PALEOENVIRONMENTAL ANALYSIS OF A MORRISON FORMATION DINOSAUR SITE, BIGHORN BASIN, WY: CONDUCTING AN INTERDISCIPLINARY FIELD STUDY THROUGH DISCIPLINARY TASKS

DEMKO, Timothy M.[1], BODENBENDER, Brian E.[2], BAAR, Eric E.[3], HOLBROOK, Cody W.[4], KUBAREK, Sara J.[1], MURPHY, Jennifer[5], RAMIREZ, Elisa M.[6],SCOTT, Justin E.[7], SWOR, Emily[1], THOMASON, Carrie[2], and YONOVITZ, Maureen[2]

(1) Department of Geological Sciences, Univ of Minnesota Duluth, 217 Heller Hall, 1114 Kirby Drive, Duluth, MN 55812, tdemko@d.umn.edu
(2) Geological and Environmental Sciences, Hope College, 35 E. 12th St, Holland, MI 49423
(3) Grand Valley State Univ, Allendale, MI
(4) Western Kentucky Univ, Bowling Green, KY
(5) Lawrence Univ, Appleton, WI
(6) Univ of Michigan, Ann Arbor, MI
(7) Casper College, Casper, WY

ABSTRACT

A project investigating a dinosaur fossil site near Shell, WY provides a model for conducting interdisciplinary undergraduate field research. The project involves 10 students who undertake stratigraphic and paleontological subprojects that contribute to understanding the paleoenvironment and paleoecology of the site. These subprojects include: 1) construction of bedrock and surficial geologic maps of the dinosaur fossil site and surrounding area; 2) development of a composite stratigraphic column that includes the fossil-bearing intervals; 3) description and analysis of the sedimentary facies of the fossil-bearing and associated intervals, especially those that contain paleosols; 4) description and interpretation of sandstone body architecture, including paleocurrent analysis; 5) construction of detailed quarry maps that record bone positions, associations, and stratigraphy; 6) analyses of bone taphonomy and diagenesis, especially the incorporation of rare earth elements; 7) taphonomic analysis of plant material in the bone-bearing and associated strata; and 8) collection, preparation, and identification of dinosaur and other vertebrate fossils found at the site, including screen washing of rip-up clast conglomerates. Some subprojects require the temporary help of other students to complete successfully, leading to cross-disciplinary training between the project teams. Students working on the stratigraphic subprojects, which had a definitive end to field data collection, were able to join the work on dinosaur fossil excavation, which continues up to the last field day. This gives the students working on stratigraphy a taste of paleontological research, and allows mentoring opportunities for those working on paleontology.

STRUCTURE OF THE PROGRAM

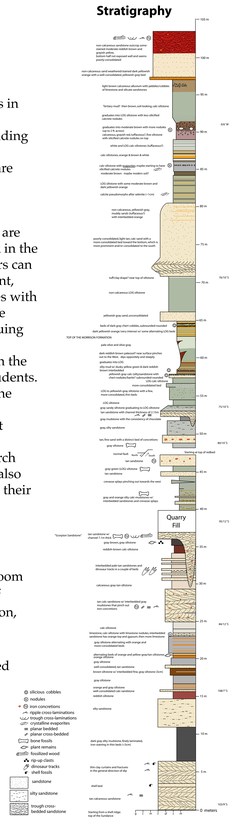
The overall goal of research at the site is to understand the paleoenvironments in which the site's fossils were preserved. Understanding the series of paleoenvironments represented at this one site is a necessary step toward building a regional picture of ancient faunas and environments in this portion of the Morrison Formation. A robust regional picture will in turn allow us to compare faunas and environments with other well-studied portions of the Morrison Formation.

