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the present contribution, indicate a dominant North Gondwanan affinity, because they are similar to those from typical Gondwanan terranes: the Bohemia (Klonk section), Armorican Massif, Montagne Noire (France) and various areas from Spain, Tunisia, Algerian Sahara, Morocco, Libya, Bulgaria. More investigations are needed.

107-34 Poster Amon, Edward

RADIOLARIANS IN LATE CRETACEOUS WEST-SIBERIAN SEA

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Keywords: Radiolarians; Late Cretaceous; Western Siberia

Radiolarians lived in Cretaceous inner West-Siberian Sea since late Albian up to Maastrichtian, thus main areas of their dwelling has been moved near to western margin of the sea (Zauralie or Zauralian zone = Trans-Urals). Sea was rather shallow, depth of basin did not exceed limits of photic zone, area of dwelling located near coastal line. In Zauralie operated meridional currents existed during Albian, Turonian, Coniacian and post-Coniacian along eastern slope of Uralian land. Prevailing direction of currents during Albian and Turonian was from the north to the south, during Coniacian and post-Coniacian - from the south to the north.Environmental conditions for radiolarians were almost ideal. Factors caused here prosperity of radiolarians were: nonfreezing sea; relative proximity of coastal line; abundance of nutritious elements brought by surface and subsurface waters from close continent and by marine currents; good aeration of waters; stable marine salinity; rather soft general climate which was varying from subtropical to moderate.Leading factor, which has caused peculiarities of rads associations in Zauralie in different epochs of Cretaceous time, was temperature. Radiolarians reacted to change of temperature in subsurface layer of water column by shift of frequency of occurrence of individuals belonging to different skeletal morphotypes. Prevailing distribution was received the forms with specific characteristics and features of skeleton construction. Morphotypes, except tolerant, could be indicators of comparative warm or cold water masses of basin.Among Spumellaria morphotype Spongodiscoida is more adaptive to warm-water conditions, morphotype Actinommoida - to more cold, morphotype Hexastiliioida is tolerant. Nassellaria are more resistant to influences of environment also are more plastic. Morphotype Cannobotryoida is characterized by absolute domination in warm Early Maastrichiat time, and morphotypes Acropyramidoida, Eucyrtidioida, Stichocapsoida almost without fluctuations of frequency are present in Albian-Maastrichtian rads associations.Morphotype Stichocapsoida is weakened in late Campanian-early Maastrichtian. In Maastrichtian appeared additional, besides temperature, factor - shift in salinity and disturbance of halophilic balance, to which Cannobotryoida and Stichocapsoida morphotypes reacted oppositely. Early Maastrichtian West-Siberian Sea began more "oceanic" on salinity.

107-35 Poster Cardoso, Tereza

ACRITARCHS FROM THE TROMBETAS GROUP (SILURIAN - LOWER DEVONIAN), AMAZONAS BASIN, BRAZIL, AND THEIR RELATIONS TO THE GONDWANA PALEOCONTINENT

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Keywords: Acritarchs; Amazonas Basin; Silurian - lower Devonian; Gondwana paleocontinent; paleolatitudes

