Vertebrate paleontology

New and exotic sites were reported this year from regions with almost no previous record of fossil vertebrates. The 1988 Journal of Vertebrate Paleontology includes reports on Cretaceous vertebrates from three areas in Cameroon, West Africa, by L. Flynn (Harvard University) and others (v. 7, p. 469–471); Miocene bats and rodents from Thailand by S. Legendre (Montpellier, France) and others (v. 8, p. 278–289); and Triassic dinosaurs and mammals from the Ishigualasto Formation of Argentina by P. Sereno (University of Chicago) and others (v. 8, p. 26A).

The first Cretaceous mammal from India was discovered by G.V.R. Prasad (University of Jammu) and A. Sahni (Punjab University) in uppermost Maastrichtian sediments in Naskal, Andhra Pradeh (Nature, v. 332, p. 638–640). Miocene vertebrates from the high southern Andes of Chile were described by J. Flynn (Field Museum of Natural History, Chicago) and others (Geological Society of America Abstracts with Programs, v. 20, p. A380). The first Eocene mammals from Antarctica were reported in a monograph on the geology and fauna of Seymour Island (Geological Society of America Special Paper 169).

J.L. Sanz (Universidad Autónomo, Madrid), A. Lacasa (Institut d'Estudis llerdencs, Lleida, Spain) and J.F. Bonaparte (Museo Argentino de Ciencias Naturales, Buenos Aires) report in Nature (v. 331, p. 433–435) the discovery of an Early Cretaceous fossil bird in the Las Hoyas Limestone, Cuenca, Spain. Because this specimen has many primitive features in common with *Archaeopteryx*, the earliest known bird from the Late Jurassic, as well as more advanced characteristics of Late Cretaceous and modern birds, it can be considered a missing link.

A new, sixth specimen of *Archaeopteryx* has been discovered in a private collection and was reported by P. Wellnhofer (Bayerische Staatssammlung Paläontologie und historiche Geologie, West Germany) in Science (v. 240, p. 1790–1792). Contrary to earlier interpretations, computed tomography studies of *Archaeopteryx* by B. Haubitz (Medizinische Hochschule) and others show the presence of an avian-like double-headed quadrate bone in this earliest true bird (Paleobiology, v. 14, p. 206–213).

Remains of 30 jaw-less fish (agnathans) were found by P. Janvier and P-Y. Gagnier (French Research Center, Paris) and R. Suarez-Sorruco (YPFB, a Bolivian oil company) in large Ordovician stone slabs in the mountains of southern Bolivia (Geotimes, May, p. 27). The British Museum (Natural History) has announced that a well-preserved skeleton of an eight-inch-long lizard-like animal was found by Stan Wood, Britain's only commercial paleontologist, in volcanic deposits laid down 340 million years ago, more than 40 million years before amniotes were thought to have evolved.

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J.R. Horner (Museum of the Rockies, Montana State University) and D.B. Weishampel (Johns Hopkins University) provide the first well-documented association of dinosaur eggs containing embryos, juveniles and adults of *Orodromeus makelai*, a new genus and species, and *Maiasaura peeblesorum* from the Upper Cretaceous of Montana (Nature, v. 332, p. 256–257). A dinosaur skull, assumed for 46 years to be from a gorgosaur, has been identified recently by R.T. Bakker (University of Colorado, Boulder), M.E. Williams (Cleveland Museum of Natural History) and P.J. Currie (Tyrrell Museum of Palaeontology, Alberta) as a new genus, *Nanotyrannus*, or "pygmy tyrant" (Geotimes, v. 33, p. 38). As the name suggests, it is a tyrannosaur one-tenth the size of *Tyrannosaurus rex*.

Several international conferences were of interest this year. A Dahlem workshop in West Berlin focused on the evolution of complex structures in vertebrates. Proceedings will be published by Wiley.

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A NATO Advanced Research Workshop on European Neogene Mammal Chronology, which included 47 earth scientists, met in May at Schloss Reisensburg near Ulm, West Germany. New small mammals from Turkey were described (Society of Vertebrate Paleontology News Bulletin, n. 144, p. 35). Results of the workshop will be published next summer by Plenum Press.

