NEW TRIDACTYL DINOSAUR FOOTPRINTS FROM THE LOWER CRETACEOUS OF THE ATACAMA REGION, NORTHERN CHILE

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ABSTRACT

We report here new evidence of tridactyl dinosaur footprints, comprising nine isolated footprints from a new locality in the Atacama Region, northern Chile. The track-bearing levels are located mainly at La Descubridora ravine and one isolated track near the intersection between La Descubridora and Carrizalillo ravines, approximately 11 km southeast from Tierra Amarilla town; the studied levels are assigned to the Pabellon Formation (Lower Cretaceous). The icnites correspond at least to two dinosaur forms, mainly ornithopods (with affinities to Hadrosauriformes dinosaurs) and theropod footprints. These are the first well-documented dinosaur icnites and the first record of ornithopod footprints from the Atacama Region. This record expands the knowledge of cretaceous ornithopods in Chile, which previously were only known from Chacarilla and Quehuita formations, Tarapacá Region, Baños del Flaco Formation in O'Higgins Region and Dorotea Formation in Magallanes Region.

Key words: dinosaur footprints, ornithopod, theropod, Lower Cretaceous, Atacama Region

RESUMEN

Nuevas pisadas de dinosaurios tridáctilos del Cretácico Inferior de la Región de Atacama, Norte de Chile. Documentamos nueva evidencia de huellas tridáctilas de dinosaurios, las que comprenden nueve huellas aisladas en una nueva localidad de la Región de Atacama, norte de Chile. Los afloramientos que portan las marcas están localizados principalmente en la quebrada La Descubridora, hallándose además una traza aislada cerca de la intersección entre las quebradas La Descubridora y Carrizalillo, aproximadamente 11 km al sudeste del pueblo de Tierra Amarilla. Los niveles estudiados son asignados a la Formación Pabellón (Cretácico Inferior). Estas trazas corresponden al menos a dos formas pertenecientes a ornitópodos (con afinidades a dinosaurios Hadrosauriformes) y terópodos. Este registro expande el conocimiento de huellas de ornitópodos cretácicos en el país, las cuales sólo eran conocidas más al norte, en las formaciones Chacarilla y Quehuita, Región de Tarapacá, Formación Baños del Flaco en la Región de O'Higgins y en la Formación Dorotea en la Región de Magallanes.

Palabras clave: huellas de dinosaurios, ornitópodos, terópodos, Cretácico Inferior, Región de Atacama

INTRODUCTION

Currently, dinosaur footprints are the most common fossil record of Mesozoic dinosaurs in Chile (Rubilar-Rogers 2003, Rubilar-Rogers *et al*. 2012), showing evidence of the major clades of dinosaurs (ornithopods, sauropodomorphs and theropods) in several track-bearing strata ranging from the Upper Jurassic to Lower Cretaceous age (Moreno *et al.* 2012; Rubilar-Rogers *et al.* 2008, 2012), along the Northern and Central Chile (Figure 1). One of the most relevant dinosaur sites in the Tarapacá Region is Chacarilla ravine, Upper Jurassic-Lower Cretaceous levels from Chacarilla Formation (Galli and Dingman 1962) which preserves ornithopod tracks (Rubilar *et al.* 2000a; Moreno *et al. 2*000), the ichnotaxa *Brontopodus* isp. (Moreno *et al.* 2000) and theropod tracks (Rubilar-Rogers *et al.* 2000b; Rubilar-Rogers *et al.* 2008). Another locality with

dinosaur footprints located near to the last site is known as Huatacondo ravine, where a diversity of pedal morphologies has been reported (Salinas *et al.* 1991), however the taxonomical status of this footprints need to be re-evaluated. In the Antofagasta Region a tracksite has been preliminary studied (Rubilar-Rogers and Otero 2008; Rubilar-Rogers 2010), revealing the presence of a single footprint of a small theropod and trackways of the ichnotaxa *Brontopodus* isp. in continental levels of the Quinchamale Formation (Maksaev 1978) of Kimmeridgian age (Charrier *et al.* 2007). Also in the Antofagasta Region, near to Calama, there is the locality of San Salvador where Moreno *et al.* (2004) reported theropod footprints (at least three morphotypes) and sauropod footprints referable to *Parabrontopodus* isp. in beds from San Salvador Formation (Lira 1989) of Kimmeridgian age (Charrier *et al.* 2007). Bell and Suárez (1989) mentioned vertebrate footprints from five localities of the Atacama Region (summarized in Figure 1 as points 5 and 6) from the Lower Cretaceous beds of the Quebrada Monardes Formation (Mercado 1982), comprising aeolian and alluvial deposits of a semi-arid terrestrial environment. These authors mentioned that most of the tracks are indistinct and vague in preservation; however, at least two footprints are identified as theropods (points 5 and 6 in Figure 1), one of which is from the locality of Cerro La Isla. Regretfully, these authors did not provide images or casts of the specimen, which cannot be confirmed. Meanwhile, the other record (Figure 4, from Bell and Suárez 1989) was found in Codocedo ravine, and was correctly identified as a theropod (more specifically a coelurosaur). Another remarkable tracksite is Termas del Flaco, located in the Tinguiririca valley, O'Higgins Region (Moreno and Pino 2002). Casamiquela and Fasola (1968) reported several footprints from the continental beds in the upper levels of the Baños del Flaco Formation (Klohn 1960), the latter restricted to a Tithonian-Berriasian age (Salazar 2012). The footprints are currently assignable to theropods, the ichnospecies *Parabrontopodus frenkii* (Casamiquela and Fasola 1968) and indeterminate ornithopods (Moreno and Rubilar 1997; Moreno and Benton 2005; Rubilar-Rogers *et al.* 2006).

