PALAEONTOGRAPHIA ITALICA

ABSTRACTS

VOL. LXXXII (1995)

ISABELLA PREMOLI SILVA, WILLIAM V. SLITER - Cretaceous planktonic foraminiferal biostratigraphy and evolutionary trends from the Bottaccione section, Gubbio, Italy

KEY WORDS: Planktonic foraminifers, Gubbio, Late Cretaceous, Biostratigraphy, Magnetostratigraphy, Chronostratigraphy, Evolutionary patterns.

ABSTRACT - A detailed Cretaceous planktonic foraminiferal biostratigraphy is defined for limestone of the Scaglia Group exposed in Bottaccione Gorge near Gubbio, Italy. This refined biostratigraphy allows recalibration of biozone boundaries with the previously measured paleomagnetic stratigraphy, the determination of local sedimentation rates, and the broader rate of evolutionary change for planktonic foraminifers at this classic Tethyan setting.

The approximately 350 m thick section begins in the upper Albian part of the Scisti a Fucoidi and extends through the Scaglia Bianca and Scaglia Rossa to the Cretaceous/Paleocene boundary. The detailed distribution of 147 species of planktonic foraminifers examined in thin section from over 480 samples defines 19 zones and 4 subzones that represent about 40 m.y. of apparently continuous pelagic sedimentation.

The major difference from previously reported studies concerns a 25-m increase of the total thickness of the interval investigated and subsequent position of zonal boundaries from within the *D. asymetrica* Zone to the top of the Cretaceous.

Overall accumulation rates for the Bottaccione sequence are 3.44 m per m.y. in the Albian portion of the Scisti a Fucoidi and lower Scaglia Bianca and 9.3 m per m.y. for the Upper Cretaceous Scaglia Group. Low rates calculated for the Maastrichtian interval may be related to the incompleteness of the uppermost Cretaceous section, whereas increased rates in the Cenomanian apparently were produced by a local pulse of sedimentation in the Umbria-Marche Basin. Diversity (= richness) at genenc and specific levels shows an overall increase from the upper Albian to the Maastrichtian. This trend was interrupted by episodes of reduced diversity in the lower Cenomanian *Rotalipora reicheli* and uppermost Cenomanian-lowermost Turonian *Whiteinella archaeocretacea*

Zones, and a marked reduction was observed at the end of the Cretaceous sequence. Maximum diversity was reached in the mid to upper Maastrichtian *Contusotruncana contusa-Racemiguembelina fructicosa* Zone and lower *Abathomphalus mayaroensis* Zone. Changes in diversity are largely dependent on extinction and diversification among keeled forms and, to a minor extent, among ornamented globigenniforms and heterohelicids.

Three major groups of planktonic foraminifers were recognized based on the gross morphology and degree of ornamentation: group one consisting of hedbergellids, *Heterohelix*, and *Laeviheterohelix*, the second one including all ornamented globigeriniforms, planispiral and planoconvex forms, and rotaliforms without true keel, and the third group consisting of all keeled forms. Regarding their life stategy, these three groups were considered as the opportunists or r-strategists, the intermediate forms, and the k-strategists, respectively. Diversity plots based on them show high-amplitude fluctuations in the intermediate group and the k-strategists, and low-amplitude fluctuations in the r-strategtsts. Overall, we distinguished two intervals during which the three groups show large fluctuations: one in the lower part of the sequence (upper Albian *T. praeticinensis* Subzone to the middle Turonian *Marginotruncana sigali* Zone), and a second one at the end of the upper Maastnchtian *Abathomphalus mayaroensis* Zone where the amplitude of the fluctuations again increases although the increase is mainly confined to the k-strategists and intermediate forms. These two intervals are separated by a period during which fluctuations in the three groups are relatively low in amplitude.

The increasing importance of intermediate forms through the upper Cenomanian *Dicarinella algeriana* Subzone, associated with a slight increase in the r-strategists that peak in the uppermost Cenomanian-lowermost Turonian *Whiteinella archaeocretacea* Zone, suggests a progressive increase in eutrophic conditions leading up to the Bonarelli Level (uppermost Cenomanian) and continuing through the lower to middle Turonian *Helvetoglobotruncana helvetica* Zone. Beginning in the *Marginotruncana sigali* Zone and beyond, environmental conditions oscillated from moderately oligotrophic to more eutrophic. The last evidence of more eutrophic conditions occurs in the Santonian *Dicarinella asymetrica* Zone and corresponds to a slight increase in the r-strategists. We associate these changes in the planktonic foraminiferal faunas with changes in the degree of stability of oceanic surface and subsurface waters. Accordingly, niche-stratification of the upper-water column probably was acquired during the upper Albian *Rotalipora appenninica* Zone and continued to the lower Cenomanian *Rotalipora brotzeni* Zone.

After minor disturbances, niche-stratification progressively weakened from the middle part of the *D. algeriana* Subzone to the *W. archaeocretacea* Zone when the upper-water column became both unstable and unstratified. The resultant oceanic conditions, strongly infiuenced by upwelling, markedly increased nutrient levels in near-surface waters and caused a proliferation of radiolarians in the Bonarelli Level and of r-strategists, whiteinellids, and, to a minor extent, the dicarinellids adjacent to this level. After this abrupt mixing episode, surface waters gradually became more stratified. However, stable conditions apparently were not reestablished until the uppermost Santonian-lowermost Campanian as indicated by the increasing importance and diversification of the k-

strategists. This trend reversed, beginning in the upper Campanian *Radotruncana calcarata* Zone and continued through the lower Maastrichtian *Gansserina gansseri* Zone. Numerous ecological niches were still present in the lower *A. mayaroensis* Zone, then the gradual disappearance of the k-strategists toward the top of this zone, paralleled by increased diversity of the intermediate forms, suggests that water masses became increasingly mixed as during the Bonarelli Event. Thus, the crisis at the end of the Cretaceous apparently was linked to the breakdown of niche-stratification in the upper-water column.

