ter, the elaborate pecked and polished stone "mortars" of the central highlands occur in no context suggesting a use for food preparation, or even grinding; they are not so used ethnographically.

In Tasmania, where 19th-century natives did not eat fish, the earliest human debris found so far shows fish constituted up to 20 percent of the meat consumed. These lower levels of the earliest Tasmanian site—Rocky Cave, in the northwest—show a gradual increase in the proportion of unmodified bones to bone tools (from five marsupial bones per bone tool to 68 bones per bone tool). A comparable change is signaled by the increase in the proportion of stone tools to bone tools (from two to 20 stone tools per bone tool). Later levels of the Rocky Cave site lack bone tools. Such items were used by 19th-century Tasmanians in the making of bark canoes, skin cloaks, and water containers.

A weakness in White and O'Connell's overview is their uncritical acceptance of the work of some of their colleagues. Foremost of these oversights is the lack of challenge of the radiocarbon dating of Lake Mungo material. This site group has a date of 33,000 to 24,000 years ago derived from "freshwater mussel shell." Major radiocarbon specialists have long concluded that freshwater shell is not a sound basis for dating a culture; it often yields overly old results, yet sometimes the dates are skewed in the opposite direction; possibly such material should simply not be submitted for dating.

If the Lake Mungo date is unacceptable, what is at present the earliest proof of human occupation of Sahul? Review of White and O'Connell's presentation suggests it is to be found in levels 28 through 30, at Devil's Lair, where dates of 24,000 to 27,000 years ago have been reported.

White, O'Connell, and their Australian (and American Australianist) colleagues are to be complimented that only 25 years after the first work by professionally trained archeologists, only 15 years after the production of the first locally awarded Ph.D., such a series of stimulating findings concerning a continent has been produced. New models for evolutionary change, both biological and cultural, have been offered. North American scholars should not overlook the work in Sahul prehistory. We can but hope that overviews of the quality of this one will be produced regularly.

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Classic Ore Deposits

Precambrian Sulphide Deposits. H. S. Robinson Memorial Volume. R. W. HUTCHINSON, C. D. SPENCE, and J. M. FRANKLIN, Eds. Geological Association of Canada, Waterloo, 1982 (distributor, GAC Publication Division, Business and Economic Service, Toronto). viii, 792 pp., illus. C$57; to members, C$47. Geological Association of Canada Special Paper 25.

About half of this book is made up of papers presented at a symposium sponsored by the Geological Association of Canada during their joint meeting with the Geological Society of America and the Mineralogical Association of Canada in Toronto in 1978. The other half is made up of solicited papers. The book has been a long time in coming, but it turns out to be well worth the wait, and, fortunately, the papers are not of the type that becomes dated rapidly.

The book opens with a paper comparing the metallogeny of the Superior, Slave, and Churchill provinces, in large part a comprehensive summary of deposits, their production history and reserves, with notes concerning their geological setting. Three papers then follow describing the geology of specific areas; these are a curious inclusion, since the areas described are relevant to only a few of the deposits covered in the book.

The nucleus of the book is a series of 18 papers describing massive sulfide deposits, all but two of which are located in Canada. Nine of the deposits would be accepted by all economic geologists as volcanogenic massive sulfides. The papers describing most of the deposits ascribe their origin to exhalations of hot brines on the sea floor. Relatively little is contributed in the way of advancing our understanding of exhalative processes, but the papers provide a valuable account of the geology of this class of deposit. Particularly welcome are the first comprehensive account of the large Crandon deposit in Wisconsin and the description of the classic, highly metamorphosed Geco deposit north of Lake Superior. The Agnico Eagle deposit has all of the hallmarks of a volcanogenic massive sulfide deposit, but it carries gold rather than copper and zinc. The paper describing it provides important input into the current argument about the formation of Archean gold deposits.

