BIBLIOGRAPHY

1. Gábos, L., 1974: *Geologia Bazinului Iara, cu privire specială asupra depozitelor neogene.* Teza de doctorat, Bucureşti.
2. Gartner S. Jr. 1968: *Coccoliths and related calcareous nannofossils from Upper Cretaceous deposits of Texas and Arkansas.* The Univ. of Kansas Paleontological Contributions **48**, 56 p.
3. Herbich F. 1877: *Geologische Beobachtungen in dem Gebiete der Kalkklippen am Ostrande des Siebenbürgischen Erzgebiete.* Földt. Közl. **VII,** Budapest.
4. Koch A. 1887: *Jelentés a Kolozsvártól délre esö terüle en az* **1886** *èv nyarán végzett földtani részletes felvételröl.* Földt: Int. Evi. fel. 1886 — ról. Budapest.
5. Ilie M. D. 1952: *Cercetări geologice în regiunea Cluj—Cojocna—Turda—Ocna Mureşului—Aiud.* An. Com. Geol. **XXIV,** Bucureşti.
6. Niţulescu O. 1936: *Contribuţii la studiul geologic al regiunii Şchiopi-Petreşti (jud. Cluj).* Rev. Muz. Geol.-Min. Univ. Cluj **VI,** 1—2 Cluj.
7. Perch-Nielsen, Katharina 1968: *Der Feinbau und die Klassifikation der Coccolithen aus dem Maastrichtien von Dänmark.* Det. Kongl. Danske Videnskb. Selskab Biol. Skrifter **16,** 1, 96 p. Köbenhavn.
8. Perch-Nielsen, Katharina 1985: *Mesozoic calcareous nannofossils,* in *Plankton Stratigraphy,* p. 329—426, Cambridge.

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NEW MAMMAL REMAINS FROM THE SARMATIAN DEPOSITS AT MINIŞU DE SUS (TAUŢ, ARAD COUNTY).

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ABSTRACT. Several remains of large mammals collected from the tuff—diatomic complex at Minişu de Sus (Tauţ, Arad County) are presented. They belonged to a rhinocerotid, *aff. Alicornops simorrense* (**Lartet**), and a tragulid, *Dorcatherium crassum* (**Lartet**), both new records for the Romanian paleofauna. The deposits have been assigned to the final Astaracian. They may belong to the lowest half of biozone MN 8, Mein scale.

Key words: Paleontology; Vertebrates; Upper Astaracian; Minişu de Sus, Romania.

Several other papers (E. Nicorici 1976; V. Codrea et. alii 1991 a, b.) have described skeleton remains from the diatomitic deposits at Minişu de Sus (Arad County), assigned to the final Astaracian.

The few dental and post-cranial pieces presented here were collected from the same level in the diatomitic quarry Bîrzaviţa II (stage III) as the Listriodon and Deinotherium remains already described.

Ord. Perissodactyla

Grandfam. Rhinocerotida Owen, 1845

Subfam. Aceratheriinae Dollo, 1885

Genus Alicornops Ginsburg & Guerin, 1979

aff. Alicornops simorrense (Lartet, 1851)

(Pl. I, fig. 1—1a)

Material: P 4/dext., isolated. At this wearing, the premolar look only partly molariform, but the tooth is extremely worn out. Occlusal surface highly affected by abrasion, displaying a marked antero-posterior concavity.

Enamel with a grayish-yellow patina. Roots recurved, badly preserved together with spongy tissue resulting from the maxillary. In occlusal view, the tooth outline is quasitrapezoid, with the large base set along the ectoloph.

Crista lacking, same as the antecrochet. Crochet simple, oriented parallelly to the ectoloph. Cingulums clearly visible anteriorly and palatally. Due to extreme wearing, the internal cingulum appears as a descending crest, detached from the hypocone towards the protocone. When less worn out, the display is continous, bordering the hypocone till the postfosette. A very small interruption at the protocone delimits the palatal cingulum from the mesial one ascending obliquely from the protocone

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towards the paracone and becoming close to the parastyle confluent with the dental wall of the protoloph. No labial cingulum is present.

