

9th International Symposium on the Cretaceous System

1-5 September, 2013
METU FACULTY OF ECONOMIC &
ADMINISTRATIVE SCIENCE BUILDING • ANKARA/TURKEY



MIDDLE EAST
TECHNICAL UNIVERSITY



ABSTRACT BOOK

CONTENTS

CONTENTS

ORAL PRESENTATIONS

• BIOSTRATIGRAPHY, ALGAE AND BENTHIC FOREMINIFERA	6
• CALCAREOUS NANNOFOSSILS, PLANKTONIC FORAMINIFERA AND GLOBAL BIO EVENTS	12
• CARBONATE PLATFORMS RUDIST BIOMINERALS	19
• CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (OAE)	26
• CRETACEOUS SEDIMENTARY BASINS, PALEOGEOGRAPHY AND TECTONIC EVOLUTION	33
• CRETACEOUS TERRESTRIAL RECORDS	38
• EVENT STRATIGRAPHY + KT BOUNDARY	40
• IGCP 609- CAUSES AND CONSEQUENCES OF SHORT-TERM CRETACEOUS SEA-LEVEL	46
• MACROPALAEONTOLOGY AND AMMONITES, SUBCOMMISSION GSSP DISCUSSIONS	52
• PALEOCLIMATE	63
• PETROLEUM OCCURRENCES IN CRETACEOUS BASINS OF TURKEY AND ADJACENT AREAS	68
• SEDIMENTOLOGY, SEQUENCE STRATIGRAPHY AND CYCLOSTRATIGRAPHY	73

POSTER PRESENTATIONS

• BIOSTRATIGRAPHY, ALGAE AND BENTHIC FORAMINIFERA	82
• CALCAREOUS NANNOFOSSILS, PLANKTONIC FORAMINIFERA AND GLOBAL BIO EVENTS	92
• CARBONATE PLATFORMS RUDISTS BIOMINERALS	96
• CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (AOE)	101
• CRETACEOUS SEDIMENTARY BASINS, PALEOGEOGRAPHY AND TECTONIC EVOLUTION	109
• CRETACEOUS TERRESTRIAL RECORDS	113
• KT – MACROPALAEONTOLOGY	116
• MACROPALAEONTOLOGY AND AMMONITES, SUBCOMMISSION GSSP DISCUSSIONS	121
• PALEOCLIMATE	122
• PETROLEUM OCCURRENCES IN CRETACEOUS BASINS OF TURKEY AND ADJACENT AREAS	123
• SEDIMENTOLOGY SEQUENCE STRATIGRAPHY AND CYCLOSTRATIGRAPHY	125

AUTHOR LIST

128

9th 1-5 September, 2013
**International Symposium
on the Cretaceous System**
METU FACULTY OF ECONOMIC &
ADMINISTRIVE SCIENCE BUILDING • ANKARA/TURKEY

ORAL PRESENTATIONS

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FOREMINIFERA

1109 - Biostratigraphy and depositional environment of Lower Cretaceous limestones from the Circum-Rhodope Belt (Chalkidhiki Peninsula and Thrace region NE Greece)

*Ivanova Daria*¹, Chatalov Athanas², Bonev Nikolay³

Geological Institute, Bulgarian Academy of Sciences Department of Palaeontology, Stratigraphy and Sedimentology Sofia-Bulgaria¹ Sofia University "St. Kliment Ohridski" Department of Mineralogy, Petrology and Economic Geology Sofia-Bulgaria² Sofia University "St. Kliment Ohridski" Department of Geology, Paleontology and Fossil Fuels Sofia-Bulgaria³

The Toroni limestones from Chalkidiki peninsula contain fragments from corals, echinoderms, bryozoa, bivalves, foraminifers, calpionellids and calcareous dinocysts. Microencrusters of the association *Lithocodium aggregatum* *Bacinella irregularis* and *Crescentiella morronensis* (Crescenti) are specific elements. The microfossil assemblage proves late Berriasian to early Valangian age. The microfacies types comprise bioclastic rudstones, grainstones, packstones, and wackestones. Bioclastic-peloidal packstones and mudstones with calpionellids and foraminifers are subordinate types. The carbonate sediments were deposited near the fair-weather wave base with oxic conditions on the sea floor.

The Alike limestones from Thrace region comprise intraclastic packstones/grainstones, peloidal packstones/grainstones, ooid-peloidal packstones/grainstones, bioclastic wackestones/packstones, and bioclastic mudstones. The bioclasts include fragments of rudists, foraminifers, echinoderms, corals, coralline and dacycladacean algae, brachiopods, ostracods, and microencrusters of the association *Lithocodium aggregatum* *Bacinella irregularis* and *Crescentiella morronensis* (Crescenti). The microfossil assemblage redefines Valangian age of those sediments. The depositional environment can be interpreted as a shelf lagoon which was marked by the occurrence of small, isolated rudist-dominated buildups.

The obtained results present strong stratigraphic evidence for pre-Valangian termination of the Late Jurassic-Early Cretaceous Balkan orogeny which was sealed by Early Cretaceous carbonate sedimentation in the Circum-Rhodope Belt. They enable regional correlation between isochronic carbonate rocks exposed in Greece, Bulgaria and Turkey.

1140 - Larger foraminifera distribution in the Natih Formation in northern Oman

*Vicedo Vicent*¹, Consorti Lorenzo², Serra-Kiel Josep³, Razin Phillipe⁴, Grelaud Carine⁴

Museu de Geologia - MCNB Palaeontology Barcelona-Spain¹ Universitat Autònoma de Barcelona Geology (Palaeontology) Barcelona-Spain² Universitat de Barcelona Stratigraphy, Palaeontology and Marine Geosciences Barcelona-Spain³ Université de Bordeaux EGID Bordeaux-France⁴

The Cenomanian shallow-water carbonates of the Natih Formation were sampled in detail in the well-exposed outcrops in northern Oman. A preliminary study revealed very interesting new data on the taxonomic composition of the very rich larger foraminifera assemblages and allowed to define their distribution in the sequence stratigraphic framework established by previous authors.

The Sequence I (Natih G, F, E; Late Albian to Early Cenomanian) is characterised by a relatively high diversity of alveoliniform foraminifera. Some morphotypes show a shell-architecture close to the genus *Ovalveolina* and *Praealveolina*, but some others exhibit shell-structures very different from all the taxa described up to now. *Chrysalidina* sp. and *Neiraquia*? sp. also occur together with these alveoliniforms. The base of the Sequence II (Natih D, C; Middle Cenomanian) almost coincides with the first occurrence of the alveoliniform genus *Decastroia*, *D. razini*?, which is cited in Oman for the first time. Finally, in the lower part of the Sequence III (Natih B, A; Late Cenomanian) there are soritids exhibiting structures close to the "Taberina" bingistani-morphotype, big forms of a new species (?) of *Decastroia*, and *Rotorbinella mesogeensis*. The upper part of the sequence III is characterized by the presence of orbitolinids and *Dohaia* sp.

1171 - Evolution and Paleobiogeographic distribution of orbitolinids in Iran

*Yazdi-Moghadam Mohsen*¹, Sajjadi Fereshteh², Abbasi Parisa²

NIOC Paleontology Tehran-Iran¹ Tehran University Paleontology Tehran-Iran²

Objectives

This study attempts to provide a comprehensive insight into the evolution and paleobiogeographic distribution of orbitolinids in Iran using data from the wells (off shore and on shore) and outcrop sections of southern, central,

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FOREMINIFERA

northeast and northwest Iran. The Iranian regional lineages of the orbitolinid taxa are described, starting in the Early Barremian and ending in the Cenomanian.

Material and methods

The data set used for this study includes nine outcrop sections and six wells. We have also included the previously published data.

Results

Based on the extensive regional data set, 22 taxa of orbitolinids were determined. They belong to six phylogenetic lineages including:

- 1- *Montseciella glanensis*-*Rectodictyoconus giganteus*
- 2- *Valserina primitiva*-*Eygallerina turbinata*
- 3- *Eopalorbitolina pertenuis*-*Palorbitolinoides hedini*
- 4- *Praeorbitolina cormyi*-*Mesorbitolina aperta*
- 5- *Conicorbitolina corbarica*-*Conicorbitolina conica*
- 6- *Orbitolina sefini*-*Orbitolina concave*

Conclusions

The following conclusions can be drawn from this study

- 1- During the Early Barremian true orbitolinids (lineages 1 and 2) were distributed only in central and northwest Iran (Central Iran and Moghan basins). No record of orbitolinids in sediments of the same age was observed in southern Iran (Zagros).
- 2- The Late Barremian-Early Aptian platform rocks of northeast (Kopet Dagh) and south Iran are characterized by enrichment of orbitolinids belonging to the lineages 2 and 3.
- 3- During the Late Aptian-Cenomanian, the taxa belonging to the lineages 3 to 6 were prevailing in carbonate platforms of south and central Iran.

1110 - Biostratigraphy of the Fahliyan and Gadvan formations in Kuh-e Genow Bandar-e Abbas area Southwest of Iran

*Nafarieh Talkhoncheh Elham*¹

NIOC Exploration Directorate Paleontology and Geochemistry Office Tehran-Iran¹

A thick succession of the Fahliyan and Gadvan formations was studied for biostratigraphy and precise age determination in Kuh-e Genow, Bandar-e Abbas area, SW Iran. The main purpose of this article was to study the benthic foraminifera and green algae with introduce assemblage zones that present in the Fahliyan and Gadvan formations. A total of 21 genus of benthic foraminifera and 23 species of green algae were identified. Based on the obtained results of benthic foraminifera as well as calcareous green algae, two local biozones are defined: *Pseudocyclamina lituus*-*Trocholina* and *Choffatella*-*Cyclamina* assemblage zones of Wynd (1965). According to the identified biozones, a Neocomian to Barremian-Aptian age is suggested for the studied succession in this area.

1173 - Revision of the shell architecture in Siderolitidae (Foraminifera) and its implication in a shallow-water Late Cretaceous biostratigraphy

*Robles-Salcedo Raquel*¹, *Vicedo Vicent*², *Caus Esmeralda*¹

Universitat Autònoma de Barcelona Geologia (Unitat de Paleontologia) Bellaterra (Cerdanyola del Vallès)-Spain¹

Museu de Ciències Naturals de Barcelona Paleontologia Barcelona-Spain²

The Siderolitidae are a group of larger foraminifera essential for the biozonation of shallow marine deposits of Campanian and Maastrichtian ages. However, their biostratigraphical potential is undervalued by a poor identification of taxa at generic and/or species level.

Siderolitids are lens-shaped foraminifera with planispiral-involute growth. The successive chamber lumina are connected by multiple intercameral foramina located at the base of the septa. A complex supplemental skeleton formed by an enveloping tridimensional network is common to all the representatives of the family Siderolitidae. The supplemental skeleton is generated by successively superposed and folded imperforated portions of outer lamellae, which envelops the chambers during growth following a more or less complex pattern depending on the genera.

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FOREMINIFERA

The recent study about the shell architecture of the siderolites genera based on well-preserved specimens from Maastricht and Pyrenees confirms the validity of the following genera: Siderolites, Pseudosiderolites, Arnaudiella and Praesiderolites, which have been controversial for a long time. Siderolites is characterized by the presence of canaliferous spines and lateral meshes, while Pseudosiderolites has lateral chamberlets and lack spines. Arnaudiella also has lateral chamberlets, but lacks lateral meshes and spines. In Praesiderolites, the enveloping canal system is reduced to the equatorial plane.

1089 - Evolution of Late Jurassic and Early Cretaceous dinoflagellate communities in East European Sea (Russia)

*Peshchevitskaya Ekaterina*¹

Institute of Petroleum Geology and Geophysics Laboratory of the Palaeontology and Stratigraphy of the Mesozoic and Cenozoic Novosibirsk-Russia¹

In the Late Jurassic and Early Cretaceous, East European Sea was periodically linked with the Boreal and Tethyal basins by the system of channels. The links with the Tethys ceased in the Early Volgian. The isolation of East European Sea increased in the Late Volgian. Nevertheless, it didn't affect Upper Jurassic dinoflagellate communities. They were very rich and diverse in the Kimmeridgian and Volgian and mostly represented by the Suborder Gonyaulacineae. First representatives of the Suborder Peridiniineae appeared in the Late Kimmeridgian. Important evolution event was the inception of the Suborder Ceratiineae in the Middle Volgian. In the Rhyazanian, the renewed links with the Boreal and Tethyal basins resulted in the inception of numerous Cretaceous taxa (Families Ceratiaceae and Gonyaulacaceae) with wide areas of distribution. In general, Late Jurassic and Early Cretaceous dinoflagellate communities of East European Sea and other Boreal and Arctic basins contain a lot of common species, although the dinoflagellate communities of Arctic seas are less diverse. In generic level, there is even substantial similarity to the dinoflagellate communities of Tethyal basins and seas of southern hemisphere.

1114 - Questioning the age and correlations of the Cretaceous Formation Falaise de Blanche in Lebanon

*Maksoud Sibelle*¹, Granier Bruno¹, Azar Dany²

Geology Earth Sciences and Univers Brest Cedex 3-France¹ Geology Natural Sciences Fanar-Lebanon²

Falaise de Blanche, the name of which is dedicated to Ch.I. Blanche (1847) who first described this distinctive geomorphological/geological unit, runs throughout the chains of Mount Lebanon, Anti-Lebanon (Lebanon), and into Southern Alawite Mountains (Syria).

According Dubertret and Vautrin (1937) it is Albian in age but later the first of these two authors (Dubertret, 1963) referred it to the late Aptian sensu anglico (i.e., Aptian sensu stricto following Moullade et al.' nomenclature, 2012). More recently, Walley (1998), while formally naming this stratigraphic unit the Mdairej Fm, allocates it to a time range spanning the Early Aptian and early late Aptian sensu anglico (i.e., Bedoulian and early Aptian sensu stricto following Moullade et al.' nomenclature, 2012). But, none of these datings is strongly constrained, and our preliminary investigations point to a new dating.

During a first field work campaign in summer 2012, we sampled and logged several sections in discrete localities of Lebanon. Thin section analyses of the material collected prove to bear rather rich micropaleontological assemblages consisting of benthic foraminifers (with representatives of the Charentiidae, Loftusiaceae, Orbitolinidae, Nezzazatidae, and Miliolidae families) and calcareous algae (mostly Dasycladales). These microfossils are not usually given enough attention though they proved to be efficient biostratigraphic tools to date sections where the classical markers (ammonites, planktonic foraminifers) are lacking.

Among many evidences, the occurrence of Montseciella arabica in the lowermost part of the unit (Saint-Marc, 1970) and that of Palorbitolina lenticularis spanning the whole interval led us to correlate this unit with the upper Kharai(-ian) of the Persian Gulf (Granier et al., 2003; Granier and Busnardo, 2013). When correlated with a North-Tethyan scale (Clavel et al., 2007), the corresponding time range of this South-Tethyan unit should be latest Barremian - Bedoulian (following Moullade et al.' nomenclature, 2012).

Forthcoming investigations in this unit and in both its overburden and its underburden (respectively the Hammana Fm above and the Abeih Fm below) will probably help to validate this working hypothesis and to get better paleogeographical reconstructions at the scale of the Arabian plate.

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FOREMINIFERA

Acknowledgements

We would like to thank the CNRSL (National Center for Scientific Research-Lebanon) and the AUF (University Agency of the Francophony) for their financial support.

1223 - Benthic foraminifera associated with sea grass 'meadows' in the Upper Maastrichtian of ENCI Quarry Maastricht The Netherlands

Hart Malcolm¹

Plymouth University School of Geography, Earth & Environmental Sciences Plymouth-United Kingdom ¹

Sea grasses (eel, turtle, widgeon and manatee) are a group of angiosperm plants totally adapted to a marine or estuarine environment. They characterize an important shallow-water environment and help generate a distinctive habitat for foraminifera and other marine biota. Sea grasses, with their rhizome root systems also provide an effective role in the stabilization of sediment. In modern, tropical environments, sea grass leaves, rhizomes, roots and intra-meadow sediments are often characterized by miliolid foraminifera that are often large (e.g., *Peneroplis*, *Sorites*, *Marginopora*). In temperate regions epiphytal taxa include smaller benthic foraminifera such as *Rosalina*, *Discorbis*, *Cibicides* and *Planorbulina*. In the sea grass meadows of Tor Bay and the Salcombe Estuary (S.W. England) the sea grass fronds, in summer, are covered in living *Elphidium crispum*, a well-known geotrophic taxon. The biconvex shape of the genus *Elphidium* does not appear to be adapted to an epiphytal existence, making it difficult to use simple morphology as a guide to the presence or absence of fossil sea grass meadows.

The oldest sea grass fossils are thought to be of Cretaceous age, though direct evidence is limited. The most important information in Maastrichtian sea grass comes from the Netherlands (van der Ham et al., 2007). In recent years both fronds and rhizomes have been described from the Upper Maastrichtian of the ENCI Quarry in Maastricht, including beautifully preserved specimens of *Thalassotaenia debeyi* (Cymodoceaceae). The benthic foraminifera (Renema & Hart, 2012) include a range of larger taxa (*Orbitoides apiculata*, *O. brinkae*, *Lepidorbitoides minor*) and *Ompahlocyclus macropora*, which is a discoidal form comparable in morphology to *Marginopora*. Larger benthic taxa such as *Calcarina* and *Baculogypsina* are often associated with modern *Thalassia* meadows. *Siderolites*, of the Upper Maastrichtian of the ENCI Quarry succession, is a close homeomorph of *Baculogypsina*.

The sea grass fossils and associated foraminifera of the 'classic' Upper Maastrichtian provide strong evidence of a sea grass meadow community that was probably assisting in the stabilization of the uppermost Cretaceous chalk sediments. This has significant palaeoecological implications as the water depth, within the photic zone, must have been quite shallow. Sea level changes in the late Maastrichtian (and above) may be limited by such shallow-water evidence within the succession as a significant fall would have exposed the sea floor. How these shallow-water chalk taxa were able to calcify in such a high pCO₂ world (perhaps with lowered pH) is also significant for palaeoenvironmental and palaeoecological research.

Ham, R.W.J.M. van der, Konijnenburg-van Cittert, J.H.A. van & Indeharberge, L. 2007. Seagrass foliage from the Maastrichtian type area (Maastrichtian, Danian, NE Belgium, SE Netherlands). Review of Palaeobotany and Palynology, **144**, 301-321.

Renema, W. & Hart, M.B. 2012. Larger benthic foraminifera of the type Maastrichtian. Scripta Geologica, Special Issue, **8**, 33-43.

1206 - A Late Cretaceous biostratigraphical and palaeoenvironmental study of the Norwegian Sea and Barents Sea area – application of dinoflagellate cysts and foraminifera

Radmacher Wiesława¹, Setoyama Eiichi², Tyszkiewicz Jarosław¹, Mangerud Gunn³, Kaminski Michael A.²

Polish Academy of Sciences Institute of Geological Sciences Kraków-Poland ¹ King Fahd University of Petroleum and Minerals Earth Sciences Department Dhahran-Saudi Arabia ² University of Bergen Department of Earth Science Bergen-Norway ³

This study was conducted in order to establish the Upper Cretaceous biostratigraphy and estimate palaeoenvironment in the Norwegian Sea and Barents Sea region based on dinoflagellate cyst analysis integrated with foraminiferal data. Due to the fact that a high number of exploration wells have been drilled, the data coverage from that area is huge and an increasing number of wells are being released. However, very little scientific work including palynology and micropaleontology has been published yet.

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FOREMINIFERA

In the Barents Sea, the Upper Cretaceous deposits are thin and discontinuous due to uplift and erosion, and in Svalbard it is completely absent. In the Norwegian Sea, the Upper Cretaceous section is much more complete and shows better preservation of dinocysts, which allows for detailed study.

Samples from seven boreholes located in the Norwegian Sea and the Barents Sea were investigated. The well-preserved and diversified dinoflagellate cysts were successfully applied for dating and estimating relative distance from the shore. The dinoflagellate cyst assemblages from the two Norwegian Sea wells allowed us to define three Interval Zones and two Abundance Zones, indicating that the studied interval ranges from the Albian to Upper Maastrichtian, though there may be some hiatuses within the succession. The assemblages are similar to those recorded in the Barents Sea and also can be compared with adjacent regions such as Greenland, the North Sea and Scotian Margin.

Foraminiferal assemblages from the same locations provide biostratigraphic and palaeoenvironmental data adequate for comparison with palynological results. The benthic assemblages consist of a diverse Deep-Water Agglutinated Foraminiferal (DWAF) fauna, with rare calcareous benthic and planktonic foraminifera. The DWAF *Uvigerinammina jankoi*-*Caudammina gigantea* Concurrent Zone and the *C. gigantea* Zone are recognized in the studied wells. A reduction in the proportion of tubular DWAF near the top of the Upper Cretaceous unit indicates bathymetric shallowing beneath the K-Pg hiatus in the SW Barents Sea.

The recorded dinoflagellate cyst assemblages suggest neritic to oceanic palaeoenvironments, though fresh-water run-off may have caused local reductions in salinity, possibly resulting in specific dinoflagellate response. The abundance of dinocysts is significantly lower in Maastrichtian sediment and the species are consistent with high latitude types. This may be related to cooler sea-surface temperatures and/or brackish water impact, which is in accord with diminished planktonic foraminiferal assemblages. Dinoflagellate acmes are a good marker horizons on both regional and local scales. An increased abundance of a new species, *Heterosphaeridium bellii*, indicates the Late Campanian and is thought to reflect changes in the palaeoenvironment, suggesting varying degrees of reduced salinity.

1124 - Biostratigraphy of the Late Albian - Cenomanian (Sarvak Formation) in the Borujen area south west of Iran

*Soradeghi Sufiani Hassan*¹, Vaziri Moghaddam Hossein²

N.I.O.C Surface Geology Tehran-Iran¹ Isfahan University Geology Isfahan-Iran²

In order to micropaleontological investigation of the Sarvak Formation, a stratigraphic section in Sabzekuh syncline (S.W. of Borujen) that is located in the S.W. Iran, was studied. In this area Sarvak Formation is a carbonate succession with 243 m. thickness. This succession dominantly consists of limestone interbedded with dolomite and rarely marly limestone. The Sarvak Formation overlies conformably the Kazhdumi Formation and is disconformably underlain by the Gurpi Formation.

The underlying lagoonal to tidal limestone of lower unit of the Sarvak Formation includes *Orbitolina* cf. *conica*, *Taberina* sp., *Chrysalidina* *gradata*, *Orbitolina* cf. *concava*, *Cuneolina* *pavonia*, *Nummuloculina* *heimi*, *Nezzazata* *simplex*, *Biconcava* *bentori*, *Trocholina* cf. *intermedia*, *Trocholina* *altispira*, *Nezzazata* *conica*, *Ovalveolina* sp., *Nezzazata* *gyra*. Foraminifers indicating the Late Albian – Early Cenomanian.

The upper Barrier, Open marine and lagoonal depositions containing *Ovalveolina* *crassa*, *Dicyclina* *schlumbergeri*, *Praealveolina* *brevis*, *Nummuloculina* *regularis*, *Multispirina* *iranensis*, *Cyclodoma* *iranica*, *Coxites* *zubairensis*, *Praesorites* sp., *Chrysalidina* *decorata*, *Pseudochrysalidina* *arabica*, *Nummofallotia* *apula*, *Daxia* *cenomana*, *Tabrina* *bingistani*, *Dictyoconus* *pachymarginalis*, *Pseudolituonella* *reicheli*, *Murgeina* *apula*, *Reticulinella* *reichli*, *Nezzazatinella* *picardi*, *Nezzazata* *gyra*, *Cuneolina* *pavonia*, *Cisalveolina* sp. foraminifers. Based on chronostratigraphic value of identified taxa, the Middel to the Late Cenomanian was ascribed to upper unit of Sarvak Formation.

This recorded foraminifer assemblage, obtained both lower and upper units allows us to assign the Late Albian – Cenomanian age for the Sarvak Formation in study area.

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FOREMINIFERA

1131 - Foraminifera from Berriasian to Upper Hauterivian Sediments of Kurilovo Area Eastern Serbia

*Polavderr Svetlana*¹

Faculty of ecology and environmental protection Geology Belgrade-Serbia ¹

Foraminifera, excluding orbitolinids, are described from the Lower Cretaceous shallowwater

Berriasian-Upper Hauterivian sediments of the Kurilovo anticline western flank, eastern Serbian, Carpathian-Balkan Arc. Stratigraphical units, dated on the basis of micropalontological analyses (thin-sections), conformable over the limestones bearing *Clypeina jurassica* are:

1. Lower Berriasian sediments, mudstones, peloidal, partly dolomitised and fenestral limestones of sub to supratidal environments containing few foraminifers (*Belorusiella* sp., *Rectocyclammina* sp.) and dasycladacean fragments, and scarce gastropods and bivalvian fragments.
2. Upper Berriasian through the Hauterivian (assuming the ?Upper Valanginian- Lower Hauterivian gap). The lowermost Upper Berriasian algal-foraminiferal limestones are a clear evidence of a notable facial discontinuity. In addition to algal association (*Zergrabiella*, *Rajkaella*), the limestones contain an abundance of foraminifers known also from post-Berriasian sediments. Wackestone with gastropods and less fenestral limestone are two constituents, along with the prevailing packstone in the lower unit. The association of foraminifers includes: *Pseudocyclammina lituus**, *Torinosuella peneropliformis*, *Charentia cuvillieri**, *Mayncina bulgarica**, *Nautiloculina cretacea**, *N. oolithica**, *Earlandia? conradi**, *Torremiroella hispanica*, *Haplopragmoides joukowski*, *Protopeneroplis tronchangelata*, *Pfenderina* cf. *neocomiensis*, *Freixialina planispiralis**, *Pseudolituonella gavonensis**, *Vercorsella* sp.*, abundant trocholinae, miliolids, and other small benthic foraminifers. The upper part of this succession, respectively Upper Hauterivian (mudstone, packstone-grainstone), abounds in orbitolinids (in press) along with the more or less the same paleontological content. The rich assemblage of foraminifers presented in this paper has a vast distribution in shallow-water sedimentary units of the Tethys. (*The species are also found in the Upper Hauterivian)

CALCREOUS NANNOFOSSILS, PLANKTONIC FORAMINIFERA AND GLOBAL BIO EVENTS

1220 - Palaeoenvironmental significance of Turonian boreal calcareous dinoflagellate cyst assemblages (NW Germany Lower Saxony)

Zobel Kerstin ¹, Keupp Helmut ¹, *Wiese Frank* ²

Freie Universität Berlin, Fachbereich Geowissenschaften Fachrichtung Paläontologie Berlin-Germany ¹ Georg-August University CRC Geobiology, Geoscientific Center Göttingen-Germany ²

Calcareous dinoflagellate cysts (c-dinocysts) are excellent palaeoenvironmental proxies, e.g., for proximity trends, salinity or temperature changes. Although c-dinocysts occur abundantly in Turonian strata of NW Germany, their potential for palaeoecological and palaeoceanographical analyses is unexploited. From the Upper Turonian Salder-Formation (NW Germany), 97 samples from 60 m thick massively bedded limestones with intercalated marl intervals were investigated. Ca. 7000 c-dinocysts were taxonomically classified and ca. 12.000 cysts diameter and wall thickness measurements were done. Dominant is the taxon Pithonelloideae (no paratabulation). Pithonella sphaerica, Pithonella ovalis and Pithonella spiralis n. sp. (in prep.) are most abundant (97-98%), ranging from 68 to 28µm in diameter. Normandia circumperforata, Pithonella cardiiformis, Pithonella discoidea, Pirumella edgarii and Obliquipithonella loeblichii occur accessorially. Only eight species in total indicate a low diversity assemblage. This is interpreted to reflect surface water nutrient depletion (analogue to modern systems: N-depletion) and is in accordance with the distant position of the working area in midst of the European shelf in relation the land areas (no riverine nutrient input) or the shelf break (no upwelling). Variations in morphology, abundance and diversity served a palaeoecologic analysis. Towards the limestones, P. spiralis is most abundant while P. ovalis and P. sphaerica decrease in number. Obliquipithonelloidea (diameter 62-75µm) dominate in marl seams, and the Pithonelloidea lack. In The large quantity of Pithonella spiralis and the dominance of spherical over oval morphotypes in general indicates pelagic settings. Wall thickness shows also variations: from the base of the section (marls seam ME) on, wall thickness decreases into the limestones both in oval and spherical morphs, and wall thickness variations are detached from cysts size. This might be the expression of a progressive world-wide late Turonian cooling. However, the interpretation only started, and a relation to sea-level triggered environmental perturbations in the form of increased water turbulence along submarine highs during lowering sea-level needs to be elaborated. In general, there is a clear trend towards a severe decrease of c-dinocyst abundance in marlier intervals, and in some marl intervals, c-dinocysts lack at all, while in the limestones, c-dinocysts can be very common. The positive correlation of c-dinocysts abundance and CaCO₃ content suggests that marlier intervals might have been result of breakdown of the carbonate factory. Thus, the calcareous biosedimentary system is rather productivity-triggered and not driven by dilution through siliciclastic input.

1169 - Nannofossil events around the Santonian-Campanian boundary and in the Upper Campanian of the northwestern Tethys (Austria)

Wagreich Michael ¹

University of Vienna Department of Geodynamics and Sedimentology Vienna-Austria ¹

Sections in the Austrian part (Northern Calcareous Alps and Ultrahelvetetic units) of the northwestern Tethys record Late Cretaceous bioevents within neritic to bathyal environments. Correlations of biostratigraphic events, especially calcareous nannoplankton and planktonic foraminifera, to macrofossils and isotope chemostratigraphy are possible. The Santonian–Campanian boundary interval was investigated in several sections. The crinoid Marsupites laevigatus (uppermost Santonian) has been found together with ammonites and inoceramids. Globotruncanites elevata has its first (local) appearance, and indicates the asymetrica–elevata planktonic foraminifer concurrent range zone. Nannofossils give evidence for standard zone CC17 and UC12-13, with Arkhangelskiella cf. cymbiformis occurring already in the Upper Santonian. The first occurrence of the nannofossil Broinsonia parca parca, which defines the base of standard zones CC18/UC14 is an early Campanian event. The nannofossil event closest to the inferred boundary is the first common occurrence of curved Lucianorhabdus cayeuxii. In the Upper Campanian, the base of zone CC22 - UC15dTP, defined by the first occurrence of Uniplanarius trifidus, correlates to the first occurrence of Radotruncana calcarata (base of the calcarata planktonic foraminifer Zone). This combined nannofossil and planktonic foraminifer event is situated above a mid-Campanian carbon isotope event and below the Late Campanian event, a significant negative carbon isotope excursion in the upper part of nannofossil zone CC22-23a.

CALCAREOUS NANNOFOSSILS, PLANKTONIC FORAMINIFERA AND GLOBAL BIO EVENTS

1230 - Quantitative analysis and shell size of Early Aptian planktonic foraminifera across the Selli Level (Cismon core Southern Alps Italy) and comparison with calcareous nannoplankton data

*Barchetta Alessia*¹, Petrizzo Maria Rose¹, Bottini Cinzia¹, Erba Elisabetta¹

Università degli Studi di Milano Scienze della Terra "A. Desio" Milano-Italy¹

The Selli Level (Early Aptian) is a regional marker-bed consisting of laminated black shales rich in organic matter, alternated with radiolarian silts and with a poor carbonate content. It is regarded as the sedimentary expression of the OAE1a (Oceanic Anoxic Event 1a) and is marked by a $\delta^{13}\text{C}$ anomaly, consisting of a pronounced negative shift followed by a long positive excursion. Planktonic foraminifera were studied in the 24 m-thick stratigraphic interval containing the Selli Level from the Cismon core (southern Alps, Italy) to obtain a quantitative documentation in terms of assemblage composition, diversity, abundance and variation of shell size. The planktonic foraminiferal assemblage throughout the interval is rather diverse and mainly composed by pseudo-planispiral with elongate chambers and ampullae (gen. *Leupoldina*), planispiral with globular and elongate chambers (gen. *Globigerinelloides* s.l.) and trochospiral taxa with globular (gen. *Hedbergella* and gen. *Gorbachikella*) and elongate chambers (gen. *Lilliputianella*).

Foraminiferal quantitative and morphometric analyses were conducted on washed residues and thin sections. Species richness and shell size measurements on selected species were performed on washed residues, and absolute abundances were obtained from thin sections. Preliminary results allow the subdivision in 3 intervals (below, within and above the Selli Level) each of them characterized by minor to major changes in species richness and specimen abundance. Planktonic foraminifera are common and diversified below the Selli Level being the assemblage composed by hedbergellids, few leupoldinids and globigerinelloids. A similar composition in terms of species richness is recorded within the Selli Level, whereas specimens abundance show a marked decline. The planktonic foraminiferal assemblage above the Selli is characterised by the occurrence of common hedbergellids, clavate hedbergellids, leupoldinids and both globular and elongate globigerinelloids. An increase in shell size of the planispiral taxa is also observed.

Comparison with calcareous nannoplankton abundance data highlights significant similarities such as the decline of both calcareous nannoplankton and planktonic foraminifera at the onset of OEA1a.

1160 - Upper Albian Maastrichtian calcareous plankton biostratigraphy and magnetostratigraphy of the classical Tethyan Gubbio section (Italy)

Coccioni Rodolfo¹, Premoli Silva Isabella²

Università degli Studi di Urbino DiSTeVA Urbino-Italy¹ Università degli Studi di Milano "Ardito Desio" Dipartimento di Scienze della Terra Ardito Desio Milano-Italy²

The Tethyan pelagic sections at Bottaccione and Contessa Highway (Gubbio, Italy) are internationally recognized to be the standard reference sections for the Late Cretaceous to Eocene geomagnetic polarity time scale calibrated to the integrated planktonic foraminiferal and calcareous nannofossil biostratigraphy. Due to the presence of a gap within Chron C31n in the Bottaccione section, we use two distinct portions of these sections to construct an upper Albian-Maastrichtian complete and well-preserved composite stratigraphic record, 333.1 m in thickness

and ~37 Myr in duration. A refined magnetostratigraphy and planktonic foraminiferal and calcareous nannofossil biostratigraphy is here presented for this stratigraphic succession. Our magnetostratigraphic framework, which includes the lowest occurrence (LO) of *Thalmanninella*

globotruncanoides defining the Albian/Cenomanian boundary, the LO of *Globotruncana aegyptiaca* occurring earlier than previously recognized, the highest occurrence of *Gansserina gansseri* and the LO of *Plummerita hantkeninoides* that allow subdivision of the latest Maastrichtian into the *Pseudoguembelina hariaensis*, *Pseudotextularia elegans* and *Plummerita*

hantkeninoides planktonic foraminiferal Zones, and the well-constrained and complete pattern of the evolutionary origin of *Racemiguembelina fructicosa* from *Pseudotextularia elegans* through *Pseudotextularia intermedia* and *Racemiguembelina powelli*, may improve reliability of Late Cretaceous correlations at low to middle latitude as well as paleoenvironmental, paleoclimatic and paleoceanographic interpretations.

CALCAREOUS NANNOFOSSILS, PLAKTONIC FORAMINIFERA AND GLOBAL BIO EVENTS

1236 - Ecologic control on the development of meridional ornamentation in the planktonic foraminiferal genus *Rugoglobigerina* (Late Cretaceous) and implications for taxonomy

Falzone Francesca ¹, *Petrizzo Maria Rose* ¹, Huber Brian T. ², MacLeod Kenneth G. ³

Università degli Studi di Milano Dipartimento di Scienze della Terra A. Desio Milan-Italy ¹ Smithsonian National Museum of Natural History Department of Paleobiology Washington, D.C.-United States ² University of Missouri Department of Geological Sciences Columbia, Missouri-United States ³

The wall ornamentation in Cretaceous planktonic foraminifera has been considered genetically controlled and taxonomically significant in analogy with Cenozoic taxa. For instance, the development of the meridional ornamentation is a diagnostic criterion used to discriminate the Late Cretaceous genera *Costellagerina* and *Rugoglobigerina*. Although some authors noted that the development of meridional ornamentation decreases poleward and could be ecologically controlled, this hypothesis was rejected for absence of evidence. Our study based on *Rugoglobigerina* specimens recovered at three mid-low latitude localities (Exmouth Plateau, Indian Ocean; Shatsky Rise, Pacific Ocean; Eratosthenes Seamount, Mediterranean Sea) confirms that the development of the meridional ornamentation is variable throughout the geographic and stratigraphic distribution of the genus. Stable isotope ($\delta^{13}\text{C}$ and $\delta^{18}\text{O}$) analyses indicate that specimens showing a more developed meridional ornamentation always yield higher $\delta^{13}\text{C}$ values than co-occurring less ornamented morphotypes and we interpret these data to indicate an ecologic/metabolic control regulating the development of the meridional ornamentation. Moreover, we highlight the difficulty in discriminating between *Rugoglobigerina*, *Costellagerina* and *Archaeoglobigerina* at mid-high latitudes, where species show identical shell morphology and ornamentation. Our study challenges the assumption that the external features of the wall represent reliable criteria for the taxonomic discrimination of Cretaceous planktonic foraminifera.

1258 - Multivariate Analyses of the Campanian-Maastrichtian Planktonic Foraminiferal Assemblages of Kokaksu Section (Bartın Nw Turkey)

Güray Alev ¹, Atakul-Özdemir A. ², Özkan-Altınır S. ³

TPAO Stratigraphy Department, Research Center Ankara-Turkey ¹ Ministry of Energy and Natural Resources General Directorate of Mining Affairs Ankara- ² Middle East Technical University Department of Geological Engineering Ankara- ³

Two different planktonic foraminiferal zonal schemes have been established within the Upper Campanian-Maastrichtian deposits of the Kokaksu Section (Bartın, NW Turkey) by Güray and Özkan-Altınır (2009). The standard globotruncanid biozones including the late Campanian Globotruncana aegyptiaca Zone, the latest Campanian-middle Maastrichtian Gansserina gansseri Zone and the late Maastrichtian Abathomphalus mayaroensis Zone was correlated with the heterohelical biozonation that comprises late Campanian Pseudotextularia elegans Zone, early Maastrichtian Planoglobulina acervulinoides Zone, middle Maastrichtian Racemiguembelina fructifera Zone and late Maastrichtian Pseudoguembelina hariensis Zone. Moreover, The Campanian-Maastrichtian boundary has been delineated by the first appearance of Contusotruncana contusa coinciding with the base of Planoglobulina acervulinoides heterohelical biozone.

Considering the responses of planktonic foraminifera to paleoenvironmental conditions, the assemblages of Upper Campanian-Maastrichtian sequence of the Kokaksu Section have been examined quantitatively. A data set comprising 58 species belonging to 16 genera recorded along the studied section has been subjected to cluster, R- and Q-mode, and ordination analyses, DCA. To figure out precisely the linkage between them, several multivariate techniques have been applied by the use of different similarity coefficients and clustering methods. The results obtained from the Q-mode cluster analysis and DCA reveals two distinct groups reflecting Campanian and Maastrichtian planktonic foraminiferal occurrences. The R cluster analyses resulted different foraminiferal assemblages reflecting different environmental conditions such as oligotrophic conditions for Campanian-early Maastrichtian and more eutrophic conditions for late Maastrichtian

CALCAREOUS NANNOFOSSILS, PLAKTONIC FORAMINIFERA AND GLOBAL BIO EVENTS

1233 - The Coniacian-Santonian calcareous plankton and carbon isotope record in Tanzania and implications for regional and global correlations

*Petrizzo Maria Rose*¹, MacLeod Kenneth G.², Huber Brian T.³, Falzoni Francesca¹, Lees Jacqueline A.⁴, Erba Elisabetta¹, Russo Fabio¹

Università degli Studi di Milano Dipartimento di Scienze della Terra "A. Desio" Milan-Italy¹ University of Missouri Department of Geological Sciences Columbia, Missouri-United States² Smithsonian National Museum of Natural History Department of Paleobiology Washington, D.C.-United States³ University College London Department of Earth Sciences London-United Kingdom⁴

A 100-m-thick, stratigraphically complete Coniacian-Santonian sequence, drilled for the first time in 2009 in Tanzania, provides one of the world's best records of calcareous plankton evolution during this time interval. Planktonic foraminifera and calcareous nannofossils are highly diversified and well preserved at site TDP 39 and, therefore, are particularly suitable for documenting and integrating the stratigraphic occurrences of marker species. Better testing of the relative reliability of the planktonic foraminifera, calcareous nannofossils, and carbon isotopic events used in the Coniacian-Santonian interval is still needed throughout tropics and subtropics, as expanded sections of this age are rarely recovered. Accurate biostratigraphy and correlation using calcareous plankton biozonation schemes as well as integration and calibration with other events, depends on the reproducibility of the data (= sequence of events) in different stratigraphic sections even when the sections are located in the same paleogeographic region. Related problems concern taxonomic inconsistencies between regions and different species concepts among workers.

In this study bio- and chemostratigraphic events observed in Tanzania are compared with those documented across the Coniacian-Santonian transition in the Cantera de Margas quarry section (Olazagutia, northern Spain), the Global Stratotype Section and Point for the base of the Santonian Stage, and with published records from Texas and Italy. Results highlight the reproducibility of a sequence of some biostratigraphic events (e.g., base occurrences of *Pseudotextularia nuttalli*, *Dicarinella asymetrica*, *Lithastrinus grillii*, *Globotruncana linneiana*, *Sigalia carpatica*), whereas uncertainties reign in the correlation of the isotopic events among localities.

1185 - Planktonic foraminifera and calcareous nannoplankton content of the Maastrichtian pelagic deposits of Hekimhan area (Malatya Basin Eastern Anatolia)

*Sarı Bilal*¹, Yıldız Ayşegül², Korkmaz Taner³, Petrizzo Maria Rose⁴

Dokuz Eylül University Geological Engineering İzmir-Turkey¹ Aksaray University Geological Engineering Aksaray-Turkey² Muğla Sıtkı Koçman University Geological Engineering Muğla-Turkey³ University of Milan Department of Earth Sciences Milan-Italy⁴

The uppermost Cretaceous (Maastrichtian) pelagic successions from Hakimhan area of the Malatya Basin (Eastern Anatolia) were studied by 688 samples, which were collected through five stratigraphic sections. The pelagic deposits conformably overlie rudist bearing shallow-water limestones and are overlain conformably by Maastrichtian dolomites and unconformably by Eocene deposits respectively.

The pelagic successions in Hekimhan area comprise Kösehasan Formation at the base and Zorbehan Formation at the top and reach up to 1100 m. The Kösehasan Formation rests over the neritic rudist-bearing limestones of the Güzelyurt Formation along a sharp contact and consists mainly of flysch-type sandstone-mudstone alternation with complete and partial Bouma sequences. Carbonate content of abundant planktonic foraminifera and nannoplankton-bearing 980-m-thick succession increases upwards and the formation passes gradually to the clayey limestones and marls of the Zorbehan Formation to the top. Occurrences of nannoplanktons *Lithraphidites quadratus* Bramlette and Martini and *Micula praemurus* (Bukry) in the first beds of the Kösehasan Formation indicate that the age of the Kösehasan Formation and overlying Zorbehan Formation is of late Maastrichtian. Another late Maastrichtian taxon *Cribrosphaerella daniae* Perch-Nielsen is observed from the lowermost part of the succession. Maastrichtian planktonic foraminifera such as *Contusotruncana walfischensis* (Todd) and *Globotruncanites pettersi* (Gandolfi) were recorded through the successions. Although planktonic foraminifera are diverse and abundant particularly in the Kösehasan Formation, index Late Maastrichtian species were not encountered. Campanian planktonic foraminifera (e.g. *Radotruncana calcarata* (Cushman), *Globotruncanites elevata* (Brotzen) etc.) obtained particularly from the lower part of the succession should have been transported from older strata. Trace fossils are common throughout the succession.

CALCREOUS NANNOFOSSILS, PLAKTONIC FORAMINIFERA AND GLOBAL BIO EVENTS

Rareness of planktonic foraminifera and nannoplanktons in the uppermost part of the succession (Zorbehan Formation) indicates shallowness of the latest Maastrichtian sea in this part of the basin. Rare echinoids, bivalves and ammonites are observed in that part of the sequence.

The obtained data indicate that sedimentation rate of the pelagic deposits is about 36.67 cm/ky for this part of the basin.

This study was financially supported by a TÜBİTAK Grant no. 109Y035.

1076 - High resolution assessment of Late Campanian (*Radotruncana calcarata* zone) foraminifera communities

Wolfgring Erik¹, Wagreich Michael¹

Universität Wien Department of Geodynamics and Sedimentology Vienna-Austria¹

The pelagic Postalm section in the Northern Calcareous Alps (Austria) has been subject of intense investigation during the past years. With the construction of a mountain road, an outcrop depicting a complete succession of Santonian to Maastrichtian sediment has become accessible and has in the following undergone detailed stratigraphic investigation.

This study focuses on plankton biostratigraphy of the *Radotruncana* (*Globotruncana*) *calcarata* total range zone. Over 66 samples have been examined for foraminifera aiming at a high resolution assessment of the assemblages present. Combining these results to cyclostratigraphic and geochemical data might provide additional information on the palaeoecology and could lead to an accurate reconstruction of the palaeoenvironment.

Quantitative analyses show typical Late Campanian foraminifera communities. The assemblages are dominated by members of the genus *Hedbergella* and small (> 125µm) members of *Heterohelix*. *Globotruncanids* observed only represent ca. 25 percent, including the genera *Radotruncana*, *Globotruncana*, *Globotruncanella*, *Globotruncanita* and *Contusotruncana*. Benthic taxa occur in varying numbers, but are present in every sample.

Observed long-term as well as sudden changes in foraminifera abundances or assemblage types could be influenced by orbital cyclicity and associated environmental changes and thus offer the possibility to correlate them to the previously established cyclostratigraphic model.

1123 - Biostratigraphy and Chronostratigraphy of the Gurpi Formation based on Planktonic Foraminifera in Kaavar Section Southwest of Iran

Hemmatinasab Meysam¹

University of Tehran Geology Tehran-Iran¹

The Gurpi Formation was studied in Kaavar Section, southwest of Iran, in order to assign time framework and chronostratigraphic boundaries by using isolated planktonic foraminifera. The formation consists of 213m marl with intercalations of limy marl and two formal members of Seymareh (*Lopha*) and Emam-Hasan.

Here on the basis of foraminiferal studies, 100 species belonging to 31 genera of planktonic foraminifera were identified. The Gurpi Formation was divided to 11 biozone as follows on the basis of planktonic foraminifera which are almost cosmopolitan: 1-*Globotruncana ventricosa* 2-*Radotruncana calcarata* 3-*Globotruncanita stuartiformis* 4-*Globotruncana aegyptiaca* 5-*Gansserina gansseri* 6-*Contusotruncana contusa* 7-*Abathomphalus mayaroensis* 8-*Pseudoguembelina hariaensis* 9-*Praemurica uncinata* 10-*Morozovella angulata* 11-*Globanomalina pseudomenardii*. The formation was deposited from middle Campanian through late Paleocene according to the planktonic foraminifera recorded. Concurrence of late Cretaceous and Paleocene index species and absence of *Plummerita hantkeninoides*, zone P0, P_a and P1, formation of hardground, existence of bioturbation, ichnofossils, glauconitic and phosphatic particle in last Maastrichtian sediments, confirm a hiatus in Cretaceous-Paleogene boundary.

Acknowledgements

Acknowledgement is given to The Research & Development of National Iranian Oil Company for financial support. The early stage of this research, including the field work, was funded by NIOC Exploration Directorate.

CALCAREOUS NANNOFOSSILS, PLANKTONIC FORAMINIFERA AND GLOBAL BIO EVENTS

1153 - Biostratigraphical and paleoecological studies of the Upper Campanian to Lower Eocene succession in North-eastern part of El Quss Abu Said plateau Farafra Oasis Western Desert Egypt

*Dakrory Ahmed*¹, Al Salameen Muna¹

PAAET, College of Basic Education, Science Dept. science Kuwait-Kuwait¹

In order to construct the biostratigraphical and paleoecological significances of the Upper Campanina to Lower Eocene succession in Farafra area, two sections were selected for planktonic and benthonic foraminiferal investigations as well as paleoecological significances in Northern Gunna (G), and El Guss Abu Said (S). Lithostratigraphically, four rock-units have been distinguished and arranged from base to top as: Khoman Chalk (Upper Campanian to Lower Paleocene), Dakhla shale (Paleocene), Tarawan Chalk (Paleocene), and Esna Shale (Upper Paleocene to Lower Eocene). Biostratigraphically, 15 planktic foraminiferal zones were recorded; 8 zones for Camp-Maastr (cf8a to cf2) and 7 zones for Paleocene-Eocene successions with equivalent three benthic foraminiferal ones (*Orthokarstenia oveyi* of Late Campanian to Late Maastrichtian; *Loxostomum applinae* of Early Paleocene; *Eponides lotus* of Late Paleocene to early Eocene) were recognized.

Clustering analysis of some selected studied taxa at the studied sections reflected middle - outer shelf to upper bathyal environment at the Late Campanian to the Late Maastrichtian times, as indicated by the presence of deep sea fauna (*Neoflabellina rugosa*, *Stensioeina Americana*), these conditions were followed by a relative fluctuation in the sea level in the Early to Late Paleocene times. A sharp deepening of the sea has become predominant just at the beginning of the early Eocene followed by middle shelf environment and finally by shallowing event as indicated by the presence of macrofauna and arenaceous forams.

1053 - Coniacian-Campanian planktonic foraminiferal biostratigraphy of the northwestern Tunisia

*Elamri Zeineb*¹, Zaghib-Turki Dalila¹

Faculty of sciences, University ElManar, Tunis Geology Kasserine-Tunisia¹

To establish a biostratigraphic study we have chosen two sections in northwestern Tunisia especially in Ellès and in El Kef regions where lithologically the series is composed in part by Kef formation and Abiod formation. Samples collected present a good preservation of microfossils providing an excellent setting to study planktonic foraminiferal distribution. Based on trochospiral forms, seven planktonic foraminiferal zones are recognized by their index species. From the base to the top, they are *Dicarinella primitiva* Interval Zone, *Dicarinella concavata* Interval Zone, *Dicarinella asymetrica* Total Range Zone, *Globotruncanella elevata*/*Globotruncanella arca* Concurrent Range Zone, *Globotruncanella ventricosa* Interval Zone, *Globotruncanella calcarata* Total Range Zone and *Globotruncanella falsostuarta* Partial Range Zone.

Besides, large heterohelicids provide a supplementary practical biozonation which may be correlated with that based on globotruncanids. So, six successive biozones are recognized. From the base to the top they are: *Pseudotextularia nuttalli* Interval Zone, *Sigalia deflaensis* Interval Zone, *Sigalia carpatica* Total Range Zone, *Ventilabrella eggeri*/*Planoglobulina manuelensis* Concurrent Range Zone, *Gublerina acuta* Interval Zone and *Gublerina cuvillieri* Interval Zone.

Associated to the planktonic foraminifera, several Inoceramids and Ammonites may be present, allowing to discuss and correlate the relevant biohorizons and to refine the Coniacian/Santonian and Santonian/Campanian boundaries.

1143 - Planktonic foraminiferal bioevents recorded across the Campanian-Maastrichtian boundary in central and northern Tunisia

*Zaghib-Turki Dalila*¹, Saïdi Ezeddine², Gallala Njoud³, El Amri Zeineb⁴

University of Tunis El Manar Geology Tunis-Tunisia¹ ETAP Petroeium exploration Tunis-Tunisia² Institut supérieur de Théologie Tunis-Tunisia³ Institut supérieur des arts et métiers Kasserine-Tunisia⁴

The planktonic foraminiferal distribution within the Campanian-Maastrichtian transition interval is detailed in several sections located in the southern Tethyan margin, especially in central Tunisia (i.e., Necham Wadi section near Kalâat Senan town, Ed Dam section near the Ellès village) and northern Tunisia (i.e., El Melah section near Sejnène village). Based on a high resolution sampling and accurate biostratigraphy analysis the C/M boundary within this interval is specified. Therefore, two types of biozonation are herein proposed and correlated and then compared

CALCAREOUS NANNOFOSSILS, PLANKTONIC FORAMINIFERA AND GLOBAL BIO EVENTS

to other biozonations previously recommended for other regions. The first is based only on *Rugoglobigerina* representatives (*Rugoglobigerina rotundata* subzone, *Rugoglobigerina scotti* subzone). The second is based on Heterohellicids (*Gublerina cuvillieri* subzone, *Planoglobulina acervulinoides* subzone). Besides, a planktonic foraminiferal semiquantitative analysis is realised in order to detect bioevents, faunal turnover features which may be related to palaeoenvironmental fluctuations in the studied area and global sea level changes. Consequently, the studied sections, less abundant in Ammonites but more abundant in planktonic foraminifera than the Tercis-les Bains section (GSSP for the C/M boundary) located in the northern Tethyan margin, provide complementary information. They may be considered as auxiliary sections for the C/M boundary.

CARBONATE PLATFORMS RUDIST BIOMINERALS

1130 - Depositional geometries in the Urgonian limestone (late Barremian-early Aptian) of the Helvetic Alps a geochemical and sequence stratigraphic correlation

*Bonvallet Lucie*¹, Godet Alexis², Spangenberg Jorge E.¹, Arnaud Vanneau Annie³, Adatte Thierry¹, Föllmi Karl B.¹
 University of Lausanne Institute of Earth Sciences Lausanne-Switzerland¹ The University of Texas at San Antonio
 Department of Geological Sciences TX-78249 San Antonio-United States² Association Dolomieu FR-38000
 Grenoble-France³

The Early Cretaceous is characterized by large fluctuations in nutrient supply, which influenced the development of the Helvetic carbonate platform. This platform was especially vulnerable, because of its position at 30°N and its attachment to the central-European continent. During the Barremian–Aptian, the carbonate factory on this platform changed from a drowned state to a heterozoan and finally a photozoan mode, expressed by the Urgonian limestone. This evolution was likely linked with a morphological change of the carbonate platform, from a ramp-like (early Barremian) to a distally-steepened platform (late Barremian and early Aptian).

In this study, both the paleoenvironmental conditions leading to and the timing of these changes, as well as the resulting depositional geometries are analyzed in order to better constrain the evolution of the platform and its morphology. A selection of representative sections was studied with geochemical and sedimentological tools. Carbon and oxygen isotopes and phosphorus contents were measured and a sequence stratigraphic framework based on the study of microfacies and biostratigraphy was established. In eastern Switzerland, a proximal-distal transect supports a morphological change through time. In central Switzerland, evidence for gravity-flow deposition during the phase of photozoan platform build up and build out was found.

1125 - The rise of the Urgonian platform during the late Barremian early Aptian An integrated stratigraphic approach

*Godet Alexis*¹, Adatte Thierry², Arnaud Vanneau Annie³, Arnaud Hubert³, Bastide Fanny², Bodin Stéphane⁴,
 Bonvallet Lucie², Föllmi Karl B.²

The University of Texas at San Antonio Department of Geological Sciences San Antonio-United States¹ University
 of Lausanne Institute of Earth Sciences Lausanne-Switzerland² Association Dolomieu Grenoble-France³ Ruhr-
 Universität Bochum Institute for Geology, Mineralogy and Geophysics Bochum-Germany⁴

During the Early Cretaceous, the Urgonian limestone was deposited in a widespread carbonate platform belonging to the northern Tethyan margin. The timing of its rise is still strongly debated, and is hampered by the lack of adequate biostratigraphic data, the incompleteness of the stratigraphic record, and the potential diagenetic resetting of original chemical signatures. A new set of sedimentological and geochemical information is addressing this issue.

Biostratigraphy is used to date key surfaces of the sequence stratigraphic framework developed in the Vercors and Swiss Jura, where subaerial exposure and potential hiati are evidenced. When possible, it has been complemented by Strontium isotope stratigraphy. In this latter area, a late Barremian age is thus deduced for the rise of the Urgonian platform.

Palaeoenvironmental considerations may help in locally refining this dating: in the Helvetic Alps, a late Hauterivian – early Barremian drowning phase is characterized by phosphogenesis and condensation. It was triggered by a humid climate and mesotrophic conditions that are unfavourable for photozoan ecosystems. Thoughtful consideration of carbonate palaeoecology thus ensures an improved and robust integration of the Urgonian platform within the complex palaeoceanographic framework of the Early Cretaceous.

1225 - Regionally correlatable *Thalassinoides* bioturbated beds in the Late Cenomanian of southern Italy carbonate platforms.

*Parente Mariano*¹, Iannace Alessandro¹, Firjia Gianluca²

University of Naples Federico II, DiSTAR, Napoli-Italy¹ University of Potsdam, Institut für Erd- und
 Umweltwissenschaften, Potsdam-Germany²

The idea of time-specific facies (TSFs), complementing the generally accepted text-book concept of time-transgressive facies, has recently re-gained attention in the community of sedimentary geologists. In this work we discuss a case-history represented by a package of beds of *Thalassinoides*-bioturbated dolomitic limestones

CARBONATE PLATFORMS RUDIST BIOMINERALS

that can be demonstrated, by means of biostratigraphy and chemostratigraphy (carbon and strontium isotope stratigraphy), to be isochronous over a (present-day) distance of more than 200 km, from the Apennine Platform to the Apulian Platform of southern Italy.

The most interesting character of these *Thalassinoides*-beds, besides their synchronous occurrence over a wide area, is the selective dolomitization of the burrow infilling. We try to explain both these peculiarities by comparing in detail the stratigraphy, sedimentology and geochemistry of the bioturbated beds at different locations. Then, we zoom out, making a comparative analysis of facies that are strictly coeval and have very similar fossil associations but lack the selectively dolomitized *Thalassinoides* burrows. Further zooming out, across geological time, we compare the Late Cenomanian *Thalassinoides*-beds with almost identical facies (i.e. shallow-water limestones with selectively dolomitized *Thalassinoides* burrows) occurring at different stratigraphic levels in the Apennine carbonate platform (around the Barremian-Aptian boundary and in the earliest Campanian). Finally, with a further zooming-out, we make a comparison with very similar regionally to supra-regionally correlatable selectively dolomitized burrow-mottled limestones of Ordovician age, which have been extensively discussed in the geologic literature.

1092 - Sustained changes of carbonate platform facies in conjunction with the arrival of nutrients and clastic (Barremian-Aptian carbonate platform – the Urgonian platform south-east France)

Arnaud Vanneau Annie¹, Adatte Thierry², Bastide Fanny², Bonvallet Lucie², Godet Alexis², Arnaud Hubert¹, Föllmi Karl B.²

Association Dolomieu Geology Grenoble-France¹ Institute of Earth Sciences, University of Lausanne Geology Lausanne-Switzerland²

Urgonian limestones were deposited on a shallow water carbonate platform during the Barremian-Early Aptian time. Sustained facies changes are related to two main ecological factors: arrival of detrital grains and nutrient. Three types of environments can be distinguished.

1 – Environments with very low clastic and nutrient input – oligotrophic to mesotrophic conditions. Rudists and miliolids were dominant in inner lagoon deposits and bioclastic coarse sand on the platform edge.

