

The Miocene carnivore fauna of Schönweg-“Brüchl” (Austria, Carinthia): I. The genus *Forsythictis*

Die miozäne Raubtierfauna von Schönweg-“Brüchl” (Österreich, Kärnten): I. Die Gattung *Forsythictis*

Von Jorge MORALES, Davit VASILYAN, Martin GROSS, Andreas HASSLER & Jérôme PRIETO

Abstract

The Miocene fossils discovered at Schönweg-“Brüchl” (Lavanttal, district Wolfsberg, Carinthia, ca. 16 My) present a diverse mammalian fauna among which four species of carnivores have been found. A single species of Viverridae is documented by a badly damaged skull but still having the P4 and M1, a p4 and a DP3. The fossils are attributed to *Forsythictis* cf. *aurelianensis* (SCHLOSSER, 1888), a species known from Europe in the late Early and early Middle Miocene.

Zusammenfassung

Die in Schönweg-“Brüchl” (Lavanttal, Bezirk Wolfsberg, Kärnten, ca. 16 My) entdeckten miozänen Fossilien zeigen eine vielfältige Säugetierfauna, aus der vier Arten von Karnivoren bekannt sind. Eine einzige Viverridae-Art ist durch einen stark beschädigten Schädel dokumentiert, der jedoch noch den P4 und M1, einen p4 und einen DP3 aufweist. Die Fossilien werden *Forsythictis* cf. *aurelianensis* (SCHLOSSER, 1888) zugeschrieben, einer Art, die aus dem späten Früh- und frühen Mittelmiozän in Europa bekannt ist.

Introduction

The Miocene fauna discovered at Schönweg-“Brüchl” (Lavanttal, district Wolfsberg, Carinthia; Fig. 1) is remarkable for the diversity of vertebrates as well as the quality of the fossils that were excavated (BÖHME et al. 2012, PRIETO et al. 2016, 2019, 2021, 2022). With an age close to 16 My the site is also a rare documentation of the paleoecosystems at the lower/middle Miocene transition. While the fossil rodents, insectivores and chiropters have been described in detail, the study of large mammals is still in its infancy. Yet, the diversity of the carnivores is also consequent. At least four species are recognized (PRIETO et al. this volume). The large-sized carnivores are rather rare and a single molar of the bear dog *Amphicyon* cf. *major* BLAINVILLE, 1841 has been discovered the other species correspond to small forms. Thus, the first occurrence in Austria of the rare and peculiar Lophocyonidae *Sivanasua viverroides* (SCHLOSSER, 1916) is noted (PRIETO et al. 2022). The mustelidae are represented by *Trocharion* aff. *albanense* MAJOR, 1903 and the Hyaenidae by cf. *Protictitherium* sp.. Other Felimorpha fossils show the presence of a viverridae at Schönweg-“Brüchl” and these remains are discussed in this work.

Keywords

Schönweg-“Brüchl”, Miocene, Badenian, Mammalia, Carnivora, Viverridae

Schlüsselwörter

Schönweg-“Brüchl”, Miozän, Badenium, Mammalia, Carnivora, Viverridae

Results and discussion

Systematic

Carnivora BOWDICH, 1821

Feliformia KRETZOI, 1945

Viverridae GRAY, 1821

Forsythictis MORALES & PICKFORD, 2021

Forsythictis cf. *aurelianusis* (SCHLOSSER, 1888)

