

"... The newly reported war does not disturb us. We are out of range of the guns. Bolivia was under martial law when we arrived, but the revolution fell flat. These people are not warlike . . ."—Elmer S. Riggs, Field Museum's curator of paleontology, seems a little too earnest as he tries to convince Museum director D. C. Davies in a letter dated September 13, 1924, that there is nothing to be alarmed about. Riggs was about to set out on phase II of the Marshall Field Paleontological Expedition to South America.*

In the autumn of 1922 Riggs had embarked on the most ambitious paleontological expedition ever attempted by Field Museum. His objective: to make, over the next five years, extensive collections of fossil mammals from Argentina and Bolivia. The expedition began its field work in Patagonia, southern Argentina, in January of 1923 and remained there until May of the following year.

After completing his work in Patagonia, Riggs went to Buenos Aires, and from there wrote to the American consulate in La Paz, Bolivia, requesting permission to make collections of Pleistocene mammals in the Valley of Tarija in southern Bolivia.

Permission was granted, and on July 23, 1924, Riggs and his son Harold left Buenos Aires for La Paz. They disembarked at La Quiaca, on the Argentine side of the border, and from there crossed over to Villazon, on the Bolivian side. From this point one could travel to Tarija, 100 miles northeastward, by mule or bus. The former, more scenic, mode, required five days; the latter could make the trip in eight hours. Riggs chose passage on the 12-passenger bus, knowing they would later be obliged to make plenty of use of mules as they pursued their work in the interior.

From Villazon the road wound over a bleak, treeless plateau, which soon gave way to deeply incised river gorges; here the road followed every turn and angle of the drab canyon walls. Further on, the bus labored up steep, zigzagging grades. At last they came to a crest that overlooked the distant expanse of the Valley of Tarija—some 20 miles long and 9 miles wide. Two hours later the travellers had descended 5,000 feet to the valley floor.

Night was falling and lights were aglimmer as the groaning bus turned out of the dry river bed onto boulder-paved streets of the town of Tarija. At their approach, a cry was raised of "La auto, la auto!" as scores of bare-footed children ran to greet the biweekly link with the outside world. A crowd of hundreds immediately gathered to glimpse the new arrivals, to help unload baggage

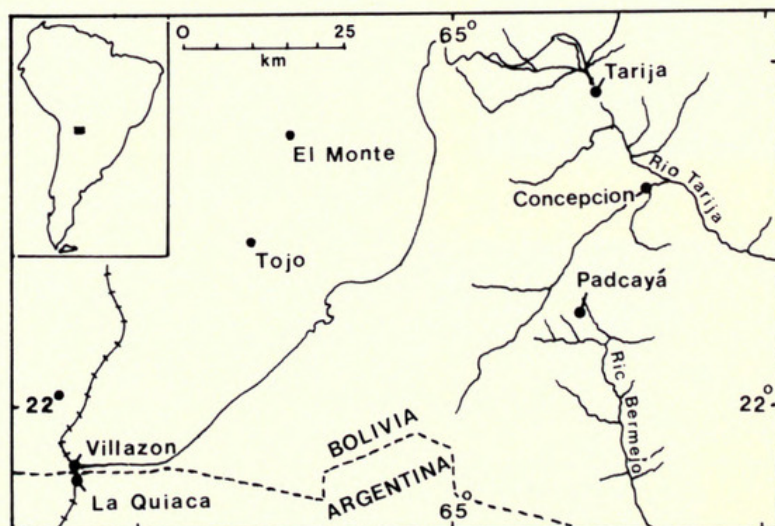
*For an account of the first phase of the expedition, see "Adventures in Patagonia," by Larry G. Marshall, in the March, 1978, Bulletin.

BOLIVIAN ADVENTURE

In Search of the Bones of Giants

By Larry G. Marshall

Larry G. Marshall, a vertebrate paleontologist who has also done extensive field work in South America, is a visiting curator in the Department of Geology.



Riggs chose passage to Tarija, Bolivia, on a 12-passenger alpine bus.



and express parcels, and in whatever way possible to have a hand in the reception.

Riggs spent the first two weeks at Tarija reconnoitering the valley. He then organized a field party, which included one José Strucco, a 35-year-old artist from Italy, who was to be of much help in the months to come.

THE FIRST EUROPEAN VISITORS TO TARIJA, centuries ago, had noted that certain *huesos de gigantes*—"giants' bones"—were the objects of special veneration and wonder by the villagers. These were the fossilized remains of animals of great size found in the floor and sides of the valley. Even then the curious objects were recognized as having once belonged to gigantic beings, and the natives looked upon them as talismans, often putting them in a special place of honor in their humble dwellings.

