research team's surprising result showed that rock glaciers are not biological deserts as had been previously thought. The microbial "signature" discovered by the team is similar to that found recently in semi-frozen lakes in the Dry Valleys of Antarctica. Following the discovery in the Green Lakes Valley, the CU-Boulder research team uncovered evidence of microbial life in rock glaciers in southern Colorado and in Wyoming. Results were presented at the Fall Meeting of the American Geophysical Union, held December 13 to 17 in San Francisco, California.

***A Prehistory of the North: Human Settlement of the Higher Latitudes.*** John Hoffecker has written a compelling account of how humans, who evolved in the tropics, came to inhabit some of the coldest places on earth over the span of nearly two million years. Far from diffusing gradually northward from their African origins, people settled Europe and northern Asia, the Arctic, and the Americas in relatively rapid bursts. This book traces the complex history of anatomical adaptations, diet modifications, and technological innovations that allowed humans the continued ability to push the boundaries of their frontier. It concludes by showing how in the last few thousand years, peoples living in the circumpolar zone—with the exception of western and central Siberia—developed a thriving maritime economy. Drawing on a number of diverse disciplines, Hoffecker's is the first book to explore human adaptation to cold environments at such an extensive scale.

***Loss of Diversity in Mountain Areas.*** Bill Bowman was interviewed for the Earth & Sky radio program to help listeners better understand the science of biodiversity studies and the consequences of its loss in mountain areas. Bowman and colleagues organized a symposium on this topic last summer at the meeting of the Ecological Society of America. The Earth & Sky radio series is a 90-second science radio program broadcast daily by 688 radio stations in the United States and many more throughout the world. Earth & Sky stories highlight the wonders of science and nature. The short version of the interview can be heard in RealAudio or MP3 format on the Earth & Sky web site.

***Unseen Colorado Mountain Aquifers Throw Water on "Teflon Basin" Myth.*** Mark Williams, five graduate students, Bruce Vaughn, James White, and several USGS and EPA personnel discovered that high-altitude aquifers honeycomb parts of the Colorado Rockies, trapping snowmelt and debunking the myth that high mountain valleys act as "Teflon basins" to rush water downstream. Geochemical and water isotope studies showed that less than half of the annual snowmelt in the Green Lakes Valley region in the high mountains west of Boulder arrives at the watershed treatment facility within a year as "new water." The team found that most of the water sampled from North Boulder Creek during the runoff months was "old groundwater" that had been stored in subterranean mountain catchments. Similar studies by Williams and colleagues near Leadville, Colorado, demonstrated that high-mountain groundwater is dominated by snowmelt that is locked underground for years or decades. Together, the research reveals that water from snow pack replenishes high-altitude groundwater reservoirs, pooling underground rather than rushing downstream toward the plains. These findings were presented at the annual Geological Society of America meeting held in Denver, November 7 to 10.

***Change in the Air: Melting Snow and Ice in Colorado's Front Range and Other Parts of the Globe.*** Nel Caine, James Dixon, Mark Dyurgerov, Tom Kittel, Craig Lee, and Tad Pfeffer were interviewed by Jim Erickson of the Rocky Mountain *News* for a series of three stories centered on environmental change in the Colorado alpine environment. The stories documented how Front Range glaciers are declining, lake ice is thinning, and some snow banks are receding to expose animal remains more than 2,000 years old. Do these changes relate to global warming? Read the articles to see researcher's latest ideas about the causes of these sometimes dramatic environmental changes. Published in the Rocky Mountain *News*, October 26.

***$1 Million Facility Completed at Mountain Research Station.*** The University of Colorado at Boulder completed a $1 million facility at the Mountain Research Station west of Boulder, providing researchers, students, and visitors with comfortable, year-round living and teaching quarters. The Moores-Collins Family Lodge, the first major construction project at the station in 30 years, replaces the original Fireweed Hostel at the site. Considered by scientists to be one of the premier alpine field stations in the world, the Mountain Research Station is located 25 miles west of Boulder at an altitude of 9,500 feet and is administered by CU-Boulder's Institute of Arctic and Alpine Research. The new two-story, 3,200-square-foot lodge includes meeting facilities for up to 70 people, a full kitchen, three bathrooms, and winterized sleeping areas for up to 32 people. The station is adjacent to Niwot Ridge, which rises in elevation to 13,500 feet and is the site of one of 26 Long-Term Ecological Research sites in North America funded by the National Science Foundation and the only one in a subalpine environment. Featuring tundra, talus slopes, forests, glacial lakes, and wetlands, the site is managed for NSF and the U.S. Forest Service by INSTAAR.

***North Greenland Ice Core Reveals Gradual and Abrupt Climate Swings.*** James White, Trevor Popp, and Annalisa Schilla are part of an international team of researchers working on the North Greenland Ice Core Project (NGRIP), which published an overview of the 123,000 year old, undisturbed deep-core record. The older part of the record showed that the Eemian period prior to the last glacial period was slightly warmer than the present day before it gradually cooled and sent Earth into an extended deep freeze. The highly detailed record of this transition was a new discovery. Although two other deep-ice cores were retrieved from Greenland in the 1990s, those cores could not provide reliable climate records of this transition because of ice layer "folding" near bedrock. The new NGRIP ice core record indicated Eemian-period temperatures, over the polar regions at least, were stable and roughly 9° Fahrenheit warmer than temperatures in the present interglacial. The transition from the Eemian into the most recent glacial period was slow and gradual, marked by general cooling and deterioration of the climate over several thousand years. The isotopes in the NGRIP ice and four Greenland ice cores drilled in recent years also indicated that while the northern part of the Greenland ice sheet was fairly stable during the Eemian, the ice sheet in southern Greenland may have been dramatically thinner or even nonexistent. The NGRIP ice core also provided evidence of air temperatures jumping 9° Fahrenheit in just five decades roughly 115,000 years ago, just prior to the slide from the Eemian into the glacial period. Published in *Nature* on September 9.

***INSTAAR Researchers Featured in University's Annual Report on Sponsored Research.*** Diane McKnight and several of her graduate and undergraduate students have been researching alpine lake ecosystems in the Green Lakes Valley watershed for a number of years as part of the Niwot Ridge Long Term Ecological Research project (NWTLTER) funded by NSF. The NWTLTER project, currently headed by Mark Williams, began at INSTAAR in 1980 (2005 update: NWTLTER was renewed for another 6 years by NSF).The Green Lakes watershed combined with adjacent Silver Lake valley supplies about 40% of the city of Boulder's water supply. In Green Lakes Valley, the group has documented

*Below left:* A bad summer day at the NorthGRIP drilling site (North Greenland Ice core Project), Greenland Ice Sheet, July 2004. The main dome was buffeted by wind and blowing snow. Photo: J. White (INSTAAR).

*Below*: Sled loads of cargo wait to be loaded onto the ski-equipped C-130 airplane at the NorthGRIP drilling site (North Greenland Ice core Project), Greenland Ice Sheet, July 2004. Photo: J. White (INSTAAR).

changing algal amounts and species distributions over the past 20 years. These ecological changes are associated with decreased ice cover and increased atmospheric nitrogen pollution from automobiles and agriculture in the Front Range. Similar trends have been observed in alpine lakes in Rocky Mountain National Park. McKnight's research group has also been researching other aquatic systems elsewhere in Colorado, the Arctic, and the Antarctic.

***Proposed Initiative Would Study Earth's Weathering Engine.*** Suzanne Anderson is participating in a national initiative to determine how the Earth's weathering engine breaks down rock to nourish ecosystems, carve terrestrial landscapes, and control carbon dioxide in the global atmosphere. Research that addresses the complex functioning of Earth's weathering interface is presently conducted by a diverse group of scientists including geochemists, geomorphologists, soil scientists, and ecologists over a variety of scales. Without targeted funding for weathering as a system, individual research efforts lack the comprehensiveness and depth needed to develop a process understanding of this integral Earth system. In contrast, development of a concerted programmatic initiative, a Weathering System Science Consortium (WSSC), could promote a systems approach to investigations of weathering by promoting interactions among different disciplines, standardizing data and sample collection for weathering systems, decoupling complex biophysicochemical systems with quantitative models, providing databases and sample storage facilities for weathering profiles, providing expertise in field-based data collection, training a new cohort of weathering specialists, and integrating field-based, computational, and experimental approaches. The head of the WWSC Organizing Committee is Susan Brantley at Penn State. Published in July 13 issue of *EOS*.

***Millennial-Scale Changes in Southeast Pacific Surface Ocean Water Properties and Patagonian Ice Sheet Extent since the Last Glacial Period.*** Joe Stoner participated in a German-led study of marine sediments from the Chilean continental margin that show a clear "Antarctic" timing of sea surface temperature changes. The changes appeared to be systematically linked to meridional displacements in sea ice, westerly winds, and the circumpolar current system. Proxy data for ice sheet changes showed a similar pattern as oceanographic variations offshore, but revealed a variable glacier-response time of up to 1000 years, which may explain some of the current discrepancies among terrestrial records in southern South America. Published in *Science* on June 25.

***740,000-Year-Old Ice Core from Antarctica Will Help Understanding of Ice Ages and Global Warming.*** James White wrote a commentary on a new ice core drilled by the European Project for Ice Coring in Antarctica, or EPICA (results published in the June 10 issue of *Nature*). The core almost doubles the age of previous ice cores and reaches far enough back in time to give scientists a chance to study climate and greenhouse gases during interglacial periods when humans had nothing to do with climate change. The core has the potential to help separate the human-caused impacts from

Dan Mann (University of Alaska-Fairbanks) examines a Holocene loess deposit many meters thick along the Delta River, Alaska Range, Alaska, September 2003. The braided river is fed by large glaciers in the Alaska Range, and is a source of loess to the surrounding landscape. Photo: S.P. Anderson (INSTAAR).

Dan Mann (University of Alaska-Fairbanks) examines a soil pit near Delta Junction, Alaska, September 2003. The soil is developed in loess over Donnelly age outwash (LGM). The addition of fine-grained loess to a soil profile increases the potential weathering fluxes from that profile. Photo: S.P. Anderson (INSTAAR).

the natural and place it in a much clearer context. The average number of years spent in a warm period between ice ages—like our current climate—has been about 6,000 years. But the current interglacial period has lasted for 12,000 years. Only one other interglacial period has exceeded that length of time—it lasted for about 28,000 years—and it happened about 450,000 years ago. The EPICA core will provide the first complete record of that period and will allow scientists to study it in more detail than ever before. Published in *Science* on June 11.

***Greenland Ice Core Project Yields Probable Ancient Plant Remains.*** James White, Trevor Popp, and Annalisa Schilla are part of a international team of researchers working on the North Greenland Ice Core Project that recently recovered plant remnants nearly two miles below the surface, between the bottom of the glacial ice and the bedrock. Researchers from the project, known as NGRIP, said particles found in clumps of reddish material recovered from the frozen, muddy ice in late July looked like pine needles, bark or blades of grass. Thought to date to several million years ago before the last ice age during the Pleistocene epoch smothered Greenland, the material will be analyzed in several laboratories. The ice cores in which the reddish material was found also contain a high content of trapped gas, which is expected to help researchers determine what the area's climate history was like on an annual basis during the past 123,000 years.

***INSTAAR Graduate Student Visited Japan with NSF EAPSI Program.*** INSTAAR graduate student Jocelyn Turnbull spent 8 weeks in Japan working on a carbon cycle research project with the greenhouse gas group at Tohoku University in Sendai (led by Dr. Takakiyo Nakazawa). She was chosen to participant in the National Science Foundation East Asia Pacific Summer Institutes (EAPSI) program for advanced graduate students. One goal of the program is for students to initiate personal relationships that will facilitate future international collaborations. Turnbull's summer project related to her PhD thesis on variations in $^{14}C$ in carbon dioxide ($^{14}CO_2$) in the atmosphere. $^{14}C$ is a nearly ideal tracer for fossil-fuel derived $CO_2$ in the atmosphere because it has zero abundance due to radioactive decay. This is in strong contrast to high activity levels in the ambient atmosphere, biosphere, and upper ocean maintained by natural $^{14}C$ production and (transiently) above-ground nuclear weapons testing. The stratosphere is a critical component of the global distribution of $^{14}CO_2$ because it is the location where $^{14}C$ is produced by interaction with cosmic rays. Turnbull's stratospheric measurements will help improve computer models that have been limited by sparse stratospheric data. The improved models will allow more accurate estimates of the human fossil fuel contribution.

***Ecology for a Crowded Planet.*** Alan Towsend participated in a multi-authored *Science* magazine Policy Forum to describe changes that are required if we hope to meet the needs and aspirations of humans while improving the health of our planet's ecosystems. Within the next 50 to 100 years, the support and maintenance of an extended human family of 8 to 11 billion people will be difficult at best. Problems as diverse as disease transmission and global climate change have benefited substantially from advances in ecology. Such advances have set the stage for emergence of a proactive ecological science in which social and political realities are acknowledged and attention is turned decisively toward the future. The ecological sciences must chart an understanding of how ecosystem services can persist given their extensive human use. Innovative research on the sciences of ecosystem services, ecological restoration, and ecological design must be massively accelerated and must be accompanied by more effective communication of ecological knowledge to society. Published in *Science* on May 28. Above text taken from the Abstract.

***"Bioblitz" Surveyed Jefferson and Boulder Counties for Grasslands Biodiversity.*** Tim Seastedt led one of several teams that surveyed 6,000 acres of publicly owned and managed grasslands in Jefferson and Boulder counties on June 25 and June 26. Known as a "biodiversity blitz," the survey tried to identify as many species as possible in 24 hours. By the end they found more than 1000 species, ranging from fungi to mammals. The two-day event was designed to provide opportunities for the public to learn first-hand how scientists study the natural world and what has been determined about ecological systems and biodiversity through the survey. The census was the largest effort of its kind ever undertaken in Colorado. Participants included researchers and students from CU-Boulder, Colorado State University, the University of Northern Colorado, the U.S. Fish and Wildlife Service, the Colorado Natural Heritage Program, local land managers, and several nonprofit organizations.

James Syvitski (INSTAAR) walks over a reservoir dam, Apennine Mountains, Italy, August 2004. Through modeling and field efforts, Albert Kettner (not pictured, INSTAAR) and James Syvitski found that these small reservoirs are extremely efficient at trapping sediment and thus, greatly impact the natural dynamics of the many small rivers that discharge into the Adriatic Sea. The project is funded by the Office of Naval Research. Photo: A. Kettner (INSTAAR).

***Children's Book on Colorado's Water Supply Supported by INSTAAR Personnel and Niwot Ridge LTER Project.*** INSTAAR faculty, researchers and graduate students visited several area elementary schools in May to hand-deliver copies of a new children's book, *My Water Comes from the Mountains*, written by Tiffany Fourment, a local environmental educator. Fourment began writing the book as a project for a summer field course, Alpine Ecology and Experiential Learning, taught by Diane McKnight at the Mountain Research Station. The book introduces children to their local watershed, which is fed by waters from the Continental Divide. Fourment narrates the path of water from alpine to plains ecosystems as it becomes the drinking supply and irrigation water for the city of Boulder and neighboring communities. The book's unique contribution to environmental education is that it goes beyond fact-based learning by enabling children to apply ideas and concepts to their own local area. About 2,000 books were purchased for 54 elementary schools in Boulder Valley and St. Vrain school districts by the Niwot Ridge Long Term Ecological Research project, which is supported by the National Science Foundation and managed by INSTAAR researchers. The publisher, Roberts Rinehart Publishers, will also be distributing the book to bookstores in national parks and schools around the country. Latest update: In September, the book was nominated for a regional book award in the children's category by the Mountains and Plains Booksellers Association. The winner will be announced in March 2005.

***INSTAAR-Mentored High School Students Win Science Fair Prizes.*** Theresa Denison and Veronica Carrasco, seniors at Centaurus High School, won several prizes in regional science fairs in spring 2004 based on their team research done under the mentorship of INSTAAR graduate student Rose Cory. Their work has helped deduce seasonal changes in the chemistry and redox state of dissolved organic matter in Nymph Lake, Rocky Mountain National Park. The details of such changes have implications for eutrophication and other aquatic processes as well as for remediation technology. They won first place in the Earth and Space Science category at the Colorado-Wyoming Junior Academy of Science as well as two prizes at the Boulder Valley Regional Science Fair: Best Project from the CU-Boulder Biochemistry and Chemistry Department, and second place in the Chemistry Division. They also won a prize from the Colorado Chapter of Soil and Water Conservation. They have been invited to participate in the National Science Fair in Washington, DC. Theresa is planning to major in biochemistry at Colorado State University, while Veronica will attend CU-Boulder.

Tyler Benton, a junior at Stratton High School in eastern Colorado, won science fair prizes for his research mentored by INSTAAR Dendrochronology Lab manager Jeff Lukas. His work used moisture-sensitive tree-ring chronologies, including one that he helped collect near Eldorado Springs, to reconstruct variability in soil moisture for the Platte Climate Division (northeast Colorado) since 1541. His results showed that the past 460 years include at least 7 that probably equaled or exceeded the extreme drought conditions of 2002, as well as several multi-year droughts more severe than the 1930s Dust Bowl. At the Colorado Science and Engineering Fair in April, Tyler received second place in the

Rose Cory (INSTAAR), Theresa Denison (Centaurus High School), and Veronica Carrasco (Centaurus High School) take a break from studying seasonal changes in the chemistry and redox state of dissolved organic matter, Nymph Lake, Rocky Mountain National Park, winter 2004. Denison and Carrasco won several prizes in regional science fairs in spring 2004 based on their team research done under the mentorship of INSTAAR graduate student Rose Cory. Photo: R. Cory (INSTAAR).

Theresa Denison and Veronica Carrasco (both from Centaurus High School) pose with their science fair poster illustrating seasonal changes in the chemistry and redox state of dissolved organic matter, Nymph Lake, Rocky Mountain National Park. Their work was done under the mentorship of INSTAAR graduate student Rose Cory. Their project won several prizes in regional science fairs in spring 2004 including 1st place in the Earth and Space Science category at the Colorado-Wyoming Junior Academy of Science. They were invited to participate in the National Science Fair in Washington, DC.

senior division of Earth and Space Sciences, and also a cash award from the Colorado Scientific Society.

***INSTAAR Hosted Annual Open House for 345 Students.*** Diane McKnight and Bill Manley led an organizing committee that hosted about 190 sixth-grade students from Southern Hills, 130 eighth-grade students from Peak to Peak, and 25 eighth-grade students from Bridge on April 2. The students were divided into groups to participate in lab tours, lectures, science games, and stream sampling activities. The students learned how climate is recorded in ice and sediment cores, how the Vikings settled Iceland, how materials such as bones and soils are radiocarbon dated, how giant animals lived in Australia during the recent past, and how greenhouse gases are affecting our atmosphere. The students also learned how glaciers work by "flying" through a 3-D landscape of Alaska and how tree rings record past droughts in Colorado. In addition, the students studied stream ecology by collecting water and insects while measuring streamflow. Students' knowledge of Antarctica was tested during a fun quiz show run by staff of the adjacent National Snow and Ice Data Center (NSIDC), including Ted Scambos. INSTAAR participants included Ryan Vachon, Shelly Sommer, Astrid Ogilvie, Bruce Vaughn, Trevor Popp, Sean Pack, and many others, particularly graduate student and professional scientist volunteers.

***Two INSTAAR Professors Exhibited Photos of the West's Ever-Changing Landscape.*** Tad Pfeffer and Robert Anderson authored a photo exhibit entitled "The Texture of History: Abandonment and Rediscovery in the American West," which opened at the Macky Auditorium Gallery on Wednesday, February 18 and ran through March 17. They tried to show that the story of the boom and bust cycle may be told not only in the words of history books, but also in the images of the objects left behind. Over the past 20 years, Pfeffer and Anderson have each been photographing solitary buildings and abandoned equipment in areas throughout the West, including Colorado, Wyoming, Nevada, and California. They have captured the details of objects and places abandoned and then often used again. And each has an eye for different aspects of the objects.