Whether because of legal complications, the number of geologists involved in their study, or just their complexity, some of the world's classic deposits are never written up comprehensively. In this regard, a paper in the book on the 160-million-ton Sullivan ore body rectifies a major lack. Finally, we learn from COMINCO geologists in print what they have been showing us during mine tours for so many years—that the deposit is exhalative in a sedimentary setting, that it is located within a former sea-floor depression, and that the massive core of the deposit overlies the main conduit for the mineralizing brines.

A paper on the Redstone copper belt of the Mackenzie Mountains is an important addition to the Copper Belt literature, because it reviews the geology of the area in the light of recent ideas on the significance of the sebkha environment to the genesis of this type of deposit. In the current economic climate these deposits constitute perhaps the most attractive target for copper exploration, and this paper is a must for anyone interested in identifying the environment in which such copper deposits are likely to occur.

The Thompson nickel belt is underrepresented in the literature, and thus a paper on it in the book is welcome. The paper is important in that it emphasizes the volcanic rocks of the belt more than has been done in the past, pointing out that highly magnesian lavas are present. Personally, I was disappointed that individual deposits did not receive more attention, including more plans and cross sections and data on metal ratios, if not grades. The district is 25 years old, and a summary of deposits and prospects, their approximate size and type, as has been provided for the much more recent Kambalda nickel camp in Western Australia, would have been most helpful.

Though the Thompson deposits are interpreted on the basis of a magmatic model, Robinson and Hutchinson interpret the Redstone nickel sulfide deposit, associated with Archean komatiite flows (in Ontario and having nothing to do with the Redstone copper belt of the Northwest Territory) as exhalative. Their key evidence is the presence of a metasomatically chloritized dacite layer between the ore and the overlying ultramafic rocks, which would prevent the sulfides from settling directly from the latter. In a summary paper Hutchinson also refers to nickel sulfides interbedded with chert at Jan shoot, Western Australia, as evidence of an exhalative origin. I have seen the location at Jan; the interbedded sulfide and chert occur within a zone across which massive sulfides grade into sulfide-free banded chert and in which the sulfides appear to be penetrating and replacing the chert. Anyone who has had occasion to handle molten iron sulfide oxide liquids knows the ex-

tent to which they "wet" silica-rich materials, creeping up the walls of tubes and penetrating the very finest of cracks. I suggest that the introduction of molten sulfide can explain its presence in the chert at Jan and perhaps at Redstone as well.

In conclusion, this book offers careful documentation of a series of deposits most of which have never been documented properly before. It does not contain a wealth of geochemical data and, with certain significant exceptions, does not present new ideas on ore genesis. The editors and the initiator of the Robinson Symposium, Paul M. Kavanagh, have achieved the even more difficult task of persuading mining company geologists to take the time to describe their deposits, many of them classics, for posterity. Anyone who is interested in what these classic deposits look like cannot afford to be without the book.

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Lizards

Lizard Ecology. Studies of a Model Organism. RAYMOND B. HUEY, ERIC R. PIANKA, and THOMAS W. SCHOENER, Eds. Harvard University Press, Cambridge, Mass., 1983 x, 502 pp., illus. $35.

The approximately 3000 living species of lizards make up one of the most diverse elements of the world's terrestrial fauna. Because lizards, like birds, are predominantly diurnal and often conspicuous, they are well suited for the investigation of various types of ecological questions. The past decade has seen a large increase in the number of studies of lizards, and this symposium (which took place in 1980) undertook the challenging task of assessing the current state of the field.

The 16 chapters are divided into three sections, each with a brief introduction. Several shortcomings are evident in the format and preparation of the volume: I found the absence of chapter summaries a handicap, and the literature citations are grouped at the end of the book but divided by chapters, thereby combining the worst features of both arrangements. The index is inadequate: "behavior," "model," "mortality," "optimality," and "selection" are only a few of the important entries that do not appear.

