Book Reviews

Tibet: Accounts from China

Geological and Ecological Studies of Qinghai-Xizang Plateau. Proceedings of a symposium, Beijing, May 1980. Science Press, Beijing, and Gordon and Breach, New York, 1981. In two volumes. Vol. 1, Geology, Geological History, and Origin of Qinghai-Xizang Plateau. xxx pp. + pp. 1–974, illus. $150. Vol. 2, Environment and Ecology of Qinghai-Xizang Plateau. xiv pp. + pp. 975–2138, illus. $175. The set, $290.

The 300-plus short papers in these two thick volumes are the proceedings of an international symposium on the Tibetan Plateau held in Beijing. About three-quarters of the geological papers, and four-fifths of the environmental ones, are by Chinese authors, generally in groups. Many of these papers report information that previously has been published only in Chinese if at all. (Most of the papers by non-Chinese authors summarize investigations reported more extensively elsewhere, and I will say little about those papers here.)

The various Chinese reconnaissance stratigraphic, petrologic, structural, geochemical, geophysical, and geothermal studies reported in volume 1 are concerned primarily with the accessible parts of southern Tibet. The papers summarize much material that was previously unavailable outside China, but they have shortcomings. Findings are expressed primarily as conclusions that, however tantalizing, cannot generally be evaluated—and hence have limited usefulness—because little information is given about data bases. Fact and assumption are not easily discriminated, and often neither can be related to specific areas. Texts and figures are often uncoordinated. The utility of many maps and figures is minimized by indeterminate locations, unexplained symbols, unspecified sources, and poor legibility.

The Tibetan Plateau now stands at an average altitude of about 5 kilometers above sea level. Papers on paleontology and paleoclimatology of Cenozoic strata in Tibet conclude that most of this uplift occurred during late Cenozoic time. The base of the continental crust is about 70 kilometers deep beneath the plateau, as shown by various reports in the volume by both Chinese and non-Chinese geophysicists; so most of the thickening of the crust must also have taken place within late Cenozoic time if the paleontologic conclusions are correct. Geophysical arguments suggest that this thickening has been primarily the product of crustal shortening accompanying the continuing convergence of India and Asia, rather than of the sliding of one continental plate beneath another. The structural geology of the plateau is, however, still so poorly known that it cannot yet be used to test these rationales. Some of the crustal thickening may, I suspect, be the result of thermal depression of density-phase transformations.

A number of reports give information, much of it new, on the geology of the segment of the Indus-Zangbo suture zone along the Zangbo (Brahmaputra) River valley, between the north base of the Himalaya and the Tibetan Plateau. The suture was not fully closed until late Eocene time or later. Here, as along the same suture exposed along the Indus River farther west, components of the suture zone dip and top south more commonly than north. The authors of several papers draw the obvious conclusion that the last subduction of oceanic lithosphere between the continental plates was southward beneath India. So strong is the widespread assumption that Indian lithosphere has slid northward beneath Tibet, however, that most of the relevant papers in this volume (as also those published elsewhere regarding the Indus segment) infer that the suture initially dipped north and has been overturned tectonically.

A number of papers give new information on the Gandize Range (Transhimalaya) magmatic arc of volcanic and batholithic rocks, north of the Zangbo valley. Zircon ages are earliest Cretaceous to Eocene, whereas potassium-argon ages of deeply eroded, migmatitic sectors are as young as Miocene. I presume the latter, young ages to date stages of postmagmatic uplift, although authors of the papers mostly accept them as ages of magmatism. Several authors infer north-dipping subduction from the Zangbo suture as the cause of the magmatism. A tendency does indeed exist for the granitic rocks in the northern part of the central section of the arc to be more silicic and potassic than those in the southern part (the reverse trend exists in the eastern section), but it is unclear whether or not this trend can be demonstrated, as is essential to support an inference of subduction polarity, to occur across strike within rocks of narrow age ranges and comparable depths of erosion. Gandize batholithic rocks extend close to most of the Indus-Zangbo suture and are truncated against it in places, so if Gandize magmatism was due to northward subduction a belt of initially intervening crust 100 kilometers or so wide was somehow removed before suturing was complete.

