11:10 AM Feely, Martin

PROTRACTED END-CALEDONIAN GRANITE MAGMATISM IN IRELAND: FIELD EVIDENCE FROM THE GALWAY BATHOLITH

FEELY, Martin and MOHR, Paul, National Univ of Ireland, Galway, Dept. of Geology, Galway

The Galway Granite is one of several early Devonian (~ 400 Ma) batholiths in Ireland. It is exposed over an area of 600 km2 on the northern side of Galway Bay in the West of Ireland. Ice-polished shoreline platforms provide superb evidence for the field relations among differing granite lithologies. The southern part of the batholith extends under early Carboniferous sedimentary strata on the floor of the Bay.

The Granite intruded into a ~ 470 Ma-old island arc metagabbro-granite gneiss belt to the north, and an oceanic metabasalt-chert suite to the south. The WNW-ESE long axis of the batholith trends oblique to the pre-emplacement Skird Rocks Fault, considered to be a splay from the continuation of the Southern Uplands Fault of Scotland across Ireland.

The batholith is cut by two major syn-consolidation faults dividing it into three blocks: western, central and eastern. There is strong field evidence that the central block was uplifted and unroofed during granite emplacement. Evidence includes the late intrusion of leucogranites exhibiting chilled margins against the earlier granite that had crystallised at a deeper level. The uniform lithology of these leucogranites contrasts strongly with the earlier calcalkaline megacrystic granodiorite and its zones of hybridised and mingled granite-hydrous diorite. One of these zones runs along the axis of the batholith, and shows evidence for a WNW-directed component of flowage.

Post-dating all the plutons are swarms of microgranite and hypabyssal latite-rhyolite dikes that mostly trend NNE-SSW, perpendicular to the batholith long-axis. Dikes invariably show chilled margins against the roof rocks of the batholith, including the late leucogranites. Incipient pyroclastic texture in dikes in proximity to breccia pipes suggests that they were fissure feeders for ignimbritic volcanoes. The preserved dike swarms are almost entirely restricted to the western and eastern blocks of the batholith, contrasting with their rarity in the uplifted central block.

11:30 AM Robinson, Peter

ORDOVICIAN ARC MAGMATISM: COMPARISON OF THE NEW ENGLAND APPALACHIANS AND CALEDONIDES OF CENTRAL NORWAY

ROBINSON, Peter, NORDGULEN, Øystein and SOLLI, Arne, Geol Survey of Norway, Trondheim, N7491, HOLLOCHER, Kurt, Union College, Geology Department, Nott St, Schenectady, NY, 12308, TUCKER, Robert D., Dept Terrestrial Magnetism, 5241 Broad Branch Rd NW, Washington, DC, 20015-1305

Extensive metamorphosed calc-alkaline intrusive rocks and volcanics appear in gneiss domes and in the east limb of the Green Mountain - Berkshire anticlinorium, western New England. These lie east of a belt of early Ordovician ophiolite fragments of probable fore-arc origin and a sequence of Cambrian - Mid-Ordovician continental slope/rise sediments of Laurentian affinity in a "Taconian accretionary prism". A common interpretation is that the volcanic and intrusive rocks belong to a "Bronson Hill magmatic arc" above an east-dipping subduction zone, and that abortive subduction of Laurentia produced features of the Taconian orogeny. Radiometric ages of the intrusives range from 488 to 442Ma (Late Tremadoc to Earliest Silurian) with most abundant activity 465-444Ma. These compare with emplacement of the Giddings Brook allochthon near Albany at 452Ma and 443 Ma for the end of high-grade Taconian metamorphism. Exposures closer to the New England coast, with volcanics and intrusives 471-460 Ma, may be an eastern exposure of the same arc terrane.

Støren and Helgeland Nappes of central Norway, contain calc-alkaline Ordovician to earliest Silurian volcanics and intrusives thrust southeastward onto Baltica during the Devonian Scandian orogeny. At high tectonic levels above extensional detachments associated with Devonian basins, the intrusives are only weakly metamorphosed/deformed and yield ages 448-430Ma At low levels similar rocks suffered strong ductile deformation during and after extensional emplacement against higher grade gneisses of deeply subducted Baltica basement. These have the lineated/foliated appearance of gneiss dome rocks in New England and yield ages 482-444Ma. The oldest magmatic rocks are early Ordovician ophiolites, locally emplaced upside down and then covered by arc volcanics. Ophiolites are now exposed on both sides of the intrusive terrane, confusing paleotectonic interpretation. Possibly the Norwegian rocks represent ophiolite and arc rocks originally emplaced on Laurentia in the Taconian collision, then re-emplaced on Baltica during early Devonian continental collision.

SESSION 21, 8:15 AM

Tuesday, March 13, 2001

T2. Paleolimnological Records of Holocene Climate Change I

Sheraton Burlington Emerald Salon II

8:30 AM Cwynar, Les C.