Protocone constriction slight. Postfosette triangular in shape, about as deep as the median valley. The opening of the median valley is blocked by a link between the protocone and hypocone. The ectoloph marked by a fold of the paracone, strong, well shaped. Although slightly visible, a wave of the ectoloph wall reveals an embryonic fold of the metacone.

Dimensions. (mm; after C. Guérin 1980):

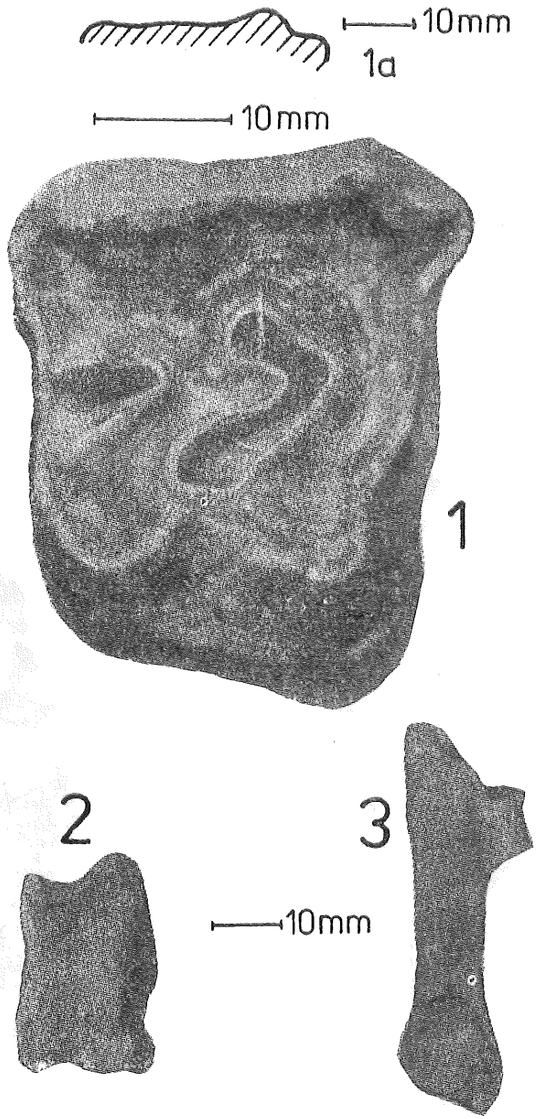
	Miniş	Sofça[1]	Nombrevilla[2]	Western Europe[3]
Length	34.4	33.0	35.0—37.1	30.0—40.0
Width	43.0	47.0	40.0—42.2	42.5—51.0

1 — K. Heissig, 1976.
2 — J. Vte. Santafé — Llopis & al., 1982.
3 — C. Guérin, 1980.

