cally extreme regions; ephemeral Yuma Wash (186 km²) in southwestern Arizona and the Chena River (5540 km²) in central Alaska. Both basins have flashy hydrologic regimes. Yuma Wash has minimal vegetation and soil development, and abundant surface runoff during rainstorms. The forested Chena basin has channel banks with an upper layer of fine sediment; is underlain by permafrost; and has steeply sloping flow duration curves indicative of relatively low baseflow and subsurface storage. We hypothesized that, relative to average river values, width would increase more rapidly downstream along both channels because of flashy discharge and erodible banks. This hypothesis was supported by the Yuma Wash data (width 0.78, depth 0.15, velocity 0.14), but not by the Chena data (w 0.41, d 0.23, v 0.38). Yuma Wash exhibits the lower downstream increase in depth and greater downstream increase in width and velocity which have been described for other arid-region rivers. The meandering Chena River apparently has sufficient bank cohesion as a result of silt-clay content, vegetation and permafrost, to have a lower rate of downstream increase in width. We interpret the relatively smaller increase in depth along the Chena to reflect a resistant cobble bed which limits scour, and extensive overbank flow during high discharges. The relatively larger increase in velocity may reflect a downstream increase in suspended-sediment concentration during high flows, and consequent dampening effect on turbulence. These results suggest that different types of hydroclimatically extreme environments may have substantially different types of downstream hydraulic geometry because of factors other than discharge variability.

BTH 49 Frankel, Kurt L.

KNICKPOINT RETREAT AND LONG PROFILE EVOLUTION THROUGH A VERTICALLY BEDDED SUBSTRATE: A FLUME STUDY

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We have designed and run a flume experiment to investigate the nature of knickpoint retreat and long profile evolution through a simulated vertically bedded reach of bedrock in an otherwise alluvial channel. The study is motivated by the presence and behavior of spectacular knickpoint propagation in Atlantic slope drainages where long term base level fall must dominate over the tectonic uplift of rocks as a dominant process driving Appalachian unroofing. The channel alluvium consists of very fine to medium sand and the material used to simulate bedrock is a block of varved glacial lacustrine sediment set into the flume such that the 1-2 mm thick alternating beds of clay and silt are vertical. Numerous calibration experiments were conducted to find the optimum combinations of discharge (~0.1 cubic meters/minute) and slope (~ 0.003) so that a stable meandering channel could be established. The simulated bedrock reach began with a thin alluvial cover atop a 30 cm wide valley bottom of a pre-existing canyon. Upon establishment of a stable meandering channel, base level was dropped 6 cm at the channel mouth, immediately generating a knickpoint that propagated upstream. The process of knickpoint migration was dominated by rotation of the knickpoint face, the result being a rapid transition from a steep waterfall-like knickpoint to a broad, convex knickzone. When the knickzone reached the simulated bedrock situated 3 m upstream of the base level fall, a plunge pool immediately formed and the knickpoint shortened and steeped. The migration process changed to a combination of parallel retreat and rotation through the simulated bedrock. The bedrock canyon was incised and attained a new valley bottom width of ~ 8.25 cm. Upstream dipping strath terraces were left in the wake of the migrating and down wearing knickpoint. As the base level fall signal was transmitted to the alluvial channel above the bedrock reach, a complex response of incision, accompanied by pulses of sediment alternately buried and excavated the bedrock reach. These results dramatically illustrated the nonlinear behavior associated with knickpoint migration and underscore the significant lag times associated with incision that may exist in natural fluvial systems, especially those in tectonically stable settings, that are in the process of adjusting to base level fall.

BTH 50 Parris, Adam

GRAIN BY GRAIN: HOLOCENE STORMS AND HILLSLOPE EROSION IN NEW ENGLAND

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To determine the history of storms and hillslope erosion in New England, we collected 23 sediment cores from small (~ 0.3- 2.2 km²) post-glacial lakes. The cores contain discreet, terrestrially derived, inorganic deposits identified by physical changes in the sediment including visual character, Loss-On-Ignition (LOI), and Magnetic Susceptibility (MS). In order to estimate the energy available for sediment transport into the lakes, we have begun measuring the grain size of inorganic sediments cm-by-cm in these cores.

