

**THE J. LOUIS AGASSIZ SYMPOSIUM,
UNIVERSITY OF MAINE
INSTITUTE FOR QUATERNARY STUDIES
EIGHTH ANNUAL RESEARCH SYMPOSIUM
2000**

**Monday, MAY 8,
0830-1700**

**Tuesday, MAY 9,
0830-1400**

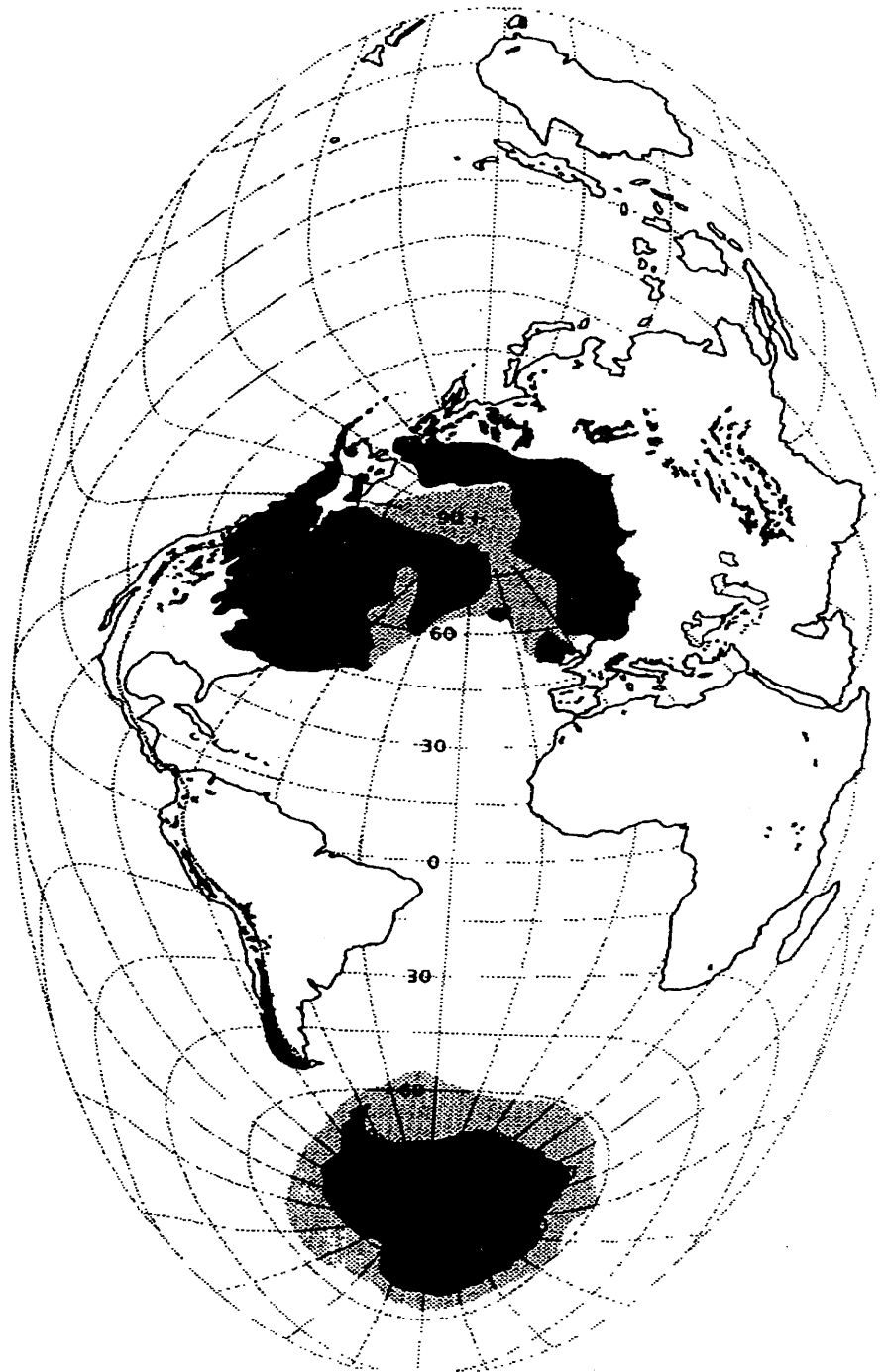
**WOOLLEY ROOM
COMMUNITY CENTER**

**DORIS TWITCHELL
ALLEN VILLAGE**

UNIVERSITY OF MAINE

ORONO, ME

**Presentations by:
University of Maine
Faculty, Students, Staff, and
Guests**



**J. LOUIS AGASSIZ SYMPOSIUM
UNIVERSITY OF MAINE
INSTITUTE FOR QUATERNARY STUDIES
EIGHTH ANNUAL RESEARCH SYMPOSIUM
MAY 8 and 9, 2000
DORIS TWITCHELL ALLEN VILLAGE: WOOLLEY ROOM**

PROGRAM

Monday, May 8

0830: COFFEE

0855: WELCOME AND INTRODUCTION: Daniel F. Belknap

SESSION 1 - ARCHAEOLOGY I

0900: DICKINSON, Pam, NEW PALEOINDIAN INVESTIGATIONS WITHIN NEW BRUNSWICK

0920: MOORE, Edward, TECHNOLOGICAL CONTINUITY AND VARIABILITY AMONG PALEOINDIAN ASSEMBLAGES IN THE NORTHEAST

0940: ROBINSON, Brian S. ACTIVITY PATTERNING OR CULTURAL TRADITION: ASSEMBLAGE VARIATION IN THE BERINGIAN TRADITION OF ALASKA

SESSION 2 - COASTAL SEDIMENTOLOGY

1000: BUYNEVICH, Ilya V., and FITZGERALD, Duncan M., INSIDE THE BEACH: STRATIGRAPHIC CLASSIFICATION OF BARRIER PROGRADATION STYLES ALONG THE NEW ENGLAND COAST.

1020: COFFEE BREAK

1040: BELKNAP, Daniel F., KELLEY, Joseph T., and GONTZ, Allen M., SEISMIC STRATIGRAPHY OF POCKMARKS, GAS SOURCE AREAS, AND POSSIBLE FLUID TRANSFER PATHWAYS, PENOBSCOT BAY, MAINE

1100: DALY, Julia F., KELLEY, Joseph T., and BELKNAP, Daniel F., NEWFOUNDLAND SALT-MARSH STRATIGRAPHY AND LATE HOLOCENE SEA-LEVEL CHANGE

SESSION 3 - PALEOECOLOGY

1120: NURSE, Andrea and DIEFFENBACHER-KRALL, Ann, MULTIPLE-CORE, LAKE LEVEL STUDIES ENHANCE UNDERSTANDING OF ACADIA REGION PALEOHYDROLOGY

1140: JACOBSON, George L.,

1200: LUNCH Doris Twichell Allen Village

SESSION 4 - GLACIOMARINE GEOLOGY AND GLACIOLOGY

1300: KELLOGG, Thomas B., FORMER ROCK-FLOORED ICE STREAMS ON THE AMUNDSEN SEA CONTINENTAL SHELF

1320: JOHNSON, Jesse, MAPPING OF ANTARCTIC ICE FRONTS

1340: HUGHES, Terence J., BYRD GLACIER AS A ROCK-FLOORED ICE STREAM ENDING AS A CALVING ICE SHELF.

