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Paleoparasitological study of rodent coprolites from "Los Altares" paleontological site, Patagonia, Argentina

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ABSTRACT

Results of paleoparasitological examination of rodent coprolites from faeces were collected from excavations at the paleontological site "Los Altares Profile", Chubut Province, Patagonia, Argentina, are presented. Each coprolite was processed, rehydrated, homogenized, processed by spontaneous sedimentation, and examined using a light microscope. Coprolites and eggs were described, measured, and photographed. Samples were positive for eggs of *Heteroxynema* (*Cavioxyura*) *viscaciae* and an unidentified oxyurid (tentatively attributed to *Helminthoxys*) (Nematoda: Oxyuridae); and for 3 morphotypes of anoplocephalids (Cestoda: Anoplocephalidae). Coprolites were dated at 2210 ± 70 BP to present. This is the first paleoparasitological research conducted in different levels of this paleontological site, extending the parasitological knowledge of ancient material in Patagonia.

1. Introduction

Micromammal remains are generally abundant in archaeological and paleontological sites in Patagonia (Pearson and Pearson, 1993; Pardiñas, 2000; Teta et al., 2005; Udrizar Sauthier, 2009; Pardiñas et al., 2011, 2012; among others). Sequences of small mammals have been the focus of several studies during the last decade in the area. Most of these contributions were centered on taphonomic, paleoenvironmental, and biogeographic features of these assemblages (Teta et al., 2005, 2009; Pardiñas and Teta, 2008; Fernández et al., 2011, 2012; among others).

One of the Holocene paleontological sites from Patagonia where the rodent assemblages were studied is "Los Altares Profile" (LAP). Research conducted at LAP provided artificially stratified sequences of paleontological remains spanning the Late Holocene to present. All the levels examined were indicative of a broad diversity of rodent bones and feces.

During recent years, paleoparasitological knowledge of rodent remains started with material obtained from archaeological sites. Antecedents of paleoparasitological studies carried out in rodent material recovered at archaeological sites from Patagonia revealed the presence of eggs of trichurids, capillariids, ascaridids, *Heteroxynema viscaciae*, *Trichosomoides*, *Pterygodermatites*, *Paraspidodera uncinata* (nematodes); and anoplocephalids and taeniid (cestodes) (Fugassa, 2006a,b; Fugassa and Barberena, 2006; Fugassa et al., 2007; Sardella and Fugassa, 2009a, b; 2011; Sardella et al., 2010; Beltrame et al., 2012, 2013).

Paleoparasitology is the study of parasites found in archaeological or paleontological material (Ferreira et al., 1979). In a broad sense, paleoparasitologists are interested on the evolution of parasites–hosts– environment relationships, as well as in the origin and the evolution of infectious diseases within a paleoepidemiological perspective (Araújo et al., 2003). Paleontological sites of Patagonia had not been studied for paleoparasitological purposes. The aim of this study is to communicate results of the first paleoparasitological analysis of the rodent coprolites obtained from different levels of LAP.

2. Materials and methods

"Los Altares Profile" (LAP) (43°53′2″S, 68°23′3″W) is located on the south shoulder of National Route 25, 1.5 km southeast of Los Altares locality, Chubut Province. It is an accumulation of sedimentary fill remnant of an ancient cave eliminated by road works.

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The 120 cm thick sequence is formed primarily by aeolian sandy silt with variable clastic material from the weathering of country rock, layers of vegetative debris, and coal fragments (Udrizar Sauthier et al., 2009). It was excavated in 12 artificial levels, each one 10 cm. Radiocarbon dates on charcoal provided ages for the basal level (artificial level 12), 2210 ± 70 BP, an intermediate level (artificial level 5), 1280 ± 90 BP, and artificial level 3, 650 ± 60 BP (Udrizar Sauthier, 2009).

Sixteen rodent coprolites from levels 1, 2 (up to 150 BP) and 4 (between 1280 ± 90 BP and 650 ± 60 BP), and 12 from level 12 (2210 ± 70 BP) were examined for parasites. Coprolites were inventoried and processed individually (Fugassa, 2006a,b). Coprolites of two size ranges were examined. The external examination of feces was conducted according to Chame (2003) and Jouy-Avantin (2003). Each coprolite was whole processed by rehydration in a 0.5% water solution of tris-sodium phosphate (TSP) in a glass tube for at least 72 h, followed by homogenization, processed by spontaneous sedimentation (Lutz, 1919), and preserved in 70% ethanol. Ten slides were prepared from each coprolite, along with the addition of one drop of glycerin, and examined at 10X and 40X using light microscopy. Eggs of parasites were measured and photographed at 40X magnification. Egg dimensions and morphologies were compared with data from the literature in order to identify the parasites at the lowest taxonomic level. Deformed or broken eggs were not measured.