FRANCESCA LOZAR - Calcareous nannofossil biostratigraphy of Lower Liassic from Western Tethys

KEY WORDS: Lower Jurassic, Calcareous Nannofossils, Biostratigraphy, Tethys.

ABSTRACT - This study concerns with calcareous nannofossil biostratigraphy of several sections located on the former southern and northern margins of the Tethys Ocean, respectively the Lombardian Basin and the Dauphinois Basin, during the Early Jurassic. It has allowed the definition of several calcareous nannofossil bioevents, Hettangian-Sinemurian in age, in Western Tethys, where the oldest Jurassic datum was so far limited to the Late Sinemurian. Data are directly calibrated to ammonite biozonation, both in the Dauphinois Basin and in the Lombardian Basin.

The first appearance of *Crepidolithus crassus* and *Tubirhabdus patulus* is correlated with the Liasicus Zone (Hettangian), whereas the genus *Mitrolithus* appears in the lowermost Sinemurian (Bucklandi Zone, for both *Mitrolithus jansae* and *Mitrolithus elegans*). Ages of bioevents are older than those reported from North-Western Europe (Boreal Realm), suggesting earlier appearances of several genera in the Tethys and the development of '1ocal" (endemic) species, particularly belonging to the genus *Mitrolithus*. The first appearance of coccoliths other than *Schizospharella punctulata* is Middle Hettangian in age in Western Tethys, but only Early Sinemurian in the Boreal Realm (Bucklandi Zone for *C. crassus* and *T. patulus* according to Bown, 1987b).

VOL. LXXXIII (1996)

INESA VISLOBOKOVA - The Pliocene Podpusk-Lebyazh'e mammalian faunas and assemblage, Western Siberia

KEY WORDS: Mammalia, Upper Pliocene, Western Siberia, Faunat evolution, Biochronology.

ABSTRACT - Three successive Pliocene mammalian faunas of the Podpusk-Lebyazh'e localities in the southem Western Siberia existed from the end of the Gilbert Chron possibly up to the Olduvai Subchron of the Matuyama Chron, between about 3.4 and1.8 Ma. The oldest of them with *Trogontherium minus*, *Equus* sp. and *Croizetoceros* sp. corresponds to the faunas of the zone MN 16. The richest second fauna contains *Archidiskodon gromovi* and *Equus livenzovensis* and is referred to as the Podpusk-Lebyazh'e assemblage. This is apparently synchronous to the Montopoli fauna of ltaly and a part of faunas belonging to the zone MN 17, its age falling in the interval 2.5-2.2 Ma. The youngest fauna with *Archidiskodon* cf. *meridionalis* and *Equus stenonis* corresponds to the end of the zone MN 17 and to the beginning of the zone MN 18. An age of about 2.2-1.8 Ma is inferred for it.

DONATA VIOLANTI - Taxonomy and distribution of recent benthic foraminifers from Terra Nova Bay (Ross Sea, Antarctica), Oceanographic Campaign 1987/1988

KEY WORDS: Benthic foraminifers, Antarctica, Recent, Ecology, Taxonomy.

ABSTRACT - Quantitative analysis and taxonomic revision of living and dead benthic foraminiferal taxa from Terra Nova Bay (Antarctica) are here presented. Grab and dredge surface samples were collected during the First Oceanographic Expedition, austral summer 1987/1988, under the aegis of the N.P.A.R (National Program for Antarctic Research).

Rose Bengal vital stain was used to separate living (red stained) and dead (unstained) tests in the total >63 llm fraction. The distribution of calcareous versus agglutinated taxa, frequencies of taxa, the living/total specimens ratio, the Total Foraminiferal Concentration (TFC) and the Living Foraminiferal Concentration (LFC) (N° of total or living specimens/l ml of wet sediment) are the parameters identifying three different foraminiferal assemblages, related to the Calcite Compensation Depth, water circulation and sedimentation processes.

Assemblage 1, dominated by calcareous foraminifers, is represented in only one sample, from 220 m depth. Shelf taxa, both epifaunal (miliolids, *Cibicides* spp.) and infaunal (globocassidulinids, and *Fursenkoina* spp.) are well represented. Moreover, the high percentages of *Trifarina angulosa* suggest a high energy environment. Assemblage 11, dominated by agglutinated foraminifers, vields rare living calcareous specimens in association to dead agglutinated forms, was collected from the Terra Nova Bay inner shelf, and from the slopes of the Crary Bank and Drygalski Basin. Foraminiferal concentrations and specific diversity are very low. Assemblage 111, consisting esclusively of agglutinated foraminifers, is restricted to the deep Drygalski Basin and is characterized by a well diversified agglutinated fauna, dominated by *Miliammina earlandi*, *Portatrochammina antarctica*, and *Pseudobolivina earlandi*. The faunal study shows that a high number of species restricted to the Antarctic and/or Subantarctic

waters could be used as ecological and paleoecological indicators in reconstructing the Antarctic environmental history.

GIOVANNI BIANUCCI - The Odontoceti (Mammalia, Cetacea) from Italian Pliocene. Systematics and phylogenesis of Delphinidae

KEY WORDS: Delphinidae, Cetacea, Mammalia, Systematics, Phylogenesis, Pliocene, Italy.

ABSTRACT - The Delphinidae (Cetacea, Odontoceti) fossil remains from Italian Pliocene sediments are examined. Several taxa described in the past are revised and the following species are recognised: *Stenella giulii* (Lawley, 1876), *Stenella* sp., *Hemisyntrachelus cortesii* (Fischer, 1829), *Hemisyntrachelus pisanus* n. sp., *Tursiops osennae* Simonelli, 1911, *Globicephala*? *etruriae* (Pilleri, 1987), *Orcinus citoniensis* ((Capellini, 1888) and *Astadelphis gastaldii* (Brandt, 1874). In particular, *Hemisyntrachelus* is revaluated to generic level and the species *Hemisyntrachelus pisanus* and the genus *Astadelphis* are described as new taxa.

