

The Golden State

Geology of Northern California. EDGAR H. BAILEY, Ed. California Division of Mines and Geology, San Francisco, 1966. 520 pp., illus. \$6.

This volume was compiled for the National Meeting of the Geological Society of America held in San Francisco in November 1966; it supplements *Geology of Southern California*, which was prepared for a similar meeting in Los Angeles in 1954. A collection of generously illustrated papers by selected authors, it is a blend of historical and current thought so well documented that anyone wishing to undertake geologic research anywhere in Northern California will find it invaluable. The greatest demand for the book, however, may well be from an interested public, for California's development as a state has been profoundly influenced by its geology, starting with the discovery of gold in its streams and the Mother Lode and continuing with the extensive exploration and development of its oil fields in the Great Valley, the Coast Ranges, and more recently offshore. The spectacular

scenery of the Sierras is well known, and laymen will appreciate the geological descriptions here given.

But it is the shaking earth, reminding both geologists and the public of latent forces that are unleashed intermittently, which most strongly captures the imagination. The San Francisco earthquake of April 1906 spurred earnest research into the causes and effects of such earthquakes. Much of the movement occurred along the large fault, the San Andreas rift, which bisects the state as far north as Tomales Bay just north of San Francisco and then trends offshore parallel to the coast as far north as Cape Mendocino. Although there is general agreement that the western side is moving northward, the magnitude of the accumulated movement is debatable, and it is discussed in two chapters of this book.

The area dealt with in this volume extends to the Transverse Ranges and to the south end of the San Joaquin Valley and the Sierra Nevada Range. The physiographic divisions treated include the Klamath Mountains in the north, the southern Cascade Range and Modoc Plateau, the spectacular Sierras,

the Sacramento and San Joaquin valleys, and the Coast Ranges. The offshore is not slighted, for both the geologic map and the text cover the submarine topography and potential ore deposits of the offshore islands, the continental shelf, and the continental slope. The latter part of the book contains detailed and well-illustrated road logs of field trips that radiate out from San Francisco. The trips traverse routes to the Peninsula south of the Bay area and on to Hollister, to the Yosemite Valley, to Point Reyes, to Clear Lake, and into the northern Coast Ranges. An excellent generalized geologic map of the entire state, scale 1:2,500,000, is folded into a pocket in the back of the book.

The editor, Edgar H. Bailey of the U.S. Geological Survey, and his editorial committee are to be complimented on the selection of papers and the careful editing. The California Division of Mines is to be commended for producing such an attractive volume at so moderate a price.

EWART M. BALDWIN

*Department of Geology,
University of Oregon, Eugene*

A Study in European Prehistory

Le Solutr  en en France. PHILIP E. L. SMITH. Laboratory of Prehistory, University of Bordeaux, Bordeaux, France, 1966. 465 pp., illus. Paper, F. 120.

According to the author, this massive study (a revised version of his Harvard doctoral dissertation) is an attempt to organize and evaluate all extant data on the French Solutrean, in order to refine our understanding of the nature of this manifestation and its geographic and temporal position. In addition to a detailed description of Solutrean assemblages from over 140 archeological sites (which constitutes almost 300 pages of the book), the author presents a history of research on the Solutrean, a consideration of its temporal position, a discussion of Solutrean techniques of stone-tool manufacture, a delineation of geographic areas of ap-

parent relative stylistic similarity within some Solutrean stages, a scheme for the interpretation of the spread of Solutrean developments from a center of origin to surrounding areas, and some tentative conclusions about relationships between the Solutrean and earlier industrial complexes. The book represents a monumental, even unique achievement. No other European industrial complex has ever been examined with such thoroughness and attention to detail. The comparative material that Smith presents includes an examination of collections from England and Belgium and a general discussion of the Spanish data, so that the work is actually much more encompassing than its title suggests; it is the definitive study of the Solutrean.

In a study of this scope it is always possible to find sections that need

qualification or rectification. Happily, the praiseworthy aspects of Smith's book far outweigh the others. I shall confine myself, in this review, to brief mention of some of the work's soundest attributes and some aspects that I think could stand revision in future editions. It must be said that the length, thoroughness, and complexity of the study are so great that there has been ample opportunity within its limits for Smith to approach single problems in a variety of ways, with a diversity of methodological tools. Often he has reached theoretical insights whose implications, had they been translated into practice, would have obviated most of my negative criticisms.