We have completed grain size measurements (1000) in two continuous sediment cores, 5.6 m and 5.7 m in length, taken from Lake Morey in Fairlee, VT. One core was collected offshore; the other was collected closer to the shore near a large delta. The basal age of the delta core is 12,800 cal yr. BP coincident with the draining of glacial Lake Hitchcock that once covered the site.

At several locations in the delta core (0-25 cm, 120-140 cm, 270-310 cm) all three techniques (grain size, LOI, and MS) detected changes that we attribute to storms. At other locations down the core (150-325 cm), only grain size analysis revealed event layers. Overall, grain size analysis was the most sensitive tool for detecting event layers (32), as opposed to LOI (9) and MS (16). Grain size analysis detects all events identified by LOI and MS.

Steady background grain sizes contrast with well defined peaks and make grain size data easier to interpret than LOI. For example, mean and median grain sizes averaged over the whole delta core (16 and 18 mm, respectively) contrast with maximum mean and median grain sizes (128.5 and 137.9 mm, respectively). Graphical analysis revealed sharp platykurtic peaks with a large volume of coarse grains (~100 mm) corresponding to the well-defined peaks in mean and median grain size.

We found good correlation between the shallower core and the deeper core, but the distal fining in the deeper core made event detection more difficult. Our results suggest that grain size is a powerful tool for detecting subtle changes in lake core sediment. Recognizing these changes yields a more complete record of storms than other methods, and may reveal temporal storm patterns not previously documented.

BTH 51 Lord, Andrea

POST-GLACIAL EVOLUTION OF NORTHERN NEW ENGLAND LAKES

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Sedimentary records from northern New England lakes provide insight into the changes in surface and lacustrine processes that took place during the early Holocene. The timing and rate of aquatic and terrestrial ecosystem development can be investigated using the elemental and isotopic compositions of sedimentary organic matter. This study focuses on lakes formed in the barren, carbon and nutrient poor watersheds that resulted from deglaciation during the late Pleistocene/early Holocene.

Four to six meter long sediment cores were retrieved from six small (0.07 to 1.43 square km) post-glacial lakes in Maine, New Hampshire, and western New York. Each core displays a transition from organic-poor sands and silts to organic-rich gyttja-type sediments. The amount of organic matter present in the sediments is an indicator of the paleoproductivity within the lake. Stable carbon isotope and carbon/nitrogen (C/N) ratios were used to determine the origin of the organic matter (aquatic vs. terrestrial) in the sediments as well as track fluctuations in the types of vegetation growing in the surrounding watershed.

Negative carbon isotope shifts of up to 7 per mil were observed in the studied cores. These correspond to increases in organic matter content within the sedimentary record, and correlate with the transition from the older organic-poor sediments to the younger organic-rich sediments.

Detailed records of isotopic and elemental composition have been produced by previous studies for four post-glacial lakes in Vermont. Comparing the isotopic and elemental records of the lakes in Maine, New Hampshire, and New York with those in Vermont gives us the opportunity to investigate differences in ecosystem establishment in northern New England on both a local and a regional scale.

BTH 52 Bierman, Paul

EROSION OF THE RIO PUERCO BASIN, NEW MEXICO – FIRST COSMOGENIC ANALYSIS OF SEDIMENTS FROM THE DRAINAGE NETWORK OF A LARGE WATERSHED

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We determined that the Rio Puerco Basin is lowering about 100 m My^{-1} by measuring ^{10}Be and ^{26}Al in channel alluvium quartz from 37 sites distributed among drainage areas ranging from 170 km² to 16000 km². The combination of easily eroded lithologies, sparse vegetation, and monsoon-dominated rainfall result in rapid sediment generation and efficient sediment delivery from tributaries to the main Puerco channel.