3. Results

The larger coprolites collected from level 1 (Fig. 1a, lines 3 and 4) were light brown and concave to conical, with a smooth surface. One extreme was dull and the other sharp. The average measurements of the feces were 11.92 ± 1.18 mm long by 4.6 ± 0.40 mm wide; the average mass was 0.09 ± 0.02 g. The smaller coprolites (Fig. 1a, lines 1 and 2) were light to dark brown and concave to conical, with a longitudinal groove. The average measurements of feces were 8.13 ± 0.44 mm long by 2.89 ± 0.24 mm wide; the average mass was 0.03 ± 0.01 g.

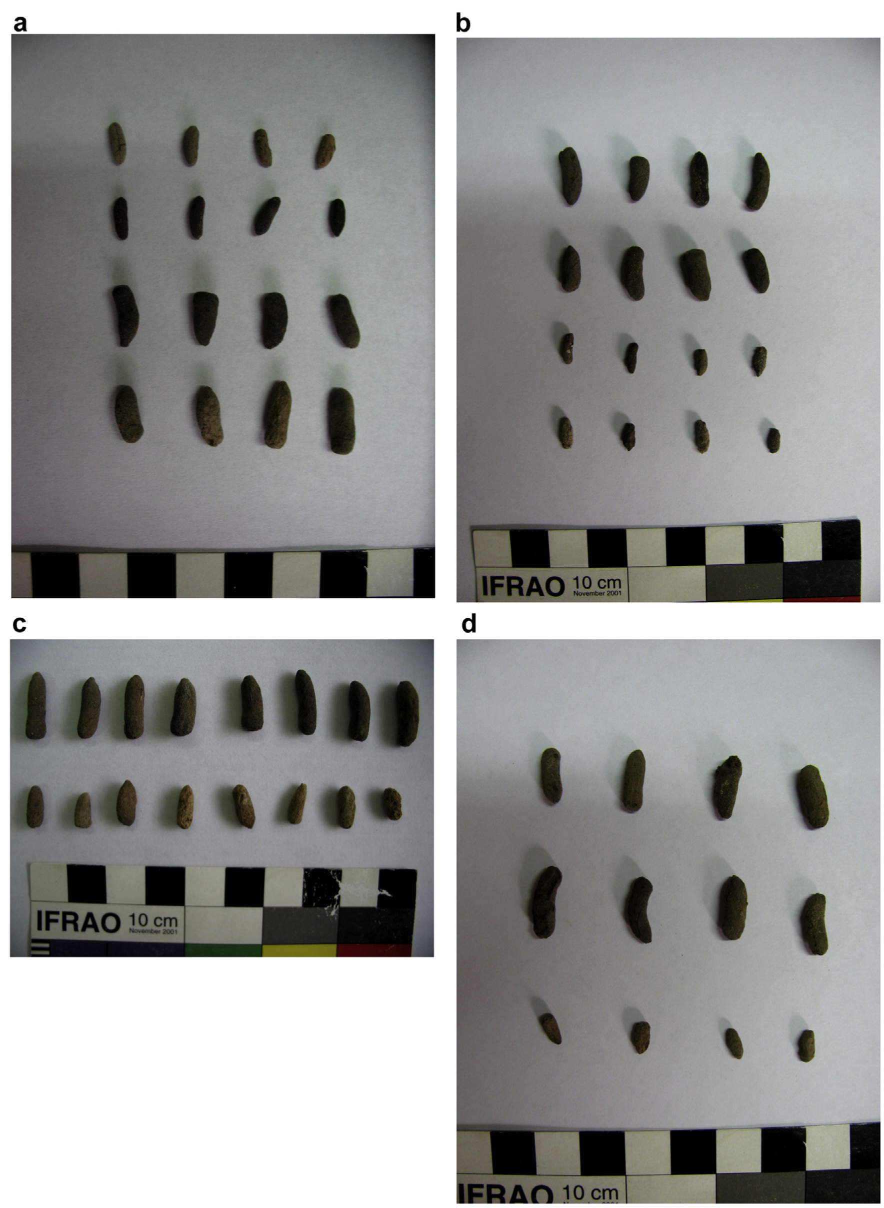

Fig. 1. Macroscopic aspect of the rodent coprolites collected from the "Los Altares Profile". a: level 1; b: level 2; c: level 4, d: level 12.

