**GEOL 497 Senior Practicum**


| Instructor: Flarsheim 420 | Email: | Office Hours: |
|---|---|---|
| Dr. Tina Niemi | niemit@umkc.edu | by appointment |


Students will develop a group research hypothesis that focuses on a geographic location away from campus where students will collect data. Students will do literature research and critiques, analyze field and laboratory data, and present their results in written and oral formats. The class will have a seminar format and include collaborative assignments. This year students used archaeological and neotectonic data collected in Jordan as their research focus for their projects. Three student research projects are to be presented at the North-Central Section of the Geologic Society of America - 38th Annual Meeting (April 1–2, 2004) Undergraduate Research in the Geosciences II (Posters).

**Student Abstracts from GEOL 497 Senior Seminar**

*LATE HOLOCENE SEDIMENTATION IN THE COASTAL ZONE OF AQABA, JORDAN*


ALLISON, Alivia J., Department of Geosciences, Univ of Missouri - Kansas City, 5110 Rockhill Road RHFH 420, Kansas City, MO 64110, ajad36@umkc.edu and NIEMI, Tina M., Department of Geosciences, Univ of Missouri-Kansas City, 5110 Rockhill Road RHFH 420, Kansas City, MO 64110



The city of Aqaba is located at the northern end of the Gulf of Aqaba along the active Dead Sea Transform fault in Jordan. In the coastal zone of Aqaba, stratified cultural remains from Roman to Islamic age (1st – 12th Century) and geologic sediments provide evidence for a change in the depositional environment over time. Analyses of sediment composition, depositional structures, fossil content, lateral stratigraphic relationships, and available age constraining artifacts were used to construct a history of paleoenvironments of the Aqaba coastal zone during the late Holocene. Exposure of a stratigraphic section in the coastal zone revealed 2-3 meters of aeolian sand interbedded with stratified Roman-Islamic aged structures and alluvium from flood events. Several sedimentary samples were collected from below the water table, recovered from 4-5 meter deep backhoe trenches, and each contained a greenish-grey clayey layer that may be interpreted as a marine embayment. Coulter particle size analysis characterized these samples as a clayey silt, while XRD analysis determined these sediments to be a clay composed of sepiolite (ferrian), calcite, kaolinite, halite, and albite. Microfossil analysis was conducted using a wet-sieving process and various echinoid spines were identified. The uppermost layers of sand in the section are composed of broken fragments of modern shells, mica, and subangular quartz and feldspar crystals. These sand particles appear to have been worked by water only, unlike most beach sands which are typically subrounded or rounded and worked by both water and wind. In order for this potential embayment to have formed, a beach barrier must have been present. While topographic lines are normally aligned parallel to the shoreline, the topographic lines in Aqaba are significantly altered and some are aligned perpendicular to the shore. This embayment may have formed due to tectonic subsidence. Subsequent siltation of the bay may have been human-induced or the result of a regional climatic change. Further research is necessary to investigate sedimentary deposits below the water table in the coastal zone of Aqaba, Jordan, as

well as the relationship of the clay horizon to tectonic activity and the antiquities of the area. Paper No. 15-4

*USING SLICKENSIDES TO UNDERSTAND FAULT MECHANICS ON THE ACTIVE WADI ARABA FAULT, JORDAN*

SMITH, Rachel C., Department of Geosciences, Univ of Missouri - Kansas City, 5100 Rockhill Road, Flarshiem Hall 420, Kansas City, MO 64110, rcs639@umkc.edu, NIEMI, Tina M., Geosciences, Univ of Missouri-Kansas City, 5100 Rockhill Road RHFH 420, Kansas City, MO 64110, and ATALLAH, Mohammad, Earth and Environmental Sciences, Yarmouk Univ, Irbid, Jordan