A workshop on Pleistocene extinctions was held at the University of Sydney, Australia. As usual, debate centered on the effects of climate change and human predation. Papers will be published in the Journal of Archaeological Science.

According to R.A. Kerr's account (Science, v. 242, p. 865–867) of Global Catastrophes in Earth History: an interdisciplinary conference on impacts, volcanism, and mass mortality, held Oct. 20–23 at Snowbird, Utah, a huge impact is the favored K/T boundary killer. However, G.S. Paul (Baltimore) suggests that dinosaurs living in polar regions year-round during the Cretaceous must have had avian-/mammal-like metabolic systems; this challenges both the climatic and meteoritic or volcanic models for extinction (Journal of Paleontology, v. 62, p. 640–652). Also, he suggests that polar dinosaurs may have served as a center for dinosaur radiation.

New publications include a special volume (Memoirs Museum Nationale d'Histoire Naturelle, Series C, v. 53) "Teeth Revisited," which assembles the proceedings of the seventh international symposium on dental morphology. In "Aspects of Freshwater Palaeoecology and Biogeography" (Palaeogeography, Palaeoclimatology, Palaeoecology, v. 62, p. 1–214), J. Gray (University of Oregon) compiles a useful list of the first freshwater occurrences of invertebrates and vertebrates, but her fresh-water criterion may misclassify some vertebrate species.

Complete descriptions for entire faunas have been published for two important localities, the Upper Pennsylvanian Hamilton Quarry of Kansas (Kansas Geological Survey Field Guide 6, edited by G. Mapes and R.H. Mapes, Ohio University) and the Eo-

cene locality of Messel, West Germany (Messel ein Schaufenster in die Geschichte der Erde und des Lebens, edited by S. Schaal and W. Ziegler, Senckenberg Museum, Frankfurt, West Germany). The Hamilton volume includes accounts of plants, invertebrates and vertebrates (Geotimes, v. 33, p. 10–13) and the book on Messel is a beautifully illustrated description of fishes, amphibians, reptiles, birds and mammals.

Two recent papers contribute to our understanding of early tetrapods. J.A. Clack (University Museum of Zoology, Cambridge, England) describes three new closely associated skulls of *Acanthostega* from the Devonian of Greenland (Paleontology, v. 31, p. 699–724). J.R. Bolt (Field Museum of Natural History, Chicago) and others (Nature, v. 333, p. 768–770) describe a new Mississippian vertebrate fauna in Iowa, which contains many well-preserved fish and tetrapod fossils.

Studies of osteological development in *Ophiacodon* and *Dimetrodon* by D.J. Brinkman (Tyrell Museum of Palaeontology, Alberta) suggest that size alone is not a good measure of age in reptiles, including dinosaurs; relative proportions of certain skeletal elements and degree of ossification are better estimates (Journal of Vertebrate Paleontology, v. 8, p. 172–180). A volume on the phylogenetic relationships of the lizard families (1988 Stanford University Press), edited by R. Estes (San Diego State University) and G. Pregill (Natural History Museum, San Diego), also appeared this year. S.D. Emslie (Point Reyes Bird Observatory) has reviewed the fossil history and phylogenetic relationships of condors in the New World (Journal of Vertebrate Paleontology, v. 8, 212–228).

Several papers on the origin and diversification of mammals were published in the Journal of Vertebrate Paleontology. T. Rowe (University of Texas) did a detailed phylogenetic analysis of the primitive mammalia and their synapsid sister-groups (v. 8, p. 241–264). He restricted the Class Mammalia to the monotremes, therians, and their extinct sister taxa, which excludes the Triassic/Jurassic morganucodonts. Z. Luo (University of California, Berkeley) suggests (v. 8, p. 20A) that mammals are composed of two monophyletic groups, the therians (marsupials and placentals) and the non-therians (monotremes, multituberculates, and triconodonts, sometimes called "Prototheria"). This contradicts recent work, which has placed either the monotremes or multituberculates closer to the therians, and denied the monophyly of the non-therians. The long-awaited description of the Early Cretaceous Cloverly triconodont, one of the most complete Mesozoic mammal specimens known, was published (v. 8, p. 1–24) by F. Jenkens and C. Schaff (Harvard University). A.R. Wyss (American Museum of Natural History, New York) provides evidence from flipper structure for a single origin of pinnipeds (Nature, v. 334, p. 427–428).

