NOTA PALEONTOLOGICA

ASTRAPOTHERIUM sp. (MAMMALIA, ASTRAPOTHERIIDAE) FROM MIOCENE STRATA ALONG THE QUEPUCA RIVER, CENTRAL CHILE

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ABSTRACT

The teeth of a single individual of a large extinct mammal, *Astrapotherium* sp. (Astrapotheriidae), were recently recovered from Tertiary sediments correlated to the Cura-Mallín Fomation exposed along the Quepuca River, Biobío Region, Central Chile. Although the species has yet to be securely determined, the remains are comparable with *Astrapotherium magnum* (Owen, 1853) and *A. hesperinum* Cabrera, 1940, from rocks of Santacrucian Mammal age (late Early Miocene) in southern Argentina and Chile. It is therefore postulated that at least part of the host rock unit containing these fossils is of that age. The rocks containing the fossil teeth of *Astrapotherium* sp. were apparently deposited in a meandering stream and flood plain environment. The presence of this vertebrate fossil also suggests abundant vegetation in the area.

Key words: Astrapotherium, Santacrucian Land Mammal Age, Cura-Mallín Formation, Río Pedregoso strata, Miocene, Chile.

RESUMEN

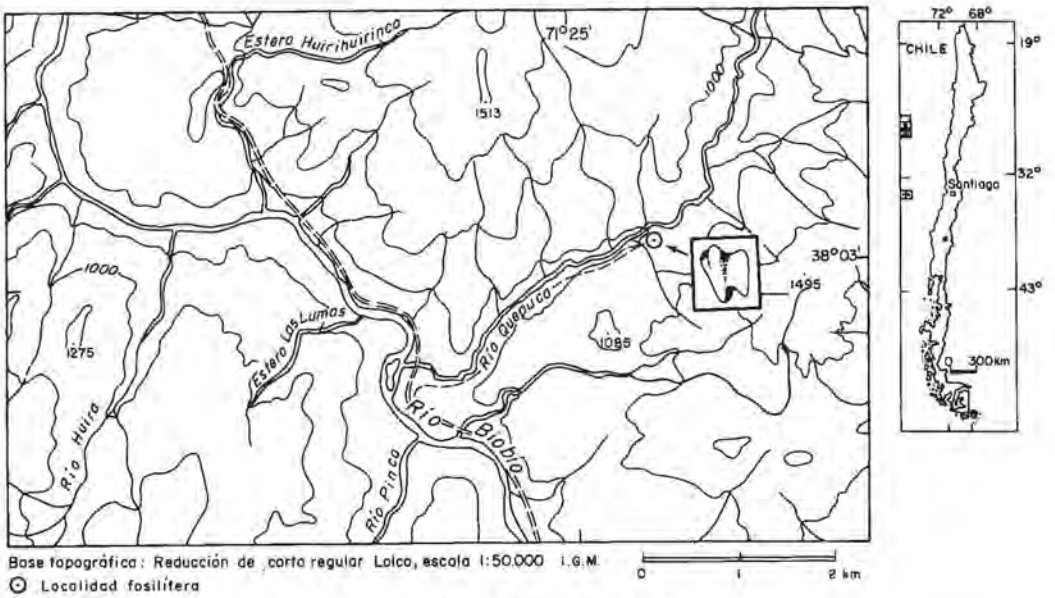
Recientemente, fueron recolectadas piezas dentarias de *Astrapotherium* sp. (Astrapotheriidae) en estratos terciarios, correlacionables con la Formación Cura-Mallín, expuestos a orillas del río Quepuca, en la Región del Biobío, Chile Central. Si bien no ha sido posible alcanzar una identificación específica, los restos son comparados con *Astrapotherium magnum* (Owen, 1853) y *A. hesperinum* Cabrera, 1940, formas características de Edad-mamífero Santacrucense (Mioceno Inferior tardío) del sur de Argentina y Chile. Se postula, en consecuencia, que al menos parte de la formación que contenía estos fósiles tiene esa edad. Las rocas en las cuales se recolectaron las piezas dentarias de *Astrapotherium* sp., fueron depositadas, aparentemente, en un ambiente de río meandriforme y de planicie de inundación; el vertebrado fósil sugiere también la presencia de abundante vegetación en el área.

Palabras claves: Astrapotherium, Edad Mamífero Santacrucense, Formación Cura-Mallín, Estratos de Río Pedregoso, Mioceno, Chile.