Early in the seventeenth century, reports of huge bones and of domelike shells—thought to be the skulls of great creatures—had already been carried to the outside world by Jesuits, and in the course of time, scientists

in Europe identified these curiosities as the teeth and bones of animals long extinct. Some found their way into museums and were eventually studied, described, and named.

In 1903 Count Créqui-Montfort, of Paris, purchased a large number of fossil mammals from Tarija resident Luiz Echezu who, with his brothers, had spent their leisure hours for many years in collecting Tarija Valley fossils. Duplicate specimens obtained from Echezu by Créqui-Montfort were described by M. Boule and A. Thévenin in a 256-page monograph, *Mammifères fossiles de Tarija*, published in Paris in 1920. Riggs was familiar with this work and was well aware of the fact that the valley was a fossil-hunter's paradise. Now that same valley lay before him, and he was eager to acquire some "giants' bones" for Field Museum.

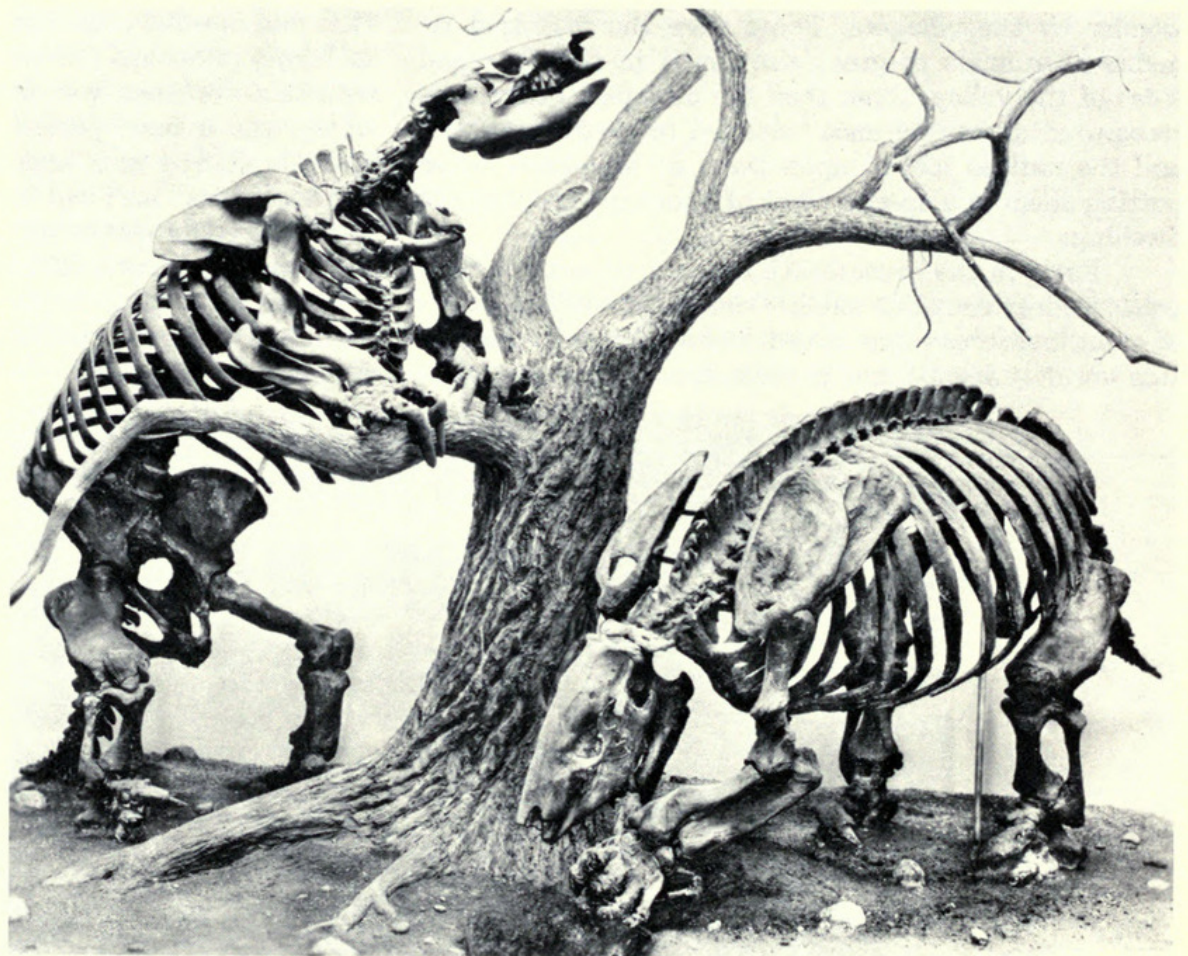
Why did these bones occur in this particular valley, and why were they so abundant? Geologists and paleontologists have long pondered these questions, and an explanation is now possible: Beginning about 65 or 70 million years ago, and up to the present, the western edge