Hemisyntrachelus shows intermediate features between the genus *Tursiops* and the genera *Orcinus* and *Pseudorca* I suggest a parsimonious cladistic hypothesis that *Hemisyntrachelus* and *Tursiops* are less specialised genera and the sister groups respectively of Globicephalinae and Delphininae subfamilies. Nevertheless, I think it is also possible that the Globicephalinae and the Delphininae are polyphyletic taxa where similar trophic adaptations are realised in genera not necessarily closed related *Hemisyntrachelus pisanus* n.sp. might be closely related to living *Pseudorca crassidens*, by having the same straight ventral contour of mandible in lateral view. *Astadelphis* may be interpreted as closely related to the living Steninae and particularly to the genus *Sousa*, even if it shows some more derived character. This hypothesis is perhaps more convincing that which than considers *Astadelphis* the most primitive genus of Delphinidae family. The study of these fossil specimens, and particularly of the isolated auditory bones (referred to several morphological groups), document the occurrence of a highly d iversif ed and abundant Delphinid community in the Pliocene Mediterranean Basin.

VOL. LXXXIV (1997)

LUCA RAGAINI - Echinoid fauna from the Quaternary fringing reef of Aqaba (Jordan)

KEY WORDS: Quaternary, Echinoids, Fringing reef, Jordan.

ABSTRACT - The echinoid fauna collected from the Quaternary fringing reef of Aqaba (Jordan) consists of 20 taxa, of which three are identified only at generic rank because of their poor conservation. This includes the first fossil record of *Microcyphus rousseaui* and the first record of *Prionocidaris verticillata* in the Red Sea. The fauna is typically Indo-West Pacific, and only the species *Laganum depressum* and *Echinometra mathae*i have a fossil distribution which includes the Mediterranean Basin. Taphonomic investigations focus on *Laganum depressum*, the most abundant species of the fossil association. Four species at least are not recorded today in this area but are found as fossils. This may be due to a faunal extinction caused by sea-level fall during the last glacial period and the subsequent immigration of Indo-West Pacific taxa during the following transgression.

THOMAS SERVAIS, STEWART G. MOLYNEUX - The *messaoudensis-trifidum* acritarch assemblage (Ordovician: late Tremadoc - early Arenig) from the subsurface of Rügen (Baltic Sea, NE Germany)

KEY WORDS: Acritarchs, Taxonomy, Biostratigraphy, Palaeobiogeography, Variability, Rugen, Germany**.**

ABSTRACT - This paper describes acritarchs of the *messaoudensis-trifidum* (formerly *messaoudii-trifidum*) assemblage from the subsurface of the island of Rügen (Baltic Sea, NE Germany). The distinctive *messaoudensis-trifidum* acritarch assemblage was originally described from the English Lake District, where it is dated as latest Tremadoc to earliest Arenig. It may be considered a characteristic microfloral assemblage of that interval over a wide area of peri-Gondwana, and is possibly of great biostratigraphical importance. The Rügen assemblage was recovered from 11 samples from the lower part of the Rügen-5 borehole. The acritarchs are only moderately well preserved, but very abundant. Intraspecific variability is important and a number of species are described in open nomenclature. The new genus *Heloriopodum* and the new species *Heloriopodum ruegenense* are described, and the new combination *Heloriopodum palliatum* (Mette) is proposed. The species *Stellechinatum sicaforme* is emended, and the name *Cymatiogalea messaoudii* is corrected to *Cymatiogalea messaoudensis*. Three new varieties are described: *Caldariola glabra* var. *annulifera*, *Cymatiogalea* messaoudensis var. *inconnexa*, and *Stellechinatum sicaforme* var. *contextum*.

GIOVANNI BIANUCCI - The Odontoceti (Mammalia, Cetacea) from Italian Pliocene. The Ziphiidae

KEY WORDS: Ziphiidae, Cetacea, Mammalia, Systematics, Pliocene, Italy.

ABSTRACT - The fossil Ziphiidae (Odontoceti, Cetacea) from Pliocene sediments of Italy are examined. A specimen from Tuscany, previously referred to *Choneziphius planirostris*, is assigned to*Tusciziphius crispus*, new genus and species. The skull of

Tusciziphius shows marked transverse enlargement of premaxillary crests as in the genera *Mesoplodon*, *Indopacetus* and *Hyperoodon* but it is also similar to *Ziphius* in the shape of nasals and in the strong asymmetry. Among the 11 fossil species of *Mesoplodon* that have been recorded in the past, only the presence of *M. longirostris* is recognised. An incomplete skull previously described as the holotype of *Hyperoodon pusillus* actually belongs to genus *Kogia* (family *Kogiidae*) and the new combination *Kogia pusilla* is proposed. *Berardiopsis pliocenicus* is considered a *nomen dubium* because both the genus and the species are based upon no significant osteological structures (caudal vertebrae). 15 isolated auditory bones are referred to the Ziphiid family, 8 of which to genus *Mesoplodon*.

JONATHAN M. ADRAIN - Proetid trilobites from the Silurian (Wenlock-Ludlow) of the Cape Phillips Formation, Canadian Arctic Archipelago

KEY WORDS: Trilobites, Silurian, Laurentia, taxonomy.

ABSTRACT - Carbonate debris flow deposits in the graptolitic Cape Phillips Formation of the central Canadian Arctic Archipelago yield rich silicified shelly faunas, and preserve the most diverse and complete record of Wenlock trilobites known from anywhere in the world. Six stratigraphically successive trilobite faunas have been identified, ranging in age from mid-Sheinwoodian to earliest Ludlow. The trilobites occur in strata interbedded with mudrocky shale rich in well preserved graptolites. As a result, their ages are known with precision. Proetoideans are the most diverse element of the trilobite faunas. This work describes all taxa of Proetidae and Tropidocoryphidae recovered from large silicified samples. At least 42 proetoidean species assigned to 9 genera are present Twenty-six species are well enough known for formal naming (of which one has previously been named), while the remainder are described in open nomenclature. New taxa include the genus *Westropia* (type species *W. benfieldi* n. sp.), and the species *Gerastos mellishae*, *G. fosterae*, *G. milleri*, *G. galei*, *G. monksi*, *Pseudogerastos forteyi*, *P. cocksi*, *P. rossi*, *P. taylori*, *Hedstroemia charlotteae*, *H. weedoni*, *Thebanaspis morrisi*, *T. toddi*, *T. rutai*, *T. welshi*, *T. smithi*, *T. jefferyi*, *Westropia skipperae*, *Winiskia youngi*, *W. curranti*, *W. longbottomae*, *Coniproetus elliottae*, *C. amphlettae*, and *Interproetus wellsae*.

