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REPORT ON THE ROUND TABLE DISCUSSION: "MEDITERRANEAN AND PARATETHYS CORRELATIONS"

by

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with contributions and remaks by

AGUILAR J. P.: letter dated December 3, 1985.
AGUSTÍ J.: Upper Miocene correlations in Eastern Spain.
ALBERDI M. T. and F. B. BONADONNA: Results on Pliocene marine—continental correlations in Spain and Italy.
ANDREESCU I.: letter dated December 12, 1985.
ČTYROKÝ P.: The stratigraphic position of the first Hipparion occurrence in Southern Moravia, Vienna basin, Czechoslovakia.
KOJUMDGIEVA E.: Tarkhanian—Tshokrakian correlation problems.
MARINESCU F.: letter dated February 27, 1986.
MENNER V. V., PEVZNER, M. A. and VANGENGEIM E. A.: letter dated December 16, 1985.
NOSOVSKY M.: letter dated January 28, 1986.
PEVZNER M. A. and VANGENGEIM E. A.: letter to F. F. STEININGER, dated October 9, 1985.
STEININGER F. F.: Remarks to the letter of PEVZNER and VANGENGEIM (October 9, 1985) and the letter of MENNER et al. (December 16, 1985).
VASS D.: letter dated December 1, 1985.

Introduction. Since 15 years one of the main goals of IGCP Project No 25, "Stratigraphic Correlation Tethys—Paratethys Neogene", has been to provide a more accurate correlation between the different main regions of the Mediterranean, the Central Paratethys and the Eastern Paratethys. As it turned out lately by the work done of our colleagues, significant differences still exist with regard to the final results of this Project.

Similar problems refer to different versions of the correlation of planktonic biostratigraphies of the world oceans and the paleomagnetic time scale (e.g. W. A. BERGGREN et al., 1985; J. A. BARRON, 1985 and C. MÜLLER, 1984) (Fig. A, B, C). Lately another version of planktonic biostratigraphic correlations appeared: H. M. BOLLI et al., 1985: Plankton Stratigraphy (Cambridge Univ. Press).

At the round table meeting of the "RCMNS Working Group on Chronostratigraphy and Geochronology" during the Budapest Congress the discussion turned up several correlation key points which were then summarized by us for the Mediterranean (Table 1), the Paratethys (Table 2) and additional correlation points and problems (Table 3). Based on this material we tried to come up with a revised tentative correlation which follows (1) the proposed Mediterranean correlation by MÜLLER (1984)—see Fig. D—and (2) the standard correlation for the Pacific by BARRON (1985)—see Fig. E. The summarized results of the Budapest round table and figures A to E were sent to all colleagues interested to raise more discussion on additional correlation points. The following questionaire was added to gain more precise information:

QUESTIONAIRE

A) Biostratigraphic data:

A. 1. Correlation points of aquatic (e.g. marine, euxinic etc) and continental environments;
correlation points between Central and Eastern Paratethys;
correlation points between Mediterranean and Paratethys.

A. 2. Those correlation points should be documented by:
a lithological section with biostratigraphic data points;
a list of species for each data point (please do not list families or genera only).

A. 3. References.

B) Radiometric data:

Radiometric data points should be documented by:

B. 1. Lithological section with position of radiometric samples and biostratigraphic data points (see A).

B. 2. Radiometric results and constants used.

B. 3. References.

C) Palaeomagnetic data:

Palaeomagnetic data should be documented by:

C. 1. Lithological section with palaeomagnetic sample points and polarity measurements.

C. 2. Biostratigraphic and radiometric data points (for indications see A and B).

C. 3. Palaeomagnetic interpretations.

C. 4. References.

An updated Neogene correlation chart was expected to be produced by this discussion and to be included in this volume of the Proceedings of the Budapest RCMNS Congress. However, since the response was rather meagre (see below), we prefer to include the answers received only without compiling an updated correlation chart.

F. RÖGL and F. F. STEININGER

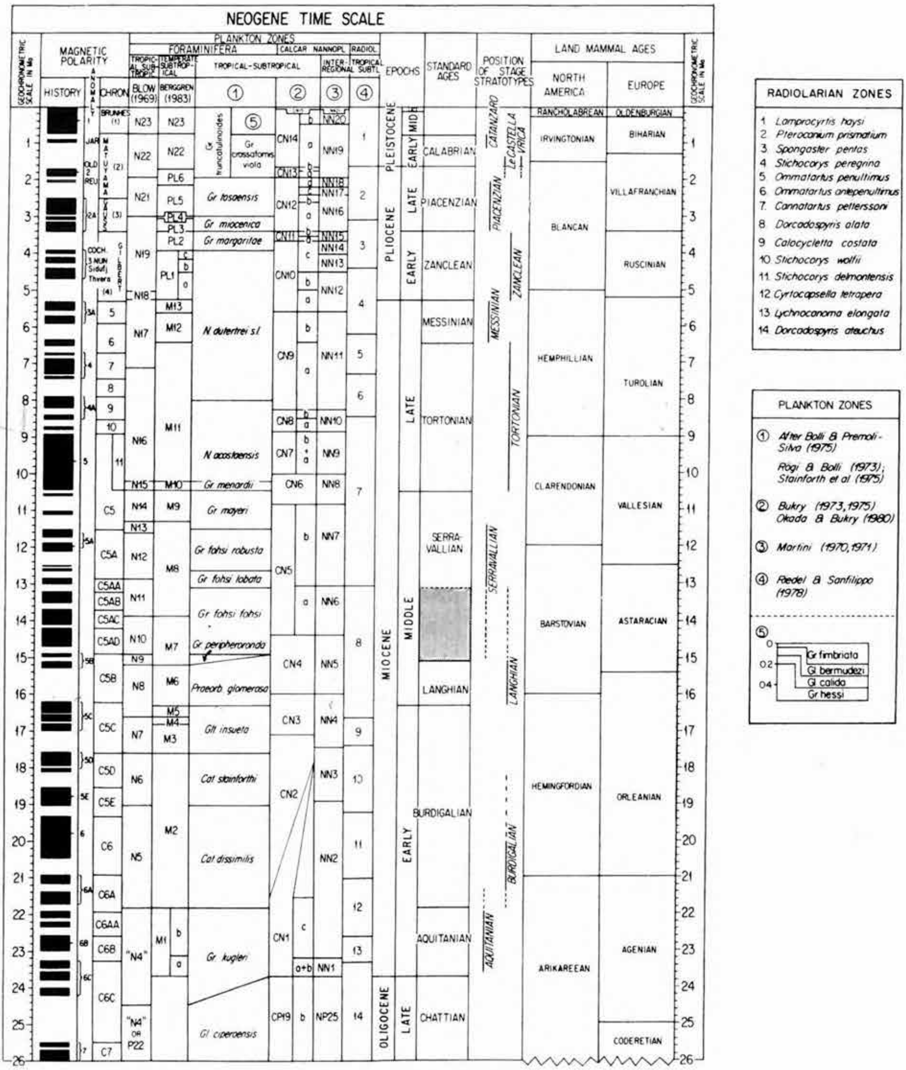


Fig. A. Neogene Geochronology and Chronostratigraphy by W. A. BERGGREN, D. V. KENT et J. A. VAN COUVERING (1985)

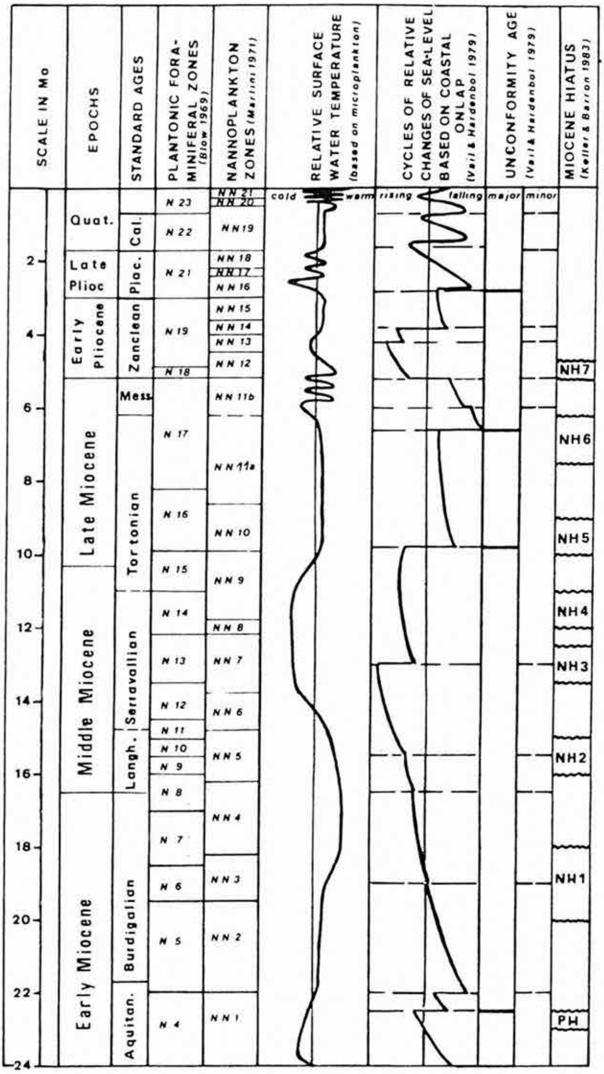


Fig. B. Neogene time-scale, surface water temperatures and changes of coastal onlap and Miocene hiatuses by MÜLLER (1985)

