Preface

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Few areas of primate evolution have experienced such a rapid and recent increase in knowledge as the paleontology of New World monkeys. As recently as 40 years ago, all fossil platyrrhines (remains of less than ten individuals) were usually placed in a single genus, *Homunculus*. Twenty years later the 15 specimens of New World monkeys were placed in six genera. Today there are more than 400 fossil remains of platyrrhine monkeys in 13 or more genera, and several additional genera are soon to be described (Figures 1 & 2). Moreover, with new field projects beginning annually in all parts of the continent and in the Caribbean, there is every reason to suspect that the fossil record of this group will continue to grow exponentially.

In light of this dramatic increase in both new fossils and new research on platyrrhine evolution, we organized a workshop and symposium for the XIIth Congress of the International Congress of Primatology in Brasilia, Brazil, to bring together a wide range of researchers interested in many aspects of platyrrhine evolution. This volume is derived from that symposium.

The first paper, *Chronology of Cenozoic primate localities in South America*, by MacFadden, sets the temporal framework for platyrrhine evolution, comments on the biogeographical origin of platyrrhines, and provides some new suggestions regarding the paleoenvironments in which the earliest platyrrhine(s) have been recovered. MacFadden reviews the evidence for the ages of the four Land Mammal Ages from which fossil platyrrhines have been recovered. The Deseadan (*Branisella*), previously thought to document the period between 37 and approximately 34 Ma (million years ago) is now known to contain rocks as young as 22 Ma and in some areas seems to have begun around 30 Ma. The Colhuehuapian (*Dolichocebus*, *Tremacebus*, and possibly *Soriacebus*) still lacks secure dates, but, on the basis of faunal correlations, is presumed to be slightly older than the succeeding Santacrucian (*Homunculus*, *Soriacebus*, and *Carlocebus*), which now seems to extend from approximately 18 Ma to 15 Ma rather than 22–16 Ma as previously reported. With this new calibration and revised faunal analyses, it also seems likely that parts of the middle Miocene La Venta deposits from Colombia (*Neosaimiri*, *Cebupithecia*, *Aotus*, *Stirtonia*, *Mohanamico*, *Micodon*) may well be from the Santacrucian rather than the Friasian as traditionally believed.

MacFadden notes that through recent work at Salla, Bolivia, the first appearance of platyrrhines in the fossil record there can be dated at approximately 26 Ma. This is roughly 10 MY younger than dates previously attributed to this event and also substantially later

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Figure 1. Map of South America and the West Indies indicating sites where fossil platyrrhine genera have been recovered.

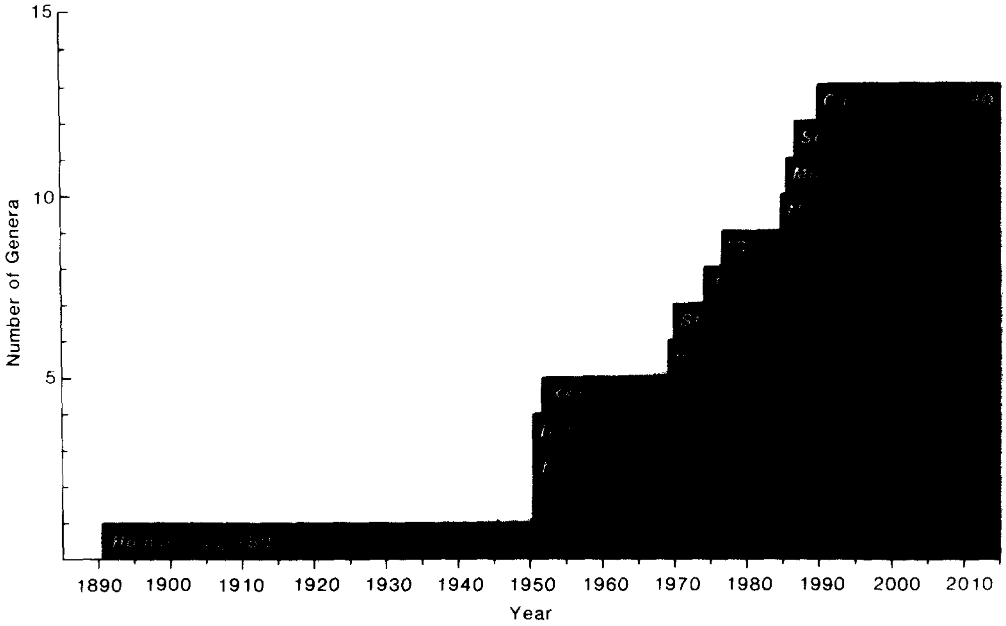

Figure 2. The increasing rate of description of fossil platyrrhine genera.

than the dates for the earliest higher primates in Africa. Finally, he suggests that the earliest platyrrhines from Salla were living in more arid, less forested environments than are many platyrrhines today.