Part of the extensive fossil collection of Bolivian Luiz Echezu.



*Moving camp in the Tarija ▲
valley*



*Reconstruction of ground
sloth skeletons discovered by
Riggs in Bolivia.*

of South America experienced bouts of geological activity that resulted in uplift and the formation of the Andes. Most of Bolivia was included in this uplift and, as a result, is now mostly a high plateau, or tableland, averaging 10,000 to 12,000 feet in elevation. Adorning the plateau are jagged mountain ranges and snow-covered peaks. To the south, the plateau falls rapidly away into the bush covered plains of the Gran Chaco of Paraguay, southeastern Bolivia, and north-central Argentina. The southern slope of the Bolivian plateau is broken into lesser mountain ranges, which enclose valleys of varying size.

The largest and best known of these is perhaps the Valley of Tarija, which lies midway down the southern slope of the Great Bolivian Plateau. It is drained by the Río Tarija, a tributary of the Río Pilcamoyo, flowing eastward across the fertile grazing lands of the Gran Chaco to the Río Paraná. Ancient streams draining into the Valley of Tarija carried with them large quantities of mud and sand, which were deposited on the relatively flat valley floor. Century after century, these deposits gradually accumulated to great thickness.

The summer rains provided an abundance of moisture which, together with heat of a tropical sun, promoted succulent vegetation. Large animals, in search of browsing and refuge from the torrid heat of the Chaco

Robert C. Thorne, former U.S. artillery captain, was hired by Riggs for his experience in operating a field camp and handling pack animals; but Thorne also did his share of digging out fossils.



plains below, followed the natural waterways up into the mountains. Always moving toward higher and cooler elevations, they eventually came upon the Valley of Tarija.

When the low plains became dry and parched, and the water in the usual drinking places failed, the lush vegetation of this valley and the cool waters of the mountain streams served as prime attractions for these animals. And so, the Valley of Tarija became a sort of "summer resort" for large animals, just as it later did for Indians, the Spanish, and today's tourists.

Many of the animal visitors died while at their "resort," and their bodies sometimes became entombed in the sediments carried down by the incoming streams. Today, midsummer rains are not as frequent as in the past, and the volume of streams entering the valley is much reduced. The vegetation is also not as lush as when the "giants" roamed these valleys. Instead of more sediments accumulating in the valley, the rainwaters are now eroding the layers of clay and ledges of sand, forming gulches and ridges. Here are to be found the fossilized teeth, bones, and sometimes entire skeletons of "giants" of centuries past.

Perhaps the most commonly encountered fossils are those of great, armored glyptodonts—distant relatives of the modern armadillo. Protected by great dome-like shells up to seven feet long, they generally resembled huge turtles. The shells, up to an inch thick, were a mosaic of hundreds of hexagonal *scutes*, or plates, each several inches in diameter. The glyptodont's head was protected by a bony *casque*, or helmet, and the short, squat legs were sheathed in bony plates; the massive tail was encased in overlapping bony rings. Thus protected, the animal had little to fear from any predator of that time.

At the approach of an enemy, the glyptodont only had to squat—bringing the edges of its shell to the ground, retract its head like a turtle, and wait for the attacker to withdraw. In some species the tail was like a great war club, studded at the end with horny knobs or blunt spikes. A quick swing of the club could deal a vicious blow.

Their rootless, peglike grinding teeth show that glyptodonts were grazing vegetarians with feeding habits similar to those of a horse; they were, in fact, the dominant grazers of their time. They had no tusks or other front teeth adapted for seizing food, and most likely gathered vegetation with an outthrust tongue.

Fossils of five or six species of ground sloths, represented by a great many specimens, were found in the Valley of Tarija, suggesting that they had been among the most common of the ancient dwellers in these regions. Heavy and ponderous, the ground sloth generally resembled a gigantic bear, and some, such as *Megatherium*, were nearly the size of an elephant. The hind legs were short and stout, and the hind foot—turned over on its



Riggs (in dark suit), Strucco (with pipe), and Thorne (rt.) pose with Bolivian field assistants.