VOL. LXXXV (1998)

AUGUSTO AZZAROLI - The genus *Equus* in North America - The Pleistocene species

KEY WORDS: Mammalia, Equidae, Pleistocene, North America.

ABSTRACT - The North American species of *Equus* of Irvingtonian and Rancholabrean age, which were summanly reviewed by the present author in 1995, are described in detail. They are: *Equus ferus,* widespread in the Pleistocene of Eurasia and well represented in the high latitudes of North America during the latest Pleistocene, but possibly also present in central North America since the earlier Irvingtonian; the related, large sized *Equus niobrarensis* and the smaller *Equus lambei*, possibly a subspecies of the latter, the stilt-legged *Equus semiplicatus* and *Equus francisci*, which betray affinities with Old World hemiones; the short legged *Equus fraternus* and *Equus conversidens,* with complicately wrinkled enamel in their teeth,closely related with the species of South America; the large, highly derived *Equus mexicanus,* of more uncertain affinities; and the stoutly built *Equus excelsus* and *Equus occidentalis,* all three endemic to North America. Their geographical and stratigraphical ranges are discussed. Species are distinguished by their size and by the characters of their skulls, dentitions and limb bones. The paper closes with a summary review of the New and Old World species of *Equus*.

FABRIZIO CECCA, PAOLO FARAONI, AGGOSTINO MARINI - Latest Hauterivian (Early Cretaceous) ammonites from Umbia-Marche Apennines (Central Italy)

KEY WORDS: Palaeontology, Systematics, Ammonoidea, Cretaceous, Hauterivian, Maiolica, Umbria-Marche Apennines, Italy.

ABSTRACT - This monograph presents the systematic description of a riche ammonite fauna of latest Hauterivian age, collected in the Maiolica Formation of the Umbria-Marche Apennines. In terms of ammonite Zones, the fauna indicates the *P. angulicostata*Auctt. Zone, *P. catulloi* subzone. The whole fauna comes from a single bed, the so-called "Guide-bed" of the Faraoni Level. Twenty-nine species have been recognized and some new taxa are proposed: *Pseudovaldedorsella* nov. genus, whose type-species is *P. crassidorsata* (Karakash), *Phyllopachyceras laeviventris* n. sp., *Barremites primitivus* n. sp., *Plesiospitidiscus breskovskii* n. sp., *Psilotissotia* (*P.*) *apenninica* n. sp., *Discoidellia pseudobertrandi* n. sp., *Discoidellia vermeuleni* n. sp.. The intraspecific variability of the above mentioned species plus that of *Pseudothurmannia sarasini* Sarkar and *P. mortilleti* (Pictet & De Loriol) as been thoroughly analyzed. The absence of ammonites identifiable as *Pseudothurmannia catulloi* (Parona) *sensu* Hoedemaeker does not imply an older age than the *P. catulloi* subzone. In fact, the whole ammonite assemblage belongs to the typical fauna which defines the *P. catulloi* subzone itself.

LUTZ MAUL, FEDERICO MASINI, LAURA ABBAZZI, ALAN TURNER - The use of different morphometric data for absolute age calibration of some South- and Middle European arvicolid populations

KEY WORDS: Arvicolidae, Dental morphology, Geochronometry, Plio-Pleistocene, Italy, Germany.

ABSTRACT - Several changes in the dental evolution of arvicolids can be documented by morphometric ratios of the lower first molar. Such data expressing the changes in enamel thickness, the relative length of the anteroconid complex and the height of the sinuids are used to compile a chronological scheme for several German and Italian arvicolid poopulations. With well-dated sites taken as fixed points, tentative curves can be constructed for the ratios in each lineage. Multiple curves, constructed for different lineages, provide a means of assessment for individual curves. Apparent conflicts between previous age extimates and those derived from our investigations are discussed.

ALESSIA CAPRINI - The food habits of some Eocene to Present-day *Equidae* deduced from observation of the teeth under the S.E.M.

KEY WORDS: Equidae, Tooth, Microwear analysis, Food habits.

ABSTRACT - The research considers the evolution of the alimentary habits of the *Equidae*, as deduced from the microwear tracks on the teeth examined under the S.E.M.. The sequence of the teeth studied starts with the first known genus, Hyracotherium from the *Eocene* and follows up to the Present-day *Equus*, both wild and domestic. From the Eocene to the Early Miocene the teeths of *Equidae*show scratches of different sizes; many of these are wide and deep with a rounded band U-shaped bottom. There are also many pits (wide and short tracks), probably caused by seeds, introduced with the diet. The teeth were easily marked because they were covered only by enamel. These horses were browsers and fed on leaves and fruits. *Merychippus* leaved in the middle Miocene when gras appeared and the graslands, dominated by graminaceans, became widespread. Some scratches on the teeth are very wide and U-shaped, and others are narrower and V-shaped, probably due to the gras. It was a mixed feeder, both on leaves and gras. Since the late Miocene up to the Present the *Equidae* have been grazers and their teeth have only one type of track, since they eat only gras. The tracks are thin, superficial, and V-shaped. In these animals the teeth are harder because they are covered with cement. The pits are small and not numerous. Horses today (such as the wild and domestic horse, donkey, and zebra) have very long wide scratches. They are produced by hard and abrasive food, such as the hay or gras found in the steppes or savanna, with silica microfibres. Some pits are probably caused by grit adhering to the food or by slintered cement.

