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A NEW PLEISTOCENE LOCALITY WITH CONTINENTAL MOLLUSKS AND MICROMAMMALS IN STRYMON BASIN (MACEDONIA, GREECE)

G. Syrides* and K. Koliadimou*

ABSTRACT

A new fossiliferous site with continental mollusks and micromammals has been found in the area of the village Dimitra in the Strymon basin, Macedonia, Greece. The fossiliferous deposits outcrop in the upper part of a river terrace. These deposits were formed in a small river marsh and possibly they are synchronous with or slightly older than the river terrace. The fossils allow the dating of the deposits and subsequently of the river terrace as Late Pleistocene.

ΣΥΝΟΨΗ

Εξετάζεται μία νέα απολιθωματοφόρος θέση με χερσαία μαλάκια και μικροθηλαστικά, που βρέθηκε στην περιοχή του χωριού Δήμητρα στη λεκάνη του Στρυμόνα, Α. Μακεδονία. Τα απολιθωματοφόρα ιζήματα, εμφανίζονται στο ανώτερο τμήμα του πρανούς μιας ποτάμιας αναβαθμίδας. Αντιπροσωπεύουν ιζήματα μικρού ποτάμιου έλους που σχηματίστηκε μέσα στην κοίτη, και πιθανώτατα είναι ισόχρονα ή ελάχιστα αρχαιότερα από το σχηματισμό της αναβαθμίδας. Με βάση τα απολιθώματα που συλλέχθηκαν και προσδιορίστηκαν, τα ιζήματα και η ποτάμια αναβαθμίδα μπορούν να θεωρηθούν Ανωπλειστοκαινικής ηλικίας.

INTRODUCTION

Strymon basin is an elongated NW-SE trending tectonic depression which was possibly formed during early-middle Miocene (PSILOVIKOS & SYRIDES, 1983, 1984; LALECHOS & SAVOYAT, 1977; ARMOUR-BROWN et al., 1977; KARISTINEOS, 1984; PSILOVIKOS & KARISTINEOS, 1986). It was gradually filled up by Neogene-Quaternary clastic sediments. According to borehole data the thickness of these sediments is more than 3.5 km (LALECHOS, 1986). Younger tectonism faulted these sediments. In the central part of the basin the plain of Strymon river was formed. Around the plain a hilly terrain consisting of Neogene sediments was developed. The creation of new relief triggered a new erosional cycle on the hilly terrain. Into the newly opened valleys several river terraces have been formed.

In one of the above mentioned river terraces a fossiliferous site with continental mollusks and micromammals was found. The first data concerning the lithostratigraphy, the fauna, the age of the deposits and the dating of the river terrace are given. Some indications about the palaeoenvironment are also discussed.

* Aristotle University of Thessaloniki, School of Geology, Department of Geology and Physical Geography, 540 06 Thessaloniki, Greece.

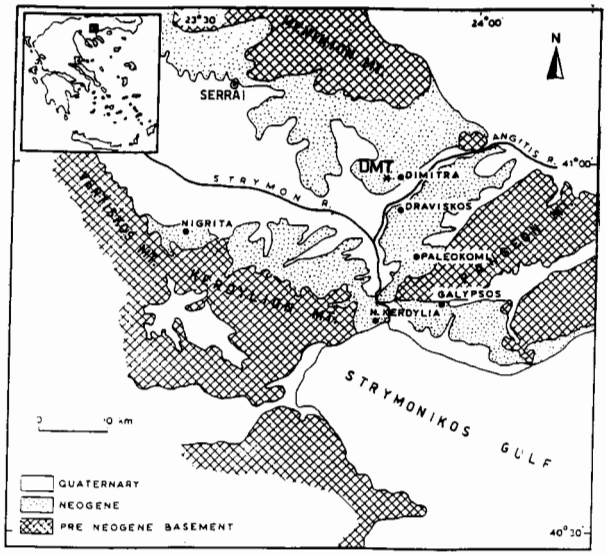

Fig. 1: Geological sketch map of Strymon basin with the new fossiliferous locality DMT(*).

Σχ. 1: Γεωλογικό σκαρίφημα της λεκάνης Στρυμόνα με τη νέα απολιθωματοφόρο θέση DMT (*).