Riggs at the work he loved best. Remarkably productive during his lifetime of 94 years (1869-1963), Riggs was a Field Museum curator for more than four decades. ▼





The Bolivian venture was not an uninterrupted field trip. Riggs at right; the others are unidentified.

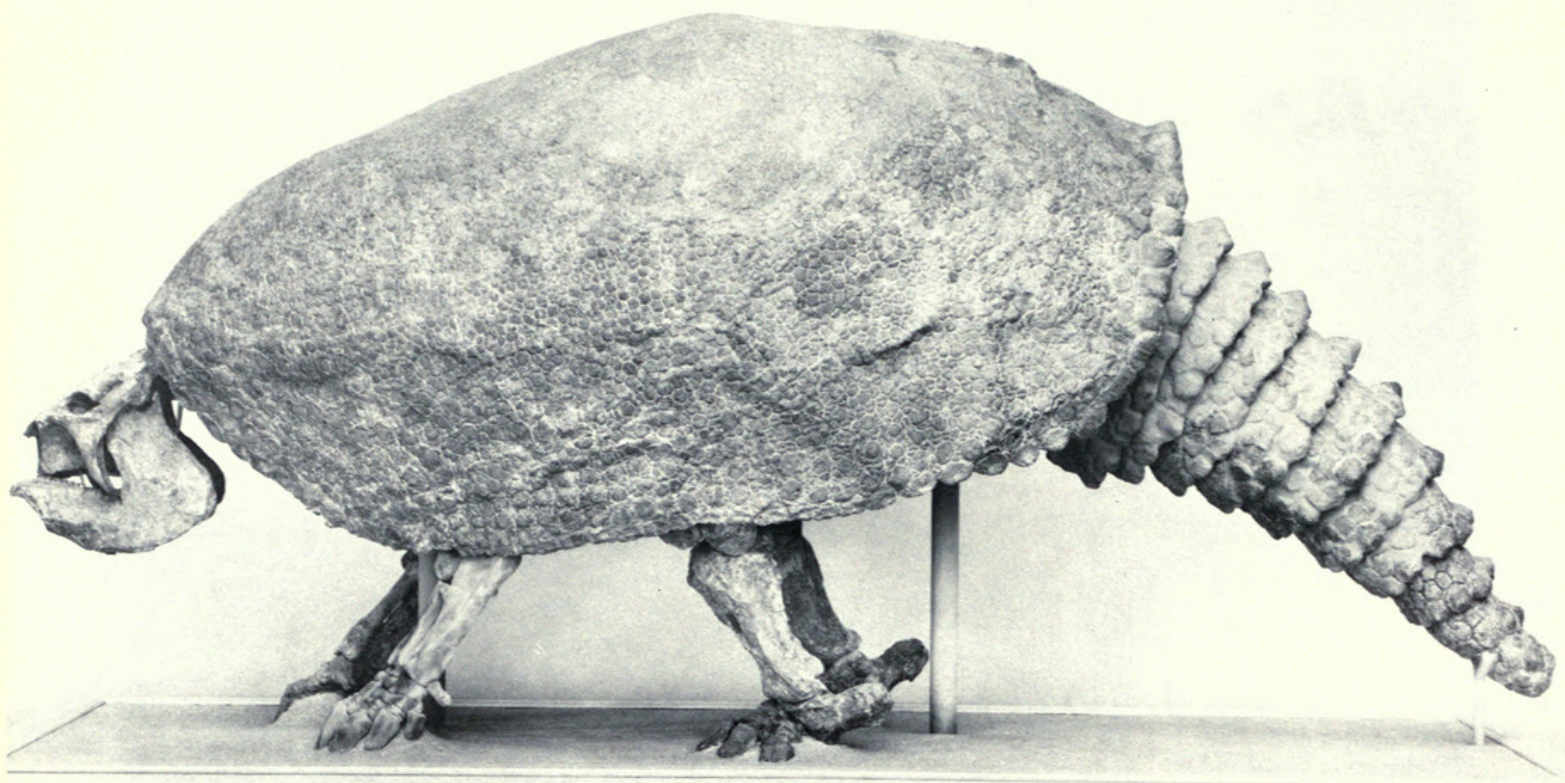
side—was armed with three strong claws; a great heel protruded backward. The leg joined the foot midway between claws and heel. The fore-feet had great claws, suitable for seizing and pulling down edible leaves, twigs, or fruit. Since these animals were without front teeth, they must have seized their food with a long, prehensile tongue, somewhat in the manner of giraffes. The food was then ground up by a broad battery of teeth and strong, massive jaws. Although inoffensive, ground sloths were far from defenseless. Any attacker venturing too close risked being gashed by the formidable claws or being crushed in a bearlike hug.

