Romanian Journal of
STRATIGRAPHY

continuation of

DARI DE SEAMĂ ALE ŞEDINŢELOR INSTITUTULUI DE GEOLOGIE ŞI GEOFIZICĂ
COMPTES RENDUS DES SÉANCES DE L'INSTITUT DE GÉOLOGIE ET GÉOPHYSIQUE
(4. Stratigrafie)

Founded 1906 by the Geological Institute of Romania

ISSN 1220-5664

Vol. 76
Supplement Nr. 7
(3 volumes)

Xth. CONGRESS
RCMNS
BUCURESTI • 1995

IUGS, REGIONAL COMMITTEE ON MEDITERRANEAN NEOGENE STRATIGRAPHY
4 – 9 September

ABSTRACTS

VOLUME 1

I.G.R. 45 N 24° E

Institutul Geologic al României
Bucureşti – 1995

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Editorial Office:
Geological Institute of Romania
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The editor has changed the name as follows: Institutul Geologic al României (1910–1952), Comitetul Geologic (1953–1966), Comitetul de Stat al Geologiei (1967–1969), Institutul Geologic (1970–1974), Institutul de Geologie şi Geofizică (1975–1993), Institutul Geologic al României (since 1994).

ROMANIAN JOURNAL OF STRATIGRAPHY supersedes "Dări de Seamă ale Şedinţelor", Series 4/Stratigrafie – the last volume with this title being No. 74.

The manuscripts should be sent to the scientific editor and/or executive secretary. Correspondence concerning advertisments, announcements and subscriptions should be sent to the Managing Editor.

ISSN 1220-5664
Classification index for libraries 55(058)

Printed by the Geological Institute of Romania
Bucharest

Xth CONGRESS OF THE REGIONAL COMMITTEE ON
MEDITERRANEAN NEOGENE STRATIGRAPHY

ABSTRACTS

VOLUME 1

TOPICS:

A. "NEW LIGHTS ON MEDITERRANEAN CHRONOLOGY"
B. "TETHYS - PARATETHYS CONNECTIONS"

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București–1995

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"NEW LIGHTS ON MEDITERRANEAN CHRONOLOGY"
" TETHYS - PARATETHYS CONNECTIONS"

AND

SYMPOSIA:

1. "NEOGENE VOLCANISM; GEOTECTONIC SETTING, VOLCANIC EDIFICES, PROCESSES AND EVOLUTION"
2. "QUANTIFYING GLOBAL CLIMATE IN THE PLIOCENE"
3. "DEFINITION AND CHRONOLOGY OF THE MAJOR NEOGENE TECTONIC EVENTS"
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"EMIL RACOVITA" INSTITUTE OF SPEOLOGY, BUCHAREST";
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"AL.I.CUZA" UNIVERSITY, JASSY.

UNDER THE AUSPICES OF:
INTERNATIONAL UNION OF GEOLOGICAL SCIENCES
SUBCOMMISSION ON NEOGENE STRATIGRAPHY
REGIONAL COMMITTEE ON MEDITERRANEAN
NEOGENE STRATIGRAPHY

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Volume 1

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Xth R. C. M. N. S. Congress, Bucharest 1995

Topic A

New Light on Mediterranean Neogene Chronology

MAGNETOBIOSTRAGAPHY OF THE PLIOCENE CONTINENTAL SUCCESSION OF THE GUADIX-BAZA BASIN (SOUTHERN SPAIN)

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The Guadix- Baza basin is located at the contact between the Internal and External Zones of the Alpine Betic Chain, In Southern Spain, covering an area of 3,000 km^2. Its infilling is made up of about 1,000 m.a.s.l., from the late Miocene (latest Turolian) up to the middle Pleistocene (Toringian). The last few years have brought to light in this at more than a hundred vertebratefossil levels distributed throughout the basin (Agusti, 1986). The set is made up of three thick litostratigraphic units displaying different facies associations (Vera et al., 1986). One is a fluvial unit, the Guadix Formation, which crops out along the edges of the basin in different thicknesses both in space and time. The Gorafe-Huelago Formation is lacustrine and crops out at the western end of the basin, while the third, the Basa Formation, also lacustrine in character, crops out at the eastern end.

Within the Basa Formation, the Galera and Zujar sections were chosen in order to develop biostratigraphic and magnetostratigraphic studies. The Galera section is a hundred meter section located on the eastern part of the basin where carbonates and marls are dominant. In this section three levels provided abundant micromammal faunas that enables us to refer them to the mammalian biostratigraphic scale. The lowermost fossiliferous Galera 1C level has delivered a typical association for the late Alfambrian (MN 15), correlatable with that found in other levels like Laina, Orrios 3 (Teruel basin) and Asta Regia (Guadalquivir basin). On the other hand, the rodent association from Galera 1G is comparable with that found in several late Villanyian sites like Islas Medas, Valdeganga 1-2 and Almenara 1. Finally, at the section, a medium sized *Mimomys* with simple dental pattern is referred to *Mimomys* cf. *savini*. In adition to the section of Galera 1, a detailed correlation with neighboring sections enabled us to place the Galera succession with respect to other significant mammalian localities of the basin displaying large mammalian fauna, like Fuentenueva 1 and Venta Micena.

In order to make feasible a more precise age control of the above mentioned mammalian succession, a paleomagnetic analysis has been carried out in the sections of Galera and Zujar. As a result of this analysis, the lower part of the Galera Section shows three normal and two reversed polarity zones. Upward trough the middle and upper Galera section a major reversed polarity period is followed near the top by a 10 meters thick normal polarity zone. According to these results, the lower part of the Galera section fits well with a part of the Gauss (2An) chorn. The uppermost normal zone found in the Galera section is therefore correlated with the Olduvai (2n) chron.

MESSINIAN PALINOSTRATIGRAPHY OF NORTH-WEST SYRIA

Gajda AJLANI

GIN RAS , Moskow, RUSSIA

In the Al Mirre basin (near Latakia) the Messinian deposits were cut by a number of qurries. They consist of two members: the lower one (up to 10-25 m), mainly saud-day, slightly gypsic, and the upper one (up to 20-30 m) consisting of pure masive gypsum. In the bottom of the lower member V. A. Kurenkova discovered a rich assemblage of planktonic foraminifers, amongst them, *Sphaeroidinella subodehescens*, *Globoquadrina dehiscens owena* and *Globigerinoides conglobatus*. It shows belonging of the complex to the upper part of Globorotalia acostaensis Zone.

In the middle part of clay member, small forms of *Globigerina* genus are predominated including *G. multiloba* , a species met only in Messinian .

The same intervals of clay members, where Messinian foraminifers were recorded, have been studied palynologicaly.

Two palynocomplexes were distingushed. The first one involves in basal and middle parts of clay member, in which the gymnospermes pollen is prevailed. *Pinus* (41-72%) and *Cedrus* (7-19%) are dominated; less are *Picea* (2%), *Abies*, *Ephedre*. Tress and shrub pollen (up to 2%) is represented by single grains: *Fagus, Quercus, Juglans, Carya, Betula, Ulnus, Ilex, Ericareae*. Among herbs (11-37%) : *Compositae* (up to 12%), *Gramineae*, *Chenopodiaceae* (up to 5%), as well as *Cruciferae, Unbelliferae, Plantaginaceae, Polygonaceae*. Spores -up to 8%.

The second palynocomplex from the upper part of clay beds differs by predominance of angiospermes (69-86%). Coniferons pollen is represented by *Pinus* (11-27), *Picea* (up to 5%), *Cedrus* and *Abies* (up to 35), *Ephedre* (up to 4%), *Podocarpus*. Among trees and shrub pollen (6,5%), *Quercus* is dominated (up to 3%), there are present also *Fagus, Betula, Alnus, Juglans, Ericareae*. Among herbs the changes took place: *Cruciferae* (7,5 -30%), *Urticaceae* (2-12%), *Chenopodiaceae* (up to 7,5%); less *Compositae* (5,5%), *Uraminea* and *Umbelliferae* (up to 3%), *Enphorbiaceae*.

The analysis of palynological data on Messinian "under evaporites" part of the North-West Syria permits to make the following conclusions. In Early Messinian, in the monutain regions of Levant coast of Mediterranean, pine - and line - cedars woods are predominated. Coastal open areas were occupied by herbaceous coenosis with participation of *Compositae*, *Graminea* and *Chenopodiaveae*. The climate was relatively arid with season temperature and humidity fluctuations, not much differnd from nowadays climate in these regions. The tendency of increasing aridization upwards the section is registered. *Coniferae* forests migrated to more high latitude zones, and drainaged coastal plains in proportion with development of Messinian regression were occupied by herb associatios well a adapted to salty substratum. Probably the influence of Messinian crisis is not reflected climaticaly so sharply in Levant mountain regions, at least in the first part of this time interval.

Paleoclimatic interpretation for the time of gypsum member deposition may be given on receiving of reliable palynological data, that are not yet to be had on Syria.

REGIONAL STRATIGRAPHIC SCHEME OF NEOGENE FORMATIONS OF THE WESTERN PARATETHYS IN THE LIMITS OF UKRAINE

A. S. ANDREEVA-GRIGOROVICH [1], A. D. GRUZMAN, A. V. IVANINA, Y. O. KULCHITSKY, P. Y. LOZYNYAK, M. I. PETRASHKEVICH, L. A. PORTNYAGINA, S. E. SMIRNOV, N. A.SAVITSKAYA , N.A. TROFIMOVICH, N. Y. SHVAREVA

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Stratigraphic construction of the past years, the results of analisis of analysis of the newest data of geological, geophysical, paleontological, sedimentological data and of materials of drilling on Neogene of Trascarpathian deep, the Folded Carpathians, Precarpathian deepand the south-western ending of East-European platform are the proposed regional stratigraphic scheme of Neogene of the western regions of Ukraine.

In this scheme at modern level a number of questions on dismembering and correlation of Neogene formation have been solved.

1. Correlation of biostratigraphic subdivision of Neogene of the Western Paratethys with Mediterranean scale is fulfilled by foraminifera and nannoplankton.
2. Correlation with the Eastern Paratethys is implimented by nannoplankton.
3. Correlation of Neogene of the Outer Carpathians with the formations of the same age of Polish and Romanian parts of the region is carried out. For the Inner Carpathians such correlation is fulfilled with the sections of Hungariy, Slovakia and Romania.
4. Connections of Sarmatian basins of the Western and Eastern Paratethys are established.

For the Folded Carpathians and Precarpathian deep:

5. Paleogene and Neogene boundary is substantiated paleontologically by planktonic foraminifera, nannoplankton and dinocysts. Basing on the newest materials this boundary lies in the floor of Midlle Krosno and Upper Menilite subsuites.

6. By planktonic foraminifera and nannoplankton, the zones in Egerian-Upper Badenian are singled out.

7. Dismembering of Upper Badenian-Lower Sarmatian by benthos foraminifera is detailized.

8. Stratification of lower molassa of Precarpathian deep is specified: correlation of Slobodka conglomerates with the middle part of Vorotyschy suite is substantiated (according to the present ideas these conglomerates are analogue with the age of Polyanitsa and Vorotyshchy suites). Coarse- cobbled horizon in the floor of Polyanitsa suite in Pockutiye is singled out with the name of Rushor conglomerates.

9. Supposition about facial substitution of Balich suite by the Stebnik suite upper horizons is expressed.

10. In the floor of the upper molassa complex under Tyrassian (gypsum-anhydrite) suite in Bilche-Volitsa zone of Precarpathian deep the thickness, composed by glauconite sandstones below and dark clays in the top, is singled out into Zhurov suite.

11. Badenian stage in Miocene section of the Precarpathians is divided into two substages; the upper one begins with gypsum-anhydrite horizon (Tyrassian suite).

For Transcarpathian deep:

12. Formations of Carpathian regiostage are singled out.

13. In the deep Solotvino part the lowest link of Miocene section (Egerian-Eggenburgian) is established - dark-coloured terrigenous deposits being singled out into Grushev suite.

14. Scheme of Pannonian deposits dismembering is detailized.

15. New structural-facial division of the deep Preneogene basement is proposed.

16. Flora of Upper Badenian formations (Teresva suite) from the sections of the rivers Bolshaya Ugolka and Teresva (Burkalo spring) is monographically processed.

BIOSTRATIGRAPHIE ET PALEOENVIRONMENT DANS LE MIOCENE SUPERIEUR AU BAS-CHELIF
(BASSINS NORD. OUEST D'ALERIE)

Zineb BELHADJ , Houria NAILI

C.R.D.-SONATRACH , ALGERIE

Dans les bassins neogenes Nord-Ouest algerien (bas-chelif) ou la strtigraphie est problematique, plusieurs coupes de terrain ont ete levee et echantillonnees dans le but de definir des d'etage precises dans le Miocene superieur, les microfacies et ainsi leur environnement.

L'abondance et la bonne conservation des foraminiferes planctoniques et benthiques ont permis la reconstitution de la succesion des depot, durant le Miocene superieur (Serravalien-Tortonien-Messinien).

Au debut du Miocene superieur (Serravalien) l'avancee de la mer est materialisee par une serie conglomeratique et gresceuse caracterise par la presence de foraminiferes benthiques indiquant un apport littoral (Elphidium, Lenticuline, Anomalinoide etc....).

A ces facies littoraux succedent des niveaux marneux Tortonien, d'une puissance considerable ou les foraminiferes benthiques du genre Uvegerine et Bulimine temoignent d'un approfondissement du milieu.

Par endroit, cette serie se termine par des niveaux cineritiques qui indiquent une activite volcanique ayant modifie la composition chimique du milieu et conduisant au developpement des depots a radiolaires et diatomees (Marnes a tripolis).

Durant le Messinien un mouvement de surrection general dans le bassin mediterraneen a engendre un confinement et ainsi favorise le developpement des depots evaporitiques.

DETALISATION OF SARMATIAN STRATIGRAPHIC SUBDIVISION IN DNISTER REGION

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For stratigraphic detalisation of Sarmatian we used transgressive-regressive cycles, related with sea-level schanges, sea shore migrantions, sedimental cyclicity, paleoenvironmental and facies changes (solinity, faunistic changes, depth, temperature), as well as biogeochemical changes (isotopes of carbon and oxygen).

Transgresive and regressive phases correspond to relatively warm and cold epechs respectively. During transgressive time, Sarmatian basin was connected with ocean.

Sarmtian stage is subdivided in to 3 subtages: early Lower (Volhynian), Middle (Bessarabian) and Upper (Khersonian). Each subtage consists of 2-3 stratigraphic horisonts, which is represented by respective some trangressive-regressive cycles.

LOWER SARMATIAN (Volhynian) is represented by twe transgressive-regressive cicles, corresponding to twe stratigraphic horisonts: Kouzhorian and Zbruchian. Each of them contains two stratigraphic units (subhorisonts).

Lower Kouzhorian one is represented by trasgressive, rather deep water clays and marbles with mollusc fauna. Upper Kouzhorian shallow water limestones, sands and clay are lagoon regressive facies with reach fossil flora rests of Bouruk (Stefirstsa 1974).

Lower Zbrouchian is transgressive and is represented by limestones with reach mollusc fauna. Volhynian terminates by regression of Upper Zbrouchian.

MIDDLE SARMATIAN (Bessarabian) is represented by 3 horisonts with transgressive-regressive origin: Novomoscovian, Vassilievian, Dnepropetrovian.

Novomoscovian consists of two parts (subhorisonts). Lower (Rybnitsa) with one of pelitomoph-oolit-foraminifera limstones are trasgressive sediments. Upper novomoscovian-trepel-opoka regressive sediments are shallow water and contain poor marine fauna and freshwater molluscs.

HIGH RESOLUTION STRATIGRAPHY AND GEOCHRONOLOGY OF THE LATE MIOCENE IN MOROCCO

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The rhythms of sedimentary cycles reflecting the climatic precession signal and the quasi-periodic obliquity and eccentricity of variation of isotope and carbonate content from the upper Miocene of the Bou Regreg section...that, Morocco, have been analyzed to estimate the ages of the geomagnetic polarity reversals...in the Tortonian/Messinian boundary at 7.04 Ma in a drill core to 5.94 ma at the proposed Pliocene GSSP at Ain el Beida.

The date estimate of 5.94 Ma for the Chron 5/ Gilbert boundary (C3 An.1n/c3r), which occurs near the times of the closure of the Rifean corridor and the beginning of the "drawdown" phase of the Messinian Salinity Crisis, is found to be in close agreement with independent approximations derived from geomagnetic pattern extrapolations by Baksi (1995), radiometric dating for volcanic... in northeastern Morocco (Cunningham et al. (in press), the isotope cyclostratigraphic... Sekleton et al.,(in press), and younger earth-orbital tuning estimates by Hilgen(1991).

A new method of analysis of cycle "signatures" uses adjusted data series as represented by a signal obtained from gray-level traces through image-enhanced photographs of the sediment cycles. The measured "timeless" signal is reduced and geometrically transformed to a signature template in order to compare its pattern with similar time constrained segments of the target precession signal (retrodicted for 35° N). conventional statistical and spectral analysis tests are used to regress to the best possible fit.

BIOZONATION (FORAMINIFERES, RONGEURS), CORRELATION MARIN-CONTINENTAL ET EUSTATISME DANS LE MIOCENE DES BASSINS NW ALGERIENS

Mostefa BESSEDIK, Lancene BELKEBIR, Arbeha AMEUR-CHEHBEUR & Bouhameur MANSOUR

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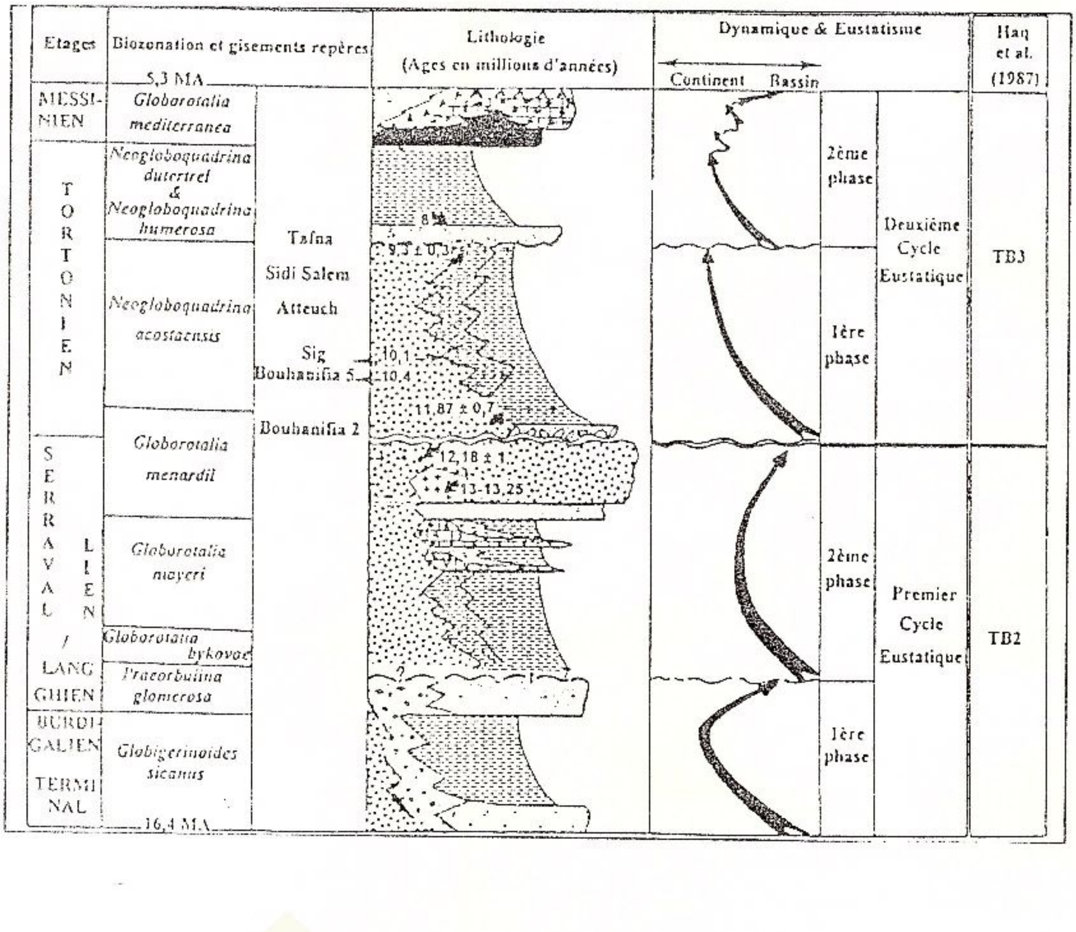
ALGERIE

Les recherches paleontologiques (foraminiferes, rongeurs) realisee dans les bassins nord-ouest algeriens (Chelif, Tafna) revelent huit biosones a foraminiferes planctoniques *(Globigerinoides sicanus* a *Globorotalia mediterranea).* Cette echelle correspond, pour le domaine marin, a une fourchette de temps allant du Burdigalien terminal au Messinien. Certains depot continentax a intermedes marins semblent etre burdigaliens a langhiens; d'autres sont nettment langhiens-serravalliens ou serravalliens correspondent a la biozone a *Globorotalia mayeri,* en l'absence de *Globorotalia peripheroronda* et la rarete de *Globorotalia bykovae.* Au Miocene superieur, les depots contintaux vallesiens a passes cineritiques de bouhanifia et de la Tafna corespondent a la succession des gisements a rongeurs de bouhanifia 2 (posterieur a 12,18 1 Ma), de bouhanifia 5(10,4 Ma), de Sig (10,1 0,7 Ma), de Feid El Atteuch (entre 10,1 et 9,7 0,7 Ma), de la Tafna et de Sidi Salem (anterieurs a 8 ou 8,3 Ma), les cinerites (11,87 0,7 Ma) intercalees dans la serie marine permettennt de cerner la base de la biozone a *Neogloboquadrina acostaensis* (ou limite N15/N16). La limite Serravallien-Tortonien est reperee au sein de la biozone a *Globorotalia menardii,* entre 13 a 13,25 et 11,25 et 11,87 0,7 Ma. L'age radiometrique obtenu (9,3 0,3 Ma) dans les cinerites situees sous les marnes bleues vieillit davantage la partie superieure de la biozone N16.

En cosequence, deux cycles eustatiques miocenes y sont mis en evidence, separes, par une discontinuite majeure (limite Serravallien-Tortonien), bien reperee au sein de la biozone N15 dont la limite inferieure est estimee entre 13 et 13,25 Ma. Le premier cycle debute au Burdigalien terminal et s'acheve au Serravallien superieur. Il peut etre subdivise en deux pulsation eustatiques, correspondant assez bien au cycle TB2 de Haq et al. et notamment sa partie TB2.3. (Burdigalien terminal-Langhien).

Le deuxieme cycle eustatique est compris entre les Biozones a *Globorotalia menardii* et *Globorotalia mediterranea.* Une pulsation transgressive (Tortonien superieur) notee vers 8 Ma, a la limite des biozones N16/N17 permet d'y individualiser deux phases eustatiques; la premiere, d'age tortonien, connait la concomitance de trois environnements: marins, marins de transition et continentaux; la deuxieme phase (Tortonien et Messinien) accuse un debordement important par rapport au bassin (migration de l'onlap) pour setendre sur l'arriere-pais. Si son maximum d'evolution est couronne par l'instalation des plates-formes carbonatees (recifs coralliens) messiniennes, elle enregistre au Messinien superieur une regression nette avec la mise en place d'un regime sedimentaire detritique et evaporitique. Le deuxieme cycle eustatique correspondrait assez bien au TB3 de Haq et al. (1987) dont la limite des phases 1 & 2 peut etre confondue avec la limite TB3.1 -TB3.2.



LA BIOSTRATIGRAPHIE DES DEPOTS DE MIOCENE EN ALBANIE, BASSE SUR LES NANNOFOSSILES CALCAIRES

Lavdie COBAJ

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Les depots de Miocene en Albanie se trouvent essentiellment dans la zone Ionienne, la Depression Preadriatique, la Depression Albano-Thessalienne (Albanie Sud, Sud-Ouest). Un grand nombre d'echantillons des coupes et des forages disperses presque dans tout le territoire d'Albanie, ont ete object d'etude de nannafossiles calcaires, foraminiferes planctoniques et spores et pollenes. Ces etudes et la richesse des depot en organismes, ont permis d'etablir une echelle biostratigraphique fine.

Les depots d'Aquitanien se presentent par des argiles avec des intercalations de couches de silts et de gres. Les argiles et les marnes sont recontrees au Burdigalien, ou ces dernieres predominent. Les associations de nannofossiles calcaires dans ces niveaux sont tres riches de petites tailles, mais pas diversifiees. *H. carteri, H. mediterranea, H.ampliaperta, C. pelagicus, S. conicus, S. dissimilis, S. moriformis, C. floridanus*, etc., sont les especes plus typiques. La rarete des marqueurs *T. carinutus, D. druggii* rend difficile L'aplication des zonations de Martini 1970 et Okada & Bukry 1980. Par concequence deux nouvelles zones (a D. deflandrei, a D. hesslandii) sont donnees en appuyant a L'apparitio de H. carteri, les disparitions de *S. conicus, S. dissimilis* et l'apparitions de H. ampliaperta. L'extinctions de ce dernier a aide de dater la limite Burdigalien-Langhien.

Le Langhien se caracterise par des argiles et des marnes, alors que le Serravallien par des argiles avec des couches de calcaires lithothamniques et de gres. La diversite des

associations de nannofosssiles commencant du Burdigalien superieur, devienne evident au Miocene moyen. L'apparition de D. exilis permrt d'identifier l'age Langhien. Dans ces depots les zones de NN5 a NN7 sont reconnues. Il faut noter que C. coalitus et *D. kugleri* sont rares. Les individus de ce dernier sont atipyques . La disparition de *S. heteromorphus* dans les echantillons etudies est notee a la basse du Serravallien.

Dans la partie inferieure du tortonien, on observe des argiles, qui se remplacent graduelement par des gres massives. Au Messinien aussi les gres deviennent frequents. Ils s'intercalent par de minces couches de silts et d'argiles. En Albanie Sud-Ouest des couches de gypses sont presentes au Messinien supereur. Les associations de nannofossiles calcaires sont riches au niveaux du Miocene superieur, mais en passant aux niveaux plus recents, elles s'apauvrissent par la crise du Messinien. Les especes *D. hamatus, D. bellus, D. pentaradiatus, D. quiqueramus, D. surculus, H.. orientalis, S. verensis, S. abies, C. tricorniculatus* etc., sont caracteristiques pour ces depots. il est a noter la rarete de *D. hamatus,* D. quinquerqamus, T. rugosus, C. tricorniculatus. L'apparition des discoastres a cinq bras est utilsse pour dater le Tortonien, tandis que L'apparition du genre *Ceratolithus* pour le Messinien.

Le phenomene du remaniement est present presque toujours. Il est evident au Miocene moyen et surtout au Miocene supperieur,ou les especes remaniees predominent. Ce phenomene pose des problemes pour traces les limites entre les zones, Qund la disparition des marqueurs est appliquee.

PALAEOENVIRONMENTAL SIGNIFICANCE OF THE MICROFLORISTIC AND FAUNISTIC ASSEMBLAGES FROM THE SARMATIAN DEPOSITS AT MINISU DE SUS, WESTERN ROMANIA.

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In Early Sarmatian (Volhynian), the gulf-like basin of Zarand had some different depositional features if comparing to what is known on the Romanian territory for this age.

Extremely interesting profiles could be found in some quarries exploiting diatomites, mainly in Birzavita II one. The pile of Volhynian deposits is represented by an alternation of diatomite and piroclastic materials, resting discordantly over an older basement.

Volhynian volcanic activity determined releases of important amounts of siliceous-rich solution, either as hydrothermal or watering origin. Under the influence of these solution, in the neighboring basinal areas, some diatom blooming episodes were recorded. The depositional environment had a restrictive evolution with large fluctuations of sea-level and salinity. Some important anoxic events are marked by fish mortality levels. The environment was a low-dynamic one, the sediments being accumulated over the fair wave base. Fresh-water input was sometimes important.

Two types of diatom associations are present. The first one, nearly uniform, includes forms belonging to the following genera: *Melosira, Fragillaria, Cymbela, Synedra,* a. s. o.

This association indicates brackish waters. Next to the diatoms, *Chrisomonadines* and fragments of sponge spicules are present. The second association, sharply different from the first one, is more varied: *Paralia sulcata, Chaetoceros* (several species), *Auliscus caelatus, Achnantes baldjikii, Cocconeis scutellum, Navicula* (several species), *Anaulus simplex, Rhopalodia gibberula,* a. s. o. *Archaeomonadinae, Silicoflagellidae* and *Ebriidae* join to these diatoms. It proves the existence some marine-brackish water levels.

A vertebrate association was discovered in the upper part of the profile. It includes: proboscideans *(Gomphotherium angustidens, Deinotherium levius),* an acerathere (aff. *Alicornops simorrense),* a water-chevrotain *(Dorcatherium crassum),* a suid *(Bunolistriodon* aff. *lockharti),* turtles *(Trionyx),* cetaceans *(Delphinodea indet.),* fishes. The terrestrial mammals are forest-dwellers, proving a forest bordering the riparrian regions of the gulf-like basin, probably in a warm-temperate and wet climate.

INTEGRATED STRATIGRAPHY OF THE TORTONIAN-MESSINIAN BOUNDARY: OF THE PIETRASECCA SECTION (CENTRAL APENNINES, ITALY)

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The Pietrasecca section is located the in Carseolani Mts., about 50 km NE of Rome. This area is characterised by pre-orogenic Mezo-Cenozoic shallow-water carbonates which are overlain by Late Miocene syn-orogenic terrigenous deposits. From a structural point of view, in the area is recognizable a NE vergent macro-anticline with a NW plunging axis (Pietrasecca-Tufo anticline). The Pietrasecca section is located on the forelimb of the Pietrasecca-Tufo anticline.

The section is about 60 m thick; in its lower portion the stratigraphic boundary between the "Calcare a briozoi e litotamni" Fm. and the overhanging Marne a Orbulina" Fm. is recognizable. This boundary points out the change from a carbonate sedimentation to a terrigenous one, which represents the involvement of the Adria foreland in the Apennine chain-foredeep system. In the upper part of the presence of thin turbiditic arenaceous strata indicates the bottom of the "Argilloso-arenacea" Fm. About 36 m above the base of the Pietasecca section an andesitic volcaniclastic level, a few centimeters thick, is interbedded in the marls of the "Marne a Orbulina" Fm.