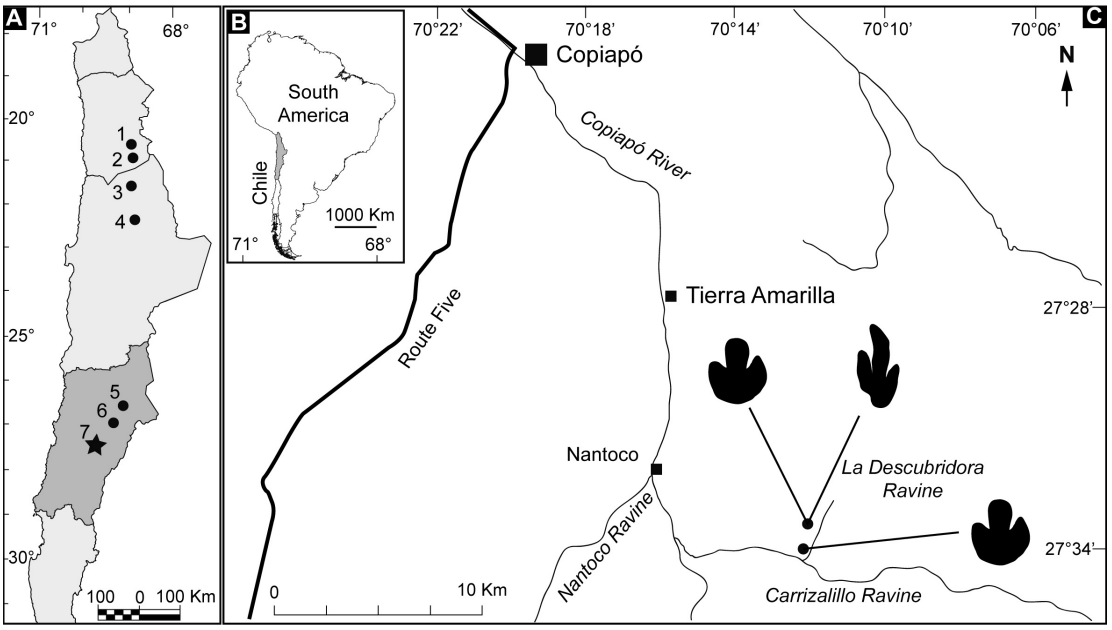

FIGURE 1. Location of the new dinosaur icnites site from La Descubridora ravine. **A**, Fossil tracksites of northern Chile; 1) Chacarilla ravine, Tarapacá Region. Chacarilla Formation, lower Cretaceous. 2) Huatacondo ravine, Tarapacá Region. Quehuita Formation, Kimmeridgian. 3) Arca ravine, Antofagasta Region. Quinchamale Formation, Kimmeridgian. 4) San Salvador, Antofagasta Region. San Salvador Formation, Kimmeridgian. 5) Codoceo ravine, Atacama Region. Quebrada Monardes Formation, lower Cretaceous. 6) Cerro La Isla, Atacama Region. Quebrada Monardes Formation, lower Cretaceous. 7), New icnite locality at La Descubridora ravine, Atacama Region. Pabellón Formation, Aptian. **B,** Relation of the Chilean frontiers within South America. **C**, expanded map of the La Descubridora ravine locality indicating the two principal sites with isolated icnites of ornithopod and theropod dinosaurs.

Here we describe a new fossil site with isolated and well preserved tridactyl footprints. Among them, most are referable to ornithopods, while at least two footprints belong to theropod dinosaurs. The icnites were discovered by geology students (Universidad de Atacama), which kindly provided the location to one of the authors (MS) who visited the site in 2011 and identified the dinosaur prints. In July of the same year all authors visited the site, collecting the data for the present study.