2 – Environments with clastic and nutrient input – mesotrophic conditions. Sediment are richer in clay and detrital grains. This allows the invasion of environment by orbitolina living in seagrass, abundance of dasycladales green algae, and deposition of so-called orbitolina marls.

3 – Environments with notable nutrient (phosphorus) and clastic input – mesotrophic to eutrophic conditions, organic-rich environments, sometimes dysoxic. Cyanobacteria proliferated and promoted oncolite or algal mat constructions. In an environment rich in organic matter, the suspension feeders such as annelids proliferated. Very flat orbitolina are also present in the most clayed environments, but green algae are missing.

These periods of change have lasted long enough to be recorded in isotopic and mineralogical curves. These periods are associated with a change in global climate and with seawater chemistry.

1176 - Larger foraminifera in Early Campanian shallow-water lagoonal facies of the Pyrenean Basin (NE Spain)

Caus Esmeralda¹, Frijia Gianluca², Di Lucia Mateo³, Parente Mariano⁴, Villalonga Raquel¹

Universitat autònoma de Barcelona Geologia Cerdanyola del Vallès-Spain¹ Universität Potsdam Institut für Erd- und Umweltwissenschaften Potsdam-Germany² RPS Energy Surrey-United Kingdom³ Università Federico II Dipartament Scienze della Terra Napoli-Italy⁴

The distribution of larger foraminifera in sedimentary rocks is controlled by two main factors: palaeoenvironment and age. As similar environmental conditions recurred several times in Earth history, the assemblages of larger foraminifera also repeated more or less similar shell shapes and structures through time. Nevertheless, larger foraminifera from different time-intervals are represented by different genera and species which evolved anew analogous shell architectures under the external drive of adaptation and the internal constrain of functional morphology. Therefore, an accurate structural analysis in three dimensions is required to identify correctly the larger foraminifera at the generic and/or specific level. This is a prerequisite for high-resolution biostratigraphy and time-correlation: wrong taxonomic identifications based on misinterpretation of shell architecture lead to false age attributions.

In the present study we document the little known, and frequently misidentified, larger foraminifera from the

CARBONATE PLATFORMS RUDIST BIOMINERALS

Early Campanian carbonate platform lagoonal facies of the Pyrenean Basin. We also show how larger foraminifer distribution can contribute to understand the evolution of depositional environments through space and time. The work has been carried out in the Montsec Mountain (Lleida, NE Spain), where the Campanian carbonate platform is spectacularly exposed. Age calibration of larger foraminifer biostratigraphy is obtained through strontium isotope stratigraphy.

1115 - End of a myth there are no rudists in Brazil!

*Granier Bruno*¹, Dias-Brito Dimas²

Université de Bretagne occidentale Sciences de la terre et de l'Univers Brest Cedex 3-France ¹ Universidade Estadual Paulista IGCE-UNESPetro/DGA Rio Claro-Brazil ²

The presence or absence of rudists in mid- and upper Cretaceous limestones of the Brazilian coastal basins is an episodically recurrent issue since the 70's. The myth of Brazilian rudists probably begun with the international diffusion of "ready-made" sedimentological models for Cretaceous carbonate environments. It will be impossible to track back the exact date of the first reference to these models in Brazil because it is probably to be found in a confidential and proprietary report.

However, as early as the 80's, authors start quoting rudists in Brazil. For instance, Falkenhein et al. (1981) report "rudistids, bryozoans, corals" in their "microfacies 50" of the Macaé Formation (Macaé Group, Quissamã Formation, Albian, as nowadays considered) of the Campos basin. But their illustrations do not provide indisputable rudistid shells.

The myth gains more credibility with Granier (the first author of the present abstract), Berthou & Poignant (1991) who state that "L'affleurement des calcaires à Rudistes et des marnes de la Fazenda Cafuz [Lower-Middle Albian, Riachuelo Formation, Sergipe Basin] est (...) l'unique gisement de Rudistes connu dans les bassins atlantiques de la marge brésilienne" [the outcrop with rudistid limestones and marls at Fazenda Cafuz is the sole locality with rudists known in the Brazilian basins sited on the South Atlantic margin]. But, we have re-examined material from this locality. The so-called rudist shells are valves of *Ostrea* similar to those illustrated by Majewske (1969: Pl. 72, fig. 2) showing the "loosely fabricated latticework of foliated layers forming chambers" in the shell.

More recently, Terra et al. (2010) reported new "Ocorrência de rudistas em amostras de testemunho do Albiano inferior da Bacia de Campos" [occurrence of rudists in core samples from Lower Albian strata of the Campos Basin]. This time the illustrated material seems to be valves of *Pycnodonte*, comparable with those illustrated by Majewske (1969: Pl. 72, fig. 1), with vesicular portions. Additional sections illustrating the skeletal microstructure of *Pycnodontid* pelecypods are found in Horowitz and Potter (1971, Pl. 35, figs. 1-4).

Although recognizing a comprehensive group of Tethyan planktonic organisms in Aptian-Albian open-sea sediments from several Brazilian and African coastal basins of the northern South Atlantic ocean (northward from the São Paulo-Walvis Ridge), Dias-Brito (2000) is emphatic regarding the absence of rudistid reefs in the coeval shallow-water carbonate facies, mainly dominated by microbial structures (oncoids, ...), and suggests: In these shallow waters, high temperatures and hypersalinity excluded coral and rudistid reefs, as well as large foraminifera such as orbitolinids (...) and alveolinids. However, apart from the corals -- which are rare (but not missing) --, we have detected in the mid- and upper Cretaceous limestones of Brazil some benthic elements which are also known from the Tethys realm, such as the foraminifera *Trocholina* (aragonitic test), *Rhapydionina liburnica* (porcelaneous test) and *Nezzazatinella picardi* (agglutinated test), and a great diversity of calcareous algae (either green or red: see Granier et al., 2008, 2013a, 2013b).

In conclusion, the question of the enigmatic absence of rudists in the South Atlantic ocean during the Cretaceous is still open.

Acknowledgments

This research was supported by Petrobras and the Brazilian Petroleum National Agency, ANP (Carbonatos do Brasil Project - Rede de Sedimentologia & Estratigrafia; PRH). Thanks are also due to Paulo Tibana who gave us access to the material he collected at Fazenda Cafuz.

CARBONATE PLATFORMS RUDIST BIOMINERALS

1144 - Early Cretaceous coral biostromes from the Neuquén Basin west-central Argentina blooms of soft substrate forms developed under mixed clastic-carbonate settings

Lazo Dario Gustavo¹, Garberoglio Ricardo Miguel¹

Universidad de Buenos Aires Ciencias Geológicas-FCEN-IDEAN Buenos Aires-Argentina¹

Scleractinian corals were significant elements of Cretaceous shallow marine settings all over the world. In particular, they were especially important in the Tethys region where they form extended framework reef facies. Northern hemisphere forms have been intensively studied, while southern faunas are generally poorly known. Most of the occurrences of Argentine Jurassic and Cretaceous corals seem to correspond to lenticular and lentiform coral-dominated beds while framework reefs are not well-represented in contrast to Tethys occurrences. In this work an integrate analysis of a number of coral biostromes recorded from the Lower Cretaceous Agrio Formation of the Neuquén Basin is presented. It includes taxonomic, taphonomic, and palaeoecological aspects of the coral association and a detailed facies analysis.

Previous studies had described six Valanginian-Hauterivian scleractinian species while recent taxonomic revision has recognized in addition at least five species.

When palaeoenvironmental conditions were suitable corals developed opportunistic and short-lived meadows composed by massive, lamellar and ramose colonies, on soft substrates in mixed clastic-carbonate settings with moderate turbidity and low to moderate sedimentation rate. Calicular arranges include cerioid, thamnasterioid, meandroid, phaceloid and plocoid. Coral biostromes usually alternate with soft substrate mollusk dominated biofacies.

1218 - Radiolitid rudist colonisation strategies in different energetic settings on Upper Cretaceous carbonate platforms

Hennhöfer Dominik K.¹, Pascual-Cebrian Enric¹, Korbar Tvrtko², Götz Stefan¹

Universität Heidelberg Institut für Geowissenschaften Heidelberg-Germany¹ Croatian Geological Survey Zagreb-Croatia²

In the Upper Cretaceous period radiolitid rudist bivalves were abundant calcifiers on Tethyan shallow-water carbonate platforms. Previous studies have demonstrated various low- to high-energetic shallow environments in which vertically growing rudist bivalves settled. However, little is known about precise colonisation strategies in environments with increased water energy. The intention of this study is to gain insight into the attachment of rudist larvae and colonisation strategies of several genera on loose grainstone sediment. For this purpose a tomographic technique based on serial grinding and image processing was applied to compute three-dimensional reconstructions of radiolitid biostromes. The data revealed that the main contributors to the biostrome, *Distefanella*, *Bournonia*, and *Pseudopolyconites*, followed different strategies within one ecosystem. For instance, cylindrical elevator morphotype *Distefanella* built up a generally loose, however anchored framework to resist sedimentation and wave energy. Additional results are the presence of a preferred growth direction affecting all genera possibly linked to a present predominant direction of water currents. The results show the ability of small and thinly walled rudists to colonise moderate to high energetic environments over multiple generations. We will discuss ecological effects, limiting factors and compare the results to colonisation strategies in other environments from previous studies.

1174 - American hippuritid rudist bivalves – patterns of migration and speciation

Mitchell Simon¹

University of the West Indies Geography and Geology Kingston-Jamaica¹

Hippuritid rudist bivalves are common faunal elements of the carbonate platforms of the Old and New Worlds. This research examines the distribution and affinities of New World hippuritids and their relationship to Old World forms. Extensive fieldwork has been undertaken in Jamaica and Puerto Rico, including the collection of extensive new material and the recording of specific occurrences in rock outcrops. Additionally, New World (and comparative Old World) hippuritids have been studied in museum collections in Europe and the Americas.

The hippuritids of the New World can be divided into two groups: (1) immigrant genera (*Hippurites*, *Pseudovaccinites*, *Torreites*) that occur in both the Old and New Worlds; and (2) endemic genera (*Barrettia*,

CARBONATE PLATFORMS RUDIST BIOMINERALS

Whitfieldiella, Parastroma, Caribbea, Praebarrettia, Laluzia) that are restricted to the New World. Old World genera occur at two levels within the Cretaceous of the New World: Hippurites resectus occurs on late Turonian carbonate platforms of Mexico; whereas Pseudovaccinites spp. occurs in the early Campanian and Torreites spp. (regarded here as an Old World immigrant) in the early to mid Campanian of Mexico, Cuba, Jamaica, Puerto Rico and Curaçao. Many previous Santonian records of these two genera are now known to be of early Campanian age, and it is probable that these forms appeared in the earliest Campanian of the Americas rather than in the Santonian.

The endemic genera have a different dentition to the Old World genera, with the sockets for the teeth comprising paired grooves. These forms can be divided into two groups: those that have a series of pallial canals in their left valves (Barrettia, Whitfieldiella, Parastroma) occurring in the late Santonian to early Maastrichtian of Mexico, Cuba, Jamaica, Puerto Rico, St. Croix and California; and those which lack pallial canals (Caribbea, Laluzia, Praebarrettia) from the latest Campanian to late Maastrichtian of Mexico, Cuba, Jamaica, Puerto Rico and Peru. This demonstrates the existence of at least two separate endemic radiations in the New World. The genera within each group are distinguished by differences in their myocardial arrangement as well as differences in their pore systems. Several genera (Barrettia, Whitfieldiella and Caribbea) show rapid evolution over relatively short intervals of time allowing the erection of chronospecies which allows biostratigraphic resolution at the substage level or better and offers potential for correlation of the arc rocks of the Caribbean. The replacement of immigrant forms in the Turonian to mid Campanian interval by endemic forms in the late Santonian to Maastrichtian suggests that during the early late Cretaceous hippuritid dispersal was possible across the Atlantic, but by the late late Cretaceous the Atlantic was too wide for further dispersal. The diversity of the hippuritids in the American region reached a peak in the early to mid Campanian (with both immigrant and endemic forms), saw a decline in the late Campanian (loss of immigrant forms and extinction of endemic forms), a second peak in the early Maastrichtian (endemic forms), but by the late late Maastrichtian only two endemic species remained, neither of which persisted to the top of the Cretaceous.

1219 - Fluctuations in the calcite aragonite ratio of polyconitid rudist bivalves during the Aptian in Iberia

*Pascual-Cebrian Enric*¹, Bover-Arnal Telm², Skelton Peter³, Gili Eulàlia⁴, Salas Ramon², Götz Stefan¹

Universität Heidelberg Institut für Geowissenschaften Heidelberg-Germany¹ Universitat de Barcelona Facultat de Geologia Barcelona-Spain² The Open University Department of Earth and Environmental Sciences Milton Keynes -United Kingdom³ Universitat Autònoma de Barcelona Departament de Geologia, Facultat de Ciències Barcelona-Spain⁴

During the latest Early Aptian, aragonite-rich rudist bivalves became less abundant and more calcitic rudist families, principally polyconitids and requieniids, took over the carbonate platforms in Iberia. Previous studies have suggested that ocean acidification and decreased aragonite saturation associated with surface seawater cooling were the major factors controlling this faunal overturn. However, there is little research on the mineralogical fluctuations at species level that allowed certain polyconitids to adapt to changing conditions of seawater. In this study, calcite/aragonite ratios of two lineages of the polyconitid genera Polyconites and Horiopleura were measured throughout the Aptian. The commissural diameters as a size indicator of the specimens, and the proportion of shell in respect to internal cavities were also quantified. The rudist bivalves analyzed were collected in the Maestrat basin, the South Iberian basin (Spain), and the Lusitanian basin (Portugal). Strontium isotopes and ammonite, orbitolinid and rudist biostratigraphies determined their ages. The results show that the calcite/aragonite ratios are inversely correlated with inferred temperature; i.e., the calcite/aragonite ratio increased with relatively colder early Late Aptian temperatures. Increase of the aragonite proportion, and shell thickening in relation to the internal cavities occurred during the latest Aptian, probably indicating ameliorating conditions for biocalcification. We will discuss the Aptian temperature fluctuations and biocalcification crises, and explore their relationships with the mineralogy and thickness of shell, size variations, and abundance patterns of the species.

CARBONATE PLATFORMS RUDIST BIOMINERALS

1071 - Evolution and extinction patterns amongst Pyrenean rudist bivalves

*Pons Jose Maria*¹, Vicens Enric¹

Universitat Autònoma de Barcelona Departament de Geologia BELLATERRA (Cerdanyola del Vallès)-Spain¹

The Montsec Range, in South Central Pyrenees, exhibits a continuous exposure of Upper Cretaceous sedimentary rocks, ranging from the Coniacian to the Maastrichtian. They mostly correspond to carbonates and siliciclastics deposited in a shallow marine platform environment, which finally evolved to a continental environment following an increase of fine to medium size (sand) terrigenous input. Rudist bivalves are abundant and diverse in all the area, and occur together with other micro- and macrofossils largely described in palaeontological literature.

The revision of this rudists fauna, recently completed, provided an accurate picture of its diversity for each time interval and also of its succeeding changes. Both aspects were quantified, analyzed, and contrasted with the sedimentological and palaeoenvironmental data provided by field geology analysis.

From Santonian to Maastrichtian, a general decrease of diversity is observed, although different rudist families, also different genera within them, exhibit different rates and patterns of evolution and extinction.

The more diverse patterns are shown by hippuritids and radiolitids, while those observed in plagioptychids, monopleurids, and requeniids are much more homogeneous.

The demise of the rudists fauna appears to be related mainly to the reduction and final lost of suitable environments, that is, of shallow carbonate platforms.

1072 - New biomineralization styles discovered in exceptionally-preserved Turonian calcispheres shed light on the nature of these previously enigmatic microfossils

*Jens E. Wendler*¹, Ines Wendler¹, Paul Bown², Timothy Rose³, Brian Huber⁴

Bremen University Geosciences Bremen-Germany¹ University College London Earth Sciences London-United Kingdom² Smithsonian Institution, National Museum of Natural History Mineral Sciences Washington D.C.-United States³ Smithsonian Institution, National Museum of Natural History Paleobiology Washington D.C.-United States⁴

Despite of extensive paleontological research our knowledge of biomineralization styles of otherwise well-known fossil shells is incomplete. Most fossils are altered strongly enough that their original bio-mineralized structures remain hidden due to the homogenizing effects of recrystallization. Here we present calcitic reproduction cells of extinct Turonian algae (pithonellid calcitarchs) at unprecedented pristine preservation from a unique microfossil-lagerstätte studied by the Tanzanian Drilling Project (TDP). Recrystallized pithonellids were previously mistaken for being original and the pristine shell-structures that reveal the original biomineral-functionality and paleontological indicative morphological traits were missed. Cathodoluminescence-spectral analysis (CL) quantitatively proves the unique preservation-state of pithonellids from TDP by showing a rare dominance of the blue CL-band over the orange CL-band. These unaltered pithonellids reveal new biomineralization styles in the form of delicate laminated architectures consisting of ply-like and interwoven structures at a complexity previously unknown from unicellular eukaryotes. Such structures provide a balance of strength and flexibility needed for protection, and the low-density crystallite-pattern may have prevented the cells from sinking to water depths from which they could not recover on excystment. Furthermore, we discovered lid-like structures (opercula) that cover the hatch opening of reproduction cells and proof an algal nature of the previously enigmatic pithonellids.

1059 - Carbonate platform response to Maastrichtian carbon cycle changes integrated stratigraphy of the Sudr Formation at Gebel Matulla west-central Sinai Peninsula Egypt

*Farouk Sherif*¹

Egyptian Petroleum Institute Exploration Department Nasr City-Egypt¹

A new biostratigraphically-calibrated $\delta^{13}\text{C}$ record from the southern Tethyan margin, at Gebel Matulla, Egypt can be correlated to global Maastrichtian carbon cycle changes and provides for the first time insights about shallow carbonate platform response to eustatic and regional sea level change. Bulk-carbonate $\delta^{13}\text{C}$ events and planktic foraminifera bio-events can be calibrated versus Maastrichtian cyclostratigraphy and the geomagnetic polarity scale. The correlation allows the identification of prominent long-term events in the Maastrichtian, namely the negative excursion of the Campanian-Maastrichtian Boundary Event (CMBE), the positive excursion of the mid-Maastrichtian Event (MME), and the decline towards the Cretaceous-Paleogene transition (KPgE). The sedimentary

CARBONATE PLATFORMS RUDIST BIOMINERALS

succession of the Maastrichtian Sudr Formation comprising of basinal chalky and platform limestones expose four unconformities which cover (1) in the upper Santonian to lowermost Maastrichtian, (2) the late CMBE, (3) the uppermost MME and large parts of the Upper Maastrichtian and (4) and the K7Pg boundary interval. The timing of two of these unconformities refers to a relation to eustatic sea level change, although the long duration argues for a superimposed local tectonic control.

Comparison of the planktonic foraminifera bio-events noted in the different paleolatitudes revealed variations in the stratigraphic range of some Maastrichtian planktonic foraminiferal marker species. This variation in the timing of the first appearances of planktonic foraminifera is primarily may be due to climatic changes in different palaeolatitudes.

Keywords: Campanian-Maastrichtian, planktonic foraminifera, biostratigraphy, carbon-isotope stratigraphy, Sudr Formation, Gebel Matulla, Egypt

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (OAE)

1246 - $\delta^{13}\text{C}$ stratigraphy OAE 2 and tectono-sedimentary evolution of NE Mexico during the terminal Cenomanian to early Coniacian

*Wiese Frank*¹

Georg-August University CRC Geobiology, Geoscientific Center Göttingen-Germany¹

In the Sierra Madre Oriental fold belt (NE Mexico), Albian to Lower Coniacian strata are exposed in the form of (in ascending order) the Cuesta del Cura Formation (CCF: slumped pelagic micrites), the Agua Nueva Formation (ANF: Corg-rich black marls and limestones) and the San Felipe Formation (SFF: siliciclastic marls, limestones, volcanic ashes). Foraminifera biostratigraphy lacks details, and no unequivocal dating of lithofacies changes between the formations is attainable. Only at the C/T boundary, excellent macrofossil biostratigraphy is available from the Sierra Madre Oriental foreland near Saltillo, while in the fold belt, macrofossils appear to be much rarer. Dating of lithofacies turnovers, OAE 2 position and lower Upper Cretaceous tectono-sedimentary events (Nuevo Leon, Linares to Monterey, ca. 150 km) was thus done by the establishment of a $\delta^{13}\text{C}$ framework (five localities: Huasteca I & II, Iturbide I & II, Puerto Pastores) and a calibration against $\delta^{13}\text{C}$ events from biostratigraphically well-dated European reference sections. In the working area, the positive OAE2 carbon isotope excursion is well developed in a thickness of ca. 100 m, which is the most expanded onshore OAE2 occurrence in Corg-rich facies. The base of the OAE2-CIE correlates with the boundary CCF/ANF (base geslinianum Zone) and shows an isochronous onset of Corg-rich deposits in shelf settings in Mexico and Europe (e.g. NW Germany). Furthermore, the Hollywell Event (Lower Turonian), the Lulworth, Round Down and Pewsey events (Middle Turonian) and the Upper Turonian Caburn, Bridgewick, Hitch Wood and Navigation events are documented. It can be shown that a thickness of ca. 300 m can be assumed for the ANF near Monterrey. The SFF starts in the basal Upper Turonian around Pewsey Event (still with *Helvetoglobotruncana helvetica*) and, crossing the Navigation Event (approximate Turonian/Coniacian boundary interval), ranges at least into the Lower Coniacian. The literature record of Lower Coniacian inoceramids from the upper SFF is in accordance with data presented here.

Increasing accumulation rates from ca. 27 mm/ky (CCF) to ca. 200 mm (ANF) in the working area are not observed in the Sierra Madre Oriental foreland, where only 4 m thickness occurs from the base Turonian to the base of the nodosoides Zone (working area: ca. 80 m). Extensive slumping, starting in the upper part of the CCF, and strong regional differential subsidence developments within NE Mexico are expression of synsedimentary tectonism. It can be related to pull-apart movements resulting from strike-slip tectonics along the San Marcos and Walper (Mojave-Sonora) megashears. Interestingly, contemporaneous tectono-sedimentary events occur in the European shelf areas, and the occurrence of a short-termed tectonic pulse on both sides of the Atlantic might be expression of a global signal (accelerated break-up of Pangaea, increased spreading rates?).

1080 - Cretaceous Towards a history of the global carbon cycle

*Helmut Weissert*¹

ETH Zurich Earth Sciences Zurich-Switzerland¹

Carbon-isotope geochemistry serves as a powerful tool for tracing the carbon cycle through geological time. The Cretaceous carbonate carbon isotope record provides an increasingly detailed documentation of multiple perturbations of the global carbon cycle. Positive excursions in the carbon isotope curve record the response of the biosphere to perturbations while negative spikes are seen as fingerprints of sudden addition of light carbon dioxide into the biosphere. These excursions are superimposed on long-term changes in Cretaceous climate. Early Cretaceous Coolhouse conditions were followed by a mid-Cretaceous Greenhouse and, again, by Late Cretaceous Coolhouse climate. These long-term climate changes are related to opening and deepening of oceanic gateways and to coupled changes in atmospheric carbon dioxide levels.

Perturbations of the global carbon cycle occurred both under greenhouse and coolhouse conditions and they coincide with Oceanic Anoxic Events. OAE1a, of Aptian age, serves as a case study for a Greenhouse pulse during Coolhouse conditions. A negative spike at the base of OAE1a records an increase in volcanic and methane derived atmospheric carbon dioxide. This greenhouse pulse triggered multiple changes in chemical and physical oceanography and in marine and terrestrial biota, causing black shale deposition, seafloor erosion and biocalcification crises.

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (OAE)

1241 - The carbonate platform record of OAE2 facies evolution and biotic change across the Cenomanian-Turonian boundary in Kefalonia (Ionian islands Greece).

*Parente Mariano*¹, Steuber Thomas², Barattolo Filippo¹

University of Naples Federico II, DiSTAR, Napoli-Italy¹ The Petroleum Institute Petroleum Geoscience, Abu Dhabi-United Arab Emirates²

Most of what we know on the paleoceanographic and paleoclimatic changes associated with the OAE2 (Bonarelli event, - 93 Ma) comes from the record of epicontinental and oceanic basins. Much less is known about the response of carbonate platforms and their biota. Widespread platform drowning at the beginning of the event indicates that paleoenvironmental disturbance took its toll also in the neritic realm. However, it is the record of resilient platforms that holds the most precious information.

We studied a section of Late Cenomanian-Early Turonian carbonates of the Apulian Platform exposed in Kefalonia (Ionian Islands, Greece). This section is extremely rich in rudists, gastropods, larger foraminifera and dasycladalean algae. It offers a text-book case-history on the response of shallow-water tropical ecosystems to the OAE2. Chronostratigraphic bracketing of the interval corresponding to the event has been obtained through a combination of larger foraminiferal biostratigraphy and strontium-isotope stratigraphy.

Fossil assemblages are dominated by m-thick beds with large radiolitids, caprinids and nerineid gastropods in the lower part of the section, alternating with thick accumulations of chondrodont bivalves. The first significant biotic change is a sharp decrease in the diversity of larger foraminifera, coinciding with the disappearance of the alveolinids. This is closely followed by the sudden disappearance first of caprinids and then of chondrodonts, and of the few survivors among larger foraminifera. This second step of biotic change coincides with the shift from coarse bioclastic facies to microbial laminites. Then, radiolitids become again abundant together with gastropods, in beds of coarse bioclastic limestones alternating with fine-grained packstones-grainstones and micritic facies with low- diversity fossil associations dominated by small benthic foraminifers and calcareous algae. The last part of the section consists of m-thick beds of coarse bioclastic rudstones/floatstones. Fossil assemblages are dominated by large radiolitids and gastropods which are joined by the first hippuritids and colonial corals in the uppermost part.

1107 - Late Jurassic to Cretaceous paleoceanography a record from the equatorial Hawasina Basin (Oman Mountains)

*Wohlwend Stephan*¹, Celestino Ricardo Filipe¹, Weissert Helmut¹

ETH Zurich Earth Sciences Zurich-Switzerland¹

The Oman mountains preserve a Cretaceous continental margin transect with the Arabian carbonate shelf and the adjacent deep Hawasina Basin which is outcropping in the nappe pile of the Oman Mountains today. The sediment successions (Sumeini, Hamrat Duru, Al Aridh and Kawr Group) provide the opportunity to investigate the response of an eastern Tethyan equatorial ocean system to multiple perturbations of the carbon cycle in the Cretaceous.

In the Hawasina Basin Upper Jurassic to Lower Cretaceous sediments of the Sidr Formation are often depleted in carbonate. Carbonate enriched intervals can be assigned to shedding of fine carbonate from the near platform and, possibly, to changes in the CCD. Samples from the finest top of carbonate turbidite intervals and from pelagic rocks were sampled for carbon isotope chemostratigraphic measurements. Preliminary data in successions dated by radiolarian biostratigraphy suggest that the global carbon isotope signal with major positive excursions is preserved in carbonate sediments from the Hawasina Basin. On a drowned seamount (Kawr Group) the whole Early to Mid Cretaceous time interval is represented by a hardground which shows increased ocean current circulation. The data available suggest that the Hawasina Basin was not affected by major anoxia during the OAE1 and 2.

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (OAE)

1164 - The sedimentary record of the OAE2 in shallow water carbonates are there black shales equivalent An example from the Southern Apenninic Platform (Italy)

*Frijia Gianluca*¹, Dickson Alex², Forkner Rob³, Minisini Daniel⁴, Jenkyns Hugh², Pacton Muriel⁵, Mutti Maria¹
 Universität Potsdam Institut für Erd- und Umweltwissenschaften Potsdam-Golm-Germany¹ University of Oxford
 Department of Earth Sciences Oxford-United Kingdom² Shell International Exploration and Production B.V Rijswijk-
 The Netherlands³ Shell Technology Center Houston-United States⁴ ETH Geological Institute Zurich-Switzerland⁵

The Oceanic Anoxic Event 2 (OAE2), spanning the Cenomanian-Turonian boundary was characterized by the extensive deposition of organic-carbon rich black shales in ocean basins worldwide. The sedimentological, geochemical and paleontological aspects of deep water expressions of OAE2 have been intensively studied in the last few decades, whereas much less attention has been put on the coeval shallow water deposits.

The Southern Apenninic Platform preserves a continuous record of shallow-water carbonates through the OAE2 offering the unique opportunity of looking at the archive of paleoenvironmental changes in a carbonate platform that grew at tropical latitudes far from the influence of a large continental block. Here we present the preliminary results of a detailed facies and geochemical study on key shallow marine sections, using biostratigraphy and carbon-isotope stratigraphy to establish the time-framework corresponding to OAE2.

The most characteristic sedimentological features are laminated, dark-brown, cm-thick beds that are fine grained and relatively enriched in organic carbon. These beds occur in distinct stratigraphic intervals across the event, interbedded with muddy lagoonal carbonates. The correlation between these deposits and deep-water black shales intervals indicates that they are coeval hence documenting different expressions of the same environmental perturbations occurring in two disparate physiographic settings.

1231 - Carbon isotope stratigraphy and biostratigraphy (Calcareous Nannofossils and Ammonites) of the Early Aptian Oceanic Anoxic Event 1a northeast Iran

*Mahanipour Azam*¹, Kani Anoshiravan², Raisossadat Nasser³
 Shahid Bahonar University Geology Kerman-Iran¹ Shahid Beheshti University Geology Tehran-Iran² Birjand
 University Geology Birjand-Iran³

Objective

One of the most widespread OAEs which is recorded worldwide is OAE 1a and has been occurred at the late Early Aptian. This event is marked by a negative $\delta^{13}\text{C}$ excursion at its base, followed by an abrupt and prolonged positive carbon isotope excursion (Menegatti et al., 1998). In the calcareous nannofossils, the nannoconid crisis (NC) is a global event marking the late Early Aptian OAE 1a (Erba, 1994; Erba, 2004), which is recorded at the upper part of NC6 nannofossil Zone (e.g., Erba, 2004). According to the Ammonites, the stratigraphic location of this event varies from the upper part of the Deshayesites ogranlensis Zone to the middle part of Deshayesites deshayesi Zone (Moreno-Bedmar et al., 2009). The aim of the present work is 1) to develop an integrated stratigraphy in a section in the northeast Iran based on carbon isotope, calcareous nannofossils and ammonites across the Aptian interval, 2) to compare the evidence of OAE 1a at the studied interval with those from the other parts of the world.

Method

For calcareous nannofossil biostratigraphic investigations, the samples were processed using the settling technique of Geisen et al. (1999). Slides were examined, using Olympus BH-2 light.

Stable isotopes ($\delta^{13}\text{C}$, $\delta^{18}\text{O}$) were measured using a Finnigan MAT 251 mass spectrometer.

Results

In this study the standard calcareous nannofossil zonations of Roth (1978) have been used. The studied interval spans from the upper NC6 to the Lower NC7 zones. The most important feature in the calcareous nannofossil assemblages is the rarity of nannoconids at the upper part of NC6 and the lower part of NC7 zones.

The carbonate carbon isotope curve of the studied section is divided into characteristic segments (C2-C7), first described by Menegatti et al., (1998) in Alpine Tethys during the Early Aptian. This trend in $\delta^{13}\text{C}$ has been also reported from other sections in mid and low latitudes sites (e.g., Spain, de Gea et al., 2003; Tunisia, Heldt et al., 2008; Germany, Heldt et al., 2012). The isotope curve is marked by a negative excursion (Upper part of NC6), followed by an abrupt positive excursion (Lower part of NC7). Along with these excursions in the carbon isotope curve, the nannoconid crisis has been documented.

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (OAE)

According to the ammonite data, the studied interval is located at the middle part of *Deshayesites deshayesi* ammonite Zone which is similar to the SE France (Moullade et al., 1998; Renard et al., 2005) and NW Germany (Mutterlose and Böckel, 1998).

Conclusion

At the studied interval in the northeast Iran, OAE 1a can be determined at the upper part of NC6 and the lower part of NC7 zones of calcareous nannofossils, where nannoconid crisis and the excursions at the carbon isotope curve have been observed. This event was documented at the middle part of *Deshayesites deshayesi* ammonite Zone. These signals have been documented at the other parts of the world and can be correlated with the studied interval.

1047 - Palaeoceanographic and palaeoclimatic inferences from Late Cretaceous foraminiferal assemblages of Crimea-North Caucasus and Mangyshlak peninsula

*Kopaevich Ludmila*¹, Beniamovskii Vladimir², Vishnevskaya Valentina³, Badulina Natalya⁴, Gabdullin Ruslan⁵
 Lomonosov MSU, Geological Faculty Regional geology and Earth's History Moscow-Russia¹ GIN RAS Department of Micropalaeontology Moscow-Russia² GIN RAS Department of Stratigraphy Moscow-Russia³ Lomonosov MSU, Geological faculty Dynamic Geology Moscow-Russia⁴ Lomonosov MSU, Geological Faculty Regional Geology and Earth History Moscow-Russia⁵

The object of the study is the Late Cretaceous sequences of Crimea-North Caucasus and Mangyshlak peninsula. 300 samples were analysed for foraminifers and radiolarians. The water depth model is based on the planktonic/benthic ratio and on the analysis of planktonic foraminiferal associations. Deep-water basin existed in Crimea-Caucasus that is confirmed with high P/B ratio and high per cent of deep-water planktonic taxa (k-strategists). The shallow water environment may be postulated for successions in Mangyshlak (low P/B ratio and high per cent of shallow water planktonic species, r-strategists). Anoxic events, radiolarian bloom and enrichment of sediments in organic carbon existed on the Cenomanian-Turonian boundary on the all studied area. Thickenings of the siliceous skeletons in the major cephalic segment of *Nassellaria* on the Cenomanian-Turonian boundary reflect environmental stress (oxygen content and others). The presence of numerous representatives of genus *Theocapsomma* and *Cryptamphorella* and *Excentrosphaerella* at Cenomanian-Turonian and Santonian-Campanian intervals was recorded and it also can be explained by good adaptation of these skeleton types to sharp changes in water media (Anoxia and Campanian cooling-time).

This work was supported by the Russian Foundation for Basic Research, project 12-05-00263, 12-05-00690.

1227 - Orbitolinid-rich intervals and their relations with the OAE1a in the carbonate platforms of central and southern Italy.

*Parente Mariano*¹, Di Lucia Matteo², Lechler Maria³, Frijia Gianluca⁴
 University of Naples Federico II, DiSTAR, Napoli-Italy¹ RPS Energy, Woking-United Kingdom² University of Basilicata, Department of Science, Potenza-Italy³ University of Potsdam, Institut für Erd- und Umweltwissenschaften, Potsdam-Germany⁴

Orbitolinid larger foraminifera are key microfossils for the biostratigraphy of Barremian-Aptian Tethyan carbonate platforms. They have been also used as harbingers of paleoenvironmental change. At the northern margin of the Tethyan Ocean, in the Urgonian carbonate platform, transient blooms of flat conical orbitolinids have been commonly interpreted as a signal of increased nutrient input, causing the shift from the Urgonian-type photozoan carbonate factory to the heterozoan carbonate production mode and, eventually, platform drowning. Building on this widely accepted concept, controversies have then arisen between authors emphasizing geologically rapid environmental changes, leading to the deposition of nearly isochronous orbitolinid-rich beds on a supraregional scale and those favouring the idea of progressive environmental deterioration, leading to the deposition of non-correlatable orbitolinid beds. Other authors have considered sea-level changes as the main control, interpreting marls with flat orbitolinids as repeatedly occurring at maximum flooding intervals.

The occurrence of similar orbitolinid-rich beds has long been known also in the carbonate platforms of central and southern Tethys. The lack of a reliable chronostratigraphic framework hindered the interpretation of their time-significance until carbon isotope stratigraphy came to the scene.

In this work we discuss the chrono-stratigraphic distribution and the paleoenvironmental meaning of flat

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (OAE)

orbitolinid-rich beds in the shallow-water carbonates of central and southern Italy, integrating our data on several sections of the Apennine and Apulian carbonate platforms with a review of published data. We use a combination of chemostratigraphy (carbon and strontium isotope stratigraphy) and biostratigraphy to build a high resolution age-model for the studied sections and to put our data in the framework of global paleoenvironmental changes during the Late Barremian-Early Aptian, with particular emphasis on the OAE1a (Selli event, -121 Ma).

1074 - The Eagle Ford Shale of South Texas Organic Carbon distribution and the Eddy Ocean Hypothesis

Waite Lowell E. ¹, *Hay William W.* ², Clarke P. R. ¹

Pioneer Natural Resources Co. Geology Irving, TX-United States ¹ University of Colorado Geological sciences Estes Park-United States ²

The Eagle Ford Shale is a mid Cenomanian to early Coniacian (89 - 96 Ma) organic carbon-rich marine deposit underlying much of south Texas. Total organic carbon (TOC) is a critical component of hydrocarbon source rocks. Regions of high TOC in today's ocean are mainly limited to anoxic basins and to regions of local upwelling and enhanced productivity along the western margins of the continents. However a few seasonally stable cyclonically rotating, mesoscale (10 - 100 km diameter) eddies, such as the Great Whirl off northern Somalia, pump nutrient-rich water bottom waters upward, promoting phytoplankton productivity.

Numerical models of the Late Cretaceous North Atlantic and Tethys suggest that the ocean was filled mesoscale upwelling vortices - eddies. The distribution of TOC within the Eagle Ford shale of south Texas are consistent with deposition by multiple sub-mesoscale eddies. An eddy-dominated ocean replete with sub-mesoscale vortices may explain local producing trends within the Eagle Ford and has implications for regional reserve estimates.

1243 - New constraints on TEX86 Sea Surface Temperatures across the mid-Cretaceous Oceanic Anoxic Event 2

Whiteside Jessica ¹, Sepulveda Julio ², Schaller Morgan ¹, Summons Roger ²

Brown University Department of Geological Sciences Providence-United States ¹ Massachusetts Institute of Technology Department of Earth, Atmospheric and Planetary Sciences Cambridge-United States ²

Transient episodes of widespread black shale deposition during the Cretaceous illustrate the Earth system response to extreme greenhouse climatic perturbations. Oceanic Anoxic Event 2 (OAE-2) across the Cenomanian-Turonian boundary (~93.5 Ma) is one of the most pronounced events, and has been linked to large igneous province volcanism, global warming, increased ocean stratification, and the onset of anoxia and euxinia. A thermally stratified ocean with sluggish circulation is implicated, and might have resulted from a markedly reduced latitudinal geothermal gradient, as suggested by TEX86 temperature reconstructions (Sinninghe Damsté et al., 2010) indicating that the mid-latitudinal Newfoundland Basin (~30°N paleolatitude) experienced very warm SSTs (33-42°C). These reconstructions, however, contradict earth system models for greenhouse conditions (e.g., Hollis et al., 2012), possibly because factors other than SST influence the TEX86 proxy values in oxygen-depleted settings, yielding higher SSTs than in situ temperatures (Schouten et al., 2012).

IODP Expedition 342 in the North Atlantic Ocean (Grand Banks east of Newfoundland; ~32°N paleolatitude) recovered a biostratigraphically well-constrained high-resolution record of OAE-2 from a pelagic setting. Large variability in the TEX86 index from these sediments occurs in tandem with changes in thermal maturity and the branched and isoprenoid tetraether (BIT) index. The isomerization ratio of steranes and hopanes indicates contrasting levels of thermal maturities in organic-rich and -poor sediments, likely indicating mixing of autochthonous (immature) and allochthonous (pre-matured) organic matter sources. Immature intervals reflect well-preserved organic matter produced in situ in surface waters. Conversely, increased thermal maturity is indicative of periods of low production/preservation of in situ organic matter from surface waters where pre-aged and pre-matured organic matter from continental weathering dominates. We discuss the role of varying organic matter sources and preservation in these sediments on the TEX86 proxy, and assess the effects of water column redox changes on archaeal lipids distribution and elevated TEX86-derived SSTs across OAE-2.

Hollis, C.J. et al., 2012. Early Paleogene temperature history of the Southwest Pacific Ocean: Reconciling proxies and models. *Earth and Planetary Science Letters* 349-350, 53-66.

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (OAE)

Schouten, S., et al., 2012. Intact polar and core glycerol dibiphytanyl glycerol tetraether lipids in the Arabian Sea oxygen minimum zone: I. Selective preservation and degradation in the water column and consequences for the TEX86. *Geochimica et Cosmochimica Acta* 98, 228-243.

Sinninghe Damsté, J.S. et al., 2010. A CO₂ decrease-driven cooling and increased latitudinal temperature gradient during the mid-Cretaceous Oceanic Anoxic Event 2. *Earth and Planetary Science Letters* 293, 97-103.

1046 - Early Cretaceous chalks from the North Sea giving evidence for global change

*Mutterlose Joerg*¹, Bottini Cinzia², Van Buchem Frans³, Ineson Jon⁴

Ruhr-University Bochum Dept. of Geology, Mineralogy and Geophysics Bochum-Germany¹ University of Milano Dept. of Geology Milano-Italy² Maersk Oil Copenhagen-Denmark³ Geological Survey of Denmark Copenhagen-Denmark⁴

In northern Europe chalks are widespread throughout the Cenomanian – Maastrichtian interval. Less well known are early Cretaceous chalks which have been encountered in the Central Graben of the North Sea. These chalks (mid Hauterivian to early Barremian; Tuxen Formation) and the overlying mudstones of the Sola Formation (late Barremian to Aptian) have been studied (calcareous nannofossils, geochemistry) in order to better understand the palaeoceanography of the Barremian – Aptian interval in the Boreal Realm.

The Barremian chalks were generated by blooming of endemic nannoconids under warm and arid conditions. Among calcareous nannofossils nannoconids were carbonate rock-forming organisms. In the Tethys nannoconids went through a crisis during the late Barremian and early Aptian, culminating during the Oceanic Anoxic Event 1a. This decline and subsequent crisis is now seen in the North Sea cores, thereby recording this signal also from the Boreal Realm. The decline of nannoconids in the latest Barremian coincides with increased nutrient and clay input. The nannoconid decline, also detected at low latitudes, was associated with the Ontong Java Plateau emplacement. We conclude that nannoconids were rock forming also at high latitudes, under clear and oligotrophic waters. Their decline was related to increased continental runoff under reinforced greenhouse conditions.

1001 - The first stable isotope record from the Santonian - Campanian pelagic sequences of the Arabian Platform in Mardin area SE Turkey

*Yilmaz İsmail Ömer*¹, Hoşgör İzzet²

Middle East Technical University Geological Engineering Ankara-Turkey¹ Viking International Ltd., Çankaya Ankara-Turkey²

The studied Santonian - Campanian pelagic sequences belong to Kastel/Lower Germav Formations in the Mazidag-Mardin area, SE Turkey. The studied sequences on the Arabian Platform overly the Karabogaz Formation with an unconformity.

The lower part of the measured sections displays an alternation of clayey limestones and marls with planktonic foraminifera and includes terrestrial plant and inoceramus fragments. This level can be seen as a relatively rich marker zone.

In the middle part of the section, black shales/dark gray-brownish colored mudstones and clayey beige-light grey coloured limestones/silty marls take place alternating facies. Black shales/dark gray coloured mudstones have thin laminations and partly interrupted by weak bioturbation features in-filled by black muds probably belonging to slope environment. Abundance of terrestrial plant and inoceramus fragments decreases in the middle part of the section. Increase in the presence of ammonite fossils has remarkably been observed in this part.

At the top of the section, marl/black shales facies display a thicker sequence with abundance of plant debris. The top most part of the section is characterized by presence of thin bedded clayey limestones with chert nodules. Along the whole measured section, no any structure belonging to pre or post depositional deformation and siliciclastic beds are recorded.

Stable isotope study along the measured section has been carried for the whole samples collected along the section. The results of analysis display that δ¹⁸O ranges between -4,23 and -3,45 and δ¹³C between 0,57 and 1,92. Along the carbon isotope curve two negative/positive peaks with 1‰ difference have been recorded at the upper and lower parts of the section. However, there is a decreasing trend in carbon in the large scale along the section, and very little /no change in the oxygen curve.

Presence of terrestrial plants including also flowering plant fragments and inoceramus together in the same

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (OAE)

pelagic environments may imply an ecological relationship, or current oriented accumulations. However, there were no counter/turbidity current structures recorded.

Stable carbon isotope peaks and co-occurrence of flowering plant fragments and innoceramus in the same level may be mutually related and coincide with Mid- and Upper Campanian events. Carbon isotope peaks display very similar pattern with Tunisian and UK sections.

Consequently, this study presents the first stable isotope curve along the Santonian - Campanian pelagic sequences of the Kastel/Lower Germav Formations in the Mazidag-Mardin area, SE Turkey. The first records of co-occurrence of ammonite, innoceramus and flowering plant zones can play an important role for the correlation along the Arabian Platform in SE Turkey and even possibly with surrounding countries.

1058 - Lithium isotope evidence for enhanced silicate weathering at the onset of OAE1a (early Aptian Selli event)

Lechler Maria¹, Pogge von Strandmann Philip A.E.², Jenkyns Hugh C.², Prosser Giacomo¹, Parente Mariano³
 Università degli Studi della Basilicata, Dipartimento di Scienze, Potenza-Italy¹ University of Oxford, Department of Earth Sciences, Oxford-United Kingdom² Università degli Studi di Napoli "Federico II", DiSTAR, Naples-Italy³

An abrupt rise of temperature, forced by a massive input of CO₂ into the atmosphere, is commonly invoked as the main trigger for OAEs. Global warming initiated a cascade of palaeoenvironmental perturbations starting with increased continental weathering and accelerated hydrological cycles that delivered higher loads of nutrients to coastal areas stimulating biological productivity. The end-result was widespread anoxia and deposition of black shales: the hallmarks of OAEs. In order to assess the role of weathering as both an OAE initiator and terminator (via CO₂ sequestration) during the Early Aptian OAE1a (Selli event, ~ 120 Ma) the isotopic ratio of lithium isotopes was analysed in sections of marine carbonates from the Pacific and Tethyan realm. $\delta^7\text{Li}$ of seawater is largely controlled by continental silicate weathering and high- and low-temperature alteration of marine basaltic material. With increasing weathering rates of continental and mafic silicates a shift to lighter $\delta^7\text{Li}$ values is expected. The studied sections illustrate this phenomenon: $\delta^7\text{Li}$ values decrease to a minimum coincident with the negative carbon-isotope excursion that effectively records the onset of OAE1a. Such a chemostratigraphy is consistent with the hypothesis that an increase in silicate weathering, in conjunction with organic-carbon burial, led to drawdown of atmospheric CO₂.

1037 - Lithological Stratigraphic Characteristics of the Aptian Cenomanian Sediments of the Abkhazian Zone of the Western Caucasus

Gabdullin Ruslan¹, Bershov Aleksey², Naumov Sergei³, Kopaevich Ludmila⁴, Scherbinina Ekaterina⁵, Samarin Evgenii⁶, Yakovishina Elena⁴, Badulina Natalya⁷

Lomonosov Moscow State University, Geological Faculty, Faculty of Global Processes Regional Geology and Earth Moscow-Russia¹ Lomonosov Moscow State University/Petromodeling Ltd. Engineering and Ecological Geology Moscow-Russia² Petromodeling Ltd. Moscow-Russia³ Lomonosov Moscow State University, Geological Faculty Regional Geology and Earth Moscow-Russia⁴ Geological Institute, RAS Laboratory of Micropaleontology Moscow-Russia⁵ Lomonosov Moscow State University, Geological Faculty Engineering and Ecological Geology Moscow-Russia⁶ Lomonosov Moscow State University, Geological Faculty Dynamic Geology Moscow-Russia⁷

For the first time was established that the data about the lithological composition of the Aptian Albian and Cenomanian sediments in the Abkhazian zone, which were based mainly on the description of natural outcrops, differ from those that were obtained during the study of the sections of boreholes that were drilled in sediments of the same age. In particular, we found that the proportion of argillaceous rocks in the Aptian Albian and Cenomanian sediments is much higher than was previously thought. The results were derived by description of natural and artificial outcrops (including core) proceeded by the author's team in the 2008-2011 period.

For the first time, a complex lithological stratigraphic and facial study of the Aptian Cenomanian sediments of the Abkhazian zone of the Northwestern Caucasus was carried in sections of the Mzymta and Khipsta river valleys. As a result, the areas of distribution of potential oil-source rocks in these sediments, which correspond to the events of the OAE-1 and OAE-2 global paleoecological crises, oil reservoir rocks and rocks-caps were defined.

This work was supported by the Russian Foundation for Basic Research, project no.12-05-00263.

CRETACEOUS SEDIMENTARY BASINS, PALEOGEOGRAPHY AND TECTONIC EVOLUTION

1030 - Late Cenomanian-Early Turonian radiolarians from the epi-ophiolitic cover of the Central Anatolian Ophiolites in Central Anatolian Crystalline Complex Turkey.

Tekin U. Kagan ¹, Goncuoglu M. Cemal ², *Uzunçimen Seda* ³

Hacettepe Univ. Geological Eng Ankara-Turkey ¹ METU Geological Eng Ankara-Turkey ² Hacettepe Univ Geological Eng Ankara-Turkey ³

Well preserved epi-ophiolitic successions are found in Yunus Emre Section in Sarıkaraman Village to the E of Ortakoy and in the Çökelek Section around Çökelek Village to the NW of Akçakent. In both sections red radiolarian cherts and micritic limestones alternate with pillow lavas and volcanoclastic olistostromes. The pillow lavas and the volcanoclastic rocks are of tholeiitic composition and cut by diabases. They represent fore-arc basalts, formed by intra-oceanic subduction of the Izmir-Ankara-Erzincan oceanic lithosphere.

Radiolarian assemblage from Yunus Emre section includes *Spumellaria* (*Halesium amissum* (Squinabol), *Patulibracchium fabianii* (Squinabol), *Alievium* sp. cf. *A. sculptus* (Squinabol), *Dactyliosphaera silviae* Squinabol, *Pseudoaulophacus* sp. cf. *P. putahensis* Pessagno, *Pyramispongia* sp., and *Patellula verteroensis* (Pessagno)) and *Nassellaria* (*Archaeodictyomitra simplex* Pessagno, *Thanarla veneta* (Squinabol), *Mita gracilis* (Squinabol), *Dictyomitra formasa* Squinabol, *Spongocapsula coronatum* (Squinabol)). The presence of the zone taxon (*Dactyliosphaera silviae* Squinabol) indicates a middle and upper Cenomanian age. Relatively less-diverse radiolarians (*Crucella cachensis* Pessagno, *Halesium amissum* (Squinabol), *Pyramispongia magnifica* Pessagno, *Dictyomitra formasa* Squinabol and *Pseudodictyomitra tiara* (Holmes) of early Turonian age have been obtained from the Çökelek section. These new radiolarian ages constraints the formation of the epi-ophiolitic sediments as late as the late Cenomanian-early Turonian in a fore-arc setting within the Izmir-Ankara-Erzincan Ocean.

1023 - Structural evolution and deformation style deciphered through integrated seismic structural model of Shakardarra Kohat Pakistan

Ghani Humaad ¹, Malik Amir ², Khan Adnan ¹, Saeed Arsalan ¹, Jan Faizan ¹, Khan Irum ¹

Bahria University Earth and Environmental science Islamabad-Pakistan ¹ Land Mark resources Research and Development Islamabad-Pakistan ²

Geologically Shakardarra is a suite of complex deformational structures related to different origins in their evolution. An integrated seismic structural model based on seismic line 865-NK-15, well data of Chanda-1 and surface orientation data is prepared. Time and depth values for Samanasuk limestone are calculated and extrapolated to the cross sections. In the northern part of Shakardarra disharmonic folds cored by Eocene evaporites are later transected by high angle thrust faults along their limbs. In the central and southern part, oppositely facing reverse slip faults present in the Siwaliks are linked and forming a pop up structure in the subsurface. These reverse slip faults are associated to strike slip fault in the south east of Shakardarra. The research suggests that the area is evolved sequentially in three episodes of deformation: i) detachment folding over the Eocene evaporites ii) thrust faulting in the northern part and iii) transpressional related reverse slip faulting in the central and southern part of Shakardarra.

1098 - Structural Styles of the Cretaceous Sedimentary Rocks Kolbano Area Timor Basin Implication for hydrocarbon trapping potential

Wahyudiono Joko ¹, Permana Asep ¹, Junusryah Lucki ²

Center for Geological Survey Ministry of Energy and Mineral Resources Bandung-Indonesia ¹ Center for Geological Survey Ministry of Energy and Mineral Resources Bandung-Indonesia ²

Timor Island is located along east-west trending Banda Arc collision belt that was represent evolution of the arc-continent to continent-continent collision between Australia-Indian plate and Asia-Pacific plate. Western part of the island is dominated by east northeast-west northwest structural trend. These structures was related to Cretaceous tectonics and subsequence activities. These structural trend was related to thrust fault and fold which were developed earlier on the area. Other structural trends are northeast-southwest which were related to sinistral strike-slip faults which were develop later. On the other hand, the dextral strike-slip faults which trend northwest-southeast are not significantly influence the area.

The structural style of the Kolbano area during Cretaceous was dominated by brittle tectonics. The tectonics were mainly compression and were followed by strike-slip dominated tectonics. Several anticlines and synclines axis of

CRETACEOUS SEDIMENTARY BASINS, PALEOGEOGRAPHY AND TECTONIC EVOLUTION

the Kolbano are northeast-southwest trending. Non-symmetrical anticlines are potentially as dilational zone which possible for hydrocarbon accumulation. Some outcrops show the characteristics of positive flower structures where hydrocarbon might be trapped.

1262 - Closing of the East Tethys Ocean Geological records from Himalayas

Hu Xiumian¹

Nanjing University School of Earth Sciences and Engineering Nanjing-China ¹

East Neo-Tethys is a north-south-direction ocean with thousands of kilometers width during late Mesozoic, and its geological record is retained in the Himalayan orogen nowadays. The widely accepted opinion is that the demise of the East Tethys ocean is due to northward drift of the Indian plate and the India-Asia continent collision. The closing process of the Eastern Tethys ocean is still unclear. Based on new data and publications, we roughly divide into three phases:

Phase 1 Onset of East Tethys demise. It spans from Late Jurassic to Early Cretaceous (~ 150 Ma - ~ 102 Ma), and is characterized by rifting and break-up of Indian continent from the East Gondwana. The Cuomei-Bunbury large igneous province (Zhu et al., 2011) plays an extremely important role on the break-up of the Eastern Gondwana. Meanwhile, in the northern margin of the Indian continent, extensional intra-plate volcanic activity was distributed widely, and were suggested as the result of decompressional melting along extensional deep-seated fractures when Greater India began to separate from the Australia Antarctica supercontinent (Hu et al., 2010). In the southern margin of Asian continent, Neo-Tethyan ocean subducted underlying the Lhasa block started around 130-120 Ma, resulting in the formation of the Gangdese arc.

Phase 2 Quickly shrinking of the Eastern Tethys due to Indian drifting: It spans from Late Albian to Paleocene (~ 102 Ma - ~ 55 Ma). At the time of Late Albian, glauconitic sandstones widely distributed in northern margin of the Indian continent, representing a major tectonic subsidence followed by the final break-up of the Indian continent from Gondwana. Subsequently, the Indian continent began a rapid "north drift"; hemipelagic and pelagic sediments deposited in the Indian northern margin where recorded Cretaceous palaeoceanographic events, such as the Cretaceous oceanic anoxic event, Cretaceous Oceanic red beds, etc. In the southern margin of the Asian continent, a subduction-related trench - arc - basin system was nicely developed. This phase was ended by the India-Asia initial collision.

Phase 3 Closing of the East Tethyan seaway. This stage spans from early Paleocene to early Eocene (~ 55 Ma to ~ 45 Ma). When India initially collided with Asia, a underfilled peripheral foreland basin system developed in the Tethyan Himalaya area south to the Yarlung Zangbo suture zone. In the Tingri-Gamba area was developed foreland carbonate ramp (Zongpu Fm) deposited between forebulge and foredeep depozones followed by siliciclastic sediments in foredeep depozone (Enba and Zhaguo fms), while in Saga-Gyangze area was developed deep-water, foredeep deposition (Sangdanlin and Zheya fms). In Himalaya, marine sedimentation ended up in middle Eocene (~ 45 Ma; Tingri and Gamba areas).

1029 - Biostratigraphy Paleoenvironments Hydrocarbon Source and Reservoir Characterization of the Cretaceous Rocks of the Mughalkot Section Lower Indus Basin Pakistan

Ahmad Sajjad¹

University of Peshawar Geology Peshawar-Pakistan ¹

In this study we have used Cretaceous outcrop data and utilized the age diagnostic fauna for biostratigraphy. The petrographic techniques were used to identify various carbonate-clastic mixed facies and paleoenvironments of the exposed rock units. The characterization of potential hydrocarbon source rock intervals is based on the geochemical data while the hydrocarbon reservoir rock intervals are characterized from the visual and plug porosity/permeability data. In the Mughalkot Section the Parh Limestone of Campanian-Maastrichtian age shows deposition in an outer shelf setting. It has low to marginal source and poor hydrocarbon reservoir rock potential. The Mughalkot Formation of Late Campanian-Maastrichtian age was deposited in an outer shelf environment. It has a low hydrocarbon source rock and a very poor reservoir rock potential. The overlying Fort Munro Formation of Maastrichtian age was deposited in a distally steepened ramp platform slope with near shore inter tidal lagoon and deep basinal setting with poor-moderate hydrocarbon potential. The unconformably overlying Pab Sandstone of Maastrichtian age was deposited in a braided fluvial-dominated deltaic setting. Its organic rich clays show a low to moderate source rock

CRETACEOUS SEDIMENTARY BASINS, PALEOGEOGRAPHY AND TECTONIC EVOLUTION

potential. The overlying Moro Formation of Maastrichtian age was deposited in upper shore face environment and shows a poor reservoir potential.

1009 - Paleobiogeographic Implications of Cretaceous Dinosaurs and Mesoeucrocodyles from Pakistan

*Malkani M. Sadiq*¹

Paleontology and Stratigraphy Branch Geological Survey of Pakistan Quetta-Pakistan¹

The Paleobiogeography of Indo-Pakistan subcontinent (South Asia) is very significant for geoscientists and bioscientist due to its past with south Pangea (Gondwana) and present association with Asia (north Pangea). Since 2000, about 3000 fossils of latest Cretaceous vertebrates from Pakistan are collected by M. S. Malkani in fluvial two red mud horizons (alternated by sandstone horizons) of Vitakri Formation. The remains of these body fossils from Pakistan are assigned to Khetranisaurus, Sulaimanisaurus, and Pakisaurus of Pakisauridae, Marisaurus and Balochisaurus of Balochisauridae titanosaurian sauropods, Vitakridrinda and Vitakrisaurus of Vitakrisauridae theropods and Pabwehshi and Sulaimanisuchus of Sulaimanisuchidae Mesoeucrocodylia. Most of these vertebrates generally show close affinity with the south Pangea (Gondwanalands), to a lesser degree with north Pangea (Laurasia). The association of Indo-Pakistan subcontinent with Madagascar and South America (via Antarctica) before Late Jurassic or Early Cretaceous, and early seed radiation and common heredity show relatively high degree of similarity of their Latest Cretaceous fauna. The trispinous distalmost caudal centra and moderately inclined skull of Pakistani titanosaurs, and complex skull of Vitakridrinda theropod show so far endemic characters. The dinosaurs and crocodiles in Gondwanalands got broad distribution prior to fragmentation.