***High-Elevation Climate Change: A New Model for Terrestrial and Aquatic Ecosystems.*** Tim Seastedt, Bill Bowman, Nel Caine, Diane McKnight, Alan Towsend, and Mark Williams (Niwot Ridge LTER PI's) published a key conceptual paper entitled "The Landscape Continuum: A Model for High-Elevation Ecosystems." Their paper employs a new conceptual model that links terrestrial ecosystems to each other and to aquatic ecosystems. At the Niwot Ridge LTER Colorado Rocky Mountain Front Range site, they have documented an increase in precipitation of more than 10 millimeters per year for the last 50 years. This increase has affected the physical processes of alpine lakes; lake-ice thickness measured in late March over a 20-year interval shows a marked decline, while temperatures over this interval have remained statistically unchanged. The changes in ice thickness are best explained by increased winter precipitation (about 1% per year), which leads to increased flows into the lakes. Greater volumes of water hold greater quantities of energy, and thus ice thickness in late winter is reduced. They have also detected an increase in inorganic nitrogen deposition from the atmosphere of 0.3 kilograms per hectare per year between 1984 and 1996. In contrast to the terrestrial ecosystems in alpine areas, which are relatively stable, lake ecosystems in the same areas are undergoing rapid changes in benthic primary production and in diatom species composition. In order to provide a conceptual framework for understanding and predicting how high-elevation systems will respond to climate change, they integrated and augmented previous conceptual models to develop a new model, which suggests that high-elevation lakes and treeline, which functions as a windbreak and collects snow, particulates, and nutrients, are the locations that experience the first negative impacts of anthropogenic materials scavenged from the atmosphere. Published in *Bioscience*, 54(2), February.

Astrid Ogilvie (INSTAAR, middle) with Steinger.?ur Jónsdóttir and Helgi Jónasson at the couple's farm called Grænavatn in the M.?vatn district in northern Iceland, June 2003. Ogilvie's fieldwork involved speaking to locals of northern Iceland about climate change. Photo: T. Woxen.

***INSTAAR Journal Editor Awarded University Medal.*** Kathleen Salzberg was awarded the CU-Boulder University Medal for her internationally renowned work on INSTAAR's journal *Arctic, Antarctic, and Alpine Research*. She was Managing Editor for 35 years and retired in October 2002. Connie Oehring replaced her; Larry Bowlds is the current Managing Editor. The internationally authored and circulated interdisciplinary journal is published quarterly. Contents include original research papers, shorter contributions, resulting correspondence, and book reviews. The journal reports on any scientific or cultural aspect of arctic/subarctic, antarctic/subantarctic, and alpine/subalpine environments and related paleoenvironments. University Medals are awarded in recognition of those persons whose achievements and contributions are particularly associated with the University. The nomination effort was led by Mark Meier and supported by many at INSTAAR and abroad.

***A Better Radiocarbon Clock also Yields Improved Understanding of Earth's Carbon Cycle and Geomagnetic Field.*** Konrad Hughen (Woods Hole Oceanographic Institute and INSTAAR alumnus) led a seven-member group—including Scott Lehman and Jocelyn Turnbull—in the construction of a new high-resolution calibration of the radiocarbon time scale back to 50,000 years before the present. The calibration was based on $^{14}C$ measurements in sediment cores from the tropical Cariaco Basin, which were correlated to the annual-layer counted chronology for the Greenland Ice Sheet Project 2 (GISP2) ice core. The results improved the accuracy of the $^{14}C$ method, thereby assisting disciplines such as archaeology and paleoclimatology. Moreover, their results yielded fundamental insights into the history of the global carbon cycle and Earth's geomagnetic field. Published in *Science* on January 9.

Oleg Antonov (VSEGEI, St. Petersburg, Russia) ascending from the Ozernaya River valley, October Revolution Island, Severnaya Zemlya, Arctic Russia (79°N), August 2003. Antonov was part of an international team studying the glacial geologic history of this region on the edge of the Arctic Ocean; it was repeatedly covered by large ice sheets, but their magnitude and timing were poorly known. The research team included members from the U.S.A. (INSTAAR and University of Illinois at Chicago), Sweden, Russia, Iceland, and the Netherlands. Photo: JJ. Zeeberg (RIVO, Netherlands).

# INSTAAR Laboratories and Other Facilities

## Amino Acid Laboratory

The purpose of this laboratory is to extract and quantify the amino acid composition and extent of racemization of indigenous proteinaceous residues preserved in biominerals for a range of environmental applications. The lab contains two HP-1100 automated high-pressure liquid chromatographs (HPLCs) and ancillary support equipment. Usually one HPLC runs in reverse-phase mode and the other in ion-exchange mode. The laboratory currently focuses on the kinetics of amino acid racemization in the eggshells of large flightless birds, and bivalve mollusks from high-latitude regions. The laboratory director is Gifford Miller. A full-time technician, Stephen DeVogel, oversees the day-to-day operation of the laboratory. Graduate and undergraduate students use the laboratory in their research projects and to gain research experience.

## AMS Radiocarbon Preparation and Research Laboratory

This laboratory provides AMS radiocarbon-dating services to researchers from the United States and Latin America. In-house research focuses on method development in AMS 14C preparation and dating, calibration of the radiocarbon time scale, and estimation of past levels of radiocarbon activity as a proxy for various geophysical and solar processes. Under the direction of Scott Lehman and Staff Chemist Jocelyn Turnbull, the laboratory processes 25 authentic samples per week.

## Atmospheric Research Laboratory

This laboratory houses instrumentation for research on surface-atmosphere trace gas fluxes. This lab is heavily involved in field research. Currently, ozone flux measurements of snow-covered landscapes are performed at several local and polar field research sites. Another project uses research vessels to investigate the uptake of ozone to the oceans. A monitoring station in the Azores is equipped with a hydrocarbon monitor for the study of long-range transport of air pollution across the Atlantic ocean. A special emphasis is the analysis of volatile organic compounds (VOC), in particular emissions of biogenic VOC from vegetation. Measurements are made by solid adsorbent sampling techniques, thermal desorption instruments, and several gas chromatographs with different detection systems, including flame ionization and mass spectrometry. The Atmospheric Research Lab also pursues boundary-layer profiling measurements from a tethered balloon platform. Related equipment includes several helium balloons, a hydraulic winch, meteorological sensors, and chemical instruments for balloon/airborne measurements of temperature, pressure, wind speed, wind direction, water vapor, ozone, VOC, and particulates. The laboratory director is Detlev Helmig.

Jocelyn Turnbull (INSTAAR, AMS Radiocarbon Preparation and Research Laboratory) helps eighth graders explore concepts of radiocarbon dating by using improvised models, INSTAAR Open House, Boulder, Colorado, April 2003. Samples measured in the radiocarbon lab are used to aid in understanding of geology, archeology, and climate change. Photo: J. Briner (INSTAAR).

Antarctic Tropospheric Chemistry Investigation (ANTCI) scientists (including INSTAAR's Detlev Helmig) with one of their tethered helium balloons used to study atmospheric transport and chemistry, South Pole, Antarctica, December 2003. The INSTAAR Atmospheric Research Lab is participating in ANTCI. Photo: D. Helmig (INSTAAR).

## Biogeochemistry Laboratories

These laboratories are specialized for preparation of water and soil samples for chemical analysis. Major equipment includes fume hood, oven, distilled water, shaker, and extraction equipment. Tim Seastedt, Alan Townsend, and Diane McKnight are in charge of these laboratories.

## Core Processing Laboratory

This room is equipped for splitting, photographing, color logging, describing, sampling, and measuring magnetic properties of sediment cores. Sinks are available for wet sieving samples for preparation of microscopic analysis or other needs. The facility is intended for use in analysis of terrestrial, lake, and marine cores. There are two analytical balances available for weighing samples, a small oven, carts for transporting cores and samples, and plenty of counter space. This room is used by INSTAAR Directorate members Gifford Miller and Anne Jennings, post-docs, and graduate and undergraduate students.

An eighth-grade student studies tree-ring records of drought conditions in Colorado in the 1800s, INSTAAR Open House, Boulder, Colorado, April 2004. He and his fellow students learned how tree growth patterns relate to climate change while visiting the INSTAAR Dendrochronology Lab. Photo: D. Lubinski (INSTAAR).

## Dendrochronology Laboratory

Research in this laboratory concerns the use of dated, annual tree rings to investigate past climatic and environmental conditions. The laboratory is fully equipped for preparing, dating, and measuring tree-ring widths for dendrochronlogical studies. The laboratory is under the direction of Connie Woodhouse with Laboratory Manager Jeff Lukas.

## Dissolved Organic Matter Laboratory

This laboratory specializes in measuring the amount and character of dissolved organic matter from diverse ecosystems. Major equipment includes Shimadzu TOC analyzer, Antec 9000 DON analyzer, Agilent 8453 spectrophotometer, FluroMax2 fluorometer, fractionation columns, and Ulter-filtration. Mark Williams and Diane McKnight are in charge of the laboratory.

## Ecosystems Laboratory

This laboratory is a sample preparation and microscopy facility for the identification and counting of algae, invertebrates, and plant material in samples from soils, lakes, and streams collected for the Niwot Ridge and McMurdo Sound LTER projects and from studies of acid mine drainage streams in Colorado. The laboratory is supervised by Diane McKnight and is used by students and researchers involved in the LTER projects.

## Environmental Computing and Imaging Laboratory

The ECI Laboratory makes it possible for INSTAAR researchers to do numerically intensive modeling and data manipulation. It is used for stratigraphic and hydrologic modeling, statistical analysis of LTER ecologic datasets, land and river system terrain analysis, and national reservoir inventory. Two parallel-processing SUN Microsystems machines (2 V880s) form the hub, totaling 16 processors, 4.6 Tb of accessible hard disk space backed by multiple RAID as well as DLT backup, and 48 Gb of RAM. The lesser machine is dedicated to web serving of outputs, images, and data. Various peripherals provide INSTAAR with large-format plotting, retro-compatible operating systems, and video editing. At present there are 68 users of the ECI, with several projects using >5% of the total resource. The last two years have witnessed significant improvements in the lab: replacement of processors by SUN, upgrading and additions to the software suites, modernization of the air conditioning by CU FACMAN, rationalization of bookkeeping, and increases in the processing power and disk space funded internally by INSTAAR. The ECI Laboratory is directed by James Syvitski.

## Herbarium

This facility is housed at the Mountain Research Station. It contains a field collection of plants of the Front Range.

## ICP-MS Trace Element Laboratory

Construction of this new facility was completed in 2004. It houses a Thermo Finnigan Element2 inductively coupled plasma mass spectrometer (ICP-MS) for the measurement of trace and minor elements in carbonates, natural waters, and other materials. A Class 1000 clean room is used for sample preparation. The laboratory is directed by Tom Marchitto.

## INSTAAR Information Center

This special library supports INSTAAR research with a collection of journals, books, and electronic resources, combined with services such as database-searching tutorials and help with research requests. Librarian Shelly Sommer and Library Assistant Jenifer Hall-Bowman staff the Information Center.

## Kiowa Environmental Chemistry Laboratory

This laboratory is the environmental chemistry laboratory for the Niwot Ridge/Green Lakes Valley Long-Term Ecological Research Program. The laboratory is located at the Mountain Research Station and is managed by Christine Siebold and directed by Mark Williams. Equipped with an ion chromatograph, a spectrophotometric flow injection analyzer, and an atomic absorption spectrometer, the laboratory analyzes air, snow, water, and soil samples collected by faculty and graduate students from alpine and subalpine ecosystems for major solutes and nutrients.

## Landscape Ecology and Conservation Laboratory

This laboratory conducts basic and applied research in three main areas: the ecology, distribution, and conservation planning of species, vegetation types, and ecosystems; multiscaled analysis of treeline structure, composition, and dynamics; and more recently, the analysis of interactions between environmental and social dynamics, including forecasting the effects of these interactions on patterns of dynamic changes and the ecological resilience of complex

socioecological systems. Research to date has focused on the development and prototyping of methods and techniques for integrated regional ecological assessments, ecosystem characterization and regionalization mapping of ecosystem units, modeling of plant species and vegetation type distributions, landscape analysis of ecotones at the alpine treeline, and integration of ecological knowledge into the planning process. Recent work has included integrating different technologies (modeling, GIS, remote sensing, development of knowledge bases, and reserve selection algorithms) to design regional networks of conservation reserves. Study areas include the western United States, with special emphasis on Colorado and the Pacific Northwest and Southwestern regions, and western Europe. The laboratory is directed by Patrick Bourgeron and managed by Hope Humphries.

## Limnology Laboratory

This is an analytical laboratory for studying water and sediment samples. The laboratory is equipped for sample preparation, analysis of metals and major cations using the atomic absorption spectrophotometer, and the preparative isolation of organic fractions using column chromatography. The laboratory is directed by Diane McKnight and is used by postdocs, graduate students, and undergraduate students enrolled in McKnight's classes.

## Micropaleontology Laboratory

This is a foraminiferal analysis laboratory equipped with sieves and other equipment needed for preparation of foraminiferal samples, and binocular microscopes, faunal reference slides, and books for foraminiferal assemblage analysis and picking of stable isotope and radiocarbon samples. An image analysis facility employing a binocular microscope, analog camera, and computer is available to all researchers or students for computer imaging of foraminifers, plant macrofossils, mollusks, beetles, and other macrofossils. The laboratory is managed and supervised by Anne Jennings.

## Mountain Research Station

The Mountain Research Station (MRS), located near Nederland, 25 miles from Boulder, is an interdisciplinary research facility of the University of Colorado devoted to advancement of study of mountain ecosystems. Its mission is to facilitate research and education to better understand the unique patterns and processes of biotic and physical systems in mountains, and how environmental changes may affect these processes.

## Oceanography Laboratory

The purpose of this facility is to develop and deploy marine instruments related to understanding sediment dynamics. Major equipment includes an underwater camera system for studying flocculation dynamics, a CTD, an attenuance meter, and a LISST (in situ laser particle size analyzer). The laboratory also houses an extensive geophysical data library of analog and digital seismic and sidescan data from glacimarine environments. James Syvitski and Eric Hutton are in charge of the laboratory.

## Paleoentomology Laboratory

The purpose of this laboratory is to prepare samples for fossil insect study. This involves soaking, heating, wet screening, and kerosene flotation of samples, all of which is done under fume hoods. The university fabricated a special over-the-sink fume hood, linked with the main fume hood in the room, so that the fumes from the kerosene flotation could be properly ventilated. Bruce Vaugh manages this laboratory as a part of the Isotope Geochemistry lab suite. Scott Elias and his students are the principal users.

## Palynology Laboratories

These laboratories comprise two pollen sample preparation laboratories and a pollen microscopy laboratory. The sample preparation laboratories have standard equipment for chemical pretreatment of sediment samples for micropaleontological analyses of pollen and diatoms. The microscopy laboratory has two high-powered, research-grade light microscopes with image analysis capabilities, several light microscopes for student use, and a binocular microscope with camera equipment. These laboratories are supervised by Vera Markgraf and Alex Wolfe.

## Plant Physiology Laboratory

This is a soils preparation laboratory directed by Bill Bowman. It houses shakers, filter apparatuses, and two $CO_2$ analyzers used for soil and plant gas exchange analysis.

## Quaternary GIS Laboratory

This facility applies state-of-the-art tools and concepts with Geographic Information Systems (GIS) and remote sensing to a variety of environmental problems at high latitudes. Quantitative spatial analysis focuses on past and present glacier dynamics in Alaska, as well as Arctic shoreline erosion and ice-field archaeology. Other projects involve graduate students and public outreach with studies of paleoclimate, paleolimnology, and geomorphology from Australia to Iceland. Under the direction of William Manley, the lab includes four workstations, a large-format scanner, peripherals, and a range of software (ArcGIS, MFWorks, ENVI, and others).

## Sediment Geochemistry Laboratory

Research in this laboratory is focused on quantitative reconstructions of past sea-surface temperatures, applications of organic geochemistry to problems in paleoclimatology, and calibration of the radiocarbon time scale. Major equipment includes trace organic clean preparation facilities, automated

pressurized fluid extraction (Dionex ASE 200), gas chromatograph (HP 6890 with 100-position autosampler, programmable temperature vaporization [PTV] inlet, and FID). Andrew Crotwell and Chanda Herring are in charge of the day-to-day operation of the laboratory under the direction of Scott Lehman.

## Sedimentology Laboratory

This laboratory provides high quality data for research projects for INSTAAR Directorate members, postdocs, graduate and undergraduate students, and outside clients. The laboratory performs both chemical and physical analyses on sediments and other material and encourages students to run their own analyses. The lab is equipped to measure grain size using a laser diffraction particle size analyzer (Malvern long bed mastersizer), total carbon and inorganic carbon content (Coulometer), carbonate content (WHOI carbonate analyzer), magnetic properties (MS, SIRM, and IRM), bulk density and mineralogy (Siemens D5000 X-Ray Diffractometer). Sieves are available for both dry and wet sieve analysis. The lab is equipped with ovens, two freeze dryers, a distilled water system, and analytical balances. The laboratory is coordinated by Wendy Roth, under the supervision of Suzanne Anderson.

## Snow and Ice Laboratory

This laboratory is built around a 400-square-foot cold room, with facilities presently configured for experimental work in heat and mass transfer in snow as well as general electronics and mechanical design and fabrication. The laboratory is directed by Tad Pfeffer.

## Stable Isotope Laboratory

This laboratory is a state-of-the-art analytical facility that uses stable isotopes to understand the processes controlling environmental change on time scales relevant to human interactions with the environment. The research focuses on the modern carbon and water cycles and paleoclimate records from ice cores, lake sediments, carbonates, and organic matter. The laboratory houses 9 mass spectrometers and 12 gas preparation systems for analysis of stable isotopes of oxygen, hydrogen, carbon, and nitrogen. The lab shares a strong collaboration with the NOAA Climate Monitoring and Diagnostic Laboratory, and analyzes isotopes in thousands of weekly samples of greenhouse gases from a global network. The stable isotope laboratory is supervised by Jim White, managed by Bruce Vaughn, and utilizes a staff of five technicians, numerous graduate students and postdocs to analyze over 48,000 samples per year.

## Terrestrial Ecosystem Analysis Laboratory

This laboratory focuses on nutrient analyses of soils and plant tissue, with an emphasis on carbon, nitrogen, and phosphorus. N and P in solution, including water samples, are also measured routinely, as are a variety of microbial functional attributes, including biomass, enzyme activities, and CO2 emissions from soils. Major instrumentation includes Alpkem autoanalyzer, Carlo-Erba CHN analyzer, benchtop spectrophotometer, and PP Systems IR gas analyzer. The laboratory is directed by Alan Townsend and managed by Briana Constance. The laboratory is consistently used by graduate students from INSTAAR as well as from CIRES, EPOB, and Geological Sciences.

Jim White (INSTAAR, left) prepares banana daiquiris for a summer Saturday night party at the NorthGRIP drilling site (North Greenland Ice core Project), Greenland Ice Sheet, July 2004. White directs INSTAAR's Stable Isotope Laboratory, which analyzes over 10,000 ice samples per year, yielding high-resolution records of past temperatures from the isotopic ratios of hydrogen and oxygen. Photo: J. White (INSTAAR).

# Library and Publications

## INSTAAR Information Center

The Information Center is the specialized library of INSTAAR. It is a unique, focused collection of materials, information resources, and services that forward INSTAAR research. Main subject areas include climatic change, ecology, earth sciences, the Quaternary, and cold regions.

The collection of print materials includes 4400 books, 2700 reports, 485 theses, and 2110 reprints of faculty publications. Computers in the Information Center provide access to an online catalog of all materials in the collection and to the bibliographic database Arctic & Antarctic Regions. The Information Center website (http://instaar.colorado.edu/other/info_center/) coordinates available information sources, including journals held in the Information Center, INSTAAR theses and other publications, electronic journals, bibliographic databases, data clearinghouses, and web resources.

