

## Finding of an Ixodid Tick Inside a Late Holocene Owl Pellet From Northwestern Argentina

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**ABSTRACT:** In the present study, we report the earliest record of *Ixodes sigelos* from the late Holocene in Argentina. The tick was recovered from an owl pellet collected within a small mammal sequence in Las Máscaras Cave, Catamarca, Argentina (27°01'12S°, 66°44'37"W) and dated at 990 ± 35 cal yr. Based on bones also present in the pellet, the tick most-likely parasitized a rodent, identified as an *Eligmodontia* sp., which had been ingested by the owl.

Ticks (Acari: Ixodida) are hematophagous ectoparasites of terrestrial vertebrates with the capacity to transmit pathogenic microorganisms to humans and to wild and domestic animals. The construction of hypotheses regarding the origin and evolution of ixodid ticks is difficult because the fossil record for ticks is scarce (Nava et al., 2009). The oldest fossil ticks correspond to specimens founded in Cretaceous amber; they have been identified as larvae of *Carios jerseyi* (Klompen and Grimaldi, 2001), *Amblyomma* sp. (Grimaldi et al., 2002), *Cornupalpatum burmanicum* (Poinar and Brown, 2003), and *Compluriscutula vetulum* (Poinar and Buckley, 2008). Furthermore, the record for the Tertiary corresponds to *Orniithodoros antiquus* (Dominican Republic amber, 30–40 million yr ago [mya]), *Ixodes succineus* and *Hyalomma* sp. (Baltic amber, 35–50 mya), *Amblyomma* cf. *A. argentinae* and *Amblyomma* cf. *A. dissimile* (Dominican amber, 14–40 mya), and *Dermacentor* cf. *D. reticulatus* (Pliocene, 2–5 mya) (Schille, 1916; Weidner, 1964; Lane and Poinar, 1986; Poinar, 1995; Keirans et al., 2002; Nava et al., 2009). There is also a report for a fossil tick in Baltic amber (35–50 mya), described as *Ixodes tertiaris* (Scudder, 1885), but this species is considered nomen nudum because the figure and description is insufficient for a generic determination (Guglielmo et al., 2009). The only records from the Holocene correspond to specimens collected from coprolites in the United States, identified as *Dermacentor* cf. *D. andersoni* (Johnson et al., 2008), and records from Brazil which were identified as an *Ixodes* sp. and an *Amblyomma* sp. (Guerra et al., 2003). However, the larva of the *Ixodes* sp. reported by Guerra et al. (2003) does not belong to *Ixodes*, but rather seems to be an argasid larva.

In the present study, we describe the presence of an ixodid tick inside a late Holocene owl pellet that was recovered in Las Máscaras Cave, Belén Department, Catamarca Province, Northwestern Argentina. The locality, Las Máscaras Cave (27°01'12S°, 66°44'37"W) (Fig. 1), is situated in a semi-arid valley at 2,400 m elevation in the Monte Desert (Cabrera, 1976). The pellet belonged to an unidentified owl and was included within a small mammal stratified sequence. Radiocarbon dating by accelerator mass spectrometry (AMS), performed on bones in the same level as the pellet, gave an age of 990 ± 35 cal yr. The pellet was examined, described, measured, and weighed according to the method of Jouy-Avantin (2003) and disaggregated with forceps and needles using a binocular microscope.