1400: GONTZ, Allen M., PRELIMINARY REPORT: EVIDENCE FROM SEISMIC REFLECTION DATA FOR ROCK-FLOORED GLACIAL TROUGHS IN THE AMUNDSEN SEA, WEST ANTARCTICA

1420: FASTOOK, James L. and NASLUND, Jens-Ove, FLOW DIRECTIONS AND "ICE DISTANCE" ROSE DIAGRAMS FOR SCANDINAVIA

1440: **COFFEE BREAK**

SESSION 5 - PERUVIAN ARCHAEOLOGY AND PALEOCLIMATES

1500: SANDWEISS, Daniel, TANNER, Benjamin, SANGER, David, ANDRUS, Fred, and PIPERNO, Dolores. EXCAVATION OF A PALEO-INDIAN AGE DOMESTIC STRUCTURE IN PERU

1520: TANNER, Benjamin, LITHIC ANALYSIS AT QUEBRADA JAGUAY: RESEARCH SCOPE AND PRELIMINARY RESULTS

1540: HOUK, Stephen, OXYGEN ISOTOPE AND TIME SERIES ANALYSES OF MARINE BIVALVES FROM THE COAST OF PERU: APPLICATIONS FOR THE GEOARCHAEOLOGY OF EL NIÑO

SESSION 6 - QUATERNARY SCIENCES EDUCATION

1600: REUSCH, Douglas N., MAASCH, Kirk A., REEVE, Andrew S., SCHAUFFLER, Molly, WELLER, Herman, and KEELEY, Page, TEACHER ACADEMY ON CLIMATE CHANGE

1620: WILL, Richard, TEACHING ARCHAEOLOGY IN THE PUBLIC SCHOOL SYSTEM

TUESDAY, MAY 9

0830: **COFFEE**

0855: **WELCOME AND INTRODUCTION:** Daniel Sandweiss

**SESSION 7 - SOUTHERN HEMISPHERE GLACIAL, CLIMATE, and
PALEOGEOGRAPHIC STUDIES**

0900: SCHNITKER, Detmar, LATE QUATERNARY PRODUCTIVITY CHANGES ON THE
TASMAN PLATEAU

0920: KELLOGG, Davida, DIATOMS IN THE SOUTH POLE WATER WELL - A PROPOSAL

0940: HALL, Brenda L., IMPROVING THE CHRONOLOGY OF LACUSTRINE RECORDS,
DRY VALLEYS, ANTARCTICA: WORK IN PROGRESS

1000: DENTON, George H., THE NEW ZEALAND PALEOCLIMATE PROJECT

1020: **COFFEE BREAK**

1040: BLACK, Jessica, CAN A LITTLE ICE AGE CLIMATE SIGNAL BE DETECTED IN THE
SOUTHERN ALPS OF NEW ZEALAND?

1100: LEWIS, Adam R., DOES MASSIVE BURIED ICE IN BEACON VALLEY, ANTARCTICA,
HAVE PALEOCLIMATIC SIGNIFICANCE?

1120: LORREY, Andrew M., LANDSCAPE EVOLUTION AND POLYGON DEVELOPMENT
ON A DEBRIS-COVERED GLACIER SURFACE, BEACON VALLEY,
ANTARCTICA.

1140: BORNS, Harold W., Jr., and WARREN, William P., AN ICE CAP ON THE CONTINENTAL
SHELF OFF WESTERN IRELAND: CONTINUING RESEARCH

1200: **LUNCH** Doris Twichell Allen Village

KEYNOTE SPEAKER:

1300: GROSSWALD, Mikhail, GLACIATION AND MEGAFLOODS IN PLEISTOCENE
EURASIA

ABSTRACTS

(listed alphabetically by author)

SEISMIC STRATIGRAPHY OF POCKMARKS, GAS SOURCE AREAS, AND POSSIBLE FLUID TRANSFER PATHWAYS, PENOBSCOT BAY, MAINE

BELKNAP, Daniel F., Dept. of Geological Sciences, University of Maine, belknap@maine.edu.,
KELLEY, Joseph T., Dept. of Geological Sciences, University of Maine,
jtkelley@maine.edu, and **GONTZ, Allen M.**, Department of Geological Sciences, University
of Maine, allen.gontz@umit.maine.edu

New seismic reflection profiling, side-scan sonar, and geotechnical probe data were collected in 1999 for a NOAA-UM-Sea Grant funded study of gas pockmarks in Penobscot Bay, Maine. Pockmarks are steep-walled dish-shaped craters in soft mud found in many parts of the world's oceans. They are known to form from eruptions of fluids and natural gas over petroleum areas, and also occur over sources of biogenic gas. One of the world's largest fields of shallow biogenic-gas-induced pockmarks is found in Belfast Bay, northern Penobscot Bay, Maine. Other embayments nearby also contain abundant gas, and at least some have pockmarks. We are determining extent of these fields and attempting to determine processes of origin, evolutionary history, and likelihood of instability of the seafloor in cases of human disturbance (such as fishing, shipping, anchoring, dredging and dredge-spoil disposal, laying of cables and pipes, and construction on the seafloor). Seismic and side-scan interpretations have been confirmed with vibracores as well as submersible and Remotely Operated Vehicle (ROV) observations. Further coring is planned for this coming field season

Seismic stratigraphy of northern Penobscot Bay is expressed as bedrock, till, Pleistocene glaciomarine mud, Holocene transgressive estuarine mud, and Holocene open embayment sediments. Natural gas deposits are common in most of the central parts of the bay, evident as parabolic-shaped "acoustic wipeouts" that mask deeper stratigraphy. Three important erosional unconformities occur in the sedimentary section: 1) a basal unconformity (BU) cut by the Penobscot River and other streams during the post-glacial lowstand (to approximately 60 m below present 10.8 ka), 2) a transgressive ravinement unconformity (TrRU) cut during erosional retreat of bluffs in the till and glaciomarine, and 3) a tidal ravinement unconformity (TdRU) active on the margins of the major tidal channels in Penobscot Bay. In addition, there is clear evidence that the pockmarks are late Holocene features, cross-cutting horizontal reflectors in the Holocene embayment sediments. Just above the TrRU is commonly found a 1-3 m thick wedge of sand and gravel, a lag or beach formed during bluff retreat.