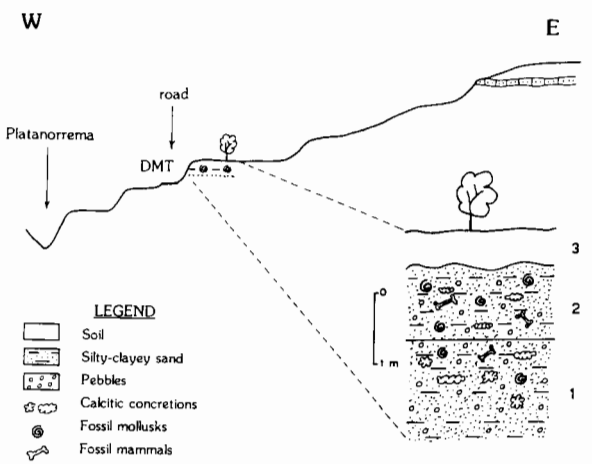

Fig. 2: Schematic profile of the Platanorrema ravine indicating the river terraces, the place and the lithostratigraphic column of the fossiliferous locality DMT.

Σχ. 2: Σχηματική μορφολογική τομή της κοιλάδας του Πλατανορρέματος με τις ποτάμιες αναβαθμίδες, την τοποθεσία και την λιθοστρωματογραφική στήλη της απολιθωματοφόρας θέσης DMT.

LITHOSTRATIGRAPHY AND FAUNA

The new fossiliferous site is situated about 2 km westwards of the village of Dimitra in a hilly terrain. The locality was named "Dimitra-2" (DMT) (Fig. 1). Along the valley-sides of "Platanorrema" several succesive river terraces occur (Fig. 2). The Platanorrema ravine cuts Neogene deposits, in a total thickness of about 150 m (SYRIDES 1993).

In the upper parts of the ravine a consolidated red-brown conglomerate occurs. In a road cutting a small section outcrops (Fig. 2). The lithostratigraphy of this small outcrop from the bottom to the top is:

1. Grey silty-clayey sands with few rounded small (2-3 cm) pebbles, and a lot of small (1-2 cm) calcitic concretions.

2. Dark brown to grey-black, massive, silty-clayey sands with several scattered pebbles, fragments of mollusks, root traces and plant remnants.

3. Soil.

The texture of these sediments indicate marshy deposits.

Several sacks of sediment sampled from the bed 2 and few sacks from the bed 1 were washed separately for mollusks and micromammals. The checking of the residue gave a lot of mollusk fragments, some micromammals, and fragments of reptile's jaws. Numerous calcitic concretions and encrustations on plant remnants, mollusk shells and micromammalian remnants, were also observed. The fauna includes the following species:

MOLLUSKA

GASTROPODA

PROSOBRANCHIA-Bithyniidae: *Bithynia* sp.

Thiaridae: *Amphimelania* cf. *holandri* (FERUSSAC, 1823),

PULMONATA-Succineidae: *Succinea* sp.

Vertiginidae: *Vertigo pygmaea* (DRAPARNAUD, 1801)

Pupillidae: *Pupilla* sp.

Valloniidae: *Vallonia* sp.

Enidae: *Chondrula* cf. *tridens* (MULLER, 1774)

Clausiliidae ind.

Helicidae ind.

BIVALVIA-Sphaeriidae: ?*Pisidium* sp.

MAMMALIA

RODENTIA: Arvicolidae: *Arvicola* cf. *terrestris* (LINNAEUS, 1758), *Microtus* cf. *arvalis* (PALLAS, 1779)

Muridae: *Apodemus sylvaticus / flavicolis* group

Muridae ind.

Sciuridae: *Spermophilus citelloides* (KORMOS, 1916).

All the above mentioned fossil material was found in the bed 2. In the bed 1 few fragmentary teeth of sciurids and arvicolids, as well as some shells of *Vertigo* sp., *Pupilla* sp., *Vallonia* sp. were found.

REMARKS ON THE FAUNA

The mollusks are represented by nine (9) families of gastropods and one of bivalves. The first collected material includes very small-sized shells and fragments of bigger shells.

