

1 **FIRST RECORD OF *INCAMYS BOLIVIANUS* (CAVIOMORPHA,**  
2 **CHINCHILLOIDEA) IN PATAGONIA (ARGENTINA)**

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9 BUSKER *ET AL.*: FIRST RECORD OF *INCAMYS BOLIVIANUS* IN PATAGONIA

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11 **Key words.** *Incamys*. Rodentia. Sarmiento Formation. Deseadan. Cabeza Blanca. Bolivia.

12 **Palabras clave.** *Incamys*. Rodentia. Formación Sarmiento. Deseadense. Cabeza Blanca.  
13 Bolivia.

14 THE American Hystricognathi, or caviomorphs, are the most antique rodent radiation in  
15 South America. Since the Eocene, they are an important extant and extinct faunal  
16 component, especially in the neotropical region of South America (Upham and Patterson,  
17 2015; Vucetich *et al.*, 2015a).

18 *Incamys* Hoffstetter and Lavocat (1970) is an extinct genus of chinchilloid rodent  
19 (former considered a dasyproctid, see Vucetich *et al.*, 2015b), currently represented by at  
20 least two species. *Incamys bolivianus* Hoffstetter and Lavocat (1970), from Salla-Luribay

21 (Deseadan South American Land Mammal Age (SALMA), late Oligocene; Bolivia) was  
22 extensively described (Lavocat, 1976; Patterson and Wood, 1982), with abundant cranial,  
23 mandibular, and dental remains collected. The presence of *I. bolivianus* in Cabeza Blanca  
24 was discussed in Patterson and Wood (1982), but never confirmed. The second species is  
25 *Incamys menniorum* Vucetich *et al.* (2015b), from Cabeza Blanca (Deseadan SALMA, late  
26 Oligocene; Patagonia, Argentina), which is known only by two isolated molars, an M3  
27 (MPEF-PV 10686) and an m3 (MPEF-PV 10685). Finally, a third doubtful species,  
28 *Incamys pretiosus* Lavocat (1976), also from Salla, requires further revision before its  
29 validation (Vucetich *et al.*, 2015b).

30 The specimen studied herein comes from Cabeza Blanca, one of the most important  
31 localities with Deseadan fauna of Patagonia (Escalante Department, at 45° 13'S and 67°  
32 28'W, Chubut Province, Argentina, Fig. 1) (Dozo and Vera, 2010). It has been prospected  
33 since the 19th century, yielding an extensive and diverse record of mammals, particularly  
34 of a (now) very well-known rodent fauna (*e.g.* Loomis, 1914; Wood and Patterson, 1959;  
35 Dozo *et al.*, 2014). To date, the revision and systematics of caviomorph rodents from  
36 Cabeza Blanca is in progress, and at least twenty caviomorph species have been described.  
37 Some of them are extensively described, with fragmentary maxillary and mandibular  
38 remains, some partial skulls and isolated teeth, turning Cabeza Blanca into one of the  
39 richest fossiliferous localities of South America, with all four superfamilies of  
40 Caviomorpha represented (*e.g.* Ameghino, 1894, 1897; Loomis, 1914; Wood and Patterson,  
41 1959; Vucetich *et al.*, 2015b).

42 The locality of Salla-Luribay is approximately 90 km southwest of La Paz, Bolivia  
43 and more than 3000 km from Cabeza Blanca. It is another well know Deseadan locality

44 with a large mammal record described, including several rodent species (*e.g.*, Hoffstetter,  
45 1968, 1976; Hoffstetter and Lavocat, 1970; Hoffstetter *et al.*, 1971; Lavocat, 1976;  
46 Patterson and Wood, 1982).

47 Despite new collections are increasing the list of rodents for these Deseadan  
48 localities, only two genera (*Incamys* and *Cephalomys*) are shared (Vucetich *et al.*, 2015b).  
49 The aim of this contribution is to describe a new specimen herein assigned to *I. bolivianus*  
50 from Cabeza Blanca (Patagonia, Argentina), which represents the first shared species and  
51 bring new elements for the discussion of the faunistic and biochronologic relationships of  
52 Cabeza Blanca and Salla.