GEOLOGICAL SETTING

The geology of the studied area is characterized by sedimentary, volcanic and intrusive rocks (Figure 2A). The oldest rocks are from Pabellón Formation (Lower Cretaceous) which is described below. The overlying Cerrillos Formation overlies this sedimentary unit and corresponds to sedimentary and volcanic sequences, composed by sandstone, conglomerate, breccias and andesitic-basaltic lavas (Arévalo 1994, 2005). The igneous rocks are represented by subvolcanic unit composed by ocoite (Upper Cretaceous) and diorites and monzodiorites from the Paleocene (Arévalo 2005). The youngest geological unit deposited over the Pabellón and Cerrillos formations is represented by aluvial Quaternary deposits (Arévalo 1994, 2005). Structurally, the area is distinguished by the presence of an inverse fault, NNE – SSW oriented, over the Cerrillos and Pabellón formations (Arévalo 1994, 2005; Figure 2A).

The Pabellón Formation contains the icnite records in the "La Descubridora" ravine (Figure 2A). This sedimentary section is part of the Chañarcillo Group defined by Segerstrom and Parker (1959) which belongs to the north part of the Andean Basin according to Salazar (2012). Detailed stratigraphical studies were performed by Corvalán (1974) and Mourgues (2007). The Pabellón Formation at present is considered

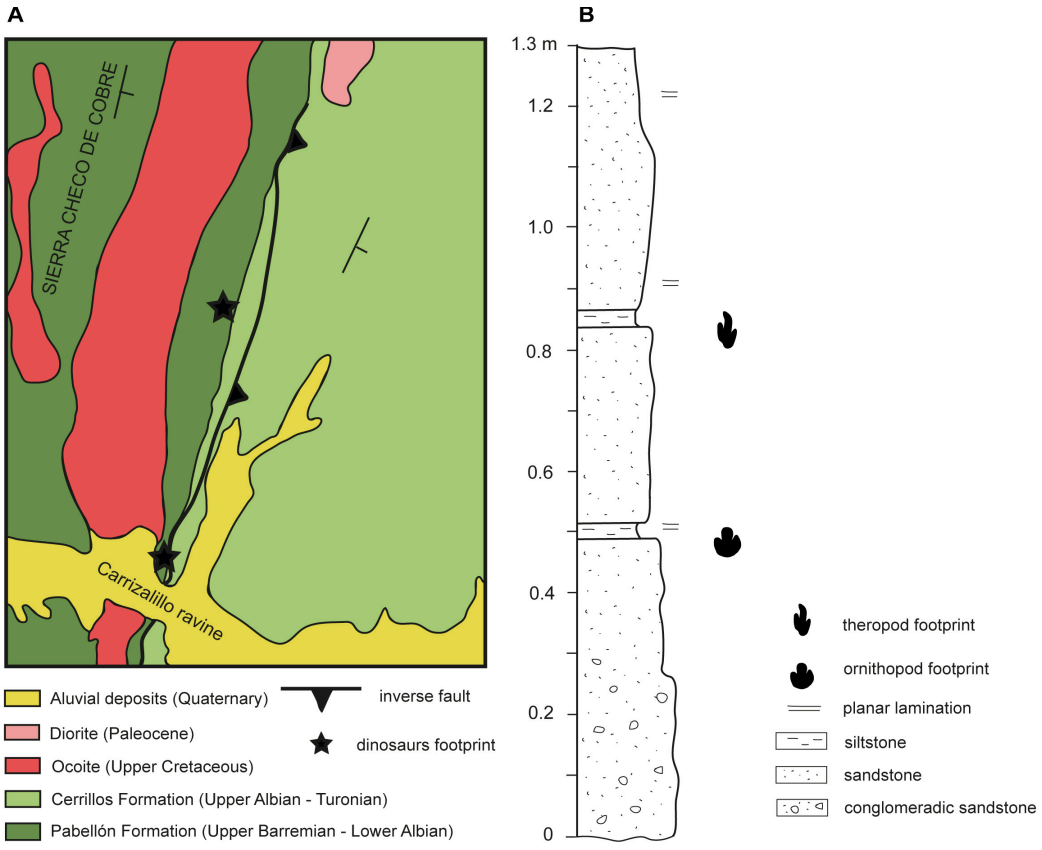

FIGURE 2 A. Geological map of the studied area modified from Arévalo (2005). B, Column of the "La Descubridora" section, from Pabellón Formation, with the dinosaur footprints layers.