AUGUSTO AZZAROLI - *Hystrix etrusca* Bosco, the late Villafranchian Porcupine from the Upper Valdarno, Central Italy

KEY WORDS: Mammalia, Hystricidae, Early Pleistocene, Central Italy.

ABSTRACT - Thespecies *Hystrix etrusca* was based by Bosco on two skulls and other remains from the Upper Valdarno, Tuscany. The skulls, of large size, are of early Pleistocene age but the complex stratigraphy of the Upper Valdarno the other fossils are referred to as *Hystrix* cf. *etrusca*. The skulls are derived in their morphology. They there compared with a skull of the smaller living *Hystrix indica* from Anatolia and the fossil *Hystrix lagrelii* from China. The skulls of late Miocene hystrixes of Greece have been taken into consideration but are in a poor state. The skull of the living *Hystrix galeata* from Somalia as well as skulls of other African hystrixes were also considered but are less closely related. Evolution of hystrixes was characterized by a development of the nasal and frontal region of the skull at the expense of the parietal-occipital region. This is interpreted as a progressive development of the sense of smel. The stratigraphy of the Upper Valdarno is also discussed in the light of recent fossil findings.

VOL. LXXXVI (1999)

MARCO VECOLI - Cambro-0rdovician palynostratigraphy (acritarchs and prasinophytes) of the Hassi-R'Mel area and northern Rhadames Basin, North Africa

KEY WORDS: Acritarchs, prasinophytes, Cambro-Ordovician, stratigraphy, Algeria, Tunisia, systematic palaeontology.

ABSTRACT - Cambro-Ordovician palynostratigraphy (acritarchs and prasinophytes) of the Hassi-R'Mel area and northern Rhadames Basin, North Africa. Detailed palynological analysis of Upper Cambrian through upper Ordovician marine sections in the Algerian Sahara (boreholes Nl2 and Uc101) and southern Tunisia (boreholes Sn1 and St1) enables precise dating, intrabasinal and extrabasinal correlation, and facilitates palaeogeographical interpretation. The majority of the 129 core samples proved palyniferous, yielding abundant, mostly well preserved acritarchs together with very infrequent prasinophytes (2 species only). Generally speaking, the stratigraphically lower levels of the four boreholes, of inferred Middle to early Late Cambrian age, are non-palyniferous. A few barren samples occur also in boreholes Nl2 and Uc101 directly above samples which yield profuse lower Tremadoc microphytoplankton assemblages. A total of 148 acritarch species and two prasinophyte phycomata species has been identified, including the following seven newly instituted species: *Ferromia clavula*, *Helosphaeridium paxillum*, *Multiplicisphaeridium dikranon*, *Peteinosphaeridium senticosum*, *Poikilofusa ciliaris*, *Polygonium arenulum*, and *Uncinisphaera fusticula*. *Ankyrotrochos* [typified by *A. crispum* (Vavrdová) comb. nov.] is defined as a new acritarch genus. Two new combinations are proposed: *Acanthodiacrodium crassus* (Loeblich & Tappan) and *Lophosphaeridium fuscipetiolatum* (Cramer & Díez). Twenty-three acritarch species have been left in open nomenclature because of insufficiency or poor preservation of specimens. Seven palynological assemblage zones are informally

defined and range in age from Late Cambrian through late Ordovician (Ashgill): *Timofeevia lancarae - Cristallinium randomense* assemblage zone (Late Cambrian); Timofeevia *phosphoritica - Dasydiacrodium caudatum* assemblage zone (latest Cambrian); *Acanthodiacrodium simplex - Arbusculidium destombesii* assemblage zone (basal Tremadoc); *Acanthodiacrodium angustum - Vulcanisphaera britannica* assemblage zone (early Tremadoc); *Arbusculidium filamentosum - Coryphidium bohemicum* assemblage zone (late Arenig); *Frankea sartbernardensis - Vogtlandia ramificata* assemblage zone (Llanvirn); and Evittia remota-Villosacapsula setosapellicula assemblage zone (Ashgill). Chronostratigraphic attributions are based mainly on comparison with previously established acritarch zones correlative with macrofossil zones. The palynozonation facilitates identification of the Cambrian/Ordovician boundary in boreholes Nl2 (Algeria) and Sn1 (Tunisia), and recognition of two important hiatuses in the study area, one corresponding to late Tremadoc through early-middle Arenig, and the other to at least the entire Caradoc. Palaeogeographically, the late Arenig-Llanvirn microphytoplankton suites show unequivocal Perigondwanan affinities. The Llanvirn assemblage does, however, contain certain ÒBalticÓ elements, previously undetected in north Africa. The present state of knowledge does not facilitate meaningful palaeogeographic interpretation of the Late Cambrian-early Tremadoc and Ashgill assemblages.

CRISTIANA RIBECAI, MARCO TONGIORGI - The Ordovician acritarch genus *Pachysphaeridium* Burmann 1970: new, revised, and reassigned species

KEY WORDS: Acritarchs, *Pachysphaeridium*, Morphology, Systematics, Ordovician, Baltica, South China.

ABSTRACT - Large, thick-walled acanthomorphitic acritarchs, bearing digitate processes with inflated distal end and striate ornamentation, constitute a distinctive form group in the Ordovician of Baltica and South China. Although the majority of these forms have been attributed by previous authors to species assigned to different genera, such as *Baltisphaeridium* Eisenack 1958 ex Eisenack 1959, *Costatilobus* Playford 1977, *Goniosphaeridium* Eisenack 1969, *Papilliferum* Yin 1994, or *Polygonium* Vavrdová 1966, the diagnosis of the genus *Pachysphaeridium* Burmann 1970 provides the most appropriate circumscription of this form group. Process morphology is the main basis for the following taxonomic revisions and innovations: emendation of *Pachysphaeridium* Burmann 1970; institution of four new species, *P. kjellstroemii*, *P. pachyconcha*, *P. sidereum*, and *P. vermiculiferum*; new combination and emendation of *P. suecicum* (Eisenack 1959); new combination of *P. balticum* (Eisenack 1951), *P. brevispinosum* (Eisenack 1931 ex Eisenack 1938), *P. bulbosum* (Uutela et Tynni 1991), *P. christianii* (Kjellström 1976), *P. irregulare* (Yin 1994), *P. mochtiense* (Górka 1969), *P. peregrinum* (Tynni 1982), *P. rhabdocladium* (Lu 1987), and *P. striatum* (Lu 1987); and tentative new combination of *P.*? *grandispinosum* (Uutela et Tynni 1991). The following species are also considered possibly assignable to *Pachysphaeridium*: *Palaiosphaeridium francinae* Górka 1980, *Costatilobus* ? *trifidus* Uutela et Tynni 1991 , *Baltisphaeridium*