The larger coprolites collected from level 2 (Fig. 1b, lines 1 and 2) were dark brown and concave to conical, with a smooth surface. One extreme was dull and the other was sharp. The average measurements of feces were 13.03 ± 1.52 mm long by 4.91 ± 0.58 mm wide; the average mass was 0.12 ± 0.03 g. The smaller coprolites (Fig. 1b, lines 3 and 4) were light brown and concave to conical, with a longitudinal groove. The average measurements of feces were 7.40 ± 0.74 mm long by 2.85 ± 0.24 mm wide; the average mass was 0.03 ± 0.005 g.

The larger coprolites collected from level 4 (Fig. 1c, line 1) were dark brown and concave to conical, with a smooth surface. One extreme was dull and the other was sharp. The average measurements of feces were 15.65 ± 1.27 mm long by 4.85 ± 0.41 mm wide; the average mass was 0.14 ± 0.02 g. The smaller coprolites (Fig. 1c, line 2) were light brown, with one extreme dull and the other sharp. The average measurements of feces were 10.22 ± 1.02 mm long by 4.11 ± 0.36 mm wide; the average mass was 0.05 ± 0.01 g.

The larger coprolites collected from level 12 (Fig. 1d, lines 1 and 2) were light brown and concave, with a smooth surface. The average measurements of feces were 13.94 ± 0.82 mm long by 4.63 ± 0.42 mm wide; the average mass was 0.10 ± 0.01 g. The smaller coprolites (Fig. 1d, line 3) were light brown and with one extreme dull and the other sharp. The average measurements of feces were 7.05 ± 0.13 mm long by 3.20 ± 0.29 mm wide; the average mass was 0.03 ± 0.01 g.

Of 60 coprolites examined, 10 were positive for Nematoda and/or Cestoda (Table 1). Only one parasite species was found from each parasitized sample. Coprolites belonged to levels 1, 2, and 4, and level 12 was negative for parasites. Eggs of nematodes were identified as follows: 10 eggs of *Heteroxynema* (*Cavioxyura*) *viscaciae* Sutton and Hugot 1988 (Nematoda: Oxyuridae) and 16 eggs of an unidentified oxyurid (tentatively attributed to *Helminthoxys* Freitas et al., 1937). With respect to the anoplocephalids (Cestoda: Anoplocephalidae), eggs of 3 morphotypes were recognized from samples, 47 with features attributed to genus *Monoecocestus* Beddard 1914 or to *Andrya* Railliet 1893 (named anoplocephalid morphotype 1), 33 eggs of another unidentified anoplocephalid (named anoplocephalid morphotype 2), and 1 egg identified as *Monoecocestus* sp (named anoplocephalid morphotype 3).

Table 1
Number of studied and parasitized rodent coprolites and parasites found by levels from "Los Altares Profile".

Level (yrs B.P.)	No of coprolites examined	No of coprolites parasitized/non parasitized	Parasite species found in each parasitized coprolite
1 (up to 150)	8 bigger	2/6	Anoplocephalid morphotype 3
			Anoplocephalid morphotype 1
	8 smaller	1/7	Anoplocephalid morphotype 2
2 (up to 150)	8 bigger	2/6	Anoplocephalid morphotype 1
			Anoplocephalid morphotype 1
	8 smaller	1/7	*Helminthoxys*
4 (1280 ± 90 - 650 ± 60)	8 bigger	3/5	*Heteroxynema viscaciae*
			H. viscaciae
			Anoplocephalid morphotype 1
	8 smaller	1/7	*H. viscaciae*
12 (2210 ± 70)	8 bigger	0/8	
	4 smaller	0/4	

Eggs of *H. viscaciae* (n = 10) (Fig. 2) were thick-walled, oblong, symmetrical, with an operculum at 1 pole. They were collected from three coprolites (two larger and one smaller) from level 4. Egg measurements (n = 7) ranged from 120 to 135 (128.57 ± 6.27) μm long and 57.5 to 67.5 (61.43 ± 3.18) μm wide.