The intracratonic Amazonas Basin is situated in northern Brazil, and at the northwest margin of the Gondwana paleocontinent. During the early Silurian the basin were glaciated at three different occasions, and transgressed by the Iapetus Ocean in times of deglaciation. The Trombetas Group consists of four formations, in ascending order: Autás-Mirim (upper Ordovician sandstones and shales), Nhamundá (Llandovery - lower Wenlock sandstones and glaciogenic beds), Pitinga (Llandovery - lower Wenlock and Ludlow - lower Pridoli shales) and Manacapuru (lower Pridoli and lower Lochkovian sandstones and shales). These formations constitute the first Paleozoic sedimentation in the Amazonas Basin. The acritarchs represents a group of marine phytoplankton that tolerate low salinity, and have an extensive distribution on a global basins. They are known since pre-Cambrian and are of great importance for biostratigraphical, paleogeographical, paleobiological, and paleoecological studies in the Paleozoic, and in the intracratonic basins of Brazil they are sometimes the only fossils present. The following acritarchs have been identified from the Silurian: Baltisphaeridium capillatum, and Tyrannus giganteus. Characteristic acritarchs from high paleolatitudes in the Perigondwana and north Gondwana regions as: Perforela perforata, Tylotopala piramidalis and Tyrannus giganteus are identified in the sediments from the Pitinga Formation. Acritarchs characteristic for low paleolatitudes as Domasia and Deunffia are associated with taxa from high paleolatitudes, e.g. Dactylofusia maranhensis, Baltisphaeridium capillatum and Perforela perforata. This mixture of forms from different paleolatitudes is also known from the late Llandovery in Jordan, the Ghadames Basin (Libya), and the Tindouf Basin in west Algeria.The Paleozoic deposits forms a major part of the sedimentary column in the Amazonas Basin. The presence of diamictites and abnormal acritarch assemblages at the Llandovery/Wenlock boundary, reflects cool climates during the early Silurian, and indicates glaciations in a period of tectonic stability.The acritarchs in the Trombetas Group shows a great similarity to those from the Silurian in United States, Canada, Saudi Arabia, Spain, Belgium, England, Libya, Poland, Turkey, Norway, Argentina, Sweden, and France.

107-36 Poster Daneshian, Jahanbakhsh

BENTHONIC FORAMINIFERAL STRATIGRAPHIC DISTRIBUTION OF QOM FORMATION IN SOUTHWEST KASHAN

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Keywords: BENTHONIC FORAMINIFERA; OLIGOCENE; IRAN; QOM FORMATION

One stratigraphic section selected for studying the deposits of Gom Formation in 70 km southwest Kashan, central Iran. The thickness of the studied section is 150 m, and 90 samples were collected. In this study, 31 genera and 35 species of benthonic foraminifera were identified. According to the foraminiferal assemblage, the age of the deposits is early Oligocene (Rupelian).

107-37 Poster Soliman, Ali

PALYNOLOGY AND DINOFLAGELLATE CYST STRATIGRAPHY OF THE GHARANDAL GROUP (MIOCENE), KAREEM-30 BOREHOLE, GULF OF SUEZ, EGYPT

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Keywords: Dinoflagellates; Biostratigraphy; Palaeoenvironment; Miocene; Egypt

Sixty samples from the Rudeis and Kareem formations (Gharandal Group), Kareem-30 borehole were palynologically investigated. Freshwater algae (Pediastrum spp.) and terrestrial palynomorphs were found to be abundant in some samples. Among the acritarchs are the marine taxa Nannobarbophora gedlii, Cyclopesilla spp., and the probable dinoflagellate Quadrina condita. Diverse neritic dinoflagellate cysts characteristic of the Miocene were recorded from most samples with variable abundance compared to the other palynomorphs. The dinoflagellate cyst assemblages are represented by common Spiniferites/Achomosphaera spp., Lingulodinium machaerophorum, Operculodinium spp., Polysphaeridium zoharyi, Hystrichosphaeropsis obscura, Melitasphaeridium choanophorum, Tuberculodinium vancampoae, Hystrichokolpoma spp. and Dapsilidinium spp. Additionlly, Tectatodinium pellitum, Nematosphaeropsis spp., Cleistosphaeridium spp., Cribroperidinium tenuitabulatum, Distatodinium paradoxum and Apteodinium spiridoides occur sporadically. The Rudeis Formation is assigned to the Early Miocene (NN2-NN3), and a late Early Miocene to Middle Miocene (NN3-NN5) assignment is suggested for the Kareem Formation based on the presence of several diagnostic dinoflagellate cysts, including Hystrichosphaeropsis obscura, Apteodinium spiridoides, Distatodinium paradoxum and Labyrinthodinium truncatum. These dates are supported by planktonic foraminifera and calcareous nannoplankton data as well as by the absence of Oligocene or older diagnostic dinoflagellate cysts.The absence or rare occurrence of protoperidiniacean (heterotrophic) genera such as Lejeunecysta, Selenopemphix, Trinovantedinium and Brigantedinium may indicate either a shortage of nutrient supply during this period, or poor preservation resulting from syn- or postdepositional oxidation. This contrasts with their common occurrence in the Shukheir-1 borehole in the same area to the south (unpublished). The presence of the thermophilic dinoflagellates P. zoharyi, T. vancampoae, M. choanophorum and others in most samples indicates the dominance of tropical to sub-tropical climatic conditions during deposition of the Gharandal Group.