Among the admirable features of the book are Fran  ois Bordes's sensitive translation of the text into French and Pierre Laurent's tool drawings. The high quality of Laurent's illustrations adds considerably to the value of the book as a research tool, as well as increases the intelligibility of artifact descriptions in the text. Bordes conveys nuances of American anthropological usage usually missed by French pre-

historians. Much philological verbiage has been wasted in defense of the usual practice in French archeology of translating the English word *culture* as *civilisation* in apparent ignorance of the fact that Lévi-Strauss (1) and other French anthropologists have used *culture* for some time. Bordes, refreshingly, follows the anthropological usage.

Smith is to be commended for the quality of his descriptive study of Solutrean artifact collections. Where possible, he relies heavily on the systematic lithic artifact typology and graphic method for interassemblage comparison developed for Paleolithic studies by François Bordes, Denise de Sonneville-Bordes, and J. Perrot (2). This method involves the construction and comparison of graphs of the cumulative percentage representation in each collection of stone artifact types arranged in a fixed order. (A certain minimum number of tools, commonly about 100, from any single provenience is usually thought necessary for the construction of such graphs, if spurious results are to be minimized.)

The backbone of the descriptive analysis is afforded by material from the Bordes-Smith excavations at Laugerie Haute conducted between 1957 and 1959 and continued by François Bordes in 1960. Laugerie Haute, Smith points out (p. 57), is critical to an understanding of the nature of the relationships between Solutrean variants, since it is "the only site known in Europe where all the principal phases recognized in the Solutrean are present and in good stratigraphic sequence." Cumulative percentage graphs and tables showing the number of artifacts of each recognized type are presented for each of the occupation levels in the Bordes-Smith excavations. Besides these collections, the body of quantified data includes the Solutrean materials from Pré-Aubert, les Jean-Blancs (Chastaing and Bouyssonie collections), les Bernoux, le Roc de Sers, le Placard, le Figuier, and Grotte Chabot classified by Smith; materials from the Peyrony excavations at Laugerie Haute, from Badegoule, la Tannerie, Pech de la Boissière, les Jean-Blancs (Peyrony collections), and le Fourneau du Diable counted by de Sonneville-Bordes, and those from Solutré reported by Combier (3). Artifacts from other collections either were inadequate in quantity for the application of the method or were inaccessible, in which case Smith presents only a résumé of published in-

formation. Unfortunately, although Smith has made some refinements in the taxonomy of specifically Solutrean artifact types, he presents a detailed account of the occurrence of the new subtypes only in the descriptive text dealing with a few occupation levels; nowhere in the tables of artifact frequencies does he list the subtypes. The utility of subdividing the artifact types for the purposes of the study seems greatly lessened by this omission.

At present, a variable number of Solutrean facies may be distinguishable. The designations usually given to the three most commonly recognized facies—"Lower," "Middle," and "Upper" Solutrean—make it clear that the dissimilarities between the facies are commonly thought to be due primarily to their different positions in a single phylogenetic sequence. At some sites it is certainly true that some facies stand in consistent stratigraphic relationship to other facies. However, other factors which might contribute to inter-facies difference are usually ignored. Few prehistorians who have described these materials have considered the possibility that differences in technological function of given assemblages or stylistic variation between distinct contemporary sociocultural groups or independent traditions might be responsible for some (perhaps a considerable amount) of the variation in Solutrean assemblages. Smith is commendably more open-minded in his approach. Although he is not entirely consistent, he usually identifies evolutionary stages ("Proto," "Lower," "Middle," "Upper," "Final") within the Solutrean by the occurrence of certain indicator forms (from the Proto-Solutrean through the Upper Solutrean these are, respectively, atypical unifacial points, typical unifacial points, "laurel leaves," and single-shouldered points sometimes in combination with "willow-leaves," whereas the Final Solutrean has all the tools characteristic of the Upper Solutrean but lacks unifacial points). Within the stages so defined, he designates groups of collections that he feels are stylistically different in ways that show the simultaneous existence of distinct traditions.

