3:40 PM Chromec, F. Winche

USE OF THE WEPP AND HEC6T MODELS TO PREDICT SOIL EROSION AND ACTINIDE TRANSPORT IN SURFACE WATER AT ROCKY FLATS

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The Rocky Flats Environmental Technology Site (Site) is using the Watershed Erosion Prediction Project (WEPP) model developed by the Agricultural Research Service to assess contributions of contaminated sediments to surface water. The WEPP model predicts runoff, soil loss, and sediment delivery, by particle size, for agricultural and rangeland conditions. The Sedimentation in Stream Networks (HEC6T) model is the latest of the HEC family of hydrologic models and has been modified to be particularly useful for modeling sediment transport in small streams. The WEPP model sediment-delivery estimates for three watersheds, totaling 950 hectares, were coupled with spatial and particle-size analysis of plutonium-239,240 (Pu) and americium-241 (Am) activity in Site soils to produce soil and actinide mobility maps in order to quantify potential sources for sediment and actinide loading to surface water and to facilitate the determination of cleanup levels for actinides in surface soils that will be protective of surface water quality. The runoff, sediment, and actinide loading estimates from the WEPP model were then used as input for the HEC6T model to estimate sediment routing and yields for the watersheds. Site surface water monitoring data was used to calibrate the models. Surface soil samples from the watersheds were analyzed for Pu and Am content and distribution among discrete water-stable particle-size fractions. GIS and Kreiging techniques were used for spatial analysis of the soil actinide activity-concentrations and to produce soil and actinide mobility maps. Parameter sensitivity was evaluated during the calibration steps. This is the first time that WEPP has been used to predict actinde transport and guide remediation strategies for a Department of Energy facility.

3:55 PM Nichols, Kyle K.

REVISITING THE PEDIMENT PROBLEM USING ^{10}Be AND ^{26}Al; A CASE STUDY OF THE IRON AND GRANITE MOUNTIAN PIEDMONTS, MOJAVE DESERT, CALIFORNIA

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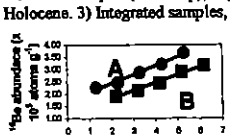
What is the sediment transport rate across large arid region piedmonts? At what rate is sediment supplied to Mojave Desert piedmonts? Are piedmonts depositional, erosional or transport surfaces? These are some of the questions that we can answer, over the 10^3 to 10^4 year time scales, by using ^{10}Be and ^{26}Al.

We collected 40 sediment samples to quantify large-scale piedmont processes and rates. 1) Valley samples collected from streams draining rangefront basins quantify sediment generation rates of the uplands (~0.01 g cm^{-2} y^{-1}). 2) Soil profile samples, from two soil pits (1-m deep), suggest sediment transport replaced deposition in the Holocene. 3) Integrated samples, from 5 transects parallel to the rangefronts, spaced at 1 km intervals down piedmont, show a remarkably regular increase in nuclide abundance for the Iron (A) and the Granite (B) Mountain piedmonts.



We used models of these isotopic data, to understand piedmont behavior. Channels migrate rapidly and rework the surface at short time scales (<1000 years). Soil pit data, B-horizon data, and maximum channel depths suggest that the current thickness of sediment in transport is 20 to 30 cm. Soil pit data also suggest a change of surface process from deposition to transport. Models show average sediment transport rates across the piedmonts are 35 ± 10 cm y^{-1}.

4:10 PM Clapp, Erik M.

SEDIMENT GENERATION AND EXPORT RATES IN THE NAHAL YAEL DRAINAGE BASIN, DETERMINED FROM COSOMOGENIC 10BE AND 26AL, NEGEV DESERT, SOUTHERN ISRAEL

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Sediment flux from Nahal Yael, a small (0.6 km^2) mountainous drainage basin in the Negev Desert has been monitored for 3 decades, an abundance of data replicated in few other basins. We measured 10Be and 26Al in 16 sediment and 8 bedrock samples representing sediment sources and sinks. We use these data to determine long-term, time-integrated (10^4 years) rates of sediment generation, identify sediment source areas and sediment generation processes, and compare rates of bedrock erosion for different lithologies. We calculated a basin-wide bedrock-equivalent lowering rate of 29 +/- 6 m/My and, assuming steady-state, a long-term sediment export rate of 79 +/- 17 tons/km^2/yr from channel sediment collected near the outlet of Nahal Yael. Our data yield erosion rate estimates slightly lower (36%) than sediment export rates calculated using the historical sediment loading data.

Measurement of cosmogenic nuclides in geomorphic features provides insight into processes shaping desert environments. Throughout most of the basin (excluding the uppermost highlands), average 10Be concentrations measured in the bedrock samples (2.4 +/- 0.63 x10^5 atoms/g) were significantly greater than those measured in the channel sediment (1.25 +/- 0.04 x10^5 atoms/g), hillslope colluvium (1.25 +/- 0.05 x10^5 atoms/g), and basin alluvium stored in terraces (1.56 +/- 0.15 x10^5 atoms/g). These data suggest that most sediment is generated on the hillslopes under colluvial cover rather than from weathering of exposed bedrock. The slightly higher nuclide concentrations measured in basin alluvium as compared to channel sediment and hillslope colluvium indicate sediment storage for a minimum of 5 ky.