Library services include help with research requests; the creation of research tools and guides; and individual and group instruction in effective online searching, catalog use, database searching, interlibrary loan, and other topics.

The room also provides study areas and a place for group discussions and meetings.

Shelly Sommer manages the Information Center, assisted by Jenifer Hall-Bowman.

## Publications

INSTAAR publishes two series: *Arctic, Antarctic, and Alpine Research,* an international quarterly journal, and Occasional Papers, an irregular monograph series.

*Arctic, Antarctic, and Alpine Research* (formerly *Arctic and Alpine Research*) is a refereed quarterly interdisciplinary journal devoted to publishing original research papers, shorter contributions, resulting correspondence, and book reviews. This internationally authored and circulated journal reports on scientific or cultural aspects of arctic/subarctic, antarctic/subantarctic, and alpine/subalpine environments and related paleoenvironments. The content of the journal reflects areas of research performed at INSTAAR.

Mark Williams was the Editor of the journal until he was replaced by Suzanne Anderson and Anne Jennings in 2004. Connie Oehring was the Managing Editor until she was replaced by Larry Bowlds in 2004. The Managing Editor is assisted by Jenifer Hall-Bowman.

The Editorial Board is composed of INSTAAR and University of Colorado faculty. Board members review papers and advise on policy. An international Interdisciplinary Board reviews papers and promotes the interests of the journal in members' respective countries. The peer reviewers are selected by the Editors.

During 2003, 107 papers were submitted to the journal, a decrease of 8% from 2002. Volume 35 (2003) contained 548 pages and included 60 research papers. First authors represented 19 countries. During 2004, 106 papers were submitted to the journal, a decrease of 1% from 2003. Volume 36 (2003) contained 636 pages and included 73 research papers. First authors represented 20 countries. Volume 36 included an international symposium, "Arctic-Alpine Ecosystems and People in a Changing Environment." Subscriber numbers have remained fairly constant, with about 700 copies of each issue distributed to subscribers (libraries, individuals, and students), exchange partners, and miscellaneous complimentary "subscribers."

*Arctic, Antarctic, and Alpine Research* has an impact factor of 1.213 (an impact factor is the ratio of citations of recent articles to the number of recently published articles). It was ranked number 2 in the Geography category and number 13 in the Environmental Sciences category in Institute of Scientific Information's Journal Citation Reports (2001).

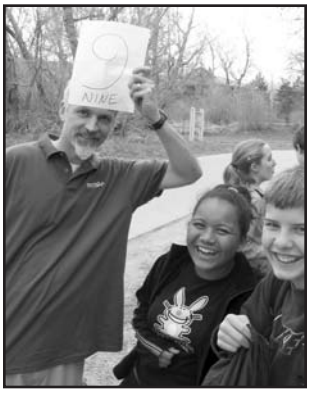
The journal has a dedicated website (http://instaar.colorado.edu/AAAR/) that includes general information about the journal, contents, and abstracts from 1996 to the present, instructions for manuscript submission, and subscription information. Full text is available online at BioOne (http://www.bioone.org) through institutional subscriptions.

The Occasional Paper series is a miscellaneous collection of reports and papers on work performed by INSTAAR personnel and their associates that are generally too long or too data intensive for publication in research journals. Occasional Paper No. 56, *Radiocarbon Date List X: Baffin Bay, Baffin Island, Iceland, Labrador Sea, and the Northern North Atlantic,* compiled by G. Dunhill, J. T. Andrews, and G. B. Kristjánsdóttir, was published in 2004.

Shelly Sommer, INSTAAR Information Center Manager, February 2005. Photo: T. Pfeffer (INSTAAR).

# Societal Outreach

Over the last few years, societal outreach and informal educational opportunities have become a more important part of INSTAAR's mission. The institute continues to present its popular Open House annually. Undergraduate students are often mentored through hands-on research projects. Younger students are also mentored as part of annual science fair projects at the K–12 level. A particularly effective effort led to the creation and distribution of a children's book on mountain hydrology and ecology, which was received enthusiastically during presentations at local elementary schools. Outreach is facilitated with an expanded and improved INSTAAR website, and with a variety of online initiatives for sharing and illustrating scientific information. On a day-to-day basis, INSTAAR members respond to inquiries from the public and the media on the broad spectrum of scientific matters that relate to INSTAAR's research. They regularly give lectures and presentations to schools and civic groups, and provide TV and radio interviews for the popular press.




Ken Mack (INSTAAR), group nine leader, shares his team spirit with several eighth graders, INSTAAR Open House, Boulder, Colorado, April 2004. Photo: D. Lubinski (INSTAAR).

In April 2003, INSTAAR continued its successful series of Open Houses by hosting 189 eighth graders from Southern Hills Middle School and Sojourner Charter School. The energetic students collected samples and learned about relationships among stream flow, water quality, and insect ecology at nearby Boulder Creek. By visiting a few of the many labs at INSTAAR and the National Snow and Ice Data Center (NSIDC), the students learned how materials such as bones and soils are radiocarbon dated, how climate controls the extent of glaciers and sea ice, and how climate is recorded in ice cores. In addition to the hands-on exercises, the students participated in lectures on Neanderthals as well as greenhouse gases and global change. Students also explored mountains and glaciers in Alaska through an immersive 3-D virtual reality facility, courtesy of the BP Center for Visualization. The Open House helped convey the diverse aspects of earth science, use of sophisticated instrumentation and modeling, and the relevance of earth science for important global and local issues.

The following year, also in April, INSTAAR expanded the Open House by hosting 345 students from Southern Hills Middle School, Peak-to-Peak Charter School, and the Bridge School. Similar to the past, the students were divided into groups to participate in lab tours, lectures, science games, and stream sampling activities. The students learned how climate is recorded in ice and sediment cores, how the Vikings settled Iceland, how materials such as bones and soils are radiocarbon dated, how giant animals lived in Australia during the recent past, and how greenhouse gases are affecting our atmosphere. The students also learned how glaciers work by "flying" through a 3-D landscape of Alaska and how tree rings record past droughts in Colorado. In addition, the students studied stream ecology by collecting water and insects while measuring streamflow. Students' knowledge of Antarctica was tested during a fun quiz show run by staff of the adjacent National Snow and Ice Data Center (NSIDC), including Ted Scambos.

Two eighth grade students answer questions about radiocarbon dating of bones, INSTAAR Open House, Boulder, Colorado, April 2004. Samples measured in the radiocarbon lab are used to aid in understanding of geology, archeology, and climate change. Photo: D. Lubinski (INSTAAR).

INSTAAR faculty, researchers, and graduate students visited several area elementary schools to hand-deliver and speak from copies of a new children's book, *My Water Comes from the Mountains,* written by Tiffany Fourment. A local environmental educator, Fourment began writing the book as a project for a summer field course, Alpine Ecology and Experiential Learning, taught by Diane McKnight at the Mountain Research Station. The Niwot Ridge LTER program assisted with production of the book, as well as with distribution to every 3-4 grade science class in the Boulder Valley and St. Vrain School Districts.

INSTAAR continued strong involvement with several CU initiatives to directly involve undergraduates and minority students in scientific research. These included the Summer Undergraduate Research Fellowship (SURF) program, the Summer Multicultural Access to Research Training (SMART) program, the Significant Opportunities in Atmospheric Research and Science (SOARS) program, and others.

Other outreach highlights for 2003 and 2004 include:

- INSTAAR personnel judged several science fairs, ranging from individual schools to regional and state fairs.
- Theresa Denison and Veronica Carrasco, seniors at Centaurus High School, won several prizes in regional science fairs in spring 2004 based on their team research done under the mentorship of INSTAAR graduate student Rose Cory. Their work has helped deduce seasonal changes in the chemistry and redox state of dissolved organic matter in Nymph Lake, Rocky Mountain National Park.
- Tyler Benton, a junior at Stratton High School in eastern Colorado, won science fair prizes for his research mentored by INSTAAR Dendrochronology Lab manager Jeff Lukas. His work used moisture-sensitive tree-ring chronologies, including one that he helped collect near Eldorado Springs, to reconstruct variability in soil moisture for the Platte Climate Division (northeast Colorado) since 1541.
- Bill Bowman was interviewed for the Earth & Sky radio program to help listeners better understand the science of biodiversity studies and the consequences of its loss in mountain areas. The Earth & Sky radio series is a 90-second science radio program broadcast daily by 688 radio stations in the United States and many more throughout the world.
- James Dixon was a particularly active speaker, including numerous public radio interviews, public lectures at ven-

Diane McKnight (INSTAAR, right rear) and Tiffany Fourment (CU Boulder Alum, with backpack) lead a group of elementary students on a field trip to Niwot Ridge LTER, near Ward, Colorado, July 2004. The students participated in the trip as part of a two-week course at the Wild Bear Science and Nature Center in Nederland, Colorado. T. Fourment is the author of the children's book *My Water Comes from the Mountains,* which she wrote after taking a summer field course with D. McKnight at INSTAAR's Mountain Research Station. Photo: C.A. Cass (CU Boulder).

ues from Colorado and Alaska to Russia, and an appearance on a NOVA documentary.

- Nel Caine, James Dixon, Mark Dyurgerov, Tim Kittel, Craig Lee, and Tad Pfeffer were interviewed by Jim Erickson of the *Rocky Mountain News* for a series of three stories centered on environmental change in the Colorado alpine. The stories documented how Front Range glaciers are declining, lake ice is thinning, and some snow banks are receding to expose animal remains more than 2,000 years old.
- The Mountain Research Station continues to participate in educational experiences for the general public, aimed at policy decisions that affect our environment. The TundraCam and Niwot Ridge climate stations are popular sites for web visitors. Several K–12 courses also use the MRS as a site to introduce students to field environmental science. Also, an Alpine Ecology course that trains in-service and preservice K–12 educators was taught at the station both years.
- Connie Woodhouse and David Anderson continued their efforts to make paleoclimatology data available via the Internet from the World Data Center for Paleoclimatology (www.ncdc.noaa.gov/paleo). Major accomplishments included the development of a fire history database, the development of an expanded archive of data from marine sediments, and a web site that describes abrupt climate change issues and includes links to paleoclimate data that document abrupt climate change.
- William Manley used a Geographic Information System (GIS) to create a movie showing how the Bering Land Bridge evolved after the Last Glacial Maximum, about 21,000 years ago (instaar.colorado.edu/QGISL). The visualization—with over 20,000 online visits thus far—reveals large-scale patterns of shifting coastlines and environments as sea level rose, blocking migration routes for humans and animals.
- As a part of an NSF-IGERT funded grant, Nataly Ascarrunz and Sasha Reed are meeting with indigenous populations of Eastern Bolivia to conduct community discussions regarding climate change and to enable the monitoring of local climate.
- INSTAAR gradate students Sasha Reed and Nataly Ascarrunz also volunteered with the Expanding Your Horizons program whose goal is to ensure that young women have ample exposure to math and science.

Ted Scambos (NSIDC, National Snow and Ice Data Center) quizzes a group of eighth grade students on their knowledge of Antarctica, INSTAAR-NSIDC Open House, Boulder Colorado, April 2004. NSIDC has joined open house efforts with INSTAAR for a number of years. The NSIDC game show in 2004 was very popular. The first student to hit their buzzer and answer correctly got a small prize. Photo: D. Lubinski (INSTAAR).

- Alan Townsend wrote seven columns in 2003 about "The Changing World" for the Boulder *Daily Camera*. Townsend's column was focused on the environment, with topics ranging from the effects of fertilizer to developments in motor vehicle technology.

- Bob Stallard was strongly involved with an innovative field, classroom, and online initiative with the nonprofit Jason Foundation for Education. As a Host Researcher, Bob provided expertise in watershed and terrestrial studies for a multidisciplinary, multimedia project on "Panama's Tropical Forests and Global Environmental Change." The Jason Foundation was founded by Dr. Robert Ballard of *Titanic* fame, and reaches students around the world at www.jasonproject.org.

Michelle Huyser (Calvin College, Michigan), a participant in the Research Experiences for Undergraduates program run at the Mountain Research Station, measuring soil temperatures, as part of a project investigating plant species effects on soil microbial activity, Niwot Ridge LTER area, Colorado, June 2004. Photo: W. Bowman (INSTAAR).

Bruce Vaughn (INSTAAR) makes a batch of homemade ice cream using liquid nitrogen in order to feed the many INSTAAR and NSIDC volunteers who participated in the Open House for 345 students, Boulder, Colorado, April 2004. Photo: D. Lubinski (INSTAAR).

A large group of eighth graders are led in a game of "simon says" while waiting for their buses to arrive after the INSTAAR Open House, Boulder, Colorado, April 2004. Photo: D. Lubinski (INSTAAR).

# Arctic Workshop

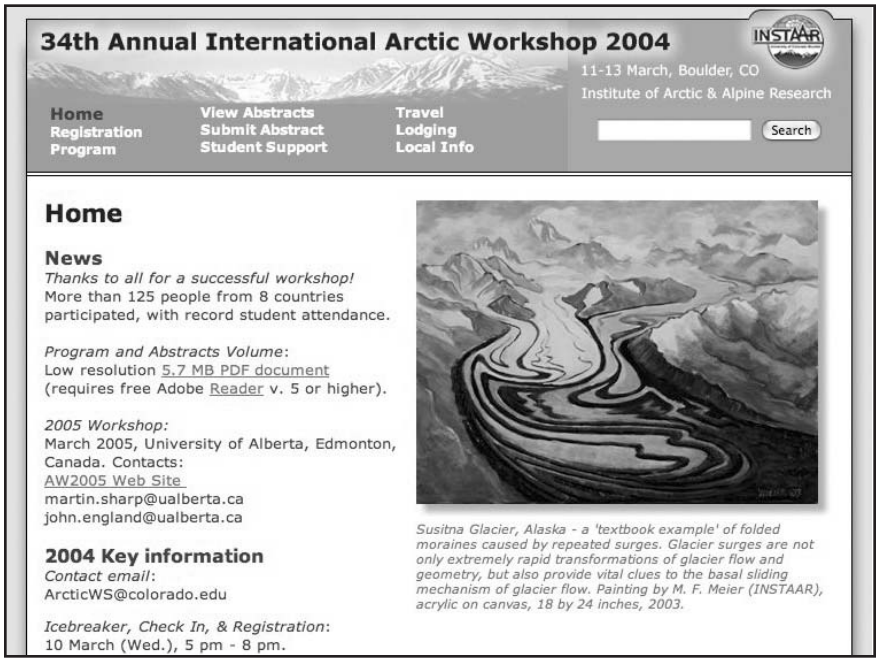
The annual Arctic Workshop was started in 1970 by Professor John T. Andrews as an informal annual gathering, held at INSTAAR, to discuss research issues of interest to Arctic scientists. The location of the Arctic Workshop began varying between Boulder and an alternate location in 1983, and has since grown into an annual internationally attended meeting hosted by academic institutes worldwide. Organized around posters and presentations and covering both past and present Arctic and Antarctic environments, the workshop now aims to reflect the whole interdisciplinary spectrum of research in the circumpolar regions, both North and South. Presentation topics include Arctic and Antarctic environments, Climatology, Archeology, Anthopology, Environmental Geochemistry, Geomorphology, Hydrology, Glaciology, Soil Science, Ecology, Zoology, Limnology, Biogeography, Oceanography, Meteorology, and Quaternary History. All those with an interest in high-latitude environments are encouraged to attend. Student participation is a vital component of this workshop, and financial support is available to this end. The U.S. National Science Foundation has generously supported registration, accommodation, and subsistence for presenting graduate students, making this meeting into a great medium for students to explore a wide variety of research studies in the Arctic and Antarctic regions.

## 33rd Annual Arctic Workshop, 3–5 April 2003

The 33rd Annual Arctic Workshop was organized in Tromsø, Norway, by the Norwegian Polar Institute, Department of Geology, University of Tromsø. Both the Research Council of Norway and the U.S. National Science Foundation offered generous support. The Organizing Committee consisted of S. Bondevik, E. Isakson, M. Hald, N. Koc, and T. Voren. The abstracts of this meeting are still available from the AW website: http://instaar.colorado.edu/other/download/AW_33.pdf

## 34th Annual Arctic Workshop, 11–13 March 2004

The 34th Annual Arctic Workshop was hosted by INSTAAR. In 2004, 125 people from 8 countries attended the meeting. A record number of students presented their research. Sessions included presentations on Iceland marine, lacustrine, and terrestrial geology and climate history, as well as sessions on Greenland, Arctic Canada, Europe, Russia, and Alaska. The Organizing Committee was led by T. Pfeffer and D. Lubinski. INSTAAR committee members also included W. Roth, A. Jennings, W. Manley, A. Ogilvie, and S. DeVogel. The abstracts of this meeting are still available from the AW website: http://www.colorado.edu/INSTAAR/AW2004/




The 2004 Arctic Workshop web site contains information about the meeting, searchable abstracts, and the proceedings in PDF format. Visit www.colorado.edu/INSTAAR/AW2004/.

# Courses Taught by INSTAAR Faculty

## 2003

### Robert S. Anderson
UC Santa Cruz, Dynamic Earth, Spring 2003
UC Santa Cruz, Numerical Modeling in the Earth Sciences, Spring 2003
GEOL 5700-004, Geomechanics, Fall 2003

### William D. Bowman
EPOB 4350, Field Biology, Summer 2003 (co-taught)

### Nel Caine
GEOG/GEOL 4241, Principles of Geomorphology, Fall 2003
GEOG/GEOL 3023, Statistics for Earth Science, Fall 2003

### James Dixon
ANTH 4020, First Americans, Spring 2003
MUSM 6960, Masters Project in Museum and Field Studies, Spring 2003
MUSM 5917, Museum Practicum, Spring 2003
MUSM 5011, Intro to Museum Studies, Fall 2003
MUSM 5917, Museum Practicum, Fall 2003
MUSM 6960, Masters Project in Museum and Field Studies, Fall 2003
ANTH 5840, Guided Study, Fall 2003

### Scott J. Lehman
GEOL 5700-010, Chemical and Isotopic Constraints on the Recent Carbon Cycle, Spring 2003

### Wesley E. LeMasurier
GEOL 1082, Physical Geology: Internal Processes, Spring 2003
CU Denver, GEOL 3231, Introductory Petrology, Spring 2003

### Thomas Marchitto
GEOL 5700-9, Recent Developments in Rapid Climate Change Research, Spring 2003

### Diane Marie McKnight
CVEN 6404, Advanced Aquatic Chemistry, Spring 2003
EPOB 2010, Alpine Ecology and Experiential Learning, Summer 2003 (with H. Galbraith and J. Larsen)
CVEN 5323, Applied Stream Ecology, Fall 2003

### Gifford Hubbs Miller
GEOL 3420-3, The Geological Record of Global Change, Spring 2003
GEOL 1060-3, Global Change: The Earth Science Perspective, Fall 2003
GEOL 1110-1, Global Change Lab, Fall 2003

### Scott D. Peckham
GEOL 4060/5060, Oceanography, Spring 2003 (with J. Syvitski)

### W. Tad Pfeffer
CVEN 3698, Engineering Geology, Spring 2003
CVEN 4838/4838, Mechanics and Dynamics of Glaciers, Spring 2003
Non-CU summer course, Terrestrial Photogrammetry with Applications to Architectural Documentation, Summer 2003
Non-CU summer course, Architectural Photography, Summer 2003

### Timothy Seastedt
EPOB 3270, Ecosystem Ecology, Spring 2003
EPOB 6100, Novel Organisms in Ecosystems, Spring 2003
EBIO 5310, Conservation and Ecology, Fall 2003 (with Carl Bock)

### James P. Syvitski
GEOL 4060/5060, Oceanography, Spring 2003 (with S. Peckham)
U of Tromsø, GEO-322, Polar Marine Sedimentary Environments, Spring 2003

### Alan Ronald Townsend
EPOB 4160, Introduction to Biogeochemistry, Spring 2003
EPOB 6100, Carbon, Climate and Society, Spring 2003
EPOB 6100, Carbon, Climate and Society, Fall 2003

### James White
GEOL 1070, Global Change, Spring 2003
ENVS 3930, Internship in ENVS, Spring 2003
GEOL 3520, Environmental Issues, Spring 2003
ENVS 4990, Senior thesis in ENVS, Spring 2003
GEOL 1110, Global Change Lab, Spring 2003
ENVS 4990, Senior thesis in ENVS, Fall 2003
ENVS 3930, Internship in ENVS, Fall 2003

### Mark W. Williams
GEOG 5241, Topics in Physical Geography, Spring 2003
GEOG 3930, Internship, Spring 2003
GEOG 3251, Mountain Geography, Fall 2003

Ice crystals on willow leaves near treeline following passage of a cold front that dropped 4 inches of snow on the first day of summer, above the INSTAAR Mountain Research Station in the Niwot Ridge LTER area, Colorado, 22 June 2004. Photo: W. Bowman (INSTAAR).