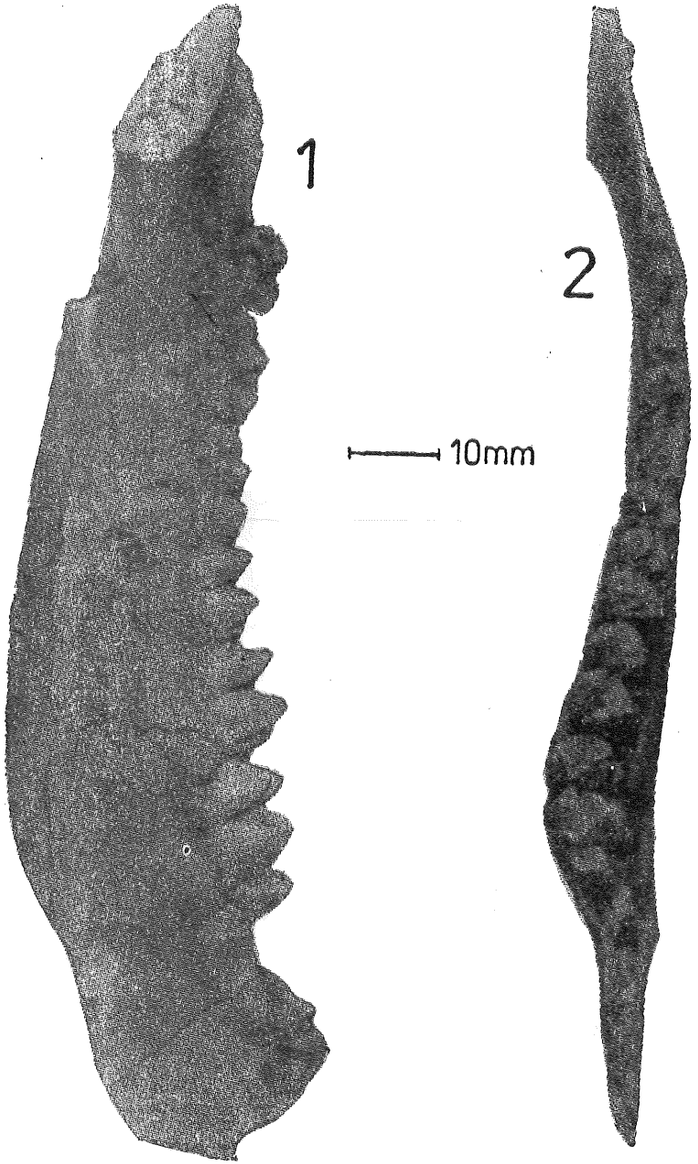
Comparisons. The presence of a strong internal cingulum and the shape of the ectoloph profile, as well as other morphological peculiarities, account for the assignement to the *A. simorrense* species. The metric data agrees with the variation range established by C. Guérin (1980). An atypica feature is the link between the hypocone and the protocone, link that lacks both in the Simorre holotype and the pieces collected at Nombrevilla (MN 9). In our piece, this feature could also be the result of advanced wearing leading to the removal of cuspids down to their basic level The Miniş tooth could be related to P4/sin. recorded by K. Heissig (1976) for Anatolia, Kütahya—Sabunca—Sofça (p. 74—75, Taf. 4, figs. 6, 7). At extreme wearing, the latter premolar could achieve the levelling of the abrasion surfaces of the two cuspids mentioned. Noteworthy are also the similarities between the ectolophs and the cingulum formations. But the pictures reveal a closed mediofosette, which lacks in our piece. The age of the deposits from Anatolia preserving the remains has been estimated as representing „the transition from the lower to the upper part of the Upper Miocene".

The species was also identified in the Middle Sarmatian (MN 9) of Bassarabia, a new subspecies being described here: *Aceratherium* (*Alicornops*) *simorrense orientalis* Lungu (**A. N. Lungu,** 1984). In this case, P4/is larger and the width between the protoloph and metaloph is visibly unequal.

Ord. *Artiodactyla*
Fam. *Tragulidae* Milnes-Edwards, 1864
Genus *Dorchatherium* Kaup, 1833
Dorcatherium crassum (Lartet, 1851)
(Pl. I, figs. 2—3; Pl. II, figs 1—2)



Pl. I. Fig. 1 — *aff. Alicornops simorrense* (Lartet). P4/dext.; occlusal view. Fig. 1a — *aff. Alicornops simorrense* (Lartet). profile of ectoloph. Fig. 2 — *Dorcatherium crassum* (Lartet); astragalus. Fig. 3 — *Dorcatherium crassum* (Lartet); calcaneum.



PL. II. Fig. 1 — *Dorcatherium crassum* (Lartet); mandible right ramus with DP/2—M/3, inner view. Fig. 2 — *Dorcatherium crassum* (Lartet); mandible right ramus with DP/2—M/3, occlusal view.

Material: jaw with right ramus; astragalus; calcaneum.

The hemimandible belonged to a young animal. The last molar was not completely out and the premolars belonged to the milk dentition. The mandible is damaged both anteriorly and posteriorly. As a result of the post-depositional pressures suffered by the diatomitic deposits bearing the remains, this bone is marked by a whole net of fissures. One of these fissures, crossing the bone along its direction, uplifted vertically the whole anterior part of the horizontal branch, DP/2 included. The ascending branch, highly flattened, is broken above the occlusal of M/3.

Two mental foramina, unequal in size, are present labially, with an elliptical outline each. The anterior, larger one is in fact a common opening of two lines of the mandibular channel, which is located under the diastema preceding the dental row. The second, smaller one, lies posteriorly to the first, under the anterior root of DP/2.

The entire dental row DP/2—M/3 has been well preserved. The dental morphology greatly resembles the one described by L. Ginsburg & C. Bulot (1987) for *Dorcatherium naui* Kaup at Bézian (MN 4).

