

REINTERPRETATION OF THE ARTIODACTYLA (MAMMALIA) FOOTPRINTS DESCRIBED BY ION POPESCU-VOITEȘTI IN 1927

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Abstract. The footprints shown in the original picture taken by Popescu-Voitești (1926) exhibit at least 10 trackways of *Pecoripeda amalphea* and *Pecoripeda gazella* (Artiodactyla). The contribution of Popescu-Voitești (1927) to the knowledge of vertebrate footprints from the Lower Miocene molasse of the Carpathian belt is of outstanding importance, as it enlarged the distribution area of those footprints in Romania. Additionally, his studies open the interest of the Romanian scientists for palaeoichnological researches, starting with the 6th decade of the 20th century. The first identification of bird footprints in Lower Miocene/ Burdigalian sediments in Europe (Grozescu, 1918) and of the artiodactyla footprints (Popescu-Voitești, 1927), together with the establishment of a nomenclature system and classification of the mammals and bird footprints (Panin & Avram, 1962; Panin, 1964), were priorities of Romanian palaeoichnology (Brustur, 2003, 2004).

Key words: Vertebratichnia, Artiodactyla (*Pecoripeda amalphea*, *P. gazella*), Lower Miocene, Ocnița, România.

INTRODUCTION

Professor Ion Popescu-Voitești published, in the scientific journal of the Geological-Mineralogical Museum of the University „King Ferdinand I” from Cluj, a short note regarding the artiodactyls from Romania. In this note, he also published a picture of a „Helvetian” outcrop situated in the Olanului Valley, at the Ocnița locality, Dâmbovița County (Popescu-Voitești, 1927, Plate V). The picture, although published in poor conditions and without a scale, presents the top of the thick bed of sandstones, with several footprints of a cloven-hoofed mammal. In order to clarify this matter, the author had sent several pictures to Paris and Vienna. He had received answers from Professor L. Joleaud* „*Empreintes de pas d'un Artiodactyle (?) d'une taille voisine de celle du chevreuil. Ce pourrait être Dicrocerus elegans, qui se trouve dans l'Helvétien de la Basse Autriche, de la Styrie, de la Silésie, de la*

Pologne”, and from Professor O. Abel**, respectively: „*Es sich wahrscheinlich um die Fusspuren eines Paarhufers handelt. Besonders die beiden Abdrücke ganz oben sind ziemlich deutlich...*” (Popescu-Voitești, 1927, p. 27). Taking into account the comments received from two well-known palaeontologists of the time, the author used these opinions for reconstructing the sedimentary conditions of the Lower “Helvetian” in the Romanian Subcarpathians (Popescu-Voitești, 1935, p. 108).

The aim of this article is to offer additional informations to the paper of Popescu-Voitești (1927), based on the study of original pictures of these footprints that exist in Professor Mircea Paucă's archive.

MAMMALIAN FOOTPRINTS IN ROMANIA

Up to now, 9 mammal ichnospecies, from the Lower Miocene molasses deposits of the Marginal Fold Nappe (N Piatra Neamț), Subcarpathian Nappe as well as of the Drăjna and Slănic synclines of the Eastern Carpathians, have been de-

* Léonce Joleaud (1880-1938), professor at the Faculty of sciences at Paris, who authored significant paleontological works (e.g. „Le ruminants cervicornes d'Afrique”, 1935) and regional geology in Algeria.

** Othenio Lothar Abel (1875-1946), Austrian paleontologist, professor at the universities of Göttingen and Vienna, forerunner of palaeobiology.

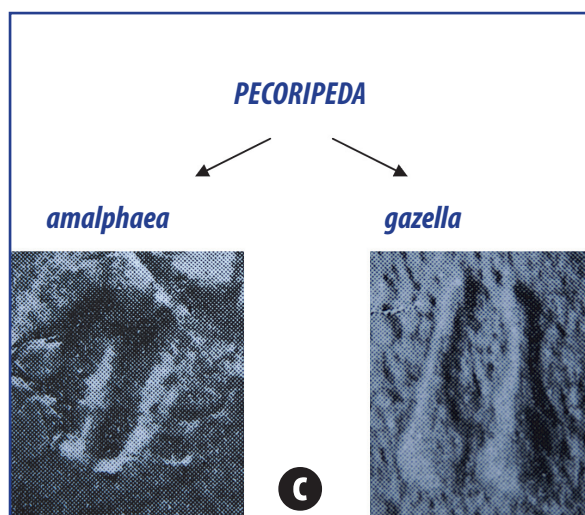
scribed (fig. 1A). These taxa were found in 7 localities: **Gârcina** (Panin, 1964), **Moinești** area (Mirăuță, 1964, 1965), **Valea Sării-Prisaca** (Panin, 1961, 1964; Alexandrescu & Georgescu, 1962; Panin & Avram, 1962; Alexandrescu *et al.*, 1986; Kordos & Prakfalvi, 1990; Brustur & Alexandrescu, 1993), **Andreiașu** (Ioniță, 1964), **Măneciu-Cerașu** (Panin *et al.*, 1966; Grujinski, 1969), **Valea Doftanei-Brebu** (Panin & Ștefănescu, 1968)

