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POLLEN HISTORY OF THE AMERICAN SOUTHWEST

Reviewed by
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POLLEN HISTORY OF THE AMERICAN SOUTHWEST¹

Pollen analysis has come a long way since its formal debut in the presentation of a paper by von Post in Oslo, Norway, in 1916. Paul Martin's study on "The Last 10,000 years," reflects the development, refinement, and maturity of palynology in his interpretation of pollen diagrams from alluvial sediments in southeastern Arizona. The many sources of error inherent in pollen analysis are obvious and well known by palynologists,

¹ Martin, Paul S. 1963. *The last 10,000 years: a fossil pollen record of the American Southwest*. University of Arizona Press, Tucson. viii + 87 pp., 37 figs., 14 plates, \$4.50.

and Martin has taken some of the more important of these into consideration in his interpretation of post-pluvial climate, chronology, and vegetation in the Southwest, and pays particular attention to those peculiar to the region.

Martin has shown a great deal of courage as well as ingenuity and insight, in recognizing the vicissitudes of pollen analysis. The paucity of pollen in alluvial floodplain deposits composed largely of inorganic material, and probably of discontinuous deposition, as well as the tedious preparation of the sediments and counting of pollen would tax the intrepidity of the bravest palynolo-

gist. Martin points out, however, that floodplain deposits record the postpluvial vegetation more continuously than the lacustrine deposits of the pluvial lakes, which have been dry during most of postpluvial time. He defends the use of floodplain alluvium as a pollen record in spite of its obvious discontinuity of deposition, as well as its erosion and the possibility of redeposition of pollen from older deposits and slope wash. The problems involved in pollen transport by floods and normal stream flow from great distances are also considered, but distortion of the pollen record from this source may be minimized if the vegetation is largely homogeneous in the hydrographic basin providing the source of the pollen.

In spite of these obvious problems, Martin lays the ground work in a well discussed interpretation of the geological and physiographical setting of the region and the source of the sediments which provide the pollen record of the study. He also relates the characteristics of flash floods, the relative effects of winter and summer precipitation in arroyo cutting, and the influence of the biseasonal rainfall on the vegetation of the Southwest. In order to understand and interpret pollen profiles, in terms of recorded vegetation, it is most important to know and understand the ecological relationships of the present flora. When this is known, then another critical factor is the determination of the modern pollen rain and how accurately it represents the vegetation from whence it comes. Martin has done just this, and presents a thorough and elucidating discourse on the existing virgin flora with both synecological and autecological interpretations. This is followed by the results of a study of the modern pollen rain as determined by analyses of sediments accumulated in stock tanks, widely scattered over the region represented by the source of pollen of the postpluvial vegetation as interred in the alluvium. It is strange that so few studies have been made in relating the modern pollen rain and the degree to which it is quantitatively representative of the adjacent vegetation.

A detailed and critical study of the pollen size-frequency of the Arizona pine species is another attempt by Martin to minimize one of the sources of error in pollen analysis in a region where a large number of species of pine may have contributed pollen to the sediments. The reviewer has applied this critique to the many species of pine in parts of the Pacific Northwest and found it to be very significant in interpreting pollen profiles where several species of pine are represented. Consideration of the effects of different tech-

niques in the preparation, extraction, and counting of pollen, as well as a treatment of the statistical reliability of the number of pollen grains counted at each level, further supports the basic theory of pollen analysis—that it reliably portrays changes in the composition of vegetation of the community or area from which pollen is contributed to the sediments.

After consideration and evaluation of the above factors influencing pollen analysis, Martin proceeds to interpret the pollen diagrams of sediments from 13 sites in southern Arizona. With the aid of radiocarbon dates he presents his interpretation of climate, chronology, and vegetational history and relates it to Early Man and the extinction of the megafauna during the early part of postpluvial times. He questions the long held theory of an altithermal interval from 8,000 to 4,000 years ago in the Southwest. Instead, he believes that this period was marked by heavy summer precipitation, caused by an increased monsoon rainfall from the Gulf of Mexico, based upon an abundance of *Chenopodiaceae-Amaranthus* and *Compositae* pollen in the lowlands and pine in the mountains. The postpluvial climate is divided into three main periods; the first from 10,500 to 8,000 years ago climatically similar to the present, a less arid interval with intensified monsoon rainfall with the climate slightly wetter than at present from 8,000 to 4,000 years ago, and an arid period from 4,000 years to the present. Martin concludes that the large mammals of the Pleistocene became extinct not from the lack of vegetation during extreme drought conditions of an altithermal, but rather were killed by Early Man in quest of food. Their extinction is regarded as a cause of the development of agriculture, as supported by the first record of corn pollen.

The many phases of pollen analysis which have been applied to this study make it difficult to present a comprehensive review in this short space. The text is well supplied with diagrams, figures, and tables, most of them well designed and clearly depicting the information intended. In several cases, however, explanations are not complete on the figures and must be sought after in the text. A number of references to rather cogent work of others, are referred to through another's publications. While this may be common practice in writing, it would seem better to make direct reference and cite the paper in the bibliography. All in all, Martin has taken on a complex study in a difficult region and has made an excellent contribution to palynology.

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