DP/2 narrow, with cuspids ranged along the antero-posterior direction. The row is dominated by the protoconid. The paraconid located anteriorly, practically absent, looking more than a parastylid. Both the hypoconid and the labial crest diverging posteriorly display wearing. In DP/3, the paraconid, hypoconid and posterior cingulum are greatly worn, while the protoconid is only slightly worn. Here, too, the cuspids range to pattern. The greatest wearing is visible in DP/4 (the first lobe), where it gets down to the collet. The posterior wing detached from the hypoconid is highly curved lingually, making up the posterior wall of the tooth. It joins the metaconid rather intimately, so that the contact area bears no traces on the lingual wall.

The molars are brachiodont. The enamel on the lateral walls is deeply wrinkled. The lingual tubercules in M/1 and M/2 obviously dominate in height the external ones. M/3 breaks the rule, except for the relation entoconid-hypoconid. The lingual walls are convex. In each molar the metastylid is clearly delimited from the internal posterior crest of the metaconid by a deep groove. The posterior division of the protoconid is also clearly visible. The first two molars are provided with extremely strong cingulums set anteriorly and posteriorly. M/3 lacks posterior cingulum. Lateral cingulums are also absent in all molars. The ectostylids are strong in M/1—M/2, while M/3 breaks the rule once more: its ectostylid is very small.

Two post-cranial pieces discovered isolated have also been assigned to this species: a damaged calcaneum, and a perfectly preserved astragalus with non-parallel axes of trochleae. By its dimensions, our astragalus compares favourably with Bézian. Its transverse diameter, distally, is smaller than of *Dorcatherium* from Beuern im Vogelsberg (H. Tobien, 1963). The one figured by Hofmann (1893) at Göriach (Taf. XV, fig. 11, 12) seems of about the same length, but somewhat narrower.

Dimensions. (mm; after van der Made, 1989):

	Length	Width			Height
		anterior	posterior	talonid	
DP/2	9.8	2.8	3.2		3.5
DP/3	12.8	3.6	4.2		
DP/4	13.2	5.4	6.0		
M/1	11.5	6.3	7.8		
M/2	12.8	7.5	8.0		9.0
M/3	18.6	8.3	9.2	5.0	10.0
DP/2–M/3	81.0				
DP/2–DP/4	35.0				
M/1–M/3	41.0				

Astragalus:	length	29.5	
	distal trasverse diameter	16.1	
	proximal transverse diameger	15.6	
Calcaneum:	length	+ 53.0	(damaged)

According to the dimensions of the dental pieces, and to those of the isolated post-cranial pieces, the skeleton remains from Miniş have been assigned to *Dorcatherium crassum* (Lartet) Dental data bring them nearer to the findings at Labitschberg or Feisternitz, and further from the ones at Göriach (MN 6) or St. Stefan (MN 8), the latter being of smaller size (A. Hofmann 1888, 1893; M. Mottl, 1961, 1964, 1966). (Fig.1) They also display obvious morphological similarities with the pieces from La Romieu (MN 4) described by F. Roman & J. Viret (1934). *Dorcatherium guntianum* H. v. Meyer is much smaller, while *D. penekei* Hofmann (from Stallhofen, Seegraben) is larger than the Miniş specimen. *D. vindobonense* H. v. Meyer (Seegraben, Labitschberg, Feisternitz, Göriach, Neudorf; M. Mortl 1961) seems to be a synonym of Lartet's species.

Discusion. Except for an apical tusk fragment assigned to the species *Gomphotherium angustidens* (E. Nicorici, op. cit.), collected from the old Bîrzăviţa I quarry with no specifications on its location within the sequence of tuff-diatomitic deposits, all the other remains of large mammals recorded so far were collected from the stage III in the new Bîrzăviţa II quarry. The site lies close to the end of the sequence of the tuff-diatomitic complex, under the plate of andesitic agglomerates (for the stratigraphic sequence at Minişu de Sus, see D. Istocescu, 1971 and D. Istocescu & F. Istocescu, 1974).