## 2004

**Robert S. Anderson**
GEOL 5700, Mechanics and Chemistry of Landscapes (Geomorphology), Spring 2004
GEOL 5700-004, Geomechanics, Fall 2004
GEOL 5700, Introduction to the Geological Science Faculty, Fall 2004

**Suzanne Prestrud Anderson**
GEOG 4120/6181, Wetland Environments, Fall 2004

**William D. Bowman**
EBIO 4140, Plant Ecology, Fall 2004

**Thomas Nelson Caine**
GEOG 3511, Introduction to Hydrology, Fall 2004
GEOG 3023, Statistics for Earth Sciences, Fall 2004

**Detlev Helmig**
ATOC 6020, Atmospheric Trace Gas Fluxes, Spring 2004
ATOC 6020-003, Seminar: Atmospheric Trace Gas Fluxes, Fall 2004

**Thomas Marchitto**
GEOL 3070, Introduction to Oceanography, Spring 2004
GEOL 4700/5700 (ENVS 5100), Paleoceanography and Paleoclimatology, Fall 2004

**Diane McKnight**
CVEN 3434, Introduction to Applied Ecology, Spring 2004
Gifford Hubbs Miller

**GEOL 5420, Quaternary Dating Methods, Spring 2004**
GEOL 1060, Global Change, Fall 2004

**Scott Peckham**
GEOL 4060/5060, Oceanography, Spring 2004 (with J. Syvitski)

**Tad Pfeffer**
CVEN 3698, Engineering Geology, Spring 2004
CVEN 5768, Rock Mechanics, Spring 2004
CVEN 4511, Finite Element Modeling, Fall 2004

**Timothy Seastedt**
EPOB 3270, Ecosystem Ecology, Spring 2004
EBIO 4800/5800, Ecology of Invasive Species, Fall 2004

**James P. Syvitski**
GEOL 4060/5060, Oceanography, Spring 2004 (with S. Peckham)

**Alan Townsend**
EEB 6100, Carbon, Climate and Society, Spring 2004

**James White**
ENVS 1000, Introduction to Environmental Studies, Spring 2004
GEOL 3520, Environmental Issues, Spring 2004
ENVS 3930, Internship in ENVS, Fall 2004
ENVS 5900, Carbon, Climate, and Society, Fall 2004

**Mark W. Williams**
GEOG 4321, Snow Hydrology, Spring 2004
GEOG 5241, Snow Modeling, Spring 2004

Diane McKnight (INSTAAR) collects water samples during a tracer experiment studying stream thermal processes, McMurdo Dry Valleys, Antarctica, January 2004. Photo: K. Cozzetto (INSTAAR).

# INSTAAR Noon Seminars

## Spring, 2003

James Syvitski, INSTAAR Director, "Half-Year of INSTAAR Activities"

Russ Graham, Denver Museum of Nature and Science, "The Colorado Ice Bison and Biogeography of Late Quaternary Bison in North America"

Detlev Helmig, INSTAAR and Program in Atmospheric and Oceanic Sciences (PAOS), "New Insights into Snow-Photochemical Processes and Snow-Atmosphere Gas Exchange (If You Ever Wonder What May Happen in Your Freezer if the Light Stays On)"

Gene Wahl, Environmental and Societal Impacts Group, National Center for Atmospheric Research (NCAR), "Quantitative Climate Interpretation from Pollen, and Data-Model Comparisons"

John Berendt, INSTAAR, "Air Magnetic Data of the West Antarctic Ice-Sheet"

Jerry Peterson, Associate Vice Chancellor for Research, CU-Boulder, "Cosmic Rays and Errors in Computer Memory Chips"

Chris Jenkins, INSTAAR, "The Importance of Being Uncertain"

Tad Pfeffer, INSTAAR, "On the Length Scale of Snow Slope Rills"

JaapJan Zeeberg (RIVO, Netherlands) calls home on a solar-charged iridium satellite phone, August 2003, October Revolution Island, Severnaya Zemlya, Arctic Russia (79°N). Zeeberg was part of an international team studying the glacial geologic history of this region on the edge of the Arctic Ocean. Photo: D. Lubinski (INSTAAR).

Eric Leonard, Geology Department, Colorado College, "Neogene Tectonic Uplift, Erosion and Isostasy on the Colorado Piedmont"

Stephen J. Mojzsis, Department of Geological Sciences and NASA Center for Astrobiology, CU-Boulder, "Investigating Early Terrestrial Atmospheres and Biospheres in the Chemistry of Sulfur Isotopes"

Sally MacIntyre, Institute for Computational Earth System Science (ICESS), University of California, "Thermal Structure, Internal Waves and Turbulence in Small and Moderate Sized Lakes with Implications for Biology"

Irina Overeem, INSTAAR, "Quantifying Stratigraphic Variability; a Case-Study of the New Jersey Shelf over the Last 21,000 Years"

Larry Benson, U.S. Geological Survey, Denver Federal Center, "Cosmogenic Dating of Pre-Pinedale, Pinedale, and Post-Pinedale Moraines in North Central and Southwestern Colorado"

Susan Zager, VECO Polar Resources, "Overview of VECO Operations and Services" (VECO is the National Science Foundation's Arctic logistics contractor, annually supporting over 100 grants and 500 scientists throughout the Arctic)

Wes LeMasurier, Department of Geology, CU-Denver, "Cenozoic Reactivation of the West Antarctic Rift System in Marie Byrd Land"

Snehalata Huzurbazar, Department of Statistics, University of Wyoming, "An Overview of Statistical Methods: What Statistics Can and Cannot Do"

James Syvitski, INSTAAR, "Predicting the Distribution and Properties of Buried Submarine Topography on Continental Shelves—New Navy Sonars Require Geological Insight"

## Fall, 2003

Jonathon A. Warrick, Coastal and Marine Geology, U.S. Geological Survey, Menlo Park, "Land Sources and Ocean Dispersal of River Sediment in Southern California"

Carrie Morrill, Advanced Study Program and Climate and Global Dynamics Division, NCAR, "Holocene Variations in Asian Monsoon Precipitation: Links to Solar Forcing and High Latitudes"

Tom Marchitto, INSTAAR, "Atlantic-Pacific Climate Teleconnections at Millennial Time Scales"

Mervi Hjelmroos-Koski, School of Public Health, University of California, Berkeley, "Worldwide Travelers Without a Passport"

Gaute Mikalsen, Department of Geology, University of Tromsø, Norway, "High Resolution Oxygen Isotope Records from North Norwegian Fjords and Shelf, Reflecting Past and Recent Oceanographic Changes in the Norwegian Current"

Jill Baron, Natural Resource Ecology Laboratory (NREL), Colorado State University, "Land Use Change and Nitrogen Emissions along the Colorado Front Range"

John Miller, National Oceanic and Atmospheric Administration (NOAA), "What a Decade of Global Atmospheric 13CO2 Measurements Tells Us about the Oceans and Biosphere"

Peter Hess, NCAR, "Global Chemical Modeling at NCAR"

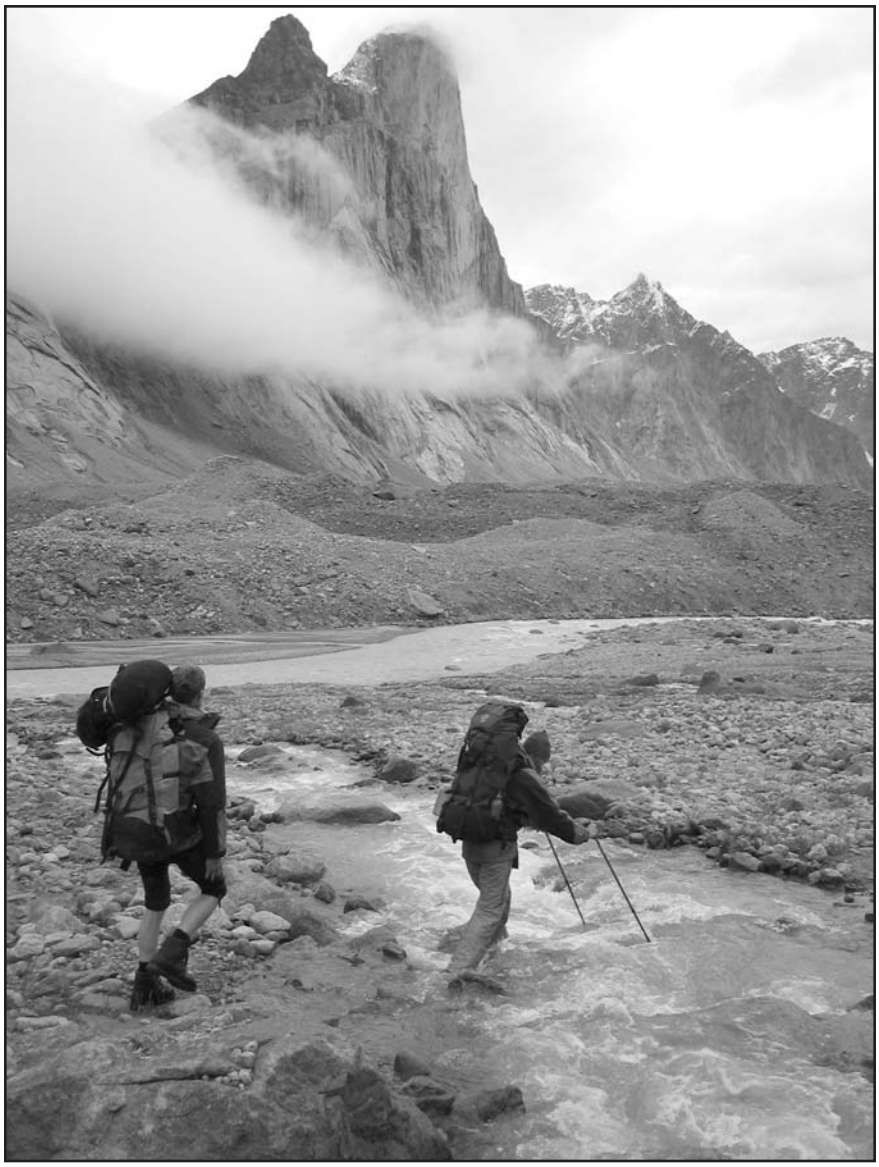
Steve Schmidt, Department of Ecology and Evolutionary Biology, CU-Boulder, "Thriving Microbial Life Beneath Winter Snow Packs and Alpine Glaciers: Novel Organisms and Biogeochemical Implications"

Jason Neff, Department of Geological Sciences, CU-Boulder, "Blowing in the Wind: The Biogeochemical Implications of Dust Deposition and Wind Erosion in Southwestern U.S. Ecosystems"

Bruce Hungate, Northern Arizona University, "Element Cycling in Response to Atmospheric Change: Ecosystem Impacts, Global Feedbacks"

James McGoodwin, Anthropology Department, CU-Boulder (and INSTAAR affiliate), "Climatic Variability and Yup'ik Eskimo Subsistence Strategies"

Russ Monson, Department of Ecology and Evolutionary Biology, CU-Boulder, "Carbon Sequestration Studies at the Niwot Ridge Ameriflux Site"



Albert Kettner and Irina Overeem (both INSTAAR) cross one of many pro-glacial tributary streams to the Weasel River in Auyuittuk National Park, Baffin Island, Canada, September 2003. Dominating the skyline is Mount Thor, with a sheer 1250-m-high face, considered by some to be the highest overhang on the planet. Photo: J. Briner (INSTAAR).

## Spring, 2004

Cindy Nevison, NCAR, "Stratospheric Influence on the Tropospheric Seasonal Cycles of Nitrous Oxide and CFCs 11 and 12: Implications for N2O and O2 Budget Studies"

James Syvitski and Scott Lehman, INSTAAR, "Discussion of INSTAAR's Strategic Plan, Generated from the Recently Completed Self Study"

Josh Schimel, University of California, Santa Barbara, "Linking Microbial Community Composition and Function at the Soil Profile Scale-Stress and Resource Interactions"

Margaret Carreiro, Department of Biology, University of Louisville, "A Tale of Two Cities: Soil Carbon and Nitrogen Cycling in Oak Forests along Urban-Rural Gradients in New York City and Louisville, Kentucky"

Najat Bhiry, INSTAAR Visiting Scientist, Université Laval, "The Temporal and Spatial Impacts of Fluctuating Climates on Nordic Ecosystems Development (e.g., Evolution of Peatland Palsas of Northern Canada)"

Jeff Lukas, INSTAAR, "Reward of the Rings: Ancient Trees Provide Multi-Century Records of Drought and Streamflow in Colorado"

Greg Asner, Carnegie/Stanford, "Grazing Systems in the Global Environment"

Alex Wolfe, University of Alberta, "An Archaeometallurgical History of the Southern Bolivian Andes: the Case for Missing Silver"

Mark Kessler, INSTAAR, "Sorted Patterned Ground"

Nichole Barger, INSTAAR, "Nitrogen Dynamics of Biological Soil Crusts on the Colorado Plateau"

Greg Tucker, Department of Geological Sciences/CIRES, CU-Boulder, "Climate Change and the Dynamics of Drainage Basin Evolution"

Joe Yaritt, Natural Resources Department, Cornell University, "Predictable (?) Patterns of Methanogenesis in Wetlands of the Discontinuous Permafrost Zone"

Adina Payton, Department of Geological and Environmental Sciences, Stanford University, "Phosphorus Cycling in the Ocean: New Approaches"

## Fall 2004

James Syvitski, INSTAAR Director, Institute Meeting

Joseph von Fischer, Department of Biology and Natural Resource Ecology Lab, Colorado State University, "Less Than 1% of Soil Volume Is Anoxic, but It Matters for Upland Ecosystem Function"

Jocelyn Turnbull, INSTAAR, "Environmental Applications of Atmospheric 14CO2 Measurements"

Tim Seastedt, INSTAAR, "Invasive plants: Causes or consequences of environmental change in Colorado?"

Hans-Petter Sejrup, University of Bergen, "The Pleistocene development of the Norwegian Continental Margin: Depositional environments, glacial history, and paleoceanography"

John Andrews, INSTAAR, "Holocene records of ice-rafted detritus (IRD): existing models and a new method"

Neal Michelutti, Earth and Atmospheric Sciences, University of Alberta, "Assessing recent and long-term environmental change on Baffin Island with lake sediments"

Mike Ryan, USDA Forest Service, Rocky Mountain Research Station, "Carbon allocation in forest ecosystems"

Laurens Ganzeveld, Atmospheric Chemistry Division, Max-Planck Institute for Chemistry, "Global modelling of reactive trace gas exchanges: Uncertainties and challenges for non-vegetated and polar landscapes"

Yusuke Kubo, INSTAAR, "Applications of stratigraphic simulation model 2D-SedFlux to tank experiments and fields"

Richard Madole, USGS, "Genesis of the Great Sand Dunes, South-Central Colorado"

John Behrendt, INSTAAR, "Shallow-source magnetic anomalies observed over the West Antarctic Ice Sheet (WAIS) require extremely high magnetization in the present field direction, "

Owen K. Mason, University of Alaska-Anchorage, "Increased coastal erosion in the western Arctic in the 21st Century? Lessons from long-term records and engineering failures"

Jason Briner and Irina Overeem (INSTAAR) study sediment grain size on Clyde Foreland, Baffin Island, Canada, August 2003. Photo: I. Overeem (INSTAAR).

# Graduate Student Talks

## Spring 2003

John Ortega, INSTAAR. "Biogenic Emissions of Volatile Organic Compounds: A Practice Talk for My Upcoming Oral Comprehensive Exam in my Department (PAOS)."

John Hollin, INSTAAR. "1958, the International Geophysical Year: Film Footage of Wilkes Station, Antarctica."

Bob Anderson, Professor, University of California Santa Cruz, Candidate for Terrestrial Quaternary Geology position with Department of Geological Sciences. "A Discussion with Grad Students (INSTAAR, Geological Sciences, and More)."

Constanze Wehenmehyer, Lawrence Livermore National Laboratory, Candidate for Terrestrial Quaternary Geology Position with Department of Geological Sciences. "A Discussion with Grad Students (INSTAAR, Geological Sciences, and More)."

Jessica Black, INSTAAR. "Can a Little Ice Age climate Signal Be Detected in the Southern Alps of New Zealand?"

Natalie Mladenov, INSTAAR. "Sources, Transport and Chemical Quality of Dissolved Organic Carbon in a Large Annually Flooded Wetland, the Okavango Delta, Botswana."

Adina Racoviteanu, INSTAAR. "Glacial Archaeology for High-altitude Inca Sanctuaries in the Peruvian Andes: Climate, Volcanoes and GIS."

Thomas Hoffmann, Department of Geography, University of Bonn, Germany. "Modeling the Holocene Sediment Budget of a Large-scale Fluvial System (Rhine River)."

John Behrendt, INSTAAR. "40 Years on the Ice: An Antarctic Slideshow from the International Geophysical Year to the Present."

Karen Cozzetto, Jenny Baeseman, and John Gartner, INSTAAR. "Streams of the Dry Valleys, Antarctica: 2002–2003 Field Season."

Eileen Gardner, INSTAAR. "The Effects of Atmospheric Nitrogen Deposition on Seasonal Dynamics of Phytoplankton in an Alpine Lake."

Gita Dunhill, INSTAAR. "Snorri Drift: A 200 kyr Oceanographic and Sedimentary Record."

Roy Coulthard, INSTAAR. "The Last Deglaciation of the Aston Lowlands, Baffin Island, Eastern Canadian Arctic: Solving the Marine Limit Enigma."

## Fall 2003

Trevor Popp, INSTAAR. "Ice Core to Bedrock at NorthGRIP, Greenland: Last Interglacial Ice and Subglacial Water."

John Ortega, INSTAAR. "Biogenic Flux Measurements at a Northern Mixed Hardwood Forest."

Rose Cory, INSTAAR. "Preliminary Results from the 2003 Alaskan Field Season: Effect of Dissolved Organic Matter on the Indirect Photolysis of Persistent Organic Pollutants."

Florence Bocquet, INSTAAR. "Photochemical Ozone Loss in Snow at Summit, Greenland."

Ken Mack, INSTAAR. "Constraining the Budget: The Measurement of deltaD of Atmospheric Methane."

Tyler Erickson, INSTAAR. "Modeling the Spatial Distribution of Snow in Rugged Terrain."

Rose Cory, INSTAAR. "Microbially Mediated Ferric Iron Reduction in Nymph Lake, Colorado."

Jason Briner, INSTAAR. "Paired Cosmogenic Isotope Data Provide Insights into Glacial-landscape Evolution along Eastern Baffin Island, Arctic Canada."

Brian Clarke, Department of Geology, University of Colorado at Boulder. "Cosmogenic Exposure Dating Vertical Transects in the Fiord Landscape of Northeastern Baffin Island: Insights into Glacial Erosion."

Matthew Miller augers while Rose Cory and Eileen Gardner (all INSTAAR) supervise, Nymph Lake, Rocky Mountain National Park, March 2003. The group was sampling lake water and sediment for Cory's work on seasonal changes in the chemistry and redox state of dissolved organic matter. The details of such changes and the microbial use of iron have implications for eutrophication and other aquatic processes as well as for remediation technology. Photo: R. Cory (INSTAAR).

