

NEW SPECIMENS OF PLATYRRHINE PRIMATES FROM PATAGONIA (PINTURAS FORMATION, EARLY MIOCENE)

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HERE we report nine new fossil specimens of platyrrhine primates collected in late Early Miocene deposits of the Pinturas Formation, Argentine Patagonia, during two joint paleontological expeditions in 2004 and 2013 carried out by the Centro Nacional Patagónico (CENPAT, Puerto Madryn, Argentina), Stony Brook University, and Laboratorio de Investigaciones en Evolución y Biodiversidad (LIEB, Universidad Nacional de la Patagonia “San Juan Bosco”, Sede Esquel, Argentina).

The Pinturas Formation (Bown and Larriestra, 1990) is located in the upper valley of the Pinturas River and its tributaries, about 50 km south of the town of Perito Moreno, in northwestern Santa Cruz Province, Argentina (Fig. 1). This formation includes the second largest collection of fossil platyrrhines from South America or the Caribbean besides the more diverse assemblage of La Venta, Colombia. To date, at least two genera and four primate species have been recognized in the Pinturas section: *Soriacebus ameghinorum* Fleagle *et al.*, 1987, *Soriacebus adrianae* Fleagle, 1990; *Carlocebus carmenensis* Fleagle, 1990 and *Carlocebus intermedius* Fleagle, 1990, as well as a third unpublished genus (Tejedor *et al.*, 2012).

The new materials reported here include isolated upper and lower teeth from five localities in the Pinturas Formation. Measurements of the specimens are given in Table 1. Additionally, three specimens previously recorded are being reassigned.

Institutional abbreviations. MACN Pv SC, Museo Argentino de Ciencias Naturales (Buenos Aires), Vertebrate Paleontology, Santa Cruz Collection; MPM-PV, Museo Padre Manuel Molina (Río Gallegos), Vertebrate Paleontology Collection.

Anatomical abbreviations. Lower case letters, *i* and *p*, indicate lower incisors and premolars, respectively; capital letters, *C*, *P* and *M* indicate upper canines, premolars and molars, respectively.

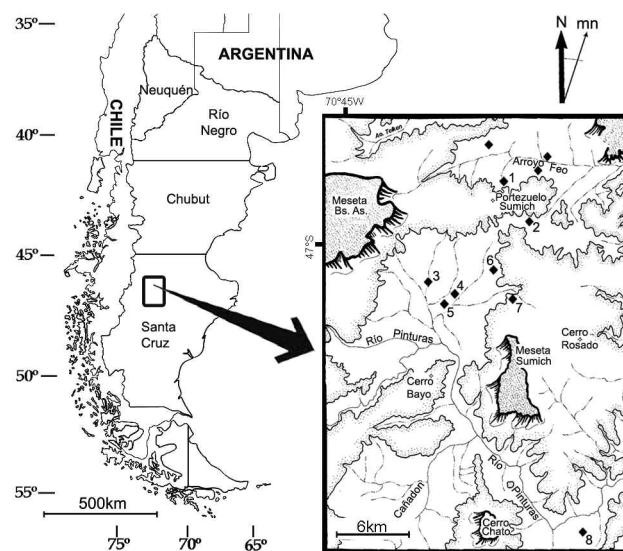


Figure 1. Map of Patagonia showing the location and detail of the Rio Pinturas area, approximately 50 km south of Perito Moreno in Santa Cruz Province, Argentina. Black diamonds indicate vertebrate fossil localities in the Pinturas Formation; 1, Portezuelo Sumich Norte; 2, Portezuelo Sumich Sur; 3, Estancia Ana Maria (Loma de las Ranas); 4, Loma de la Lluvia; 5, Cerro de los Monos; 6, Estancia Los Toldos Norte; 7, Estancia Los Toldos Sur; 8, Estancia el Carmen. From Bown and Larriestra (1990).