Pockmarks often occur directly over broad gas deposits. In these cases, the gas is always depleted adjacent to the pockmarks, suggesting migration and release. However, there are pockmarks that are distant from obvious gas sources. Besides the broad gas deposits, there are several examples of "brightening" of seismic reflectors that suggest gas enhancement. These occur as disseminated patches in tidal channel sand and gravel deposits, and as localized bright lines at the TrRU. Often the localized bright spots are inclined, and in several cases lead from gas deposits to surface pockmarks. We speculate that these are areas of greater permeability that have allowed more rapid gas migration. In 1999 we emplaced a geotechnical probe and gas sampling device ("Spearfish") into a variety of these occurrences, and were able to document presence of methane as well as excess gas pore pressures. We intend to core and probe in these localities again this summer.

CAN A LITTLE ICE AGE CLIMATE SIGNAL BE DETECTED IN THE SOUTHERN ALPS OF NEW ZEALAND?

BLACK, Jessica L., Institute for Quaternary Studies, University of Maine,
Jessica.L.Black@umit.maine.edu

The goal of my research is to determine if a clear Little Ice Age (LIA) signal, similar to that in the North Atlantic region, is found in the Southern Hemisphere. The LIA was a late Holocene interval of climatic cooling registered by expansion of alpine glaciers and sea ice in the North Atlantic region. Here there are two phases of the LIA: an early phase from 1250 AD to 1390 AD, and a main phase from 1550 AD to 1880 AD (Porter, 1986). After 1860-1880 AD, rapid warming led to rapid glacier retreat throughout the North Atlantic region that has continued to the present day. The LIA is considered to be the latest cool episode in a 1500-year climate cycle that characterizes the North

Atlantic basin (Bond et al., 1999). The field area chosen to accomplish the major research goal is the Southern Alps of New Zealand, located in the South Pacific at 45°S latitude, on the opposite side of the planet from the North Atlantic region. The Southern Alps contain many mountain glaciers fronted by well-preserved Holocene moraine complexes. Due to high precipitation and ablation activity gradient, these glaciers respond to climate change on a decade scale.

The chronology of the Holocene moraines deposited by the Hooker and the Mueller Glaciers in Mount Cook National Park in the Southern Alps is controversial. Preliminary dating of the moraines from lichenometry and dendrochronology pointed to a LIA climate signal in this portion of the Southern Hemisphere (Burrows, 1973; Lawrence and Lawrence, 1965). The implication is that the LIA is a global event and hence requires a global causative mechanism. However, new weathering rind studies suggested that most of the moraines may have formed prior to the LIA (Gellatly, 1984). The implication is that a LIA climate signal similar to that in the North Atlantic region did not occur in the Southern Alps. If so, then LIA might be simply a regional event, with a regional cause. To resolve this dilemma, I undertook a detailed study of the Mueller and Hooker Valleys, reinvestigating the chronologies of the pertinent moraine systems. I began by constructing a detailed geomorphologic map using the sequence-mapping technique and available historical records. I then used a new lichenometry technique, the Fixed Area Largest Lichen (FALL) method of Bull and Brandon (1998), to construct a more detailed chronology for these moraine systems.

Preliminary results indicate that the Hooker and Mueller moraine assemblages are equivalent in age with those deposited in the North Atlantic region during the main phase of the LIA. The morphology of the surficial glacial deposits suggests that the climatic response of these glaciers was of a similar magnitude to the alpine glaciers of the North Atlantic region. The collapse of the New Zealand glaciers in the last century is also approximately synchronous with that of glaciers in the North Atlantic regions. A tentative conclusion is that at least the main phase of the LIA climate cooling is a global phenomenon. However, further evaluation of the accuracy and precision of the FALL lichenometry method is necessary. There are also significant differences in abruptness and magnitude of the LIA cooling event from the previous cooling events that are part of the 1500 year climate cycle of the North Atlantic, during the last 100,000 years.

AN ICE CAP ON THE CONTINENTAL SHELF OFF WESTERN IRELAND: CONTINUING RESEARCH

BORNS, Harold W., Jr., Department of Geological Sciences and Institute for Quaternary Studies, University of Maine, borns@maine.edu, and **WARREN, William P.**, Head, Quaternary Division, Geological Survey of Ireland

Bedrock erosional features in the form of remolded roches moutonnées and crag-and-tail features, coupled with the transport directions of erratic boulders along the west coast of Ireland and radiocarbon dates, demonstrate that an ice cap formed seaward on the continental shelf during the last glacial cycle.

As the ice cap expanded it merged with the ice cap over the midlands and together they flowed northward along the join. Eventually the flow divide of the ice cap on the shelf shifted eastward reversing the ice flow across the coastal zone from easterly to westerly flow, after about 13,000 years ago.

This newly identified marine-based ice cap is the southern and western most reported from the North Atlantic region. Its presence and history reflect changes in sea levels, sea ice and climate in the North Atlantic during the last glacial cycle.

INSIDE THE BEACH: STRATIGRAPHIC CLASSIFICATION OF BARRIER PROGRADATION STYLES ALONG THE NEW ENGLAND COAST.

BUYNEVICH, Ilya V., and **FITZGERALD, Duncan M.**, Department of Earth Sciences, Boston University, Boston, MA 02215, valeriy@bu.edu

Geomorphic evidence of coastal progradation is found throughout the world, although the modes of seaward growth and their stratigraphic signatures can be highly variable. In areas where surficial expression of barrier growth has been modified or obliterated, subsurface information provides the only means of reconstructing the patterns of coastal accretion. Using high-resolution ground-penetrating radar (GPR) transects and sediment cores from six New England barriers, four styles of barrier progradation were identified: uniform, non-uniform, punctuated, and complex.

Uniform progradation is characterized by a sequence of evenly spaced, seaward-dipping reflectors with a sigmoidal-oblique configuration (e.g., Flat Point Barrier, Maine). In non-uniform style, the thickness of individual progradational units varies along a shore-normal section due to fluctuations in sediment supply or changes in shoreline orientation. Rapid accretion (5 m/yr) next to a jetty was recorded as a series of sigmoidal-oblique reflectors separated by wide reflection-free areas (Wells Beach, Maine). Punctuated progradation is manifested by sharp GPR reflectors that can be short and steep (Hunnewell Barrier) or tangential-oblique, representing entire paleo-beach surfaces (Castle Neck and Horseneck Barriers, Massachusetts). Cores taken through these strong reflectors reveal significant amounts of heavy mineral lag deposits (> 30% by volume) or accretionary gravel units attributed to large magnitude erosional events. Complex progradation style is distinguished by complex sigmoidal-oblique configuration resulting from a combination of basinward accretion and aggradation. An estuary-margin Riverside Beach barrier, Maine, reveals a thick sequence of stacked reflectors with bounding surface geometry that changes from concave to convex-upward in a seaward direction, suggesting an increase in sediment supply. Individual reflectors are produced by concentration of mica, commonly deposited during high-magnitude riverine discharge events.