Prosobranch gastropodes are represented by few material. An ovoid with broken lip shell was determined as *Amphimelania* cf. *holandri* (FERUSSAC, 1823) (Pl.I,2). Few calcareous pointed at the top with concetric growth lines operculi indicate the existence of *Bithynia* sp. (Pl. I,1).

Plumonate gastropodes are the vast majority of the fauna with abudant small sized (<3mm) shells. Few broken shells with very rapidly enlarging whorls belong to the genus *Succinea* (Pl. I,3). Several very small ovoid shells, with convex whorls and slightly thickened mouth with 5 teeth (1 parietal) and strong transverse rib, were determined as *Vertigo pygmaea* (DRAPARNAUD, 1801) (Pl. I,4). Few small cylindrical to ovoid shells of *Pupilla* sp.(Pl.I,6)as well as several small discoidal shells of *Vallonia* sp. (Pl.I,7)were also found. The majority of the material contains fragmentary shells of *Chondrula*. Although the material is broken the recovery of numerous mouth fragments, allows the recognition of the angular, parietal, subcolumellar and palatal lamellas. According to the aperture morphollogy the material can be determined as *Chondrula* cf. *tridens* (MULLER, 1774) (Pl.I,5). The family Clausiliidae is represented by several fragments of broken sinistral spires preserving the apex and some whorls with transverse ribbed decoration. Few fragments of the aperture, with their lamellar morphology indicate the existence of more than two genera. The family Helicidae is represented by numerous indetermined fragments of big shells and few of smaller shells.

The bivalves are represented by a small (3 mm) complete valve and two fragments of Sphaeriidae. The morphology of the hinge dentition is very similar to that of *Pisidium* sp.

Micromammals are abudant in DMT but few are complete teeth. The material includes sciurids, arvicolids and murids. Among them the sciurids are abundant including 8 complete teeth and many fragments. The DMT sciurids

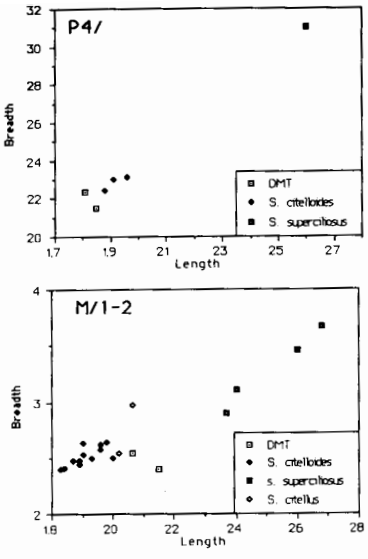

Fig. 3: Scatter diagrams of the width of the posterior lobe against the lengt. Measurements for *S. citelloides* and *S. superciliosus* from BLACK & KOWALSKI (1974).

Σχ. 3: Διαγράμματα διασποράς του πλάτους του οπίσθιου λοβού ως προς το μήκος του δοντιού. Μετρήσεις για τα *S. citelloides* και *S. superciliosus* από τους BLACK & KOWALSKI (1974).