to be a marine-to-transitional sedimentary succession mainly composed by calcareous siltstone, calcareous sandstone and siltstone; restricted levels contain conglomerates while fossil remains of invertebrates are relatively abundant and indicate a late Barremian - early Aptian age based on invertebrates (Mourgues 2007, Pérez *et al.* 1990). The section that contains the footprints is located in the lower part of La Descubridora ravine and reaches 1.28 m of thickness (Figures 2A and 2B). The lowermost unit of the section is composed by conglomeratic sandstone to coarse-size sandstone, with 0.3 m thick. Overlying is a unit with 0.18 m of thickness, composed by medium-sized sandstone that contains the ornithopod footprints near the roof of this single level (Figure 2B). Upsection is a siltstone layer with 0.03 m of thickness and planar lamination. Overlaying the unit is medium-sized sandstone with 0.32 m of thickness containing theropod footprints near the top of the level (Figure 2B). Upsection is a siltstone unit of 0.03 m thick. Overlying is a unit with 0.31 m of thickness composed by medium-size sandstone, which gradually decreases to fine-size sandstone. The uppermost unit is 0.11 m thick of medium to fine-size sandstone (Figure 2B).

The ichnite-bearing section corresponds to the lower part of the Pabellón Formation, assigned to the late Barremian in age (Lower Cretaceous) based on fossil invertebrates and stratigraphic correlations (Mourgues 2007).

MATERIAL AND METHODS

The footprints were measured, analyzed and interpreted *in situ* on the La Descubridora ravine (the GPS point was omitted in order to protect the site). All were photographed and drawn in a map of the site (1 x 1 m scale), using semitransparent paper, and giving a reference number (Figure 2). Additional measurements were complemented in the laboratory from referential images collected from the site. A schematic section was taken in the best and largest exposition of the icnites, in order to provide stratigraphic context to the icnite-bearing levels and correlate them with the known geologic setting described for the area.

Classification of the footprints

Dinosaur footprints are generally conspicuous and easily identified. However, regarding the tridactyl footprints, there is a remaining controversy especially among dinosaurs that produce tridactyl tracks of medium size. Such controversy (Moratalla *et al*. 1988, Thulborn 1990, Lockley 1991, Romilio and Salisbury 2011, Castanera *et al*. 2013) is a consequence of the overall similarity in the shape of ornithopod and theropod icnites with the three main toes resting on the floor. To avoid this difficulty, the discrimination between theropod and ornithopod footprints was carried out considering morphological and metric characters. The former refer to features of the autopodial anatomy that can be observed in the trace itself. Among these, the presence or absence of clawed digits, presence of pads, interdigital membranes, and presence and shape of the heel (Moratalla *et al*. 1988). Metric characters refer to the different dimensions that can be obtained from the trace, from which parameters can be analyzed as a set. In order to obtain parameters to discriminate between tridactyl ornithopod and theropod footprints, the methodology proposed by Moratalla *et al* (1988) was followed. Each print was measured according to the scheme shown in Figure 3. These measures are related to: track width (W); total length of the tread (L) which corresponds to the total length of the digit 3 (L3) considered from the tip of the digit until the posterior "heel"; total length of the digits 2 and 4 (L2 and L4); long from the tip of the digit to its base (BL2-4); base width of the digits (WB2-4); width in the middle part of the digit (WM2-4); the distance between the "heel" and interdigital region between digits 2 and 3 (K) and between digits 3 and 4 (M).

Using photographs and drawings of all the tracks, the parameters proposed by Moratalla *et al.* (1988) (see Table 1) were calculated. These parameters are a value of likelihood of being either theropod or ornithopod. Because of the lack of preserved step patterns and trackways; the laterality of the footprints could not be used to provide certainty on digit identity. Due to this, measurements and subsequent analyses were performed over each isolated trace, testing its eventual left or right laterality (see Table 2 and 3) respectively.