1151 - Late Jurassic-Early Cretaceous transition in the Lurestan Basin SW Iran Evolution from a dominantly evaporitic to a deep marine setting

*Sarfi Mehdi*¹, Ghasemi-Nejad Ebrahim¹, Yazdi-Moghadam Mohsen²

University of Tehran Geology Tehran-Iran¹ NIOC, Exploration directorate Paleontology & Geochemistry Tehran-Iran²

The Jurassic/Cretaceous transition is the only remaining boundary among Phanerozoic systems with no accepted global definition. Lack of major changes in fauna and flora, predominantly arid climate and extensive regressions which caused hiatus or condensations are among main difficulties towards establishing this boundary. In the Arabian plate late Jurassic is defined by widespread deposition of evaporites such as Hith Formation in the Persian Gulf and the Gotnia Formation in Iraq and Lurestan basin of Iran. In the study area the evaporites of the Gotnia Formation are sharply overlain by the deep deposits of the Garau Formation, known as the Radiolaria Flood Zone (RFZ). The RFZ facies is considered deep and consists of pelagic fauna. In order to understand mechanisms and timing of the paleoenvironmental turnover, an integrated biostratigraphy (foraminifera, nannofossils and palynology) and Sr-isotope stratigraphy in two selected sections are established, providing well-established bio- and excellent chemostratigraphy proxies for testing and detecting paleoenvironmental changes in the Lurestan Basin at the Jurassic/Cretaceous boundary. Petrographic studies, field spectral gamma ray as well as total organic carbon (TOC) analyses are performed too. Results show however, that the transition between evaporites of the Gotnia and overlying Garau deep facies is very sharp though there is no evidence of significant rapid increase of sea level in either global or regional scale.

1255 - Sedimentary environment analysis on China Danxia

*Liu Xiuming*¹, Guo Hui², Lü Bin¹, Liu Zhi²

Fujian Normal University School of Geographical Science Fuzhou-China¹ Lanzhou University Research School of Western Environment and Climate Change Lanzhou-China²

China Danxia is a geomorphological name given in China to landscape developed on continental red sedimentary beds. This red beds developing during Cretaceous are mainly calcium cemented glutenite, sandy conglomerate, and sandstone, building up unique 'China Danxia' landform. It has long been recognized the Danxia strata to be formed in the rivers and lakes in the arid oxidation conditions of intermountain basins. The red color is considered due to late dehydration from original iron hydroxide. However, our field survey found that red color varying with bedding is the original color. But grey celadon within red stratum, their color changing not following bedding, is

CRETACEOUS SEDIMENTARY BASINS, PALEOGEOGRAPHY AND TECTONIC EVOLUTION

actually the later formed secondary color. This observation is incompatible to the red color due to 'late dehydration'. Investigation on magnetic mineralogy shows that the Danxia strata with red trivalent Fe maghemite and hematite, and relative content is even much higher than that of Quaternary loess and paleosols in the Loess Plateau, contradicting to the reductive environment of formation and preservation sediments submerging under water (such as rivers and lake sediments). In compare characteristics of modern river and lake sediments, and climate conditions of modern red bed developing, we questioning China Danxia strata was not formed in the rivers and lakes within the intermountain basin, instead, was pluvial series products of wide intermountain basins. During Cretaceous the Qinghai-Tibetan Plateau was not presence, the planetary wind system was controlling huge area on low latitudes of Asian under arid oxidation condition: temporary running water formed and left the bedding and cross bedding. But such water leaves very soon. Such pluvial sediments were actually under drought oxidation pedogenic environment. That is why China Danxia strata coming out trivalent iron oxide red color and with clear bedding as well. The central and northern tropical and subtropical arid plains in Australia are the modern example of reddish process.

1010 - Geodynamics of Indo-Pakistan Subcontinent (South Asia)

*Malkani, M. Sadiq*¹

Paleontology and Stratigraphy Branch Geological Survey of Pakistan Quetta-Pakistan ¹

Indo-Pakistan subcontinent (South Asia) is a peninsula but in the past it was a part of Gondwanalands and during northward journey it was an island. During Late Triassic (220 Ma) the lands united as Pangea. The breakup of Pangaea started in Middle Jurassic (170 Ma) while the breakup of Gondwana started in Late Jurassic (160 Ma). Indo-Pakistan separated from Madagascar during Late Jurassic and started northward journey at Jurassic-Cretaceous boundary time (145Ma). Most of Cretaceous passes as journey and island. It migrated rapidly covering more than 6000km in about 70-80 million years. Its northwestern corner collided first time with Afghan block of Tethys and Asia at Latest Cretaceous about 75-70 Ma. This corner acts as a pivot point for counterclockwise rotation. Consequently Western Indus Suture, close to Zhob-Waziristan-Kuram and its adjoining western areas like Katawaz basin began to rise, ended the Paleo Vitakri River systems of Sulaiman foldbelt flowing from east to west (Indo-Pakistan shield toward Neotethys) and started the Paleo Indus River systems originated from north flowing toward south. It deposited the molasse Chamalang (Ghazij) Group in the Indus basin and Murgha Faqirzai and Shagala formations in the Balochistan basin. This shows the beginning of Neotethys closure

1175 - Cretaceous Tectonic Evolution of the Western and Central Pontides

*Tüysüz Okan*¹

Istanbul Technical University Eurasian Institute of Earth Sciences Istanbul-Turkey ¹

Southern continental margin of the Black Sea, the Pontides, consists of two tectonic units separated by Intra-Pontide suture, the Istanbul Zone (Western Pontides) in the west and the Sakarya Zone (Central and Eastern Pontides) in the east. Cretaceous sedimentary basins developed on both tectonic units. The sediments deposited on these basins shed light onto the tectonic evolution of the Black Sea and the Pontides.

On the Western Pontides, an east-trending archipelago separating the Western Black Sea Basin in the north and the Zonguldak-Ulus basin in the south developed during the Barremian-Early Aptian, under the control of a tensional tectonic regime. A short-lived carbonate platform developed on this archipelago, which subsided at the end of the Early Aptian. The Zonguldak and Ulus basins on the Western Pontides, presently separated by the late Cretaceous Eocene Devrek basin, were a single, southward deepening basin during the Early Cretaceous, the former consists essentially of neritic deposits, whereas the latter is made of relatively deep basinal deposits. The Ulus Basin in the south was located on the southern continental margin of the Istanbul Zone facing to the Intra-Pontide Ocean to the south. The deposition within Zonguldak-Ulus basin continued until the Cenomanian, when a short but regional uplifting occurred.

The Central Pontides is covered by Early Cretaceous to Tertiary sediments of Sinop Basin, which is a northerly-deepening basin, in contrast to the contemporaneous Zonguldak-Ulus Basin of the Western Pontides. Deposition in the Sinop Basin started during the Barremian under the control of an extensional tectonic regime and continued until late Cenomanian-Early Turonian, when a sudden subsidence occurred. Early Cretaceous sediments of this basin

CRETACEOUS SEDIMENTARY BASINS, PALEOGEOGRAPHY AND TECTONIC EVOLUTION

are mainly represented by siliciclastic turbidites with huge olistoliths and debris flow horizons, indicating an active tectonic environment of deposition.

Western and the Central Pontides juxtaposed probably during the Cenomanian as a result of closing of the eastern part of the Intra-Pontide Ocean. During the Cenomanian, the Istanbul Zone uplifted while the Central Pontides subsided due to juxtaposition of both tectonic units. After the juxtaposition, an east-trending extensional magmatic arc has been established on both tectonic units in response to northward subducting Tethys Ocean to the south. Two periods of magmatism can be recognized. During the Turonian-Early Santonian an extensional tectonic regime associating magmatism and volcanogenic sedimentation caused rifting of the continental crust in the Black Sea in the north. During the Middle-Late Santonian, arc magmatism stopped and the entire region was covered by a deep marine and only pelagic carbonates deposited. This period corresponds to the breaking-up the continental crust and starting of sea-floor spreading in the Western Black Sea Basin. Second period of arc magmatism started during the Campanian, and lasted until the beginning of the Maastrichtian.

During the Maastrichtian, the Neo-Tethys Ocean closed to the south, and the Pontides and the Kırşehir Continental Block collided. After this continental collision, continuing compressional tectonic regime caused developing of a fold and thrust belt all along the Pontides.

1079 - Early Cretaceous sedimentary evolution of a pelagic basin margin (the Manín Unit central Western Carpathians Slovakia)

*Lintnerova Otilia*¹, Michalik Jozef², Fekete Kamil²

Comenius University Economic Geology Bratislava-Slovakia¹ Slovak Academy of Sci. Geological Inst. Bratislava-Slovakia²

Deposition of Lower Cretaceous hemipelagic planktogenic limestones of the Manin Unit in N part of the Alpine-Carpathian basinal system started after submarine erosion evoked by Late Berriasian extension. The Ladce Formation reveals limestone sedimentation inhomogeneity on the slope, whereas cyclical strata of the Upper Valanginian Mrázňica Fm indicate typical basinal conditions. A $\delta^{13}\text{C}$ excursion (1.5 to 2.6 VPDB) in the *Campylotoxus* - *Verucosum* ammonite zone inside the Ladce Fm pale limestone could indicate a climatic change (the global Weissert Event). Limestone without black shale documents local oxic conditions in marginal part of the basin. Overlying dark limestone of the Mrázňica Formation was associated rather with climate instability; general (slight) cooling and wetting enabled fine terrigenous input from dryland into basin. Epibenthic colonization of soft bottom was gradual and long-lasting. Benthic epifaunal islands formed around hard objects on muddy bottom in the Kaličo and Lúčkovská fms. Increasing calcification of benthic organisms and (delivery of sediment?) resulted in carbonate platform progradation during Aptian. The platform growth stopped during mid-Albian collapse when hard rock surface bored by infaunal organisms has formed. The sequene was covered by thick shales of the Butkov Fm.

CRETACEOUS TERRESTRIAL RECORDS

1121 - Terrestrial record of Late Cretaceous rocks in India Distribution biodiversity and biogeographic affinities

*Guntupalli V.R.Prasad*¹

University of Delhi Department of Geology Delhi-India ¹

As compared to the extensive occurrence of marine Late Cretaceous rocks in both peninsular and extra-peninsular (Himalayan) regions, the continental Late Cretaceous rocks occur restricted to two peninsular Indian basins, viz., the Deccan Volcanic Province (DVP) and the Cauvery basin. In the DVP, these rocks are confined to the Upper Cretaceous Lameta Formation underlying the oldest volcanic flows and thin Upper Cretaceous-Lower Palaeocene sedimentary beds (intertrappean beds) intercalated with the volcanic flows. These sedimentary beds are exposed all along the eastern, northern, and southern margins and a few along the western margin of the DVP. In the Cauvery basin in South India, the shallow marine Cretaceous sequence ranging from Albian to Maastrichtian is topped by the continental Kallamedu Formation of Late Maastrichtian age. Through the application of bulk screen-washing techniques many fossil groups represented by fish, amphibians, reptiles, and mammals have been documented from these volcano-sedimentary sequences. Similarly, the sandy clays of the Kallamedu Formation have yielded a few remains of fish, amphibians, turtles, crocodiles, dinosaur and mammals. In comparison to the Lameta and intertrappean biota, the Kallamedu fauna is relatively less abundant but is equally important from palaeobiogeographic point of view. The fauna from both stratigraphic levels exhibits Gondwanan as well as Laurasian biogeographic affinities.

1266 - Climatic and environmental indications of carbon and oxygen isotopes from the Lower Cretaceous calcrete and lacustrine carbonates in Southeast and Northwest China

*Li Xianghui*¹, Sun Yong ¹, Zhou Yong ², Wang Yin ³, Liu Ling ³

Nanjing University State Key Laboratory of Mineral Deposit Research, School of Earth Sciences and Engineering Nanjing-China ¹ The 402th Geological Survey The 402th Geological Survey Chengdu-China ² Development Bureau of Jiangsu Province East China Mineral Exploration and Development Bureau of Jiangsu Province Nanjing-China ³

Carbon and oxygen isotopic ratios were determined from ~100 Lower Cretaceous samples from four carbonate-bearing facies in Southeast (SE) and Northwest (NW) China for palaeoclimatic and palaeoenvironmental analyses. The samples were interpreted as sediments within sublithofacies of distal alluvial ponds (SF1), open shallow lakes (SF2), littoral lakes (SF3), and marshes (SF4). Results of analyses show in SE China, $\delta^{13}\text{C}$ values range between -5.0 and 3.0 with a negative trend through time, and $\delta^{18}\text{O}$ values are all negative (-19.3 ~ -7.4); in NW China, $\delta^{13}\text{C}$ values range from -4.0 to 4.0 with periodic change, and $\delta^{18}\text{O}$ values range between -18.0 and 1.5.

Both relatively heavy values and pronounced covariances of most $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ indicate semiarid climate and domination of closed brackish lakes, marshes, and ponds in NW and SE China during the Early Cretaceous. Of them, positive $\delta^{13}\text{C}$ (0.0 to 4.0) and relatively heavy $\delta^{18}\text{O}$ (-5.0 to 1.5) values suggest interruptions of arid-evaporation in intermittences of the early Hauterivian in SW Fujian, of the middle Aptian in West Jiuquan basin, of the late Aptian in SW Ordos basin, and of the late Aptian - early Albian in Liupanshan basin. In a short interval of the Early Aptian, the hot and humid climate occurred in local SW Zhejiang by high kaolinite content and in West Jiuquan basin by warm flora could be an exception. Particularly, extremely negative $\delta^{18}\text{O}$ values (mainly -19.0 ~ -9.0) indicate relatively low temperature in SE Fujian in the Berriasian-Barremian, in Liupanshan basin in the late Aptian, in SW Ordos basin in the late Albian, and in West Jiuquan basin in the mid-late Aptian, which is supposed to attribute to the presence of 2500 m ~ 4500 m in elevation. More positive values and more covariance ratios of $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ in NW China than in SE China and in mainland China than in America indicate a arider climate in former than in later, probably attributing to the palaeogeography in distance to sea.

A tentative correlation of the Early Cretaceous $\delta^{13}\text{C}$ value excursion of calcretes shows a good compatibility between marine OAEs and terrestrial carbonate sediments and between NW China and America continents, implying a global response to carbon cycle in both marine and terrestrial environments. The feature suggests the potential of global correlation and application of terrestrial calcrete $\delta^{13}\text{C}$ excursions in pre-Cenozoic.

CRETACEOUS TERRESTRIAL RECORDS

1158 - Continental Scientific Drilling Project of Cretaceous Songliao Basin Continuous High-resolution Terrestrial Archives and Greenhouse Climate Change

Wang Chengshan¹, Graham Stephan², Koeberl Christian³, Dong Hailiang¹, Feng Zhiqiang⁴

China University of Geosciences State Key Laboratory of Biogeology and Environmental Geology Beijing-China¹

Stanford University Department of Geological and Environmental Sciences Stanford-United States² University of

Vienna Department of Lithospheric Research Vienna-Austria³ Daqing Oil field Company Ltd Institute of Exploration

and Development Daqing-China⁴

The ICDP project Continental Scientific Drilling Project of Cretaceous Songliao Basin is aimed to obtain complete high-resolution climate records of the terrestrial environment for the whole Cretaceous time period in the Songliao Basin, and will advance our understanding of climate change in the Cretaceous greenhouse world, and its relationship to geological events relevant to carbon cycles. The Cretaceous provides significant rock records of the global climate changes under the condition of greenhouse climate. The long-lived Songliao Basin in northeastern China provides an excellent opportunity to recover a nearly complete Cretaceous terrestrial sedimentary record based on basin-filling history. The newly completed SKI drilling located at the northern part of the Songliao Basin covered the mid-to-Upper Cretaceous strata with total length of 2485.89m. The upcoming SKII drilling will continue to core the mid-to-Lower Cretaceous strata. New findings were revealed from studies on the SKI cores. For example, marine foraminifera fossils were first discovered in the Songliao Basin which provides direct evidence for marine water incursions; the formation of terrestrial hydrocarbon source rocks was later than the oceanic anoxic events according to high-resolution cyclostratigraphic analysis; the offset of Mr0 in Cretaceous magnetic Normal Superchron was dated by high-resolution paleomagnetic analysis. Together with the climatologically sensitive deposits, oxygen isotope studies on continental sediments and the paleontology data, the climate during Cretaceous in Songliao Basin is a temperate and humid climate condition with four cooling events, three warming events and three semiarid events.

1105 - The palaeobiogeographic implications of Early Cretaceous Australian tribosphenic mammals

Rich Tom¹, Trusler Peter², Evans Alistair³, Siu Karen⁴, Vickers-Rich Patricia²

Museum Victoria Sciences Melbourne-Australia¹ Monash University Geosciences Clayton-Australia² Monash

University Biology Clayton-Australia³ Australian Synchrotron Clayton-Australia⁴

The tribosphenic morphology of mammalian molars makes possible both a crushing and slicing function on a single tooth. Metatherians/marsupials and eutherians/placentals either have tribosphenic molars or are descended from ancestors that did. The widespread view is that both groups originated in the northern hemisphere during the Mesozoic.

Twenty-eight mandibles and one specimen consisting of two worn and broken upper molars have been found in the Early Cretaceous of polar southeastern Australia. The lower dentitions have been tentatively referred to placentals. Alternatively, they have been regarded as a southern hemisphere group convergent on them, the Australosphenida. The upper molars have features suggestive of metatherians.

If the Australian tribosphenic mammals are eutherians and metatherians, this implies these two groups originated, "...somewhere on the Earth's dry surface."

On the other hand, if it is found that the metatherian-like upper molars occlude with the eutherian-like lower molars, this suggests a close relationship implying it is neither a metatherian or eutherian, combining as it would contradictory characters. Thus would support the australosphenidan hypothesis. At this writing such a test is underway.

EVENT STRATIGRAPHY + KT BOUNDARY

1048 - Deccan Volcanism Chicxulub Impact Climate change the KTB Mass Extinction and delayed Marine Recovery

*Keller Gerta*¹, Adate Thierry²

Princeton Univ. Geosciences Princeton-United States¹ Lausanne Univ. ISTE Lausanne-Switzerland²

For more than three decades the end-Cretaceous (KTB) mass extinction has been popularly attributed to a single large meteorite impact (Chicxulub) on Yucatan. Today there is common agreement that this could not have been the sole cause for the KTB mass extinction, but rather a contributing factor. The long-term biological, environmental and climatic changes before and after the bolide impact horizon call for a multi-causal scenario, certainly involving volcanism as increasingly evident in four out of the five major mass extinctions in Earth History. For the KTB mass extinction, Deccan volcanism has emerged as the most likely cause revealing a one-to-one relationship between the nature and tempo of the mass extinction with the onset coinciding with the worlds longest lava flows and ending with the last major eruption at the KTB. This main phase of Deccan eruptions in C29r was accompanied by rapid global climate warming followed by cooling and sea-level changes. Ultimately, the effects of massive volcanic emissions, impact, climate changes, ocean acidification, ocean anoxia and atmospheric changes have to be considered in any extinction scenario in order to understand the causes and consequences of the KTB or any of the other mass extinctions in Earth History.

1197 - Danian Pareorine Gastropoda after the end-Cretaceous mass extinction in Haymana-Polatlı Basin Central Anatolia

*Hoşgör İzzet*¹

Viking International ANKARA-Turkey¹

Danian gastropod faunas are relatively poorly known, limiting our understanding of the behavior of the group during the end-Cretaceous mass extinction. Pareorine turritellid gastropods are common components of many Late Cretaceous to Recent benthic marine assemblages worldwide. Infaunal suspension-feeding Mesalia Gray, 1847 originated during either the Late Cretaceous (Maastrichtian) in northern Africa or the early Paleocene (Danian) in northern Africa and western Iran. Mesalia erguni is a new species of pareorinid gastropod described from the Danian (Early Palaeocene) Erif section of Haymana-Polatlı Basin. In the Haymana Basin of central Anatolia, palaeontological research at the K/Pg boundary has been focused mainly on planktic foraminifers, and to a lesser extent on benthic foraminifers. Central Anatolia has one of the best records of the end-Cretaceous mass extinction and the subsequent Early Palaeocene recovery. They are characterized by limestones which contain abundant benthic foraminiferous and dacycladales algae. As a result of the present studies, representatives of the genus Mesalia belonging to the new species Mesalia erguni is reported for the first time from Central Anatolia. Moreover, this finding represent the first reports of these taxa for Turkish localities.

1106 - Distribution of planktonic foraminifera on the K T

*Mikadze Khatuna*¹

Institute of Paleobiology Georgia National Museum Tbilisi-Georgia¹

Late Cretaceous is an exceptionally favorable phase in the evolution of planktonic foraminifera, but on the border of the K/T progress is sharply asleep. A detailed study of the Upper Cretaceous planktonic foraminifera in Georgia made it possible to establish a similar pattern.

The Lower Maastrichtian deposits are represented by: Globotruncanita stuarti, Rugoglobigerina rugos, Stensioina pommerana. At the end of the Lower Maastrichtian appear: Planoglobulina acervulinoides, Rugoglobigerina hexacamerata, Abathomphalus intermedius. Out of the planktonic foraminifera in the Middle Maastrichtian are present: Gansserina gansseri, Planoglobulina carseyi, Abathomphalus intermedius, Stensioina pommerana pomerana, Pyramidina rudita.

The Upper Maastrichtian deposits are characterized by: Abathomphalus mayaroensis, Kassabina falsokalkarata, Rugoglobigerina ordinaria, Planoglobulina acervulinoides.

And at the end of the upper Maastrichtian disappear almost all forms of plankton and only benthic are met in single specimens: Gaudrina rugosa, Gyroidinoides imitate, Anomalinoides midwayensis. The Danian sediments are represented by: Stensioina beccariiiformis, Guembelitra cretacea, G. danica, Globconusa daubjergensis.

EVENT STRATIGRAPHY + KT BOUNDARY

Thus on the boundary of K/T all the leading generations practically disappeared. Also disappeared generations, which played a crucial role in biocomplexity of the entire Upper Cretaceous as well. All the complex changes that have been fixed on the boundary of K/T have been surely

1022 - Latest Cretaceous Land Vertebrates in Pakistan; a Paradise and a Graveyard

*Malkani, M. Sadiq*¹

Paleontology and Stratigraphy Branch, Geological Survey of Pakistan, Quetta-Pakistan¹

The latest Cretaceous land vertebrates are found in Vitakri Formation of major anticlinoria, starting from west to eastward in the eastern Sulaiman foldbelt are Jandran, Vitakri-Mari Bohri, Dhaola-Andari, Phulali-Pikal-Siah Koh and Fort Munro. Vitakri Formation is the host of these vertebrates; however sandstone and muds of Pab Formation and coeval strata are also expected to yield Late Cretaceous land vertebrates in Pakistan. The diverse archosaur finds as five genera and two families of titanosaurian sauropods, two genera and one family of theropods, two genera and one family of mesoeucrocodyles and one genus and one family of pterosaur. Most of the bones found as clusters/pockets, however some are also found as isolated. The richest bone intensity is found in the Vitakri Dome, eastern plunge of Mari Bohri anticline and northwestern limb of Dhaola anticline. The bone intensity is decreasing eastward especially in the Fort Munro anticlinorium. The occurrences of diverse land vertebrates in the Sulaiman Basin of Pakistan show a paradise. Further their rich bone clusters of these diversified land vertebrates in Sulaiman basin also show a graveyard. All these diverse land vertebrates became extinct at the Cretaceous-Tertiary boundary in Pakistan.

1118 - Nature and cause of delayed marine recovery after the end-Cretaceous mass extinction Case study of ODP Sites 1049-1050 Western North Atlantic

*Mateo Paula*¹, Keller Gerta¹, Adatte Thierry², Khozyem Hassan², Spangenberg Jorge²

Princeton University Geosciences Princeton-United States¹ University of Lausanne Lausanne-Switzerland²

In the aftermath of the end-Cretaceous mass extinction marine recovery was delayed for half a million years due to high-stress environmental conditions. Full marine biotic recovery occurred only after the last phase of Deccan volcanism. The main objective of this study is to test the hypothesis that the delayed marine recovery was caused by the last phase of Deccan volcanism in C29n based on high-resolution planktonic foraminiferal biostratigraphy, stable isotopes, mineralogy and geochemistry of ODP Sites 1049-1050 in the western North Atlantic. Results show that opportunist species dominate in the aftermath of the mass extinction in biozone P1a and again in P1b. High stress conditions in P1b culminated in the Dan-C2 warm event expressed by $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ excursions. During this event, paleoenvironmental proxies indicate increased physical weathering associated with climate warming and eutrophication of surface waters that led to decreased primary productivity. A plausible explanation for these observations is persistent stress conditions due to background levels of volcanic activity in the earliest Danian (biozone P1a) followed by the last phase of Deccan volcanism (C29r, biozone P1b) injecting significant amounts of greenhouse gases into the atmosphere and leading to rapid climatic and environmental perturbations thus prolonging full marine recovery.

1259 - Isotopic geochemical and palynological characterization of K-Pg Boundary from Northern Branch of NeoTethys; Mudurnu – Geyikpınarı Basin NW Turkey

*Açikalin Sanem*¹, Ömer Yılmaz İsmail², Smit Jan³, Vonhof Hubert⁴, Vellekoop Johan⁵, Altın Sevinç Ö.², Fornaciari Eliana⁶

Badley Ahton & Associates Ltd. Dept. of Geology Eskişehir-Turkey¹ Middle East Technical University Geological Engineering Ankara-Turkey² VU University - Amsterdam Faculty of Earth and Life Science Amsterdam-The Netherlands³ Vrije Universiteit Brussel Earth System Science, Department of Geology Brussels-Belgium⁴ Utrecht University Marine Palynology, Faculty of Geosciences Utrecht-The Netherlands⁵ Padova University Department of Geosciences Padova-Italy⁶

Although the K-Pg boundary has a crucial importance for worldwide correlation of basins and better understanding of the conditions in this time span of Earth's history, it has not been studied enough detail in Anatolia. In this study we aim to fill up this gap by investigating a Late Cretaceous – Early Paleogene marine succession from NW Turkey in

EVENT STRATIGRAPHY + KT BOUNDARY

terms of sedimentological features, isotopic ratios, palynology and geochemistry.

In the southern and middle part of the Central Sakarya Basin, the Campanian – Maastrichtian are represented by biostratigraphically dated thick, complete, deep marine, mainly siliciclastic succession. From the Early Paleocene onward, echinoderm bearing sequence of alternating lime-mudstone and marls with organic rich clay intervals become dominant. Two successions (Okular and Goynuk sections; 4,50m and 3,35m thick respectively) within the transition from siliciclastics to carbonates, containing the K-Pg boundary, was measured, sampled and studied in detail. The lowermost Danian in the Okular Section is represented by darker clay on top of the laterally continuous 2-3mm thick reddish ejecta layer. At 17th cm of the Danian of the Okular section another reddish-iron rich layer is observed. At Goynuk section the K-Pg boundary is also represented by laterally continuous 2-3 mm thick reddish ejecta layer. This thin ejecta layer is overlain by 16–17 cm thick darker muddy level similar to the Okular section. At 17th cm above the K-Pg boundary of the Goynuk section, the transition from mud-dominated to limey mudstone lithologies is evident.

The palynological samples from the both sections yielded an abundance of well-preserved palynomorphs. The K-Pg interval displays a succession of regional and global stratigraphic events, such as the First Appearance Datums (FADs) of *Disphaerogena carposphaeropsis* and *Trabeculidium quinquetrum* and the bloom of *Manumiella druggii* in the uppermost Maastrichtian and the subsequent FADs of *Senoniasphaera inornata*, *Damassadinium* cf. *californicum* and *Carpateella cornuta* in the lowermost Danian, confirming the placement of the K-Pg boundary at the at the reddish ejecta layer at the base of the dark clay layer encountered at the Goynuk and Okular sections. The Cretaceous–Paleogene transition in both sections are characterised by an abrupt negative shifts in $\delta^{13}C$ values, which exhibit c.1,3-2,4‰ negative shift in two sections. Ir concentration of the ejecta layer of the Okular Section reaches up to 7.41ppb which is typically in the range of concentrations detected from other worldwide K-Pg Boundaries. In second reddish layer Ir concentration remains stable in the background values (0.77ppb), whereas Ru, Pt, Pd, Ni and Cr exhibit a slight increase. Similar to Okular Section, the Goynuk Section is also characterised by an abrupt increase in all PGEs at ejecta layer (Ir:7.23 ppb), but second enrichment about 15cm above the ejecta layer has not been observed.

In summary, we believe that the Central Sakarya Region succession contains remarkably complete K-Pg boundary record. The data above indicate that the lowermost 2-3 mm thick continuous, reddish layer can be attributed to the worldwide K-Pg ejecta layer, therefore the bottom of the red layer marks the Cretaceous – Paleogene boundary in the basin.

1119 - Environmental stress linked to Deccan Volcanism mass extinction and delayed recovery

*Punekar Jahnavi*¹, Keller Gerta¹, Mateo Paula¹

Princeton Univ. Geosciences Princeton-United States¹

The global impact of Deccan volcanism on marine biota can be estimated based on the response to environmental crises by planktic foraminifera, such as changes in species abundances and morphology, dwarfing, disaster opportunist blooms, extinctions, evolution, delayed ecosystem recovery and stable isotope excursions ($\delta^{13}C$ and $\delta^{18}O$). The best species index of environmental catastrophe is *Guembelitra cretacea*, the sole long-term survivor of the Cretaceous-Tertiary boundary (KT) mass-extinction and a disaster opportunist that thrived during high-stress intervals. Here we trace times of high-stress correlative with the three phases of Deccan volcanism from India through the Tethys, Atlantic into Texas based on quantitative species analysis, high-resolution biostratigraphy, magnetostratigraphy and radiometric dating. Results show a strong correlation between *G. cretacea* blooms and (1) $\delta^{13}C$ excursions with the main phase-2 of Deccan volcanism in C29r that ends with the KT mass extinction, (2) $\delta^{13}C$ excursions with phase-3 in C29n and the Dan-2 warm event. These results indicate that Deccan volcanism induced environmental stress can explain both the gradual extinction and faunal turnover patterns leading up to the KT mass extinction and the long delayed recovery phase (~500 ka) that has remained an enigma for so long.

EVENT STRATIGRAPHY + KT BOUNDARY

1088 - Biostratigraphical interest of Planktic Foraminifera and Guembelitra blooming across the K Pg transition at Atlantic (Bidart SW France) and Tethys realms (Spain Agost Caravaca and Tunisia El Kef Ellès) *Gallala Njoud*¹

Université Ez-zitouna, Institut Supérieur de Théologie de Tunis Département de civilisation Tunis-Tunisia ¹

At the Tethys and the Atlantic realms, the extinction rate at the K/Pg boundary reach about 95 % of the planktic foraminiferal species; whereas the Cretaceous survivors persisting along the Danian could be restricted to opportunist species as *Gt. cretacea* and *Gt. cf. trifolia*, and probably some generalist species of *Hedbergella* and *Heterohelix*. The *Guembelitra cretacea* species, present a biostratigraphical interest, and define the *Guembelitra cretacea* biozone of the lower Danian interval.

The ecological opportunist or disaster species *Guembelitra cretacea* is present in very low frequencies (<2.5%) in late Maastrichtian faunal assemblages of normal open marine environments in the Bidart section but more abundant at the lower Danian *Gt. Cretacea* biozone. During this early Danian biozone (*Gt. cretacea* and *Pv. eugubina* zone), the relative abundance of *Guembelitra* increased. They reached about 40%. This high *Guembelitra* abundance compared with the frequencies of the other species at the lower Danian of Bidart section is marked-contrasts with the very high abundances (80%) generally found in the basal Danian throughout the Tethys (El Kef GSSP and Ellès sections in Tunisia). This disaster opportunist is adapted to stress ecological conditions. Like the *guembelitrids*, the *hedbergellids* species and perhaps few *heterohelicids* could be possible survivors.

1232 - Calcareous nannofossils biostratigraphy of the Cretaceous Paleogene boundary southwest Iran *Mahanipour Azam*¹, Parandavar Mohammad ², Aghanabati Ali ³

Shahid Bahonar University Geology Kerman-Iran ¹ Geological Survey of Iran Geology Tehran-Iran ² Islamic Azad University Geology Tehran-Iran ³

Objective

In the last decades, one of the most significant fossil groups for investigating of the K/Pg mass extinctions were calcareous nannofossils. The aim of the present work is to document through a high-resolution study, the stratigraphic occurrence of calcareous nannofossils across the K/Pg boundary interval at the Kabir-Kuh section in southwest Iran (part of the Neotethys).

Method

Samples were taken at 15 cm intervals at the boundary and at 2.5 meters below and above the boundary. To avoid small sized coccoliths, samples were processed by simple smear slide method as described by Bown and Young (1998). Smear slides were examined using an Olympus BH-2 light microscope with cross-polarized light at a magnification 1000-1500X.

Results

In this study the standard calcareous nannofossil zonations of Sissingh (1977) have been used for the Maastrichtian and Martini (1971) and Varol (1989) have been used for the Paleocene sediments. The studied interval spans from the *Nephrolithus* frequency Zone (CC26) to the *Heliolithus kleinpellii* Zone (NP6) of Martini (1971) and to NTp10B Zone of Varol (1989). The preservation of nannofossil specimens is moderate to good and no significant decrease in the Cretaceous calcareous nannofossil assemblages has been observed towards the K/Pg boundary. Just near the boundary, the abundance and diversity of Cretaceous calcareous nannofossils decreased and is followed by a bloom of the *Thoracosphaera operculata* and the appearance of the new-Paleocene taxa (e.g., *Futyanina petalosa*, *Cruciplacolithus primus*,), which is similar to the other parts of the Tethyan Realm across the K/Pg boundary interval (Gardin, 2002; Tantawy, 2003). Above the K/Pg boundary, the Cretaceous species can be observed along with new-Paleocene taxa. The most important matter is whether these species should be considered as reworked species or survivors. The same condition observed in the other parts of the world (Northwest Tunisia: Gardin, 2002; Egypt: Tantawy, 2003; South Atlantic Ocean: Bernaola and Monechi, 2007 and so on). Some authors consider the Cretaceous species found in the Paleocene sediments as reworked (e.g., Gartner, 1996), while some others (e.g., Gardin, 2002; Bernaola and Monechi, 2007) consider some of the Cretaceous species found in the Paleocene sediments as true survivors. In the studied interval, some of the Cretaceous calcareous nannofossils with good preservation and continuity which observed above the K/Pg boundary are considered as true survivors and not reworked.

EVENT STRATIGRAPHY + KT BOUNDARY

Conclusion

In the studied interval, spanning CC26 Zone of Sissingh (1977) in the Cretaceous sediments and NP1 to NP6 zones of Martini (1971) and NTP1 to NTP10B zones of Varol (1989) in the Paleocene sediments, a sequence of calcareous nannofossil events is identified. The recognition of these bioevents confirms the continuity of sediments in the Kabir Kuh section.

The K/Pg boundary at the studied interval is marked by an important decrease in the abundance and diversity of Cretaceous calcareous nannofossils which is followed by a bloom of the *Thoracosphaera operculata* and the appearance of the new-Paleocene taxa. Above the K/Pg boundary some of the Cretaceous species have been observed with a good preservation and continuity which considered as true survivors.

1096 - Multiproxy Evidence of main Deccan Volcanic Pulse near the Cretaceous-Tertiary Boundary

*Thierry Adatte*¹, Alicia Fantasia¹, Bandana Samant², Dhananjay Mohabey², Gerta Keller³, Brian Gertsch⁴

Lausanne University ISTE Lausanne-Switzerland¹ Nagpur University Dpt of Geology Nagpur-India² Princeton University Dpt of Geology Princeton-United States³ MIT Earth, Atmospheric and Planetary Science Department Cambridge-United States⁴

Recent studies indicate that the bulk (80%) of Deccan trap eruptions (phase-2) occurred over a relatively short time interval in magnetic polarity C29r. Multiproxy studies from central and southeastern India place the KT mass extinction near the end of this main volcanic phase, suggesting a cause-and-effect relationship. In India a strong floral response is observed as a direct response to Deccan volcanic phase-2. In subsequent intertrappean sediments a sharp decrease in pollen and spores coupled with the appearance of fungi mark increasing stress conditions linked to volcanic activity. This interval is characterized by high Chemical weathering (CIA) values, probably due to increased acid rains resulting from SO₂ emissions. Beyond India, multiproxy studies also place the main Deccan phase in the uppermost Maastrichtian C29r below the KTB as indicated by a rapid shift in 187Os/188Os ratios in deep-sea sections coincident with rapid climate warming, coeval increase in weathering and major biotic stress conditions (dwarfing and decreased abundance in calcareous microfossils). These observations indicate that Deccan volcanism played a key role in increasing atmospheric CO₂ and SO₂ levels that resulted in global warming and acidified oceans, which led to increased biotic stress that predisposed faunas to eventual extinction at the KTB.

1008 - Major Bioevents and Extinction of Land Vertebrates in Pakistan; Cretaceous-Tertiary and Other Boundaries

*Malkani M. Sadiq*¹

Paleontology and Stratigraphy Branch Geological Survey of Pakistan Quetta-Pakistan¹

The four major bioevents and extinction of terrestrial vertebrates are found in Pakistan. The first major bioevent occurs at the Permo-Triassic boundary from where the land vertebrates initiated. After the Permo-Triassic boundary the dinosaurs-largest land animals along with mesoeucrocodyles and pterosaur-the flying reptiles were occurred during the Mesozoic of Pakistan. The second bioevent is found at the Cretaceous-Tertiary boundary where these dinosaurs, mesoeucrocodyles and pterosaur became extinct and the mammals (also birds) became dominant. After the Cretaceous-Tertiary boundary disaster the Baluchitheria-largest land mammals were found on the Sulaiman/middle Indus basin (the eastern flank of Western Indus Suture), and Kakar-Khorasan/Katawaz/northern Balochistan basin (western flank of Western Indus Suture). These Baluchitheria migrated from Asia to Indo-Pakistan subcontinent via western Indus Suture. The third bioevent occurs at the Oligocene-Miocene boundary from where the Baluchitheria became extinct. After this third bioevents the rhinocerotoids, anthracotherids, proboscideans, carnivores, chalicotheres, deinotheres, bovids, suids, Creodonta, ruminantia, amynodontiae, and crocodilians were found in the Indus basin of Pakistan. The fourth bioevent is found on the Pleistocene-Holocene boundary from where the man civilization seems to be evolved.

EVENT STRATIGRAPHY + KT BOUNDARY

1267 - K-T Boundary Impact Related Faulting in Alabama

*Cemen Ibrahim*¹, Smith Charlie², A. Mancini Ernest¹

University of Alabama Department of Geological Science Alabama-United States¹ University of Alabama

Department of Geological Sciences Alabama-United States²

It is now commonly recognized that a large asteroid (or bolide) impact caused the major extinction event at the end of Maastrichtian during the late Cretaceous. The event led to extinction of Dinosaurs and is considered as the start of the Tertiary epoch. The location of the impact is identified as the circular basement structure at Chicxulub, in the Gulf of Mexico. If so, the K-T boundary in the Southeastern U.S. should record the effect of this large impact related faults in its vicinity.

We have studied K-T boundary outcrops including the Moscow Landing K-T Boundary outcrop near Demopolis, Alabama which contains the best exposures of the boundary. This outcrop displays tilted small normal fault blocks where Prairie Bluff chalk deposits dip slightly towards the fault plane in the hanging walls. Near the fault plane Prairie Bluff chalk bedding is chaotic and contains a mixture of soft sediment deformation. In many fault blocks the bedding is almost vertical and truncated by the Danian transgressive surface. Adjacent to the fault planes, the outcrop also contains mass-flow conglomerates with green bubbly spheroids and laminated pebbly sandstone layers. The faulting may be initiated by Chicxulub impact event, followed by deposition and redeposited by strong currents. Fine grained deposits must have been removed during low-stand erosion preceding the Danian transgressive surface.

Our interpretations in the Moscow Landing outcrop site suggest that the Chicxulub impact may be responsible for small scale normal faults and associate deposits in southern Alabama at the K-T boundary.

IGCP 609- CAUSES AND CONSEQUENCES OF SHORT-TERM CRETACEOUS SEA-LEVEL

1077 - The pelagic record of sea-level changes the Tethyan Upper Campanian in Austria

*Wagreich Michael*¹, Neuhuber Stephanie¹, Wolfgring Erik¹, Hohenegger Johann²

University of Vienna Department of Geodynamics and Sedimentology Vienna-Austria¹ University of Vienna

Department of Paleontology Vienna-Austria²

Upper Campanian bathyal sections around the Radotruncana calcarata zone at the margins of the northwestern Tethys (Penninic Ocean or Alpine Tethys) in Austria have been investigated. Section Oberhehenfeld (Ultrahelvetica) was located at the northern, European passive margin, and comprises grey pelagic marls. The section at Postalm (Northern Calcareous Alps) was situated at the southern, active Austroalpine continental margin, comprising cyclic deposits of red pelagic marls and marly limestones. Biostratigraphy of the sections is well defined by planktonic foraminifera and nannofossils (CC21-22ab/UC15cdTP). The duration could be constrained by cyclostratigraphy, indicating c. 806 kyr for the zone.

Sedimentary geochemistry, mineralogy and stable isotopes are used to identify environmental changes, i.e. sea-level cycles. Three transgressions may be identified within the zone by a combination of carbonate associated Uranium and Sr/Ca ratios. Sr/Ca decreases dramatically in the middle of the Oberhehenfeld profile and suggest a rapid transgression. A phyllosilicate maximum in the upper part of the zone and the associated lowest Sr/Ca ratio suggest regression. Changing redox conditions during sea level fluctuations may also influence Uranium contents where three identified peaks in the section record periods of sea level rise, corroborated by phyllosilicate and Sr/Ca data.

1265 - Early Cretaceous eustasy sea-level changes and shoreline shifts a puzzle of reconstructions and explanatory mechanisms

*Ruban Dimitriy*¹

Southern Federal University Division of Mineralogy and Petrography, Geology and Geography Faculty Rostov-Russia¹

Presently, several alternative and somewhat incompatible reconstructions of the Early Cretaceous eustatic fluctuations are available. To judge about their reliability and to obtain a correct model of global watermass dynamics for this epoch require multiple far-distance (even planetary-scale) inter-regional correlations of sedimentary successions. Modern advances in sequence stratigraphy can facilitate these correlations. However, an application of this approach faces with serious difficulties. Firstly, absolute sea-level changes, shoreline shifts (transgressions and regressions), and water-depth changes should be differentiated to avoid a mix of evidence leading to erroneous interpretations. Secondly, cycles of the same order may differ spatially because of complex and difficult-to-predict coincidence of eustatic influences, regional/local tectonic activity, and sediment supply. Thirdly, it is expected that the very hierarchy of eustatic cycles may also differ spatially as a result of the same coincidence. Fourthly, global eustatic mechanisms might have "stopped" at some intervals of the geologic history, when global tectonic processes were "calm" and there were not glaciations. Fifthly, it is not always easy to make a distinction between regional and global tectonic processes. Solution (or, at least, careful consideration) of the above-mentioned problems is essential for the reconstruction of the Early Cretaceous eustasy. Searching for the explanatory mechanisms of the latter is not easier. On one hand, significant advances in global plate tectonic reconstructions and dynamic topography modelling since 2000 have permitted a new insight into the tectonic control on eustatic fluctuations. On the other hand, it has become clear that tracing distinctions between glacioeustatic and tectonic signals in the available stratigraphic records is challenging. This is especially important, because glacioeustasy cannot be excluded for the Early Cretaceous, although this was an epoch of "greenhouse". Anyway, deficiency of appropriate stratigraphic records representing the entire Earth remains the central problem for the reconstruction of the Early Cretaceous eustasy.

1049 - End-Cretaceous greenhouse warming & cooling sea-level changes biotic stress and Deccan Volcanism

*Keller Gerta*¹, Adatte Thierry²

Princeton Univ. Geosciences Princeton-United States¹ Lausanne Univ. ISTE Lausanne-Switzerland²

The latest Maastrichtian global short-term greenhouse warming increased temperatures by about 4°C in the oceans and 8°C on land. It began in C29R, and more specifically during the upper part of zone CF2 and continued into the middle of zone CF1 when temperatures rapidly cooled for the remainder of the Maastrichtian. The entire duration of this greenhouse warming was likely less than 100 ky as estimated from zones CF1-CF2, which span 120 ky and

IGCP 609- CAUSES AND CONSEQUENCES OF SHORT-TERM CRETACEOUS SEA-LEVEL

160 ky, respectively. Severe environmental stresses accompanied this greenhouse warming in planktic foraminifera marked by decreased abundance and diversity, dwarfed survivors, blooms (60-90%) of the disaster opportunist *Guembelitra* cretacea and lack of recovery prior to the mass extinction. From Brazil to Central America, the Middle East to India sea-level changes accompanied these climatic and environmental changes. The sea level fall scoured submarine channels that infilled with transported clastic sediments including impact spherules followed by normal sedimentation leading up to the maximum flooding surface at the KTB. Deccan volcanism is the likely cause for these short-term climate changes as a result of increasing atmospheric CO₂ and SO₂ levels leading to global warming, ocean acidification, and increased biotic stress that predisposed faunas to eventual extinction at the KTB.

1159 - Sea level changes in the upper Turonian of the Tethyan Himalaya

*Chen Xi*¹, Wang Chengshan², Wu Huaichun², Jia Jianzhong³, Huang Yongjian³

China University of Geosciences Institute of Earth Sciences Beijing-China¹ China University of Geosciences State Key Laboratory of Biogeology and Environmental Geology Beijing-China² China University of Geosciences School of Earth Sciences and Resources Beijing-China³

Although data suggest elevated temperatures and high sea level in Turonian, rapid sea level changes possibly caused by polar ice growth and melting events were discussed. We investigated the Turonian marine strata of the Gongzha section located within the Tethyan Himalaya tectonic zone. The bio- and C-isotopic stratigraphies of the upper Cretaceous sediments within the same section were initially established by Li et al. in 2006. To clarify, the biostratigraphy of the Turonian in this section, which was discussed by Wendler et al. in 2009, we undertook new studies of the planktonic foraminifers as well as detailed sedimentary logging and sequence stratigraphic analysis. Our new planktonic foraminiferal zones differ from the scheme proposed by Li et al., (2006), but it is in agreement with the neighboring section described by Wendler et al. (2009). The C-isotopic events additionally correlate well with the ones in the European reference curve.

The strata are mainly composed of marl and marly limestone couplets and thin bedded limestones. Based on stratal geometry, the lithology assemblages, microfacies, carbonate contents, natural gamma, and the sizes of terrigenous grains, the succession was subdivided into eight transgressive parasequences and two third order sequences. The carbonate content and natural gamma values were measured for top layers of each couplet at a resolution of ~10 cm. The carbonate of marine sediments is mainly originated from skeletons of marine fauna, while the natural gamma is related to the content of terrigenous input which dilutes the autogenic minerals in the sediment. They were used as proxies to characterize the effects of marine and terrigenous fluxes on the sediments. Both the carbonate content and natural gamma curves can be divided into 8 cycles, which match well with the sedimentary cycles. We attribute the variations of lithology, %CaCO₃ as well as natural gamma values to the sea level fluctuations. Spectral analysis of the carbonate content and natural gamma series reveals significant peaks at ~0.37 m, 0.7 m, 1.7 m and ~7.68 m with ratios of ~20 : 40 : 100 : 400, which matches well with Late Cretaceous orbital parameters. We therefore relate them to the eccentricity, obliquity and precession forcing.

Based on sequence stratigraphy, %CaCO₃ and natural gamma, the relative sea level changes were estimated. Our work indicates that the sedimentary and carbonate cycles are mainly controlled by global sea level changes and occur in concert with changes in the Earth's orbital parameters. Two significant fast (~200 kyr) falling events at ~91.6 and ~90 Ma with depositional environment changing from pelagic basin to outer ramp were identified, which correspond with the global sea level curves established in New Jersey Coastal Plain and Moscow depression. The effects of subsidence, sediment loading and thermal expansion in the study area can hardly lead to the abrupt and significant sea level falls. The only mechanism for the two falling events is the growth and melting of polar glaciers.

1250 - Records of Cretaceous Sea-Level Changes on the Central Tauride Carbonate Platform Evolution from Eustatic Tectonic Control

*Yilmaz İsmail Ömer*¹, Altınar Demir¹

Middle East Technical University Geological Engineering Ankara-Turkey¹

Peritidal carbonate successions in the central Tauride Platform have been studied on different stratigraphic sections. Peritidal carbonates display shallowing upward meter-scale cyclic patterns representing short-term sea-level changes through the sections.

In the Tauride platform, meter-scale cyclicity starts with subtidal facies including daysclad algal wackestone/

IGCP 609- CAUSES AND CONSEQUENCES OF SHORT-TERM CRETACEOUS SEA-LEVEL

packstone, foraminiferal wackestone/packstone/grainstone facies at the bottom and is followed upward with intertidal birdseye/fenestral limestone, laminar stromatolite facies. The cycles are capped by supratidal stromatolite facies and subaerial features such as mudcracks, dissolution vugs and microkarstic mantling breccias.

This cyclic arrangement can easily be traced along the whole measured stratigraphic sections. Penetration depth of the karstification is limited within 1-2 meters. Therefore it is estimated that sea-level changes are short-term and in the order of meter, and not hundreds of meters.

Within the Tithonian interval, stromatolites and subaerial exposure structures are less frequently recorded on Tauride platform, however from the Berriasian onward stromatolites and subaerial exposure structures are more frequently recorded. The Tithonian/Berriasian boundary is totally transitional and there is no time gap or erosion within the boundary beds.

Some polygenic/monogenic intraclastic and bioclastic packstones facies are interpreted as storm related/tidal channel excursion deposits between the cyclic facies alternations. These facies generally lie at the bottom of cycles and are covered by shallowing upward features.

In Aptian, there are three repetitive karst breccias levels within the peritidal sequence. These karst breccias levels are overlain by thicker stromatolite beds and can be correlated in long distance. These levels also correspond to disappearing of some benthic microorganisms and interpreted as type-1 sequence boundary.

Bauxite deposits lying on the "Cenomanian-Turonian" peritidal carbonates and infilling the paleokarst dolines reaching to 150 m in some places are overlain by "Santonian-Campanian" rudist bearing shallow water carbonates. Laterally, this karst surface may thin up and form relatively thinner surfaces.

Polygenic conglomerates including limestone pebbles derived from the underlying rock units are overlain by Maastrichtian shallow water carbonates. This conglomerate facies is few meters in thickness and can be correlated in the NW-SE direction along the Tauride platform. These types of tectonically controlled sea-level changes can be stated as 1st or 2nd order.

The Cenomanian to Turonian bauxite and Campanian to Maastrichtian polygenic conglomerate facies display a tectonically controlled sea level change whereas cyclic meter-scale facies changes within Berriasian to Albian are eustatic sea level changes. Tectonically controlled sea level changes display millions of years time gap at the exposure surfaces, however eustatic sea level changes present thousands of years time gaps at exposure surfaces and generally in meter-scale. They can be interpreted as 4th or 5th order sea level changes.

The third order sea level changes are detected as karst breccias located on the top of shallowing upward parasequence sets which are generally characterized by frequently alternating exposure surfaces and thicker stromatolites. These breccias can be followed by a change in the pattern of benthic organism associations or faunal turn over.

Dolomitization/dolostone levels can coincide with the third-order sea-level falls and can be correlated along the platform.

1093 - Palaeoenvironmental changes in the Albian-Cenomanian boundary interval of the Eastern Carpathians linked to the Late Albian Oceanic Anoxic Event 1d

Melinte-Dobrinescu Mihaela C.¹, *Roban Relu-Dumitru*²

National Institute of Marine Geology and Geoecology Sedimentology Bucharest-Romania¹ University of Bucharest Geology and Geophysics Bucharest-Romania²

The main aim is to present fluctuations in sedimentology, as well as calcareous nannofossil and geochemical content of the uppermost Albian-lowermost Cenomanian sediments of the Eastern Carpathians. A detailed sampling of 14 m marine hemipelagites was achieved, for identifying the nannofossil content and geochemical characteristics. The studied interval spans 101.7-97.6 Ma, between the first successive occurrences of nannofossils *Eiffellithus turriseiffelii* and *Corolithion kennedyi*. The main lithofacies is a shaly one. The oldest deposits are grey-green shales, followed by youngest red shales. Concerning the geochemistry, the SiO₂ is dominant (35 up to 60%), followed by Al₂O₃ (averaging 15 %) and Fe₂O₃ (8-10 %). Red facies are richer in Fe₂O₃. The $\delta^{13}\text{C}$ values vary between -25.30 and -24.01. Within the oldest sediments, a 2 m thick interval yielded less negative $\delta^{13}\text{C}$ values, between -24.5 and -24.01

Grey-green and red shales accumulated in deep water environments. Possibly, their different colours are linked to the transition from a disoxic to an oxic setting. The grey-green shales are almost barren of nannofossils, which occurred consistently in the red shales. Additionally, the disoxic facies contain two minor positive excursions of $\delta^{13}\text{C}$ that could be assigned to the Oceanic Anoxic Event 1d.

IGCP 609- CAUSES AND CONSEQUENCES OF SHORT-TERM CRETACEOUS SEA-LEVEL

1070 - What caused cyclic sea level fluctuations during the Cretaceous super-greenhouse climate

Jens E. Wendler¹, Ines Wendler¹, Christoph Vogt¹, Jochen Kuss¹
Bremen University Geosciences Bremen-Germany¹

While in the present icehouse episode sea level apparently is controlled dominantly by the waxing and waning of polar ice caps, this controlling factor is controversial when it comes to sea level fluctuation during the Cretaceous greenhouse episode. Controversy exists because ice played a much smaller role and was only temporarily present on just one pole. Yet global sea level kept fluctuating at rates comparable to the icehouse mode. The amount of water in the global oceans in fact seems to have alternated following a consistent cyclic beat regardless of which mode, icehouse or greenhouse. So, what could have controlled sea level during the greenhouse mode? Here we follow this question by examining cyclic global stable isotope data that are correlated to sea level cycles deposited during the Cenomanian-Turonian peak greenhouse period. A sedimentary succession from Jordan that represents a Cretaceous shelf environment was analyzed. Mineralogical cycles in this section are associated with the cycles of fluctuating global sea level and suggest a cyclic pattern in continental weathering. Given the potential of water storage on land in groundwater aquifers, the observed signal could explain sea level changes due to a process that doesn't require ice caps for water storage.

1038 - The Santonian-Campanian boundary positive carbon isotope excursion and Late Cretaceous climatic trends Pacific coast Canada

Zakharov Yuri D.¹, Haggart James W.², Beard Graham³, Safronov Peter P.¹

Far Eastern Geological Institute Russian Academy of Sciences (Far Eastern Branch) Vladivostok-Russia¹ Geological Survey of Canada Natural Resources Canada Vancouver-Canada² Qualicum Beach Museum Vancouver Island-Canada³

This study presents oxygen and carbon isotope fluctuations identified in well-preserved ammonite and bivalve fossils of the Upper Cretaceous Nanaimo Group from Vancouver and Hornby islands. The Santonian-Campanian boundary in British Columbia is associated with a positive $\delta^{13}\text{C}$ excursion (to 4.2‰) which appears to be contemporaneous with the Santonian-Campanian Boundary Event reported recently from some regions. The lack of laminated black shales at the Santonian-Campanian boundary interval in British Columbia, with associated heavy $\delta^{13}\text{C}$ values, seems to be in agreement with the idea that most of the world's oceans were characterized by oxygen-rich, but not anoxic, deep waters during Coniacian-Campanian time. Palaeotemperatures for the late Santonian-Campanian of British Columbia, determined on the basis of oxygen isotopic analysis, suggest a direct relationship with basic Late Cretaceous climatic trends (e.g. temperature fall toward the cool climates of the Maastrichtian). The coolest Campanian palaeotemperatures were calculated from the ammonite *Pachydiscus* cf. *ootacodensis* (11.3-26.4°C) and the bivalve *Inoceramus* sp. (about 19.7°C), from the late Campanian Occidentalis Zone (Northumberland Formation). In contrast, the highest palaeotemperatures were obtained from the shells of presumed earliest Campanian bivalves and varied between 25.1 and 33.7°C, which we assume to represent the regional expression of the early Campanian warming event.

1056 - Benthic Foraminiferal Biofacies and Depth Estimates of the Lower Cretaceous of Eastern Russian Plate

Zorina Svetlana¹

Central Scientific Research Institute of Geology of Industrial Minerals / Kazan federal University Management department Kazan-Russia¹

The paleobathymetric modeling of the early Cretaceous sedimentary basin in the Eastern Russian Plate was undertaken on the basis of habitat specificity of benthic foraminifera that were identified from the Lower Cretaceous part of borehole 1 (Tatarskiye Shatrashany). It was established that calcareous benthic foraminifera Lagenida, Nodozariida, Polymorphinida, Rotaliida inhabited on the entire shelf. Increasing the emergence of new calcareous species are marked the basin deepening up to the base of the neritic zone. It was the best tool of paleobathymetric interpretation that calcareous forms are disappeared on the boundary of the shelf and upper bathyal zone. The agglutinated forms such as Lituolida, Trochamminida, Astrorhizida, Textulariida, Ataxophragmiida и Ammodiscida are taking deeper parts of the basin from lower neritic to upper bathyal zone where they are abundant. The generic and species diversity of calcareous and agglutinating community, the emergence of new species, the total

IGCP 609- CAUSES AND CONSEQUENCES OF SHORT-TERM CRETACEOUS SEA-LEVEL

population of foraminifera were calculated. There were constructed the curves on these parameters including bathymetric zonation. Bathymetric curves characterize the variation of depth in the basin for Upper Hauterivian Middle Aptian and Middle Albian megasequences. Spikes in bursts of biodiversity and abundance of foraminifera mark maximum flooding surfaces separating transgressive systems tract and

1132 - Cretaceous Eustatic Sea Levels Revisited

*Haq Bilal*¹

US National Science Foundation and University of Paris Ocean Science Bethesda-United States ¹

Past sea level changes are normally measured using stratigraphic criteria along extant or fossil continental margins or in the interior sedimentary basins. The continental margins, by definition, tend to coincide with the transition from continental to oceanic crust where the build-up and release of stress due to several geodynamic processes can result in a regional crustal warp response with a strong vertical component. Thus, any stratigraphic estimation of eurybatic variations (local or regional sea-level change) at such a dynamic boundary is likely to have been influenced by local tectonics and would represent a measure of regional relative change of sea level only. Continental interior basins, on the other hand, even when they afford relative tectonic quiescence for specific durations, suffer from greater potential of not preserving a stratigraphic record during significant periods of lowstands due to non-deposition, as well as erosional hiatuses during the subaerial exposure.