Alicornops simorrense covers a wide stratigraphic interval. The species occurs at the level of biozone MN 6 and becomes extinct in MN 10, when more massive specimens were identified, corresponding to evolved forms (C. Guérin, 1980, 1982, 1988). The evolutional direction recorded for Western Europe seems to be confirmed by the findings in Turkey: while the Sofça forms are smaller, the pieces identified in more recent deposits at Yeni Eskihisar account for the presence of larger specimens (O. Sickenberg & al., 1975).

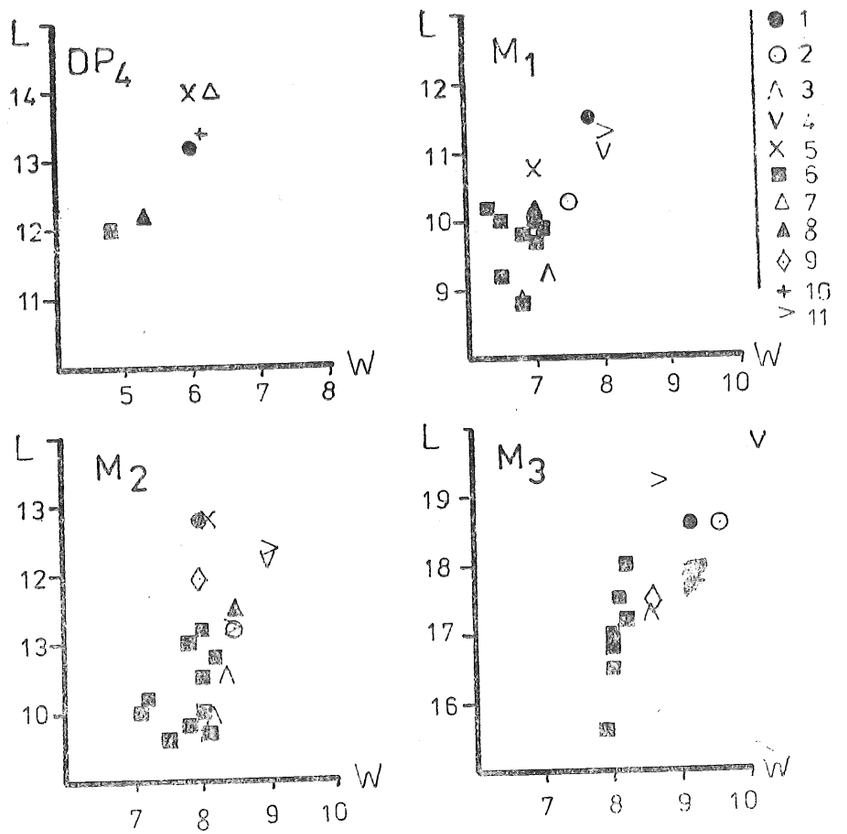


Fig. 1: Length — width diagram of DP/4 and lower molars of *Dorcatherium*: 1. Miniş; 2. Vordersdorf (A. Hofmann, 1888); 3. Göriach (A. Hofmann, 1893); 4. Labitschberg (A. Hofmann op. cit.); 5. Feisternitz (M. Mottl, 1961); 6. Göriach (M. Mottl, op. cit.); 7. Labitschberg (M. Mottl, op. cit.); 8. Piberstein (M. Mottl, op. cit.); 9. St. Stefan (M. Mottl, 1964); 10. Bézian (L. Ginsburg & C. Bulot, 1987); 11. Leiding (A. Hofmann, 1893).

The material available for the studied specimen does not allow for the time being the estimation of its evolutional stage.

Dorcatherium crassum can be identified starting with the Orleanian up to the Vallesian, being a common presence within Astaracian mammalian assemblages.

The record of large mammals present in the diatomic deposits at Miniş support the assumption that these deposits are of late Astaracian age. They are seemingly somewhat older than the ones at Comaneşti 1, the latter deposits having been depicted from a paleofaunistic viewpoint by

M. Feru & alii (1980) and C. Rădulescu & P. Samson (1988) respectively They belong to the lowest half of biozone MN 8.

The volhynian age of the deposits may also be accounted for by the malacological paleofauna of the diatomites present here, such as: *Cardium lithopodolicum, C. lithopodolicum sarmaticum, C. vindobonense vindobonense, Mactra vitaliana eichwaldi. Abra reflexa, Pirenella picta mitralis, P. disjuncta disjuncta* (R. Givulescu & L. Rűffle, 1986).