have triangular upper molars and romboid lower ones, well developed intermediate tubercles on the crests, absent mesostyle (upper molars) (Pl.II,4,5,6) and ectostylid (lower molars) (Pl. II.1,2,3) (ORLOV, 1968; PIVETEAU, 1958; CHALINE, 1973). These characters allow the distinction from the genera *Sciurus* and *Marmota* while they suggest closer relationships with *Spermophilus* CUVIER, 1825. The sciurid cheek teeth from DMT are small (Fig. 3) and hypsodont. P_4 (Pl. II.1) has two large roots. The posterior root extends along the posterior border of the tooth. These characters are similar to those of *S. citelloides* (KORMOS, 1916). The DMT *Spermophilus* differs from the late Pleistocene *S. superciliosus* (KAUP, 1839) in size (Fig. 3) and in the number of the P_4 roots (BLACK & KOWALSKI, 1974). It also differs from the recent *Spermophilus citellus* in the P_4 morphology. The dimensions and the teeth morphology allow to suppose that the DMT sciurids can be consider as *Spermophilus (Citellus) citelloides*. The arvicolids are represended by two species *Arvicola* cf. *terrestris* (LINNAEUS, 1758) and *Microtus* cf. *arvalis* (PALLAS, 1779). The material of *Arvicola* is fragmentary and only two complete teeth (Pl. II.8,9) and a fragment of M_1 (Pl. II.7) can be identified. *Arvicola* evolved from *Mimomys* (HINTON, 1926; CHALINE, 1974; RABEDER, 1981; NADACHOWSKI, 1982,1990; HEINRICH, 1990); the proposed evolutionary line is *Arvicola cantiana* - *Arvicola cantiana/terrestris* - *Arvicola terrestris*. *Arvicola cantiana* follows the *Mimomys* enamel pattern, *Arvicola cantiana- terrestris* is an intermediate form and *Arvicola terrestris* follows the *Microtus* enamel pattern. In the last species the enamel of the lower molars becomes thicker in the anterior and thinner in the posterior wall of the salient angles (HEINRICH, 1990). The morphological features of the DMT material indicate similarities with *Arvicola terrestris*. *Microtus* is represented by six fragmentary teeth. The material is badly preserved and the determination is based on the morphological features of M_1 (Pl. II.10,11) and M^3 (Pl. II.12). The DMT *Microtus* differs from *M. agrestis* (LINNAEUS, 1761) in the morphology of the anteroconid complex (ACC) and the symmetrical development of the M_1 saglient angles; It differs from *M. nivalis* (MARTINS, 1842) in the absence of the triangular communication and the morphology of the anteroconid complex (NADACHOWSKI, 1982; CHALINE, 1974). The above mentioned characters of the DMT microtine are similar to those of *Microtus arvalis* (PALLAS, 1779). However, it is referred as *M.* cf. *arvalis* because of the bad preservation and the few material. Three fragmentary teeth of murids have been found in the DMT fauna. The small size, the position of t12 in M^2 (Pl. II.14) the position and the shape of the terminal hill and of the posterior accesory cusp, as

well as the presence of a lingual cingulum in M_1 (Pl. II.13) indicate that the DMT murid belongs to *A. sylvaticus/flavicolis* group. However the poverty of the material, as well as the similarity in morphological features and size of *A. sylvaticus* and *A. flavicolis* does not allow idendification of the species. There are also some fragments of teeth of a second murid species in the DMT fauna. We hope that further collection will provide more data.

BIOCHRONOLOGY - PALAEOENVIRONMENT

The material from DMT provides some information about the age of the fauna and some indications about the palaeoenvironment. The DMT mollusk fauna does not include any characteristic species for a certain age determination. All the genera are living today. *Bithynia*, *Succinea*, *Vertigo pygmaea*, *Pupilla* and *Pisidium* are present in the Pleistocene lignitic deposits of Megalopolis and are still living (SCHUTT et al., 1985), while *Chondrula tridens* is mentioned by SCHUTT (1985) from the Pliocene continental deposits of Asia Minor. However, the mollusks from DMT give remarkable indications about the palaeoenvirenment. *Bithynia* lives on stones in stagnant and flowing waters (PFLEGER & CHATFIELD, 1988). *Amphimelania holandri* lives on submerged stones in rivers and streams. *Succinea* lives on permanently wet places and can be considered as amphibious (PFLEGER & CHATFIELD, 1988; KERNEY & CAMERON, 1979). *Pupilla* lives in dry calcareous places and grassland (KERNEY & CAMERON, 1979). *Vallonia* is an open grassy habitat snail but also lives near marshes. *Chondrula tridens* lives in dry open calcareous places, especially in short turfed grassland (KERNEY & CAMERON, 1979). Clausiliidae and Helicidae are two big families of land snails living almost everywhere. Sphaeriidae is one of the few fresh-water bivalve families and include genera living in swamps, river, canals and lakes (PFLEGER & CHATFIELD, 1988).