Biostratigraphy

62 samples have been collected from the "Marne a Orbulina" Fm. and the lower portion of the "Argilloso-arenacea" Fm. On these samples quantitative and semi-quantitative analyses have been carried out, using respectively nannofossil and foraminiferal assemblages. In the basal portion calcareous nannofossil analysis has pointed out the presence of *Discoaster quinqueramus* whose first occurrence (FO) indicates the base of CN 9 zone (Okada and Bukry, 1980) (upper Tortonian). About 33 above the base of the Pietrasecca section the FO *Amaurolithus primus* has been recognized. This event defines the base of CN 9b subzone (Okada and Bukry, 1980) (uppermost Tortonian--Messinian). Finally, 3 m above this event, in a sample located in correspondence of the volcaniclastic level, the FO of A, *delicatus* has been found. This latter event occurs within the CN 9b subzone close to the Tortonian-Messinian boundary (Flores et al., 1992). Foraminiferal analysis carried out on samples collected in the same position of those analyzed for the nannofossil biostratigraphy, has allowed us to recognize the Tortonian-Messinian boundary, since the FO of *Globorotalia conomiozea* has been found. This event which indicates the base of the *G. conomiozea* zone (laccarino, 1985), occurs in correspondence of the sample that recorded the FO of *A. delicatus.* Moreover, in a sample located about 4 m below the FO of *G. conomiozea,* the FO of *G. menardii* form 5 has been recognized. In the lower part of the Pietrasecca section other marker species such as *G. suterae,* whose FO is located about 10 m below the Tortonian-Messinian boundary (base of the *G. suterae* subzone, laccarino, 1985), *Globigerinoides obliquus exstrmus (G. obliquus extremus* zone) and *G. menardii* form 4 have been found.

Magnetostratigraphy

Due to poor outcropping condition it was possible to sample only the upper part of the Pietrasecca section (30 m thick). In order to extend the magnetostratigraphic analysis lower down, the Tufo basso section (7 m thick) has been sampled. This latter section is located a few kilometers NW of the Pietrasecca section, 123 oriented cores have been collected by drilling in situ with standard paleomagnetic sampling techniques. Paleomagnetic samples have been taken with an average spacing of about 30 cm.

The magnetic properties of the analyzed samples are largely due to magnetite. Pilot specimens were progressively AF or thermally demagnetized. The two techniques were equivalent and all the remaining specimens were thermally demagnetized. Demagnetization diagrams generally revealed a stable and well defined ChRM. The ChRM directions and polarity zones show that five polarity reversal are recorded in the Pietrasecca-Tufo basso composite section. Four magnetozones labeled R1-N1 to R2-N2 are well defined. Some samples with normal polarity located within the upper part of the R2 magnetozone have been referred to a short normal polarity event. This event is recorded over a stratigraphic thickness of about 70 cm.

Isotopic analyses (^{40}Ar / ^{39}Ar, ^{87}Sr/ ^{86}Sr)

A ^{40}Ar/^{39}Ar determination on a plagioclase separated from the volcaniclastic level gave a disturbed spectrum, saddle shaped. The obtained chronological information is poor, we can only tell that the age is equal or younger than the age of the saddle bottom, which is 7.17 Ma.

In order to integrate the biostratigraphy and the Magnetostratigraphy of Pietrasecca section an isotopic analysis (Sr/ Sr) has been carried out the foraminiferal assemblages.

Conclusive remarks

In the Pietrasecca section the FOs of *G. conomiozea* and *A. delicatus,* which define the Tortonian-Messinian boundary, have been found in a reverse magnetozone (R2). Within that this biovent has been isochronous and taking into account the results from ODP leg 138 (Eastem Equatorial Pacific), which show the FO of *Amaurolithus* spp. within C3Br.2r (Raffi,1992), it is possible to correlate the magnetozones recognized in the Pietrasecca section with the CK92 GPTS (Cande and Kent, 1992). In addition, sedimentation rates calculated considering different magnetostratigraphic solution show that the identification of R2 with C3Br.2r is the only realistic correlation to the Ck92 GPTS.

In this frame of reference the Tortonian-Messinian boundary recognized in the Pietrasecca section occurs in the uppermost part of C3Br.2r. According to the CK92 GPTS its age is 7,0 Ma while the modified GPTS of Baksi (1993) provides an age of 7,1 Ma.

These age are slightly older than that calculated for the Crete section (6,92 Ma) by Krijgsman et al. (1994).

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AKTSCHAGAYL CARDIIDE AND MACTRIDAE: SYSTEMATICS AND PHYLOGENY

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Mactridae and *Cardiidae* (Bivalves) indicate the marine deposits of Aktschagyl. There are descriptions of more than 200 species of *Cardiidae* and 70- of *Mactridae* and there is no one opinion about number of genera in literature (Andrusow, 1902; A Ali-Zade, 1967, 1969; Starobogatov, 1970; Vasilyeva, 1980; History of Paratethys..., 1986; Paramonova, 1989). Author revised this material for the first time.

1. Subfamily *Lymnocardiinae* Stoliczka, 1871 is subdivided into 6 genera: *Cerastoderma* Poli, 1795 (3 subspecies, 7 species); *Avicardium* Kolesnikov, 1950 (8 species); *Raricardium* Paramonova, 1986 (1 species); *Acobaecardium* Paranova, 1986 (1 species); *Aktschagylocardium* Danukalova, 1990 (4 species).

2. Representatives of *Cerastoderma* played the main role in the history of Aktschagyl *Lymnocardiinae*. *Cerastoderma dombra dombra* inhabitated all the basin from the early Aktschagyl. 10 species and subspecies and 3 endemic genera (*Raricardium, Acobaecardium*, *Miricardium*) are divided from cerastoderma; *Avicardium* was divided from *Miricardium* and *Aktschagylocardium*- from *Avicardium* or *Miricardium* during this time. Development of *Cardiidae* took pats of increase of sizes and smooth out of ribs (*Avicardium*, *Aktschagylocardium*) or strengthening of ribs (*Raricardium, Miricardium*). *Cardiidae* were dimished at in the end of late Aktschagyl in connection of decrease of a salinity; *Cerastoderma dombra dombra* becoms widespread again. Endemic genera become extinct at the end of Aktschagyl. Apsheron *Cardiidae* appeared as descendants of Aktschagyl *Cerastoderma* (Ddavitaschvili, 1933; Astafyeva-Urbaytis, 1963; A. ALI-Zade, 1961, 1973; Popov, 1977).

3. Family Mactridae Lamarck, 1809 is subdivided into 3 genera: Aktschagylia Starobogatov, 1970 (9 Species); Kirghizella Andrussow, 1905 (2 species) and *Avimactra* Andrussow, 1905 which is subdivided into 2 subgenera: Avimactra (Avimactra) Andrussow (1 species) and *Avimactra (Andrussella)* Korobkov, 1954 (1 species).

Representatives of Aktschagylia were the most widespread and frequent particularly at the end of early at the beginning of late Aktschagyl. Endemic genera Kirghizella and Avimactra separates from it the early Aktschagyl. Avimactra has more large shell than others and it inhabited only south parts of basin. The abatement and complete extinction of Mactridae development was at the end of Aktschagyl, which was connected with quick changing of outward condition (distillation of Basin).

5. The migration of Cardiidae and Mactridae took place from south to north parts of basin. An origin of Aktschagyl Cardiidae and Mactridae is an enigma. Probably, their direct ancestors spread in the basin together with early Aktschagyl transgression from south or west areas of Paratethys.

LOWER MIOCENE SILICEOUS MICROFOSSILS FROM THE BENDING ZONE OF EAST CARPATHIANS

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The deposits with the siliceous microfossils of which have been studied for biostratigraphical, paleoecological and paleogeographical interpretations are part of the external facies of the Tarcău Nappe developed at the external part of the bending zone of East Carpathians. They are stratigraphically comprised between the Podu Morii Beds, at bottom, and the Cornu Beds (Lower Gypsum), at top, and comprise, from bottom to top, the following litostratigraphic units: Upper Kliwa sandstone, upper menilites with diatomite, and supramenilitic dysodilic shales. This interval represents generally what was considered to be Upper Oligocene (Grigoraş, 1955, 1960; Popescu 1952) and in the latter years demonstrated to be Lower Miocene on the basis of nannoplankton studies (Lebenzon, 1973; Ştefănescu et al., 1979, Dicea & Dicea, 1980; Melinte 1993).

The presence of diatoms in the upper menilites was documented long ago (Filipescu, 1931, 1936), and the diatom flora was latter studied by Krestel (1970) in her unpublished thesis. In a preliminary paper (Dumitrică, 1989) we reported also the presence of other groups of siliceous microfossils (silicoflagellates, endoskeletal dinoflagellates, ebridians and archaeomonads) in the dysodilic shales intercalated in the Upper Kliwa Sandstone, and discussed their biostratigraphic significance. Encouraged by these findings we have continued the investigations on the whole interval mentioned above. The results have been very conclusive. Sections from several localities have been collected and the following ones have been until present investigated:

a) *Buştenari*, on a left rivulet of the Doftaneţ brook, at cca. 2 km. E of Buştenari village. The brook exposes the Podu Morii Beds, the Upper Kliwa Sandstone in the Buştenari Sand facies and the upper menilites with diatomites.

b) *Văleni de Munte*, the right and left banks of the Teleajen river, downstream the small bridge leading to the Frânghieşti village. The section exposes the same lithostratigraphic units as above.

c) *Valea Muscelului* along the homonymic brook, upstream the village. The interval investigated comprises the upper menilites with diatomites and supramenilitic dysodilic shales.

d) *Muncelu Caramaneşti.* Only the supramenilitic shales, well exposed near the upper border of the village, have been investigated.

e) *Sibiciu de Sus* The section disposed along the Buzău river downstream the mouth of Sibiciu brook, exposes variegate diatomites, Kliwa sands and dysodiles under the Lower Miocene molasse.

f) *Malul Alb quarry,* Sibiciu de Sus. The diatomites of the menilitic horizon has been herein investigated.

One of the results of these investigations is the finding of 3 distinct diatom assemblages:

- a marine assemblage with *Actinoptychus thumii*, corresponding to the Upper Kliwa sandstone,
- a freshwater assemblage with *Melosira praegranulata,* corresponding to the upper menilites with diatomites, and
- a marine assemblage with some freshwater diatoms, corresponding to the supramenilitic dysodiles.

The *Actinoptychus thumii* assemblage is characterised by the abundance or common occurrence of *A. undulatus, A. senarius, A. splendens, A. thumii, A. bifrons* and of many species of other genera. All these species are marine, and many are littoral or sub-littoral. Besides diatoms, the study of which will be made later, the assemblage contains also silicoflagellates, ebridians, endoskeletal dinoflagellates, archaeomonads, sponge spicules, rare phytoliths and sometimes very sparse indeterminable fragments of radiolarians, as follows: *Corbisema flexuosa, Dictyocha fibula, Mesocena elliptica minoriformis, M. apiculata, Naviculopsis navicula, N. quadrata, N.* cf. *biapiculata, Distephanopsis stradneri, D. crux, D. raupii, Distephanus speculum, Canopilus schulzii, Haplohermesinum retrospinosum, Podamphora* sp., *Ammodochium pyramidale, Pseudammochium robustum, Parathranium intermedium, Actiniscus pentasterias, Foliactiniscus folia, F. atlanticus, Cinctactiniscus* cf. *intermedius, Cardifolia onoporoides, C. gracilis,* etc. Many other species, subspecies or even genera are new. The great number of new taxa would suggest a certain endemism of this assemblage. It is, however noteworthy the great similarity between this assemblage and the Lower Miocene assemblages described by Locker & Martini (1989) from North Atlantic at the level of the *Naviculopsis navicula* zone or *Foliactiniscus folia* zone. This would suggest a certain connection with the boreal domain, connection already supposed by Bosniacki

(1911) to explain the boreal forms of the ichtyofauna. Boreal influences are also supposed by the predominance of species of the genera *Distephanopsis* and *Distephanus* over *Dictyocha*.

The *Melosira praegranulata* assemblage is characterized by the abundance of species of the genus *Melosira (M. praegranulata, M. praeislandica)* and of othe freshwater species. The assemblage is similar to the one described by Rehakova (1969) from the freshwater Lower Miocene of the former Czechoslovakia, and is characteristic of the upper menilites and especially of the diatomites so well developed in the Malul Alb Hill at Sibiciu de Sus. This proves the lacustrine nature of these deposits. The assemblage contains also sometimes rare or very rare marine elements (silicoflagellates, ebridians) which probably represent periodical marine influxes. It has been admitted that the dysodilic shales and the menilites correspond to a subsiding system of lagoons (Grigoraş, 1955) wherein the Kliwa sandstone (a mixture of marine and eolian sand according to Filipescu, 1936) represents psamitic accidents or episodes (Dumitrescu, 1952). This interpretation may very well explain the above mentioned characteristics of the diatomites.

The assemblage of the supramenilitic dysodiles has a predominantly marine character. The freshwater diatoms are subordinate, being especially represented by *Melosira spp*. Among the marine species, the following ones could be cited: *Foliactinuscus atlanticus, Calcipedinium hexastylus, Distephanopsis crux parvus, Haplohermesinum schulzii, Hermesinum longispinum, Parathranium intermedium*, etc.

Regarding the biostratigraphic value of the siliceous microfossils, it is noteworthy that many diatom species of the *Actinoptychus thumii* assemblage are common to the Egerian from Wallern, Austria (Rehakova, 1975) or to Lower Miocene from Potor (Czechoslovakia) or from various localities of Hungary (Hajos, 1986). Of a particular value are the silicoflagellate species *Naviculopsis navicula* and N. quadrata found in the upper part of the Upper Kliwa Sandstone from Sibiciu de Sus and Buştenari. These two species are short ranged, their occurrence marking the *Naviculopsis navicula* zone of Marini (1972) or the *Naviculopsis quadrata* zone of Bukry (1981). According to Martini *N. navicula* zone corresponds to part of zone NN2 (*Discoaster druggi* zone) and to zone NN3 (*Sphenolithus belemnos* zone), whereas according to Bukry the *N. quadrata* zone would correspond to the *Sphenolitus belemnos* zone. These data are in agreement with the recent calcareous nannoplankton biostratigraphic data published by Melinte (1993) who included the whole interval studied by us in zone NN2.

POLLEN, PELLETS AND PALEOENVIRONMENT

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Pollen provides the basis both for determining past climates and ecologies and for providing biostratigraphic control in dynamic systems. It has generally been interpreted in terms of the pollen rain in a region, but there are disturbing factors (taphonomic) independent of climate, ecology or sedimentology, that may alter the pollen composition and jeopardize subsequent interpretations. In this respect, pollen spectra of owl pellets are here compared for the first time with the local pollen rain, showing that the pollen distribution in pellets reflects the dietary preference of the owls in terms of their hunting areas and behavior, preferred species prey, and the dietary regimen of the prey species. Pellet accumulations in sediments may then introduce biases in the pollen spectra.

STRATIGRAPHIC FEATURES OF THE MIDDLE MIOCENE FROM THE WESTERN BORDER OF THE TRANSYLVANIAN BASIN

(poster presentation)

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As a part of the western marginal area of the Transylvanian Basin, the Miocene geological units from the eastern limit of the Trascau Massif (Apuseni Mountains) are constituent mainly by siliciclastic deposits and algal-bioclastic (Leitha type) limestones.

The sedimentation of the Garbova de Sus Formation (Lower Badenian) usually started with sands (Garbova de Sus, Moldovenesti, etc.) or microconglomerates (Podeni, Lopedea Veche, etc.) characteristic to a nearshore to beach environment. The development of the limestones started in the "Upper Lagenidae Zone" and ceased at the first part of the Badenian (Langhian), when the chemical deposits occur. The most representative types of facies are the bioclastic (algal, foraminiferal, mollusc, brachiopod, and echinid debris), algal *(Lithothamnium, Lithophyllum, Mesophyllum, etc.)*, and with foraminifera.

The mechanisms of the Middle Miocene transgression have been restored on the basis of the sedimentologic data and the correlation of the sequences. The sediments are structured in two sequences, the first one being dominantly siliciclastic and having a strong coastal onlap, and the second one being mainly carbonatic, with a regressive character.

The detailed examination of the Lower Badenian sequences has shown that the process of the fossil concentration was controlled both by repeated short-term reworking and re-populating of the sea-floor, and by stratigraphic condensation caused by eustatic oscillations in transgressive shallow marine environments. The presence of the big foraminifera *(Amphistegina, Heterostegina)*, of the laminated marls, of the sands with echinids and ostreids (Garbova de Sus), and the diagenetic features, indicate a shallowing tendency and the temporarily establishing of the restrictive-lagoonal environment, beginning to the middle part of the sequence. After a new transgressive event, the shallow marine environment is defined by the presence of ostreids *(Neopycnodonte navicularis)* and rhodoliths. Foraminiferal associations include mostly sublitoral species which occur in fine sediments. Among benthics, there was a huge abundance of "*Lagenidae*", most of the species belonging to the "Upper Lagenidae Zone" of Badenian. The benthic associations also include agglutinated species and a great number of calcareous species. The planktonics belong to the N-9 "Orbulina suturalis Biozone". Microfauna also contain other fossil groups, as the bryozoans *(Cellaria, Crisia),* brachiopods *(Argyrotheca, Megerlia)* and ostracods *(Aurila, Parakrithe, Xestoleberis).* Subsequently the evolution of the facies lead to the deposition of the chemical deposits (Cheia Formation).

The Kossovian deposits were brought to surface in some areas by the fault systems. From a lithological point of view these formations consist of grey-grenish marls with silty levels, tuffitic marls and yellowish tuffs, all about 10 to 15 m thick. The lithological sequence is very close to that outcropping in the Cheia quarry, close to Turda. The Kossovian deposits separated in this area ("Radiolarian shales" and "Spirialis marls") are typical for the Carpathian Domain.

Usually, the Badenian deposits are overlain by the siliciclastites of the Pannonian s.str. (Lopadea Formation), bearing ostracoda. In the northern area (Podeni) occur silty clays, marls and tuffs belonging to the Sarmatian, with rather poor foraminiferal associations (species of *Protelhidium, Bolivina, Elphidium,* and *mysidae)* occur.

A DINOFLAGELLATE CYST BIOZONATION FROM BURDIGALIAN TO MESSINIAN OF THE PRE-ADRIATIC ZONE IN ALBANIA

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The data are concerned with dinoflagellate cysts assemblages occurring in Miocene (from Burdigalian to Messinian) sediments of the Ndroq and Rogozhina sections. The information comes from 170 samples collected from these sections. Samples (80-100 gr.) of sediment were treated with hydrochloric and hydrofluoric acids (HCl, HF), oxidised with nitric acid (HNO_3), treated with potassium hydroxide (KOH), separated by floating in heavy liquid {potassium cadmium iodide solution (CdI_2, 2KI) sp.gr. 2.1}. Canada balsam was used as mounting medium.

The sections are situated in the Pre-Adriatic zone which, from the paleogeographical point of view, represent a depression between two ridges anticlinal. Lithostratigraphy: the Burdigalian deposits consist from clay layers, clays that are intercalated between sandy layers, followed by marls shales and silt layers intercalations. From Langhian to Messinian, deposits consist of clay layers that are intercalated between silt layers and sand beds. In the upper part of the section the sand beds are predominating. From the point of view of dinoflagellates cyst biostratigraphy, these deposits are divided into five dinoflagellate cyst assemblage zones as following:

Zone 1 - Cordosphaeridium cantharellum
Zone 2 - Apteodinium sp.
Zone 3 - Pentadinium laticinctium - Hystricosphaeropsis obscura
Zone 4 - Tuberculodinium vancampoae
Zone 5 - Palaeocystodinium golozwense

The zones are named after particular species that last occur at their tops, or after particular species that first appear at their bases. Many of the occurring taxa are long ranging forms. A biozonation dynoflagellate cyst in the upper part of the sections has not been erected due to the fall of dinoflagellate cyst species per sample.

The five dinoflagellate assemblage biozones described, have been calibrated against planktonic foraminiferal biozones and calcareous nannoplanktonic biozones. Also, the sections are divided into palynomorph assemblages. The distinguishing characteristic of the dinoflagellate assemblages is abundance and diversity cysts from Burdigalian to the lower part of Serravalian and scarcity from the upper part of Serravallian to Messinian. Also, a deep fall of paleogeographic ratio (number of dinoflagellate cysts) / (number of dinoflagellate cysts + number of spores and pollen) % in the upper part of Serravallian reflect the distinctive environment changes. The statistical analysis allows to reconstruct the relationships between dinoflagellate cysts, paleoclimate and paleoenvironment.

PROPOSAL FOR THE DEFINITION OF THE MIOCENE SUPERSTAGES IN THE PARATETHYAN REGION

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The aim of that proposal is to subdivide the Miocene for three superstages which can be correlated in regional, or later , in global scale. The most significant results of the previous stratigraphic studies made with international co-operation, are that the difficulties of regional or global stratigraphic-chronostratigraphic correlation are based on:

- the lack of the real Chronostratigraphic Standard Scale for Miocene and for Neogene
- Miocene standard and regional stages have not yet been defined by GSSP
- the boundaries of the Lower-Middle-Upper Miocene are based on the definition of the stage - boundaries , not on the base of the main changes in the evolution
- The used stratotype sections have been difficult to be positioned in time and space, difficult to correlate intercontinental or world-wide due to:
    - the same time interval is not represented by same facies in different regions / or basins
    - the different rate of the marine, continental and volcanic facies in sedimentary basins/or regions
    - different evolutionary history of the basins
    - different litostratigraphic, biostratigraphic, sequence stratigraphic subdivision of the basins, heterochronity of the boundaries set up by various methods
    - the lack of mega-cycle analysis
    - researches focused on finding boundary points instead of intervals

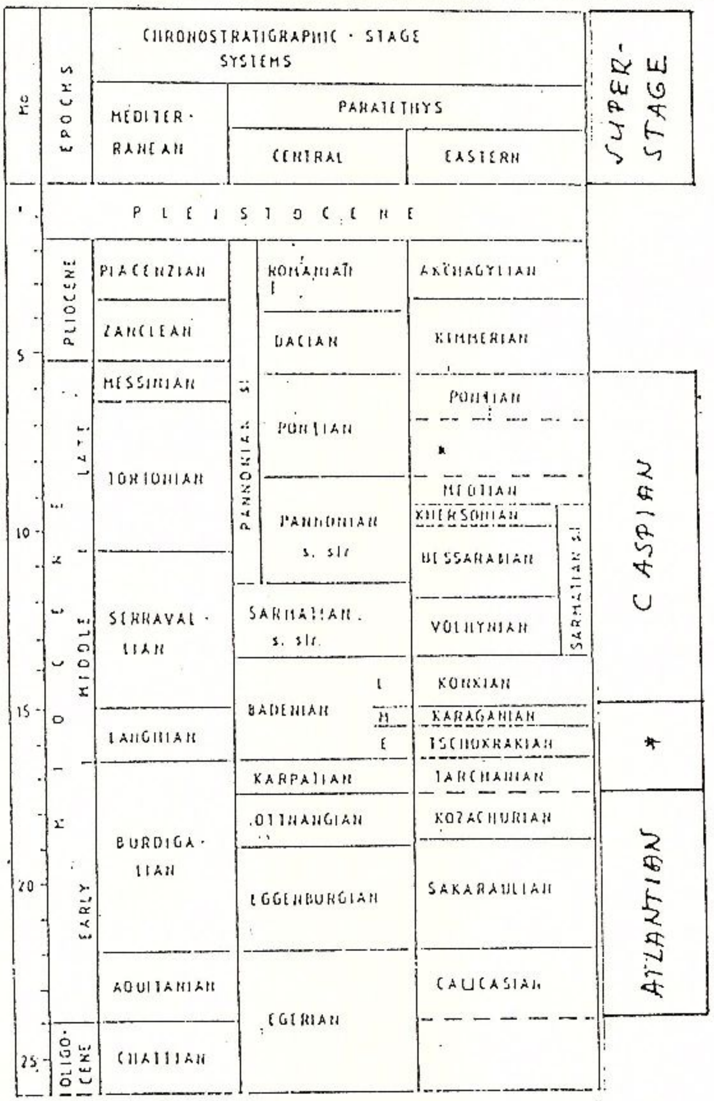
The authors opinion is that the analytic, detailed studies have to be followed by synthesising studies, involving all elements of stratigraphy, those which can show same evolutionary history in a region.. The proposal for Paratethys region can be seen in table 1.

The main reason for collecting the Miocene stages into superstages are as follows:

- history of the stratigraphic - chronostratigraphy studies (Paleogene/Neogene boundary, Chattian-Aquitanian, concept of Mediterranean or Cerithian Stage, Pannonian/Pontian boundary, etc.)
- heterochronicity of the results of biostratigraphic studies using various fauna or flora elements
- global events (plate tectonic events, magmatic events, climatic events, changes in time and space of the Paratethyan sedimentary basin, etc.)
- changes of paleobiogeographic connections in time and space (Lower Miocene: atlantic-indopacific, Middle Miocene: mediterranean, Upper Miocene: caspian)
- results of the cycle- and event stratigraphy (the three superstages represented by three mega-cycle, salinity crisis-, paroxysm of volcanic activity repeated three times, regional discordances at the beginning of the mega-cycles, etc.)

The problems of that proposal are:
- the superstages can not be defined by GSSP
- the proposed boundaries not equal with the currently used Lower / Middle Miocene and the Middle / Upper Miocene boundaries

The first test of the superstages was made by compiling the Miocene Paleogeographic Map Series of the Carpathian Basin. During the compilation, the content of the superstages were based on those from all stratigraphic elements which could identify the similarities, which have the same value, and were lost all represented the differences, which have not the same value in different areas.



* according to Nevesskaya et al and Nosovsky (1985) : this time interval represents the Meotian stage

EXTENDING THE ASTRONOMICAL TIME SCALE INTO THE MIOCENE

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We present an accurate chronostratigraphic frame work for the late Miocene of the Mediterranean based on integrated magnetostratigraphic, cyclostratigraphic and biostratigraphic (dinoflagellates, planktonic foraminifera) data. Sections were selected on Gavados (Greece) and Sicily (Italy) which show a distinct cyclic bedding consisting of rhythmic alternations of homogeneous pelagic marls and brownish coloured laminated beds (sapropels). The correlation of our results to the GPTS (CK94) shows that continuous successions are sampled from 6.5 to 9.7 Ma.

An astronomical polarity time scale is constructed, based on the correlation of the cyclic patterns to the astronomical target curves of solution La90. The Tortonian/ Messinian boundary, formally defined as the first regular occurrence of the *Globorotalia conomiozea* group is now dated at 7.24 Ma. The duration of the Messinian stage arrives at 1.91 Ma since the Miocene/ Pliocene boundary has been dated at 5.33 Ma. In addition, several important biostratigraphic datum are absolutely dated.

^{40}Ar/^{39} datings, using TCR sanidine 85G003 of 27.92 Ma as the standard, yielded ages of 6.934 + 0.016 (biotite) and 6.936 + 0.006 (sanidine) for a volcanic ash layer in our sections. These ages are in excellent agreement with its astronomical age of 6.938 Ma. Argon dating of additional ash layers will be discussed.

DINOFLAGELLATA FROM THE PANNONIAN SEDIMENTS OF THE NW PART OF VIENNA BASIN

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The Pannonian sediments are very typical for the Paratethys. They overlie the Sarmatian and are overlain by the Pontian in the Paratethys. The typical Pannonian interconnected lake system existed in the Pannonian, Transylvanian, Dacian, Euxinian and Caspian Basins. In the Pannonian Basin and adjoined satellite basins (including the Vienna Basin), the endemic brackish water facies with *Congeria, Melanopsis* and characteristic ostracodes are developed in the Pannonian. In this facies, the water salinity was probable lower than 16 $^0/_{00}$.

The Pannonian of the Vienna Basin was divided by Papp (1951) into five biozones based on the mollusc faunas: A, B, C, D, E and by Jiriceck (1975) on the basis of Ostracoda test subdivided the zone E to the E_1, E_2, E_3 subzones.

The studied localities are situated in the NW part of the Vienna Basin. There were observed dark- grey clay sediments from clay pit near Gbely town. The rich association of Dinoflagellata was obtained from processed samples using the traditional palynological methods. In this association were mainly represented *Spiniferites bentori* (Rossignol, 1964), Sarjeant 1970, *Gonyaulax digitale* (Pouchet), Kofoid 1911, *Pontiadinium obesum* Szuto- Szentai 1978 and *Chytroeisphaeridia* sp.. Some of the samples were rich in *Pleurozonaria (? Mechekia ultima)* too.

Stratigraphical position of the studied samples (E2-3, Jiricek, 1975) *Spiniferites bentori* zone (Szuto- Szentai) were given on the basis of Ostracoda and Dinoflagellata.

CORRELATION OF OLIGOCENE AND LOWER MIOCENE PLANKTONIC FORAMINIFERA AND PALYNOMORPHS ASSEMBLAGES IN THE VIMA FORMATION (NORTH TRANSYLVANIA)

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Two sections were investigated: Poiana Porcului Valley (Fantanele) and Imoasa Valley (Vima Mare), both situated on the northern slope of the Vima Syncline.