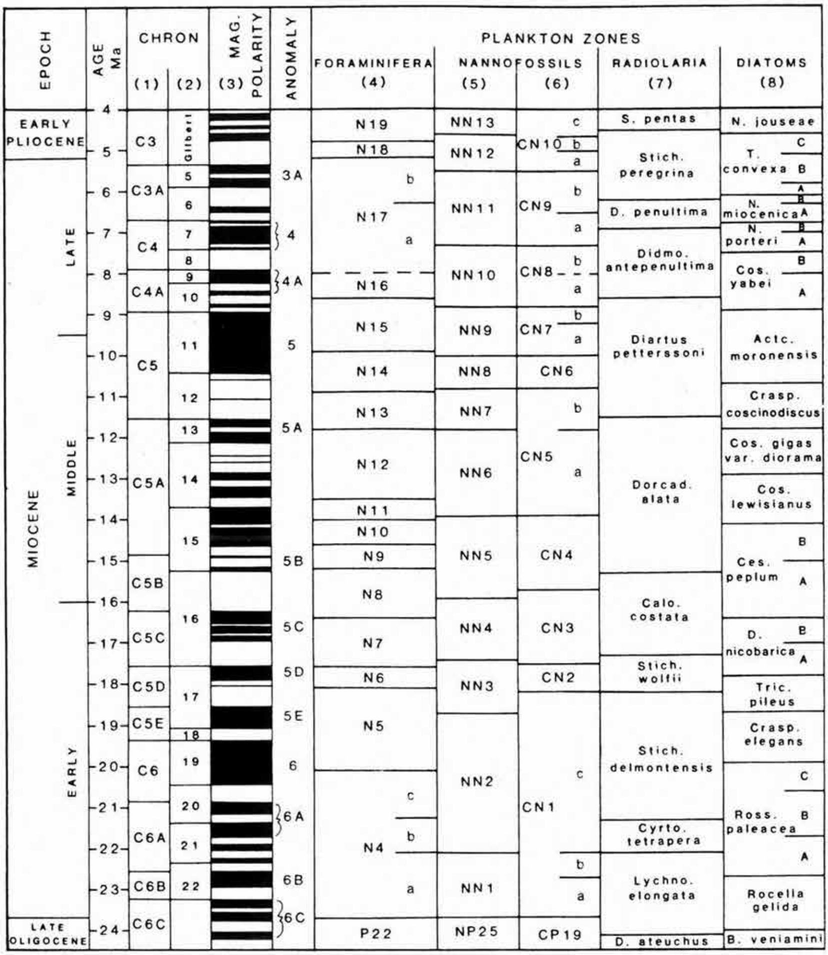


Fig. C. Miocene time scale by Barron (1985)

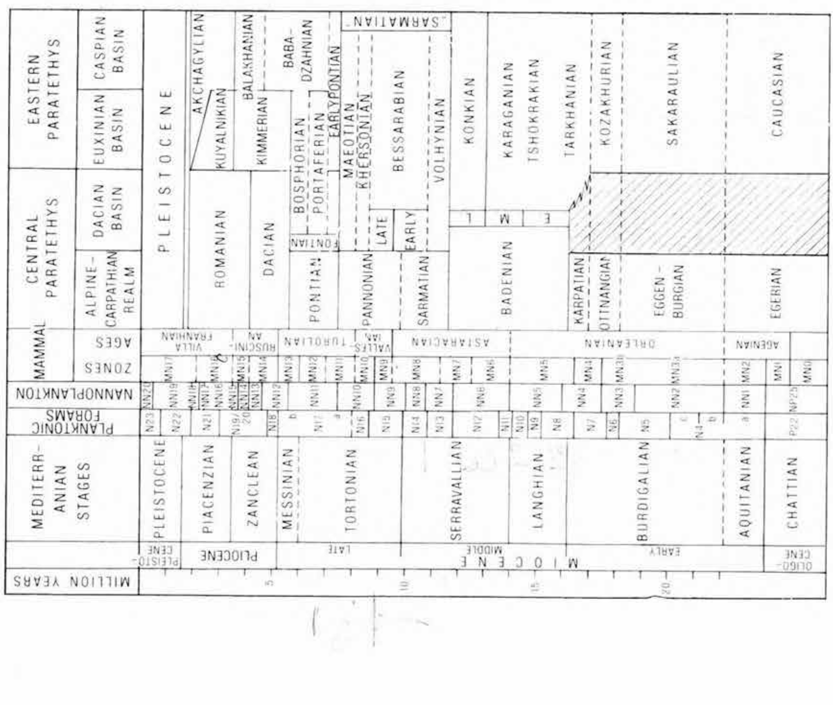


Fig. D. Tentative Neogene Mediterranean—Paratethys Correlation table

1 Correlation of calcareous nannoplankton zonation—planktonic foraminifera zonation and radiometric ages according to C. MÜLLER (1984—see also Fig. B in this article), *2* radiometric ages of Central Paratethys stage boundaries according to D. VASS et al. (1985—Abstract volume of VIII. RCMNS Congress)

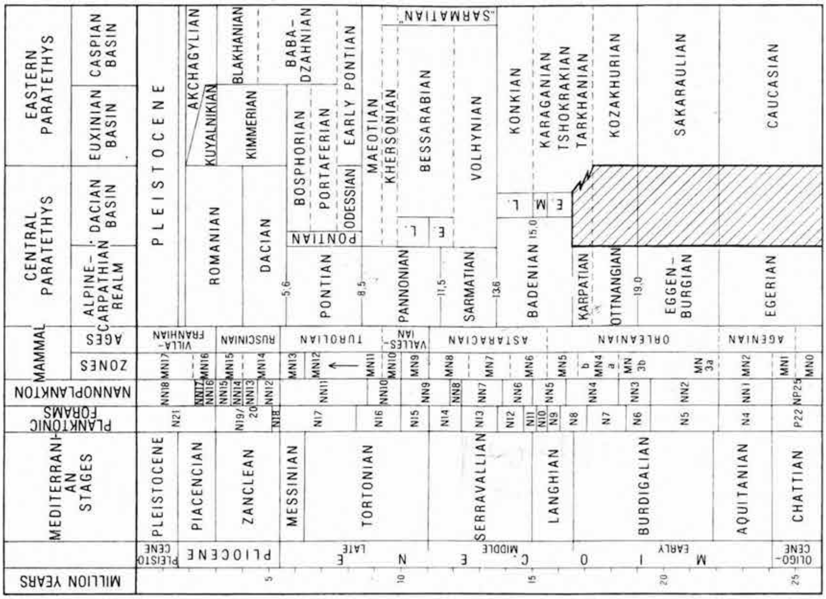


Fig. E. Tentative Neogene Mediterranean—Paratethys Correlation table

1 Miocene correlation of calcareous nannoplankton zonation—planktonic foraminifera zonation and radiometric ages according to J. A. BARRON (1985—see also Fig. C in this article), *2* Pliocene correlation according to W. A. BERGGREN et al. (1985—see also Fig. A. in this article)

Table 1

Mediterranean correlation key points

Marine—continental correlations:
MN15 La Juliana = *Globorotalia crassaformis?*
late MN 13 La Alberca = N18?
MN13 Crevillente 6 = Messinian
MN12 Crevillente 4 = *Globorotalia conomiozea*
Crevillente 1—3 = N16--MN11
early MN10 Kastellios = early N16 (reversed)
MN5 Chelas 2 = N9
MN4 Chelas 1 and Quinto de Pombeja = N8
MN3b Navigao = N7
MN3a Lisboa, Univ. Catholica = NN2
MN3a Maigen (Austria) = NN2/3
MNO Cap Janet = below P/N-boundary

Table 2

Paratethys correlation key points

Apsheronian = NN17—18 upper	0,95 ± 0,11 my
	1.05 ± 0.12 my
Akchagylian = NN17—18	2.19 and 2.55 my

MN16 = Bevesti, Malusteni, Jaros—with palaeomagnetics
early Kimmerian = NN11—12
late Maeotian = NN10
middle Maeotian = NN9, *Discoaster hamatus*
Maeotian, with *Unio flabellatus*, no mollusc correlation to mammals
Khersonian: Kalfa with molluscs
Hipparion appearance = middle Bessarabian
"Sarmatian" (sensu lato), abs. age 13.5—9.5 my
early Maeotian with *Catinaster coalithus*
early Sarmatian with *Catinaster coalithus* also
Konkian = NN6/7
Tarkhanian = NN4 and Karpatian molluscs
Caucasian = NP25--NN1

Table 3

Additional correlation points and problems

1 Pliocene—Pleistocene boundary according to the new boundary stratotype (AGUIRRE & PASINI, Episodes vol. 8, no. 2, 1985) at 1,6 m.y.

2 Eastern Paratethys stage system according to NEVESSKAYA et al. (1984, Int. Geol. Congr.)

3 Correlation of Eastern Paratethys partly by nannoplankton (SEMENENKO and LULIEVA, 1985, Abstracts; NOSOVSKY, 1985, Abstracts).

4 Subdivision of Pontian in absolute time not prooved, only estimated. Correlation of Pontian to Late Tortonian (partly) according to VEKUA by means of ostracods (1985, Abstracts).

5 Dacian/Romanian boundary according to ANDREESCU (Athens, 1981).

6 Base of Pontian in MN11 by correlation of molluscs of the Eichkogel and Tihany localities (ČTYROKÝ, pers. comm. at the RCMNS meeting).

7 Correlation of mammal zonation according to MEIN at the discussion meeting and MEIN (Bratislava and Athens), lower part compare to RÖGL and STEININGER (1983); additional correlations:

MN1 = Paulhiac = in Oligocene (RINGEADE, 1978)

MN6 = Devinska Nova Ves, sand hill (Neudorf) = Middle Badenian

MN7 = La Grive, La Grenatière = late NN6 (AGUILAR, 1982) = about Sarmatian according also to Steinheim—Nexing correlation

MN8 = Late Sarmatian s. str./Volhynian with molluscs at Comanești 1 (FERU et al., 1980)

MN9 = first *Hipparion* = Pannon C/D at Comanești 2 (FERU et al., 1982); = Gaiselberg, Pannon C (ZAPFE, 1949) = uppermost Pannon 8 at Hovorany (comm. of ČTYROKÝ); late Bessarabian at Nessebar (KOJUMDGIEVA, 1971)

MN10 = Pannonian E of Vösendorf

MN16/beginning of Villafranchian in *Gr. crassaformis* zone (ALBERDI and BONADONNA, Abstr. 1985).

8 Position of the Langhian according to CITA and RYAN, N8 pp—N10 lower part (beginning of *Praeorbulina* to FAD *G. druryi*); see also "Activity reports and Proceedings of Bratislava RCMNS" nannoplankton zone NN4 to NN6, top according to RYAN et al. (1974) coinciding with top of NN5.