Hans-Peter Marshall, INSTAAR. "High Frequency Radar Measurements and Slope Stability Modeling in Alpine Snowpacks: Development of Tools for Avalanche Prediction and Snow Hydrology."

Ryan Vachon, INSTAAR. "Stories from the Drop: Stable Isotopes of Precipitation."

Keri Holland, INSTAAR. "Short-term Fate of Nitrogen in Alpine Tundra."

Kari-Lise Rorvik, University of Tromsø. "Last Glacial Maximum: A High Resolution Record from Isotope Stage 2 in the NE Nordic Seas."

## Spring 2004

Craig Lee, INSTAAR. "Ice Patch Archeology in Colorado? A review of Paleontological Discoveries and Archeological Possibilities."

Natalie Mladenov, INSTAAR." A Biocultural Assessment: Landscape Effects on Organic Matter, Transport Modeling, and Ecosystem Economics in the Okavango Delta of Botswana."

Sarah Stapleton, INSTAAR. "Climate, Streamflow, and Salmon in the Yakima River Basin."

Gréta Björk Kristjánsdóttir, INSTAAR. "Mg/Ca Paleotemperature Estimates from Arctic Benthic Foraminifera: New Calibrations and Application to the Last Two Millennia."

Ice core drilling equipment at the summit of Quelccaya, Peru, summer 2003. The extracted core is unique because it contains ice analyzable to annual resolution. The international team was led by Lonnie Thompson of the Byrd Polar Research Center (Ohio State University). Photo: R. Vachon (INSTAAR).

Jocelyn Turnbull, INSTAAR. "Detection of Fossil Fuel CO2 Emissions: Using Radiocarbon as a Tracer."

Trevor Popp, INSTAAR. "Blue Ice at Mt. Moulton, West Antarctica: Weaving Together Half a Million Years of Climate Using a Volcanic Clock."

Valentine Roche, CU Graduate Student Career Counselor; Dr. James Syvitski, Director of INSTAAR and Professor of Geological Sciences; and Dr. Karen MacClune, a recent CU/INSTAAR Alum and Consultant with S.S. Papadopulos and Associates. "Job Search and Career Advice Panel: What Happens after INSTAAR?"

Jan Pollman, INSTAAR Visiting Graduate Student. "Development of a Method for the Analysis of Sesquiterpenes in Ambient Air."

Shad O'Neel, INSTAAR. "Force Balance Analysis at Columbia Glacier."

Rose Cory, INSTAAR. "Explanation of the Fluorescence Index."

Yarrow Axford, INSTAAR. "Glaciers, Bugs, and Ancient Mud: Reconstructing 10,000 Years of Climate Change in Iceland."

Carl Bern, INSTAAR. "Biogeochemistry, Isotopes, and Tectonics in Costa Rica."

## Fall 2004

Paul Abood, INSTAAR. "Alpine Lakes as Hotspots of Dissolved Organic Carbon Production."

Hans-Peter Marshall, INSTAAR. "Measurements of Snow Stratigraphy Using High Frequency Microwave Radar at the Swiss Federal Institute for Snow and Avalanche Research (SLF)."

Zach Guido, INSTAAR. "Bolivia: Pachamama, Erythroxylon Coca Lamarck and Bald Bus Tires. A Tour of Bolivia's Social, Political, and Geographical Character Based on Three Years of Living in a Rural Town Working for the Peace Corps."

Nancy Hoalst Pullen, INSTAAR. "Getting Down and Dirty in the Tropics: Hydrologic Flowpaths and Soil Properties of Small Tropical Forest Catchments."

Trevor Popp, INSTAAR. "North Greenland Ice Core Project (NGRIP): New Results from 2004 and Fingerprinting Abrupt Climate Change."

Sasha Reed, INSTAAR. "Controls on Nitrogen Fixation in a Tropical Lowland Rainforest, Plus Some Video of Costa Rican Wildlife."

Vladimir Mikhalenko (Russian Academy of Sciences) maneuvering through nieve penitentes, which are unique snow and ice formations created by irregular evaporation and melting patterns under intense sunlight, Coropuna, Peru, July 2003. Mikelenko was a member of an international team drilling an ice core at the summit of Coropuna, the fourth highest peak in Peru. Photo: R. Vachon (INSTAAR).

Dylan Ward, INSTAAR. "New Constraints on the Late Cenozoic Incision History of the New River, Virginia."

James Syvitski, INSTAAR Director. "How to Make the Most of your Graduate Career at INSTAAR."

Tim Tomaszewski, INSTAAR. "Sprucing Things Up with Foliar Nitrogen Spray at a Colorado Subalpine Forest."

Wim Lekens, University of Bergen, Norway. "Complex Climate Variations in a Glacial World: Examples from the Southern Norwegian Sea."

Natalie Mladenov (INSTAAR) shows an eighth grade student how to electronically measure water properties like temperature and conductivity during the INSTAAR Open House, Boulder, Colorado, April 2004. Photo: D. Lubinski (INSTAAR).

# Research Grants 2003–2004

Anderson, Katherine; Elias, Scott: NSF ATM 9910639. Collaborative Research: Testing Earth System Models with Paleoenvironmental Observations. 1999–2003. $138,835.

Anderson, Suzanne: NSF OPP 0345136. Collaborative Research: The Role of Loess Weathering in Global Geochemical Cycles. 2003–2005. $178,860.

Anderson, Suzanne: NSF EAR 0310313. Linkages Between Soil Water and Stream Water: Hydrology and Hydrochemistry in a Dissected Terraced Landscape. 2003–2006. $148,306.

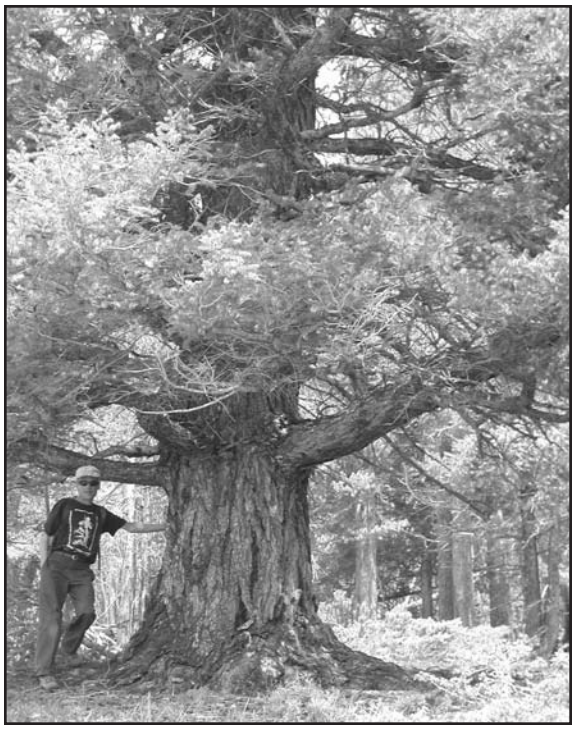
Andrews, John: NSF OPP 0118455. Paleo Ice Flow Paths from Till Provenance in the Ross Embayment, Antarctica. 2001–2004. $27,913.

Andrews, John: NSF OPP 0133709. Support for Participation of Graduate Students in the Annual Arctic Workshop. 2002–2005. $73,375.

Andrews, John; Jennings, Anne: NSF OPP 0004233. Ice Extent and Late Glacial and Deglacial History of W. Hunafloi, NW Iceland: Combining Terrestrial and Marine Evidence. 2001–2005. $205,000.

Andrews, John; Jennings, Anne; Ogilvie, Astrid: NSF OPP 0326776. Warm Times, Cold Times: Quantitative Reconstructions of Near-Shore Environments Over the Last 2000 Years in Vestifirdir, NW Iceland: Natural Changes and Human Responses. 2003–2006. $236,000.

Andrews, John; Jennings, Anne; Ogilvie, Astrid: NSF OPP 0326776. Warm Times, Cold Times: Quantitative Reconstructions of Near-Shore Environments Over the Last 2000 Years in Vestifirdir, NW Iceland: Natural Changes and Human Responses. 2003–2006. $76,000.



Mark Losleben (INSTAAR) stands next to a large and old (>350 years) Douglas fir tree near Dillon Reservoir, Colorado, June 2003. This and other trees at the site were cored to develop a drought-sensitive tree-ring chronology, extending from 1372 to 2002, that has been used to reconstruct streamflows for the Blue River above Dillon Reservoir. Photo: C. Woodhouse (INSTAAR).

Barger, Nicole; Woodhouse, Connie: National Park Foundation OCG 4544B. National Parks Ecological Fellowship: Regional Versus Local Controls on Pinyon-Juniper Woodland Expansion on the Colorado Plateau: The Role of Climate, Atmospheric $CO_2$, and Land Use Change. 2003–2005. $50,000.

Behrendt, John: NSF OPP 9814036. Interpretation of an Aeromagnetic Survey Over the Butcher Ridge Igneous Complex, Transantarctic Mountains. 1999–2003. $50,000.

Bourgeron, Patrick: Brown University PO #P978039. Linking the US-LTER with the ILTER Network. 2004–2006. $24,724.

Bourgeron, Patrick: Nature Conservancy MPO-032802. Canyonland Integrated Ecological Assessment—Phase 1: Ecosystem Characterization at the Canyon Country Ecological Research Site. 2002–2003. $67,000.

Bourgeron, Patrick; Humphries, Hope: Interior USGS OCG 4561B. IPA: Landscape Analysis for Geographic Analysis and Monitoring. 2003–2004. $85,000.

Bourgeron, Patrick; Seastedt, Timothy: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $177,224.

Bowman, William: NSF INT 0112281. Responsiveness of Alpine Vegetation to N. Inputs—A Comparison Between Central European and North American Sites. 2001–2005. $63,461.

Bowman, William: NSF INE 0112281. REU Supplement to: Responsiveness of Alpine Vegetation to N. Inputs—A Comparison Between Central European and North American Sites. 2003–2005. $19,134.

Bowman, William; Seastedt, Timothy: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $246,168.

Buttenfield, Barbara; Seastedt, Timothy: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $61,220.

Caine, T. Nelson: Max Kade Foundation OCG 4396B. New Approaches to the Understanding of Sediment Budget Components in Alpine Environments. 2002–2003. $39,500.

Caine, T. Nelson; Williams, Mark; Seastedt, Timothy: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $371,064.

Calkin, Parker: NSF ATM 9905493. Collaborative Research: Tree-Ring Based Records of Temperature and Glacial Fluctuation Spanning the Past Two Millennia, Prince William Sound, Alaska. 1999–2003. $121,754.

Dixon, E. James: Interior National Park Service 1443CA991000046. Culture History of Beringia: An Archeological Synthesis. 2000–2005. $172,694.

Dixon, E. James: NSF OPP 0331608. Archeological Analysis and Publication, On Your Knees Cave, S.E. Alaska. 2003–2005. $300,000.

Dixon, E. James: NSF OPP 0331608. Archeological Analysis and Publication, On Your Knees Cave, S.E. Alaska. 2003–2004. $166,186.

Dixon, E. James; Manley, William: NSF OPP 0222490. Archeology of Alaska Glaciers and Snowfields Phase II. 2002–2005. $259,267.

Dyurgerov, Mark; Meier, Mark: NSF OPP 0425488. Acceleration of Glacier Wastage in the Arctic System: Facts, Causes and What to Expect. 2004–2007. $317,737.

Dyurgerov, Mark: NASA Goddard NAG5-13691. Updating the Results of Glacier Contributions to Sea Level Change. 2003–2005. $103,924.

Dyurgerov, Mark; Bahr, David, Meier, Mark: NSF BCS 0099236. Toward a Realistic Estimate of Sea-Level Rise and Global Water Balance Due to Glacier Wastage. 2001–2003. $249,976.

Elias, Scott: NSF ESI 9818837. Arctic Connections: An Interactive CD-ROM Program for Secondary Science Education. 1999–2004. $730,100.

Elias, Scott: NSF OPP 9911048. Nature of Late Pleistocene Climatic Ameliorations in Eastern Beringia. 2000–2004. $207,263.

Elias, Scott: NSF ESI 9818837. Arctic Connections: An Interactive CD-ROM Program for Secondary Science Education. 2000–2004 $237,250.

Elias, Scott: NSF ESI 9818837. Arctic Connections: An Interactive CD-ROM Program for Secondary Science Education. 2000–2004. $3,804.

Elias, Scott: NSF ESI 9818837. Arctic Connections: An Interactive CD-ROM Program for Secondary Science Education. 2002–2004. $5,485.

Elias, Scott; Seastedt, Timothy: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $71,510.

Harper, Joel; Pfeffer, W. Tad: NSF EAR 9901492. Postdoctoral Research Fellowship. 1999–2003. $5,000.

Irina Overeem (INSTAAR) traveling on Clyde Fjord, Baffin Island, Canada, August 2003. An INSTAAR team consisting of J. Briner, A. Kettner, and I. Overeem was studying the responses of arctic rivers to deglaciation and climate change. Photo: I. Overeem (INSTAAR).

Hart, Charles: NSF OPP 0202911. SGER: Geochronology or Ross Sea Carbonates: Collaborative Participation with the Italian National Antarctic Research Program CARBONANT Cruise 2002. 2001–2004. $34,376.

Helmig, Detlev; Hare, Jeffrey: NSF OCE 0410058. Development of Ship-Borne Atmosphere-Ocean Ozone Flux Measurements by the Eddy Correlation Technique. 2004–2007. $409,980.

Helmig, Detlev: EPA R-82522101-5. Development of Techniques for Eddy-Correlation Measurements of Non-Methane Volatile Organic Compounds Fluxes in the Atmosphere. 1996–2003. $499,926.

Helmig, Detlev: NSF OPP 0137538. Collaborative Research: Trace Gas Deposition Processes in the Arctic Boundary Layer. 2002–2005. $117,770.

Helmig, Detlev: NSF OPP 0240976. Surface-Atmosphere Ozone Fluxes at Summit, Greenland. 2003–2006. $284,710.

Helmig, Detlev: Commerce NOAA NA03OAR4310072. Study of Air Transport and Photochemistry in the North-Atlantic Region of Hydrocarbon Analysis at Pico Island/Azores. 2003–2006. $359,481.

Helmig, Detlev: NSF ATM 0304704. Sesquiterpene Emissions from Natural, Urban and Agricultural Vegetation in the United States. 2003–2005. $229,213.

Helmig, Detlev: NSF OPP 0230046. Collaborative Research: Antarctic Tropospheric Chemistry Investigation (ANTCI). 2003–2007. $56,371.

Helmig, Detlev; Birks, John: NSF ATM 9911186. Sesquiterpernoid Compound Emissions from Vegetation—Chemical Analysis Technique for Ambient Measurements of the Contribution in the Formation of Ozone and Aerosols. 2000–2003. $260,000.

Helmig, Detlev; Milford, Jana: EPA RD-83107901. Atmospheric Aerosols from Biogenic Hydrocarbon Oxidation. 2003–2006. $139,218.

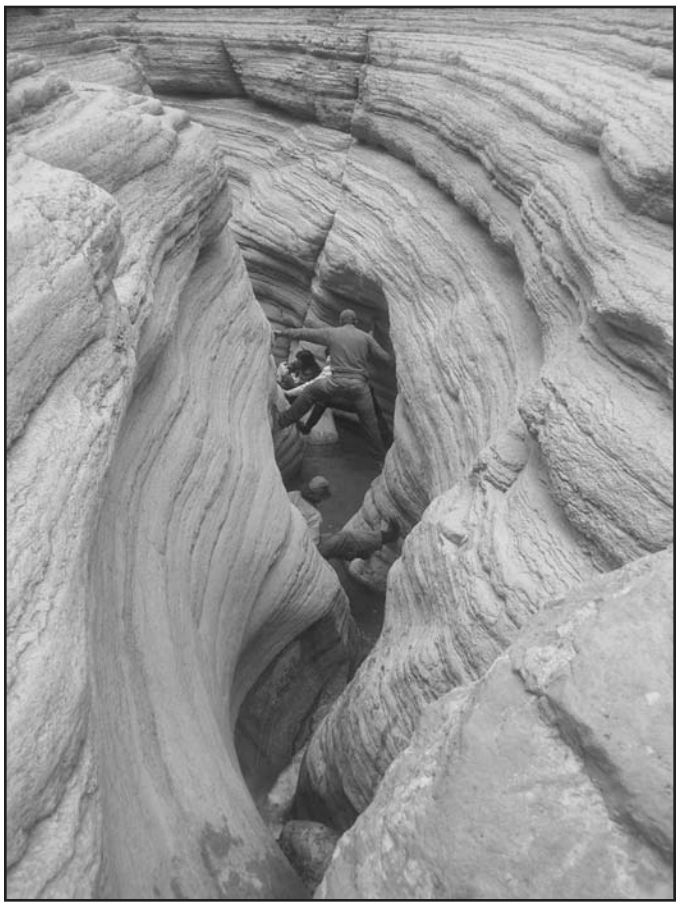
Hoffecker, John: NSF BCS 0132553. Kostenki: Initial Upper Paleolithic in Eastern Europe. 2002–2005. $161,572.

Jenkins, Chris: DOD Navy ONR N00014-04-1-0252. Demonstration to NATO of dbSEABED Seafloor Database. 2004. $3,595.

Jenkins, Chris: University of New Orleans 58527. Pilot Data Structure of Louisiana Offshore Sand Resources. 2004. $25,000.

Jenkins, Chris: DOD Navy ONR N00014-05-1-0080. Spatial Variability and Robust Interpolation of Seafloor Sediment Properties Using the SEABED Data Bases. 2004–2006. $57,301.

Jenkins, Chris: Interior USGS 02WRAG0061. Development of usSEABED Database and 3-D Mapping Techniques. 2002–2005. $39,463.



Sampling water from a side stream of the Grand Canyon, Arizona, November 2003. A cooperative team made up of researchers from USGS, INSTAAR, Centers for Disease Control, and Colorado Mountain College sampled water from seeps and springs feeding the Colorado River to assess water quality, stable isotopes, and presence of norovirus. Photo: B. Vaughn (INSTAAR).

Jenkins, Chris: DOD Navy ONR N00014-03-1-0849. Site Visit: Evaluation of a New Data System for European Coastal Seafloors. 2003. $3,218.

Jenkins, Chris: Interior USGS 02WRAG0061. Database and 3-D Mapping Techniques. 2003–2005. $100,000.

Jennings, Anne; Andrews, John: NSF ATM0317832. Holocene Marine Climate Evolution and Variability from Multi-Proxy Analyses of High Resolution Shelf Cores in the Northern North Atlantic (West of 20W). 2003–2006. $403,447.

Jennings, Anne; Andrews, John; Anderson, David: NSF OPP 0082347. Ice-Ocean-Atmosphere Interactions Along the East Greenland Margin on Decade to Century Timescales Over the Last 14 ka. 2000–2004. $463,664.

Lehman, Scott: Commerce NOAA NA04)AR4310098. Improving Detection of Recently Added Fossil Fuel $CO_2$ in the Atmosphere Using $^{14}C$. 2004–2005. $132,843.

Lehman, Scott: NSF OCE 0081257. Collaborative Research: A Benchmark Record of Temperature for the Last Four Glacial Cycles in Sediments of the Bermuda Rise. 2000–2004. $570,892.

Losleben, Mark: Commerce NOAA RA133R-05-SE-1588. Halocarbon Atmospheric Sampling. 2004–2005. $13,992.

Losleben, Mark: Commerce NOAA RA133R-05-SE-1850. Carbon Cycle Atmospheric Gas Collection. 2004–2005. $15,675.

Losleben, Mark: Commerce NOAA RA1330-03-SE-0010. Halocarbon Atmospheric Sampling. 2002–2003. $12,966.

Losleben, Mark: Commerce NOAA RA1330-03-SE-0045. Carbon Cycle Atmospheric Gas Collection. 2002–2003. $14,704.

Losleben, Mark: Harding ESE, Inc. S68D98112-SITEOP-701. Site Operator Agreement, CASTNet II Site 701 (CO94). 2002–2003. $4,830.