The second paper, *Evolving climates and mammal faunas in South America* by Pascual and Ortiz Jaureguizar reviews the major changes in the mammalian fauna of South America throughout the Cenozoic Era and attempts to relate these to climatic changes and geotectonic events both regionally and globally. They divided the fossil record of South America into a series of Cycles and Subcycles based on faunal similarity between different Land Mammal Ages, as known primarily from the southernmost part of the continent (Argentina, Brazil, Chile, and Bolivia). Except for an early (late Cretaceous or early Paleocene) period in which the mammalian fauna of South America had numerous taxa in common with North America, mammalian evolution in South America is characterized by the adaptive radiation of native groups, including edentates, marsupials and several orders of ungulates. This endemic fauna was augmented by the appearance of rodents and primates in the Oligocene and by the "invasion" of a host of North American taxa, beginning in the late Miocene and peaking in the Pliocene. Like that of North America, the mammal fauna of South America experienced widespread extinctions at the end of the Pleistocene.

This paper enables us to see the fossil record of New World monkeys in the context of geological and environmental changes as well as the evolutionary history of other groups of mammals in South America. Platyrrhines first appear during the Patagonian Faunistic Cycle, early Oligocene to middle Miocene. The beginning of the Patagonian Cycle is marked by precipitous drops in both temperature and sea level, usually associated with Antarctic glaciation. This sea level drop also suggests increased opportunities for immigration to the island continent (see Fleagle, 1988). They are relatively low in both diversity and abundance throughout the cycle, but ranged to the southernmost end of the continent. Pascual and Ortiz Jaureguizar note that there are few, if any, primates from the Patagonian Cycle that are smaller than 1 kg (but see Fleagle, 1990) and suggest that this "small primate adaptive niche" was occupied by the diverse and abundant caenolestid marsupials.

Primates disappear from the southernmost South America at the end of the Patagonian Faunistic Cycle. However, Pascual and Ortiz Jaureguizar note that much of the fauna from the West Indies (including primates, rodents, and sloths) suggests an origin from mammals of the Pansantacrucian Subcycle rather than from mammals of later time periods (see Ford, 1990). From the earliest part of the middle–late Miocene Panaraucanian Faunistic Cycle, there is a diverse primate fauna from the La Venta deposits in Colombia. Because of the vast geographical distance, environmental conditions at La Venta were presumably different from those in the southern part of the continent and the fauna of La Venta is distinct from that of the more southern localities attributed to this cycle. In any case, Pascual and Ortiz Jaureguizar note that this fauna is characterized by both the presence of primates less than 1 kg in size and the absence or rarity of caenolestid marsupials.

The next two papers discuss the paleontology and geology of the Miocene Pinturas Formation in the southern part of Argentina. In *New fossil platyrrhines from the Pinturas Formation, southern Argentina*, Fleagle describes three new platyrrhine species from this very rich series of sites that has yielded over 250 primate fossils during the past 5 years. The four primate taxa from this site range in size from less than 1 kg to over 3 kg, and the two genera (*Soriacebus* and *Carlocebus*) differ considerably from one another in dental morphology and proportions. However, neither genus shows unambiguous phyletic relationships with any single group of extant platyrrhines, and both preserve a number of primitive features lost in later platyrrhine lineages. These new fossils demonstrate unanticipated combinations of morphological features which necessitate a reassessment of the morphological transformations involved in platyrrhine phylogeny as they have been reconstructed from extant taxa alone.

Bown and Larriestra discuss *Sedimentary paleoenvironments of fossil platyrrhine localities, Miocene Pinturas Formation, Santa Cruz Province, Argentina*. This formation consists of three distinct sedimentary sequences separated by erosional unconformities: a lower sequence of very mature paleosols formed on pyroclastic mudrocks; a middle sequence composed largely of paleodunes; and an upper sequence of poorly bedded pyroclastic rocks. Primates are abundant in the lower and the upper sequences. They report radiometric dates from the lower sequence of 16·6 ± 1·5 and 13·3 ± 3·3 Ma.

