

parent in his comparisons of vocalizations between subspecies. "Greatest attention is given to those vocalizations concerned with intragroup cohesion, because they are the most likely to be involved with maintaining interspecific segregation and thus to be evolutionarily more conservative than other call types." The taxonomy of the red colobus is in a confused state by comparison with that of the other colobus monkeys, and the similarities and differences in the vocalizations between five subspecies are used to clarify their taxonomic status.

Throughout the book, field methods and analytical procedures are fully explained. Their value will be appreciated by anyone who has ever attempted (or who plans to attempt) a systematic quantification and definition of the complex relationships between a species and its forest biome. Approximately half the book is devoted to the elucidation of such ecological relationships. They are dealt with in detail under such headings as food habits, ranging patterns, temporal distribution of activities, censuses of anthropoid primates, interspecific relations, and mortality.

The book is clearly written and well illustrated. At the end of most chapter sections the results from the red colobus are compared with those of studies of other Colobinae. In keeping with the author's reluctance to speculate in the absence of adequate data, a general synthesis relating these data to current theories of sociobiology and ecology is withheld until the final chapter. Here, comparisons are drawn primarily between parallel studies of other primates in the Kibale Forest that were carried out by Struhsaker and his co-workers according to common goals and research techniques. This is the most interesting chapter of the book, as we gain not only an overview of the place of the red colobus in its forest community, but also new insights concerning such topics as ecological niche separation among sympatric rain-forest monkeys, ecological parameters affecting grouping tendencies among different species, the influence of the dispersion pattern of a monkey species' food on its social organization, and the relation of similarities and differences in social organization between various species to their presumed evolutionary histories.

The heuristic importance of the undisturbed rain forest is exemplified by this book, and the need for rain forest conservation is underscored as we learn that the density and diversity of primate species in undisturbed rain forest are much greater than in secondary forest of the same area.

Struhsaker's book undoubtedly will be an indispensable source of information for

all concerned with sociobiology, ecology, and conservation. In addition it may serve as a model to those intending to undertake similar research, particularly on rain forest species.

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## Interpreting Burial Customs

**Death and the Afterlife in Pre-Columbian America.** Papers from a conference, Washington, D.C., Oct. 1973. ELIZABETH P. BENSON, Ed. Dumbarton Oaks Research Library and Collections, Washington, D.C., 1975. x, 196 pp., illus. \$10.

There are two recurrent themes in this loosely organized group of papers by archaeologists and ethnographers—the sociology of burials and the mythology of the afterworld.

The sociological approach developed from Hertz's (1) studies of death and burial as a *rite de passage*, through Brown's (2) collection of studies of burial remains as a source of information on the differential distribution of social roles. Its basic assumption is that the position of an individual in various socioeconomic status hierarchies is recorded in his form of burial and burial accouterments. Equating access to exotic resources with access to other scarce commodities, including intangibles such as authority as well as basic economic resources, this view assumes that the greater the differential distribution of status goods associated with burials, the more stratified the society. Using this reasoning, James Brown examines the "Southern Cult" at Spiro in the book under review and Edward and Jane Dwyer discuss Paracas burial textiles. Both articles attempt generally to elaborate on the degree of stratification within status hierarchies by examining the distribution of goods within sets of burials.

The mythological approach views burial artifacts as representing "worlds beyond the grave and *not* worlds with which we are familiar" (p. 192). Thus, the interpretation of burial artifacts concerns itself with the "esoteric or occult matters which to the Indians were probably far more important than economic or social conditions" (p. 193). Several authors proceed to take what had been considered genre burial art and give it new meanings as representations of the "nether" world. For example, Peter Furst uses ethnographic analogy to suggest that West Mexican Nayarit tomb art illus-

trates not merely a populist view of life but an ancient world view which saw the living and the dead coexisting in one arena with only a few critical and fragile barriers between them. Thus, the so-called "two-story houses" (see illustration) become representations of a house of the living above ground and a counterpart dwelling of the "dead" below. Under Michael Coe's deft hand, Maya pictorial burial pots, which many believe to be records of actual events in Maya court life, are found usually to illustrate the adventures of the "hero twins" in the Maya underworld—functioning as a sort of "Book of the Dead" for the Maya elite.

These sociological and mythological approaches need not be contradictory. If Coe is right about the "hero twins" myth, Maya pots can no longer be taken as directly representing historical scenes. However, this does not mean that access to exotic burial goods was not differential or that their presence does not relate to the economic and social role of the deceased. In turn, concern with the economics of their manufacture and distribution does not preclude the study of them as mythological. And as Coe and Furst point out, both the world of the living and that of the dead are depicted through familiar forms. Although the Maya pictorial palaces may not be the "Maler Palace" at Tikal, they do give some idea of what palace interiors must have looked like and how people in them behaved toward one another.