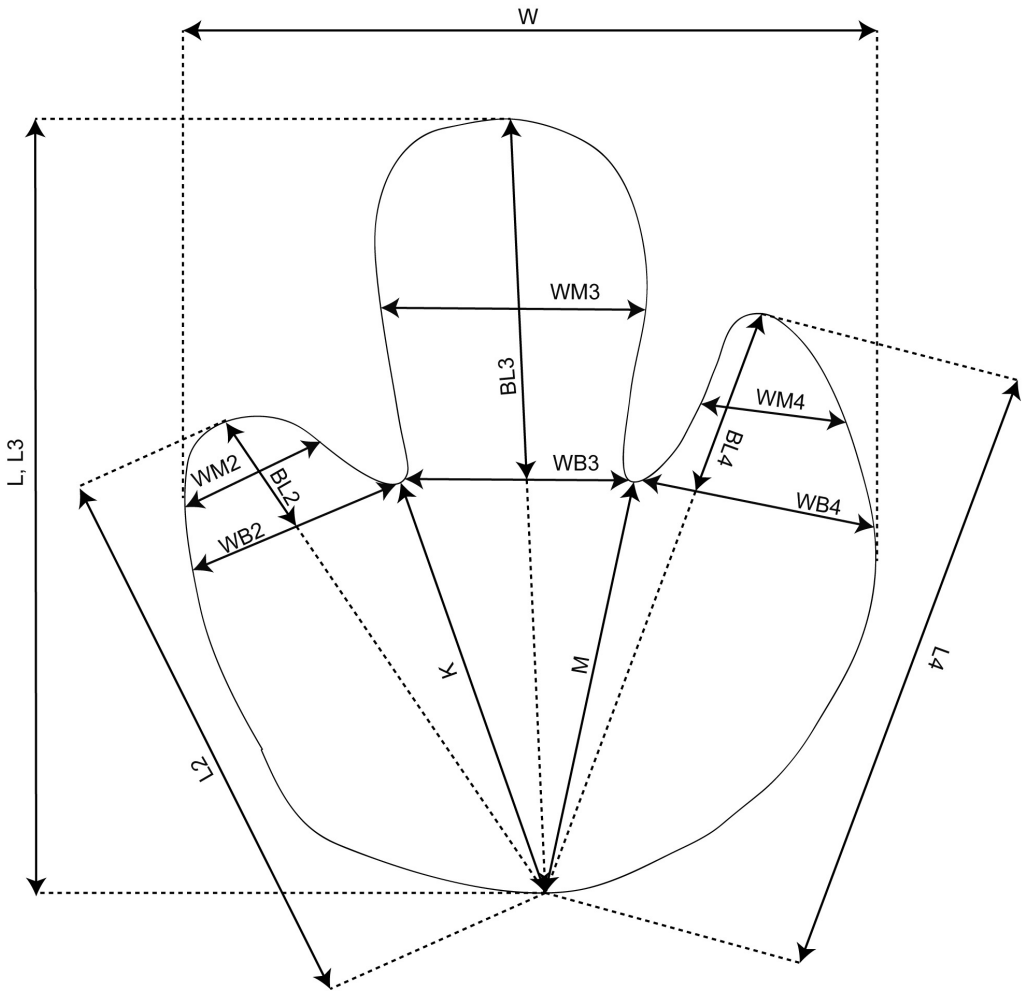

FIGURE 3. Measurements taken from an individual footprint. Abbreviations: L, track length; W, track width; L2-4, whole digit length; BL2-4, basal digit lengths; WL2-4 basal digit widths; WM2-4, middle digit widths; K and M, "heel" to interdigital lengths (modified from Moratalla *et al*. 1988).

DINOSAUR FOOTPRINTS

Description of dinosaur icnites

The material comprises nine isolated footprints *in situ* (Figure 1 and 4). These icnites are preserved in four different blocks which are part of a single outcrop. Two of these blocks allow observing the occurrence of icnites at least in two different stratigraphic levels (Figure 2B), since eight footprints are present in the same ravine (La Descubridora) and one was found near its intersection with the Carrizalillo ravine (Figures 1 and 2). No trackway patterns or steps were visible between both fossil-bearing blocks. A considerable bioturbation observed in one block precluded establishing any possible trackway pattern. These footprints are numerated and described from north to south along the ravine were they are preserved: Footprints 1 and 2 in the same block (level B in the column, Figure 2), footprints 3-7 (level A in the column) and one isolated icnite (number 8) is located 10 meters from track 5. Track 9 was found near an internal road almost in the intersection with the Carrizalillo ravine.

The icnites 1 (Figure 4A) and 2 (Figure 4B-C) are consistent with a theropod type using the methodology established by Moratalla *et al* (1988) (Table 1 and 2). One of these, icnite number 1, is similar in shape to those described as morphotype A (trackways 3 and 4) from site III of the Chacarilla Formation (see Figure 7 in Rubilar-Rogers 2008), where the length of digits 2 and 4 is about half the total footprint length, although, in the current studied case (footprint 1) digit 2 is not elongated in comparison to the lateral digits (left side in the Figure 3A), the heel is more rounded compared with those typical in theropods, and the distal end of the toes do not show acuminated tips as indication of claw marks. Both footprints run in the same direction and are separated by 2.14 m between them.

In the level A, a big block (2.6 m long and 2.37 m wide) with a notorious bioturbation was found, however, we describe only the five most notorious icnites (Figure 4D-E). Footprints 3, 4 and 6 in the same block were identified as ornithopods. The icnites 5 and 7 are dubious after the use of the discrimination parameters (Moratalla *et al* 1988). Footprints on this block are almost all clover shaped, with rounded heels as observed in ornithopods (see Figure 4F and G for a detailed view). No hand impressions where found associated with the ornithopod footprints (with characteristic half-moon shaped).