The world-wide stratigraphic record of the Cretaceous, both along ancient margins and in continental interiors, not only lends itself to interpretations of the eurybatic changes but also offers the testing of various geodynamical models of crustal response to long and short wave length perturbations, especially on time-scales of third-order sea-level changes (~1-3 MY). Recent years have seen further refinements of Cretaceous time scales and biostratigraphy so that more meaningful global correlations can be attempted than possible before. In the reconstruction of the new eustatic (global mean) sea-level curve for the Cretaceous our approach has been to review world-wide sequence-stratigraphic data and retaining only those well-dated events that have wide spatial distributions (and redacting those due to purely regional causes). This has allowed the recognition of consistent patterns that persist globally, though the expression of magnitude of sea-level change (measure of rises and falls) differs widely in different localities. Our reevaluation of Cretaceous eurybatic changes around the world clearly reaffirms the validity of a broad underlying signal of eustasy (global sea level changes) which local conditions often modify but cannot wholly overshadow. We show our results against the designated Stage stratotypes (recognized formal international subdivisions of the Cretaceous System) as well as alongside stable isotopic data from a relatively complete Cretaceous section in Contessa, Italy.

1078 - Stable isotopes and micro- nannoplankton stratigraphy of West Carpathian J K boundary sections Slovakia

*Michalik Jozef*¹, Lintnerova Otilia ², Halasova Eva ³, Rehakova Daniela ³

Slovak Academy of Sci. Geological Inst. Bratislava-Slovakia ¹ Comenius University Economic Geology Bratislava-Slovakia ² Comenius University Geology and Paleontology Bratislava-Slovakia ³

Plankton (calpionellid-, calcareous dinocyst- and nannoplankton) and O and C isotope fluctuations in West Carpathian Brodno, Strapková and Hlboča J/K boundary key sections resulted from paleoenvironment fluctuations. Tithonian Rosso Ammonitico nannofossil assemblages were dominated by *Conusphaera*. *Polycostella* abundance increased during start of the calpionellid *Chitinoidella* Zone and decreased towards the *Crassicollaria* Zone. *Helenechia* accompanied by first small nannoconids appeared during Middle Tithonian. *Obliquipithonellid* abundance in the *Semiradiata* Zone indicates surface water warming.

Start of Late Tithonian *Crassicollaria* Zone is correlable with the reverse magnetic Kysuca Subzone. Small nannoconids, *Hexalithus noeliae* and *Litaphidites carniolensis* appeared within the *Microstaurus chisti* Zone. Stable isotopes ($\delta^{18}O$, $\delta^{13}C$) and low Corg indicate colder period, disturbed by warmer latest Tithonian episode. The J/K boundary is defined by morphological change of *Calpionella alpina* tests. The standard *Calpionella* Zone base is located below the reverse Brodno magneto-Subzone. Poorly diversified nannofossils (*Watznaueria*, *Cyclagelosphaera*, *Conusphaera*, *Polycostella*) are relatively abundant. Boundary interval is designated by the *Nannoconus wintereri* FO together with small nannoconids at the base, and the *Nannoconus steinmanni* minor FO at the top. Temperature increase indicated by oxygen isotopes followed Late Tithonian cooling. Nannoconids bloomed due to temperature / salinity changes associated with earliest Berriasian warm

IGCP 609- CAUSES AND CONSEQUENCES OF SHORT-TERM CRETACEOUS SEA-LEVEL

1188 - Palynomorph response to Turonian Lower Coniacian sea-level and water-mass changes in the Bohemian Basin Czech Republic

Olde Kate ¹, *Jarvis Ian* ¹, Uličný David ², Trabucho-Alexandre João ³, Čech Stanislav ⁴, Laurin Jiří ², vábenická Lilian ⁵, Gröcke Darren ³

Kingston University London Centre for Earth and Environmental Sciences Research Kingston upon Thames-United Kingdom ¹ Academy of Sciences of the Czech Republic Institute of Geophysics Prague-Czech Republic ² Durham University Department of Earth Sciences Durham-United Kingdom ³ Czech Geological Survey Prague-Czech Republic ⁴ Czech Geological Survey Regional Geology of Sedimentary Formations Prague-Czech Republic ⁵

High-frequency Turonian Coniacian transgressive-regressive fluctuations in the Bohemian Cretaceous Basin, Central Europe, have previously been interpreted as being significantly influenced by short-term eustasy. A new research core drilled in offshore marine sediments of the central basin provides a continuous record in predominantly hemipelagic facies. A stratigraphic framework is provided by inoceramids, calcareous nannofossils and carbon stable-isotope chemostratigraphy, combined with basin-scale e-log correlation. Palynological (organic-walled dinoflagellate cysts, spores, pollen) and geochemical records are compared to transgressive-regressive profiles derived from nearshore siliciclastic strata. Proximity proxies from palynological and geochemical data are not always consistent, exemplifying the need for an understanding of the provenance of both siliciclastic and palynological constituents, and assessing possible changes in water mass circulation, before making simplistic sea level interpretations. An understanding of the palaeoenvironmental preferences of dinoflagellate species is essential. Palynological assemblages in the Bohemian Cretaceous Basin were likely influenced by changes in water mass circulation and input from hypopycnal flows. Influxes of dinocyst species from connected areas reflect changes in communication between basins, driven by regional tectonics and eustasy. Variation in the proportion of peridinioid dinocysts, considered to be the product of heterotrophic dinoflagellates, are thought to have been controlled principally by changing nutrient levels.

MACROPALEONTOLOGY AND AMMONITES - SUBCOMMISSION GSSP DISCUSSIONS

1073 - The Global Boundary Stratotype and Section Point (GSSP) for the base of the Santonian Stage Cantera de Margas Olazagutia northern Spain.

Lamolda Marcos A. (coord.)¹, Gallemí Jaume², Ion Jana³, López Gregorio², Martínez Ricardo⁴, Melinte Mihaela C.⁵, Paul Christopher R.C.⁶, Peryt Danuta⁷, *Pons Jose Maria*⁴

Universidad de Granada Estratigrafía y Paleontología Granada-Spain¹ Museu de Geologia de Barcelona - MCNB Paleontologia Barcelona-Spain² Institutul Geologic al Romaniei Bucharest-Romania³ Universitat Autònoma de Barcelona Departament de Geologia Bellaterra (Cerdanyola del Vallès)-Spain⁴ National Institute of Marine Geology and Geoecology Bucharest-Romania⁵ University of Liverpool Department of Earth and Ocean Sciences Liverpool-United Kingdom⁶ Polska Akademia Nauk Instytut Paleobiologii Warszawa-Poland⁷

The Cantera de Margas section has a continuous exposure in its eastern border, through about 160 m, from the middle Coniacian to the middle Santonian.

The GSSP for the base of the Santonian Stage (CSB) lies at 94.4 m and is marked by the first occurrence of the inoceramid *Platyceramus undulaticus*, which occurs through 11.5 m, and is very common in the first 2 m. Between 7 m below and 4.7 m above the CSB, there are 10 additional noteworthy bioevents to characterise the CSB interval. These allow correlation of Olazagutia with northern and southern temperate provinces, in addition to other Tethyan localities.

The CSB is bracketed by Peak 3 and the Michel Dean $\delta^{13}C$ stable carbon isotope events, 3.55 m below and 4.4 m above the CSB, respectively and lies immediately above the $\delta^{13}C$ minimum between these two peaks.

Calibration by graphic correlation using stable carbon isotope events indicates that only four bioevents appear to be reliable as time planes: both the FO and LO of *P. undulaticus*, the FO of the nannofossil *Lucianorhabdus cayeuxii*, and the FO of the inoceramid *Platyceramus cycloides*. The latter is also a good proxy for the CSB.

1087 - On the lower boundary of the Maastrichtian in the International Stratigraphical Scale and its position in the General Stratigraphical Scale of Russia

*Benyamovskiy Vladimir*¹, Baraboshkin Evgeny², Guzhikov Andrey³, Kopaevich Ludmila², Vishnevskaya Valentina⁴, Sel'zer Vladimir⁵, Pervushov Evgeny⁶, Aleksandrova Galina¹, Ovechkina Maria⁷

Geological Institute Russian Academy of Sciences Moscow-Russia¹ Geological Department Lomonosov Moscow State University Moscow-Russia² Geological Department Chernyshevsky Saratov State University Saratov-Russia³ Geological Institute Russian Academy of Sciences Moscow-Russia⁴ Geological Department Chernyshevsky Saratov State University Saratov-Russia⁵ Geological Department Chernyshevsky Saratov State University Saratov-Russia⁶ Paleontological Institute Russian Academy of Sciences Moscow-Russia⁷

The approved definition of the Maastrichtian lower boundary in the International Stratigraphical Scale by the first occurrence of ammonite *Pachydiscus neubergicus*, makes the traditional Maastrichtian lower boundary in the Russian General Stratigraphical Scale, defined at the base of *Belemnella lanceolata* Zone, two belemnite zones older than the international level. To solve this problem we analyzed published and recently collected field data on relationships of macro- and micropaleontological zonal units in key sections documenting the Campanian / Maastrichtian transition in the south of the Russian Plate, Mangyshlak, and Crimea. The preliminary but very important results are the following. The base Maastrichtian of the GSSP corresponds to the from the upper part of LC19 Zone to the basal part of LC20 Zone in the the Upper Cretaceous benthic foraminifera infrazonal scale of Eastern Europe and Mangyshlak (Benyamovskiy, 2008). Based on this correlation it is first shown that the lower part of the *Belemnella lanceolata* Zone actually represents the upper Campanian and corresponds to the interval ranging from the middle part of LC18 Zone to the lower part of LC20 Zone in the benthic foraminifera infrazonal scale by Benyamovskiy (2008). This contribution was supported by RFBR project 12-05-00196-a.

MACROPALEONTOLOGY AND AMMONITES - SUBCOMMISSION GSSP DISCUSSIONS

1235 - Towards a GSSP proposal for the base of the Albian Stage at Col de Pré-Guittard (Vocontian Basin southeast France)

*Petrizzo Maria Rose*¹, Gale Andrew S.², Huber Brian T.³, Jenkyns Hugh C.⁴, Bown Paul R.⁵, Barchetta Alessia¹
 Università degli Studi di Milano Dipartimento di Scienze della Terra A. Desio Milan-Italy¹ University of Portsmouth School of Earth and Environmental Sciences Portsmouth -United Kingdom² Smithsonian National Museum of Natural History Department of Paleobiology Washington, D.C.-United States³ University of Oxford Department of Earth Sciences Oxford-United Kingdom⁴ University College London Department of Earth Sciences London-United Kingdom⁵

A detailed study across the Niveau Kilian black shale in the Col de Pré-Guittard section (Vocontian Basin, southeast France) well documents an abrupt planktonic foraminiferal turnover and a negative $\delta^{13}\text{C}$ shift across the Aptian-Albian transition. Stratigraphically ordered events relative to the base of the Niveau Kilian include: (1) appearance of the calcareous nannofossil *Praediscosphaera columnata* (circular form) and *Helicolithus trabeculatus* at -8 m; (2) extinction of *Paraticinella eubejaouaensis* at -2.25 m and of all late Aptian planktonic foraminifera species between -3.0 and -0.2 m; (3) appearance of the small planktonic foraminifera *Microhedbergella miniglobularis* at -2.0 m; (4) onset of a 1 negative $\delta^{13}\text{C}$ excursion at -1 m; (5) minimum $\delta^{13}\text{C}$ values between +0.3 and +0.6 m; and (6) appearance of the small planktonic foraminifera *Microhedbergella renilaevs* at +0.4 m. The succession falls within the upper part of the ammonite *Hypocanthoplites jacobi* Zone. Reports of the same sequence of planktonic foraminifera and $\delta^{13}\text{C}$ events from deep-sea sites in the North and South Atlantic and Indian Oceans demonstrate that they can be globally correlated. We propose that the GSSP for the base of the Albian Stage be defined at the lowest occurrence of *Microhedbergella renilaevs* where $\delta^{13}\text{C}$ values are at their minimum.

1247 - Inoceramids and biozonation in the El Rosario section Coahuila northeastern Mexico a potential Global Boundary Stratotype Section and Point for the Turonian-Coniacian boundary (Upper Cretaceous)

Ifrim Christina¹, *Wiese Frank*², Stinnesbeck Wolfgang¹
 Ruprecht-Karls-University Institut für Geowissenschaften Heidelberg-Germany¹ Georg-August University CRC Geobiology, Geoscientific Center Göttingen-Germany²

The Rosario section in northern Coahuila, northeastern Mexico, contains a complete record of sediment across the Turonian-Coniacian boundary. Thirteen inoceramid taxa were hitherto identified: *Inoceramus longelatus*, *I. lusatae*, *Mytiloides herbichi*, *M. incertus*, *M. mytiloidiformis*, *M. scupini*, *Didymotis costatus*, *Cremnoceramus waltersdorfensis waltersdorfensis*, *C. waltersdorfensis hannovrensis*, *C. deformis erectus*, *C. deformis dobrogensis*, *C. crassus inconstans*, and *C. crassus crassus*. They are mostly abundant and provide a fine zonation across the Turonian-Coniacian boundary. The uppermost Turonian *Mytiloides scupini* and *C. waltersdorfensis w.* zones and the lowermost Coniacian *C. deformis erectus* and *C. deformis dobrogensis* zones are well represented in Rosario and much more expanded than in the sections of the US Western Interior and Europe which seem to contain hiatus. The early Coniacian *C. waltersdorfensis hannovrensis* is an unreliable index species for correlation between the Old and New World due to its scarcity in North America. We suggest to correlate the European *C. waltersdorfensis hannovrensis* Zone with the North American *C. crassus crassus* Zone. Most last occurrences of inoceramid species appear to be diachronous between the Western Interior Seaway, El Rosario and Europe and should thus not be used for precise intercontinental correlation. Inoceramid abundance (acme) events are known from many sections across the Turonian-Coniacian boundary, but only few of them seem to be isochronous. These are the *Didymotis* I Event, possibly the *Herbichi* and the *Waltersdorfensis* events, and the *Erectus* I and II events. Other acmes seem to have been driven by local or regional rather than global ecological causes. Ammonites are rare, mostly endemic and provide a much lower resolution across the Turonian-Coniacian boundary than inoceramids. Sediments at El Rosario were deposited in an open shelf environment, undisturbed by local tectonic movements or other factors (sea-level, currents, regional tectonics) affecting sediment deposition in epicontinental seas. The continuous and expanded limestone-marl deposition, apparently without major hiatus or changes in litho- and biofacies, the excellent exposition and minimal structural deformation of strata, as well as the well-preserved and diverse fauna with elements of the Western Interior Seaway, the western Tethys and the South Atlantic are ideal attributes for long-distance time correlation. The Rosario section bears a high potential to be used as a Global Boundary Stratotype Section and Point (GSSP) for the base of the Coniacian. All requirements for that are complied at El Rosario.

MACROPALEONTOLOGY AND AMMONITES - SUBCOMMISSION GSSP DISCUSSIONS

1192 - Tethyan carbon isotope stratigraphy across the Jurassic-Cretaceous boundary

*Price Gregory*¹, Főzy István², Pálffy József³, Janssen Nico⁴

Plymouth University Earth Sciences Plymouth-United Kingdom¹ Hungarian Natural History Museum Department of Paleontology and Geology Budapest-Hungary² Eötvös Loránd University Department of Geology Budapest-Hungary³

This research focuses on Late Jurassic–Early Cretaceous carbon isotope stratigraphies derived from measured sections in the Bakony and the Gerecse Mts. (Hungary), constrained by ammonite, belemnite and calpionellid biostratigraphy together with magnetostratigraphy. The aim has been to evaluate whether a consistent pattern in carbon isotope variation can be established, particularly with respect to the Jurassic–Cretaceous boundary. We assess the possible controls on carbon isotope variation and the correlation potential. We observe a decrease in carbon isotopes through the Late Jurassic, consistent with carbon isotope stratigraphies of the Western Tethys. A change to more positive carbon isotope values in the Early Cretaceous is observed, potentially reflecting a change to increasingly nutrient-rich conditions and enhanced carbon cycling. Biostratigraphic and magnetostratigraphic data allow us to accurately place the low point seen in the carbon isotope curve within these schemes. This $\delta^{13}\text{C}$ minimum appears in the upper part of magneto subzone M19n2n and towards the middle of calpionellid Zone B (i.e. the Alpina Subzone). The differences in carbon isotope stratigraphies seen across the Jurassic–Cretaceous boundary elsewhere potentially arise from a combination of factors, including the analysis of discontinuous sections (each with different diagenetic histories) providing data for composite curves, pervasive diagenesis, low sampling resolution or analysis of poorly constrained or correlated sections.

1253 - The Records of Shark Teeth on the Drowned Arabian Carbonate Platform Late Coniacian-Late Santonian Mardin-Mazıdag Area Se Turkey

*Yılmaz İsmail Ömer*¹, Cook Tod, D.², Wagreich Michael³, Hoşgör İzzet⁴, Murray Alison, M.²

Middle East Technical University Geological Engineering Ankara-Turkey¹ University of Alberta Department of Biological Sciences Alberta, Edmonton-Canada² University of Vienna Center for Earth Sciences, Department of Geodynamics and Sedimentology Vienna-Austria³ Viking International Ltd. Çankaya, Ankara-Turkey⁴

The studied area is located in the Arabian Platform, in SE Turkey. The examined section lies within the Karabogaz Formation and unconformably overlies the dolostones of the Derdere Formation. At the contact, there is a 5-10 cm thick layer of gray-green colored claystone/mudstone over the reddish-yellowish colored oxidized surface of the unconformity which penetrates 10-40 cm into the underlying dolostones. The overlying layer is composed of maroon colored mudstone with 10 cm thickness. The next upper layer, with a thickness of 20 cm, is characterized by abundant marine fish remains, both teeth and bones, phosphate fragments, oncoids, and glauconites.

A 40 cm thick gray-dark gray laminated marl/mudstone with some bioturbation includes abundant fish remains. The middle to upper part of the succession includes clayey limestones with fish remains and phosphate fragments, but the fish teeth and phosphate fragments are of relatively lower abundance higher in the section.

Alternation of marl and clayey limestones continues towards the top of the succession and includes some vertebrate bones. A relatively thin shelled bivalve abundance can be seen near the top of the succession. The top of the succession is characterized by chert nodules within clayey limestones with fish remains, and solitary sponge molds and fragments.

This 8,9 m thick succession transgressively overlies a drowned carbonate platform in the Arabian Platform, and presents a relatively condensed sequence characterized by presence of fish remains, phosphate nodules, oncoids, fragments, glauconites. According to nannofossil analysis, the age can be assigned as Late Coniacian to Late Santonian.

Reported from this succession for the first time are numerous teeth from four selachian families. The recovered taxa include *Squatina* cf. *S. hassei* (Squatinidae), *Squalicorax* cf. *S. lindstromi* (Anacoracidae), *Carcharias* sp. (Odontaspidae), and *Scapanorhynchus* cf. *S. rapax* (Mitsukurinidae). These taxa have a cosmopolitan distribution and have been reported from the Western Interior Seaway and east coast of North America, and Europe. Although these pelagic species are normally found in deeper waters, the small size of the recovered individual specimens might indicate that this locality was situated in shallower water that would offer protection for juveniles.

MACROPALEONTOLOGY AND AMMONITES - SUBCOMMISSION GSSP DISCUSSIONS

There is not any coarse clastic intercalated with marls and limestones in the studied sequence. Overlying successions are planktonic forams, plant fragments, inoceramus and ammonites bearing Campanian-Maastrichtian marls, shales and limestones which belong to Lower German Formation in the region.

The presence of pelagic facies with abundant shark remains and phosphate deposits on the drowned platform may indicate a sudden rise of tectonically controlled sea level, increase of nutrient due to upwelling currents and oceanic and biogeographic connection with Central Atlantic and European/Mediterranean Tethys oceans.

1044 - Biostratigraphic and magnetostratigraphic criteria of Boreal-Tethyan correlation of the Berriasian

Shurygin Boris¹, Dzyuba Oxana¹, Bragin Vasily¹, Kazansky Alexey¹

Trofimuk Institute of Petroleum Geology and Geophysics Siberian Branch of RAS Novosibirsk-Russia¹

New paleomagnetic data from the Nordvik Peninsula (Northern Siberia) show that the boundary between the Volgian and Ryazanian stages (= *chetae-sibiricus* ammonite zonal boundary) is within the magnetozone M17r. This boundary is placed within the same magnetozone as the *jacobi-occitanica* ammonite zonal boundary. It was also found that the former magnetozone M17r at Nordvik, which includes the *sibiricus-kochi* ammonite zonal boundary should correspond to magnetozone M16r. The combined biostratigraphic and paleomagnetic data show that the Boreal *sibiricus* ammonite Zone is correlated with at least the major part of the Tethyan *occitanica* ammonite Zone, and the Boreal *kochi* ammonite Zone is correlated with the lower part of the *paramimounum* Subzone of the Tethyan *boissieri* ammonite Zone. Correlation of the Tethyan and Boreal biostratigraphic scales calibrated against magnetostratigraphy is best supported by paleontological data at the Middle-Upper Berriasian transition (*occitanica-boissieri* ammonite zone transition). This is a contribution to RFBR120500453 and IGCP608.

1198 - Taphonomy of crinoid beds associated with large subaqueous dunes from the Lower Cretaceous of the Neuquén basin west-central Argentina

Lazo Dario Gustavo¹, Bressan Graciela Susana¹, Schwarz Ernesto², Veiga Gonzalo Diego²

Universidad de Buenos Aires Ciencias Geológicas-FCEN-IDEAN Buenos Aires-Argentina¹ Universidad Nacional de La Plata Centro de Investigaciones Geológicas La Plata-Argentina²

Exceptionally preserved stalked crinoids have been recorded from Valanginian beds of the Agrio Formation in the Neuquén Basin. The crinoid beds occurred within a 30-m thick succession consisting of cross-bedded sandstones and mixed sediments. Cross-bedded sets are up to 5 m thick and the crinoid beds are invariably associated with reactivation surfaces separating consecutive sets. The scale and architecture of the cross-bedded strata suggest that they represent the migration of large subaqueous dunes (or sand waves) in a tide-influenced subtidal setting. Crinoids appear as well-preserved specimens with different degrees of articulation but there are undetectable degrees of fragmentation, abrasion, and roundness. The best preserved specimens were recorded from the base of a key crinoid bed. Some of these specimens are almost completely articulated including stem with cirri, calyx and arms with pinnules, whereas other specimens are represented either by articulated arms with attached pinnules or isolated stem fragments with cirri. Completely articulated crinoids indicate that these specimens were suddenly buried, probably during life, and no subsequent reworking or bioturbation took place. Avalanching was the most likely burial mechanism of stalked crinoids that probably inhabited the dune toe and/or through on the leeward side of the bedforms. In contrast, beds bearing abundant disarticulated specimens suggest that these suffered significant exposure time prior to final burial in the dune through.

1214 - The Jurassic Cretaceous boundary in the Neuquén Basin southern Andes new geochronological and palaeontological data

Aguirre-Urreta Beatriz¹, Vennari Verónica V.¹, Lescano Marina¹, Naipauer Maximiliano¹, Concheyro Andrea¹, Ramos Victor A.¹

University of Buenos Aires Instituto de Estudios Andinos Don Pablo Groeber Buenos Aires-Argentina¹

The Jurassic-Cretaceous (J/K) boundary is the only major Phanerozoic system boundary that lacks an internationally accepted reference stratigraphic section and its present established age is based on a number of assumptions, including the relative duration of ammonite zones, the first appearance datum (FADs) of calcareous nannofossil

MACROPALEONTOLOGY AND AMMONITES - SUBCOMMISSION GSSP DISCUSSIONS

markers, the constant spreading rates of magnetic anomalies, and the extrapolation of Ar-Ar isotopic data. Precise radio-isotopic U-Pb data are unavailable for the Berriasian, and drawing the boundary between the Jurassic and Cretaceous systems is now a days a matter of global scale discussions. We report here the recent finding of a hundred-metre-thick sequence of marine black shales in the Andean region of the Neuquén Basin of western Argentina, interbedded with ash-fall tuffs that provides important data on this boundary. This succession, part of the Vaca Muerta Formation, bears a characteristic ammonite fauna together with calcareous nannofossils, which have a well-established correlation with classic Tethyan faunas and nannofloras. This transition in the Andes, as recognized on the basis of ammonite zones and nannofossil bioevents, is, for the first time, constrained by precise U-Pb zircon dating. The new U-Pb zircon age of 139.55 ± 0.18 Ma obtained by chemical-abrasion isotope-dilution thermal ionization mass spectrometry (CA-ID-TIMS) is near the base of the Berriasian. Several calcareous nannofossil markers previously identified in the Tethys are recognized in the studied section. The first occurrence (FO) of *Umbria granulosa* is considered the principal event of subzone NJK-B and correlated with the uppermost Tithonian. The appearance of *Rhagodiscus asper* is a further marker for this subzone as it is considered a secondary bioevent for its upper part. Another Late Tithonian marker is the FO of *Nannoconus wintereri*, a bioevent of subzone NJK-C while the FO of *Nannoconus kamptneri* minor defines the base of subzone NJK-D, assigned to the Berriasian. Currently, this event is considered a reliable marker of the Tithonian-Berriasian boundary. In the study section, the last occurrence (LO) of *Polycostella senaria* and *Nannoconus wintereri* and the FO of *Nannoconus steinmannii* minor confirm the Berriasian age for the studied interval. The preserved ammonites are grouped in the *Substeueroceras koeneni* biozone traditionally ascribed to the Late Tithonian, although it may reach the earliest Berriasian, and in the *Argentineroceras noduliferum* biozone of the Early Berriasian. As the obtained age is more than 5 Ma younger than the age of the Jurassic-Cretaceous boundary in the currently accepted geological time scale of the International Commission on Stratigraphy, this contribution shows that there are still existing problems and discrepancies in its determination and emphasizes the need of more accurate absolute data coupled with precise biostratigraphy.

1172 - The calcareous nannofossil *Lithraphidites quadratus* - a marker for the base of the Upper Maastrichtian

*Wagreich Michael*¹

University of Vienna Department of Geodynamics and Sedimentology Vienna-Austria ¹

Substage boundaries are still not defined for the major parts of the Cretaceous stages as still some stage GSSPs are missing. The Maastrichtian Stage is divided into two substages. Although the base of the Maastrichtian is already defined by a GSSP (based on several bioevents, including the first occurrence (FO) of the ammonite *Pachydiscus neubergicus*), the subdivision into a lower and an upper substage still lacks an accepted boundary marker for the base of the upper Maastrichtian. Boreal (i.e. belemnites) and Tethyan (i.e. ammonites) macrofossil zonations differ considerably due to increasing provincialism in a cooling greenhouse world, and the extinction level of inoceramids is positioned around this boundary interval. Plankton zonations seem to include diachronous events, e.g. FO *Abathomphalus mayaroensis*, FO *Nephrolithus frequens*.

The first occurrence of *Lithraphidites quadratus* BRAMLETTE & MARTINI, 1966, a calcareous nannofossil (family Lapideacassaceae) provides a nannofossil marker event that is recognized in most of the nannofossil standard zonations for the Late Cretaceous (CC, NC, UC - zones). Thus, the first occurrence of *Lithraphidites quadratus* defines the base of CC25b, UC20a (both Tethyan TP and Boreal TB provinces), and NC22. Only the austral bioprovince seems to lack this marker.

Correlations indicate the FO of *Lithraphidites quadratus* in the lower part of chron C31n in Tethyan sections, at the onset of the first negative excursion of the "Mid-Maastrichtian carbon isotope event", above the extinction level of inoceramids, with an age around 69.0 - 69.2 Ma. The diachronous FO of *Abathomphalus mayaroensis* occurs both below or above the FO of *Lithraphidites quadratus*, whereas the FO of *Racemiguembelina fruticosa* is well below.

MACROPALEONTOLOGY AND AMMONITES, SUBCOMMISSION GSSP DISCUSSIONS

1097 - Basal Berriasian Ammonite Assemblages and Tracking of the J/K Boundary in Carbonate Sequences of Gerecse Mts. Hungary

*Szives Ottília*¹, Főzy István¹, Szinger Balázs²

Hungarian Natural History Museum Department of Geology and Paleontology Budapest-Hungary¹ MOL Hungarian Oil and Gas Plc. Exploration Laboratories Budapest-Hungary²

The Upper Jurassic-Lower Cretaceous fossiliferous deposits of the Gerecse Mts. (Transdanubian Range, Hungary) are well known and studied for decades. Calpionellids and ammonites are among the most important fossil groups to help us fixing the basal Berriasian as the base of the Cretaceous system. In Gerecse Mts., Early Tithonian ammonite record is excellent and it seemed that in some outcrops also the J/K boundary can be traced. Overall 17 outcrops were investigated, 5 of them were possible candidates for finding J/K boundary containing good cephalopod and calpionellid assemblages from both Tithonian and Berriasian.

Where macrofossil record was insufficient or ambiguous, more thin sections were made and let calpionellids decide the age. On the basis of integrated studies we concluded all of the 5 localities were discontinuous, and basal Berriasian deposited directly on Early/Middle Tithonian beds. Semiforme and Fallauxi Zones were recognized, in some cases the Ponti Zone, and the basal Berriasian Jacobi Zone also provided a rich suite of ammonite material. No evidence was found to prove the presence of Microcanthum Zone.

Summarizing the results, carbonate sections of the Gerecse Mts. are incomplete, lack Upper Tithonian deposits, besides are more condensed as the coeval, classic localities of Bakony Mts. (Hungary).

1090 - The species of genus *Ovulaster* Cotteau 1884 (Echinoidea Micrasterina) distribution in time and space

*Gallémí Jaume*¹

Museu de Geologia-MCNB Dpt. Paleontologia Barcelona-Spain¹

A total of eight species have been assigned to the genus *Ovulaster* Cotteau, 1884: *Ovulaster zignoanus* (dOrbigny, 1853), *O. gauthieri* Cotteau, 1884, *O. auberti* Gauthier, 1892, *O. obtusus* Cotteau, 1910, *O. elevatus* Tzankov, 1984, *O. conicus* (Ilieva, 1998), *O. reticulatus* Smith & Gallémí, 1999, and *O. protodecimae* Giusberti, Fantin & Buckeridge, 2005. Two of them (*O. elevatus* and *O. protodecimae*) are junior synonyms of formerly described species.

The vague Senonian or Upper Cretaceous stratigraphic distribution of the species described between 1853 and 1984 was partially reassessed in the late 1970's using data relying on biostratigraphically significant macrofossils and foraminifera. Species described from 1998 to 2005, ranging from the Lower Maastrichtian to the lower Danian, have benefited from such biostratigraphic tools including calcareous nannoplankton.

Fieldwork in Pyrenees and in the Betic Ranges, as well as access to *Ovulaster* specimens kept in palaeontological collections of Paris, Lyons, Munich, Sofia, Padova, Valdagno and Cinto Euganeo have resulted in a more complete image not only of their ecology but also of their biostratigraphic and palaeogeographic distribution across the Upper Cretaceous/Palaeocene Tethyan sedimentary record.

This is a contribution to projects Moesian Platform (Museu de Geologia de Barcelona-MCNB) and CGL2011-25581 (Ministerio de Ciencia e Innovación, Spain).

1191 - Ammonite extinction revisited

*Goolaeys Stijn*¹, Steurbaut Etienne¹, Dupuis Christian²

Royal Belgian Institute of Natural Sciences Earth & History of Life Brussels-Belgium¹ University of Mons Geology Mons-Belgium²

For the causes of ammonoid extinction (Class Cephalopoda, Early Devonian-Late Cretaceous), an entire array of different hypotheses and theories have yet been proposed. Among these, sea level changes, Deccan Trapp volcanism and the Chicxulub impact are the most popular and commonly cited. The inconsistencies between the proposed theories generally root in too narrowly geographically and geologically spread datasets, and more importantly in the different possible interpretations of negative evidence (absence of species/specimens). This applies to most fossil groups, and is certainly true for ammonoids. However, by intensive collection efforts in many classic sections and by the discovery of several new localities during the last decade, our understanding of latest Maastrichtian ammonoid diversity greatly improved. Today it is possible to give a much more refined overview based on much more positive evidence.

MACROPALEONTOLOGY AND AMMONITES, SUBCOMMISSION GSSP DISCUSSIONS

For example, both at the GSSP and several other sections in the Tunisian Trough Basin, ammonoids were found within the topmost meters of the Maastrichtian, until very close to the Cretaceous/Paleogene (K/Pg) boundary level. About 900 uppermost Maastrichtian ammonoids were collected, all from within the last 420,000 years of the Cretaceous. With 22 species on record, belonging to 18 genera and 10 families, and with representatives of each of the four large ammonoid suborders (Phylloceratina, Lytoceratina, Ammonitina and Ancyloceratina), the Tunisian fauna demonstrates that ammonoids were both taxonomically and morphologically diverse until their very end. The updated version of the compilation of latest Maastrichtian ammonoid occurrences worldwide documents at least 53 species, 29 genera and 13 families in the ultimate half million year of the Cretaceous, including many more localities and a wider variety of settings.

The new positive evidence allows refuting two commonly cited hypotheses on latest Maastrichtian ammonoid diversity 1) as being negatively influenced by Deccan volcanism, and 2) as impoverished and prone to extinction. A major extinction triggered by the Chicxulub impact seems the most plausible theory at present.

1201 - Cretaceous ammonites from East of Iran Qayen area

*Raisossadat Seyed Naser*¹, Mousavinia Abdolmajid², Khazaei Ahmadreza¹, Asadi Shahram³

University of Birjand Geology Birjand-Iran¹ Payam Noor University Geology Mashhad-Iran² Payame Noor University Geology Birjand-Iran³

The study area is a part of eastern margin of Lut Block (Fauvelet and Eftekharneshad, 1990). Previous works in the study area including Raisossadat et al. (2011) on stratigraphy of the study area, Raisossadat and Skelton (2005), Khazaei et al., (2011) on rudists and Babazadeh et al. (2010) on orbitolines. The Cretaceous deposits have been studied. New ammonite material is described from near Ghomenjan (Qumenjan) village (Qayen quadrangle), in eastern Iran. The lithology of measured section is including sandy limestone, limestone with intercalations of marl and marly limestone and in upper part thick bedded limestones.

The identified ammonites include *Anisoceras plicatile*, *Calycoceras gentoni*, *Calycoceras newboldi*, *Calycoceras* sp., *Hysteroeras orbigny*, *Hypoturrilites gravesianus*, *Hyphoplites* cf. *costosus*, *Mantelliceras mantelli*, *Mantelliceras dixon*, *Mantelliceras* sp., *Puzosia* (P.) sp., *Scaphites* sp. and *Turrilites* (*Turrilites*) *costatus* that are reported for first time from east of Iran. Based on identified fossils an Early? - Late Albian- Middle Cenomanian age is suggested for the section.

Based on Delamette, and Kennedy (1991), Owen (1999), and Kennedy and Jolkicev, (2005), *H. orbigny* subzone, *M. dixon*, *M. mantelli* biozones and *T. costatus* subzone are suggested based on identified assemblage ammonites. The ammonite fauna confirm similarity with those genera and species that are reported from central Iran and have less similarity with those are reported from Kopet Dag. During Cenomanian north east and center of Iran were affected by Boreal fauna including *Mantelliceras* and *Schlonbachia*. However the presence of *Anisoceras*, *Scaphites*, *Turrilites* and *Puzosia* in the study area could be commented the east of Iran was affected by Tethyan fauna more than Boreal and might be located between Kopet Dag and Central Iran.

References:

- Babazadeh, S. A, Raisossadat, S. N. and Ahrari, F. 2010. Biostratigraphy and evolutionary study of the Cretaceous orbitolinids in the sedimentary deposits of east Lut, south west of Qayen. *Sedimentary Facies*, 3, 1, 1-10.
- Delamette, M., and Kennedy W. J. 1991, Cenomanian ammonites from the condensed deposits of the helvetic domain (Western Alps, France and Switzerland), *J. Paleont.*, 65, 3, 435-465.
- Fauvelet E. and Eftekharneshad, J. 1990 (compiler). Explanatory text of the Qayen quadrangle geological map, 1/250000 scales, 200 pp., Geological Survey of Iran, Tehran.
- Kennedy, W.J. and Jolkicev, N. 2005. Middle Cenomanian ammonites from the type section of the Sanandino Formation of northern Bulgaria *Acta Geologica Polonica*, 54, 3, 369-380.
- Khazaei A., Raisossadat S.N. and Asadi Sh. 2011. Rudist bivalves (Requieniidae family) in Early Cretaceous sediments from SW Qayen, Eastern Iran, Paleobiogeographic aspects. *Sedimentary Facies*, 3, 2, 52-67.
- Owen, H.G. 1999. Correlation of Albian European and Tethyan ammonite zonations and the boundaries of the Albian stage and substages: some comments, *Scripta Geologica, Special Issue*, 3, 129- 149.
- Raisossadat S. N. and Skelton, P. W. 2005. First record of rudist fauna from the Qayen area, Eastern Iran. 7th International Cretaceous Symposium, Neuchatel, Switzerland.
- Raisossadat, S.N., Mousavinia, A. Khazaei, A. and Asadi, Sh. 2011. Stratigraphy of Cretaceous deposits in Southwest of Qayen area (East of Iran). *Proceeding of the 5th Symposium of Iranian Paleontological Society*, 216-222.

MACROPALEONTOLOGY AND AMMONITES, SUBCOMMISSION GSSP DISCUSSIONS

1213 - Exceptional preservation of Decapod Crustacea from the Lower Cretaceous of the Neuquén Basin Argentina

*Aguirre-Urreta Beatriz*¹, Lazo Dario¹, Rawson Peter F.²

University of Buenos Aires Instituto de Estudios Andinos Don Pablo Groeber Buenos Aires-Argentina¹ University of Hull Centre for Marine and Environmental Sciences Scarborough-United Kingdom²

The Neuquén Basin (34° - 39°30'S), located in the eastern foothills of the southern Andes in west-central Argentina, is an important Meso-Cenozoic depocentre forming a large marine embayment. This embayment was connected to the Pacific Ocean to the west through an active volcanic arc. From the Late Jurassic to the Early Cretaceous more than 2,000 m of mostly marine sedimentary rocks accumulated in the basin. In particular, the Agrio Formation represents mixed clastic-carbonate sedimentation in shoreface to offshore palaeoenvironments on a storm-dominated, shallow-marine ramp, spanning from the late Early Valanginian to the latest Hauterivian. The Agrio Formation has an abundant fossil record composed of ammonoids, nautilids, gastropods, bivalves, serpulids, and corals; bryozoans and echinoids are locally abundant while decapod crustaceans occur sporadically throughout the formation. They are represented by body fossils such as carcasses and isolated claws but also by burrowing traces. We report here exceptionally preserved specimens of the palinurid *Astacodes falcifer* Bell recovered from dark grey shales in the uppermost part of the Agrio Formation. Most specimens consist of still-articulated hard parts, including articulated cephalothorax, abdomen, base of pereopods and tail fan and remarkably some of them show compound eyes with mineralized cuticle. The eyes are large, nearly circular in shape and are attached to a thickly sclerotized peduncle. The eye surface preserves numerous square facets of the same size, and the vision can be described as superposition optics. Most carcasses are enclosed in calcareous nodules while fragmentary parts of carapaces, usually poorly preserved, may represent remains of exuviae. The excellent preservation of the lobsters, with articulated carapaces and their enclosure within cylindrical nodules reminiscent of decapod burrow systems indicates that they probably died within their burrows, and remained there during the earliest stages of fossilization. Energy Dispersive Analysis X-Ray shows that the stalked eyes are mineralized by calcium phosphate; the phosphatization of such delicate compound eyes requires very rapid, almost *in vivo*, mineralization, previous to burial and indicates that diagenesis occurred prior to significant decay.

1200 - IGCP608 Asia-Pacific Cretaceous Ecosystems aim role and general introduction

*Ando Hisao*¹

Ibaraki University Department of Earth Sciences, Faculty of Science Mito-Japan¹

A newly approved IGCP608 Asia-Pacific Cretaceous Ecosystems aims to delineate Cretaceous ecosystems and how they responded to the paleoenvironmental changes that affected the South-East Asian and adjacent Western Pacific region. This project comprises two groups of major topics to be discussed over five years: 1) variations of terrestrial and marine environments, and 2) evolution of terrestrial and marine ecosystems. The terrestrial strata widely distributed in South and East Asia yield abundant indicators, both biotic and lithologic, that are essential for deciphering how the ecosystems were affected by paleoclimatic and paleoenvironmental changes. Marine sediment records in the Western Pacific rim and Eastern Tethys region provide several significant information on the marine paleoenvironmental changes, including paleoceanographic conditions, temperature fluctuations, latitudinal temperature gradients, OAEs, ORBs, ocean acidification, etc. We look forward to obtain important results such as the establishment of close links between atmospheric CO₂ levels, global temperature and precipitation, climatic zonation patterns, paleo-weathering conditions and orbital-scale paleoclimatic fluctuations. The project has an important role in promoting communication at the level of Cretaceous geoscience among the various Asian countries, including some countries outside Asia, following the previous East Asian Cretaceous IGCPs (350, 434 and 507).

MACROPALEONTOLOGY AND AMMONITES, SUBCOMMISSION GSSP DISCUSSIONS

1216 - *Conulus* et al. – an example of Cretaceous echinoid-rich deposits from Turonian of Poland

*Borszcz Tomasz*¹, Dubicka Zofia², Zatoń Michał³

Institute of Oceanology Department of Marine Ecology Sopot-Poland¹ University of Warsaw Faculty of Geology Warszawa-Poland² University of Silesia Faculty of Earth Sciences Sosnowiec-Poland³

We have sampled six outcrops in southern Poland along 35 km transect of transgressive carbonate deposits (with clastic input), securely dated by inoceramid bivalves and foraminifera as lowermost Lower– Middle – lower Upper Turonian.

Our results combined with literature offer a general scenario for development of Cretaceous echinoid biofacies, including (i) facies shift related to sea-level changes, followed by (ii) regional taxonomic replacement and turnover of echinoid community structure from diverse and infrequent to species-poor but abundant (low and high mortality), (iii) re-colonization of new habitats by opportunistic/invasive echinoid species, (iv) rapid increase of abundance fluctuating temporally and varying horizontally in local and regional scales as indicated by echinoid mapping and sieving, (v) establishment of secondary tier communities on dead epibenthic echinoids by impoverished sclerobionts, and (vi) formation of dense echinoid accumulations as a result of spatial within-habitat mixing (transport evidenced by tests abrasion + autochthonous with preserved tubercles) and high abundance punctuated by physical events.

Thin (~ 8 cm), extremely dense concentration (> 80%) noted only in a single outcrop refers to the *Conulus-Camerogalerus* bed with genesis that could be attributed to local acme punctuated by debris flow activated by local synsedimentary tectonics. This record provides the first evidence that transition between 'Jurassic' and 'modern' style echinoid "shell"-beds occurred after Turonian.

Comparison of stratigraphic significance of our accumulations to bio-events from Germany and Spain reveal these as debatable, because of strong local/ regional overprints.

1122 - The first discovery of Stromatolite Biostrome in the Upper Cretaceous continental sediments Mongolia

*Chuluun Minjin*¹, Hendrickson Grant²

Technical University IBEX Ulaanbaatar-Mongolia¹ IBEX Ulaanbaatar-Mongolia²

The Cretaceous rocks of Mongolia are represented by continental sediments, such as sandstones, conglomerates and mudstones. They contain a rich variety of fossils; fishes, dinosaurs, crocodiles, turtles, mammals, plants and invertebrates. Study of these fossils make it possible to determine ages and depositional environments of the host beds. These studies establish regional stages which can be correlated with international standard stages. (Michael J. Benton et al, 2000). One main feature of the Cretaceous rocks of Mongolia is the lack of contained carbonate beds. However in 2013, for the first time, we discovered several Stromatolite Biostrome in beds of the Tsogt-Ovoo Formation which were being mapped in south Mongolia as part of a mineral exploration program. Rocks of this formation are represented by red, green and gray coloured sandstones, conglomerates and sandy mudstones. Thickness of the formation varies between 50 to 100 meters. Thickness of the Stromatolite biostromes are about 1 to 1.5 meters and spatially 45m by 55m. Shape of the stromatolites are domed forms (*Collenia*) and individual size are maximum 40-50 cm high and 50-60 cm in diameter. The preservation of these stromatolites is excellent and in the colony of stromatolites we often find many tubes 4-5 cm high and 0.5 cm in diameter. Origin of these tubes is unknown, but may belong to annelid worms. These Stromatolites appear to have grown on thin (10-60 cm) limestone layers.

In the search of the literature for comparisons we don't find information about close relatives type and ages re Stromatolite Biostromes in the world. We note the information about another type of bioherme, the Eocene Fossil Lake in Wyoming, USA (Mark A. Loewen et al, 1999; V. Leroy Leggett et al, 2007) and biohermes in early Cretaceous Jinju Formation, Korea (In Sung Paik, 2005) where stromatolites have been found with insect fossils.

This new discovery of Stromatolite Biostrome in Mongolia is important new information for the fossil record and clearly more detail investigation will be required to determine better information on the paleoenvironmental situation during the Cretaceous period of Central Asia.

MACROPALEONTOLOGY AND AMMONITES, SUBCOMMISSION GSSP DISCUSSIONS

1228 - First Report of a Heterodont Bivalve (*Aphrodina dutruegi*) in the Cenomanian of Southeastern Turkey northern Arabian Plate

*Hoşgör İzzet*¹, Yılmaz İsmail Ömer²

Viking International Ankara-Turkey¹ Middle East Technical University Geological Engineering Ankara-Turkey²

The important shallow infaunal Heterodont bivalve, *Aphrodina dutruegi* (Cocquand, 1862) has recently been observed for the first time in lower Upper Cretaceous successions of the Mardin-Mazıdağı region, Sakız section from the southeastern Turkey, northern Arabian Plate. In most localities throughout the northern Arabian Platform of southeast Turkey and adjacent area, the Lower Cretaceous sedimentary succession is rather monotonous and consists of exclusively shallow-water carbonate rocks, limestones, dolomites and, sporadically, intraformational sandstone-shale. As in many parts of the Arabian Platform, the Early to Late Cretaceous of the southern Turkey is represented by shales and carbonates of the well known Mardin Group of Aptian-Coniasian age. Here, we focus on largely neglected bivalve species *Aphrodina dutruegi* from the Derdere Formation of the Mardin Group. The studied heterodont species have been collected from one of the most important outcrops of the Cenomanian rocks of the Mardin Group located 30 km southwestern of Mazıdağ area, at Mardin. During the Cenomanian, the earliest stage of the Late Cretaceous, *Aphrodina dutruegi* had a tripartite distribution. From the presence of this new record in Egypt (Galala Formation, central-east Sinai, Late Cenomanian), Jordan (Shuayb Formation=Hummar Formation, Late Cenomanian-Early Turonian) and Southeastern Anatolia-Mardin area, it is assumed that a faunal exchange between the three regions was possible during Cenomanian time. Larvae of *Aphrodina dutruegi* could have migrated along the North Arabia shelf within the Tethys seaway (between Egypt and SE Turkey).

1212 - Ichnofauna of the Karai Formation Uttatur Group Tamil Nadu India

*Paranjape Amruta*¹, Kulkarni Kantimati¹, Kale Anand²

Agharkar Research Institute Geology and Palaeontology Pune-India¹ Bharat Petro Resources Ltd. Mumbai-India²

Ichnofossils from Late Aptian-Early Turonian sequence of Karai Formation, Uttatur Group exposed along Karai-Kulakkalnattam traverse are being reported. Cyclicity of glauconitic shales grading to fine sandstones is common in the lower part of this fossiliferous Formation. Ichnofauna is commonly well preserved in sandstone beds. Lower part of the formation is characterized by low diversity ichnofauna comprising horizontal *Thalassinoides* and rare *Planolites*, while younger beds, preserve a diverse abundant assemblage comprising *Thalassinoides*, *Planolites*, *Palaeophycus*, *Taenidium* and *Chondrites*. Some sandstones towards the top show abundant *Macaronichnus* isp. In contrast, overlying Odiyum Sandy Clay Member is characterised by sandstones lacking body fossils, is highly bioturbated and exhibits ichnofaunal variation in limited spatio-temporal extent. Trough cross bedded to thin bedded, climbing ripple-laminated sandstones are cyclically deposited. Thinly bedded sandstones, commonly carbonate cemented, show networks of *Ophiomorpha* and *Thalassinoides*; while in thicker sandstones, *Gyrochorte*, *Ophiomorpha*, *Rhizocorallium*, *Thalassinoides*, *Palaeophycus*, *Planolites*, *Taenidium*, *Scolicia* prevail. In the upper part, more massively bedded sandstones show development of *Arenicolites*. The ichnofaunal succession, change in gross lithology, fauna and associated primary sedimentary structures suggest a shift from distal Cruziana ichnofacies to Skolithos ichnofacies indicating a shallowing depositional trend from middle/outer neritic to shoreface environment.

1217 - On the evolution of the Late Cretaceous sea-urchin *Micraster* The tale of the *Micraster*-evolution

*Schlüter Nils*¹, Wiese Frank¹

Georg-August University of Göttingen, Geoscience Centre Dept. of Geobiology Göttingen-Germany¹

The Late Cretaceous echinoid genus *Micraster* is one of the most famous examples of a continuous evolutionary lineage in invertebrates. Since the late 19th century, the transformation of certain morphologies of the test (e.g. ornamentation of the paired petals, the periplastral region) in successive stratigraphic intervals has been interpreted to be driven by gradual evolutionary changes. This has been iteratively demonstrated by several authors. However, only few stratigraphically well-constrained data are available, describing the temporal distribution of the evolutionary states of the ambulacra. Furthermore, previous works considered exclusively populations from lithologically monotonous nannofossil limestones of cool temperate regions. Here we present new data on the temporal morphological changes of the paired petals and the periplastral area for the interval upper Turonian to

MACROPALEONTOLOGY AND AMMONITES, SUBCOMMISSION GSSP DISCUSSIONS

lower Coniacian from warm temperate regions with heterolithic ramp deposits (Cantabria, northern Spain). The deviations between populations from different facies realms are most obvious in the temporal appearance of morphologies, the abundance peak shifts of morphological states are diachronous; abundance peaks in advanced states occur earlier in northern Spain than in southern England; the temporal occurrence pattern of these states are very divergent, predominately monophenotypic in successive intervals in the Chalk facies (southern England), whilst polyphenotypic populations in the heterolithic facies are found in each stratigraphic interval. Additional, evolved states were already present in primitive species of *Micraster* (*M. leskei*) in populations of northern, which is in contradiction to previously published works.

We conclude that an involvement of plastic responses to environmental cues is a more plausible explanation of the observed patterns than evolutionary (genetic) induced changes in the morphological states of the ambulacral zones of *Micraster*. Thus, the morphospecies concept, chronospecies respectively, in this genus, based on progression of distinct characteristics (i.e. ambulacral ornamentation) within certain successive stratigraphic intervals, has to fail in the upper Turonian/lower Coniacian. According to the here presented outcome, the evolution of *Micraster* is not an example for a continuous evolutionary lineage as interpreted by previous works. Further, it follows that the evolution of *Micraster* has to be revised carefully. Therefore it is inevitable to include larger populations of different palaeoenvironmental settings in further studies.

1020 - New Pterosaur from the Latest Cretaceous Terrestrial Strata Of Pakistan

Malkani M. Sadiq¹

Paleontology and Stratigraphy Branch, Geological Survey of Pakistan, Quetta-Pakistan ¹

The pterosaurs are divided into two major groups like the Jurassic form Rhamphorhynchoidea (small and tooth bearing pterosaurs) and the Cretaceous Pterodactyloidea (large in size with toothless beak) (Romer 1958). But some rare forms with teeth survived until Cretaceous-Tertiary extinction. Most of the opinions are in the favor of quadruped locomotion while some are in the favor of bipedal. At the end of Cretaceous highly developed forms of birds evolved and competition with them may be a factor for their extinction. So far dinosaurs and crocodiles are reported from the Cretaceous of Indo-Pakistan but now pterosaur-the flying reptile is being reported first time. A dentary ramus of *Saraikisaurus minhui* (Pterosauria, Pterodactyloidea, Saraikisauridae, Saraikisaurinae) has been found from the latest Cretaceous terrestrial (close to shore meandering stream over bank deposits) Vitakri Formation of Top Kinwa locality, Vitakri area, Barkhan District, Balochistan Province (Sulaiman Basin), Pakistan. The preserved dentary ramus shows carnivorous type elongated skull with eight teeth. This ramus shows internal pneumatic texture/structure. The teeth are oval to suboval, some overlapped. The total length of preserved dentary ramus is 5.8cm. The dentary is slender. After the collision of Indo-Pakistan subcontinent, this pterosaur may be migrated from Asia like China, Korea, etc.

PALEOCLIMATE

1139 - Geochemistry of shales of the Lower Cretaceous Mural Formation Northern Sonora Mexico Implications for source area weathering paleoclimate and provenance

*Jayagopal Madhavaraju*¹, Carlos Manuel González-León¹, Hannes Löser¹, Teresa Pi²

Universidad Nacional Autonoma de Mexico ERNO, Instituto de Geologia Hermosillo-Mexico¹ Universidad Nacional Autonoma de Mexico Instituto de Geologia D.F.-Mexico²

The Mural Formation is well developed in northern Sonora and has been divided into eight members viz. i) Fronteras (F), ii) Rancho Bufalo (RB), iii) Cerro La Ceja (CLC), iv) Tuape Shale (TS), v) Los Coyotes (LC), vi) Cerro La Puerta (CLP), vii) Cerro La Espina (CLE) and viii) Mesa Quemada (MQ). Major, trace and rare earth elements (REE) were carried out on the shale samples of Mural Formation that crops out in the northern Sonora. The purposes of the present study are: a) to determine the geochemical variations among different members of the Mural Formation, Sonora, b) to deduce the potential stratigraphic variation in provenance signatures and source area weathering, c) to infer paleoclimatic conditions that prevail during the Aptian-Albian times.

The X-ray diffraction data reveals that the shales mainly consist of illite and kaolinite and minor amounts of chlorite and smectite. The shale samples from the various members of the Mural Formation show large variations in major and trace elements. On the SiO₂/Al₂O₃ diagram most of the samples plot in the Fe sand and Fe shale fields. Th, Rb and Al₂O₃ show positive correlation with K₂O which suggest that the concentration of these elements are mainly controlled by illite. Most of the trace elements are depleted with respect to those of PAAS. The chemical index of alteration values (CIA: 55 to 89) and A-CN-K (Al₂O₃ – CaO+Na₂O – K₂O) relationships indicate the moderate to intense weathering in the source region. The chondrite normalized REE pattern and elemental ratios like La/Sc, Th/Sc, Th/Co, La/Co and Eu/Eu* suggest that these shales were mainly derived from the felsic source rocks. In addition, Sc vs Th, La/Sc vs Th/Co and La-Th-Sc plots also support the felsic nature of the source rocks.

Furthermore, the detrital zircon geochronology of the sandstones of Rancho Bufalo and Cero La Ceja members show five main groups of detrital zircon age populations viz. Proterozoic (2120 – 578 Ma), Paleozoic (527 – 259 Ma), Triassic (227 – 206 Ma), Jurassic (182 – 145 Ma) and Early Cretaceous (145 – 117 Ma). The Proterozoic zircons were mainly derived from the basement rocks of the Caborca block, whereas the Triassic zircon grains derived from Triassic arc magmatism in the Mesozoic Cordilleran arc exposed in Mesozoic strata on the Colorado Plateau. The Jurassic zircons were derived from Jurassic continental arc in northwestern Mexico and southern Arizona. The Early Cretaceous detrital zircons ranging from 145 to 117 Ma were derived from the Alisitos volcanic arc presently exposed in the southern and Baja California.

1184 - Geochemical proxies for palaeoenvironmental change towards understanding the Cretaceous hothouse

*Jarvis Ian*¹

Kingston University London Centre for Earth and Environmental Sciences Research Kingston upon Thames-United Kingdom¹

An increasingly extensive geochemical toolbox, and high-resolution analyses of successions worldwide, have led to major advances in understanding of Cretaceous palaeoenvironmental change. High-resolution stable-isotope and elemental chemostratigraphic analyses of Cretaceous pelagic and hemipelagic carbonates provide a tool for global correlation, dating and palaeoenvironmental analysis. Astrochronological tuning of geochemical time series offers a step-change in dating precision and accuracy. Oxygen stable-isotope analyses ($\delta^{18}\text{O}$) of pristine fossils and bulk pelagic sediments, complemented by biomarker (TEX₈₆), Mg/Ca ratio, and clumped-isotope ($\Delta 47$) data underpin knowledge of climate change. Carbonate ($\delta^{13}\text{C}_{\text{carb}}$) and organic carbon ($\delta^{13}\text{C}_{\text{org}}$) stable-isotope analyses of marine and terrestrial materials provide insights into the Cretaceous global carbon cycle, including variations in atmospheric pCO₂, and feedbacks during oceanic anoxic events (OAEs). Neodymium ($\epsilon\text{Nd}(t)$), strontium ($^{87}\text{Sr}/^{86}\text{Sr}$) and osmium isotopes ($^{187}\text{Os}/^{188}\text{Os}$) record variations in terrestrial weathering fluxes, pulses in volcanic activity (e.g. Large Igneous Province emplacement), and changing ocean circulation patterns. Regional to global changes in water-column and sediment redox conditions linked to OAEs, are evidenced from trace-element proxies and fractionation in a wide range of isotope systems (e.g. N, S, Fe, Mo, U). The practical application of multidisciplinary, multi-proxy analyses will be demonstrated using case studies from the Tethyan and Boreal Upper Cretaceous of Europe.

PALEOCLIMATE

1043 - A composite Berriasian carbon-isotope curve from Boreal sections

*Dzyuba Oxana*¹, Izokh Olga², Shurygin Boris¹

Trofimuk Institute of Petroleum Geology and Geophysics Siberian Branch of RAS Novosibirsk-Russia¹ Sobolev

Institute of Geology and Mineralogy Siberian Branch of RAS Novosibirsk-Russia²

Detailed carbon-isotope curve is constructed for the Maurynya section (eastern slope of the Northern Urals) and is updated for the Nordvik section (Northern Siberia). These curves are based on geochemical isotope analyses of Boreal belemnite (Cylindroteuthididae) rostra from the J–K boundary strata. A comparison of the reconstructed carbon-isotope curves with similar curves from other Boreal sections (1) reveals correlatable excursions in the J–K boundary interval, and (2) allows the creation of a Boreal composite carbon-isotope curve that characterises the upper Volgian–Ryazanian in detail. We interpret all of the significant shifts in carbon isotope values as reflecting changes in the organic carbon burial rates. One of the most remarkable positive carbon isotope excursions in the Boreal curve is recorded in the top part of the upper Volgian taimyrensis ammonite Zone slightly above the J–K boundary, which is established here by palaeomagnetic data. Because a significant positive carbon isotope shift was also observed immediately above the J–K boundary in the Tethyan Guppen-Heuberge pelagic-carbonate section (Switzerland), this positive carbon isotope event can be regarded as a useful marker for a Panboreal and Boreal–Tethyan correlation of J–K boundary beds. This is a contribution to RFBR120500453 and IGCP608.