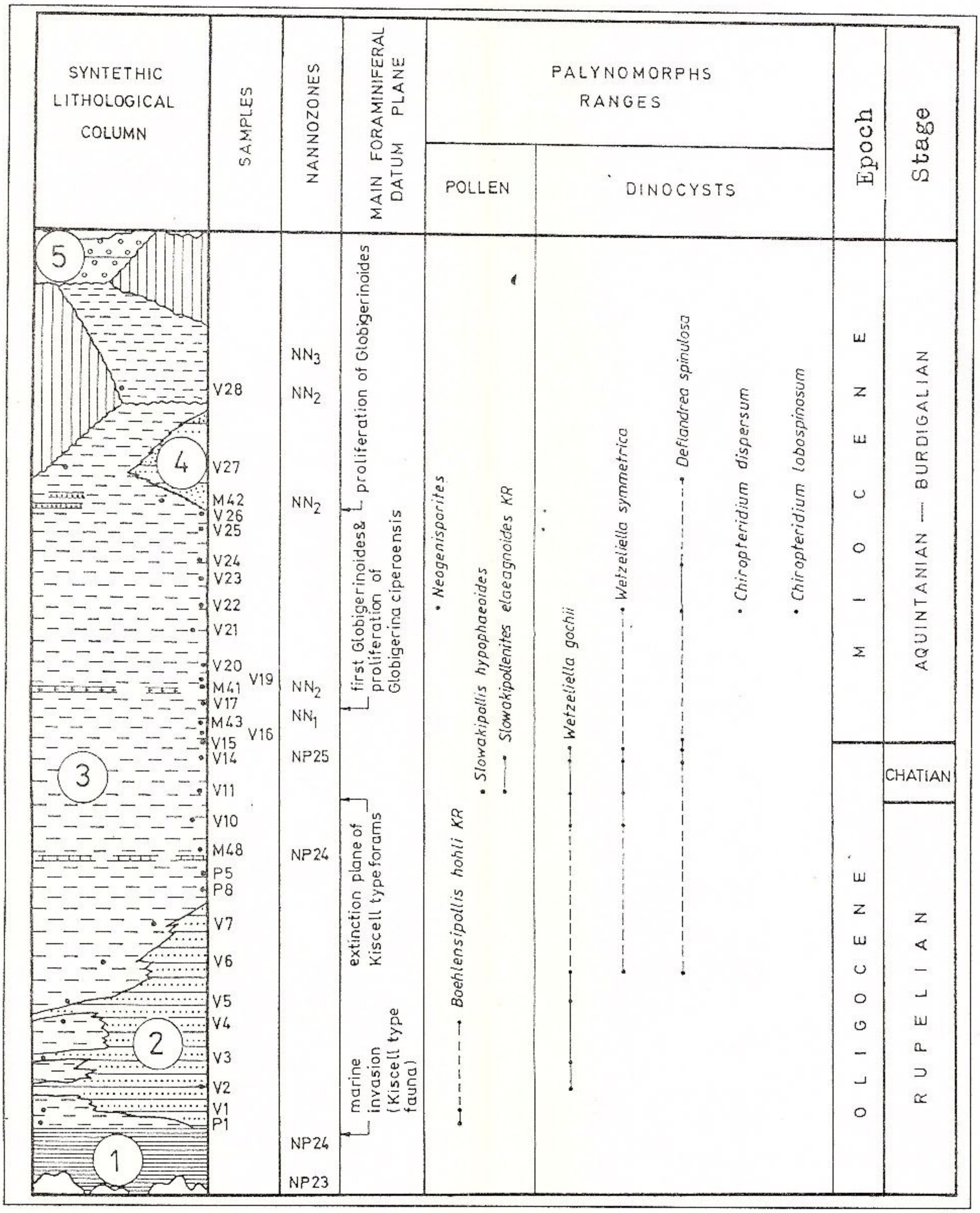
Palynomorph asemblages, typical of the *Boehlensipollis hohli* Zone, were recorded below the Vima Formation, in the Ileanda Formation. Due to the anoxyc facies the palynomorphs are very scarce.

Beginning with the Vima Formation, concomitantly with the recurrence of the marine facies, a rich palynomorph assemblage was recorded. The lower part of the Vima Formation contains continental assemblage (*Boehlensipollis hohli* Zone); immediately above it (samples V2 - V6), the continental assemblage is overlain by a marine palynomorphs assemblage, typical of the Wetzeliella gochtii Zone: *Wetzeliella symmetrica, Rhomboidinium draco, R. perforatum* occur in the whole lower part of the Vima Formation. Both zones - continental and marine - belong to the Rupelian.

In the same samples, foraminifera assemblages typical of the Kiscellian (Upper Rupelian) were recorded.

In the upper half of the Vima Formation (samples V11 - V14), the continental palynomorphs assemblage is represented by *Slowakipollis*, whereas the marine one is make up of *Wetzeliella gochtii, W. symmetrica, Deflandrea spinulosa.* This assemblage is characteristic for the Upper Oligocene (Chattian). Planktonic foraminifera are represented by scarce species of globigerinae (*Beolla, Bolliella, Globigerina ciperoensis, G. wagneri, G. megaperta)* which belong to the Upper Oligocene.

The upper part of the Vima Formation yielded a palynomorphs assemblage with *Chiropteridium* (marine) and *Neogenisporites* (continental), both genera being mentioned by diverse authors in the Upper Oligocene and Lower Miocene. The foraminifera occurring at this level are characteristic of the lower Miocene: *Globigerinoides primordius*, *G. triloba, G. immaturus* (N4-5 Zone).


SYNTETHIC LITHOLOGICAL COLUMN
SAMPLES
NANNOZONES
MAIN FORAMINIFERAL DATUM PLANE
PALYNOMORPHS RANGES
POLLEN
DINOCYSTS
Epoch
Stage
1
2
3
4
5
V28
V27
M42
V26
V25
V24
V23
V22
V21
V20
M41
V19
V17
M43
V16
V15
V14
V11
V10
M48
P5
P8
V7
V6
V5
V4
V3
V2
V1
P1
NN3
NN2
NN2
NN2
NN1
NP25
NP24
NP24
NP23
proliferation of Globigerinoides
first Globigerinoides& proliferation of Globigerina ciperoensis
extinction plane of Kiscell type forams
marine invasion (Kiscell type fauna)
Neogenisporites
Boehlensipollis hohli KR
Slowakipollis hypophaeoides
Slowakipollenites elaeagnoides KR
Wetzeliella gochii
Wetzeliella symmetrica
Deflandrea spinulosa
Chiropteridium dispersum
Chiropteridium lobospinosum
M I O C E N E
O L I G O C E N E
AQUINTANIAN — BURDIGALIAN
CHATIAN
R U P E L I A N

CONTINENTAL PLIOCENE OF THE UPPER DON DRAINAGE BASIN (CENTRAL RUSSIA) -STRATIGRAPHY AND PALEOGEOGRAPHY

Yu. IOSIFOVA,

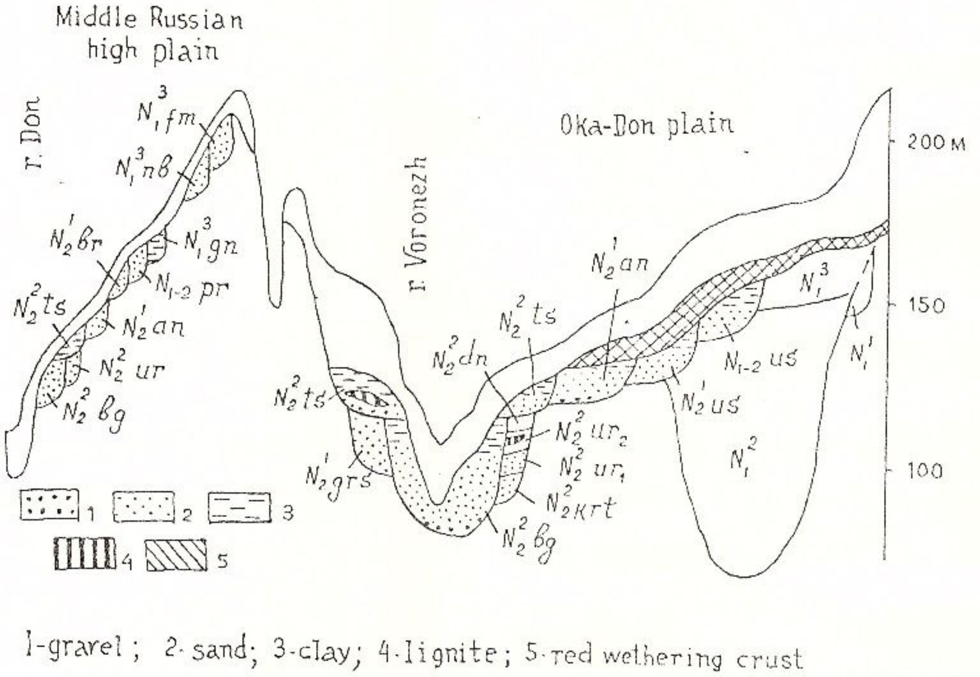
The Pliocene time at the Upper Don basin was marked by formation of least 10 terraces; those dated to the Lower Pliocene form a series of descending steps adjoining each other, while the Upper Pliocene alluvium shows a sequence of superimposed layers. Total stratigraphic thickness of the alluvium is about 150 m. The Upper Kimmerian and Akchagylian fluvial sediments yielded abundant mammal remains, which permits a tentative correlation of the sequence with the zonal scale developed by P. Mein. Molluscs remains together with pollen and spores were also recovered from the alluvium. There are sections (Korotoyak and Uryv in the Voronezh region) where the whole sequence of deposits is exposed, from the Raena event to the Pre-Olduvai part of the Matuyama epoch (including the Gauss/Matuyama boundary and the Reunion event). Many layers of the sequence contain in abundance (Fig. 1).

The data mentioned above permitted to develop a comprehensive climatic-stratigraphic scheme of the Pliocene subdivision in the Upper Don region, cold and warm horizons being distinguished (see Table 1).

Data on the fossil flora and fauna allow to identify principal events in the evolution of climates and environment, and to correlate them with the events recorded in northern Europe.

The main trend in the environmental evolution within the Upper Don basin seems to be progressive cooling of climate throughout of the Pliocene, as clearly visible in the climatic curve. Most pronounced cooling is recorded at the base of the Matuyama epoch; it corresponds to the Pre-Tiglian of northern Europe. The Early Pliocene optimum and at least 3 optima within the Pre-Olduvai part of the Matuyama epoch stand out sharply

Fig I Geological structure of the Pliocene in the Upper Don basin



against the general trend towards cooling; the warm intervals were essentially humid, forests spread up to 46 N during the Reunion event (That is at The time when "the Great Akchagylian transgression" reached its maximum) which corresponded to zones C1 to 3 of the Tiglian in the Netherlands (Fig. 2).

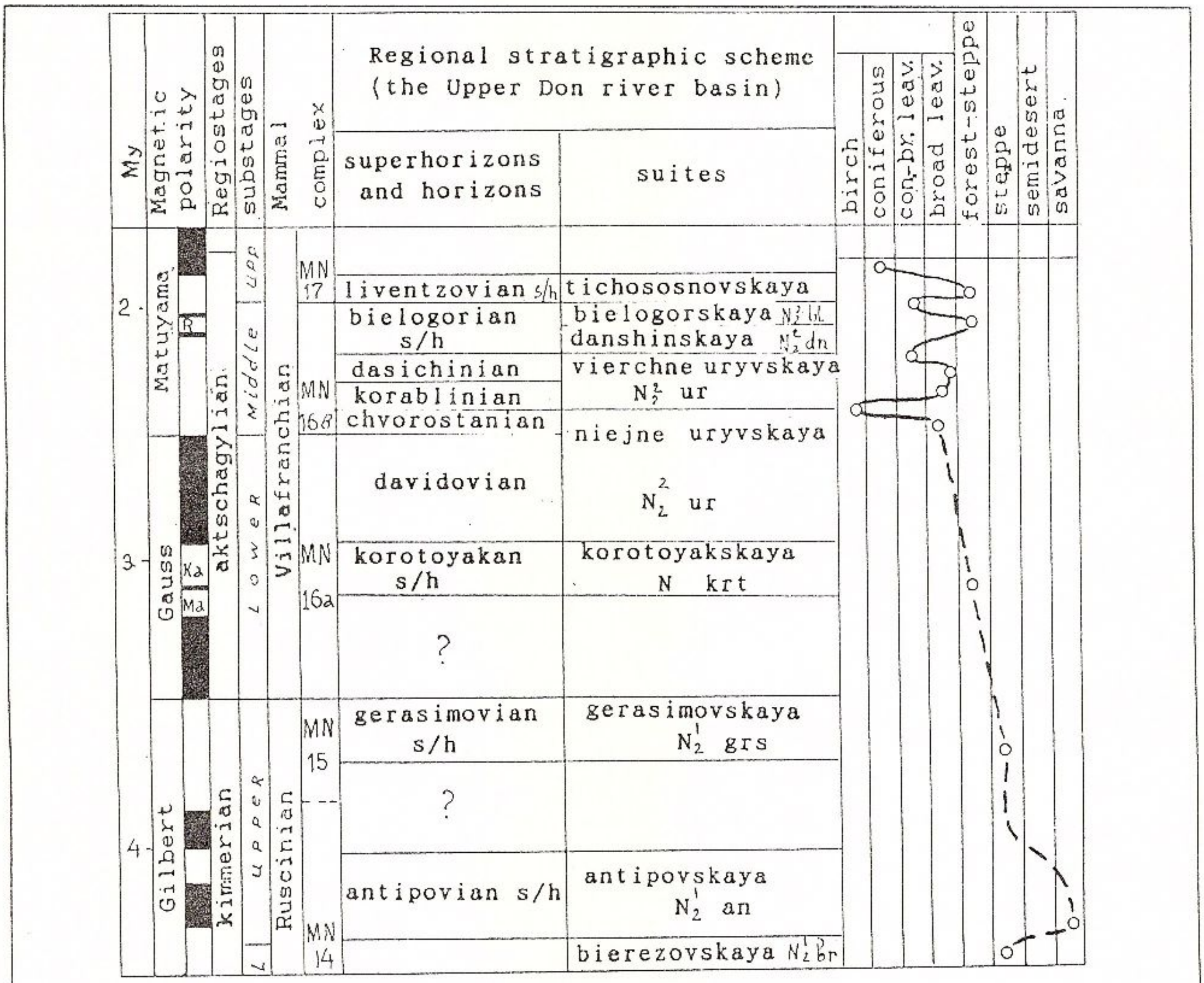
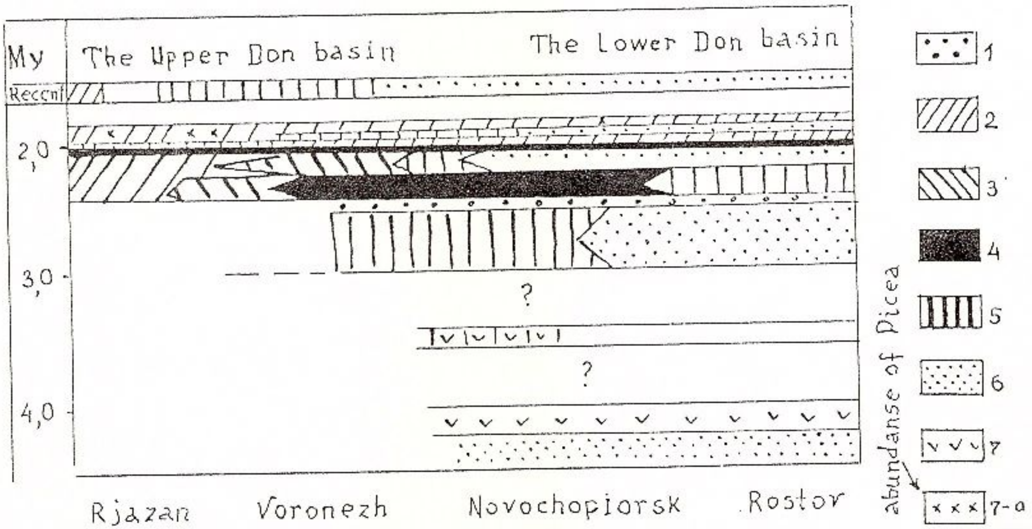


Fig 2. The landscape-climatic profile Rjazan - Rostov-na Donu



NEW CONTRIBUTION FOR THE SARMATIAN BIRD FAUNA OF PARATETHYS

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Univ. Cluj-Napoca, ROMANIA

The Upper Miocene bird fauna of Paratethys has been treated in several papers in the last decades (Grigorescu, D., & Kessler, E., 1977, 1988; Kurotschin, E., & Ganea, E. 1975; Kessler, E. 1984, 1992,) what had made possibility to describe a bird fauna with new species.

At the reexamination of the remains from Kishinev (Rep. Moldova) and the Ciobanita (Romania, South Dobrogea) the authors identified two new taxons from the undetermined bones: *Otis bessrabicus* n. sp. (see *Larus* sp. Kessler 1984, 1992) from Kishinev (Col. Macarovici - Oescu , 1941 from Fac. Geology Univ. Iasi) and *Tringa grigorescui* n. sp. from Ciobanita (South Dobrogea, Coll. Fac. Geology, Lab. of Paleontology, Univ. of Bucharest).

With the two new taxons the fossil bird fauna of Paratethys has increased to 20 species.

NEOGENE/ QUATERNARY MICROMAMMAL S FROM MYGDONIA BASIN (MACEDONIA, GREECE)

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The preliminary results from the study of micromammalian faunas from the Mygdonia basin (Macedonia, Greece) are given. The Neogene-Quaternary deposits of the Mygdonia basin have divided in two groups: the Premygdonian group and the Mygdonian Group. Three formations have been distinquihed in the Premigronian Group. These are from bellow to upwards: Chrysavgi Fm., Gerakarou Fm., and Platanochori Fm. Chrysavgi Formation is the oldest formation of the basin and consists of alternated lenses and lenshaped beds of grey-white, unconsolidated, coarse conglomerates and sand with intercalations of silty and silty-clayey layers. Gerakarou formation consists of alternated lenses and lenshaped beds of uncosolidated gravels, coarse sand and reddish-brown silt and clay. Platanochori Formation consists of typical fluvial-fluviolacustrine sediments, sands, sandstones, conglomerates, silty-sands, silt-clay and marly limestones.

Several mammalian localities have been found in the Premygdonian group and abundant material has been unearthed.

The locality "Chrysavgi-1" (CHR) is situated in the upper part of Chrysavgi Formation. The micromammalian fauna includes the following species *Prolagus* n. sp., *Alloptox* sp., *Byzantinia bayraktepensis, Megacricetodon minor* and *Myomimus* sp. The composition of the fauna suggests a Late Middle Miocene age (Upper Aragonian, MN7+8).

The locality "Gerakarou-1" (GER) is situated in the Gerakarou Formation and includes a well studied macromammalian fauna. The micromammalian fauna is very poor consisting of *Mimomys* sp., Lagurini ind., *Apodemus* cf. *mystacinus* and *Histrix major.* The locality has been dated to the transition between Pliocene/Pleistocene.

The localities "Ravin of Voulgarikis" (RVL) and "Apollonia-1" (APL) are both situated in the Platanochori Formation. The fauna of RVL includes the species *Beremedia fissudens, Episoriculus* sp., *Sorex* sp., Leporidae ind., *Spermophilus nogaici, Pliospalax* n. sp., *Myomimus* sp., *Glis* aff. *glis, Sicista* aff. *subtilis, Cricetinus* n. sp. , *Apodemus mystacinus, Apodemus sylvaticus, Mimomys savini, Micrrtus pitymyoides, Lagurodon arankae.* The locality APL is poor in micromammals. The fauna consists of *Erinaceus praeglacialis,* Leporidae ind. and *Laguradon arankae.* Both localities have been dated to Early Pleistocene. The fauna of RVL is more rich and allows a better age determination. The faunal composition and especially the arvicolids indicate that the RVL fauna is dated to the end of the *"Mimomys savini-Mimomys pusillus* rodent zone" (Fejfar &Heinrich, 1990) and suggests a Biharian age.

The small fauna from "Chrysavgi-1" is the first Late Aragonian fauna from Greece and can be correlated with the Late Aragonian-Early Valessian turkish faunas. More over it has a great local interest because it gives first biochronological evidences for the dating of the Chrysavgi formation. The fauna from "Ravin of Voulgarakis" provides the poor knowlege about the Biharian faunas from the East Mediterranean region. The poor faunas from "Gerakarou-1" and "Apollonia-1" complete the rich macromammalian fauna and helps to the dating of these localities.

THE TIME APPEARANCE OF PANNONIAN (s. l.) MOLLUSCAN SPECIES IN HUNGARY AS DETERMINATED BY MAGNETOSTRATIGRAPHY

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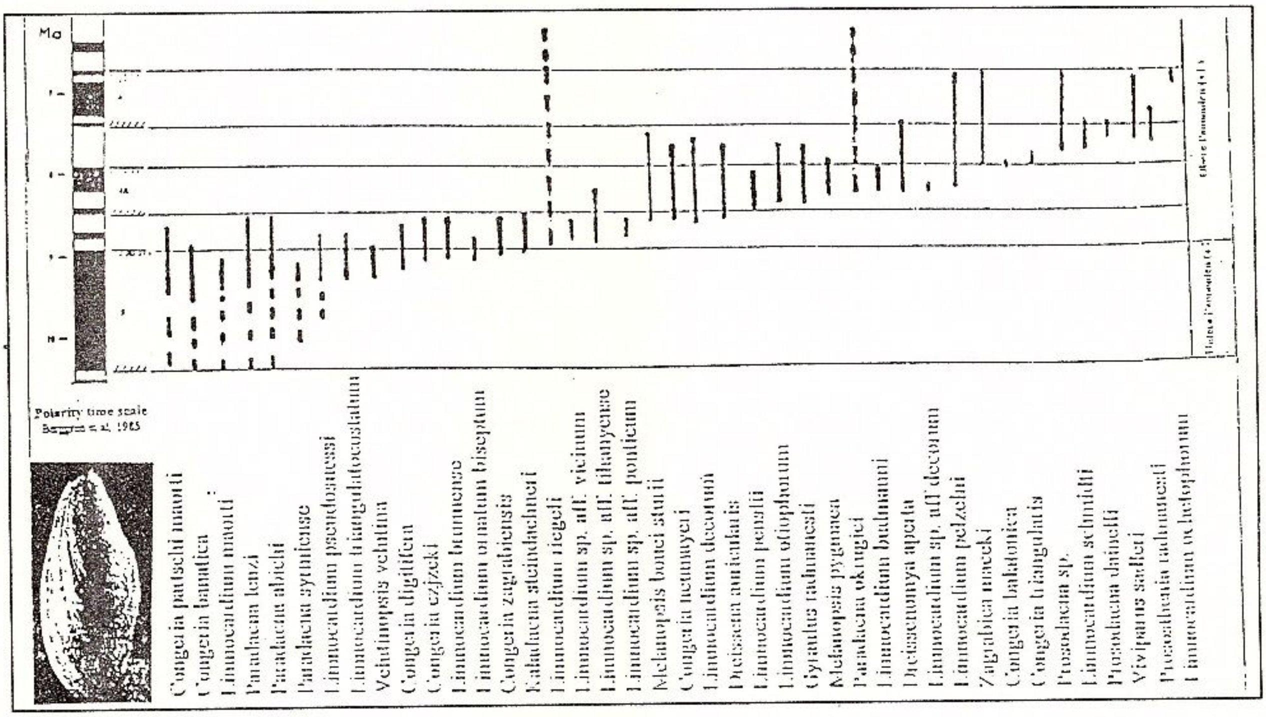
The time range for the Pannonian (s.l.) molluscan species in the Pannonian Basin has been determined on the basis of magnetostratigraphy of six, full coring boreholes.



1. Table The time range and location of Molluscan species

⇒ The faunal change between the Early and Late Pannonian (s.l.) can be correlated with the top of the anomaly 5 (8.9 Ma, Berggren et al. 1985).

⇒ In the offshore facies, the so called Pontian species such *as C. zagrabiensis, Kaladacna steindachneri* etc. accompanied by Early Pannonian (s.l.) species continuing to exist appear at 8.9 Ma.

⇒ In the shoreface facies, new Limnocardium species that have not been described yet and that developed from small Limnocardium known from the Pannonian (s. str.) beds of the Vienna Basin are observed. In addition to them, also Early Pannonian *Melanopsis* and *Theodoxus* species continuing to exist, can be observed in the time range of 8.9 to 9.5 Ma.

⇒ The species of *Congeria ungula caprae* fauna appeared after 8.5 Ma whereas the species of the *Congeria balatonica* fauna appeared after 8.2 Ma. For the appearance of *Prosodacna* 7.6 Ma was obtained.

The Early Pannonian (s.l.) deposits in the Pannonian Basin are, in a wide generalisation, of brackish, lacustrine, prodelta facies, whereas the Late Pannonian (s.l.) deposits are featured by deltafront, delta plain, fluvio-lacustrine, terrestrial facies.

The filling process of the entire basin proceeded from the arc of the Carpathians to the inner, subsiding sub-basins. The delta progradation was also followed by the fauna. As a result, both the time of appearance of species and the faunal composition featuring the inner basins differ from those featuring the basins found in the mountains foreland.

The boreholes studied were drilled on a mountains foreland or on elevated ridges. Each time of appearance determined on the basis of these boreholes is interpreted as a date of appearance of endemic molluscan species. However , its absence is not considered as the date of extinction of the species.

In the Danube-Tisza Interfluve, the dates of appearance of molluscs determined by seismographic projection of the magnetostratigraphic time ranges obtained from borehole Kaskantyu-2 considerably differ from the time range shown in Table 1.

Some examples:

Congeria banatica	>8.9 to 5.8 Ma
Congeria partschi maorti	>8.9 to 5.8 Ma
Paradacna lenzi	>8.9 to 5.8 Ma
Kaladacna steindachneri	~8.9 to 5.8 Ma
Prosodacna sp.	~7.6 to 4.2 Ma.

⇒ Based on K/Ar dating, and magneto- and seismography, the boundary between the Early and Late Pannonian (s.l.) in Hungary is correlated with the upper boundary of the anomaly 5 (8.9 Ma).

⇒ Based on magnetostratigraphic and fission track methods, this boundary correlates with the upper boundary of the Pannonian s.str. in the area of the Central Paratethys, whereas it can be identified approximately with the lower boundary of the Meotian in the area of the Eastern Paratethys, but not with the lower boundary of the Pontian.

⇒ As shown by stratigraphic studies of the Pannonian (s.l.) in Hungary, the late Neogene stages of the Central Paratethys (RCMNS 1975) do not fill the entire time interval but there is a gap of approx. 2 Ma between the Pannonian s.str. and the original Pontian stages which has so far not been defined by stages.

NEW CONSIDERATIONS ABOUT THE DIVISION OF VILLAFRANCHIAN

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Since 1865, when L. Pareto introduced the term Villafranchian, several opinions about the meaning and the chronological limits of Villafranchian have been supported. The term has been used variously, providing great confusion among scientists. During the last decades, several articles have been published, giving new data about the subdivision of Villafranchian (Azzaroli, 1967; Heintz, 1967, 1970; Agusti et al. 1987; Mein, 1990; Guerin, 1990; Torre et al., 1992, Caloi & Palombo, 1995 in press). Our recent studies on the Villafranchian faunas of Macedonia (Greece) allow us to revise all the known data and to propose a subdivision of Villafranchian. We tried to eliminate the problems, coming from the use of the term and to give, as much as possible, detailed chronology.

The study of greek faunas suggests that there is a break in the homogeneity of the villafranchian assemblages after the Faunal Unit (F.U.) of Seneze I., at the end of Pliocene, where the fauna of the greek locality "Gerakarou-1" (GER) is situated. This break is mostly recognised in the associations of Artiodactyls, while other faunal elements (carnivores, perissodactyles, elephants) seem to be more stable or highly variable.. The associations of Artiodactyls from Olivola, Tasso and Farneta have transitional characters between the typical Villafranchian ones and those of Middle Pleistocene (Galerian).

Concerning all the known data and the new ones from the study of the greek villafranchian macromammalian assemblages, the following suggestion is given:

- Preservation of the term Villafranchian (3.2 - 1 Ma) for historical reasons.
- Subdivision of Villafranchian in Villanyian (3.2 - 1.8 Ma) and Protogalerian (1.8 - 1 Ma) according to Caloi & Palombo (1995 in press)
- Subdivision of Villanyan in Earliest (MN 16a of Mein 1990, F. U. Triversa of Torre et al. 1992), Early (MN 16b of Mein 1990, F. U. Montopoli of Torre et al. 1992), Middle (MN 17a of Agusti et

NEW RADIOMETRIC DATINGS BRACKETING THE TORTONIAN/MESSINIAN BOUNDARY IN NORTHERN APENNINES (ITALY)

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A continuous, mainly hemipelagic, marine succession ("euxinic pelites") interposed between the middle Miocene Marnoso-arenacea Fm and the Messinian gypsum evaporites in Northern Apennines (Italy) contains several biotite-rich volcanoclastic levels, suitable for radiometric dating. Various sections in the area have been since few years from biostratigraphic and chronological point of view (Vai et al., 1993).

This study is mainly devoted to Monte del Casino II section, where a consistent number of volcanoclastic levels and a fairly continuous fossil record were recognised. These characteristics make this section suitable for the two aims of this research: 1) to bracket the Tortonian/ Messinian boundary and 2) to check the stratigraphic continuity of volcanoclastic levels and investigate their behaviour in a series which covers a relatively narrow interval of time. For this purpose seven biotite rich levels spread on a 18 m long section which goes from *Gr. suterae* FAD to the LOD of small helicoliths were selected for radiometric study. ^{40}Ar/^{39}Ar step-heating experiments were performed on biotites separated from these levels. Chemical tests (Mg, Fe, K) made on biotites of different sizes show an overall high potassium content, indicative of unaltered samples, but various degrees of homogeneity, which may be due to an original characteristic of the sample and/or multiple source.

Radiometric data do not match exactly the stratigraphic succession. The interval between *Gr. suterae* and *Gr. saheliana* FADs is quite complicate, only one biotite has an undisturbed spectrum, but its age is too young compared to all other samples. Integrated total ages (which are fauna. At the same time, *Mesotragocerus* ,a new genus of cervavituses *(C. variabilis)* are numerous in the subcomplex described, though they are completely absent in the late Emetovka fauna. *Procapra* cf. *capricornis* is replaced by *P.* aff. *rodleri* and *Gazella schlosseri* is replaced by *G. pilgrimi*. Giraffes are also subjected to changes*:* *Chersonotherium eminens* is replaced by *Samotherium maeoticum*. At the initial stage of development of the Novoelizavetovsky subcomplex (the early Emetovka fauna) the first appearance of *Palaeoryx* and *Palaeotragus* representatives are observed.

There are grounds to suppose that in the period of existence of the faunistic grouping of the early Meotian age, the Novoelizavetovsky subcomplex, typical savanna landscapes predominated: paleotragines are comparatively numerous, antelopes are various, hipparions and procapres predominate. Only in the fauna of locality of Novoelizavetovka inhabitants of comparatively afforestated biotopes occupy a considerably place. They are cervavituses and forest tragocerines.

The Novoelizavetovsky faunistic subcomplex, together with the Belinski one, characterises the Turolian stage of development of the Hipparion fauna in the Northern Black Sea region and belongs to the MN 12 Zone.

MIOCENE MAGNETOSTRATIGRAPHY OF CONTINENTAL DEPOSITS IN CENTRAL SPAIN; DATING ARAGONIAN AND VALLESIAN STAGE BOUNDARIES

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Accurate dating of (continental) mammal assemblages are still very rare. The rich and numerous fossil localities of Central Spain provide a well determinate and long biostratigraphic record ranging from MN 4 (14 Ma; Orleanian) to MN 11 (8 Ma; Turolian). The good paleomagnetic signal of the sediments - mainly red silts/sands and limestone - provide reliable magnetostratigraphic results across several important (Orleanian/ Astaracian, Astaracian/Vallesian, Vallesian/Turolian and corresponding MN zones) biostratigraphic boundaries.