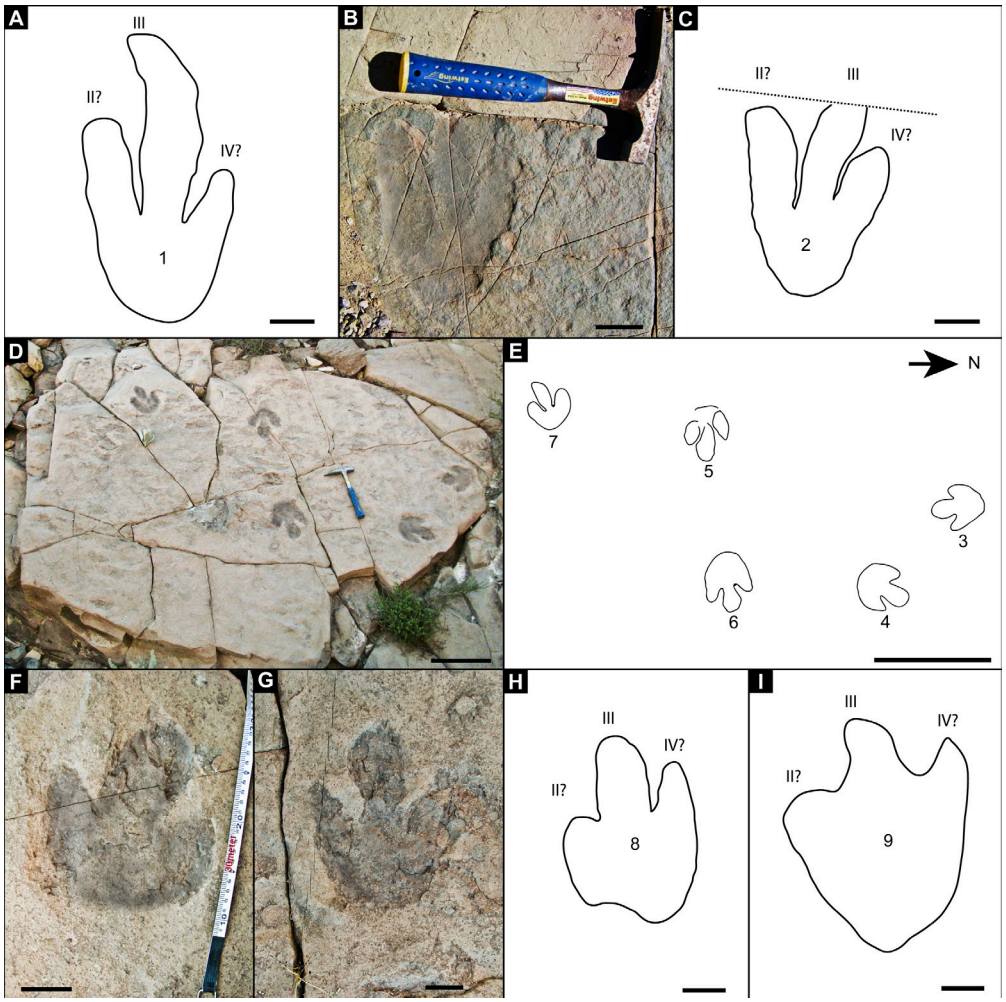

FIGURE 4. Photos and schematic drawings of the dinosaur footprints from La Descubridora ravine. A, interpretative drawing of the footprint 1; B-C, photo and drawing of the footprint 2; D-E, photo and drawing of the central block with ornithopod footprints 3-7; F and G, detail of the footprints 4 and 6 respectively; H, drawing of the isolated footprint 8; I, drawing of the isolated footprint 9. Scale-bar in A, B, C, F, G, H, I, 5 cm; scale-bar in D and E, 50 cm.

Two isolated icnites 8 and 9 (Figure 4F-I) are interpreted as ornithopods using Moratalla's parameters. In the case of number 8, this probably belonged to a right foot with a short digit, since the heel has a notorious notch suggesting the identity of the left digit as digit 2.

DISCUSSION

Tridactyl footprints are one the most common dinosaur tracks in the world, being also the best-represented kind of dinosaur record in Chile (Rubilar-Rogers 2003). There are three formations with ornithopod footprints in the country; two of them are of Upper Jurassic age, consisting mainly of small-sized ornithopods (Rubilar-Rogers *et al*. 2012). On the other hand, Lower Cretaceous records from northern Chile are only known from one site in the Tarapacá Region (Rubilar-Rogers *et al*. 2000, 2012) comprising medium-to-large sized ornithopods. The icnites studied here expand this record along the Atacama Region.

