AN INFANT ORNITHOPOD DINOSAUR TIBIA FROM THE LATE CRETACEOUS OF SEBEŞ, ROMANIA

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Introduction

Since 2010 the Transylvanian Museum Society (Cluj-Napoca, Romania), the "Ioan Raica" Municipal Museum (Sebeş, Romania), the University of Bucharest (Romania), the American Museum of Natural History (New York, USA), and the University of Southampton (UK) have collaborated on a project focused on the vertebrate paleontology and geology of the Late Cretaceous of the Sebeş region of Romania. The aim of this project is to better understand the peculiar dinosaur-bearing faunas of the European terminal Cretaceous, which included bizarre dwarfed and late-surviving relict species that inhabited an ancient island archipelago.[1] The most notable result of our project thus far has been the discovery of the aberrant new dromaeosaurid theropod *Balaur bondoc*, a close relative of the iconic Central Asian *Velociraptor mongoliensis*. The type specimen of *B. bondoc* was discovered by M. Vremir, described by our joint Cluj-Bucharest-New York team in 2010,[2] and later monographed by our group.[3] Here we describe a fragmentary, but intriguing, new specimen collected during fieldwork in 2011: the tibia of a small ornithopod dinosaur that may have been less than one year old at the time of death.

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[1] Nopcsa 1914; Weishampel *et alii* 1991; Benton *et alii* 2010; Weishampel, Jianu 2011.

[2] Csiki *et alii* 2010; Vremir 2010.

[3] Brusatte *et alii* in press.

Geological Setting

The specimen described here, MMIRS (SN) 654,[4] was discovered by D. Naish in June 2011 during a joint fieldtrip that included many of the authors of this paper (S. Brusatte, G. Dyke, M. Vremir, Z. Csiki-Sava). It comes from the basal-most part of the continental Sebeş Formation (SBF), well exposed at the Petreşti-*Arini* (PT) locality (Sebeş, Alba County) in the southwest Transylvanian basin. Here, Upper Cretaceous (Campanian-Maastrichtian) sedimentary deposits form part of a large-scale regressive cycle involving both deep - and shallow-water marine deposits as well as continental red beds.[5]

The PT site is a recently exposed (2007, AHE-Sebeş) artificial outcrop created during the construction of a hydrotechnical project (**fig. 1**). Six closely-positioned fossil vertebrate-bearing horizons have been identified in the basalmost section of the Sebeş Formation (L0-L5, **fig. 2**), all located within a 50 m thick paludo-fluvial sequence of latest Campanian-earliest Maastrichtian age.[6] This sequence lies conformably above the underlying marine Bozeş Formation (BOF). The PT vertebrate assemblage includes the rhabdodontid ornithopod dinosaur *Zalmoxes* (which is represented by well preserved cranio-dental, axial and appendicular elements); freshwater pleurodiran turtles (Dortokidae); a large pterosaur (Azhdarchidae?); and multituberculate mammals. Specimen MMIRS (SN) 654 originated from layer 1B: a dark-red calcareous silty-claystone. From a taphonomic point of view, layers 1 to 4 have yielded strictly autochthonous and parautochthonous skeletal elements well preserved in a riverbank floodplain environment.

Based on calcareous nannoplankton assemblages identified from the top of the conformably underlying neritic-estuarian sequence,[7] a lowermost Maastrichtian age has been proposed for the portion of the section from which MMIRS (SN) 654 was discovered.[8] The stratigraphically lower vertebrate layer L0 (estuarine facies), which has yielded a large sized pterosaurian wing-bone fragment (wph2?) and a single parautochthonous *Zalmoxes* specimen (incomplete femur), is most likely latest Campanian in age (being conformly situated a few meters above the late Campanian turbidites), and the oldest well dated Late Cretaceous vertebrate horizon identified so far in Romania. A similar littoral to paludo-deltaic transitional facies referred to the lower Maastrichtian Vurpăr Fm[9] is known from the mouth of the Stauini valley (Vinţu de Jos area, VS in tab.1), where numerous plant remains, a crocodylomorph tooth[10] and an indeterminate dinosaurian long-bone shaft were collected.

[4] MMIRS (SN) 654: "Ioan Raica" Municipal Museum Sebeş (Natural Science Collection).
[5] Codrea *et alii* 2010; Vremir 2010.
[6] Ibid.; Csiki-Sava *et alii* 2012.
[7] Ramona Bălc personal communication, 2012.
[8] Csiki-Sava *et alii* 2012.
[9] Codrea, Dica 2005.
[10] Nopcsa 1905.

Fig. 1. The Petreşti-Arini site, where the new specimen MMIRS (SN) 654 was discovered. This site is a recently opened (2007) artificial outcrop that preserves the basal-most portion of the continental Sebeş Formation (latest Campanian?-Maastrichtian, Late Cretaceous): **A:** downstream section of the outcrop, 45-110 m above the base of the formation; **B:** the fossiliferous layer L1B with the location of MMIRS (SN) 654, indicated by R. Totoianu (August 2012); **C:** S. Brusatte and G. Dyke investigating fossiliferous layer L4 (now covered) from where several associated *Zalmoxes* sp. specimens were collected (June 2012)

Specimen Preparation

The specimen was prepared in the field by M. Vremir and final preparation was performed by Amy Davidson at the American Museum of Natural History (AMNH). A preparation record is held in the AMNH Division of Paleontology database. During final preparation, the bone surface was scrubbed with a stiff brush in tap water and remaining matrix scraped off with a carbide needle. Water was used to improve visibility of the cancellous bone when carving off matrix from the epiphysis. Two previous adhesive joins were taken apart, matrix was scraped off the contacts, and the fragments were rejoined with a mixture of 3M Scotchlite® glass microballons and Paraloid® B-72 (Rohm and Haas Company), an ethyl methacrylate and methyl acrylate copolymer.

Specimen Description

Specimen MMIRS (SN) 654 is a partial left tibia that measures 72.7 millimeters in preserved proximodistal length (**fig. 3**). This fragment includes the complete distal end and much of the shaft. The shaft is slender and gracile. It is slightly medially

bowed in anterior view and is anteriorly concave when seen in medial or lateral views. The cross section at the preserved proximal end of the shaft is ovoid in shape, 9 millimeters in mediolateral width by 10 mm in anteroposterior length. The cross section becomes more triangular in shape distally, due to ridges on the lateral and posterior surfaces. The lateral ridge becomes more prominent, and also shifts slightly anteriorly, as it continues distally along the shaft before it merges with the lateral edge of the lateral malleolus.

The distal end is expanded relative to the shaft, especially in the mediolateral direction; it is 24 millimeters wide by 12.5 millimeters in maximum length. The flaring of the distal end into lateral and medial malleoli is slightly asymmetrical, in that the medial malleolus is somewhat larger than the lateral one. The lateral malleolus extends slightly ventrally relative to the medial malleolus, and neither malleolus is offset from the shaft by a distinct notch or inflection point. Yet, the lateral edge of the lateral malleolus is partially eroded, so this structure may originally have been more extensive laterally. There is a deep fossa between the lateral and medial malleoli along the ventral edge of the anterior surface of the tibia, which continues onto the distal end of the bone. This smooth surface - which is visible in both anterior and distal views - would have articulated with the astragalus. Immediately dorsal to this articular surface, on the anterior face of the tibia, is a small flat region that would have been overlapped by the ascending process of the astragalus. Lateral to this, the anterior surface of the lateral malleolus is flat and marked by a series of proximodistally oriented striations. This surface would have articulated against the posterior surface of the distal end of the fibula.

The posterior surface of the tibia is marked by a conspicuous proximodistally oriented ridge, which is positioned slightly closer to the medial edge of the bone than the lateral edge. As a result of this ridge, the distal end of the tibia is triangular in distal view, with the ridge and the two malleoli forming the apices. The ridge is most prominent distally but quickly diminishes as it continues proximally, such that it completely merges with the posterior surface and is no longer recognizable as a discrete structure approximately 20 millimeters proximal to the distal edge of the bone. The posterior surface of the tibia medial to the ridge is approximately flat whereas lateral to the ridge it is concave. These appear as straight and concave edges, respectively, when the tibia is seen in distal view.