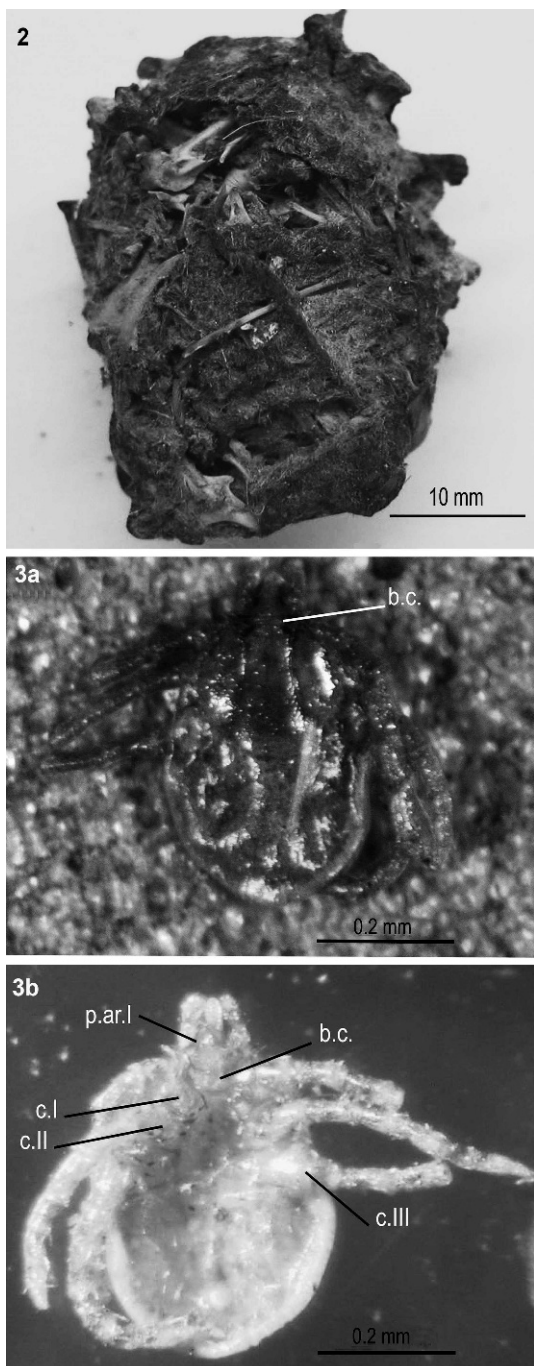
The pellet weighed 2.03 g and measured 29 × 17 × 16 mm (Fig. 2). The microscopic examination of the disaggregated pellet revealed the presence of a single tick, which was fixed in 96% ethanol. The mammalian cranial remains contained in the pellet were separated and identified as an *Eligmodontia* sp. (Rodentia, Cricetidae, Sigmodontinae). *Ixodes sigelos* Keirans, Clifford and Corwin, 1976 (Acari: Ixodida: Ixodidae) was identified in accordance with the description of Keirans et al. (1976). The diagnostic characters (Fig. 3a, b) included: a palpal article I with a large anterior projection that ventrally had a moderately large, bluntly rounded, posteriorly directed spur; a basis capituli with a moderately large and distinct cornua that was constricted ventrally posterior to mid-length; the auriculae was absent; coxa I with a broadly rounded internal spur plus a small, bluntly triangular external spur; and coxae II and III without definite spurs. The tick was deposited in the tick collection of the Instituto

Nacional de Tecnología Agropecuaria, Estación Experimental Agropecuaria Rafaela (accession number 2109).

The present report constitutes the oldest record of *I. sigelos* and the first mention of a tick for late-Holocene times in Argentina. The larva of *I. sigelos* recorded is morphologically identical to extant specimens. Females, nymphs, and larvae of this species (the male is still unknown) were described on the basis of specimens collected from rodents captured in Chile (Keirans et al., 1976), and subsequent studies suggest that sigmodontine rodents are their main hosts (González-Acuña and Guglielmo, 2005; Guglielmo et al., 2005; J. Sanchez, pers. obs.). Thus, it is probable that the rodent found in the pellet (*Eligmodontia* sp.) was the host of the tick. The geographical distribution of *I. sigelos* is restricted to Chile and Argentina (Guglielmo et al., 2005). The previous records of this species in Argentina (Fig. 1) correspond to several localities in the Patagonian steppe (Santa Cruz, Chubut, and Río Negro Provinces) (Sanchez et al., 2010) and to a single record of a nymph collected on the sigmodontine rodent *Akodon spegazzinii* in Hualinchay, Tucumán Province, northwestern Argentina (Guglielmo et al., 2005), which



FIGURE 1. Distribution of *Ixodes sigelos* in Argentina. \*Las Máscaras Cave, Department Belén, Catamarca Province (González-Acuña and Guglielmo, 2005; Guglielmo et al., 2005; Sanchez et al., 2010).



FIGURES 2–3. (2) Pellet (Las Máscaras Cave, Catamarca, Argentina,  $990 \pm 35$  cal. yr BP). (3) Larva of *Ixodes sigelos*. (a) Dorsum view (b.c. = basis capituli). (b) Venter view (b.c. = basis capituli, c.I = coxa I, c.II = coxa II, c.III = coxa III, p.ar.I = palpal article I).

corresponded to the Yungas montane forest (Cabrera, 1976), clearly a more-humid environment than that currently observed in Las Máscaras Cave area. However, studies on small mammals from the same stratified sequence as the pellet have suggested more-humid conditions in that area about 1,000 cal yr. (Madozzo Jaén, 2009).

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