Along paraglacial coastlines, changes in sediment supply (fluvial, offshore, or nearby glacial deposits) may introduce various amounts of texturally and compositionally heterogeneous sediments, which can alter the rates of seaward accretion and preserve a record of individual progradational episodes. Local sea-level history and storm frequency exert a major control on the magnitude of accretionary and erosional phases of barrier development. The relative importance of these processes can be assessed on GPR images. A survey of progradational sequences reported in the literature indicates widespread application of the proposed classification.

NEWFOUNDLAND SALT-MARSH STRATIGRAPHY AND LATE HOLOCENE SEA-LEVEL CHANGE

DALY, Julia F., Dept. of Geological Sciences, University of Maine, Orono, ME 04469-5790, julia@iceage.umeqs.maine.edu; **KELLEY, Joseph T.**, Dept. of Geological Sciences, University of Maine, Orono, ME 04469-5790, jtkelley@maine.edu; **BELKNAP, Daniel F.**, Dept. of Geological Sciences, University of Maine, Orono, ME 04469-5790, belknap@maine.edu.

The influence of glacioisostatic adjustment on late Holocene sea-level change can be addressed by comparing data from spatially distant locations. The coast of Newfoundland affords an excellent opportunity to constrain differential isostatic adjustment across a relatively small (~450 km x ~500 km) region. Different Holocene sea-level histories are predicted for different parts of the island in response to the migration of a collapsing glacial forebulge across the island (Quinlan and Beaumont, 1981). At present, sea-level is falling at the northern end of the Northern Peninsula, and rising elsewhere around the island. Determination of late Holocene sea-level change by analysis of salt-marsh stratigraphy at four locations around Newfoundland is the basis for defining trends in sea-level change around the island. At each marsh, surface samples were collected to determine modern foraminiferal assemblages at different elevations. Cores collected along transects define the general marsh stratigraphy, and to provide samples of basal peats. A comparison of modern to fossil foraminiferal assemblages will be used to assign a paleoenvironment to the basal peat. This environmental description relates the basal sample to a paleo-mean high water range. Examination of the general stratigraphy of each marsh indicates that sea-level rise is occurring at three locations (Port-au-Port peninsula, Deadman's Bay, and the Avalon peninsula), but that recent sea-level change at the fourth location (St. Paul's Inlet) may be more complex. St. Paul's Inlet is located between an area of falling sea level to the north and rising sea level the south, but the transition between these two sea-level trends has not been well defined. The development of salt marsh at St. Paul's Inlet includes both regressive and transgressive features, and may reflect a recent transition from falling to rising sea level. If this hypothesis is correct, this record could constrain the timing and position of the transition between falling and rising sea level. The stratigraphies described for all locations vary significantly, indicating that there is a strong local control (e.g. local sediment flux, inlet dynamics, isostatic changes) on the development of salt-marshes along this coast.

THE NEW ZEALAND PALEOCLIMATE PROJECT

DENTON, George H., Institute for Quaternary Studies, University of Maine.
debbies@maine.edu.

I will outline the current status of the New Zealand Paleoclimate Project. This interdisciplinary project involves scientists from five countries. The major goal is to develop a detailed paleoclimate record through the last glacial/interglacial transition from glacial geologic and palynologic evidence. The results will be used to evaluate the cause(s) of abrupt millennial-scale paleoclimate changes.

NEW PALEOINDIAN INVESTIGATIONS WITHIN NEW BRUNSWICK

DICKINSON, Pam, Department of Anthropology and Institute for Quaternary Studies,
University of Maine, Orono, Maine. pam.dickinson@umit.maine.edu

The Paleoindian cultural period in the Northeast was 10,000 to 11,000 radiocarbon years ago. Site identification for this period has traditionally focused on the presence of fluted points. Paleoindian sites have been identified throughout the Northeast including Maine, Nova Scotia and Prince Edward Island. However, there are no identified Paleoindian sites in New Brunswick. In focusing on the fluted point it is possible that some sites are largely ignored or disregarded as having a Paleoindian component. More emphasis is being placed today on understanding what identifies a site as being Paleoindian without the presence of a fluted point. Two sites in New Brunswick that do not contain fluted points hold potential for being Paleoindian in age based on other artifact classes. The degree of continuity and/or variability of assemblage morphology and technology from the sites in New Brunswick will be compared with a known Paleoindian site from Nova Scotia.

FLOW DIRECTIONS AND "ICE DISTANCE" ROSE DIAGRAMS FOR SCANDINAVIA

FASTOOK, James L. Dept. Computer Science and Institute for Quaternary Studies, University
of Maine, fastook@maine.edu, and **NASLUND, Jens-Ove**

1. Cumulative ice velocity directions: The idea is to answer the question: how long (total time during glacial cycle) did a specific direction prevail at the locality?
2. Cumulative "ice distance": The idea here is to present a sort of "ice distance" (total time x ice velocity), that would be a measure of how much ice has passed over the locality during the glacial cycle. Perhaps this would give a strong correlation with till fabric.
3. Separate time periods: it would be very useful to be able to separate velocity-direction (and ice distance-direction) information for different time periods during the cycle, for example into the Early Weichselian and Late Weichselian.

PRELIMINARY REPORT: EVIDENCE FROM SEISMIC REFLECTION DATA FOR ROCK-FLOORED GLACIAL TROUGHS IN THE AMUNDSEN SEA, WEST ANTARCTICA

GONTZ, Allen M., Department of Geological Sciences, University of Maine,
allen.gontz@umit.maine.edu

A recent scientific cruise on the RVIB Nathaniel B. Palmer, NBP00-01, in the Amundsen Sea, recovered evidence of as many as 17 glacial troughs emanating from West Antarctica. Seismic reflection data and multi-beam bathymetry were used to image the sub-bottom environment of one of these troughs. Two perpendicular seismic lines, one trough-parallel and one trough-perpendicular, along with the accompanying multi-beam data in Glacial Trough #10, offshore of the eastern edge of the Getz Ice Shelf, revealed characteristics unlike those found in the Ross Sea and offshore of the Antarctic Peninsula. Multi-beam data reveal rugged, irregular bathymetry in the trough. Seismic data show that the relief is controlled by bedrock with a sediment veneer of varying thickness. Greatest amounts of sediment accumulation are found in small basins between bedrock highs and at greater distances from the Getz Ice Shelf front. The least cover is over bedrock highs. The geometry of the sediment cover suggests that the Getz Ice Shelf grounding line retreated through this position recently.

GLACIATION AND MEGAFLOODS IN PLEISTOCENE EURASIA

GROSSWALD, Mikhail; Institute of Geography, Russian Academy of Sciences, Moscow, visiting Libra Professor, Institute for Quaternary Studies, University of Maine.

During the last (Late Weichselian) ice age and probably the other Pleistocene ice ages, ice sheets covered both the entire Arctic margin of Eurasia and, turning in a thick floating ice shelf, the deep Arctic Ocean. A wealth of geologic evidence as well as climate-based glaciological models support this reconstruction. The Polar ice sheets controlled the Eurasian continental paleohydrology. They impounded the north-flowing rivers, giving rise to a multitude of meltwater lakes and runoff deflections. In addition, as we came to know lately, the ice sheets generated high-power cataclysmic megafloods.