The uncorrect stratigraphic position of the Langhian within NN4 (HAQ, 1983) is without any explanation or reason, compare also the discussion of BANDET et al. (C. R. Acad. Sc. Paris, t. 299, sèr. II, no. 10, 1984, p. 651).

9 Tortonian according to MARTINI (Bratislava, 1975) NN 9—11, boundary Serravallian/Tortonian at base of N15 (RYAN et al., 1974).

10 Boundary Egerian/Eggenburgian at the NN$^1/_2$ boundary, no NN1 in the Eggenburgian. Caucasian must reach below the P/N—boundary, corresponding at least to late Egerian also by the occurrence of NP25.

11 The lower part of Fig. E: N4—5 is according to KELLER (Micropaleont., vol. 26. p. 372, 1980). The correlation to the nannozonation does not correspond to any other correlation. N4 as total range zone of *Gr. kugleri* does not cover much of NN2 but correlates with NN1 and the upper part of NP25.

J. P. AGUILAR (letter dated December 3, 1985)

I Mediterranean key point (voir Table 1) corrections proposées:

Chelas 2 (N9—N10) zone C2 (AGUILAR, 1982) probablement MN5. Pour le gisement de Chelas 2, un âge plus récent devrait être envisage, âge voisin de celui de Sansan (zone C3 AGUILAR, 1982) ou MN6.

Chelas 1 entre N8 et N9 niveau à *Hispanotherium* zone C2 (AGUILAR, 1982) = MN5.

Quinto de Pombeiro N8 zone C1 (AGUILAR, 1982) = MN4b.

Lisboa R2. Quinto de Navigao entre N7 et N8 MN4a (MEIN, 1975, ANTUNES in 1982; REBEIRO et al. 1979). Pourquoi MN3b? Est-ce sur la corrélation donnée par AGUILAR (1982)?

Lisboa Univ. Catolica N4—N5 zone A5 (AGUILAR, 1982) = MN3a

Cap Janet: pas de relation entre P et N. Ce niveau est de l'Aquitanien parastratotypique (ALVINERIE, ANGLADA, CARALP et CATZGRAS, 1977).' Si la zone N4 est reconnue bien au-dessus, rien n'indique clairement que c'est la base de N4 puisque N3 ou P22 n'y sont pas reconnues dans ces formations très littorales.

Eléments de corrélations supplémentaires:

— Les Cévennes N4 zone A2 (AGUILAR, 1982), ce qui implique pour la zone MN1 un âge aquitanien.

— Beaulieu âge radiométrique 17.8±0.5 M.A. (BAUBRON et al., 1975) nouvelle datation à paraître 17.5±0.5 (AGUILAR, BAUDET, CLAUZON)

Ceci implique pour la partie supérieure de la zone B (AGUILAR, 1982) un âge de 17.5 M.A. environ.

— Veyran NN6 Partie supérieure de la zone C2 (AGUILAR, 1982) zone MN5 ou MN6??

II Figure de corrélation

Fig. D (corrélation MÜLLER):

— La limite Plaisancien—Zancléen est admise à —3.3 M.A., il faudrait donc déplacer la limite.

— La zone MN13 commence dans le Tortonien supérieur (zonation de MEIN, 1984).

— La zone MN5 est caractérisée par le gisement de Langenmoosen. Ce gisement est attribué au Karpatien d'après CICHA, FAHLBUSCH et FEJFAR, 1972, ainsi que dans le tableau de corrélation du volume "Corrélation du Néogène de la Paratéthys centrale" (Geological Survey Prague, 1975).

Dans le tableau d'après l'extension de la zone MN5, Langenmoosen serait du Badénien.

— L'Ottnangien est caractérisé par le gisement d'Orechov que l'on doit corréler avec la base de la zone C1 (AGUILAR, 1982) ou de la zone MN4, mais cette limite Ottnangien/Eggenburgien ne peut être fixée à 19 M.A., puisque le gisement de Beaulieu qui appartient à la partie supérieure de la zone B ou à la zone MN3b est un gisement plus ancien que celui d'Orechov, ayant un âge radiométrique de —17,5±0,5 M.A.

— Pour la limite Aquitanien—Burdigalien, GOMINARD et al. (1985) proposent un âge de —20,6 M.A.

J. AGUSTÍ: Upper Miocene correlations in Eastern Spain

Two kinds of data are presented in this report. The first ones occur in four sections which permit the correlation between the continental and the marine scale. The sections are as follows (Fig. 1):

A) Casa del Acero. Fortuna basin (Murcia, SE of Spain).

B) La Hornera section. Fortuna basin. (Murcia, SE of Spain).

C) Molina de Segura section. Fortuna basin (Murcia, SE of Spain).

D) San Onofre section. Tortosa area (Tarragona, NE of Spain).

Palaeomagnetic data are also available from the Lower part of the last section.

The other data occur in a continental section with radiometric samples and biostratigraphic points (La Celia section, Murcia, SE of Spain)

A) *Casa del Acero section* (Figs. 1, 2, 3)

The Fortuna basin is an intramontainous basin filled by marine sediments ranging from the Tortonian I and II up to the Messinian (MONTENAT, 1977). A detailed study of the geology of this basin was done by SANTISTEBAN (1981). In the borders of the basin, the terminal Miocene passes into reef and evaporitic deposits. These ones are covered by deltaic and continental beds which sometimes include fossiliferous horizons with mammals. Three evaporitic groups were distinguished by SANTISTEBAN (op. cit).. The lower one overlies clays and marls of marine origin which contain *Globigerinoides elongatus* and *G. extremus*. *Globorotaria mediterranea* is also present in this lower evaporitic group. The continental beds of Casa del Acero, as well as those from la Hornera and Molina de Segura, were deposited over the Upper evaporitic group (Fig. 2). Casa del Acero has yielded a mammal association belonging to the MN12 zone (AGUSTÍ et al., 1981):

Petenyella repenningi, *Schizogalerix* sp. I, *Schizogalerix* sp. II, Echinosoricinae indet., *Hispanomys adroveri*, *Kowalskia meini*, *Parapodemus barbarae*, *Occitanomys adroveri*, *Valerimys turoliensis*, *Eliomys truci*, *Atlantoxerus* sp., *Hipparion concudense* ssp., *Metailurus* n. sp., Cervidae indet., *Tragoportax gaudryi gaudryi*, "*Mastodon*" sp.

Thus, levels belonging to the Middle Turolian (MN12) overlie marine beds from the Messinian.

B) *La Hornera section* (Figs. 1, 2, 3)

Like the Casa del Acero section, this sequence belongs to the third evaporitic group (above the horizons with *G. elongatus* and *G. extremus*). It shows a transition from green marls of marine origin to lacustrine beds, some of them with mammal remains. The fauna found at La Hornera is composed of the following elements:

Apodemus gudrunae, *Stephanomys ramblensis*, *Eliomys truci*, *Muscardinus vireti*, *Hispanomys* sp., *Prolagus* cf. *michauxi*. This association is typical of zone MN13 (Upper Turolian).

C) *Molina de Segura section* (Figs. 1, 2, 4)

The lower part of the sequence is formed by green and bluish marls with intercalations of gypsum and sand. These beds overlie the beds of the third evaporitic group with *G. elongatus* and *G. extremus*. Samples MSA 1 and 3 have yielded many valves of the ostracod species *Cyprideis pannonica*, possibly indicating a late Messinian age (ZACHARIASSE, oral com.). In the upper part of the section up to 11 fossiliferous sites with mammals have been recovered (from base to top):

Molina de Segura-D: Occitanomys adroveri, *Valerimys turoliensis*, *Stephanomys* cf. *ramblensis*, Suinae indet.

Molina de Segura -1: Valerimys turoliensis, *Stephanomys ramblensis*, *Hipparion* aff. *concudense*.

Molina de Segura-E: Hipparion gromovae, Cervidae indet., ?Antilopini indet.

Molina de Segura-2: Prolagus cf. *michauxi*, *Occitanomys* sp.

Molina de Segura-3: Stephanomys ramblensis, *Paraethomys miocaenicus*, *Hispanomys* sp.

Molina de Segura-4: aff. *Propotamochoerus* sp.

Molina de Segura-6: Stephanomys ramblensis, *Prolagus* cf. *michauxi*.

Molina de Segura-7: Occitanomys sp., *Paraethomys miocaenicus*.

Molina de Segura-8: Stephanomys ramblensis, *Paraethomys miocaenicus*, *Prolagus* cf. *michauxi*, Leporidae indet., *Hipparion* sp.

Molina de Segura-9: Apodemus gudrunae, *Paraethomys miocaenicus*, *Stephanomys ramblensis*, *Occitanomys* sp., *Hispanomys* sp., *Critcetus kormosi*, Cervidae indet.

Molina de Segura-10: Stephanomys cf. *margaritae*, *Paraethomys miocaenicus*.

The Molina de Segura horizons D and 1 could be situated at the base of the zone MN13 or in the top of the zone MN12 (because of the presence of *Valerimys turoliensis*). The horizons from Molina de Segura-E to M. de Segura-10 probably belong to the base of the Ruscinian, MN14, because of the presence of *Stephanomys* cf. *margaritae*.

D) *San Onofre section* (Figs. 1, 5)

It consists, from base to top, of

1) Grey marine marls.

2) Marls with thin sandstone beds.

3) Transitional sequence of yellow to brown clays.
4) Continental sequence of dark clays with hydromorphic horizons.
5) Limestones, occasionally travertinic.

Disconformably over the latter, the section continues with cemented breccias coming from indeterminate alluvial fans.

At the San Onofre-1 site of the continental sequence, a discrete mammal microfauna was recovered *(Apodemus jeanetti, Occitanomys* sp., *Muscardinus* aff. *vireti* and *Prolagus* cf. *michauxi)* indicating a MN14 zone or base of the MN15. In the lower part of the section a foraminifera fauna is composed of *Globigerinoides extremus, Globigerina decoraperta, Florilus bouenus, Elphidium crispum, Ammonia beccarii tepida* and *Bulimina* cf. *Fussiformis baccata* (see AGUIRRE et al.). This association indicates an age older than the *Globorotalia inflata* zone. The ostracod association corresponds to SISSING zone 9 (AGUIRRE et al., op. cit.) which partially overlaps the *G. crassaformis* zone. The palaeomagnetic imprints show a sequence which goes from normal to reverse and again to normal at the top of the marine sequence.