This program has been funded for three years, so our students' research tasks are developed with that time-frame in mind. Ten students are supported to work in the program each year. This means that individual students or pairs of researchers can pursue independent investigations into varied aspects of the paleoenvironment, working in parallel with other researchers during the field season and in series with researchers who hand off some of the projects from one season to the next. We divided the students into those pursuing fossil-based projects and those pursuing geology-focused projects, and assigned faculty to advise each group. One consideration in choosing student participants is to provide a balance between the two kinds of projects and therefore more consistent project advising for all students. Another consideration is the inclusion of students from two-year colleges in the program. This has focused student selection on those relatively early in their undergraduate careers so as to provide a cohort of researchers with somewhat similar backgrounds and levels of experience. The focus on early-career undergraduates has the advantage of providing the opportunity for the research experience to inform students' subsequent coursework and career goals, and also allows some students to continue their projects through independent study at their home institution.

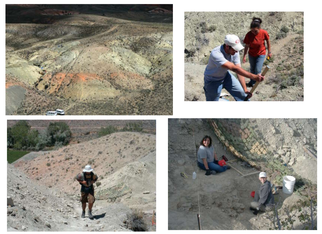
ACKNOWLEDGMENTS

We thank J. Barwis (Holland, MI), E. Hansen, G. Peaslee, and P. Atkins (Hope College), and M. Uhen (Cranbrook Institute of Science) for assistance in classroom instruction. R. Simon (Dinosaur Safaris, Inc), G. Storrs (Cincinnati Museum of Natural History), and M. Uhen provided logistical support and field instruction, and J. Anderson facilitated field access. T. Vogel (Michigan State University) arranged for XRF and ICP-MS analyses, and I. Steele (University of Chicago) provided microprobe access. W. Simpson (Field Museum) generously provided access to comparative fossil collections. This material is based upon work supported by the National Science Foundation's Research Experiences for Undergraduates program, grant number EAR-0353589.

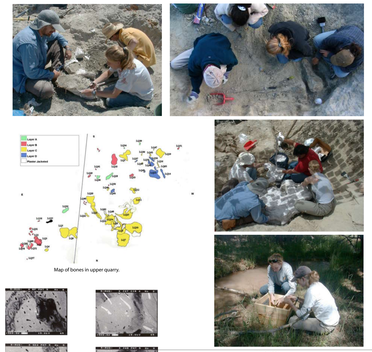
Stratigraphy



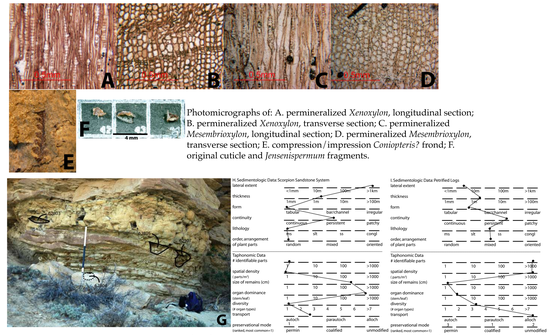
Surficial and Bedrock Geologic Maps



Vertebrate Paleontology



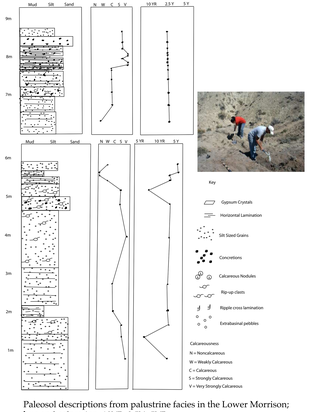
Taphonomy of Fossil Plants



Photomicrographs of: A. permineralized *Xenoxylon*, longitudinal section; B. permineralized *Xenoxylon*, transverse section; C. permineralized *Mesembrioxylon*, longitudinal section; D. permineralized *Mesembrioxylon*, transverse section; E. compression/impression *Coniopteris?* frond; F. original cuticle and *Jensenispermum* fragments.

G. Sampling localities for dispersed cuticle within the Scorpion Sandstone overbank mudstones; H and I. Taphograms based on Demko (1995) ms, mudstone; slt, siltstone; ss, sandstone; congl, conglomerate; autoch, autochtonous; parautoch, parautochthonous; alloch, allochthonous; permin, permineralized.

Paleopedology



Paleosol descriptions from palustrine facies in the Lower Morrison; hue and coloration, 10YR, 2.5Y, 5YR.

Stratal Architecture of the Scorpion Sandstone