Fig. 2. Egg of *Heteroxynema* (Cavioxyura) *viscaciae* (Nematoda: Oxyuridae). Bar = 40 μm.

Eggs of an unidentified nematode (n = 16) (Fig. 3) were collected from one smaller coprolite from level 2. These eggs were thick-shelled mainly at the edges, symmetrical, oblong, with an uncertain image of an operculum. Egg measurements (n = 15) ranged from 77.5 to 92.5 (83.17 ± 3.83) μm long by 45.0–52.5 (47.86 ± 3.23) μm wide. These eggs were tentatively identified as *Helminthoxys* sp. (Oxyuridae).

Eggs of anoplocephalids attributable to genus *Monoecocestus* or *Andrya* (n = 47) (Fig. 4) were collected from levels 1, 2 and 4 from three larger coprolites. Eggs are square to sub-rounded, with their edges slightly folded. The embryophore is in the form of a pyriform apparatus, blunt or with short horns (anoplocephalid morphotype 1). Egg measurements ranged from 67.5 to 87 (78.20 ± 5.84) μm long and 62.5 to 87 (76 ± 6.96) μm wide (n = 25).

Eggs of another unidentified anoplocephalid (n = 33) (Fig. 5) were also collected from one smaller coprolite from level 1. Eggs are surrounded by a gelatinous layer. The embryophore is in a form of a pyriform apparatus (anoplocephalid morphotype 2). The egg measurements ranged from 80 to 92.5 (84.83 ± 4.06) μm long and 70 to 87.5 (79.33 ± 4.27) μm wide (n = 15).

One egg with characteristics attributed to *Monoecocestus* sp. was collected from one larger coprolite from level 1 (anoplocephalid

Fig. 3. Eggs of an unidentified nematode. Bar = 20 μm.

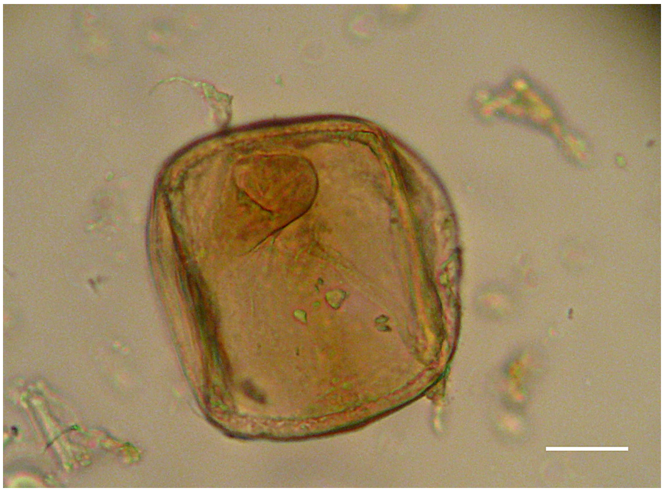

Fig. 4. Egg of anoplocephalid, probably *Monoecocestus* or *Andrya* (Cestoda: Anoplocephalidae). Bar = 20 μm.

morphotype 3). The egg measurements were 67.5 μm long by 57.5 μm wide.

Other non-parasitic microscopic remains, including stellate root hairs of *Malvella leprosa americana* (Charophyta: Malvaceae), known by the common name alkali mallow; and one diatom identified as belonged to genus *Diploneis* Cleve 1894 (Ochrophyta: Diploneidaceae), were also found in samples.

4. Discussion

Information on parasitic associations of wild rodents, particularly those inhabiting the area under study, is scarce. This is the first paleoparasitological study carried out in LAP. It is not currently possible to identify the specific biological origin of all the rodent coprolites examined. Nevertheless, there is information available with respect to both current and fossil rodent communities living in relative proximity of the area covered in this study, as indicated by owl pellet contents (Udrizar Sauthier, 2009). The dominant species of these rodent communities in LAP were *Eligmodontia* sp. (51.23%), *Reithrodon auritus* (12.97%), *Ctenomys* sp. (11.23%), *Phyllotis xanthopygus* (5.32%) and *Akodon iniscatus* (4.36%), all representing more than 85% of the micromammals registered. At least 20 species of micromammals were found in LAP. The poor bone quantity of large rodents in the small mammal records is probably due to this type of archaeofaunistic owl pellet accumulations, as owls do not feed on them.