E) *La Celia section* (Figs. 1, 6, 7)

The main interest of this section consists in the existence of lava beds intercalated within fossiliferous deposits. One of these extrusive beds immediately above a lacustrine deposit has yielded the following mammal association (Los Gargantones):

Parapodemus lugdunensis, Occitanomys sondaari, Prolagus crusafonti, Alilepus cf. *turoliensis*, Cervidae indet., *Hipparion* aff. *concudense, Microstonyx* sp., *Tragoportax gaudryi crusafonti.*

This association is typical of MN11 zone (Lower Turolian). The volcanic episode from La Celia is also documented in the area by many pipes and intrusions which transsect the fluviatile and lacustrine beds. The age of the whole episode was established by NOBEL et al. (1981) by different methods, giving the following values:

sanidine	7.2 ± 0.3
K-richterite	7.6 ± 0.2
apatite fission tr.	7.2 ± 1.4

These values also coincide with other samples from Jumilla area (Las Cabras, Las Minas, Calasparra), the dates of which range from 7.2 to 7.6. Because of chemical particularities all the volcanic episode belongs to a single source (NOBEL, oral com.).

Conclusions

Conclusions: According to the data presented, the following correlations are proposed:

1) The Lower Turolian (MN11) must be correlated with the Upper Tortonian (7.2 Ma.) according to the data from La Celia section.

2) The Middle Turolian (MN12) is correlated with the Messinian, since, at Casa del Acero, horizons of that MN zone overlie marine evaporitic deposits of this stage. Until now, the Middle Turolian was considered to be time-equivalent with the Upper Tortonian.

3) The Upper Turolian (MN13) must be considered equivalent to the extreme top of the Messinian, according to data from La Hornera and Molina de Segura sections.

4) The zone MN14 (Lower Ruscinian) is partially correlated with the *G. crassaformis* zone (Middle Pliocene).

In Fig. 4 by MÜLLER (1984) and Fig. 5 by BARRON (1985), both authors correlate the base of the Vallesian with the base of the Tortonian. But we know (after MEIN) that *Hipparion* (the Vallesian indicator) is present in Serravallian beds of the Rhone basin. So, the lower part (or, at least, part of the lower part) of the Vallesian must be correlated with the Upper Serravallian. On the other hand, it seems clear (section of Kastellios Hill, Greece, DE BRUIJN et al., 1971) that the Upper Vallesian may be correlated with the Lower Tortonian. So, the scheme of correlations between the marine and continental scales is as follows:

Lower Vallesian—Upper Serravallian
Upper Vallesian—Lower Tortonian
Lower Turolian—Upper Tortonian
Middle and Upper Turolian—Messinian
Lower Ruscinian—Middle Pliocene

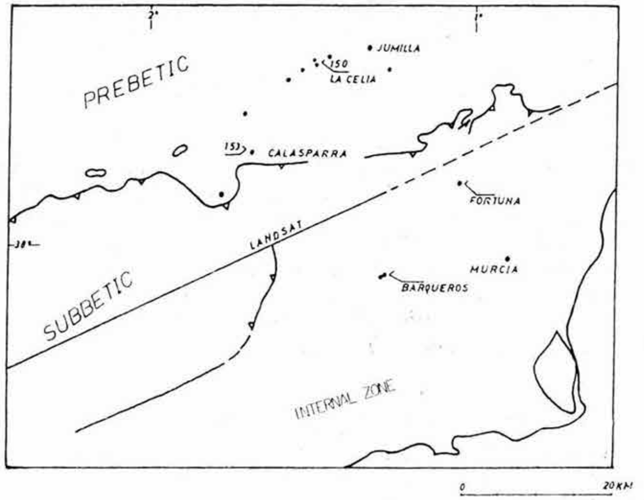


Fig. 1. Map of situation of the localities of SE Spain cited in the text (after AGUSTÍ et al., 1985)

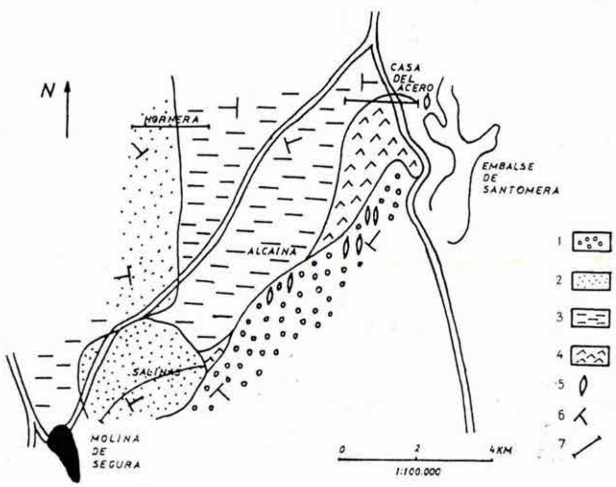
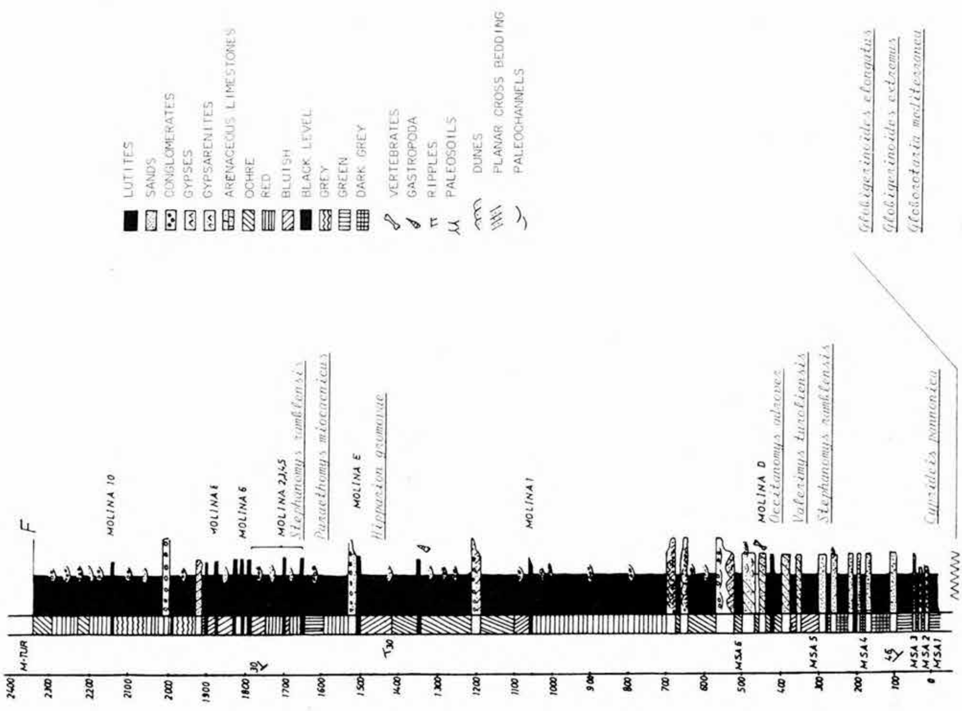


Fig. 2. Location of the sections in the Fortuna basin (after AGUSTÍ et al., 1985)
1 Alluvial system, *2* deltaic facies, *3* marine clays and muds, *4* evaporitic facies, *5* reefs, *6* dip, *7* situation of the sections



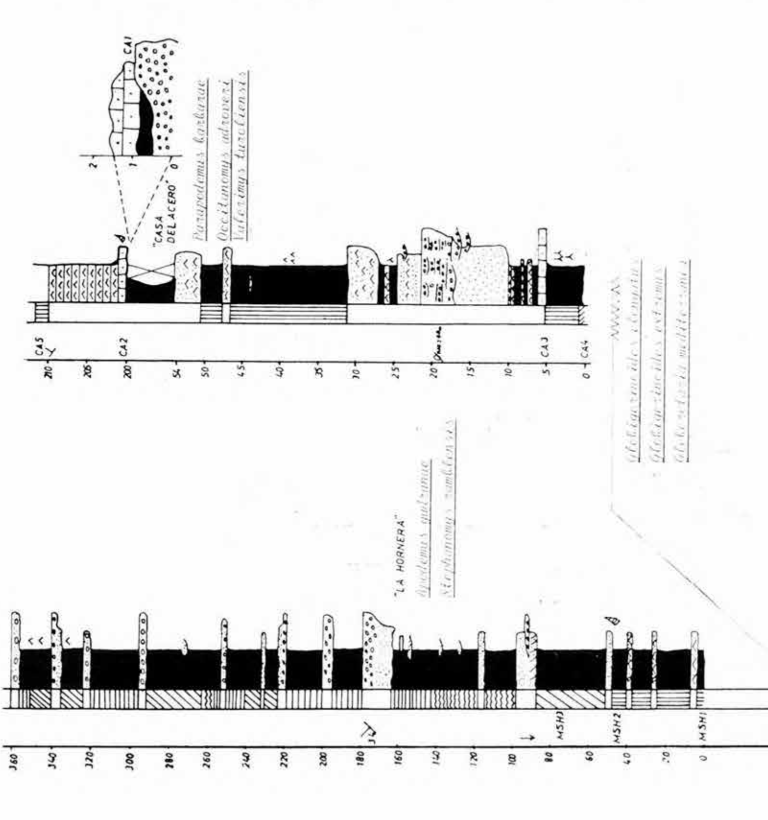


Fig. 3. Sections of Casa del Acero and La Hornera

Fig. 4. Section of Molina de Segura (after AGUSTÍ et al., 1985)