The importance of the relation between the sociology and the mythology of death can be seen in the crucial, but usually implicit, assumption made by the sociological authors that a deceased's relative position within status hierarchies is directly recorded in the goods placed in his grave at death. A study of a modern mortuary in Tucson, Arizona, by J. Moosman (3) has suggested that this may be an unwarranted assumption. Moosman found that among low-income Mexican-Americans there were a wide variety of expenditures that did not seem to relate to socioeconomic status. Often the cause of death dominated significantly, through shared concepts about death and the afterlife, over socioeconomic status in affecting the level of expenditures on funerals. A person who had died of a drug overdose, no matter what his family background, was rarely given more than the bare essentials of a funeral, whereas young women who died of breast cancer, even those from the poorest families, were the subject of the greatest expenditures, many made possible by contributions from a wide network of distant kinsmen. This example obviously does not disprove any of the interpretations in the book, but it

does suggest the need to study the relation between practices associated with death and the native's own views of the afterlife.

Social and economic background are likewise important to the study of the mythology of death. Without this background, the "mythologies" may become just so many exotic tales of strange people with strange ideas. Cecelia Klein, in her article, argues that the Aztecs were not obsessive or irrational in their interest in death and sacrifices because "the infamous death cult is seen as resting on a highly rational cosmological base" which saw human sacrifice as necessary to the world's survival. Most cosmologies are rational when viewed in context, but few carried sacrifice to the fine art of the Aztecs. The real question is why the death cult was a part of the rational cosmology. One tentative answer is provided by the economics and sociology of the Aztec Empire as described by Cook (4). Hearts may have been burned, but the rest of the sacrificed victims often ended up as Aztec dinners. Cook suggested that Aztec warfare and sacrifice may have been a way to cut down exploding populations in the Valley of Mexico as well as hedges against notoriously variable harvests.

Thus, the two approaches have something to offer each other, but the potential is not realized. (Brown and the Dwyers do attempt to deal with mythology a little, but they seem uncomfortable with it; only Furst succeeds in pulling the two approaches into a semblance of integration.) Most of the articles are designed to reconstruct the specifics of the view taken of death and the afterlife in some one particular culture. This is clearly a goal of the book: "to discover what these objects meant to the ancient people who made them" (p. 196). This does lead to interesting reading, especially Benson's discussion of Mochica burial pottery. Little or no attempt is made to bring a unified view to the subject, however. This is best illustrated by Johannes Wilbert's contribution, which describes in the minutest detail the afterlife envisioned by the Warao of Venezuela and the game plans people employ to assure themselves a place in the "hereafter." The article does not mention anything about funerals or specific burial customs—how people are interred, what ceremonies are performed, what grave goods are involved, who participates in the funeral. The visions conjured up in this book of the world of the living and the world of the dead thus remain separated in limbos of their own.

As separate as the sociology and mythology approaches are kept, their applications in this book share some short-

comings. First, only two of the articles consider the archeological context of burials in detail. This is largely because so many of the available burial goods were unearthed by looters rather than by archeologists. But it is also because few studies have advanced to a stage where contextual evidence is seen as critical. This leads to a second problem. One of the major attractions of graves and grave goods in the study of social systems and even mythologies is that burial data are quantifiable. Burial pots can be measured and weighed, depictions can be typologized, and replicated elements can be counted. Moreover,

many types of inferences concerning symbolism can be substantiated by recording the repeated association of elements. Yet none of the papers here is based on the clear presentation of quantified data. Statements with qualifications of "sometimes," "occasionally," and "least frequently" appear in "hordes" in place of tables and statistics.

Even with, or perhaps because of, these shared drawbacks, the mythology and sociology approaches remain separated and the idealists and the materialists are clearly identifiable. The view that the sociology and the mythology of death and burial are



"Polychrome Nayarit house model of the type generally described as a 'two-story dwelling.' Height, 47 cm. Four individuals are seated within the two-walled house, three others in front of it. Below, two individuals are seated inside a rectangular entrance to an enclosed chamber, flanked by a symmetrical five-stepped stairway, somewhat resembling the outlines of a five-level pyramidal temple platform. The roof of the house above and the facade below are covered with a repetitive design resembling the Huichol yarn cross, or *tsikúri* . . . , which, in one form, functions as a protective symbol for children and, in another, as a spirit trap or barrier for the dead, in which case it is called *túwe*, 'jaguar,' by some Huichol." [Minneapolis Institute of Arts. Photograph courtesy of Alfred Stendahl. Reproduced from *Death and the Afterlife in Pre-Columbian America*]

connected is not new. What would be innovative is a study like Moosman's, of their relation from both idealist and materialist perspectives. Only from such studies which provide quantified data can general principles be extracted to bridge some of the gaps between the realities of death and visions of the afterlife in Pre-Columbian America.

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#### References and Notes

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2. J. A. Brown, Ed., "Approaches to the Social Dimensions of Mortuary Practices," *Am. Antiq.* **36**, no. 3, part 2 (1971).
3. J. E. Moosman, "Ethnographic Funerals and Archaeological Burials: The View from the Mortuary," unpublished manuscript, Arizona State Museum, Tucson.
4. S. F. Cook, "Human sacrifice and warfare as factors in the demography of pre-colonial Mexico," *Hum. Biol.* **18**, 81 (1946).