### 53 **GEOLOGICAL SETTING**

54 In Cabeza Blanca (Fig. 1) Cenozoic marine and continental sedimentary rocks are  
55 exposed. From base to top, the stratigraphic column is composed of Eocene–Oligocene  
56 “Tobas del Sarmiento”, Sarmiento Group or Sarmiento Formation (Feruglio, 1949; Andreis  
57 *et al.*, 1975; Spalletti and Mazzoni, 1977, 1979), as described by Reguero and Escribano  
58 (1996), which in turn are covered by early Miocene shallow marine strata corresponding to  
59 the “Patagoniano” (*sensu* Feruglio, 1949) or Chenque Formation (Bellosi, 1987, 1990;  
60 Sciutto *et al.*, 2000). On top of these beds there are some Plio-Pleistocene conglomeratic  
61 fluvial deposits (Rodados Patagónicos).

62 The Sarmiento Formation is primarily composed of fine-grained tuffaceous siltstones,  
63 mudstones, and fine-grained sandstones (Dunn *et al.*, 2013), as the result of aeolian  
64 accumulation of fine-grained pyroclastic material under a temperate climate, alternating  
65 moments of drought and rain (Andreis *et al.*, 1975; Spalletti and Mazzoni, 1977; Bellosi,

66 2010). At Cabeza Blanca, the Sarmiento Formation has been subdivided in two sections  
67 based on the fossil record, the basal levels with Casamayoran fauna and the overlying  
68 levels with a Deseadan faunal association (Reguero and Escribano, 1996). The material  
69 described here comes from the Deseadan levels of Sarmiento Formation. Absolute dates are  
70 lacking for Cabeza Blanca, but Deseadan levels were dated in other localities such as Salla,  
71 Bolivia (29.4 – 25.65 Ma), Moquegua, Perú (26.25 Ma), and from Argentina, Gran  
72 Barranca (29.4 – 24.2 Ma) (Dunn *et al.*, 2013 and references therein) and Scarritt Pocket  
73 (27.17 Ma) (Vucetich *et al.*, 2014).

#### 74 **MATERIALS AND METHODS**

75 The studied specimen (MPEF-PV 10721), corresponds to a left mandibular fragment  
76 preserving p4-m1 of *I. bolivianus* which is stored in the paleontological collection of the  
77 Museo Paleontológico “Egidio Feruglio” (**MPEF-PV**) in Trelew (Chubut Province,  
78 Argentina). It was collected during fieldwork conducted by members of the Instituto  
79 Patagónico de Geología y Paleontología (**IPGP**), in upper levels (Deseadan SALMA, late  
80 Oligocene) of the Sarmiento Formation in Cabeza Blanca (Sciutto *et al.*, 2000) (Fig. 1).

81 The study is based on the description of the fossil remain and its comparison with  
82 different caviomorphs housed at Museo Argentino de Ciencias Naturales “Bernardino  
83 Rivadavia” (**MACN**), Museo de La Plata (**MLP**), Museo Paleontológico “Egidio Feruglio”  
84 (**MPEF-PV**), and Museo “Prof. Juan Olsacher” (**MOZ-PV**) (Supplementary Online  
85 Information); data of *I. bolivianus* was taken from bibliography, mainly from Patterson and  
86 Wood (1982).

87 The measurements were obtained using a digital caliper with an accuracy of 0.01mm.  
88 We followed Pérez (2010) for the mandibular nomenclature and Marivaux *et al.* (2004) and  
89 Candela and Rasia (2012) for the dental homologies.

## 90 SYSTEMATIC PALEONTOLOGY

91 Order RODENTIA Bowdich, 1821

92 Infraorder CAVIOMORPHA Wood and Patterson, 1959 (in Wood 1955)

93 Superfamily CHINCHILLOIDEA Bennet, 1833

94 Genus *Incamys* Hoffstetter and Lavocat, 1970

95 *Type species.* *Incamys bolivianus* Hoffstetter and Lavocat, 1970.

96 *Included species.* *I. menniorum* Vucetich *et al.*, 2015b (the status of *I. pretiosus* Lavocat  
97 1976 pends on a deeper revision).

98 *Chronological and geographic distribution.* Salla beds of Bolivia (late Oligocene) and  
99 Cabeza Blanca beds of central Patagonia, Argentina (late Oligocene).

100 *Diagnosis.* Cheek teeth tetralophate, marked lingual hypsodonty in uppers; anteroloph fully  
101 separated in earliest stages of wear, becoming joined with paracone buccally; other lophs  
102 united early and converge posterointernally on hypocone; posterolophid isolated in early  
103 stages of wear of lower teeth; other lophids united early and converge anteroexternally on  
104 protoconid; metalophid short, connected to protoconid (only cheek teeth; Patterson and  
105 Wood 1982) (Vucetich *et al.*, 2015b).