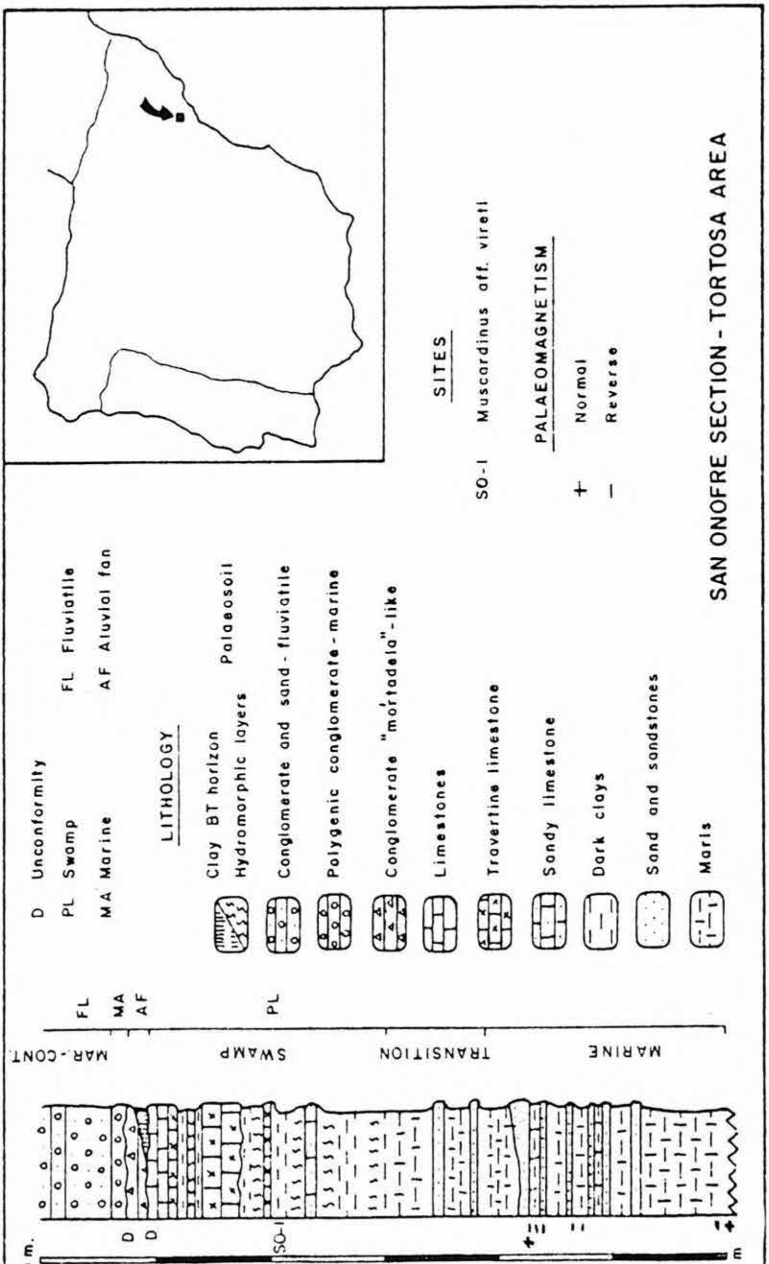


Fig. 5. Section of San Onofre (after AGUIRRE et al., op. cit., see also AGUSTÍ et al., 1983)

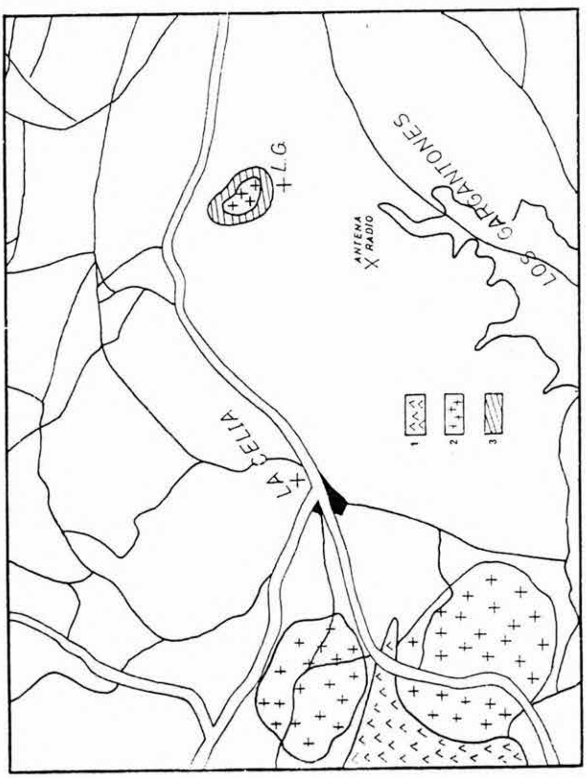


Fig. 6. Location of the sections from La Celia and Los Gargantones (after AGUSTÍ et al., 1985)

1 Diapiric gypsum (Trias), *2* intrusion, *3* extrusive level

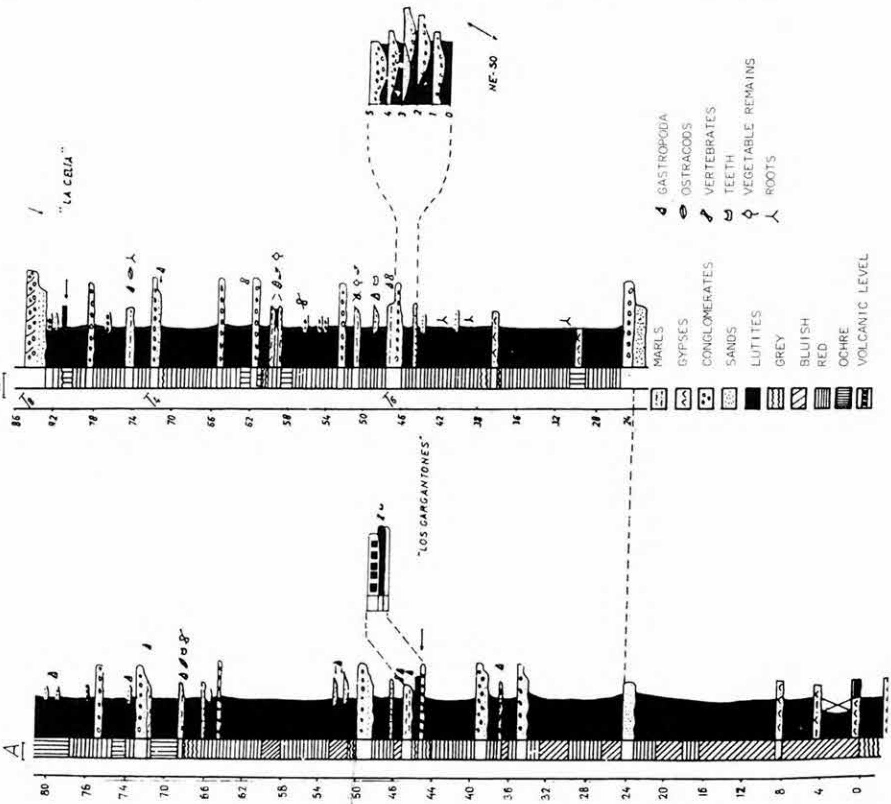


Fig. 7. Sections of Los Gargantones and La Cella (after AGUSTÍ et al., 1985)

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M. T. ALBERDI and **F. P. BONADONNA:** Results on Pliocene marine—continental correlations in Spain and Italy

The age of La Juliana deposit (Spain) is considered by MONTENAT and DE BRUIJN (1976) as Early Ruscinian and correlated with the Late—Middle Pliocene (younger than *Globorotalia crassaformis* zone). ("The Early Ruscinian thus seems to be coeval with the Late Pliocene, but a correlation with the middle Pliocene cannot be excluded" MONTENAT et DE BRUIJN, 1976, p. 255). After some research in the field, in our opinion, the stratigraphy of La Juliana deposits is not so clear as MONTENAT and DE BRUIJN maintain. Moreover, the deposit was completely removed by agricultural activities and it is now impossible to subject it to a geological—palaeontological revision. Furthermore, the definition of MN14 and MN15 (the rodent horizons of La Juliana) in Spain is rather confused. As can be seen in Fig. 1, in the Tortosa area (San Onofre section) the horizon called "MN14 or beginning of MN15" by AGUIRRE et al. (1982) is found in a swamp sediment overlying the *Globorotalia crassaformis* zone, i.e.MN16b (also note that the top of the *Globorotalia crassaformis* zone was found to be 2.1 MA old in Vrica section (Italy). On the other hand, in the La Gineta deposit (Jucar valley, Spain), MN15 underlies a conspicuous discordance (Ibero-Manchega I) which in turn underlies the Casas del Rincon series (Fig. 1) (ALBERDI and BONADONNA, 1985).

The series (50 m thick), situated in the Southern Spanish Meseta, is formed by carbonate layers of a marshy and lacustrine environment, and it is transgressive on other lacustrine series in which Ruscinian fauna was found. In the whole series close isotopic measurements were performed (LEONE, 1985) to determine the palaeoclimatic trend of the deposition epoch. From the oxygen isotopic composition of carbonate layers and fresh water gastropods it is possible to build a palaeoclimatic curve (Fig. 1); the comparison of this curve with THUNELL's curve (1979) for the Mediterranean palaeoclimate shows that the cold—warm (probably arid)—cold sequence of Rincon is mirrored on THUNELL's sequence, in which the first cold has an age of 3.1—3.2 Ma, the warm stage 2.7—2.6 Ma and the last cold 2.6—2.5 Ma. The Rincon 1 fauna is located in the second cold of the sequence while Rincon 2—3 just below the first one; the age of Middle Villafranchian fauna of Rincon 1 deposit is so fixed at 2.5—2.6 Ma.

