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978-0-521-87241-6 - The Paleontology of Gran Barranca: Evolution and Environmental Change through the Middle Cenozoic of Patagonia

Edited by R. H. Madden, A. A. Carlini, M. G. Vucetich and R. F. Kay

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The Paleontology of Gran Barranca Evolution and Environmental Change through the Middle Cenozoic of Patagonia

Gran Barranca in Patagonia exposes the most complete sequence of middle Cenozoic paleofaunas in South America. It is the only continuous continental fossil record anywhere in the southern hemisphere between 42 and 18 million years ago, when climates at high latitudes transitioned from warm humid to cold dry conditions. Located on a narrow peninsula, surrounded by the southern oceans and close to Antarctica, Gran Barranca was ideally situated to record the biotic response to these climatic changes.

This volume presents the geochronology of the fossil mammal sequence and a compilation of the latest studies of the stratigraphy, sedimentology, mammals, plants, invertebrates, and trace fossils. It is also the first detailed treatment of the vertebrate faunal sequence at Gran Barranca. Based on more than 10 years of fieldwork and study by the contributors, it provides important new evidence about biotic diversity, evolution, and change in the native species. A revised taxonomy allows a re-evaluation of the origin and extinction of herbivorous mammals, marsupials, and xenarthrans, and the earliest occurrence of rodents and primates in southern latitudes.

Academic researchers and advanced students in vertebrate paleontology, geochronology, sedimentology, and paleoprimateology will find a wealth of new information and interpretations about the paleontology of Gran Barranca in this book.

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Preface

In *Splendid Isolation*, Simpson described South America as a natural experiment in evolution, where one sees “evolution at work” through the Cenozoic. This experiment, and many of the most dramatic events that shaped the history of the peculiar South American mammal fauna, are recorded in the sediment sequence at Gran Barranca south of Lake Colhue-Huapi in central Patagonia. Gran Barranca is a spectacular sequence of mammalian faunas that serve as the basis for the biostratigraphic and biochronologic sequence of the mammal-bearing middle Cenozoic of South America. To this day, no other sequence with these characteristics has been found.

After its discovery and recognition of its significance around the turn of the twentieth century, over the next 100 years Gran Barranca has been visited by numerous research expeditions, not only from Argentina, but also France, the USA, and other countries. Even after all this effort, our understanding of the middle Cenozoic of South America is still full of uncertainties.

Over the past 15 years, the editors returned repeatedly to Gran Barranca in search of answers to some of the biggest outstanding questions about the mammalian evolution in South America. Duke University paleontologists first visited Gran Barranca at the invitation of Rosendo Pascual in 1990 while in Patagonia working the “Friasian” middle Miocene along the eastern slope of the Andes. Joint Museo de La Plata (MLP)/Duke expeditions started collecting in earnest at Gran Barranca in 1993. At that time, interest centered on the two highest faunal levels, representing the late Oligocene – early Miocene, for their potential content of fossil primates and rodents. The scope of our interests and activities at Gran Barranca changed along with discovery. From 1995 on, MLP/Duke expeditions expanded our work, and we began collecting throughout central Patagonia, sometimes with large field crews, gradually enriching our knowledge of the mammal sequence. At Gran Barranca we undertook detailed study of numerous stratigraphic profiles where we discovered and rediscovered faunal levels, and brought radiometric age control to a comprehensive magnetic polarity stratigraphy. All of this has enabled the elaboration of a new bio- and chronostratigraphic scheme for the middle Cenozoic of South America, and sharpened our understanding of many fundamental questions about mammalian evolutionary history.

The fruits of this research documented by this book could not have been made without a significant and sustained

effort in field research at Gran Barranca. Our first expeditions in Patagonia were in the company of the geologist, vulcanologist, and sedimentologist Mario Martin Mazzoni. Mario worked with us in the “Friasian” and at Scarritt Pocket, but his greatest contribution to our work was made at Gran Barranca, where his stimulating ideas were interwoven with a deadpan ironic humor that sustained us through difficult times of conflicting opinion. Mario died prematurely in 1999, and throughout this book he is remembered in many ways.

Many other institutions and individuals have been helpful in the development of this project. Financial support for the field work, laboratory analyses, technical services, and study of museum collections all over the world was provided by the National Science Foundation (grants to R. F. Kay and R. H. Madden), Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) (grants to M. G. Vucetich), Agencia Nacional de Promoción Científica y Tecnológica (ANPCYT) (grants to M. G. Vucetich and A. A. Carlini), Facultad de Ciencias Naturales y Museo (UNLP) (grants to M. G. Vucetich).

We thank the governments of the Province of Chubut and the Municipality of Sarmiento for permission to undertake fossil collecting at Gran Barranca from 1995 onwards. The authorities of the Museo Paleontológico “Egidio Feruglio” in Trelew allowed access to their collections. For special assistance at Gran Barranca we thank Pan American Energy and the staffs at Cerro Dragón and Valle Hermoso for hospitality, generous collaboration, and many forms of material support during the field work. The Vera family kindly granted permission for us to work on their land.

Many individuals have participated in the Duke University/Museo de La Plata paleontology expeditions to Gran Barranca. Participants include Richard F. Kay, Richard H. Madden, Alfredo A. Carlini, Maria Guiomar Vucetich, Alejandra Abello, Alejandra Alcaraz, Ramiro Almagro, Daniel Aquino, Roberto Avila, Judith Babot, Eduardo Bellosi, Valeria Bertoia, Diego Brandoni, Nicolas and Pedro Carlini, Martín Ciancio, Richard Cifelli, Roberto “Tito” Cidale, Valeria Clar, Noelia Corrado, Carlos Dal Molin, Cecilia Deschamps, Georgina Erra, Analía Francia, Patricia García, Germán Gasparini, Javier Gelfo, Jorge Genise, Damián Glaz, Verónica Gomis, Mirta González, Adrián Guillaume, Jennifer Josef, Derek Johnson, Alejandro Kramarz, Cecilia Krmptotic, José H. Laza, Diego Licitra, Jessamyn Markley, Mario M. Mazzoni, Jorge Noriega, María Encarnación Pérez,

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The tiny vertebrate materials studied in this book were found through many hours of diligent and patient hand-picking by Juan Canale, Nico Carlini, Georgina Erra, Verónica Gomis, Clay Madden, Alejandra Medinilla, Sebastián Poljak, Juliana Sterli, Marianela Talevi, Carolina Vieytes, and Danilo Vucetich.

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