Fig. 5. Eggs of unidentified anoplocephalid (Cestoda: Anoplocephalidae). Bar = 20 μm.

The rodent host of some of the smaller samples was tentatively identified as *Microcavia australis* (Caviomorpha:Caviidae), the southern mountain cavy of South America, based on the morphology, the size and on the amount of samples found in each level. Some of the larger samples and some of the smaller were attributed to *Lagidium viscacia* Molina 1782 (Caviomorpha: Chinchillidae), the "chinchillón" or "vizcacha serrana", based on the morphology, the size of the fecal material, and on the coproparasitological knowledge on similar coprolites previously examined (Beltrame et al., 2012, 2013). The family Chinchillidae contains chinchillas, viscachas, and their fossil relatives, and is restricted to southern and western South America (Reig, 1986; Canevari and Vaccaro, 2007).

Anoplocephalidae are very well represented in small mammals (Wickström et al., 2005). Intermediate hosts for these parasites in small mammals include terrestrial arthropods (insects, mites, and also myriapods and arachnids) (Beveridge, 1994). Representatives of 3 genera of Anoplocephalidae were identified in this study, but arthropod remains were not found in samples.

Monoecocestus spp. were previously found from archaeological sites from Patagonia from coprolites collected from the historical site "Alero Mazquiarán" (Chubut Province), assigned to the interface of Araucanian and Tehuelche cultures (Sardella and Fugassa, 2009a). *Monoecocestus* was also present in Holocene rodent coprolites collected from the archaeological site "Alero Destacamento Guardaparque" (ADG) located in the Perito Moreno National Park (Santa Cruz Province). Eggs of *Monoecocestus* found from ADG probably belonged to different species, because they exhibited significant differences among layers (Sardella et al., 2010). *Monoecocestus* sp. was also present in rodent coprolites collected from Cueva Huenul 1 (CH1), northern Neuquén (Patagonia, Argentina), an archaeological site that provides stratified sequences of archaeological and paleontological remains dating from the Late Pleistocene/Early Holocene Transition to the Late Holocene. The coprolites were tentatively assigned to *L. viscacia* (Beltrame et al., 2012). From CH1, other eggs with morphological features attributed to the genus *Andrya* or to *Monoecocestus* were also found (Beltrame et al., 2013).

In the present study, another species of *Monoecocestus* (see Fig. 5) was only found in coprolites from level 1. This is the first identification of this morphotype of anoplocephalid from faecal material from Patagonian rodents.

Species of oxyurid nematodes are monoxenic parasites that live in the posterior third of the digestive tract of various vertebrates and arthropods (Anderson, 2000). Heteroxynematidae includes nematodes that evolved in sciuromorph, caviomorph, and myomorph mammals, with the primitive *Heteroxynema* sp. noted by Hall (1916) for *Heteroxynema cucullatum*, a parasite of the rodent *Eutemias amoneus operarius* from North America.

The genus *Heteroxynema* has been found in ancient material from other archaeological sites, in rodent coprolites collected from the archaeological site Cerro Casa de Piedra 7 (CCP7), located in the Perito Moreno National Park, Santa Cruz Province, Argentina, dated at 10,620 to 9390 BP. The rodent host was assigned to an unknown species of Caviomorpha (Hystricognathi) that lived during the Pleistocenic transition in Patagonia (Sardella and Fugassa, 2011). *H. viscaciae* was also present in rodent coprolites collected from CH1. The coprolites were tentatively assigned to *L. viscacia* (Beltrame et al., 2012).

Another oxyurid found in the present study was tentatively attributed to *Helminthoxys*. The genus *Helminthoxys* includes species parasites of caviomorph rodents. The type-species, *Helminthoxys caudatus* Freitas et al., 1937 has been reported from the caviid *M. australis* in Argentina (Freitas et al., 1937); *Helminthoxys velizy* is specific to the chinchillid *Lagidium peruanum* (Bolivia and Peru), *Helminthoxys abrocomae* to the Octodontoidea, including *Helminthoxys freitasi* from *Trichomys aperoides* (Brazil) and *Helminthoxys gigantea* to *Octodon degus* (Chile) and to *Octodon bridgesi* (Argentina) (Sutton and Hugot, 1993). *H. abrocomae* was also recovered from *Abrocoma cinerea* (Thomas) (Rodentia: Caviomorpha) collected from the Andes of Bolivia (Hugot and Gardner, 2000). If the present finding is confirmed as *Helminthoxys* sp., it extends its geographic range to Chubut Province. This is the first time this parasite has been found from old material.