The middle Miocene Armantes section (17 - 12 Ma) shows a rhythmic alternation of red silts with whitish limestone which suggest a relation with the orbital cycles of precession and eccentricity. We sampled in detail a 250 kyr interval of this section in which the cyclicity is most evident and in which three polarity reversals are recorded. we studied the relation between various parameters (carbonate content, gamma ray, clay minerals and rock magnetic parameters) and the cyclic patterns. The results suggest that diagenetic process caused delayed acquisition of the hematite component, while the magnetite component probably presents the original primary detrital magnetisation.

al. 1987, F. U. Saint Vallier of Torre et al. 1992) and Late (MN17b of Agusti et al. 1987, MNQ 18 of Guerin 1990, F.U. Seneze I of Torre et al. 1992). The proposed Villanyan coincides with the Villanyan of the micromammalian scale.

- Recognition of the term Protogalerian for the macromammalian faunas from 1.8 - 1 Ma (F.U. Olivola, Tasso, Farneta), according to the idea of Caloi & Palombo (1995 in press). Protogalerian could be subdivided in Early (MNQ 19 of Guerin 1990, MmQ 1 of Agusti et al. 1987, F. U. Olivola- Tasso of Torre et al. 1992) and Late (MNQ 20 of Guerin 1990, MmQ 2 of Agusti et al 1987, F. U. of Farneta of Torre et al. 1992). The Protogalerian coincides with the lower part of Biharian on the micromammalian scale.

THE EARLY MEOTIAN FAUNAS OF UKRAINE

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An early developmental stage of the Meotian Hipparion fauna of the Northern Black Sea region is characterised by the Novoelizavetovsky faunistic subcomplex. Until recently, the fauna of large mammals of the above mentioned subcomplex has remained insufficiently studied as a composition of localities forming it and taxonomic composition of the rictocenoses that were not revealed completely.

At present, Novoelizavetovsky subcomplex unites faunistic groups of large mammals from 3 localities: Novaya Emetovka 1, Novoelizavetovka and Emetovka 2. The theriofauna of Novaya Emetovka 1 represents an initial stage of development of the Early Meotian fauna of the Novoelizavetovsky subcomplex of the Belinski complex (complexes and subcomplexes names are given after E. L. Korotkevich). The Novaya Emetkova 2 theriofauna is considered as the last stage of the Novoelizavetovsky subcomplex.

Rictocenoses of Novaya Emetovka differ in species composition of most of ungulate (*Hipparion, Palaeotragus, Gazella, Procapra*). Some forms which occupy a successive stratigraphic position in the same phyletic lineage are found in theriofaunas (*Hipparion* sp. - *H. moldavicum, Procapra* cf. *capricornis* - *P.* aff. *rodleri, Palaeotragus* sp.- *P. rouenii*).

In the characteristic of the Novoelizavetovsky subcomplex we wish to emphasise that this early stage of the Hipparion fauna development in the studied region is also tightly connected with the late faunistic stage of Berislavsky complex, the Grebenikovsky subcomplex. It is quite possible to consider a faunistic group of Novaya Emetovka 1 as a transitional link between them. So, the last Chiloteria are still present, Achthiaria are identified, gazelles and procapres are represented by similar species, *Hipparion verae* and *Hipparion* sp. add its composition

During the development of the Novoelizavetovsky subcomplex fauna changes in species composition on predominant groups of ungulates take place. *H. verae* and small *Hipparion* forms disappear and Hipparion similar to *Hipparion moldavicum* replaces them. The latter becomes a common species for the Novoelizavetovsky subcomplex at the final stage of development of its equivalent to K/Ar ages) for three out of four samples in the aforementioned interval are equal, again younger than overlying samples. Samples containing the more homogeneous biotite population (but also smaller-sized and scarce one) has a disturbed spectrum and a meaningless total age. Above the *saheliana* FAD there is a correspondence between the stratigraphy and radiometric data, which range from 7.40 Ma, for the oldest sample, to 7.02 Ma for the upper and younger one.

Obtained data introduce some problems: 1) samples between *suterae* and *saheliana* seem younger than expected, so their "ages" cannot be explained by contamination with older reworked material; 2) the equation chemical homogeneity = reliable samples is not always true. A partial me that the biotite sometimes has a non-ideal behaviour as geochronometer, and also the $^{40}Ar/^{39}Ar$ may be unable to discern an original disturbance of the system.

To extrapolate the limit we have tentatively used samples related either to *suterae-saheliana* interval or *saheliana-conomiozea* one, but using as upper tie-point the only datum above the paleontologic limit, whose chemical characteristics are considered rather poor. Obtained age of the T/M range from 7.08 to 7.16 Ma respectively, for a FCT biotite age of 27.55 Ma (Lamphere et al., 1990), not far from extrapolate age from other two sections in the area, 7.26 + 0.10 Ma (Vai et al.,1993). Age differences between the two extrapolate values is equivalent to 2σ assigned error to analysed samples, so it is not statistically significative. These data become 7.18 and 7.26 Ma, respectively, normalising to the proposed astronomical calibration for FCT age, equivalent to 27.95 Ma (Renne et al., 1994).

A sample from nearby Monte Tondo section, taken at the *conomiozea* FAD gives a datum of 7.15 + 0.04 Ma, within the extrapolated limit in Monte del Casino II section; this further information should be used with caution because there are paleomagnetic evidence of sedimentation discontinuity in that section.

Some problems were evidenced during this research , mainly concerning a poor lateral continuity (equivalent stratigraphic interval have different numbers of volcanoclastic levels in near sections) and an insufficient reproducibility of some data from the same level when comparing separate sample collections. These discrepancies were evidenced here, where a massive number of analyses was done on a small area, but they may be a more general interest.

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THE NEOGENE CONTINENTAL SEQUENCE OF THE EMPORDA BASIN (EN SPAIN)

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In this paper, a biostratigraphical appraisal of the Neogene continental basin of Emporda (En Spain) is done. Five main units are distinguished. The late Vallesian and the middle Turolian (late Miocene) have been recognized in the Southern Alluvial fan System. Thus, the locality of Sant Mari Vell delivered a micromammal association that includes *Rrotundomys bressanus, Rotundomys* sp., *Anomalomys gaillardi, Progonomys woelferi, Occitanomys hispanicus* and that can be referred to the late Vallesian (MN 10). To the North, in more distal facies, the locality of Camallera is characterized by the presence of *Ruscinomys schaubi, Kovalskia fahlbuschi, Parapodemus* cf. *barbarae* and *Atlantoxerus adroveri,* thus indicating the Turolian (MN12).

The late Turolian (Messinian) is present at the locality of Bascara, in the Fluvia Lower AlluvialSystem, which delivered the following association: *Ruscinomys lasallei, Pseudocricetus kormosi, Kowalskia* sp. *Apodemus* aff. *gudrunae, Occtanomys* aff. *adroveri,* and others. The late Turolian (Messinian) is also present in the locality of Romanya.

Over the Pliocene Marine Unit of Viladamat, of Zanclean age, the early Alfambrian (early Pliocene) is present in the locality of Vilafant, with *Pseudocricetus barrierei, Paraethomys jaegeri,* Apodemus cf. *dominans, Castillomys crusafonti, Muscadinus* aff. *vireti* and *Prolagus michauxi.*

The early or late Alfambrian is also present in the Palol de Revardit Alluvial Systhem on the basis of the presence of *Occitanomys brailloni* at the locality of Cornella

PARSIMONY AND UNITARY ASSOCIATION IN CONTINENTAL BIOCHRONOLOGY

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The continental fossil localities of the European Tertiary are mainly in formations isolated from each other. Each local fauna is often considered by the paleomammalogists as a "snapshot" in the geological time scale.

Evolutionary criteria are classically used to range the mammalian localities along a "time Line". An original way to use this method has recently been proposed (Martinez, in press); it is inspired from parsimony procedures. The chronological successions obtained could be then treated as synthetic sections, each locality being considered as a fossiliferous level.

The Unitary Associations method has been elaborated in the late seventies in order to establish concurrent rage zones taking virtual associations into account (for example, sets of synchronous species who never coexisted in the same locality for ecological reasons). In the case of continental localities with fossil mammals, the problem is the lack of strtigraphical time control. But if we have an objective way to obtain regional chronological successions based on biological evolution, using the Unitary Associations method is possible and correlations can be proposed.

There is no theoretical obstacle to this reasoning. However, some practical problems persist and have to be discussed: localities/lineages ratio above or below which the parsimony methods can not be used; biogeographic constraints related with endemism; circular reasoning due to the fact that some lineages may have not been established independently of stratigraphy; taxonomic discrepancies between authors...

The first associations has been distinguished in the Tortonian deposits of deep litoral zone and in lower part (lithothamnic limestones and argillas) of the second molassic type of Tortonian. Over 100 species have been recorded in them. Many of them appeared since in the earlier deposits but their extintion occur within the Tortonian, some of them appear and extinct within the Tortonian and some others appear for the first time in Tortonian and continue after the Tortonian, mostly from Pliocene up to the recent. Based on the above mentioned data, we consider the age of this association as early Tortonian. Several species , characteristic of Middle Miocene deposits, as *Cardita jouanneti jouanneti, Cardita jouanneti laeviplana, Cardita crassa longogigantea, Cardium kunstleri, Ancila glandiformis* et var., *Volutilithes ficulina Mitrella fallax, Conus elongatus, Conus berghausi, Clypeaster altus, Clypeaster gibosus, Clypeaster portentosus elatior* have been recorded.

These species have not been considered later than Tortonian by any studious and in any country.

By the other hand, the following biozones have been distinguished in the Tortonian deposits, based on planktonic foraminifera, from bottom to top:

a. Globorotalia miozea-Globigerina nepenthes zone,

b. Globorotalia menardi -4 zone and,

c. Globorotalia menardi-5 zone.

Comparing these biozones of planktonic foraminifers with the macrofaunistic associations from several regions, it results that *Globorotalia miozea-Globigerina* nepenthes zone is in conformity with the *Cardita jouanneti-Ancila glandiformis* association. But, something different is happened in the Guret e Zeze section. In the argillic-sandstone facies with the characteristic *Cardita jouanneti-Ancila glandiformis* association, the Albanian specialists have distinguished *Globorotalia conomiozea* biozone, belonging to Messinian age. This co-association is most contradictory and shows that something is wrong.

It is accepted that the Tortonian, together with Messinian, belong to the Upper Miocene. But, this fact doesn't justify the above mentioned macrofossils younger than of Tortonian age.

Therefore, the position of *Globorotalia conomiozea* zone or the factors which allow the presence of this biozone in these deposits must be re-evaluated.

There also exists another unconformity regarding the bathimetry of the sedimentation basin: the presence both of the macrofossils and microfossils (not more than 50 and over 150 m, respectively).

Based on the great importance of these problems regarding the biostratigraphy of the Mediterranean Neogene, the discussion of them is useful.

This study in only a preliminary attempt for the further clarification of these problems.

de Terri. Some scarce remains belonging to a medium sized *Mimomys* and to *Apodemus* cf. *dominas* probably indicates the existence of the late Pliocene in the Fluvia Upper Alluvial System.

AGE UNCONFORMITY BETWEEN *CARDITA JOUANNETI - ANCILLA GLANDIFORMIS* (MOLLUSCA) ASSOCIATION AND *GLOBOROTALIA CONOMIOZEA* (FORAMINIFERA) ZONE IN TORTONIAN DEPOSITS OF "GURET E ZEZE" SEQUENCE (ALBANIA)

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Two following main kinds of Tortonian deposits can be distinguished in the Pre-Adriatic Depression of Albania:

a- argillic and argillic-marly deposits of deep littoral zone (50-200) and,

b- typical molasse deposits consisting of calcarenitic limstones with *Lithothamnium* and *Clypeaster*, argillas and sandstone with the argillic and aleurolitic intercalations. This type of deposits belongs to the litoral zone (up to 50 m). The deposits of the first type (a) are similar to the Tortonian stratotype in Italy, whereas those of the second type (b), regarding the macrofossil content, are most similar with the deposits of some regions of Italy (Colli torinesi, S. Agata, Stazzano, Montegibbio, Preappennino Piacetino, Arenarie di Ponsano etc.) and with the Badenian and Vindobonian stages and also with the 2 nd Mediterranean stage of Vienna-Pannonian basin.

The **"Guret e Zeze"** sequence consists of the molasse type deposits, where the Tortonian ones rich in macrofossils, are transgressive set on the Burdigalian.

Three following characteristic macrofossil association are distinguished, from bottom to top:

a. *Cardita jouanneti-Ancila glandiformis*,

b. *Melanopsis-Pirenela-Terebralia* and,

c. *Amyclina-Clavatula*.

These associations occur in other regions of Tortonian deposits in Albania as well.

THE LOWER MIOCENE FAUNAL RENEWAL - PROBOSCIDEAN DATUM - IN EUROPE: CONTRIBUTION (RODENT BIOCHRONOLOGY AND RADIOMETRIC DATING) OF THE FRENCH FOSSIL MAMMAL-BEARING LOCALITY OF BEAULIEU.

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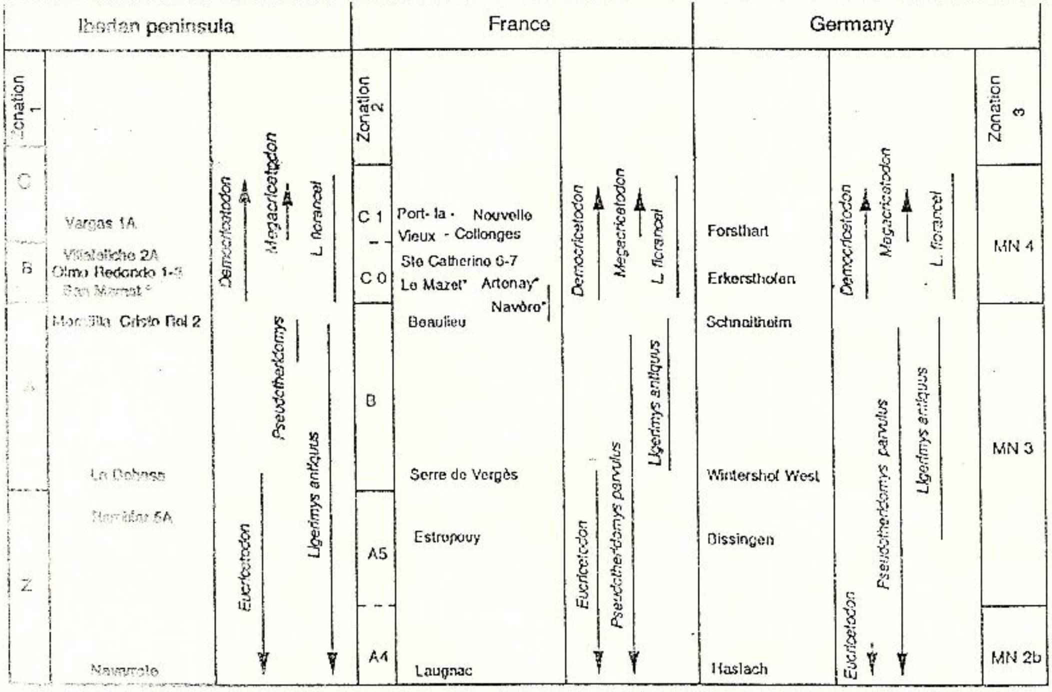
The formation of Beaulieu (near Aix-en-Provence, France) shows coastal deposits overlain by lacustrine limestones. At is contemporaneous of a volcanic complex which has been dated 17,6 + 0,7 Ma by Ar/Ar method, a dating which fits very well with a previous K/Ar dating of 17,8 + 0,5 Ma. The Beaulieu fauna of mammals now comes from several sites, one of them yielding several large mammals. The fauna defines a reference level (Table 1) posterior to the one of Serres de Verges, and prior to the one Sainte Catherine 6. The fauna of Beaulieu indicates the MN3 zone of the Mammal Neogene scale. The reference level of Beaulieu is prior to the first occurrence of the criceted *Democricetodon*. In Europe, this occurrence usually comes with the one of the first proboscideans. These levels with *Democricetodon* and the first proboscideans are referred to zone MN 4 of the general Neogene mammalian zonation for Europe, to zone B of Daams and Freudenthal zonation, and it defines a new zone in Aguilar's zonation of 1982: zone CO. The radiometric dating of Beaulieu provides the lower boundary to the major faunal turnover recognized all over Europe as well as in Africa and Asia in the Early Neogene (Table 2).



Stratigraphic distribution of some rodents during the Lower and Middle Miocene

1 - after Daams et al. (1988), 2 - after Aguilar (1982), 3 - after Fahlbusch (1989)

Table 1 - Rodent biochronology for the Lower Miocene in Europe based on zonations of Daams and Freudenthal (1988) for Iberian peninsula, of Aguilar (1982) for France, and zonation MN (Fahlbusch 1989) for Germany. Asterisk indicates faunas with rodents and proboscideans; arrows give the distribution of reference lineages of rodents.

Zonation Aguilar 1982	EUROPE				AFRICA AND MIDDLE-EAST				ASIA		MN zonation
	Portugal	France	Poland	Hungary	East Africa	Libya	Egypt	Israel	Thailand	Japan	
C 1 – C 0	Q. do Narigao	Le Mazet Artenay	17.05 Ma ▨ Belchatow	16.8 Ma ▧ Nemti Ipolytarnoc		Gebel Zelten	Moghara	Negev	Maelong	Banjóbora	MN 4
	Immigration of Proboscidea into Europe and Asia, *Democricetodon* into Europe, North of Africa, and Middle-East										
B	Cristo Rel 2	Beaulieu 17.0 Ma			Faunal Set II 17.5 to 18 Ma						MN 3

▧ Rhyolitic tuff overlying the mammal locality, dated by P. R. Renne in Goldsmith et al. (1994)

▨ Rhyolitic tuff overlying the mammal locality, dated by Burchart et al. (1988)

Table 2 -The dating of the faunal exchange between Africa and Eurasia during the Lower Miocene according to biochronological correlations and radiometric datings.

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ENDEMIC EVOLUTION OF MOLLUSCS IN THE PANNONIAN LAKE

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The Pannonian basin, a member of the Central and East European Neogene epicontinental basin system (Paratethys) became isolated by the late Miocene. Reconstruction of the Pannonian lake as an isolated reservoir is based on the extremely high degree of endemism, characteristic of its biota, and is supported by stable isotopic data.

The Pannonian lake served as a stage for one of the most conspicuous radiation of bivalves and gastropods in the Earth's history. In the six or seven million years of its existence, about one thousand described species, dozens of endemic genera, several endemic subfamilies, and two endemic families (*Lymnocardiidae* and *Valenciennidae*) evolved in the lake. This spectacular diversification was due to adaptive radiation. As a consequence of a geological event at the Sarmatian/Pannonian boundary, most of the restricted marine Sarmatian fauna became extinct, and the lake was repopulated from three main sources:

Representatives of two bivalve families (dreissenids and lymnocardiids) were descendants of marginal marine ancestors (some prosobranchs, like hydrobiids, may also belonged to this group). These molluscs had to cope with the lack of ebb and flow, change in concentration and chemistry of salt content, while, on the other hand, they got rid of some competitors and predators. As a rule, endemic radiation is characteristic of long-lived lakes (see the Recent examples of lakes Tanganyika, Baikal, Malawi, Victoria, etc.). In the Pannonian lake, a sudden increase in diversity of lymnocardiids and dreissenids is perceptible from stratigraphic zone E, i.e. about 2.0-2.5 my after the formation of the lake. The Pannonian lake lymnocardiids were assigned into 13 endemic genera, representing about 200 species. The 100 species of dreissenids belong to genera *Congeria, Dreissena,* and the endemic genus *Dreissenomya.*

Most prosobranchs and some bivalves (unionids) derived from fluviatile ancestors. Necessity to spread upstream favours streamlined shell shape and excludes planctonic larvae for fluviatile molluscs. These constraints are released in a lake. Immigration into the Pannonian lake of streamlined fluviatile snails (*Viviparus, Theodoxus, Valvata, Micromelania)* was often accompanied with shouldering of the shell. This pattern appears in iterative way in *Melanopsis* as well.

Pulmonats came mainly from shallow standing freshwater and marshes. They had to face with wave action and the considerable water depth of the lake. Adaptation of pulmonats (planorbid and lymnaeids) to the new conditions was so successful in the Pannonian lake that they were able to conquer the deep water environments where no other gastropod occurred. Family Lymnaeidae is an extremely plastic group as far as shell form is concerned. This plasticity led to the evolute shells of the genus *Valenciennius.* The evolutionary lineage leading from *Radix* to *Valenciennius* has been designated by several generic names.

Punctuation in the evolutionary record in general seems to be the results of formation of peripherally isolated subpopulations. Consequently, fully gradual evolution of benthic mollusc lineages in the Pannonian lake can be explained by the low chance for formation of peripheral isolates. Though increasing diversity of molluscs throughout the lifetime of the lake indicates common occurrence of cladogenesis, most well-studied examples of evolution reflect anagenetic changes.

DESIGNATION OF THE BASE OF THE PONTIAN STAGE IN PANNONIAN BASIN

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Stratigraphic correlation of the Neogene Paratethyan basin with each other and with the Mediterranean and global scales has always been a delicate issue. In order to create a more treatable subdivision, a system of regional stages was established for the area. Due to differences in the evolution of individual basins in the Paratethyan realm, however, two series of stages were introduced: one for the Western and Central Paratetys, and another for the Eastern Paratethys.

The two systems have two stages in common: the Sarmatian and the Pontian. The Sarmatian, however , is used in two different senses: in the Pannonian basin it covers a shorter interval of time (and, therefore, a less complete stage) than in the Dacian basin and Eastern Paratethys.

As to the Pontian, both the first description of the "Pontian layer" by Le Play, and the definition of the Pontian regional stages by Andrusov, came from the Euxinian basin. The base of the Pontian was designated by malacological data, and it is intimately associated with a paleogeographic event, resulting in a connection between the formerly closed Pannonian basin molluscs entered the Dacian and Euxinian basins, where this faunal change is conspicuous. We do not know, however, any positive evidence of westward migration among molluscs, ostracods, or dinoflagellates. Therefore, definition of the base of the Pontian with the opening of a strait between the Pannonian and Dacian basins, or with the first appearance of common species on both sides of the Carpathians, as put down by P. Stevanovic in "Chronostratigrphie und Neostatotypen, Pontien", is unambiguous for the

Dacian and Euxinian basins, but, in lack of westward migrations, difficult to apply in the Pannonian basin.

Molluscs regarded as first immigrants to the Dacian basin at the Pontian include *Dreissenomya digitifera "Pontalmyra" otiophora, Valenciennius reussi, Congeria Zagrabiensis,* etc. Appearances of these species in the Pannonian basin, however, can hardly be regarded as synchronous, and seem to well precede the date of their immigration to the Dacian basin. Several lines of evidence, obtained in Hungary in the last decade, including biostratigraphic (molluscs, dinoflagellates, mammals), magnetostratigraphic, seismic stratigraphic and radiometric methods, indicate that most of the "Lower Pontian" molluscan species appeared earlier than 9 my ago in the Pannonian basin. In the Kaskantyu-2 borehole *D. digitifera* appears more than 100 m below the top of magnetic anomaly 5 (8,9 my). *P. otiophora* is a probable descendant of the Pannonian *"Lymnocardium" promultistriatum* and *"L." desertum,* hardly can be distinguished from them. Typical *otiophora,* however, together with *Valenciennius reussi,* occurs in the Tata outcrop, belonging to the Spiniferites paradoxes zone. According to the analyses of boreholes Kaskantyu-2, Tiszapalkonya-1, and Berhida-3, this dinoflagellate zone is also situated within the magnetic anomaly 5 (10,3 to 8,9 my). In addition, first appearance of *Congeria zagrabiensis* and *C. praerhomboidea* in the Berhida-3 borehole also falls into the paradoxes zone.

In contrast to data, most authors agree that the Pontian in the Eastern Paratethys started about 7 my ago (see radiometric, fission track, mammal stratigraphic data).

For a correct correlation of the base of the Pontian between the Dacian and the Pannonian basin by molluscs, one has to take into account the youngest Pannonian basin forms that appear in the Lower Pontian of the Dacian basin. These molluscs include, for example, *Lymncardium riegeli* and the genus *Prosodacnomya;* indeed, their appearance in the Pannonian basin can be dated about 7,5 my, thus being more in accord with the Eastern Paratethyan data. This new correlation also provides explanation for the fact that "Early Pontian" localities in the Pannonian basin yield mammal remnants belonging to the Lower Turolian, while Pontian localities in the Eastern Paratethys provide fossils belonging to the Upper Turolian and Ruscinian.

The above data suggest that the "last" common stage of the Central and Eastern Parartethys, i. e. the Pontian, refers to different time interval and to geological formations of different age in the respective basins.

THE LARGER FORAMINIFERA OF MIDDLE OLIGOCENE-LOWER MIOCENE OF IONIAN ZONE AND KORCA DEPRESSION (SOUTH ALBANIA)

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In the middle Oligocene and lower Miocene deposits of south Albania (Ionian zone and Korca depression, where this author has made studies for biostratigraphic and paleogeographic purposes) , larger foraminifera have been recorded. In the two zones, the Oligocene and Miocene deposits are represented by a sequence of terrigenous rocks. Based upon larger foraminifera, the author established the boundary between Oligocene and Miocene in both studied areas.

In the first part of the paper was given a short presentation of the geographic-geologic position and the facies of the regions.

It have to be underlined that the larger foraminifera have been studied on thin sections, which were prepared from the detritic limestones and free material drew out from clays as well.

In the second part the paper, there are given the information on genera and species of large foraminifera which are found in south Albania. in both regions were recorded the same species and genera, but the difference between them consists in the manner of the their place.

In the Ionian zone, species and genera are reworked inside the flysch- fliyschoidal deposits of the Middle Oligocene. In the lateral part (Tirane, Valesh, Tervoll) the foraminifera are found in situ. In the Koca depression they are found in deposits of Middle Oligocene, the same as to lateral parts. In the deposits of Upper Oligocene - Lower Miocene, the foraminifera aer reworked inside

slumps which have derived from the lateal parts of the basin. The phylogenetic development and the manner of placing of larger foraminifera inside the rocks reflects exactly the sedimentary - tectonic evolution of both basins. These data give the informations for ares having the same evolution and the changes between them.

The study shows the distribution of the larger foraminifera in south Albania and the paleogeographic data which testify for the correlation of both basins with Mediterranean ones during the Middle Oligocene - Lower Miocene. The paper is accompanied with plates of larger foraminifera where their study was performed on thin sections and in forms which are diged up from clays and slumps of the both regions.

BIOSTRATIGRAPHY AND PALEOGEOGRAPHICAL INTERPRETATION OF MIDDLE OLIGOCENE - MIDDLE MIOCENE SUCCESSION IN THE NORTHERN MESOHELENIC BASIN (KORCA DEPRESSION, SOUTH-EAST ALBANIA) BASED UPON FORAMINIFERA AND CALCAREOUS NANNOFOSSILS

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Korca Depression sidtuated in south - east of Albania is the extention towards the north of Mesohelenic basin in Albanian teitory, or the north pat of the socalled Albano - Thessalian basin by other authors.

The oldest deposits (Middle Oligocene) are transgessivly set on the ultrabasics and cretaceous - eocene limestones basement. Terigenous deposits of various characteristics are successive until Middle Miocene.

The biostratigraphy is detailed based on the studies of foraminifera and calcareous nannofossils. The range - chart of these group is controlled by the facies. So, neritic environment of Middle Oligocene is not propitious to planktonic organisms, whereas it is favouable to larger foraminifera. The number of planktonic foraminifera and calcareous nannofossils increased in the turbidits of Late Oligocene-Early Miocene and these organisms become abundant in the marls of Late Burdigalian - Langhian age.

The planktonic foraminifera data permit us too include these depposits in the interval of Globorotalia opima opima Zone at the base and Globigerinoides bispherricus Zone at the top. Some transitional forms between *G. Bispherricus* and *G. Praeorbulina,* similar to *P. sicana,* are found at the of top the series.

Calcareous nannofosils assemblages prove that the base of the succession belongs to Sphenolithus distentus - NP 24 Zone the top to Sphenolitus heteromorphus - NNS Zone giving evidence of Langhian deposits.

The larger foraminifera are represented by:

-*Nummulites fiichteli, Lepidocylina (N) praemarginata, L. (E) elephantina* in the Middle Oligocene;

-*Nummulites bouilleei, Lepidocyclina (N) morgani, L. (E) dilatata, Operculina complanata, O. ammonoidea, Austrotrillina striata, Archais hensoni* in the Late Oligocene;

-*Miogypsina gunteri, M. gunteri- tani, M . tani* int. *tani- globulina, M. globulina* in Aquitanian;

-*Miogypsina globulina, M. intermedia* in the lower part of Burdigalian.

The acquired data of smaller benthic, larger and planktonic foraminifea and calcareous nannofossils allowed us to made the paleoecological interpretation. Thus, together with the studies carried out by the other authors in North Greece, we have a paleogeographical view more complete of the Mesohelenic basin.

NEOGENE BIOSTRATIGRAPHY OF MERSA MATRUH AREA, WESTERN NORTH COAST OF EGYPT

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One hundred samples were collected from the Neogene -Quaternary rocks around the Marsa Matruh area, from seven different stratigraphic section, which buonded by longitudes 28^0 $35'$ and $27^0 08'$ E and latitudes $31^0 20'$ N on the western north coast of Egypt.

One hundred and six foraminifers species are identified and discussed from the Miocene sediments from the area around Mersa Matruh. These species assigned the Miocene succession to three stratigraphical biozones, from base to the top they are:

(1) Cancris auriculus Zone (Langhian age, lower Middle Miocene);
(2) Heterolepa dutemplei Zone (Serravallian age, middle Middle Miocene);
(3) Amphistegina radiata Zone (Serravallian age, middle Middle Miocene).

Both paleoecological and microfacial investigations indicated that all sediments of this area were deposited under a shallow marine environment and tropical to subtropical conditions.

The identified benthic foraminifera species referred to paleoclimatic conditions during the time of deposition of the succession, indicate that the temperature ranges from 9^0 - 13^0 and salinity which may range from 3.5 to 3.8 %.

According to the planktic / benthic ratio, the depth ranges may be approximately until 200 m.

Pliocene and Quaternary sediments are poorly fossiliferous and were not paleontologically investigated.