and **Ocnița** (Popescu-Voitești, 1927) (fig. 1B). Except for the Moinești site, where only bird footprints were found (Mirăuță, 1964, 1967), and the Andreiașu site, where *Hippipeda* isp. (Ioniță, 1964) and *Lariformes* and *Ciconiiformes* bird footprints are present (Paucă, 1942, 1952), in all the other sites the footprints belonging to the Artiodactyles *Pecoripeda amalpheia* and *P. gazella* (fig. 1C) have a remarkable frequency.

no	Ichnospecies	1	2	3	4	5	6	7
1	<i>Canipeda longigriffa</i> * Panin & Avram 1962			+				
2	<i>Felipeda felis</i> Panin 1964	+						
3	<i>Felipeda linxi</i> * Panin & Avram 1962			+				
4	<i>Felipeda minor</i> Panin, Lazarescu & Grujinski 1966					+		
5	<i>Hippipeda</i> isp. (Hipparion)				+			
6	<i>Pecoripeda gazella</i> * Vialov 1961	+		+		+	+	+
7	<i>Pecoripeda amalpheia</i> Vialov 1961	+		+		+	+	+
8	<i>Proboscipeda enigmatica</i> Panin & Avram 1962			+				
9	<i>Rhinoceropeda problematica</i> Panin & Ștefănescu 1968						+	

Abbreviation: 1. Gârcina (Neamț County); 2. Moinești zone (Bacău County); 3. Valea Sării-Prisaca (Vrancea County); 4. Andreiașu (Vrancea County); 5. Măneciu-Cerașu (Prahova County); 6. Valea Doftana-Brebu (Prahova County); 7. Ocnița (Dâmbovița County)

a



b

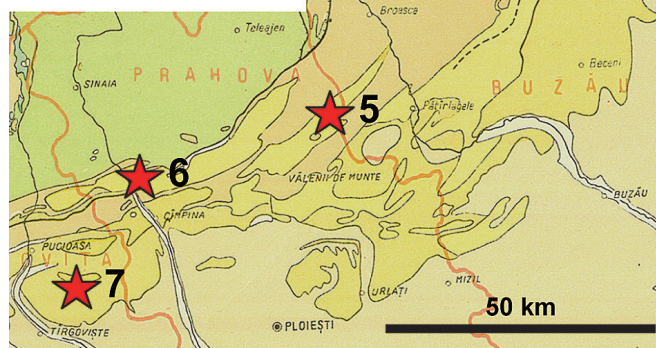


Fig. 1 The placement of the mammal footprints in the Lower Miocene Molasse of Romania (**A, B**) and ichnospecies of *Pecoripeda* from the Valea Sării-Prisaca area (**C** – after Panin & Avram, 1962)

POPESCU-VOITEȘTI'S PHOTO REINTERPRETATION

As collaborator (1909-1942), and for a short interval (1930-1931), Director of the Geological Institute of Romania, Professor Popescu-Voitești was constantly preoccupied of tectonic and stratigraphic aspects of the Miocene and Pliocene terranes occurring in the Getic Depression and Subcarpathians. During his investigations, he firstly discovered in Romania, in the Olanului Valley, close to the Ocnița locality (Dâmbovița County), in 1926, mammal footprints on the surface of a "Helvetian" sandstone bed (fig. 2A, B).

His discovery closely succeeded the first identification of bird footprints in the Burdigalian of Europe, made by Grozescu (1918), in the Schitul Frumoasa site, Bacău County (cf. Sargeant & Reynolds, 2001, p. 21).

The close examination of the footprints from the original picture leads to the conclusions that at least 10 trackways are present (fig. 2C). These tracks are generated by mammals of Artiodactyla group that were moving on the substratum surface. Therefore, they are not „bird footprints”, as initially described by Popescu-Voitești (fig. 2B).

