The sensitivity of the fluvial systems demonstrated here indicates fluvial activity was closely linked to deglaciation, and that few lags between events existed. The formation of an extensive single channel at 10.6-9.9, rather than a series of channel/fan-delta/glaciolacustrine complexes indicates deglacial style took the form of rapid breakup of an extensive thin, dead-ice cover, rather than slow retreat of an active ice front.
This supports the contention that features previously identified as hummocky moraines through the study area and to the south, thought to indicate recessional positions, were misidentified. Also, this implies the subglacial topography, formed by large subglacial floods, is largely pristine.

SESSION 231, 01:30 PM

Thursday, November 16, 2000

T54. Big Storms of the Past: Evidence and Importance of Paleostorms in the Geologic Record (GSA Quaternary Geology and Geomorphology Division)

Reno/Sparks B8&9

1:30 PM Jennings, Karen L. 53018

TIMING OF STORM-INDUCED DEPOSITONAL EVENTS ON VERMONT ALLUVIAL FANS
JENNINGS, Karen L., and BIERMAN, Paul R., Department of Geology, University of Vermont, Burlington, VT 05405, kjenning@zoo.uvm.edu
This field-based study of five alluvial fans in Vermont uses multiple backhoe trenches and radiocarbon dating of wood and charcoal to determine the depositional history of each alluvial fan. The fans range in volume from 1,300 to 20,000 m3, and in age from 250 to 13,000 calibrated 14C years before present. All five fans have experienced episodic deposition, followed by periods of little or no fan aggradation as evidenced by soil development and the ages of preserved organic material. Aggradation on these fans is caused by an increase in hillslope runoff, which may be the result of increased local storm magnitude, frequency, or duration.

The youngest fan, located in Maidstone, Vermont, represents the aggradation of 4,770 m3 of fine sand and silt within a time frame of 150 to 200 years. The Bridgewater alluvial fan shows the majority of aggradation occurring between 3000 to 6000 years BP. An alluvial fan at Bristol, shows rapid aggradation events at 9,300 years BP and 4,000 years BP, with a smaller event at 3,200 years BP. These three depositional events are separated by times of little deposition with minor A-horizon soil development. In Eden Mills, Vermont, the alluvial fan shows rapid deposition early in its history, from 13,300 to 12,900 years BP, followed by moderate deposition until 9,500 years BP. Evidence of channel incision followed by rapid filling dates to 6,000 years BP. Small amounts of deposition on the fan ensued until historic clear-cutting of the adjacent hillslope triggered approximately 3000 m3 of material to be deposited on the fan surface, causing close to a meter of vertical aggradation during the past 100 years. A fifth alluvial fan in Hancock, was difficult to date well because preserved organic material was extremely decomposed. However, the Hancock fan also shows a characteristic sequence of rapid aggradation episodes interrupted by periods of fan quiescence as evidenced by large gravel units which overlie buried A and B soil horizons.

1:45 PM Ely, Lisa L.

HOLOCENE FLOOD ACTIVITY IN DIFFERENT CLIMATIC REGIONS OF THE WESTERN U.S.
ELY, Lisa L., Dept. of Geological Sciences, Central Washington University, Ellensburg, WA 98926, ely@cwu.edu; HOUSE, P. Kyle, Nevada Bureau of Mines and Geology, University of Nevada, Reno, NV 98557
A synthesis of numerous paleoflood records has allowed comparisons of the magnitude, frequency and geomorphic implications of floods in different hydroclimatic regions of the western U.S. during the Holocene. Preliminary results from ongoing paleoflood investigations in the Great Basin, northwestern and southwestern U.S. indicate that the occurrence of Holocene flood events at timescales of 100's to 1000's of years differs among these regions. A connection between paleofloods and climatic variations has been shown in the Southwest during the late Holocene, with the frequency of large floods increasing during periods of cooler, wetter climatic conditions. In the interior Northwest, although individual rivers show distinct changes in the frequency of large floods, a regionally synchronous response to Holocene climatic changes is not apparent. In the Columbia River Basin the periods of increased and decreased flood frequency appear to be the opposite of those in the Southwest, mirroring the modern interannual pattern of winter precipitation in the two regions. In other subregions of the Northwest the paleofloods are either randomly distributed through time or show some similarities with the timing of the southwestern floods. Continued study of multiple rivers within the different subregions will refine these initial patterns.