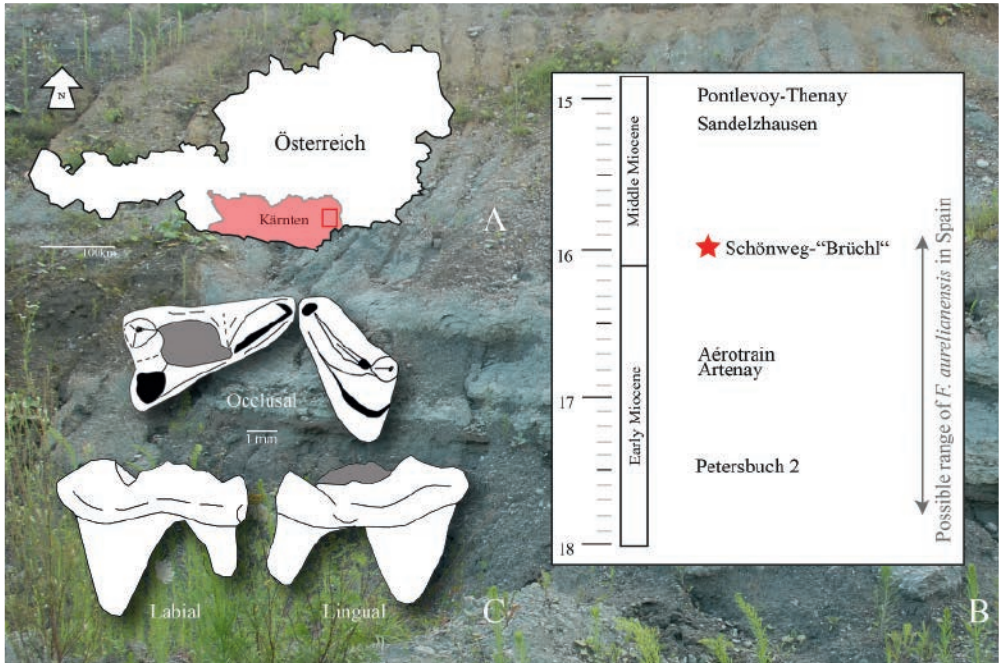


Fig. 1: Geographic (A) and chronostratigraphic (B) location of the Schönweg-“Brüchl” locality. Localities containing forms close to *Forsythictis aurelianusis* (SCHLOSSER, 1888) have been added (see text). C. *F. cf. aurelianusis*, left P4-M1. Note that the P4 lacks the apex of the protocone (in grey).

Abb. 1: Geographische (A) und chronostratigraphische (B) Lage der Fundstelle Schönweg-“Brüchl”. Lokalitäten, die Formen enthalten, die *Forsythictis aurelianusis* (SCHLOSSER, 1888) nahe stehen, wurden hinzugefügt (siehe Text). C. *F. cf. aurelianusis*, linker P4-M1. P4 mit fehlender Spitze des Protokons (in grau).

Fossil material: a very damaged skull with the left first upper molar (M1) in situ, associated with a left damaged fourth upper premolar (P4). A left deciduous third premolar (DP3). A left deciduous third premolar (dp3).

Measurements (LengthxWidth in mm): P4: 6,41x3,43 (L metastyle: 2,67); M1: 2,36x4,55; DP3: 4,50x3,25; dp3: 4,70x1,92.

The deteriorated skull only conserves the left M1, but the P4 was formerly associated with this fossil. The skull is so damaged and flattened that no relevant description is possible and no figuration necessary. Both teeth present “viverrids” characteristics. The P4 lacks the apex of the protocone. It is graceful, with a low parastyle of moderate size, in front of a protocone also moderately developed. The M1 has a sub-triangular occlusal shape. The paracone is highly developed, with a distobuccally

