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Occurrence of Oaks in Late Pleistocene Vegetation in the Mojave Desert of Nevada.—The nature of Pleistocene environmental change in Southwestern deserts is not well known. Quaternary fossil plant remains comparable to those found in eastern North America were thought to be non-existent in these deserts until Wells and Jorgensen (Science 143:1171–1174. 1964) reported that ancient wood rat middens are sources of abundant plant material. Modern wood rats(*Neotoma* spp.) gather most of the plant material found in their middens within thirty meters of the site (R. B. Findley, Univ. Kans. Publ. Museum Nat. Hist. 10:514–523.. 1958.), and fossil middens presumably also represent strictly local vegetation. Studies of such remains, together with advances in palynology, are providing evidence that changing vegetation has greatly altered the desert landscape during the last 40,000 years.

Two species of oaks, *Quercus chrysolepis* and *Q. dunnii,* not previously reported in late Pleistocene vegetation of the Mojave Desert, were found by the author to be present in ancient wood rat middens located in the Newberry Mountains, south of

Las Vegas, Nevada. It is unlikely that the vegetation of the area has been much altered by either ancient or recent human activities, particularly because the plant cover is too sparse to carry fire. Creosote bush *(Larrea tridentata)* is dominant up to about 1,100 meters on the alluvial fans that cover most of the area. Pinyon *(Pinus monophylla)*, oak *(Quercus turbinella)*, and juniper *(Juniperus californica)* are generally dominant above that level, although juniper also extends to a slightly lower level (above 950 meters). *Quercus turbinella* and *Juniperus californica* extend to less than 800 meters on several mesic sites. On the summit of Spirit Mountain, at about 1,700 meters, there is a small previously unreported population of *Quercus chrysolepis*.

Thirty wood rat midden sites were found in the study area (about 0.8 km^2) of granitic outcrops at about 850 meters elevation. The middens consisted of compact, indurated plant matter and dung, blackened and cemented with dried urine. They are found in crevices, under overhangs, and in shallow caves. Of the thirty sites inspected for woody plant remains, two contained pinyon, oak, and juniper; two had juniper and oak; one had oak only; nineteen had juniper only; and the contents of six are undetermined. Remnants of acacia, purshia, yucca, and some unidentified seeds and fragments were also recovered. Scrub oak *(Q. turbinella)* and juniper *(J. californica)* grow in the midden area at present, far below their normal altitudinal limit, growing in protected pockets that receive runoff from large rock exposures.

Radiocarbon dating was carried out with materials from a site selected because it contained the largest quantity and best preserved remnants of woody plants no longer growing in the immediate vicinity. There was a lens of *Pinus monophylla* needles in the midden material that was dated at 13,380 ± 300 years B.P. (Gak-1988). At this site another stratum of midden material contained remnants of *Quercus dunnii* (*Quercus palmeri* Engelm.) and perhaps *Quercus chrysolepis,* although remnants of the latter are too poorly preserved to be positively identified. Acorns from this stratum were dated at 9,500 ± 240 years B.P. (A–1017).

P. J. Mehringer studied middens from Sacatone Wash, 3.6 km south of this site, at 730 meters. These also yielded *Pinus monophylla* and *Quercus dunnii* and have been dated, respectively, at 19,620 ± 600 years B.P. (I–3659) and 9,490 ± 150 years B.P. (I–3669) (Mehringer, pers. comm.). Although Quaternary oak remnants in fossil wood rat sites are abundant in the Chihuahuan Desert (P. V. Wells, Science 153:970–974. 1966), this area is the first reported location for fossil late Pleistocene oak from the Mojave Desert.

Local evidence indicates an altitudinal depression for pinyon of over 300 meters during the late glacial. This agrees with evidence from elsewhere in the Mojave that the lower limit of the pinyon-juniper woodland lay at least 60 meters below its present level (P. V. Wells and R. Berger, Science 155:1640–1647. 1967). The local intrusion of *Quercus dunnii,* and perhaps also of *Quercus chrysolepis,* in early post-pluvial time is indicative of climatic warming. *Quercus dunnii* no longer occurs in the region at all, although Spirit Mountain offers some habitats that seem suitable for it. Although an altitudinal depression of 800 meters is suggested for *Quercus chrysolepis* since 9,500 B.P., this displacement might not be due solely to the regional temperature shift. The midden area rock rapidly channels runoff into pockets of soil at the base of the cliffs. These outcrops provide shade that permits the growth of *Quercus turbinella* far below its present average lower limit. *Quercus chrysolepis* could have occupied this habitat in a similar manner. The elevational change of pinyon that occurs under open slope conditions may not be directly comparable to the elevational change of *Quercus chrysolepis*, which today occupies more mesic microhabitats.

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