

Dinosaur trackways (*Gigantosauropus asturiensis* n. g. n. sp.; *Hispanosauropus hauboldi* n. g. n. sp.) in the Jurassic of Asturia near La Griega and Ribadesella (Spain)

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with 5 figures in the text

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Abstract: Several dinosaur trackways are described from the Kimmeridgian of Asturia and classified as Megalosauroida. *Gigantosauropus asturiensis* n. g. n. sp. is established for the 1.35 m long imprints as one type of the trackways, *Hispanosauropus hauboldi* n. g. n. sp. for the smaller ones.

Key words: ichnofossils, trails, Saurischia (Megalosauroida), Dinosauria, Kimmeridgian, new taxa; Asturia, Logroño Province.

Introduction

The footprints were discovered during a student excursion of the Geological Institute of Ruhr University, Bochum in Asturia. There the Jurassic forms two widely spanning hollows (geological map SUAREZ VEGA, 1974). The discovery sites (fig. 1) are in each case in the eastern flank cut on the coast north of Colunga (1) or west of Ribadesella (2) in Gijón province:

1. The Colunga occurrence can be reached at ebb tide on the Playa de la Griega about 300 m east of the Rio Libardón river delta, at the foot of the steep edge in the western part of the La Griega Jurassic section. The tracks are in an almost horizontal surface layer imprinted 5.75 m over the red series (see below). There are tridactyl footprints of two bipedal saurians which belong to several trackways.

2. The Ribadesella discovery site already belonged to the long well-known Jurassic section at the west side of the Playa. Three successive track horizons in the coastal cliff at the northern end of the retaining wall are accessible at ebb tide and then can be easily looked over from the coastal rock. They are ca. 22 m above the red series (see below). A footprint is at present in a rock block directly exposed on the wall.

The age of the discovery layers (fig. 1) is best detected in the Ribadesella section. Here the erosive 135 m powerful, red Wealden sediments, the “Gijón layers”, are first situated over Toarcian marine shelf chalks. In the base are fluvial conglomerates and sandstones as well as several well-trained coal seams. The second Wealden unit, the “Tereñes marl”, is in the lower section a silt and chalk sandstone with desiccation cracks

and ripple marks, then becomes a bituminous, prominently ostracode-bearing, pelecypod shell chalk, lime chalk marl and marl with predominantly monomict faunal assemblages. They were developed in offshore shallow water. In the “Ribadesella sandy chalk marl” occur washed-in ammonites from the Lower Kimmeridgian (*eudoxus*-Zone, DUBAR 1925; DUBAR & MOUTERDE 1957). Also the top of the “Tereñes marl” belongs to the Lower Kimmeridgian. However, it probably represents the whole Wealden including the red “Gijón layers” of the Kimmeridgian.

Description of the Tracks

GARCIA-RAMOS & VALENZUELA (1977 and 1981) described numerous dinosaur tracks for the first time from the Asturian Jurassic. They placed them into Theropoda and/or Ornithopoda without closer assignment. Furthermore a tooth of *Megalosaurus* (SCHULZ 1858 in MALLADA 1902) is mentioned.

In the investigation and representation of the impressions and tracks, we followed the global terminology suggestions of HAUBOLD (1971, 1974), which clearly brought these works together. We thank Dr. HAUBOLD (Halle/Saale) for his examination of the manuscript and for valuable taxonomic advice.

The footprints are partly incompletely delivered, which particularly applies to those in the Ribadesella section. The specified dimension usually comes from the well preserved prints.

Order Saurischia SEELEY 1888
Suborder Theropoda MARSH 1881
Infraorder Carnosauria HUENE 1920
Superfamily Megalosauroidea NOPCSA 1928
Family Megalosauridae HUXLEY 1869

Genus *Gigantosauropus* n. g.

Type species: *Gigantosauropus asturiensis* n. sp.

Etymology: Giganto = after Gk./Lat/, enormous.

Diagnosis: Giant-sized, bipedal, tridactyl footprints with short, blunt toes, a clearly issued heel and foot pad, plantigrade.

Gigantosauropus asturiensis n. sp.

Etymology: asturiensis = after the historical Asturia province.

Holotype: Right footprint, fig. 2, 3.