THE MIOCENE BIOSTRATIGRAPHY IN WESTERN SINAI, EGYPT

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The Miocene sequence exposed in the western part of Sinai, Peninsula of Egypt, included some planktonic foraminiferal biozones. These biozones are somewhat facilitated the delineation of the different Miocene boundaries; the local and inter-regional correlation of the sequence. The Oligocene / Miocene boundary coincides with the first occurrence of *Globigerinoides primordius*, and the Lower/Middle Miocene one equates to the base of Praeorbulina glomerosa Zone, whereas the Langhian / Serravallian contact places at the initial appearance of Orbulina universa Subzone

PALEOENVIRONMENTAL REGIMES OF THE MIOCENE FORAMINIFERA IN RELATION TO THEIR ECOLOGICAL CONDITIONS AT WADI GHARANDAL AREA, WEST SINAI, EGYPT

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Twenty eight species of benthic foraminifera representing 12 genera have been identified in samples collected from two Miocene sections at Wadi Gharandal, west of Sinai. Of these samples 12 which yielded 100 more benthic foraminiferal specimens have been analyzed quantitatively to give an idea about the paleoecological significance of the area under study.

Q-mode principal components analysis of foraminiferal occurrence data has demonstrated that salinity is the most distinct factor which may have controlled changing paleoenvironments prevailing over this period of time. It is noteworthy that salinity increase upward in the studied sections.

On the other hand, the presence of deep water benthic genera together with shallower water inner neritic forms suggests deposition under turbididic conditions.

LE BASSIN DE ZARAND, GOLFE DE BASSIN PANNONIQUE

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Dans le present etude on a mis en evidence les ansambles des Foraminiferes et d'Ostracodes, coreles avec les Mollusques, correspondant aux entites du Miocene moyen et superieur.

Sarmatien: a) Volhynien superieur-l'ansamble a *Porosononion subgranosus* (Egg.), *Dendritina elegans* (d'Orb.), *Hemicytheria omphalodes* (Rss.)- la zone avec *Ervila dissita podolica* Eich., *Cardium politioanei* Jek;

b). Bessarabien infeieur avec *Dogielina sarmatica* Bogd-Volosh., *Peneroplidae* div. sp., *Aurila notata* (Rss.), *Aurila hispidula* (Rss.), coresponde a la zone Tapes gregarius gregarius-ponderosus d'Orb.

Malvensien: a) Malvensien inferieur est caracterise par: *Hungarocypris auriculata* (Rss.), *Hemicytherea lorenthey* (Meh.)-coresponde a la zone *Limnocardium cekusi (Gorj.-Kramb.), Limnocardium praeponticum* (Gorj.-Kramb.);

b) Malvensien superieur se caracterise par *Hungarocypris hierogliphica* (Meh.), *Hemicytheria brunnensis* (Rss.), qui coresponde a la zone *Congeria zsigmondy* Hal., *Congeria subglobosa* Part.

Pontien: L'ensemble *Candona (Pontoniella) acuminata striata* (Mand.), *Bakunella dorsoarcuanta* (Zal.), corresponde a la zone *Congeria ungulacaprae* Munst., *Congeria croatica* Brus.

A la base d'un riche faune d'*Ostracodes* du Sarmatien, on a separe le Bessarabien inferieur avec: *Aurila notata* (Rss.), *Aurila hispidula* (Rss.), *Leptocythere plana* (Schn.), *Leptocythere bituberculata* (Serem.), *Leptocythere monotuberculata* Sok., *Loxoconcha valiente* (Stanc.), *Loxocncha ornata* (Schn.), *Xestoleberis aff. glaberescense* (Rss.).

Dans une suite continue des depots ou leur partie inferieur appartient au Malvensien superieur, on a separe l'interval appartenant au Pontien, sur la base des suivantes Ostracodes: *Candona (Pontiniella) acuminata striata* (Mand.), *Candona (Pontoniella) hastata* Krst., *Bakunella dorsoarcuata* (Zal.), *Pontoleberis pontica* (Stanc.), *Cypria tocorjescui* Hang.

SOME FORAMINIFERAL DATA ON SERRAVALLIAN - TORTONIAN BOUNDARY IN THE IONIAN ZONE OF ALBANIA

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The biostratigraphic study of Serravallian - Tortonian boundary of several sections within Ionian zone of Albania based on foraminifera gives us the possibility to separate these sections in two mains groups.

The sections as Preza, Ndroqi, and Rrogozhina which are located within Peri-Adriatic - Depression (PAD) are characterized by another development of foraminifera along this boundary especially for planktonic ones in comparison with sections with are located in southern and south-eastern border of PAD.

These later sections as concerning this boundary are characterized by a poverishment in foraminifera especially the planktonic ones.

The main purpose of this study is to realize a reliable correlation between these two groups of sections. In this work is shown the distribution of some significant species of Foraminifera between Late Serravallian and Early Tortonian sediments of the both groups mentioned above.

The sections of PAD such as Preza, Ndroqi and Rrogozhina and especially Peza section which is located in northern part of PAD along the Serravallian / Tortonian boundary are characterized by a slightly dominance of planktonic foraminifera over the benthonic ones. The last occurrence of such planktonic species as *Globorotalia peripheroronda, Globigerinoides ruber, Globorotalia mayeri* could be used successfully for recognition of the Upper Serravallian sediments while the last occurrence of *G. mayeri* was taken into account to date the Serravallian / Tortonian boundary (Prillo and Hasanaj, 1994).

In all the sections which are located in the south and south-eastern of PAD the dominance of planktonic foraminifera is occurred in the stratigraphic levels not younger than the last occurrence of *G. peripheroronda*. It is difficult to use planktonic species for recognition of this boundary because in many cases the last occurrence of *G. peripheroronda, G. mayeri* and so on are the same.

For correlation of these sections for both groups would be used the dominance biofacies of *Bolivinitidae* or the first appearance of *Brizalina albanica* which is proved to be a good index fossil for recognition of the Upper Serravallian sediments and its dominance for recognition of uppermost Serravallian and younger sediment of Ionian zone of Albania.

FOSSIL MAMMAL COLLECTIONS OF THE PALEONTOLOGICAL AND GEOLOGICAL MUSEUM OF THE UNIVERSITY OF ATHENS: *ANCYLOTHERIUM PENTELICUM* GAUDRY& LARTET (*MAMMALIA, PERISSODACTYLA*) FROM PIKERMI (ATTICA, GREECE)

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A significant effort has been made during the years to prepare and study the important old collections stored unprepared in the Palaeological and Geological Museum of the University of Athens. In the framework of this effort, we present some fossil bones of *Ancylotherium pentelicum* GAUDRY & LARTET that come from old excavations that took place in the classical locality of Pikermi during the last century and at the beginning of the current century. The rareness of the fossils of *Ancylotherium pentelicum* obliged us to study this material consisting of metatarsals, tarsals, carpals and long bones. In parallel we discuss some crucial biostratigraphical problems concerning the rich Pikermian fauna (THEODOROU et al. 1988). Despite the fact that we accept that important stratigraphical information has been lost during the excavations of the past we try give some data concerning the accompanying fauna of this species. Biometrical and morphological observations are given separately for each bone category. The available material allows us to improve our knowledge on the Upper Miocene mammals of southern Greece.

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RUPELIAN MOLLUSC FAUNA OF SOLENOVIAN TYPE IN TRANSYLVANIA (ROMANIA)

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The Dolheni Group in NW Transylvania is constitued of Bizusa and Creaca Formations, in the lower part, and of the Ileanda Formation, Gruia Sandstone and Dancu Beds, in the upper part. This group is of Rupelian age (the nannoplankton mainly belongs to the NP Zone) and it contains a peculiar mollusc fauna (see Moisescu, 1968, 1972, 1975; Rusu, 1972, 1977, 1988), clearly distinct from that of the surrounding formations.

The malacologic assemblage of the Bizusa Beds (slightly bituminous marls) and of the Creaca Beds (sands and calcareous sandstones), characteristic of a pliohaline brackish environment (-16,5), is formed of *"Cardium" lipoldi* ROLLE *(= ? Korobkoviella kiktenkoi* (MERKLIN)), *Cerastoderma serogosicum* (NOSS). *C. chersonense* (NOSS.), *C. mutabile* POPOV, *C. merklini* KOJUMDG. & SAPUNDG., *Europicardium transsilvanicum* (HOFM. IN SCHRETER), *Merclinicardium apostolovense* (MERKLIN), *Janschinella garetzkii* (MERKLIN), *Lenticorbula sokolovi s. s.* (KARLOV), *L. samodurovi* (MERKLIN), *L. mefferti* TITOVA, *Ergenica cimlanica* (POPOV), *Urbnisia lata* GONTSCH., *Abra brevis* (BOSQ), *Limacina (=Spiratella) sp.* etc.

The Ileanda Beds (bituminous argillites, deposited offshore) contain two distinct communities of molluscs: a brackish one, spread on the thickness of the formation, which is constituted of *"Cardium" lipoldi*, *Cerastoderma serogosicum* and *Janschinella garetzkii,* and a normal marine (euhaline) one, of northern origin, situated in the base of the formation, forming the Nucula comta Level.

The Gruia Sandstone (=Cetate Sandstone - partium, namely Corbulidae bearing lumachelle sandstone, deposited nearshore) is rich in *Lenticorbula sokolovi s. s., L. subtriangulum* (MOISESCU), *L. helmerseni trasylvanicum* (MOISESCU, 1972) *(= L. h. major-* MERKLIN, 1974), *Lentidium nitidum* (SOW.), *Polymesoda convexa* (BRGT.), *P. brongniarti* (BAST.), *Congeria kochi* ANDR., *C. tenuissima* MOISESCU, 1964 *(=C. aralensis* MERKLIN, 1974), *Hydrobia obtusa* (SANDB.), *Stenothyra obtusa* (SANDB.), *Stenothyra pupa* (NYST.), *Stenothyrella lubricella* (SANDB.), *Brotia escheri grossecostata* (KLEIN), and *B. transsylvanica* (MOISESCU). Specimens of *Janschinella qaretzkii* are rarely found.

As regards *J. garetzkii* (MERKLIN , 1961), we agree with Tatishivili (1966) according to whom this name should include both *J. vinogrodskii* (MERKLIN, 1961) and *J. melitopolitana* (NOSSOVSKI, 1962), which represent only morphs of a unitary species. All these morphs are found in Transylvania, within the same population, a gradual transition being observed between them.

For the Solenovian-type mollusc fauna, Janschinella garetzkii Zone has been established as total-range zone, therefore with the extension of the index species and characterized by endemic species and genera (*Janschinella, Lenticorbula, Ergenica, Urbnisia, Merklinicardium, Korobkoviella).* In Transylvania, this zone is intercalated between two local zones: Tympanotonos labyrinthum / Ampullinopsis crassatina Zone (concurrent range zone), in the base and Pycnodonte callifera Zone (assemblage zone), in the top.

The malacologic assemblages of the Jansckinella garetzkii Zone are known in the Tard Clay from Hungary (Baldi, 1984, 1986), in the Ezerovo Formation in the Upper Tracia Basin from Bulgaria (Kojumdgieva, Sapundgieva, 1981) and in the formations included in the Solenovian "Horizon" of the Eastern Paratethys, namely in Foreblacksea, Volga-Don interfluve and Ergeni, North Caucasian Foredeep, Georgia, Mangishlak, North Ustjurt and Priaralia, Western Kopetdag, Central Kizilkum (see Merklin, 1961, 1974; Karlov, 1962; Nossovsky, 1962, 1970; Tatishvili, 1966; Popov & Titova, 1982; Kazakhashvili, 1984; Voronina & Popov, 1984; Ilina et al., 1985).

The endemic Solenovian- type fauna is a result of the isolation (during the Rupelian), for the first time, of the "Transeuropean realm" (Rusu, 1977) or better said of the Paratethys (Baldi, 1979, 1984). The Paratethys disconnection from the Tethys and the

Northern realm was due, as we presumed in 1988, to a contemporaneous global eustatic sea level drop, confirmed by recent studies (Prothero, 1994), which determined the separation of an inner continental sea -the Solenovian Sea (Rusu, 1988) - extending from Slovenia to Turkmenia and Kazahstan. This sea is characterized by low salinity and stagnant anoxic bottom water, quite similar to those of the actual Black Sea. Under these euxinic conditions in the offshore, below a certain depth, sapropelic muds were formed while in the littoral zone falum-bearing sands were accumulated.

The isolation of the first Paratethys (Protoparatethys phase, Rusu, 1988) took place in the early Kiscellian (Baldi, 1979), and it was total, excepting unsignificant interruptions, in contrast with the next phase (Eoparatethys) during which, in fact, the Paratethys realm communicated widely with the open seas. The episodic resuming of the connections, only with the northern realm, is marked by the occurrence, at certain levels, of boreal euhaline organisms.

NEW MARKER LEVELS IN OLIGOCENE AND LOWER MIOCENE DEPOSITS FROM NW TRANSYLVANIA (ROMANIA)

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Our investigation on the Oligocene-Lower Miocene deposits from the Preluca depositional Area (NW Transylvania) pointed out some contrast lithological markers and some biohorizons unknown in the region . As they have a paleontological control based upon calcareous nannoplankton and planktonic foraminifera, these isochronous marker levels can be used for high resolution regional correlation in the Carpathian area.

In the lower part of the Bizusa Formation (12-15 m of mainly bituminous calcareous marls) we have identified a benthonitized tuff layer (3 - 5 cm) which we call the **Glod Tuff**, belonging to the upper part of the NP_{22} Zone of the Rupelian (base of the Kiscellian from the Central Paratethys). This tuff is likely situated at the same level of the **Fulgeris Tuffs** (Stefanescu et al., 1992, unpublished data) from the Lower Menilite Formation of the East Carpathians. and to one of the tuffs from the interval Cardium lipoldi - Engenica Zone of the Tard Clay from Hungary (Báldi, 1984)

Limacina (=*Spiratella*) specimens have been found throughout the section of the Bizusa Formation, being associated with a brackish molluscan fauna of Solenovian type (Janschinella garetzkii Zone). It is to note that the **Limacina Horizon** from Transylvania is younger than the homonymous ones from Georgia, Ukraine, Hungary, Austria and Czechia.

The boundary NP_{22} / NP_{23} nannoplankton zones has been established in the lower part of the Bizusa Formation at *Reticulofenestra hillae* and *R. umbilica* LAD and *R. ornata* FAD (fig. 1).

A coccolithic limestone (15-30 cm thick) occurs in the upper third of the Ileanda Formation (45-60 m of bituminous argillites) consisting of *Reticulofenestra ornata* and *Transversopontis fibula* specimens. This limestone, identifieed as Jucha's (1969) **Tilawa Limestone**, is situated towards the terminal part of the NP_{23} Zone and suggest the correlation of the Ileanda Formation with the Lower Dysodyles Formation from the East Carpathians (Haczewski, 1889, Stefanescu et al., 1993) and with part of what is included in the "Menilitic Formation" in the West Carpathians (Haczewski, 1989, Bubik, 1992, Krhovski & Djurasinovic, 1993).

The boundary of the NP_{23} / NP_{24} zones lies towards the top of the Ileanda Formation, at Helicosphaera recta FAD.

In the lower part of the Vima Formation (350-400 m of siltic clays and marly clays) of Late Rupelian - Early Burdigalian age a coccolithic limestone (15 cm thick) occurs at 50-60 m above the base of the formation. It consists of *Cyclicargolithus floridanus* and *Reticulofenestra ornata.* This limestone, identified as Uhlig's (1883) **Jaslo Limestone** is situated within the nannoplankton NP_{24} and planktonic foraminifer P_{21} respectively zones, being wide-spread along the Carpathians Arch. Thus the **Jaslo Limestone** is present in the Krosno Beds and in the Menilitic Formation of the West Carpathians (Kotlarczyk, 1980; Haczewski, 1984, 1989; Bubik, 1992; Krhovsky et al., 1992), in the Pucioasa Formation with Fusaru Sandstone and in the Bituminous Shales Formation with Kliwa Sandstone of the East Carpathians (Wdowiarz, 1959; Kotlarczyk, 1961, 1980; Alexandrescu & Brustur, 1985; Ionesi, 1986; Haczewski, 1989, Stefanescu et al., 1993) and in the Pucioasa Formation from the South Carpathians (the westernmost section discovered by us being Valea Muereasca from the Getic Depression).

In the upper third of the Vima Formation, on the Valea Cocii section (Magoaja locality) ten layers of benthonitized tuffs reaching 1-5 cm in thickness occur on a 7 m thick interval, which we call **Valea Cocii Tuffs.** These tuffs are assigned to the lower part of the NN_{2a} Zone (over *Helicosphaera kamptneri* and *Reticulofenestra pseudoumbilica* FAD) and N_5 Zone respectively (imediately above *Globigerinoides triloba, G.immaturus, Globorotalia semivera, Planostegina heterostegina and Planoperculina complanata* FAD).

The **Valea Cocii Tuffs** can be correlated, according to their lithological aspect and stratigraphic position, with the **Mlacile Tuffs** from the Vinetisu Formation of the East Carpathians (Stefanescu et al., 1993; Melinte, 1993).

The terminal part of the Vima Formation, starting with the **glauconite sequence** (fig.1), includes species of the NN_{2b} and N_6 Zone respectively and correspond to the Chechis Clays from Transylvania (Popescu, 1972, Marunteanu, 1993) and to the lower part of the Cornu Formation from the southern part of the East Carpathians.

According to the nannoplankton ranges , the Oligocene / Miocene boundary would be situated below the **Valea Cocii Tuffs** at *Dictyococcites bisectus* s.s. and *Zygrhablithus bijugatus*

LAD and at *Helicosphaera mediterranea* and *H. scissura* FAD, being not marked in the planktonic foraminifera fauna.

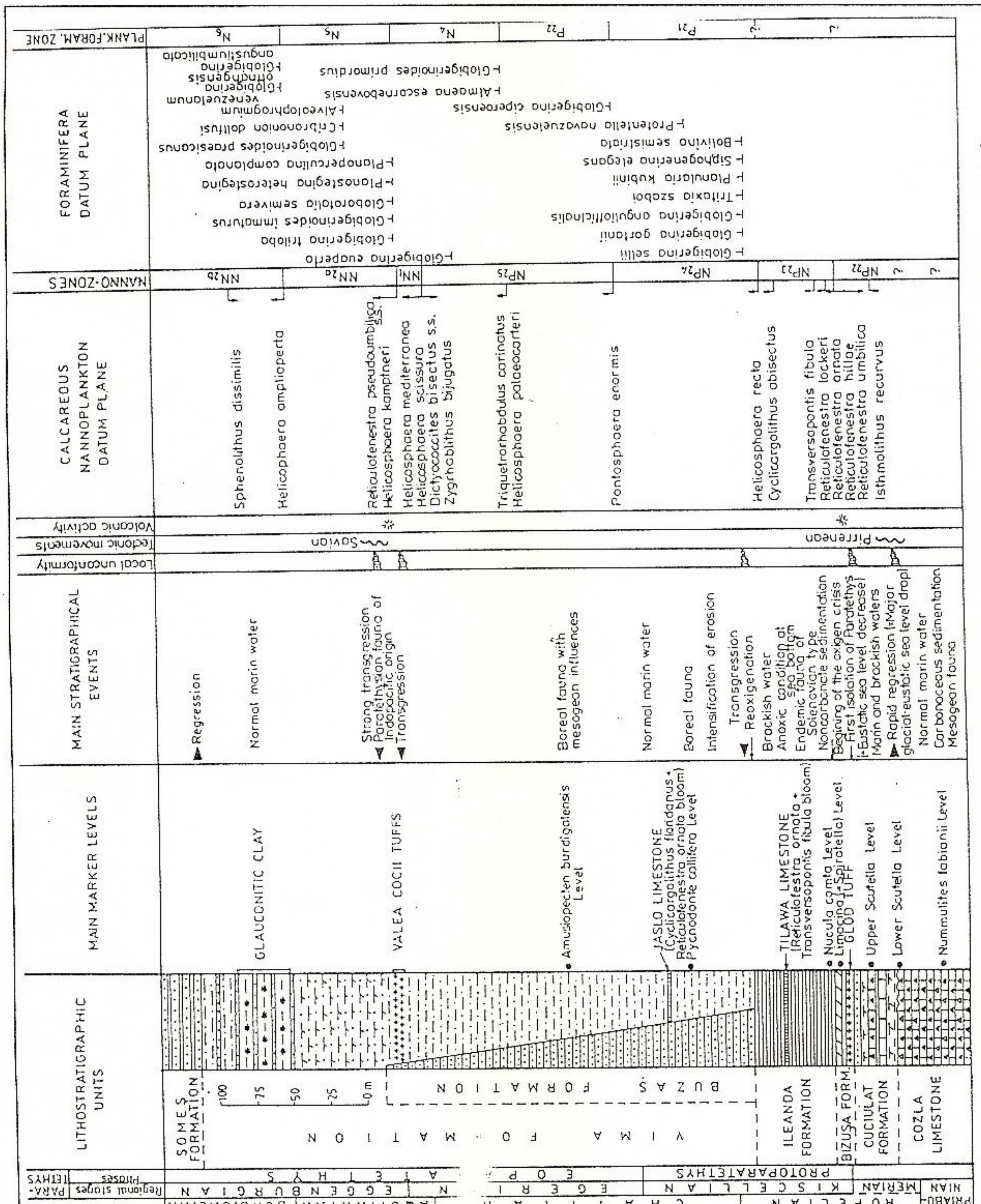

Fig.1 GENERALIZED OLIGOCENE-LOWER MIOCENE SUCCESSION IN PRELUCA AREA (TRANSYLVANIA)

THE GIBLISCEMI - FANEROMENI SUCCESSION; POTENTIAL FOR A NEW (MIDDLE / UPPER MIOCENE) STRATOTYPE IN THE MEDITERRANEAN. A DINOFLAGELLATE CYST BIOSTRATIGRAPHY

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Astronomical influences upon climate and sedimentary facies depend upon the changing position of the Earth's axis in its varying path around the sun (Berger 1977).

Since the pioneer paper of Milankovitch (1941) a huge amount of examples have shown the relationships between astronomical force and rhythmicities in the Pliocene and Quaternary climate and sedimentary record.

Such periodic climatic and oceanographic changes and the resulting rhythmic sedimentation patterns can be preserved in the sedimentary record (cycles), provided that the sediment supplying mechanisms (weathering and transport from the land, production of biogenic sediment in the ocean) as well as the relative sedimentary facies are sufficiently sensitive (De Boer , 1991).

Sedimentary cycles comparable to the Pliocene- Quaternary ones have been reported in the Mediterranean Middle - Upper Miocene too. Using magneto and biostratigraphic data as calibration (datum) points along the sequences, a trustworthy cyclostratigraphy starts to develop for the Upper Miocene with the same potential as the well established younger intervals.

The present study is part of the MIOMAR (MIOcene Marine Archives Reading) project. Major aims are to extend the astronomical polarity Time Scale into the Miocene and to develop an integrated (bio- magneto- cyclo - chemo) stratigraphy for the late Middle to Late Miocene in the Mediterranean.

A high resolution (23 kyr) dinoflagellate cysts event biostratigraphy in the open marine Gibliscemi- Faneromeni succession is here presented with this purpose. These sections cover the entire upper Middle and Upper Miocene (including the Serravallian/Tortonian and Tortonian/Messinian boundaries).

They were selected instead of the conventional stratotypes because of:

* the continuity of the succession

* the presence of characteristic sedimentary cycle patterns.

The latter allowed the succession to be astronomically dated by means of tuning to the orbital time series of precession, obliquity and eccentricity.

SUCCESSION DES EQUIDES DANS LE PLIOCENE DU BASSIN DACIQUE (ROUMANIE)

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On discute la morphologie et la biométrie comparatives, ainsi que la chronologie, des restes fossiles d'"Equidés pliocènes du Bassin Dacique.

Hipparion malustenense Radulesco & Samson, 1967, de taille réduite, diffère de *H. crassum* par les M, pli caballin quadruple, 35 plis sur les P, pli cabalin de double à triple et par le Mt3 (type) plus grand dans l'ensemble de ses dimensions; largeur distale sus-articulaire plus grande que celle de l'articulation.

Localités: Beesti (MN 14), Malusteni (MN 15a), Pliocène inférieur, Romanian inférieur.

Plesippus (Allohippus) major euxinicus Samson, 1974 - Equidé de très forte taille; dentition dépassant comme dimensions les pièces équivalentes de la Plaine Russe, M1/ plus grande que M2/, M1 égale à M/2, jugales inférieurs relativement étroites, Mc3 élancé avec la surface pour le petit cunéiforme très réduite et les tubercules sus-articulaires bien développés (pièce type).

Localités: (?) Malusteni (MN 15a), Pliocène inférieur, Romanian inférieur; Oasele (localité- type), Radovanu (MN 16a), Pliocène moyen, Romanian moyen.

P. (A.) athanasiui Samson, 1974 - Equidé de très grande taille, dépassé seulement par *P.(A.) major euxinicus*. Un riche matériel a permis l'étude de toutes les parties squelettiques. Les dimensions craniennes qu'on a pu prendre (manque de cranes entiers) et des séries dentaires sont un peu plus grandes que les memes dimensions rencontrées chez les espèces pliocènes mieux connues: *P. (A.) stenonis vireti* (St. Vallier), *P. (A.) stenonis guthi* (Chilhac), *P. (A.) stenonis cf. vireti* (Puebla de Valverde); les éléments postcraniens ont des dimensions significativement plus grandes.

Jugales supérieures: différence marquée entre P2? (allongée) et P3/; moins grande différence entre P4/ et M1/, et M2/; faible développement transversal; indices protoconiques (IP) ne dépassant pas 40; rapport entre IP P3/- P2/ très élevé (201,26); nombre des plis des fossettes, en moyenne, 6,5 sur les P, 8,5 sur les M; pli caballin absent jusqu'à triple sur les P, absent jusqu'à double sur les M.

Jugales inférieures: structure "sténonienne" typique; sillon lingual en "V"; sinus vestibulaire atteignant le sillon lingual sur les M, rarement le pédicule sur les P; pli caballinide généralement peu développé, souvent absent; différence importante de taille entre M/1 et M/2 en faveur de cette dernière, moins importante entre M/2- M/3; faible développement transversal; indices postflexidiques (IF) presque égaux sur P/2 et P/3, plus grands sur P/3 que sur P/4, différence modérée entre P/4 et M/1, plus grands sur M/1 que sur M/2.

Les métapodes ne présentent pas d'importants traits propres à l'exception de leurs grandes dimensions (X Longueur Mc3 = 257,33; N= 44; Mt3= 292,48; N= 48), grande dimensions reflétée par toutes les autres pièces squelettiques.

Localités: La Pietris, Valea Graunceanului (localité- type), horizon faunique de Tetoiu-1 (1,8 Ma, événement d'Olduvai), Pliocène supérieur, Romanian supérieur.

STRATIGRATIGRAPHIC CORRELATION OF THE EASTERN PARATETHYS KIMMERIAN AND DACIAN STAGES BY MOLLUSCS, DINOCYST AND NANNOPLANCTON DATA.

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As N.I. Andrusov noted the Dacian Stage of Teissere "contained equivalents of the Kimmerian Stage". Then Romanian researchers found within the Dacian deposits some molluscs (e.g. *Euxinicardium, Tauricardium, Oraphocardium, Limnodacna, Pteradacna, Plagiodacna, Prionopleura* and others) common for the Kimmerian of the South of the USSR.

A.G. Ebersin and V.N. Semenenko (1966) have found some guide forms of the Dacian molluscs within the Kimmerian of the North Azov area for example *Horiodacna rumana* was found with the molluscs association typical to the Duabian facies of the Kimmerian.

The Kimmerian basin (as well as the present Black Sea basin) consisted of two basins East-Euxinian (which occupied the Azov Sea basin and was somewhat more expanded) and the Kimmerian basin proper which occupied the aquatorium of the present Black Sea. At the north-west the Kimmerian basin connected with Dacian basin by narrow Reni strait, located in the lower stream of modern valley of the Danube River.

During the Kimmerian time activity of mud-volcanic processes increased in the Kerch-Taman Zone and the Kimmeria East-Euxinian basin was exposed to hydrosulphuric infection. Apparently owing to that the grater part of the Kimmerian strata (except of its lower part) is non-calcareous in this region.

The lower Kimmerian rocks (so-called the Azovian horizon9 are calcareous and contain nannoplankton of the NN 11 Zone as follows: *Ceratolithus tricorniculatus* Gartn., *Discoaster* *inqueramusqu* Gartn. and others, and higher *Ceratolithus acutus* Gartn. et Bukry (identifications of Dr. S.A. Lyuljeva) together with mollusc fauna.

Besides molluscs and coccoliths there were for the first time extracted following dinocysts (identifications of Dr. E.S. Oleinik): *Pondiadinium inequicornutum* (Balt) St. et Evitt., *Impagidinium* sp., *Tecttatodinium* sp., *Spiniferites ramosus* (Ehrb.), *Hystrichosphaeridium tubiferum* (Ehrb.) Defl., *Thalassiophora balcanica* Baltes and prazinophytes scarcely occur:

Higher in non-calcareous part of the section coccoliths are naturally absent but rather many genera of dinocysts occur: *Pontiadinium, Tectatodinium, Hystrichosphaeridium, Chytrosphaeridium and Leiosphaeridia (L. pannonica* Baltes). The analysis of the microphytoplankton assemblage and comparison of it with the Neogene (Pontian-Dacian) assemblages of Romania and partly Italy (Zanclian) (Habib, 1971, Ventkatachala, Baltes, 1962) permit to determine the Pontian-Kimmerian age of these deposits from the one rand and from the other one we can speak about a brackish relatively shallow water environments for planktonic organisms that time.

In the lower stream of the Danube River there were drilled the Dacian deposits with a thickness of up to 200 m which filled eroded base of the above mentioned Reni strait. The Dacian clays and siltstones containing abundant *Viviparus ovidii nasonis* Bog., and *Prosodacna (Psilodon) hauei* (Cob.), *Pachydacna cobalceski* Font. and others as well yield nannoplankton layers of the NN 11 Zone with *Amaurolithus amplificus* (Bukry et Percival), *A. delicatus* Gartner et Bukry, *Ceratolithus acutus* Gartner et Bukry, *C. rugosus* Bukry et Bramlette and *Florisphaera profunda* Okada et Honjo was found for the first time in outcrops.

The available data testify that Dacian and kimmerian Regio-Stages of the Paratethys correspond to Zancliana of the Mediterranean and support the point of view of Dr. V.N. Semenenko (1979) that the Miocene-Pliocene boundary is placed above the Pontian s.str.

this investigations were supported by International Scientific Foundation (J. Soros Foundation) grant N° U4 x000.

