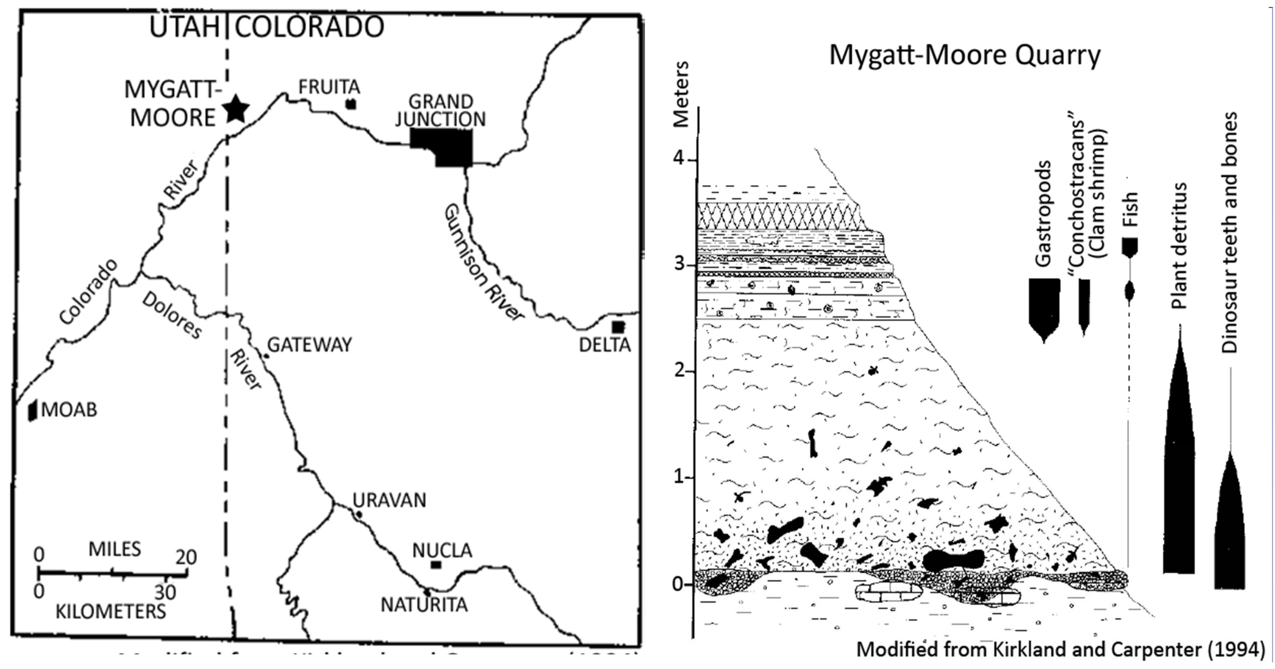
UNIVERSITY OF MARYLAND
DEPARTMENT OF GEOLOGY

Stable Istotope Geochemistry Laboratory

ABSTRACT

For more than a century, morphological studies have been used to attempt to understand the partitioning of resources in the Morrison Fauna, particularly between members of the two major clades of neosauropod (long-necked, megaherbivorous) dinosaurs: Diplodocidae and Macronaria. While it is generally accepted that most macronarians fed 3-5m above the ground, the feeding habits of diplodocids are somewhat more enigmatic; it is not clear whether diplodocids fed higher or lower than macronarians. While many studies exploring sauropod resource portioning have focused on differences in the morphologies of the two groups, few have utilized geochemical evidence. Stable isotope geochemistry has become an increasingly common and reliable means of investigating paleoecological questions, and due to the resistance of tooth enamel to diagenetic alteration, fossil teeth can provide invaluable paleoecological and behavioral data that would be otherwise unobtainable. Studies in the Ituri Rainforest in the Democratic Republic of the Congo, have shown that stable isotope ratios measured in the teeth of herbivores reflect the heights at which these animals fed in the forest due to isotopic variation in plants with height caused by differences in humidity at the forest floor and the top of the forest exposed to the atmosphere. The depositional environment of the Upper Jurassic Morrison Formation has also been highly debated for over a century, but it seems likely that it was a dry, semiarid environment lacking dense, thick rain forest; however, by measuring carbon stable isotope ratios in leaves from modern plants closely related to those present during the Late Jurassic, it is observed that a significant variation in stable isotope ratios with height occurs not only in trees within a closed canopy forest but also in isolated trees far from a forest environment. With this knowledge, it is now possible to investigate the partitioning of resources via feeding height in herbivorous fossil animals regardless of whether or not they lived in a closed canopy setting as long as it is assumed that they fed largely on the same plants. Applying this to the problem of Morrison neosauropods, it appears that if diplodocids and macronarians likely did not partition resources strictly by height as significant overlap in stable isotope ratio values was observed between the two groups. Instead, it follows that these groups must have partitioned resources by being specialized to feed on different groups of plants, which is consistent with tooth morphology.



$$\delta^{13}C = [(^{13}C/^{12}C)_{sample}/(^{13}C/^{12}C)_{std} - 1] \times 1000$$