In her paper, *Models for the origin of the anthropoid postcranium*, Dagosto addresses the issue of whether the postcranial skeleton of anthropoids, including platyrrhines, is likely to have evolved from a prosimian ancestor or whether prosimians are a uniquely derived group which retain a primitive mammalian postcranial skeleton. If the latter were true, it would considerably increase the likelihood that anthropoids were not a natural group. She concludes that anthropoids are most probably derived from a prosimian-like ancestor and that similarities between anthropoids and "primitive mammals" are probably evolutionary reversals related to quadrupedal locomotion.

In *Locomotor adaptations of fossil platyrrhines*, Ford reviews the skeletal remains of fossil platyrrhines in order to reconstruct their likely locomotor habits and compares each of the fossil taxa with her reconstruction of the ancestral platyrrhine (see Ford, 1988). She finds evidence of considerable locomotor diversity and concludes that all of the fossils depart in some way from the hypothetical ancestor of the group. Moreover, she argues that there are no derived skeletal features characteristic of platyrrhines that can distinguish them from primitive African anthropoids such as the parapithecids; thus the question of platyrrhine origins is very difficult to evaluate on the basis of postcranial anatomy.

The papers by Kay and by Rosenberger, Setoguchi and Shigehara discuss the phyletic relationships of a variety of fossil platyrrhines, including strongly opposing views of the systematics of two recently described La Venta primates, *Mohanamico hershkovitzi* and *Aotus dindensis*. In *The phyletic relationships of extant and fossil Pitheciinae (Platyrrhini, Anthropoidea)*, Kay reviews the phyletic position of the extant members of this subfamily (*Pithecia*, *Chiropotes*, and *Cacajao*). He finds that they share numerous derived anatomical features that support their grouping as a distinct monophyletic taxon, but demonstrates that their relationship to other extant platyrrhines is ambiguous. He then reviews several fossils (*Cebupithecia* and *Mohanamico*) that have been linked to the extant pitheciines, and discusses their likely phyletic position among platyrrhines.

In *The fossil record of callitrichine primates*, Rosenberger, Setoguchi and Shigehara discuss the phyletic relationships of all fossil platyrrhines from the Oligocene through Recent of South America and the Caribbean that have been compared to or classified with callitrichines (including *Branisella, Dolichocebus, Neosaimiri, Soriacebus* and *Xenothrix*). They find that only *Micodon* and *Mohanamico* can be convincingly linked with callitrichines and that those which seem to have callitrichine relationships tell very little about the evolutionary history of the group except that it was in existence by the middle Miocene.

Although there are no native platyrrhines living today in the Caribbean outside Trinidad, there is an increasingly diverse fauna known from Pleistocene and recent deposits on the islands of Jamaica, Hispaniola, and Cuba. Ford reviews these fossil remains, many of them discovered in the last few years, in her paper entitled *Platyrrhine evolution in the West Indies*. She finds evidence for up to seven endemic taxa of platyrrhines on these three islands (including *Alouatta*, *Ateles*, "*Saimiri*", and *Xenothrix*).

The papers in this special issue of the *Journal of Human Evolution* demonstrate quite clearly that the study of platyrrhine evolution is in a very active phase. There are now enough fossils (and investigators) that we can address critically, if not definitively resolve, broader questions about the evolutionary history of the group. What is the relationship between primate diversity and climate? What has been the evolutionary role of primates in community evolution in South America and in the Caribbean? Has the evolution of primates in the New World influenced, or been influenced by, the evolution of other mammalian groups such as marsupials? Similarly, we can now address general phylogenetic questions. Is the evolutionary history of platyrrhines characterized by a series of long-lived distinct lineages or by a series of successive, increasingly modern radiations as seems to be the case in the Old World (Delson & Rosenberger, 1984)? What evidence does the fossil record of platyrrhines provide about the common ancestor of platyrrhines and catarrhines and the common ancestors of the very distinct modern lineages that could not have been suspected from study of the modern forms alone?

This volume contains expanded versions of papers presented at a symposium held at the XIIth Congress of the International Primatological Society in Brasilia, Brazil. We are grateful to Dr Milton Thiago de Mello, for inviting us to organize a symposium on this topic, to the L. S. B. Leakey Foundation for providing funds and to Warren Kinzey, Richard Thorington, Miguel Soria, Walter Hartwig, Robert Costello and Jeffrey Froelich.

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