The species mentioned confirm the environment pattern suggested before for this area (V. Codrea & alii, 1991 a, b). It must have been a closed forest environment, in a rather warm climate, characterized by gallery forests bordering the Zarand gulf basin. *Dorcatherium* is a good indicator of such of paleoenvironment (W. Wagner *fide* P. y. Sondaar. 1974). The same forest environment (with a tendency towards swamps) is also typical for *Alicornops simorrense*.

Few data are available on the paleofloristical elements preserved within the diatomites. A single fossil remain collected from andesitic tuffs and representing a foliar print (kept in the collection of Ţării Crişurilor Museum in Oradea) has been recorded so far in a paper (R. Givulescu & L. Rűffle op. cit.). It has been assigned to *Zanthoxylon europaeum* Unger, which reaches here its easternmost limit of distribution.

Noteworthy for paleogeographical interpretations is the fact that the findings from Miniş represent new species for the paleofauna of our country, also providing new details with regard to the distribution area they covered in Europe during the Upper Astaracian.

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We dedicate this paper, not without a pang in our heart, to our ex-collaborator and friend, the late geologist Cornel Dudaş, one of the best specialists in the Miniş deposit, who has left us too early.

BIBLIOGRAPHY

1. Codrea V. Laslo-Faur, Al., Dudaş, C., Hosu, Al., Barbu, O., (1991a) *The first Neinotherium levius Jourdan from the Sarmatian diatomitic-tuffaceous complex at Minişu de Sus (Tăuţ, Arad district). in :* The Volcanic Tuffs from the Transylvanian Basin Romania, 103—109, Cluj-Napoca.
2. Codrea, V., Laslo-Faur, Al., Dudaş, C., (1991b): *Listriodon aff. lockharti* (Pomel) *from the Sarmatian diatomitic-tuffaceous complex at Minişu de Sus (Tăuţ, Arad district).* in: The Volcanic Tuffs from the Transylvanian Basin Romania, 93—102, Cluj-Napoca.
3. Feru, M., Rădulescu, C., Samson, P., (1980): *La faune de Micromammifères du Miocène de Comăneşti (dép. d'Arad).* Trav. Inst. Spéol. „E. Racovitza", **XIX**, 171—190, Bucureşti.
4. Ginsburg, L., Bulot, Ch., (1987): *Les Artiodactyles sélénodontes du Miocène de Bézian à La Romieu (Gers).* Bull. Mus. natn. Hist. nat. Paris, 4 sér., **9**, C, **1**, 63—95, Paris.