The DMT micromammals provide some data for the age of the locality as well as for the palaeoenvironment. *Arvicola terrestris* is known from Late Pleistocene until recent (HEINRICH, 1990; RECOVETS, 1990). It is usually living near water, in marsh vegetation and grasslands (PETROV, 1992). *Microtus arvalis* is known since the Late Pleistocene (RABEDER, 1981) and is one of the most common rodents in Europe during this time span. Today it is widely distributed in the fields throughout Europe and lives in meadows, marshlands and along river banks (NADACHOWSKI, 1982; PETROV, 1992). *Apodemus sylvaticus* is known since the beginning of the Pleistocene while *A. flavicolis* is known since the Late Pleistocene (NADACHOWSKI, 1982; FEJFAR & HEINRICH, 1989). During Late Pleistocene *A. sylvaticus/flavicolis* group occurs in many European localities but during Latest Pleistocene this group declines and seems to connected especially with the warmer phases (NADACHOWSKI, 1982). *A. sylvaticus* inhabits shrubs and fields with bushes while it is rarely found in forests (NADACHOWSKI, 1982; PETROV, 1992). On the other hand *A. flavicolis* is a forest mouse; sometimes it can be found outside of the forests in places with trees or bushes (PETROV,1992). According to NADACHOWSKI (1982,1990) two *Spermophilus* species are present in the Late Pleistocene of Europe: the small-sized *S. citelloides* (KORMOS, 1916) and the large-sized *S. superciliosus* (KAUP, 1839). The dental morphology of this two species is similar to that of the recent small-sized *S. citellus* (LINNAEUS, 1766) and *S. suslicus* (GULDENSTAEDT, 1770) as well as with that of the large-sized *S. major* (PALLAS, 1779). Small-sized *Spermophilus* is present in several Late Pleistocene localities in Austria, Hungary, France, Germany, former Czechoslovakia, Poland and European Russia. It is abundantly represented in faunas from fluviatile sediments representing stream and flood

plain deposits. *Spermophilus citelloides* depends on warm climate (BLACK & KOWALSKI, 1974). Today *Spermophilus* is typical inhabitant of steppe-like areas, occuring in pastures and embankments (PETROV, 1992).

The texture and sedimentological characters of the fossiliferous deposits indicate a small marshy environment. The river terraces in the sides of "Platanorrema" indicate alternative periods with higher and lower erosional rates. During periods of diminished erosion river valleys with small marshes developed. In a following period of intensive erosion, the river cuts deeply into the previous deposits and forms a new terrace. In DMT the fossiliferous sediments are located in the top of the deposits of a river terrace. This indicates that the terrace was formed after the deposition of the fossiliferous sediments. Thus the fossiliferous sediments can be concidered as slightly older than or synchronous with the river terrace.

CONCLUSIONS

The presence of *Spermophilus citelloides*, *Arvicola* cf. *terrestris* and *Microtus* cf. *arvalis*, in the DMT fauna indicates a Late Pleistocene age. The fresh water mollusks *Bithynia* sp., *Amphimelania* cf. *holandri* and ?*Pisidium* indicate a constant presence of water (stream or river marsh). In the other hand the fossiliferous sediments reveal marshy palaeoenvironment. The rest of the land snail fauna are representatives of open calcareous grassland (*Vertigo pygmaea*, *Pupilla*, *Vallonia*, *Chondrula tridens*) but with some representatives of more wet places (*Succinea*). The so far collected palaeoenvironmental data indicate the existence in the wider area of DMT of a low hilly terrain with grassy vegetation, drained by several terraced valleys with scattered small marshes in their river beds. The fossiliferous sediments represent marshy deposits and were exposed after the formation of a river terrace. The age of the formation of the river terrace can be considered as slightly older than or synchronous with the fossiliferous sediments. This assumption allow us to date the formation of this river terrace into Late Pleistocene.

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REFERENCES

ARMOUR-BROWN, A., de BRUIJN, H., MANIATI, C., SIATOS, G. and NIESEN, P. (1977). The geology of the neogene sediments north of Serrai and the use of rodent faunas for biostratigraphic control. - *Proc. 6th Coll. Geol. Aegean Reg.*, 2, 615-622.

BLACK, C.C. and KOWALSKI, K. (1974). The Pliocene and Pleistocene Sciuridae (Mammalia, Rodentia) from Poland. - *Acta Zool. Cracov.*, XIX, 19, 461-486, 6pls.

