MCMICKEN COLLEGE OF ARTS AND SCIENCES
Geology

SUMMER RESEARCH OPPORTUNITIES
FOR UNDERGRADUATE WOMEN

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The Department of Geology is pleased to offer the following research project for the summer of 2006. Interested students are urged to contact the faculty member(s) directing the project that most interests them. By contacting the faculty member, you can discover more about the project, learn what your responsibilities will be and if possible, develop a timetable for the twelve-week research period.

MODELS FOR LIMESTONE-SHALE CYCLES IN THE KOPE FOUNDATION

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The occurrence of shell-rich limestone beds in successions of sparsely fossiliferous mudstones has long intrigued sedimentary geologists. A common genetic interpretation of mixed limestone-mudstones is founded on two fundamental assumptions, both of which we question in this study. The first assumption is that limestone-dominated intervals (especially those comprising shell beds or "coquinites") record short-term, relatively high-energy sedimentation events. The second assumption is that mudstone intervals record low-energy, relatively steady background sedimentation over long relatively storm-free periods. At first glance, these assumptions appear to be well supported by a variety of sedimentologic and taphonomic attributes. Indeed, many limestones within shale-dominated successions worldwide exhibit storm-related features, such as scours, graded bedding, and ripples. Conversely, mudstone units appear homogeneous, with only subtle color changes and scattered shelly debris or silt laminae present as easily distinguishable features; additionally, their fine-grained character suggests deposition as background sediments in low-energy environments. In fact, there is abundant evidence that mudstone intervals contain the record of multiple stormscouring and depositional events that are masked by relatively high rates of sediment input and a scarcity of larger skeletal material to produce coquinas or major lag beds. Conversely, taphonomic and paleontological evidence indicates that background conditions during deposition of shell-rich limestones were actually as quiescent as those represented in the mudstone intervals, but low input of siliciclastics allowed concentration of highly time-averaged skeletal.

The present study tests two hypotheses: a) that Kope mudstone-limestone cycles record regular oscillations of sediment input, with calcareous intervals (including skeletal limestones) recording low net input, and mudstone-dominated intervals representing rapid input of terrigenous sediment; b) that these cycles were mediated by regular oscillations of sea-level and/or climate. Resolution of these issues requires a multi-disciplinary approach involving a) detailed logging record of sedimentologic and paleontological aspects of sections, b) profiles of magnetic susceptibility, and c) geochemical study of the Kope mudstones. The first of these will be the subject of this WISE project, the second is to be carried out by Brooks Ellwood of the Louisiana State University, and the third will be a WISE project supervised by Barry Maynard of the UC Geology Department.

This WISE project will involve detailed correlation and three dimensional relationships of cycles in

the Kope. If the storm winnowing model best explains Kope cyclicity, then we anticipate that shell rich calcareous intervals observed in outcrop should correlate downslope into thicker packages of distal calcareous storm beds. Conversely, if the cycles are the product of periodic oscillations in siliciclastic sediment supply then we would predict that their downslope equivalents should be more condensed, i.e., thinner intervals of condensed, perhaps nodular or phosphatic limestones. Preliminary study of distal ramp Kope facies in the Ohio subsurface indicates that major limestone beds traced in outcrop can also be identified in outcrop and indeed that these beds are condensed. However, more basinal sections recorded by dark brown to black graptolitic shale in the center of the Sebree trough are not so readily correlated. Assuming that the efficacy of the MS method can be fully documented in unequivocally correlated outcrop sections, we intend to extend the method to log distal drill core sections, We anticipate that it will be possible to identify the same MS episodes in more featureless basinal shales and that this will permit an assessment of whether these intervals thicken or thin into the subsurface, a key test of the depositional models.