Generally, medium-to-large sized ornithopod dinosaurs show two main footprint morphologies mostly differentiated by the wider form of the distal end of the digits (*e.g.* Thulborn 1990). For example, the distal end of the digit III is wider compared to the accuminated tip observed in non-hadrosauriformes ornithopods. There are several osteological features in derived hadrosaurs which correlate with a predominantly quadrupedal posture or even an obligate quadrupedality (Maidment and Barrett 2012). The absence of any manual impression among the studied icnites is consistent with an early hadrosauriform productor, nevertheless, an artifact of preservation should not be ruled out.

Such ichnofacies with medium-to-large sized ornithopods are characteristic during the Cretaceous when the diversification of the group occurred (Lockley and Wright 2001). Within the country, similar icnites were previously reported at El Carbón ravine from beds of the Chacarilla Formation (Rubilar-Rogers *et al*. 2000). The latter unit, initially assigned to an undifferentiated Jurassic-Cretaceous age, was then refined to the Lower Cretaceous based on the presence of ornithopod ichnofacies. In the present work, the facies with medium-to-large sized ornithopod icnites are consistent with the assignation to a Lower Cretaceous age for the Pabellón Formation.

The data suggests that almost all the icnites (3, 4, 6, 8 and 9) were left by an ornithopod rather than a theropod on the basis of parametric characters.

Regarding the theropod track record, footprints 1 and 2 match the parametric and non parametric criteria for theropod affinities. However, in the case of icnite 5 and 7, the parametric characterization is ambiguous giving similar values to ornithopod and theropod morphotypes.

CONCLUSIONS

We identify two types of tridactyl icnites attributed to ornithopod and theropod dinosaurs found in the locality of La Descubridora ravine, from Lower Cretaceous levels of the Pabellón Formation exposed in the Atacama Region, northern Chile. The productor of these ornithopod footprints is related to a form closer to Hadrosaurifomes than other basal ornithopod such as basal iguanodontian or Dryomorpha. At least two icnite-bearing levels are detected during our study. These are the first ornithopod footprints reported from the Atacama Region and the first well-documented dinosaur footprints from this Region. Previous records from Chile comprise ornithopod footprints from the Chacarilla Formation (Kimmeridgian-Lower Cretaceous) (Galli and Dingman 1962); Quehuita Formation (Kimmeridgian) (Salinas *et al*. 1991); and Baños del Flaco Formation (Tithonian) (Moreno and Pino 2002). The present record is the fourth well-established occurrence of ornithopod icnites and their second occurrence of Cretaceous age from Chile. The footprint record from the Pabellon Formation is potentially useful for the study of paleobiogeography during the Lower Cretaceous of this part of South America as well as for establishing the limits of the Andean Basin during this period.

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Appendix

TABLE 1. Parameters established by Moratalla *et al*. (1988) for the discrimination between tridactyl footprints (for abbreviations see Figure 3).

Track parameters	**Threshold values and probability that the track is either theropod or ornithopod**
L / W	80.0% Theropod >1.25> Ornithopod 88.2%
L / K	70.5% Theropod >2.00> Ornithopod 88.0%
L / M	65.0% Theropod >2.00> Ornithopod 90.7%
BL2 / WM2	76.1% Theropod >2.00> Ornithopod 97.7%
BL3 / WM2	72.7% Theropod >2.20> Ornithopod 97.7%
BL4 / WM2	76.1% Theropod >2.00> Ornithopod 97.4%
L2 / WB2	84.6% Theropod >3.75> Ornithopod 90.2%
L3 / WB3	70.6% Theropod >4.00> Ornithopod 91.5%
L4 / WB4	73.7% Theropod >3.75> Ornithopod 93.4%

TABLE 2. Measurements from all the footprints described in this article (for abbreviations see Figure 3)