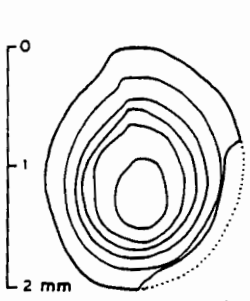
CHALINE, J. (1974). Les proies des rapaces, - *DOIN eds*, 1-141, Paris.

FEJFAR, O. and HEINRICH, W.D. (1989). Muroid rodent biochronology of the Neogene and Quaternary in Europe. - in *Plenum Press (ed.), European Neogene Mammal Chronology*, 91-118, New York.

HEINRICH, W.D. (1990). Some aspects of the evolution and biostratigraphy of Arvicola (Mammalia, Rodentia) in the Central European Pleistocene. - *Geo-*

logical Survey (ed.), Int. Symp. Evol. Phyl. Biost. Arvicolids, 165-182, Prague.
HINTON, M.A.C. (1926). Monograph of the voles and lemmings (Microtinae) living and extinct. - in *R. Clay & Sons (ed.)*, 1-488, London.
KARISTINEOS, N. (1984). Paleogeography of Serres basin (in greek). - Thesis. *Sci. Ann. School Sci.*, Thessaloniki Univ., 10, 23, 1-230.
KERNEY, M.M. and CAMERON, R.A.D. (1979). Land snails of Britain and North-West Europe. - in *Harper Collins (ed.)*, 1-288.
LALECHOS, N. (1986). Correlations and observations in molassic sediments in onshore and offshore areas of Northern Greece. - *Mineral Wealth*, 42, 7-34, Athens.
LALECHOS, N. and SAVOYAT, E. (1977). La sedimentation neogene dans la fosse Nord-Egeenne. - *Proc. 6th Coll Geol Aegean Reg*, 2, 591-603.
NADACHOWSKI, A. (1982). Late Quaternary rodents of Poland with special refence to morphotype dentition analysis of voles. - *Panst. Wydaw. Nauk (ed.)*, Krakow.
NADACHOWSKI, A. (1990). Review of fossil Rodentia from Poland. - *Senckenbergiana biol.*, 70, 4/6, 229-250.
ORLOV, Y.A. (1968). Funtamentals of paleontology (Mammalia). - *Ist Prog. Scient. Transl.* VIII, 1-585, Jerusalem.
PETROV, B. M. (1992). Mammals of Yugoslavia. Insectivores and rodents. - *Nat. Hist. Mus. Belgr. Suppl.*, Sp. issues, vol. 37, p. 1-186, Belgrad.
PFLEGER, V. and CHATFIELD, J. (1988). A guide to snails of Britain and Europe. - in *Hamlyn (ed.)*, 1-216.
PIVETEAU, J. (1958). Traite de Paleontologie VI. - in *Masson et C^ie (ed.)*, vol. 2, 1-943, Paris.
PSILOVIKOS, A., and SYRIDES, G. (1983). Stratigraphy, sedimentation and palaeogeography of the Strymon basin, Eastern Macedonia/N. Aegean sea, Greece. - *Clausthaler Geol. Abh.* 44, 55-87.
PSILOVIKOS, A. and SYRIDES, G. (1984). Neogene and Quaternary palaeoenvironments in the northern Aegean area. - *Ann. Geol. Pays. Hell.* 32, 105-114.
PSILOVIKOS, A. and KARISTINEOS, N. (1986). A depositional sedimentary model for the Neogene uraniferous lignites of the Serres graben, Greece. - *Pal. Pal. Pal.*, 56, 1-16.
RABEDER, G. (1981). Die Arvicoliden (Rodentia, Mammalia) aus dem Pliozan und dem alteren Pleistozan von Niederosterreich. - *Beitr. Palaont. Osterr.*, 8, 1-373, Wien.
RECOVETS, L.T. (1990). Principal developmental stages of the water vole genus *Arvicola* (Rodentia, Mammalia) from the East European Pleistocene, - *Geological Survey (ed.), Int. Symp. Evol. Phyl. Biost. Arvicolids*, 165-182, Prague.
SCHUTT, H. (1985). Kanozoische Landschnecken der Turkei (Kanozoikum und Braunkohlen der Turkei, Nr. 25). - *Arch. Moll.*, 115, 179-223.
SCHUTT, H., VELITZELOS, E. and KAOURAS, G. (1985). Die Quartarmollusken von Megalopolis (Griechenland). - *N. Jb. Geol. Pal. Abh.*, 170, 183-204.
SYRIDES, G. E. (1995). Neogene mollusk faunas from Strymon basin, Macedonia, Greece. First results for biochronology and palaeoenvironment. - *Geobios*, M.S.18: 381-388 (1st European Palaeont. Congress, July,7-9, 1993, Lyon).

