

Land Use History of North America *Colorado Plateau*

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Packrat Middens

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Fossil packrat (or woodrat) middens provide information on past environments because they are a rich source of debris collected by packrats in the past. Packrat middens have been important for paleoecological reconstructions of the arid southwest since their discovery in the 1960s. They contain extremely well-preserved leaves, seeds, fruits, twigs, pollen, bones, shells, and reptile scales. These fossils are usually encased in the amber colored crystallized urine, sometimes called "amberat".



White-throated woodrat



Packrat midden

Midden is an archeological term meaning roughly "garbage pile," so the study of packrat middens is really the dissection of old garbage piles left by packrats. In order to conserve water in an arid environment, the packrat produces very viscous urine.

The packrat often urinates on its garbage pile, marking its territory and building the midden. When this urine crystallizes, it acts as a glue holding the entire garbage pile together. Fossil debris held within the midden becomes mummified, preserving it indefinitely. As long as the midden is protected from water, such as under a rock ledge, it will persist. Packrat middens are aged using radiocarbon dating. Fossil middens have been found that were older than 50,000 years, the practical limit of aging them using radiocarbon dating.

The fossils contained within the midden preserve a record of the plants and animals that lived within a packrat's range (usually

**Repeat Photography
Stream Gaging**

30 to 100 meters) of the fossil site. Thus, this technique provides a very powerful tool for reproducing past biotic communities at a specific site. Also the plant parts are so well preserved that they can be identified to individual species. These specific identifications from localized sites makes possible more detailed reconstructions of the past plant distributions and past plant communities than is possible through other methods.



Midden contents

Research results from packrat midden studies on the Colorado Plateau have produced results showing that in the late Pleistocene era most plant species grew 2000 to 3300 feet (600 to 1000 m) lower in elevation than today. But rather than a simple lowering of Merriam's modern life zones, many of the plant communities were different than today's because of what has been termed individualistic migration of plant species. The individualistic movements of plant species have caused a reshuffling of plant assemblages resulting in different plant communities characterizing different time periods. These results imply that in the near future, plant communities will change both position and character due to global warming. Rather than simple migrations of plant communities, climatic change is going to result in individualistic responses from different plant species.

Research:

Packrat Midden Research in Grand Canyon. On the Colorado Plateau the ice age (Pleistocene) vegetation of the Grand Canyon has been determined through the analysis of plant fossils preserved in caves and fossil packrat middens. Large changes occurred as the most recent ice age ended and the Holocene era began.

Late Holocene Environmental Change in the Upper Gunnison Basin, Colorado. The Upper Gunnison Basin is a high elevation (3100 to 3600 m) region on the edge of the Colorado Plateau in southwestern Colorado. Its unusual ecological characteristics include an absence of plant and animal taxa that should occur here. Fossil and archaeological

evidence indicates that many of the missing species existed in the Basin during the late Pleistocene to middle Holocene.

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