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107-38 Poster Gedik, Fatma

BIOSTRATIGRAPHY IN THE MARINE OLIGOCENE SEDIMENTS OF DENIZLI REGION

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Keywords: Paleontology; Stratigraphy; Oligocene; Denizli

The main objective of this study is to determine the benthic foraminifera found within the Çardak and Tokça formations exposed in Çardak-Dazkir-Çivril area (north of Denizli).In Turkey, marine Oligocene sequences have not been investigated and their fossil content not identified. The detail paleontological studies concerning the marine Oligocene rocks around the Denizli are limited. The marine Oligocene units are represented by Çardak and Tokça formations and they are investigated by using paleontological and stratigraphical data. Rupelian to early Chattian Çardak and late Chattian Tokça formations composed of shallow marine clastic and carbonate rocks and they are characterized by the presence of Nummulitidae and Lepidocyclinidae.It has been assigned that the abundance of Nummulites fichteli Michelotti, Nummulites vascus Joly & Leymerie and Operculina complanata Defrance species in Çardak formation characterize Rupelian to early Chattian corresponding to SB21-SB22 zone in study carried out in Mediterranean countries (Cahuzac & Poignant, 1997, 1998, 2002) and Turkey (Sirel, 2003).It is concluded that, the species belonging to genus Nummulites in Tokça formation completely disappeared, instead the species Eulepidina dilatata (Michelotti) belonging to family Lepidocyclinidae appeared. This species has been also accepted as late Chattian (SB23) by the above mentioned authors. The ages assigned for Çardak and Tokça formations by these authors have been also accepted in this study. The determined ages have been also correlated with calcareous nannoplanktone and coral species identified from the units.

107-39 Poster El-Shamma, Abd El-Ghany Abd El-Naby

NEOCOMIAN - CENOMANIAN PALYNOZONATIONS OF THE WESTERN DESERT, EGYPT AND THEIR RELATION WITH ASA PROVINCE

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Keywords: palynozonation; potanical province; sporomorphs

Neocomian - Cenomanian sequences of twelve wells in the northern part of the Western Desert were palynologically investigated. A number of palynozones have been suggested based upon the successive appearance and dominance of the most stratigraphicaly important taxa. The study revealed that the general feature of the recovered palynomorphs carries the same characters of ASA phytoprovince. A slight difference in the qualitative distribution of some endemic forms was expected northward of the botanical province. Spores were more differ, and gymnosperms were more less than the tropical zone. Palaeoecological setting of the study sequences was interpreted according to spormorph / planktonic ratio which indicates prevailing of shallow marine conditions during the time of disposition.