Until recently, footprints of megafloods were known only in glaciated mountains. But in late 1990s an analysis of high-resolution imagery resulted in discovery of evidence for the megafloods which were not related to mountain glaciers (V.Baker, University of Arizona). This was found in Eurasia, within the Caspian-to-Black Sea (Manych) spillway. In the wake of the discovery, this author located and traced continuous zones of parallel ridge-and-furrow landforms (straight-line channels, bars, "grivas", Baer's mounds, etc.) from the High Arctic in south- and southwest directions for thousands of kilometers to the Black Sea and European proglacial. Geomorphic complexes produced by recent (late-glacial and Holocene) cataclysmic outburst floods were recognized in these landforms. Hydraulics of the floods were tentatively quantified and found to have been commensurate with those of billion-year-old Martian megafloods.

After evaluating several alternative explanations and eliminating the impossible, the hypothesis "survived" that the source of the Eurasian megafloods could only be in the deep Arctic Ocean, which turned, as a result of ice-plugging the Fram Strait, into an ice-dammed subglacial lake. Mechanism of the outbursts themselves was akin to binge/purge oscillations of MacAyeal. The timing of the latest megafloods seemed to keep pace with the Caribbean "reef chronostratigraphy" of Blanchon and Shaw: they occurred at about 12, 10 and 7 kyr B.P., i.e., at onsets of the warm Bølling, Preboreal and Atlantic intervals.

The megafloods were clear effects of a Polar glaciation, they would've never occurred unless continuous ice sheets had formed in the Arctic. On the other hand, quite probably that the megafloods swept away the sedimentary sequences left over by Polar ice sheets on the Eurasian coasts. This may explain the scarcity of glacial record on those coasts which keeps puzzling glacial geologists. I suggest that the new minimalistic paleoglacial reconstructions based on this scarcity are erroneous. The "second-order glacial geology" of Kola Peninsula and the White Sea conclusively confirms this suggestion.

IMPROVING THE CHRONOLOGY OF LACUSTRINE RECORDS, DRY VALLEYS, ANTARCTICA: WORK IN PROGRESS

HALL, Brenda L., Department of Geological Sciences and Institute for Quaternary Studies, University of Maine, Orono, ME 04469 and Department of Geology and Geophysics, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, ball@USGS.GOV

The Dry Valleys of Antarctica contain records of past lake-level changes on 1,000-100,000-year timescales that afford valuable paleoclimate information for the past 0.5 m.y. One problem with interpreting and using the data is that some of the records lack reliable chronologies. Although the radiocarbon method can be used successfully to date algal mats within near-surface features, such as deltas and shorelines, lake-bottom sediments cannot be dated easily because of possible radiocarbon reservoir effects. Moreover, radiocarbon dating is limited to the last 40,000 years, too short of a timespan for many lacustrine sediments present. To address both the radiocarbon reservoir effect and the time limitation of the radiocarbon method, I have begun to experiment with thermal ionization mass spectrometry (TIMS) uranium-thorium dating of Dry Valleys lacustrine carbonates. By comparing $^{234}\text{U}/^{230}\text{Th}$ and ^{14}C ages of the same samples, I determined that the former lake-bottom reservoir effect at Lake Vida, a closed-basin lake now located four kilometers from the nearest glacier, was ~3500 years at ~9500 calendar years ago. This offset is likely due to the lack of aeration in the lake because of perennial ice cover and density stratification. I also determined an offset of ~20,000 years for a sample located at the former Ross Sea ice grounding line in Miers Valley. This large offset suggests that glacial meltwater containing old CO_2 had not yet been diluted by the lake water. These results show that the lake-bottom radiocarbon reservoir effect is variable and can be significant. This has

important implications for future work involving the study of lacustrine sediment cores in the Dry Valleys.

OXYGEN ISOTOPE AND TIME SERIES ANALYSES OF MARINE BIVALVES FROM THE COAST OF PERU: APPLICATIONS FOR THE GEOARCHAEOLOGY OF EL NIÑO

HOUK, Stephen, Institute for Quaternary Studies, University of Maine, Orono, Maine 04469.

Stephen.Houk@umit.maine.edu

Geoarchaeological data from Peru suggest that the El Niño/Southern Oscillation (ENSO) phenomenon did not occur prior to the time period 7000-5000 B.P. Peruvian archaeological sites older than 5000 B.P. and located on the coast north of 10° S latitude contain faunal assemblages of tropical species. In contrast, sites south of 10° S latitude or younger than 5000 B.P. consistently contain assemblages of temperate species. These data indicate tropical conditions in northern Peru during the early and middle Holocene. However, the oxygen isotope contents of bivalves recovered from the Peruvian archaeological sites of Siches (8000 to 3500 B.P.) and Ostra Base Camp (6250 to 5450 B.P.) were interpreted by Nicholas using temperature equations derived from Japanese mollusks. This interpretation suggests that temperatures at 5000 B.P. were 3-4°C cooler than those of today. If correct, this interpretation implies that the Humboldt Current would have been stronger at 5000 B.P. than it is today.

In 1984, researchers from the University of Maine and the University of Pittsburgh collected and later analyzed Peruvian specimens of *Chione subrugosa*, *Trachycardium procerum*, and *Anadara tuberculosa* in order to understand environmental changes associated with the 1982-83 ENSO. More specimens were collected and analyzed in 1995 in order to examine the normal shell chemistry and growth during non-ENSO years. Oxygen isotope data from these modern collections have not been correlated with time. Rather, they have been correlated with distances from the ventral margins of the shells.

By conducting a time-series analysis of daily and semi-daily growth increments, the oxygen isotope curve and temperature increment of the 1982-83 ENSO can be calibrated with modern sea-surface temperature data to provide calibrations specific to species that occur in Peruvian middens. Nicholas' growth increments and oxygen isotope curves on *Protothaca ecuatoriana* from the Siches and Ostra Base Camp middens can then be correlated with paleotemperature data using the new calibration. Growth increment analysis provides daily, seasonal, and annual resolution. Thus, temperature oscillations associated with ENSO should be evident in the shells and easily distinguished from seasonal variation.

BYRD GLACIER AS A ROCK-FLOORED ICE STREAM ENDING AS A CALVING ICE SHELF.