Specimen Histology

Petrographic diaphyseal cross-sections of the tibia were prepared to examine bone histology and infer the developmental stage of the individual at the time of death. These sections were taken near the proximal-most preserved tip of the specimen, where it was naturally fractured. Although fungal infestation has obscured many of the histological details, the majority of the cortex is composed of fibro-lamellar bone tissue with longitudinally-oriented primary vascular canals (**fig. 4A**). Bone with circumferentially-oriented vascularization is present in one quadrant of the cortex and spans approximately 13% of the circumference. Some incomplete vascular canals are present at the periosteal surface, thereby giving it a scalloped

profile (**fig. 4B**). Trabecular bone lines the walls of the medullary cavity and occupies the majority of the cross-sectional area. The hollow medullary cavity and the bone cortex each compose 15-20% of the diameter. Secondary osteons, growth lines (e.g. lines of arrested growth, annuli), and changes in vascular/fibrillar pattern nearer the periosteal surface are absent. Collectively, this suggests that the MMIRS (SN) 654 was a young, rapidly growing individual at the time of death, and was perhaps less than a year old. Notably, the vascularization pattern composed of longitudinal and circumferential primary vascular canals resembles the histological features observed in the mid-diaphyseal femoral sections of a juvenile *Tenontosaurus* figured by Werning[11], although the canals are less dense in MMIRS (SN) 654. However, another femoral section of *Telmatosaurus* figured by Benton *et alii*[12] exhibits sub-plexiform bone texture, which is distinct from the fibro-lamellar texture in MMIRS (SN) 654.

Specimen Identification

Although specimen MMIRS (SN) 654 is incomplete, the presence of several anatomical characters allows us to determine its phylogenetic affinities and identification. First, the size and general shape of the bone are suggestive of its dinosaurian nature. The distal end of the tibia is subrectangular and transversely expanded and has a distinct lateral malleolus, which are characteristics of dinosaurs and their closest relatives.[13] Furthermore, the facet on the anterior surface of the distal tibia indicates that an astragalar ascending process would have been present, also a feature of dinosaurs and close relatives.

When compared to dinosaur taxa previously reported from the Haţeg Basin[14] and its surroundings,[15] MMIRS (SN) 654 is not similar to the tibiae of nodosaurids, which are heavily built, robust, and have a massive distal end.[16] Furthermore, it is dissimilar to the tibiae of sauropods, which are only weakly to moderately expanded mediolaterally at the distal end, somewhat club-like, and have a reduced medial malleolus.[17] Superficially, MMIRS (SN) 654 shows similarities with the tibiae of small and/or juvenile theropods, which are often gracile, are expanded mediolaterally at the distal end, and have distinct lateral and medial malleoli. A large number of theropod taxa have been reported from the Transylvanian Upper Cretaceous, but most of these are based solely on teeth[18]. Among Transylvanian theropods, associated skeletal remains, including a tibia, are known only for the dromaeosaurid *Balaur bondoc*[19], while isolated distal tibiae have also been reported for the controversial taxa *Heptasteornis* and *Bradycneme*.[20] In all of

[11] Werning 2012, figure 5A.
[12] Benton *et alii* 2010.
[13] Benton 2004; Brusatte *et alii* 2010; Nesbitt 2011.
[14] Weishampel *et alii* 2010.
[15] Codrea *et alii* 2010.
[16] Vickaryous *et alii* 2004.
[17] Upchurch *et alii* 2004.
[18] Csiki, Grigorescu 1998; Codrea *et alii* 2002.
[19] Csiki *et alii* 2010.
[20] Naish, Dyke 2004; Csiki *et alii* 2010.

these cases, the tibiae are fused to the proximal tarsals to create a tibiotarsal bone, whose ginglymoid distal articular surface is distinctly different from that seen in MMIRS (SN) 654. Although it is possible that MMIRS (SN) 654 lacks tibiotarsal fusion because of its early ontogenetic stage, there are no known examples of a theropod taxon lacking a ginglymoid articular surface as a juvenile but gaining one later in adulthood. Therefore, MMIRS (SN) 654 cannot be assigned to any currently known Transylvanian theropod. A theropod affinity is furthermore unlikely because theropods usually have a lateral malleolus that is offset from the shaft by a distinct inflection point and lack the deep, notch-like articular surface for the astragalus that encroaches onto the anterior surface of the distal end of the tibia.

MMIRS (SN) 654 does, however, exhibit marked similarities to the tibiae of the Transylvanian ornithopods *Zalmoxes* and *Telmatosaurus*. The tibiae of both taxa are fortunately well-known because they are represented by several specimens,[21] including a partial ontogenetic series for *Telmatosaurus*.[22] This wealth of information enables a detailed comparison between small and large individuals of these taxa and the new specimen MMIRS (SN) 654. The shaft of MMIRS (SN) 654 is slightly laterally bowed in anterior view, a feature reminiscent of the tibiae of *Zalmoxes*, but differing from the straight tibiae of *Telmatosaurus*. The pattern and degree of expansion of the distal end is also similar to the condition in *Zalmoxes*, in that the medial margin is continuously and smoothly arched with no inflection point separating it from the shaft. In contrast, an inflection point is present in both neonate and adult tibiae of *Telmatosaurus* (and also in other derived hadrosauroids, such as in *Charonosaurus*).[23] The histology of the new specimen is also most consistent with *Zalmoxes*, as it is nearly identical to the histology of a small *Zalmoxes* femur described by Benton *et alii*, but does not exhibit the plexiform vascularizaton pattern seen in femoral histological sections of *Telmatosaurus*.[24] Although the possible comparisons are limited, the above observations suggest that MMIRS (SN) 654 is most probably referable to the rhabdodontid ornithopod *Zalmoxes*.

Two species of *Zalmoxes* are currently known from the Upper Cretaceous of Transylvania. The tibia of *Zalmoxes shqiperorum* can be differentiated from that of *Z. robustus* by being more gracile and less laterally bowed.[25] Despite the incomplete nature of MMIRS (SN) 654, it appears to be more similar to the morphology described for *Z. shqiperorum* than that known in *Z. robustus*, suggesting that the Petreşti specimen belongs to *Z. shqiperorum*. With that being said, we acknowledge that this identification is very tentative, because the general rarity of early juvenile stage tibiae of *Zalmoxes* (especially those referable to *Z. robustus*) makes comparisons difficult.

The small tibia from Petreşti is greatly similar, both in its relative proportions and its morphological features, to that of a juvenile *Zalmoxes* specimen

[21] Weishampel *et alii* 2003; Godefroit *et alii* 2009.
[22] Grigorescu, Csiki 2006.
[23] Godefroit *et alii* 2001.
[24] Benton *et alii* 2010.
[25] Godefroit *et alii* 2009.

from Vălioara (Haţeg Basin), described by Weishampel *et alii*[26] and referred by them to *Z. shqiperorum* LPB (FGGUB) R.1087 (**fig. 5**). Nevertheless, MMIRS (SN) 654 is significantly smaller than (about 55% the size of) the Vălioara tibia. Based on direct comparisons with LPB (FGGUB) R.1087, which is complete and 171 mm long, the estimated total length of MMIRS (SN) 654 would be around 94 mm. This makes MMIRS (SN) 654 the smallest ornithopod tibia reported so far from the Transylvanian area, with the exception of the definitively neonate, baby hadrosauroid remains from the Tuştea nesting site. Its diminutive size - the smallest ever recorded, to our knowledge, in any rhabdodontid specimen - is concordant with our histological data identifying the individual represented MMIRS (SN) 654 as being a very early juvenile (see also below).

Discussion

Implications for Understanding Dinosaur Dwarfism and Ontogenetic Changes: Because the new specimen MMIRS (SN) 654 is so small and young it does not contribute any substantial new information on ornithopod dwarfism. Yet it may contribute, however, to our understanding of the tempo, mode, and timing of ontogenetic development in the endemic European ornithopod clade Rhabdodontidae.

The bone histology of MMIRS (SN) 654 clearly suggests that the individual was very young at the time of death, possibly less than one year old. It contrasts with long bones of the closely related, somewhat dwarfed rhabdodontid ornithopod *Mochlodon* from Hungary and Austria, which, despite their diminutive sizes, exhibit osteohistological characteristics commonly associated with somatic maturity, including smaller sized lacunae, secondary bone remodeling, and the presence of external fundamental system (EFS) with tightly spaced growth lines near the bone periphery.[27] Even the smallest individuals included in the rhabdodontid sample surveyed by Ősi *et alii*[28] (e.g., MTM V 01.101, a tibia that is 148 mm long) are markedly larger than the individual represented by the new tibia MMIRS (SN) 654. Although some results of the Ősi *et alii* survey are still difficult to interpret (such as the conflicting association between smaller absolute body size and more advanced ontogenetic stage suggested by osteohistology, reported in several specimens), it is clear from both its absolute size and osteohistological characteristics that the Petreşti specimen represents a less advanced ontogenetic stage than documented thus far in the rhabdodontid clade.