bulbosum Kjellström 1971, *B. semibulbosum* Górka 1979, *Goniosphaeridium goerani* Górka 1980, *G. connectum* Kjellström 1971. A neotype is designated for *P. christianii* (Kjellström 1976), whose holotype has been destroyed. A new neotype is also designated for *P. brevispinosum* (Eisenack 1931 ex Eisenack 1938) whose previous types (Eisenack's holotype and neotype) were lost. The geographic and stratigraphic distributions of all species judged to be authentic or likely representatives of *Pachysphaeridium* are documented: *Pachysphaeridum* is confined to the Ordovician of Baltica and South China. A possible phylogenesis of the form group is briefly discussed.

VOL. LXXXVII (2000)

AUGUSTO AZZAROLI - On *Equus livenzovensis* Baigusheva 1978 and the "stenonid" lineage of Equids

KEY WORDS: Mammalia, Equidae, Pliocene-Pleistocene, Eurasia.

ABSTRACT - *Equus livenzovensis* is the oldest horse documented in Eurasia. It immigrated from Northern America 2.6-2.5 My ago and is well represented in Southern Russia; doubtful remains were also collected in central Italy and the species probably ranged as far as Spain. Its lineage seems to have become extinct before the end of the Pliocene in Nothern America but survived in Eurasia, where it gave origin to *Equus stenonis* and E*quus stehlini*, and in the early Middle Pleistocene to *Equus süssenbornensis* and its allies.

MICHELANGELO BISCONTI, ANGELO VAROLA - Functional hypothesis on an unusual mysticete dentary with double coronoid process from the Miocene of Apulia and its systematic and behavioural implications

KEY WORDS: Biomechanics, Cetacea, Dentary, Feeding Behaviour, Mediterranean, Mysticeti, Systematics, Trophic Web.

ABSTRACT - An unusual baleen whale dentary was found in the "Pietra Leccese" formation near Lecce, Apulia (Southern Italy). It bears a double coronoid process that is formed by an anterior satellite and a posterior true coronoid process. Between them an elliptical opening leads to a medial fossa in which a portion of the muscle temporalis attached. In this work, a biomechanical approach was used to infer the function of this dentary into the context of feeding behaviour. The functional analysis followed a strictly comparative method and allowed broad inferences in such fields as systematics and palaeoecology. The whale bearing this dentary was able to catch escaping prey with

wide gape and quick closure of its mouth. These behavioural features allowed it to occupy a niche that could be superimposed on that of living rorquals.

MICHELANGELO BISCONTI - New description, character analysis and preliminary phyletic assessment of two Balaenidae skulls from the Italian Pliocene

KEY WORDS: Balaenidae, Italy, Phylogeny, Pliocene, Skull morphology.

ABSTRACT - Two pliocenic balaenid skulls were re-examined to understand their phyletic relationships and to infer systematics. The crania are collected in the Museo di Storia Naturale e del Territorio of the University of Pisa. Both crania were studied in the past but no accord about their systematic and phylogenetic allocation was reached. By morphological and comparative analysis with a large part of the Balaenidae fossil record, it was possible to confirm the original systematic statement by the first Authors: *Balaena montalionis* Capellini and *Balaenula astensis* Trevisan. A cladistic analysis was conducted on the basis of 75 cranial characters by Hennig86 and close affinities between *Balaena mysticetus* and *Balaena montalionis*, and between *Balaenula astensis* and *Balaenula balaenopsis* were found. However, some aspects of the phyletic relationships of *Balaenula astensis* need further investigations due to the presence of many evident heterochronic features.

GIORGIO CARNEVALE, WALTER LANDINI - A fossil damselfish (Pisces, Pomacentridae) from the Late Miocene of Central Italy. Biological and biogeographical considerations

KEY WORDS: Perciformes, Pomacentridae, Messinian, Central Italy, systematics, eco-ethology, biogeography.

ABSTRACT - A fossil damselfish from the Late Miocene of Central Italy is described. A detailed description and consequently an exact taxonomical introduction is not possible due to the incompleteness and state of conservation of the specimen. Numerous anatomical features allow a placement in the Pomacentridae, therefore the find in question is the fourth fossil representative of this family. Biogeographical analysis indicates that the early evolutionary history of the family is characterized by a long stasis period and a limited distribution followed by diversification and geographical dispersion beginning from the Late Oligocene.

VOL. LXXXVIII (2001)

L. M. FORESI, S. IACCARINO, R. MAZZEI, G. SALVATORINI, A. M. BAMBINI - Il plancton calcareo (Foraminiferi e nannofossili) del Miocene delle Isole Tremiti

KEY WORDS: Stratigraphy, planktonic Foraminifers, calcareous nannofossils, Miocene.