HUGHES, Terence J., Department of Geological Sciences and Institute for Quaternary Studies, University of Maine. debbies@maine.edu

Cruise 00-01 of RVIB Nathaniel B. Palmer to the Amundsen Sea in February and March of 2000 mapped the calving fronts of the Ross, Getz, and Dotson ice shelves, cored sediments from the Antarctic continental Shelf of the Amundsen Sea, mapped the bed topography, and conducted seismic profiling. These studies preceded major calving events from the Ross Ice Shelf and identified five major troughs in the Amundsen Sea that were formerly occupied by rock-floored ice streams in which glacial marine sediments of variable thickness formed a thin blanket over rugged bedrock topography. A present-day analog to these conditions appears to be Byrd Glacier, which is grounded on rugged bedrock as it passes through the Transantarctic Mountains, and which continues as a major flowband of the Ross Ice Shelf that ends where the next large calving event is likely to occur. A major problem to be solved is whether large transverse crevasses that form where Byrd Glacier becomes afloat are carried passively to the calving front, and then reactivated to release giant icebergs. In the worst-case scenario, a single giant iceberg could drift across and block McMurdo Sound, thereby requiring a "Berlin Airlift" to supply McMurdo Station or shut it down--and thereby shut down all but the US Antarctic research out of Palmer Station on the Antarctic Peninsula. Key to answering this question is determining whether Byrd Glacier is grounded on a frozen bed, a thawed bed of wet bedrock, a wet bed that drowns much bedrock, or a combination of these. Models that give each scenario are presented, and the assumptions leading to these scenarios are discussed. A research plan to make the correct determination is outlined.

MAPPING OF ANTARCTIC ICE FRONTS

JOHNSON, Jesse, Dept. Computer Science, University of Maine, jessej@cedar.umeqs.maine.edu

Cruise 00-01 of the Nathaniel B. Palmer took place in February and March of 2000. The ship traveled along the Ross, Getz, and Dotson ice shelves. During the journey along these ice shelves, accurate data was collected from the ship's radar. The data from the radar were transformed into the position of the ice shelf by a computer program which accessed the ship's GPS data base. A newly determined set of ice shelf positions was then plotted against older sets of mapping data. By having several sets of older data, as is the case for the Ross Ice Shelf, the shelf's longitudinal advance rate was obtained. The calving of the very large iceberg, B15, makes such data especially interesting. The Ross ice shelf positions represent the maximum extent of the Ross ice shelf in recent time, and the advance rate may hold clues about the nature of such large calving events.

DIATOMS IN THE SOUTH POLE WATER WELL - A PROPOSAL

KELLOGG, Davida, Institute for Quaternary Studies, University of Maine,
tomk@iceage.umeqs.maine.edu

The SPWW is a 24-m diameter by 15-m deep melt pool from which Amundsen-Scott Station has drawn its drinking water since 1995. The compressed snow/polar ice preserves a record of wind transported marine and non-marine diatoms and terrestrial nonbiogenic particulates, as well as the largest concentration of micrometeorites yet discovered. The sediment in this pool is a concentrated lag deposit of atmospheric particles that were incorporated into essentially horizontal ice layers, and were liberated as the ice melted downward. Age-depth relationships of these ice strata were established by Kuivinen et al. (1982) from ice core stratigraphy. The SPWW Project is capable of recovering concentrated diatom samples spanning a 1100 time period with a resolution of 10-100 years. This is a 10-100-fold increase in sampling resolution over what has so far been possible for diatoms in ice cores.

The discovery of marine and non-marine diatoms in sediments melting out of the ice in the SPWW suggests a solution to the hitherto intractable problem of low diatom concentrations in antarctic ice cores and consequent time-averaging of samples. The SPWW sediments will provide a diatom record intermediate between those in snow pits (in which very fine resolution is possible over a total time period of 5-10 years), and the longest ice cores (in which 100,000 years may be covered, but sampling resolution is too coarse to reveal rapid fluctuations). The down-well sequence of occurrences and non-occurrences of marine and non-marine diatoms in SPWW samples should reveal whether the rapid shifts in wind regime represented in Siple Dome pit D are also represented at the Pole, which is higher and more isolated from coastal sources of diatoms; approximately when such shifts occurred at this central site on the Antarctic Ice Sheet; and how wind patterns have varied at this site.

FORMER ROCK-FLOORED ICE STREAMS ON THE AMUNDSEN SEA CONTINENTAL SHELF

KELLOGG, Thomas B., Department of Geological Sciences and Institute for Quaternary Studies, University of Maine, tomk@iceage.umeqs.maine.edu

Fifteen linear or curved troughs occur on the Amundsen Sea continental shelf. Depths are usually greatest (900-1500 m) at their southernmost ends near the calving fronts of ice shelves, or off glaciers. Depths decrease and the walls become less steep as the troughs broaden into shallow depressions on the outer continental shelf. In several cases two or more troughs merge in the mid-shelf region in tributary fashion to form compound-troughs. Two of these compound troughs attain depths greater than those near the southern ends of the individual tributaries. The troughs are not flat-bottomed but display trough-parallel elongated or irregular shaped topographic highs that rise as much as 500 m above trough floors on either side. Some of these topographic highs have steep slopes on their stoss sides and gentler slopes on their lee sides; others show the opposite pattern. Seismic profiles show that these topographic highs are bedrock with little or no sediment cover.

Because the Amundsen Sea troughs emerge from beneath ice shelves or are directly downstream from known glaciers, they presumably record the former positions of grounded ice streams. The massive Pine Island and Thwaites troughs and the large number of deep, lightly sedimented troughs fronting the Getz and Dotson ice shelves, indicate that intense glacial activity characterized the entire Amundsen Sea sector during former glaciations, with grounded ice extending to the shelf break. There were more ice streams discharging into the Southern Ocean in this sector than in either the Ross or

Weddell sea embayments. Unlike the sediment covered glacial troughs in the Ross and Weddell seas, the Amundsen Sea troughs have irregular bedrock floors. This suggests that the presence of a fluidized sediment bed is not a necessary precondition for rapid ice stream flow.

DOES MASSIVE BURIED ICE IN BEACON VALLEY, ANTARCTICA, HAVE PALEOCLIMATIC SIGNIFICANCE?

LEWIS, Adam R., Institute for Quaternary Studies, University of Maine, Orono, ME, 04469,
Adam_Lewis@apollo.umenfa.maine.edu

The central portion of Beacon Valley, Antarctica, contains massive ground ice beneath 10 to 100 cm of diamicton and volcanic ash deposits up to 8.1 million years old. Two hypotheses have been put forth to explain the existence of the ice in one of the coldest and driest places on Earth. One hypothesis explains the ice as a lens segregating from active sand wedges in the overlying soil. This explanation implies the continuous formation of relatively young ice beneath soil that may be much older. The ice would therefore have little paleoclimatic significance.

The second hypothesis explains the ice as a remnant of an East Antarctic outlet glacier preserved beneath ablation till. This requires the ice to be the same age or older than the covering deposits. The existence of ice 8.1 million years old would argue strongly for Antarctic ice-sheet and climate stability since the formation of the Antarctic Circumpolar Current in the early Miocene. The stability of Antarctic climate within an ACC dominated regime has ramifications for the studies of ocean and atmospheric circulation, and global sea level.

