DETERMINATION OF HOLOCENE DISPLACEMENT AT C-746-U LANDFILL

ITR Site Review on September 20, 2005

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The ITR team visited the Kentucky Geological Survey Core Facility in Lexington, Kentucky, to review the drilling plan and to observe and discuss the processing and description of cores. At the time of our visit, drilling was underway and core had been retrieved along Line 2 of the drilling plan. Members of William Lettis and Associates (WLA), including John Baldwin and Keith Kelson were at the facility describing core and graphing preliminary results. They gave us an overview of the field program and their progress to date. Throughout the day, they were available to answer questions. Also, Ed Woolery and Steve Hampson of the University of Kentucky, David Amick of SAIC, and Marshall Davenport of Bechtel Jacobs were present most of the day to discuss the project and answer questions. In addition, Amick and Davenport inspected cores for organics that might be used in radiocarbon dating.

Drilling Plan

We agreed that the drilling plan, in general, appears to be a good strategy and allows enough flexibility to investigate Holocene faulting in the vicinity of the C-740-U Landfill. According to the plan, cores will be collected from as many as 80 boreholes drilled to 30-ft-depth along two transects, lines 1 and 2. On the basis of Ed Woolery's interpretation of seismic reflection surveys along the two transects, several zones of deformation have been identified and are targeted in the drilling plan. During phases 1 and 2 of the drilling plan boreholes are spaced 20 ft apart across the deformation zones along lines 1 and 2. This is to be followed in phases 3 and 4 by drilling of boreholes in between the initial boreholes, resulting in 10-ft-spacing across the deformation zones. Depending on the findings from cores collected during phases 1-4, additional boreholes may be drilled in areas of interest.

Questions remained as to whether or not 10-ft spacing would be adequate to identify faults and fault displacements. If they extend close to the ground surface, faults are likely to be encountered in the cores. If they terminate close to the bottom of the boreholes, faults could be missed and therefore absent in the cores. In the latter case, structural interpretations will be based on apparent stratigraphic offsets alone. It may be difficult to identify faults with confidence, if displacements are small or include a strike-slip component. In addition, variability in depths of particular unit boundaries related to surface topography at the time of burial and to compaction especially during collection of cores may contribute to uncertainties in interpretation of possible fault displacements. Currently, the plan calls for intervening boreholes to be drilled if faults cannot be resolved at 10-ft-spacing. We are concerned that these particular problems, if encountered, may not be resolved with additional boreholes.

Processing of Cores

Facilities at the Kentucky Geological Survey Core Facility are very good for processing and storing of cores. Cores are well labeled and processing of the cores appeared to be both reliable and systematic.

Core Descriptions and Correlation of Units

Description of cores and correlation of units by the WLA team was careful and systematic. The level of detail was appropriate and necessary for correlation of units. We examined descriptions and correlations of two cores collected from two different target areas along line 2 and were satisfied with both. However, we were less satisfied with the interpretation of the various units. The WLA team did not seem well-acquainted with distinguishing characteristics of various Quaternary units including loesses and loessal paleosols. Given that descriptions and correlations are underway, we agreed that it would be helpful to have a Quaternary geologist very familiar with these units, perhaps Leon Follmer of the Illinois State Geological Survey, examine a few of the cores and review the interpretation of the units. This should help with the correlation of the KRCEE core stratigraphy with the regional Quaternary stratigraphy. In addition, it may be advantageous to run laboratory analyses (i.e., grain-size analysis, sedimentary petrology) to help with the interpretations of units.

Interpretation of Faulting

If fault displacements are small and comparable to uncertainties in depths of unit boundaries, as discussed above, it may be very difficult to identify faults and fault displacements. Statistical analysis of the depths and dips of certain boundaries may help to identify fault offsets. However, it may still be necessary to trench targeted areas. If trenching is not permitted, geoslicing could be considered as an alternative.

Interpretation of the age of the various units is critical for the determination of recency of faulting. It seems likely that organic material for radiocarbon dating will be found in the upper 10 ft of the cores. It seemed less likely that there will be organic material for dating in the lower 20 ft of the cores. We suggest that if no such material is found in the lower portion of the cores that optically stimulated luminescence (OSL) dating be performed to constrain the age of the deeper and older units. Large samples not exposed to the sunlight will be necessary for OSL dating.

Addendum

On October 4, Leon Follmer with John Nelson visited the core facility to assist the WLA team with interpretations of Quaternary units in the cores. Follmer and Nelson viewed two sets of cores that straddled the two faults interpreted from seismic line 2. Follmer identified the Peoria, Roxana, and Loveland Silt (loess), along with the Metropolis Formation, itself divisible into three local lithofacies. He found the Farmdale and Sangamon Geosols to be present, along with older, unnamed soils developed in the Metropolis Formation. Follmer's unit identifications should enhance the WLA team's ability to determine the presence or absence of faulting within the sampled interval.