The Vălioara tibia LPB (FGGUB) R.1087 was not sampled histologically, but histologic data is available for its associated femur LPB (FGGUB) R.1088. As in the new tibia MMIRS (SN) 654, longitudinal canals are present in the cortex of the femur. These vascular canals extend to the bone periphery, suggesting that active bone growth was occurring at the time of death.[29] However, features of the osteohistology of LPB (FGGUB) R.1088 indicate a more advanced ontogenetic

[26] Weishampel *et alii* 2003.
[27] Ősi *et alii* 2012.
[28] Ibid.
[29] Benton *et alii* 2010.

stage than that of MMIRS (SN) 654, including bone remodeling in the inner cortex of the bone.[30] Another femur assigned to *Z. robustus* LPB (FGGUB) R.1387 shows dense remodeling across the inner and middle cortex and a total of eleven reported growth lines, indicating an even later ontogenetic stage for the individual.

Based on the estimated body length of the juvenile *Zalmoxes* specimen LPB (FGGUB) R.1087,[31] the young Petreşti individual would have been only around 65-70 cm long if isometric growth is assumed. Due to the ambiguous species-level classification of MMIRS (SN) 654 and dearth of somatically mature specimens of *Zalmoxes*, the body size of fully grown individuals is uncertain (previous estimates ranging from 2.5 m[32] to 4.0-4.5 m[33]). In addition, the lack of growth lines in MMIRS (SN) 654 prevents growth rates from being inferred and compared to growth rates in other rhabdodontid specimens. Age estimates and size indices (e.g., body size estimates) would allow construction of life history curves for dwarf rhabdodontids, which could be compared to those of other ornithopods. However, such work is outside the scope of this paper. With such data, the present specimen, as the youngest rhabdodontid specimen yet reported, could provide a critical data point that affords insight into heterochronic processes (i.e., neoteny, post-displacement, progenesis) that may have led to dwarfism in several rhabdodontid taxa.

The Distribution of *Zalmoxes* in Romania

In the latest Campanian?-Maastrichtian continental deposits of Transylvania, ornithopod dinosaurs are represented by the hadrosauroid *Telmatosaurus* and the more common rhabdodontid *Zalmoxes*.[34] Specimens referable to either *Zalmoxes robustus* or *Z. shqiperorum* are known from more than 24 localities from the Maastrichtian Sînpetru and Ciula-Densuş formations in the Haţeg Basin, distributed in various channel, overbank, and floodplain facies.[35] Recently, *Zalmoxes* was recorded in the Maastrichtian of the northern Transylvanian basin in the Jibou area,[36] as well as in the Rusca Montană Basin,[37] in red overbank facieses.

Zalmoxes is also well represented in the Upper Cretaceous terrestrial deposits of the Sebeş area; all known occurrences in this area are listed in Table 1. Nopcsa[38] was the first to identify *Zalmoxes* specimens (at that time referred to *Mochlodon*) in the Sebeş area, at Vurpăr (the type locality of *Z. shqiperorum*). More recent field studies indicate a wider stratigraphic and geographic distribution for *Zalmoxes* on both sides of the Mureş passageway, as specimens of this taxon can be confidently identified at 9 vertebrate localities, spanning the whole terminal Cretaceous

[30] Ibid.
[31] Ősi *et alii* 2012.
[32] Ibid.
[33] Benton *et alii* 2010.
[34] Codrea *et alii* 2010.
[35] Weishampel *et alii* 2003.
[36] Codrea, Godefroit 2008; Codrea *et alii* 2010.
[37] Codrea *et alii* 2009; Codrea *et alii* 2012.
[38] Nopcsa 1905 (type material housed in BMNH London; Weishampel *et alii* 2003).

continental succession in Romania (**Tab. 1**).[39] This list now includes the Petreşti-*Arini* site, where the small tibia MMIRS (SN) 654 was found.

Frequency of *Zalmoxes*

Regarding the frequency and relative abundance of *Zalmoxes* in the Sebeş area, two vertebrate fossil sites are worthy of mention. The classic Nopcsa site at Vurpăr (near Vinţu de Jos) exposes the basal portion of the Romanian uppermost Cretaceous continental succession. This relatively small outcrop has until now provided more than 100 identified specimens referable to *Zalmoxes* (60% NISP), of which one third belongs to four partial skeletons (including the holotype of *Z. shqiperorum*). About half of the isolated specimens and two partial skeletons (again, 50%) assigned to this taxon represent young/subadult individuals. Interestingly, the only other dinosaurian taxa identified here are the basal nodosaurid *Struthiosaurus transylvanicus* (two partial skeletons and several other isolated postcranial and armor elements)[40] and a possible small theropod.[41] The absence of sauropod or hadrosaurid dinosaur remains is notable, and may be the result of their particular paleoecology (these taxa were present in the area during the time of deposition, but did not frequent the local environment on account of their ecological preferences), paleobiogeography (sauropod and hadrosaurid dinosaurs did not live in the area during the deposition of the Vurpăr deposits), age differences between the different localities (sauropods and hadrosaurids colonized the Transylvanian region only after the deposition of the basal part of the continental succession), or sampling biases (we have yet to record these taxa even though they existed in this region).

The second, more restricted site where *Zalmoxes* is relatively well represented is Petreşti-*Arini*, the site where the small tibia MMIRS (SN) 654 was found, and which exposes the basal-most portion of the Romanian terminal Cretaceous continental succession. *Zalmoxes* is represented here by several cranio-dental, axial and appendicular elements, including isolated frontal and parietal, teeth, vertebrae, femurae, closely associated rib, coracoid and tibia (possibly belonging to one individual); and the juvenile tibia MMIRS (SN) 654 described here. These represent roughly 75% of the identified specimens from the site. A preliminary ontogenetic evaluation indicates that half of the *Zalmoxes* specimens (MNI=6) were young or subadult animals (as in Vurpăr). However, MMIRS (SN) 654 is the only extremely small, early-stage juvenile specimen (an animal a few years of age or younger) known so far from the Sebeş area, and indeed, from the whole Transylvanian region.

[39] Vremir 2001, unpublished MSc Thesis (materials collected between 1999 and 2001); Codrea *et alii* 2010; Jipa 2012, unpublished PhD Thesis.

[40] Codrea *et alii* 2010.

[41] Therrien *et alii* 2002 (this material was never published or figured and its identity remain problematic).

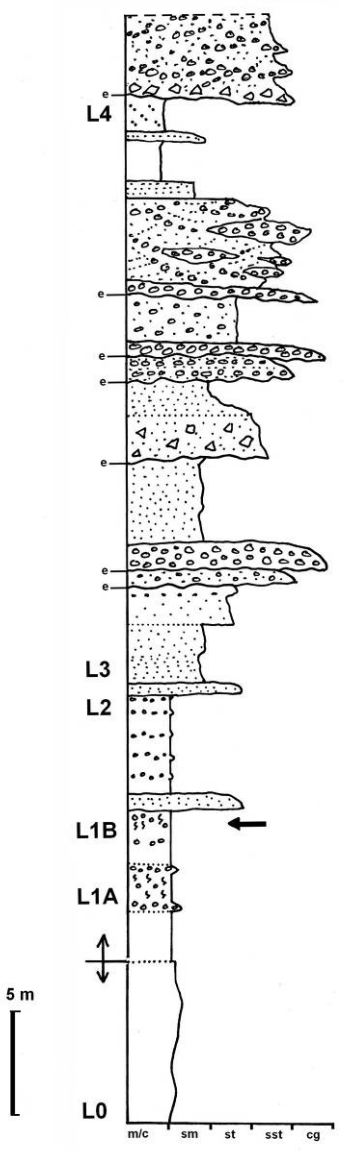

Fig. 2. Stratigraphic log of the uppermost Campanian-lower Maastrichtian at the Petreşti-*Arini* site (base of the Sebeş Formation), where the new specimen MMIRS (SN) 654 was discovered. See the text for a brief description of the fossiliferous layers (labeled as L0, L1, L2, L3, and L4). The arrow on the right denotes the point in section where the new tibia specimen was discovered. The double-headed arrow on the left indicates the hypothesized position of the Campanian-Maastrichtian boundary. The *x* axis on the bottom denotes grain size, ranging from mudstone-claystone on the left to conglomerate on the right

Fig. 3. Specimen MMIRS (SN) 654, a partial left tibia of the basal euornithopod *Zalmoxes* cf. *Z. shqiperorum*, from Petreşti-*Arini*, in anterior (A), posterior (B), lateral (C), medial (D), and distal (E) views. In E the anterior surface is towards the bottom of the image. Scale bar equals 1 cm. Photos by Mick Ellison