1063 - Contemporaneous environmental changes in the Boreal and Tethyan Lower Cretaceous (Valanginian Barremian) evidenced by stable isotope patterns

*Meissner Philipp*¹, Bodin Stéphane¹, Mutterlose Jörg¹, Malkoč Matthias¹

Institut für Geologie, Mineralogie und Geophysik Ruhr-Universität Bochum Bochum-Germany¹

We present stable isotope findings (d18O, d13C) and trace element data (Mg, Sr, Fe, Mn) of 420 belemnite rostra from stratigraphically well-dated sections in northwest Germany and southeast France. The studied interval covers the earliest Valanginian to latest Barremian. Combined with previously published data of 1595 rostra a detailed stable isotope record has been established for both, the Tethys and the Boreal Realm. This combined data set suggests contemporaneous episodes of major environmental change for both realms, which in turn indicate a global control. The d18O data display long-term temperature fluctuations of up to 7°C with a cooling in the late Valanginian Hauterivian and a distinctive warming of about 5°C in the late early Barremian. The Valanginian d18O data, however, show rather complex patterns documenting that a latitudinal effect is involved as well. The first detailed d13C record of the Valanginian non-arctic Boreal Realm is presented, showing a major positive carbon isotope excursion (CIE), the Weissert event. This study highlights the amplitude of environmental perturbations in the Early Cretaceous and supports the idea of combined regional and global factors behind these shifts.

1211 - Paleoclimatic maps new element to discuss evolution and radiation of major clades exemple of angiosperms radiation

*Chaboureaux Anne-Claire*¹, Donnadieu Yannick¹, Sepulchre Pierre¹, Franc Alain²

UMR 8212 - CNRS-CEA-UVSQ, CEA Saclay LSCE Gif sur Yvette-France¹ INRA UMR Biodiversité Gènes et Communautés CESTAS Cedex -France²

In 1875, Darwin raised an abominable mystery with the sudden appearance of Angiosperms during the Cretaceous. Their diversification during this period marks the beginning of a rapid transition in the Mesozoic floras, from a dominance of ferns, conifers and cycads to ecosystems dominated by angiosperms. Since, many questions are still debated, especially the nature of primitive flowers, the evolution of major lineages, and the control factors of their rapid diversification. Here we investigate the role of the climate, and the relation between global climate and evolution of major clades. Is the apparition of Angiosperms favored by the concomitant evolution of climate? According to climate and paleogeographic constraints, what were the migration routes possible?

For this, we simulated the climate for 5 paleogeographic maps from the Trias to the late Cretaceous. Climate modeling has been performed with the global climate model FOAM to obtain monthly precipitations and temperatures. These climatic variables have been translated to climatic regions (polar, cold, temperate warm and cold, arid, and tropical climates) according to the classification of Köppen. Combined paleogeography and climatic regions provide new elements of discussion about the dispersal paths for the species.

PALEOCLIMATE

Results show that with a constant atmospheric CO₂, mean annual continental temperatures and precipitation are the highest for the Cenomanian (95Myr). On the contrary, precipitations are weak for the Trias and Jurassic times. These older paleogeographies with vast size of supercontinent show large arid zones. Cretaceous paleogeographies, with smaller areas and dispersed continents, show an important decrease of the arid areas, which even reach their lower value during the mid-Cretaceous at 95 Myr. In parallel, temperate climate reaches a peak at this time. The mid Cretaceous is so a key period, with a chiasmus in the evolution and repartition of temperate and arid climate. Another interesting point is the location of various Angiosperms fossils (Central Europe, North America, Asia) dated from the middle-late Cretaceous in temperate zones of Köppen. The location of the fossils-rich regions under a temperate climate raises the hypothesis that the development of temperate humid conditions could trigger explosion and diversification of Angiosperms clades.

To conclude, experiments show that the paleogeography was a major control factor for the evolution of the continental climate types on the Earth surface. The continental configuration during the mid-Cretaceous with small areas and dispersed continents was optimal, and allowed extension of the temperate zones, providing new habitats for angiosperms. The development of temperate climate areas could trigger and control diversification of one of the biggest current clades.

1034 - Paleoenvironmental change during the Early Cretaceous

*Föllmi Karl*¹

University of Lausanne Institute of Earth Sciences Lausanne-Switzerland ¹

The Early Cretaceous environment was strongly influenced by the breakup of Pangea, which was associated with the formation of rift basins and important volcanic activity. These processes interacted with greenhouse conditions, and the climate oscillated between "normal" greenhouse, predominantly arid conditions, and intensified greenhouse, predominantly humid conditions. Humid conditions were particularly intense during shorter episodes of environmental change (EECs) - the Valanginian Weissert, the latest Hauterivian Faraoni, the latest Barremian to earliest Aptian Taxy, the early Aptian Selli, the early late Aptian Fallot and the late Aptian to early Albian Paquier Episodes. In general, the EECs had a prehistory, during which the stage was set for environmental change. Life and climate co-evolved during the Early Cretaceous. Arid conditions may have affected continental life, such as across the Tithonian-Berriasian boundary. Humid conditions and the corresponding tendency to develop dys- to anaerobic conditions in ocean waters led to phases of accelerated extinction in oceans, and to larger vegetation covers on the continents, such as during the Valanginian, when herbivores thrived. During Early Cretaceous EECs, reef systems and carbonate platforms were particularly vulnerable. They were the first to disappear and the last to recover, often only after several million years.

1102 - Some data on the Late Cretaceous paleogeography in the Georgia (on the basis planktonic foraminifera and nannoplankton)

Gavtadze Tamara ¹, *Mikadze Khatuna*², Chkhaidze Zviadi ¹

Institute of Geology Javakhishvili University Tbilisi-Georgia ¹ Insitute of Paleobiologyt Georgia nNational Museum Tbilisi-Georgia ²

The Gagra-Java zone extends along the Southern slope of the Greater Caucasus, in its turn subdivided into three facies types: Abkhazia-Racha, Odishi-Okriba and Dzirula.

With the help of the carried out analyses it is possible to judge, that in the Upper Cretaceous period in the Gagra-Java zone a warm tropical climate can be inferred, where temperature of water varied from 150C to 270C, and depth of the basin - from 80m to 200m.

The analysis of the Late Cretaceous nannoplankton and foraminifers association of the Zhinvali-Gombori subzone of the Mestia-Tianeti zone of GCFS (East Georgia) has shown the existence of four sedimentary cycles: Cenomanian-Lower Turonian, Middle Turonian-Early Campanian, Late Campanian-Early Maastrichtian and Late Maastrichtian. In the Cenomanian-Early Turonian there was a basin of isolated, regressive sea in the southern part of the moderately cold-water belt. From the Late Turonian the boundary between the warm- and moderately cold-water belts moved to the north. Transgression that started in the Late Turonian lasted till the Early Coniacian. In the middle part of the Early Coniacian is outlined shoaling of the basin.

PALEOCLIMATE

1147 - Paleohydrology of Cretaceous Continents

*Hay William W.*¹, DeConto Robert M.², Flögel Sascha³

University of Colorado Geological Sciences Estes Park-United States¹ University of Massachusetts Geosciences Amherst, MA-United States² Helmholtz Zentrum für Ozeanforschung GEOMAR Kiel-Germany³

Brian Fords Aquatic Dinosaur hypothesis has caused us to rethink what conditions on land were like during the Cretaceous. Their fossils are most often found in environments representing swamp or shallow water deposits. We suggest that the Cretaceous hydrologic cycle may have been very different from that of today. There were none of the fields of permanent snow and ice that source the headwaters of most modern rivers. Today, eroded sediment is flushed to the sea during the melts, resulting in spring floods. However, there is evidence from numerical climate models that the flow of Cretaceous rivers was more evenly distributed throughout the year. They delivered less water to the sea but left much of it behind in lakes and swamps that served as local sources for atmospheric moisture. They also left much of their sediment load on land as paludal and lacustrine sediments.

1007 - Depositional Environments of Cretaceous Strata of Indus Basin (Pakistan)

*Malkani M. Sadiq*¹

Paleontology and Stratigraphy Branch Geological Survey of Pakistan Quetta-Pakistan¹

The Cretaceous sediments are more than 3000 meter thick in the Indus basin. The upper Indus Basin shows marine Chichali, (glauconitic muds), marginal marine Lumshiwal (quartzose sandstone with subordinate shale) and Kawagarh (limestone) and continental, back barrier and deltaic Hangu (coal, laterite, sandstone and shale) formations. The middle and lower Indus basins represent Early Cretaceous fine pelagic, shallow marine and deltaic Parh Group (Sembar, Goru, Parh formations; belemnite bearing shale, marl and limestone). The Late Cretaceous was emerged by a regression of sea which shows the Mughal Kot (shale and sandstone with minor limestone), Fort Munro (limestone), Pab (mainly sandstone with subordinate shale) and Vitakri (alternating red muds and sandstone) formations of Fort Munro Group, deposited under muddy to sandy shelf, distal deltaic and fluvial environments. The dinosaurs were the huge land animals at that time but became extinct at K-T boundary due to natural disasters and adverse paleoclimates. At early Paleocene the transgression of sea emerged, which deposited the marine Sangiali (bivalves, nautiloids and gastropods bearing limestone and shale), Rakhi Gaj (siliciclastic) and Dungan Limestone of Sangiali Group. Eocene was mostly marine, deltaic and partly terrestrial. The Oligocene and onward the mollasse alluvial environments became dominant.

1084 - Mid-Cretaceous paleoclimate a low-latitude record from a Fossilagerstätte in Tanzania benthic and planktic foraminifera faunal changes single-species stable isotopes and grain-size

*Wendler Ines*¹, Wendler Jens E.², Huber Brian T.³, MacLeod Kenneth G.⁴

University of Bremen Department of Geological Sciences Bremen-Germany¹ University of Bremen Department of Geological Sciences Bremen-Germany² Smithsonian Institution Department of Paleobiology Washington, DC-United States³ University of Missouri Department of Geological Sciences Missouri-United States⁴

Paleoclimatic greenhouse conditions of the mid-Cretaceous are still far from being understood as evidenced by the controversy on glaciations during the Turonian one of the warmest periods of the Mesozoic. Absolute paleotemperature estimates and reconstructions of stability or fluctuation of climate and sea-level critically depend on high-resolution records of well-preserved fossil material. We present a data compilation of grain-size, foraminiferal assemblages and single-species stable isotopes from Turonian clayey siltstones with exceptionally well-preserved microfossils that were drilled in Tanzania and represent a low-latitude record. The data indicate stable environmental conditions during the Early and most of the Middle Turonian, arguing against a glaciation during that period. In the uppermost H. helvetica Zone and lower M. schneegansi Zone (Middle/Late Turonian), two phases of simultaneous shifts in benthic foraminifera associations, increase in grain-size and shifts in foraminiferal $\delta^{13}\text{C}$ appear to reflect a stepwise shallowing in relative sea-level, which is supported by a dramatic increase in planktic biserial foraminifera during the second phase. A change in foraminiferal preservation at this level precludes interpretation of $\delta^{18}\text{O}$ data, but absence of simultaneous $\delta^{18}\text{O}$ shifts in benthic and planktic foraminifera during the first phase does not support the glaciation hypothesis as a cause for the regression.

PALEOCLIMATE

1082 - Fluctuating sea-surface temperature seasonalities in the mid-Cretaceous greenhouse world Insights from rudist bivalve shell geochemistry

*Stefan Huck*¹, Thomas Steuber², Stefano Bernasconi³, Ulrich Heimhofer¹

Lebniz University Hanover Institute for Geology Hanover-Germany¹ The Petroleum Institute Abu Dhabi-United Arab Emirates² ETH Zurich Geological Institute Zurich-Switzerland³

The Cretaceous period is generally considered to have been a time of warm climate, but there is an on-going dispute about the existence of cool interludes - including the short-termed installation of polar ice caps. Mid-Cretaceous shoal-water ecosystems have been proven to show characteristic response modes (e.g., microencruster-blooms) to major climatic and environmental changes related to oceanic anoxic events (OAEs), times of widespread pelagic organic matter burial. Some biotic changes predate OAE1a by few 100kyrs, an observation that is in favour of gradual and pulsed volcanic CO₂-outgassing as main trigger of this event.

We aim at reconstructing the evolution of Barremian-Aptian sea-surface temperatures (SSTs) and SST seasonalities in the prelude, during and in the aftermath of OAE1a. The outer low-Mg calcite-shell layer of rudist bivalves (e.g., *Toucasia*), collected at carbonate platform settings in the (sub-)tropical Tethyan realm (France, Croatia, Spain), serves both as chemostratigraphic and palaeoclimatic archive. Sclerochronological variations in isotopic ($\delta^{18}\text{O}$, $\delta^{13}\text{C}$, clumped isotopes) and geochemical composition (Sr, Fe, Mn, Ba, Ca/Mg) provide insights into seasonal and long-term palaeoclimatic and palaeoenvironmental changes. The outcome of this work will be of significance both for those studying the triggering factors of oceanic anoxic events and the palaeoecology of rudist bivalves.

1094 - Drastic Shrinking of the Hadley circulation in the Mid-Cretaceous Supergreenhouse

*Hasegawa Hitoshi*¹, Tada Ryuji², Jiang Xinsheng³, Suganuma Yusuke⁴, Imsamut Suvapak⁵, Charusiri Punya⁶, Ichinnorov Niiden⁷, Khand Yondon⁷

Nagoya University Museum Nagoya -Japan¹ the University of Tokyo Department of Earth and Planetary Science Tokyo-Japan² Chengdu Institute of Geology and Mineral Resources Chengdu -China³ National Institute of Polar Research Tokyo-Japan⁴ Bureau of Geological Survey Department of Mineral Resources Bangkok-Thailand⁵ Chulalongkorn University Department of Geology Bangkok-Thailand⁶ Mongolian Academy of Sciences Paleontological Center Ulaanbaatar-Mongolia⁷

Understanding the behaviour of global climate system during extremely warm periods is one of major themes of paleoclimatology. Proxy data demonstrate that equator-to-pole temperature gradient was much lower during the mid-Cretaceous supergreenhouse period, implying larger meridional heat transport by atmospheric and/or oceanic circulation. However, reconstructions of atmospheric circulation during the Cretaceous have been hampered by lack of appropriate datasets based on reliable proxies. Desert distribution directly reflects the position of subtropical high-pressure belt, and prevailing surface-wind pattern preserved in desert deposits reveals the exact position of its divergence axis, which marks poleward margin of the Hadley circulation. We reconstructed temporal changes in the latitude of subtropical high-pressure belt during the Cretaceous based on spatio-temporal changes in the latitudinal distribution of deserts and prevailing surface-wind patterns in Asian interior. We found a poleward shift in the subtropical high-pressure belt during the early and late Cretaceous, suggesting a poleward expansion of the Hadley circulation. In contrast, an equatorward shift of the belt was found during the mid-Cretaceous supergreenhouse period, suggesting drastic shrinking of the Hadley circulation. These results, in conjunction with recent observations, suggest existence of a threshold in atmospheric CO₂ level and/or global temperature, beyond which the Hadley circulation shrinks drastically.

PETROLEUM OCCURRENCES IN CRETACEOUS BASINS OF TURKEY AND ADJACENT AREAS

1154 - Palaeoenvironment and Qualitative and quantitative assessment of organic matter of Gurpi Formation in southwest of Iran

Zarei Elahe¹, Ghaseminejad Ebrahim¹

Geology Department of Geology tehran-Iran¹

The Gurpi Formation is known as a source rock in a few localities in the Zagros basin. Qualitative and quantitative assessment of sedimentary OM and depositional environment interpretation was performed via palynological and organic geochemistry analysis. Palynofacies analysis and Aliphatic n-alkanes distribution suggest open marine environment. The amount of total organic matter (TOC) is relatively low (less than 1%). To investigate the cause of the low quantity of organic matter cross plots of Calcite equivalent percentages vs. TOC, Pr/nC17 vs. Ph/nC18, Pr / Ph vs. Pr + Ph/nC17 + nC18 and Sulfur vs. TOC were used. These cross plots indicated a mixed marine and terrestrial organic matter for the two sections studied. Moreover, the data gained confirm that the formation was deposited in a more marine and anoxic condition in a roughly constant production trend of organic matter at the Kavar section (southwestern margin of zagros) relative to the second section (Farhadabad) located to the northeast. High TOC, Pr/nC17 and Pr+Ph /nC17+nC18 values in early Maastrichtian parts of the sections suggest increase in terrestrial organic matter input and anoxic condition as cause for the increase in TOC content. Comparing the values of S1, S2, Tmax and TOC based on Rock-Eval pyrolysis indicate that the formation is thermally in early mature stages and does not present a good producing potential for petroleum except for minor intervals in early Maastrichtian.

1068 - Source Potential Evaluation of Albian Kazhdumi Formation in Fars Area Zagros Basin Iran

Ahanjan Asghar¹, Khaleghi Mehdi¹, Tarhandeh Elham¹, Tezheh Farid¹

National Iranian Oil Company Geochemistry Tehran-Iran¹

Kazhdumi Formation is believed to produce most of the oils in Dezful Embayment, but in Fars area its potential has not been evaluated. A lot of oil bearing reservoirs occurred in Fars area and their source rock (s) has not been determined precisely. Some authors believe Kazhdumi can act as a source rock for these oils.

In order to evaluate the source potential of Kazhdumi Formation, we selected 80 cutting samples from 18 wells drilled in different parts of the Fars area for Rock-Eval and vitrinite reflectance measurements.

Rock-Eval analysis showed that Kazhdumi Formation in most of the studied area has poor source potential, except in two parts which showed fair potential for both oil and gas generation. The first one was the northwestern part of coastal and subcoastal Fars, approximately parallel to Kazerun fault. The second part was in some wells in the northeastern part of interior Fars, possibly parallel to high Zagros fault.

Finally, considering the Rock Eval and vitrinite reflectance results for these two parts, we may estimate two local basins for Kazhdumi Formation in these parts with early to medium maturity which may have contributed in oil and gas generation in these parts.

1261 - Petroleum System of the Adiyaman Region Southeast Anatolia (Sea) Turkey (Karababa+Karaboğaz Karababa (!) System)

Canatalı Aysegül¹, Çorbacioğlu Hüsni¹, Soylu Cengiz¹, İztan Haluk¹

Turkish Petroleum Corporation Research Center Ankara-Turkey¹

The Adiyaman area is situated on the northern part of the Arabian platform and holds the most productive oil fields in Turkey. In the area there are two Cretaceous aged carbonate source rocks which are Karababa-A Member and Karaboğaz Formation. Almost all of the oil accumulations are generated dominantly from Karaboğaz Formation and lessly from Karababa-A Member. Karaboğaz Formation has good-very good hydrocarbon potential due to its high TOC, S2 and HI values. Karababa-A Member has also good hydrocarbon potential in the area. Due to its Type-IIS kerogen, Karababa-A Member generated oil at lower temperatures relative to Karaboğaz Formation. Main reservoir rock is mainly Karababa-C Member and the seal rocks are Sayindere and Kastel formations.

The purpose of this study is to determine the hydrocarbon potential and the petroleum system of the region by using the relationships between the elements (source, carrier, reservoir and seal rocks) and the processes (generation, migration, accumulation, and preservation) which have been working in the area. In order to reach this aim, older geological, geochemical, sedimentological and recent production data belong to the chosen wells from the study area brought together and evaluated, and thus, hydrocarbon generation and expulsion history in the area

PETROLEUM OCCURRENCES IN CRETACEOUS BASINS OF TURKEY AND ADJACENT AREAS

were determined by using one-dimensional mathematical modelling.

Based on the results of this study, Petroleum System of the Adıyaman Region has generally Cretaceous elements and processes. Thus, it has been proved that, the dominant petroleum system in the study area is KARABABA+KARABOĞAZ KARABABA (!) .

1251 - Sedimentology Stratigraphy and Paleogeography of Cretaceous Reservoirs in Southeast Anatolia (Sea) Turkey

*Yilmaz Erhan*¹

TPAO Research Center Ankara-Turkey ¹

The Cretaceous reservoirs are Sinan (Lower Member), Garzan, Beloka and Karababa (C Member) formations in southeast Turkey. The deeper marine deposits of Germav, Karaboğaz and Sayindere formations are also carry reservoir characteristics in some areas when fractured.

The Lower member of late Maastrichtian Sinan Formation was first named in Sinan-1 well as "Sinan Reef" by Blakslee et al. (1960). The main outcrop area is in northwestern part of Batman and northeast of Diyarbakır. The "Lower Member" is mainly composed of thin shale inter-bedded shallow marine limestone and dolomite. The tidal flat dolomites in the upper part is the productive interval in the wells drilled in the north of main aerial extend of the formation. Moreover, fine-medium crystalline dolosparites and peloidal-intraclastic-bioclastic grainstones are also form reservoir intervals.

Middle Maastrichtian Garzan Formation was described by Halstead (1960) in Garzan Field wells for Maastrichtian reefal limestones. The formation crops out in between Gercüş village of Mardin city and northern flank of Gercüş anticline. It shows underground extension in platform area in around Mardin, Batman and Siirt. The formation is composed of upward shoaling carbonates containing shallow marine, reef complex and shelf slope environments including shale inter-bedded dolomite and large shell fragmentary (rudist, mollusk), orbitoid limestone that is reefoidal in places. The reservoir facies is shallow marine carbonate buildup complex (shelf edge-back) composed of bioclastic packstone/grainstone/rudstone.

Middle-late Campanian Beloka Formation is composed of two members in underground. The lower section named "Dirik Member" consists of clayey and glauconitic limestones and upper section named "Bada Member" consists of bioclastic limestones. The name of "Beloka limestone dolomite formation (Raman reservoir rock)" nomenclature was first used by Schmith (1964) in stratigraphic correlation chart. Beloka Formation shows limited outcrops in around Körkandil Mountain, İspandika and Mardin region. The formation is widespread in Mardin highs in Batman-Siirt extend and around Nusaybin-Cizre and, is characterized by shallow marine, slope and deep marine environments. The shallow marine Bada Member is the reservoir section. The Dirik Member containing deeper marine clayey limestone carries source rock characteristics in some areas.

Aptian-early Santonian(?) early Campanian Mardin Group is composed of Areban, Sabunsuyu, Derdere and Karababa formations from bottom to top. Karababa (C member) and Derdere formations are the reservoir units. It was first described and named by Handfield (1959) as "Derdere Formation" in Korudağ anticline. The formation crops out in around Antakya, Kilis, Adıyaman, Diyarbakır, Mardin, Siirt, Şırnak and is composed of restricted-semi restricted shallow marine limestone-dolomitic limestone and dolomites. Organic matter-rich spheroidal fossiliferous limestone section carrying source rock potential is penetrated in the lower part in wells in Gaziantep-Adıyaman and Diyarbakır-Batman-Siirt area. Shallow marine limestone and dolomites are reservoir sections in the upper part of Derdere Formation.

Late Coniasian(?) early Campanian Karababa Formation is divided into three members as "A", "B" and "C" from bottom to top. It was first named as "Karababa limestone" by Gossage (1956) in Karababa Mountain. A Member is composed of organic rich, phosphate, planktic foraminiferal limestone, B Member is siliceous, chert nodular and chert inter-bedded, spheroidal, planktic foraminiferal limestone and C Member is composed of shallow marine bioclastic limestone. The C Member carries reservoir rock characteristics while A Member shows source rock characteristics.

Key words: SEA, Cretaceous, Sinan, Garzan, Bada, Karababa, Derdere

PETROLEUM OCCURRENCES IN CRETACEOUS BASINS OF TURKEY AND ADJACENT AREAS

1039 - Geochemistry Origin and Correlation of Crude Oils in Cenomanian Sarvak Sequence of Northern Fars Zagros Basin Iran

*Ahanjan Asghar*¹, Tezheh Farid¹, Khaleghi Mehdi¹, Kobraei Mehdi¹

National Iranian Oil Company Geochemistry Tehran-Iran¹

Despite many dry wells drilled in Northern Fars area, only Cenomanian Sarvak reservoir in Saadat abad and Sarvestan fields contains medium gravity oils of 27-31°API and thus determining the origin of these oils was a challenge.

In order to determine the origin of these oils, 2 crude oil samples from Cenomanian Sarvak reservoirs and 4 possible Cretaceous source rock samples analyzed for their biomarker and carbon isotope values.

The biomarker source related parameters of the oils showed marine marl/carbonate facies with normal salinity depositional environment for the source of these oils. Biomarker maturity related parameters showed medium maturity for the oils, which is fairly coincident with the observed API gravity of the oils. Comparison of biomarker parameters of the oils with those of possible source rocks showed mix signature especially for the sterane and hopane biomarker parameters between those of Lower and Upper Cretaceous sediments. However, in aromatic biomarkers and carbon isotope values oils showed better correlation with lower Cretaceous Fahliyan Formation. Finally, the authors speculated that the oils in Cenomanian Sarvak reservoir is mainly produced from Lower Cretaceous Fahliyan Formation or unrecognized source of similar characteristics in undrilled part of the section which then contaminated during upward migration.

1148 - Cretaceous Petroleum Plays of the Black Sea Region

*Simmons Mike*¹, Davies Chris¹, Rees Emily¹

Neftex Earth Model Oxford-United Kingdom¹

The Black Sea retains an abiding fascination for petroleum geologists. Large structures, seepage, widespread sources rocks and producing fields around its margins invite serious consideration of its exploration potential notwithstanding the challenges of drilling in deep water.

The eastern Black Sea contains many large structures on the Shatsky Ridge, Andrusov Ridge and elsewhere, but play risk, especially on reservoir presence and quality and on source rock maturation history and migration pathways, remains high. Recent wells drilled by supermajors have not been successful. With little data from the subsurface outcrops around the margins of the basin can provide key insights.

Fundamental uncertainties exist on the tectonic history of the eastern Black Sea. Whilst its early (Triassic/Jurassic – Early Cretaceous) history as part of the Izanca Ocean and the passive margin of northern Tethys is reasonably clear, debate still rages on the timing of the opening of the eastern Black Sea vs. the western Black Sea and the creation of oceanic crust. Some models postulate opening during the mid-Cretaceous (synchronous with the western Black Sea) – others a Palaeogene (Eocene) opening. Each model has implications for petroleum systems development and thermal history. Our observations on the outcrop geology of the margins suggests an Eocene opening based on (i) the lack of mid-Cretaceous rift-related volcanism; (ii) the occurrence of Eocene back-arc rift related volcanism; (iii) differential sedimentation and subsidence that suggests an Eocene phase of rifting.

Early Cretaceous rifting may have led to localised potential source rocks deposition in syn-rift successions in the Turkish Western Black Sea (onshore seeps support this), but further offshore and in the Eastern Black Sea it is the Oligo-Miocene Maykop Formation and equivalents that will provide charge. Outcrop data provides insight in the richest horizons within this (at its base) which is a valuable input into petroleum systems modelling.

Reservoir presence and quality remains a key risk. The Late Jurassic – Early Cretaceous carbonate succession provides a superficially attractive target (including much publicised reefal build-ups) but the sequence stratigraphy of these carbonates as gleaned from outcrops can identify other reservoir facies and provide clues to the karstification and diagenesis of this succession and implications for reservoir quality.

Sequence stratigraphy as deduced from outcrop successions can also help identify potential intervals of lowstand sand development in the basin. Intervals within the Valanginian and Aptian all contain potential lowstands (and subsequent transgressive sand sheets) worthy of further consideration.

Finally outcrop geology provides insight into the provenance of sands entering the eastern Black Sea Basin and potential issues for reservoir quality. Provenance from arc-related volcanics and ophiolites is an issue around the

PETROLEUM OCCURRENCES IN CRETACEOUS BASINS OF TURKEY AND ADJACENT AREAS

Turkish and Georgian margin, whilst provenance from metamorphosed flysch is an issue on the Ukrainian margin. Sands derived from the Russian Shield or local granitic sources in the Russian Caucasus offer better prospects of good sand quality.

1040 - Cretaceous Source Rock Investigation Oil-Source Rock Correlation in Abadan Plain Southwestern Iran

Kobraei Mehdi ¹, Rashidi Mehrab ¹, Ahanjan Asghar ¹, Hassanzadeh Payam ¹
National Iranian Oil Company Geochemistry Tehran-Iran ¹

The origin of recently explored seven Cretaceous to Jurassic oil reservoirs in Abadan Plain was a challenge. There are also of well-known source rock in this area of Iran.

In order to determine the possible source rock(s) for these oils and make oil-oil correlation, the authors used rock Eval, the biomarker and Carbon isotope values for the oils and different possible source rock in Cretaceous Succession.

Rock Eval pyrolysis was performed on 8 wells in the intervals as possible source rocks, which constitute the main objective of the study. Also analysis of VRo has done for measuring the maturity level. Geochemical analysis have done on oil and extracted hydrocarbon from cutting for further oil-source correlation.

The best characteristic of Kazhdumi Fm is in the eastern part of studied area in which average TOC reach 2-3 %. By using VRo and modeling data, The Kazhdumi Fm is in early maturity window. The Gadvan Fm shows low source potential. TOC value in Garau Fm is 1.5 %, and HI reach 350 mg/g.

Using age-related biomarker and $\delta^{13}C$ in analyzed oils, Garau Fm has indicated as the main source but Jurassic sediment and also Kazhdumi Fm should not be ignored.

1067 - Origin of Cenomanian Sarvak Oil of Kaki Field in Coastal Fars Area Zagros Basin Iran

Ahanjan Asghar ¹, Tezheh Farid ¹, Tarhandeh Elham ¹, Khaleghi Mehdi ¹, Kobraei Mehdi ¹, Rashidi Mehrab ¹, Hassanzadeh Payam ¹
National Iranian Oil Company Geochemistry Tehran-Iran ¹

Kaki field in north western part of the Coastal Fars area contains oil with gravity of 29 API in Cenomanian Sarvak reservoir. The origin of this oil was a challenging issue. Some authors believed in Jurassic and others believed in cretaceous source for this oil.

In order to determine the origin of the oil and its geochemical characteristics, we used the gas chromatography, gas chromatography- mass spectrometry methods and isotope analysis of the oils and 3 possible Paleozoic, Jurassic and Cretaceous source rocks.

The biomarker analysis of sterane and hopane fractions showed a marine shale source with relatively medium to high maturity and normal salinity for depositional environment of the source rock of this oil. These Geochemical characteristics best fits to Albian Kazhdumi Formation. For better source to oil correlation, the carbon isotope data of different oil fractions were also compared to Paleozoic, Jurassic and cretaceous source rocks. The isotope data also showed relatively good correlation with Albian Kazhdumi Formation.

Finally, the biomarker and isotope analysis showed Kazhdumi Formation as the main contributor in charging of Sarvak oil reservoir which this then confirmed with the fair to good source potential for Kazhdumi Formation in this field.

1263 - Is there another giant Şelmo oilfield in SE Turkey

Çoşkun Bülent ¹

METU Department of Geological Engineering Ankara-Turkey ¹

The giant Şelmo oilfield, producing from the Middle and Lower Sinan dolomites, Cretaceous in age, and operated by Mobil oil company since 1960s, is one of the biggest oilfield in SE Turkey. Similar huge and oily structure has not been discovered to date. Following Late Cretaceous and Miocene ophiolitic emplacements in the Kastel basin, many faulted and fractured carbonate blocks were occurred in this field. The Şelmo oilfield is a huge anticline structure whose the 4 km long big axis is oriented in E-W direction, nearly parallel to the northern Late Cretaceous thrust edge. Tectonic evaluations and subsidence rate curves of existing exploration and development wells indicate that the Şelmo structure is an older Late Cretaceous structure affected, later on, by Miocene tectonics. No other oilfield, as big as Şelmo, which contains enormous quantities of oil, has not been discovered yet in SE Turkey. In other word,

PETROLEUM OCCURRENCES IN CRETACEOUS BASINS OF TURKEY AND ADJACENT AREAS

the regional expansion of this field is still unknown. Then, the question is that is there another giant Şelmo oilfield, in somewhere, in SE Turkey? If the response is yes, where should it be located? This work aims to find responses to this question by means of scientific studies in order to outline the suitable other oily structural and dolomitic zones for Middle and Upper Sinan carbonates around the Şelmo-Çelikli-Dodan area in SE Turkey.

1252 - Sedimentology and Reservoir Characteristics of the Lower Member of Sinan Formation in İkiztepe-Çamurlu-Kozluca Fields Southeast Anatolia (Sea) Turkey

*Yılmaz Erhan*¹, Araç Mehmet¹

TPAO Research Center Ankara-Turkey¹

The Lower Member of the late Maastrichtian Sinan Formation shows a shallowing-up carbonate section on a low angle carbonate slope (ramp) in southern fields (İkiztepe-Çamurlu-Kozluca) parallel to Syrian border. It overlies the Lower Member of Germav Formation gradationally and is overlain with discordant boundary by the Upper Member of Paleocene Germav Formation.

The Lower Member of Sinan Formation is composed of 4 different facies of carbonate sand shoal-fore shoal complex. Carbonate sand shoal (Ramp crest) environment is characterized by peloid, bioclastic grainstone (F1) forming first order reservoir facies. The large benthic foraminifers, bioclasts (echinoid, mollusk, etc.), intraclasts, peloids, small benthic and planktic foraminifera are components bound with coarse calcite cement. The most important diagenetic events are dissolution and calcite cementation. Dissolution formed secondary pores as well as enlarged the primary voids and coarse calcite, dolomite and syntaxial cementations decreased the rock porosity. It comprises 5-30% oil-filled intergranular, intragranular, moldic, vuggy and fine fracture porosities. On the other and, the facies is nonporous and impermeable where the cementation is abundant. The mean porosity is around 20%. Fore shoal (slope) sediments are characterized by 3 facies. The constituents of phosphate pelletoidal bioclastic packstone (F2) facies are bioclasts (echinoid, mollusk), peloids, small benthic foraminifera and phosphate pellets. The diagenetic occurrences are dissolution, syntaxial cementation and stylolitization. The Facies-2, gradational to Facies-1 and 3 has very low porosity around 2-5% as oil-filled vuggy, intragranular and stylolite type pores. The mean porosity is 2-3% and the facies does not show reservoir characteristics.

The main constituents of planktic foraminiferal, peloid and bioclastic packstone (F3) sedimentary facies are large benthic foraminifera, bioclasts (echinoid, mollusk), peloids, planktic and small benthic foraminifers. The bounding material is lime mud. The dissolution is the major diagenetic event and calcite cementation is very rare. The oil-filled pores ranging 0-2% are vuggy, moldic and intragranular pores. The mean porosity is 10-12% and this facies is classified as 2nd order reservoir.

Argillaceous, shell fragmentary, planktic foraminiferal wackestone-packstone (F4) sedimentary facies is composed of planktic foraminifera and fine-grained sand sized benthic shell fragments and binding material is rare clayey lime mud. It does not show reservoir characteristics and comprises 2-3% oil-filled moldic and intragranular pores.

The thickness and reservoir characteristics of facies F1 and F3 of Sinan Formation (Lower Member) increase from north to south towards Syrian border.

SEDIMENTOLOGY, SEQUENCE STRATIGRAPHY AND CYCLOSTRATIGRAPHY

1194 - Clay mineral associations in Lower Cretaceous 3rd order depositional sequences from Estremadura (Portugal)

*Sá Caetano Paulo*¹, Lezin Carine², Rey Jacques², Tavares Rocha Fernando³, Gonçalves Paula³, Bordalo da Rocha Rogério¹

Universidade Nova de Lisboa DCT/CICEGe Monte Caparica-Portugal¹ Université Toulouse GET Toulouse-France²
Universidade Aveiro GEOBIOTEC Aveiro-Portugal³

Mineral associations, particularly of clay minerals, have been widely used in multidisciplinary stratigraphic studies. This study presents the results of the mineralogical analyses of Lower Cretaceous depositional sequences from the Lusitanian Basin, in the region of Estremadura, west Portugal. The Lower Cretaceous of this region is generically represented by marine deposits from subtidal platform environments with predominant carbonate sedimentation and the use of sequence stratigraphic concepts has allowed the establishment of thirty three 3rd order depositional sequences. Within this geologic framework, a study of the mineral content of the deposits was performed in order to ascertain the characteristics and type of mineralogical signatures present, both in the context of the sequential organization of the series, as in their paleogeographic positions. Thus, several 3rd order depositional sequences, corresponding to diverse sequential and paleogeographic contexts were selected: Guia - sequences Va6 and Va7(base); Mexilhoeira - Va7(top), Ha1 and Ha2(base); Cabo Espichel - Ha3; Ericeira - Ha5; Guincho - Ha7; Crismina - Ap2.

Sampling work performed resulted in the collection of a total of 217 samples, the majority of which correspond to limestones, although dolomitic limestones, dolomites, marls and sandstones are also present. Considering these lithologies, it was decided to determine mineralogical associations in total sample and insoluble residue, besides clay mineral associations. Mineralogical studies, including semi-quantitative determinations, were performed by X-ray diffraction, and all obtained results were analysed using discriminant and multivariate statistical analysis. The results of the mineralogical study has allowed to confirm and even make some adjustments to the proposed sequential scheme but mainly can be considered as good descriptors of the type of mineralogical signature obtained in each of the different sequential and paleoenvironmental contexts analysed. In a general assessment, the set of results obtained, with clear predominance of kaolinite and illite over expansive clay minerals, is in accordance with the paleogeographical positioning of the studied sections, i.e., in the more proximal (platform) areas of the basin. Therefore, the relative proportion between these clay minerals mainly reflects the control of eustatic and climatic influences on the depositional environments. From the point of view of the sequential organization, and in most sequences (Va6, Va7, Ha1, Ha3 and Ap2), significant increases in illite regarding kaolinite, are registered around maximum flooding surfaces. However, sequences Ha5 and Ha7 do not present, in terms of the relationship of the mineralogical associations with the sequential organization, a similar signature to the remaining sequences. In the case of Ha5, there is clear predominance of kaolinite over illite in almost the whole section. Regarding sequence HA7, there is occurrence of a kaolinite peak around the maximum flooding surface, and maximum illite occurring near the sequence boundaries. These results from Ha7 sequence are generally more consistent with proposed models for sequences originated in deeper marine environments than with suggested models for proximal environments. This sequence also shows further unusual characteristics when confronted with the other studied sequences: an unusual facies uniformity, high thickness (above 40m), and the presence of periodic structures related to variations in orbital patterns.

1152 - Astrochronology of the Valanginian Stage using the 405-kyr eccentricity cycles palaeoceanographic implications

*Martinez Mathieu*¹, Deconinck Jean-François¹, Pellenard Pierre¹, Reboulet Stéphane², Laurent Riquier³
université de Bourgogne UMR CNRS/uB 6282 Biogéosciences Dijon-France¹ Université Claude Bernard, Lyon 1
Laboratoire de Géologie de Lyon: Terre, Planète, Environnement Lyon-France² Université Pierre et Marie Curie, Paris
VI IStEP: Institut des Sciences de Terre - Paris Paris-France³

The Valanginian Stage is marked by a global $\delta^{13}\text{C}$ positive excursion (the "Weissert Event") whose causes and consequences are not precisely known, partly due to an unfocused time scale. This study aims at refining the duration of the Valanginian Stage using the identification of the 405-kyr eccentricity on hemipelagic marl-limestone alternations of the Vocontian Basin (Southeastern France). The selected sections, including GSSP candidates and hypostratotypes, are well-dated by ammonites and precisely correlated by limestone bundles and a bentonite layer. High-resolution gamma-ray spectrometry measurements were performed every 0.20 m and treated for spectral

SEDIMENTOLOGY, SEQUENCE STRATIGRAPHY AND CYCLOSTRATIGRAPHY

analyses to detect sedimentary cycles (multi-taper method and weighted amplitude spectrogram). Precession, obliquity, 100-kyr, 405-kyr and 2.4-myr eccentricity were identified by comparing sedimentary to orbital period ratios. The 405-kyr eccentricity cycle is continuously recorded throughout the series, allowing a duration estimate of the Valanginian Stage of 5.08 myr. By combining the proposed duration with available radiometric ages, it appears that the Paraná-Etendeka Large Igneous Province could not be responsible for the initiation of the Weissert Event. In addition, a stronger obliquity control on marl-limestone alternations in the Nicklesi and Furcillata subzones suggests the development of low-extension polar ice in this interval.

1019 - Sequence stratigraphic framework of the Late Barremian-Early Cenomanian platform in North Sinai Egypt

*Salama Yasser*¹, Saber Shaban¹, Grammer Michael², Elshazly Soheir¹, Abdel-gawad Gouda¹

Beni suef University Geology Beni suef-Egypt¹ Oklahoma State University Boone Pickens School of Geology Oklahoma-United States²

The Late Barremian-Early Cenomanian successions in north Sinai consist of siliciclastic-dominated facies and carbonate-dominated facies. A detailed facies and biostratigraphic analysis has been carried out to construct a high resolution sequence stratigraphic framework. The platform deposits are subdivided into thirteen microfacies types that define nine facies belts. The intertidal siliciclastic facies is characterized by sandstone and iron-oooids packstones, whereas the peritidal facies are indicated by dolostone and mudstone. Wackestone and packstone with miliolids and cyanobacterium were deposited in restricted lagoon environments, while the open marine biota are widespread in open lagoons. The high energy subtidal shoals are dominated by oolitic or bioclastic grainstones and rudstone. The rudist facies are deposited in shallow subtidal rudist biostromes in the form of bafflestone facies. The rudist biostromes grade seaward to the foreslope and deep marine facies (mudstone, wackestone and shale with orbitolinids and planktonic foraminifers).

Based on new biostratigraphic data and facies stacking patterns, a high resolution sequence stratigraphic framework has been established for the Late Barremian-Early Cenomanian succession. It is subdivided into 9 third order depositional sequences with a duration varying between 1 and 8 Ma. These sequences correlate to the equivalent sequences in the adjacent countries.

1024 - Sequence stratigraphy and stable isotopic composition of Cenomanian-early Campanian succession of northwestern Iraq

*Al-Juboury Ali*¹, Al-Haj Mohamed¹, Al-Hadidy Aboosh²

Mosul University Geology Mosul-Iraq¹ North Oil Company Geology Kirkuk-Iraq²

Upper Cretaceous (Cenomanian-Early Campanian) successions represented by Gir Bir, Wajna and Mushorah formations are studied in 15 wells from northwestern Iraq based on sequence stratigraphy and stable isotopic C and O and some trace elements composition. The upper parts of the Gir Bir Formation was deposited under mixing zone conditions depending on the gradual increment in oxygen and carbon isotopes and strontium with depth. Whereas sharp negative values of d18O and d13C and decline in Sr/Al and Ba/Al ratios in the uppermost surface of the formation is an indicative of exposure surface (meteoric water) conditions. Homogeneity in oxygen and carbon isotopic values and other elements in Mushorah Formation indicating its ineffective diagenesis near the surface. Gradual variation in d13C from positive in the upper part of Gir Bir Formation to low and negative values at the surface of the formation reflects a regressive sequence from deeper to shallower areas upwards of lagoonal facies and then to exposure (marine regression and platform exposure) forming unconformity surface. Sharp increase in d13C in Mushorah Formation reflects deep marine (transgressive) conditions covering most of exposed parts of the platform. The studied succession was deposited within about 19my including three 3rd order sequences (A, B, and C).

SEDIMENTOLOGY, SEQUENCE STRATIGRAPHY AND CYCLOSTRATIGRAPHY

1138 - Analysis of sedimentary structures from the Barremian Strata of Timimoun (central Sahara Algeria)

*Bouregaa Slimane*¹

Laboratory Geology of Sahara; University Kasdi Merbah Ouargla Earth & Univers sciences Adrar-Algeria¹

In this work we study the Barremian strata cropping out in the south west of Algeria, from a sedimentological point of view. Three sections from Timimoun (Region of Gourara) have been measured and sampled, in which the deposits are composed principally of silicoclastic facies (clays, siltstones and sandstones). On the basis of detailed analysis of sedimentary structures, we found a variety of physical sedimentary structures like: parallel and low angle stratification, overturned cross stratification; through cross bedding, climbing ripples and Hummocky cross stratification; These structures suggests the action of oscillatory combined and/or unidirectional currents flow, which their origin and velocity have changed through time; We try to establish a depositional facies model.

1031 - Sequential interrelationship of the uppermost Aptian-lowermost Albian deposits in the Transcaucasian Intermontane area of Georgia

*Kakabadze Mikheil*¹, Kakabadze Irakli¹, Sharikadze Mevlud²

A. Djavakhishvili Tbilisi State University, A. Djanelidze Institute of Geology Palaeontology & Stratigraphy Tbilisi-Georgia¹ Georgian Technical University Palaeontology Tbilisi-Georgia²

Lower Cretaceous platform deposits are widely distributed in the western part of the Transcaucasian Intermontane area of Georgia, where they are characterized by spatial and temporal litho- and biofacies variations. At different levels the stratigraphic gaps with erosional boundaries are characteristic, though certain sequence boundaries are conformable.

On the basis of study of unconformities, alternation of depositional successions and their biostratigraphy at the Aptian-Albian boundary the stratigraphic frames of two adjacent sequences are specified as: (a) uppermost Aptian-lowermost Albian (A3 1Al 1 1) and (b) lowermost Albian-middle Albian (Al1 1Al2 1).

Transgressive tract of the A3 1Al1 1 sequence begins from the Acanthohoplites nolani Zone, whereas the regressive tract begins from the upper part of the Hypacanthoplites jacobi Zone. Transgressive tract of the next Al1 1Al2 1 sequence begins in the Leymeriella tardefurcata Zone (apparently from its second half) and continues up to the first half of the Douvilleiceras mammilatum Zone. As to its regressive tract, it begins in the second half of the Douvilleiceras mammilatum Zone and continues in the Middle Albian Hoplitites dentatus Zone.

1155 - Sequence stratigraphy and depositional environment of the Gurpi Formation (Campanian-Maastrichtian) in NW of Zagros Basin Iran

*Ghaseminejad Ebrahim*¹, zarei elahe¹

Geology Geology tehran-Iran¹

Depositional environment and sequence stratigraphy of the Gurpi Formation in southwestern Zagros basin was investigated using outcrop samples from two sections. The identification of sequences is based on an integration of evidences derived from foraminiferal proxies such as ratios of Planktonic/Benthic and epifauna/infauna and palynological analysis such as dinocyst indices and palynofacies. Statistical studies on foraminiferal content of the samples show that the ratio of P/B and abundance of phytoclast increase while abundance and diversity of dinoflagellate decrease in sequence boundaries (SB). The significant increase of transparent amorphous organic mater (TAOM) and dinoflagellate species diversity with high ratio of P/B and infunal/epifunal are dominated in transgressive system tract (TST). Maximum flooding surfaces (MFS) are also marked by an abrupt decrease of phytoclast, abundance peaks of agglutinate benthic and infaunal foraminifera and the highest ratio of planktonic/benthic foraminifera. HST is characterized by an increase in amount of black phytoclast particles, a clear decrease in TAOM percentage. Accordingly, seven time lines with a resolution varying from 1 to 5 my and three complete 3rd order sequences and one system tract (TST) were differentiated. Paleontological data in combination with sedimentological features suggest that the Gurpi Formation was deposited in a pelagic environment under dysoxic to anoxic conditions in an open marine area.

SEDIMENTOLOGY, SEQUENCE STRATIGRAPHY AND CYCLOSTRATIGRAPHY

1264 - Depositional Environments and Sequence Stratigraphy of the Derdere and Karababa Deposits (Cenomanian- Lower Campanian) in the Cemberlitas oil field Southeastern Turkey

*Mulayim Oğuz*¹, Cemen Ibrahim², A. Mancini Ernest¹

University of Alabama Department of Geological Science Alabama-Turkey¹ University of Alabama Department of Geological Sciences Alabama-²

The frontal belt of the southeastern Anatolian fold-thrust belt in Turkey contains several small to medium size oilfields, producing from the Cretaceous Mardin Group carbonates. Many oil fields are located along the E-W to SW-NE trending, narrow and asymmetrical anticlinal structures which are associated with contractional faulting in the area. Cemberlitas oil field (COF) in Adiyaman, southeastern Turkey is one of the most important oil fields in the region. The Upper Cretaceous Derdere and Karababa formations of the Mardin Group are the main reservoir and source rocks in the oil field. We have conducted detailed microfacies analysis and determined depositional environments and sequence stratigraphy of the Derdere (Mid-Cenomanian-Turonian) and Karababa (Coniacian-Lower Campanian) in the Cemberlitas oil field. Based on our interpretation of available well logs and examination of thin sections prepared from core and well cuttings of 8 exploration and production wells in the study area, we have recognized the presence of 8 microfacies in the Derdere and Karababa formations. These microfacies are: (1) fine crystalline dolomite, (2) medium-coarse crystalline dolomite, (3) bioclastic wackestone/packstone, (4) lime mudstone, (5) phosphatic-glaucinitic planktonic wackestone, (6) Planktonic foraminiferous wackestone/packstone, (7) dolomitic planktonic foraminiferous wackestone, (8) mollusk-echinoid wackestone/packstone. The microfacies suggest that the Derdere Formation was deposited in a shallow marine lagoonal to shelf depositional environment and the Karababa Formation was deposited in a deep to shallow marine intrashelf depositional environment. We have identified two-third order sequences in these strata. These sequences are bounded by an Upper Turonian lower sequence boundary (SB1) at the base of the Derdere sequence and a lower Campanian upper sequence boundary (SB2) at the top of the Karababa sequence. The transgressive deposits display a predominance of deep subtidal facies, while highstand deposits reflect shallow subtidal facies. These boundaries are: Late Turonian (SB1) and Lower Campanian (SB2). Each depositional sequence shows transgressive (TST) and highstand (HST) systems tracts and packages of facies. These sequences are compared with those of neighboring areas to differentiate local, regional and global factors that controlled sedimentation within the study area. The interplay of marine transgressions and regressions driven by eustacy with local tectonic uplift events controlled deposition and diagenesis. Diagenesis included the generation of secondary porosity as a result of dolomitization and karstification processes. Karstification requires exposure of carbonate rocks to surface. Paleokarst phases in the Cemberlitas oil field are closely related to the evolution of rifting along the Northern Arabian palaeomargin. Rifting coincides with episodes of sudden sea-level fall in the region caused by eustatic sea-level changes and local tectonic events. These events commonly involve tilting of the fault blocks related to the movement of normal faults of differing magnitudes in each palaeogeographic palaeotectonic range.

1003 - Chemostat and Palaeomagnetic Studies of Late Cretaceous Outcrop Sediments of Ariyalur Area Cauvery Basin South India

*R Nagendra*¹, M Venkateshwarlu², R Nagarajan³, P Sathiyamoorthy¹, A.N Reddy⁴

Anna University Geology Chennai-India¹ NGRI Geology Hyderabad-India² Curtin University Geology Sarawak-Malaysia³ (f) ONGCr Geology Chennai-India⁴

The Cauvery Basin in southern India is evolved during Late Jurassic. The geochemistry of Campanian sandstones infers their weathering and provenance history. These sandstones are immature, poorly sorted and grain supported. Abundance of plagioclase feldspar indicates rapid deposition of sediments from a nearby felsic source rocks. The Maastrichtian limestone negative d13C and d18O values and a moderate co-variation between d13C and d18O indicate that the alteration of original isotopic composition is due to diagenesis. The positive Ce/Ce confirms the clastic input into the system, and negative Mn values and Th/U ratios in this limestone indicate their association with precipitation of carbonates in reducing conditions. The high ratio of Mn/Al concentration confirms the relative sea-level rise at Campanian-Maastrichtian boundary. The increasing trend of Mn flux in the Maastrichtian limestone suggests relative rise of sea level. The TST and MFS in Maastrichtian Formations are recognized by the positive digressions in Ti/Al. The Cenomanian-Maastrichtian sedimentary lithosections in Cauvery Basin is correlated with the GTS-2008 from Chron C34n to C30n and identified magnetozones are matched. The gap in the latitudinal drift history of the Indian subcontinent has been at 20°S during late Cretaceous period and placed above the Deccan traps.

SEDIMENTOLOGY, SEQUENCE STRATIGRAPHY AND CYCLOSTRATIGRAPHY

1268 - Middle-Upper Albian Comanche Shelf Sequence Stratigraphy Fredericksburg Group Texas

*Gargili Damla*¹, Scott Robert W.², Formolo Michael J.²

Turkish Petroleum Corporation Research Center Ankara-Turkey¹ University of Tulsa Department of Geosciences Tulsa-United States²

This research focuses on the characterization of sequence stratigraphy of the Middle-lower Upper Albian Fredericksburg Group, a part of the Comanche Platform, in Texas using geochemical parameters, petrographic and paleontologic evidences. Diagenetic features on subaerial exposure surfaces yield valuable evidences to determine relative sea-level change history. The fundamental understanding of the controls of those features on geochemical signatures has increased the use of geochemistry for identifying exposure surfaces.

The objectives of the research are 1) to test published carbonate sequence stratigraphic models of the Albian Fredericksburg Group in Texas, 2) to evaluate the extent of sea-level fall recorded at the top sequence boundary, and 3) to understand the diagenesis of the Fredericksburg Group and describe the origin of the dolomite in the Fort Terrett Formation.

The Fort Terrett Formation records one long-term transgressive-regressive cycle and is composed of small-scale, high-order cycles and the sea-level cycles correlates with published curves. Petrographic and geochemical results of this study demonstrate a mixing (Dorag) model as an additional mechanism for the dolomitization of the Fort Terrett Formation that complements published seepage reflux and evaporative (sabhka) models.

To achieve the objectives of the project, a field study in Texas and geochemical measurements were conducted to generate required datasets. One hundred and twenty-six samples from several outcrops were taken for petrographic and geochemical analyses. As part of the project, the subsurface equivalent formations of the Fredericksburg Group were studied by examining the cores and well logs from Bee and DeWitt counties on the Stuart City Shelf Margin.

1257 - Shoreline Architecture and Sequence Stratigraphy of Campanian Iles Clastic Wedge Piceance Basin Colorado Influence of Laramide Movements in Western Interior Seaway

*Karaman Ozge*¹, Steel R.²

TPAO TPAO Ankara-Turkey¹ The University of Texas at Austin Department of Geological Sciences Austin-United States²

The Campanian Iles Formation of the Mesaverde Group in northwestern Colorado contains a stacked series of some 11 shoreline sequences that form clastic wedges extending east and southeastwards from Sevier orogenic belt to the Western Interior Seaway. Iles Formation shorelines and their alluvial and coastal plain equivalents (Neslen Formation, Trail and Rusty Members of the Ericson Formation) are well exposed from Utah and from southern Wyoming into northwestern Colorado. The Iles Clastic Wedge was examined in the subsurface Piceance Basin and at outcrops in Meeker and south of Rangely, NW Colorado. The correlation of 9 measured outcrop sections and log data of 110 wells reveal that the clastic wedge contains low-accommodation regressive-transgressive sequences (8-39 m thick) of Loyd Sandstone, Sego Sandstone, Corcoran Member, and Cozzette Member and their updip-equivalent Neslen Formation strata. Facies association of the sandstone succession indicates storm-wave dominated coasts that transit seaward into offshore/prodelta mudstones with thin-bedded sandstones and extend landward into tidal/fluviol channels and coal-bearing strata; facies associations also indicate interdeltic coastal embayments with moderate tidal influence. Fourteen 75-km-long Piceance Basin transects (dip and strike oriented) makes it possible to evaluate coastline variability, and the progressive southeasterly pinchout of the 11 coastline tongues within the larger Iles Clastic Wedge. The thickness and great updip-downdip extent of the Iles stratigraphic sequence (compared to the underlying Blackhawk or overlying Rollins sequences) support previous observations of a low accommodation setting during this time. It has been suggested that this low accommodation was caused by combined effects of embryonic Laramide uplifts and Sevier subsidence across the region. Uplift or greatly reduced subsidence across the Western Interior Seaway would have caused an increase in coastal embayments as well as generally accelerated coastal regressions and transgressions in this 3.3 My interval.

SEDIMENTOLOGY, SEQUENCE STRATIGRAPHY AND CYCLOSTRATIGRAPHY

1186 - Depositional Environments and Diagenesis of the Lower Cretaceous (Neocomian) Fahliyan Formation in Bibi- Hakimeh Khyrabad Kilurkarim and Rage-Sefid Fields in the Zagros Basin Southwest Iran

*Rostami Alireza*¹

National Iranian Oil Co. Geology Tehran-Iran¹

Detailed lithologic and petrographic analyses of the Fahliyan Formation in the BibiHakimeh, Khyrabad, Kilur Karim and Rag-e Sefid field show depositional and diagenetic history on the Lower Cretaceous (Neocomian) strata of a part of Dezful South in the Zagros region. Observations of core and cuttings samples indicate that lower part of the Fahliyan Formation consists of stromatoporoid boundstone and skeletal grainstones, indicating deposition in a shallow, high energy platform. These high energy facies alternate with wackesone and mudstones suggestive of deposition below wave base. The mudstone dominated lithofacies increases upward and eventually grade into organic-rich shales of the overlying Gadvan Formation, indicative of deepening of the depositional environments in response to a relative rise in sea-level.

The Fahliyan Formation has experienced a complex diagenetic history that encompasses the following four diagenetic realms. (1) Marine diagenesis resulted in precipitation of circumgranular fibrous cements, early dolomite, and early anhydrite. (2) Passive margin diagenesis occurred during slow and continuous burial of the unit from Early Cretaceous to Oligocene and led to physical and chemical compaction, and the formation of mosaic and syntaxial calcite cement. (3) Collision margin burial diagenesis occurred with Africa collided with Eurasia during Oligocene – Middle Miocene time. Deep burial by overriding thrust blocks, heating, and migration of fluids toward the platform caused organic maturation and hydrocarbon migration. Combined, these resulted in a complex set of diagenetic changes that included precipitation of late anhydrite, saddle dolomite, quartz, replacement of anhydrite by saddle dolomite, and pyrite. (4) The post-orogenic burial diagenesis has been active since the Middle Miocene and encompasses the continuation of diagenetic processes that began during the collision margin phase.

The reservoir porosity in the Fahliyan Formation is dominated by between crystal (BC) porosity resulted from recrystallisation and dolomitisation, and fractures which possibly enhanced by late dissolution.