Losleben, Mark: Commerce NOAA RA1330-04-SE-0016. Halocarbon Atmospheric Sampling. 2003–2004. $13,992.

Losleben, Mark: Commerce NOAA RA1330-04-SE-0193. Carbon Cycle Atmospheric Gas Collection. 2003–2004. $15,218.

Losleben, Mark: MACTEC Engineering & Consulting, Inc. 6064035004-3230 EPA Contract No. 68D-03-052. Site Operator Agreement, CASTNet II Site 701 (CO94). 2003–2008. $4,830.

Lubinski, David: NSF OPP 0196182. Collaborative Research: Reconstructing the Past 20,000 Years of Glacial and Sea-Level History for Severnaya Zemla, Russia, 80 North. 2000–2005. $174,818.

Manley, William: NSF OPP 9977972. Collaborative Research: Paleoglaciology of Alaska—Climate Parameters During the Last Glacial Maximum from GIS Determination of Equilibrium Line Altitudes. 1999–2003. $230,801.

Manley, William: VECO USA, Inc. Subcontract 381068-33 OPP-0001041. Completion of Preliminary GIS Database for the Arctic, Alaska, and Greenland: Contract with BECO Polar Resources. 2003. $9,587.

Manley, William; Dixon, E. James: NSF OPP 0222490. REU Supplement to: Archeology of Alaska Glaciers and Snowfields Phase II. 2003–2005. $7,275.

Manley, William; Dyurgerov, Mark; Meier, Mark: NSF ATM 0081379. Spatial Analysis and Calibration of Glacier-Climate Relationships Across Alaska. 2000–2004. $284,636.

Manley, William; Maslanik, James: NSF ARC 0224071. High-Resolution Imagery and Terrain Model for Collaborative Research of Environmental Change at Barrow, Alaska. 2002–2005. $98,455.

Manley, William; Maslanik, James: NSF ARC 0224071. High-Resolution Imagery and Terrain Model for Collaborative Research of Environmental Change at Barrow, Alaska. 2002–2005. $123,351.

Marchitto, Thomas: NSF OCE 0425522. Accurate Calibration of Multiple Paleoceanographic Proxies in Benthic Foraminifera. 2004–2006. $183,646.

Marchitto, Thomas: Columbia University Subaward No. ONE (1) OCE 0214180. Holocene Variations in Upper North Atlantic Deep Water (Labrador Sea Water) Properties. 2003–2005. $61,420.

Marchitto, Thomas: Columbia University Subaward No. Two (2) OCE 0221979. Reconstruction of the End Member Contributions to and Ventilation Rate of Glacial-Age Lower Atlantic Deep Water. 2003–2005. $18,052.

Markgraf, Vera: NSF ATM 0082067. Collaborative Research: Patagonia Lake Drilling Project (PATO): Phase II. 2000–2003. $179,617.

Markgraf, Vera: University of Minnesota T5246373001 ATM 0081279. Patagonian Lake Drilling Project (PATO) Phase II. 2001–2003. $62,935.

McKnight, Diane: NSF OPP 0338299. Collaborative Research: Biogeochemistry of Dissolved Organic Matter in Pony Lake, Ross Island. 2004–2007. $284,607.

McKnight, Diane: Ohio State University Research 739204 PO# RF009915335 OPP 00-96250. McMurdo Dry Valley Long Term Ecological Research (Research Studies). 2000–2005. $439,791.

McKnight, Diane: Ohio State University Research 739204 PO# RF00915335 OPP 0096250. McMurdo Dry Valley Long Term Ecological Research (Operations). 2000–2005. $315,321.

The three-peaked volcano Coropuna, Altiplano, Peru, July 2004. The volcano was visited by Doug Burbank (University of C Santa Barbara), Brian Clark (UC Santa Barbara, former INSTAAR), and Bob Anderson (INSTAAR) while on a pilot trip to assess the potential for determining rates of incision of the Colca and Cotahuasi Rivers, the structural evolution of the plateau, and the climate history embedded in the moraine complexes surrounding the major volcanoes on the altiplano. One of the peaks of Coropuna was visited previously by a team led by Lonnie Thompson (Byrd Polar Research Center, The Ohio State University). Thompson's team retrieved an ice core from its summit. Photo: R.S. Anderson (INSTAAR).

McKnight, Diane: Ohio State University Research 739204 PO# RF00915335 OPP 0096250. McMurdo Dry Valley Long Term Ecological Research (Equipment). 2000–2005. $25,000.

McKnight, Diane: NSF OPP 009182. Collaborative Research: The Direct and Indirect Photolytic Fate of Persistent Organic Pollutants in Arctic Surface Waters. 2001–2004. $158,498.

McKnight, Diane: Ohio State University Research Foundation 739204 PO# RF00915335 OPP 0096250. McMurdo Dry Valley Long Term Ecological Research. 2001–2005. $5,400.

McKnight, Diane: Keystone Center OCG4399B X-98840101-0. Characterization of Stream Ecosystem in Snake River Basin for the Snake River Task Force. 2001–2003. $56,713.

McKnight, Diane: Ohio State University Research Foundation 739204 PO# RF00915335 OPP 9810219. The Role of Natural Legacy on Ecosystem Structure and Function in a Polar Desert: The McMurdo Dry Valley LTER Program. 2000–2005. $14,681.

McKnight, Diane: Colorado State University G-5840-1 R-82964001-0. Influence of Climate-Induced Alterations in Dissolved Organic Carbon on UV Radiation and Metal Toxicity in High Elevation Streams. 2002–2005. $227,999.

McKnight, Diane: Ohio State University Research Foundation 739204 PO# RF00915335 OPP 0096250. McMurdo Dry Valley Long Term Ecological Research: TEA Supplement. 2002–2005. $12,447.

McKnight, Diane: Consortium of Universities for the Advancement of Hydrologic Science 0326064 EAR-0326064. A Community-based Consortium for the Advancement of Hydrologic Science. 2003–2004. $22,062.

McKnight, Diane; Flores, Nicholas; Waldman, Donald: NSF SES 0108652. A Decision-Making Framework for Stream Restoration from Acid Mine Drainage. 2001–2004. $45,131.

McKnight, Diane; Seastedt, Timothy: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $119,680.

McKnight, Diane; Seastedt, Timothy: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $59,986.

Miller, Gifford: NSF ATM 0082254. Collaborative Research: Megafauna Extinction, Ecosystem Disruption and Climate Change: Assessing the Human Factor. 2000–2005. $358,865.

Miller, Gifford: NSF OPP 0138586. Collaborative Research: Laurentide Ice Sheet Dynamics: Applying Cosmogenic Exposure Dating to Constrain Chronology and Glacial Style in the Eastern Canadian Arctic. 2002–2005. $241,540.

Miller, Gifford: NSF OPP 0138010. High-Resolution Constraints on the Magnitude and Timing of Climate Change in Iceland Over the Past 15 ka. 2002–2005. $14,049.

Miller, Gifford: NSF OPP 0138010. High-Resolution Constraints on the Magnitude and Timing of Climate Change in Iceland Over the Past 15 ka. 2002–2005. $95,305.

Miller, Gifford: NSF OPP 0138010. High-Resolution Constraints on the Magnitude and Timing of Climate Change in Iceland Over the Past 15 ka. 2002–2005. $64,000.

Miller, Gifford; Steig, Eric: NSF OPP 0004466. Collaborative Research: The NE Sector of the Laurentide Ice Sheet Dating Outlet and Local Glacier Moraines at Clyde with Cosmogenic Isotopes. 2001–2003. $92,356.

Miller, Gifford; Steig, Eric: NSF OPP 0004466. Collaborative Research: The NE Sector of the Laurentide Ice Sheet Dating Outlet and Local Glacier Moraines at Clyde with Cosmogenic Isotopes. 2001–2003. $63,597.

Miller, Gifford; Stoner, Joseph: NSF ATM 0318479. Collaborative Research: Quantitative Estimates of Holocene Warmth and Climate Variability Derived from Icelandic Lake Sediments. 2003–2006. $339,506.

Nevison, Cynthia: NSF ATM 0431644. SGER: Modeling River Nitrogen Export to Coastal Zone in the Community Climate System Model (CCSM). 2004. $25,000.

Ogilvie, Astrid; Andrews, John; Jennings, Anne; Barlow, Lisa: NSF OPP 97262510. Environmental Changes and Human Responses in the North Atlantic (Iceland and Greenland Sectors) During the Last 2,000 Years: A Contribution to the ARCSS Systems, Integration and Modeling Initiative. 1998–2004. $409,954.

Ogilvie, Astrid; McGoodwin, James: NSF OPP 0002651. Landscapes and Seascapes: Linkages Between Marine and Terrestrial Environments and Human Populations in the North Atlantic (Iceland Sector: A Contribution to the HARC Initiative. 2000–2005. $366,945.

Overeem, Irina: NSF OPP 0240823. Channel Switching in Fluvio-Deltaic Systems Draining Land Ice; Clyde River, Baffin-Island as a Type-Location. 2003–2004. $61,823.

Peckham, Scott: University of Alaska Fairbanks UAF 05-0023/PO#FP500466 NAG5-11822. Toward Improved Process-Based Pan-Arctic Prediction of Land Surface Moisture and Energy Fluxes. 2004–2005. $15,000.

Peckham, Scott: University of Alaska Fairbanks FP206280 OPP 9818066. Conversion of ARYTHYM Hydrologic Model from Fortran to IDL. 2002–2003. $15,000.

Cactus, Valley of the Volcanoes, southern Peru, July 2004. The persistent dustiness of arid coastal Peru commonly provides this kind of depth perspective to the landscape. The valley was visited by Doug Burbank (University of California at Santa Barbara), Brian Clark (University of California at Santa Barbara, former INSTAAR), and Bob Anderson (INSTAAR) while on a pilot trip to assess the potential for determining rates of incision of the Colca and Cotahuasi Rivers, the structural evolution of the plateau, and the climate history embedded in the moraine complexes surrounding the major volcanoes on the altiplano. Photo: R.S. Anderson (INSTAAR).

Peckham, Scott: GW Scientific, LLC OCG4480B. WERC Hydrologic Model, Conversion and Testing. 2002–2003. $12,000.

Peckham, Scott: University of Alaska Fairbanks UAF 03-0036 / PO# FP406660 OPP 0229705. Conversion of Hydrologic Model from Fortran to GUI. 2002–2004. $30,000.

Peckham, Scott: Interior USGS 03WRAG0029. Modeling Sediment Transport to Molokai's Coral Reef. 2003–2005. $46,830.

Pendall, Elise; White, James: University of Nebraska LWT 62-123-06541 & 26-6223-0002-040. Stable Isotope Tracers of $CO_2$ Fluxes on Shortgrass Steppes under $CO_2$ Enrichment. 1999–2003. $295,155.

Pendall, Elise; White, James: University of Nebraska LWT 62-123-06541 & 26-6223-0002-040. Stable Isotope Tracers of $CO_2$ Fluxes on Shortgrass Steppes under $CO_2$ Enrichment. 1999–2003. $780.

Pfeffer, Tad; Rick, Ursula: NASA Goddard NGT5-155. Ozone Fluxes into Snowpacks and Their Role in the Tropospheric Ozone Budget. 2003–2006. $48,000.

Pfeffer, W. Tad: NSF OPP 0317345. Seismological Investigation of Columbia Glacier Calving Mechanics. 2004–2007. $382,856.

Pfeffer, W. Tad: NSF OPP 0425387. Support for Participation of Graduate Students in the Annual Arctic Workshops 2005–2007. 2004–2007. $22,850.

Pfeffer, W. Tad: NSF OPP 0425387. Support for Participation of Graduate Students in the Annual Arctic Workshops 2005–2007. 2004–2007. $72,800.

Pfeffer, W. Tad: NSF OPP 0121399. Columbia Glacier Photogrammetry. 2001–2003. $43,218.

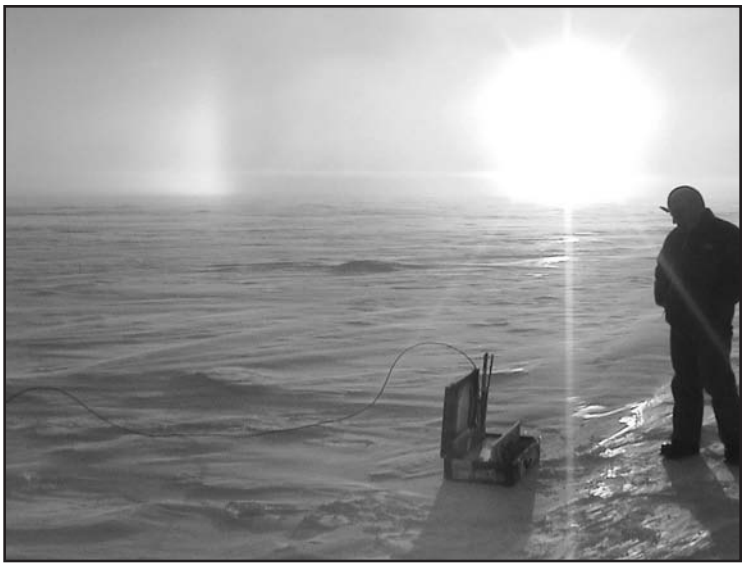
Pfeffer, W. Tad: NSF OPP 0118721. Collaborative Research: Linking Subglacial Hydrology and Sliding Dynamics Through Variations Along the Glacial Length. 2002–2004. $156,916.

Pfeffer, W. Tad: NSF OPP 0228223. SGER: Columbia Glacier Photogrammetry. 2002–2004. $44,147.

Pfeffer, W. Tad: NSF OPP 0240972. Seismological Investigation of Columbia Glacier Calving Mechanics. 2003–2005. $91,934.

Pfeffer, W. Tad; Marshall, Hans-Peter: NASA Goddard NGT5-30416. Snow Slope Stability: Modeling and Investigations. 2001–2005. $81,317.

Seastedt, Timothy: NSF DEB 9810218. RET Supplement to: The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range: UMB Supplement. 2004–2005. $9,750.



Air samples were collected from the snow surface during an expedition to Law Dome, Antarctica, October 2004. The samples, collected throughout the day and night, were used to investigate photochemical production of carbon monoxide. Photo D. Ferretti (INSTAAR).

Seastedt, Timothy: NSF DEB 9806438. Collaborative Research: Identifying Ecosystem Controls on Biodiversity: A US/UK Project. 1998–2003. $399,962.

Seastedt, Timothy: NSF DEB 9810218. REU Supplement to: The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function, and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1999–2005. $76,000.

Seastedt, Timothy: EPA PE-98872201. Developing Sustainable management Procedures for Wide-Spread Noxious Weeds on Public Lands in the Colorado Front Range. 2002–2004. $40,000.

Seastedt, Timothy: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function, and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. UMB Supplement. 2003–2005. $105,800.

Seastedt, Timothy: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function, and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. UMB Supplement. 2003–2005. $10,127.

Seastedt, Timothy; Breiter, Nehalem: Interior National Park Service CA-1200-99-007 UCO-06. How Selective Are Biological Controls?: Testing Non-target Herbivory by Biological Control Agents for Yellow Toadflax (*Linaria vulgaris*) and Dalmation Toadflax (*Linaria genistifolia*). 2003–2005. $6,458.

Seastedt, Timothy; Sudding, Katherine: Agriculture CSREES 2001-35320-10628. Causes and Consequences of Invasion of a C3-C4 Grassland by Diffuse Knapweed. 2001–2005. $280,000.

Seastedt, Timothy; Townsend, Alan; Wessman, Carol; Williams, Mark: NSF DEB 9810218 The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function, and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $3,012,486.

Seastedt, Timothy; Townsend, Alan; Wessman, Carol; Williams, Mark: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function, and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005 $69,809.

Seastedt, Timothy; Townsend, Alan; Wessman, Carol; Williams, Mark: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function, and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $166,679.

Seastedt, Timothy; Townsend, Alan; Wessman, Carol; Williams, Mark: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function, and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $50,000.

Seastedt, Timothy; Townsend, Alan; Wessman, Carol; Williams, Mark: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function, and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $29,060.

Sievering, Herman: Agriculture Forest Service 01-DG-11242343-012. Impact of Canopy Nitrogen Deposition on Forest Carbon Storage: A Manipulative Experiment at the Howland AmeriFlux Site. 2001–2006. $9,300.

Sievering, Herman: Tulane University TUL-083-9900 DE-FC03-90ER61010. Nitrogen Atmosphere-Forest Canopy Exchange at Coniferous and Mixed Forest AmeriFlux Sites: Relation to $CO_2$ Fluxes. 2001–2003. $84,565.

Sievering, Herman: Agriculture Forest Service 02-DG-11242343-073. Impact of Canopy Nitrogen Deposition on Forest Carbon Storage. 2001–2006. $9,300.

Sievering, Herman: Tulane University TUL-130-0203 DE-FC03-90ER61010 901214. Nitrogen Flux and Carbon Sequestration at Coniferous and Mixed Forest AmeriFlux Sites. 2002–2004. $95,000.

Sievering, Herman: Agriculture Forest Service 03-DG-11242343-159. Impact of Canopy Nitrogen Deposition on Forest Carbon Storage. 2001–2006. $8,900.

Sievering, Herman; Seastedt, Timothy: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function, and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $70,203.

Stallard, Robert: NSF DEB 0212284. Collaborative Research: Effects of Soil-Borne Resources on the Structure and Dynamics of Lowland Tropical Forests. 2002–2005. $155,108.

Stallard, Robert: Interior National Park Service CA-1200-99-007 UCO-04. Analysis of Rivers and River Basins Within Alaska Network Parks. 2003–2005. $31,453.

Stallard, Robert: Interior National Park Service CA-1200-99-007 UCO-11. Central Alaska Network Parks Hydrologic Assessment. 2003–2004. $40,000.

Stoner, Joseph: NSF OCE 0351096. Collaborative Research: Establishing Quaternary Climate/Terrestrial/Oceanic Linkages in Southern Alaska and IODP Site Survey. 2004. $689.

Field truck gets hung up on a boulder while trying to site a new base camp in western Tibet, August 2004. The team, led by Lonnie Thompson of the Byrd Polar Research Center (Ohio State University), was in search of a potential ice coring site. Photo: R. Vachon (INSTAAR).

Lubos Halada (Institute of Landscape Ecology, Slovak Academy of Sciences) walks to the research site of a joint Slovak-US project investigating the comparative effects of N deposition on alpine vegetation, Salatin, Western Tatra Mountains, August 2004. Photo: W. Bowman (INSTAAR).

Stoner, Joseph: Texas A&M University Research Foundation F001671 / 418920-BA268. Paleomagnetism (paleointensity, secular variation, geomagnetic excursions, magnetic stratigraphy and environmental magnetism) from ODP Leg 202 Sediments. 2002–2005. $28,120.

Stoner, Joseph: NSF OPP 0241291. Development of Late Holocene Paleomagnetic Dating Curves for the High Arctic. 2003–2005. $104,210.

Stoner, Joseph: NSF EAR 0309012. Collaborative Research: Holocene Geomagnetic Field Variability from the High-latitude Southern Hemisphere. 2003–2004. $44,374.

Syvitski, James: DOD Navy ONR N00014-04-1-0236. Modeling the Effect of Climatic and Human Impacts on Margin Sedimentation. 2004–2005. $128,684.

Syvitski, James: University of New Hampshire 05-901 NNG04GH75G. Understanding the Changing Carbon, Nitrogen and Water Cycles in the Earth System. 2004–2007. $60,000.

Syvitski, James: Indiana State University OCG4644B BCS 0317570. Collaborative Research: Sediment Production and Alluvial Buffering in a Steepland River Basin: Waipaoa River Basin, New Zealand. 2004–2005. $12,000.

Syvitski, James: DOD Navy ONR N00014-00-1-0810. Predicting the Distribution and Properties of Buried Submarine Topography on Continental Shelves. 2000–2005. $674,282.