106 *Incamys bolivianus* Hoffstetter and Lavocat, 1970

107

Fig. 2.1–2

108 ***Holotype*** (As stated by Patterson and Wood 1982). Anterior portion of the skull, back as  
109 far as M3, with associated left ramus, including a complete set of upper and lower cheek  
110 teeth. Deposited at Museum Nationale d'Histoire Naturelle, Paris; cited without identifying  
111 number by Hoffstetter and Lavocat (1970: 173) and without museum identification as **SAL**  
112 117A (skull) and **SAL** 117B (ramus) by Lavocat (1976: 50).

113 ***Referred specimen from Cabeza Blanca***. **MPEF-PV** 10721, left mandibular fragment with  
114 p4-m1.

115 ***Geographic and stratigraphic provenance***. The specimen **MPEF-PV** 10721 comes from  
116 Cabeza Blanca locality (Escalante Department, at 45° 13'S and 67° 28'W, Chubut  
117 Province, Argentina), upper section of Sarmiento Formation, Deseadan SALMA, late  
118 Oligocene (Reguero and Escribano, 1996).

119 ***Diagnosis***. Cheek teeth tetralophate and protohypsodont, with sigmoid design with  
120 moderate wear. Hypoflexus/id funnel shaped, with protocone/id and hypocone/id more  
121 separated than *I. menniorum* and clearly shallower than *I. menniorum*, becoming a  
122 fossette/id with heavy wear. Enamel layer homogeneous and continues. Cement absent.  
123 Anterofossetid rapidly lost due to wear.

## 124 **DESCRIPTION AND COMPARISONS**

125 MPEF-PV 10721 is a well-preserved left partial mandible (Fig. 2.1), preserved from  
126 the middle of the diastema to just behind m1 and including p4-m1 (14 mm length). The  
127 preserved portion of the diastema is flat, with the dorsal surface just below the level of the

128 alveolar border. A small mental foramen opens dorsally, and it appears to be in the deepest  
129 part of the diastema. There is a smaller accessory foramen posterior to the mental foramen,  
130 as in *Scleromys osbornianus* and *S. quadrangulatus* (Fig. 2.1) (Kramarz, 2006). Both  
131 foramina are anterior to p4. The chin is broken. The notch of insertion for the *masseter*  
132 *medialis pars infraorbitalis* (mmpi) muscle is below p4, like in *Garridomys* and *I.*  
133 *bolivianus* (Kramarz *et al.*, 2013; Patterson and Wood, 1982). The notch is large and  
134 slightly oblique. The masseteric crest extends from the most posterior section of the notch,  
135 as a continuation, up to the most posterior level of the p4. The incompletely preserved  
136 lateral crest reaches the notch for the mmpi at the level of m1, but it is not fused to the  
137 latter; it is very low and straight, as in *I. bolivianus* (Patterson and Wood, 1982). The  
138 horizontal crest is not present.

139         The preserved lower teeth are protohypsodont. All preserved teeth are in the size  
140 range of *I. bolivianus* (Tab. 1). The holotype of *I. menniorum*, an m3 (Fig 2, 3–4), is  
141 slightly bigger than the size range of m3 for *I. bolivianus* (Patterson and Wood, 1982).  
142 Cement is absent, like *Scleromys* (Kramarz, 2006) and *I. bolivianus* (Patterson and Wood,  
143 1982). The enamel layer is complete and homogeneous, like *I. bolivianus*, while in lower  
144 molars of *I. menniorum*, the enamel layer is thinner in the anterior walls and posterior wall  
145 of hypoflexid (Vucetich *et al.*, 2015). In this stage of wear, it is difficult to recognize  
146 cuspids and crest, but the relative position can be identified by comparison with other  
147 genera, like *Scleromys*, *Garridomys* and *Incamys*.

148         The permanent premolar (Fig. 2.2) is larger than m1 (Tab. 1), with three crests and  
149 the talonid wider than the trigonid. The lophids are arranged in a sigmoid design, with the  
150 anteriormost corresponding to the metalophulid I, which is transversally straight and short.