1234 - An integrated stratigraphy and orbital tuning of the Maastrichtian (Late Cretaceous) from the Basque Basin (W Pyrenees) and reappraisal of the Campanian Maastrichtian boundary

*Dinarès-Turell Jaume*¹, Elorza Javier², Pujalte Victoriano³, Stoykova Kristalina⁴

Istituto Nazionale di Geofisica e Vulcanologia UF Laboratorio di Paleomagnetismo Rome-Italy¹ University of the Basque Country Department of Mineralogy and Petrology Bilbao-Spain² University of the Basque Country Department of Stratigraphy and Paleontology Bilbao-Spain³ Bulgarian Academy of Science Department of Paleontology and Stratigraphy Sofia-Bulgaria⁴

We present an integrated, cyclo-magnetostratigraphic analysis and study of the calcareous nannofossils of the Maastrichtian hemipelagic succession in the Zumaia and Sopelana sections of the Basque Basin that extent back in time recent studies in the area (Batenburg et al., 2012; Dinarès-Turell et al., 2013). The sections were correlated at bed-by-bed scale through careful analysis of the lithological stacking pattern and significant sedimentary features. A carbonate proxy record for the uppermost Maastrichtian strata at Zumaia (Ten Kate and Sprenger, 1993) and a newly developed high-resolution record for the Lower Maastrichtian strata in Sopelana are used for spectral analysis. The continuous wavelet spectrum helped to determine and visualize the orbital forcing at both the short (~100-ky) and long (405-ky) eccentricity band. We applied bandpass Gaussian filters to the carbonate record to extract the relevant periodicities and provide a cycle-numbering scheme starting at the Cretaceous/Paleogene (K/Pg) boundary. The inferred 405-ky eccentricity is then used as a first-order tuning to alternative orbital solutions the accuracy of which can be assessed, and to set a chronostratigraphic framework for the entire Maastrichtian. The studied Maastrichtian section at Sopelana extends down to the upper part of chron C32n.1n and comprises about 14 long-eccentricity cycles and a total duration of ~ 5.5 My. The Zumaia section, despite the presence of numerous interbedded turbidites and some tectonic complications along the lower part of the Maastrichtian offers the possibility to extent the stratigraphy into the Campanian. The global new Basque Basin chronostratigraphic framework that includes magnostratigraphy and calcareous nannofossil bio-events in addition to cyclostratigraphy, allows comparison to integrated studies from other land-based sections and deep-sea records. The cyclostratigraphic framework also allowed us to estimate the duration of previously defined sea-level-related 3rd-order depositional sequences in the basin, which appear to be strongly paced by the long-term 1.2 My obliquity amplitude modulating cycle. Moreover, the opportunity of an alternate and more suitable reference section for the actual Global Boundary Stratotype Section and Point (GSSP) of the Maastrichtian stage defined at Tercis les Bains (SW France) is discussed.

SEDIMENTOLOGY, SEQUENCE STRATIGRAPHY AND CYCLOSTRATIGRAPHY

Batenburg, S. J., et al. (2012). Cyclostratigraphy and astronomical tuning of the Late Maastrichtian at Zumaia (Basque country, Northern Spain), *Earth Planet. Sci. Lett.*, 359, 264-78.

Dinarès-Turell, J., et al. (2013). Detailed correlation and astronomical forcing across the Upper Maastrichtian succession from the Basque Basin. *Bol. Geol. Min.*, 124 (2), 249-277.

Ten Kate, W.G. and Sprenger, A. (1993). Orbital cyclicities above and below the Cretaceous/Paleogene boundary at Zumaya (N Spain), Agost and Relleu (SE Spain). *Sedimentary Geology*, 87, 69-101.

Acknowledgements: Research funded by project CGL2011-23770 of the Spanish Ministerio de Economía y Competitividad. JDT acknowledges a sabbatical grant from the Spanish Ministerio de Educación.

1161 - Sequence and seismostratigraphy of the Cretaceous deposits in some of the wells in south of Iran

*Amirkhani Ali*¹, Seifi Hamid², Mirzakhani Marzieh²

N.I.O.C Surface geology Tehran-Iran¹ N.I.O.C Geophisic Tehran-Iran²

The studied area is located in the south of Iran. In order to study of sequence and seismostratigraphy of the Cretaceous deposits three transects containing 12 wells were chosen and studied. The Cretaceous succession in this area is mainly composed of shale, marl, limestone and reefal rudstone interbeds. Sharland et al., (2001) studied the Arabian Plate and 18 maximum flooding surfaces were recognized from Beriazian to the Late Maastrichtian, then 18 stratigraphic sequences were distinguished in this area.

In the studied area, based on the Sharland et al. (2001) studies, from the top of Khalij member of Gadvan Formation (Early Aptian) to the end of the Maastrichtian nine stratigraphic sequences (Sequences 7 to 16) were distinguished, then Paleogeography and Paleoenvironment of each sequence were studied and correlated with the Arabian Plate (Sharland et al. 2001). In this area a system of paleohighs and troughs exist that plays the most important role to hydrocarbon system. Due to understand the roles of these paleohighs and troughs in the hydrocarbon system, seismostratigraphy and stratigraphical facies and environmental deposits were considered.

1260 - "Mid-Campanian" Submarine Fan Development in the Mudurnu-Göynük Basin (Nw Anatolia) a Sequence Stratigraphic Framework

*Ocañoğlu Faruk*¹, Yılmaz İsmail Ömer², Özkan Altın Sevinç²

Eskişehir Osmangazi University Eskişehir Osmangazi University Eskişehir-Turkey¹ Middle East Technical University Eskişehir Osmangazi University Ankara-Turkey²

Late Cretaceous deposits in the Mudurnu Göynük basin are represented by deep marine siliciclastic in an overall convergent setting in relation to Tethyan collision to the south. The "mid-Campanian" submarine fan system with ca. 200 m thickness extends more than 50 km particularly in the SE of the basin between the Tana and Nallıhan towns, and constitutes a good reservoir target for petroleum exploration. It consists of two gravelly sandstone and conglomerate units separated by thick mudstone or thinner sandstone-mudstone alternations. The lowermost submarine fan element comprises 20 m thick thin-bedded sandstone-mudstone alternation within thick sand-free basinal marls having abundant nannofossils assigning the Early Campanian age (Yılmaz et al., 2012a,b). The mudstone/sandstone ratio is low (<1), sandstones include current ripples, slump structures and show only Tcd sequences. This sequence is overlain by gray mudstone succession with occasional black shales including abundant *innoceramus* shell accumulation. This couple was interpreted as a fraction of a low stand and subsequent transgressive systems tract. The first coarse unit (20 m thick) overlies the underlying mudstone with an erosive contact and consists of gravelly sandstones with alternation of conglomerates. Sandstone beds are often amalgamated. Individual beds of 15 – 20 cm thick show Tab and typically topped by thin (<2 cm) coalified organic levels. Conglomerate beds display scoured base and always clast supported. They comprise extra basinal blocks (mainly limestone, metamorphic rocks and granites) as well as large rip-up marl blocks. This unit is overlain by a mudstone – sandstone alternation with occasional thin matrix supported conglomerates, and comprises planktonic foraminifera of Late Campanian-Maastrichtian including *Globotruncana arca*, *Globotruncana rosetta*, *Globotruncana hilli*. It is suggested that this couple corresponds to a shelf edge lowstand fan delta system and following transgressive systems tract. The second coarse unit is very similar to the first one but it is thinner. An overall coarsening upward trend is evident here. This is similarly overlain by a mudstone and rippled sandstone – conglomerate alternation up in the section. Massive, grey mudstones with rare small microfossils occurred towards the top comprises Early Paleocene planktonic foraminifera including *Parasubbotina pseudobulloides*, and represent deep outer shelf conditions.

SEDIMENTOLOGY, SEQUENCE STRATIGRAPHY AND CYCLOSTRATIGRAPHY

The submarine fan system introduced herein records at least two important relative base level drop and subsequent sea level rises in the "Mid-Campanian" and the Maastrichtian in the Mudurnu – Göynük Basin. Further robust paleontological time frame based on nannofossils and detailed facies analysis would indicate probable linkages between this basin-wide record and global eustatic events in the Late Cretaceous time.

1104 - Sedimentology of deep water carbonates of the Cretaceous Nakfunu Formation Timor Basin Indonesia

*Permana Asep*¹, Kusworo Aris¹, Kusnama Kusnama¹, Maryanto Sigit¹, Mararis Denis²

Geological Survey Ministry of Energy and Mineral Resources Bandung-Indonesia¹ Geological Engineering Jendral Soedirman University Purbalingga-Indonesia²

The Cretaceous of the Nakfunu Formation consists of claystones, interbedded shales, wackstones and packstones, with thin layer of red and white cherts, and sometimes black ferro magnesium as lenses or nodules. Distinctive characteristics of this formation are consists of rhythmically bedded of 3 to 30 cm in thickness, with sharp, flat, planar to undulatory contacts. Most of this unit occurs as interbedded or massive, with relatively rare of sedimentary structure, although centimeter lamination are common.

The sedimentological study on the outcrops along the Oetuke and Oebanak Rivers allows the definition of mostly fine grained sequences representing deep water turbidite facies. Detailed litological analysis of this sequence may be divided into three units, (1) medium thickness of intercalation wackstone-packstone and shales, (2) thinly bedded of wackstone-packstone interbedded claystone, (3) thickly bedded of wackstone-packstone interbedded claystone. Under the microscopic analysis the carbonates unit shows a mixing of litoclastic grain and bioclastic material representing deep water environment. Evidence for turbidity facies is identified from bedding and lamination structures, microscopic shape sorting, and Bouma intervals. This evidence indicates a very distal environment of deposition, and these units clearly show that much of the fine-grained material deposits may be introduced by turbidity currents.

9th 1-5 September, 2013
**International Symposium
on the Cretaceous System**
METU FACULTY OF ECONOMIC &
ADMINISTRIVE SCIENCE BUILDING • ANKARA/TURKEY

POSTER PRESENTATIONS

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FORAMINIFERA

1177 - *Broeckina gassoensis* a larger foraminiferal index fossil for the Middle Coniacian shallow-water deposits (Pyrenees)

*Caus Esmeralda*¹, Parente Mariano², Vicedo Vicent³, Frijia Gianluca⁴, Ricard Martínez⁵

Universitat Autònoma de Barcelona Geologia cerdanyola del Vallès-Spain¹ Università Federico II Dipartimento Science della Terra Napoli-Italy² Museu de Ciències Naturals de Barcelona Paleontologia Barcelona-Spain³ Universität Potsdam Institut für Erd- und Umweltwissenschaften Potsdam-Germany⁴ Autònoma de Barcelona Geologia Bellaterra-Spain⁵

A new porcelaneous, flat discoidal larger foraminifer, *Broeckina gassonensis*, from the Middle Coniacian of the Pyrenean Basin has been investigated. Its main characteristics are: annular chambers with multiple apertures regularly distributed in the periphery of the disc, simple radial septula interrupted at the distal, equatorial part of the chambers by a preseptal passage and the axes of the stolons connecting the successive chambers are radially arranged and their position alternate with septula.

In the Pyrenean bioprovince *B. gassoensis* is the first complex porcelaneous larger foraminifer of the Late Cretaceous Global Community Maturation cycle, and it represents the rise of the K-strategy after the dramatic mass extinction of the Cenomanian/Turonian Boundary, when the most successful groups of larger foraminifera of the Middle Cretaceous GCMC were completely wiped out. *B. gassoensis* has all the characters of K-strategists: large test size, large size of the megalospheric embryo and marked dimorphism, and a true endoskeleton.

According to the age established by SIS for the deposits containing *B. gassoensis* it took about 5 My to re-build the genetic information supporting K-strategy after the crisis.

Broeckina is a true newcomer, genetically unrelated to the Cenomanian genus *Pastrikella*, which has similar test architecture but disappeared at the CTB.

1051 - Biofacies analysis of Upper Cretaceous deposits in West Siberia implications of palynomorphs

*Lebedeva Natalia*¹

Trofimuk Institute of Petroleum Geology and Geophysics Siberian Branch Novosibirsk-Russia¹

Different palynomorph groups (spores and pollen of terrestrial plants, dinoflagellate cysts, prasinophytes, acritarchs, *Zygnemataceae* algae, and others) have been thoroughly studied to define major patterns in their distribution depending on the impact of different environmental factors and to establish their palaeoecological characteristics. The comparative analysis of palynomorph assemblages from coeval Cenomanian–Coniacian sediments of the Ust'-Yenisei area, Berezovskaya 23k, Yuzhno-Russkaya 113, Leningradskaya-1 boreholes and Santonian–Campanian sequences of the Ust'-Yenisei, Khatanga and Polar Urals regions reveals transgressive–regressive cycles, which are best evident in coastal sections and smoothed in their marine counterparts. The biofacies and compositions of palynomorphs form the regular succession from the periphery toward central parts of the West Siberian basin. The facies successions in Santonian–Campanian sections of the eastern and western parts of the basin are inconsistent with each other, which may be explained by influence of both the West Siberian and Russian seas on sedimentation in its western areas.

1126 - Micropaleontology and Biostratigraphy of the Tirgan Formation in west Kopeh- Dagh and its correlation with the Dariyan Formation in Southwest of Iran

*Haeri Aghahesam*¹, Golabkesh Afshar Reza²

NIOC exploration Directorate Geology and Geochemistry studies Tehran-Iran¹ Azad University of Mashhad Geology Mashhad-Iran²

Paleontological studies on the Dariyan Formation in the Southwest of Iran it has a thickness 350m. and it consists of limestone and argillaceous limestone. The Tirgan Formation in west Kopeh-Dagh region has a thickness of 1250m. and it mainly consist of limestone, and its comparison with the Dariyan and Tirgan Formations (Messinow Section) contain benthic foraminifera with range of the Late Barremian – Aptian in age which, including: *Trocholina odukpaniensis*, *Trocholina alpina*, *Iraqia simplex*, *Haplophragmoides globosus*, *Acicularia elongata*, *Epistomina* sp., *Neomersia cretacea*, *Dictyoconus arabicus*, *Trocholina elongata*, *Paracoskinolina sunnilandensis*, *Neotrocholina friburgensis*, *Choffatella decipiens* and *Palorbitolina lenticularis*.

Acknowledgements

Acknowledgement is given to The Research & Development of National Iranian Oil Company for financial support.

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FORAMINIFERA

1141 - Remarks on "*Taberina*" *bingistani* HENSON 1948 architecture and age

*Vicedo Vicent*¹, Frijia Gianluca², Sharp Ian³, Embry Jean-Christophe³, Jalali Mahmood⁴, Caus Esmeralda⁵
 Museu de Geologia - MCNB Palaeontology Barcelona-Spain¹ Universität Potsdam Institut für Erd- und
 Umweltwissenschaften Potsdam-Germany² Statoil Bergen-Norway³ NIOC, National Iranian Oil Company Tehran-
 Iran⁴ Universitat Autònoma de Barcelona Geology (Palaeontology) Barcelona-Spain⁵

The generic adscription of the larger foraminiferal species *bingistani* from the Middle Cretaceous of Iran was controversial since its description. Henson (1948) ascribed it to the genus *Taberina* (species-type *T. cubana*), a Paleocene American porcelaneous larger foraminifer with conical-to-peneropliform shape, multiple apertures radially arranged, septula and pillars.

In the following years and until now, the species was attributed indistinctively to *Taberina*, *Pseudorhapydionina* or *Pseudorhipidionina*, and it has been observed in several localities of the Middle East, and also in south Italy. Recent investigations on the Cenomanian deposits of the Sarvak Formation outcropping in western Iran found abundant specimens of "*T.* *bingistani*", which allowed us to perform a detailed study of its architecture. It is characterised by elongate, conical to subcylindrical shells with saucer-shaped adult chambers uniserially arranged. The periphery of the chambers is subdivided by radial septula, while the centre has pillars. The endoskeleton elements alternate with the apertures.

The precise age of this species has been constrained using carbon isotope stratigraphy through the correlation of our carbon profile with the reference pelagic curve. This allowed us to assign to "*T.* *bingistani*" a Middle - Late Cenomanian age.

1060 - Benthic foraminifera from the Upper Santonian Alan-Kyr Section (Crimean Mountains)

*Benyamovskiy Vladimir*¹

Geological Institute Russian Academy of Sciences Moscow-Russia¹

Alan-Kyr Section is located in the central part of the northern slope of Crimean Mountains, near Belogorsk Town. Upper Santonian deposits are represented by 25 meter thick alternation of cherty limestones with chert nodules, marls and carbonate clays. They lay on the limestones of undifferentiated Upper Turonian-Coniacian and are covered by white marls of Campanian. The lowermost part of Upper Santonian is characterized by presence of *Bolivinoidea strigillatus* (Chapman), acme *Stensioeina perfecta* Koch, and mass occurrence of *Stensioeina incondita* Koch and *S. gracilis* Brotzen. These new data allow to make following preliminary conclusions:

1. Santonian of the Belogorsk region is represented only by Upper substage.
2. Upper Santonian Zone *Bolivinoidea strigillatus* LC10 is characterized by an acme *S. perfecta* Koch, 1977, and mass occurrence of *S. incondita* Koch and *S. gracilis* Brotzen.

This work was supported financially by RFBR grant 13-05-00447 A.

1061 - *Stensioeina* (benthic foraminifera) in the Middle Turonian-Santonian of the East European Platform Mangyshlak Peninsula and Crimea

*Benyamovskiy Vladimir*¹, Sadekov Aleksey²

Geological Institute Russian Academy of Sciences Moscow-Russia¹ University of Cambridge Godwin Laboratory for Palaeoclimate Research Department of Earth Sciences Cambridge-United Kingdom²

Taxa of the genus *Stensioeina* play a significant role in the benthic foraminifera zonal stratigraphy of the Middle Turonian-Santonian of the East European Platform and in Mangyshlak and Crimea (Maslakova, 1959; Benyamovskiy, 2008; Sadekov & Benyamovskiy, 2009). The Middle-Upper Turonian Subzone LC5a includes *Stensioeina praeexsculpta* (Keller, 1935), and *S. laevigata* Akimetz, 1961 (= *S. polonica* Witwicka, 1958). The Lower Coniacian Subzone LC6a is characterized by the FA of *S. granulata* (Olbertz, 1942) and *S. emscherica* Baryschnikova, 1959. The Middle Coniacian Zone LC7 contains an acme of *S. emscherica*, and FA of rare *S. exsculpta* (Reuss). The Upper Coniacian - Lower Santonian Zone LC8 is characterized by an acme of *S. exsculpta*, and the disappearance *S. praeexsculpta* and *S. laevigata*. The Middle Santonian Zone LC9 is characterized by an acme *S. incondita* Koch, 1977, and FA of rare *S. gracilis* Brotzen, 1945. According data of Alan-Kyr reference section in Crimea the Upper Santonian Zone *Bolivinoidea strigillatus* LC10 is characterized by an acme *S. perfecta* Koch, 1977, and mass occurrence of *S. incondita* and *S. gracilis*. The upper Upper Santonian Zone LC11 is denoted by the FA of *S. pommerana* Brotzen, 1936. The studies were supported financially by RFBR grants 12-05-00196-A and

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FORAMINIFERA

1162 - Benthic foraminifers in the Early Turonian shallow-water carbonates of Southern Appenines (Italy)

*Arriaga Maria Eugenia*¹, Frijia Gianluca², Parente Mariano³, Caus Esmeralda¹

Universitat Autònoma de Barcelona Geology Bellaterra-Spain¹ Universität Potsdam Institut für Erd- und Umweltwissenschaften Potsdam-Germany² Università degli Studi di Napoli "Federico II" Scienze della Terra Napoli-Italy³

The Cenomanian-Turonian boundary (CTB) represents one of the major turning points in larger foraminifera evolution. It is well documented that the most representative taxa of the middle Cretaceous Global Community Maturation Cycle (GCMC) went extinct in two distinct steps during the OAE2. However, little is known about the post-extinction recovery, which led to the evolution of a new stock of larger foraminifera at the beginning of the late Cretaceous GCMC.

The current work is part of a project which aims at investigating the recovery pattern of larger foraminifera after the CTB mass extinction. The founding step of this project is an accurate study of the architecture of Early Turonian shallow-water benthic foraminifera.

The study has been carried out in the Southern Appenines, which hosts one of the few resilient carbonate platforms which escaped drowning at the OAE2 and preserves a nearly continuous record of shallow-water sedimentation across the CTB. The work is based on three sections (Monte Coccovello, Raia del Pedale and Monte Varchera). The main foraminifera identified in this work are: *Montcharmontia apenninica*, *Nezzazatinella cf. aegyptiaca*, *Reticulinella kaeveri*, *Scandonea samnitica*, *Paleocornulina triangularis*, *Paleocornulina ausonensis*. The chronostratigraphic distribution of the each species is constrained by SIS and carbon isotope stratigraphy.

1168 - Biostratigraphy of the Lower Cretaceous deposit in Peygho section based on Orbitoline West of Kopet-Dagh depositional environment NE IRAN

*Mansouri Golamhasan*¹, vahidinia mohamad¹
ferdowsi university geology mashhad-Iran¹

Introduction:

In this study, Tirgan and Sarcheshme Formations with 120 meters thickness have been studied in detail at Peygho section in the West of Kopet-Dagh depositional environment. Tirgan Formation has been consists of oolitic limestones with accompany of dark shaly limestones. Sarcheshme Formation has been consist of shale and marl with intercalation of limestones units. The contacts of two formations are conform.

Method:

In the following survey, we took 80 sampels from 120 meters thickness of mentioned Formations whit 1.5 meter interval . The following samples have been studied by polaraised binocular Microscope in micropalontology lab in geology department of Ferdowsi university of Mashhad.

Result:

The studies have demonstrated that the mentioned Formations contains 16 benthic foraminiferal species belonging to 8 genera in frame of 2 biozones and one sub-zone as below:

1- *Palorbitolina lenticularis*, 2- *Preorbitolina cormyi*, 3- *Montseciella arabicus*

Conclusion:

Our research has proposed Barremian-Aptian ages for transition of Tirgan to Sarcheshme formations at Peygho section.

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FORAMINIFERA

1202 - Dinoflagellate Cyst Biostratigraphy and Paleoenvironmental Interpretation of Maastrichtian and Basal Danian Sediments from Brazos River Texas USA.

*Aydin Tuba*¹, Firth John V.², Yancey Thomas E.¹

Texas A&M University Geology & Geophysics COLLEGE STATION-United States¹ Texas A&M University Integrated Ocean Drilling Program College Station-United States²

Early Maastrichtian to basal Danian sediments from Brazos River, Texas were studied to document dinoflagellate cyst biostratigraphy and paleoenvironments. Three interval of dinoflagellate cysts datum are determined. Interval-I occurs within the Neylandville Formation, and presence of *Alterbidinium acutulum* and *Xenascus ceratoides* indicate an age no younger than Early Maastrichtian. Interval-II presents within the Corsicana Formation. Presence *Disphaerogena carposphaeropsis*, *Palynodinium grallator* and *Deflandrea galeata* indicate Late Maastrichtian in age. Interval-III occurs within the Kincaid Formation. Danian marker species *Carpetella cornuta* and *Damassidinium californicum* occurs within this interval. Acme abundances of *Glaphyrocysta* species complex and *Cribroperidinium* species complex determined within this interval. An acme of *Yolkinigymnium lanceolatum* occurred immediately below the Cretaceous-Paleogene boundary. Palynofacies analysis is combined with dinoflagellate cyst assemblages indicate that the Neylandville Formation and the first depositional stage of the Kincaid Formation occurred under mixed marine and terrestrial influence. Dinoflagellate cyst based paleoproductivity proxy (Peridinioid/Gonyaulacoid ratio) shows two intervals of high paleoproductivity, correlated with $\delta^{13}C$, before and after the K-Pg boundary. Temperatures based on both TEX86 and $\delta^{18}O$ stable isotope indicates a cooling trend towards the boundary.

1111 - Non-marine Cretaceous Ostracods in Mongolia assemblages and development.

*Yondon Khand*¹, Jygdernamjil Munkhtsetseg¹, Jalbaa Undariya²

Paleontological Centre, Mongolian Academy of Sciences Department of Invertebrate Ulaanbaatar-Mongolia¹ Mongolian University of Science and Technology Department of Geology and Petroleum Engineering Ulaanbaatar-Mongolia²

Study of the Cretaceous ostracods has allowed to extend their systematic composition and it now includes 150 species, 40 genera and 3 superfamilies. In the Cretaceous, eight ostracod assemblages were established, three from Lower Cretaceous, one from transitional beds, and four from the Upper Cretaceous, correspondingly. These are: 1) Berriasian-valanginian: Cypridea, Torinina; 2) Hauterivian-barremian: Cypridea, Limnocypridea; 3) Aptian-albian: Cypridea, Timiriasevia, Lycopterocypris; 4) Albian-cenomanian: Cypridea, Bisulcocypridea; 5) Cenomanian-turonian: Cypridea, Lycopterocypris; 6) turonian-santonian: Bogdocypris, Limnocythere, Gobiocypris; 7) Campanian: Cypridea, Talicypridea, Mongolocypris, Altanicypris; 8) Maastrichtian: Talicypridea, Altanicypris, Bogdocypris, Eucypris.

According to the changes of the variety and taxonomic composition of ostracods of that time, the ancient lakes could be included into the stages of developing, blooming and degradation stages, as a whole. Moreover, many groups of the limnic organisms had already composed a stable biocenosis, and many modern taxa, particularly representatives of *Limnocythere*, *Candona*, *Eucypris*, *Cypria*, *Cyprinotus*, *Ilyocypris* genera appeared in the middle of the Cretaceous time. During the development of nonmarine ostracods, there had been a possible connection between Cenozoic branches with Cretaceous ones, and, probably, founded a base of some modern groups of ostracods.

Key words: Cretaceous, ostracoda, assemblage, development.

1167 - The evolution of the earliest representatives of the genus *Orbitoides* implications for Late Cretaceous biostratigraphy

Albrich Sergi¹, Frijia Gianluca², Parente Mariano³, *Caus Esmeralda*⁴

Universitat Autònoma de Barcelona Geologia Bellaterra-Spain¹ Universität Potsdam Institut für Erd- und Umweltwissenschaften Potsdam-Germany² Federico II Scienze della Terra Napoli-Italy³ Universitat Autònoma Geologia Bellaterra-Spain⁴

The age of Late Santonian-Maastrichtian shallow-water carbonate platform deposits has been frequently established by means of the stratigraphical distribution of the successive species of the genus *Orbitoides*. However,

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FORAMINIFERA

the biostratigraphy of the oldest species (previously included in *Monolepidorbitoides*) is controversial. This is mainly due to the incomplete knowledge of the architectural differences between the species and to the lack of correlation between their type-localities.

New studies carried out in the type-locality of each species and complementary works on continuous sections in the South Pyrenees, permitted to identify three successive chronospecies: *Orbitoides hottingeri*, *O. sanctae-pelagiae* and *O. douvillei*. The fossil populations of shells of these three species show gradual morphological changes in time that are marked by: 1) an increase of the size and morphological complexity of the embryonic apparatus of the A-generation; 2) an increase of the size of the adult specimens; 3) the progressive appearance and development of true lateral chamberlets.

The main taxonomic consequences of our revision of the earliest orbitoids are the following: the long-neglected species *O. sanctae-pelagiae* must be reinstated; *O. dordoniensis* and probably *O. midorientalis* are synonyms of *O. sanctae-pelagiae*.

Strontium Isotope Stratigraphy (SIS) supports a Early Campanian age for all the three successive chronospecies.

1166 - The revision of *Hensonina* an Albian spirillinid (Foraminiferida) endemic of the Western Tethys

*Consorti Lorenzo*¹, Calonge, Garcia Amelia², Caus, Gracia Esmeralda¹

Universitat Autònoma de Barcelona Geology Cerdanyola del Vallès-Spain¹ Univeridad de Alcalà Geology Alcalà de HERNANES-Spain²

The revision of the architecture and palaeogeographic distribution of the spirillinid genus *Hensonina* MOULLADE and PEYBERNÉS, 1973 has been carried out and its taxonomy discussed. The study is based on specimens from the locality type (Montgrí massif, NE of Spain) and several other localities of the Iberian Peninsula.

The shell of *Hensonina* is lens-shaped with lamellar perforate texture. Its architecture shows a clear planispiral involute pattern consisting of two chambers: the first chamber or proloculus is spherical while the second one is tubular, undivided and ogival in section. The lateral walls have perforations of a larger calibre producing a particular reticulate ornamentation.

Consequently, these characteristics are not consistent with those of *Trocholina lenticularis* HENSON, 1948, chosen by the authors as the species type of the genus *Hensonina*. Therefore, a redefinition of “*Hensonina*” is needed and a new species type has to be designed.

At present “*Hensonina*” is only known from the Albian deposits of Western Tethys, while *T. lenticularis* occurs in Albian-Cenomanian deposits of the Middle-East.

1163 - Biostratigraphy and Micropaleontological Study on the Cutting and Core Samples of the Garau Formation in Mahi-Dasht Well # 1 West Iran

*Asnafi Mohammadreza*¹

NIOC exploration directorate Geology and Geochemistry studies Tehran-Iran¹

The present study has been carried out on 539 cutting and core samples of the Surgah and Garau formations of Mahi-Dasht well # 1, west Iran.

The Garau Formation disconformably overlain by the Surgah Formation and it disconformably rests on the Gotnia Formation. A detailed microscopic study was carried out on all cutting and core samples in order to determine the geological age for the Garau Formation in this well. Based on present microfauna and lithological evidences, the Garau Formation can be divided into three intervals and the Early - Late Cretaceous (Aptian- Cenomanian) age can be ascribed to this rock unit in the Mahi-Dasht well # 1.

The encountered microfossils of the studied well have been illustrated on plates 1- 4 and their stratigraphic distributions have been shown on the enclosed relevant paleolog of this report.

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FORAMINIFERA

1042 - Belemnite diversity and biostratigraphy of the Jurassic–Cretaceous boundary interval in Siberia

*Dzyuba Oxana*¹

Trofimuk Institute of Petroleum Geology and Geophysics Siberian Branch of RAS Novosibirsk-Russia¹

The stratigraphic distribution and taxonomic diversity of belemnites from the Volgian and Ryazanian of Western Siberia (Maurynya and Yatriya rivers) and northern Eastern Siberia (Boyarka River and Nordvik Peninsula) are studied. The dynamics of belemnite diversity in the Western Siberia correlates well with climatic events. An increase of species number in the terminal Volgian–beginning of the Ryazanian corresponds to a temperature elevation in Siberian palaeoseas, and the subsequent reduction of species diversity in the second half of the Ryazanian is correlated with a gradual cooling. The peak of belemnite diversity falls on the beginning of the Cretaceous. The East Siberian high-resolution successions of belemnite zones and beds are recorded in the West Siberian sections almost completely. In these sections the intervals correlated by belemnites with synchronous sections of the Pechora River basin, Kong Karls Land, and California, are recorded. Since in the Volgian–Ryazanian boundary beds of Siberia a great number of belemnite species known from the Tordenskjoldberget Member, Kong Karls Land, were found, it is inferred that the accumulation of the member started not in the Valanginian as many researchers believe but immediately at the beginning of the Cretaceous. This is a contribution to RFBR120500453 and IGCP608.

1005 - Structural evolution and deformation style deciphered through integrated seismic structural model of Shakardarra Kohat Pakistan.

*Ghani Humaad*¹, Malik Amir², Khan Adnan¹, Saeed Arsalan¹, Jan Faizan¹

Bahria University Earth and Environmental science Islamabad-Pakistan¹ Land Mark resources Research and Development Islamabad-Pakistan²

An integrated seismic structural model based on seismic line 865-NK-15, well data of Chanda-1 and surface orientation data is prepared to understand the structural style at surface and subsurface. The Jurassic Samanasuk limestone is interpreted as a principal horizon in the seismic section for which time to depth values are calculated and extrapolated to the cross sections. In the northern part of Shakardara disharmonic folds cored by Eocene evaporites are later transected by high angle thrust faults along their limbs. In the central and southern part, folds in the Siwaliks are transected by south facing reverse faults at surface, while the seismic section shows that these south facing reverse faults at surface are linked to north verging blind reverse fault in the subsurface. These reverse faults are originated from strike slip fault present in south eastern part of Shakardara. The oppositely facing reverse faults are forming pop up structure in the subsurface. The change in the axial trend of folds at surface and the presence of pop up structure in subsurface narrates dominant transpressional deformation in the central and southern part. The research suggests that the area is evolved sequentially in three episodes of deformation: i) detachment folding over the Eocene evaporites

1149 - Foraminifera Radiolaria and Stratigraphy of Turonian deposits in Crimean Mountains (for example Biuk-Karasu Section)

*Kopaevich Ludmila*¹, Bragina Liubov²

Lomonosov MSU, Geological Faculty Regional geology and Earth Moscow-Russia¹ Geological Institute RAS laboratory of micropalaeontology Moscow-Russia²

Biuk-Karasu Section is located in the northern slope of Crimean Mountains. Turonian deposits are represented by 31m thick alternation of chalklike limestones and cherty limestones with chert nodules, marls and carbonate clays. They lay on the limestones of undifferentiated Upper Cenomanian and are covered by white chalklike limestones of Coniacian. Several stratigraphic levels of the Turonian are characterized by Foraminifera and Radiolaria. Samples 23-25 yield Foraminifera: *Whiteinella paradubia* (Sigal), *Marginotruncana canaliculata* (Reuss), *Marginotruncana pseudolinneiana* (Pessagno), *Marginotruncana coronata* (Bolli), and *Radiolaria Patulibracchium inaequalum* Pessagno, *Phaseliforma turovi* Bragina, *Pseudodictyomitra pseudomacrocephala* (Squinabol). Samples 26-30 yield Foraminifera *Marginotruncana renzi* (Gandolfi), *Marginotruncana canaliculata* (Reuss), *Archaeoglobigerina cretacea* (d'Orbigny), and *Radiolaria Dictyomitra densicostata* Pessagno, *Pseudodictyomitra* sp. aff. *Ps. pseudomacrocephala* (Squinabol), *Tubilustrionella guttaeforma* (Bragina).

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FORAMINIFERA

The planktonic foraminifera recovered from this interval of the Biuk-Karasu Section represent faunas characteristic of the Cretaceous Transitional or Temperate Province. They comprise whiteinellids, archaeoglobigerinids and double-keeled marginotruncanids. Tethyan umbilico-convex concavatotruncanids and single-keeled marginotruncanids, biostratigraphically important, are absent. Concavatotruncana concavata, the appearance of which is placed in the Upper Turonian boundary, is absent. Thus the age of the studied interval can be dated as the Middle-Late Turonian. This work was supported by RFBR grants 13-05-00447 and 12-05-00

1026 - Fossil woods of *Sequoioxylon Torrey* (Cupressaceae) from the Upper Cretaceous of Zeya-Bureya Basin Russian Far East

*Afonin Maxim*¹

Institute of Biology and Soil Science, Far Eastern Branch, Russian Academy of Sciences Paleobotany Vladivostok-Russia¹

New fossil species of the morphogenus *Sequoioxylon Torrey* (Cupressaceae), *S. burejense* Blokh. et M. Afonin (Blokhina, Afonin, Kodrul, 2010) and *S. dimyense* M. Afonin sp. nov. (Afonin, 2013, in print) were described on the basis of wood anatomy from the Upper Cretaceous of Zeya-Bureya Basin, Russian Far East. The fossil woods studied originate from the upper part of Lower Tsagayan Subformation of the Tsagayan Formation. These deposits are dated as Middle Maastrichtian based on palynology (Markevich, Bugdaeva, Bolotsky, 2010). Cretaceous woods of Cupressaceae were found in the Zeya-Bureya Basin for the first time.

The new species are characterized by combination of characters of modern members of the subfamily Sequoioideae (monotypic genera *Sequoia*, *Sequoiadendron*, and *Metasequoia*), family Cupressaceae.

Our analysis of published and original paleobotanical data led to the supposition that members of the Sequoioideae apparently appeared in Zeya-Bureya Basin at the end of the Early Cretaceous (late Albian). At the middle–end of the Late Cretaceous (Santonian-Maastrichtian) on the territory of Zeya-Bureya Basin Sequoioideae probably were one of the main components of woody vegetation.

The research was supported by the Russian Foundation for Basic Research (No. 11-04-01208) and Presidium of the FEB RAS (No. 12-I-P28-01, 13-III-B-06-001).

1117 - Early Cretaceous bathyal sea cucumbers (Echinodermata Holothuroidea) from the western North Atlantic Ocean

Reich Mike¹, Gale Andrew S.², Schlüter Nils³, Ben Thuy³, *Wiese Frank*⁴

Geoscience Museum Georg-August University Göttingen-Germany¹ School of Earth and Environmental Sciences University of Portsmouth Portsmouth-United Kingdom² Department of Geobiology Georg-August University Göttingen-Germany³ CRC Geobiology, Geoscientific Center Georg-August University Göttingen-Germany⁴

Sediments recovered from the lower bathyal ODP Leg 171 at Site 1049 on the Blake Nose escarpment (western North Atlantic) offer an opportunity to study well-preserved fossil deep-sea echinoderms, including sea cucumbers. Among echinoderms, holothurians are the most common megafaunal elements in the deep sea. Today, several holothurian groups are unique in being confined to the deep sea. While there is some knowledge on shelf-sea holothurian records, deep-sea taxa are virtually unknown.

Here we present the first detailed analysis of early Cretaceous holothurian assemblages from Blake Nose. The fauna consists of dissociated ossicles and other skeletal elements, dominated by members of the Laetmogonidae and Myriotrochidae; representatives of the Chiridotidae are less frequent. Laetmogonids are surface-dwelling species and predominantly bathyal; myriotrochids and chiridotids live in large aggregations in soft sediments. All these fossil species are closely related to modern representatives.

This is the first detailed report of Aptian holothurians worldwide as well as the first description of a member of elasipodid holothurians ever recorded from the early Cretaceous. The discovery of a bathyal holothurian community of nearly modern composition of early Cretaceous age implies that at least a significant part of the modern deep-sea fauna is much older than previously assumed.

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FORAMINIFERA

1182 - The First Lizard (Order Squamata) fossil from South Korea and other faunal remains from the Late Cretaceous Seonso Conglomerate

Huh Min ¹, Park Jin-Young ¹

Chonnam National University Earth Systems and Environmental Sciences Gwangju-Republic of Korea ¹

Late Cretaceous (Campanian) Seonso Conglomerate of Boseong, South Korea, is one of the richest places for dinosaur egg fossils (Huh et al., 1999). Since the first excavation in 1998, more than 200 individual egg specimens were discovered, and 3 ootaxons, including *Spheroolithus* (Zhao and Li, 1988), *Faveoololithus* (Zhao and Ding, 1976), and 1 unidentified taxon (DRCC-D109), which contains a partial egg and associated shell fragments, were reported (Huh et al., 1999; Huh and Zelenitsky, 2002). During the excavation for dinosaur egg fossils in the year 2000, a body fossil of a non-marine reptile (DRCC-BT001) was discovered, and was reported as a partial skeleton of a Testudine (Huh et al., 2006). But now, it turns out to be a large lizard (Order Squamata) species, which also is the first lizard fossil to be reported in South Korea. The fossil specimen contains a mandible (left), a pterygoid, a humerus (right), a scalpulocoracoid (right), and 2 unidentified bone fragments. The right humerus and the right scalpulocoracoid are well preserved, but the other pieces, including the mandible and pterygoid, are partially preserved. The humerus measures 98 mm from head to condyle. The body of the humerus is erect, which is different from the humerus of a Testudine that has a sigmoid curve. The humerus also has a wide proximal and distal end, which is a characteristic that can be seen in Lepidosauria (both rhynchocephalians and squamates). The partial mandible measures 127 mm long from front to end. The alveolar bone does not show any tooth sockets, which tells us that this specimen is a pleurodont. Additional studies on this specimen may help us understand the evolution of Mesozoic squamate species, and also fill in their patchy history. In 2003, alongside the eggs and the lizard fossil, three fossils of *Koreanosaurus* (Huh et al., 2011) were found. The holotype KDRC-BB2 (a partial skeleton) lacks the skull, but the animal may have looked similar to *Zephyrosaurus* (Sues, 1980) and *Orodromeus* (Horner and Weishampel, 1988). There is a hypothesis that *Koreanosaurus* might be a *Jeholosauridae* or a closely related genera, but additional materials are required to test this (Han et al., 2012). By comparing the Boseong fossil materials with other Asian Late Cretaceous fossil species, the faunal remains of the Seonso Conglomerate may help us understand the evolution of Asian fossil faunas and also the Late Cretaceous paleoecosystem of Korea.

1045 - Biostratigraphy and inter-regional correlation of the Jurassic–Cretaceous boundary strata in Russian Far East

Shurygin Boris ¹, Urman Olga ¹, Dzyuba Oxana ¹

Trofimuk Institute of Petroleum Geology and Geophysics Siberian Branch of RAS Novosibirsk-Russia ¹

Representatives of genus *Buchia* (Bivalvia) are numerous in the upper Volgian–lower Valanginian of Northern Sikhote-Alin (NSA). We have studied buchias from key section on the right bank of the Amur River (Komsomolsk section). *Buchia terebratuloides* Beds, *B. unschensis* and *B. terebratuloides* Beds, *B. volgensis* and *B. okensis* Beds, and *B. inflata* and *B. keyserlingi* Beds have been established here. The *B. unschensis* and *B. terebratuloides* Beds also contain Tethyan ammonite *Pseudosubplanites?* sp. Numerous finds of *B. uncitoides* and *B. tolmatschowi* in NSA sections mentioned in various publications enable to assume existence here of beds with buchids, corresponding to complete *B. okensis*–*B. uncitoides*–*B. tolmatschowi* succession fixed in British Columbia (or *B. okensis*–*B. jasikovi*–*B. tolmatschowi* succession in Siberia). Our investigation allowed us (1) to make more accurate correlation of the J–K boundary strata of Southern Primorye, NSA and Western Priokhotye, where Boreal and Tethyan molluscan fauna can be found together; (2) to construct a correlation scheme of the J–K biostratigraphic zonation of Russian Far East with bio- and magnetostratigraphic zonation of Northern Siberia and Western Mediterranean. This is a contribution to RFBR120500453 and IGCP608.

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FORAMINIFERA

1100 - Correlation of Upper Cretaceous Foraminiferal Radiolarian and Nannoplankton Zonal Schemes (Eastern European area of Russian Sector)

*Vishnevskaya Valentina*¹, Kopaevech Ludmila², Beniamovskii Vladimir³, Ovechkina Maria⁴

GIN RAS Department of Stratigraphy Moscow-Russia¹ Lomonosov MSU, Geological Faculty Regional geology and Earth Moscow-Russia² GIN RAS Department of Micropalaeontology Moscow-Russia³ University of KwaZulu-Natal Earth and Environmental Sciences Durban-South Africa⁴

Microfossils (planktonic and benthic foraminifers, radiolarians, and nannoplankton) are widespread within the Upper Cretaceous of the Russian sector of the Eastern European Platform. Traditionally, the biostratigraphy of sedimentary deposits of the Eastern European Platform is based on the macrofauna. However, some stratigraphic intervals contain little or no macrofauna, and biostratigraphic subdivision can only be done on the basis of the microfossils. The proposed integrated scheme for the Upper Cretaceous of the Russian sector of Eastern European area consists of 12 planktonic foraminiferal subdivisions, 23 benthic foraminiferal zones, 10 radiolarian zonal subdivisions with 18 infrazonal bioevents and 26 nannoplankton zones.

Thus, the planktonic and benthic foraminiferal zonations shows substage and intrastage subdivisions, whereas nannoplankton and radiolarian zonations allows the establishment of stage boundaries, being mutually complementary.

The integration of microfossil biostratigraphic data from sequences in the Russian sector of Eastern European Platform seems very promising for creation of a united micropalaeontological zonal scale for the temperate region.

1066 - The Rio Argos section (Caravaca Spain) candidate for GSSP of the lower boundary of the Barremian stage

*Miguel Company*¹, Roque Aguado², François Baudin³, Slah Boulila³, Rodolfo Coccioni⁴, Jean-François Deconinck⁵, Fabrizio Frontalini⁴, Luca Giusberti⁶, Mathieu Martinez⁵, Mathieu Moiroud⁵, Fabrice Monna⁷, Luis O⁸, Pierre Pellenard⁵, Peter F. Rawson⁹, Laurent Riquier³, Gregorio Romero¹⁰, José Sandoval¹, José M. Tavera¹, Helmut Weissert¹¹

Universidad de Granada Departamento de Estratigrafía y Paleontología Granada-Spain¹ Universidad de Jaén Departamento de Geología Linares-Spain² Université Pierre et Marie Curie-Paris 6 UMR CNRS 7193 ISTEP Paris-France³ Università di Urbino Dipartimento di Scienze della Terra, della Vita e dell'Ambiente Urbino-Italy⁴ Université de Bourgogne UMR CNRS 5561 Biogéosciences Dijon-France⁵ Università di Padova Dipartimento di Geoscienze Padova-Italy⁶ Université de Bourgogne UMR CNRS 5594 ARTÉHIST Dijon-France⁷ Universidad de Cádiz Departamento de Ciencias de la Tierra Puerto Real-Spain⁸ University of Hull Centre for Marine and Environmental Sciences Scarborough-United Kingdom⁹ Universidad de Murcia Departamento de Química Agrícola, Geología y Edafología Murcia-Spain¹⁰ ETH Zentrum Geologisches Institut Zurich-Switzerland¹¹

This communication is an outline of the formal proposal of the Rio Argos section (Caravaca, SE Spain) as GSSP for the base of the Barremian stage. We carried out an integrated analysis of this section including biostratigraphy (ammonites, foraminifera and calcareous nannofossils), chemostratigraphy (organic matter and stable isotopes) and cyclostratigraphy (magnetic susceptibility and clay mineralogy).

The lithological succession of the section (40 m thick) consists of a monotonous alternation of marls and marly limestones with no evidence of interruptions or condensations. The primary marker event of the base of the Barremian stage (first occurrence of the ammonite species *Taveriaidiscus hugii*) was recorded 23 m above the base of the section. This event falls within the NC5C calcareous nannofossil subzone, the *Hedbergella semielongata* planktonic foraminiferal zone, and the *Dorothyia ouachensis* benthic foraminiferal zone and roughly coincides with the beginning of a slightly negative trend interval in the $\delta^{13}\text{C}$ curve. According to the cyclostratigraphic analysis the base of the Barremian would be located 0.7 myr after the onset of the organic-rich Faraoni event. Indirect correlation by ammonite and isotope stratigraphy with the Gorgo a Cerbara section (central Italy) allows to correlate the Hauterivian-Barremian boundary with the upper part of chron CM5n.

BIOSTRATIGRAPHY, ALGAE AND BENTHIC FORAMINIFERA

1091 - First record of Brachiopoda from Maastrichtian - Paleocene successions

*Hegab Adel*¹, Farouk Shreif²

Assiut-University Geology Assiut-Egypt ¹ Egypton petroleum Exploration Cairo-Egypt ²

The Maastrichtian-Paleocene rhynchonellid and terebratulid brachiopod fauna from Southern Galala, Gulf of Suez and Farafra Oasis (two different exposed sections) are recorded and studied for the first time in Egypt. These assemblages consisting of five species including four species come from Maastrichtian deposits, these are *Gyrosoria farajraensis* n. sp., *Orbirhynchia nadiae* Motchurova, *Rectithyris whisky* Sandy, and *Terebratula* sp, while the other one species extracted from Danian deposits is *Rhytisoria alabamensis* Cooper. Their internal and external morphology are illustrated, whereas the paleobiogeography is discussed.

Keywords: Brachiopoda, Maastrichtian-Paleocene, Southern Galala, Farafra Oasis, Egypt.

1199 - Recognising agents of selection for decoupling effects of different biotic interactions on ancient echinoid communities

*Borszcz Tomasz*¹, Jagt John W.M. ², Donovan Stephen K. ³

Institute of Oceanology Department of Marine Ecology Sopot-Poland ¹ Natuurhistorisch Museum Maastricht Maastricht-The Netherlands ² Netherlands Centre for Biodiversity – Naturalis Leiden-The Netherlands ³

We have assembled a unique collection of the large holasteroid echinoid *Hemipneustes striatoradiatus* (Leske) from various localities and horizons of the upper Maastrichtian of northeast Belgium and the southeast Netherlands. These specimens will be used to test the influence of contrasting biotic interactions on echinoid communities (test size distributions) and their responses to interactions (test thickness) along a spatio-temporal scale. With the exception of rare examples of other activities (expressed as depressed apical parts, bite marks, and syn-vivo dented tests), two main types of traces have been recognised. The first comprises differently shaped regeneration traces, often covering large part of tests; these may reflect the predatory actions of certain arthropods such as stomatopods. However, our present study has also offered insight into the second type of predominant traces, i.e., the circular holes recognised as the ichnogenus *Oichnus* Bromley. In our collection these traces occur in three principal forms. One is penetrative (*O. simplex*), the other two are not, but are either parabolic (*O. paraboloides*), or have a distinct central boss and internal blisters (*O. excavatus*), occasionally reaching tens of holes per test. Such have been interpreted to be the result of drilling by parasitic gastropods and domicinal (or embedment) structures, respectively. However, an alternative, more parsimonious interpretation could be that both kinds of holes were produced by the same agent. Due to host size, related test thickness threshold or different drilling capacities, one group of borings are penetrative and the other not. This exemplifies that, even if the interpretation of biotic interactions in the fossil record is ambiguous, diverse stressors could be recognised and used as ecological and evolutionary tools.

1150 - First Records of Radiolarians from pelagic red limestones of Upper Cretaceous Elmalı Dere Formation in Maçka area Trabzon NE Turkey

*Türk Emine*¹, Çapkinoğlu Şenol ¹, Gedik İsmet ¹

KTÜ Geology Trabzon-Turkey ¹

The Upper Cretaceous Elmalı Dere Formation consists mainly of thin- to medium-bedded, red-coloured pelagic limestones with andesite, tuffite and agglomerate interbeds. A fauna comprising grain samples of radiolaria and planktonic foraminifera was first recovered from strata in the Çatak2 measured stratigraphic section in the Maçka area (Trabzon) of this unit. A total of 19 species of radiolarian were identified from the Çatak2 section including *Patulibracchium torvitis* Pessagno, 1971, *Patulibracchium teslaensis* Pessagno 1971, *Crucella esportoensis* Pessagno, 1971, *Alievium gallowayi* Pessagno, 1972, *Alievium superbus* (Squinobal, 1914), *Patellula verteroensis* (Pessagno, 1973), *Archaeospongoprimum salumi* Pessagno, 1973, *Archaeospongoprimum bipartitum* Pessagno, 1973, *Dicyomitra formasa* Squinobal, 1904, *Dicyomitra koslova* Foreman, 1975, *Dicyomitra multicostata* Zittel, 1876, *Dicyomitra duodecimcostata* (Squinobal, 1903.b) *Diacanthocapsa acuminata* Dumitrica, 1970, *Diacanthocapsa ancus* (Foreman, 1968), *Amphipydax stocki* (Campbell&Clark, 1944), *Amphipydax conicus* Nakaseko & Nishimura 1981, *Amphipydax ellipticus* Nakaseko & Nishimura 1981, *Pseudoaulophocus gallowayi* White, 1928 and *Pseudoaulophocus lenticulatus* (White, 1928). This fauna refers to a Santonian-Campanian (Late Cretaceous) age.

CALCAREOUS NANNOFOSSILS, PLAKTONIC FORAMINIFERA AND GLOBAL BIO EVENTS

1210 - Lower Cretaceous plain Crimea (South Ukraine) problems and solutions

Tuzyak Yaryna¹

Ivan Franko National University of Lviv Geology faculty Lviv-Ukraine ¹

Among timber most relevant and pressing issues of the Mesozoic stratigraphy still remains the problem of the Cretaceous system. It consists of the following.

1. Despite the nearly 200-year history of the study of Cretaceous stages of the lower division have the status of non-ratified.

2. Under the concept of GSSP borders the Lower Cretaceous stages tiers have approved stratotypes.

3. Discussing remains a problem of the boundary between the Cretaceous and Jurassic systems.

This state of knowledge is explained by the following factors.

1. The accumulation of sediments in three different sedimentary basins - Tethyan, Boreal and Austral. For each area must be approved by their own stratigraphic section and correlation criteria defined at the global scale (interregional).

2. Insufficient degree of scrutiny of the Regions (Tethyan, Boreal and Austral region), in the structure of the sedimentary cover which involved the Lower Cretaceous deposits (that is, the study of groups of fauna and flora that for the Cretaceous sediments are orthostratigraphic status), as well as other methods stratigraphy.

3. Availability of research results at international level.

In this region has long been South of Ukraine and its constituent plain Crimea. This is the circumstances surrounding a number of reasons.

Lower Cretaceous occurs at significant depths (3000 m), and its study is only possible based on drilling, which is complicated by varying degrees of availability of rainfall, limited coring and sporadic paleontological material.

However, despite the obvious fragmented paleontological and biostratigraphic data from the Lower Cretaceous of them over the last 20-30 years have substantially risen, which was the key to the development and improvement of biostratigraphic framework at the local and regional level (Plotnikova L.F.; 1982, Leschukch R. J.; 1992, Tuzyak Ya.M., 2011).

The present work is the outcome of years of research biostratigraphic's oil and gas volcano-clastic-carbonate-clay complex of the Lower Cretaceous plain Crimea.

During the last decades, the literature has institution of work on complexes of foraminifera fossils for certain regions of the South of Ukraine. This will fill the gap biostratigraphic study, contributing to the representation of the distribution in time and space of the Early Cretaceous foraminifera plain Crimea.

An integrated approach to the study of the different stratigraphic methods techniques allowed to mark a preliminary biostratigraphic scheme dismemberment of the Lower Cretaceous of the territory, which is subject to further research can be a basis for the creation of parallel zonal scales for the essential details of the regional stratigraphy of the south of Ukraine, as well as help to resolve a number of issues of global stratigraphy as South of Ukraine is binding correlation link on the border east-west in the Tethyan belt.

1222 - Late Campanian - Early Maastrichtian Planktonic Foraminiferal Assemblages in the Middle Vistula River Section Poland Palaeoenvironmental and Stratigraphical Inferences

Peryt Danuta¹

Polish Academy of Sciences Institute of Paleobiology Warszawa-Poland ¹

The Middle Vistula River section, comprising a set of natural and artificial exposures scattered along the Middle Vistula River, central Poland, offers an insight into the whole Upper Cretaceous succession of the area. It is a part of the Border Synclinorium, the geotectonic structure that originated at the Cretaceous/Paleogene passage through the tectonic uplift and inversion of the former Danish-Polish Trough (Kutek & Głazek, 1972).

The studied interval comprising the upper Campanian – lower Maastrichtian rocks is exposed between the villages Dorotka and Dziurków on the western bank of the river and between Łopoczno and Kamień on the eastern bank. Stratigraphically the studied interval encompasses eight inoceramid zones from the Cataceramus subcompressus Zone to the Endocostea typica Zone. The Campanian/Maastrichtian boundary is located in the upper part of the "Inoceramus" redbirdensis Zone (Walaszczyk, 2004) or in the lowest part in the Belemnella sumensis Zone (Remin, 2012). Sediments studied yielded well preserved foraminiferal fauna with planktonic and benthic forms. It represents the Globotruncana aegyptiaca and Rugoglobigerina penyi planktonic foraminiferal zones. Planktonic foraminifera form 5 to 60% of the assemblages (Peryt, 1980; Dubicka & Peryt, 2012). More than 30 species of planktonic

CALCAREOUS NANNOFOSSILS, PLANKTONIC FORAMINIFERA AND GLOBAL BIO EVENTS

foraminifera are recorded. In the lower part of the studied interval (*Cataceramus subcompressus*, „*Inoceramus*” *tenuilineatus* and *Sphaenoceras partenuiformis* inoceramid zones) planktonic foraminiferal assemblages are well diversified with common deep-water planktonic foraminifera. The drastic change in planktonic foraminiferal assemblages is recorded in the „*Inoceramus*” *altus* Zone where globotruncanids are almost completely absent; *Heterohelix* (up to 80%) dominate planktonic foraminiferal assemblages. In the uppermost part of the subsequent *Trochoceras costaecus* Zone appear *Rugoglobigerina* which in the middle part of the „*Inoceramus*” *redbirdensis* Zone shortly forms over 30% of planktonic foraminiferal assemblages. The recorded changes in planktonic foraminiferal assemblages reflect probably latest Campanian – earliest Maastrichtian eustatic sea-level drop which lasted throughout „*Inoceramus*” *altus*, „*I.*” *inkermanensis*, *Trochoceras costaecus*, *I. redbirdensis* and lower part of the *Endocostea typica* inoceramid zones sensu Walaszczyk (2004) (Dubicka and Peryt, 2012).

The FOs of *Rugoglobigerina milamensis* and *R. pennyi* in the middle part of „*I.*” *redbirdensis* Zone, very close to the Campanian–Maastrichtian boundary as defined by inoceramids, may be a good proxy for this boundary in temperate regions.

REFERENCES:

- Dubicka Z. & Peryt D. Latest Campanian and Maastrichtian palaeoenvironmental changes: Implications from an epicontinental sea (SE Poland and western Ukraine). *Cretaceous Research* 37, 272-284.
- Kutek J. & Głazek J. 1972. The Holy Cross area, Central Poland, in the Alpine cycle. *Acta Geologica Polonica* 22, 603-653.
- Peryt D. 1980. Planktic foraminifera zonation of the Upper Cretaceous in the Middle Vistula River Valley, Poland. *Palaeontologia Polonica*, 41, 3-101.
- Remin Z. 2012. The *Belemnella* stratigraphy of the Campanian-Maastrichtian boundary; a new methodological and taxonomic approach. *Acta Geologica Polonica* 62, 495-533.
- Walaszczyk I. 2004. Inoceramids and inoceramid biostratigraphy of the Upper Campanian to basal Maastrichtian of the Middle Vistula River section, central Poland. *Acta Geologica Polonica* 54, 95-168.

1207 - Biostratigraphy of the Upper Cretaceous to Paleocene Deposits on the Tang-E Holestem and Poshteh Stratigraphic Sections Southwest Iran

Hosseinzadeh Ruhollah ¹, *Asnafi Mohammadreza* ²

Ferdowsi University Geology Mashhad-Iran ¹ N.I.O.C. Exploration Directorate Geology and Geochemistry studies Tehran-Iran ²

Tang-e Holestem and Poshteh stratigraphic sections have been measured and sampled in south flank of Kabir-Kuh anticline in Lurestan province, Southwest Iran. A total of 400 thin-sections prepared and studied for biostratigraphically purposes in order to establish biozones and compare with those of Wynd (1965) and some significant Cretaceous and Paleogene planktonic foraminifera biozones.

Based on micropaleontological and lithological studies, the stratigraphic sections of Tang-e Holestem and Poshteh divided in ascending order from Sarvak to Surgah, Ilam, and Gurpi Formations (Late Cretaceous (Cenomanian) - to Late Paleocene.

37 biozones established based on index planktonic foraminiferal species consistent with eleven biozones of Wynd (1965) in Zagros basin. Here, biozones based on Cretaceous and Paleogene planktonic foraminiferal scheme were identified which almost are cosmopolitan. The Chronostratigraphical boundaries are based on this zonal scheme. As compare with the Wynd (1965) and the planktonic foraminiferal zonations, unreliability of some Wynd zones demonstrated. Some discrepancy observed between obtained age by Wynd biozones and those of new or Tethyan planktonic foraminifera's schemes.

There is a distinct hiatus between Cretaceous-Paleogene boundary which microbiostratigraphic studies justify that absence of the zones P0, P_α, and P1 in base of Paleocene. Absence of these planktonic foraminiferal zones, which assigned to Early Paleocene (Danian) age, show hiatus in the Gurpi Formation.