ABSTRACT - [Calcareous plankton (Foraminifers and nannofossils) of the Miocene of the Tremiti Islands]. The p1anktonic foraminifers and calcareous nannofossils assemblages of ten Miocene stratigraphic sections of the Tremiti Islands have been studied. The investigated succession includes the Cretaccio Formation (about 165 m thick) and the basal part (about 3 m thick) of the overling S. Nicola Formation. The first unit lies with angular unconformity on the S.Domino Formation (Oligocene in age) and its base (3-3.80 m) is composed of green (red when wheathered) glauconitic doloarenites which are often thinly stratified or laminitic and with Elasmobranch teeth and apatite grains. Carbonatic fraction is absent in the glauconitic doloarenites because of dissolution. They are followed by about 22 m of stratified ocraceous-yellow dolomitic limestones (the thickness of the strata is from decimetric to beyond 2 m), more arenaceous in the lower part and more marly in the upper part. The carbonates dissolution characterizes the lower part of this interval and decreases progressively upwards; so the calcareous plankton becomes abundant and well preserved from the upper part of the interval. However the major lithology of the Cretaccio Formation is represented by decimetric-metric light marly layers (in particular whitish and reddish bands are alterned) (about 140 m thick); the calcareous plankton is constantly abundan. In the uppermost part of the formation, an interval 3-5 m thick, rich in glauconite and fossils (especially *Flabellipecten* and *Neopycnodonte*) was observed. In the studied sections, the S.Nicola Formation conformably lies on the glauconitic calcarenites; previously, the Authors reported an unconformable boundary between the two formations. Only the lowermost part (3 m thick) of S.Nicola Formation has been studied; it is composed of yellowish calcarenites and the whitish limestones with *Cardium* and Serpulids assemb1ages (calcareous plankton is rare or absent, while microbenthos is abundant). In the succession all the planktonic foraminifers and nannofossils gones and subzones of the Langhian-Messinian interval were recognized; from the biostratigraphic point of view the succession encompasses the interval from P*raeorbulina glomerosa* s.l Zone (*P. glomerosa sicana* Subzone) and *Discoaster exilis-Sphenolithus heteromorphus* Zone (*D. exilis-Helicosphaera* ampliaperta Subzone) to ’Xon distinctive” Zone and *Amaurolithus delicatus-A.amplificus* Zone, respectively. For each biostratigraphic units we provide: the lower and upper boun- dary, the thickness, the reliability and the succession of the bioevents and a short description of the associations. In the S.Domino, Caprara and Cretaccio islands, the Cretaccio Formation is Langhian. A Burdigalian age (*G. trilobus* Zone and *S. heteromorphus* Zone of the foraminifers and calcareous nannofossi1s, respectively) for the lower part of the formation, glauconitic and barren of calcareous plankton could not be excluded. In the S. Nicola Island the Cretaccio Formation includes also the Serravallian, Tortonian and Messinian stages. In particular, the glauconite rich levels of the upper part of the unit belong to the last two stages representing a condensed and perhaps also discontinuous sedimentation, probahly due to

strong currents effects. For the first time, a Messinian age for the upper part of the Cretaccio Formation and for the lowermost part of the S. Nicola Formation has been documented on the basis of the calcareous plankton. In the past, the S. Nicola Formation has been considered of Middle Pliocene age. The Messinian age of these sediments is also confirmed by the presence of the benthonic forarniniferal assernblages with *Bulimina echinata*, *Bolivina dentellata* and *Rectuvigerina gaudrynoides*. Through the new bio-chronostratigraphic framing, the Miocene sedirnentary succession of the Tremiti Islands is perfectly correlable to that of central-southern Salento Peninsula. Infact, the two areas are very similar for theirs lythologic, chronological and dynamic features. Also the closure of Miocene cycle sedimentation is synchronous in both localities and realized during Messinian. In appendix, the cornplete list of the taxa and their original references are added. Systematic, evolutionary, stratigraphic and bibliographic remarks have been carried out for many planktonic foraminifers.

GIORGIO CARNEVALE, CHIARA SORBINI, WALTER LANDINI, ANGELO VAROLA - *Makaira* cf. *M. nigricans* Lacépède, 1802 (Teleostei: Perciformes: Istiophoridae) from the Pietra Leccese, Late Miocene, Apulia, Southern Italy

KEY WORDS: Perciformes, Istiophoridae, *Makaira* cf. *M. nigricans*, Late Miocene, Southern Italy.

ABSTRACT - A well preserved skull (MAUL 917/1) and two rostra (MAUL 57/1; MAUL 60/1), all referred to *Makaira* cf. *M. nigricans* Lacépède, 1802, are described herein. All the specimens were collected from Tortonian calcarenites of Pietra leccese (Apulia, Southern Italy). Based on the ecological characteristics of its living relatives, the presence of *M. nigricans* in the Pietra leccese indicates that deep, warm water existed at or near the fossilization area. Small morphometric differences between the Pietra leccese specimens and other living and fossil *M. nigricans* materials could be attributed to the isolation effect of the low stand of eustatic level and the semi-enclosed configuration of the Mediterranean at Tortonian times. The associated fauna is also briefly discussed.

VOL. LXXXIX (2002-03)

AUGUSTO AZZAROLI - Phylogeny of the genus *Equus* L.

ABSTRACT - The genus *Equus* developed gradually in Northern America from the late Hemphillian *Dinohippus*. Its oldest well documented representatives date approximately from 3.7 Ma, with *Equus simplicidens*. In the later Blancan this species gave rise to a specialised lineage represented by *Equus stenonis*, with its forerunners and descendants. This strain, characterized by a deep indentation of the narial notch and an elongated snout slightly pointed downwards at its anterior extremity, has not been recorded in Northern America after the Blancan but dispersed in Eurasia, where it became extinct in the early Middle Pleistocene with *Equus süssenbornensis* and its relatives. The Indian *Equus sivalensis* and *Equus namadicus* are related to this strain.
Other strains emerged between the late Blancan and the early Irvingtonian. Their early histories are imperfectly known. One strain is represented by the large, sturdy *Equus idahoensis*, a possible forerunner of the Irvingtonian *Equus excelsus* and possibly of other species. In the late Blancan an elongated, slender metapodial may document an ancestor of *Equus simplicidens* and through it of Asian hemiones, possibly also of African assess. *Equus fraternus*, which gave origin to the South American species, and its relative *Equus francisci* may descend from an unnamed, late Blancan species represented by short, rather stout metapodials.
African zebras are well documented in the late Pliocene by *Equus koobiforensis* from the area of Lake Turkana but the origin of this species, as well as the histories of living zebras are poorly known. The middle Pleistocene, Algerian *Equus mauritanicus* is too recent to document their earlier history.