Syvitski, James: Exxon Mobil Upstream Research Company UR-0418. Developing a 3D Numerical Model Able to Simulate Continental Margin Stratigraphy. $2001–2003. $200,400.

Syvitski, James: NSF OCE 082228. Collaborative Research: Experimental and Theoretical Study of Linked Sedimentary Systems. 2001–2004. $126,310.

Syvitski, James: DOD Navy ONR N00014-01-1-0905. Seabed Variability and Its Influence on Acoustic Prediction Uncertainty. 2001–2005. $343,100.

Syvitski, James: DOD Navy ONR N00014-02-1-0041. Modeling the Effect of Climatic and Human Impacts on Margin Sedimentation. 2001–2004. $181,000.

Syvitski, James: DOD Navy ONR N00014-01-1-0338. Sediment Flux to the Coastal Zone: Predictions for the Navy. 2001–2003. $146,968.

Syvitski, James: NSF OPP 0100120. An Integrated Assessment of the Impacts of Climate Variability on the Alaskan North Slope Coastal Region. 2001–2005. $295,544.

Syvitski, James; Stewart, J. Scott: Exxon Mobil Upstream Research Company UR-01306. Developing a 3D Numerical Model Able to Simulate Continental Margin Stratigraphy. 2003–2004. $122,008.

Townsend, Alan; Schmidt, Steven: NSF DEB 0089447. Phosphorus Regulation of Decomposition, Microbial Dynamics, and Foliar Chemistry in Moist Tropical Forests. 2001–2005. $570,925.

Townsend, Alan; Seastedt, Timothy: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function, and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $127,552.

Veblen, Thomas; Seastedt, Timothy: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function, and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $71,951.

Walker, Donald; Seastedt, Timothy: NSF DEB 9810218. The Niwot Ridge Long Term Ecological Research Program 1998–2004: Controls on the Structure, Function, and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range. 1998–2005. $32,206.

White, James: NSF OPP 0413572. SGER: Retrieval of Basel Water from the NorthGRIP Borehole. 2004–2005. $2,470.

White, James: NSF DGE 9987607. IGERT Full Proposal: Carbon, Climate, and Society. 2004–2005. $30,575.

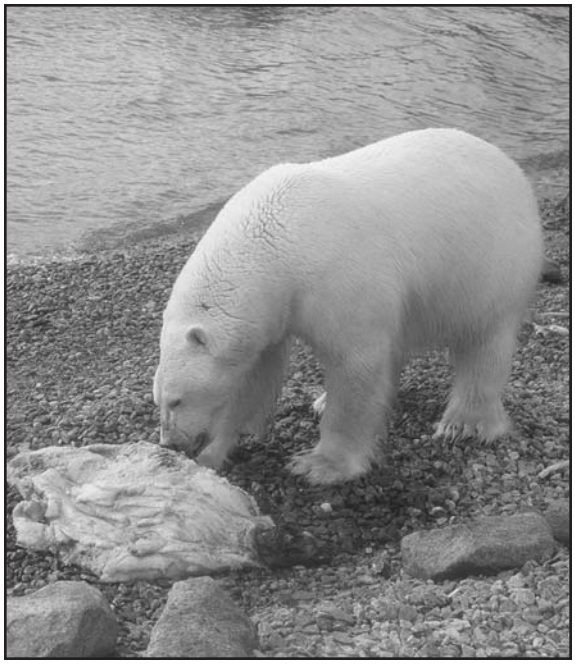
White, James: NSF DGE 9987607. IGERT Full Proposal: Carbon, Climate, and Society. 2004–2005. $42,266.

White, James: NSF DGE 9987607. IGERT Full Proposal: Carbon, Climate, and Society. 2004–2005. $5,562.

White, James: NSF DGE 9987607. IGERT Full Proposal: Carbon, Climate, and Society. 2004–2005. $10,744.

White, James: NSF DGE 9987607. IGERT Full Proposal: Carbon, Climate, and Society. 2004–2005. $5,858.

White, James: NSF OPP 9815200. Stable Isotope Studies at West Antarctic ITASE Sites. 1999–2004. $177,856.



A polar bear eats the leftovers of an INSTAAR team's dinner, Clyde Fjord, Baffin Island, Canada, August 2003. Jason Briner, Albert Kettner and Irina Overeem were glad to be safely inside a small Inuit hunting cabin. Photo: I. Overeem (INSTAAR).

White, James: NSF OPP 9909968. Developing a 480,000 Year Climate Record for West Antarctica. 2000–2003. $120,023.

White, James: NSF ATM 0081294. Collaborative Research: Isotopic Characteristics of Precipitation Across the United States: Patterns and Processes. 2000–2005. $358,871.

White James: NSF DGE 9987607. IGERT Full Proposal: Carbon, Climate, and Society. 2002–2005. $24,034.

White, James: University Corporation for Atmospheric Research S03-39667 ATM 9732665. High-Precision $^{12}CO_2/^{13}CO_2$ Ratio Measurements Using an Optical Fiber Based Difference Frequency Generation Laser Source. 2002–2005. $221,431.

White, James: NSF OPP 0230316. Collaborative Research: Refining a 500-kyr Climate Record from the Moulton Blue Ice Field in West Antarctica. 2003–2005. $58,005.

White, James: Commerce NOAA NA03OAR4310042. Stable Isotopes of $CO_2$ in Aircraft Measurements to Constrain the U.S. Biosphere Carbon Sink, and Development of Isotopic Standards for Atmospheric Greenhouse Gases. 2002–2004. $474,178.

White, James: NSF DGE 9987607. IGERT Full Proposal: Carbon, Climate, and Society. 2003–2005. $786,449.

White, James; Miller, John; Ferretti, Dominic: NSF OPP 0095078. Measurements of Stable Isotopes in Atmospheric Gases from the NorthGRIP Ice Cores. 2001–2005. $170,000.

White, James; Miller, John; Ferretti, Dominic: NSF OPP 0087357. Measurement and Interpretation of $\delta^{13}C$ in Atmospheric Methane from the Law Done Ice Cores. 2001–2005. $309,377.

White, James; Townsend, Alan: NSF DGE 9987607. IGERT Full Proposal: Carbon, Climate, and Society. 2000–2005. $2,236,762.

Williams, Mark: Mountain Studies Institute OCG4595B EPA X7 98887901-0. New Tools for Evaluating Alpine Sensitivity and Water Quality in the Upper Animas Watershed. 2004–2005. $15,000.

Williams, Mark: Interior National Park Service H1200040001 UCO-02. Analysis of PRIMENet Data and Contributions to Final Report. 2004–2006. $50,000.

Williams, Mark: State of Colorado Dept. of Natural Resources C188325 PO# 04000000031 EPA R83067401. Mary Murphy Mine Source Water & Flowpath Identification. 2002–2004. $40,000.

Williams, Mark: Idaho State University 02-232A DEB 0216588. Complexity Across Boundaries: Coupled Human and Natural Systems in the Yellowstone Northern Elk Winter Range. 2002–2004. $35,548.

Williams, Mark: Colorado Mountain College 1671. Isotope Tracing Analysis for Leadville Mine Drainage Tunnel, California Gulch Superfund Site and Affected Areas. 2003–2004. $50,152.

Williams, Mark: Interior National Park Service CA-1200-99-007 UCO-07. Soda Butte Creek: Vital Signs Monitoring Program. 2003–2004. $24,760.

Williams, Mark: Interior National Park Service CA-1200-99-007 UCO-08. Developing Screen Procedures and Sampling Protocols for Assessment of Deposition-Sensitive Surface Waters in the Rocky Mountains. 2003–2006. $50,000.

Williams, Mark: Interior National Park Service CA-1200-99-007 UCO-09. Development of Vital Signs for the N-Status of Ecosystems in National Parks: DIN, DON, and C:N in Streams and Rivers. 2003–2004. $32,440.

Williams, Mark: Interior National Park Service CA-1200-99-007 UCO-13. Developing Screening Procedures and Sampling Protocols for Assessment of Deposition-Sensitive Surface Waters in the Rocky Mountains. 2003–2006. $12,000.

Williams, Mark; Bowman, William; McKnight, Diane; Seastedt, Timothy; Townsend, Alan: NSF DEB 0423662. Long Term Ecological Research: The Landscape Continuum Model: A Biogeochemical Paradigm for High Elevation Ecosystems. 2004–2005. $789,760.

Williams, Mark; Bowman, William; McKnight, Diane; Seastedt, Timothy; Townsend, Alan: NSF DEB 0423662. Long Term Ecological Research: The Landscape Continuum Model: A Biogeochemical Paradigm for High Elevation Ecosystems. 2004–2005. $15,120.

Williams, Mark; Dyurgerov, Mark; Konovalov, Vladimir: NSF ATM 0118384. Regional Updating and Expansion of the Global Historical Climate Network (GHCN) Database: High Mountain Areas of Central Asia. 2001–2004. $99,851.

Williams, Mark; McKnight, Diane: NSF DEB 0087248. LTER Cross-site: Dissolved Organic Nitrogen Intersite Comparison (DONIC). 2000–2004. $196,506.

Williams, Mark; McKnight, Diane: NSF DEB 0087248. LTER Cross-site: Dissolved Organic Nitrogen Intersite Comparison (DONIC). 2000–2004. $46,499.

Williams, Mark; McKnight, Diane: NSF DEB 0087248. LTER Cross-site: Dissolved Organic Nitrogen Intersite Comparison (DONIC). 2000–2004. $56,500.

Wolfe, Alexander P.: University of Wisconsin LaCrosse DEB 0089600. RUI: Integrating Algal Physiological Ecology and Paleolimnology to Decipher the Effects of Atmospheric Deposition and Climate Change on Alpine Lakes. 2001–2003. $7,550.

Two Inuit men display narwhal tusks, Clyde Inlet Fjord, northeastern Baffin Island, August 2003. Jason Briner (INSTAAR) and his team met the men while researching the ice sheet history of the fjord. Late summer is prime whale hunting season, a long tradition of the Inuit. With hunting restrictions on the endangered Bowhead whale, the Narwhal is the more commonly hunted whale today. In this harsh country, Inuit happily brew tea for passersby. Photo: J. Briner (INSTAAR).

Woodhouse, Connie: Denver Board of Water Commissioners 07896A. Contract with Denver Water Updates and Improvements of Tree-Ring Reconstructions of South-Platte River Streamflow. 2004–2005. $19,935.

Woodhouse, Connie: NSF ATM 0080889. Collaborative Research: Reconstruction of Drought and Streamflow Over the Coterminous United States from Tree Rings, with Extensions into Mexico and Canada. 2000–2004 $35,674.

Woodhouse, Connie: Denver Board of Water Commissioners 07278A. Contract with Denver Water for Dendrochronological Work. 2003. $8,489.

Woodhouse, Connie; Webb, Robert: Commerce NOAA RA1330-02-AE-0037. Extended Hydroclimatic Records for the Upper Colorado River Basin. 2002–2004. $69,709.

Woodhouse, Connie; Webb, Robert; Syvitski, James: Commerce NOAA RA1330-03-AE-0032. Extended Hydroclimatic Records for the Upper Colorado River Basin. 2003–2005. $84,806.

# Support at INSTAAR

| Source of Funds | 2002/03 AY New Awards | 2002/03 AY K$ | 2003/04 AY New Awards | 2003/04 AY K$ |
|---|---|---|---|---|
| **Federal Agencies** | | | | |
| NSF | 24 | $ 3,374 | 26 | $ 4,503 |
| DoDefense | 5 | 382 | 4 | 323 |
| EPA | 2 | 43 | 1 | 139 |
| NASA | 1 | 24 | 5 | 176 |
| DoInterior | 4 | 144 | 9 | 317 |
| DoAgriculture | 1 | 9 | 1 | 9 |
| DoCommerce | 5 | 425 | 6 | 642 |
| **Non-Federal Agencies** | 18 | 683 | 13 | 660 |
| **Gift Funds** | 4 | 308 | 0 | 0 |
| **Total Awards Received** | **64** | **$ 5,392** | **65** | **$6,319** |
| **CU General Funds** | | $ 1,528 | | $ 1,718 |
| **CU Match** | | 56 | | 16 |
| **Auxiliary Funds** | | $ 743 | | $ 1,083 |
| **Total Revenue** | | **$ 7,719** | | **$9,136** |

# Expenditures at INSTAAR

| | | |
|---|---|---|
| **Budget Expenditures by Fund** | | |
| Contract and Grant Funds | $ 5,745 | $ 6,226 |
| General Funds | 1,229 | 1,582 |
| Plant Funds | 145 | 744 |
| Auxiliary Funds | 747 | 955 |
| Gift Funds | 136 | 97 |
| **Total Expenditures** | **$ 8,002** | **$9,604** |
| **Budget Expenditures by Type** | | |
| Salaries (+ benefits, stipends, student aid) | $ 4,605 | $ 4,852 |
| Operating Expenses | 1,106 | 1,659 |
| Travel | 314 | 395 |
| Equipment | 316 | 1,107 |
| Tuition | 86 | 81 |
| Subcontracts | 255 | 162 |
| Recharges + Indirect Cost Recovery | 1,274 | 1,525 |
| **Total Expenditures** | **$ 8,035** | **$8,677** |
| **Other Revenue/Expenditure** | **$ 9** | **$ 696** |
| (INSTAAR R/E tracked through other CU units) | | |

# Theses Completed

## 2004

Appel, Marcella. 2004: Photochemical effects on the copper binding capacity of stream and wetland humic substances in the Colorado Rocky Mountains. Boulder. Thesis (MS) University of Colorado.

Erickson, Tyler Allen. 2004: Development and application of geostatistical methods to modeling spatial variation in snowpack properties, Front Range, Colorado. Boulder, 190 pp. Thesis (PhD) University of Colorado.

Knauf, Meredith Christine. 2004: Rock glaciers as contributors to water quality in alpine catchments: Green Lakes Valley, Colorado, USA. Boulder. Thesis (MA) University of Colorado.

Lazar, Brian. 2004: Relationship between water storage and sliding in a temperate valley glacier. Boulder. Thesis (MS) University of Colorado.

Liu, Fengjing. 2004: Hydrological controls on stream water chemistry in Alpine catchments, Colorado Front Range, U.S.A. Boulder, 167 pp. Thesis (PhD) University of Colorado.

Miller, Matthew. 2004: Effects of hyporheic zone interaction on the biogeochemistry of a headwater stream, Green Lakes Valley, Colorado Front Range, United States. Boulder, 78 pp. Thesis (MS) University of Colorado.

Mujica-Crapanzano, Laura Rosa. 2004: Landscape analysis of vegetation and diversity patterns at Niwot Ridge, Colorado. Boulder, 192 pp. Thesis (PhD) University of Colorado.

## 2003

Briner, Jason Paul. 2003: The last glaciation of the Clyde Region, Northeastern Baffin Island, Arctic Canada. Boulder, 282 pp. Thesis (PhD) University of Colorado.

Coulthard, Roy Dennis. 2003: The glacial and sea level history of the Aston Lowlands, East-Central Baffin Island, Nunavut, Canada. Boulder, 123 pp. Thesis (MA) University of Colorado.

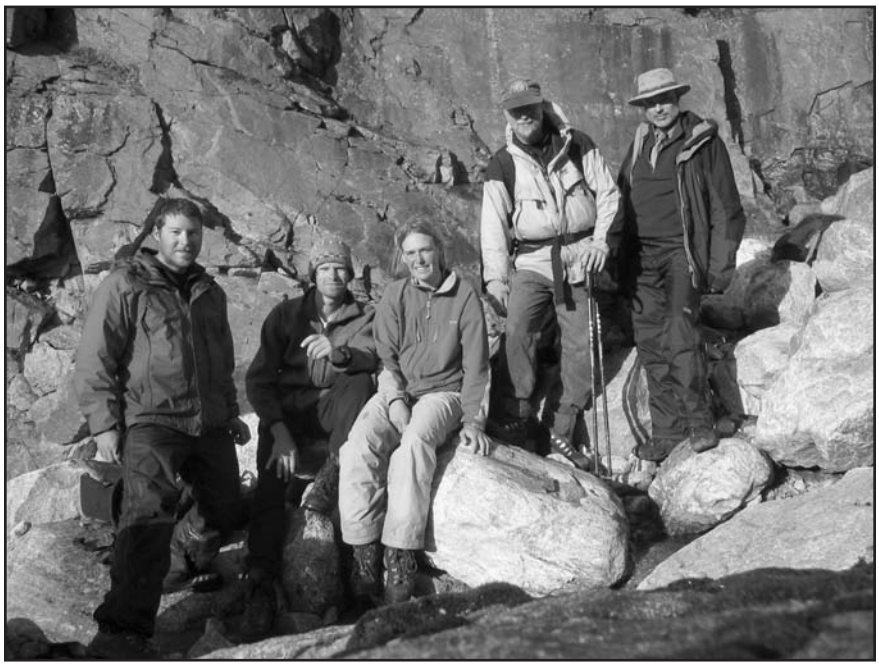
Gardner, Eileen Margaret. 2003: Effects of nutrient enrichment on phytoplankton in an alpine lake, Colorado, U.S.A. Boulder, 52 pp. Thesis (MA) University of Colorado.

Kinner, David Andrew. 2003: Multi-scale estimation of erosion and deposition in the Mississippi River Basin. Boulder, 201 pp. Thesis (PhD) University of Colorado.

Principato, Sarah Marie. 2003: The Late Quaternary history of EasternVestfirdir, NW Iceland. Boulder, 258 pp. Thesis (PhD) University of Colorado.

Quillman, Ursula. 2003: Late Holocene paleoceanographic variations of Isafjardardjup, NW-Iceland. Boulder, 126 pp. Thesis (MS) University of Colorado.

Jason Briner (INSTAAR), Albert Kettner (INSTAAR), Irina Overeem (INSTAAR), P. Thompson Davis (Bentley College and INSTAAR Affiliate), and John Leonard, Clyde Fjord, northeastern Baffin Island, Canada, August 2003. Taking advantage of geologic projects that overlap at the head of Clyde fjord, northeastern Baffin Island, the temporary team of five hiked from fjord to adjacent 1000-m-high plateau to sample rocks for cosmogenic radionuclides. The abundance of cosmogenic radionuclides reveals patterns of past ice sheet erosion. Photo: J. Briner (INSTAAR).



# Publications 2003


Abbott, M.B.; **Wolfe, A.P.** 2003: Intensive pre-Incan metallurgy recorded by lake sediments in the Bolivian Andes. Science 301: 1893–1895.

Abbott, M.B.; Wolfe, B.B.; **Wolfe, A.P.**; Seltzer, G.O.; Aravena, R.; Mark, B.G.; Polissar, P.J.; Rodbell, D.T.; Rowe, H.D.; Vuille, M. 2003: Holocene paleohydrology and glacial history of the central Andes using multiproxy lake sediment studies. Palaeogeography, Palaeoclimatology, Palaeoecology 194(1–3): 123–138.

**Anderson, S.P.**; Blum, A.E. 2003: Controls on chemical weathering: Small- and large-scale perspectives. Chemical Geology 202(3–4): 191–193.

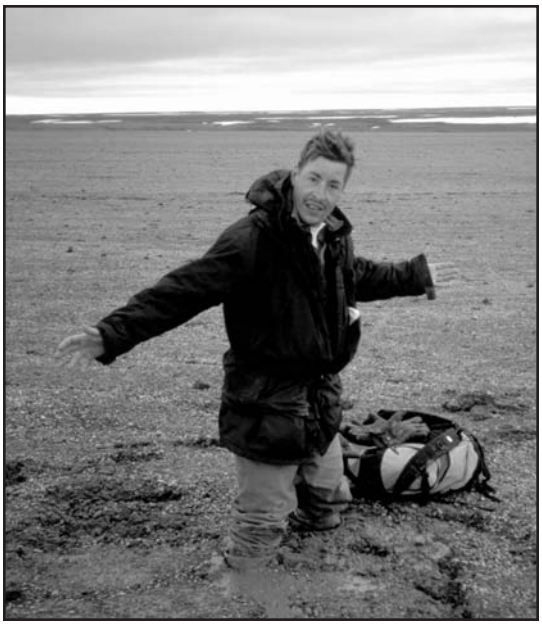
**Anderson, S.P.**; Longacre, S.A.; Kraal, E.R. 2003: Patterns of water chemistry and discharge in the glacier-fed Kennicott River, Alaska: Evidence for subglacial water storage cycles. Chemical Geology 202(3–4): 297–312.