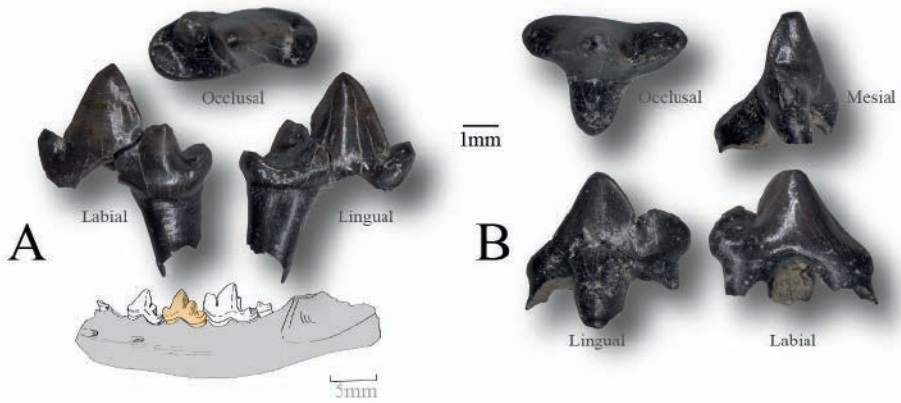


Fig. 2: The deciduous dentition of *Forsythictis* cf. *aurelianensis* (SCHLOSSER, 1888). For comparison, a drawing of the left mandible of Petersbuch 2 (Germany) showing the p4 (in red; after Roth 1988). A. Left dp3. B. Left DP3.

Abb. 2: Das Milchzahngewiss von *Forsythictis* cf. *aurelianensis* (SCHLOSSER, 1888). Zum Vergleich eine Zeichnung des linken Unterkiefers von Petersbuch 2 (Deutschland), die den p4 zeigt (in rot; nach Roth 1988). A. Linker dp3. B. Linker DP3.

projected stylar platform that ends in a small parastyle. The metacone is small, coniform. Buccally from these two cusps there is a fairly deep depression. The valley of the trigone is very wide. The dp3 has been glued posteriorly to the main cusp and part of the enamel is missing at the front of the tooth. The roots -only the distal one has been preserved- were clearly divergent. This is a typical feature of the deciduous dentition. It is an elongated tooth with a large main cusp. The occlusal shape is slightly curved, as a result of a convex inflection of the lingual wall of the trigonid. The accessory mesial cusplet is less high than the distal one, which is developed at the posterior wall of the main cusp at the labial border of the tooth. A very weak cingulid outlines the talonid. The milk upper premolar has also been glued (protocone). The tooth is shaped like a robust T, the protocone having a central position on the labial side of the paracone. Parastyle and protocone are not developed as cusps but are in fact the result of the extension of the paracone walls. The metastyle is separated from the protocone by a deep notch.

Discussion

MORALES & PICKFORD (2021) have extensively discussed the validity of *Leptoplesictis* FORSYTH MAJOR, 1903 as well as the complex taxonomic history of the genus. They note that the inclusion of *Stenogale aurelianensis* SCHLOSSER, 1888 in this genus has caused considerable taxonomic confusion and a significant increase in intraspecific variation of the species. By comparing *L. filholi* of La Grive (FORSYTH MAJOR 1903), *L. aurelianensis* of Petersbuch 2 (ROTH 1988) and a new mandible of Moratilla 2, they come to the conclusion that the Eurasian forms assigned to *Leptoplesictis* must actually be assigned to two genera, one of which being new: *Forsythictis*. This genus contains two species, the little known *F. atavus*, and the species *F. aurelianensis* described at the end of the 19th century in France (SCHLOSSER 1888).

The upper dentition of *Forsythictis aurelianensis* is little known. Part of the material previously attributed to this species by VIRET (1951) and DE BEAUMONT (1973) has been recently included by MORALES & PICKFORD (2021) in *Leptoplesictis filholi*. The dimensions of the P4 and

M1 from Schönweg-“Brüchl” are very close to those published by GINSBURG (2002) for this species in Artenay (France, lower Miocene). Unfortunately, this author has not described nor figured the fossils. Similarly NAGEL et al. (2009) describe three partly fragmentary teeth of *F. cf. aurelianensis* at Sandelzhausen, including a slightly larger ($L=2.9 \times W=5.5$) but not figured M1. Anyway, the Austrian M1 is morphologically very close to the M1 determined as *F. atavus* from the Vieux-Collonges (DE BEAUMONT 1973, ROTH 1988; France; age uncertain, lower to middle Miocene, see PRIETO et al. 2022). In addition, these molars differ well from those attributed by VIRET (1951) to *Leptoplesictis filholi* from the La Grive (France, middle Miocene). The two deciduous teeth are assigned to *F. cf. aurelianensis* for size reasons, but also, in the case of the dp3, because it is morphologically very close to the definitive p4 of *Leptoplesictis aurelianensis*.