PLATE I



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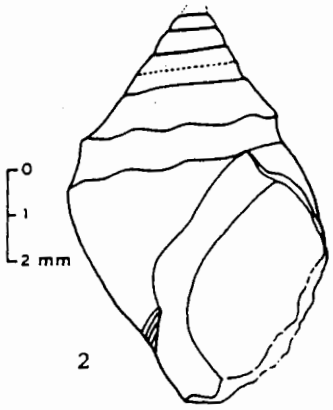

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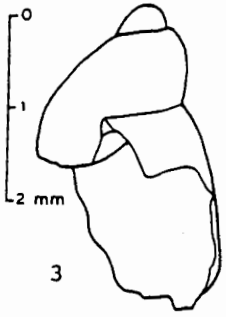

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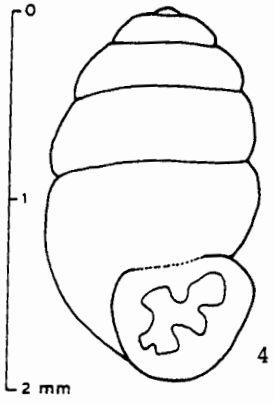

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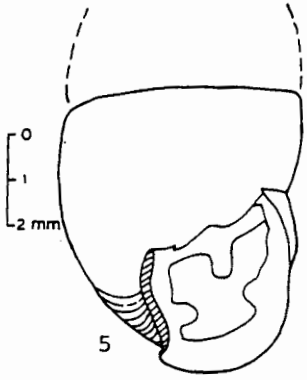

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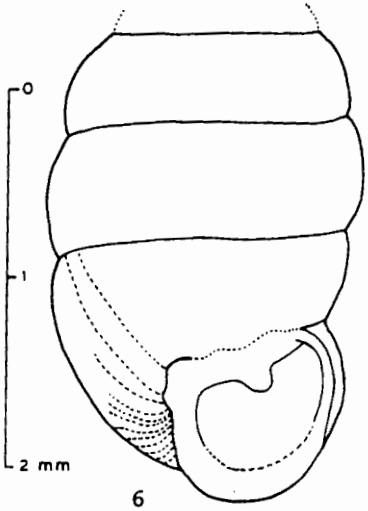

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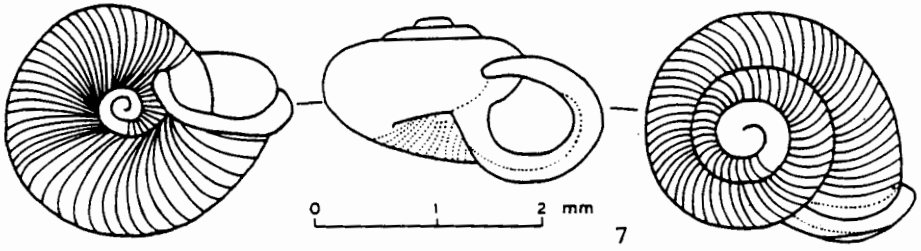