DESCRIPTIONS

MPM-PV 17395 (Fig. 2.1). Right lower canine from Portezuelo Sumich Norte, the type locality of *Soriacebus ameghinorum*. This specimen shows several similarities in morphology and size to the canine in the holotype of *S. ameghinorum* (MACN Pv SC2) (Fleagle *et al.*, 1987), but differs by being less robust, more compressed mesiodistally, and having a less developed basal cingulum. It is noted that this specimen closely resembles the Lower Morph 2 of Tejedor (2002), including MACN-Pv SC76 and MACN-PvSC68, that have been assigned to a pitheciine taxon, possibly *S. ameghinorum*.

MPM-PV 17397 (Fig. 2.2). Right lower canine from Portezuelo Sumich Sur, the type locality of *Soriacebus adrianae*. The crown is complete and relatively low, as in MPM-PV 17395, also sharing approximately the same structure and size proportions. However, MPM-PV 17397 is slightly longer mesiodistally, giving a more subtriangular appearance in cross-section, and has a less developed distolingual heel. The overall crown cross-section is rather subtriangular as in the type of *S. ameghinorum*, although less robust, with a weak entocristid, and a less developed lingual cingulum. The crown is slightly taller and more robust than in MACN.Pv SC22 (*cf. Carlocebus carmenensis*; Tejedor, 2002).

MPM-PV 17401 (Fig. 2.3). Right lower p2 collected in Portezuelo Sumich Sur. Moderately to heavily worn on the apical crest on the buccal side. The crown is relatively low, unicusped, with a small distal heel and well developed pre- and postprotocristids. Comparisons with p2 in the mandibular fragment MPM-PV 1605 assigned to *S. adrianae* (see Tejedor, 2005a) reveal that they are indistinguishable, although p2 is more worn in MPM-PV 1605. Also according to the root size and shape, it is close to the type of *S. adrianae* (MACN-Pv SC59), although the crown is broken in the latter. Thus, this new specimen represents the best morphological evidence for a p2 in *S. adrianae*.

MPM-PV 17402 (Fig. 2.4). Lower left p4 collected in Estancia El Carmen. It has four cusps, with the protoconid by far the most prominent, followed by the metaconid. The trigonid is closed, lacking a paraconid. A small entoconid is lingually projecting giving the tooth an elliptical shape, as seen in p4s of *Homunculus*, *Mazzonicebus* and the living *Callicebus* (Kay, 2010). Noteworthy, is the development of the hypoconid, a cusp not generally present on p4s. Re-

garding its proportions and overall morphology, MPM-PV 17402 is almost indistinguishable from MACN-Pv SC309, an isolated p4 from Cerro de los Monos formerly included –with reservations– in *C. carmenensis*, but now being assigned to a new genus (Tejedor *et al.*, 2012). The p4 in the holotype of *C. carmenensis* (MACN-Pv SC266) is more molariform with a well developed talonid basin, lacking the elliptical occlusal outline shape above mentioned (see Fleagle, 1990, fig. 14b).

MPM-PV 17400 (Fig. 2.5). Left upper I2 collected in Portezuelo Sumich Sur. It is slightly worn only at the tip of the crown, high-crowned, and exhibits a bucco-lingually compressed shape, as well as a weak lingual cingulum with no lingual heel. It has the general appearance of an I2 of a living pitheciine, but due to the scarcity of upper incisors in the Pinturas record, tentative attribution remains open, although its pitheciine status is unquestioned.

MPM PV 17399 (Fig. 2.6). Right upper P2 collected at Portezuelo Sumich Sur. This specimen is proportionally smaller than all other teeth reported here. It is single-rooted, single-cusped, and triangular in outline with a complete lingual cingulum. Although somewhat smaller, the morphological pattern of MPM-PV 17399 is similar to that of *S. ameghinorum*, as inferred by comparisons with P2 in MACN-Pv SC4 (see Fleagle *et al.*, 1987, fig. 4), a partial maxilla of *S. ameghinorum*, but closer in size to *S. adrianae*. The only previous evidence of upper premolars of *S. adrianae* is MACN-Pv SC389, a maxillary fragment with P2-3 collected at the Loma de la Lluvia locality.

