Report for 2005KY48B: Reconstructing Late Quaternary Paleohydrology of the Lower Ohio Valley

Publications

- Conference Proceedings:
    - Brown, D.A. and H.D. Rowe, 2005, Developing late Quaternary paleolacustrine climate records in the Salt River Basin, Kentucky, in Proceedings of the Fall 2005 American Institute for Professional Geologists Meeting.

Report Follows

Problem and Research Objectives

Kentucky possesses two very important Late Quaternary paleohydrological archives: lacustrine sediments and speleothems (cave deposits). Extensive glacial-age lacustrine and alluvial deposits along the northern border of the state indicate that Kentucky is geographically located in a unique region that yields important paleoclimatic information regarding atmospheric circulation patterns and geomorphic responses to climate change in an area proximal to continent-scale ice sheets, and Quaternary climate change and its impacts on the drainage patterns within the Ohio Valley have a commanding effect on the modern surface and near-surface hydrology of Kentucky. Previous investigations completed by the US Geological Survey and the Kentucky Geological Survey along the Ohio River in the vicinity of Owensboro and Paducah identified at least two large Wisconsin-age paleolakes within the glacial valley train. In addition, investigations in the Salt River basin revealed that the lower reaches of the Salt and its tributaries were occupied by a large, long-lived paleolake, perhaps during both the Illinoisan and Wisconsin glacial episodes. This study expands on previously existing paleolimnological work by 1) constructing coherent geochronologies for Wisconsin-age fluvio-lacustrine deposits in the lower Ohio Valley drainage, 2) characterizing regional variability in geomorphic/hydrological settings during the last glacial episode, and finally 3) developing a paleohydrology/paleoclimatology record from lacustrine facies preserved in the Salt River basin.

Methodology

Long sediment cores were collected in the vicinity of Owensboro and Paducah, Kentucky and studied with a focus on down-core grain-size variations. A core collected from the Salt River Basin (south of Shepherdsville, Kentucky) was also utilized in the investigation. Project funding also supported installation of cave environment monitoring equipment (temperature, humidity and drip plates) in Crystal Cave (Fayette County). Speleothems obtained from this cave will hopefully provide a record of hydrologic history in the central Bluegrass Region going back several thousand years through the utilization of U-Th techniques.

Principal Findings and Significance

Based upon analysis of the Salt River Basin core, variations in down-core gamma, magnetic susceptibility, bulk geochemistry, and bulk stable isotopes provide only limited information on paleoenvironment. The sediments were deposited very rapidly (60 feet in ~1500 years), so pollen succession is also limited in its ability to define shifts in paleoenvironment. Down-core grain-size changes are likely the most useful tool for understanding subtle shifts in environmental conditions. Acquisition of a laser-particle grain-size analyzer to define high-resolution (sub-decadal) changes in fluviolacustrine deposition archived in the sediment cores is planned through separate funding (July 2006). Speleothems collected from Crystal Cave are being dated using the U-Th technique to assess the hydrologic history of the central Bluegrass Region.