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ABOUT ZONAL CORRELATION OF THE MEOTIAN STAGE OF THE EASTERN PARATETHYS

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The Meotian deposits widely distributed over the Euxinian-Caspian and Dacian basins of the Parateths are well studied and subdivided in detail. There are two distinct associations distinguished by the molluscan fauna. The first one is the early Meotian with predominantly marine molluscs, among them *Mytilaster incrassatus* (Orb.), *Loripes pseudoniveus* (Andrus.), *Cerastoderma arcella mithridatis* (Andrus.), *Dosinia maeotica* Andrus., *Paphia abichi* (Andrus.), *P. curta* (Andrus.), *Abra tellinoides* Sinz., *Ervilia pusilla minuta* Sinz., *Gibbula maeotica* (Andrus.),*Bittium reticulatum* (Costa), *B. acutum* Osaul., *Rissoa subinflata* (Andrus.), *Alvania pseudalvania* (Andrus.), *Mohrensterinia carinata* (Andrus.), *Hydrobia micra* Stekl., *H. ventrosa* (Mtg.), *Odostomia insculpta* (Mtg.), dominate. Brackish-water *Congeria, Caspiohydrobia, Pseudoamnicola* and others are common in places. Discovering within the Lower Meotian (ancient Riona Gulf) of the layer where numerous gastropods *Alvania montagui* Payr., *Rissoa ventricosa* Desh., *Polinices catena helicina* (Broc.), and others were found together with *Dosinia, Ervilia, Mytilaster, Paphia abichi, Loripes, Bittium reticulatum* is of special importance. These forms typical Mediterranean species common from the Miocene up to the present time but they have not never beck found in the Meotian deposits (Iljina and others, 1976, p.37).

At the beginning of the late Meotian time brackish-water *Congeria panticapaea* (Andrus.), *Caspiohydrobia tamanensis* Iln., *Hydrobia ossavinarum* Andrus., *H. striatocarinata* Andrus., *Pseudoamnicola (Barassia) margaritaeformis* (Andrus.), and *Turricaspia carinata* (Andrus.), dominated among the molluscs. The marine elements were rare.

Only *Abra tellinoides* still existed among the marine species.

Decreasing of salinity during the late Meotian is fixed by the foraminiferal associations; Mediterranean elements practicaly dissapear, euryhaline ones dominate (A.K. Bogdanovich, 1965, 1969).

Within the lower part of the Meotian of the Kerch-Taman stratotype nannoplanktonic interbeds were distingished (NN 9 Zone) where several associations were found (identifications of S.A. Lyuljeva). They are as follows: *Catinaster coalitus, Catinaster mixicanus* and *Catinaster calyculus* and *Discoaster hamatus* (together with *Catinaster coalithus*) and *Lithostramation* perdurum as well; numerous *Braarudosphaera bigelowi* and *Pontosphaera* are rockforming. *Catinaster coalithus* was found also in the above mentioned interbed with marine gastropods of the Lower Meotian deposits near the town of Tkvartchelli (Western Georgia) together with *Braarudosphaera bigelowi* and abundant reworked Eocenian coccoliths. In the upper part of the Meotian of the Kerch peninsula nannoplancton association of NN 10 Zone and *Discoaster neohamatus, D. neorectus* and others were found (V.N. Semenenko, S.A. Lyuljeva, 1978).

The lower part of the Meotian is predominantly magnetized reversaly and the upper one is normally magnetized. Both of them are correlated with the paleomagnetic epochs 8 and 7 (V.N. Semenenko and M.A. Pevzner, 1979).

Within the directly underlying late Sarmatian (s.l.) deposits of the Kerch Peninsula there are volcanic ash interlayers which permit to obtain the data of 9.5 mln. years treck method (Chumakov I.S. et al., 1984, 1988).

Thus (V.N. Semenenko, 1979) the greater part of the Meotian is correlated with the Tortonian (Ryan, Cita et al., 1974).

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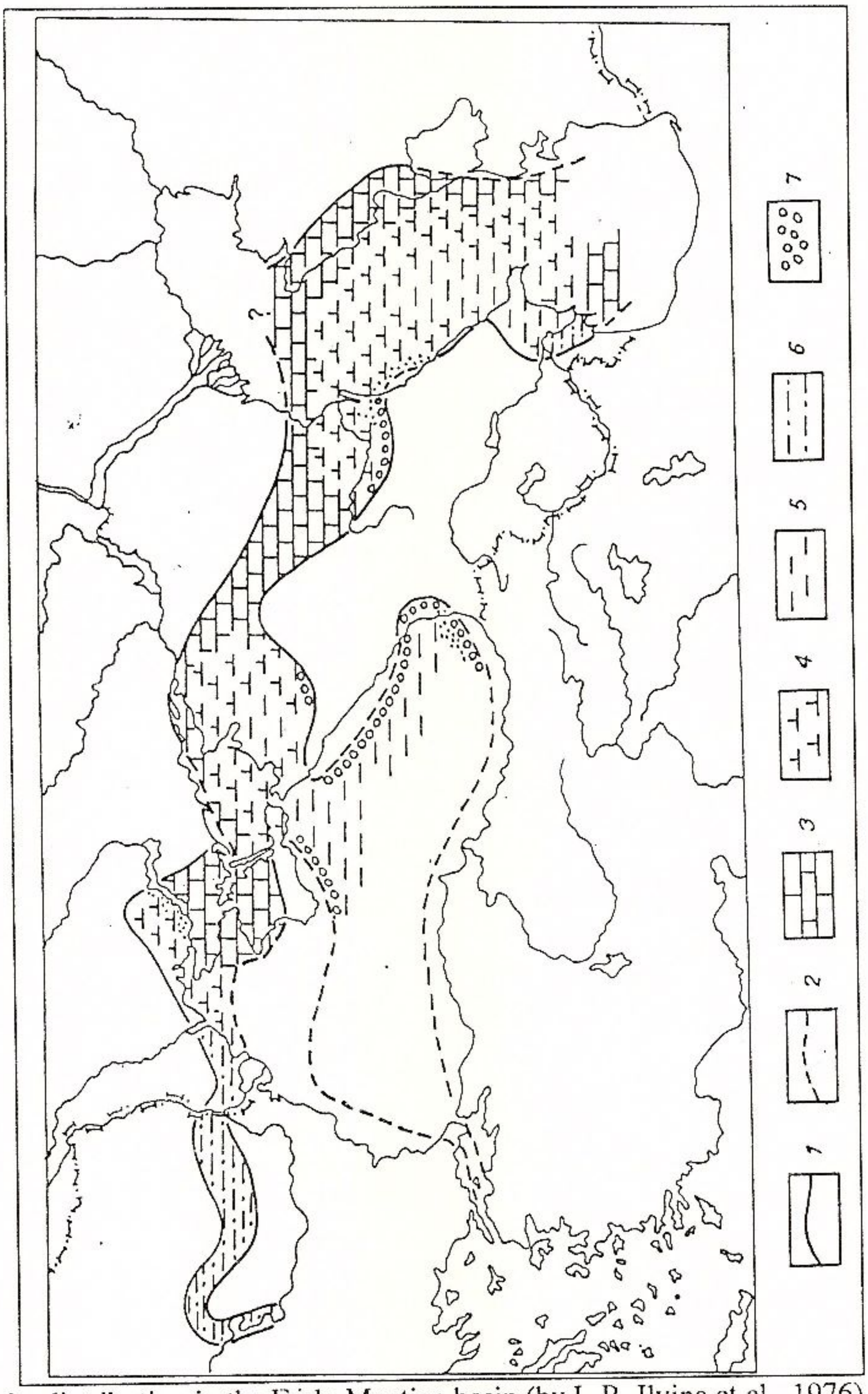

Deposits distribution in the Early Meotian basin (by L.B. Ilyina et al., 1976).

Legend:

1.-the shoreline; 2.-supposed shoreline; 3.-limestones; 4.-clay and limestone; 5.-clay; 6.-limestone-clay interbeds; 7.-conglomerates.

HIGH FREQUENCY ENVIRONMENTAL FLUCTUATIONS DURING THE MESSINIAN IN THE SORBAS BASIN. WESTERN MEDITERRANEAN

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A series of 120 m of marls was studied in the Sorbas basin with the aim of analyzing the environmental evolution of this basin and its relation to fluctuations in the Earth-Sun geometry during the Early Messinian. This series can be easily correlated with the open Ocean, and sedimentation is marked by well defined small scale cyclically. The latest Miocene deposition begins with a transgressive calcarenitic unit of approximately 20 m thickness. This unit is overlaid by yellow sands (approx. 5m thickness) which rapidly pass upwards to the marls that in turn are overlaid in the central part of the basin by the Gypsum deposits, the Evaporite unit.

At first glance, these marls can be divided in two parts: in the lower part (approx. from 0 to 80m.) the marls are gray in color, while the upper part is more beige in color. Looking more closely, small-scale sequences ranging in thickness from 1.5 to 3m, can be recognized in both parts. In the lower part these sequences are identified by the presence of whiter, more indurated layers regularly intercalated within the gray marls. In the upper part these cycles are a bit more complex, they are still limited by these white more indurated layers on top and bottom of the sequence but a sapropel unit is intercalated in the middle part of the gray marls. The term sapropel is used here to refer to brownish, well laminated layers. The white indurated layers are consistently rich in diagenetic silica (opal CT) in the lower part of the series and biogenic opal in the upper part. From bottom to top 56 cycles were identified in the series prior to the beginning of the evaporite sedimentation.

The stratigraphy of this section is mainly based on some planktic foraminifera and calcareous nannofossils bio-events that have been previously identified both in the Open Ocean and Eastern and Western Mediteranean and calibrated to the Magnetostratigraphic scale. PF- events 3,4 and 5 of Sierro et al (1993) are recorded in the section.

A high resolution sampling was carried out (1 sample every 3.5Ky) to analyse the planktic foraminifera and Nannofossil assemblages, carbonate, organic matter and dolomite contents and stable isotopes.

Some of these parameters are marked by long and short term quasi-periodic fluctuations clearly related to the lithological cycles. Most of the high frequency changes seem to have been caused by quasi-periodic fluctuations in the intensity and position of seasonal thermocline and pycnocline all along the Messinian.

A spectral analysis was applied to the planktic foraminifera signal showing that there is a notable concentration of power around the precession band.

PALYNOLOGY AND CYCLOSTRATIGRAPHY IN THE CENTRAL MEDITERRANEAN (UPPER PLIOCENE - LOWER PLEISTOCENE)

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Upper Cenozoic climatic changes are considered to have been controlled by the cyclic variations of the Earth's orbital parameters (eccentricity, obliquity, precession). Geochemical (CaCO3, §18 O) and micropaleontological (foraminifers mainly) records have been correlated with the astronomic curves.

In the same way, palynological records-pollen grain countings and palynofacies- start to be understood in terms of high- resolution cyclostratigraphy (Fig.1). This approach is applied to exposed sections of marine deposits, the age of which is established on biostratigraphic and paleomagnetic data. The investigation concerns three sections from Sicily and Zakynthos island, representative of several periods from the onset of the north hemisphere glacial-interglacial cycles.

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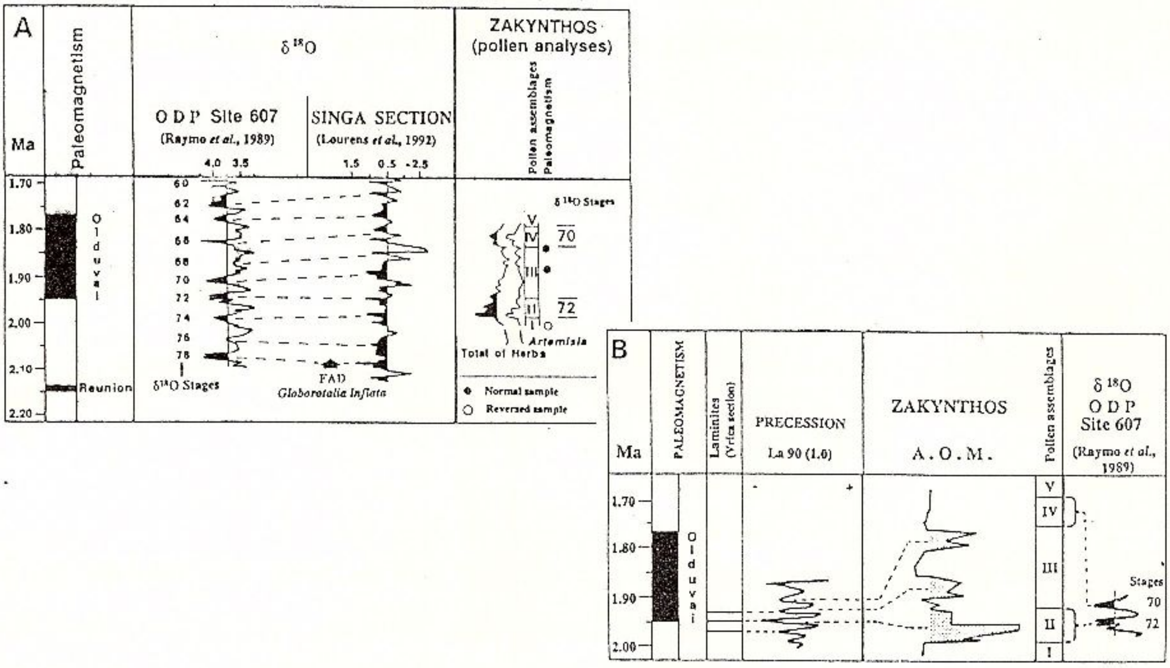

Fig. 1. Palynology applied to the lower Citadel section in the Zakynthos island (Greece) (Suballyova *et al.*, in press).

A. Relationships between pollen curves and δ^{18}O Stages using bio- and magnetostratigraphy.

B. Specified chronologic calibration of the section using palynofacies: Amorphous Organic Matter maxima are correlated with minima of Precession.

PLIOCENE CLIMATOSTRATIGRAPHIC RELATIONSHIPS BETWEEN THE NORTHWESTERN MEDITERRANEAN AND THE CENTRAL PARATETHYS REGIONS

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A climatostratigraphic subdivision of the Pliocene has been established in the Northwestern Mediteranean region (Suc, 1982 and 1984), based on changes in pollen assemblages within foraminifer beds. Four zones characterize the Pliocene before the earliest steppe assemblage which corresponds to the earliest glacial in the Northern hemisphere: PI a-b-c (i.e. approximately the Zanclean stage) and PII. Such a climatostratigraphy has been correlated with that of The Netherlands (Suc and Zagwijn, 1983) and, patly, with that of the Portugal (Diniz, 1984). Up today, no climatostratigraphic subdivision has been evidenced in the South Mediterranean region (Suc et al., 1995).

Recently, thanks to the record of lowermost Zanclean nannoplankton in the Ticleni borehole (SW Romania), a successful pollen comparison has been achievable with the Garraf 1 borehole, which is used as reference section (Drivaliari et al., in press). For the first time, reliable arguments allow relationships between the Central Paratethys regional stages and the Mediterranean standard stages (Fig.1).

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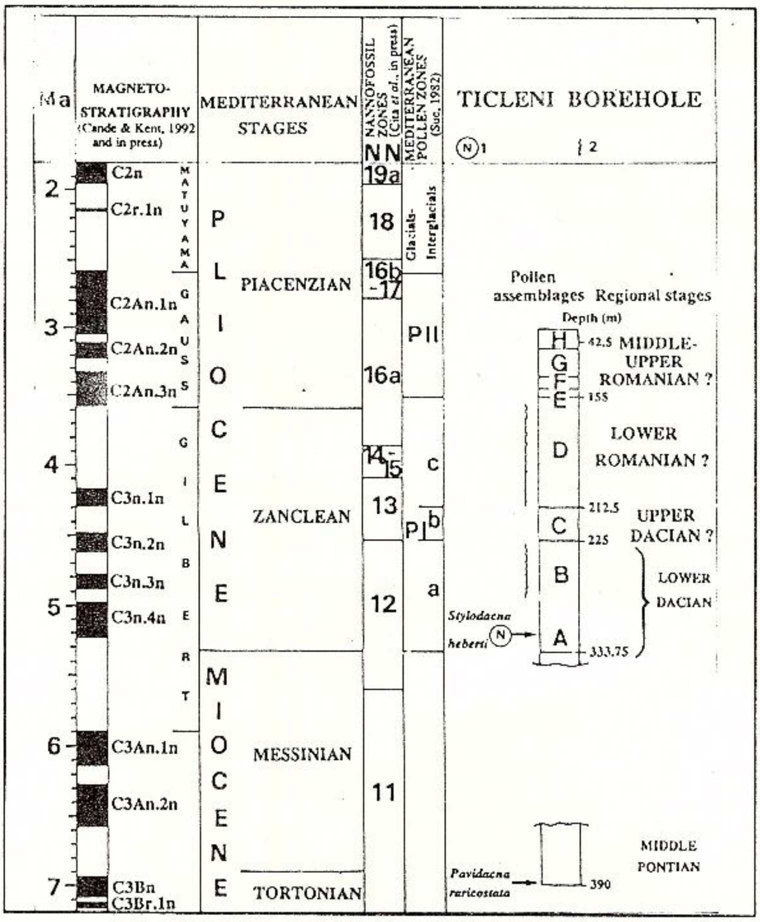

BIOCHRONOLOGIE DU PLIOCENE DU BORD MERIDIONALE DU BASSIN DACIQUE (ROUMANIE)

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Trois ensembles mammalians pliocenes, decouverts dans les depots sablo-graveleux, affleurant dans les carrieres de Ciuperceni et de Lisa (dep. de Teleorman), localites situe a proximite du Danube, permettent d'etablir des correlations avec la biozonation du Neogene mediterraneen, fondee sur les Mammiferes, et aussi avec la biostratigraphie locale.

Voici la succession chronologique des faunes et leurs principales particularites.

CIUPERCENI-1: faune sans Arvicolides, formee exclusivement d'especes vivant en milieu boise, telles que *Dibolia getica, Pliopetaurista dehneli, Zamolxifiber covurluiensis, Paracervulus australis, Sus minor, Dicerorhinus cf. megarhinus.*

L'absence des *Mimomys primitifs*, formes assez nombreuses dans le site susjacent de Ciuperceni-2, et le facies structural archaique des especes identifiees permettent d'encadrer cette faune dans la zone MN 14 (Ruscinien inferieur; Dacien ?final). Elle represente une phase a climat humide et chaud, pareil a celui signale en Grece septentrionale et en Anatolie, au debut du Pliocene.

CIUPERCENI-2 (superpose a Ciuperceni-1): faune diversifiee, a *Mimomys occitanus* en association avec quelques immigrants asiatiques, habitants d'espaces ouverts (*Pliospalax compositodontus, Ochotonoides csarnotanus, Trischizolagus dumitrescuae, Pliopentalagus* sp.) et avec des especes sylvestres, dont la plupart persistent dans cette region des le Ruscinien inferieur. Bien que les deux groupes ecologiques soient representes par un nombre quasi-egal d'especes, les elements de savano-steppe sont dominants du point de vue quantitatif.

Le stade evolutif de *Mimomys occitanus* indique un age ruscinien superieur (MN 15b; Romanien inferieur) et la composition de la faune suggere un changement climatique, caracterise par une diminution notable de l'humidite, ce qui a entraine le changement de l'environnement. Une evolution similare du climat a ete constatee dans le nord de la Peninsule Balkanique (Bulgarie, N. de la Grece) et en Anatolie, regions qui formaient, au Pliocene inferieur et moyen, une surface continentale unitaire avec la zone investiguee par nous.

LISA : faune a *Anancus arvernensis* et *Mammuthus (Archidiskodon) primitif,* associes avec *Pliospalax tourkobouniensis, Cervus sp.(? pardinensis) et Cervide* indet.Cette faunule, qui met en evidence l'arrivee sur ces lieux d'une nouvelle vague d'immigrants, parmi lesquels un element d'origine africane, pourrait correspondre a la zone MN 16b (Villanyien inferieur; Romanien moyen final).

COMPARATIVE STUDY OF *HIPPARION* FROM ARGOLIS, ATTICA AND EUBOEA (SOUTHERN GREECE)

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Our studies on fossil mammals of Greece that we have carried out during the last years have clearly shown that some opinions taken for granted cannot be easily documented. The biostratigraphy of some famous localities is not well known due to the fact that there is inadequate information from old excavations. Many localities have not been excavated during the last decades. A lot of results have been based on erratic data, originating from old excavations and mixed material coming from different horizons. In this paper we present a comparative study on the morphology of *Hipparion* and the biostratigraphy of the mentioned fossiliferous localities. The material that we used comes from the classical locality of Pikermi and Chalkoutsi in Attica, Kerassia locality (Island of Euboea) and Hermioni (Argolis, Peloponnesus). The excavations on the Island of Euboea and Chalkoutsi are not yet finished but the *Hipparion* bones and dentitions already available allow us to discuss the biostratigraphical situation of all these localities.

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CONTRIBUTION TO THE STUDY OF THE TERRESTRIAL NEOGENE OF GREECE . ARTIODACTYLA AND RHINOCEROTIDAE FROM THE KERASSIA AND CHALKOUTSI LOCALITIES

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The first results of recent excavations (1992-1994) at two Neogene vertebrate localities of Greece are discussed here. The scientific knowledge on the composition of the fauna and the magnetostratigraphy and biostratigraphy of these two localities is given mainly by KOUMANTAKIS, 1971, HEYE et al., 1980, MADE et al., 1989. The systematic excavations that we carry out show that we can expect a lot of new findings and biostratigraphic data. The only serious drawback is that the condition of the fossils at Kerassia is very bad marking the preparation of the fossils extremely difficult and time consuming.

The fauna of the first locality, as it is given by the findings that are already prepared from Kerassia, is consisted of *Perissodactyla (*Equidae and Rhinocerotidae), *Artiodactyla* (Bovidae, Giraffidae) and Carnivora, while that of the second locality, Chalkoutsi, is characterized by the presence of *Perissodactyla* (Equidae and Rhinoceridae), *Artiodactyla* (Bovidae and Giraffidae) and Carnivora.

This study is based mainly on Bovidae and Rhinocerotidae. Equidae are studied separately while the material of Carnivora is at the moment inadequate for any serious taxonomic and biostratigraphic work.

The excavations were financially supported by the Research Commission of the University of Athens.

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THE PLIO- PLEISTOCENE BOUNDARY IN GERAKAS SECTION, ZAKYNTHOS (IONIAN ISLANDS). BIOSTRATIGRAPHIC AND PALEOECOLOGICAL OBSERVATIONS.

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The section Gerakas is located in the northeast side of the island of Zakynthos and comprises three parts: "Seliniako Topio" section, Gerakas I section and Akrotirio Gerakas section.

Detailed sedimentary facies analysis leads to the recognition of three units which are indicative of coastal-shallow marine environment and are bounded by unconformities. Unit 1 is composed of laminated marls embedded into blue marls. The base of Unit 2 is characterised by the presence of a thin sandy conglomerate which is going into lithified brown sandstone. The upper part of Unit 2 is composed of bluish marls with laminated marly intercalations and a variety of macrofossils and trace fossils. Finally, Unit 3 is composed of brownish calcareous sandstones.

Based on calcareous nannofossil biostratigraphic events, it is possible to recognize the Plio-Pleistocene boundary in "Seliniako Topio" section. The lower part of this section can be placed between 1.89 Ma (highest occurrence of the species *Discoaster broweri* and *Discoaster triradiatus)* and 1.60 Ma (lowest occurrence of the species *Gephyrocapsa oceanica* s. l.). The lowest occurrence of the species *Gephyrocapsa oceanica* s. l. points out an age between 1.57- 1.61 Ma and allows the recognition of the Plio-Pleistocene boundary in the above -mentioned section based on biostratigraphic events.

The available data for lower part of the section point to Upper Piacenzian (Upper Pliocene).

The uppermost part of the lower Unit is placed between 1.60 Ma and 1.45 Ma (highest occurrence of *Calcidiscus macintyrei)* and can be assigned to Lower Pleistocene (Lower Selinuntian).

The quantitative micropaleontological analysis of calcareous nannofossils indicate a coastal-shallow marine environment of low salinity and low temperature in Upper Piacenzian- Lower Selinuntian times and a tendency to higher temperatures in about 1.60 ma. Furthermore, Lower Pleisocene is characterised by relatively warm water of low productivity.

THE EARLY PLIOCENE (RUSCINIAN) ARTIODACTYLS ON THE TERRITORY OF THE FORMER USSR

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The composition of artyodactyls assemblages depends on both global climatic and palaeogeographic events influencing on the migration processes and geographical speciation.

At the beginning of the Pliocene on the south of Eastern Europe more humid climate conditions as compared with preceding time promoted to the wider spread of a decrease of a part of the forests and wet stations and to a decrease of a part of the animals of the open areas. The number of suiformes, large progressive muntjacs and small cervines increased sharply, the areas of oxes enlarged and a diversity of antelopes diminished. A part of the descendants of the late Miocene genera (*Propotamochoerus, Parabos*) invaded there from the other regions of Eurasia due to the new migration routes and environments. Approximately a half of artiodactyls genera (*Hippopotamus, Paracamelus, Croizetoceros, Cervus, Pseudalces, Plioportax*) made their first occurrences there during the Pliocene. The majority of them also were allochtonic. Four groups of artyodactyls (hippopotamus, camels, elks and sivatheriines) had the late miocene ancestors on the other continents: camels and elks came from America, hippopotamus and sivatheriines were African by origin.

In the European-Siberian subarea, the common European species (*Propotamochoerus provincialis, Paracervulus australis, Procapreolus cusanus*) occurred together with endemics and typical of central Asia *Paracamelus, Eostyloceros* and *Muntiacus.* A number of progressive species (*Procapreolus wenzensis, Cervus warthae, Cervus perrieri, Parabos boodon*) appeared in southern Eastern Europe during the second half of the early Pliocene. In the Central Asia subarea, *Eostyloceros* and *Pliocervus* inhabited together with *Palaeotragus* and *Samotherium.* At the end of the early Pliocene the large muntjacs continued to exist there.

At the end of the early Pliocene the most thermophilic forms disappeared and the forms, which were more tolerant of lower temperatures, became wide spread.

LA STATOLOGIE, UNE NOUVELLE DISCIPLINE NEO ET PALEOZOOLOGIQUE

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L'objet de cette discipline est forme par l'etude anatomique-structurale du statolite, une composante essentielle du statocyste, organe d'equilibre et d'orientation des especes de la famille des Mysidae, classe Crustacea. Elle contien deux sous-disciplines: la neostatolithologie, a savoir l'etude des statolites actuels et la paleostatolithologie, l'etude des statolites fossiles.

Le statolite est un corpuscule microscopique, biosynthetique, a forme spheroidale jusqu'a discoidale, d'origine minerale (fluorine, calcite aux formes fossiles, vaterite aux formes actuelles) et de nature organique, a structure microlamellaire concentrique et a structure neurale tres complexe.

lLa famille des Mysidae vit dans toutes les eaux du globe, sans tenir compte de salinite et de profondeur. .

La presente etude contient les resultats des recherches, des investigations que j'ai faites entre 1970 -1980, quand les recherches ont ete reprise par les professeurs A.P. Ariani (Naples) et K. Wittmann (Vienne), qui, a la suite de leur activite concretisee en nombreux travaux publies, ont conduit vers la confirmation et la promotion de cette discipline neo et paleozoologique.

L'objet d'etude a ete forme initialement par un corpuscule calcaire microscopique, tres abondant dans les depots du Sarmatien inferieur et moyen de la Paratethys Centrale et Orientale, en constituant, du point de vue stratigraphique, un repere particulierement important, une raison pour laquelle il a ete l'objet de recherche pour beaucoup de micropaleontologues de divers pays, etant attribue a plusieurs groupes systematiques vegetaux et animaux. L'etude de la structure du statolite a conduit vers l'etablissement de la formule statolitaire qui a un caractere de specificite taxonomique.

La statolithologie presente une importance scientifique et economique:

1. Dans la paleontologie, la decouverte des mysides fossiles.

2. Dans la zoologie et la paleontologie, l'identification d'un nouveau critere taxonomique, la formule statolitaire, tout comme le dechiffrage de la phylogenie des especes fossiles et actuelles.

3. Dans la biostratigraphie, l'etablissement du repere de la biozone a statolites de mysides dans le Sarmatien inferieur et moyen.

4. Dans l'hydrobiologie, on observe generalment que dans le milieu marin vivent des mysides a statolites de fluorine et dans le milieu dulcicole-saumatre celles a statolites de calcite.

5. Dans la paleogeographie, on a correle la Paratethys Centrale avec celle Orientale et on a etabli que l'elevation de la chaine carpathique s'est produite plus tot, a savoir pendant le Sarmatien inferieur et pas pendant le Sarmatien moyen. De plus, il est possible de correler la Paratethys avec la Tethys.

6. Dans l'economie, la decouverte des "gisements vivants" de flourine et des substances proteiques dans la biomasse des mysides.

NEOGENE MOLLUSCAN FAUNA AND STRATIGRAPHY OF THE DATCA PENINSULA (MUGLA, TURKEY)

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In this study, Neogene units of Datca (Mugla) Peninsula have been examined. Seven measured stratigraphic sections and molluscan fauna of Yildirimli formation were determined and thirty-seven specimens were described.

One of these specimens, *Hydrobia tanerae* n. sp., is proposed to be a new species. Stratigraphic level of molluscan fauna is evaluated by Electron Spin Resonans Methods are applied on *Cerastoderma (Cerastoderma) edule* Linne, *Anadara (Anadara) diluvii* (Lamarck) var. *pertransversa* Sacco, *Viviparus brevis trochlearis* Tournouer and also supported by field studies. It is found that Neogene units show a short period that is Late Piasensien in Datca Peninsula and the formation age is not Pliocene known as previously. The area known as continental in Early Pliocene and marine in Late Pliocene is a lagoon in connection with shallow marine in Late Piasensien according to the paleoecological characteristic of pelecypod and gastropod fauna.

Based on the paleogeographic and stratigraphic location of this fauna, it is considered that most of the fauna belong to the Tethys while only three out of thirty-seven of them located the Atlantic province. It is assumed that the three species carried out from Atlantic province to there or they may adopt themselves to that conditions.

Xth R. C. M. N. S. Congress, Bucharest 1995

Topic B

Tethys - Paratethys connections

LATER PALEOGENE - MIOCENE BIOGEOGRAPHY AND MARINE TERRESTRIAL PERI - TETHYAN CONNECTION. CONTRIBUTION FROM ATLANTIC TO INDO-PERSIAN TETHYS AND MIDDLE ASIA ANFD FROM NORTH AFRICA TO EUROPE MARINE AND TERRESTRIAL CONNECTIONS.

CONNECTION FRAME: EOCENE - EARLY - LATE MIOCENE. PALEOBIOLOGICAL EVIDENCE.