MPM-PV 17394 (Fig. 2.7). Right maxilla with P3-4 and partial alveolus of P2 from Portezuelo Sumich Norte. Both premolars have a subtriangular occlusal shape, more distinctly in P3. Like the upper premolars of *Soriacebus*, the P3 has three roots, while P4 has two. P3-4 have a well developed paracone buccally, and a small and low protocone in lingual position. The P3 shows a moderately developed lingual cingulum with a crestiform bulge at the hypocone position. The P4 has greater development of protocone and the presence of a tiny hypocone joined by a hypoprotocrista; the talon basin is wider and the mesial area has a small fovea. These premolars resemble P3-4 in MACN-Pv SC4 in terms of proportions and general morphology. The greatest difference between P3s of MPM-PV 17394 and MACN-Pv SC 4 (see Fleagle *et al.*, 1987, fig. 4) is the stronger and better

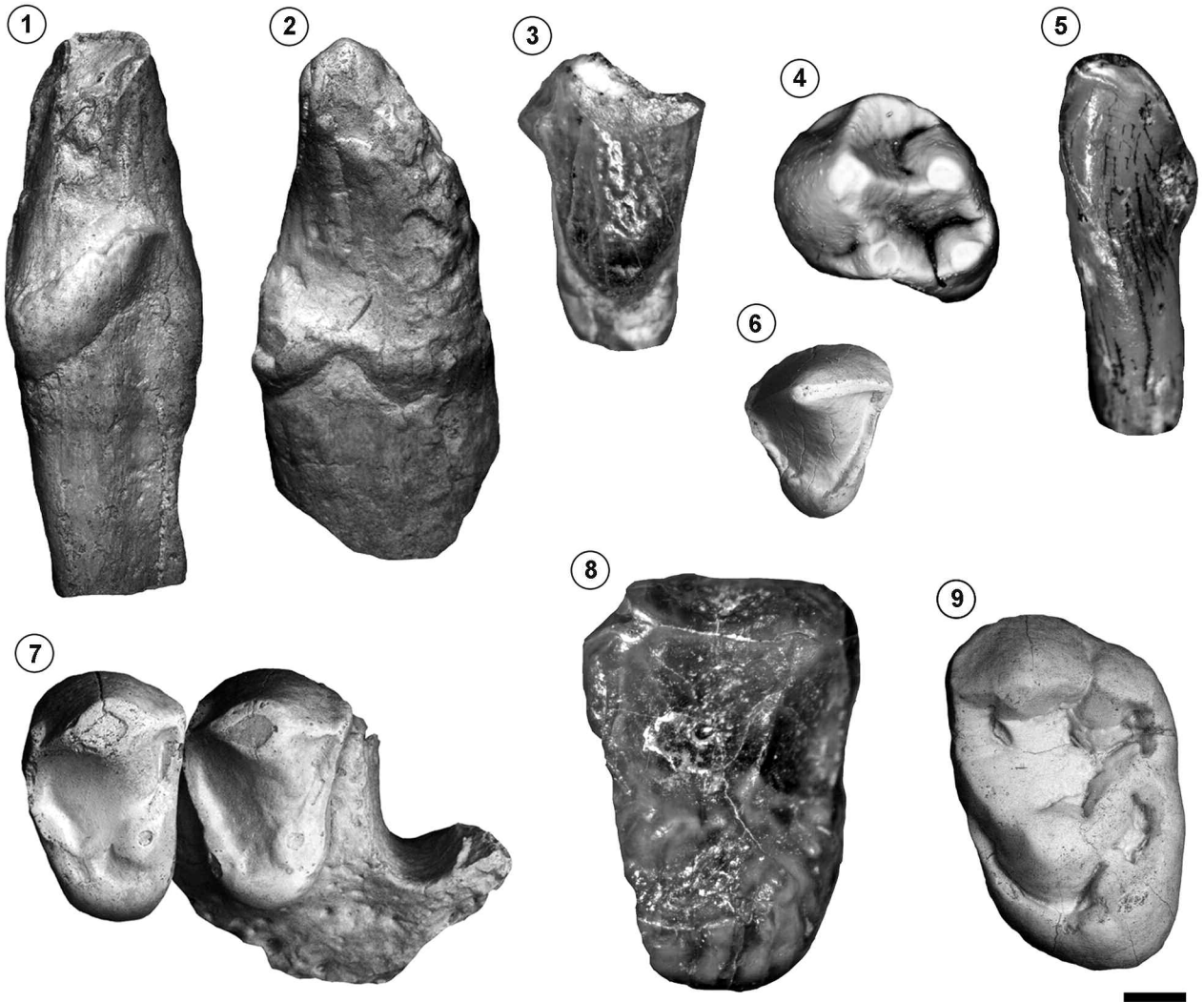


Figure 2. New specimens from the Pinturas Formation (Argentina). **1**, MPM-PV 17395, right lower canine (buccodistal view); **2**, MPM-PV 17397 right lower canine (buccal view); **3**, MPM-PV17401, right lower p2 (buccal view); **4**, MPM-PV 17402, left lower p4 (occlusal view); **5**, MPM-PV 17400, left upper lateral incisor (lingual view); **6**, MPM-PV 17399, right upper P2 (occlusal view); **7**, MPM-PV 17394, fragmentary maxilla with P3-4 and partial alveolus of P2 (occlusal view); **8**, MPM-PV17403 left upper M1 or M2 (occlusal view); **9**, MPM-PV 17398 left upper M3 (occlusal view). Scale bar= 1mm.

developed hypocone in the latter

MPM-PV 17403 (Fig. 2.8). Left upper M1or M2 collected at Loma de las Ranas. Although somewhat broken mesially, a mesial fovea is evident. The molar has a well developed hypocone with no connection to the postprotocrista. The lingual cingulum is strong, and the talon is distally broad. In general, this molar resembles upper molars of *C. carmenensis*, such as MACN-Pv SC 98; MACN-Pv SC 254 or MACN-Pv SC 316.

