

## **RM-CESU - Project Progress Report, FY 05**

**Project Title: Research Fossil Diatoms from the Florissant Formation**

**Park: FLFO**

**Funding Source: Rocky Mountains CESU Research Funding (\$9500); Florissant Fossil Beds National Monument (\$13,900); University of Colorado at Boulder (\$3000)**

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**University Partner, PI: University of Colorado, Boulder; Dr. Dena Smith**

**Student Participants: Mary Ellen Benson**

### **Project Description:**

This project is examining the diversity, abundance, and taxonomic composition of late Eocene fossil freshwater diatoms from the Florissant Formation in order to better understand the paleoecology of the ancient lake environment at Florissant. The deposits at Florissant represent one of the world's earliest well-preserved fossil records for freshwater diatoms, yet these diatoms have received only minimal scientific examination. The results of the present study are intended to provide: 1) assessment of the taxonomic diversity of the diatoms, 2) new evidence towards reconstruction of diatom evolutionary history, 3) a better understanding of the Eocene freshwater lake and its ecology and paleoenvironment, and 4) enhanced interpretation of the ancient biota and ecology for the Monument's visitors.

Diatoms reflect a wide variety of physical, chemical, and ecological parameters that make it possible to reconstruct ancient aquatic habitats (including lake size, depth, salinity, pH, and trophic status), and therefore, climatic setting. A recent, preliminary study of the microscopic fossil diatoms of the Florissant Formation shows that the deposit has a high potential to render significant new discoveries. The current research is examining spatial and stratigraphic occurrences of diatoms, in order to determine diversity, abundance, taxonomic composition, and paleoenvironment. This work involves the following phases: 1) field collections, 2) laboratory processing and slide preparation, 3) cataloging collection, 4) microscopic analysis, 5) identification and description of diatom taxa, 6) paleoenvironmental analysis, and 7) manuscript preparation.

### **Preliminary Project Results:**

Our CESU agreement with University of Colorado at Boulder for this project was established in May 2005. The person doing most of the actual research work is Mary Ellen Benson, who is completing the project as her Ph.D. dissertation at University of

Colorado at Boulder. The project's other researcher, Dr. Sarah Spaulding, as well as the Principle Investigator Dr. Dena Smith and NPS official Dr. Herb Meyer, all have faculty appointments at University of Colorado and will serve as thesis committee advisors to Ms. Benson. This project is scheduled for completion September 30, 2008, and thus the results reported here are only preliminary.

During June 2005, field work was completed to collect samples from the Florissant Formation at a site just outside the Monument's boundary, at Clare's Quarry. Additional samples will be made within the Monument at a later date. Laboratory spaces have been set up for work at CU. Ms. Benson's committee has been approved by the grad school and the geosciences department, and she is preparing the research proposal for her Ph.D., which will encompass many of the elements defined in the original CESU proposal and agreement. Sample preparation is underway and has involved developing a specialized technique for the Florissant samples, and this was successfully accomplished. Microscopic slides have been prepared, and SEM photographs of some of the diatoms have been made. Taxonomic identification of the diatoms is underway.

Specifically, the preliminary examination of the diatoms from the Clare's Quarry Section #1 (collected 06/15/05) shows the following:

#### Examination

Samples for examination were selected on the basis of their presumed likelihood of containing diatoms according to previous reports that they occur in "paper shale." In addition, samples were taken from some of the mudstone layers to check for accuracy of previous reports. A total of 27 sample intervals out of the 50 from the entire section were examined. Care was taken to physically isolate and document the character of the exact layer of each subsample. The identifications are extremely preliminary as they were made from temporary smear slides and rudimentary digital photographs. One slide each was made for most subsamples, but multiple slides were made for several.

#### Abundance

The diatoms range from completely absent or extremely rare to modestly common. They occur in 13 of the 27 samples examined. They are extremely rare or very rare in 9 of these intervals; are rare in one interval; and are relatively common in 3 intervals. The most productive intervals occur within the top 90 cm. of the section. The 3 richest intervals consist of paper shale or shale with mudstone. The number of individuals seen increased with the increase in number of types observed.

#### Diversity

Thirteen basic diatom morphotypes were informally designated to accommodate the forms seen in these samples. These included 3 kinds of centric and 10 pennate forms. Divisions within these 13 types allowed for some further refinement. Of the 3 most productive zones, one interval contained 13 different morphotypes, another had 17, and another had 10.

#### Association with Other Fossils

Ostracods, plants, and insects were noted wherever seen in association with the subsamples examined. Ostracods were found in 2 zones where diatoms were absent; in 2 intervals where diatoms were very rare; and in one interval in which diatoms were common and diverse. Insects were found in subsamples of 3 intervals, but these were intervals in which diatoms were not present. A conifer leaf was observed on the surface of a subsample that yielded no diatoms. A deciduous leaf was observed on the surface of a subsample that had only extremely rare diatoms.

#### Occurrence

As these samples were unprocessed, the clay and other organic particles in the original sediments remained in the samples. As a result, diatoms were often partially coated or enclosed in a clay matrix. Additionally, elongate pennate forms showed a pattern of matting of diatoms or diatoms with clay in 8 of the subsamples.

#### **Follow-up of this Project**

The work on this project will continue through September 2008. Mary Ellen Benson plans to prepare a student improvement grant to the National Science Foundation, which could help to provide for additional on-going financial support of the research.

#### **Publications, other reports expected/ with dates**

The following publication is being prepared as a preliminary report that will be included in the volume *Paleontology and Stratigraphy of the Late Eocene Florissant Formation, Colorado* (editors H. Meyer and D. Smith), which will be a collection of papers on Florissant paleontology to be published as a Special Paper for the Geological Society of America. The first draft will be completed by January 31, 2006. Our contribution to this from this project is:

S. Spaulding, M. Benson, H. Meyer and D. Smith  
Diatom Diversity in Ancient Lake Florissant

The majority of the work for this project will be reported in Mary Ellen Benson's Ph.D. dissertation, which will be completed in 2008.