Flood deposits from the early to mid-Holocene are more common in the Northwest and northern Great Basin regions than in the Southwest, where most paleoflood records cover only the mid- to late Holocene. Most of the deposits in the northern two regions are benches of vertically accreting overbank deposits along the channel margins. Different channel or flood dynamics in the northern rivers has resulted in less frequent erosional removal of flood deposits from this type of geomorphic setting. These older sites are particularly useful in flood-frequency analyses by providing maximum flood-stage thresholds that have not been exceeded over long time periods, but are less likely to preserve complete flood chronologies up to the present. In these cases, multiple sites or inset stratigraphic sections are necessary to reconstruct the frequency of floods over comparable time periods in the different regions.

2:05 PM Knox, James C.

HOLOCENE STRATIGRAPHIC RECORD OF LARGE FLOODS ON THE UPPER MISSISSIPPI RIVER, NORTHWESTERN ILLINOIS AND WESTERN WISCONSIN
KNOX, James C., 234 Science Hall, Geography Dept., University of Wisconsin, Madison, 550 North Park Street, Madison, WI 53706-1491. knox@geography.wisc.edu
Vertical sedimentological variations in floodplain alluvium of the Upper Mississippi River indicate that Holocene climate changes have strongly influenced the recurrence frequencies of large floods during the last several thousand years. The Holocene alluvial record of the UMR is relatively continuous at many sites because the UMR has been aggrading nearly continuously during the Holocene in the reach along extreme northwestern Illinois and western Wisconsin. The locational positions of modern thalweg and major secondary channels appear to have been relatively stable at many of the river reaches during the Holocene. The stability is attributed in large part to a stepped-sequence of cut-terraces (Bagley terrace complex) created by a major down-cutting episode during drainage of proglacial lakes following termination of the last glacial advance into the valley headwaters.

Holocene alluviation is sequentially burying these terrace surfaces causing the depth of Holocene alluvium to commonly range from 15-20 m or more at or near thalweg locations to 0 m beginning at the margins of intermediate and higher surfaces of the stepped cut-terrace sequence. Greatest depths of Holocene alluviation occur at mouths of major tributaries where large Holocene alluvial fans produce convexity in the longitudinal profile of the UMR, but the complexity of sedimentation on fan surfaces makes paleohydrologic interpretations more difficult there than elsewhere. Preliminary results indicate that late Holocene large floods have recurred in multi-century episodes centered upon about 300, 1200, 2200, 3300, and 3700 calendar years ago. The alluvial sedimentology indicates similar multi-century episodes occurred during the middle and early Holocene, but precise ages have not yet been determined. Comparison of fossil proxy climate indices with the alluvial stratigraphy indicates that relatively modest climate changes were responsible for the adjustments in recurrence frequencies of large floods.

2:20 PM Noren, Anders J.

A 13,000-YEAR REGIONAL RECORD OF HOLOCENE STORMS FROM TERRIGENOUS LAKE SEDIMENT, NORTHEASTERN USA
NOREN, Anders J. and BIERMAN, Paul R., Department of Geology, University of Vermont, Burlington, VT 05405, anoren@zoo.uvm.edu.
Lakes in the hilly terrain of the northeastern United States preserve sedimentary archives that reveal the spatial and temporal patterns of major Holocene storm events. We retrieved eighteen 3.5- to 6-meter sediment cores from eleven small (0.03 to 4 sq. km), deep (13 to 32 m) Vermont and New York lakes with steep drainage basins across a ~20,000-sq.-km region. Visual logging, magnetic susceptibility, X-radiography, and loss-on-ignition analysis document core stratigraphic variability; multiple radiocarbon dates provide age control.

In each core, several layers of coarse-grained, mineral-rich sediment with abundant macrofossils of terrestrial plants punctuate the otherwise fine-grained, organic-rich gyttja matrix. The character of these coarse layers leads us to believe that they originated as terrestrial sediment eroded from the uplands during severe storm events. If this hypothesis is valid, the ages of these terrigenous layers correspond to the approximate dates of large storms that passed over the lakes' drainage basins.