INTRODUCTION

On February 24, 1989, the upper molar of an extinct mammal attributed to *Astrapotherium* (Astrapotheria, Astrapotheriidae) was collected by Nicolás Blanco, a Geology student at the Universidad de Concepción, and one of the authors (M.S.) from Tertiary sedimentary rocks along the east bank of the Quepuca River, a tributary of the Biobío River, in Central Chile (38°0,29'S; 71°24,3'W, Text-Fig. 1, for geographic data see Sheet Curacautín, SJ-19-9 3800-7030, scale 1:250.000, Instituto Geográfico Militar, 1985). Afterwards, Carlos Emparan, Renate Wall, from the Servicio Nacional de Geología y Minería, and the authors visited this locality on November 18, 1989, and recovered the upper right **P4-M3** of the same animal. This is the first record of *Astrapotherium* for the Tertiary sedimentary rocks exposed north of the Aisén Region, and it is of special importance for delimiting the age of the host strata (equivalent to the Cura-Mallín Formation of Niemeyer and Muñoz, 1983).

In this note the authors give a preliminary identification of this fossil, place it in stratigraphic context,



Text-Fig. 1. Map showing locality where *Astrapotherium sp.* was collected.

and discuss its age implications for the rock unit which contains it.

The only previous reports of *Astrapotherium* Burmeister, 1879, for Chile are a specimen of *A. magnum* from the Palomares (=Santa Cruz) Formation at Laguna del Toro in Magallanes (Hemmer, 1935) and the type of *A. hesperinum* from the Río Frías Formation in Aisén (Cabrera, 1940). In South America, genus *Astrapotherium* is represented by 23 species found in rocks of Oligocene-Miocene age (Mones, 1986).

Abbreviations include: L. length; W. width; m: meters; cm. centimeter; mm. millimeters; **M.** upper molar; Ma. megaannum or millions of years ago, a point in time; MNHN SGO-PV: Museo Nacional de Historia Natural, Santiago, Sección Geología, Vertebrate Paleontology collections.

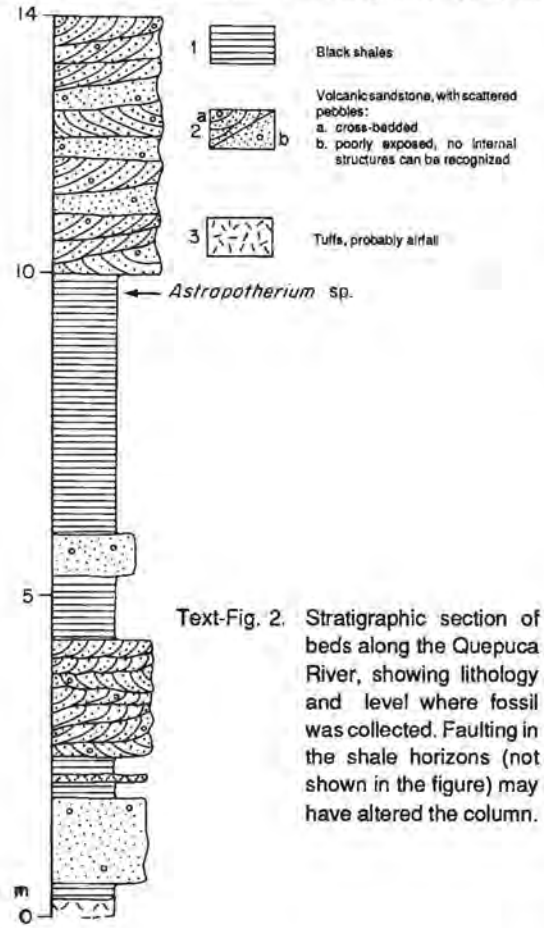
STRATIGRAPHIC CONTEXT

Widespread volcano-sedimentary successions of Tertiary age, assigned to the Cura-Mallín Formation (*sensu* Niemeyer and Muñoz, 1983) and its equivalent units (>1.000 m thick; Suárez and Emparan, 1988; in prep.), crop out in the Andean region between latitudes 38° and 39°S. They comprise three main units, which from an older to younger stratigraphic order (however **b.** overlies and laterally interfingers with **a.**) are: **a.** a mainly volcanic complex, well exposed in the Guapitrio River (equivalent to the Río Queuco Member of the Cura-Mallín Formation of Niemeyer and Muñoz, 1983), formed principally by ash-fall tuffs, pyroclastic flows, lava flows, and tuffites and sandstones of a lacustrine and fluvial facies; **b.** a mainly sedimentary unit well exposed in the Pedregoso River (Río Pedregoso Beds of Sandoval, 1977, and equivalent to the Malla-Malla Member of the Cura-Mallín Formation of Niemeyer and Muñoz, 1983), and composed of sandstones, shales, ash-fall tuffs and tuffites, conglomerates, volcanic debris flows, lahars, subordinate pyroclastic flows, oil-shales, limestones and lava flows, deposited in lacustrine, deltaic and fluvial systems; and **c.** a unit of orthoconglomerates, debris flow deposits and ignimbrites, deposited by alluvial systems and typically exposed in the Tralilhue and Liucura rivers.