The distribution of *Forsythictis aurelianensis* is nowadays both geographically and stratigraphically questionable. Indeed, MORALES & PICKFORD (2021) do not propose a revision of all occurrences of the genera *Leptoplesictis* and *Forsythictis* in the European fossil record and some taxonomic assignments remain to be demonstrated. *F. aurelianensis* is known from the late early Miocene in Germany, France and possibly Spain. Indeed, the fossil enriched karst infilling of Petersbuch 2 has yielded two mandible fragments of this species (ROTH 1988). Artenay is a slightly younger French locality than Petersbuch 2, as shown for example by the degree of evolution of the Eomyidae rodent *Ligerimys* (*L. florancei* and *L. antiquus* respectively). GINSBURG (2002) recognized a maxillary fragment with P2-M1, as well as a fragment of P4 and a partial humerus. He added postcranial elements from Aérotrain, a French site of similar age (BULOT 1988). According to ROBLES (2014: 390; *Leptoplesictis* in the text), *F. aurelianensis* is restricted to the lower Aragonian of Spain known from four sites and originally assigned to *Paleogale minuta* by GOLPE-POSSE (1974). Robles considers the more recent Iberian forms as belonging to *L. filholi*. Recently, JOVELLS-VAQUÉ & CASANOVAS-VILAR (2021) have intensively discussed the dating of the localities El Canyet, Costablanca, Els Casot. Based on this work and the stratigraphic position of the locality, the age of Can Canal can probably be estimated at 15.9 My (Casanovas-Vilar pers. comm.). Thus *F. aurelianensis* may occur in Spain between ca 17.8 and 15.9 My. When SCHLOSSER (1888) described the new species *Stenogale aurelianensis*, he noted the origin of the specimen as being from the sands of the Orleanais, although the mandible fragment was already listed by GERVAIS (1867-69, *Plesictis* sp.) as coming from Suèvres (France). This locality also contains *L. florancei* (STEHLIN & SCHAUB 1951, Bulot 1988) and is therefore close in age to Artenay. However, STEHLIN & HELBING (1925) doubt the origin of the fossil and propose Pontlevoy-Thenay as more likely. This proposal was followed by many authors afterwards. The locality contains cricetid rodents such as *Cricetodon* and *Megacricetodon lappi*, which indicate a younger, middle Miocene age of around 15 My (see details for example PRIETO & RUMMEL 2016). Pontlevoy-Thenay corresponds to the last occurrence of the species although the presence of *F. cf. aurelianensis* at Sandelzhausen is close (NAGEL et al. 2009; ca 15.2 My).

At present, a second species, *Forsythictis atavus*, is restricted to France and its stratigraphic range partially covers that of *F. aurelianensis* (MORALES & PICKFORD 2021). It is important to note, however, that the age of Vieux-Collonges is debated (PRIETO et al. 2022), and that the two molars considered by the authors could be more recent or older than the age proposed in their work. Finally, *F. ibericus* is only known from Moratilla 2, an Early Miocene locality in Spain (MORALES & PICKFORD 2021). The approximately 15.8 My old site belongs to the local zone Db. This short zone is remarkable for the evidence of migratory phenomena in this geographical area showing certain endemic features at this time (OLIVER & PELÁEZ-CAMPOMANES 2013).

Conclusions

The presence of *Forsythictis cf. aurelianensis* is new in Austria and is one of the few examples of the genus in central Europe. Although the fossil material is limited, it documents the upper dentition of the species, which is rare in the fossil record. In this way, it reconfirms the importance of Schönweg-“Brüchl” not only on a local level, but especially for the understanding of the evolution of faunas and ecosystems from the very end of the Early Miocene onward.