THE PREBOREAL OSCILLATION IN EASTERN NORTH AMERICA

CWYNAR, Les C., VINCENT, J. and KUREK, J., Univ of New Brunswick, Department of Biology, Fredericton, NB, E3B 6E1, SPEAR, R.W., State Univ of New York, Department of Biology, Geneseo, NY, 14454

The Preboreal Oscillation is a short-lived (~200 yr) cooling that occurred early in the Holocene, centered at about 9600 yr BP (uncalibrated 14C yr). Originally discovered in NW Europe and well-documented in the Greenland ice cores and some North Atlantic marine records, there is scant evidence for it in eastern North America (Yu & Eicher, Science 282: 2235-2238). We have analyzed cores of lake sediment from Maritime Canada and the White Mountains of New Hampshire for their organic content, and used chironomid analysis to reconstruct past maximum lake-water temperatures. These analyses demonstrate the occurrence of the Preboreal Oscillation across this region.

8:50 AM 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, Univ of Vermont, Department of Geology, Department of Geology, University of Vermont, Burlington, VT, 05405, GALSTER, Josh C, Univ of Vermont, Department of Geology, 1316 E. Whitman St., Apt. 1A, Pocatello, ID, 83201

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.

Together, the records from these lakes suggest that at least three major periods of increased storminess occurred during the Holocene, peaking at ~2000, 6000, and between 8500-10000 calendar years before present. Preliminary spectral analyses indicate that storm frequency may follow centennial- and perhaps millenial-scale cycles.

9:10 AM Lini, Andrea

ISOTOPIC RECORDS IN POST-GLACIAL LAKE SEDIMENTS: IMPLICATIONS FOR BIOTA AND LANDSCAPE EVOLUTION

LINI, Andrea, GALSTER, Joshua, HOWSE, Rachael and LORD, Andrea, Univ of Vermont, Geology, Perkins Hall, Burlington, VT, 05405

Assessing the effects of natural climate variability on the Earth's biosphere is a key issue in the current efforts to predict the consequences of present and future global change. Because climatic perturbations affect the biological communities in and around lakes, evidence of local and regional environmental histories can be found in the elemental and isotopic compositions of sedimentary organic matter. The extreme climatic changes associated to glacial-interglacial transitions had profound ecological impacts. Lake sediments provide natural archives that record the response of the Earth system to such perturbations. In particular, new lakes formed after the glaciers retreated present a unique opportunity to investigate how, and at what rate, watershed and lake ecosystems were established on once glaciated landscapes. A few previous studies have examined the response of lake ecosystems to glacial-postglacial climate change. However, most of the previously studied lakes are located in regions that were not glaciated during the late Pleistocene. Thus, their sediments document the response of pre-existing lake ecosystems to climate change rather than the development of new ecosystems on a barren, carbon and nutrient-poor landscape.

Detailed records of isotopic and elemental composition, produced for four post-glacial lakes in Vermont, provide remarkable insights into the individualistic response of lacustrine ecosystems to extreme climatic events and suggest that even on a local scale the response of different lakes to environmental change might not be identical. If, as our data suggest, geochemical records such as those provided by carbon isotopes reflect the individualistic response of the developing lake systems to the local geology, hydrology, and biota, these factors must be considered before attempting correlation of environmental climate proxies on a local, regional, or global scale. Our results also provide constraints on how much time is needed for lake ecosystems to recover from extreme natural or anthropogenic disturbances.

9:30 AM Francis, Donna

LATE HOLOCENE CLIMATE CHANGE IN NEW ENGLAND AS INFERRED FROM CHIRONOMID REMAINS IN LAKE SEDIMENTS

FRANCIS, Donna, University of Massachusetts, Dept. of Geosciences, Amherst, MA, 01003

The use of chironomid remains and transfer functions to infer past temperatures has been shown to be an effective tool in the study of late-glacial and early Holocene climate change in Atlantic Canada and Europe. In this study, we use fossil chironomids from New England lake sediments to study more recent and more subtle climate changes. We are interested in the time period known as the Little Ice Age (approximately AD1450 - 1850). Chironomids are a diverse insect group (Diptera: family Chironomidae) which is distributed worldwide and the larval stages live in all aquatic habitats. Several environmental factors, including temperature, determine the distribution of species. In order to construct transfer functions for chironomids and temperature, modern surface samples have been collected and analyzed to extend the existing training set from northern Atlantic coast regions into southern New England. Tests of inference models using the entire Atlantic coast set as well as only the New England set show that a subset of these data produce the most accurate temperature reconstructions. The models will be tested using both summer lake-surface temperatures and mean July air temperatures. Results to date indicate that in some ponds, a cooler period corresponds to the Little Ice Age time period, with a change in temperature of 1-2° C. This result suggests that chironomids may be effective for temperature reconstruction throughout the Holocene period. This study is part of a large multiproxy effort in New England which also includes stable isotopes, sediment geochemistry, diatoms, and pollen.