107-40 Poster Hidalgo, Renata

PRECAMBRIAN MICROFOSSILS IN THE PARAGUAI BELT, BRAZIL *

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Keywords: microfossils; precambrian; Amazon Craton; snowball Earth; Brazil

The Earth, during late Precambrian and Cambrian (750-500 My), witnessed two major events which affected both its deposits and the fossils: a sequence of global glaciation (snowball) which conditioned afterward a bloom development of animal diversification phyla. The Paraguay Belt located in the southeast of Amazon Craton is an area favored by several researches. However, paleontological data are scarce and so their application for stratigraphic survey are not satisfactory. It was not revealed as yet through Brazilian Precambrian, an Ediacara Biota, so there are doubts both on Biochronostragraphy and Paleoenvironmental of these deposits: Brazilian Neoproterozoic beds are present in the Paraguay Belt, especially in the Corumbá Group (Mato Grosso do Sul state) and Araras Group (Mato Grosso state). Palynological research on dark

colored siltstones, shales, marls, and limestones of the Tamengo Formation (Corumba Group), southern Paraguay Belt, revealed a lot of amorphous organic matter and identifiable microfossils such as: i) Bavlinella faveolata, ii) Eoentophysalis croxfordii, iii) Siphonophycus sp., iv) Helicothricoides waltheri, and v) Leiosphaeridia crassa. Nogueira et al. (2003) described in Araras Group, a Neoproterozoic post-glacial cap carbonate overlies glaciogenic diamictites of the Puga Formation associated with a Varanger/Marinoan age (~600-590 This cap carbonate comprises dolomites of the Mirassol d'Oeste Formation and the basal portion of the Guia Formation (carbonate). Previous analysis of palynological residues from dolostones, limestones, and cherts identified microfossils: i) Bavlinella faveolata, ii) Soldadophycus bossii, iii) Leiosphaeridia sp., iv) Siphonophycus spp., and v) Symplassophaeridium sp. The extreme variations between icehouse and greenhouse certainly stressed the living beings of these times but their records are still polemic. It is then important to look for fossils from post-glacial cap carbonates which might cast important consequences on the knowledge of the events in South America during these times fitting gaps of these times is comparing to other continents. We are now conducting such researches. NOGUEIRA, A. C. R., RICCOMINI, C., SIAL, A. N., MOURA, C. A. V., FAIRCHILD, T. R. 2003. Soft-sediment deformation at the base of the Neoproterozoic Puga cap carbonate (southwestern Amazon craton, Brazil): Confirmation of rapid icehouse-greenhouse transition in snowball earth. Geology. , v.31, p.613 - 616.

107-41 Poster Ahmed, S. Taher

MICROPALEONTOLOGICAL STUDIES OF THE LATE MIOCENE SEDIMENTS IN THE SOUTHEASTERN PART OF BANGLADESH

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Keywords: Late Miocene; Shallow marine; Ostracods; Foraminifera

The foraminieras and the ostracods from the southeastern part of the Cox's Bazar, Bangladesh have been studied. Seventeen species of Ostracoda belonging to the fourteen genera and forty one species of calcareous foraminifera belonging to twenty two genera identified from the studied sediments. The age of the studied samples has been ascertained as Late Miocene. The environment of deposition of the sedimentary basin was warm tropical to subtropical, shallow marine, having good interconnections with the adjoining open sea.

107-42 Poster Bartholdy, Jan

THE HOLOCENE DEVELOPMENT OF THE ARAL: INVESTIGATIONS BASED ON BENTHIC FORAMINIFERA

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Keywords: Holocen; development of the Aral; Investigations; benthic foraminifera.

The lake Aral is located in the central Asian Tural lowland. The climate of the region is arid, with an average rainfall of 20 mm. In 1960, the lake occupied an area of about 65.000 km² and had a maximal depth of 67 m, thus being the 4th biggest in the world. In present times, the lake Aral is extended in only half of the original area, while its salinity enormously increased from 10 PSU at the beginning of the 60's to 80 PSU today. The reasons for this dramatic change in the water and various ecosystems balance are twofold. They are a) mainly due to direct human impact and b) of socio-economic background. The consequences of both were and still are dramatically for the environmental protection and the ecological systems of the lake.In 2002, there were recovered cores in the northern area of the Aral lake. Two of them coming from the Tschebas bay, could be macro- and micropaleontologically investigated. They are ca. 3.0 m in length and consist of greyish silty clay from the base to ca. -1.20m, followed at the top by black clay. Both sediment types are partially laminated, while gypsum occurs at specific stratigraphic layers. The isolated fauna contains molluscs, ostracods, insects and plant remains. Foraminifera were only recorded in the layer interval between -2.0 to -1.0 m. Their diversity is low and includes only few species of Ammonia, Cribroelphidium and Elphidiella. The frequency of Cribroelphidium is relatively constant throughout this layer. Ammonia in turn, dominates the first (lower part) half, while Elphidiella the second (upper), a fact which indicates an increase in salinity from brackish to high salinity waters. The enrichment of common aberrant forms in some horizons from the lower to the upper part of the cores points to environmental stress (at -1.49, -1.65 and -1.97m ca. 30% aberrant forms, while at -1.13m they increase up to 50-65%).