Several papers describe parts of the Himalayan crestal region. Large but unspecified portions of these papers obviously are recycled from non-Chinese papers regarding extra-Tibetan areas. This crestal region is dominated by gneisses, migmatites, and early Tertiary(?) granites whose petrology (kyanite-sillimanite assemblages, muscovite granites, potassium-argon uplift ages of 10 to 20 million years) indicates to me that about 15 kilometers of material was eroded from above the exposed rocks during late Cenozoic uplift. The rock assemblages are those I would expect to see in a deeply eroded continental-margin magmatic arc, so I infer that an Andean Paleogene(?) magmatic arc, paired to the south-dipping Indus-Zangbo subduction system, trended along what is now the Himalayan crest. The downward-decreasing temperatures of metamorphism and south-verging structures of the south flank of the high Himalaya to me seem more likely to be products of the spreading of shallow batholiths, since removed by erosion, above the preserved terrain than of the long-distance thrust faulting assumed by authors in this volume and many others before them. The volume does not contain information, much needed, on deformation, vergence, and metamorphism north of the crest.

Several papers mention suture zones trending eastward across the Tibetan Plateau farther north, but little is reported about them. Reconnaissance stratigraphic and paleontologic studies on upper Paleozoic and lower Mesozoic strata of the plateau, summarized briefly in the volume, can be interpreted to indicate that these northern sutures represent subduction of broader intervening oceans during late Mesozoic (and early Tertiary?) time than does the better known Indus-Zangbo suture.

The papers of volume 2 deal with detailed and general aspects of zoology, botany, biogeography, physiology, meteorology, glaciology, hydrology, geomorphology, soils, ecology, and agriculture. The obvious role of humans in the

desertification of the temperate-climate region of southern Tibet is mentioned only by several non-Chinese participants.

Chinese scientists are moving to end their long isolation by sharing their findings with, and by learning from and collaborating with, scientists throughout the international community. These volumes place all of us interested in a unique part of the world much in the debt of the organizers of the symposium. It is to be hoped that expanded reports, to be released outside China, will present the detailed bases for conclusions summarized in the volumes.

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Dasyurids and Their Kin

Carnivorous Marsupials. MICHAEL ARCHER, Ed. Royal Zoological Society of New South Wales, Mosman, Australia, 1982. In two volumes. xvi, 804 pp., illus. $49.

Modern biology is perfused with the notion that research should not be organism-oriented. Rather, organisms serve researchers by providing vehicles for the testing of hypotheses of general interest. This two-volume work is ample testimony to the continuing power and utility of interdisciplinary focus on groups of organisms. It is based on a symposium organized by Michael Archer and held in Sydney in May 1980. Archer and the officers of the Royal Zoological Society of New South Wales, which sponsored the symposium, decided, after several discouraging approaches to commercial publishers, to find their own printer for the proceedings. This meant that Archer handled the editorial chores, the society tended to the business aspects, and the book is being sold at cost. I find the volumes impressive not only because of the generally high quality and current interest of their content but because of their luxurious quality and relatively low price. Both volumes have color frontispieces, and each paper is adorned with a small black-and-white drawing inset next to the abstract. An especially thoughtful feature is a summary in Spanish provided for each paper.