The presence of non-parasitic microscopic remains such as *Malvella leprosa americana* and the diatom *Diploneis* sp. are indicative of the presence of an environment characterized by saline waters in LAP. This site could have been influenced by different paleoenvironmental conditions than those exhibits at present. Parasitic life-cycles could also have been influenced in a different way in the period covered in the present study. This is the first paleoparasitological research conducted in different levels of LAP and extends the parasitological knowledge of ancient material in Patagonia.

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References

Araújo, A., Jansen, A.M., Bouchet, F., Reinhard, K., Ferreira, L.F., 2003. Parasitism, the diversity of life, and paleoparasitology. Memórias do Instituto Oswaldo Cruz 98 (1), 5–11.

Beltrame, M.O., Sardella, N.H., Fugassa, M.H., Barberena, R., 2012. Paleoparasitological analysis of rodent coprolites from the archaeological site Cueva Huenul 1, Patagonia (Argentina). Memórias do Instituto Oswaldo Cruz 107 (5), 604–608.

Beltrame, M.O., Fugassa, M.H., Baberena, R., Udrizar Sauthier, D.E., Sardella, N.H., 2013. New record of anoplocephalid eggs (Cestoda: Anoplocephalidae). Parasitology International 62, 431–434.

Beveridge, I., 1994. Family Anoplocephalidae Cholodkovsky, 1902. In: Khalil, L.F., Jones, A., Bray, R.A. (Eds.), Key to the Cestode Parasites of Vertebrates. CAB International, Wallingford, pp. 315–366.

Canevari, M., Vaccaro, O., 2007. Guía de mamíferos del sur de América del Sur. L.O.L.A, Buenos Aires, Argentina.

Chame, M., 2003. Terrestrial mammal feces: a morphometric summary and description. Memórias do Instituto Oswaldo Cruz 98 (1), 71–94.

Fernández, F., Pardiñas, U.F.J., Teta, P., Barberena, R., 2011. Environmental stability during the Pleistocene-Holocene transition in northwestern Patagonia? The small mammals of Cueva Huenul 1 as evidence. Current Research in the Pleistocene 28, 154–156.

Fernández, F., Teta, P., Barberena, R., Pardiñas, U.F.J., 2012. Small mammal remains from Cueva Huenul 1, northern Patagonia, Argentina: taphonomy and paleoenvironments since the Late Pleistocene. Quaternary International 278, 22–31.

Ferreira, L.F., Araújo, A., Confalonieri, U., 1979. Subsídios para a paleoparasitologia do Brasil: parasitos encontrados em coprólitos no município de Unaí, MG. In: Anais do V Congresso da Sociedade Brasileira de Parasitologia, Campinas, p. 56.

Freitas, T.J.F., Lent, L., Almeida, L.L., 1937. Pequena contribucao ao estudo da fauna helmintologica de Argentina (Nematoda). Memórias do Instituto Oswaldo Cruz 32, 195–209.

Fugassa, M.H., 2006a. Enteroparasitosis en poblaciones cazadoras-recolectoras de Patagonia Austral (PhD thesis). Universidad Nacional de Mar del Plata, Mar del Plata, 276 pp.

Fugassa, M.H., 2006b. Exámen paleoparasitológico de sedimentos de un sitio arqueológico, Río Mayo, Chubut, Argentina. Parasitología Latinoamericana 61, 172–175.

Fugassa, M.H., Barberena, R., 2006. Cuevas y zoonosis antiguas: paleoparasitología del sitio Orejas de Burro 1 (Santa Cruz, Argentina). Magallania 34 (2), 57–62.

Fugassa, M.H., Sardella, N.H., Denegri, G.M., 2007. Paleoparasitological analysis of a raptor pellet from southern Patagonia. Journal of Parasitology 93 (2), 421–422.

Hugot, J.-P., Gardner, S.L., 2000. *Helminthoxys abrocomae* n. sp. (Nematoda:Oxyurida) from *Abrocoma cinerea* in Bolivia. Systematic Parasitology 47, 223–230.