An Eocene-Miocene age range for the sedimentary strata exposed in the Pedregoso River has been suggested by previous authors (*i.e.* Osorio *et al.*, 1982; Palma-Heldt, 1983; Cisternas and Díaz, 1985). An important lacustrine facies association included in these strata developed between 17.5 ± 0.6 (biotite)

and 13.0 ± 1.6 Ma (whole rock), as indicated by K-Ar dates on an intercalated tuff and lava flow, respectively (Suárez and Emparan, 1988; in prep.).

Radioisotopic (K-Ar) dates indicate that these rocks accumulated between 22.0±0,9 and 10.7±1.1 Ma (Suárez and Emparan, 1988).



Text-Fig. 2. Stratigraphic section of beds along the Quepuca River, showing lithology and level where fossil was collected. Faulting in the shale horizons (not shown in the figure) may have altered the column.

The *Astrapotherium* fossil remains were collected from the upper part of a 14 m exposure of cross-bedded sandstones and shales exposed along the Quepuca River (Text-Figs. 1, 2), and comparable to some of the fluvial and lacustrine facies exposed along the Guapitrio River, about 25 km to the south (Text- Figs. 1, 2). The measured section includes, from top to bottom:

4.00 m	Coset of cross-bedded light-green volcanic sandstones, with scattered pebbles (less than 1 cm in diameter).
4.00 m	Dark gray massive shales occasionally laminated; with medium-grained sand grains and slickenside planes common; the teeth of *Astrapotherium* were collected in upper 0.5 m; no other fossil vertebrates were observed.
0.65 m	Fine to medium-grained light green volcanic sandstones (badly exposed).
1.00 m	Dark gray shales with scattered fine to medium-grained sands; slickenside planes common.
1.80 m	Coset of cross-bedded light green volcanic sandstones; fine to medium-grained with isolated pebbles; no upward grain size variation observed; some slickenside planes.
0.30 m	Dark gray shales, massive, with medium size-grained sand clasts.
0.10 m	Tuff; poorly exposed (airfall?).
0.20 m	Dark gray sandy shale; probably faulted upper contact.
1.30 m	Light green medium-grained volcanic sandstones.
0.25 m	Greenish-gray tuffaceous shale, fissile, with carbonaceous seams and slickenside planes.
0.30 m	Massive medium gray tuff.

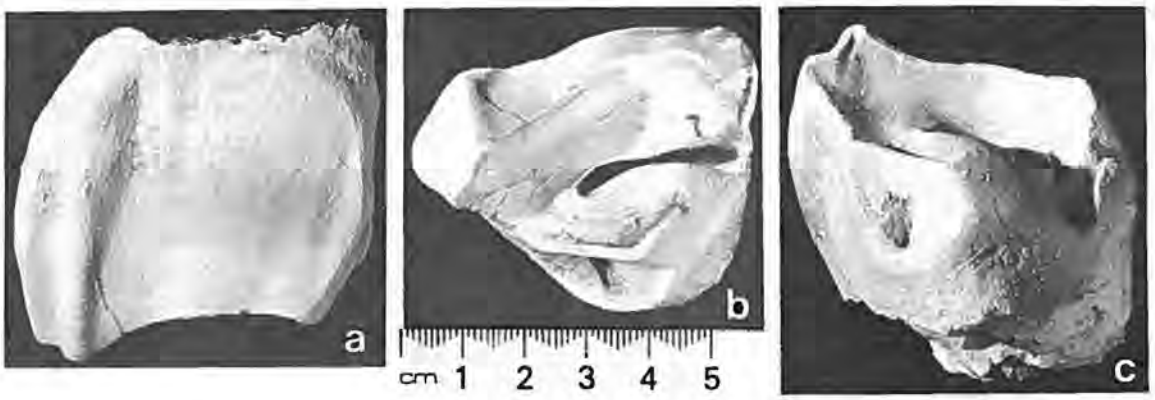
Unexposed base

FOSSIL

The fossil material includes an isolated left upper third molar **(M3)** (Text - Fig. 3a-c) and right upper fourth premolar **(P4)** and three molars **(M1-3)** (Pl. 1, Figs. 1-3). The right **P4-M2** were recovered in sequential contact, while the left and right **M3**'s were isolated. All of the teeth were found within 1 m of each other, *in situ,* and in the same level. Based on similarities of occlusal wear the authors believe that they are all referable to a single individual (MNHN SGO-PV 4003).