CALCAREOUS NANNOFOSSILS, PLAKTONIC FORAMINIFERA AND GLOBAL BIO EVENTS

1103 - Late Cretaceous (Cenomanian Santonian) foraminiferal biostratigraphy from W Valles San Luis Potosí Platform Mexico

*Omaña Rosa María de L.*¹, López-Doncel Rubén Alfonso², Torres José Ramón²

UNAM Paleontology Mexico, D.F-Mexico¹ UASLP Geology San Luis Potosí-Mexico²

The Upper Cretaceous sequence in the western part of the Valles–San Luis Potosí Platform mostly consists of two lithological units that reflect the interaction of several factors as sea-level changes, tectonic factors, and the type and supply of sediments. The El Abra Formation is a shallow-water carbonate deposit dated as mid-late Cenomanian (Pseudolituonella reicheli Assemblage Zone) that mostly consists of peloidal-bioclastic packstone–grainstone. Lithological variations and increased detritic influx is recorded in the lower part of the hemipelagic-pelagic Soyatal Formation, which represents the transition to open marine deeper and eutrophic environment in the latest Cenomanian/earliest Turonian (Whiteinella archaeocretacea Partial Range Zone) which is linked to a sea-level rise, that occurred on a global scale.

The overlying Helvetoglobotruncana helvetica Total Range Zone (early/mid Turonian) corresponds to recovery of oligotrophic conditions, with the occurrence of keeled forms (k-strategists). Upward in the pelagic sequence of the Soyatal Formation, identification of the planktic foraminifera has led to the recognition of two biostratigraphic zones: Dicarinella concavata Interval Zone (late Turonian/earliest Santonian) and Dicarinella asymetrica Total Range (early/late Santonian). These planktic zones indicate that the studied part of the Valles–San Luis Potosí platform remained drowned until the late Santonian.

DGAPA-PAPIIT IN119208 Project grants

1245 - Major Biomarkers of Sembar-Goru Formations (Late Jurassic to Early Cretaceous) on the Basis of Foraminifera in Lower Indus Basin Pakistan

*Solangi Sarfraz Husaain*¹, Brohi Imdad Ali¹, Nazeer Adeel², Usmani Parveen¹, Sahito Ali Ghulam¹, Napar Latif Dino¹

University of Sindh Centre for Pure and Applied Geology Jamshoro, Hyderabad-Pakistan¹ Pakistan Petroleum Limited Exploration Department Islamabad-Pakistan²

Goru Formation is known reservoir rock of Pakistan. Most of petroleum production in Sindh Monocline and Badin Platform is associated with sands of Lower Goru Formation. Various studies were carried out to understand the system of Sembar Sequence Stratigraphy and the depositional environment of Goru Formation. Recent development of sequence Stratigraphy has opened new horizon in the delineation of Sembar-Goru formation as part of various sequences of fluvio-deltaic system which has been discussed by various workers, suggesting that age equivalent fluvio-deltaic sands change into distal slope and basin muds across shelf edge. This new concept has induced the role of biostratigraphy in the sequence stratigraphic studies of Sembar-Goru by integrating wireline, core and available seismic data.

Various studies on the biostratigraphy of Sembar-Goru are present. But major Biomarkers of Sembar-Goru Formations (Late Jurassic to Early Cretaceous) in the form of Biostatigraphic Chart have not been discussed. In this paper biostratigraphic data from different wells were gathered to report major Biomarkers of Sembar-Goru Formations. Biostratigraphy of various well cutting were carried out under high resolution microscopes. These well cuttings samples were taken from Badin Block area of Sindh Monocline and Zindapir area of Sulaiman Fold Belt. On the basis of studies, a detailed biostatigraphic chart has been prepared with pictorial representation of fossils records. This chart is helpful for future geological studies as reference. IEDS classification is taken as standard to illustrate the different zones of fossilization record. This chart is also helpful to establish the different zones of fossilization in all over age equivalent strata of Pakistan.

1057 - Biostratigraphy of the Shiranish Formation (Campanian - Maastrichtian) in the Subsurface section of Khanke Oil Well No. 1 Duhok area North of Iraq.

*Qasim Abdulrahman*¹, Abawi Tarik²

University of Duhok Applied Geosciences Duhok-Iraq¹ University of Mosul Geology Mosul-Iraq²

This study deals with biostratigraphy of the Shiranish Formation in Khanke well No.1, which is located about 23 Km., southwest of Duhok city, Northern Iraq.

Shiranish Formation consists lithologically of alternations of limestone and marly limestone with few chert nodules.

CALCAREOUS NANNOFOSSILS, PLAKTONIC FORAMINIFERA AND GLOBAL BIO EVENTS

68 planktonic foraminiferal species belonging to 17 genera and 52 benthonic foraminiferal species belonging to 27 genera were identified.

Seven biozones within the Shiranish Formation in the studied section were recognized. These biozones represent the Middle Campanian – Late Maastrichtian, (from older at base):

Abathomphalus mayaroensis Total Range Zone.

Contusotruncana contusa Interval Zone.

Gansserina gansseri Interval Zone.

Globotruncana aegyptiaca Interval Zone.

Globotruncanella havanensis Partial Range Zone.

Globotruncanita calcarata Total Range Zone.

Rugoglobigerina rugosa Interval Zone.

The common occurrence of species belonging to the benthonic genus *Bolivinoidea* permits the recognition of four biozones, (from older at base):

Bolivinoidea draco draco Total Range Zone.

Bolivinoidea draco miliaris Interval Zone.

Bolivinoidea decoratus Total Range Zone.

Bolivinoidea angulatus Total Range Zone.

The planktonic foraminiferal assemblages from the Shiranish Formation are of typical Tethyan character. The high planktonic foraminiferal diversity (68 species) and the study of the Paleoenvironment indicates a tropical – subtropical climatic conditions during deposition of the Shiranish Formation.

1204 - Albian biostratigraphical succession from La Gara (Tajerouine area central northern Tunisia)

*Nébiha Ben Haj Ali*¹, Mouna Kamzi¹

Faculté de Sciences Géologie Tunis-Tunisia¹

The biostratigraphic study of the Albian from the Gara plateau (Tajerouine area, central northern Tunisia) which is the typical field of the Fahdene formation (Albian-Cenomanian) is carried out for the first time. A rich association of benthic and planktonic microorganisms has been recognized. The good preservation of the material permits recognition of a lot of bioevents within the Albian and establishment of new chronostratigraphic context for the different lithological units of this formation. The section starts with the lower clays from the lower Albian due to presence of *Pleurostomella subnodosa* and *Favusella* sp. They belong to the *Ticinella bejaouaensis* zone of the Tethysian province. The Allam limestones correspond to the *Hedbergella planispira* zone, whereas the medium clays cover the *Ticinella primula* zone and therefore do not exceed the middle Albian. Based on planktonic foraminifera, Mouelha limestones (the uppermost of these clays) attributed to the Vraconian or the upper Albian s. st., belong to the *Biticinella breggiensis* zone (*Ticinella praeticinensis* sub-zone) and mark the basis of the upper Albian. The lower part of upper clays of the Fahdene formation is dated upper Albian based essentially on planktonic foraminiferal evidence (*Rotalipora subticinensis* sub-zone, *Rotalipora ticinensis* sub-zone and *Rotalipora appenninica* zone). From a Biostratigraphic point of view, there is close correlation with the northwestern area (Jebel Goraa) and northern Tunisia (Jebel Oust).

CARBONATE PLATFORMS RUDISTS BIOMINERALS

1146 - Microfacies and Sedimentary Environments of Campano- Maastrichtian Formations in East Atlas Saharan (Djebel Gaâga North East Of Algeria).

*sana Benmansour*¹, abdelwahheb yahiaoui¹

Research Laboratory "Natural risks and Regional Planning" (LRNAT) University of Batna/Algeria EARTH SCIENCES ras el aioun-Algeria¹

I-Introduction:

The Saharan Atlas extends from south western Algeria to the Tunisian border chain. The study focused on the eastern part of this area (Eastern Atlas Sahara), in the region of Tébessa.

II-Results:

1-Stratigraphy:

The series of the late Cretaceous consists of three lithostratigraphic units: (1) alternating limestone and marl, (2) marl, (3) limestone: The unit (1) is represented by 65 m white chalky limestone, in decimetric beds alternating with small levels greenish gray marl.

Microscopic examination shows limestone with Globotruncana, Hétérohélix, Lagena, Nodosaria and prisms of Inoceramus. Unit (2) covers 110 m of gray marls at the base and yellowish green at the top, intercalating between marl limestone formations of middle Campanian and those Maastrichtian limestone. Microscopically, they are marl with Globotruncana, hedbergella and Hétérohélix. Unit (3) form a powerful series limestone (280 m) of the upper Maastrichtian. Microscopically, they are limestone fine with rare Globotruncana, Hétérohélix, Dentalina, Nodosaria, ostracods and echinoderms.

2-Microfaciologic Analysis:

2-1.In the first unit:

2-1-1. Microfacies 1 (Mf1): biomicrite with Planktonic and Benthic foraminifera.

It is a chalky microfacies with Hedbergella, Globotruncana, Hétérohélix and Nodosaria. The other elements are relatively rare, which are calcispheres, some remains of ostracods and benthic foraminifera (Lagena, Lenticulina). The texture is wackestone- packstone. The micritic matrix has a ferruginisation, which is stressed by iron mineralization.

2- 1- 2.Microfacies 2 (Mf2): Bio-Micrit with Planktonic foraminifera.

It is a microfacies that consists of 75% of the formed elements. They are represented by foraminifera, mainly planktonic (Hebergella) and rare Hétérohélix, Globotruncana and Frondicularia delfaensis SIGAL. These particles are accompanied by clasts, mainly ostracodes. The matrix is micritic.

2-2.In the second unit:

2-2-1. Microfacies 3 (Mf3): Grey marl with benthic and Planktonic foraminifera.

Metric interval of marl, greenish, rich in planktonic foraminifera (Hétérohélix, Hebergella, Globotruncana) and benthic (Frondicularia, Nodosaria, Lenticulina, Ammodiscus, Dentalina, Néoflabellina).

2-2-2. Microfacies 4 (MF4): Yellowish Green Marl with Benthic and planktonic Foraminifera.

This microfacies is very similar to the previous one, the difference is localized only in the color wich becomes yellowish and microfaunistic content where we notice the disappearance of Frondicularia delfaensis SIGAL and Globotruncana calcarata and proliferation of Hedbergella.

2-3.In the third unit:

2-3-1. Microfacies 5 (MF5): Bio-Micrit with Planktonic foraminifera, phosphate And glauconite

Limestone with Hedbegella and Nodosaria, often light gray with packstone texture. This relatively coarse microfacies is containing phosphate and local concentrations of glauconite. The matrix is micritic. The particles are essentially, Heddbegella, Hétérohélix and Globotruncana. These are rarely accompanys with ostracods and echinoderms clasts.

2-3-2. Microfacies 6 (MF6): Bio-micrit with rare planktonic and benthic foraminifera.

This is a mudstone microfacies with micritic matrix. The microfauna are represented just with rare Hedbergella, Hétérohélix, Globotruncana and Nodosaria.

Conclusion:

The sedimentological study of the cut shows the close relationship between changes in those environments deposits and fauna and microfauna content. The assemblages of micro-organisms in the series of Campano-Maastrichtian of Gaâga led to define six microfacies which the deposit is characterized by external platform -basin.

CARBONATE PLATFORMS RUDISTS BIOMINERALS

1083 - Rudist bivalve shells as chemostratigraphic and palaeoenvironmental archive assessing ecological boundary conditions of Barremian subtropical carbonate platform ecosystems

*Stefan Huck*¹, Ulrich Heimhofer¹

Leibniz University Hanover Institute for Geology Hanover-Germany¹

A Late Barremian carbonate-platform succession (Sausset-les-Pins section), deposited on a proximal part of the Provence platform (Marseille area, S France), has been investigated applying high-resolution chemostratigraphy and detailed sedimentological analysis. The aim of the project is to reconstruct the evolution of this northern Tethyan subtropical carbonate platform ecosystem during the early onset of enhanced (submarine) volcanic activity related to the emplacement of the Ontong Java large igneous province (Late Barremian). The 60-m thick section is composed of peloidal-bioclastic pack-/grainstones (subordinate mud-/wackestones) rich in rudist bivalves of Urgonian facies. In order to obtain information on the palaeoecological and palaeoenvironmental boundary conditions of this carbonate platform, we combine an in-depth microfacies analysis with a detailed geochemical analysis of rudist bivalve shells. The outer low-Mg calcite shell layer of rudists is relatively resistant against diagenetic alteration and therefore serves as chemostratigraphic (C, Sr) and palaeoenvironmental archive. Intra-shell (sclerochronological) variations in isotopic ($\delta^{18}\text{O}$, $\delta^{13}\text{C}$) and geochemical composition (Sr, Fe, Mn, Ba, Ca/Mg) provide insights into seasonal and long-term (Myr) palaeoclimatic and palaeoenvironmental changes.

1025 - Petrography Facies analysis and mineralization in the upper Cretaceous Bekhme Formation Northern Iraq

*Al-Juboury Ali*¹, Shingaly Waleed², M Elias Elias¹

Mosul University Geology Mosul-Iraq¹ Salahaddin University Geology Erbil-Iraq²

Carbonate-hosted lead-zinc ore deposits in northern Iraq are located within Northern Thrust Zone in the Foreland Belt of Taurus Mountains. The ores at Lefan section are hosted by Bekhme Formation (upper Cretaceous) and are studied in details using standard petrographic and scanning electron microscopy. They existed in platform carbonates and hosted mainly by dolostone and dolomitic limestone. The ore-forming processes are essentially linked to the environment (fore-reef facies) in which sedimentation and early diagenesis took place. The studied lead-zinc deposits (sphalerite and galena with minor pyrite) have commonly been deposited within the host rocks through dissolution/replacement process or through void infilling. The remaining voids are filled by dolomite cement and late calcite locally associated with a late oxidation event. The general paragenetic sequence of ore deposits is initially pyrite followed by sphalerite and finally galena. Sedimentological evidence and features of stable isotope and fluid inclusions are consistent with the genetic proposal of base-metal mineralization that was caused by deeply circulating high temperature mineralizing fluids (brines) within the source basin or by tectonic processes, which possibly leached metals from either the diagenesis of host rocks or the dewatering of deeper buried siliciclastic beds or both

1224 - Sr and C-isotope stratigraphy of the Upper Cretaceous shallow-water carbonates of the southern Apennines chronostratigraphic calibration of foraminiferal biostratigraphy and platform evolution.

*Frijia Gianluca*¹, Di Lucia Matteo², Mutti Maria¹, Parente Mariano³

Universität Potsdam Institut für Erd- und Umweltwissenschaften Potsdam-Golm-Germany¹ RPS Energy Woking-United Kingdom² Università degli Studi di Napoli Federico II DiSTAR Naples-Italy³

The biostratigraphy of the Upper Cretaceous carbonate platform deposits of the southern Apennines is mainly based on larger foraminifera. Several biozones can be defined, documenting a nearly complete stratigraphic record from the Cenomanian to the Campanian. However, the time-resolution is quite low (only two biozones cover the Turonian-Campanian time-slice) and the chronostratigraphic age of the biozones is poorly constrained. In this work we used a combination of strontium isotope stratigraphy (SIS) and carbon isotope stratigraphy to improve the stratigraphic resolution and solve the problem of chronostratigraphic calibration. Stratigraphically consistent $\delta^{13}\text{C}$ curves were obtained by carefully microsampling the micrite of mudstones-wackestones or the micritic matrix of mud-rich packstones and floatstones. More than 100 samples of low-Mg calcite of rudist shells were used for SIS. Accurate cleaning techniques were used to avoid the contamination by surficial coatings of Fe-Mn oxydes and diagenetic calcite overgrowths. A whole suite of petrographical and

CARBONATE PLATFORMS RUDISTS BIOMINERALS

geochemical analyses was performed in order to select the best preserved samples. Moreover, multiple subsamples were collected from each stratigraphic level in order to test the internal consistency of data.

The numerical ages obtained with SIS were used as tie-points to facilitate the correlation between the $\delta^{13}\text{C}$ curves of the studied sections and the standard reference curve of the English Chalk, which contributed to further improve stratigraphic resolution. The resulting age-model was used for the chronostratigraphic calibration of the biostratigraphic ranges of the most significant species of larger foraminifera. For some species a good consistency emerges by comparison with the ranges established by SIS in coeval successions of the peri-Adriatic region. The chemostratigraphically supported chronostratigraphic dating of the studied successions was also used as a basis for analyzing the main steps in the Late Cretaceous sedimentary evolution of the southern Apennine carbonate platform and especially its sea-level history.

1157 - Campanian-Maastrichtian carbonate microfacies from the Eastern Fore-Balkan (Bulgaria)

Andreeva Polina¹, Stefanov Yavor², Metodiev Lubomir³, Kiselinov Hristo⁴, Dochev Docho⁵, Petrova Silvia¹
 Geological Institute, BAS Paleontology, Stratigraphy and Sedimentology Sofia-Bulgaria¹ Sofia University "St. Kliment Ohridski" Department of Mineralogy, Petrology and Economic Geology Sofia-Bulgaria² Geological Institute, BAS Laboratory of Geocollections Sofia-Bulgaria³ Geological Institute, BAS Geotectonic and Regional Geology Sofia-Bulgaria⁴ Sofia University "St. Kliment Ohridski" Geology, Paleontology and Fossil Fuels Sofia-Bulgaria⁵

The Upper Campanian–Lower Maastrichtian sequence in Komunari and Kamendel Sections (Eastern Fore-Balkan, Bulgaria) corresponds to the Nikopol, Mezdra, Yankovo, Dobrina and Kayluka Formations. In these units, seven microfacies types (MFT 1-7) were recognized.

The Upper Campanian Nikopol Formation consists of shallow-marine carbonates deposited in agitated hydrodynamic conditions (intraclastic-bioclastic packstones/grainstones of MFT 7, and bioclastic packstones/grainstones of MFT 6). Upward sections, relatively deep-water glauconitic silty wackestones with fine biodetritus (MFT 1), and silty spiculite wackestones/packstones (MFT 2) of the Upper Campanian Mezdra Formation and Lower Maastrichtian Yankovo Formation occur. The latter is bounded through a prominent erosive plane, by storm-related lag deposits of the Lower Maastrichtian Dobrina Formation. This surface combines with layer of Pycnodonte vesicularis concentration (floatstones/rudstones of MFT 3). The succession continues upwards with open-marine sandy echinoderm packstones (MFT 4). High-energy bioclastic packstones and grainstones (MFT 5) with bryozoans, brachiopods, ostracods and coralline algae build up the Upper Maastrichtian Kayluka Formation.

The Campanian–Maastrichtian sediments from the Eastern Fore-Balkan associate with diverse marine settings, located below the storm wave base or between the fair-weather wave base and the storm wave base.

This study is supported by the Bulgarian National Science Fund (Grant DMU 03/64).

1120 - Petrography and isotopic study of carbonate rocks Lower Cretaceous Dalmiapuram Formation of Cauvery Basin Southeastern India

Jayagopal Madhavaraju¹, Robert W Scott², Alcides N Sial³, Sooriamuthu Ramasamy⁴
 Universidad Nacional Autónoma de México Estación Regional del Noroeste, Instituto de Geología Hermosillo-Mexico¹ University of Tulsa and Precision Stratigraphy Associates Geosciences Department Tulsa-United States² Universidade Federal de Pernambuco NEG - LABISE, Departamento de Geologia Recife-Brazil³ University of Madras⁴ Department of Geology Chennai-India⁴

The Cauvery Basin at the southeastern tip of the Indian plate was an Albian to Danian marine embayment. The Precambrian craton was flooded during the Albian Age and nearshore to shelf sediments were deposited. The carbonate rocks are well developed in the following formations: Dalmiapuram Formation: Albian age; Kulakkalnattam Formation: Turonian to Santonian age; Kallankurichchi Formation: Maastrichtian age; Niniyur Formation: Danian age. Based on the lithology, the Dalmiapuram Formation is divided into two members, viz. gray shale member and limestone member. The limestone member is further divided into three litho-types viz. biohermal limestone, bedded biostromal limestone/marls and marls. The purposes of the present study are to find out the petrographic variations, microfossil assemblages, diagenetic imprints, and isotopic variations in the Dalmiapuram Formation.

CARBONATE PLATFORMS RUDISTS BIOMINERALS

The common petrographic types identified in the Dalmiapuram Formation range from bioclastic wackestone to coral boundstone. Foraminifera and calcareous algae were recorded together with various indeterminate bioclasts. Planktonic foraminiferal species are rare and poorly preserved in these limestone samples. Five specimens are provisionally compared to Late Albian species in the Atlantic oceans: the cosmopolitan *Muricohedbergella planispira* (Tappan) (Huber and Leckie, 2011), *Hedbergella astrepta* Petrizzo and Huber, (2006) and *Hedbergella* sp. cf. *H. libyca* Petrizzo and Huber (2006). The Albian benthic foraminifer *Arenobulimina* is present in numerous samples. A small trochospiral form is identified as *Nezzazata Omara*. Other foraminiferal groups represent textulariids, lenticulinids and milolids. Calcareous algae are relatively common and diverse in the Dalmiapuram Formation. Among the several groups, Corallinaceae is relatively more abundant than other Rhodophytes and Dasyclades. Fragments of *Pseudolithothamnium* sp. and *Lithocodium aggregatum* Elliot are present in these limestones. The fossil ranges recognized in this study support an age range of Upper Albian to Cenomanian. In addition, nannofossils in the Dalmiapuram Formation suggest an Early Albian to Turonian age (Kale and Phansalkar, 1992). The diagenetic alterations of isotopic signatures can be assessed using certain elemental concentrations (Sr and Mn). The absence of correlation between Mn and Sr indicate that the trace element geochemistry of these limestones was not altered. The limestones of the Dalmiapuram Formation show large variations in $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values (-6.07 to +2.93‰; -7.08 to -0.39‰; respectively). In the present study, the carbon and oxygen values are not correlated which further supports that these limestones retain their primary isotopic signatures. The low diversity assemblage of foraminifera and calcareous algae and other organisms in the Dalmiapuram Formation is characteristic of a nearshore carbonate shelf or ramp. The low diversity and abundance of planktonic species with coral and coral-algal buildups suggests more offshore conditions, probably within storm wave-base.

1229 - First data on the strontium isotope stratigraphy of the Upper Cretaceous rudist limestones of Hungary the Ugod Limestone Formation.

*Parente Mariano*¹, Haas János², Frijia Gianluca³, Less György⁴

University of Naples Federico II, DiSTAR, Napoli-Italy¹ Eötvös University, Geological, Geophysical and Space Science Research Group of Hungarian Academy of Sciences, Budapest-Hungary² University of Potsdam, Institut für Erd- und Umweltwissenschaften, Potsdam-Germany³ University of Miskolc Institute of Mineralogy and Geology, Miskolc-Egyetemváros-Hungary⁴

The biostratigraphy of Upper Cretaceous carbonate platforms is mainly based on rudists and larger foraminifera. The chronostratigraphic calibration of the biozones based on these fossils is often controversial because of the lack of correlation with ammonoid and planktonic foraminifera zones. This problem has been successfully tackled during the last 15 years by applying strontium isotope stratigraphy (SIS).

We present the first data on the SIS of the Ugod Limestone Formation which is widely exposed in the Bakony Mts, western Hungary and has been also drilled in some boreholes.

The Ugod Limestone consists mainly of rudist-rich bioclastic limestones and rudist biostromes. A facies zonation from inner platform to platform margin and proximal foreslope deposits has been defined for this unit. Up to now the chronostratigraphic dating of the Ugod Limestone has been mainly obtained indirectly through lateral correlation with basinal facies.

We use the strontium isotope ratio of well preserved rudist and ostreid shells, coming from several outcrops in the area of Sümeg and Ugod, to derive the first direct chronostratigraphic dating of the Ugod Limestone Formation. All the analysed shells give consistent Early Campanian ages, ranging from 81.2 to 80.5 Ma.

Further studies are needed to more precisely define the chronostratigraphic age of the base and top of the Ugod Limestone at different localities. This is a prerequisite for the reconstruction of the evolution of the Ugod Limestone carbonate platforms, from their inception with inundation of intrabasinal highs to their final drowning.

This research was financed by the Hungarian Scientific Research Fund (OTKA Grant № 100538).

CARBONATE PLATFORMS RUDISTS BIOMINERALS

1136 - Biostratigraphical and palaeogeographical correlation based on the rudist assemblages of Upper Cretaceous shallow marine deposits from Borod and Roşia basins Apuseni Mountains Romania

Săsăran Liana ¹, Özer Sacit ²

Babeş-Bolyai University Dept. of Geology Cluj-Napoca-Romania ¹ Dokuz Eylül University Department of Geological Engineering Izmir-Turkey ²

The correlation of the shallow-marine Upper Cretaceous sequences from Borod and Roşia basins based on new data obtained by reviewing of the rudist assemblages is the main topic of this study. Detailed stratigraphical and palaeontological studies were performed in four shallow marine sequences to get a high-resolution chronostratigraphy of the rudist associations. The sedimentary facies successions from all studied occurrences show close similarities consisting of basal conglomerates and breccia, marls, bioclastic sandstone and rudist-bearing limestones. These facies represent the submarine fan deltas and shallow-marine deposits were formed along a shelf margin palaeoenvironment. More than 80 rudist species have been identified from these mixed siliciclastic-carbonatic deposits, the rudist assemblages covering nearly the same time interval (Late Santonian-Late Campanian). Several endemic genera (e.g. *Miseia*, *Favolaviana*, *Colveraia*, *Pseudopolyconites*, *Pseudosabinia*) were identified thus delineating their northwestern palaeobiogeographical boundaries within the central-eastern Mediterranean area. The biostratigraphical and palaeogeographical distribution of the rudist assemblages reveals that the Borod and Roşia basins was connected with two different biogeographic provinces during the Santonian-Campanian: the central Alpine Gosau province but with eastern provinces of Mediterranean Tethys.

1099 - Late Barremian-Turonian Rudist Biostratigraphy of the Carbonate Platform in North Egypt

Salama Yasser ¹, Abdel-Gawad Gouda ¹, Steuber Thomas ², Saber Shaban ¹, El-Shazly Soheir ¹, Grammer Michael ³

Faculty of Science, Beni suef University Geology Beni suef-Egypt ¹ Petroleum Institute Petroleum Geosciences Abu Dhabi-United Arab Emirates ² Oklahoma State University Boone Pickens School of Geology Oklahoma -United States ³

The late Barremian-Turonian shallow-marine carbonate platform of north Egypt contains characteristic rudist associations. The recognition of these rudist associations is useful to resolve biostratigraphic problem, which has been calibrated by means of ammonites, benthic foraminifera, calcareous algae and non rudist bivalves. Many rudist levels associated with orbitolinid foraminifera, calcareous algae and non-rudist bivalves are identified from the Late Barremian to Turonian interval in north Egypt. Nine rudist levels are identified from the late Barremian through early Cenomanian at Gabal Raghawi of north Sinai. The Rudist level GR I with *Horiopleura* sp. and *Toucasia carinata* is the oldest one and suggests the late Barremian-Early Aptian age that recorded for the first time from north Sinai. The second rudist level GR II contains *Eoradiolites plicatus* associated with *Lithocodium aggregatum* and *Bacinalla irregularis*. At Gabal Yelleg of north Sinai, ten rudist levels are recorded from the Albian-Turonian succession. However, in north Eastern Desert, one rudist level can be traced at Wadi El-Dakhl and Saint Paul areas yielding *Eoradiolites liratus*. At Abu Roash area, in north Western Desert, the Turonian succession contains three rudist levels.

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (AOE)

1190 - Boreal organic-rich sediments of Oceanic Anoxic Event 2 dinoflagellate cysts nutrients and anoxia

Young Tom ¹, *Jarvis Ian* ¹, Dodsworth Paul ², Tocher Bruce ³, Waller Martyn ¹, Trabucho-Alexandre João ⁴
 Kingston University London Centre for Earth and Environmental Sciences Research Kingston upon Thames-United Kingdom ¹ Stratasolve Ltd Warrington-United Kingdom ² Statoil Shale Oil and Gas Research Houston-United States ³ Durham University Department of Earth Sciences Durham-United Kingdom ⁴

Diverse palynological assemblages have been recovered from Cenomanian-Turonian boundary (CTB) successions in the central North Sea and onshore NE England that contain organic-rich deposits characteristic of Oceanic Anoxic Event 2 (OAE2). The stratigraphic extent of the event is evidenced by a marked positive excursion in $\delta^{13}\text{C}_{\text{org}}$ profiles. Palynomorphs are absent in the chalks immediately underlying the onset of the positive isotope excursion. Pulses of abundant spores and pollen are associated with the appearance of organic-walled dinoflagellate cysts (dinocysts) in marlier but organic-lean sediments characterizing the early stages of the event. Dinocyst assemblages are characteristic of an outer neritic setting. High abundances of Spiniferites and Pterodinium cornutum and the presence of abundant peridinioid cysts suggest increased nutrient input, reinforced by the association with terrestrial palynomorphs. Black shales are confined to the CTB interval and the peak of the $\delta^{13}\text{C}_{\text{org}}$ excursion. These are characterized by abundant Cyclonephelium, which has been reported to be representative of anoxic conditions, reduced salinity, and lower nutrient environments. Dinocyst assemblages suggest that a nutrient-rich environment developed at the onset OAE2 was followed by more nutrient-depleted conditions during peak sediment anoxia, indicating that preservation rather than productivity was the primary control on black shale deposition.

1050 - Micropaleontological study of Cenomanian Turonian in Tebessa area (NE Algeria)

Palaeoenvironmental implications and evidence of the OAE2 onset

Kechid-Benkherouf Fatiha ¹, Ruault-Djerrab Muriel ³, Maandi Nabila ³
 Fstgat-Usthb Geology Algiers-Algeria ¹

A detailed micropaleontological study has been carried out in two outcropping sections, of middle Cretaceous age from north-eastern Algeria. The comparative study aims (1) to describe and define the palaeoenvironment around the Cenomanian-Turonian boundary and (2) to identify micropaleontological proxies of the oxygenation shift during the so-called OAE2.

The counting of the microfossils (foraminifera and ostracods) has been combined with microfacies analysis of indurated limestones. Fluctuations of microfossil ratios and microfacies indicate a relatively deep and calm, often poorly-oxygenated, depositional environment, on a distal ramp.

The incoming of the OAE2 was detected by means of several biological events, in chronological order : disappearance of Rotalipora specimens, Heterohelix event, last occurrence of Th. Planoconvexa and finally "filament event". Such events are worldwide known at the C/T boundary and are indeed useful tools for palaeoenvironmental comparison and long-range correlation.

1075 - High-resolution carbon isotopic records of the Lower Cretaceous Mural Formation Cerro Pimas section Sonora Mexico

Jayagopal Madhavaraju ¹, Yong IL LEE ², Robert Scott ³, Carlos Manuel Gonzalez-Leon ¹, Sooriamuthu Ramasamy ⁴
 Universidad Nacional Autonoma de Mexico Estacion Regional del Noroeste, Instituto de Geologia Hermosillo-Mexico ¹ Seoul National University School of Earth and Environmental Sciences Seoul-Korea, South ² University of Tulsa and Precision Stratigraphy Associates Geosciences Department Tulsa-United States ³ University of Madras Department of Geology Chennai-India ⁴

The Lower Cretaceous stratigraphic succession of the Mural Formation in northern Sonora that crops out at Cerro Pimas was deposited on shallow marine platform during Aptian-Albian time. The Mural Formation in north-central Sonora has been divided into six member's viz.: Cerro La Ceja, Tuape Shale, Los Coyotes, Cerro La Puerta, Cerro La Espina and Mesa Quemada members. These members are laterally continuous from northeastern to northwestern Sonora, in a 300 km-long transect showing only minor facies changes. The purposes of the present study are:

a) to provide an isotopic record of Lower Cretaceous limestones of the Mural Formation, Sonora, b) to identify OAE intervals in the Cerro Pimas section and c) to compare the carbon isotopic curve of this section with that of global isotopic curves established by various authors. The high-resolution carbon isotope record provides better stratigraphic resolution that allows precise determination of global anoxic events (OAEs).

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (AOE)

The petrographic study reveals a range of lithofacies from bioclastic wackestone to boundstones. The micro-biota in limestones in the Cerro Pimas section is low diversity. Prominent age-diagnostic fossils in the limestones of this section are benthic foraminifera; calcareous algae are rarely present and long ranging. This biota is consistent with the published Upper Aptian to Lower Albian age of strata in this section. The Aptian-Albian boundary correlates with the base of the Los Coyotes Member. The limestones of the Mural Formation show negative to positive $\delta^{13}\text{C}$ values (-4.63 to +2.6‰ VPDB) and $\delta^{18}\text{O}$ values varying from -12.74 to -8.34‰ VPDB. The absence of correlation between $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values supports a primary marine origin for the $\delta^{13}\text{C}$ values of limestones from the Cerro Pimas section. The carbon isotopic curve of the Cerro Pimas section is compared with curves of Scholle and Arthur (1980) and Herrle et al. (2004) to understand the similarities between them. Based on the published isotope curves, we have identified six comparable segments (C8, C9, C12, C13, C14 and C15) of the Menegatti et al. (1998) isotope curve and also six identical segments (Ap10, Ap12, Al2, Al4, Al5 and Al6) of the Herrle et al. (2004) curve. In the lower part of the Cerro Pimas section, the Tuape Shale Member shows increased detrital input, followed by decreased detrital contamination in the Los Coyotes Member. Overlying the clastic interval in the Early Albian Los Coyotes Member, the commencement of OAE1b is indicated by an increase in $\delta^{13}\text{C}$ value followed by a decrease in $\delta^{13}\text{C}$ values. Furthermore, such abrupt changes in carbon isotopic fluctuations indicate the presence of OAE1b in the Mural Formation in northern Mexico confirms the global nature of the Early Albian anoxic event.

1239 - Aptian (Lower Cretaceous) carbon isotope stratigraphy in Sierra del Rosario eastern Durango State Mexico.

*Moreno-Bedmar Josep Anton*¹, Núñez-Useche Fernando¹, Barragán Ricardo¹, Company Miguel²

Instituto de Geología, Universidad Nacional Autónoma de México Paleontología México D.F. -Mexico¹ Facultad de Ciencias, Universidad de Granada Departamento de Estratigrafía y Paleontología Granada-Spain²

In recent years, the study of the Aptian carbon isotope stratigraphy has been widely analyzed, especially in the Old World. We study the isotopic record of the $\delta^{13}\text{C}_{\text{carb}}$ of a section of Mexico, New World, through analysis of 32 bulk rock samples of limestone. Rocks come from the uppermost part of the Cupido and the lower part of the La Peña formations in a section located in the Francisco Zarco Dam at Durango State, northeast Mexico. The isotopic data are calibrated using ammonite biostratigraphy, the most precise biozonation that exists for the Aptian stage, allowing us to make a precise correlation between the carbon isotopic record of Mexico and several European sections. We recognize a negative excursion in the section with amplitude of about 1‰ immediately below the *Dufrenoyia justinae* ammonite Zone, uppermost Lower Aptian. In the Old World, two different negative excursions of very similar age have been found in several stratigraphic sections. The first corresponds to the "Aparein level", an episode found in Northern Spain and linked to a negative variation higher than 5‰. The second is a 1-2‰ negative shift recorded in many European sections. In the Spanish section, where the "Aparein level" was defined, this minor negative excursion is also recorded and located immediately below the abrupt shift. The Mexican negative excursion corresponds with the second shift described. In the Spanish section this negative excursion was defined in platform carbonate facies of the uppermost part of the Sarastarri Formation, a truly compatible sedimentary environment with the Cupido Formation in Mexico.

Neither in Mexico nor even in any other European section, there is a strong ^{13}C depletion for the uppermost Lower Aptian as reported for the "Aparein Level". Taking this into account, we redefine the local expression of the "Aparein level" as an event characterized by the immediately previous negative minor shift in the C-isotope that has an amplitude of about 2‰.

1208 - Development of an improved stratigraphic framework and depositional model for the Upper Cretaceous Eagle Ford Shale Texas

*Forshaw Joline*¹, Jarvis Ian¹, Tocher Bruce², Pearce Martin³, Gröcke Darren⁴

Kingston University London Centre for Earth and Environmental Sciences Research Kingston upon Thames-United Kingdom¹ Statoil Shale Oil and Gas Research Houston-United Kingdom² Statoil Biostratigraphy Bergen-Norway³ Durham University Department of Earth Sciences Durham-United Kingdom⁴

The deposition of episodic black shales during the Cretaceous has been observed globally within the stratigraphic record. Although the causes of these events are still debated, they are thought to be the result of reduced oxygenation and increased euxinic conditions of bottom waters in the oceans, leading to the increased preservation

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (AOE)

of organic matter. This organic matter makes these shales ideal potential source-rocks for petroleum exploration. During the Cenomanian – Turonian, organic-rich shales of the Eagle Ford Formation were deposited throughout the US Maverick and East Texas Basins. The stratigraphic framework and palaeoenvironmental interpretation of these sediments is currently based primarily on calcareous microfossils and macrofossils, with little work having been carried out on palynofacies and organic-walled dinoflagellate cysts (dinocysts). Preliminary results are presented of a new dinocyst assemblage, palynofacies and geochemical study of the Eagle Ford Shale, with the aim of producing an integrated stratigraphic framework and better palaeoenvironmental interpretation. Sub-surface cores have been analysed from shallow to deep-water facies to assess regional trends within the Maverick Basin. This multidisciplinary approach builds a firm foundation for further research incorporating outcrop material and core material from the East Texas Basin to build a good spatial coverage for the Eagle Ford Shale.

1026 - Fossil woods of *Sequoioxylon Torrey* (Cupressaceae) from the Upper Cretaceous of Zeya-Bureya Basin Russian Far East

Afonin Maxim¹

Institute of Biology and Soil Science, Far Eastern Branch, Russian Academy of Sciences Paleobotany Vladivostok-Russia ¹

New fossil species of the morphogenus *Sequoioxylon Torrey* (Cupressaceae), *S. burejense* Blokh. et M. Afonin (Blokhina, Afonin, Kodrul, 2010) and *S. dimyense* M. Afonin sp. nov. (Afonin, 2013, in print) were described on the basis of wood anatomy from the Upper Cretaceous of Zeya-Bureya Basin, Russian Far East. The fossil woods studied originate from the upper part of Lower Tsagayan Subformation of the Tsagayan Formation. These deposits are dated as Middle Maastrichtian based on palynology (Markeevich, Bugdaeva, Bolotsky, 2010). Cretaceous woods of Cupressaceae were found in the Zeya-Bureya Basin for the first time.

The new species are characterized by combination of characters of modern members of the subfamily Sequoioideae (monotypic genera *Sequoia*, *Sequoiadendron*, and *Metasequoia*), family Cupressaceae.

Our analysis of published and original paleobotanical data led to the supposition that members of the Sequoioideae apparently appeared in Zeya-Bureya Basin at the end of the Early Cretaceous (late Albian). At the middle–end of the Late Cretaceous (Santonian-Maastrichtian) on the territory of Zeya-Bureya Basin Sequoioideae probably were one of the main components of woody vegetation.

The research was supported by the Russian Foundation for Basic Research (No. 11-04-01208) and Presidium of the FEB RAS (No. 12-I-P28-01, 13-III-B-06-001).

1163 - Biostratigraphy and Micropaleontological Study on the Cutting and Core Samples of the Garau Formation in Mahi-Dasht Well # 1 West Iran

Asnafi Mohammadreza¹

NIOC exploration directorate Geology and Geochemistry studies Tehran-Iran ¹

The present study has been carried out on 539 cutting and core samples of the Surgah and Garau formations of Mahi-Dasht well # 1, west Iran.

The Garau Formation disconformably overlain by the Surgah Formation and it disconformably rests on the Gotnia Formation. A detailed microscopic study was carried out on all cutting and core samples in order to determine the geological age for the Garau Formation in this well. Based on present microfauna and lithological evidences, the Garau Formation can be divided into three intervals and the Early - Late Cretaceous (Aptian- Cenomanian) age can be ascribed to this rock unit in the Mahi-Dasht well # 1.

The encountered microfossils of the studied well have been illustrated on plates 1- 4 and their stratigraphic distributions have been shown on the enclosed relevant paleolog of this report.

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (AOE)

1199 - Recognising agents of selection for decoupling effects of different biotic interactions on ancient echinoid communities

*Borszcz Tomasz*¹, Jagt John W.M.², Donovan Stephen K.³

Institute of Oceanology Department of Marine Ecology Sopot-Poland ¹ Natuurhistorisch Museum Maastricht Maastricht-The Netherlands ² Netherlands Centre for Biodiversity – Naturalis Leiden-The Netherlands ³

We have assembled a unique collection of the large holasteroid echinoid *Hemipneustes striatoradiatus* (Leske) from various localities and horizons of the upper Maastrichtian of northeast Belgium and the southeast Netherlands. These specimens will be used to test the influence of contrasting biotic interactions on echinoid communities (test size distributions) and their responses to interactions (test thickness) along a spatio-temporal scale. With the exception of rare examples of other activities (expressed as depressed apical parts, bite marks, and syn-vivo dented tests), two main types of traces have been recognised. The first comprises differently shaped regeneration traces, often covering large part of tests; these may reflect the predatory actions of certain arthropods such as stomatopods. However, our present study has also offered insight into the second type of predominant traces, i.e., the circular holes recognised as the ichnogenus *Oichnus* Bromley. In our collection these traces occur in three principal forms. One is penetrative (*O. simplex*), the other two are not, but are either parabolic (*O. paraboloides*), or have a distinct central boss and internal blisters (*O. excavatus*), occasionally reaching tens of holes per test. Such have been interpreted to be the result of drilling by parasitic gastropods and domicnial (or embedment) structures, respectively. However, an alternative, more parsimonious interpretation could be that both kinds of holes were produced by the same agent. Due to host size, related test thickness threshold or different drilling capacities, one group of borings are penetrative and the other not. This exemplifies that, even if the interpretation of biotic interactions in the fossil record is ambiguous, diverse stressors could be recognised and used as ecological and evolutionary tools.

1042 - Belemnite diversity and biostratigraphy of the Jurassic–Cretaceous boundary interval in Siberia

*Dzyuba Oxana*¹

Trofimuk Institute of Petroleum Geology and Geophysics Siberian Branch of RAS Novosibirsk-Russia ¹

The stratigraphic distribution and taxonomic diversity of belemnites from the Volgian and Ryazanian of Western Siberia (Maurynya and Yatriya rivers) and northern Eastern Siberia (Boyarka River and Nordvik Peninsula) are studied. The dynamics of belemnite diversity in the Western Siberia correlates well with climatic events. An increase of species number in the terminal Volgian–beginning of the Ryazanian corresponds to a temperature elevation in Siberian palaeoseas, and the subsequent reduction of species diversity in the second half of the Ryazanian is correlated with a gradual cooling. The peak of belemnite diversity falls on the beginning of the Cretaceous. The East Siberian high-resolution successions of belemnite zones and beds are recorded in the West Siberian sections almost completely. In these sections the intervals correlated by belemnites with synchronous sections of the Pechora River basin, Kong Karls Land, and California, are recorded. Since in the Volgian–Ryazanian boundary beds of Siberia a great number of belemnite species known from the Tordenskjoldberget Member, Kong Karls Land, were found, it is inferred that the accumulation of the member started not in the Valanginian as many researchers believe but immediately at the beginning of the Cretaceous. This is a contribution to RFBR120500453 and IGCP608.

1005 - Structural evolution and deformation style deciphered through integrated seismic structural model of Shakardarra Kohat Pakistan.

*Ghani Humaad*¹, Malik Amir ², Khan Adnan ¹, Saeed Arsalan ¹, Jan Faizan ¹

Bahria University Earth and Environmental science Islamabad-Pakistan ¹ Land Mark resources Research and Development Islamabad-Pakistan ²

An integrated seismic structural model based on seismic line 865-NK-15, well data of Chanda-1 and surface orientation data is prepared to understand the structural style at surface and subsurface. The Jurassic Samanasuk limestone is interpreted as a principal horizon in the seismic section for which time to depth values are calculated and extrapolated to the cross sections. In the northern part of Shakardarra disharmonic folds cored by Eocene evaporites are later transected by high angle thrust faults along their limbs. In the central and southern part, folds in the Siwaliks are transected by south facing reverse faults at surface, while the seismic section shows that these south

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (AOE)

facing reverse faults at surface are linked to north verging blind reverse fault in the subsurface. These reverse faults are originated from strike slip fault present in south eastern part of Shakardara. The oppositely facing reverse faults are forming pop up structure in the subsurface. The change in the axial trend of folds at surface and the presence of pop up structure in subsurface narrates dominant transpressional deformation in the central and southern part. The research suggests that the area is evolved sequentially in three episodes of deformation: i) detachment folding over the Eocene evaporites

1091 - First record of Brachiopoda from Maastrichtian - Paleocene successions

*Hegab Adel*¹, Farouk Shreif²

Assiut-University Geology Assiut-Egypt ¹ Egypt petroleum Exploration Cairo-Egypt ²

The Maastrichtian-Paleocene rhynchonellid and terebratulid brachiopod fauna from Southern Galala, Gulf of Suez and Farafra Oasis (two different exposed sections) are recorded and studied for the first time in Egypt. These assemblages consisting of five species including four species come from Maastrichtian deposits, these are *Gyrosoria farajraensis* n. sp., *Orbirhynchia nadiae* Motchurova, *Rectithyrus whisky* Sandy, and *Terebratula* sp, while the other one species extracted from Danian deposits is *Rhythisoria alabamensis* Cooper. Their internal and external morphology are illustrated, whereas the paleobiogeography is discussed.

Keywords: Brachiopoda, Maastrichtian-Paleocene, Southern Galala, Farafra Oasis, Egypt.

1149 - Foraminifera Radiolaria and Stratigraphy of Turonian deposits in Crimean Mountains (for example Biuk-Karasu Section)

*Kopaevich Ludmila*¹, Bragina Liubov²

Lomonosov MSU, Geological Faculty Regional geology and Earth Moscow-Russia ¹ Geological Institute RAS laboratory of micropalaeontology Moscow-Russia ²

Biuk-Karasu Section is located in the northern slope of Crimean Mountains. Turonian deposits are represented by 31m thick alternation of chalklike limestones and cherty limestones with chert nodules, marls and carbonate clays. They lay on the limestones of undifferentiated Upper Cenomanian and are covered by white chalklike limestones of Coniacian. Several stratigraphic levels of the Turonian are characterized by Foraminifera and Radiolaria.

Samples 23-25 yield Foraminifera: *Whiteinella paradubia* (Sigal), *Marginotruncana canaliculata* (Reuss), *Marginotruncana pseudolinneiana* (Pessagno), *Marginotruncana coronata* (Bolli), and *Radiolaria Patulibracchium inaequalum* Pessagno, *Phaseliforma turovi* Bragina, *Pseudodictyomitra pseudomacrocephala* (Squinabol). Samples 26-30 yield Foraminifera *Marginotruncana renzi* (Gandolfi), *Marginotruncana canaliculata* (Reuss), *Archaeoglobigerina cretacea* (d'Orbigny), and *Radiolaria Dictyomitra densicostata* Pessagno, *Pseudodictyomitra* sp. aff. *Ps. pseudomacrocephala* (Squinabol), *Tubulustrionella guttaeforma* (Bragina).

The planktonic foraminifera recovered from this interval of the Biuk-Karasu Section represent faunas characteristic of the Cretaceous Transitional or Temperate Province. They comprise whiteinellids, archaeoglobigerinids and double-keeled marginotruncanids. Tethyan umbilico-convex concavatotruncanids and single-keeled marginotruncanids, biostratigraphically important, are absent. *Concavatotruncana concavata*, the appearance of which is placed in the Upper Turonian boundary, is absent. Thus the age of the studied interval can be dated as the Middle-Late Turonian. This work was supported by RFBR grants 13-05-00447 and 12-05-00

1066 - The Rio Argos section (Caravaca Spain) candidate for GSSP of the lower boundary of the Barremian stage

*Miguel Company*¹, Roque Aguado², François Baudin³, Slah Boulila³, Rodolfo Coccioni⁴, Jean-François Deconinck⁵, Fabrizio Frontalini⁴, Luca Giusberti⁶, Mathieu Martinez⁵, Mathieu Moiroud⁵, Fabrice Monna⁷, Luis O⁸, Pierre Pellenard⁵, Peter F. Rawson⁹, Laurent Riquier³, Gregorio Romero¹⁰, José Sandoval¹, José M. Tavera¹, Helmut Weissert¹¹

Universidad de Granada Departamento de Estratigrafía y Paleontología Granada-Spain ¹ Universidad de Jaén Departamento de Geología Linares-Spain ² Université Pierre et Marie Curie-Paris 6 UMR CNRS 7193 ISTEP Paris-France ³ Università di Urbino Dipartimento di Scienze della Terra, della Vita e dell'Ambiente Urbino-Italy ⁴ Université de Bourgogne UMR CNRS 5561 Biogéosciences Dijon-France ⁵ Università di Padova Dipartimento di

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (AOE)

Geoscienze Padova-Italy ⁶ Université de Bourgogne UMR CNRS 5594 ARTÉHIST Dijon-France ⁷ Universidad de Cádiz Departamento de Ciencias de la Tierra Puerto Real-Spain ⁸ University of Hull Centre for Marine and Environmental Sciences Scarborough-United Kingdom ⁹ Universidad de Murcia Departamento de Química Agrícola, Geología y Edafología Murcia-Spain ¹⁰ ETH Zentrum Geologisches Institut Zurich-Switzerland ¹¹

This communication is an outline of the formal proposal of the Rio Argos section (Caravaca, SE Spain) as GSSP for the base of the Barremian stage. We carried out an integrated analysis of this section including biostratigraphy (ammonites, foraminifera and calcareous nannofossils), chemostratigraphy (organic matter and stable isotopes) and cyclostratigraphy (magnetic susceptibility and clay mineralogy).

The lithological succession of the section (40 m thick) consists of a monotonous alternation of marls and marly limestones with no evidence of interruptions or condensations. The primary marker event of the base of the Barremian stage (first occurrence of the ammonite species *Taveraidiscus hugii*) was recorded 23 m above the base of the section. This event falls within the NC5C calcareous nannofossil subzone, the *Hedbergella semielongata* planktonic foraminiferal zone, and the *Dorothia ouachensis* benthic foraminiferal zone and roughly coincides with the beginning of a slightly negative trend interval in the $\delta^{13}\text{C}$ curve. According to the cyclostratigraphic analysis the base of the Barremian would be located 0.7 myr after the onset of the organic-rich Faraoni event. Indirect correlation by ammonite and isotope stratigraphy with the Gorgo a Cerbara section (central Italy) allows to correlate the Hauterivian-Barremian boundary with the upper part of chron CM5n.

1182 - The First Lizard (Order Squamata) fossil from South Korea and other faunal remains from the Late Cretaceous Seonso Conglomerate

Huh Min ¹, Park Jin-Young ¹

Chonnam National University Earth Systems and Environmental Sciences Gwangju-Republic of Korea ¹

Late Cretaceous (Campanian) Seonso Conglomerate of Boseong, South Korea, is one of the richest places for dinosaur egg fossils (Huh et al., 1999). Since the first excavation in 1998, more than 200 individual egg specimens were discovered, and 3 ootaxons, including *Spheroolithus* (Zhao and Li, 1988), *Faveolithus* (Zhao and Ding, 1976), and 1 unidentified taxon (DRCC-D109), which contains a partial egg and associated shell fragments, were reported (Huh et al., 1999; Huh and Zelenitsky, 2002). During the excavation for dinosaur egg fossils in the year 2000, a body fossil of a non-marine reptile (DRCC-BT001) was discovered, and was reported as a partial skeleton of a Testudine (Huh et al., 2006). But now, it turns out to be a large lizard (Order Squamata) species, which also is the first lizard fossil to be reported in South Korea. The fossil specimen contains a mandible (left), a pterygoid, a humerus (right), a scapulocoracoid (right), and 2 unidentified bone fragments. The right humerus and the right scapulocoracoid are well preserved, but the other pieces, including the mandible and pterygoid, are partially preserved. The humerus measures 98 mm from head to condyle. The body of the humerus is erect, which is different from the humerus of a Testudine that has a sigmoid curve. The humerus also has a wide proximal and distal end, which is a characteristic that can be seen in Lepidosauria (both rhynchocephalians and squamates). The partial mandible measures 127 mm long from front to end. The alveolar bone does not show any tooth sockets, which tells us that this specimen is a pleurodont. Additional studies on this specimen may help us understand the evolution of Mesozoic squamate species, and also fill in their patchy history. In 2003, alongside the eggs and the lizard fossil, three fossils of *Koreanosaurus* (Huh et al., 2011) were found. The holotype KDRC-BB2 (a partial skeleton) lacks the skull, but the animal may have looked similar to *Zephyrosaurus* (Sues, 1980) and *Orodromeus* (Horner and Weishampel, 1988). There is a hypothesis that *Koreanosaurus* might be a *Jeholosauridae* or a closely related genera, but additional materials are required to test this (Han et al., 2012). By comparing the Boseong fossil materials with other Asian Late Cretaceous fossil species, the faunal remains of the Seonso Conglomerate may help us understand the evolution of Asian fossil faunas and also the Late Cretaceous paleoecosystem of Korea.

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (AOE)

1045 - Biostratigraphy and inter-regional correlation of the Jurassic–Cretaceous boundary strata in Russian Far East

Shurygin Boris¹, Urman Olga¹, Dzyuba Oxana¹

Trofimuk Institute of Petroleum Geology and Geophysics Siberian Branch of RAS Novosibirsk-Russia¹

Representatives of genus *Buchia* (Bivalvia) are numerous in the upper Volgian–lower Valanginian of Northern Sikhote-Alin (NSA). We have studied buchias from key section on the right bank of the Amur River (Komsomolsk section). *Buchia terebratuloides* Beds, *B. unschensis* and *B. terebratuloides* Beds, *B. volgensis* and *B. okensis* Beds, and *B. inflata* and *B. keyserlingi* Beds have been established here. The *B. unschensis* and *B. terebratuloides* Beds also contain Tethyan ammonite *Pseudosubplanites*? sp. Numerous finds of *B. uncitoides* and *B. tolmatshowi* in NSA sections mentioned in various publications enable to assume existence here of beds with buchiids, corresponding to complete *B. okensis*–*B. uncitoides*–*B. tolmatshowi* succession fixed in British Columbia (or *B. okensis*–*B. jasikovi*–*B. tolmatshowi* succession in Siberia). Our investigation allowed us (1) to make more accurate correlation of the J–K boundary strata of Southern Primorye, NSA and Western Priokhotye, where Boreal and Tethyan molluscan fauna can be found together; (2) to construct a correlation scheme of the J–K biostratigraphic zonation of Russian Far East with bio- and magnetostratigraphic zonation of Northern Siberia and Western Mediterranean. This is a contribution to RFBR120500453 and IGCP608.

1150 - First Records of Radiolarians from pelagic red limestones of Upper Cretaceous Elmalı Dere Formation in Maçka area Trabzon NE Turkey

Türk Emine¹, Çapkinoğlu Şenol¹, Gedik İsmet¹

KTÜ Geology Trabzon-Turkey¹

The Upper Cretaceous Elmalı Dere Formation consists mainly of thin- to medium-bedded, red-coloured pelagic limestones with andesite, tuffite and agglomerate interbeds. A fauna comprising grain samples of radiolaria and planktonic foraminifera was first recovered from strata in the Çatak2 measured stratigraphic section in the Maçka area (Trabzon) of this unit. A total of 19 species of radiolarian were identified from the Çatak2 section including *Patulibracchium torvitis* Pessagno, 1971, *Patulibracchium teslaensis* Pessagno 1971, *Crucella esportensis* Pessagno, 1971, *Alievium gallowayi* Pessagno, 1972, *Alievium superbus* (Squinobal, 1914), *Patellula verteroensis* (Pessagno, 1973), *Archaeospongoprimum salumi* Pessagno, 1973, *Archaeospongoprimum bipartitum* Pessagno, 1973, *Dicyomitra formosa* Squinobal, 1904, *Dicyomitra koslovae* Foreman, 1975, *Dicyomitra multicostata* Zittel, 1876, *Dicyomitra duodecimcostata* (Squinobal, 1903.b) *Diacanthocapsa acuminata* Dumitrica, 1970, *Diacanthocapsa ancus* (Foreman, 1968), *Amphipydax stocki* (Campbell&Clark, 1944), *Amphipydax conicus* Nakaseko & Nishimura 1981, *Amphipydax ellipticus* Nakaseko & Nishimura 1981, *Pseudoaulophocus gallowayi* White, 1928 and *Pseudoaulophocus lenticulatus* (White, 1928). This fauna refers to a Santonian-Campanian (Late Cretaceous) age.

1100 - Correlation of Upper Cretaceous Foraminiferal Radiolarian and Nannoplankton Zonal Schemes (Eastern European area of Russian Sector)

Vishnevskaya Valentina¹, Kopaevich Ludmila², Beniamovskii Vladimir³, Ovechkina Maria⁴

GIN RAS Department of Stratigraphy Moscow-Russia¹ Lomonosov MSU, Geological Faculty Regional geology and Earth Moscow-Russia² GIN RAS Department of Micropalaeontology Moscow-Russia³ University of KwaZulu-Natal Earth and Environmental Sciences Durban-South Africa⁴

Microfossils (planktonic and benthic foraminifers, radiolarians, and nannoplankton) are widespread within the Upper Cretaceous of the Russian sector of the Eastern European Platform. Traditionally, the biostratigraphy of sedimentary deposits of the Eastern European Platform is based on the macrofauna. However, some stratigraphic intervals contain little or no macrofauna, and biostratigraphic subdivision can only be done on the basis of the microfossils. The proposed integrated scheme for the Upper Cretaceous of the Russian sector of Eastern European area consists of 12 planktonic foraminiferal subdivisions, 23 benthic foraminiferal zones, 10 radiolarian zonal subdivisions with 18 infrazonal bioevents and 26 nannoplankton zones.

Thus, the planktonic and benthic foraminiferal zonations shows substage and intrastage subdivisions, whereas nannoplankton and radiolarian zonations allows the establishment of stage boundaries, being mutually complementary.

The integration of microfossil biostratigraphic data from sequences in the Russian sector of Eastern European Platform seems very promising for creation of a united micropalaeontological zonal scale for the temperate region.

CRETACEOUS PALEOCEANOGRAPHY AND OCEANIC ANOXIC EVENTS (AOE)

1117 - Early Cretaceous bathyal sea cucumbers (Echinodermata Holothuroidea) from the western North Atlantic Ocean

Reich Mike ¹, Gale Andrew S. ², Schlüter Nils ³, Ben Thuy ³, *Wiese Frank* ⁴

Geoscience Museum Georg-August University Göttingen-Germany ¹ School of Earth and Environmental Sciences University of Portsmouth Portsmouth-United Kingdom ² Department of Geobiology Georg-August University Göttingen-Germany ³ CRC Geobiology, Geoscientific Center Georg-August University Göttingen-Germany ⁴

Sediments recovered from the lower bathyal ODP Leg 171 at Site 1049 on the Blake Nose escarpment (western North Atlantic) offer an opportunity to study well-preserved fossil deep-sea echinoderms, including sea cucumbers. Among echinoderms, holothurians are the most common megafaunal elements in the deep sea. Today, several holothurian groups are unique in being confined to the deep sea. While there is some knowledge on shelf-sea holothurian records, deep-sea taxa are virtually unknown.