151 In the area of the metaconid, there is a crest posteriorly oriented, which seems to be the  
152 posterior arm of the metaconid. Antoine *et al.* (2012) coded p4 of *Incamys bolivianus* as  
153 having complete metalophulid II, but in this specimen, we can't confirm the presence or  
154 absence of this structure do to wear. A notorious spur posteriorly oriented comes from the  
155 middle of the metalophulid I. It is triangular in outline and is almost as big as the posterior  
156 arm of the metaconid. According to Patterson and Wood (1982), is present in some  
157 specimens of *I. bolivianus*. The second crest in position is the hypolophid, which runs  
158 obliquely from the posterior arm of the protoconid plus ectolophid, to the lingual end of the  
159 posterolophid. It is also concave to the front, as the posterolophid. The posterolophid is the  
160 posterior crest and forms the posterior crest, which is long and slightly concave. The  
161 mesoflexid is almost closed in lateral view, and transversely longer than half of the tooth.  
162 The hypoflexid is fused to the metafossettid; it is slightly oblique and wider at the lingual  
163 section.

164 The m1 (Fig. 2.2) has a quadrangular outline, with a curved posterior wall and  
165 straight lingual and anterior walls. The position of the lophids are similar to the premolar  
166 (see above), but the mesoflexid is closed on the lingual side. The latter is oval in outline at  
167 this stage of wear and placed at the anterolingual portion of the molar. The hypoflexid is  
168 markedly shallower than in the premolar, and it is almost closed due to wear, in a lateral  
169 view. This is a major difference with *I. menniorum* (Vucetich *et al.*, 2015b), in which the  
170 hypoflexid is much deeper and seems to remain open even in heavy worn molars (Fig 2–4),  
171 while in *I. bolivianus*, hypoflexid is closed in heavy worn molars (Patterson and Wood,  
172 1982). Although the only lower molar of *I. menniorum* known to date is an m3, we consider  
173 that is in a similar stage of wear than MPEF-PV 10721, because of the presence of both



174 mesofossettid and metafossettid (Fig 2, 2–3). The hypoflexid is oblique, slightly funnel  
175 shaped and is fused to the metafossettid, thus extending over half of the tooth. In *I.*  
176 *menniorum*, the hypoflexid is not funnel shaped, because the hypoconid and protoconid are  
177 much closer to each other than in *I. bolivianus* (Vucetich *et al.*, 2015). The anterior lobe has  
178 a triangular outline and is larger than the posterior lobe.

## 179 **DISCUSSION AND CONCLUSION**

180 Based on the description of Patterson and Wood (1982) and in the following  
181 characters: the mental foramen opens dorsally and anterior to p4, the notch for the mmpi  
182 muscle is below the p4 and is continuous with the masseteric crest, the larger p4 with  
183 respect to the molar, the funnel shaped hypoflexid and clearly shallower than *I. menniorum*,  
184 the straight anterior and lingual walls and curved posterior one of m1, the size range, the  
185 absence of cement, and the complete enamel layer we can confidently assign MPEF-PV  
186 10721 to *I. bolivianus*.

187 MACN A 52–113 is an isolated left upper molar from the Ameghino collection. It has  
188 no provenance information and it is assumed to have been recorded from Cabeza Blanca  
189 without further justification (Wood and Patterson, 1952; Patterson and Wood, 1982). Wood  
190 and Patterson (1959) described this tooth as an indeterminate dasypsectid, and later  
191 Patterson and Wood (1982) interpreted it as an upper cheek tooth of *I. bolivianus*. After  
192 revising the specimen, we concluded that it corresponded to an upper molar based on the  
193 connected hypocone with the protoloph, but not with the protocone, and with the  
194 posteroloph, with minor wear present (Patterson and Wood, 1982). Based on the supposed  
195 provenance, they inferred that *I. bolivianus* was distributed in Patagonia as well as in

196 Bolivia. However, we consider it venturesome to use the assignment of this molar to  
197 Cabeza Blanca without further information on its geographical provenance. Therefore, the  
198 mandibular fragment here described is the first unquestionable remain that confirms the  
199 presence of *I. bolivianus* in deseadan levels of Cabeza Blanca.