All these footprints form a natural mold or concave epirelief (*sensu* Tulborn & Wade, 1989), at a single horizon (= „tracking surface”, *sensu* Fornós *et al.*, 2002). Some of the footprints are very clear (fig. 2C1), what was remarked also by Professor Othenio Abel (*v. supra*). They belong to the ichnospecies *Pecoripeda amalphea*, with an oval outline and pointed termination (trackways 1-2; the ratio between the length (L)/width (w) is between 1.03 and 1.09. Most of the other footprints (trackways 3 to 10), that belong to *Pecoripeda gazella*

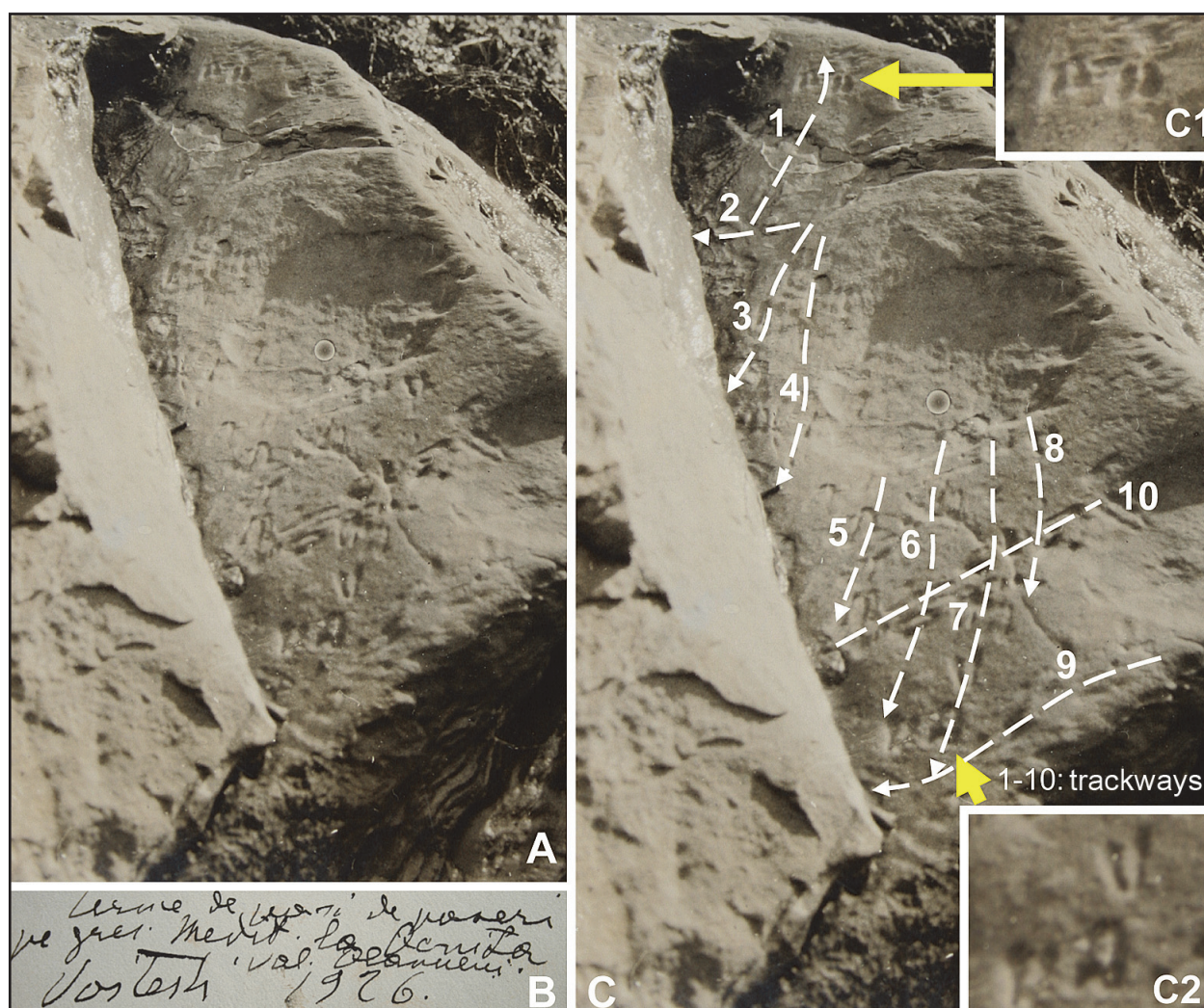


Fig. 2 Artiodactyla footprints identified by Popescu-Voitești in the Burdigalian from the Olanului Valley (Ocnița locality). **A.** Fragment of the original picture (8 x11 cm), without scale; **B.** The olograph explanation of Voitești 1926; **C.** The interpretation of footprints belonging to at least 10 trackways; **C1.** *Pecoripeda amalphea* Vialov 1961; **C2.** *Pecoripeda gazella* Vialov 1961

(L/w $\approx$ 1.24-1.25)***, have a longish outline and a pointed termination (fig. 2C2).