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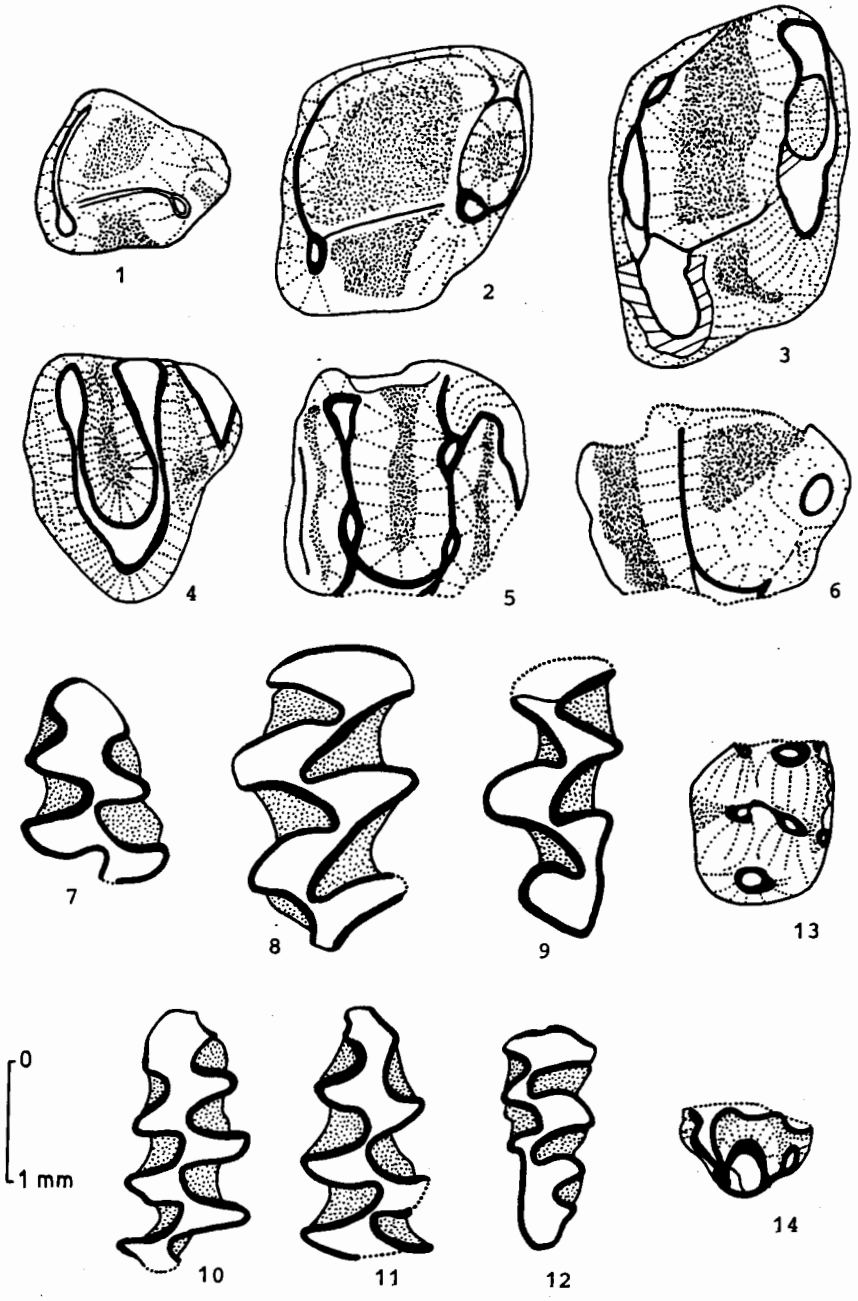
Pl. I: 1. *Bithynia* sp. (operculum), 2. *Amphimelania* cf. *holandri* (FERUSSAC), 3. *Succinea* sp., 4. *Vertigo pygmaea* (DRAPARNAUD), 5. *Chondrula* cf. *tridens* (MULLER), 6. *Pupilla* sp., 7. *Vallonia* sp.

Pl. II:

PLATE II



Pl. II: *Spermophilus citelloides* (KORMOS, 1916) 1. P_4 dex, 2. M_1 dex, 3. M_2 dex, 4. P^4 dex, 5. M^{1-2} dex, 6. M^3 sin; *Arvicola* cf. *terrestris* (LINNAEUS, 1758) 7. M_1 dex, 8. M^1 sin, 9. M^3 sin; *Microtus* cf. *arvalis* (PALLAS, 1779) 10. M_1 sin, 11. M_1 dex, 12. M^3 dex;; *Apodemus sylvaticus / flavicolis* group 13. M_1 sin, 14. M^2 dex.