Few (<~20%) of these terrigenous layers were deposited synchronously in neighboring study lakes across this region during the Holocene, and at only one time (~1200 BP) were these layers deposited synchronously in more than half of the study lakes. The disparate ages of terrigenous layer deposition in separate lakes suggests that most storms of great intensity or duration affected localized areas. The most severe Holocene storms in this region probably were not hurricanes or other physically large storms, but rather small, high-intensity storm cells that were capable of producing devastating effects.

2:40 PM Ford, Kathryn H.

PRELIMINARY EXAMINATION OF THE IMPACT OF HURRICANES IN A COASTAL LAGOON
FORD, Kathryn H., Graduate School of Oceanography, Univ. of Rhode Island, South Ferry Rd., Narragansett, RI 02882, khford@gso.uri.edu; KING, John W. and QUINN, James G., Graduate School of Oceanography, Univ. of Rhode Island, South Ferry Rd., Narragansett, RI 02882.
There are several challenges associated with measuring the impact of storms in the coastal environment. The fairly infrequent events leave a record of their impact in only a few areas and generally in environments where records can be easily confused with other effects, such as migrating deltas. Biological mixing in these shallow marine environments makes dating difficult. However, the hypoxic bottom waters in the deep basins of a handful of coastal lagoons in southern Rhode Island have the potential to yield well-preserved records. As part of a project measuring the baseline conditions within one of these lagoons, 7 sediment cores were examined for indications of past storm activity. Storm layers were identified using grain size, magnetic susceptibility, and organic carbon measurements.
Geochemical proxies with known introduction dates were used to date the cores (e.g. polychlorinated biphenyls (PCBs) introduced in 1929 and dichloro diphenyl trichlorethane (DDT) introduced in 1939). In addition, the Ambrosia (ragweed) pollen rise is correlated with European settlement around 1700. The depth of the first appearance of these proxies in the cores was compared with the associated age.
The sedimentation rate was calculated at approximately 0.2 cm/yr. This rate was used to correlate the storm layers with historical events which are known to have produced washover deposits in the lagoons. At these sandy storm layers, a decrease in contaminant concentrations could be expected due to the larger grain size. However, an increase in the concentrations of polycyclic aromatic hydrocarbons (PAHs), PCBs, DDT, copper, lead, arsenic, and cadmium suggest that the storms are causing the change, and directly affect contaminant concentration in the sediments. Eelgrass abundance and diatom community shifts will also be examined.

2:55 PM Donnelly, Jeffrey P.

SEDIMENTARY EVIDENCE OF PREHISTORIC HURRICANE STRIKES IN SOUTHERN NEW ENGLAND
DONNELLY, Jeffrey P., Geology and Geophysics Department, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, jdonnelly@whoi.edu; ETTINGER, Robert and CLEARY, Peter, Department of Geological Sciences, Brown University, Providence, RI 02912
Historical records of North American hurricanes date back 370 years, reliable records maintained by the National Oceanic and Atmospheric Administration (NOAA) only go back to the late 19th century. In this study we develop a prehistoric record of intense hurricane strikes in the northeast United States using storm-induced deposits within coastal wetland sediments as proxies for hurricane landfalls.

Five intense hurricanes occurring in 1635, 1638, 1815, 1869, and 1938 have made landfall on the New England coast since European settlement. Historical records indicate that four of these hurricanes (1635, 1638, 1815, and 1938) and Hurricane Carol, a strong Category 2 storm in 1954, produced significant storm surges (>3m) in southern Rhode Island. Storm surges of this magnitude can overtop barrier islands removing sediments from the beach and nearshore environment depositing these sediments across the surface of salt marshes. In a regime of rising sea level, accumulation of marsh sediments on top of overwash deposits will preserve a record of overwash deposition.

In a previous study we examined the record of overwash deposition at Succotash Salt Marsh in East Matunuck, Rhode Island which yielded evidence of six hurricane strikes in the last 700 years with storm surge capable of overtopping the barrier beach. To test whether the events recorded at Succotash Marsh are also evident in other coastal wetlands in the region we examine sediments from the Barn Island Salt Marsh 30 km to the west of Succotash Marsh in this study.

Analysis of numerous vibra-cores and the excavation of an erosional scarp within the marsh revealed several sand layers to a depth of 150 cm. Two sand layers between 10 and 20 cm were likely deposited by the 1938 Hurricane and Hurricane Carol (1954). The age of additional sand layers have been determined with radiocarbon methods, pollen analysis and evidence of lead