MPM-PV 17398 (Fig. 2.9). Left upper M3 from Loma de la Lluvia. Despite being an M3, the four main cusps of this

tooth are developed and it shows two roots, although the lingual one is broken. The paracone and protocone are well developed, rounded and low, while the metacone is small and lingually displaced. The hypocone is bulbous and distolingually expanded, connected to the postprotocrista by a short hypoprotocrista. Based on its morphology and size, this M3 could be assigned to *C. carmenensis*.

Comments on previous records of isolated teeth from the Pinturas Formation

MACN-Pv SC 236 (Fig. 3.1). Is a right maxillary fragment

TABLE 1. New specimens from Pinturas Formation.

Species	Specimen	Description	Locality	MD	BL
indet	MPM-PV 17395	Right lower canine	P. Sumich Norte	3.86	4.41
indet	MPM-PV 17397	Right lower canine	P. Sumich Sur	4.20	3.37
<i>S. ameghinorum</i>	MPM-PV 17394	Maxilla with P3-4	P. Sumich Norte	2.83; 2.86	4.05; 4.33
<i>C. carmenensis?</i>	MPM-PV 17398	Left upper M3	Loma de la Lluvia	3.62	6.12
<i>S. adrianae</i>	MPM-PV 17399	Right upper P2	P. Sumich Sur	2.46	2.97
~Pitheciinae	MPM-PV 17400	Left upper lateral incisor	P. Sumich Sur	2.31	1.59
<i>S. adrianae</i>	MPM-PV 17401	Right lower p2	P. Sumich Sur	3.17	2.34
<i>C. carmenensis?</i>	MPM-PV 17402	Left lower p4	Estancia El Carmen	4.85	3.74
<i>C. carmenensis?</i>	MPM-PV 17403	Left upper M1 or 2	Loma de las Ranas	~4.75	6.20
<i>Other specimens mentioned in the text</i>					
<i>C. carmenensis</i>	MACN-Pv SC 236	Right maxilla with P2-3	P. Sumich Norte	3.30; 4.06	4.71; 5.86
indet	MACN-Pv SC 35	Left upper P2?	P. Sumich Norte	3.10	4.22
indet	MACN-Pv SC 116	Left upper P3?	Estancia Ana María	3.34	4.92
<i>S. ameghinorum</i>	MACN-Pv SC 4	Maxilla with C-P4	P. Sumich Norte	2.96; 2.80; 265	3.46; 3.93; 4.15