Smith's criteria of stylistic distinctness are detailed differences in the shapes of the cumulative percentage graphs of collections or, for ungraphed collections, formal artifact characteristics which he considers pertinent. Because the Solutrean stages are defined

in cumulative fashion, each stage having one or a few indicator-forms super-added to the types persistent from earlier stages, if examples of the indicator artifact types are not numerous and homogeneously distributed horizontally throughout the site, sampling error is very likely to produce apparent differences between collections which are not really significantly different. Smith is well aware of this. He ascribes the differences between collections recovered from levels 9 to 3 at Laugerie Haute West by the Bordes-Smith excavations and collections recovered from the same levels by the Peyronys to this cause, and assigns these levels to the Upper Solutrean although the Bordes-Smith levels produced no single-shouldered points (p. 143). Whether Smith is right or wrong in his conclusions, his recognition of the possible role of these nontemporal factors in causing interassemblage difference is valuable. An obvious and desirable next step, building upon Smith's work, is to attempt to evaluate the contribution of each causal factor to the differences between collections. Such a step would give Paleolithic studies considerably more impetus in the years to come.

Some features of the work are considerably more controversial than those I have mentioned so far. Among the most insecurely grounded are Smith's recognition of the Proto-Solutrean and his delineation of the temporal relationships between occurrences of occupations which pertain to the same Solutrean phase, in different geographic areas.

From level G at Laugerie Haute West, the Peyronys recovered a collection of artifacts which they referred to the Proto-Solutrean, conceived of as a development prior to the Lower Solutrean, since level G was stratigraphically earlier than Lower Solutrean at the site (4). Smith recognizes similar levels at two other sites, Badegoule and le Trilobite, and although no Proto-Solutrean materials were recovered from the Bordes-Smith excavations at Laugerie Haute West, he feels that the case for the existence of the stage is sufficiently sound for its recognition as stratigraphically prior to the Lower Solutrean. Although the Proto-Solutrean may be a distinct Solutrean facies, its stratigraphic relationship to other facies is far from conclusively demonstrated. At Laugerie Haute, the Peyrony collections from level G were mixed with

Aurignacian V materials. At Badegoule, the Proto-Solutrean level underlies the Middle Solutrean, not a Lower Solutrean level, and at le Trilobite, the collection (which Smith was unable to study) comes from the only Solutrean level at the site. It would seem to me premature, in the absence of other evidence, to discount the possibility that the Proto-Solutrean may be a local or functional Lower Solutrean variant rather than a prior phylogenetic stage.

Smith indicates (p. 385) that the common tendency to view all collections from the same Solutrean stage as exactly contemporaneous negates the possibility of determining direction and rates of diffusion of artifact complexes. His own scheme of development and diffusion of Solutrean phases purports to show that the stages are, in fact, out of temporal phase from region to region. However, lacking convincing chronometric data, he bases his scheme primarily on morphological similarity between artifact complexes, and development in these complexes is compared to a standard derived from the relatively complete Solutrean sequence at Laugerie Haute. This involves the fallacious supposition that even where independent local developmental traditions exist, their evolutions must pass through the same steps, defined by the same stage-marking artifacts, that are perceivable at Laugerie Haute. A chart (p. 385) of the temporal relationship between Solutrean phases in different regions appears to show that Solutré and the Pyrenean sequence exhibit relative stagnation or retardation with respect to the Laugerie Haute sequence, but in both these cases Smith has ignored what he elsewhere recognizes as evidence that those developmental sequences involve idiosyncratic characteristics and indicator-forms that are not comparable with developments at Laugerie Haute (pp. 294, 337-38). In this case also Smith is unconvincing.