The first section, Physiological Ecology, is the shortest and does not fully represent the scope of work in that area. Studies of the thermal relations of lizards have been in the forefront of environmental physiology, and work on water relations has been nearly as extensive, but neither topic is included. The chapters on activity metabolism by A. F. Bennett and on biophysical models by W. P. Porter and C. R. Tracy are, to a large extent, shorter versions of material presented by Bennett and Tracy in volumes 12 and 13 of the *Biology of the Reptilia* (edited by C. Gans and F. H. Pough, Academic Press, 1982). In contrast, K. A. Nagy's analysis of the annual energy budget of the small iguanid lizard *Uta stansburiana* is new and presents one of the most detailed applications to date of the doubly labeled water technique to field studies of animal energetics. The potential errors in estimation of energy flow with this method are numerous, but in the laboratory Nagy found only a 7 percent difference between estimates of energy flux obtained with doubly labeled water and estimates based on calorimetric measurements of food and feces. If similar accuracy can be obtained in field studies, calculations of energy flow at the level of populations are credible.

The second section, Behavioral Ecology, is dominated by a masterly review of sexual selection and territoriality by J. A. Stamps. Her analysis is limited to lizards, but the model she proposes is a general one. A process of formulation and testing of hypotheses leads to the conclusion that sexual dimorphism and territoriality in lizards are best explained by characteristics of their reproductive biology, not by trophic relationships. The power of this formal approach to behavioral ecology is illustrated by insights that unfold in a sequence that is aesthetically as well as intellectually satisfying.

Part 3, Population and Community Ecology, opens with a descriptive model of life-history variation by R. E. Ballinger that defines a component of genetic variance representing phylogenetic constraints such as body shape and reproductive mode. Like Stamps's model of sexual selection, Ballinger's life-history model integrates recent studies of the ecology of lizards to form a synthesis that promises new insights. Three different approaches to community ecology are represented by chapters on *Cnemidophorus* by T. J. Case and on *Anolis* by E. E. Williams and by J. Roughgarden and his associates. Case and Roughgarden *et al.* present mathematical models of interspecific interactions, whereas Williams extends the descriptive methods of his analysis of the *Anolis* fauna of Puerto Rico to other islands in the West Indies. The juxtaposition of these different approaches clearly illustrates the merits and problems of each. The mathematical models provide a sense of generality but depend upon anecdotal details to support conclusions of competitive exclusion. Williams's "close view" provides extensive information about the particular cases being considered, but the very quantity of specific, perhaps unique, detail makes generalization difficult.

The symposium reviewed here took place in the 15th anniversary year of a symposium of the same title that summarized the first burgeoning of work on lizards (*Lizard Ecology*, edited by W. W. Milstead, University of Missouri Press, 1967). The introduction to the new symposium presents graphs illustrating a rapid increase in the quantity of work on lizards in the past 15 years, the papers in the symposium allow one to assess the change in quality. That analysis leaves me with a sense of disappointment at the narrow perspective of many of the chapters.

The most conspicuous failure to integrate information from related approaches is the division between biophysical modelers and field ecologists. One receives the impression that proponents of biophysical models see the models as ends in themselves, not as steps to biological understanding, and that models are being extended beyond their ability to provide reliable information. Ecologists in turn appear to ignore the potential value of biophysical models to address specific, limited questions in field studies. For example, a biophysical model might transcend purely descriptive analysis of the structural habitat to identify important functional characteristics of the home ranges of lizards (see chapter 8 by Stanley F. Fox). Models can be used to test ecological hypotheses as well as to generate them: Do changes in the foraging behavior and in the use of microhabitats by sympatric lizards during dry periods reflect interspecific competition, as A. E. Dunham contends (chapter 12)? Or are they only a response by the lizards and their insect prey to changes in the physical environment?

An important, albeit discouraging, inference from the symposium is that the full integration of biophysical models and field studies may be more complicated than one would hope. Roughgarden's chapter summarizes the use of a "gray-body temperature index" (GBTI) to characterize the thermal niche of *Anolis*. The GBTI is defined as the equilibrium