Abbreviations: MD= Mesiodistal; BL= Buccolingual; measurement in mm.

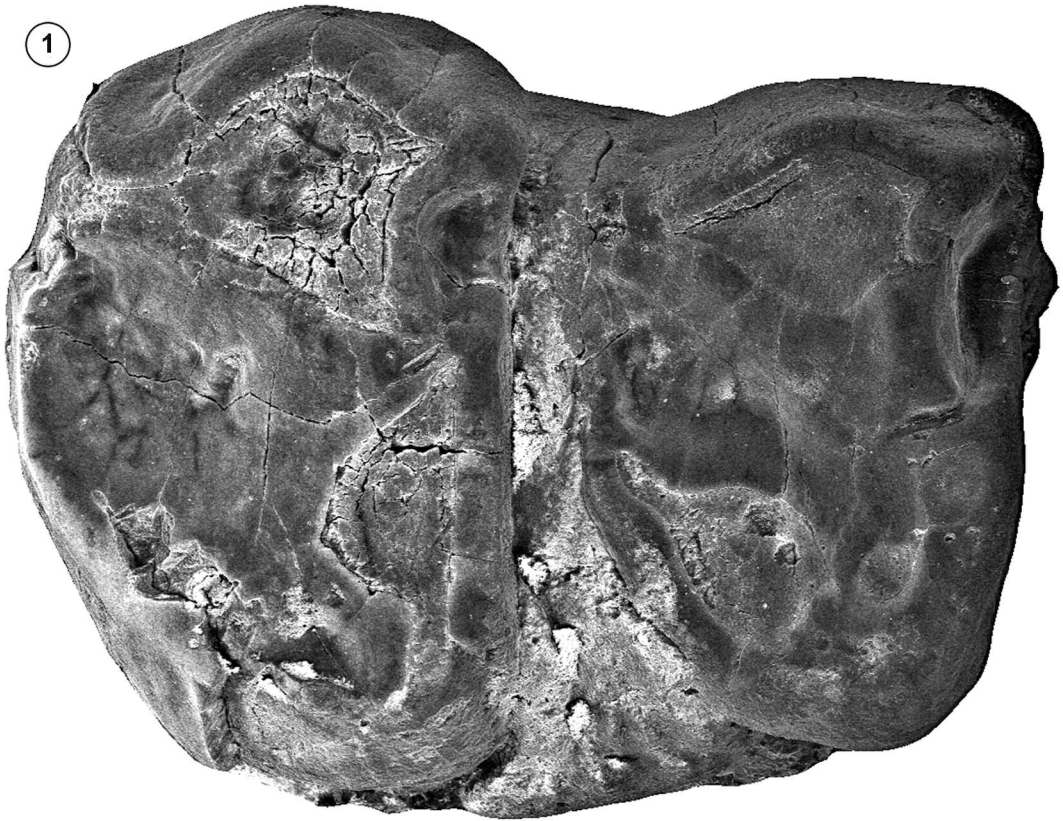
with two premolars from Portezuelo Sumich Norte, and assigned to *C. carmenensis*. Although Fleagle (1990) described these premolars as P3-4; because the most anterior alveolus likely pertains to a canine instead of P2 based on its larger size and shape. In addition, the occlusal outline of the anterior tooth is triangular, as seen usually in P2s of living platyrrhine primates. But most important is that the P3 has three roots, as in the upper premolars of *Soriacebus*. The presence of three roots in upper premolars is a primitive character for platyrrhines, but the number of upper premolar roots found in specimens assigned to *Carlocebus* varies among different specimens, including MACN-Pv SC 77 (Tejedor, 2000).