In the Rincon series, rodents are only found in MN16a and MN16b (Early and Middle Villafranchian respectively, ALBERDI et al., 1982). Furthermore, the isotopic record of the marine clay sequence of San Onofre (*G. crassaformis* zone, also analyzed for palaeomagnetism) indicates that the age of San Onofre is probably intermediate between the Ibero—Manchega I discordance of La Gineta and the Rincon 2—3 horizon. Indeed, the palaeomagnetic sequence of San Onofre shows a short normal episode at the beginning, a long reversal episode in the central part of the

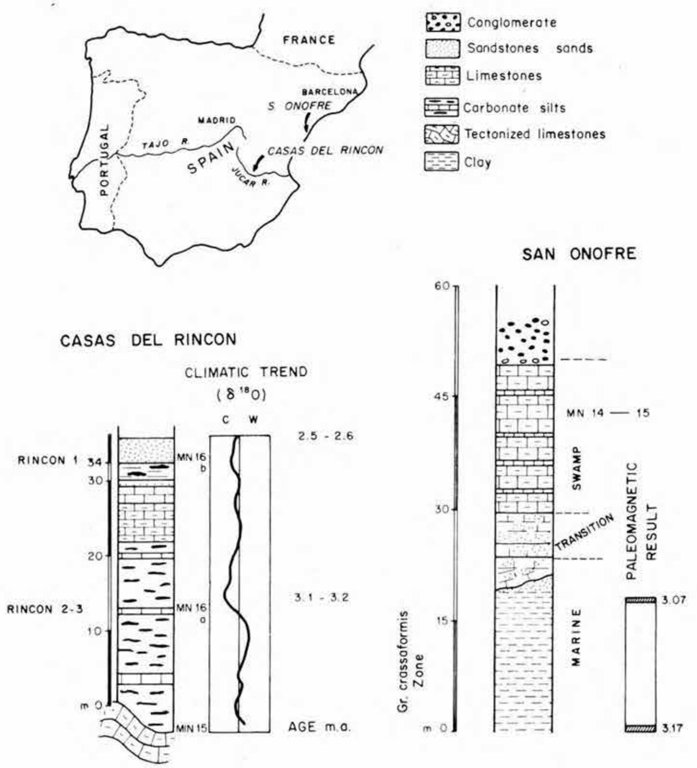
FRANCE
BARCELONA
S. ONOFRE
MADRID
PORTUGAL
TAJO R.
SPAIN
CASAS DEL RINCON
JUCAR R.
Conglomerate
Sandstones sands
Limestones
Carbonate silts
Tectonized limestones
Clay
SAN ONOFRE
CASAS DEL RINCON
CLIMATIC TREND
($\delta^{18}O$)
C W
RINCON 1
RINCON 2-3
MN 16 b
MN 16 a
MN 15
2.5 - 2.6
3.1 - 3.2
AGE m.a.
MN 14 — 15
SWAMP
TRANSITION
MARINE
Gr. crassaformis Zone
PALEOMAGNETIC RESULT
3.07
3.17

Fig. 1.

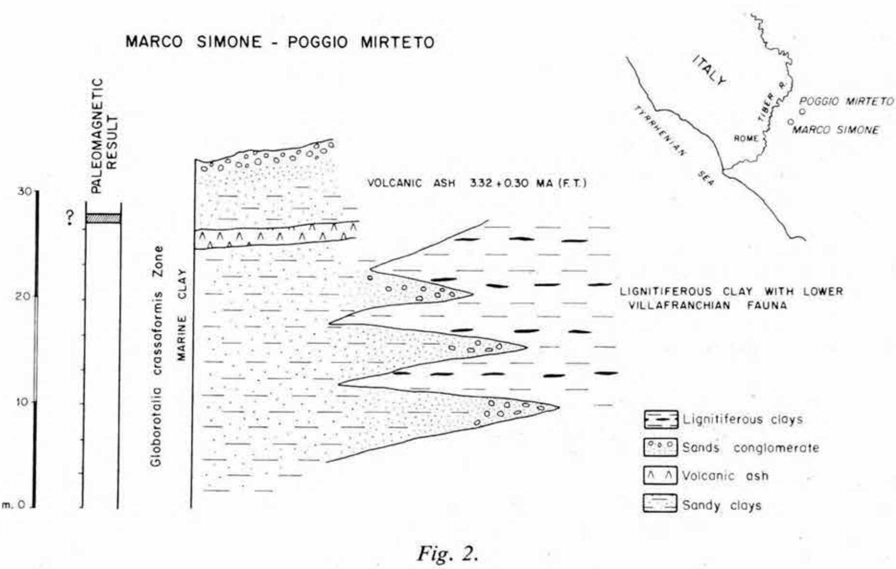
MARCO SIMONE - POGGIO MIRTETO
PALEOMAGNETIC RESULT
?
Globorotalia crassaformis Zone
MARINE CLAY
VOLCANIC ASH 3.32 ± 0.30 MA (F.T.)
LIGNITIFEROUS CLAY WITH LOWER VILLAFRANCHIAN FAUNA
ITALY
TIBER R.
POGGIO MIRTETO
MARCO SIMONE
ROME
TYRRHENIAN SEA
Lignitiferous clays
Sands conglomerate
Volcanic ash
Sandy clays

Fig. 2.

series and a new probably normal episode at the end. This palaeomagnetic sequence probably corresponds to the Mammoth reversal subzone (3.07—3.17, MCDOUGALL, 1979; 3.05—3.15 MANKINEN and DALRYMPLE, 1979) in good agreement with the inferred age of *G. crassaformis* zone and with the palaeoclimatic sequence.

For Poggio Mirteto (Rome), we have the following data (Fig. 2):

1) The lignitiferous clay of vertebrate deposits *(Tapirus arvernensis, Mastodon arvernensis)* are heteropical with Middle Pliocene marin clays (*Globorotalia crassaformis* zone);

2) in the marine clays there is a volcanic ash horizon dated by *K/Ar* and fission tracks methods: the most consistent age is 3.32±0.03 Ma (ARIAS et al., 1981);

3) palaeomagnetic results on marine clays show only reversed magnetization, i.e. the series was sedimented during a reversal (ARIAS et al., 1976).

The combination of the above results shows that the Poggio Mirteto deposit is older than 3.0 Ma it may have been deposited during the last part of the Gilbert reversal zone (i.e. older than 3.41 Ma) or during the Mammoth reversal subzone (3.17—3. 0 Ma).

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I. ANDREESCU (letter dated December 12, 1985)

In my opinion I consider that the figures D and E are fitting pretty well most of the data (biochronologic, magnetostratigraphic, radiometric, paleogeographic etc) available till now. However, as concerns the Paratethys, I feel that these figures have a "weakness" that, between ourselves, could be essential in Western-Eastern Paratethys correlation. Namely, I have adopted the opinion according to which in the Western Paratethys the Pontian stage starts inside of MN11 zone. As you know, in the Eastern Paratethys both MN11 and MN12 zones are considered by many authors (see GABUNIA, 1979 etc) as belonging to the Maeotian stage. This assumption is maintained in spite of the fact that neither in Soviet territory nor in Romania the mammal remains of the MN12 zone have ever been found related directly to undisputable Maeotian mollusc faunas. On the other hand I am not convinced yet, that the Western Paratethys Vallesian and Turolian Mammal sites are being correctly assigned to an age or another. In this respect compare, for example:

a) Csákvár = Pannon B = Bessarabian; Kohfidish = Pannon C = Kersonian; Eichkogel, Podlesice = Pannon E1 = Maeotian (PAPP, 1975);

b) Vösendorf = Pannon E1; Eichkogel = Early Pontian; Polgárdi—Baltavár = Late Pontian (PAPP, 1978; Sofia);

c) Csákvár, Gaiselberg = Pannon C = Berislav, Eldar = Kersonian; Kohfidisch, Vösendorf = Pannon D = Taraclia, N Elizabetovka, Grebeniki, Bazaleti = Early Maeotian (GABUNIA, 1975); Vösendorf = Grebeniki = MN11 (GABUNIA, 1979);

d) Csákvár, Gaiselberg = Pannon B = Vösendorf = Pannon E; Polgárdi = Uppermost Pannon—Lowermost Pontian; Eichkogel, Kohfidisch = Early Pontian (STEININGER, 1975);

e) Csákvár, Vösendorf = MN10 = Sevastopol, Varnitza; Kohfidisch, Eichkogel = MN11 = = Grasulovo, Eldar, Berislav (MEIN, 1975);

f) Gaiselberg, Rudabánya = MN9 = Pannon C—D; Vösendorf = MN10 = Pannon E; Kohfidisch Eichkogel = MN11 = Early Pontian; Csákvár = MN12 etc (RABEDER, 1985).

It's amazing, isn't it? However, in my interpretation, I consider Vösendorf in the upper part of MN10 or lowermost part of MN11 = Late Pannonian = Late Maeotian; Eichkogel, Kohfidish if = Tihany (= Portaferrian), then they have to be assigned rather to the MN12 zone (lower part). This does not contradict the statement according to which the Lowermost Pontian is located inside of MN11 zone.

P. ČTYROKÝ: The stratigraphic position of the first *Hipparion* occurrence in Southern Moravia, Vienna Basin, Czechoslovakia.

According to JIŘIČEK (1985) and RABEDER (1985) the teeth of *Hipparion primigenium* were found in the Kyjov-coal seam in the lignite coal pit in Hovorany and Sardice. These two localities have surely the same stratigraphic position because they represent only two historic stages of a coal pit, changing from one to the another of the districts of the two villages—Hovorany and Sardice.

The mammal remains collected during the last 30 years from these localities are, besides *Hipparion*, unidentified, well-preserved mastodont teeth and other bone remains. They were found at the bottom of the Kyjov-coal seam which is the final coal-bearing member of the zone B of the Pannonian (according to PAPP's molluscan zonation). It was proved in the area of the Sardice coal mine in many cores that the top of the coal seam is overlain by the basal sandy member of zone C with a typical mollusc fauna (see ČTYROKÝ, 1975). From the Hovorany lignite is cited also *Dinotherium giganteum* KAUP, deposited in collection of Natural History Museum in Vienna (PIA-SICKENBERG, 1934).

The *Hipparion* remains from Hovorany and Sardice were deposited in the Moravian Oil Mines at Hodonín and were checked by A. PAPP personally during his visit at Hodonín in 1967. Unfortunately, this *Hipparion* material seems to be lost now. The mastodont remains are under study by O. FEJFAR (Praha).

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E. KOJUMDGIEVA: Tarkhanian—Tshokrakian—correlation problems

The subdivision and correlation of Tarkhanian and Tshokrakian are controversial. The two principal correlations are:

Tshokrakian	Up.	Kwalitian beds with Lutetia intermedia	Up.	Tshokrakian
	Low.	Zukian beds with typ. Tshokrakian fauna	Mid.	
Tarkhanian	Up.	Argunian beds with Spirialis	Low.	
	Mid.	Terian beds with Amussium denudatum	Up.	Tarkhanian
	Low.	Kuvinian (Kamyshlakian) beds with Foraminifers	Low.	