The Wadi Araba fault (WAF) is one of the main strike-slip faults in the Dead Sea Transform plate boundary, which separates the Arabian plate on the east from the Sinai subplate on the west. Structural orientation data were collected from slickenside striations on the fault plane exposed in the area of the intersection of the NE-trending, strike-slip WAF and the dip-slip Khunayzira at the south end of the Dead Sea basin. These slickenlines are best observed in the polished pebbles of the upper Pleistocene conglomerates exposed within the deep incisions of the Wadi Khunayzira and Wadi An Nakhbar streams and provide evidence for multiple faulting mechanisms. Oriented pebbles were collected from the fault plane in order to study the formation sequence of the striations. Detailed generation data for the lineations were obtained from SEM and high magnification petrographic microscopic images of the striated pebble surfaces. Analyses of the cross-cutting relationship between the striations observed in these images indicate three principle directions of movement on the fault plane oriented N16E, 76SE. One motion is predominantly strike-slip with a rake orientation of 3°N. The second direction is nearly pure dip-slip with an orientation of 88°S. The third direction indicates right-reverse slip oriented 22°N. Our analyses of the striated pebble surfaces suggest that the most recent faulting on this fault plane was the oblique movement. These data indicate that the fault is oriented within in a present-day stress field that allows for both dip slip and strike slip on the fault over a very short period of time. Faulting associated with several historical earthquakes over the past 1500 years has ruptured this segment of the WAF as is indicated by offset archaeological ruins located 10 km south of the site for this study area. Because repeated motion on this fault plane would obliterate earlier faulting events, only the last few slips are preserved on the polished pebbles. Our preliminary results suggest that the past several earthquakes have had vastly different focal plane mechanisms. Paper No. 15-2

*COMPARISON OF EARTHQUAKE-DAMAGED WATERWORKS STRUCTURES OF ROMAN TO ISLAMIC AGE AT QASR TILAH, JORDAN*

MCCABE, Janice M., Department of Geosciences, Univeristy of Missouri - Kansas City, 5110 Rockhill Road, Flarsheim Hall 420, Kansas City, MO 64110, akajmccabe@sbcglobal.net and NIEMI, Tina M., Geosciences, Univ of Missouri-Kansas City, 5100 Rockhill Road RHFH 420, Kansas City, MO 64110

The Qasr Tilah archaeological site is located on the Wadi Araba fault portion of the Dead Sea transform in Jordan. This fault system has experienced several major damaging earthquakes including those of 363 A.D. and 1068 A.D. Archaeological excavations and architectural survey of the Qasr Tilah site were conducted in May 1999, May 2001, January 2003, and July 2003 as part of the Wadi Araba Earthquake Project. The main objectives of excavation were to date the timing and assess the magnitude of earthquakes that have impacted the site. This study focuses

on defining the construction periods of the aqueducts and water reservoir system at Qasr Tilah, Jordan. Several aqueducts of various constructions and elevations lie parallel to the course of the Wadi Tilah. The oldest aqueduct, Phase I, is cut into the bedrock and is plastered in the channel and on the outer wall. This type of construction is suggestive of technologies of the Nabataeans (1st Century B.C-2nd Century A.D.). The Phase II aqueduct appears to be a widening of the older aqueduct at the same elevation although evidence for this phase is spotty. The upper Phase III aqueduct is approximately 1.9 m above the Phase I aqueduct channel floor. It is constructed of large undressed boulders of local limestone with mortar and cobbles used as chinking blocks. It is also plastered. The characteristics of this aqueduct are the same as those observed in the sections at the water reservoir, which has been radiocarbon dated to ca. 641-687 A.D. The Phase III aqueduct connects to the water reservoir through a vertical outflow channel flowing from the top of the reservoir and a settling pool at the base of the reservoir. X-ray diffraction analyses of mortar and plaster samples collected from the various aqueducts do not reveal any discernable difference in construction materials. Analyses of thin sections from the mortar and plaster samples is underway. The aqueduct systems and reservoir at Qasr Tilah have clearly been disrupted by several earthquake faulting events when the system was still functioning and after it had been filled with sediment. Paper No. 15-3