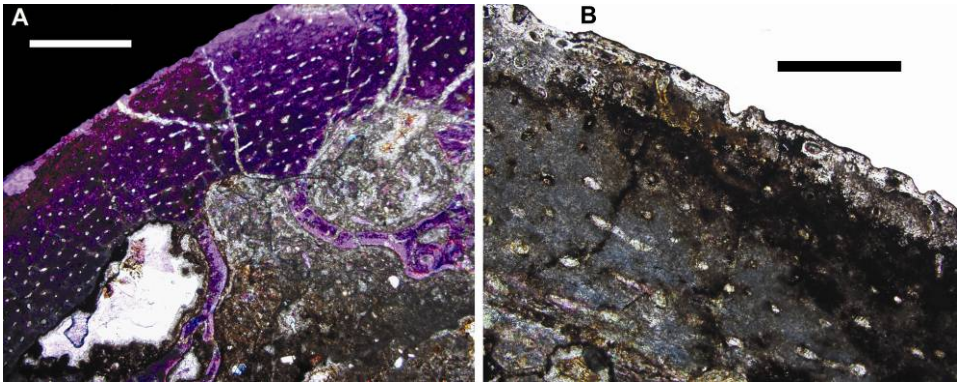

Fig. 4. Transverse histological thin sections of specimen MMIRS (SN) 654, sampled along the proximal diaphysis of the bone near the proximal-most preserved tip (fractured end) of the specimen. Scale is 1,000 microns and 500 microns in B

In all other listed sites in Table 1, which cover mainly the middle and upper portions of the southwestern Transylvanian continental succession, *Zalmoxes* specimens are relatively rare (NISP 5-20% of local faunas). The significance of this distributional pattern is as yet poorly understood, but it is certainly worthy of more detailed investigation.

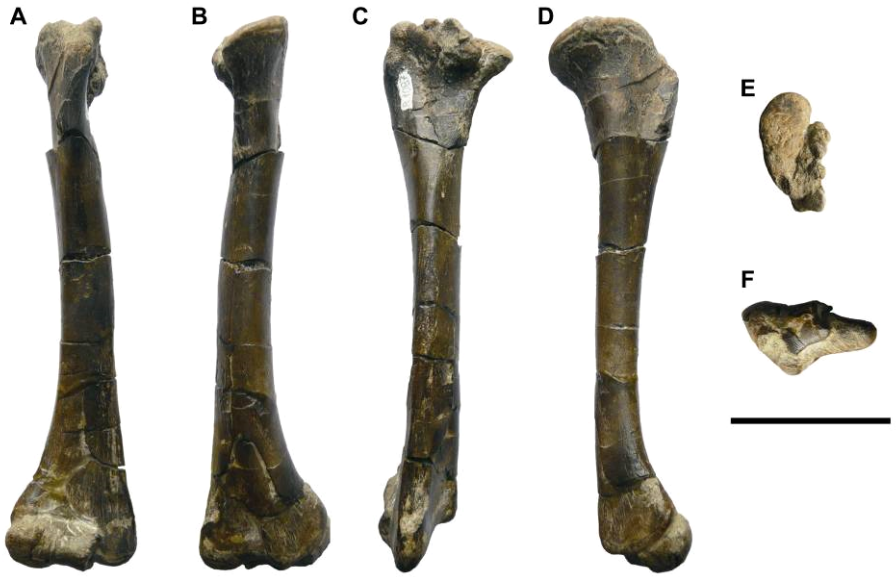

Fig. 5. Specimen LPB (FGGUB) R.1087, a left tibia (with associated astragalus) of the basal euornithopod *Zalmoxes* (*Z. shqiperorum*), from Vălioara (Haţeg Basin) (see Weishampel *et alii* 2003), in anterior (A), posterior (B), lateral (C), medial (D), proximal (E), and distal (F) views. In F the anterior surface is towards the top of the image. Scale bar equals 5 cm

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Tibia unui pui de dinozaur ornithopod din Cretacicul superior de la Sebeş, Romania

(rezumat)

Faunele de dinozauri Cretacic târzii din Transilvania sunt printre cele mai ieşite din comun la scară globală, în principal prin prezenţa a numeroase specii relictuale şi pitice. Prezenta contribuţie descrie un element scheletic fragmentar, dar interesant, aparţinând unui astfel de dinozaur: o recent identificată tibie parţială a unui ornithopod de talie mică. Specimenul a fost decoperit în 2011 în succesiunea inferioară, Maastrichtian bazală, a Formaţiunii de Sebeş ce aflorează în situl Petreşti-*Arini* lângă Sebeş, judeţul Alba, România. Caracteristicile diagnostice ale tibiei includ: capătul distal lăţit transversal, cu condilul lateral extins uşor distal faţă de cel medial; lipsa unei deviaţii excesive (laterale sau mediale) ale condililor articulari; prezenţa unei creste puternice pe faţa posterioară a capătului distal şi existenţa unei fosete adânci pe faţa distală a capătului distal, fosetă extinsă şi pe faţa anterioară a acestuia. Trăsăturile menţionate nu sunt caracteristice pentru dinozaurii nodosauride, sauropode sau theropode cunoscute anterior din Cretacicul târziu din România, dar apar la cele două genuri de ornithopode din Transilvania: *Zalmoxes* şi *Telmatosaurus*. Arcuirea laterală a diafizei tibiale, precum şi conturul continuu al marginii mediale, la contactul dintre diafiză şi condilul medial, sunt trăsături cunoscute anterior la *Zalmoxes*, sugerând că tibia de la Petreşti-*Arini* poate fi atribuită acestui taxon, posibil pitic, de ornithopod rhabdodontid. Studiul osteohistologic al specimenului arată că exemplarul de la care provine tibia era într-un proces rapid de creştere somatică şi probabil avea mai puţin de un an în momentul morţii. Atât dimensiunile absolute, cât şi caracterele osteohistologice ale specimenului sugerează că acesta reprezintă cel mai tânăr (imatur din punct de vedere ontogenetic) exemplar de *Zalmoxes* cunoscut. Descoperirea specimenului descris a oferit şi oportunitatea reexaminării distribuţiei şi frecvenţei genului *Zalmoxes* în Cretacicul superior transilvan. Această analiză a demonstrat că specimene atribuibile acestui gen pot fi identificate cu grad înalt de certitudine în nouă localităţi de vertebrate fosile, distribuite pe întreaga succesiune stratigrafică a Cretacicului terminal continental din România, fiind deosebit de abundente în câteva dintre aceste localităţi.

Explicaţia figurilor

Fig. 1. Situl de la Petreşti-*Arini*, unde a fost descoperit specimenul MMIRS (SN) 654. Situl corespunde unui afloriment artificial deschis recent (2007) prin devierea râului Sebeş, şi expune secţiunea bazală a Formaţiunii de Sebeş (Cretacic superior, Campanian superior?-Maastrichtian). **A:** secţiunea aval a deschiderii, 45-110 m deasupra limitei inferioare a formaţiunii; **B:** nivelul fosilifer L1B cu localizarea specimenului MMIRS (SN) 654, indicat de R. Totoianu (august 2012); **C:** S. Brusatte şi G. Dyke investigând nivelul fosilifer L4 (în prezent acoperit), de unde au fost colectate mai multe resturi fosile atribuite genului *Zalmoxes* (iunie 2012).

Fig. 2. Profilul stratigrafic al Campanianului superior-Maastrichtianului inferior din situl de la Petreşti-*Arini* (baza formaţiunii de Sebeş), unde a fost descoperit specimenul MMIRS (SN) 654. Vezi textul pentru descrierea sumară a nivelelor fosilifere (marcate L0, L1, L2 L3 şi L4). Săgeata din dreapta indică poziţionarea în profil a specimenului nou descoperit. Săgeata dublă din stânga indică limita presupusă dintre Campanian şi Maastrichtian. Pe axa *x* din partea de jos se indică caracteristicile granulometrice ale depozitelor, variind de la argile (în stânga) până la conglomerate (în dreapta).

Fig. 3. Specimenul MMIRS (SN) 654, tibie stângă incompletă aparţinând euornithopodului bazal *Zalmoxes* cf. *Z. shqiperorum*, de la Petreşti-*Arini*, în vedere anterioară (A), posterioară (B), laterală (C), medială (D) şi distală (E). În E faţa anterioară este orientată în jos. Scara reprezintă 1 cm. Fotografii de Mick Ellison.

Fig. 4. Secţiune histologică transversală a specimenului MMIRS (SN) 654, probat pe zona proximală a diafizei - porţiunea fracturată). Scara = 1000 microni în figura A, respectiv 500 de microni în figura B.