Gondwana has been the focus of many publications this year. Biogeographic studies of vertebrates in "Aspects de la Géologie du Gondwana" (Annales Société Géologique du Nord, v. 57) reflect a compact Pangea, "Laurasiaticogondwana," and support an expanding earth hypothesis. Michael Archer (University of New South Wales, Australia) edited "Possums and Opossums: Studies in Evolution" (Surrey Beatty and Sons, Sydney), which appeared late in 1987. It describes new families, genera and species of South American and Australian Tertiary marsupials.

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It has been assumed that the mammalian faunas of North and South America were even more varied before the Pliocene than they are today. However, L.M. Van Valen's (University of Chicago) review (Nature, v. 333, p. 113) of J. Boneparte's (Museo Argentino de Ciencias Naturales, Buenos Aires) recent studies of South American Cretaceous mammal faunas suggests this is not the case. This is further substantiated in a paper (National Geographic Research, v. 4, p. 23–55) by L.G. Marshall (Institute of Human Origins) and C. Muizon (Museum National d'Histoire Naturelle, Paris) on the dawn of the age of mammals in South America.

A product of the Perissodactyl Evolution Workshop, held in 1985, was published ("The Evolution of Perissodactyls," Oxford University Press, 1989). Several contributions in this volume revise traditional ideas about perissodactyls. M. McKenna (American Museum of Natural History, New York) and others described the oldest known perissodactyl-like mammal from the Paleocene of China. Its similarities to primitive elephants and arsinoitheres suggest that all three groups had a common origin in the Old World in the Paleocene. J. Hooker (British Museum of Natural History) showed that *Hyracotherium* is most closely related to palaeotheres and not to horses.

A special issue of Palaeogeography, Palaeoclimatology, Palaeoecology (v. 63) edited by A.K. Behrensmeyer (National Museum of Natural History, Washington, D.C.) and S. M. Kidwell (University of Chicago), was dedicated to ecological and evolutionary implications of taphonomic processes. "Comparative Primate Biology" edited by J. Erwin (Alan R. Liss, 1986–1988) comprises of five volumes; v. 1, on systematics, evolution, and anatomy is of greatest interest to vertebrate paleontologists. "The Encyclopedia of Human Evolution and Prehistory," edited by I. Tattersall, E. Delson, and J. Van Couvering (American Museum of Natural History, New York) was also published in 1988 (Garland Press). "Late Pleistocene and Early Holocene Paleoecology and Archeology of the Eastern Great Lakes Region" (Bulletin of the Buffalo Society of Natural Sciences, v. 33), edited by R.S. Laub (Buffalo Museum of Science), N.G. Miller and D.W. Steadman (New York State Museum, Albany), includes eight new studies in late Quaternary vertebrate paleontology.

Some systematists' assumption that fossils do not contribute to understanding phylogenetic relationships was challenged by several papers this year. J.G. Maisey (American Museum of Natural History, New York) in Evolutionary Biology (v. 22, p. 1–36) and J. Gauthier (California Academy of Sciences, San Francisco) and others in Cladistics (v. 4, p. 105–209) demonstrate that the claim can be refuted with cladistic analysis. Maisey shows that the contradictory ideas about primitive skeletal tissue can be solved by integrating the fossil record, which illustrates that acellular bone is phylogenetically primitive for vertebrates, and that skeletal calcifications increase in complexity in early vertebrates. Gauthier and others use amniote phylogeny as an example of the roles fossils play in phylogenetic inference. We can look forward to a productive year in vertebrate paleontology.

Russell W. Graham
Illinois State Museum, Springfield, 62706
Jacques Gauthier
California Academy of Sciences, San Francisco, 94118
Donald Prothero
Occidental College, Los Angeles, 90041
Hans-Peter Schultze
Museum of Natural History, University of Kansas, Lawrence, 66045