EXCEPTIONAL PRESERVATION AND DIVERSITY OF INSECTS
FROM THE PALEOBURN LOCALITY OF THE EOCENE GREEN RIVER FORMATION OF COLORADO

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ABSTRACT

The Paleoburn locality of the Parachute Creek Member of the Green River Formation, located in the Parachute Creek Basin near Parachute, Colorado, is known for its characteristic red coloration and fossil rocks that can exhibit varying degrees of three-dimensional preservation. This study investigates lithology, sedimentological conditions, and taphonomic processes to better understand the preservation potential and diversity of fossil insects found at this locality. Samples were collected from two end-member sites along the gradient to study whether lithology is correlated with the diversity and quality of insects preserved. In the field, samples were standardized by collecting time. Specimens were identified to family and taphonomic data (specimen size, preservation, relief) were recorded. Sedimentological characteristics (matrix color, texture) were also collected for each site.

A total of 2,700 specimens were collected from ten sites, with 200 specimens (100 per site) for each site. Two sites were red in color, with the remaining sites being gray to tan in color. The number of families sampled was not significantly different between the two sites, but there was a significant difference in level of completeness (P = 0.022). In the red site, the average specimen size was 5 mm, and most specimens showed some level of preservation as only 10% were found to be complete. Although these differences in preservation were significant between the paleoburn site, many other factors likely come into play in the total preservation of insects as well. These results support the findings of other studies, which have shown that lithology does not strongly affect the completeness of specimens preserved.

Insect completeness and preservation differ between sites. The number of families sampled was not significantly different between the two sites, but there was a significant difference in level of completeness (P = 0.022). In the red site, the average specimen size was 5 mm, and most specimens showed some level of preservation as only 10% were found to be complete. Although these differences in preservation were significant between the paleoburn site, many other factors likely come into play in the total preservation of insects as well. These results support the findings of other studies, which have shown that lithology does not strongly affect the completeness of specimens preserved. Although three-dimensional preservation has been well documented for the Paleoburn site, the majority of samples (90%) were preserved in two dimensions. Lithological characteristics were not found to be correlated with insect size, preservation levels, or overall site diversity. In general, these results support the findings of other studies, which have shown that lithology does not strongly affect the diversity and quality of insects preserved in lake sediments. Additionally, color differences likely reflect chemical alterations from secondary fluids, and this appears to influence neither the diversity nor the preservation quality of insects. The results differ in relative abundance of insect families may reflect real differences in the distribution of the living assemblages as opposed to taphonomic filtering.

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CONCLUSIONS

More specimens from the red site are preserved in 3D relief than specimens from the tan site. The results of the analyses and diversity estimations suggest the family-level diversity does not differ between sites, and that the total family-level diversity has been under-sampled. The taxonomic compositions of the red and tan assemblages do not differ significantly at the family level. We speculate that this difference may be due to a spatial gradient within the lacustrine environment. In general, these results support the findings of other studies, which have shown that lithology does not strongly affect the diversity and quality of insects preserved in lake sediments. Additionally, color differences likely reflect chemical alterations from secondary fluids, and this appears to influence neither the diversity nor the preservation quality of insects. The results differ in relative abundance of insect families may reflect real differences in the distribution of the living assemblages as opposed to taphonomic filtering.

FUTURE WORK

Investigate matrix coloration, mineralogy, and secondary diagenetic alteration in future research. We document the taphonomic basis of color differences, and investigate scenarios for their generation. Determine the influence of primary taphonomic biases and secondary diagenetic alteration on the taxonomic composition of the assemblages, focusing on the Paleoburn locality. Make comparisons between the insects of the Paleoburn locality and modern insect assemblages, where they are preserved as carbonaceous compressions.