SESSION 108

G13.03 - New applications of mathematical statistics in Earth Sciences
MONDAY, August 23, 2004 - 9:00
Room: 18

Conveners:

Agterberg Frederik P., Gotway Crawford Carol A.

108-1 Oral Lewin, Eric

APPLICATION OF MULTIVARIATE STATISTICAL METHODS TO DETERMINATE FACIES FROM CHARACTERISTIC SIZE SPECTRA

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Keywords: geomathematics; multivariate statistics; spectral data; sedimentological facies

Many measurements which are not simple scalar values are mathematically represented by distributions, which are positive functions of one continuous parameter, with a 100% constraint for the integrate of this function. Such is the case of grain size distributions in sedimentology. From the mathematical point of view, this resembles to the more classical compositional data problem. The aim of this study is to try to draw bridges between these different approaches.Therefore, a classical fore step of many sedimentological studies is the definition of characteristic facies, defined from the categorisation of observational data, most usually of qualitative type, and as such quite frequently defined more or less with some interpretative model in mind. However, some of these observational data can be quantities, such as object size distributions, granulometric spectra, colorimetric spectra, or can be quantified on the base of presence frequencies, thus defining relative abundance spectra.Multivariate statistics, such as principal component analysis or cluster analysis technics, can be applied on such data. The idea behind that is to try to establish quantitative indexes for the facies definition, with a more objective approach. However, care must be given to the direct application of classical algorithms, because of the closure constraint.

108-2 Oral Kotov, Sergey Robertovich

A COMPARISON OF GREENLAND ICE AND BALTIC SEA SEDIMENT RECORD: A CONTRIBUTION TO CLIMATE CHANGE ANALYSIS

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Keywords: singular spectral analysis; climate; sediments

Climatic records from Greenland ice and Baltic Sea provide as well information about global climate changes as about local basin peculiarities. A data record from Greenland was produced by the Greenland Ice Sheet Project Two (NSIDC, 1997). The ratio delta 18-th of oxygen serves as a proxy measure of climate conditions during Holocene. A Baltic Sea data record is represented by a sequence of grey values of a sediment core from the Eastern Gotland Basin. Classical approaches of time series processing allow us to make only preliminary conclusions on climatic systems behavior due to the high level of noise and shortness of available time series. For signal-to-noise enhancement and decomposition of signals on primitive independent constitutes, we used singular spectral analysis (SSA) specially designed for such series (see e.g. Ghil et al., 2002) and grown up on junction of the theory of dynamical systems and multivariate statistics. For the first time, this method has been applied to sedimentological data from Baltic Sea. Undoubtedly, the record from Greenland ice reflects climatic changes. Decomposed and de-noised signals demonstrate the obvious presence of 'global' components with concordant periodicities of about 900, 500 and 400 years in both records. The contribution of 'global' components to entire signal from Baltic Sea in terms of variability of records is estimated as 20-21%. The rest must be regarded as a reflection of local geo-climatic processes. The reconstructed part of a signal from Greenlandic ice corresponding to two main principal components and reflecting more then 33% of entire variability confirms our present results of global climate predictions. According to them, our planet now is on the end part of ascending temperature branch of global long-periodical, about 900 years, process (Kotov, 2000). The estimation of the number of leading independent processes is in agreement with our previous estimations of the number of degrees of freedoms of geo-climatic systems obtained by independent methods. Both signals correspond to complex periodical (non chaotical) behavior.