200 Rodent fauna of Salla and Cabeza Blanca are highly diverse, with only two shared  
201 genera (*Incamys* and *Cephalomys*) between both localities (Vucetich *et al.*, 2015b), and  
202 only *I. bolivianus* as a shared species. Curiously, the locality of Lacayani, placed very close  
203 to Salla in Bolivia, and assigned to the same SALMA, does not share any rodent genera  
204 with Salla (Vucetich, 1989) but shared all of them with Cabeza Blanca (Vucetich *et al.*,  
205 2015b). A comparable situation is reported with other fossil mammals (*e.g.* Billet *et al.*,  
206 2008; Ciancio, 2010). It is known that Deseadan mammal faunas of Salla and Patagonia  
207 show important differences (Billet *et al.*, 2008; Ciancio, 2010; Vucetich, 1989; Vucetich *et*  
208 *al.*, 2014) and even between close Patagonian localities, important faunal difference are  
209 recorded (Vucetich *et al.*, 2014). It is still unclear if the cause of this faunal differences are  
210 ecological or chronological, as proposed by some authors (*e.g.*, Wood and Patterson, 1959;  
211 Hoffstetter *et al.*, 1971; Patterson and Wood, 1982; MacFadden *et al.*, 1985; Vucetich,  
212 1989; Billet *et al.*, 2008; Vucetich *et al.*, 2014; Vucetich *et al.*, 2015b). A better knowledge  
213 of Patagonian localities and Lacayani absolute ages and a collection effort in other than  
214 traditional Deseadan localities is much needed to help resolve this matter.

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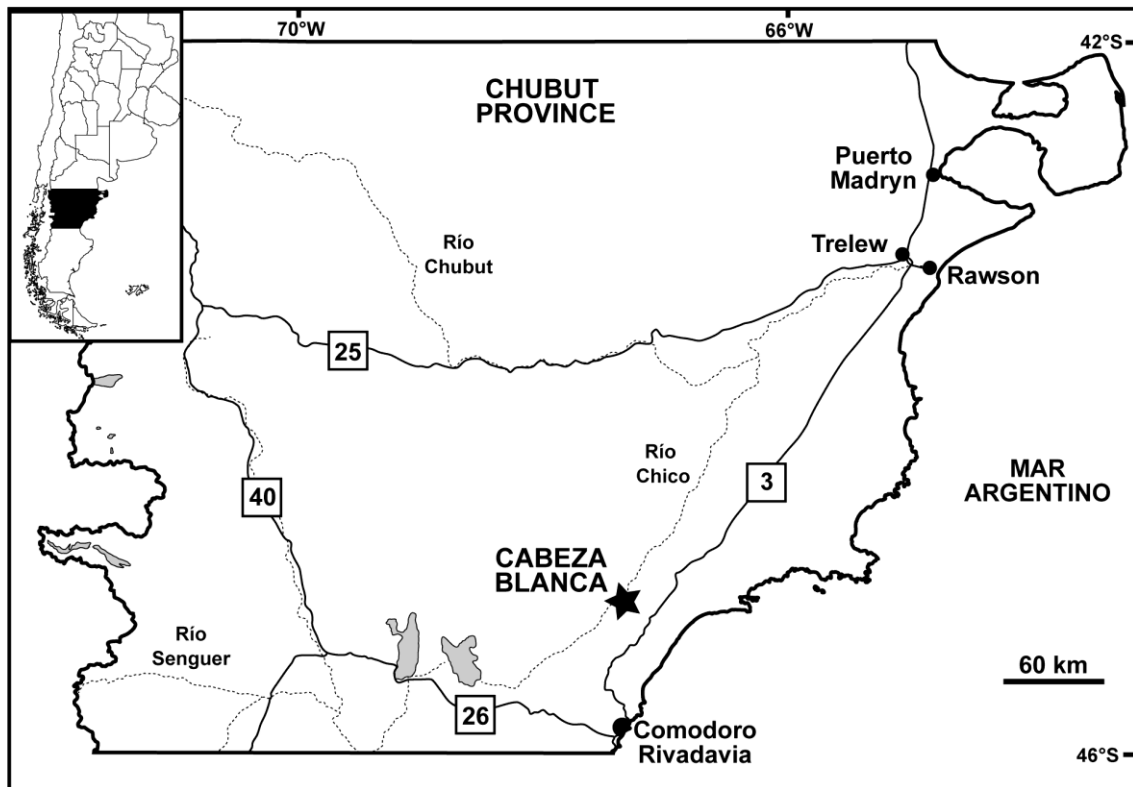
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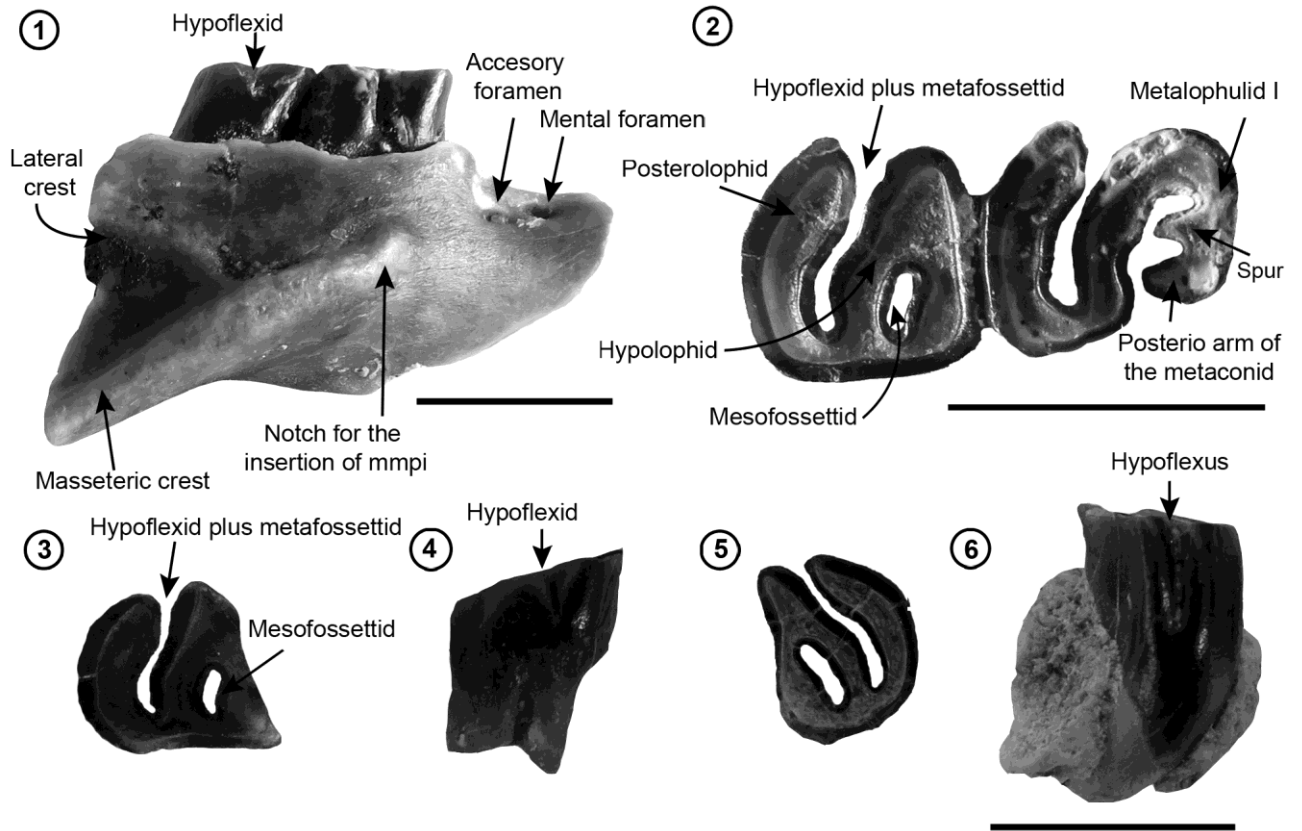
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351 **Figure 1.** Map of Chubut Province (Patagonia, Argentina) showing the location of Cabeza  
352 Blanca. Scale bar = 60 km.