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1. The fundamental Paleogene events, which determined Early - Miocene biogeography of the Peri Tethys region, had been African - Arabian plate collision with Eurasia and replacement of "non-glacial" termic regime to glacial one. As a result of Alpine belt uplifting, invasion possibility of continental Biota had arised: Central Asian mammals vcould come to South Europe- (Transilvania, South Bulgaria - in Middle and Late Eocene),- some Asian and African vertebrates came to Western Europe (in Rupelian). Late Eocene - Oligocene cooling led to reduction of rich Tethys biota and migration of North european elements in Mediterranean Tethys (during Chattian, especially). Spread invasions both vertebrates and mesophylic warm temperate flora ("Turgai" type) from East to West took place in the second part of Oligocene-.

2. Begining of Early Miocene. Ancient Mediterranean flora- was forming in result of sharp seasons fluctuation anfd arid environments. Continental Europe was included to Palearctic region- (by vertebrates data) in consequence of Trans-Eurasian exchanges. A new Ancient Mediterranean benthonic fauna was formed, some elements of latter penetrated to Central and Eastern Paratethys.

3. Early Miocene. "Turgai" type flora was desintegrated and substituted by Ancient Mediterranean immigrants in North-West Eurasia. Floristic diversification with refugiums forming took place in Mediterranean region according to humidity conditions. Latitude differenciation of vertebrates was increasing. Northward migrations of marine biota resulted in elimination of North-

European region. Both North Sea and Paratethys basins were entering to ancient Ancient Mediterranean region.

4. Early- Middle Miocene, climatic optimum time. Maximum all - Cenozoic integratin of continental fauna took place. Intensive mammal exchange between Africa and Asia led to displace of northern Palearctic boundary to North Africa. Increasing of vertical diversification of relief and vegetation was observed. Eastern Paratethys lost connections with Central one, but preserved hemi-closed strait to Indo- Persian basin.

5. Middle Miocene. Sharp floristic desintegration resulted from: - subtropical *Laurus* woods in refigiums; mediterranean xerric vegetation; -mountain leavefall woods. Latitude mammals differenciation led to broke up into North, Middle and South Palearctic subregions. Marine Mediterranean fauna passed to Eastern Paratethys (in Konkian).

6. Late Miocene. Steppe and savanae - like landscape became predominant in Boreal region. The spread Caucasian floristic refugium desintegrated to Pontian and Hyracanian ones. By mammals data, Palearctic region included the most part of Ethiopic and Oriental regions.

ON *GALEACYSTA ETRUSCA* AND THE CONNECTIONS BETWEEN THE MEDITERRANEAN AND THE PARATETHYS

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Several palynologcal studies carried out in late Messinian Deposits from Italy evidence the occurrence of the dinoflagellate cyst *Galeacysta etrusca.*

The gonyaulacoid cyst spans a short time interval: it occurs in the upper part of the Messinian, while it is missing in the lowermost Pliocene with the exception of some sparse, probably reworked, remains.

Galeacysta etrusca has a widespread geographic distribution: its presence is recorded in deposits from Northern (Torre Sterpi, Piedmont), Central (Cava Serredi, Tuscano; Maccarone, Marche) and Southern Italy (Eraclea Minoa, Sicily). The species shows strong morphological variations probably related to environmental conditions. It usually occurs in great numbers and is often found in assemblage with a "pitted" *Impagidinium*, which represents a "membrane-less" episode of *Galeacysta* (Biffi, personal communication). With the lowermost Pliocene transgression a sharp change in the dinoflagellate cysts assemblage occurs with the appearance of open marine taxa such as *Impagidinium patulum.*

The presence in Paratethys sediments of forms very close to *Galeacysta,* lead to pose some questions: did *Galeacysta* migrated from Paratethys ? Is it endemic to the Mediterranean ? Similar questions apply to the old problem of brackish and fresh water faunas of the "lago- mare" facies.
This contribution exposes the present knowledge of *Galeacysta* distribution in Italy, suggested to be representative of the Mediterranean area.

A comparison is made with the paratethyan distribution based on few studies available for this realm.

The comparison offers the chance to unravel dispersal events and phylogenetic relationships between different forms of *Galeacysta* from the two basins.

BIOSTRATIGRAPHIC STUDIES ON PLANKTONIC GASTROPODS FROM THE NEOGENE OF THE CENTRAL PARATETHYS

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The research on marine planktonic gastropods carried out in recent years has clearly verified that this group of molluscs represents an important biostratigraphic tool for the regional and inter-regional corelations of Cenozoic marine sediments. The investigations on planktonic gastropods have become more intensive in the area of Paratethys since the end of 80's.

There are two groups of planktonic gastropods which are preseved in the fossil record, namely the heteropods and the pteropods. The pteropods of Central Paratethys are represented by eight genera (*Limacina, Creseis, Styliola, Clio, Vaginella, Cavolinia, Cuvierina, Praehyalocylis*), which are distributed from the Middle Eocene to the Middle Miocene in this area. The Pseudothecostomata and the Heteropoda are rather rare and only recorded from the Early Badenian.

The diagnostic value of the pteropods for biostratigraphy has been studied for several decades within different areas of Central Paratethys. These studies focused mainly on Middle Miocene deposits which generally contain the geatest abundance of pteropod species in the Central Paratethys (especially the Early Badenian). Concerning this time period the first comprehensive results came from Romania and Poland.

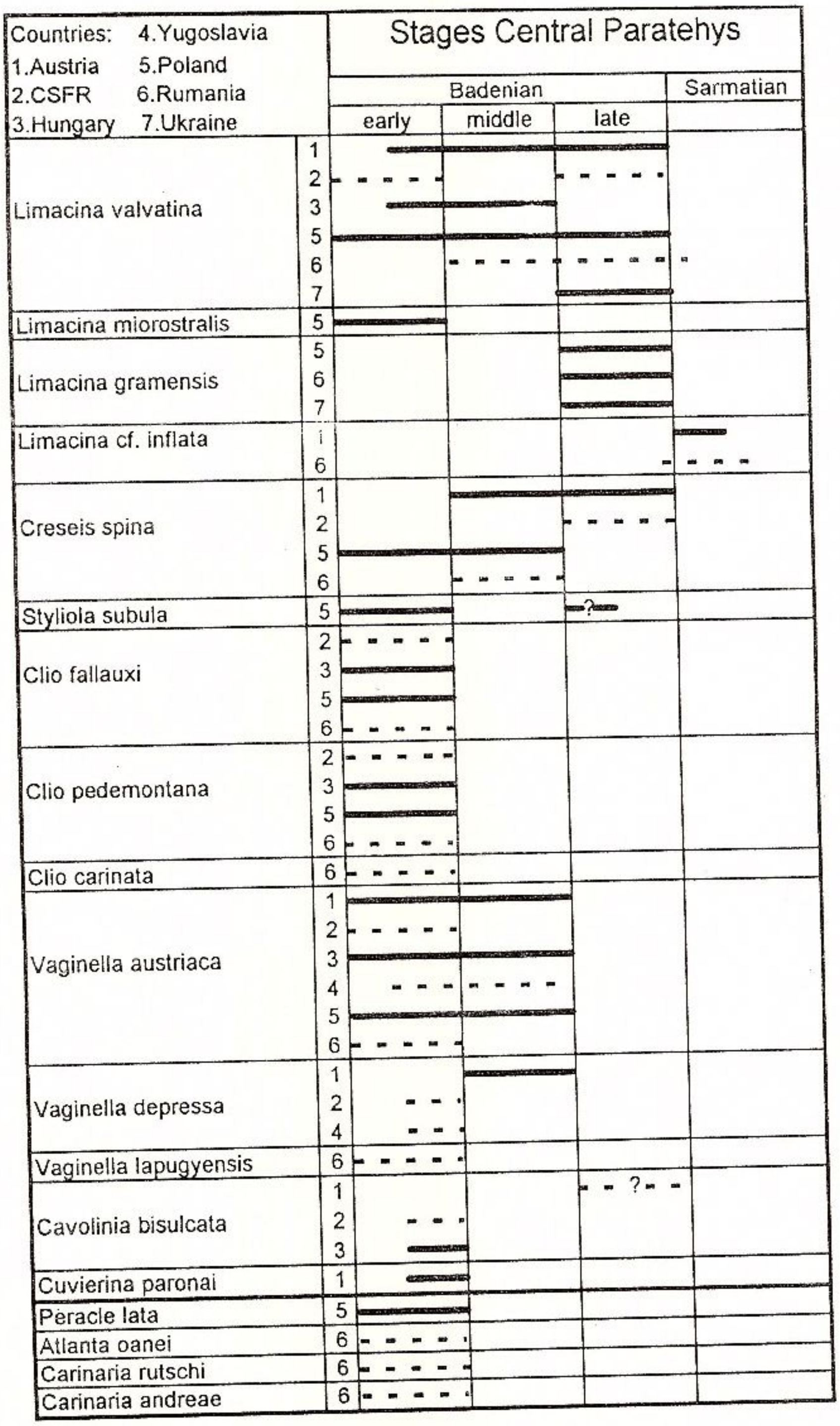
In the present paper the latest studies on the distribution and biostratigraphy of the planktonic gastropods in the Central Paratethys are summarised. The research was carried out on material from Tertiary deposits of Austria, Hungary and Poland, mainly concentrating on the Badenian(Middle Miocene). In addition literature data from other parts of Central Paratethys are used for biostratigraphic interpretation (see fig. 1)

As shown by the examinations we have carried out so far, species seeming to be of importance in regard to a biostratigraphic classification of the Middle Miocene in the Central

Paratethys are as follows: *Vaginella austriaca* (one of the most frequent species, only Early and Middle Badenian), *Clio pedemontana* and *Clio fallauxi* (frequent species onmly Early Badenian), *Limacina gramensis* (medium frequency, only Late Badenian), *Cavolina bisulcata* (rare occurrence, only Early Badenian).

In addition mass occurences of species and genera are particulaarly important as correlation horizons.

A comparison is also made with the pteropod record of the Mediterranean area and the North Sea basin.



Stratigraphic ranges of planktonic gastropods from the Middle Miocene of the Central Paratethys

▬ revised data - - data from literature

TETHYS - PARATETHYS CONNECTIONS DURING NEOGENE TIME

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East Paratethys Mediterranean basin got stable connection with the Tethys in Early Miocene and these connections fonctionated with regular breaks until the end of Pliocene. The most wide communications had place durring transgressive stages of Paratethys evolution, in time of regressions, connections seased up to stop of communications . During transgression stages and climate optimums had place wide communications, during regression and cooling - isolation from Tethys.

Evidences of wide Tethys - Paratethys connections are marine transgressions, high sea level, salinity and appearance of ocean origin fossils (polyhaline mollusks, plankton foraminifers, calcareous nannofossils (coccoliths) as well as autigene glauconite in sediments. Main marine connection of East Paratethys with Tethys had place in following stages.

Early Miocene
Caucasian - Early Aquitanian stage, 25 - 20 MY;
Sacaraulian - Late Aquitanian stage, 22 - 20 MY;
Tarkharian - Langian, 17 16 MY;
Chokrakian - Langian, 15 - 14 MY;
Konkian - Early Serravalian, 12 - 13 MY;
Sarmatian - Late Serravalian, 11 - 7 MY;
Early Maeotian - Early Messinian, 6.8 - 6.0 MY;
Early Pontian - Middle Messinian, 5.4 - 5.0 MY;
Akchagyalian - Piacenzian, 3.5 - 1.6 MY.

EAST PARATETHYS - TETHYS MARINE CONNECTIONS ALONG EUPHRAT PASSAGE DURING NEOGENE

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The Paratethys basin was formed to the North of Tethys ocean in the Early Oligocene. The Oligocene history indicates connections only with the North Atlantic biogeographic province. The earliest connection with the Tethys dates him Early Miocene (Caucasian and Sacaraulian basins).It is marked by appearance of Indo - Pacific mollusc elements in the East Paratethys basins. Connections between the Mediterranean and the Indian ocean continued to the end of the Middle Miocene (Serravalian) as well as between Mediterranean and West Paratethys.

In the Middle Sarmatian (Tortonian) these connections were stopped, and the only passage between East Paratethys was fonctioned - across East Turkey and Araks Valley.

New field work in the East Anatolia (together with S. Bayraktutan) was revealed the evidence of marine Pliocene sediments in the upper Euphrat (Karasu) and Araks valleys, near Erzerum: calcareous nannoplankton (with index form for the Late Pliocene - *Pseudoemiliania lacunosa* forma *ovata)*, authigenic glauconite, smectite and geochemical rations of Na, K and Cl ions indicating marine origins of these sediments.

Marine connections between East Paratethys and Mediterranean began from Early Miocene and had place for the following stages

Late Miocene - Middle-Late Sarmatian - Tortonian basins, 11.5 - 7.0 MY;
Early Macotian - Early Messinian basins, 6.8 - 6.0 MY;
Early Pontian - Mid Messinian transgressions, 5.6 - 5.0 MY;
Late Pliocene - Akchagyalian (only Caspian basin) - Piacenzian transgressions, 3.5 - 1.6 MY.

Early Pleistocene : Early Apscheronian - Early Calabrian (unilateral flow from Caspian to Mediterranean), 1.6 - 1.4 MY.

In Pliocene, Paratethys was isolated and separated on 3 marine basins: Pannonian, Euxinian and Caspian without any connections. Only Caspian sea got connection with Mediterranean along Euphrat - Araks strait and formed Akchagylian basin with marine molluscs, foraminiferras, calcareous nannoplankton.

PALEOGEOGRAPHICAL AND PALEOECOLOGICAL EFFECTS OF CLIMATIC AND SEA LEVEL OSCILLATIONS IN EAST PARATETHYS LATE NEOGENE BASINS

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On base of palynological, biochemical and isotope analyses main climatic characteristics (humidity, annual summer and winter temperatures) of Sarmatian, Maeotian, Pontian and Pliocene stages were studied. Most of East Paratethys basins were connected with Mediterranean just during Neogene time. Sea level changes correlated with global ones, of ocean, exclude entirely isoleted basins. Climatic warming followed by marine transgressions, ocean fauna penetrating in inner basins, forest landscape and terrestrial fauna dispersing with climatic cooling connects marine regressions, isolation from ocean, aridisation of landscapes. Different climatic and treansgressive-regressive cycles are studied with range of time from 1 million years to 50-6 thousand years and with vertical rate of sea level from100-150 to 15- 20 meters. Last sea level oscillations have global dispersion and can be marked in other parts of World ocean.

CALCAREOUS NANNOPLANKTON AND MOLLUSCS FROM A FEW BADENIAN - SARMATIAN OCCURENCES OF THE WESTERN TRANSYLVANIAN BASIN AND VIENNA BASIN (poster)

Carmen CHIRA

There is a correlation given by the calcareous nannoplankton and molluscs from a few occurences of the Badenian and Sarmatian deposits from the Western Transylvanian Basin and the Vienna Basin.

From the Western Transylvanian Basin there were studied sections from Livada, Aiton, Ceanu Mic and Turda (marls quarry). And as far as concerning the Vienna Basin, there were analised the sections from Siebenhirten and St. Margarethen Kiesgrube, and reanalised the sections from the holostratotypes of the Badenian - Baden Sooss and Sarmatian - Nexing.

The badenian marly deposits are represented at Livada and Borzeşti by the NN5-*Sphenolithus heteromorphus* Zone and the *Neopycnodonte navicularis* Zone (Lower Badenian). At Borzeşti we have found also (N. Mészáros, L. Ghergari, C. Chira, 1992) an alternance of marls and sand bearing scarce specimens of *Spiratella (=Limacina)* that we assigned to the Upper Badenian. In the Cheia area (quarry) (L. Ghergari, N. Mészáros, A. Hosu, S. Filipescu, C. Chira, 1991) the Badenian sediments begin from a conglomeratic level overlain by a gypsiferous facies. The nannoplankton assemblage from the upper part of the gypsum formation belongs to NN5 Zone. The whole assemblage was considered to have a Middle Badenian (Wielician) character. The upper part of the section belongs to NN6 - *Discoaster exilis* Zone (Upper Badenian = Kossovian). There are also reworked forms from Lower Badenian, even from Priabonian.

The holostratotype of Badenian stage from Baden - Soos, as known, contains calcareous nannoplankton belonging to NN5 Zone and a rich mollusc fauna, where *Neopycnodonta navicularis* is also present.

The nannoplankton assemblages from Aiton, Ceanu Mic and Turda belong to the Sarmatian s. str. (NN6/NN7, NN7, NN8, probably NN9). By Aiton, there are present marls (with intercalated sands and tuffs) and microconglomerates withs the most rich Sarmatian molluscs faunaassemblages from the western border of the Transylvanian Basin (North of Arieş Valley and Turda, nearby Cluj). These assemblages present affinities with those from Siebenhirten (*Rissoa* Beds) and also Nexing (*Ervilia* Beds). In the molluscs assemblages from Aiton there are reworked forms from Badenian, too.

The nannofossils assemblages from Siebenhirten (more rich than from Nexing) and those from Nexing, have mostly the same forms as the assemblages from Romania. Lack of useful guide - fossils for the Sarmatian s. str. precludes the correlation with the standard Nannoplankton zonation (as it was also remarked for Nexing by H. Stradner & R. Fuchs, 1979 and for other occurences from Austria, than those mentioned here). In the Sarmat s. str. from St. Margarethen Kiesgrube the nannofossils are almost absent. There are also reworked nannofossils from Eocene and Cretaceous in both bassins.

THE PALEOGEOGRAPHICAL EVENTS IN THE BOREAL NEOGENE : THEIR CORRELATION AND RELATIONSHIPS

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The boreal paleogeographic environments had a complicated evolution in the Neogene: there occured climatic changes (at least three optima were recorded), intense eustatic fluctuations (sea level rises often coincided with the warmings), alternations in land and sea position (caused by tectonic processes), opening of sea straits (the Bering and other straits), etc. These events affected the biotic evolution and migrations. The Neogene development of the Mediterranean should be studied at the background of subglobal paleogeographic and biotic processes.

CONNECTIONS OF EASTERN PARATETHYAN PALEOBASINS WITH TETHYAN SEAS IN MIDDLE AND LATE MIOCENE

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Connections of Eastern Paratethyan paleobasins with Tethyan seas. The widest connections were in the Early Tarchanian and Early Konkian. In the Varnian (Middle Karaganian), Late Veselyankian (end of the Konkian), and the more so in Late Maeotian time, on the contrary, short term connections existed. Most probably the seas of Eastern Paratethys communicated with Eastern Mediterranean through a strait which could have existed in the south-east of Paratethys, in the areas of Predtalyshky and Akero-Araxinsky depressions (East Turkey and Iran). The existence of South eastern connections is proved by the presence of diverse polyhaline assemblages in Transcaucasia and Transcaspian. The presence of indo-Pacific genus *Obtortio* (Gastropoda) is recorded in Lower Tschokrakian deposits.

MIOCENE MAMMALIAN FAUNA FROM BELCHATOW IN POLAND

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The coal mine at Belachatow is situated in Central Poland ($51^0 15'$ N, 19^0 20'E). A brown coal sedimentary basin is formed in Jurassic and Cretaceous rocks. During the Alpine orogenesis an important tectonic movement took place to the north of the Carpathians, forming the so called Belchatow tectonic fault up to 500 meters deep. This depression is now filled with Tertiary and Quaternary sediments. The accumulation began in the Early Miocene. Coal seams alternate with lacustrine sediments. Two tuffite horizons have been dated by the track method. A paleobotanic investigation revealed several cycles of vegetation, during the Miocene, from landscape through swamp forest to forests of dry habitats. The lacustrine sediments contain numerous bivalves and gastropods.

Mammalian remains are known from three horizons. The lowermost, Belchatow C yelded teeth of *Gomphotherium angustidens* and *Hyotherium soemmeringi.* Insectivores, as in the remaining levels, were rare and badly preserved but diversified. In Belchatow C 3 families with 6 taxa have been identified including *Plesiodymylus* cf. *chantrei* and *Chainodus intercedens.* Particularly interesting is the discovery of teeth of Maghiroptera. From among the rodonts 13 taxa representing 8 families have been identified. They contain 2 species of *Ligerimys, Neocometes similis, Anomalomys minor* and *Glirudinus undosus*, which point to mammalian zone NM4. The tuffits above the layers with the fauna of Belchatow C are dated at 1.8 ± 1.7 My.

In Belchatow B among large mammals only scarce remains of indeterminate carnivores were present, but micromammals were numerous. No less than 5 families of insectivores (Talpidae, Dimylidae, Soricidae, Erinaceidae and Metacodontidae) were represented by 8 taxa, e.g.

Plesiosorex germanicus, Plesiodimylus chantrei and *Chainodus intercedens.* Among the 22 taxa of rodents cricetids are dominant. As regards eomyds the genera *Keramidomys* and *Leptodontomys* appear for the first time. Sciurids are dominated by flying squirrels (*Myopetaurista, Forsythia, Ratufa, Blackia*). This assemblage points to mammalian zone NM5/6. Above the fossiliferous horizon a tuffite layer was dated by the track method at 16.2 ± 1.3 My.

Belchatow A is the uppermost fossiliferous layer. The insectivores are represented by 3 families with 7 taxa, among others *Plesiodimylus chantrei* and *Desmanella* have been identified. There are 22 taxa of rodents. Glirids and sciurids reach a peak of their diversity. Among the glirids a new species of *Glis* is very numerous. *Muscardinus* appears for the first time in Blchatow represented by *M. hispanicus.* The presence of *Microtocricetus molassicus* is important for stratigraphic reasons and suggests mammalian zone NM9.

The paleoecological analysis indicates rather stable climatic conditions during the sedimentation at Belchatow. The presence of Megachiroptera and *Neocometes* suggests the environment of tropical forest. The composition of the rodent association is similar in all layers, with forest species prevailing.

the presence of *Gomphotherium angustidens* below the tuffite dated about 18 my is important for the determination of the Proboscidean event. Distinct morphological evolution can be treced in several lineages during the Miocene.

Six papers concerning the micromammals of Belchatow have been published by the authors of this abstract, 3 others are in press.

CHANGES IN COMMUNICATIO WITH THE OPEN SEA DURING THE DEPOSITION OF THE EARLY OLIGOCENE MENILITIC FORMATION (ZDLANICE UNIT)

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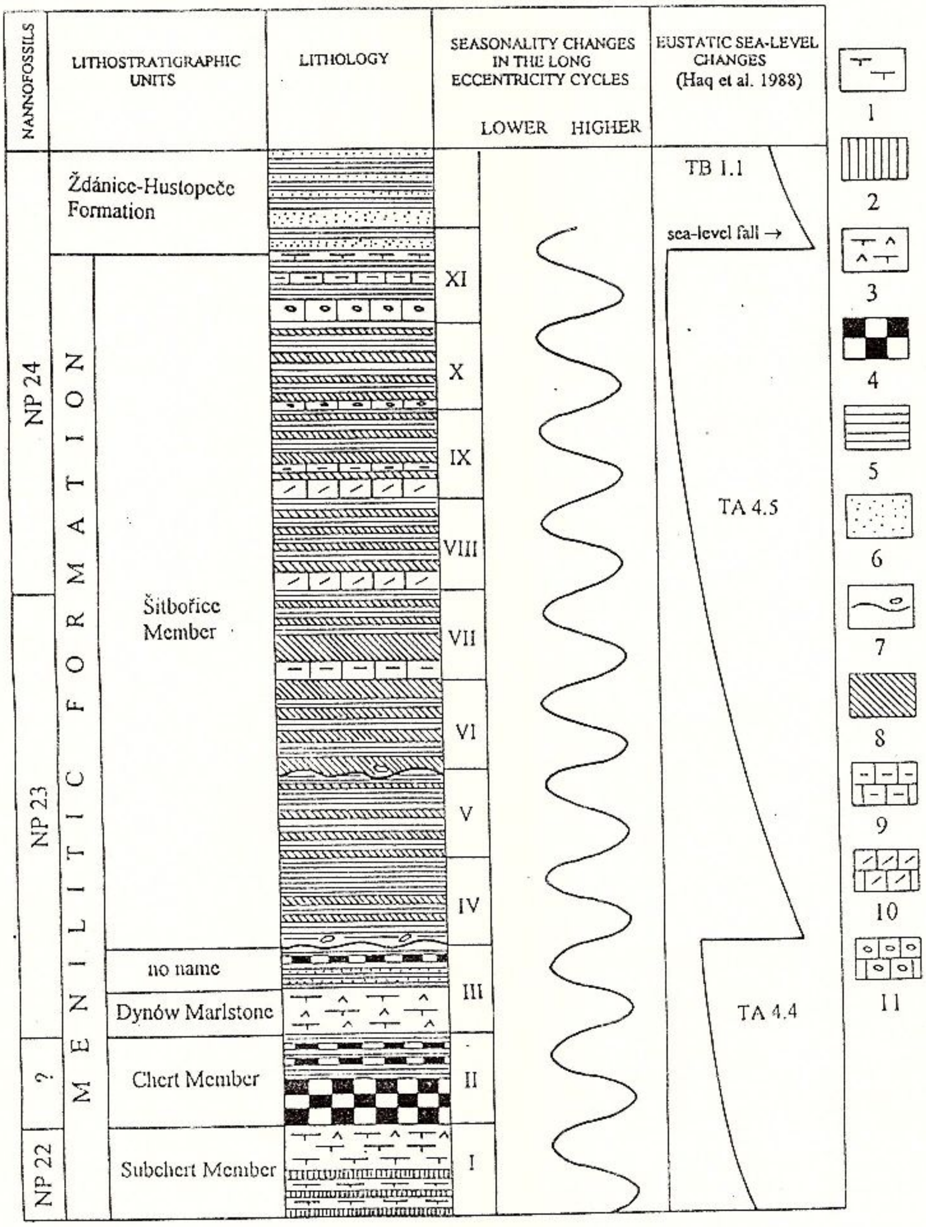
The Menilitic Formation deposited in the Carpathian area during the first stage of the Paratethys (Protoparatethys) restriction from communication with an open sea. A degree of communication was primarly by the tectonical induced paleogeographic changes in the northern margin of the European Tethys. Complete isolation lasted, however, only short period during NM 23 biochron when inland Solenovian Sea originated. The most important controls imposed on litho- and biogacial changes in the Menilitic Formation were: 1) tectonically controlled depth of sill (sills) which separated the Protoparatethys, 2) global eustatic sea level changes, and 3) oxygenation of the bottom waters. The latter was controlled by the amount of water exchange with open sea and by precipitations. At times of high positions of sill and/or sea level low stands (NP 23 biochrone) an outflow of the surface water over the sills predominated. Salinity of the surface waters and oxygenation of the bottom waters decreased. Periods of the high sea level stand were characterised by influx of marine surface waters. Surface salinity increased and enabled thriving of planktic foraminifers and/or calcareous nannoplankton. Under some critical treshold conditions this general trend was modulated by short term fluctuations in amount of precipitations (the Subchert Member, middle part of the Sitborice Member). Outflow of the surface waters during the more humid periods and inflow of marine surface waters during the drier periods influenced surface salinity.

The division of the lower Menilitic Formation into members reflects an overprint of the orbitally driven climatic fluctuations over the long term-trend of the gradual isolation. Each of the first three Members- The Subchert Mb., the Chert Mb., and the Dynow Marlst., deposited approximately during one long eccentricity cycle (ca 410 ka). The lower parts of these members indicate alternations of period of strongly increased and decreased differencesamong seasons. Lithological record in our latitudes show an alternation of dry and wet conditions. The upper parts of the Members are characterised by higher input of terrigenous material due to higher runoff at time when differences among the seasons were generally more ballanced. The quasi- periodic alternation of the levels rich in pelagic biogenous material (coccoliths and planktic forams in the Subchert Mb., diatoms in the Chert Mb., and coccoliths and diatoms in the Dynow Marlst.) with more silty layers in which biogenous material is diluted, dissoluted or primarly absent reflects an alternation of drier and wetter conditions in short orbital (precessional ?) cycles.

Blooms of calcareous nannoplankton dominated by *Dictyococcites ornatus* in the Dynow Marlst. are interpreted as indicartive of short increase in communication with an opensea at time of the sea level high stand (the TA 4.4 eustatic cycle). The deposition of the Stiborice Mb. began after the sea level drop. Good communication with an open sea was not restored before the uppermost part of the Member (the high stand of the TA 4.5 eustatic cycle). Quasi-periodic lithological changes and blooms of calcareous nannofossils in the lower part of the Stiborice Mb. infer influence of orbital forcing. Approximately seven to eight cycles can be recognised in the Member. They are considered to be reflections of the long eccentricity orbital cycles. The Menilitic Fm. deposited during ca 4.4 Ma, among 32.9 Ma (the base of NP 22 Biozone) and 28.5 Ma (the Rupelian/ Chattian boundary), which is in close ageement with duration of supposed 10 - 11 long eccentricity orbital cycles (4.1 - 4.5 Ma). Conceptal scheme showing the link between lithofacies and climatic change possibly driven by the long eccentricity orbital cycles (periodicity ca. 410 ka). Periods characterised by balanced seasons are supposed to be wetter in general. During the periods of highly contrasting seasons wet and dry conditions alternated having been forced supposedly by precesional and / or obliquity orbital cycles.

Explanations: 1) light - coloured marls; 2) brown calcareous clay; 3) silicified marlstone; 4) chert; 5) non/ calcareous clay; 6) sandstone; 7) wash- out horizon with pebbly mudstone; 8) ochreous rusty coloured silty claystones; 9) layer of concretional clayey carbonates; 10) layer of concretional dolomitized clayey carbonates with siderite; 11) calcareous nannofossil - chalk.



Conceptual scheme showing the link between lithofacies and climatic change possibly driven by the long eccentricity orbital cycles (periodicity *ca* 410 ka). Periods characterized by balanced seasons are supposed to be wetter in general. During the periods of highly contrasting seasons, wet and dry conditions alternated having been forced supposedly by precessional and/or obliquity orbital cycles.

Explanations: 1 - light-coloured marl; 2 - brown calcareous clay; 3 - silicified marlstone; 4 - chert; 5 - non/calcareous clay; 6 - sandstone; 7 - wash-out horizon with pebbly mudstone; 8 - ochreous and rusty coloured silty claystones; 9 - layer of concretional clayey carbonates; 10 - layer of concretional dolomitized clayey carbonates with siderite; 11 - calcareous-nannofossil-chalk.