108-3 Oral Tavares, Geovan

MODELING AND SIMULATING 3D OIL RESERVOIRS WITH GEOLOGICAL OBJECTS

TAVARES Geovan[1], LOPES Hélio[1], PESCO Sinésio[1], POLETTO Carlos Alberto[2], DE DEUS SOUTO FILHO João[3], BARRETO JR. Abelardo[3], FRIEDRICH Anelise[3]
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Keywords: computational geology; boolean simulation; stochastic simulation

Starting in 1995 a team of petroleum geologists and engineers from Petrobras together with computational mathematicians from Pontifical Catholic University of Rio de Janeiro designed and implemented a software with the objective to build 3D equiprobable scenarios of oil reservoirs from information at the wells and knowledge of the geological formation.The software Petbool (acronym for Petrobras and boolean) was build under sedimentology assumptions. The geological forms handled by the software are channels, lobes, lens, domes, dunes, tabular and sigmoids. The simulation can be constrained to the wells, global volume proportion, facies vertical proportion curve, area proportion map, top and bottom surfaces, and geological forms spacial physical properties. The question to be answered is what is (stochastically) the topology of the oil reservoir? The topology of the oil field can be understood and reveals itself by using analysis tools like connected geological forms, connected wells, fence diagrams and spatial diffusion of physical properties.The 3D Geological Modeling pipeline adopted throughout the software is the following3D Geological Mapping à Geological Objects Parametrizationà Stochastic Modeling of Geological Objects à Flow and Statistical AnalysisAt the core of the software Petbool is the topologically based software ModVis, a data structure for geometric modeling and visualization. The software Petbool runs under several platforms and operational systems, SUN under Solaris (60, 80, Blade) Silicon Graphics Irix and IBM Aix. By the end of 2004 it will be available a version for Windows and Linux.

108-4 Oral Thiergärtner, Hannes

MATHEMATICAL SPATIO-TEMPORAL ANALYSIS BY FEW AVAILABLE DATA OF A PHENOLIC GROUNDWATER DAMAGE IN A BROWN FIELD

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Keywords: classification; groundwater; contamination; few available data

Phenolic chemicals form multi-substantial systems. They can pollute aquifers by the leacheate from tar residues and thy are changing in space and time. Quantified models of the contaminant's composition, spatial distribution and temporal alteration are required for the remediation. Large data sets at extended devastated sites allow the application of mathematical models for groundwater flow, contaminant transport and mass balances.These models fail if there are only few observation points. The most unspecific multivariate-statistical methods cannot be applied then because the necessary statistical assumptions cannot be tested, etc.Multi-dimensional heuristical models of pattern recognition have been tested to generate results regarding attribute patterns, object patterns, the spatial distribution of object classes, and the temporal development of objects in case of only few input data. A six-step sequence of non supervised classifications was developed. The procedure is composed of the following elements:(1) Determination of contaminant association patterns (cosine measure cluster dendrograms)(2) Visualisation of a spectral analysis of polluting constituents(3) Determination of classes of pollution (Euclidean metrics cluster dendrograms) (4) Determination of descriptive class characteristics(5) Interpretative temporal analysis of classes of pollution(6) Regional division (classification of the area regarding its multivariate properties).The solution will be demonstrated at a groundwater damage in a brown field which is explored by 12 observation wells and analysed by only two measuring campaigns. The concentration values for phenol, mono-, di-, and tri-methylphenol allow a reduction to five classifying attributes. The analysis of objects results in seven separate classes. They differ mainly by their levels of concentration of the hazardous chemicals and by their contaminant patterns.