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354

355 **Figure 2.** 1-2, left mandible fragment of *Incamys bolivianus* MPEF-PV 10721 from  
 356 Cabeza Blanca (Patagonia, Argentina). 1, lateral view (reversed); 2, occlusal view. Scale  
 357 bar = 5 mm. 3-6, *Incamys menniorum* MPEF-PV 10685, 3, occlusal view; 4, labial view  
 358 (reversed); MPEF-PV 10686, 5, occlusal view; 6, lingual view (reversed). Scale bar = 5  
 359 mm. Anterior to the right. **Mmpi**: *masseter medialis pars infraorbitalis*.

**TABLE 1. Dental measurements (in mm) of MPEF-PV 10721 compared with *I. bolivianus* from Salla.**

	<i>p4</i>			<i>m1</i>		Total length
	<i>L</i>	<i>AW</i>	<i>PW</i>	<i>L</i>	<i>W</i>	
<b>MPEF-PV 10721</b>	3.30	2.44	3.25	2.96	3.31	6.26
<b>Size range of <i>I. bolivianus</i><sup>1</sup></b>	2.97-4.24	2.14-3.09	3.03-3.61	2.67-3.57	-	-

Abbreviations: *AW*, anterior maximum preserved width; *L*, total preserved length; *PW*, posterior maximum preserved width; *W*, maximum preserved width. <sup>1</sup>

*(Patterson and Wood, 1982: tab. 4).*

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