REFERENCES

- BEAUMONT G. D. (1973): Contribution à l'étude des viverridés (Carnivora) du Miocène d'Europe. – Archives des Sciences, 26 (3): 285–296.
- BÖHME M., AIGLSTORFER M., UHL D. & KULLMER O. (2012): The Antiquity of the Rhine River: Stratigraphic Coverage of the *Dinotheriensande* (Eppelsheim Formation) of the Mainz Basin (Germany). – PLoS ONE, 7 (5): e36817.
- BULOT C. (1988): Nouvelle étude des Rongeurs et des lagomorphes du Miocène de Suèvres (Loir-et-Cher). – Bulletin du Museum National d'Histoire naturelle Paris, 10 (4): 385–404.
- FORSYTH MAJOR C. I. (1903): New Carnivora from the Middle Miocene of La Grive-St-Alban, Isère, France. – Geological Magazine, 4 (10): 534–537.
- GERVAIS P. (1867-1869): Zoologie et paléontologie générales 2ème série, Nouvelles recherches sur les animaux vertébrés dont on trouve les ossements enfouis dans le sol et sur leur comparaison avec les espèces actuellement existants. – Arthus Bertrand, Paris, 263 pp.
- GINSBURG L. (2002): Les carnivores fossiles des sables de l'Orléanais. – Annales de Paléontologie, 88: 115–146.
- GOLPE POSSE J. M. (1974): Faunas de yacimientos con Suiformes en el Terciario español. – Paleontologia i Evolucio, 8: 1–87.
- JOVELLS-VAQUÉ S. & CASANOVAS-VILAR I. (2021): Dispersal and early evolution of the first modern cricetid rodents in Western Europe: new data from the Vallès-Penedès Basin (Catalonia). – Comptes Rendus Palevol, 20 (22): 401–439.
- MORALES J. & PICKFORD M. (2021): Taxonomic revision of the genus *Leptoplesictis* (Viverridae, Mammalia) with description of new fossils from Grillental VI (Namibia) and Moratilla 2 (Spain). – Communications of the Geological Survey of Namibia, 23: 161–176.
- NAGEL D., STEFEN C. & MORLO M. (2009): The carnivoran community from the Miocene of Sandelzhausen (Germany). – Paläontologische Zeitschrift, 83 (1): 151–174.
- OLIVER A. & PELÁEZ-CAMPOMANES P. (2013): *Megacricetodon vandermeuleni*, sp. nov. (Rodentia, Mammalia), from the Spanish Miocene: a new evolutionary framework for *Megacricetodon*. – Journal of Vertebrate Palaeontology, 33 (4): 943–955.

Acknowledgments

We thank the *Naturwissenschaftlichen Verein für Kärnten* for their financial support as well as the Brenner brick company (since 2019 Wienerberger), the Palko company and the Kollmann family vlg. Brüchl for the access to the clay pit. Jorge Morales is supported by the Spanish Research Projects PGC2018-094122-B100 (AEI/FEDER, UE) and PID 2020-116220GB-I00

Authors' addresses

Dr. Jorge Morales,
Departamento de
Paleobiología,
Museo Nacional de
Ciencias Naturales-
CSIC - C/José Gutiérrez
Abascal 2,
28006, Madrid, Spain.
E-Mail:
jorge.morales
@mncn.csic.es

PD Dr. Martin Gross,
Abteilung für Geologie
& Paläontologie,
Universalmuseum
Joanneum,
Weinzöttlstraße 16,
8045 Graz, Austria.
E-Mail: martin.
gross@museum-
joanneum.at

Dr. Andreas Hassler,
Burgstall-St.Andrä
99, 9433 St. Andrä,
Austria. E-Mail:
dr.hassler@aon.at

Dr. Jérôme Prieto,
Department für
Geo- und Umwelt-
wissenschaften,
Ludwig-Maximilians-
Universität, Richard-
Wagner-Straße 10,
80333 München,
Germany.
E-Mail: j.prieto@lrz.
uni-muenchen.de