MACN-Pv SC 35 (Fig. 3.3). Left upper premolar collected in Portezuelo Sumich Norte, and described as a P2 of *S.*

ameghinorum by Tejedor (2000). While this is certainly a P2, the general morphology differs from *S. ameghinorum* and all other species reported from the Pinturas Formation. The paracone is lingually displaced, thus reducing the occlusal surface, while the buccal cingulum is complete, unlike all other premolars from Pinturas. The protocone is placed close to the paracone closing the mesial area with a pre-protocrista surrounding a shallow fovea.

MACN-Pv SC 116 (Fig. 3.2). Left upper premolar from Estancia Ana María. Although mentioned by Tejedor (2000) as a P4 of *S. ameghinorum*, this specimen strongly resembles MACN-Pv SC35 in the morphological pattern, differing from all other Pinturas premolars. The lingual half of this tooth is worn, but a small hypocone appears to be present. The paracone is also placed more lingually, as seen in

Figure 3.1, *Carlocebus carmenensis*, MACN-Pv SC 236, right upper P2-3, occlusal view; 2, genus and species *indet.*, MACN-Pv SC 116, left upper P3or4?, occlusal view; 3, genus and species *indet.*, MACN-Pv SC 35, left upper P2or3?, occlusal view. Scale bar= 1mm.



MACN-Pv SC35, and a complete buccal cingulum is present, as well as a protocone close to the paracone, reducing the occlusal area. However, the larger size and more expanded talon indicate that this may be a P3, possibly pertaining to the same taxon as MACN-Pv SC35 (P2, Fig. 3.2), differing from all species previously described from Pinturas.

DISCUSSION

The Pinturas Formation has a record of over 100 fossil primate specimens, many of them previously attributed to the four described species, while others have been either tentatively assigned or left unallocated with their position being uncertain (Fleagle *et al.*, 1987; Fleagle, 1990; Tejedor, 2002, 2005a,b). As mentioned above, a new genus is being described (Tejedor *et al.*, 2012) and the possibility of a still greater diversity is likely. Among nine specimens reported here, four can be referred to formerly known species. MPM-PV 17401 and MPM-PV 17399 are relevant for being assigned to *S. adrianae*, a species still poorly represented in the Pinturas record, and new information on its anatomy was provided. MPM-PV 17394 is undoubtedly assigned to *S. ameghinorum* and offers valuable information on the morphology of the upper premolars because of its excellent preservation. Two lower canines reported here, MPM-PV 17395 and MPM-PV 17397, contribute to a possible expansion of the record for the genus *Soriacebus*, or more broadly to pitheciines, although a more precise attribution is still pending.

The remaining three specimens described here (MPM-PV 17402, MPM-PV 17403 and MPM-PV 17398) exhibit the morphology and size proportions compatible with *C. carmenensis*. However, as noted by Fleagle (1990), there is morphological variability among the specimens tentatively assigned to *C. carmenensis*, which warns us of possible misallocations, as was shown by the report of a new taxon from the locality of Cerro de los Monos (Tejedor *et al.*, 2012). Additionally, relevant differences were mentioned in connection with MACN-Pv SC35 and MACN-Pv SC116, indicating a possible new taxon. Based on these uncertainties, a more detailed study and precise taxonomic classification are needed for to better understand the relatively abundant collection of Pinturas primates.

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