5. Givulescu, R., Rüffle, L., 1986: *Zanthoxylon europaeum* Unger 1847 *in der fossilen Flora Rumäniens.* Docum. natur. **33**, 47—49, München.
6. Guérin, C., (1980): *Les Rhinocéros (Mammalia, Perissodactyla) du Miocène terminal au Pléistocène supérieur en Europe Occidentale. Comparaison avec les espèces actuelles.* Doc. lab. Géol. Lyon, **79**, fasc. **1**, **3**, 1182 p. Lyon.
7. Guérin, C., (1982): *Première biozonation du Pléistocène européen, principal résultat biostratigraphique de l'étude des Rhinocerotidae (Mammalia, Perissodactyla) du Miocène terminal au Pléistocène supérieur d'Europe Occidentale.* Geobios, **15/4**, 593—598, Lyon.
8. Guérin, C., (1988): *Contributions à l'étude du gisement miocène supérieur de Montredon (Herault). Les grands mammifères.* **6**. *Les perissodactyles rhinocerotidae.* Palaeovertebrata, Mém. extr., 97—134, Montpellier.
9. Heissig, K., (1976): *Rhinocerotidae (Mammalia) aus der Anchitherium-Fauna Anatoliens.* Geol. Jb., *w*, **19**, 121 S, Hannover.
10. Hofmann, A., (1888): *Beiträge zur Säugetierfauna der Braunkohle des Labitschberges bei Gamlitz in Steiermark.* Jahr. d.k.k. geol. Reich., **38/4**, 545—562, Wien.
11. Hofmann, A., (1893): *Die Fauna von Göriach.* Abh. d.k.k. geol. Reich., **15/6**, 87, S, Wien.
12. Istocescu, D., (1971): *Studiul geologic al sectorului vestic al bazinului Crişului Alb şi al ramei Munţilor Codru şi Highiş.* Inst. geol., St. teh. ec., Ser. J, **8**, 201 p, Bucureşti.
13. Istocescu, D., Istocescu Felicia, (1974): *Consideraţii geologice asupra depozitelor neogene ale baz. Crişurilor.* St. cercet. Geol., Geof., Geogr., **19**, 115—127, Bucureşti.
14. Lungu, A. N., (1984): *Gipparionovaja fauna srednego sarmata Moldavii (Kopy nyo mlekopitajuscie).* Stiinca, 144 p, Kisinev.
15. Made, van der J., (1989): *The bovid* Pseudoeotragus seegrabensis *nov. gen., nov. sp. from the Aragonian (Miocene) of Seegraben near Leoben (Austria).* Proc. Kon. Ned. Akad. v. Wet., B, **92/3**, 215—240.
16. Mottl, Maria, (1961): *Neue Säugetierfunde aus dem Jungtertiär der Steiermark. Die* Dorcatherium *(Zwerghirsche) der Steiermark.* Mitt. d. Mus. f. Berg. Geol. u. Tech. am Landesmus. „Joanneum", **22/8**, 21—71, Graz.
17. Mottl, Maria, (1964): Dorcatherium *aus dem unteren Sarmat von St. Stefan im Lavan al.* Carinthia II, Mitt. d. Naturwiss. Ver. f. Kärn., **74**, 22—24, Klagenfurt.
18. Mottl, Maria, (1966): *Neue Säugetierfunde aus dem Jungtertiär der Steiermark. VIII Eine neue unterpliozäne Saugetierfauna aus der Steiermark.*, Mitt. d. Mus. f. Berg. Geol. u. Tech. am Landesmus. „Joaneum", **28**, 103—132, Graz.
19. Nicorici, E., (1976): Trilophodon angustidens (Cuvier) *din Sarmaţianul inferior de la Minişul de Sus (Bazinul Zarandului).* D. S. Inst. geol., **LXII/3**, 77—79, Bucureşti.
20. Pavlovic, B. M., (1969): *Miozän-Säugetiere des Toplica-Beckens.* Ann. Géol., Pén. Balk., **34**, 377—394, Beograd.
21. Rădulescu, C., Samson, P., (1988): *Les cricétidés (Rodentia, Mammalia) du Miocène (Astaracien supérieur) de Roumanie.* Trav. Inst. Spéol. „Emile Racovitza", **XXVII**, 67—78, Bucureşti.
22. Roman, F., Viret, J., (1934): *La faune de Mammifères du Burdigalien de La Romieu (Gers).* Mém. Soc. géol. France, nouv. sér., **IX(21)**, 67 p., Paris.
23. Santafé-Llopis, J. vte, Casanovas-Cladellas, M.L., Alferez, Delgado Fco. (1982): *Presencia de* Aceratherium tetradactylum (Lartet, 1837) *y* A. (Alicornops) simorrense (Lartet, 1851) *(Mamm. Perissodactyla en el Valleciense inferior de Nombrevilla (Daroca, Teruel)* Acta Geol. Hisp., **17/1—2**, 63—76, Madrid.
24. Sickenberg, O., Becker-Platen, J. D., Benda, L., Berg, D., Engesser, B., Gaziry, W., Heissig, K., Hünermann, K. A., Soudaar, P. Y., Schmidt-Kittler, N., Staesche, U., Steffens, P., Tobien, H., (1975): *Die Gliederung des höheren Jung tertiärs und Altquartärs in der Türkei nach Vertebraten und ihre Bedeutung für die internationale Neogen-Stratigraphie.* Geol. Jb., B, **15**, 167 S, Hannover.
25. Sondaar, P. Y., (1974): *The* Hipparion *of the Rhone Valley.* Geobios, **7/4**, 289—306, Lyon.
26. Tobien, H., (1963): Dorcatherium KP *und* Heteroprox ST *(Partiodactyla, Mamm.) aus der miozänen Kieselgurlagerstätte von Beuern im Vogelsberg (Kr. Giessen).* Notizbl. hess. L.-Amt Badenforsch. **91**, 7—15, Wiesbaden.