This subdivision is mainly valid for argillaceous sediments. The correlation with limestones and sands is also controversial, e.g. the Gorian beds (Ostrea beds) are attributed by GONTCHAROVA and KVALIASHVILI to the Kuvinian beds, and by ANANIASHVILI to the Terian beds. The correlation with other realms requires complementary studies of planktonic foraminifers and calcareous nannoplankton.

Karpatian. The presence of NN5 zone in the Karpatian (also below the FAD Praeorbulina) must be verified.

Khersonian—Maeotian. The Khersonian/Maeotian boundary is at 9.8 Ma. (CHUMAKOV et al., 1984).

F. MARINESCU (letter dated February 27, 1986)

Commençons par les informations: par le magnétisme le Bessarabien supérieur et Khersonien semblent être vers 11.8 MA (s'accordant avec les 9–10 MA de la zone C du Pannonien et du Méotien inférieur). En plus n'oublie pas que les zones CD du Pannonien sont approximatives. Méotien inférieur et zone E sont approximativement Méotien supérieur.

Des données préliminaires du mangétisme donnent le Bosphorien (Pontien supérieur) vers les époches 5+6 et le Portaferien le 7.

La limite basale du Dacien semble passer vers 5.5–5.6 tandis que la base du Romanien correspond à l'épisode Cochiti (donc vers 3.9 MA).

Maintenant voilà le problème: il concerne la base du Badénien qui, conformément au tableau, correspond à 16.5 MA. Presque la même valeur a été obtenue aussi chez nous par le magnétisme, mais les mensurations ont été faites à la base des "marnes à globigérines" et du " tuf de Slănic " aux environs de Slănic Prahova, où dans la région la base du Badenien (d'après *Praeorbulina*) est à +300 m plus en bas. De même on ne peut pas oublier les 18.5 MA obtenus par BERGGREN pour le tuf de Dej, qui sont une réalité. D'ailleurs le problème est encore plus difficile (et maintenant voilà la question) en ce qui concerne cette limite dans les Carpates Orientales : elle (la limite basale du Badénien) passe à l'apparition, ou à l'acmée de *Praeorbulina =(Candorbulina?)*. S'il s'agit de l'apparition, alors les choses sont compliquées parce que aux plusieurs coupes cette apparition (par des rares exemplaires) est synchrone au maximum de *sicanus* (et les informations ne proviennet pas seulement de POPESCU , mais de plusieurs micropaléontologistes de chez nous). Donc ainsi même le Karpatien est mis en cause. Si l'on commence le Badénien par l'acmée de *Praeorbulina*, alors tout est O.K., cela correspond à environ la base des tufs (Dej, Slănic etc) et donc vers 16.5

MA, mais la limite du Badénien a été définie "mit dem Auftreten" donc... voilà le problème important pour la Paratéthys en générale et surtout pour les Carpates Orientales, qui ne peuvent pas être passée comme rien, tout comme le problème ne peut pas être escamoté.

V. V. MENNER, M. A. PEVZNER and **E. A. VANGENGEIM** (letter dated December 16, 1985)

I At present there are three stratigraphic levels to correlate the Central and Eastern Paratethys Neogene deposits:

1) the base of the Dacian = the base of the Kimmerian;

2) the base of the Sarmatian (s. SUESS) = the base of the Sarmatian s.l.;

3) the base of the Tarkhanian corresponds to the base of the Karpatian due to common malaco faunas and nannoplankton (GONCHAROVA, 1985; ANANIASHVILI, SAKHELASHVILI, 1984; MUSYLEV, PEVZNER, 1983; NOSOVSKY, BOGDANOVICH, 1984; NOSOVSKY et al., 1975; MINASHVILI, 1981, 1983).

According to palaeomagnetic data the base of the Tarkhanian is: 17.1 Ma. (PEVZNER and VANGENGEIM, 1985, Budapest Congress, Abstracts p. 461 ff). The radioisotopic dating of the Karpatian base is 17.5 ± 0.5 Ma. (VASS, 1985, Budapest Congress, Report on activity of the RCMNS, p. 20 ff.).

II In The Eastern Paratethys the Pontian corresponds to Magnetic Polarity Epoch 6 and the end of Epoch 7. In the thickest Pontian sequence of the Taman peninsula the lower 9 m of 123 m only are normally magnetized, while the rest of the Pontian strata and the Kimmerian base (3 m) have reversed magnetization. According to the palaeomagnetic data the Pontian top is aged 6.1 Ma and its base — 6.8—6.9 Ma. So, the Pontian lasted not more than 0.8 Ma.

In case the Pontian shows reverse magnetization the deposits are to be correlated with Epoch 8 or with the lower part of Gilbert Epoch, its duration cannot exceed 0.6 Ma. For this, all our stratigraphic constructions must proceed from a short Pontian.

III The zonal scales demonstrated at the Congress differed from each other both in boundary datings for N and NN zones and in relations between N and NN zones themselves as well as in radiometric and paleomagnetic scales. Therefore on a general correlation scheme the boundaries between N and NN zones as well as MN zones must be omitted.

IV On Figures D and E the Babadzhanian horizon should correspond to the Portaferian and Bosphorian ones.

Remarks to: Mediterranean key points (see Table 1)

MN12 Crevillente 4 — *Globorotalia conomiozea*, this is the Messinian s.str. Therefore the Messinian should correspond not only to MN13 zone (Fig. 4 and 5) but partly to MN12 zone, as a minimum.

Remarks to: Paratethys correlation points (see Table 2)

The Aspheronian = parts of NN18 and NN19 zones;

The Akchagylian = NN16, NN17 and partly NN18 zones (the figure is correct);

The locality Kalfa (MN19 zone) coincides with the deposits with Bessarabian molluscs. *Catinaster coalithus* has been found in Upper Bessarabian (MINASHVILI, 1983).

The Konkian is corresponding to the uppermost part of NN5 and not younger than NN6. *Coronocyclus nitescens* (does not occur higher than NN6) has been found at the Konkian top and the Volhynian base (MINASHVILI, 1983).

The Caucasian equals the Aquitanian only but does not contain any specific zonal nannoplankton species (NOSOVSKY, 1984, and this article).

Remarks to: Additional correlation points (see Table 3)

The Tihany and the Eichkogel localities cover the beds with *Congeria rhomboidea* (BARTHA et al., 1971, pp. 37, 90—93), i.e. they should be assigned to the Pontian top but not its base.

There are no distinct criteria to draw boundaries between MN zones for the Turolian in the Paratethys. These zones should be better connected with narrow MN11 →MN13.

Attention should be paid to the fact that in Vösendorf dating beds on molluscs do not coincide with those on mammals: the latter are actually related to MN10 zone (i.e. the Sarmatian) but the presence of *Congeria balatonica* speaks that these deposits belong to the F—G—H—zones of PAPP (the Pontian), i.e. the mammal remains have been redeposited (see details in the letter of DRS. M. A. PEVZNER and E. A. VANGENGEIM to Prof. STEININGER from 9th October 1985; see this letter in this article and the reply by F. STEININGER).

M. NOSOVSKY (letter dated January 28, 1986)

Die Begründung der Korrelation des Neogen der Zentralen und Östlichen Paratethys ist in meinem Vortrag beim Kongress dargelegt, dessen englischen Text Sie besitzen (Budapest Congress, Abstracts p. 424 ff).

Was die Kaukasische Regionalstufe betrifft, so sind ihre Lage und ihr Alter in dem publizierten Vortrag des Kongresses von Athen (1979) und in dem oben erwähnten Vortrag von Budapest genau beleuchtet.

Deshalb sollte in den mir übersandten Figuren D und E die Kaukasische Regionalstufe nur dem oberen miozänen Teil der Eger-Regionalstufe im Sinne des Aquitan entsprechen.

Im gegebenen Fall bringe ich nicht nur meine persönliche Meinung zum Ausdruck, sondern den offiziell akzeptierten Beschluss von 1981 des Zwischen-behördlichen Stratigraphischen Kommitees der UdSSR über das untermiozäne Alter der Kaukasischen Regionalstufe.

M. A. PEVZNER and **E. A. VANGENGEIM** (letter to **F. F. STEININGER** dated October 9, 1985)

One of us has promised you in Budapest to write you in more detail about our considerations concerning the Vösendorf locality.

1) The presence of *Congeria balatonica*, *C. partschi* and *C. zsigmondyi* at Vösendorf are mentioned in the publications by PAPP (1951.: 113—117) and PAPP and THENIUS (1953.: 5—10). According to BARTHA (1971, see also Table 2 in PEVZNER, VANGENHEIM, 1985), *C. balatonica* is a form characteristic of the middle horizon of the Upper Pannonian (s. l.); *C. partschi* and *C. zsigmondyi* are only characteristic of the Lower Pannonian. Co-presence of these forms may be, apparently, explained by redeposition of the last two.

2) C. balatonica is of the same stratigraphic range as *Melanopsis fuchsi* which is characteristic of the Eichkogel locality. Thus, on the basis of the mollusc fauna, Vösendorf (with the Vallesian fauna of mammals) is of the same age as Eichkogel (with the Turolian mammal fauna).

3) Vösendorf mammalian fauna is quite correctly attributed to the MN10 zone of the Vallesian. The E zone of the Pannonian is correlated both by you and PAPP with the Upper Maeotian of the Eastern Paratethys. In the Maeotian of the Eastern Paratethys the mammalian fauna is of a Pikermy type (Chimishlia, Taraklia and other localities) and should be attributed to the Turolian. The boundary between the Vallesian and Turolian in the Eastern Paratethys corresponds to the boundary between the Sarmatian and Maeotian. On the basis of the mammalian fauna the E zone of the Pannonian should be attributed to the Sarmatian. You hardly agree with it. There is nothing for us but suggest that remains of mammals in Vösendorf are redeposited.