## Surfaces of Solids

**Surface Physics of Materials.** J. M. BLAKELY, Ed. Academic Press, New York, 1975. Two volumes. Vol. 1. xiv pp. + pp. 1-278, illus. + index. \$29. Vol. 2. xiv pp. + pp. 279-548, illus. \$27. Materials Science and Technology.

Surface physics and chemistry are old subjects. In their long history, they have grown in a rather haphazard way. They lack coherence and have been plagued by an unusually large collection of poor experiments, wrong data, and occasional bad theories.

The present sophistication of solid state physics and chemistry and the pressing need of today's technology to develop materials for chemical, engineering, electronic, and manufacturing purposes has accelerated the rate at which surface research has been moving. The motion, however, has not always been forward, and keeping up with the literature—and, of course, distinguishing the good from the bad and the right from the wrong—is a very difficult task.

The present book of ten chapters on the different aspects of surface research is intended to be a critical review that "attempts to predict the most profitable avenues for future research." The authors "are all individuals who have made substantial contributions to the development of [the] areas about which they have written."

I found the subjects and the authors very well chosen. The subjects range from the generally important and somewhat stale-

mated subject of surface crystallography, through electronic structure and transport, statistical thermodynamics of surfaces, and surface vibrations, to chemical analysis of surfaces and adsorption, segregation, and chemisorption on surfaces. The omission of magnetism and magnetic properties of surfaces is not easy to understand, but it does not mar the quality and the usefulness of the rest of the book.

I found particularly appealing the emphasis on the new physical and chemical methods for studying surfaces. For example, low-energy electron diffraction, the various forms of photon spectroscopy, ionization spectroscopy, atomic beam scattering, and ion mass spectroscopy are repeatedly discussed in connection with the various aspects of surface research. The reader can easily gain a realistic view of the present state of the art. He can also, through examples and reports of controversies, infer some of the limitations entailed by these methods.

In a similar way, the theoretical aspects of surface research are presented in bits and pieces, mostly from a subjective and rather partial perspective, but the book as a whole provides a fairly comprehensive view of what is being done and what lies ahead.

The presentation of the book is generally satisfactory, although it is sprinkled with misprints. Its illustrations are many and useful, but I find it annoying that they have been reduced in size in a completely random way, so that some complicated figures are too small to convey useful information and some trivial one-line graphs occupy three-quarters of a page. These are, however, minor irritations in a useful book.

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## Macromolecules

**Ionic Polymers.** L. HOLLIDAY, Ed. Halsted (Wiley), New York, 1975. xii, 416 pp., illus. \$43.50.

This book is a collection of eight contributions by 11 authors. It treats a specialized branch of polymer science that can be said to be quite new, the study of polymeric molecules containing ionic or salt groups. The subject matter encompasses a wide span of structures, from the wholly inorganic silicates and phosphates to the largely hydrocarbon-like ethylene-acrylate copolymers. The editor, Holliday, claims that the book attempts to produce a sys-

tematic and integrated picture of the ionic polymers, both organic and inorganic, and, in my opinion, the attempt has been largely successful. In an introductory chapter, Holliday provides an overview that serves very well to put the succeeding chapters in context. An important feature of the book is its insistence on treating wholly inorganic materials such as polyphosphates and polysilicates in terms familiar to polymer scientists who are mostly concerned with organic molecules. In this connection, the chapter by H. H. Ray on inorganic glasses as ionic polymers is especially instructive.

The chapter by Ruskin Longworth on ionomers deserves mention. The term "ionomer" is used generically by the Du Pont Company to describe polymers consisting of a hydrocarbon backbone and pendant acid groups. These groups, which may be carboxylic acids, sulfonic acids, or others, are neutralized partially or completely with various cations. Some of these ionomers have taken on considerable commercial importance, particularly in coating applications, where their optical clarity, outstanding toughness, and good adhesion to high-energy surfaces make them perform better than conventional coating materials. Longworth presents a comprehensive summary of the considerable body of work that has been done on ionomers; from preparation and characterization to studies of structure, morphology, and rheological properties.

The systematic investigation of the properties-structure relationships in ionic polymers is at a very preliminary stage of development. This book points up this fact with striking clarity and provides the first comprehensive guide for the exploration of this largely unknown territory.

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**Advances in Chromatography 1975.** Proceedings of a symposium, Munich, Nov. 1975. A Zlatkis, E. Bayer, L. S. Ettre, and I. Halász, Eds. Elsevier, New York, 1975. xvi, 736 pp., illus. \$74.95.

**Advances in Holography.** Vol. 1. Nabil H. Farhat, Ed. Dekker, New York, 1975. xii, 170 pp., illus. \$17.50.

**Advances in Image Pickup and Display.** Vol. 2. B. Kazan, Ed. Academic Press, New York, 1975. xiv, 254 pp., illus. \$26.

**Agricultural Pharmacy.** Kenneth Redman. Published by the author and distributed by Stu-

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