

Project Completion Report

Rocky Mountains Cooperative Ecosystem Studies Unit (RM-CESU)

Project Title: Excavation of Fossils from the Florissant Formation to Investigate the Response of Insects to Climate Change during the Eocene-Oligocene Transition

Project Code: UCOB-56, *J1212080054*

Type of Project (Research, Technical Assistance or Education): Research

Funding Agency: National Park Service

Partner University: University of Colorado Boulder

NPS Agreement Technical Representative:

Dr. Herbert W. Meyer
Paleontologist
Florissant Fossil Beds National Monument
P.O. Box 185
15807 Teller County Road 1 (for FedEx or UPS)
Florissant, CO 80816 USA
phone: 719-748-3253 / fax: 719-748-3164
Herb_Meyer@nps.gov

Principal Investigators (with complete contact information):

Dr. Dena M. Smith
Department of Geological Sciences
UCB 265
CU Museum
University of Colorado-Boulder
Boulder, CO 80309
Phone: 303-735-2011
FAX: 303-735-2347
dena@colorado.edu

Start Date of Project: September 30, 2008

End Date of Project: December 31, 2011

Funding Amount: \$20,000

Project Summary, including descriptions of products, work accomplished and/or major results. If the information is restricted (e.g. location of endangered species or cultural resources), indicate the title and location of the final report. Also add web sites where project-related information may be found.

This project accomplished a major new excavation of fossil insects, plants, and mollusks from the Florissant Formation during 2009 and 2010. Approximately 4,200 fossils were collected, prepared, and accessioned/cataloged for the monument's collections. Fossil

specimens were given catalog numbers and labels and were entered into the NPS ICMS database. Most fossils were identified taxonomically (generally to the level of order for insects and family or genus for plants). This work was accomplished at the University of Colorado for the fossil insects and at Florissant Fossil Beds National Monument for the fossil plants and mollusks. Field notes for the excavation were compiled by Jenell Thoene, a graduate student from University of Colorado who managed the excavation and completed a Master's thesis on the project.

The Master's thesis by Jenell Thoene was completed for the degree requirements of the Department of Museum and Field Studies at the University of Colorado Boulder and is titled "*Taphonomy of Insects from the Florissant Formation, Colorado.*" A digital copy of this thesis is attached. The intended focus of the RM-CESU project on climate change shifted more to taphonomy during the course of the work for the Master's thesis. The taphonomic study examined factors that influence the fossilization of insects in different sedimentary environments of the Florissant Formation lake deposits. Understanding the depositional environments that influence taphonomic processes is important in using fossil insects to help reconstruct paleoenvironments, and this in turn contributes to better understanding climate change during the Eocene-Oligocene transition. Fossil insect data were also examined by rarefaction analysis during the project to estimate taxonomic diversity at Florissant. Thus, the important original objectives of the RM-CESU project were achieved.

The project's scientific findings, based primarily on Thoene's thesis, were presented during the Geological Society of America Annual Meeting in 2011. This abstract, by J. Thoene, D. Smith, C. Nufio, and H. Meyer, is available online at http://gsa.confex.com/gsa/2011AM/finalprogram/abstract_193280.htm. In addition, the same authors have a manuscript in review with the journal *Palaios* titled "*Depositional Setting and Fossil Insect Preservation: A study of the late Eocene Florissant Formation, Colorado*".

This project provided preliminary results that will contribute to future research. For example, the insects that were sampled and identified in this project will now be used, in combination with insects from other fossil localities, to study broader patterns of climate change during a 23 million year time interval in Colorado. This study, titled "The Response of Insects to Climate Change in the Eocene through Oligocene of Colorado" has received funding from the National Science Foundation's Sedimentary Geology and Paleobiology Program (Project #1123802).

This project also provided important fossil collections that are contributing to another ongoing RM-CESU project (*Research on Freshwater Invertebrate Fossils from the Florissant Formation as Evidence for Eocene-Oligocene Climate Change*) with the University of Washington (see J8W07100009). This other project will help provide evidence of past climate change based on fossil mollusks, in addition to the information obtained from fossil insects in this project.

Number of students participating in this project: undergraduates, graduate students, degrees conferred.

1 graduate student at the University of Colorado (Jenell Thoene) was directly involved throughout the project. She managed the excavation and cataloged collections. She

completed a Master's thesis based entirely on her work for this project.

3 paleontology interns supported by the Geological Society of America GeoCorps America program provided substantial assistance to the Monument for fossil excavations and cataloging collections.

3 student STEP employees for the Monument were substantially involved in fossil excavations and were largely responsible for overseeing the cataloging of collections.

3 other students provided minor assistance in fossil excavations.

Lessons Learned from this project.

From a scientific standpoint, we learned several important things about the preservation of insects and how to best sample fossil outcrops to obtain high quality fossil insect specimen. Specifically, we learned the following:

- 1) Fossil insects within the Florissant Formation can be equally abundant across different sediment types (shale, mudstone, siltstone).
- 2) The presence of diatoms does not seem to enhance the preservation potential or quality of specimens as the preservation quality of specimens as previously thought.
- 3) The greater turbidity and grain sizes associated with the production of siltstone layers did not negatively impact the quality of specimens.
- 4) Specimens preserved in siltstone were smaller than those found in the other sediments and were less variable in size than those found within the more time-averaged mudstone and shale sediments.