The partial skeleton of a ground sloth known as *Scelidotherium* was found one day by Strucco. Its head was partly exposed by erosion, while the rest of the skeleton was buried. As Strucco and his party were busy excavating the specimen, the landowner appeared. Drunk and surly, he demanded compensation for the unauthorized excavation, but Strucco was stubborn. After a protracted dispute and the smoking of several cornhusk cigarettes, the two parties finally came to an amicable settlement: the landowner was to receive two pesos, or 65 cents, for the privilege of digging on his property. The

excavation proceeded without further incident.

Another great extinct animal of this region was the toxodont. The name, meaning "bow-tooth," and referring to the strongly curved upper grinding teeth, was given by the British anatomist Sir Richard Owen upon studying specimens brought back to England by Charles Darwin nearly a century before. Toxodont was a ponderous beast, with forelimbs shorter than the hind. The dorsal placement of the eyes, ears, and nostrils suggests that it had aquatic habits. The animal's general appearance was that of a hippopotamus; it apparently lived near rivers and streams and was a plant-eater.

Glyptodonts, ground sloths, and toxodonts were all members of groups which originated in South America, but discovered in the same fossil beds as these animals are others which originated on continents to the north, and which have close living relatives in North America, Europe, and Asia. These "immigrants" came to South America from North America via the Panamanian land bridge, which was formed only a few million years ago. Before the appearance of this bridge there was no continuous connection between the two Americas, and South America was, as Australia is today, an "island



Glyptodont, on view in Hall 38

continent." Some of the animal immigrants from the north have names familiar to most of us, including the deer, horses, dogs, cats, and skunks, and relatives of the camel and of the elephant.

Elmer Riggs looked for fossils in the Valley of Tarija between July and November, 1924, when the approach of the torrential midsummer rains made further collecting impractical. The specimens were packed in large wooden crates and taken by truck to La Quiaca. From there they went by train to Buenos Aires, and then by ship to Chicago. Riggs and his son left Tarija in December.

Some two and a half years later, Riggs, accompanied now by Robert C. Thorne of Vernal, Utah, returned to Tarija to resume his unfinished work; and once again he was joined by José Strucco. The main qualification of Thorne, a former captain in the U.S. artillery, was his experience in operating field camps and in working with pack animals.

Upon his arrival at Tarija, Riggs found another revolution in progress and the province again under martial law. Because of this, the local constable would not grant permission to resume diggings. As a special favor, Riggs was allowed to establish camp at one of the sites he had worked in 1924, but the constable gave explicit instructions that actual digging could not be done, and the next morning a cavalry contingent rode out to make sure that the orders had not been violated. In just a matter of days, however, the constable did come

through with permission for collecting to resume—but just in the vicinity of Tarija.

While awaiting permission to work other areas, Thorne and Strucco reconnoitered the Valley of Padcayá, some 30 miles south of Tarija. The Padcayá valley was only about one-fourth the size of the Tarija, but Thorne and Strucco reported back that it was rich in fossils and apparently had never been worked by collectors. Within two days, camp was established at Padcayá, well beyond the constable's jurisdiction and well south of the mini-revolution.

The beds near Padcayá were similar in age and origin to those of Tarija, and many of the fossil mammals proved to belong to the same species. The valley had once been occupied by a lake, the shoreline of which could still be distinguished. The latter part of June and all of July were spent in the little valley, during which several prize specimens were secured. Early in September permission was finally received to collect again in the valley of Tarija, and camp was set up there.

By the end of September collecting activities for the second Marshall Field Paleontological Expedition came to an end. It had been a long, drawn-out enterprise, not without its hazards; but Riggs returned to Chicago with a special sense of achievement. During his five years' work on the continent, he had amassed for Field Museum more than 1,200 specimens of fossil animals from Argentina and Bolivia—the largest collection of South American fossils outside South America. □



Marshall, Larry G. 1978. "Bolivian Adventure." *Field Museum of Natural History bulletin* 49(5), 16–22.

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