RAYMOND L. BERNOR, LASZLO KORDOS, LORENZO ROOK, JORDI AGUSTÍ, PETER ANDREWS, MIRANDA ARMOUR-CHELU, DAVID R. BEGUN, DAVID W. CAMERON, JOHN DAMUTH, GUDRUN DAXNER-HÖCK, LOUIS DE BONIS, OLDRICH FEJFAR, NARDOS FESSAHA, MIKAEL FORTELIUS, JENS FRANZEN, MIHÁLY GASPARIK, ALAN GENTRY, KURT HEISSIG, GABOR HERNYAK, THOMAS KAISER, GEORGE D. KOUFOS, ENDRE KROLOPP, DÉNES JÁNOSSY, MANUEL LLENAS, LUKÁCS MESZÁROS, PAL MÜLLER, PAUL RENNE, ZBYNEK ROČEK, SEVKET SEN, ROBERT SCOTT, ZBIGNIEW SZYNDLAR, GY. TOPÁL, PETER S. UNGAR, TORSTEN UTESCHER, JAN A. VAN DAM, LARS WERDELIN, REINHARD ZIEGLER - Recent advances on multidisciplinary research at Rudabànya, Late Miocene (MN9), Hungary: a compendium.

KEY WORDS: Mammal Faunas, Biogeography, Palaeoecology, Late Vallesian, Late Miocene, Rudabànya, Hungary.

ABSTRACT - Rudabánya is a rich late Miocene fossil locality first exploited for its vertebrate remains by Pethö in 1902. The first fossil primate was discovered by the local Chief Mining Geologist, Gabor Hernyák. Professor Miklos Kretzoi made Rudabánya famous in 1969 by publishing a manuscript on the new hominoid primate, Rudapithecus hungaricus, recognized herein as Dryopithecus brancoi. In 1991 L. Kordos and R.L.

Bernor initiated a project to undertake new excavations and a detailed systematic study of the vertebrate fauna. This 37 author contribution represents a compendium initial report on these studies. A detailed edited volume will follow this publication. We find that there are 112 vertebrate taxa recorded from Rudabánya, 69 of which are fossil mammals. The Rudabánya fauna outcrops at no less than seven different localities, all believed to be essentially synchronous in age. There are no direct radioisotopic dates from Rudabánya, the lower age is constrained by a single crystal argon date of 11.4 m.y. ± 0.1 m.y., and biochronologic correlations support a latest MN 9 age of ca. 10-9.7 Ma. Paleogeographically, the Rudabánya fauna developed on the edge of the extensive Pannonian lake, which supported a warm, equable subtropical climate. Zoogeographically, Rudabánya is most closely allied with the late Astaracian (MN8)-early Vallesian (MN9) Spanish vertebrate localities, and particularly Can Llobateres (straddling the MN9/MN10 boundary). These central and western European localities contrast strikingly with correlative eastern Mediterranean-Southwest Asian localities in their community structure. In particular, Rudabánya and Can Llobateres supported diverse lineages of small and medium sized mammals that were dominated by more archaic late early and middle Miocene European faunas. Vallesian localities in Greece and Turkey document an entirely different and progressive “proto-Pikermian” megafauna rich with advanced carnivore and ungulate assemblages. Of particular note is the sharp increase in hypsodont ungulates seen in the eastern Mediterranean-southwest Asian region. Finally, we briefly utilize these zoogeographic and paleoecological observations to contrast current competing hypotheses on “European versus African” ancestry of the African ape-human clade.

FLORIAN A. FLADERER, MATILDE FIORE - The Early Pleistocene insular hare *Hypolagus peregrinus* sp. nov. from Northern Sicily.

KEY WORDS: Early Pleistocene, Vertebrata, Lagomorpha, Leporidae, Mediterranean island fauna.

ABSTRACT - The leporid remains from the Early Pleistocene endemic island faunal complex of Monte Pellegrino near Palermo are described as a new species *H. peregrinus*. The type material of the Pellegrino Occidentale (POC) site consists of nearly 100 specimens, including a nearly complete skull, mandibles, parts of the girdles including a distal scapula and a complete coxa, and parts of the limbs with proximal and distal ends, a nearly complete ulna, one astragalus, and three complete calcanei. The skeleton displays strong differences if compared with *H. igromovi*, *H. beremendensis* and *H. brachygnathus* from continental Europe. The skull has a short muzzle, and its inner respiratory openings reveal a non-cursorial life habit. The forelimb architecture suggests a greater range of adductional movements in the shoulder and a stronger capacity of getting load by the extensor-flexor antagonism. Within the hindlimb locomotion activities the lateral movements of the femur have probably been a basic

feature, and the stoutness of the tarsals is different from cursorial as well as fossorial leporids. The cluster analysis underlines the outstanding rank of the new species.
It is supposed that the ancestor species (very probably *H. brachygnathus*) entered the Northern Sicilian palaeoarchepelago in the Early Pleistocene from the southern Apennine peninsula. The isolated population adapted its behavioural range into steeper habitats. *H. peregrinus* is interpreted as a phylogenetically advanced species and a secondary ambulatory relict member of the wide spread Neogene Archaeolaginae. It very probably lived in the middle to latest Early Pleistocene.

CARLO CORRADINI - Late Devonian (Famennian) conodonts from the Corona Mizziu Sections near Villasalto (Sardinia, Italy).

KEY WORDS: Conodonts, Taxonomy, Biostratigraphy, Late Devonian, Famennian, Sardinia.

ABSTRACT - A rich conodont fauna from two sections in the Clymeniae limestones of South-eastern Sardinia (Italy) allow to state a Famennian age for the investigated rocks. Sixteen conodont biozones in continuous sequence from the Lower *crepida* to the Lower *praesulcata* have been recognised. Ninety-four conodont taxa of twelve genera are discussed and illustrated. *Palmatolepis* is quite always the dominant genus, but in some levels *Icriodus*, *Polygnathus* and *Bispathodus* are also abundant.