A particular shape can be recorded in the trackways 9 (?) and 10, where a deformation (= sliding marks) of the footprints are observed. Similar patterns were described at some artiodactyla footprints from the Slănic Syncline (Panin *et al.*, 1966) and at the *Hipparion* (*Hippipeda* isp.) footprint from the Andreiașu site (Ioniță, 1964). Deformations of vertebrate footprints, due to the sliding on the substratum, are known from deposits older than Miocene one. Hence, such a pattern was described for the Triassic tetrapods from Wyoming, USA (Boyd & Loope, 1984), as well as for the artiodactyla footprints in Lower Oligocene deposits from Spain (Astibia *et al.*, 1994). Probably, these sliding footprints are quite frequent.

The footprint of a big-sized cloven-hoofed identified in the Lower Miocene/Burdigalian deposits in the Prisaca site (Panin & Avram, 1962, p. 463, pl. III, fig. 18) could argue for the presence of a cervine, possibly resembling to *Dicrocerus elegans*. This species inhabited large open areas during the Middle Miocene, interval characterised by a global warming (Miocene Climatic Optimum, 17-15 Ma). This taxon, a folivor one (Mennencart *et al.*, 2011), that lived in an environment with very big herds (Azanza *et al.*, 2011), has disappeared from the Central European faunas during the Upper Miocene interval (Vislobokova, 2005).

DISCUSSION AND CONCLUDING REMARKS

The contribution of Prof. Popescu-Voitești to the knowledge of vertebrate footprints from Lower Miocene molasse deposits of the Carpathian belt is very important, because it enlarged the areal distribution of these footprints on the Romanian territory. On the other hand, his pioneering researches have given an impulse, for such studies, starting with the sixth decade of the last century.

In this context, there have been published contributions of Panin & Avram (1962, p. 457) and Panin (1964, p. 342), re-

*** The values of the ratio L/w are not precise, due to the approximate measurements of the two parameters on the picture. Even so, the length and width values are inside the numbers obtained by Panin & Avram (1962), Panin *et al.* (1966) and Panin & Ștefănescu (1968). Unfortunately, a short field-work in the Ocnița area (23 July 2005) did not allow the discovery of the site identified by Popescu-Voitești in 1927.

garding the establishment of a nomenclature system and classification of the mammals and bird footprints, in use nowadays, with some emendations that have been recently brought by Sarjeant & Langston (1994), Sarjeant & Reynolds (2001), and Sarjeant *et al.* (2002).

(2002). Additionally, Panin (1961) is the first author who applied the morphological classification of Vialov, against that of Santucci & Nyborg (1999), a controversy recently clarified by Sarjeant & Reynolds (2001, p. 22).

The revision of bird and mammal footprints, initially described by Panin & Avram (1962), has led to the establishment of ichnospecies-types *Anatipeda anas*, *Ardeipeda egretta*, *Charadriipeda recurvirostridea*, *Gruiipeda maxima* and *Felipeda linxi*, *Canipeda longigriffa* and *Pecoripeda gazella*, respectively by Sarjeant & Langston (1994) and Sarjeant *et al.* (2002). By continuing these researches, the identification, in the Miocene deposits of Spain, of trackways containing numerous footprints of *Canipeda longigriffa* and *Felipeda linxi*, has offered an excellent material for reconstructing the trace-makers, probably belonging to carnivores, herpestids and aeluroids, as well as for estimating their speed of movement (Anton *et al.*, 2004).

The first identification in Europe of bird footprints in the Lower Miocene/Burdigalian deposits of the Romanian Carpathian area (Grozescu, 1918), as well as of artiodactyla footprints (Popescu-Voitești, 1927), together with the publication of a still valuable today nomenclature system and classification of some mammals and bird footprints (Panin & Avram, 1962; Panin, 1964), represent outstanding contributions to the Romanian palaeoichnology (Brustur, 2003; 2004).

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