Fig. 5. Specimenul LPB (FGGUB) R.1087, tibia stângă (asociată cu astragalul) al euornithopodului bazal *Zalmoxes* (*Z. shqiperorum*) de la Vălioara (Bazinul Haţeg) (vezi Weishampel *et alii* 2003), în vedere anterioară (A), posterioară (B), laterală (C), medială (D), proximală (E) şi distală (F). În figura F, faţa anterioară este orientată în sus. Scara = 5 cm.

Tab. 1. Distribuţia şi frecvenţa relativă a genului *Zalmoxes* în depozitele Cretacice superioare din zona Sebeş.

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Cuvinte-cheie: Cretacic, dinozaur, ornithopod, paleontologie, Sebeş, Transilvania, *Zalmoxes*.

Locality	Stratigraphic unit	Age	Depositiponal environment	Materials, skeletal elements, ichnites, ontogeny (**J**=juvenile; **S**=subadult; **A**=adult)	Frequency (**Vr**=vary rare; **R**=rare; **Co**=common; **F**=frequent; relative % NISP -macrovertebrates); Associated vertebrate taxa:	
Petreşti-Arini (PT)	Top Bozeş Fm. (layer 0)	Latest Campanian	Brackish estuarian facies; Tidal flat; (siltstone); Level 0	*Z. robustus*? nearly complete femur **A?**	**Vr** 50%	Pterosauria indet. (Azhdarchidae, large size) **Vr**
	Base Sebeş Fm. (layers 1-5)	Latest-Campanian? - Earliest Maastrichtian	Fluvial; moderately to well drained overbank facies; dark red silty calcareous claystone; purple mudstone	*Z.* sp (*Z. shqiperorum*?). Fragmentary cranio-dental; isolated or associated axial and apendicular elements **J**, **S**, **A**	**F** 60%	"*Muehlbachia*" (Dortokidae) **Co**; Ornithopoda indet. **Co**; Multituberculata (Kogaionidae? indet. –small morph) **Vr**
Cuptorului hill (DC)	"Şard" Fm. lower section	Early Maastrichtian	Fluvial; well drained overbank facies; red calcareous claystone; sandy-silty pointbar facies	*Z.* sp. fragmentary vertebrae **A?**	**R**	*Kallokibotion* -basal Testudines **Co**; '*Muehlbachia*' Dortokidae **R**; *Struthiosaurus*? **Vr**; Dinosaurian footprints (?*Hadrosaurichnus*)
Vurpăr (VP)	"Şard" Fm. lower section	Early Maastrichtian	Fluvial; well drained overbank facies; dark red to brownish red calcareous bioturbated sandy claystone, mudstone; bluish-gray siltstone	*Z. shqiperorum* type: partial skeleton A; *Z.* sp. : 3 partial skeletons **A**, **S**; teeth, fragmentary axial, appendicular elements **S**, **A**	**Ab** 60%	*Allodaposuchus precedens* **R**; *Kallokibotion* sp. **R**; "*Muehlbachia nopcsai*" (Dortokidae) **Co**; *Struthiosaurus transylvanicus* **Co**; Theropoda indet. **Vr**; Aves indet. **Vr**
Sebeş-Glod (SbG/ A-D)	Sebeş Fm. mid-lower section	Late-early? Maastrichtian	Fluvial: moderately and well drained overbank facieses; brownish-red, dark-red silty calcareous claystone; purple mudstone; pinkish-gray to bluish-gray silty-sandstone	*Z.* sp. disarticulated, mostly fragmentary axial and apendicular elements **A?**	**R** 5%	*Allodaposuchus* **Co**; Crocodylomorpha indet. **R**; *Kallokibotion* sp. **Co**; Dortokidae **Co**; Pterosauria, Azhdarchidae(*Eurazhdarcho langendorfensis*); cf. *Hatzegopteryx* sp. **R**; Titanosauria (*Magyarosaurus*) **Co**; Hadrosauria (*Telmatosaurus*) **R**; Theropoda (*Balaur bondoc*) **R**; Dinosauria indet. **Ab**; Avialae indet. **Vr**, Multituberculata (cf. *Barbatodon* sp.) **Vr.**
La Cutină (Dl.Feţii-DF)	Sebeş Fm. middle section	Late-early? Maastrichtian	Fluvial: well drained overbank facieses; brownish-red silty claystone	*Z.* sp. isolated vertebra **A?**	**R**	Dortokidae ("*Muehlbachia*") **R**; *Kallokibotion*? **R**; Dinosauria indet. **R**
Lancrăm (LcB)	Sebeş Fm. middle section	Late-early? Maastrichtian	Fluvio-paludal: bluish-gray, dark- gray mudstone; sandy-pebbly cross-laminated channel fills; crevasse splay;	*Z.* sp. isolated fragmentary limb bones (scapula, humerus, radius, etc). **A?** pair of footprints reffered to	**R** 10%	*Kallokibotion*? sp. **Vr**; *Allodaposuchus* **R**; Titanosauria (*Magyarosaurus*) **Co**; Hadrosauroidea (*Telmatosaurus*) **R**; Dinosauria indet. **R**; footprints (*Iguanodontichnus*) **Vr**

			point-bar; coarse channel lags; occasional reddish overbank facies	*Zalmoxes*? **A?**		
Oarda de Jos (OdA,B)	Sebeş Fm. middle section	Late-early? Maastrichtian	Fluvio-paludal: overbank, brownish-red silty claystone, sandy-pebbly channel fills, crevasse splays; bluish-gray siltstone-mudstone	*Z.* sp. isolated teeth; mostly fragmentary axial and appendicular elements (humerus, femur) fragmentary ischium **A**	**F** 10%	Lepisosteidae; Characiforme **F**; *Albanerpeton* **Co**; Discoglossidae **Co**; Squamata **Co**; cf. *Acynodon* sp. **R**; *Doratodon* sp. **R**; *Allodaposuchus precedens* F; *Kallokibotion* sp. **R**; Dortokidae **Co**; Pterosauria indet. **Vr**; Titanosauria (*Magyarosaurus*?) **R**; *Telmatosaurus transsylvanicus* **R**; Theropoda indet. **Vr**; Enantiornithidae indet. **R**; Multituberculata (Kogaionidae indet.) **R**; various eggshells **R**
Râpa Roşie (RR)	Sebeş Fm. upper section	Late? Maastrichtian	Fluvial: cross laminated sandy-pebbly shallow meandering channel facieses; mainly red overbank claystone-mudstone	*Z.* sp. various fragmentary limb bones (humerus, femora) and vertebrae, **A?**	**R** 5%	*Allodaposuchus* **R**; cf. *Doratodon* **Vr**; *Kallokibotion* **R**; Testudines indet. Co; Pterosauria (giant Azhdarchoidea) **R**; Titanosauria (?*Magyarosaurus*) Co; Nodosauridae (*Struthiosaurus*?) **Vr**; *Telmatosaurus* **Vr**; Theropoda indet. **Vr.** Dinosauria indet. **Co**
Râpa Lancrăm (RL)	Sebeş Fm. upper section	Late? Maastrichtian	Fluvial: cross laminated sandy-pebbly shallow meandering channel facieses; overbank red claystone	*Z.* sp. fragmentary distal caudal vertebra **A?**	**R** 20%	*Kallokibotion* sp. **R**; Titanosauria indet. (cf. *Magyarosaurus*) **R**; Dinosauria indet. Co.