To test these hypotheses I conducted a sedimentological study comparing the ice-cemented wedge and covering deposits to the sediment contained within the ice. Results indicate that the sediment from the buried ice is inconsistent with a contraction crack origin. The ice contains almost no subaerially weathered, aeolian material, whereas the ice-cemented wedges are composed entirely of weathered, aeolian sand and gravel. The buried ice also contains large, glacially modified boulders that could not have been introduced to the ice through contraction cracks. Furthermore, the ice was derived from a source outside of Beacon Valley. About 5% of the boulders in the ice and covering till are granite. Granite bedrock does not crop out in Beacon Valley. Ash deposits provide the minimum age of the buried ice. Two sand wedges penetrating the ice contain vertical interbeds of ice-cemented volcanic ash. The ash provides the minimum age of the wedge and the surrounding ice.

LANDSCAPE EVOLUTION AND POLYGON DEVELOPMENT ON A DEBRIS-COVERED GLACIER SURFACE, BEACON VALLEY, ANTARCTICA.

LORREY, Andrew M., Department of Geological Sciences, University of Maine,
drew@iceage.umeqs.maine.edu

Beacon Valley in the Dry Valleys region of Antarctica may hold stratigraphic clues to the stability of the East Antarctic Ice Sheet (EAIS) during the Cenozoic. Debris-covered glaciers and the large polygon array are prominent features in Beacon Valley. $^{40}\text{Ar}/^{39}\text{Ar}$ ages of ashes in Beacon Valley are of Miocene age, which implies that the buried ice is quite old. Can ice exist for such a long time in a polar desert environment? Can a landscape covered with patterned ground be considered stable? Surveys and excavations of many polygons in Beacon Valley yielded information pertinent to both patterned ground formation and landscape stability of this region. Mapping the physical characteristics of these polygons allows morphological comparison of these features along the long axis of the debris-covered glacier. Some down-glacier trends observed included increases in polygon size, polygon relief, steepness of polygon trenches, width of polygon trenches, and thickness of sedimentary cover. The preservation of delicate stratigraphic and sedimentologic features, such as aeolian bedding, intact volcanic ash wedges, textural immaturities of ash grains as well as buried desert pavements suggest that this particular area of patterned ground may not have been formed by typical cryoturbative processes. The process by which these polygons form may actually be the preservation mechanism for the buried glacial ice in Beacon Valley. The buried Miocene ice in this valley, as well as the stratigraphy contained in this particular polygon complex would have likely been destroyed in a temperate glacial climate. This evidence contradicts the hypothesis of a meltdown of the EAIS during the Pliocene, and supports a stable polar climate in the Dry Valleys region since Miocene time.

TECHNOLOGICAL CONTINUITY AND VARIABILITY AMONG PALEOINDIAN ASSEMBLAGES IN THE NORTHEAST

MOORE, Edward. Institute for Quaternary Studies, University of Maine.
edward.moore@umit,maine.edu

Lithic Analyses of two Paleoindian assemblages addresses technological and morphological relationships with respect to similarities and differences in the mode of tool production. The assemblages were excavated from two sites, Janet Cormier and Nicolas, located in southern Maine within the Little Androscoggin River drainage. The sites are attributed to the general Paleoindian period (ca.11,000-9,000 ¹⁴C BP) based on the presence of diagnostic projectile points. Points from the Janet Cormier assemblage show forms which are fluted and unfluted. Nicolas site points are unfluted and resemble forms described as Holcombe-like, a possible derivative of the Fluted Point Tradition (11,000-10,000 ¹⁴C BP). Analysis of lithic materials indicates strong similarities between the kinds of materials employed in tool production and the presence of biface and uniface industries. The dominant lithic materials include cryptocrystalline and microcrystalline varieties most likely derived from sources in the Munsungun region of north-central Maine and the Mt. Jasper Formation in Berlin, N.H. Manufacturing strategies used to produce the tool industries can be characterized predominately as a flake technology. This technology involved the production of flakes from a parent mass of material which were subsequently formed into tools. Morphological evidence from the tools suggest the parent mass of material most likely occurred in the form of biface cores and tabular cores. The latter core emphasizes the removal of flakes from a ridged core face and primarily utilized for the production of unifaces.

MULTIPLE-CORE, LAKE LEVEL STUDIES ENHANCE UNDERSTANDING OF ACADIA REGION PALEOHYDROLOGY

NURSE, Andrea and **DIEFFENBACHER-KRALL, Ann**, Institute for Quaternary Studies, Environmental Sciences Laboratory, University of Maine, Orono, Maine,
abnurse@tdstelme.net, Ann_Dieffenbacher@umenfa.maine.edu

Because the Acadia region is located at the confluence of Arctic, Pacific, and maritime air masses, it is an ideal location to study changes in Holocene atmospheric circulation patterns. Lake level fluctuations in small, closed-basin ponds reflect changes in regional paleohydrology and paleoclimatology. Although a number of studies provide paleohydrology data from sites through out Maine, Quebec, and the maritime provinces, differences in site morphology and research technique compromise comparative data. Recent lake level studies at Mansell Pond, a small, closed-basin pond in Alton, Maine, employed multiple-core research methodology developed by Digerfeldt and refined by Almquist-Jacobson. The study analyzed lake sediment cores, taken on transect from shallow littoral to deep basin zones, for changes in sediment texture, organic content, and macrofossil content. Multiple radiocarbon dates correlated changes in sediment patterns across the lake basin over the past 8000 years. Lake level fell at Mansell Pond between 8000 BP and 6000 BP, and remained low until 5000 BP. Since 5000 BP, lake level has risen continuously to the present level. Regional significance of lake level change can not be determined without correlated data from a number of radiocarbon-dated, multiple-core studies from closed-basin lakes located throughout Acadia. Mathews Pond is a closed-basin pond in the St. John foothills biophysical region of Maine. The lake level survey of Mathews Pond combines multiple-core sedimentology and macrofossil content with pollen and charcoal analysis. Objectives of the Mathews Pond study include 1) assessment of sedimentation patterns across the basin; 2) comparison of Holocene hydrologic changes with paleohydrology at Mansell Pond; 3) correlation of climate conditions with fire regime and vegetation change on a broad landscape scale.

TEACHER ACADEMY ON CLIMATE CHANGE

REUSCH, Douglas N., Dept. Geological Sciences, University of Maine, doug@iceage.umeq.s.maine.edu, **MAASCH, Kirk A.**, Dept. Geological Sciences, University of Maine, **NORTON, Stephen A.**, Dept. Geological Sciences, University of Maine, **REEVE, Andrew S.**, Dept. Geological Sciences, University of Maine, **SCHAUFFLER, Molly**, Dept. Geological Sciences, University of Maine, **WELLER, Herman**, College of Education, University of Maine and **KEELEY, Page**, Maine Mathematics and Science Alliance, Augusta

The National Research Council's seminal publication National Science Education Standards strongly emphasizes student inquiry to develop understanding of the earth system. In response to a request by the Maine Mathematics and Science Alliance for teacher professional development in earth system science, we submitted a proposal "Maine and the Global Climate System", which has been funded for 2000-1. During a two-week summer session (July 17-28) based at the Bryand Global Sciences Center, teachers and project staff will collaborate to develop plans and produce materials needed to educate their students about this topic. During the school year, several follow-up meetings will take place to promote successful implementation of these plans. The project staff brings together expertise both on diverse scientific matters and educational issues such as curriculum development, instructional practice, assessment, and cognitive research.