- PRIETO J. & RUMMEL M. (2016): Some considerations about the small-mammal evolution in South Germany, with emphasis on late Burdigalian-earliest Tortonian (Miocene) cricetid rodents. – *Comptes Rendus Palevol*, 15 (7): 837–854.
- PRIETO J., HASSLER A., PRINZ G., GROSS M. & BÖHME M. (2016): Die miozänen Kleinsäuger von Schönweg-“Brüchl” (Kärnten). – *Carinthia II*, 206./126.: 503–524.
- PRIETO J., HASSLER A. & GROSS M. (2019): Ein seltenes Fossil eines Stachelbilches aus Kärnten. – *Carinthia II*, 209./129.: 581–586.
- PRIETO J., HASSLER, A. & GROSS, M. (2021): Der Falsche Vampir (Chiroptera, Mammalia) aus dem Miozän von Kärnten. – *Carinthia II*, 211./131.: 181–190.
- PRIETO J., RUMMEL M., SCHOLZ H. & MEIN P. (2022): A new middle Miocene lineage based on taxonomic revision of the large and rare cricetid-rodent genus *Lartetomys*. – *Palaeobiodiversity and Palaeoenvironments*, 102: 223–236.
- PRIETO J., VASYLIAN D., BÖHME M., GROSS M., HASSLER, A. & MORALES J. (2022): Die miozäne Raubtierfauna von Schönweg-“Brüchl” (Österreich, Kärnten): II. Eine Übersicht. – *Carinthia II*, 212./132.: 163–174.
- PRIETO J., GROSS M., HASSLER A. & BÖHME M. (2022): Presence of the peculiar carnivore *Sivanasua* in Carinthia. – *Historical biology*: DOI: 10.1080/08912963.2022.2032029
- ROBLES J. M. (2014): Miocene Carnivorans of the Vallès-Penedès Basin (NE Iberian Peninsula). – PhD, Barcelona, 434 pp.
- ROTH C. (1988): *Leptoplesictis* Major 1903 (Mammalia, Carnivora, Viverridae) aus dem Orléanum und Astaracium/Miozän von Frankreich und Deutschland. – *Paläontologische Zeitschrift*, 62 (3): 333–343.
- SCHLOSSER M. (1887-88): Die Affen, Lemuren, Chiropteren, Insektivoren, Marsupialer, Creodonten und Carnivoren des europäischen Tertiärs. II Theil. – *Beiträge zur Paläontologie Österreich-Ungarns und des Orients*, 7: 226–386.
- STEHLIN H. G. & HELBING H. (1925): Catalogue des Ossements de Mammifères Tertiaires de la collection Bourgeois à l'École de Pont-Levoy (Loir-et-Cher). – *Bulletin de la Société d'Histoire naturelle et Anthropologie de Loir-et-Cher*, 18: 77–277.
- STEHLIN H. G. & SCHAUB S. (1951): Die Trigonodontie der simplicidentaten Nager. – *Mammalia*, 15 (4): 204–210.
- VIRET J. (1951): Catalogue critique de la faune des mammifères miocènes de la Grive Saint-Alban (Isère). Première partie : chiroptères, carnivores, édentés pholidotes. – *Nouvelles archives du Muséum d'histoire naturelle de Lyon*, 3: 5–104.

ZOBODAT - www.zobodat.at

Zoologisch-Botanische Datenbank/Zoological-Botanical Database

Digitale Literatur/Digital Literature

Zeitschrift/Journal: [Carinthia II](#)

Jahr/Year: 2022

Band/Volume: [212](#) [132](#) [2](#)

Autor(en)/Author(s): Morales Jorge, Gross Martin, Hassler Andreas, Prieto Jerome

Artikel/Article: [The Miocene carnivore fauna of Schönweg-“Brüchl” \(Austria, Carinthia\): I. The genus Forsythictis. Die miozäne Raubtierfauna von Schönweg-“Brüchl” \(Österreich, Kärnten\): I. Die Gattung Forsythictis 157-162](#)