**Anderson, S.P.**; Walder, J.S.; **Anderson, R.S.**; Kraal, E.R.; Cunico, M.; **Fountain, A.G.;** Trabant, D. 2003: Integrated hydrologic and hydrochemical observations of Hidden Creek Lake jökulhlaups, Kennicott Glacier, Alaska. Journal of Geophysical Research—Earth Surface 108(F1): article 6003.

Andreev, A.A.; Tarasov, P.E.; Siegert, C.; Ebel, T.; Klimanov, V.A.; Melles, M.; Bobrov, A.A.; Dereviagin, A.Y.; **Lubinski, D.J.**; Hubberten, H.W. 2003: Late Pleistocene and Holocene vegetation and climate on the northern Taymyr Peninsula, Arctic Russia. Boreas 32(3): 484–505.

**Andrews, J.T.**; Cartee-Schoolfield, S. 2003: Late Quaternary lithofacies, provenance, and depositional environments (~12–30 cal ka), north and south of the Denmark Strait. Marine Geology 199(1–2): 65–82.

**Andrews, J.T.**; Giraudeau, J. 2003: Multi-proxy records showing significant Holocene environmental variability: the inner N. Iceland shelf (Húnaflói). Quaternary Science Reviews 22(2–4): 175–193.

JaapJan Zeeberg (RIVO, Netherlands) trapped in some nasty mud that forms when the soil layer above the permafrost has a high liquid water content, October Revolution Island, Severnaya Zemlya, Arctic Russia (79°N), August 2003. Zeeberg was part of an international team studying the glacial geologic history of this region on the edge of the Arctic Ocean; it was repeatedly covered by large ice sheets, but their magnitude and timing were poorly known. The research team included members from the U.S.A. (INSTAAR and University of Illinois at Chicago), Sweden, Russia, Iceland, and the Netherlands. Photo: J.J. Zeeberg (RIVO, Netherlands).


**Andrews, J.T.**; Hardadottir, J.; **Stoner, J.S.**; Mann, M.E.; **Kristjánsdóttir, G.B.**; Koç, N. 2003: Decadal to millennial-scale periodicities in North Iceland shelf sediments over the last 12000 cal yr: Long-term North Atlantic oceanographic variability and solar forcing. Earth and Planetary Science Letters 210(3–4): 453–465.

**Andrews, J.T.**; Hardardóttir J.; **Kristjánsdóttir, G.B.**; Grönvold K.; **Stoner J.S.** 2003: A high-resolution Holocene sediment record from Húnaflóaáll, N Iceland margin: century- to millennial-scale variability since the Vedde tephra. The Holocene 13(5): 625–638.

**Andrews, J.T.;** Helgadóttir, G. 2003: Late Quaternary Ice Cap Extent and Deglaciation, Húnaflóaáll, Northwest Iceland: Evidence from Marine Cores. Arctic, Antarctic, and Alpine Research 35(2): 218–232.

**Andrews, J.T.**; MacLean, B. 2003: Hudson Strait ice streams: a review of stratigraphy, chronology and links with North Atlantic Heinrich events. Boreas 32(1): 4–17.

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Barclay, D.J.; Wiles, G.C.; **Calkin, P.E.** 2003: An 850 year record of climate and fluctuations of the iceberg-calving Nellie Juan Glacier, south central Alaska, USA. Annals of Glaciology 36: 51–56.

**Barger, N.N.**; D'Antonio, C.M.; Ghneim, T.; Cuevas, E. 2003: Constraints to colonization and growth of the African grass, Melinis minutiflora, in a Venezuelan savanna. Plant Ecology 167(1): 31–43.

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**Benson, L.**; Liddicoat, J.; Smoot, J.; Sarna-Wojcicki, A.; Negrini, R.; Lund, S. 2003: Age of the Mono Lake excursion and associated tephra. Quaternary Science Reviews 22(2–4): 135–140.

**Benson, L.**; Linsley, B.; Smoot, J.; Mensing, S.; Lund, S.; Stine, S.; Sarna-Wojcicki, A. 2003: Influence of the Pacific Decadal Oscillation on the climate of the Sierra Nevada, California and Nevada. Quaternary Research 59(2): 151–159.

**Benson, L.**; Lund, S.; Negrini, R.; Linsley, B.; Zic, M. 2003: Response of North American Great Basin Lakes to Dansgaard-Oeschger oscillations. Quaternary Science Reviews 22(21–22): 2239–2251.

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Brian Clark (University of California at Santa Barbara, former INSTAAR) in Colca Canyon, Peru, July 2004. The Colca River cuts through the edge of the altiplano near Arequipa in southern Peru, generating one of the world's deepest canyons. Clark was part of a team assessing the potential for determining the rates of incision and working on other structural and glacial geologic problems. Photo: R.S. Anderson (INSTAAR).

Dethier, D.P.; Benedict, J.B.; Birkeland, P.W.; **Caine, N.**; **Davis, P.T.**; **Madole, R.F.**; Patterson, P.E.; Price, A.B.; Schildgen, T.F.; Shroba, R.R. 2003: Quaternary stratigraphy, geomorphology, soils, and alpine archeology in an alpine-to-plains transect, Colorado Front Range. *In* Easterbrook, D.J. (ed.), Quaternary Geology of the United States: INQUA 2003 Field Guide. Reno, Nevada. Desert Research Institute: 81–104.

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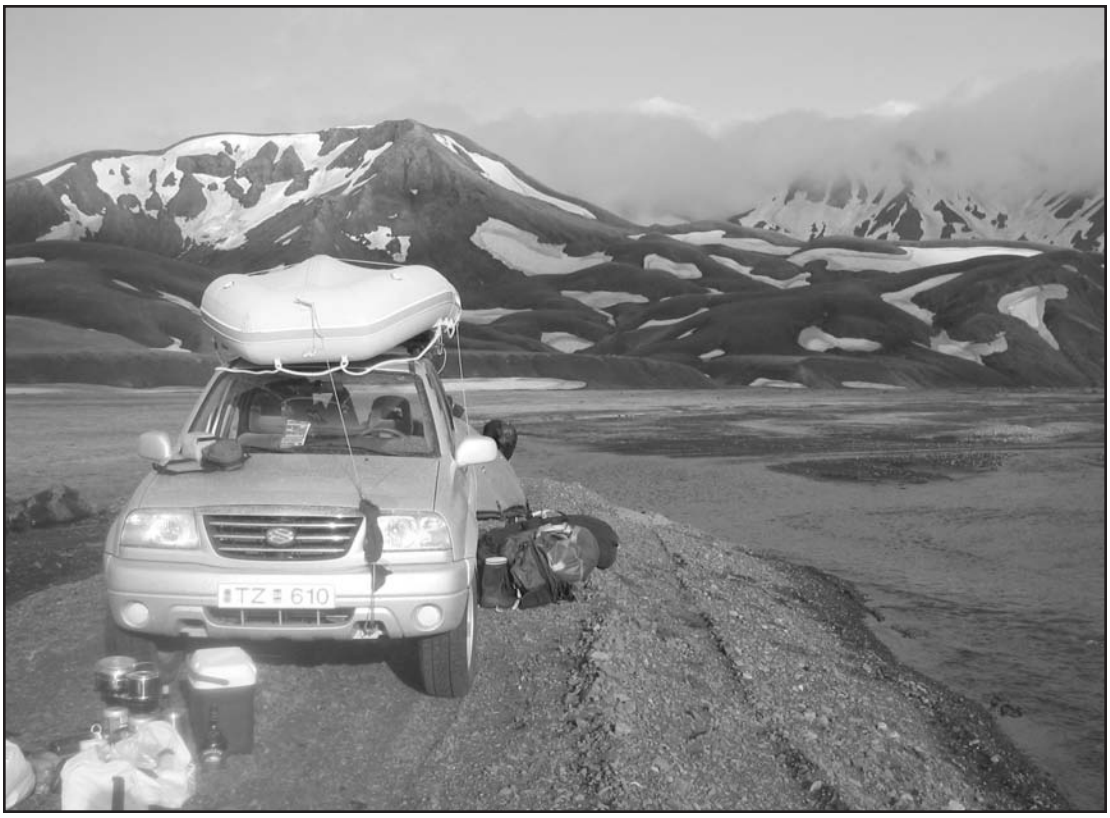
Albert Kettner (INSTAAR) pulls the inflatable boat ashore in Clyde Fjord, Baffin Island, Canada, August 2003. A. Kettner and I. Overeem were looking for shells to date marine and riverine sediments that constrain the influence of deglaciation on river systems through time. Photo: I. Overeem (INSTAAR).



Yarrow Axford and her team of helpers car-camped across Iceland to sample surface sediments from dozens of lakes, south central Iceland, July 2003. Photo: J. Briner (INSTAAR).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P. Thompson Davis (Bentley College and INSTAAR Affiliate) and Neal Michelutti (University of Alberta) enjoy the scenery of Perfection Pass, near Inugsuin Fiord on northeastern Baffin Island, Canada, May 2003. Little Ice Age moraines in the middle ground were deposited on the valley floor by glaciers descending through the spectacular peaks. Light and snow conditions in May allow for snowmobile travel to investigate glacial history and Holocene climate change. Photo: J. Briner (INSTAAR).

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A tidewater glacier extends into Clyde Fjord, Baffin Island, Canada, August 2003. The glacier was seen by an INSTAAR team while studying the responses of arctic rivers to deglaciation and climate change. Photo: I. Overeem (INSTAAR).


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Vertebrae from one of ten narwal that died together during severe sea-ice conditions more than 50,000 years ago, October Revolution Island, Severnaya Zemlya, Arctic Russia (79°N), August 2003. The bones lie about 50 meters above present sea level, demonstrating substantial glacioisostatic uplift during retreat of a thick ice sheet. Photo: D. Lubinski (INSTAAR).

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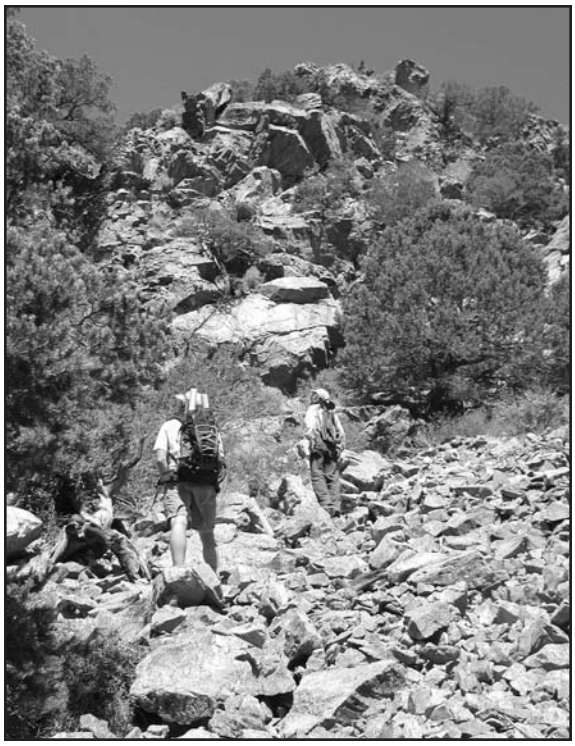

Kurt Chowanski and Mark Losleben (INSTAAR) scout a slope for old pinyon pines in North Crestone Creek, near Crestone, Colorado, August 2003. The oldest trees at this site were over 450 years old, and ring-width data from them will be used to reconstruct drought variability in the Rio Grande basin. Photo: Connie Woodhouse (INSTAAR).

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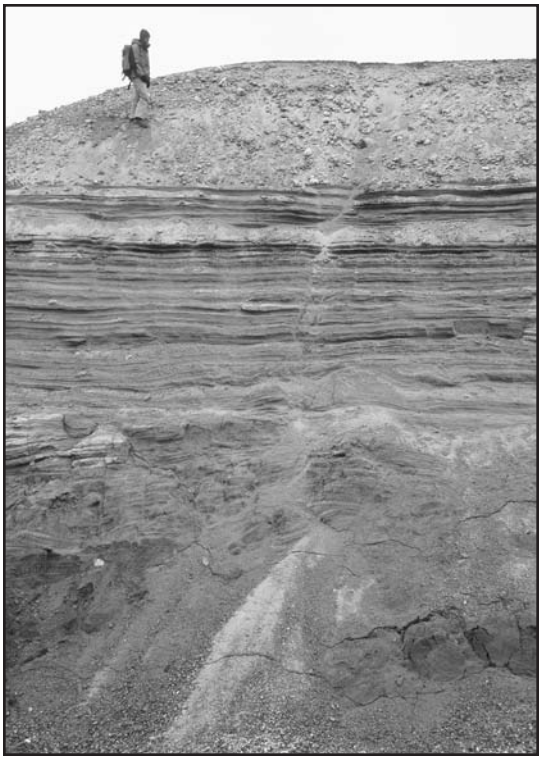

Irina Overeem (INSTAAR) walks on top of a layered terrace, Baffin Island, Canada, August 2003. The layering holds clues to how Arctic river systems respond to changing climate. Photo: I. Overeem (INSTAAR).


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Base camp for a Quaternary glacial geologic study of October Revolution Island, Severnaya Zemlya, Arctic Russia (79°N), August 2003. This region on the edge of the Arctic Ocean was repeatedly covered by large ice sheets, but their magnitude and timing were poorly known. The research team included members from the U.S.A. (INSTAAR and University of Illinois at Chicago), Sweden, Russia, Iceland, and the Netherlands. Photo: J.J. Zeeberg (RIVO, Netherlands).

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Boaters' view of the Grand Canyon during a water sampling trip, Arizona, November 2003. A cooperative team of researchers from USGS, INSTAAR, Centers for Disease Control, and Colorado Mountain College rowed the Canyon in a hydrologic field sampling effort aimed at better understanding the ground water sources of seeps and springs that feed the canyon. It is unclear whether increased ground water pumping on the developing Coconino Plateau to the south is tapping into the same sources that may feed the sensitive ecosystem in the Grand Canyon. Photo. B. Vaughn (INSTAAR).


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One of the numerous Tibetan peaks (Meili Snow Mountains) sighted during an expedition to find new ice coring sites, western Tibet, August 2004. The team was led by Lonnie Thompson of the Byrd Polar Research Center (Ohio State University). Photo: R. Vachon (INSTAAR).

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Courtney Meier (INSTAAR and Ecology and Evolutionary Biology, CU) and helper Gordon Bowman setting up plots for soil phenolic measurements, Niwot Ridge LTER, Colorado, July 2003. Photo: W. Bowman (INSTAAR).


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Gifford Miller (INSTAAR) and P. Thompson Davis (Bentley College and INSTAAR Affiliate) return to basecamp at midnight after a 190-km-long day sampling rocks for cosmogenic radionuclides, Cape Raper, southern Aston Lowlands, northeastern Baffin Island, Canada, May 2003. The samples will constrain the erosional style of the northeastern Laurentide Ice Sheet. Photo: J. Briner (INSTAAR).

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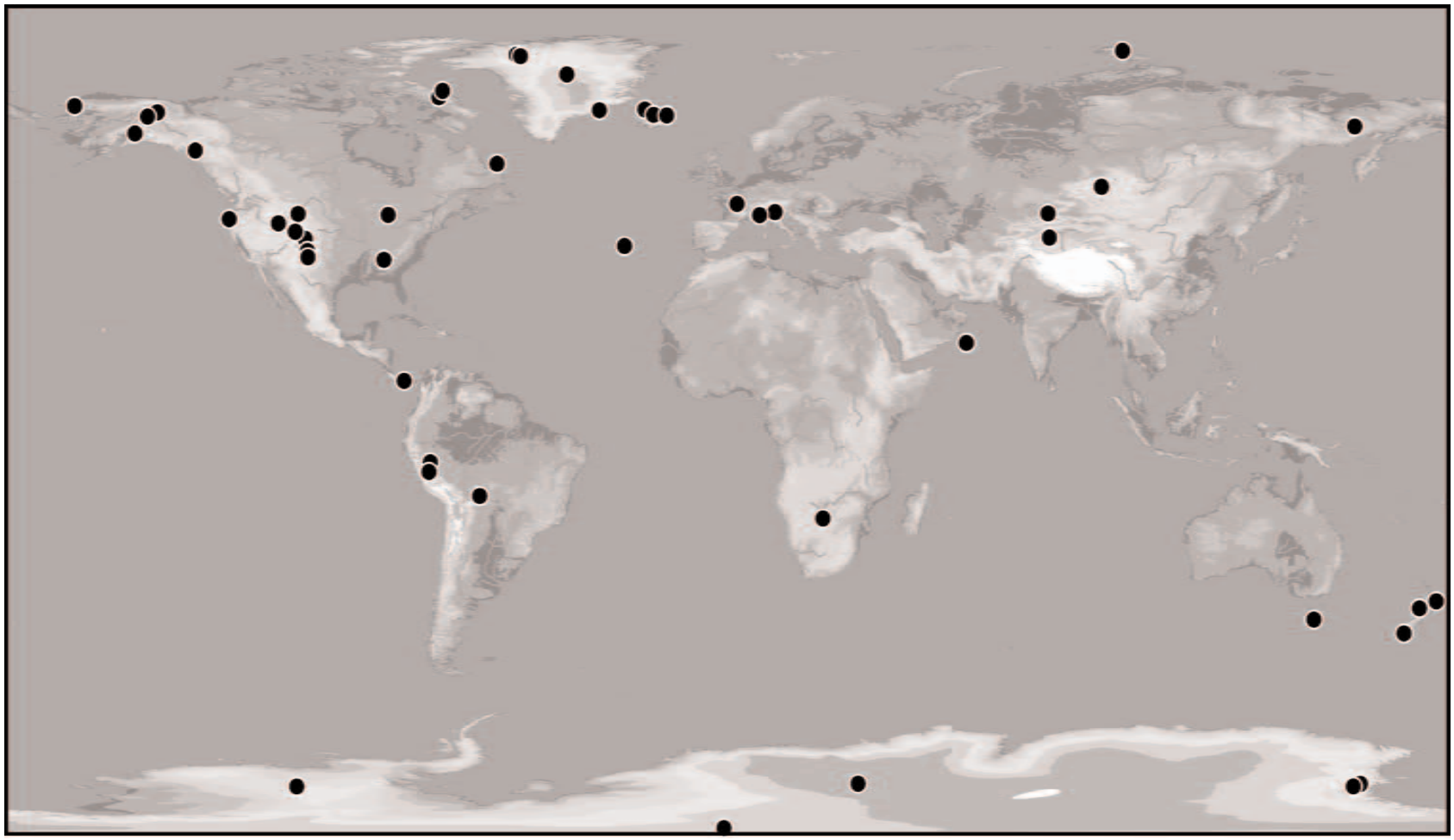
Field Crew at archeological research site PET-408, Prince of Wales Island, Alaska, June 2004. Back row left to right: Andrew Ericson (Mercyhurst College), Eric Parrish (INSTAAR), Professor Alexandr Orekhov (Northern International University, Magadan, Russia), Terence Fifield (USFS Archaeologist, Prince of Wales Island Districts, Tongass National Forest), E. James Dixon (INSTAAR, Museum and Field Studies, Anthropology), Craig Lee, (INSTAAR, Department of Anthropology), Evan Head, (Tlingit, USFS Volunteer). Front row: Erik Erwin (INSTAAR, Department of Anthropology), Felix Christiaan Gumbiner (CU, Department of Anthropology), Mary Bruun, (Western Washington University). Photo: E.J. Dixon (INSTAAR).

# Where in the world is INSTAAR?

Active field programs 2003-2004.



Colorado

University of Colorado at Boulder