We will frame the academy around five scientifically-rich questions pertinent to the societally relevant issue of climate change in the immediate future. What is the present-day average annual temperature of Earth's atmosphere? What are the variables that determine this temperature? What was Earth's temperature in the past? What processes may have caused past climate changes? Based on knowledge of present and past climate, what predictions, including uncertainties, can be made about future climate? Participants will conduct an array of field investigations coupled with laboratory and computer activities. Their research will include the collection and analysis of environmental samples that supply surrogate data for short- and medium-term climate change. Throughout, we will consider interactions between climate and other components of the earth system.

ACTIVITY PATTERNING OR CULTURAL TRADITION: ASSEMBLAGE VARIATION IN THE BERINGIAN TRADITION OF ALASKA

ROBINSON, Brian S. Institute for Quaternary Studies, University of Maine. brianr@maine.edu

The earliest artifact assemblages from Alaska are characterized by contrasting frequencies of artifacts and, apparently, two distinct technologies for the production of projectile points, including bifaces and microblade insets. These two technologies have been lumped together as specialized activities of the same cultural tradition by some archaeologists, and separated into distinct cultural traditions representing separate Asian migrations by others. The two contrasting interpretations also represent different possible origins for Clovis Culture. Assemblage variability and landform associations in the Tangle Lakes region of Alaska suggest that adaptation to Arctic conditions may have alternated between extremely efficient lithic technologies in winter, and more wasteful but rapidly produced technologies in summer, creating contrasts in both artifact form and raw material on a seasonal basis. This dual technological system may have its origins in Asia prior to 12,000 B.P.

EXCAVATION OF A PALEO-INDIAN AGE DOMESTIC STRUCTURE IN PERU

SANDWEISS, Daniel, Department of Anthropology and Institute for Quaternary Studies, University of Maine, daniels@maine.edu, **TANNER, Benjamin**, Institute for Quaternary Studies, University of Maine, brtanner@hotmail.com, **SANGER, David**, Department of Anthropology and Institute for Quaternary Studies, University of Maine, sanger@maine.edu, **ANDRUS, Fred**, Geology Department, University of Georgia, and **PIPERNO, Dolores**, Smithsonian Tropical Research Institute.

New excavations of the Terminal Pleistocene component (ca. 10,000-11,000 ¹⁴C yrs BP) at Quebrada Jaguay, southern Peru, uncovered dozens of postholes from multiple versions of a single structure, apparently rectangular. Quebrada Jaguay is a maritime-oriented site, probably occupied seasonally. Hearths, midden, artifacts, and a possible storage unit suggest that the structure was domestic. Wrapped seabirds placed in postholes shed light on early ritual activities. The final version of the structure was cemented, probably deliberately. Subsequent inhabitants were unable to cut this cement, and the occupation focus shifted to other sectors of the site.

LATE QUATERNARY PRODUCTIVITY CHANGES ON THE TASMAN PLATEAU

SCHNITKER, Detmar, School of Marine Sciences, University of Maine, detmars@maine.edu

The accumulation rates of benthic foraminifers in two piston cores from the Tasman Plateau at 48° 08' S and 48° 33' S increased five- to eight-fold during glacial intervals of the past 500,000 years, indicating drastic increases of biological productivity of the overlying waters. During interglacial periods the benthic faunas are composed mainly of infaunal species that indicate relatively low and constant influx of organic matter. During glacial periods, the benthic foraminiferal faunas are characterized by drastic increases of the so-called phytodetritus feeding species *Alabaminella weddellensis* and *Epistominella exigua*. The sharp foraminiferal abundance increases indicate a northward displacement of the high-productivity region of the Polar Frontal Zone during glacial intervals. The preponderance of phytodetritus feeders documents that the high primary productivity was strongly pulsed, probably in the form of spring blooms that overwhelmed the grazing capacity of planktonic heterotroph consumers.

LITHIC ANALYSIS AT QUEBRADA JAGUAY: RESEARCH SCOPE AND PRELIMINARY RESULTS

TANNER, Benjamin, Institute for Quaternary Studies, University of Maine.
brtanner@hotmail.com

Quebrada Jaguay, a late Pleistocene site in Southern Peru, is recognized as one of the few sites in the Americas that features evidence of a Paleoindian maritime adaptation. Stone tools and the debris from their manufacture are the only class of manufactured items recovered at the site, and I am carrying out a technological analysis of this lithic material. A technological analysis focuses on how tools (in this case stone tools) were made. Preliminary results from a pilot examination of a single 1x1 m unit indicate that there is some change in lithic technology through time. A planned survey of a cobble field near the site should shed some light on quarrying activities. After completion of this study, we will know more about the lithic technology of early maritime sites in Peru, as well as how Quebrada Jaguay fits into Paleoindian settlement patterns.

TEACHING ARCHAEOLOGY IN THE PUBLIC SCHOOL SYSTEM

WILL, Richard, Institute for Quaternary Studies, University of Maine, and Archaeological Resesearch Consultants, Inc. willarc@ACADIA.NET

Much of the literature on Maine archaeology and prehistory is inaccessible to the general public and, in particular, children in grades K-12. Archaeologists are successful in communicating among themselves; occasionally speaking in public forums, such as historical society meetings or annual meetings sponsored by the Maine Archaeological Society; and even more rarely talking in school classrooms at the invitation of teachers who hear about a "dig" going on in their area. This observation is particularly surprising since much of the archaeological work conducted in Maine during the last decade has been funded by cultural resource management concerns, which, at least for projects with federal review require a public education component. In an attempt to share more of what archaeologists do as scientists and what they have learned about Maine prehistory, 130 Maine social studies and science teachers were surveyed. The results showed that most of them would teach archaeology in the classroom if relevant materials were available. Several workshops with teachers were held and ultimately an archaeology kit was developed that is now used in 40 schools. The success of the effort depended on the production of curriculum materials that were rigorously reviewed by the people who were mostly likely to use them and the manufacture of high quality artifact casts to provide a hands-on learning experience for students. Most importantly, the effort required integrating what archaeologists do using the Maine Department of Education's Learning Standards and obtaining adequate funding to see the project through completion. The latter was accomplished with a grant from the Central Maine Power Committee on Gift Giving. In an era of utility deregulation and where competition for new markets is a business goal, obtaining grants from utility companies in the range of \$10,000-\$20,000 for educational projects in Maine is not unrealistic.