Footprint/Laterality	W	L. L3	L2	L4	BL2	BL3	BL4	WB2	WB3	WB4	WM2	WM3	WM4	K	M
1/Right	165.3	323.8	239.7	185.3	111.1	208.1	70.44	52.64	47.91	48.3	50.51	61.63	37.63	123.4	113.2
2/Right	174.5	220.5	214.7	187.3	114.6	118.7	76.77	46.64	44.11	47.8	52.62	52.16	49.06	97.11	111.5
3/Right	206.8	238.2	190.7	175.3	61.68	112.5	50.64	65.7	76.98	64.75	46.3	82.72	48.9	136.9	137.6
4/Right	216	242.5	181.6	191.9	47.5	116.1	62.05	70.79	71.78	76.79	47.81	85.06	41.52	134.4	132
5/Right	203.1	247.7	174.3	189.5	131.7	170.2	107.4	64.83	20.16	18.95	53.56	79.56	62.4	74.3	83.59
6/Right	213	270	208.1	232.1	67.15	113.4	67.8	74.71	54.83	66.61	55.52	84.67	52.27	151.2	157.5
7/Right	203.4	227	159.9	172.2	76.44	139.3	77.82	64.89	34.2	72.39	62.08	61.62	66.83	86.96	92.03
8/Right	155.6	223.4	153.6	188.4	13.77	95.38	62.26	42.42	59.93	50.91	26.08	58.71	36.24	135.9	129.1
9/Right	222.9	276.2	208.9	259.5	24.73	82.5	49.5	77.35	93.36	54.29	61.24	52.62	41.34	198.4	210.2
1/Left	165.3	323.8	185.3	239.7	70.44	208.1	111.1	48.3	47.91	52.64	37.63	61.63	50.51	113.2	123.4
2/Left	174.5	220.5	187.3	214.7	76.77	118.7	114.6	47.8	44.11	46.64	49.06	52.16	52.62	111.5	97.11
3/Left	206.8	238.2	175.3	190.7	50.64	112.5	61.68	64.75	76.98	65.7	48.9	82.72	46.3	137.6	136.9
4/Left	216	242.5	191.9	181.6	62.05	116.1	47.5	76.79	71.78	70.79	41.52	85.06	47.81	132	134.4
5/Left	203.1	247.7	189.5	174.3	107.4	170.2	131.7	18.95	20.16	64.83	62.4	79.56	53.56	83.59	74.3
6/Left	213	270	232.1	208.1	67.8	113.4	67.15	66.61	54.83	74.71	52.27	84.67	55.52	157.5	151.2
7/Left	203.4	227	172.2	159.9	77.82	139.3	76.44	72.39	34.2	64.89	66.83	61.62	62.08	92.03	86.96
8/Left	155.6	223.4	188.4	153.6	62.26	95.38	13.77	50.91	59.93	42.42	36.24	58.71	26.08	129.1	135.9
9/Left	222.9	276.2	259.5	208.9	49.5	82.5	24.73	54.29	93.36	77.35	41.34	52.62	61.24	210.2	198.4

TABLE 3. Values obtained according to the parameters presented in Table 1. In bold, values for theropods (for abbreviations see Figure 3)

Parameters/ Laterality	L/W	L/K	L/M	BL2/ WM2	BL3/ WM3	BL4/ WM4	L2/ WB2	L3/ WB3	L4/ WB4
1/Right	**1.96**	**2.62**	**2.86**	**2.20**	**3.38**	1.87	**4.55**	**6.76**	**3.84**
2/Right	**1.26**	**2.27**	1.98	**2.18**	**2.27**	1.56	**4.60**	**5.00**	**3.92**
3/Right	1.15	1.74	1.73	1.33	1.36	1.04	2.90	3.09	2.71
4/Right	1.12	1.80	1.84	0.99	1.37	1.49	2.57	3.38	2.50
5/Right	1.22	**3.33**	**2.96**	**2.46**	2.14	1.72	2.69	**12.29**	**10.00**
6/Right	**1.27**	1.79	1.71	1.21	1.34	1.30	2.79	**4.92**	3.48
7/Right	1.12	**2.61**	**2.47**	1.23	**2.26**	1.16	2.46	**6.64**	2.38
8/Right	**1.44**	1.64	1.73	0.53	1.62	1.72	3.62	3.73	3.70
9/Right	1.24	1.39	1.31	0.40	1.57	1.20	2.70	2.96	**4.78**
1/Left	**1.96**	**2.86**	**2.62**	1.87	**3.38**	**2.20**	**3.84**	**6.76**	**4.55**
2/Left	**1.26**	1.98	**2.27**	1.56	**2.27**	**2.18**	**3.92**	**5.00**	**4.60**
3/Left	1.15	1.73	1.74	1.04	1.36	1.33	2.71	3.09	2.90
4/Left	1.12	1.84	1.80	1.49	1.37	0.99	2.50	3.38	2.57
5/Left	1.22	**2.96**	**3.33**	1.72	**2.14**	**2.46**	**10.00**	**12.29**	2.69
6/Left	**1.27**	1.71	1.79	1.30	1.34	1.21	3.48	**4.92**	2.79
7/Left	1.12	**2.47**	**2.61**	1.16	**2.26**	1.23	2.38	**6.64**	2.46
8/Left	**1.44**	1.73	1.64	1.72	1.62	0.53	3.70	3.73	3.62
9/Left	1.24	1.31	1.39	1.20	1.57	0.40	**4.78**	2.96	2.70

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