

***Palaeolagus haydeni* – an Early Oligocene fossil rabbit**

¹Tudor Păpuș, ¹Cristian Coroian, ^{2,3,4}I. Valentin Petrescu-Mag

¹ Faculty of Animal Science and Biotechnologies, University of Agricultural Science and Veterinary Medicine Cluj-Napoca, Cluj-Napoca, Romania; ² Department of Environmental Engineering and Protection, Faculty of Agriculture, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Cluj-Napoca, Romania; ² Bioflux SRL, Cluj-Napoca, Romania; ³ University of Oradea, Oradea, Romania. Corresponding author: I. V. Petrescu-Mag, zoobiomag2004@yahoo.com

Abstract. *Palaeolagus haydeni* is an Early Oligocene fossil lagomorph widely regarded as one of the earliest well-documented rabbit-like mammals. Known primarily from the White River Group deposits of North America, this species offers valuable information on the early evolution, morphology, and ecology of lagomorphs. The present study synthesizes data on its geological distribution, skeletal morphology, dentition, and inferred paleoecology. Morphological analyses, supported by recent micro-CT investigations, indicate that *P. haydeni* occupies a stem position relative to extant lagomorph families, displaying a combination of primitive and derived traits. Limb proportions and cranial features suggest a generalized mode of locomotion and herbivorous diet adapted to open or semi-open Oligocene environments. As such, *P. haydeni* represents a crucial reference point for reconstructing the early lagomorph body plan and for understanding the evolutionary processes that led to the specialization of modern rabbits and pikas.

Key Words: Early Oligocene, fossil rabbit, lagomorph evolution, Lagomorpha, paleoecology, paleomorphology, *Palaeolagus haydeni*, White River Group.

Introduction. *Palaeolagus haydeni* is a well-documented fossil species of rabbit (order Lagomorpha, family Leporidae) that lived during the Early Oligocene in North America (Wolniewicz & Fostowicz-Frelik 2021). This taxon represents one of the earliest known lagomorphs that can be confidently assigned to a true rabbit-like lineage, providing key evidence about the early evolution of rabbits and their morphological adaptations (Wolniewicz & Fostowicz-Frelik 2021). Its fossil record extends primarily across the White River Group rocks of the central United States, including Nebraska and Wyoming (Troxell 1921; en.wikipedia.org) (Figure 1).

Geological Age and Distribution. *Palaeolagus* lived approximately 33 to 23 million years ago during the Oligocene epoch, a time of significant climatic cooling and grassland expansion in North America (WorldSpecies.org 2025). Fossils have been recovered from multiple sites within the Brule Formation and other units of the White River Group in states such as Nebraska, Wyoming, North Dakota, and South Dakota (Wolniewicz & Fostowicz-Frelik 2021). Extensive material from these deposits makes *P. haydeni* among the best-represented early leporids in the North American fossil record (WorldSpecies.org 2025).

Morphology and Size. The overall body plan of *P. haydeni* is reminiscent of modern rabbits: small, herbivorous, and likely adapted to a cursorial lifestyle (Ruf et al 2021). Adult individuals were small, approximately 25–30 cm in body length, similar to the size of many extant rabbits (fr.wikipedia.org; en.wikipedia.org). However, compared with modern rabbits, *P. haydeni* had proportionally shorter hind limbs, suggesting that its locomotion was somewhat different from the powerful hopping gait seen in today's rabbits. It likely moved with more generalized running or scampering motions (Ruf et al 2021; fr.wikipedia.org; en.wikipedia.org).

Skull and Dentition. The dental formula and skull anatomy of *P. haydeni* exhibit classic lagomorph features: two pairs of upper incisors (a diagnostic trait distinguishing lagomorphs from rodents) and cheek teeth adapted for herbivory (Ruf et al 2021). Recent micro-CT studies have provided new, detailed anatomical data for the skull, showing a combination of primitive and derived features (datadryad.org; en.wikipedia.org). These reveal that *P. haydeni* does not fall squarely within the crown groups of rabbits or pikas, but instead occupies a stem position relative to modern lagomorph families, making it critical for understanding early lagomorph evolution and the emergence of modern traits (Ruf et al 2021; datadryad.org; en.wikipedia.org).

Paleoecology and Behavior. The paleoecological context of *P. haydeni* suggests that this species inhabited open woodlands, savannas, and plains environments that were becoming more widespread in Oligocene North America (Wolniewicz & Fostowicz-Frelik 2021). Like modern rabbits, it was herbivorous, feeding on vegetation available in these habitats (Fostowicz-Frelik 2013). However, its limb proportions hint that it was less specialized for hopping and more adapted to generalized terrestrial locomotion, possibly using burrows or dense vegetation for shelter and predator avoidance (Darwent 2007; en.wikipedia.org).