Except for minor damage to the posterior edge of the right **M2** and medio-labial edge of the right **M3**, the teeth are complete and remarkably well preserved. Although the right **P4-M2** were found together, there is no trace of the maxillary bone nor were any bone fragments observed.

The fossil is confidently referable to the genus *Astrapotherium* (order Astrapotheria, family Astrapotheriidae) which is known only from Early Miocene rocks of Colhuehuapian and Santacrucian age in Argentina and Chile (Bondesio, 1986; Marshall *et al.*, 1986; Marshall and Salinas, 1990). However, the identity of the species is uncertain. This is due to the fact that 23 species names have been assigned to *Astrapotherium* (see Mones, 1986, p. 180) and these



Text-Fig. 3. *Astrapotherium* sp. (Astrapotheria, Astrapotheriidae) from strata exposed along Quepuca River. MNHN SGO-PV 4003. Left **M3**, **a.** labial; **b.** occlusal; **c.** lingual views. Measurements (in mm): **M3** L = 58.4, W = 45.3.

have not received a synthetic systematic revision. Consequently, the number of valid species has yet to be securely determined. Synonymies for Santacrucian species of *Astrapotherium* are discussed by Scott (1928) and Tauber (1985). Scott (1928), based solely on size, recognized three Santacrucian species as valid: *A. giganteum, A. magnum and A. nanum;* these are, by astrapothere standards, of large, medium and small size, respectively.

AGE

The fossil from the Quepuca River compares closely in size with specimens of *Astrapotherium magnum* (Owen, 1853) from the Santa Cruz Formation of Southern Argentina and Chile, and with *A. hesperinum* Cabrera 1940, from the Santacrucian age Río Frías Formation along the Alto Río Cisnes, Chile (see Marshall and Salinas, 1990). Although the exact species identity of the fossil must await a comprehensive study of all type specimens, one of the authors (L.G.M.) has determined that it compares better with Santacrucian than with Colhuehuapian age species. In addition, the genus *Astrapotherium* and family Astrapotheriidae are unknown in rocks younger than Santacrucian age (*sensu* Marshall and Salinas, 1990) in Argentina and Chile. Therefore, the beds along the Quepuca River are older than 15 Ma which is the upper age limit of the Santacrucian Land Mammal Age (see Marshall *et al.*, 1986). Based on this information and on the K-Ar dates reported above, the host strata equivalent to the Cura-Mallín Formation is at least in part Santacrucian in age (late Early Miocene).

PALEOENVIRONMENT

The only nearly complete skeleton of an astrapothere yet known is of *Astrapotherium magnum,* collected from the Santa Cruz Formation in southern Argentina (Riggs, 1935). This animal was about the size of a living cow. It stood about 1.37 m in height at the shoulders and was about 2.88 m from the tip of the nose to the end of the pelvis. This size corresponds to the specimen D.14251 of the Field Museum of Chicago, and although it does not represent the general size of this species, it gives an idea of its proportions. Considering the large head-size, the large projecting upper canine teeth, and the probably small proboscis of the *Astrapotherium,* the low-crowned cheek teeth and probable padded feet may indicate that it fed upon lush vegetation along riparian or in meadow habitats (Riggs, 1935; Scott, 1937). It is a good indicator for low land continental environments.

This interpretation of the paleoenvironment of *Astrapotherium,* based primarily on anatomical features, is supported by the depositional environment

inferrred for the fossil level at the Quepuca River. The black shale and crossbedded sandstone association is interpreted as having been deposited in a meandering river system, adjacent to an active volcano(es). The crossbedded sandstones represent channel or bar deposits, while the shales may be flood-plain accumulations (swamps or oxbow lakes?).

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PLATE 1

Figures

Astrapotherium sp. (Astrapotheria, Astrapotheriidae) from the strata exposed along the Quepuca River. MNHN SGO-PV 4003.

1 - 3 Right P4-M3. 1. Labial; 2. Occlusal; 3. Lingual views. Measurements (in mm): **P4** L: 26.9; W: 31.9; **M1** L:45.3; W: 46.0; **M2** L: 59.3; W: 56.5; **M3** L: 59.8; W: 45.7; **M1-3** L: 146.5. (p. 223)

PLATE 1