Additionally, nuclide data suggests differences in rates of erosion for different lithologies. From our data, we find that gneissic granite erodes more slowly (13.8 +/- 3.4 m/My), than pelitic schist (28.0 +/- 19.6 m/My) or amphibolite (16.5 +/- 5.4 m/My).

4:25 PM Nezat, Carmen A.

THE PHYSICAL AND CHEMICAL CONTROLS ON RARE EARTH ELEMENT CONCENTRATIONS IN DISSOLVED LOAD, SUSPENDED LOAD, AND RIVER CHANNEL SEDIMENTS OF THE HOKITIKA RIVER, NEW ZEALAND

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Recent sediment flux estimates suggest that rivers draining high-standing oceanic islands between Australia and Asia may contribute 50% of the total sediment flux to the oceans. Because the residence time of this sediment may be very short compared to larger continental rivers, terrestrial geochemical inputs to the ocean, calculated from these larger rivers, may be in error.

The Hokitika River in New Zealand flows out of the Southern Alps westward into the Tasman Sea. Its steep gradient enables the river to act as a 'shoot,' transporting water and sediments quickly from the mountains to the ocean. Its catchment (352 km2) is underlain predominately by schist. Precipitation is 9.4 m/yr, and suspended sediment yield is 17,000 t/km2/yr. We have measured the rare earth element (REE) concentrations in the dissolved load, suspended load and river channel sediments of the Hokitika River for comparison to major world rivers and to establish what effect particle residence time has on geochemistry.

REE concentrations of the Hokitika suspended load and river channel sediments differ little from each other and the average upper crustal values. Though the suspended load normalized to the upper crust resembles the Amazon River REE pattern (positive anomaly for the mid-REE), the Hokitika normalized REE values are lower by an order of magnitude. These preliminary data suggest that REE concentrations in the suspended load increase with residence time (which is orders of magnitude larger in the Amazon River). The dissolved REE concentrations of the Hokitika River normalized to the upper crust display patterns and concentrations similar to the Ohio and Mississippi Rivers, suggesting that the solution chemistry (e.g., pH), and not the residence time, controls the dissolved REE concentrations. Our initial REE results indicate that rapid physical weathering minimizes differences in chemistry between the weathering products and reactants.

4:40 PM Smoot, Joseph P.

VARIABILITY OF SEDIMENTATION RATE AT OWENS LAKE, CALIFORNIA, AND PYRAMID LAKE, NEVADA DUE TO FLUCTUATING LAKE LEVELS

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Variations in sedimentation rate due to fluctuating lake levels are compared in two similar lakes fed by large rivers draining the Sierra Nevada. Both lakes are intermittently hydrologically closed and have similar climatically induced lake level histories. Pyramid Lake attained greater depths and had a much larger effective fetch than Owens Lake. Numerous small streams draining directly from the Sierra Nevada also feed Owens Lake, whereas small drainages into Pyramid Lake are mostly dry.

An examination of late Quaternary sedimentary records of the two lakes from cores and outcrop suggests systematic changes in sedimentation rate in response to climate change. Within the central lake basins, sedimentation rates were highest during lowest lake levels, and lowest during the highest lake levels. Superimposed on these large sediment packages, decimeter-scale successions of sediment also reflect changes in lake level. In these decimeter-scale successions, shallowing lake sequences are much thicker than those indicating deepening. This was due to wave focussing of sediment into a progressively smaller area and to erosion of lake sediments left in the drainages. Rising lake levels drowned drainages, causing deltaic sedimentation further from the basin center and resulting in dispersal of suspended sediment over a larger area. Decimeter-scale sediment sequences containing wave-deposited sand show less asymmetry, probably due to the erosion of fine-grained sediment by waves.

Sedimentation rates vary within a lake basin from proximity and geometry of drainages, drainage influence on lake level changes, and inherited topography from wave and stream erosion. For instance, in the narrow Truckee River valley south of Owens Lake, lake regression produced strongly asymmetric upward coarsening successions on top of thin transgressive wave deposits and muds. Canyon cutting during very low lake levels changed this pattern to transgressive mud layers separated by desiccation surfaces, tufas, or wave deposits, as deltaic sedimentation was focussed into the canyon and mud deposition required lake level to exceed canyon depth. In the wider Owens River valley, this topographic effect was unimportant and lateral variability in deltaic sedimentation was more pronounced.

SESSION 115, 01:30 PM

Tuesday, October 26, 1999

T54. Subglacial Processes and the Behavior of Ice Sheets II (GSA Quaternary Geology and Geomorphology Division)

CCC A207-209

1:30 PM Licht, K. J.

VERTICAL SEDIMENT FABRIC AND ITS RELATION TO MEGAFLUTES IN THE CENTRAL ROSS SEA, ANTARCTICA

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Sediment fabric measurements from central Ross Sea (CRS) till reveal that elongate particles are oriented with their long axes nearly vertical, relative to the seafloor. Fabric was estimated by three different methods to characterize all particle size fractions of the sediment. CRS core sites with vertical fabric are spatially associated with megaflutes identified from Multibeam Swath Bathymetry. Apparent long-axis orientations of 1797 pebbles from six cores were measured off X-radiographs. Only pebbles with a long-short axis ratio >1.5 were considered. The six cores all show a nearly vertical fabric (70-80°) at depths >65-100 cm to the base of the core (2-3 m). Anisotropy of magnetic susceptibility measurements also reveal a nearly vertical fabric. Additionally, significant sediment