Tab. 1. The distribution and relative frequency of the genus *Zalmoxes* in the uppermost Cretaceous continental deposits of the Sebeş area

LISTA ABREVIERILOR

AAR-SI	- Analele Academiei Române. Memoriile Secţiunii Istorice. Bucureşti (s. III, 1922-1947).
Academica	- Academica. Academia Română. Bucureşti.
ACG	- Anuarul Comitetului Geologic. Institutul Geologic al României. Bucureşti.
ACMI	- Anuarul Comisiunii Monumentelor Istorice. Bucureşti.
ActaArchHung	- Acta Archaeologica. Academiae Scientiarum Hungaricae. Budapest.
ActaBC	Acta Bacoviensia. Serviciul Judeţean Bacău al Arhivelor Naţionale. Bacău.
ActaMN	- Acta Musei Napocensis. Muzeul Naţional de Istorie a Transilvaniei. Cluj-Napoca.
ActaMP	- Acta Musei Porolissensis. Muzeul Judeţean de Istorie şi Artă Zalău. Zalău.
Acta Siculica	- Acta Siculica. Analele Muzeului Naţional Secuiesc. Sfântu Gheorghe.
ActaZC	- Acta Zoologica Cracoviensia. Institute of Systematics and Evolution of Animals. Kraków.
ADIU	- АРХЕОЛОГІЯ І ДАВНЯ ІСТОРІЯ УКРАІНИ. Kiev.
AÉ	- Archaeologiai Értesitö a Magyar régészeti, müvésyt-történeti és éremtani társulat tudományos folyóirata. Budapest.
AHR	- Asiatic Herpetological Research. Chengdu Institute of Biology. Chengdu.
AIIA	- Anuarul Institutului de Istorie şi Arheologie Cluj. Cluj-Napoca (din 1990 Anuarul Institutului de Istorie „George Barit").
AIIAI/AIIX	- Anuarul Institutului de Istorie şi Arheologie „A. D. Xenopol" Iaşi. Iaşi (din 1990 Anuarul Institutului de Istorie „A. D. Xenopol" Iaşi).
AIIGB	- Anuarul Institutului de Istorie şi Arheologie „George Barit" Cluj-Napoca. Cluj-Napoca vezi AIIA.
AIIN	- Anuarul Institutului de Istorie Naţională. Cluj-Sibiu.
AInf	- Archäologische Informationen. Mitteilungen zur Ur- und Frühgeschichte. Bonn.
Altertum	- Das Altertum, Routledge, part of the Taylor & Francis Group.
Aluta	- Aluta. (Studii şi comunicări - Tanulmányok és Közlemények). Sfântu Gheorghe.
AM	- Arheologia Moldovei. Institutul de Istorie şi Arheologie „A. D. Xenopol". Iaşi.
AmAnthropol	- American Anthropologist. Washington, D.C.
AnB	- Analele Banatului; serie nouă. Timişoara.
Angustia	- Angustia. Muzeul Carpaţilor Răsăriteni. Sfântu Gheorghe.
Annales de Paléontologie	- Annales de Paléontologie. Association Paléontologique Française. Paris.

Antaeus	- Antaeus. Communicationes ex Instituto Archaeologico Academiae Scientiarum Hungaricae. Budapest.
Antiquity	- Antiquity. A Quartely Review of World Archaeology. York.
AntTard	- Antiquité tardive. Revue internationale d'histoire et d'archéologie (IVe-VIIIe s.). Turnhout.
AO	- Arhivele Olteniei. Craiova; serie nouă (Institutul de Cercetări Socio-Umane. Craiova).
APA	- Acta Praehistorica et Archaeologica. Berlin.
APR	- Acta Palaeontologica Romaniae. Romanian Society of Paleontologists. Bucureşti.
Apulum	- Apulum. Acta Musei Apulensis. Muzeul Naţional al Unirii Alba Iulia. Alba Iulia.
AR	- Archeologické rozhledy. Praha.
ARA	- Annual Review of Anthropology. Palo Alto.
ArbInstHalle	- Arbeiten aus dem Institut für Vor- und Frühgeschichte der Martin-Luther-Universität Halle-Wittenberg.
Archaeologia Bulgarica	- Archaeologia Bulgarica. Sofia.
ArchAustr	- Archaeologia Austriaca. Viena.
ArchHung	- Archaeologia Hungarica, Dissertationes Archaeologicae Musei Nationalis. Budapest.
ArchKözl	- Archaeologiai Közlemények. Pesten.
Argesis	- Argesis. Studii şi comunicări. Muzeul Judeţean Argeş. Piteşti.
Arheologija	- Archeologija. Organ na Archeologičeskija Institut i Muzei pri Bulgarskata Akademija na Naukite. Sofia.
ArhRom	- Arhiva Română. Arhivele Statului. Bucureşti
AŞUAIC-I	- Analele Ştiinţifice ale Universităţii „Al. I. Cuza" din Iaşi. Istorie. Iaşi.
Athenaeum	- Athenaeum. Studi periodice di litteratura e storia dell'antichità. Pavia.
ATS	- Acta Terrae Septemcastrensis. Sibiu.
AUA	- Annales Universitatis Apulensis. Series Historica. Alba Iulia.
AUSB	- Annales Universitatis Scientiarium Budapestinensis de Rolando Eötvös Nominatae, sectio Historica. Budapest.
AusgrabFunde	- Ausgrabungen und Funde. Berlin.
AUVT	- Annales d'Université „Valahia" Târgovişte. Târgovişte.
BA	- Biblioteca de arheologie. Bucureşti.
BÁMÉ	- A Béri Balogh Ádám Múzeum Évkönyve. Szekszárd.
Banatica	- Banatica. Muzeul de istorie al judeţului Caraş-Severin. Reşiţa.
BAR	- British Archaeological Reports (International Series). Oxford.
BC	- Biblioteca şi cercetarea. Cluj-Napoca.
BCH	- Bulletin de correspondance hellenique. L'Institut de correspondance hellenique d'Athenes (continuă Bulletin de l'Ecole francaise d'Athenes- 1868-1871). Atena.
BCMI	- Buletinul Comisiunii Monumentelor Istorice / Buletinul Comisiei Monumentelor istorice. Bucureşti.
BCŞS	- Buletinul Cercurilor Ştiinţifice Studenţeşti. Alba Iulia.
BerRGK	- Bericht der Römisch-Germanischen Kommission des Deutschen Archäologischen Instituts. Frankfurt am Main.
BG	- Boabe de grâu. Bucureşti

BHAB	- Bibliotheca Historica et Archaeologica Banatica. Muzeul Banatului Timişoara. Timişoara.
BIRSNB	- Bulletin de l'Institute Royal des Sciences Naturelles de Belgique. Bruxelles.
BMA	- Bibliotheca Musei Apulensis. Muzeul Naţional al Unirii Alba Iulia. Alba Iulia.
BMI	- Buletinul Monumentelor Istorice. Bucureşti.
BMJT	- Buletinul Muzeului Judeţean Teleorman. Seria Arheologie. Alexandria.
BMM	- Bibliotheca Musei Marisiensis. Seria Archaeologica. Târgu Mureş.
BMMK	- Békés Megyei Múzeumok Közleményei. Békéscsaba.
BMS	- Bibliotheca Musei Sabesiensis. Muzeul Municipal „Ioan Raica" Sebeş.
BollVerona	- Bollettino del Museo Civico di Storia Naturale di Verona. Verona.
BOR	- Biserica Ortodoxă Română. Patriarhia Română. Bucureşti.
BR	- Budapest Régiségei. Budapesti Történeti Múzeum. Budapest.
Britannia	- Britannia. A Journal of Romano-British and Kindred Studies. The Society for the Promotion of Roman Studies. Cambridge.
Brukenthal	- Brukenthal. Acta Musei. Muzeul Naţional Brukenthal. Sibiu.
BSAF	- Bulletin de la Société Nationale des Antiquaires de France. Paris.
BSHNT	- Bulletin de la Société d'Histoire Naturelle de Toulouse. Toulouse.
BSNR	- Buletinul Societăţii Numismatice Române. Societatea Numismatică Română. Bucureşti.
BTh	- Bibliotheca Thracologica. Institutul Român de Tracologie, Bucureşti.
Buletin foaie oficială	- Buletin foaie oficială. Iaşi.
BulletinAMNH	- Bulletin of the American Museum of Natural History. New York.
BulletinSGF	- Bulletin d'Societe Geologique France. Paris.
Buridava	- Buridava. Studii şi materiale. Muzeul Judeţean „Aurelian Sacerdoteanu" Vâlcea. Râmnicu Vâlcea
BV	- Bayerische Vorgeschichtblätter. München.
CA	- Cercetări arheologice. Muzeul Naţional de Istorie a României. Bucureşti.
CAANT	- Cercetări arheologice în aria nord-tracă. Bucureşti.
CAn	- Current Anthropology. Chicago.
Carnets de Géologie	- Carnets de Géologie. Brest.
CCA	- Cronica cercetărilor arheologice. Bucureşti.
CCGG	- Cahiers du Centre Gustave Glotz. Sorbonne (Paris).
CFS	- Courier Forschungsinstitut Senckenberg. Senckenberg Forschungsinstitut und Naturmuseum. Frankfurt am Main.
Ciências da Terra (UNL)	- Ciências da Terra (UNL). Earth Sciences Journal. Caparica.
ClausthalerGeo	- Clausthaler Geowissenschaften. Institut für Geologie und Paläontologie. Clausthal-Zellerfeld.