The scope of the volumes is not as extensive as the title implies. A very large fraction of the species of marsupials are carnivorous or at least omnivorous, and especially is this true for the Western Hemisphere forms. Yet these volumes deal almost exclusively with Australian species, even New Guinea representatives being only occasionally mentioned. Ostensibly, the symposium was to cover the families Dasyuridae, Thylacinidae, Thylacoleonidae, Myrmecobiidae, and Notoryctidae. In fact it is largely a treatise on the diverse and fascinating members of the Dasyuridae (over 50 species ranging in size from a 3-gram *Planigale* to the 9-kilogram Tasmanian devil, *Sarcophilus*). Of the 63 papers following the introduction, one is a philosophical essay on building phylogenies (by J. A. W. Kirsch), four treat marsupials generally, five concern the extinct marsupial lion *Thylacoleo*, six are on the Tasmanian wolf or thylacine, and 47 are on dasyurids. None of the papers focuses on the numbat (Myrmecophagidae) or the marsupial mole (Notoryctidae). In spite of these biases, the volumes are amply justified. It affirms one's faith in science to read a multidisciplinary and synthetic treatment given to a group of organisms about which almost nothing was known just 20 years ago. In this sense, *Carnivorous Marsupials* is a tribute to Australian mammalogists.

Aside from bringing together available information on a large group of mammals, the book has much of interest for the evolutionist, ecologist, ethologist, physiologist, paleontologist, and even conservationist. A foreword by John Calaby, mammalogist and leading historian of Australian biology, gives an absorbing history of the study of Australian carnivorous marsupials beginning in 1770 with the voyage of the *Endeavour*. Did you know that Errol Flynn's father (T. T. Flynn) was a professor of biology in Tasmania and did pioneering research on reproduction in the Tasmanian devil? Archer in his introduction writes informally and enthusiastically about the symposium, its publication in these volumes, and the "beasts" that are its heroes. A total of 69 papers were submitted for publication. All were reviewed by two referees and 63 were accepted. A few of the papers I found to be weak, but in general the quality is excellent. The papers are arranged in six sections: Reproduction, Ecology, Physiology, Behaviour, Palaeontology, and a miscellaneous collection on Morphology, Cytology, Genetics, Electrophoresis and Phylogenetic Relationships. These are followed by an index to taxonomic names and a list of errata.

Four of the six major sections are introduced by significant review papers. Initiating the section on reproduction is a review of life history strategies in dasyurids by A. K. Lee, P. Woolley, and R. W. Braithwaite. Their story begins with the pioneering research of Woolley, who in 1966 described her discovery of a monestrous strategy in *Antechinus stuartii*. This pattern, now known for nine species in the family, involves all of the adult males' dying shortly after a brief annual breeding season. Moreover, only a few females manage to breed in more than one season. Enough is known of 30 species for the authors to assign them to six general life history categories. The ecology section is launched with a review of dasyurid ecology by B. J. Fox. He concludes that the general arthropod diet of this group leads to a low number of species living microsympatrically. This plus a generally significant sexual dimorphism leads to expanded niche widths. Hence sympatric species are markedly different in size (differences exceed the theoretical minimum limiting similarities), and there is marked habitat segregation of species in the same general area. An excellent review of communication in the dasyurids by D. B. Croft introduces the behavior section. Social behavior in this family seems limited to mating and maternal care. The repertoire of communication signals is comparable in size, however, to that of similar eutherians. Finally, Archer's review of the dasyurid fossil record includes a model effort to synthesize paleontological and neontological data into a classification of the family (nine groups at the subfamily level are recognized).

For those interested in the increasingly prevalent phenomenon of extinction, two papers are recommended. One (by Smith) is a good general review of the probably extinct thylacine and offers some comments regarding causes of its extinction. The second (by K. A. Johnson and A. D. Roff) is a fascinating and comprehensive account of the extinction of the western quoll (*Dasyurus geoffroii*) in the Northern Territory. Some of their evidence comes from interviews with old aboriginal men who remembered the quoll from their youth. The authors postulate that extinction was caused by a combination of competition with European foxes and feral cats, the movement of aborigines to missions, resulting in a cessation of the practice of patchy burning of the countryside in favor of less frequent but larger-scale fires, and invasion of European rabbits, who destroyed the vegetation during drought periods, causing loss of native prey for the quoll.

The final paper to be mentioned is that by F. S. Szalay giving a new appraisal of marsupial phylogeny. Although Szalay's conclusions are based largely on tarsal morphology, other kinds of characters