Type locality: Playa de la Griega, Jurassic section north of Colunga, 300 m east of the Rio Libardón delta, Gijón province, Asturia, Spain.

Type stratum: “Tereñes marl”, 5.75 m above the base.

Material: Appropriate left footprints of the La Griega trackway and 4 badly preserved others; 2 pressing into the west wall of the Ribadesella section.

Dimensions (indicated in m):

La Griega, right track, holotype (see fig. 2, 3)

Length

Width

Toe angle

II	III	IV	1	2	3	4	5	II/III	III/IV
1.35	1.30	1.06	1.00	1.18	1.08	0.64	0.63	20°	20°
Bulge width		Bulge height		Sole pad width			Track depth		
0.15-0.25		0.12-0.17		0.06-0.22			0.10		

La Griega, left track (see fig. 2, 3)

Length			Width					Toe angle	
II	III	IV	1	2	3	4	5	II/III	III/IV
0.95	1.30	1.00	0.75	1.00	0.90	0.87	0.65	20°	25°
GANG width		Pace	Stride	Step angle			Foot position		A
1.00		1.25	2.35	90°			5°		0.70

Ribadesella, left track

Length			Width					Toe angle	
II	III	IV	1	2	3	4	5	II/III	III/IV
1.15	1.25	1.00	0.83	0.80	0.70	0.54	0.30	20°	20°

remaining data not measurable

Diagnosis: Bipedal tracks, tridactyl, plantigrade trained footprints with short, blunt toes and a clear heel extended from of digits III and IV; foot length 1.35 m, foot width 1.18 m, stride 2.35 m. Toe angle 20°-25°, distinct foot pads.

Description: The six large prints from La Griega belong to two tracks. The older points NNW. Two of the same footsteps are overlain by the recent, oppositely directed trace (fig. 2, 3). The size of the two well-preserved prints achieve lengths of 1.35 m and widths of ca. 1.20 m. They lie close together and are only little shifted toward each other in the march direction. The step length of one side is 2.30 m. A clear heel is extended from digits III and IV. Particularly remarkably, high sole pads between 6 and 22 cm wide rise in the right print. The external bulge is high and broad.

The two large Ribadesella prints from the western cliff are to a large extent identical to those from La Griega in their size and formation. The tridactyly and strong edge thickening can still be clearly detected, while all remaining features are smeared.

Comparison: Dinosaur tracks of this size have not been published thus far. They differ from other forms by their enormous dimensions.

GARCIA-RAMOS & VALENZUELA (1977, 1981) mention numerous tracks from neighboring sections. They describe type K from western Lastres, a tridactyl print with a length of 96 cm and width of 91 cm. They interpret these values as oversized due to sliding. Whether the form is most comparable with our type remains to be checked.

Occurrence: Northern Spain, Asturias, La Griega and Ribadesella, "Tereñes marl".

Age: Kimmeridgian.

Genus *Hispanosauropus* n. g.

Type species: *Hispanosauropus hauboldi* n. sp.

Etymology: Hispania = old, Latin name of the Iberian peninsula.

Diagnosis: Medium-sized, bipedal, tridactyl, plantigrade impressions with clear heel. The print width is remarkably small in relation to the length. Sole pads are developed.

Hispanosauropus hauboldi n. sp.

Etymology: hauboldi = in honor of Dr. Helmut HAUBOLD, Halle/Saale.

Holotype: Impression at the Ribadesella wall, fig. 4, 5.

Type locality: Ribadesella, west side of the Playa, rock block at the northern retaining wall, Gijón province, Asturias, Spain.

Type stratum: "Tereñes marl".

Material: Numerous footprints of several tracks near La Griega and Ribadesella.