Measured activities of ^{10}Be range from 0.5 to 24 * 10^5 atom g^{-1} and can be interpreted as rates of sediment generation that range from 2.1*10^4 kg km² y^{-1} to 1.0 *10^6 kg km² y^{-1}, the equivalent of rock erosion at 8 to 400 m My^{-1} (ρ=2600 kg m³). Basin to basin variance is high for smaller basins (<2000 km²) but dampens at larger scales. The weighted average rock erosion rate for 16 headwater basins (μ=440 km²) is 100 m My^{-1}, similar to that (103 m My^{-1}) calculated from ^{10}Be activity of sediment collected just below the confluence of the Rio Puerco's two largest sub-basins (14200 km²). Our nuclide-based denudation estimates are consistent with previously published values determined by several different methods.

Three results suggest an underlying dynamic equilibrium of upland sediment production and delivery of alluvium to the Rio Puerco over the Holocene. 1) ^{10}Be-based sediment generation rates are well correlated with bedrock lithology. 2) 20th century sediment yields for 5 USGS gages are similar to ^{10}Be-based estimates for the same drainage basins. 3) Fifteen samples from a 7 m vertical arroyo wall deposited over several thousand years, but exposed by channel incision in the late 19th century, have similar ^{10}Be activities (1.08 +/-0.10 * 10^5 atom g^{-1}) demonstrating that nuclide abundance in sediment does not change significantly over time.

This study demonstrates cosmogenic nuclides have the potential to provide rapid assessment of long-term erosion rates not only in small, homogeneous basins but over a wide range of tributary areas, lithologies, and vegetation covers.

BTH 53 Severs, Matt J.

THE HOLOCENE HISTORY OF WARWICK POND, BERMUDA

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Warwick Pond located in the southwestern part of Bermuda is the only natural freshwater pond on the island. ^{14}C dates recovered from basal sediments indicate an age of 2645 +/- 55 YBP. Six vibracores were extracted in a N-S transect from the pond in June 2001 to determine the sediment character, possible effects of rising sea levels, and to create a Holocene history of the pond. Representative samples were returned for organic carbon, grain size, grain morphology, and clay mineralogical analyses.

The basic sedimentological facies are similar in all the cores except for changes in relative thickness spatially. A basal clay greater than 90cm is overlain by a hemic (fibrous) "peat," the thickness of which varies across the transect with the thickest accumulation in the northern half of the pond. Hemic peat is overlain by alternating bands of ostracod "sand" and sapric (gelatinous) "peat." Overlying this is a unit that has been separated into poorly banded sapric "peat" intervals and well-banded sapric "peat" intervals. Modern unconsolidated sediments are found at the top. TOC values ranging from 9.6% to 51.5% indicate that most sediments are organic-rich sands instead of true peat. There are well preserved cycles consisting of a basal ostracod "sand" overlain by dark sapric "peat" bands without sand that then increase in sand content and become lighter in color upsection until the next ostracod "sand". A physical process such as a major storm event may explain this pattern by causing the resuspension of the pond sediments and concentrating the sand.

BTH 54 Enzel, Yehouda

RAINFALL DURING MODERN AND HOLOCENE DEAD SEA LAKE-LEVEL CHANGES AND WATER RESOURCES DURING LONG-TERM DROUGHTS IN THE MIDDLE EAST

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Recently constructed chronologies of Dead Sea levels over the last 3000 years will be presented. To quantify these changing levels in terms of precipitation and water resources in the basin and the severity of Middle East droughts, we construct an analogue for lake level changes in terms of 19th and 20th centuries rainfall fluctuations of Jerusalem; the longest rainfall record in the region. By that we overcome the complexity of the hydrologic system of the Dead Sea and the sparsely rainfall data synchronous with modern natural Dead Sea levels. We show that fluctuations in Jerusalem rainfall represent large areas in Israel and neighboring countries. The historic lake curve of the Dead Sea and rainfall data since 1880s are utilized to calculate the mean and standard deviation of Jerusalem rainfall during rise (648 mm/yr, sd=122 mm), fall (445 mm/yr, sd=117 mm), and stable (553 mm/yr, sd=120 mm)