Jouy-Avantin, F., 2003. A standarized method for the description and study of coprolites. Journal of Archaeological Sciences 30, 367–372.

Lutz, A., 1919. *Schistosoma mansoni* e a schistosomatose segundo observaçoes feitas no Brasil. Memórias do Instituto Oswaldo Cruz 1, 121–155.

Pardiñas, U.F.J., 2000. Tafonomía de microvertebrados en yacimientos arqueológicos de Patagonia (Argentina). Arqueología 9, 265–340.

Pardiñas, U.F.J., Teta, P., 2008. Small mammals and paleoenvironments around the Pleistocene-Holocene boundary in Patagonia. Current Research in the Pleistocene 25, 30–32.

Pardiñas, U.F.J., Teta, P., Formoso, A.E., Barberena, R., 2011. Roedores del extremo austral: tafonomía, diversidad y evolución ambiental durante el Holoceno tardío. In: Borrero, L.A., Borrazzo, K. (Eds.), Bosques, montañas y cazadores. Investigaciones Arqueológicas en Patagonia Meridional, CONICET-IMHICIHU, Bs. As., Argentina, pp. 61–84.

Pardiñas, U.F.J., Udrizar Sauthier, D.E., Teta, P., 2012. Micromammal diversity loss in central-eastern Patagonia over the last 400 years. Journal of Arid Environments 85, 71–75.

Pearson, O.P., Pearson, A.K., 1993. La fauna de mamíferos pequeños de la Cueva Traful I, Argentina, pasado y presente. Prehistoria 1, 211–224.

Reig, O.A., 1986. Diversity patterns and differentiation of high Andean rodents. In: Vuilleumier, F., Monasterio, M. (Eds.), High Altitude Tropical Biogeography. Oxford University Press, New York, pp. 404–438.

Sardella, N.H., Fugassa, M.H., 2009a. Parasites in rodent coprolites from the historical archaeological site Alero Mazquiarán, Chubut Province, Argentina. Memórias do Instituto Oswaldo Cruz 104 (1), 37–42.

Sardella, N.H., Fugassa, M.H., 2009b. Paleoparasitological analysis of rodent coprolites in holocenic samples from Patagonia, Argentina. Journal of Parasitology 95 (3), 646–651.

Sardella, N.H., Fugassa, M.H., Rindel, D.D., Goñi, R.A., 2010. New paleoparasitological results for rodent coprolites from Santa Cruz Province, Argentina. Memórias do Instituto Oswaldo Cruz 105 (1), 33–40.

Sardella, N.H., Fugassa, M.H., 2011. Paleoparasitological finding of eggs of nematodes in rodent coprolites dated at the Early Holocene from the archaeological site Cerro Casa de Piedra 7, Santa Cruz, Argentina. Journal of Parasitology 97 (6), 1184–1187.

Sutton, C.A., Hugot, J.P., 1993. First record of *Helminthoxys gigantean* (Quentin, Courtin et Fontecilla, 1975) (Nematoda: Oxyurida) in Argentina. Research and Reviews in Parasitology 53, 141–142.

Teta, P., Andrade, A., Pardiñas, U.F.J., 2005. Micromamíferos (Didelphimorphia y Rodentia) y paleoambientes del Holoceno tardío en la Patagonia noroccidental extra-andina (Argentina). Archaeofauna 14, 183–197.

Teta, P., Udrizar Sauthier, D.E., Pardiñas, U.F.J., 2009. First data on Late-Pleistocene rodents from central arid Patagonia as paleoenvironmental indicators. Current Research in the Pleistocene 26, 180–182.

Udrizar Sauthier, D.E., 2009. Los micromamíferos y la evolución ambiental en el río Chubut (Chubut, R. Argentina) (Ph. D.thesis). Universidad Nacional de La Plata, Argentina.

Udrizar Sauthier, D.E., Pardiñas, U.F.J., Tonni, E.P., 2009. *Tympanoctomys* (Mammalia: Rodentia) en el Holoceno de Patagonia, Argentina. Ameghiniana 46, 203–207.

Wickström, L.M., Haukisalmi, V., Varis, S., Hantula, J., Henttonen, H., 2005. Molecular phylogeny and systematics of anoplocephalinae cestodes in rodents and lagomorphs. Systematic Parasitology 62, 83–99.