CMPUMichigan	- Contributions from the Museum Paleontology. The University of Michigan. Michigan.
Codrul Cosminului	- Codrul Cosminului, Seria Nouă. Analele Ştiinţifice de Istorie, Universitatea „Ştefan cel Mare" Suceava. Suceava
CommArchHung	- Communicationes Archaeologicae Hungariae, Magyar Némzeti Muzeum. Budapesta.
Communications	- Communications. École Des Hautes Étude en Science Sociales – Centre D'Études Transdisciplinaires (Sociologie, Anthropologie, Politiques), Paris.
Copeia	- Copeia. American Society of Ichthyologists and Herpetologists. New York.
Corviniana	- Corviniana. Acta Musei Corvinensis. Hunedoara.
CRAcadSciParis	- Comptes Rendus De L'Academie Des Sciences. Serie II, Fascicule A - sciences de la Terre et des Planetes. Paris.
CretaceousRes	- Cretaceous Research. Published by Elsevier.
Crisia	- Crisia. Culegere de materiale şi studii. Muzeul Ţării Crişurilor. Oradea.
Cultura creştină	- Cultura creştină. Publicaţie apărută sub egida Mitropoliei Române Unite cu Roma Greco-Catolică şi a Facultăţii de Teologie Greco-Catolică din Universitatea „Babeş-Bolyai" Cluj-Napoca, Departamentul Blaj. Blaj.
Cumania	- Báks - kiskun Megyei Múzeumok Közleményei. Kecskemét.
Dacia	- Dacia. Recherches et découvertes archéologiques en Roumanie. Bucureşti, I, (1924) - XII (1948). Nouvelle série: Revue d'archéologie et d'historie ancienne. Bucureşti.
Danubius	- Danubius. Muzeul de Istorie Galaţi. Galaţi.
DMÉ	- A Debreceni déri Múzeum Évkönyve. Debrecen.
Dolgozatok	- Dolgozatok az Erdély Nemzeti Múzeum Érem - és Régiségtárából. Kolosvár (Cluj).
DolgSzeged	- Dolgozatok. A. M. Kir. Ferencz József Tudományegyetem Archaeologiai Intézetéböl. Szeged.
DP	- Documenta Praehistorica. Poročilo o raziskovanju paleolitika, neolitika in eneolitika v sloveniji. Ljubljana.
Drobeta	- Drobeta. Muzeul Regiunii Porţilor de Fier. Drobeta Turnu-Severin.
Dumerilia	- Dumerilia. Association des amis du laboratoire des reptiles et amphibiens du Muséum = AALRAM. Paris.
Eclogae	- Eclogae Geologicae Helvetiae. Swiss Journal of Geosciences. Swiss Geological Society. Zürich.
EHR	- The English Historical Review. Oxford University Press (UK).
Environment & Progress	- Environment & Progress. Universitatea „Babeş-Bolyai" Cluj-Napoca. Facultatea de Ştiinţa şi Ingineria Mediului. Cluj-Napoca.
EphNap	- Ephemeris Napocensis. Institutul de Arheologie şi Istoria Artei, Cluj-Napoca. Cluj-Napoca.
ErdMúzÉvk	- Erdélyi Múzeum Egyesület Évkönyve. Kolosvár (Cluj).
EstudiosAlava	- Estudios del Museo de Ciencias Naturales de Alava. Vitoria.
Eurasia Antiqua	- Eurasia Antiqua. Zeitschrift für Archäologie Eurasiens. Mainz am Rhein.

FbÖst	- Fundberichte aus Österreich. Wien.
FK	- Földtani közlöny. Magyarhoni foldtani tarsulat folyóirata. Budapest.
FöldrKözl	- Földrajzi Közlemények. Budapest.
FoliaArch	- Folia Archaeologica. Magyar Történeti Múzeum. Budapest.
Gemina	- Gemina. Timişoara.
Geodiversitas	- Geodiversitas. Museum National d'Histoire Naturelle Paris. Paris.
Gerión	- Gerión. Revista de historia antigua, Universidad Complutense de Madrid. Madrid.
Germania	- Germania. Römisch-Germanischen Kommission des Deutschen Archäologischen Instituts. Frankfurt am Main.
Godišnjak	- Godišnjak. Jahrbuch Knjiga. Sarajevo-Heidelberg.
HAC	- Historiae Augustae Colloquia Nova Series. Bari.
Hantkeniana	- Hantkeniana. Periodical of the Department of Palaeontology, Eötvös University. Budapest.
Hermes	- Hermes. Zeitschrift für klassische Philologie. Stuttgart.
Hesperia	- Hesperia. Journal of American School of Classical Studies at Athens. Athens.
Hierasus	- Hierasus. Muzeul Judeţean Botoşani. Botoşani.
HJ	- The Historical Journal. University of Cambridge (UK).
Hrisovul	- Hrisovul. Academia de Poliţie „Alexandru Ioan Cuza". Facultatea de Arhivistică. Bucureşti.
HTRTÉ	- A Hunyadmegyei Történelmi és Régészeti Társulat Évkönyvei (1880-1913). Deva.
HU	- Historia Urbana. Institutul de Cercetări Socio-Umane. Sibiu.
IA	- International Affairs. Royal Institute of International Affairs. London.
Instrumentum	- Instrumentum (Bulletin du Groupe de travail europeen sur l'artisanat et les productions manufacturees dans l'Antiquite. Montagnac.
Ioan Neculce	- Ioan Neculce. Buletinul Muzeului de Istorie a Moldovei. Iaşi.
Iranica Antiqua	- Iranica Antiqua. Leiden.
Istros	- Istros. Muzeul Brăilei. Brăila.
Îndrumător pastoral	- Îndrumător pastoral. Episcopia Ortodoxă Română de Alba Iulia. Alba Iulia
JAMÉ	- A Nyiregyhazái Jósa András Múzeum Évkönyve. Nyíregyháza.
JAMT	- Journal of Archaeological Method and Theory. New York.
JCH	- Journal of Contemporary History. University of Cambridge (UK), University of Wisconsin at Madison (USA).
JMH	- The Journal of Modern History. University of Chicago.
JMV	- Jahresschrift für mitteldeutsche Vorgeschichte. Halle (Saale).
JRGZM	- Jahrbuch des Römisch-Germanischen Zentralmuseums zu Mainz. Mainz.
JRS	- The Journal of Roman Studies. London.
JSP	- Journal of Systematic Palaeontology. British Natural History Museum. London.

JTa	- Journal of Taphonomy. Paleontological Network Foundation.
Klio	- Klio. Beiträge zur Alten Geschihte. Berlin.
Korunk	- Korunk. Kolozsvár. Cluj-Napoca.
KözlDebrecen	- Közlemények a Debreceni M. Kir. Tisza István-Tudományegyetem Régészeti Intézetéből. Debrecen.
Latomus	- Latomus. Revue d'études latines. Bruxelles.
MA	- Mitropolia Ardealului. Revista oficială a Arhiepiscopiei Sibiului, Arhiepiscopiei Vadului, Feleacului şi Clujului, Episcopiei Alba Iuliei şi Episcopiei Oradei. Sibiu (1956-1991). A continuat *Revista Teologică*, (1907-1947) şi este continuată de aceeaşi revistă.
MAGW	- Mitteilungen der anthropologischen Gesellschaft in Wien. Wien (1912-1941).
Marburger Studien	- Marburger Studien. Marburg.
Marisia	- Marisia. Studii şi Materiale. Târgu Mureş.
Marmatia	- Marmatia. Baia Mare.
Mas de las Matas	- Mas de las Matas. Grupo de Estudios Mastnos. Mas de las Matas.
Materiale	- Materiale şi cercetări arheologice. Bucureşti.
MBGAEU	- Mitteilungen der Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte. Berlin.
MedTrans	- Mediaevalia Transilvanica. Satu-Mare.
MÉFRA	- Mélanges de l'École française de Rome. Antiquité. Roma.
Mehedinţi	- Mehedinţi - Istorie şi cultură. Drobeta Turnu Severin.
MemAntiq	- Memoria Antiquitatis. Complexul Muzeal Judeţean Neamţ. Piatra Neamţ.
MemMNHistNat	- Memoires du Museum National d'Histoire Naturelle - Serie C: Sciences de la Terre. Paris.
MemPadova	- Memorie degli Istituti di Geologia e Mineralogia dell' Universita di Padova. Padova.
MES	- Middle Eastern Studies. The University of Texas at Austin.
MFMÉ StudArch	- A Móra Ferenc Múzeum Évkönyve. Studia Archaeologica. Szeged.
MIAK	- Materialy i issledovanija po archeologii Kubani. Krasnodar.
MittUngGeo	- Mitteilungen aus den Jahrbuch der Kön. Ungarische Geologischen Anstalt. Budapest.
MKÉ	- Múzeumi és Könyvtári Értesitő. Budapest.
MKFIÉ	- A Magyar Királyi Földtani Intézet Évkönyve. Mitteilungen aus dem Jahrbuch der Kgl. ungar. Geolog. Anstalt. Annales Instituti Regii Hungarici Geologici. Budapest.
MN	- Muzeul Naţional de Istorie a României. Bucureşti.
MÖSTA	- Mitteilungen des Österreichischen Staatsarchivs. Österreichischen Staatsarchiv. Wien.
Natl Geogr Res	- National Geographic Research Journal. Washington, D.C.
NeuesJahrGP	- Neues Jahrbuch für Geologie und Paläontologie Monatschafte. Stuttgart.
NTS	- The Nordic Textile Journal. University College of Borås. The Swedish School of Textiles.
OJA	- Oxford Journal of Archaeology, Blackwell Publishing Inc.