4) Data on Vösendorf indicate just redeposition:

a) presence of pebbles and concretions from Pannonian conglomerates;

b) rolled mollusc shells;

c) rolled bones of mammals (PAPP, 1951.: 113—117; PAPP and THENIUS, 1953.: 5—10; Miozän M_6, Pannonien. 1985.: 187, 190).

The rich faunal complex of Vösendorf suggests, probably, a near transportation during re-deposition.

Thus we have no doubt that the Vösendorf mammalian fauna belongs to the MN10 zone of the Vallesian, but its belonging to the E zone of the Pannonian is rather doubtful (i.e. we believe that in zone E this fauna is not in situ).

F. F. STEININGER: Remarks to the letter of PEVZNER and VANGENGEIM (October 9, 1986) and the letter of MENNER et al. (December 16, 1986).

At the Budapest Congress PEVZNER and VANGENGEIM (see: Budapest Congress Abstracts, 1985, pp. 461—462) presented a new correlation chart for the Eastern and Central Paratethys and the Mediterranean stages. In this contribution the correlation of the Late Miocene Eastern and Central Paratethys stages differs extremely from the results obtained so far. Therefore this contribution in the letters of MENNER et al. (letter dated December 16, 1985) and PEVZNER and VANGENGEIM (dated October 9, 1985) is published above.

PEVZNER and VANGENGEIM (Budapest Abstracts, p. 462) correlate the Eastern Paratethys Pontian with the entire Pannonian of the Central Paratethys respectively and they state, by their correlation table, that a gap exists in the Central Paratethys between the Sarmatian (sensu SUESS) and the Pannonian resp. the Pontian. This gap would span about 4 million years in their correlation. That would mean there are no equivalents of upper Bessarabian, Chersonian and Maeotian known in the Central Paratethys and there are no mammal faunas of zone MN10 and MN11 in situ. There is no need to discuss this miscorrelation at length—since it seems to be based on palaeomagnetic and radiometric data only, disregarding all other stratigraphic evidence. The evidence for the equivalents of late Bessarabian, Chersonian and Maeotian in the Central Paratethys have been published recently in: PAPP et al., 1985: M_6—Pannonien (Slavonien and Serbien). — Chronostrat. and Neostrat., 7. Budapest (Akad. Kiadó). However, since most of this miscorrelation by PEVZNER and VANGENGEIM seems to be caused by an erroneous interpretation of the biostratigraphic principles of PAPP's Pannonian zonation and the Vösendorf locality, I will try to summarize these points very briefly:

(1) PAPP's Pannonian biozonation (1951; 1953; PAPP et al. eds. 1985), as far as one can jugde by his published work, is based on the evolution of different phylogenetic lineages (Melanopsids, Congeriids and partly Limnocardiids) and the biozones (A—to—E) represent the acmes in the evolution of these different taxa. In each lineage, there seems to be evidence for a gradual transition between the different taxa within one given phylogenetic line and therefore scarce appearances are explained and evident already before the acme of the taxon and also of course still after the acme of the taxon. The Pannonian biozones A to E are defined therefore only by the acme of the evolution of the typical assemblage of the zone. PAPP's biozonation which is based on molluscs was duplicated and refined by ostracods, this biozonation based on ostracods was treated lately extensively by JIŘIČEK (1985 in PAPP et al. (eds. 1985).

(2) *Vösendorf:* PEVZNER and VANGENGEIM state directly and indirectly in their letter (see above) that because of the scarce record of *Congeria balatonica* (which has its acme in the Pontian) in Vösendorf, the Vösendorf locality belongs to the Pontian and is therefore of the same age as the Eichkogel locality (which is according to mammals MN11 Turolian in age). The MN10 (Vallesian) mammal fauna from Vösendorf locality is, in their opinion, redeposited. However, according to PEVZNER's and VANGENGEIM's correlation table, also the exceptionally rich and typical MN11 mammal faunas of Eichkogel (a lacustrine lake deposit) and Kohfidisch (a fissure filling) have to be redeposited, since the gap shown spans also the MN11 zone in the Central Paratethys! This also means that the MN10 and MN11 mammal faunas known from Czechoslovakia, Hungary, Roumania and elsewhere in the Central Paratethys are, according to this correlation chart, redeposited! In this relation it will be interesting to see how the radiometric ages between 11.8 Ma and 8.4 Ma coming from biostratigraphically well-dated Pannonian horizons are explained (see

Vass, 1985 in Papp et al. 1985 and Vass, 1985 p. 23.—Report of RCMNS Working-Groups, Budapest Congress) and the palaeomagnetic dates coming from the Hungarian Pannonian (see Budapest Abstract volume).

The Vösendorf section shows in general (for details see Papp, 1951: 113 ff; Papp and Thenius, 1954: 3 ff and Papp, 1985: p. 187 ff in Papp et al. 1985): greenish marls at the base

— followed by 0.15 up to 1.5 m sand, rich in fossils, "transgressively" overlying the greenish marls

— followed, respectively passing into greyish sandy marls up to 12 meters thick, rich in fossils.

The greenish marls at the base, the sandy horizon and the overlying greyish marls contain a typical and rich ostracod fauna indicating Papp's Zone E and, according to Jiříček's ostracod zonation, they belong to the upper part of zone E (E_2 to E_3) (see Papp and Thenius, 1954 p. 25; Jiříček, 1985. 378 ff in Papp et al. 1985).

No macrofossils were recovered from the greenish marls. The sandy horizon is rich in plants (fruit and wood remains), ostracods, molluscs, fish-, reptile- and mammal-remains (see Papp et Thenius, 1954; revised faunal lists in Papp et al. 1984). *Congeria balatonica* is recorded as a rare element, respectively, as a very rare element from the base of this horizon only (see Papp and Thenius, 1954, p. 13). Papp (1951, p. 115) considers that *Congeria balatonica* could have originated already in Zone D.

The greyish sandy marls on top of the section contain a rich leaf flora, ostracods and molluscs. It is essential to note that the bivalves—*Congeria, Limnocardium*—are frequently double-valved and in "living position". The sandy horizon, with its "transgressive" character is explained by Papp as a sort of near-shore lumachelle, cutting channels and moulds into the underlying greenish marls where fossils were trapped. No wonder that lots of fossils are worn in this horizon, e.g. the larger melanopsids, congeriids and mammal remains. However, there is no indication at all that the mammal remains should have been redeposited through time.

The geological situation of Vösendorf is fixed by several drill hole sections in the near-surroundings. There is also a complete section between Zone E at the base of the Eichkogel hill and the top of this hill which is made up of lake deposits (limestones)—the type locality for the MN11 Eichkogel mammal fauna.

For the literature, see Papp et al., 1985 cited above.

D. VASS (letter dated December 1, 1985)

May I turn your attention to the most recent modifications of the Paratethys Neogene radiometric time scale: For other details, see the article of D. Vass, I. Repčok, K. Balogh et J. Halmai in this volume:

1) *The numeric age of the Pannonian/Pontian respectively the Maeotioan/Pontian boundary:*

My present opinion is that a more realistic age of the base of Pontian stratotype in the Euxino—Caspian region is about 7.0 Ma. The numeric age suggested for the above-mentioned boundary by Andreescu (1981) is too old. It seems that the Pontian of the Dacic basin (Andreescu) and of the Euxinic—Caspian region—where the Pontian was originally described in the Odessa region—do not have the same volume. Because of these differences there are discrepancies in palaeomagnetic records of the Pontian in Dacic basin and the Pontian of the Kertch and Taman Peninsula (Semenenko and Pevzner, 1981; Pevzner, 1985; see Abstracts volume). I am more inclined to accept the opinion of Semenenko and Pevzner and the still existing radiometric dates of the Pontian show that the Pannonian/Pontian boundary should be about 7.0 ± 0.2 Ma. Now we plan a borehole for the magnetostratigraphic investigation of a "Pontian" section in the Danube lowland (Bratislava—Komárno) to verify what really represents the Pontian in the West Carpathians. But this is a song for the future.

2) The numeric age of Sarmatian (s. SUESS)/Pannonian boundary is shifted back to 11.0 Ma. The majority of radiometric ages of volcanic rocks closely related to this boundary support this this numeric age of 11.0 Ma.

3) The numeric age of Eggenburgian estimated in our radiometric time scale is supported by a F.T. age of 20.5 ± 0.9 Ma from the Upper Krosno Beds in the Silesian tectonic unit of outer Carpathians. The dated tuff is found in a sequence of Eggenburgian age (NOWAK et al., 1985—Abstracts), but some other dates mentioned by NOWAK et al., especially the Badenian dates, are unrealistic.

4) The Badenian/Sarmatian boundary is near the boundary NN6/NN7 zones, or within the zone NN7 (R. LEHOTAYOVÁ, 1982; N. MÉSZÁROS, 1985: Abstracts, top of Konkian). According to BARRON (1985) the NN6/NN7 boundary is in chron 13—app. 11.9 Ma; according to BERGGREN et al. (1985) in chron CS 5 AA—13 Ma. The radiometric age of the Badenian/Sarmatian boundary 13.6 ± 0.2 Ma, is not in accordance with either BARRON's or with BERGGREN et al.'s correlations, but the numeric age of 13.6 Ma is supported by 6 dates concerning the Upper Badenian and by 26 dates concerning the Lower Sarmatian.

5) Palaeomagnetic investigations on the Hajnačka section with a mammal fauna of MN16 (OPDYKE, paper given at the Budapest Congress) shows a normal polarity and is considered as chron 3 or Gauss (2.48—3.40 Ma). The mammal fauna of Hajnačka was recovered from the strata considered as a maar-fill. Another maar or diatreme, that of Hajnačka Castle Hill, near the fauna locality is cut by a basalt dike, the radiometric age of which was dated at 2.75—0.44 Ma (isochron age, BALOGH, MIHALIKOVA, VASS, 1981).

6) Some additional comments on the Pannonian/Pontian boundary: If the Late Maeotian really corresponds to NN10 zone, then BARRON's correlation of the top of NN10 zone with lower part of the chron 7—ca 7.3 Ma is close to the base of Pontian numerically calibrated at 7.0 ± 0.2 Ma but BERGGREN et al.'s correlation of NN10 zone with the lower half of the chron 9 and chron 10 is not in accordance with these results.

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