As will have been evident, Smith relies heavily on the evidence of artifacts, especially lithic artifacts, in his presentation. In justification of this approach, it must be pointed out that phase recognition in the Solutrean has always been based on the artifactual materials. In fact, even in the primary reports the paucity of published information about other evidence from Solutrean occupation levels is rather frustrating. Smith's interpretation of Solutrean habitats has been greatly

hampered by this fact. Largely, I suspect, because of the spotty nature of the available information, Smith occasionally slights the evidence that does exist. His résumé (p. 64) of the Peyrony faunal list from level G at Laugerie Haute West does not include *Cervus*, and his summary of fauna from Cheynier's excavations at Badegoule (5) is far from complete, omitting, for example, *Mustela nivalis* and *Felis sylvestris* from the Proto-Solutrean and dropping chamois, wolf, fox, hare, rodents, and birds from the Solutrean II summary. These oversights are unfortunate, since they detract from the utility of the book to general students or specialists interested in the reconstruction of past local environments and in the extent of utilization of those environments by prehistoric men.

In spite of these and other faults of detail, the general quality of Smith's work is exceptionally good. It will be invaluable as a comprehensive and authoritative reference to anyone interested in Old World prehistory. One of its most important consequences will, I hope, be the development of increased interest and activity in the scientific study of prehistory.

LESLIE G. FREEMAN

Department of Anthropology,
University of Chicago,
Chicago, Illinois

References

1. C. Lévi-Strauss, *Tristes tropiques* (Plon, Paris, 1955).
2. F. Bordes, *Recherches sur les limons quaternaires du bassin de la Seine* (Masson, Paris, 1953); D. de Sonneville-Bordes and J. Perrot, *Bull. Soc. Prehist. Franc.* 51, 327-35 (1954); 52, 76-79 (1955); 53, 408-12 and 547-59 (1956).
3. J. Combier, "Les fouilles de 1907 à 1925. Mise au point stratigraphique et typologique," in M. Thorat R. Riquet, J. Combier, "Solutré," *Trav. Lab. Géol. Fac. Sci. Lyon*, n.s. 2, 93-224 (1955).
4. D. Peyrony and E. Peyrony, "Laugerie Haute, près des Eyzies (Dordogne)," *Arch. Inst. Paléontol. Humaine Mém.* 19 (1938).
5. A. Cheynier, "Badegoule. Station solutréenne et protomagdalénienne," *Arch. Inst. Paléontol. Humaine Mém.* 23 (1949).

Prehistory in the Americas

An Introduction to American Archaeology. Vol. 1, North and Middle America. GORDON R. WILLEY. Prentice-Hall, Englewood Cliffs, N.J., 1966. 540 pp., illus. \$16.95.

This is the first volume of a projected two-volume work designed to give an integrated synthesis of New World prehistory. American archeology is a vast and complex subject with many facets, the ordering of which

presents an extremely difficult task. To complicate the problem further there are many differences of opinion among experts in the interpretation of the incomplete data with which the anthropologist must work when dealing with prehistory. There are no adequate written records such as exist for so much of the Old World.

Willey's approach has been to divide the area covered into 16 major cultural traditions, dealing with the chronological, regional, and ethnographic features of each. These range from the very early, simple, and scantily documented Big Game Hunting and Old Cordilleran traditions to the highly advanced Mesoamerican tradition of the south. Each tradition is in turn divided into chronological stages which demonstrate the growth and development within it. This is not to say that it is possible to fence in each division like so many agricultural plots, but the traditions do exist and probably constitute the best framework for presenting the data. Within this theoretical frame Willey has described in satisfying detail the outstanding features of each tradition, such as its material culture and, where this may be inferred, its social and political organization.

The diversity of the American Indian is immense. It is estimated that at the time of Columbus there were more than 2000 separate languages spoken in the Americas, none of which may with certainty be related to any of the Old World. Indian cultures varied from those of the simplest hunting and gathering groups to highly urbanized, civilized peoples, with vast differences in social and political organization and technological skills. Some groups adjusted to life in the frozen Arctic, others to hot arid deserts or tropical jungles. From the Arctic Eskimo to the inhabitants of Tierra del Fuego can be found in varying degrees almost the complete scale of human adaptations.

It is generally agreed that the American aborigines derived from Asia. All have dark hair and brown eyes. Otherwise there is a wide range in physical types, including variations in blood type, stature, features, and skin color. Is this the result of immigration by peoples of different origins over a long period of time, or of variations that took place after arrival in America? Even more difficult is the problem of the origin of the culture traits that were