ŐL	- Ősrégészeti Levelek. Prehistoric newsletter. Budapest.
Oltenia	- Oltenia. Studii şi comunicări. Arheologie – Istorie. Craiova.
OpuscArchaeol	- Opuscula Archaeologica Radovi Arheološkog zavoda. Zagreb.
Oryctos	- Oryctos. Musée des Dinosaures d'Espéraza.
PA	- Patrimonium Apulense. Alba Iulia.
PalaeoAfricana	- Palaeontologia Africana. Annals of the Bernard Price Institute for Palaeontological Research, University of the Witwatersrand. Witwatersrand. Johannesburg.
Paleobiology	- Paleobiology. The Paleontological Society. Gainsville.
Palevol	- Palevol. Comptes Rendus de l'Académie des sciences. Issy-les-Moulineaux.
Pallas	- Pallas. Revue d'études antiques. Université du Mirail. Toulouse.
PamArch	- Památky archeologické. Praha.
PAS	- Prähistorische Archäologie in Südosteuropa. Berlin.
PBF	- Präehistorische Bronzefunde. München.
Peuce	- Peuce. Studii si comunicări de istorie veche, arheologie şi numismatică. Tulcea.
PLoS ONE	- PLoS ONE. International, peer-reviewed, open-access, online publication.
PNAS	- Proceedings of the National Academy of Sciences of the United States of America. Washington.
Pontica	- Pontica. Muzeul de Istorie Naţională şi Arheologie Constanţa. Constanţa.
PPP	- Palaeogeography, Palaeoclimatology, Palaeoecology ("Palaeo3"). An International Journal for the Geo-Sciences.
PPS	- Proceedings of the Prehistoric Society. Cambridge-Londra.
Programm Mühlbach	- Programm des evaghelischen Untergymnasium in Mühlbach und der damit verbundenen Lehranstalten. Mühlbach (Sebeş).
PZ	- Prähistorische Zeitschrift. Deutsche Gesellschaft fuer Anthropologie, Ethnologie und Urgeschichte, Institut für Prähistorische Archäologie. Berlin.
RA	- Revista Arheologică. Institutul de Arheologie şi Istorie Veche. Chişinău.
Renaşterea	- Renaşterea. Cluj-Napoca.
RÉV	- Revue des études latines. Paris.
RevAquitania	- Revue Aquitania. Revue interrégionale d'archéologie. Aquitaine.
RHSEE/RESEE	- Revue Historique du Sud-Est Européen. Academia Română. Bucureşti şi Paris (din 1963 Revue des Études Sud-Est Européennes).
RI	- Revista de Istorie (din 1990 Revista istorică). Bucureşti.
RJTRG	- Romanian Journal of Tectonics and Regional Geology. Bucureşti.
RM	- Revista Muzeelor. Bucureşti.
RMGM	- Revista Muzeului de Gelogie şi Mineralogie. Cluj-Napoca.
RMM	- Revista Muzeelor şi Monumentelor. Bucureşti.
RMM-MIA	- Revista Muzeelor şi Monumentelor. Monumente Istorice şi de Artă. Bucureşti.

RRH	- Revue Roumaine d'Histoire. Academia Română. Bucureşti.
RRL	- Revue Roumaine de Linguistique. Academia Română - Institutul de Lingvistică „Iorgu Iordan - Al. Rosetti". Bucureşti
RT	- Revista Teologică. Sibiu.
RVM	- Rad Vojvodanskih muzeja. Novi Sad.
SAA	- Studia Antiqua et Archaeologica. Iaşi.
SAHIR	- Studia et Acta Historiae Iudaeorum Romaniae. Institutul de Istorie „A. D. Xenopol" Iaşi. Iaşi.
SAI	- Studii şi articole de istorie. Bucureşti.
Sargetia Naturae	- Sargetia. Acta Musei Devensis. Series Scientia Naturae. Deva.
Sargetia	- Sargetia. Buletinul Muzeului judeţului Hunedoara (Acta Musei Devensis). Deva.
SASTUMA	- Saarbrücker Studien und Materialien zur Altertumskunde. Bonn.
SB	- Studia Bibliologica. Bucureşti.
SBV	- Studia bibliologica Valachica. Târgovişte.
SC (Ştiinţele Naturii)	- Studii şi Cercetări (Ştiinţele Naturii). Complexul Muzeal Bistriţa-Năsăud. Bistriţa.
SCB	- Studii şi cercetări de bibliologie. Bucureşti (1955-1963).
SCIM	- Studii şi cercetări de istorie medie. Bucureşti.
SCIV(A)	- Studii şi cercetări de istoria veche. Bucureşti (din 1974, Studii şi cercetări de istorie veche şi arheologie).
SCN	- Studii şi cercetări numismatice. Bucureşti.
SEER	- The Slavonic and East European Review. University College London.
SlovArch	- Slovenská Archeológia. Nitra.
SMICont	- Studii şi materiale de istorie contemporană. Institutul de Istorie „Nicolae Iorga" Bucureşti. Bucureşti.
SMIMod	- Studii şi materiale de istorie modernă. Institutul de Istorie „Nicolae Iorga" Bucureşti. Bucureşti.
SMK	- Somogyi Muzeumok Kozlemenyei. Somogyi Megyei Muzeumok. Kaposwar.
Starinar	- Starinar, Tređa Serija. Arheološki Institut. Beograd.
StComSM	- Studii şi comunicări. Muzeul judeţean Satu Mare. Satu Mare.
StudArch	- Studia Archaeologica. Budapest.
StudGeolSalmanticensia	- Studia Geologica. Salmanticensia. Universidad de Salamanca. Departamento de Geología. Salamanca.
StudiaTGCV	- Studia. Theologia Graeco-Catholica Varadiensis. Oradea.
StudiaUBBG	- Studia Universitatis „Babeş-Bolyai". Series Geologia. Cluj-Napoca.
StudiaUBBH	- Studia Universitatis „Babeş-Bolyai". Series Historia. Cluj-Napoca.
Študijné Zvesti AUSAV	- Študijne Zvesti. Archeologickeho Ustavu Slovenskei Akademie Vied. Nitra.
Suceava	- Anuarul Muzeului Judeţean. Suceava.
SympThrac	- Symposia Thracologica. Institutul Român de Tracologie.
Terra Sebus	- Terra Sebus. Acta Musei Sabesiensis. Sebeş.
Thraco-Dacica	- Thraco-Dacica. Institutul Român de Tracologie. Bucureşti.

Tibiscum	- Tibiscum. Studii şi Comunicări de Istorie şi Etnografie. Caransebeş.
Tibiscus	- Tibiscus. Muzeul Banatului Timişoara. Timişoara (1971-1979).
Tisicum	- Tisicum. A Já́sz-Nagykun-Szolnok megyei mú́zeumok é́vkönye. Szolnok.
Transilvania	- Transilvania. Foaia Asociaţiunii Transilvane pentru Literatura Română şi Cultura Poporului Român. Braşov.
Tyragetia	- Tyragetia. Muzeul Naţional de Arheologie şi Istorie a Moldovei. Chişinău.
UPA	- Universitätsforschungen zur Prähistorischen Archäologie. Berlin.
Vjesnik	- Arheološkog muzeja u Zagrebu. Vjesnik Arheološkog muzeja u Zagrebu. Zagreb.
VZBGW	- Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien. Wien.
WPZ	- Wiener Prahistorische Zeitschrift. Selbstverlag der Wiener Prahistorischen Gesellschaft. Wien.
Zalai Múzeum	- Zalai Múzeum. Zalaegerszeg.
ZfA	- Zeitschrift für Archäologie. Berlin.
Ziridava	- Ziridava. Muzeul Judeţean Arad. Arad.