ŽDÁNICE UNIT, WESTERN CARPATHIANS

CLIMATIC CHANGES ON NORTHERN ASIA FOR THE PLIOCENE IN A CONTEXT OF GLOBAL CLIMATIC CHANGES

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The palaeotundra, amd maybe permafrost, on the lowlands of the NE Asia appeared at first as far as 6.6 - 5.1 Ma (zone *Neodenticula kamtshatica*). At the same time, the palaeotundra appeared in Alaska (tundra insect from the clays of the Kamp Lava). At the same time, the arrid conditions established in Siberia and there was a cooling at the end of that time. There were traces of the Messinian crisis in many regions of the Northern Hemisphere that time. In the Pliocene optimum of 4.5 - 4 (3.5) Ma, the vegetation in the lower course of the Kolyma river, in Chukotka, in the middle course of the Lena river, etc., was the south tundra, annual mean temperature was higher with 10 - 12^0 C than present ones and precipitation were 2-3 times larger. For the same time V. Zykyn (1986) described the subtropical malacofauna at the south of W Siberia. The displacement of vegetation zones to the North was aroximately equally (till 17^0 latitude) for the NE Asia and SW Siberia. For that time a considerable warming was known practically for all the continents. Thus, the climate of the Ukraine was near to subtropical. The warming was fixed by Brunsuiman floras in the Rhine valley. The penetration of the thermophile *Globorotalia punicticula* is known in the Mediterranean sea. The summer temperature of the surface waters near the Anctarctide shores was 7 - 10^0 C higher than present one; taht caused a sharp decrease of the Antarctic glacier shield. The trace of the cold snap are known near 3.5 Ma. Palynospectra transitional from a northern taiga to a forest tundra environment the environmental changes in the Alazea river have been identified. That time in the Northern Siberia is badly studied. At the south of Siberia an aridization was established. This stage can be corresponded to the Scott's glaciation in Anctarctide, V'edma in Patagonia, the expansion of glaciers on the Vranghel ridge, etc. The short time warming, at 3.4 Ma is fixed by the expansion of the spruce taiga in the lower course of the Kolyma river. The first glaciation of the Chukotka coincides with the Beringian transgression and is dated to 3.2 Ma. With that cooling connected, the appearance of the first palaeoarctic molluscs on the south west of Siberia, in Mediterranean sea -

the appearance of *Globorotalia crassiformis* at the Vranghel ridge - the expansion of the glaciers. The second glaciation of the Chukotka (2.5 - 2.4 Ma) corresponds with a cooling and appearance of the first Lemmus in Europe and Siberia, on the south of W Siberia - of the first pseudomorphs of the ice-widges. During that period, the glaciation of the Alps, Caucasus, Pamir, etc., the glaciation el'kreek in Nevada, Nebraska, Iowa is known. This time dates the most ancient loesses of the Southern Tajikistan, Tashkent region and China. The separate stages of warming and cooling 2.3 - 1.8 Ma are studied in different sections from the Irtish river to the Bering Strait. Generally, this stage can correspond to the Tegelen of Europe. The warming at 1.8 - 1.6 Ma is known in NE Asia. In Greenland it is associated with 1.8 -1.6 Ma infiltration of the forest vegetation far into the North, whereas on the North of Ukraine at that time in the Cenozoic; last time the wintee temperature was positive. Near 1.6 Ma, in the lower course of Kolyma river, for the first time in cenozoic the tundra steppes associations expanded. In cooling, corresponds with the Eburon of Europe and the Middlton of North America.

UPPER NEOGENE - LOWER PLEISTOCENE CORRELATION OF SOUTH CASPIAN BASIN (EASTERN PARATETHYS) WITH MEDITERRANEAN SEA

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The stratotype and classic outcrops of the Upper Neogene - Quaternary succession in Eastern Azerbaijan are an excellent basement for better understanding the stratigraphy and correlation of Upper Neogene - Quaternary deposits of oil-and-gas bearing areas of South Caspian basin. Outcrops of the Pontian stage (Miocene), Productive series, Akchagyl stage (Pliocene), Apsheron stage, Baku horizon (Quaternary) are particularly well on the Apsheron Peninsula. Correlation of the Eastern Paratethys stages with the standard Mediterranean stages for the Upper Neogene- Quaternary is hindered by the lack of zonal fossils, the faunas of Eastern Azerbaijan often being endemic. However, the new , regional work, carried out bay us, had enabled to make a number of new suggestions regarding their inter-regional correlation:

- The Pontian stage (Pontian beds) is almost entirely equivalent to the Messinian (Late Miocene).
- The Kimmerian stage (Productive series) is equivalent to the latest Messinian an much of the Zanclian (Early Pliocene).
- The Akchagylian stage almost entirely equates to the Piacenzian (Late Pliocene).
- The Apsheron stage is equivalent to the Calabrian (Eopleictocene).
- The Baku horizon and the Mingechaur beds (Lower Pleistocene) stratigraphically correspond to the Sicily of Mediterranean scale

The paleogeographic of South Caspian basin demonstrates, that the major transgression at the beginning of the Pontian was followed by further regression. At the end of Pontian time, the basin lost its connection with the world oceans and led to Productive Series deposition. The fall-sea level is observed at the base of Pereriv Suite deposition, which are characterised by freshwater deposition. Reconnection with the world oceans was established in Akchagylian time, but was followed largely by repeated isolation which has continued for today. The most of the Neogene, the South Caspian basin was in the site of deposition in restricted, reduced salinity conditions.

THE CONNECTION BETWEEN THE DACIC AND MEDITERRANEAN BASINS BASED ON CALCAREOUS NANNOPLANKTON ASSEMBLAGES

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At the beginning of the Sarmatian, the isolation and the division of the Paratethys in some intermittently connected basins (Pannonic, Dacic, Euxinic, etc.) determined a continuous decreasing of the water salinity and, therefore, a big change of the aquatic biota.

The presence of the calcareous nannoplankton, at different stratigraphic levels, in the Middle Miocene - Pliocene deposits of the Dacic Basin, proves a series of connections, as a rule of short standing, between the Dacic and Mediterranean basins.

The nannofossils which arrived concomitantly with the shallow marine water levels in a medium with more or less low salinity either died or try to adapt themseves to the new conditions, through the seizes of morphostructural changes.

In the Volhynian - Lower Bassarabian a succesive distribution, irregular in time and space, of the two types of nannoplankton has been established (Mărunţeanu, 1994): type A. that characterizes the Pannonian facies (Stradner and Fuchs, 1980) and type B, typical of the Mediterranean facies (Theodoridis, 1984). This fact proves the episodic coming of the brackish waters from the Pannonian Basin and marine water from the Mediterranean Basin.

In the Upper Bassarabian - Lower Meotian time interval, the Dacic Basin was totally isolated from the Pannonian and Mediterranean Basins because the calcareous nannofossils, sporadically met in the small species of *Thoracosphaera* and *Scyphosphaera.*

The next standing connections, between the Dacic and Mediterranean Basins, are proved by calcareous nannoplankton assemblages from:

- *Dosinia* beds (Uppermost part of Lower Meotian = Oltenian)- NN 11 Zone;

-*Laeptodonta* beds (Upper Meotian = Moldavian) - NN 11 Zone;

-*Chartoconcha gigantea* and *Valenciennius krambergeri* beds (Upper Pontian = Bosphorian) - NN 11 Zone;

- *Stylodacna heberti* beds (Lower Pontian = Getian) - NN 12 Zone;

- *Viviparus bifarcinatus* and *Psilunio prominulus* beds (Middle Romanian = Pelendavian) - NN 15 and NN 16 Zones.

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CHANGES IN NANNOFOSSILS ASSEMBLAGES DURING THE OLIGOCENE - LOWER MIOCENE INTERVAL IN THE EASTERN CARPATHIANS AND TRANSYLVANIAN BASIN

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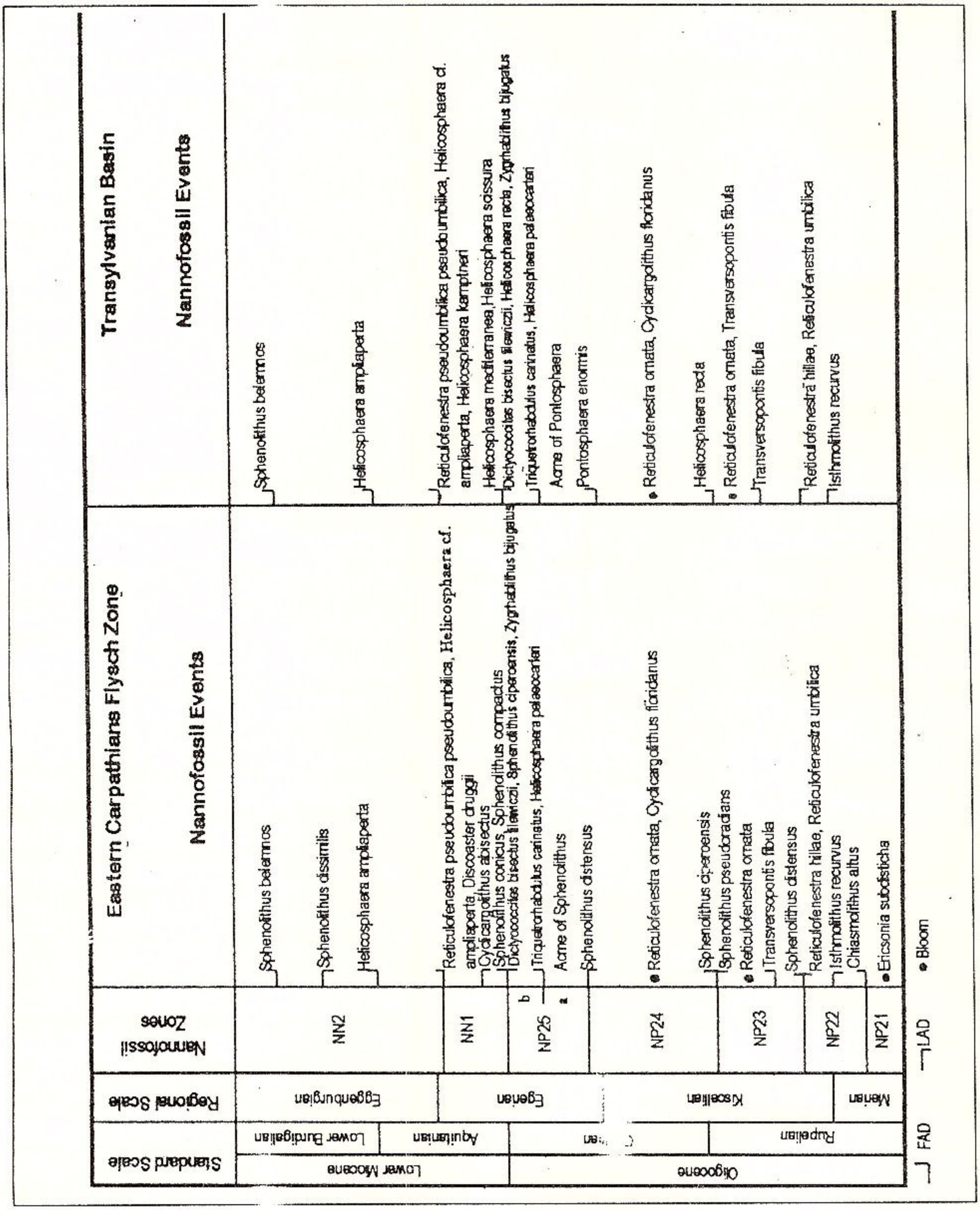
The changes in the Oligocene - Lower Miocene nannofossils assemblages and calcareous nannoplankton index species, used for a more accurate biostratigraphy in the Eastern Carpathians Flysch Zone Belt and in the Transylvanian Basin are discussed.

The Rupelian nannoflora (zones NP_{21} - NP_{23} , lower part) from the two studied areas is similar, but since the NP_{23} nannoplankton zone (the first isolation of the Paratethys, fide Rusu, 1988) endemic species occure with the cosmopolitan ones. It is also to mention that, as in the whole Carpathian Chain (Krhovsky and al., 1992; Nagymarosy, 1991) within the NP_{23} and NP_{24} zones levels of calcareous schists with monospecific assemblages were identified. Remarkable differences between Chattian-Lower Aquitanian nannoflora from the Eastern Carpathians Flysch Zone and the Transylvanian Basin were observed. While in the Eastern Carpathians the genus *Sphenolithus* is very common, with an acme in the lower part of the NP $_{25}$ Zone, in the Transylvanian Basin is almost absent. From the former area a great frequence of the genus *Pontosphaera*, with an acme also in the lower part of the NP_{25} Zone was identified. In these conditions, different index species for the establishement of the Oligocene- Miocene boundary were used: in the Eastern Carpathians Flysch Belt the species *Sphenolithus conicus* and *Sphenolithus compactus* while in the Transylvanian Basin , the *Helicosphaera mediteranea* and *Helicosphaera scissura* species .The Upper Aquitanian was marked by a nannofloristic turnover. The differences between the nannofossils marker species, characterised the Upper Aquitanian- Lower Burdigalian (Eggenburgian) vanished. Despite of this homogenisation, the genus *Sphenolithus* is more common in the Eastern Carpathians nannoplankton associations, while the genera *Helicosphaera* and *Pontosphaera* prevailing in the nannoflora assemblages from the Transylvanian Basin. The changes in the distribution pattern could be explained by different paleoenvironmental conditions as well as by the temperature control.



LOWER MIOCENE PALEOBIOGEOGRAPHY OF ECHINOIDS FROM THE PARATETHYS, A BASIS FOR COMPARISON TO THE MEDITERRANEAN TETHYS

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Echinoids are potentially useful in the reconstruction of marine connections and general palaeobiogeographic patterns. They are restricted to the marine environment and the genera are redily identifiable. Uncertainties remain in the definition of species due to the high intraspecific morphological variation of sea-urchins. An additional probl;em lies in the fact that many species are restricted to distinct environments. Thus, the presence or lack of the echinoid species will not only be due to their distribution patterns, but also to preservation potentials and related taphonomic factors, facies distributions as well the ease and extent of collecting.

Palaeobiogeographic patterns of Lower Miocene echinoids from the Paratethys show a moderated diverse assemblage of genera which in part are very well preserved. Their distribution is associated with the specific environments, such as *Parascutella* to highly mobile shallow sands. There seems to be a general decrease in diversity from the Western to the Central Paratethys. The Rhone valley of France is highly diverse and in a sense comparable to the Mediterranean Tethys. The molasse of Switzerland and southern Germany, however, contain a very restricted fauna. The Austrian Molasse again shows an increase in diversity , with at least 10 genera recorded so far.

PALAEOGRAPHIC LINKS BETWEEN EARLY MIOCENE SEA BASINS OF SOUTH UKRAINE AND MEDITERRANEAN REGION

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Stratigraphic volume of Lower Miocene in South Ukraine is determined in composition of Caucasian, Sacaraulian, Cozachurian and Tarkhanian regional stages.

n this new volume, each stage is characterised by its unique specific peculiarities of fauna. It has been stated, that only marine basin of Cazachurian time is remarkable for a high degree of endemicity, typical for eurihaline marine fauna, conventionally named "Oncophors" (*Rzehakia, Eoprosodacna, Limnopappia*, etc.).

Deposits of the earliest Miocene stage - Caucasian- contain few remains of mollusc fauna. Their species composition is distinguished by endemic character (*Cegastroderma prigorovskii, Corbula helmerseni,* etc.), which is also typical for the one-age deposits of the other parts of Eastern Paratethys: Upper Baigubec North Usturt, Uplisciche beds of Georgia, Sivasch beds of Ukraine, etc.

The deposits of Sacaraulian and Tarkhanian Stages are associated with malacofauna, designating the conditions of the normal marine basins, which had underwent slightly ecology changes of marine basins during the final stage.

In spite of a certain endemic character of mollusc communities, characteristic of deposits of Eastern Paratethys Lower Miocene, the general character of this fauna is generally a Mediterranean one, with the remnants of polihaline species, opposite to the Euxinian - type fauna in the Middle Miocene of this region.

Beginning with Sacaraulian times, there have been stated a number of species common to Early Miocene fauna of the Southern Europe. Among them , the following molluscs: *Glycimeris fichteli, Laevicardium spondyloides, Achantocardia grandis* and others, which makes it possible to compare it with the Lower Burdigalian fauna of the Mediterranean Basin; Lower and Middle

Tarkhanian with faunistic complexes of Carpathian Central Paratethys with Upper Burdigalian Mediterranean fauna.

Palaeogeographic links between Sacaraulian and Tarkanian marine basins, traced in the Northeast of Ukraine, with Central Paratethys basins and in the South, between Prut and Dniestr rivers (Komratian beds) began to manifest themselves through the Bârlad Depression, to the Eastern Carpathians of Romania.

In our opinion, the second direction of palaeogeographic links influencing species - and form-origination in South Ukrainian Late Miocene marine basin, is set in the South East of Eastern Paratethys, where it was connected with the Indo-Oceanic part of Tethys through Eastern Mediterranean and Mesopotamian Depression.

Complex palaeogeographic links of marine basins of Eastern Paratethys Early Miocene predetermined intermediate composition of faunistic communities in the South Ukraine Basin, which prevents direct correlation of Lower Miocene deposits of South Ukraine and Mediterranean. In this connection, it is sensible to use regional stratigraphic schemes of Neogene for this part of Eastern Paratethys.

TORTONIAN MOLLUSCS OF THE BURELLI DEPRESSION (ALBANIA) AND THEIR AFFINITY WITH THE PANNONIAN MOLLUSCS OF PARATETHYS

P. PASCHKO

The following molluscs have been recorded in the Burelli Depression: *Melanoides escheri pulchra* Paschko, *Melanopsis bouei rarispina* Lor., *M. bouei trispina* Paschko, *Psilunio* cf. *atavas* (Partsch, M. Hoernes), *P. odettus* Paschko, *P. trapesoidalis* Paschko.

This association with the endemic elements shows in the same time the affinity with the Pannonian molluscs association of Paratethys. *M. bouei trispina* has been also recorded in the Tortonian coal-bearing deposits of Preadriatic Depression.

COMPARATIVE SARMATIAN DIATOM ASSEMBLAGES FROM GETIC AND ZARAND AREAS AND THEIR PALEOECOLOGIC AND PALEOGEOGRAPHIC IMPLICATIONS

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Basic information for the stratigraphic, paleogeographic and paleoecologic interpretations of the Sarmatian diatomaceous deposits from Paratethys have been provided by the study of two sections, for the two distinct realms occurring on the Romanian territory: Carand section (Zarand basin) for the Pannonic type, and Ocnele Mari section (Dacic basin) for the Extra Carpathian type.

Biostratigraphic analysis of Carand section reveals the following diatom assemblages: a) for Volhynian: *Thalassionema nitzschioides* assemblage, Triceratium pentagonum assemblage and *Zygoceros hungaricus - Stictiodiscus hungaricus* assemblage; b) for the Basarabian: *Coscinodiscus sarmaticus- Coscinodiscus doljensis* assemblage.

At Ocnele Mari, only the Basarabian is presented, therefore, only *Coscinodiscus sarmaticus - Coscinodiscus doljensis* assemblage was identified; this assemblage contains the same association described at Carand, but less diversified.

The episodic communications between the Pannonian and extra-Carpathians are marked by the presence of some Pannonian species (*Stictiodiscus hungaricus* Pant., *Zygoceros hungaricus* Pant., *Hemiaulus biharensis* Pant., *Surirella biharensis* Pant.) in the Basarabian deposits from Ocnele Mari.

Excepting some endemic species, found in Carand section, the Sarmatian diatom assemblages are similar with assemblages mentioned in Indo- Pacific.

This fact suggests the existence of doubtless direct connections between Paratethys and Tethys. Some Mediterranean species from Carand and Ocnele Mari (*Cocconeis grata* Ostr., *Mastogloia angulata* Lewis var. *sarmatica* Jurilj, *Mastogloia castracanei* Pant.) mentioned also in Hungary, Slovakia and Croatia assert the possibility of the existence of south-westwards connections.

The great sensibility of diatoms to paleoenvironmental conditions allowed us to trace detailed curves for paleosalinity and paleotemperature.

Concerning the paleosalinity conditions, the Volhynian- Basarabian diatom assemblages indicate alternative normal marine, marine-brackish and brackish levels. The marine character is also proved by representatives of Silicoflagellata and Ebridians. At Carand, as a result of adaptation to the changes in salinity, as well as of isolation, many endemic species occurred.

Concerning the paleotemperature conditions, two moments of north-boreal influence are pointed out: the first, in the Lower Volhynian, supported by a level enriched in Biddulphia aurita Lyng. and the second, at the upper part of Basarabian pointed out by *Thalassiothrix longissima* Cl.

Coscinodiscus sarmaticus - Coscinodiscus doljensis diatom assemblage dated Basarabian is suitable for correlation with the *Coscinodiscus doljensis* Zone (Z. Rehakova, 1977) and with *Anaulus simplex* Zone (M. Hajos, 1985) established for the Basarabian in Central Paratethys.

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RELATIONSHIPS AND CORRELATION OF THE PLIOCENE MAMMALIAN FAUNAS OF THE DACIAN BASIN

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Paleontological investigations carried out on the fluviolacustrine deposits of the Dacic Basin resulted in accumulation of important data concerning series of biological events which appear to be of stratigraphic significance. A review of the mammalian associations from southern Moldova (the classical fossil sites of Bereşti and Măluşteni) and Oltenia (fossil sites located in the valleys of the Jiu and Olt Rivers and their tributaries) is presented, information drawn from studies on mammals being supported by various lines of evidence as moluscan faunas and paleomagnetic determinations. The stratigraphic distribution of the mammalian assemblages of the Dacic Basin is indicated, and correlation with Mediterranean equivalent localities and the MN zones are suggested.

The studied paleontological sequences span a time interval of approximately 2.5 million years (My), from more than 4 My (age of Bereşti fauna assigned to the Late Dacian, MN-14) to about 1.8 My (age of the mammal association from Valea Grăunceanului in the Olteţ valley, Oltenia, Late Romanian, MN-17). This chronological interval included an alternation of several distinct climatic phases shifting from warm-temperate to cold conditions.

Analyses of the mammalian assemblages showed that during certain phases, characterised generally by a warmer climate, several elements of the Mediterranean faunas penetrated to the Dacic Basin as *Trischizolagus*, a lagomorph distributed otherwise from Spain in the west, to Afghanistan in the east, some rodent species of the genera *Pliospalax* and *Orientalomys*, known from Anatolia and the Aegêan region and other forms Early and Early Late Pliocene in age. A significant dispersal event is marked by the presence at Tuluceşti (southern Moldova) and Cernăteşti (Oltenia) of a very primitive elephant "*Mammuthus*" *rumanus* (Ştefănescu), related to M. *africanavus* (Arambourg) of North Africa. The occurrence of *M. rumanus* marks the earliest record of elephant in Europe (the Dacic Basin) during the middle Gauss subchron. An increase of continentality was registered towards the end of the Neogene (MN-17)as shown by the presence of a species of *Allactaga* (related very probably to the south-western Asiatic *euphratica* group) at Cherleştii-Moşteni (Olt valley, Oltenia). During a warmer interval within the Olduvai event, The Eastern Mediterranean influence is indicated by the occurrence of giraffids (*Mitilanotherium*) in the Dacic Basin (sites of Valea Grăunceanului and Fântâna lui Mitilan in the Olteţ valley, Oltenia), a similar giraffid being described from Volaks (Macedonia, Greece). In addition, at Valea Grăunceanului occurs, among other forms, a large-sized terrestrial cercopithecine monkey (*Paradolichopithecus*), a pangolin (*Manis* sp.) and a large-sized ostrich species. It is worth mentioning that in the same area (Dealul Mijlociu), pebbles which seem to be linked to human activity (tools of "Olduwan appearance") were found. These artefacts are dated to about 1.8 My.

SOME MIOCENE SCUTELLINA (ECHINOIDEA, ECHINODERMATA) FROM SIWA OASIS AND EL SALUM, WESTERN DESERT, EGYPT

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Seven *Scutella* species and two *Amphiope* ones, including the new species *Amphiope miocenica*, have been recorded from three Miocene sections: North Siwa, Zituna sections (Siwa Oasis), and Wadi Aqrab (El Salum), Western Desrt of Egypt. These species are:
Scutella zitteli Beyrich; *S. stefaninii* Desio (Moghra Formation, Burdigalian*); S. robecchi-bricchetti* Desio; S. lovisatoi Lambert; *S. rostrata* Fuchs; *S. ammonis* Fuchs; *S. subrotunda* Lamark and *Amphiope truncata* Fuchs (Marmarica Limestone Formation; Langhian - Serravallian). A comparison between the Egyptian Miocene Scutellina recorded in this work with those of Paratethys area shows that seven species recorded and described from the Badenian (Middle Miocene) of Paratethyan region (Hungary, Vienna Basin, Romania, Austria and Ukraine), have been referred by Vadasz 1915 and Szorenyi 1953 to Scutella. By comparing these seven species with the genera of family Scutellidae described by Dunham 1955, the species must be referred to *Parascutella*. This indicates that genus *Scutella* never entered to the Paratethys area absolutely.

THE BIVALVE FAUNA AS A BASE FOR THE RECONSTRUCTION OF THE MIDDLE MIOCENE HISTORY OF PARATETHYS

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The study is based on bivalve collections housed in numerous institutions of Central and East European countries as well as on monographic papers. The list of bivalves from 40 localities on both parts of Paratethys comprises about 450 species. The study is focused on bivalve faunas recorded in the sandy facies.

Comparison of the species composition of Early Badenian *versus* Tschokrakian bivalve assemblages suggests that Central and Eastern Paratethys were isolated from one another. This is well exemplified by the family Pectinidae. The Central Paratethyan bivalve fauna contains 32 pectinid species but none of them was recorded in the Eastern Paratethys, where the pectinids are represented by three endemic species.

The distributional pattern of the Central Paratethyan bivalve assemblages as well as low level endemism point that during the Early Badenian (corresponding to Langhian) there was a wide connection between the Mediterranean area and the Central Paratethys. Bivalve data indicate, in addition, the existence of both north-eastern Italian passage and the connection through the Albanian- Thessalian and the Axios Depressions.

The species composition and the distributional pattern of the Tschokrakian bivalve assemblages suggest that the Eastern Paratethys was connected with the world ocean in its south-eastern part. Traditionally, the Indo-Persian connection is postulated but the immigrant species seem to show the link with the East-Mediterranean area.

On the other hand, the similarity of the Late Badenian (corresponding to Early Serravalian) and the Konkian bivalve assemblages supports the supposition about faunistic integration of the whole area from the Atlantic on the west to the Transcaspian in the east. The representatives of the family Pectinidae confirm this similarity as well. The Eastern Paratethyan fauna contains 5 pectinid species all of them being known also from the Central Paratethyan assemblages (totalling in 33 pectinid species). Contrary to the Tschokrakian, however, in the Konkian time, the Eastern Paratethys communicated with the world ocean both to the west (through the Central Paratethys), and to the south-east (through the East Mediterranean).

"PARATETHYAN" MOLLUSC FAUNAS FROM THE NEOGENE OF MACEDONIA AND THRACE, NORTHERN GREECE

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Northern Greece has been considered as transitional zone between Tethys and Paratethys.

Several years ago only a few isolated fossiliferous sites with Paratethyan-like mollusc faunas were known (Alatini, Trilophos). Investigations started previous years in the area of Macedonia and Thrace, northern Greece, reveal new fossiliferous sites with Paratethyan mollusc faunas. These faunas are included in Neogene sediments and consisted of a monotonous mollusc association.

Limnocardiidae:	*Pseudoprosodacna, Pseudocatillus*
Dreissenidae:	*Dreissena, Congeria*
Veneridae	*Parvivenus*
Mactridae:	*Spisula*
Neritidae:	*Theodoxus*
Melanopsidae:	*Melanopsis*
Hydrobiidae	*Hydrobia*
Helicidae	*Helix*

Although these sites geographically distributed into different basins (Axios-Thermaikos basin, Strymon-Serres- Strymonikos gulf basins, Xanthi-Komotini basins), reveal faunal stability and lithological similarities of their sediments and overlaid by the Lower Pliocene sediments. Thus, the Uppermost Miocene seems to be the time span of a Paratethyan water invasion in northern Greece.

The presence and distribution of these faunas in the sediments of the Northern Aegean basins set up a debate of a new stratigraphic and paleogeographic reconsideration.

AKTSHAGYLIAN EPISODE IN THE PLIOCENE HISTORY OF THE AZOV-BLACK SEA BASIN

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1. Did the Aktshagylian sea occupied the whole Black Sea-Azov basin, or it was restricted to its Azov part ? All present know findings of the Aktshagylian mollusc fauna are situated in the Azov area. No traces of Aktshagylian molluscs are present in the Black Sea basin itself : the Pontian molluscs gave rise to the Kimmerian - Kuyalnikian (Egrissian), Egrissian - Gurian and Gurian - Tshaudian ones. There is no place for the Aktshagylyan molluscs in this uninterrupted stream.

2. Based on general considerations, some researchers affirm that transgression proceeds uniformly all over a basin. As a result, when the transgression reaches a basin it is never restricted to one of its parts, but affects the basin as a whole. Besides, presence of the "Aktshagylian elements" in the Kuyalnikian ostracod fauna of Western Georgia as well as findings of Aktshagylian fauna in Dardanelles seems to be in favour of a general Black Sea transgression in Aktsagylian time.

3. Every Neogene transgression has its limits. The Aktshagylian transgression attained the Azov Bay of the Black Sea but did not proceed further west into the Black Sea Depression, then occupied by the Kuyalnikian (Egrissian) basin. Only a temporary link has been formed between the two basins. They came in contact for a very short period of time but one basin did not engulf the other.

4. The "Aktshagylian elements" in the ostracod fauna, indicated by some researchers, actually represents common forms for the Aktshagylian and Kuyalnikian deposits, but wut widespread in Aktshagylian or first described there. A detailed examination of these forms points to their appearance before the Aktshagylian time. Consequently they cannot be considered as "Aktshagylian elements".

5. Presence of the Aktshagylian fauna in Dardanelles poses the question how was it transtorted unto there? The data given above prelude their transportation from the Aktshagylian to the Mediterranean Basin, via Black Sea Basin. An alternative may be circum-Black Sea prochoresis of the Aktshagylian fauna. This concept is accepted by some adepts of the western provenance of the Aktshagylian forms of molluscs. The hypotesis has been suggested for the first time by A. G. Ebersin (1931). It is assumed that the marine link between the Eastern Mediterranean and the Caspian Basin was situated within the geosynclinal area of Eastern Turkey and NW Iran, between the Arabian plate and the Anatolian and lesser Caucasian massifs.

6. The author shares this view and suggests that the Aktshagylian molluscs fauna was born not in the Eastern Mediterranean and not in the Aktshagylian basin itself. Most probably it originated in the strait or a chain of lakes connecting these two basins. From the strait it could later migrate werward, to the Eastern Mediterranean and eastward to the Caspian region.

7. If the Aktshagylian geological body was not present in the Black Sea Basin, it is irrelevant to include the Aktshagylian stage into the Neogene stratigraphic scale of the Black Sea basin. It is to be replaced by the Kuyalnikian (Egrissian) stage.

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