Figure 1. *Palaeolagus haydeni*, an ancient rabbit, and an extinct genus of lagomorph in the family Leporidae. Locality: White River Badlands, Wyoming USA. Stage: Oligocene (Rupelian 33.9 million years ago). Size: 16.5x12x5.6 cm. Source: Didier Descouens CC BY-SA 3.0.

Evolutionary Significance. The genus *Palaeolagus* is significant because it lies close to the divergence between the two main extant lagomorph lineages (rabbits/hares and pikas) (Wolniewicz & Fostowicz-Frelik 2021). Its mosaic of morphological characters supports the idea that early lagomorphs retained a suite of primitive traits not seen in modern taxa, providing insight into how modern rabbits and pikas evolved specialized locomotor and dental adaptations later in the Cenozoic (Wolniewicz & Fostowicz-Frelik 2021; en.wikipedia.org).

Conclusions. The fossil rabbit *Palaeolagus haydeni* represents a key taxon for understanding the early evolutionary history of Lagomorpha during the Oligocene of North America. Its rich and well-preserved fossil record, particularly from the White River Group, allows for detailed analyses of morphology, functional anatomy, and paleoecology, making this species one of the most informative early leporids known to date.

Morphological evidence, especially from cranial and dental structures, demonstrates that *P. haydeni* exhibits a mosaic of primitive and derived traits. This combination supports its placement outside the crown groups of modern rabbits and pikas, instead indicating a stem position relative to extant lagomorph families. Recent micro-CT-based studies have refined this interpretation by revealing internal cranial features that further clarify the transitional nature of this taxon.

From a paleoecological perspective, *P. haydeni* appears to have been adapted to open or semi-open habitats associated with the climatic cooling and landscape changes of the Early Oligocene. Limb proportions suggest a locomotor strategy less specialized for saltatory movement than that of modern rabbits, implying a more generalized terrestrial mode of locomotion. This functional morphology is consistent with an early stage in the evolution of the highly specialized cursorial and hopping adaptations seen in later leporids.

Overall, *P. haydeni* provides critical insight into the early lagomorph body plan and the sequence of morphological changes that preceded the diversification of modern rabbits and pikas. Its study underscores the importance of integrating classical paleontology with modern imaging techniques to reconstruct evolutionary patterns with greater accuracy and reduced phylogenetic uncertainty.

Conflict of Interest. The authors declare that there is no conflict of interest.

References

- Darwent C. M., 2007 Lagomorphs (Mammalia) from late Miocene deposits at Lemudong'o, southern Kenya. *Kirtlandia* 56:112-120.
- Fostowicz-Frelik Ł., 2013 Reassessment of *Chadrolagus* and *Litolagus* (Mammalia: Lagomorpha) and a new genus of North American Eocene lagomorph from Wyoming. *American Museum Novitates* 2013(3773):1-76.
- Ruf I., Meng J., Fostowicz-Frelik Ł., 2021 Anatomy of the nasal and auditory regions of the fossil lagomorph *Palaeolagus haydeni*: systematic and evolutionary implications. *Frontiers in Ecology and Evolution* 9:636110.
- Troxell E. L., 1921 *Palaeologus*, an extinct hare. *American Journal of Science* 5(4):340-348.
- Wolniewicz A. S., Fostowicz-Frelik Ł., 2021 CT-informed skull osteology of *Palaeolagus haydeni* (Mammalia: Lagomorpha) and its bearing on the reconstruction of the early lagomorph body plan. *Frontiers in Ecology and Evolution* 9:634757.
- *** Datadryad.org, <https://datadryad.org/dataset/doi%3A10.5061/dryad.crjdfn338> [Last view: December 2025]
- *** En.wikipedia.org, <https://en.wikipedia.org/wiki/Palaeolagus> [Last view: December 2025]
- *** Fr.wikipedia.org, <https://fr.wikipedia.org/wiki/Palaeolagus> [Last view: December 2025]

*** Worldspecies.org, <https://www.worldspecies.org/ntaxa/3682673> [Last view: December 2025]

Received: 15 October 2025. Accepted: 29 November 2025. Published online: 30 December 2025.

Authors:

Tudor Păpuc, Faculty of Animal Science and Biotechnologies, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Calea Mănăştur Street, 400372 Cluj-Napoca, Cluj, Romania, e-mail: tudor.papuc@usamvcluj.ro

Cristian-Ovidiu Coroian, Faculty of Animal Science and Biotechnologies, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Calea Mănăştur Street, 400372 Cluj-Napoca, Cluj, Romania, e-mail: cristian.coroian@usamvcluj.ro

Ioan Valentin Petrescu-Mag, University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Faculty of Agriculture, Department of Environmental Engineering and Protection, 3-5 Calea Mănăştur Street, 400372 Cluj-Napoca, Romania, e-mail: zoobiomag2004@yahoo.com

This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

How to cite this article:

Păpuc T., Coroian C.-O., Petrescu-Mag I. V., 2025 *Palaeolagus haydeni* — an Early Oligocene fossil rabbit. *Rabbit Gen* 15(1):11-14.