Dimensions (indicated in m):

Ribadesella, holotype (see fig. 4, 5)

Length			Width				Toe angle	
II	III	IV	1	2	3	4	II/III	III/IV
0.43	0.51	0.37	0.36	0.36	0.25	0.09	30°	22°

Sole pad width

0.05-0.07

La Griega (see fig. 4)

Length			Width					Toe angle	
II	III	IV	1	2	3	4	5	II/III	III/IV
0.45	0.52	0.30	0.22	0.26	0.25	0.16	0.05	15°	22°

Bulge width

0.11

Bulge height

0.12

one side step length

1.60

Diagnosis: Bipedal tracks, tridactyl, plantigrade-trained prints with remarkably narrow heel and short toes in relation to the length, as well as a distinct foot pad

Description: The medium-sized impressions are more frequent in both horizons than the larger ones, and those near Ribadesella in the eastern coastal cliff have been spaciouly opened. The tridactyly is clear only in a few specimens due to preservation. In these a heel and sole pad (width 7 cm) are developed. The tracks are narrow (max. 36 cm) with a length of 52 cm. The toe angle varies between 15° and 30°. The step length is 1.60 m.

Comparison: With their sizes, the footprints fit in well with descriptions of megalosaurid forms. In particular they recall the Upper Jurassic tracks from Barkhausen/Wiehengebirge/NW Germany (KAEVER & LAPPARENT 1974), some impressions from the Wealden of Enciso/Logroño Province (CASANOVAS-CLADELLAS & SANTAFE LLOPIS 1971, 1974; BRANCAS et al. 1979) and Asturias (GARCIA-RAMOS & VALENZUELA 1977, 1981), as well as *Irenesauripus* STERNBERG 1932 and the theropod footprints from Texas (LANGSTON 1974).

The prints from Barkhausen, ?*Megalosauropus teutonicus* KAEVER & LAPPARENT (n. HAUBOLD the generic name is preoccupied; pers. comm.), are alike in

step length, but substantially broader (56 cm), without clear heel and foot pad, and digitigrade. Additionally the toe angle (26°-30°) differs. A direct link between both track forms does not seem possible to us.

Prints of several trackways published under 1A (BRANCAS et al. 1979), from Barranco de la Fuente de Abajo at Camino de Varcibe near Enciso, are more similar and belong perhaps to the new kind. They are only shorter, but otherwise more comparable in dimensions and appearance. The authors also placed them in the Carnosauria without closer assignment.

Contrary to *Hispanosauropus*, *Megalosauripus* from Barranco Valdecevillo near Enciso (CASANOVAS-CLADELLAS & SANTA FE LLOPIS) and *Irenesauripus* from the Upper Cretaceous of British Columbia both possess long, narrow toes with claws, broad heels, and different toe angles.

The theropod tracks from Texas assigned by LANGSTON to *Irenesauripus* deviate in the same way.

Whether some forms mentioned by GARCIA-RAMOS & VALENZUELA from Asturia (e.g. type H) can be assigned here cannot be judged with certainty based on the data that are currently well known.

O c c u r r e n c e : Northern Spain, Asturia, La Griega and Ribadesella, “Tereñes marl” and ?Enciso, Camino de Varcibe (Logroño Province).

A g e : Kimmeridgian, ?Upper Cretaceous.

Literature

[see original paper]

Figure Captions

Fig. 1. The localities of the dinosaur trackways in Asturia, with a survey of the Kimmeridgian sequence. Abbreviations: *D* = ammonite discovery DUBAR (1925); *St* = disturbance; 1, 2 = track discovery points and layers; a = Lias/Dogger-chalk marl; b = Gijón conglomerate, sandstone; 3 = Tereñes marl; d = Ribadesella sandy chalk marl

Fig. 2. *Gigantosauropus asturiensis* n. g. n. sp. – above: right print = holotype; below: right and left prints of the track near La Griega in the survey.

Fig. 3. *Gigantosauropus asturiensis* n. g. n. sp. Scheme of the right and left prints near La Griega (see fig. 2, below); right = holotype. In the upper left part is a sketch of the measurements (see in addition S. 410). – Abbreviations: II, III, IV = phalanges; 1-5 = width of the castings; a, b = toe angle; A = foot distance of the single track; G = trackway width; P = pace; I = step angle; arrow = march direction.

Fig. 4. *Hispanosauropus hauboldi* n. g. n. sp. – above: the best-preserved print from the Ribadesella section north of the wall, holotype; below: imprint from the La Griega section.

Fig. 5. *Hispanosauropus hauboldi* n. g. n. sp. Scheme of the holotype. Measurements see p. 411. This is drawn upside-down compared with fig. 4.

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