Here we present the first detailed analysis of early Cretaceous holothurian assemblages from Blake Nose. The fauna consists of dissociated ossicles and other skeletal elements, dominated by members of the Laetmogonidae and Myriotrochidae; representatives of the Chiridotidae are less frequent. Laetmogonids are surface-dwelling species and predominantly bathyal; myriotrochids and chiridotids live in large aggregations in soft sediments. All these fossil species are closely related to modern representatives.

This is the first detailed report of Aptian holothurians worldwide as well as the first description of a member of elasipodid holothurians ever recorded from the early Cretaceous. The discovery of a bathyal holothurian community of nearly modern composition of early Cretaceous age implies that at least a significant part of the modern deep-sea fauna is much older than previously assumed.

CRETACEOUS SEDIMENTARY BASINS, PALEOGEOGRAPHY AND TECTONIC EVOLUTION

1145 - Late Cretaceous Synsedimentary Tectonic in Eastern Atlas Saharan (North East Of Algeria)

*Sana Benmansour*¹, abdelwahheb yahiaoui¹, ahmed inal²

Research Laboratory "Natural risks and Regional Planning" (LRNAT) University of Batna/Algeria EARTH SCIENCES ras el aioun-Algeria¹ University of Batna/Algeria EARTH SCIENCES CONSTANTINE-Algeria²

I- Introduction:

The late cretaceous is one of the most significant periods in the geological history of the Eastern Atlas Saharan in view of the important tectonic and sedimentary events that affected the region at this time.

The present study focuses on the characterization of the sedimentary of late cretaceous deposits under control of tectonic, located in the area of Tebessa, in the north eastern part of Algeria.

The selected site is located in the wilaya of Tebessa, about 17 km from the main town of the wilaya.

II- Materials and methods:

The section studied is approximately 280 m thick, are composed mainly of limestone. The survey of the geological section was supplemented by measurements of bedding planes, fault planes, stylolithiques joints. In order to make stereographic projections,

Was used stéréonet Aug 2000.

III- Results

A-Plans strata: The stereogram of bedding plans shows the main direction:

D: N 130 ° E, P: 10 ° NE. This direction does not correspond to the Atlas phase (NW / SE), or the Alpine stage (N-S). We can consider that this direction has undergone a deformation resulting from the combination of Alpine tectonics and paleotectonic (accident base) which would lead to virgation of Dj. Gaâga.

B-faults Plans: From stereogram of fault planes, three mean directions are mentioned:

- D1: N 40 ° E, P: 20 ° SE;
- D2: N 120 ° E, P: 5 ° W;
- D3: N 175 ° E, P: 40 ° S.

The first two directions correspond to steps (corresponding to the first and second recesses sinistral to dextral offsets). They are the result of shortening NS direction (phase alpine). The third direction is normal faults, they are always the result of a NS shortening (phase alpine).

C-joints Plans: From stereogram plans joints, two main directions are determined:

- D1: N 50 ° E, P: 85 ° SE • D2: N 150°E, P:85°NE ;

These two directions result of shortening direction N-S (Alpine phase).

D-joints stylolites: we mentions two main directions:

D • 1: N 30 ° E, P: 80 ° SE corresponds to the direction of tectonic stylolites (perpendicular to the stratification). They are the result of shortening NW / SE (Atlas phase).

- D 2: N 125 ° E, P: 25 ° SW. This direction represents Stratiform stylolites (diagenetic).

4 - The synsedimentary tectonics: In order to show the tectonic / sedimentation relationship, compression context Cretaceous of Eastern Atlas Saharan and specifically in the area of Gaâga (Tebessa) was studied and analyzed synsedimentary structures recorded. Measures levied on land allow us to highlight the existence of slumps and growth faults. The slip plans are observed slumps oriented NE. Synsedimentary normal faults are steering NW / SE. These directions correspond to the extensional episode of laramienne phase

VI- Conclusion:

In conclusion, it appears that the region of Gaâga results from the combined action of several tectonic style and variable extensions.

CRETACEOUS SEDIMENTARY BASINS, PALEOGEOGRAPHY AND TECTONIC EVOLUTION

1032 - Seismites in the Turonian series north of the Saharan Atlas (Algeria)

*Herkat Missoum*¹

FSTGAT USTHB Geology Algiers-Algeria¹

The Middle Turonian strata of the Preatlasic zone, located in the north of the Eastern Saharan Atlas, comprise metric scale structures showing undulations evoking seismites. This interpretation is based on the wavy form of the limestone beds which are sealed under planar bed, indicating that they result from the detachment of sedimentary strata. These seismites are observable in the same level of several Turonian sections cropping in the Preatlasic zone. This feature suggests linking them to seismic movements happening in the vicinity of the well known North Atlantic fault, in connection with a strike-slip motion through this period.

In the Saharan Atlas bordering the Preatlasic zone, drag folds are visible in the middle Turonian series, possibly related to the seismic movements which generated the strata undulations observed in the Preatlasic zone. This seismic activity signifies that a first tectonics occurred during the middle to late Turonian times in the Atlantic Basin which may have registered transtensional movements in its north margin, involving its gradual subsidence and a correlative rising of the Preatlasic zone. In this area, numerous surfaces corresponding to subaerial unconformities mark discontinuities at the top of the sequences, attesting of its probable tectonic uplift.

1178 - The fracture pattern and mechanical stratigraphy of the Cretaceous sediments in Isfahan Iran

*Farzipour Saein Ali*¹, Tajmir riah Zahra¹, Beygi Soheila¹, Vatan dust Masoumeh¹, Safaei Homayon¹

University of Isfahan Geology Isfahan-Iran¹

Deformation pattern and fracturing in sedimentary rocks are being controlled by the mechanical stratigraphy of the sedimentary sequences. Field evidences demonstrate that the mechanical units are not exactly matchable with stratigraphical units. The vertical and lateral facies changes in sediments can affect significantly on lithology, porosity, diagenesis and boundary of the sedimentary layers, which are the controlling factors for fracture patterns consequently. One of the main objectives of this work is to study the relationship between the fracture patterns and the different lithological units of the cretaceous sediments in Isfahan area (central Iran), within the two below locations:

1 - Lower Cretaceous strata in the Dizlu area, 55 km North East of Isfahan.

2 - The Upper Cretaceous strata in the Kolahghazi area, 25 km South East of Isfahan.

A complete Stratigraphic study has been done in this area. The structural studies were done in order to define fracture characteristics (fracture typology, geometry and attitude), fracture network properties (organization in fracture sets, hierarchy, length, spacing, density) and their correlation with stratigraphy.

We acquired fracture data by measuring the orientation (strike and dip), the spacing and the length of fractures on the sections which are nearly vertical. The data were acquired by using two methods: sample lines and inventory areas. We analyzed fracture data by using statistical plots and diagrams.

The fracture analysis in this study confirms that the fracture pattern has a very distinct relation to the stratigraphical sequences. The majority of the joints terminate to the genetic unit boundaries or the flooding surface which apart the transgressive from regressive hemicycle. In other word the sequence stratigraphy and mechanical stratigraphy boundaries has a special agreement.

The change in distance between fractures (joint density) related to and thickness, lithology type, tensile strength and the relative deformation of the rock units. With increasing thickness of rock units the extended joint density decreases. In fact, a linear relationship exists between fracture spacing and layer thickness. This linear relationship is not clear where the thickness of the sedimentary units is greater than 0.5 m, equivalent to a very thick layer; diffusion of a linear trend can be seen in these cases.

Joint density generally is increased by changing the lithology of the sedimentary units from dolomitic limestone to limestone, sandstone, conglomerate, marl and shale. It must be considered that if sandstone is more fine-grained and it is influenced by the stronger degree of the diagenesis, the joint density within sandstone will increase and the distance between them will decrease. According to this study, it must be considered that the distribution of fractures and the distance between them is not only influenced by the set of parameters including the thickness, lithology, grain size, forming sedimentary rocks and sedimentary structures, We have to consider diagenetic processes also. This study illustrates how integrating sedimentology and sequence stratigraphic interpretations with data on structural kinematics can lead to refined predictive understanding of fracture attributes.

CRETACEOUS SEDIMENTARY BASINS, PALEO GEOGRAPHY AND TECTONIC EVOLUTION

1156 - Provenance of Lower Cretaceous Sindong Group sandstones Gyeongsang Basin Korea determined by scanning electron microscope-cathodoluminescence and zircon Zr Hf analysis

Yi Joohhyeon ¹, Lee Yong Il ¹

Seoul National University School of Earth and Environmental Sciences Seoul-Korea, South ¹

The Sindong Group (Aptian-Albian) forms the lowest strata in the Gyeongsang Basin, the largest nonmarine sedimentary basin in southeastern Korea, which was formed by oblique subduction of the paleo-Pacific plate beneath the East Asian continental margin. The Sindong Group is distributed in the NNE-SSW-trending trough developed along the western basin margin, and is consisted of 2-3 km thick sediments deposited in the fluvio-lacustrine environments. It is subdivided into three stratigraphic units: the Nakdong, Hasandong, and Jinju Formations with decreasing age. Previous paleocurrent analysis indicated that the Sindong Group was derived from western and northwestern sources, the Yeongnam massif. The provenance of Sindong Group sandstones was studied by petrography and by analyzing scanning electron microscope-cathodoluminescence (SEM-CL) on quartz grains and Zr/Hf ratio of detrital zircons. Samples were collected from three different stratigraphic levels (lower, middle, and upper) from each formation in three different parts (north, center, and south) of the basin to interpret the spatio-temporal changes of sediment dispersal systems. Sandstone petrography reveals that provenance belongs to the transitional continental block setting, which was dominated by medium-grade metamorphic rocks. On the basis of the SEM-CL analysis 60-80% of quartz grains were derived from metamorphic rocks, 20-40% of quartz grains from plutonic rocks, and 0-20% of quartz grains from volcanic rocks. It is notable that plutonic quartz grains decreases upsection in the northern and central parts of the basin at the expense of increasing metamorphic quartz grains. However, in the southern part the plutonic quartz content does not change upsection, although a slight increase (<7%) is noted in the Hasandong sandstones. Instead, a significant amount of volcanic quartz grains (~25%) is observed in the upper Jinju Formation in the southern part, and 6-9% in the middle and upper Jinju sandstones in the central part. Zircon Zr/Hf analysis reveals that detrital zircon grains in the northern part were mostly (63%) derived from anorogenic granites in the Nakdong Formation, but mostly (>80%) from orogenic magmatic rocks, the Jurassic granites, in the Hasandong and Jinju Formations. In the central part, detrital zircons were mostly (>80%) derived from the Jurassic granites in all three formations and in the southern part the Jurassic granites provided about 60-69% of detrital zircons in all three formations. Quartz grain SEM-CL results and detrital zircon Zr/Hf ratio distributions of the Sindong Group sandstones can be grouped into three source rock types: basement rocks of the Yeongnam massif, Triassic anorogenic granitic rocks, and Jurassic granites of arc-affinity. Provenance of the Sindong Group had not changed significantly in time and space, except for active continental arc volcanism occurring mainly in the central and southern parts during the middle-upper Jinju Formation deposition.

1237 - The Role of Stratigraphic Reperes and Distribution of Fracturation Facies to the Comprehension of the Geodynamic Evolution Of the Northern Border of Atlasic Basin Case of the Kasserou-Mestaoua Meridian (North East Algeria)

Youcef Brahim EL Hadj ¹, Chadi Mohammed ¹

Mentouri University Geology and environment laboratory Merouana-Algeria ¹

The current study tries to analyze the geodynamic evolution of a characteristic unit that belongs to the southern fringe of the north-eastern Algeria, alpine belt external zones, also to extract the nature of deformation mechanisms involved in their evolution and integrating the set in a regional tectonic context, which takes in consideration the evolution of the Algerian alpine belt.

Situated in the North-east of Algeria (area of Merouana), the studied massifs include a carbonate and terrigenous sets of Mesozoic age. In these massifs the thickness and lithologic variations and the distribution of tectonic structures attest that the sedimentation and the geodynamic evolution are frequently controlled by the rhegmatic. The stratigraphic correlation, the biosedimentologic data and the repartition of the fracturing facies, along a meridian cross section in the Merouana area have allowed to retrace the geodynamic Mesozoic and Cenozoic evolution of the area study, to discuss the relation of the structural legacy-sedimentation and to demonstrate the autochthony of these massifs (Mestaoua and Kasserou).

CRETACEOUS SEDIMENTARY BASINS, PALEOGEOGRAPHY AND TECTONIC EVOLUTION

1215 - Development of Berdiga Terrane in Eastern Pontides Turkey

*Gedik İsmet*¹, Türk Emine¹, Softa Mustafa¹
 KTÜ Geology Trabzon-Turkey¹

Stratigraphic investigations in Eastern Pontides reveals that Berdiga Terrane splitted from a continent having undergone a Hercynian Orogeny. The stratigraphic development of terranes began with the development of Şenköy Formation consisting of conglomerates, sandstones, siltstones and marls with intercalations of basic volcanic rocks. Volcani-sedimentary facies continued up to Late Dogger and then facies change from sandstones to dolomitic rocks. This chemical sedimentation episode continue, at least, until Late Aptian consisting ca. 600 m of carbonate rocks, most in thick bedded and in sparitic facies, indicating a neritic environment. Convergence between terranes start at begin of Late Cretaceous and uplifted areas develops due to collisions, leading to occurrence of clastic sedimentation with andesitic lava and pyroclastic intercalations. Hence, the time of oceanic plateau period ends with the collisions of terrains at begin of Late Cretaceous. The first collisional momentums of terrains lead to the first uplifts at the end of Cretaceous and subdued to erosions during Paleocene. With the onset of Eocene some parts of this region is submerged again and Eocene deposits with very different sedimentologic characters develop. Convergent movements between terranes continued further after Eocene and deep-marine sediments and ultramafic rocks of oceanic crust are up thrustured over the confining oceanic plateaus.

1196 - Structural characteristics of the Cretaceous-Paleogene successions for a part of the Eastern Fore-Balkan (Bulgaria)

*Kiselinov Hristo*¹, Vangelov Dian², Andreeva Polina³, Vangelova Viktoria⁴
 Geological Institute, BAS Geotectonics and Regional Geology Sofia-Bulgaria¹ Sofia University "St. Kliment Ohridski"
 Geology, Paleontology and Fossil Fuels Sofia-Bulgaria² Geological Institute, BAS Paleontology, Stratigraphy and
 Sedimentology Sofia-Bulgaria³ Sofia University "St. Kliment Ohridski" Department of Mineralogy, Petrology and
 Economic Geology Sofia-Bulgaria⁴

It is widely accepted that the easternmost part of the Fore-Balkan zone (Bulgaria) has simple structural composition. The latter is represented of gently folded Predzan and Asparuhovo anticlines, and Asparuhovo syncline. These regional fold structures are characterized by cores composed of Lower Cretaceous sediments and limbs of Upper Cretaceous-Paleogene carbonate and siliciclastic successions.

New field data presented in this study indicate that the Fore-Balkan zone is distinguished by much more complicate structural composition. More than twenty-five fault predestinated folds with various characteristics and orientation are recognized and described. The folded Upper Cretaceous-Paleogene sequences are affected by Late Alpine deformations, whereas the Lower Cretaceous turbiditic successions are underwent at least two (Early and Late Alpine) tectonic events. The frame of the zone is also characterized by different distribution of the stress fields, detachment level, scale, style and intensity of deformation. Most probably, it is a result of the salient geometry of the East Balkan thrust front, which allowed to separated the studied area on western "wide", less deformed part and eastern "narrow", with more and reoriented structures.

The received structural data suggest that the deformations are result of subthrust tectonics in front of thin-skinned thrust-fold belt with flat/ramp geometry of the master fault and sinistral transpression mechanism of shortening.

CRETACEOUS TERRESTRIAL RECORDS

1054 - Preliminary description of undescribed axial elements of the *Itasuchus jesuinoi* holotype (Mesoeucrocodylia; Neosuchia) from the Marília Formation (Bauru Group) Late Cretaceous (Maastrichtian) Uberaba Municipality Minas Gerais State Southeastern Brazil

Cezar Geroto Caio Fabricio¹, Bertini Reinaldo José²

UNESP Pós-Graduação em Geologia Regional, Instituto de Geociências e Ciências Exatas Rio Claro-Brazil¹ UNESP Departamento de Geologia Aplicada, Instituto de Geociências e Ciências Exatas Rio Claro-Brazil²

The present contribution provides a preliminary description of previously undescribed axial elements of *Itasuchus jesuinoi*, a Crocodyliformes from the Upper Cretaceous of Southeastern Brazil. Identifications and descriptions of the vertebrae were made by comparisons with other Crocodyliformes axial remains, observed in the literature. There are two centra of cervical vertebrae, possibly the third and fourth ones. The cervical vertebra V has a diapophysis ventrally inclined and a parapophysis short. The cervical vertebra VIII presents diapophysis laterally displayed and zygapophyses showing open angle between right and left ones. The only complete vertebra is a first or second dorsal, with neural spine and diapophysis close to prezygapophysis. There are four presacral vertebrae preserved, presenting short neural spines, elongated anteroposteriorly, with diapophysis and parapophysis fused in the transverse process. The lengths of their centra are 36.37mm, 36.63mm, 35.41mm. The first caudal preserved is probably the XIV or XV, with ventral keel for the chevron well developed, thin transverse process posteriorly inclined, and length of the centrum 37.20mm. Another three caudal vertebrae, probably between XVIII and XXIII, have triangular and thin neural spines, with transverse processes inclined laterally obliquely. Comparisons with axial elements of another Crocodyliformes can provide more information about relationships of *Itasuchus*.

1004 - The Late Cretaceous Paleoherpertological Diversity in the Maevarano Formation Mahajanga Basin Northwestern of Madagascar a Reckoned Migration of Dinosaurs

Raveloson Miky Lova Tantely¹

University of Antananarivo Paleontology Antananarivo-Madagascar¹

Extraordinary preservation of reptile and amphibian remains from the deposits of Maevarano Formation, northwestern of Madagascar has afforded a unique glimpse into Late Cretaceous ecosystem. Non-avian dinosaurs (abelisaurid and noasaurid theropods, titanosaurian sauropods) crocodyliforms, frogs and snakes and turtles are the most abundant taxa in this Late Cretaceous fauna. This study focuses on possible climate conditions reigning into both the zoogeographical and phytogeographical province of Indo-Madagascar, at the end of Mesozoic Era with profound implications both on the paleoecological niche reconstructions in the Maevarano ecosystem and on the paleobiogeographical aspect of Indo-Madagascar. Migration event of abelisauridae dinosaurs has been hypothesized after the supposed split of Indo-Madagascar short-lived landmass between 120 and 90 Ma. However, this migration event was probably suggested by climate reigning difference between these two continental landmasses that could have had a profound consequence on phytogeographical province of these two landmasses, a reckoned dispersal corridor, and also the cannibalism encountered with *Majungasaurus crenatissimus* (Kristi Rogers et al, 2003). In fact this *Majungasaurus crenatissimus* has suggested an evolutionary form among the abelisauridae taxa of the Gondwanan landmasses.

1055 - Preliminary description of previously undescribed appendicular elements of the *Itasuchus jesuinoi* holotype (Mesoeucrocodylia; Neosuchia) from the Marília Formation (Bauru Group) Uberaba Minas Gerais State Brazil

Cezar Geroto Caio Fabricio¹, Bertini Reinaldo José²

UNESP Pós-Graduação em Geologia Regional, Instituto de Geociências e Ciências Exatas Rio Claro-Brazil¹ UNESP Departamento de Geologia Aplicada, Instituto de Geociências e Ciências Exatas Rio Claro-Brazil²

This contribution provides preliminary descriptions of the previously undescribed appendicular elements of *Itasuchus jesuinoi*, a Mesoeucrocodylia from the Upper Cretaceous of Southeastern Brazil. The left humerus is robust, almost straight, presenting prominent deltopectoral crest, 176.36mm in length. The posterior circular depression is almost inexistent and the posterior deltoid groove is shallow. The ulnae are preserved, laterally flattened, with more proximal compression, the length of the left ulna is 149.68mm and the right one measures 146.70mm. The right femur is robust, with a medial torsion which laterally shifts the distal epiphysis, 220.38mm in

CRETACEOUS TERRESTRIAL RECORDS

length. The fourth trochanter is anteromedially displayed, cranium-medial crest being discrete, the crest for the Musculus Ileo-Femoralis being elongated and deep. Both tibiae are preserved, but only the right one is complete, 182,48mm in length, the left one losing the distal epiphysis. Both fibulae are preserved, but the right one lost the distal epiphysis, and the left fibula is well preserved, 160,24mm in length. There are 4 metapodials, morphologically typical of Crocodyliformes, with compressed distal portions and broad articulated facets and proximal portions, lengths being, from first to fourth, 80mm, 85mm, 77,13mm, 96,53mm. These characteristics will be compared to other appendicular elements, preserved in Crocodyliformes from Bauru Group.

1006 - Dinosaurs and Crocodiles from the Cretaceous Terrestrial Ecosystem of Pakistan

*Malkani M. Sadiq*¹

Paleontology and Stratigraphy Branch Geological Survey of Pakistan Quetta-Pakistan ¹

So far, the Late Cretaceous (Maastrichtian) Lameta Formation of India has served as the sole source of information on Cretaceous vertebrates of the Indo-Pakistan Peninsula. Recently since 2000, about 30 localities of Pakistan has yielded three thousand fossilized bones/ pieces of bones of dinosaurs (cranial includes 4 skulls, numerous axial and appendicular elements, many coprolite pieces and four types of armour plates) from the Sulaiman (middle Indus) basin. The remains of well developed and well preserved body fossils from the Latest Cretaceous Vitakri Formation yielded the herbivorous Khetranisaurus barkhani, Sulaimanisaurus gingerichi and Pakisaurus balochistani of Pakisauridae, and Marisaurus jeffi and Balochisaurus malkani of Balochisauridae titanosaurian sauropods, and carnivorous small bodied Vitakrisaurus saraiki and large bodied Vitakridrinda sulaimani of Vitakrisauridae theropod dinosaurs, and carnivorous Pabwehshi pakistanensis and Sulaimanisuchus kinwai of Sulaimanisuchidae mesoeucrocodyles, and possibly the partial dentary ramus of pterosaur-the flying reptile. Further the remains of poorly recognized body fossils from the Late Jurassic Sembar Formation of Lower Indus/Kirthar basin yielded titanosaur (Brohisaurus kirthari). The trackways from the Middle Jurassic Samanasuk Limestone represent confrontation scenario between a group of walking wide gauge Malakhelisaurus mianwali titanosaurian sauropods and a narrow gauge running Samanadrinda surgahri Vitakrisauridae theropod.

1165 - Sedimentary facies analysis of the upper Sindong Group of Cretaceous Gyeongsang Basin in southwestern Korea

*Cheong Daekyo*¹, Paik Seik¹, Moon Jinah¹

Kangwon National University Geology Chuncheon-Korea, South ¹

Sedimentary facies analysis has been carried out for the sedimentary sequence of the Cretaceous Gyeongsang Sedimentary Basin - the Hasandong and Jinju Formations of Sindong Group in ascending order in Gunwi-gun, Gyeongbuk. Conglomerates, sandstones and mudstones are prominent in the study area, and small scale felsitic intrusive rocks are partly observed in the Jinju Formation. The sandstones of both Hasandong and Jinju Formation are lithic arkose, and some sandstones with high matrix content are feldspathic wacke. Roundness of the sandstones is angular to subrounded, and sorting is moderately sorted to well sorted. Textural maturity of the sandstones is submature, and compositional maturity is immature. Moreover, gravels and rock fragments within the conglomerate and sandstone facies are gneiss or quartzite fragments. These results reflect that the sandstones had been supplied from the nearby source rocks which were metamorphic origin. Sedimentary rocks in the study area have been classified into seven sedimentary facies - Gcs, Gms of conglomerate facies, Sm, Sh, Sc of sandstone facies, Md, Mgr of mudstone facies, based on lithology, color, bedding, sedimentary structure, mineral composition, and texture. Furthermore, the whole sedimentary sequence in outcrops has been grouped into three sedimentary facies associations according to vertical and lateral continuity and occurrence in outcrops of seven sedimentary facies in order to interpret sedimentary environments. The sedimentary environments of the sequence are supposed to be a braided river system for Hasandong Formation, the marginal setting between lacustrine and fluvial environments for Jinju Formation.

CRETACEOUS TERRESTRIAL RECORDS

1112 - On the Taphonomy Dinosauria and Ostracoda in the Non-marine Cretaceous of Mongolia.

*Rinchen Barsbold*¹, Yondon Khand², Demchig Badamgarav¹

Paleontological Center, Mongolian Academy of Sciences, Department of Vertebrate, Ulaanbaatar-Mongolia¹

Paleontological Center, Mongolian Academy of Sciences, Department of Invertebrate, Ulaanbaatar-Mongolia²

Non-marine Cretaceous of Mongolia contains many organic groups with different ecology and taphonomy. Two main groups -- the Dinosauria and Ostracoda, have been selected here with the aim to emphasize the complicated relationships of these animals incomparably differed in their size and total participation in biomass, as a whole.

In the Early Cretaceous, extensive lake basins and accumulation of the fine grained lacustrine and fluvio-lacustrine sediments were dominated, including coal-bearing and volcanic ash deposits under the humid climatic condition. The Lower Cretaceous contains mostly limnic Invertebrates, plants and few Dinosaurs species and Late Cretaceous environments are gradually transformed from fluvio-lacustrine into dune accumulation. Fossil record contains mass-burials of the dinosaurs, buried in situ. In contrast, the Ostracoda were microscopic animals, tolerant for different environments. In spite of the big differences of these groups, their burials could be often coincided; sometimes the burials were closely connected and, in some cases, the burials were quite divided, in full accordance with their ecology and taphonomy. Evidently these coincidences and non-coincidences express, not complete, and not so definitely, but quite real relationships between ecology and taphonomy, characteristic for so different animal groups, as the Dinosauria and Ostracoda.

Key words: Cretaceous, taphonomy, Dinosaurs, Ostracoda

1108 - The New Data about the Lower Cretaceous Continental Deposits of Southeastern Transbaikial

*Korostovsky Roman*¹, Yadrichenskaya Nataliya¹

Chitageols Olengui department Chita-Russia¹

Stratigraphy of the Lower Cretaceous continental deposits of southeastern Transbaikial which developed in rifts depressions is being object for discussion now and a long time before. Strata display in very different sedimentary rocks, unrestrained horizons along lateral, frequent facial substitutions. This is provoked ambiguity of understanding volume formations and series.

The Lower Cretaceous deposits of southeastern Transbaikial consist from volcanogenic-terrigenous Turga Suite, terrigenous Kutya Suite and Kamenskaya Unit according to Legend for Geological maps scale 1:200 000 and 1:1 000 000. New data about structure, paleogeography and tectonic evolution of continental sedimentary basins has got after new geological research and different thematic works. We think the real scheme of Lower Cretaceous deposits must be change essentially. Turga Suite is able to correspond series, divides and suites consist its must have own names. Every Suite must be done stratotype. According to the Code of Stratigraphy only middle part of modern Turga Suite must keep its name. Volume and age of Kutya Suite must be review also.

1254 - Magnetic properties of Cretaceous paleosol around Sydney Australia and its environmental significances

*Lü Bin*¹, Liu Xiuming¹, Guo Hui²

Fujian Normal University School of Geographical Sciences Fuzhou-China¹ Lanzhou University Key Laboratory of Western China's Environmental Systems (Ministry of Education) Lanzhou-China²

The rock magnetism parameters of a laterite paleosol profile in the Long Reef Beach, northeast of Sydney, Australia, were measured, including high and low frequency magnetic susceptibility, isothermal remanent magnetization, hysteresis loop and the temperature-dependent magnetization (high temperature). These data show and suggest that: 1) the major magnetic mineral in upper part of the profile is magnetite. Down to the middle section, the major magnetic mineral becomes maghemite; while in the bottom of the section, the major magnetic mineral is hematite. 2) These mineralogy variations from magnetite (top part) to hematite (in bottom) indicate environmental change of from dry to moist. 3) Magnetic particles are coarse, usually single domain (SD) or multiple domain (MD) dominantly. 4) Thermally stable maghemite is commonly found in the middle and lower part of section, which is product of magnetite oxidation, indicating its arid tropical or subtropical pedogenic condition dominantly.

K/T - MACROPALEONTOLOGY

1116 - Ammonite bioevents in the Berriasian Valanginian boundary interval in Bulgaria

Ivanov Marin¹, Idakieva Vyara¹

Sofia University "St. Kliment Ohridski" Department of Geology, Palaeontology and Fossil Fuels Sofia-Bulgaria¹

In the last years the ammonite distribution in the Berriasian/Valanginian boundary interval in Bulgaria has been subject of new investigations and revisions. Our recent observations on continuous sediment successions in this stratigraphic interval allowed us to define bioevents of the first and last occurrence of "key" ammonite taxa. The first occurrence of *Tirnovella alpillensis*, *Thurmanniceras otopeta* and *Th. petransiens*, which are used to define Interval Zones and Subzones are precisely established. The first appearance of *Kilianella* spp. has been determined in the *T. alpillensis* Subzone, while its mass occurrence is observed in the *Th. otopeta* Subzone. The last occurrence of *T. alpillensis* and *Berriasella* spp. (gr. *B. calisto*) is identified in at the lower parts of the *Th. otopeta* Subzone. The first representatives of *Olcostephanus* have been recorded from *Th. otopeta* Subzone. The Berriasian/Valanginian boundary is drawn by the first occurrence of *Th. petransiens* coinciding approximately with the appearance of *Neocomites* and *Sarasinella*. In the hemipelagic and siliciclastic deposits of North Bulgaria are recognized the Berriasian Suibthurmannia boissieri Zone with *T. alpillensis* and *Th. otopeta* Subzones and the *Th. petransiens* Zone at the base of the Valanginian. These biostratigraphic units are precisely characterized and correlated with the Mediterranean standard zonation.

1142 - Echinoid species distribution in the Upper Cretaceous of Dobrogea SE Romania

Gallémí Jaume¹, López Gregorio¹, Martínez Ricard², Lazăr Iuliana³

Museu de Geologia-MCNB Dpt. Paleontologia Barcelona-Spain¹ Universitat Autònoma de Barcelona Dpt. Geologia (Paleontologia) Bellaterra-Spain² University of Bucharest Lab. of Paleontology (Dpt. of Geology) Bucharest-Romania³

In 1956, Chiriac studied the taxonomy and biostratigraphy of the cretaceous echinoids of southern Dobrogea (Moesian Platform) but no echinoids had been reported until now from the Cretaceous formations of northern Dobrogea (Babadag Syncline). Fieldwork (2008 to 2010) in both areas provided ammonoids and inoceramids allowing setting a biostratigraphic framework for the echinoids. Chiriac's 1956 echinoids collection (University of Bucharest and National Museum of Geology, Bucharest) was also revised.

Species identified in the Moesian Platform include: *Conulus subrotundus* Mantell, 1822 and *Camerogalerus minimus* (Desor, 1842) from the lower Middle Turonian to the Upper Turonian; *Protocardia coteauanus* (d'Orbigny, 1855) from the lower Middle Turonian; *Epiaster michelini* (Agassiz, 1847) in the middle part of the Upper Turonian, and *Micraster normanniae* Buaille, 1883 in the upper Middle Turonian and the uppermost Turonian.

The species recognised in the Babadag Syncline are *Plesiocorys* (*Plesiocorys*) *placenta* (Agassiz, 1847) in the Lower Coniacian and *Rispolia subtrigona* (Catullo, 1827) from the Lower Coniacian to the uppermost Lower Coniacian. Two holasteroids (*Holasteropsis*?) have also appeared in the Lower Coniacian.

This is a contribution to projects "Moesian Platform" (Museu de Geologia de Barcelona-MCNB) and CGL2011-25581 (Ministerio de Ciencia e Innovación, Spain).

1238 - Preliminary ammonite zonation for the Aptian-Lower Albian of Mexico Central Atlantic Domain

Barragán Ricardo¹, Moreno-Bedmar Josep Anton¹, González-Arreola Celestina¹

Instituto de Geología, Universidad Nacional Autónoma de México Paleontology México D.F.-Mexico¹

Focus of this research stands out the problems of using the Mediterranean standard ammonite zonation, Tethyan Domain sensu stricto, in Lower Cretaceous rocks from Mexico. The abundance of some endemic Mexican species and genera makes the use of the Mediterranean ammonite zonation very difficult when dealing with Mexican facies. Taking this into account, a proper ammonite zonation for Mexico and the Central Atlantic Domain is under construction. This Atlantic ammonite zonation can ultimately also be applied to coeval rocks from the south of the United States, from countries in Central America, and probably from countries in the northern portion of South America as well. Several sections in northeast and central Mexico were sampled on a bed-by-bed basis. A posterior study of the ammonite stratigraphic ranges was accomplished, towards the construction of the composite biozonation. Sections studied include the Francisco Zarco Dam section in Durango State, the "La Boca" Canyon and the "La Huasteca" sections in Nuevo León State, several sections in the Lampazos area in Sonora State, the "Cerro Chino" section in Chihuahua State and the "Mina Texali" section in Puebla State. Our integrated study allowed for

K/T - MACROPALEONTOLOGY

the identification of five ammonite zones, one subzone and two horizons, namely: the zones *Dufrenoyia justinae*, of the Lower Aptian, *Caseyella aguilerae* and *Kazanskyella* sp. of the Upper Aptian, *Immunitoceras* sp. of the Upper Aptian-Lower Albian and finally *Douvilleiceras* sp. which is assigned to the Lower Albian; the subzone *Gargasicerat?* *adkinsi*, at the topmost of the Lower Aptian D. *justinae* Zone; and the horizons *Huastecoceras trispinosoides* and *Paracheloniceras* sp., which define the base and the top of the Upper Aptian respectively. The preliminary ammonite zonation presented herein is based on an exhaustive taxonomic revision of the Aptian and Albian species, including sampled material and specimens of previous works being currently held in official paleontological collections. Several Mexican endemic species as well as some genera, also present in the south of the United States and probably in some Latin American countries, are currently under revision. The Mexican ammonite zonation will be improved with the incorporation of the stratigraphic ranges of those taxa into the scheme.

1242 - The Lower Upper Cenomanian deposits at El Golea from Tademaït Basin (Central Algerian Sahara) Sedimentologic Paleoenvironmental and Taphonomic analysis.

*Bouregaa Slimane*¹, Bensalah Mustapha²

Laboratoire Géologie du Sahara Université Kasdi Merbah Ouargla Sciences de la Terre et de l'Adrar-Algeria¹

Laboratoire de Recherche n° 25 « PRHPM-LECT », Université de Tlemcen Sciences de la Terre et de l'Univers Tlemcen-Algeria²

In this work, the basal part of Upper Cenomanian deposits from the "Calcaires inférieurs" Formation at El Golea in north of Tademaït Basin (Algeria) is studied from the sedimentological, taphonomic and environmental points of views for the first time.

The successions which are sampled and measured correspond to the *Neolobites vibrayeanus* zone where it is represented by three facies : a- dolomitic limestones containing scarce pioneer oyster, b- white chalky limestones which are very bioturbated (mainly thalassinoids), which contain rich fauna represented by bivalves, cephalopods, gastropods, echinoids, stromatoporoids and coral; c- bioclastic limestones with pecten rich beds.

By the analysis of lithofacies and biofacies we suggest that these facies, in first marks the onset of transgression, within were deposited under shallow subtidal conditions in the offshore system; and secondly, it indicates very shallow conditions (intertidal to supratidal); which reflect a shallowing upward evolution. The presence of ammonites and echinoids in this facies suggest Stenohaline conditions, with low energy; Also, the occurrence of high bioturbation indicates that the bottom water was well oxygenated throughout this time. But the low specific diversity may reflect an eventual stress in paleo-environmental conditions.

By analysis of the taphonomic parameters of macrofauna such: the orientation of shells, the degree of disarticulation, bioerosion and encrustation we distinguished that there were different taphonomic features point to the manifest of an episodic storm events.

The studied successions can be interpreted as there were deposited during transgressive/regressive cycle of third order. This case study gives us valuable insights in order to understand the effects of sea level changes in carbonates depositional systems.

1133 - Early Cretaceous marine gastropods from west-central Argentina and their palaeoecology and palaeobiogeographic affinities

Cataldo Cecilia Soledad¹, Lazo Dario Gustavo¹

Universidad de Buenos Aires Ciencias Geológicas-FCEN-IDEAN Buenos Aires-Argentina¹

The Lower Cretaceous outcrops of the Argentinean Neuquén Basin bear an abundant and relatively diverse marine gastropod fauna that was scarcely studied in the past and required a thorough taxonomic revision. Also, its palaeoecological and palaeobiogeographic implications were not assessed so far. The present work is based on the revision of former collections in addition to further field collecting. More than 2200 specimens were studied, coming from 39 localities in west-central Argentina where the Lower Valanginian-Lower Barremian bearing units are exposed. The taxonomic study revealed the presence of 26 gastropod species belonging to 20 genera and 18 families. Eight taxa were recorded for the first time in this basin. This fauna shows palaeobiogeographic affinities at different taxonomic levels with the lower Cretaceous gastropods from the Andean basins of Chile, Peru, northwest South America, the Argentinean Austral Basin, the Antarctic Peninsula, the Tethys area and northern Europe. The palaeoautoecology of the recorded taxa was evaluated and a predominance of epifaunal over semi-infaunal and

K/T - MACROPALEONTOLOGY

infaunal species was found. Also, epifaunal grazing and/or deposit feeding were more common, although several carnivore species were present. This work represents a landmark advance in our knowledge of the Lower Cretaceous gastropod faunas of the Southern Hemisphere.

1179 - *Pseudocosmaticeras brandti* (Redtenbacher) and *Cataceramus barabini* (Morton) a key fossil assemblage from the uppermost Campanian of the East-Fore Balkan (Bulgaria)

Dochev Docho¹

Sofia University Geology, Paleontology and Fossil fuels Sofia -Bulgaria ¹

The eastern part of the East Fore-Balkan tectonic unit (Bulgaria) contains varied epicontinental carbonate Upper Cretaceous rocks. The latter usually compose prominent outliers that occur near the northern boundary of the East Fore-Balkan. One of them called "Pizdrishki kairyak" and located close to the Tsonevo dam (Varna District) offers good Campanian–Maastrichtian exposures that yielded interesting coeval ammonites and inoceramids. The ammonites of *Pseudocosmaticeras brandti* (Redtenbacher, 1873) and the inoceramids of *Cataceramus? barabini* (Morton, 1836) have been identified and referred this assemblage to the Campanian.

P. brandti is widely distributed ammonite species in Europe, and designated as Upper Campanian marker fossil in Northern Aquitaine (France). It has been described from different localities in Bulgaria before, but always associated with Lower Maastrichtian strata. *C.? barabini* is an inoceramid taxon that occurs in the uppermost Campanian and the lowermost Maastrichtian in the U. S. Western Interior, whereas in Europe (including Bulgaria), it appears later on, and associates with the lower Maastrichtian.

The fossil assemblage of the Pizdrishki kairyak locality gives a new data about the stratigraphic occurrence of *C.? barabini* in Bulgaria, and suggests an earlier lower FAD of this inoceramid at the uppermost Campanian in Bulgaria. This study is supported by the Bulgarian National Science Fund (Grant DMU 03/64).

1113 - New ammonite data for the biostratigraphy of the Upper Barremian in North Bulgaria

Idakieva Vyara¹, Ivanov Marin ¹

Sofia University "St. Kliment Ohridski" Department of Geology, Palaeontology and Fossil Fuels Sofia-Bulgaria ¹

The objective of this work is to represent a modern detailed biostratigraphic subdivision of the Upper Barremian based mainly on recent findings of an abundant and well-preserved ammonite fauna in North Bulgaria. The sediments with Late Barremian age are widely distributed in the studied area, belonging to different facies. The richest cephalopod assemblages have been collected from the clayey limestone and marl deposits. The ammonite assemblages are dominated by heteromorphic taxa and by the last representatives of Pulchellidae. In the last years the standard Mediterranean ammonite zonation has been significantly modified, due to changes in the zonal and subzonal ranks, correction in ammonite ranges, taxonomic revisions, etc. This leads to highly differentiated zonal scheme for the Upper Barremian. The newly established representatives of the genera *Artareites*, *Camereiceras*, *Gassendiceras*, *Pseudoshasticrioceras* are reported for the first time in Bulgaria. Of a particular interest are some recently collected specimens belonging to genus *Gassendiceras*, which representatives were proposed for a horizon markers in the Tethyan Realm. This study allowed the recognition of the following ammonite zones: *Toxancyloceras vandenheckii*, *Gerhardtia sartousiana*, *Imerites giraudi* and *Martelites sarasini*. These zones and their subdivisions can be correlated with the standard Mediterranean ammonite zonal scheme.

1081 - Lower Valanginian ammonite biostratigraphy in the Betic Cordillera (southeastern Spain) new data

Company Miguel¹, Tavera José M. ¹

Universidad de Granada Departamento de Estratigrafía y Paleontología Granada-Spain ¹

The Lower Valanginian ammonite biostratigraphy in the Mediterranean region has little changed during the last fifteen years, which strongly contrasts with the substantial improvements introduced in the zonal schemes for other Lower Cretaceous stratigraphic intervals. In this communication, we present a new zonation for the Lower Valanginian in the Betic Cordillera, based on the analysis of the stratigraphic distribution of more than 10000 ammonites collected bed-by-bed in some fifteen sections in the Caravaca-Cehegín region (SE Spain). From bottom to top, the following biostratigraphic units can be distinguished:

K/T - MACROPALAEONTOLOGY

- *Thurmanniceras pertransiens* Zone, which can be subdivided into two subzones: a lower *T. pertransiens* Subzone and an upper *Neolissoceras salinarium* Subzone. The latter is characterized by the disappearance of *Olcostephanus drumensis* and the appearance of *Luppovella superba*.
 - *Neocomites neocomiensiformis* Zone, also with two subzones: the *Baronnites hirsutus* Subzone below (characterized by the appearance of *Busnardoites subcampylotoxus* and *Olcostephanus guebhardi*) and the *Valanginites dolioliformis* Subzone above (*Busnardoites campylotoxus* is restricted to this subzone).
 - *Karakaschiceras inostranzewi* Zone, subdivided as well into two subzones: the *K. inostranzewi* Subzone and the *Saynoceras contestanum* Subzone.
- The assemblages characterizing each of these units can be recognized throughout the Mediterranean region.

1189 - The CRETACAM project a new look at Santonian to Maastrichtian deposits of the Belgian Campine basin.

Goolaerts Stijn¹, Jagt John W.M.², Kennedy William James³, Fraaije René H.B.⁴, van Bakel Barry W.M.⁴, Van Knippenberg Paul², Simon Eric¹, Marquet Robert¹, De Saegher Patrick¹, Duser Michiel¹
 Royal Belgian Institute of Natural Sciences Earth and History of Life Brussels-Belgium¹ Natuurhistorisch Museum Maastricht Maastricht-The Netherlands² Oxford University Oxford-United Kingdom³ Oertijdmuseum De Groene Poort Boxtel-The Netherlands⁴

The Royal Belgian Institute of Natural Sciences (RBINS) holds a collections of well over 7000 Cretaceous fossils that were collected by the RBINS staff in the early 1930ies during the construction of several coal mine shafts in the eastern part of the Belgian Campine Basin. These fossils include ammonites, nautilids, belemnites, bivalves (inoceramids and other), gastropods, crustaceans, brachiopods, echinoderms and other. The majority of the material is from mine shafts 1 and 2 of the Houthalen and Zolder mines, in-between 400 and 600 m below surface. Both mines are located in the eastern part of the Campine Basin.

Since their discovery, the majority of this material has never been thoroughly studied and published. Detailed listings of the fauna and an overview in relation to the stratigraphy are absent. In the 1930ies, by the varying amounts of glauconite, chalk, sand, sandstone and the 'Gyrolithes' ichnofossils, the sediments between 400 and 600 m depth were interpreted as belonging to the 'Smectite de Herve' facies. Therefore, early students referred to fossils from this locality as Campanian in age, while more recent studies and ongoing work document Santonian to Maastrichtian ages with (from bottom to top) the Asdonk and Sonnisheide Members (Vaals Formation), the Zeven Wegen, Beutenaken Marl, Beutenaken Chalk, Vijlen and Lixhe Members (Gulpen Formation).

The CRETACAM project aims for fully documenting the lithological, stratigraphical, paleontological and paleo-ecological changes in the Santonian to Maastrichtian sequence of the eastern part of the Campine Basin. In a first step, all locality information of all 7000 specimens was digitalized. In a second and ongoing step, the taxonomy of all specimens will be revised by an international team of paleontologists.

1052 - The Cheloniceratinae a possible substitute to Deshayesitidea for the Aptian biozonation

Pictet Antoine¹

Institut of Earth Sciences, University of Lausanne Geology and Paleontology Lausanne-Switzerland¹

Early Aptian ammonite biozonation is based on Deshayesitidae, defined by the FAD of the index fossils. Unfortunately, this biozonation is very disputed (Bogdanova & Mikhailova 2004; Ropolo et al. 2006; Reboulet et al. 2009; Moreno-Bedmar 2010). The index species are rare and of adult stage. It turns out that the adult morphs are indistinguishable. It is therefore preferable to use the abundant and diversified Cheloniceratinae.

The Cheloniceratinae show an evolution through the successive genera *Prochelonicerases*-*Chelonicerases*-*Epichelonicerases*-*Douvilleicerases* (Ropolo et al., 2008). The section, the morphology of the spines, the number of intercalaries, bifurcations, and regularity of ornamentation is regarded as intraspecific variability in only a few species. However, some criteria like the flattening of the section, increasing of the bifurcations, then trifurcations, changing in the spines, clearly show an evolutionary trend. It is also noted that the ecological environment related to eustatic variations, plays an important role in the turnover of the Douvilleiceratidae, especially following sequence boundaries.

In conclusion, the Cheloniceratinae show an evolution marked by morphological changes sufficiently characteristic to allow to establish individualized biostratigraphic intervals. More data are required to consolidate the proposition made here.

K/T - MACROPALAEONTOLOGY

1134 - Early Cretaceous encrusting faunas from the Neuquén Basin west-central Argentina and their palaeocological implications

Luci Leticia ¹, *Lazo Dario Gustavo* ¹, Cichowolski Marcela ¹

Universidad de Buenos Aires Ciencias Geológicas-FCEN-IDEAN Buenos Aires-Argentina ¹

The Agrio Formation (late Valanginian – earliest Barremian) of the Neuquén Basin (Argentina) presents diverse marine mollusk assemblages. Hard substrate faunas, however, have been given little attention. Shells of three cephalopods and two bivalve basibiont genera were examined for encrusters, in order to characterize and describe them. Nineteen encrusting taxa were found. Encrusting bivalves were represented by a gryphaeid oyster and a plicatuliid, while byssate one comprised mytilids and anomiids. Six serpulids and one sabellid polychaete worms were recognized. Bryozoans comprised five cyclostomes, and one cheilostome. Agglutinated foraminifers are represented by one species, and a single coral specimen was also found. Oysters are overwhelmingly dominant, usually exceeding 70% of the fauna. Serpulids are a distant second in abundance, mostly represented by a single species. Cyclostome bryozoans are third in importance. The encrusting assemblage is indicative of a well-oxygenated, shallow-marine setting of moderate to high energy, and moderate to low turbidity. Several of the taxa show Tethyan affinities. While in composition this fauna is in agreement with other Early Cretaceous hard-substrate faunas, unlike most other cases solitary organisms are strongly predominant, in both diversity and abundance, over colonial species, resulting in a characteristic encrusting fauna strongly dominated by aggregated oysters and serpulids.

MACROPALEONTOLOGY AND AMMONITES, SUBCOMMISSION GSSP DISCUSSIONS

1085 - Carbon isotope stratigraphy and biostratigraphic implications for Late Cretaceous global correlation

*Wendler Ines*¹

University of Bremen Department of Geological Sciences Bremen-Germany¹

Chemostratigraphic correlation based on bulk sediment $\delta^{13}\text{C}$ is increasingly used for high-resolution correlation over large distances, but complications arise from a multitude of possible influences from local differences in biological, diagenetic and physico-chemical factors on individual $\delta^{13}\text{C}$ records that can mask the global oceanic signal. A review of twenty Late Cretaceous global-scale $\delta^{13}\text{C}$ records is presented in order to identify differences and similarities in secular $\delta^{13}\text{C}$ trends that help establish a global reference $\delta^{13}\text{C}$ record for this period. The sections represent various palaeo-latitudes in both hemispheres and different oceanic settings from the Boreal, Tethys, Western Interior, Indian Ocean and Pacific Ocean, and with various diagenetic overprinting. The $\delta^{13}\text{C}$ records are correlated based on independent dating with biostratigraphic and paleomagnetic data and reveal good agreement of the major isotope events despite offsets in absolute $\delta^{13}\text{C}$ values and variation in amplitude between sites. This consistency confirms global-scale applicability of $\delta^{13}\text{C}$ -stratigraphy for the Late Cretaceous, including sediments that underwent lithification and burial diagenesis. The test for isochroneity of first and last occurrences of marker species shows isochroneity of most planktic foraminifer zonal boundaries relative to $\delta^{13}\text{C}$ shifts for the mid-Cretaceous sea-level high and diachroneity for the Late Campanian and Maastrichtian global sea-level fall.

PALEOCLIMATE

1193 - Clumped isotope thermometry of belemnites dynamic polar climates during the Cretaceous greenhouse

*Price Gregory*¹, *Passey Ben*²

Plymouth University Earth Sciences Plymouth-United Kingdom ¹ Johns Hopkins University Department of Earth and Planetary Sciences Baltimore-United States ²

In this study we determine sub-Arctic marine temperatures obtained from fossil mollusks (belemnites) using carbonate clumped-isotope thermometry. Here we use a mollusk-specific calibration recently developed at Johns Hopkins University. From these analyses we infer sub-Arctic early Cretaceous marine temperatures ranging from of 10–20°C. These, possibly seasonally biased, warm sub-Arctic temperatures are warmer than present mean summer water temperatures at 60–65°N and are therefore consistent with a warmer 'greenhouse' world featuring a shallow (equable) latitudinal temperature gradient. Our combined temperature and $\delta^{18}\text{O}$ -carbonate data imply seawater $\delta^{18}\text{O}$ values that have a remarkably modern character in that they are similar to modern high latitude seawater but more positive than modelled Cretaceous seawater. We identify a cooler Late Valanginian interval with temperatures consistent with polar regions a few degrees above freezing and are also coincident with increased $\delta^{18}\text{O}$ seawater values. Thus we find evidence of intervals when polar ice was unlikely, and also when polar ice was plausible. Both scenarios support the view of generally warm but dynamic polar climates during greenhouse intervals that were punctuated by minor periods of ice growth.

PETROLEUM OCCURRENCES IN CRETACEOUS BASINS OF TURKEY AND ADJACENT AREAS

1248 - Review of the Biostratigraphy Sedimentology Diagenesis and Petroleum Prospects of the Late-Early Cretaceous and Early-Late (i.e. Middle) Cretaceous Sequences in Lebanon

*Bellos George*¹

American Unbiversity of Beirut Geology Graduate Sin elFil-Lebanon ¹

a. Objectives: Lebanon is part of the Levantine plate, a tectonically active margin that has been affected by the Syrian Arc Deformation and the Dead Sea Transform System (DSFS), which led to the present features. Potential reservoirs were found in the Middle Cretaceous Strata of the PaleoTethys, but not clearly identified in Lebanon.

b. Methods: These strata should be examined in more details with XRD, conventional microscopy, organic and rare earth geochemistry and other methods in order to clearly link the results found by previous workers to the current project. A large micropaleontology component will be needed to properly date these sequences too, as previously it was carried for the entire period in the 1970s.

c. Results: The hydrocarbon products are important to study within the context of the Aptian to Cenomanian formations, because they have somehow to reflect that these rocks functioned as reservoirs, as assumed by many workers during the past 45 years.

d. Conclusion: Based on revising the previous works on Petroleum prospectivity in Lebanon, for the past 50-60 years one can draw the conclusions that are presently drawn: hydrocarbon was found in Middle-Cretaceous strata, and that means that they did act as reservoirs.

1033 - Geochemical Characterization and modelling of the source rocks Cenomano-Turonian (Cretaceous) of the Djebel Bottena. South East area of Constantine-Algeria.

*Sadaoui Moussa*¹, Khelif Nour El Houda ¹, Bensekhria Aida ²

University M Geology Boumerdes-Algeria ¹ University of Batna Geology Batna-Algeria ²

The South Eastern Constantine basin is located in the South eastern of the Saharian Atlas.

The petroleum system are upper Crétaceous age, the principals source rocks are represented in the Turonian, Cenomanian and the upper Albian (Vraconian).

Study of the kerogen, shaws that it is amorphous marine originated type, with a small proportion in continental, it is early oil phase in the Turonian, oil-gas phase in the Cenomanian. Modeling the dynamic aspect of source rocks using the software PetroMod 09 "1D" allowed us to determine the timing, type and quantities of hydrocarbons generated and expelled for different the source rocks of Upper Cretaceous and confirm the good capacity levels rocks located between the junction of the South Atlasic Fault, mainly the Vraconian, which reached a conversion rate of 86%. The Cenomanian is less important, with 51%, and finally the Turonian with 31%. They enter the phase of hydrocarbon generation in Cretaceous and Tertiary between 76 and 55 Ma, with quantity of oil and gas expelled reaching 13 MTons and 0.29 MTons on 12 MTons and 0, 26 MTons respectively generated, the timing of expulsion are very new, it takes place between the Miocene and the current period.

1041 - Application of Light Hydrocarbons to Geochemical Evaluation of Bangestan Reservoir (Albian-Campanian) Oils in Marun Oilfield SW of Iran

*Tezheh Farid*¹, Monjezi Zahra ²

Exploration directorate (National Iranian Oil Company)/ Shahid Chamran University of Ahvaz Geochemistry Tehran-Iran ¹ Shahid Chamran University of Ahvaz geology Tehran-Iraq ²

The purpose of this study was to examine the potential of C7 light hydrocarbons as biomarkers for petroleum exploration to geochemical evaluation of Asmari and Bangestan Reservoir (Albian-Campanian) Oils in Marun oilfield. The Oils from Bangestan reservoirs with a variable $\delta^{13}C_{\text{‰}}$ ratio -27.10 to -26.77‰ PDB, and Pristane/Phytane ratio from 0.78 to 0.91 shows the source rock of this oils should be marine Marl-carbonate. The isomeric parameters of C7 included single-branched and multiple-branched heptanes and isomeric pairs, such as nC7/Methylcyclohexane ratio vs. Toluene/nC7 ratio, 2-MH+2, 3-DMP vs. 3-MH+2, 4-DMP, n-Heptane ratio vs. iso-Heptane ratio.

PETROLEUM OCCURRENCES IN CRETACEOUS BASINS OF TURKEY AND ADJACENT AREAS

The ratios for nC7/Methylcyclohexane and Toluene/nC7 ranged from 1.5 to 1.8 and 0.53 to 1.23, respectively. The n-Heptane value and iso-Heptane value ranged from 30.5 to 39.3 and 1.55 to 1.95 respectively and the toluene+methylcyclohexane, Iso+Cycloheptanes, n-C7 ranged from 31 to 52%, 23 to 42% and 25 to 29% respectively. The use of this technique as a qualitative tool shows that all the oils from the Bangestan Reservoirs were super mature, free of biodegradation and generated from marine Marl-carbonate source.

1095 - Organic Geochemistry of the Cretaceous Petroleum System of North Persian Gulf

*Ahanjan Asghar*¹

National Iranian Oil Company - Exploration Directorate Geochemistry Office Tehran-Iran ¹

The purpose of this study is twofold. First, we present the results of reconnaissance sampling of a range of source rocks from throughout North margin of Persian Gulf. Bulk geochemical analyses of this sample suite demonstrate the presence of a variety of potential source rocks, but strongly suggest that known occurrences of oil in Cretaceous reservoirs of North margin of Persian Gulf are sourced mainly by Lower Cretaceous marine shale. We investigate this correlation further in the second part of the study, by examining detailed source rock-to-oil relationships through molecular biomarker and Isotope analysis of nine Cretaceous oil samples and two dissolved gas from eight producing fields scattered throughout the region, as well as purported source rocks (29 samples). The new data suggest that the oils constitute two oil families, and that the source rock was predominant marine shale deposited in an oxic to suboxic environment.

A negative correlation suggests that Upper Cretaceous intervals of limestone, marl, and black shale previously believed to be important source rocks can be discounted as an important contributor to this basin. Instead, the new data suggest a Lower Jurassic source rock contribution in charging Cretaceous reservoirs of Soroush, Abouzar, Nowroz and Arash oil fields.

SEDIMENTOLOGY SEQUENCE STRATIGRAPHY AND CYCLOSTRATIGRAPHY

1127 - Late Cretaceous post-obduction sediments of the Qahlah Formation Oman Mountains Lithofacies Association and Depositional System

*Ahmed Abbasi Iftikhar*¹, Salad Hersi Osman²

Sultan Qaboos Univ Earth Science Muscat-Oman¹ Univ of Regina Geology Regina-Canada²

Siliciclastic sequences deposited in peripheral basins in close proximity of orogenic belts record uplift history, paleodrainage system and climatic changes associated with uplift of the mountain systems. Thick conglomerate sequence was deposited subsequent to ophiolite emplacement during late Cretaceous in north Oman mountains especially around Jabal Nakhl and Saih Hatat domes. The conglomerates were deposited by streams draining through the allochthonous Ophiolite and Hawasina complexes after their obduction on autochthonous Mesozoic and older Oman shelf sequence and their subsequent uplift. The conglomerate sequence belongs to the Qahlah Formation of late Cretaceous age and is sandwiched between Semail Ophiolite/Hawasina Complex and Cretaceous/Tertiary carbonate rocks. The siliciclastics of the Qahlah Formation are the first sediments to be deposited over the obducted oceanic crust sequence of ophiolite and Hawasina lithologies. In north Oman around Qalhat village (Sur), Fanja, Al-khod, Rusayl and Ibra areas, the thickness of the formation varies from 140m to over 700m and is comprised of interbedded conglomerate, sandstone and siltstone lithofacies in various proportions in different parts of the formation. The lithofacies association and clast sorting and roundness suggest deposition by stream-dominated alluvial fans. Clast size in conglomerate ranges from pebble to boulders, subangular to subrounded, both grain and matrix (sandstone) supported. Cross-bedding, fining upward sequences in conglomerate and channelized conglomerate and sandstone suggest deposition from high energy flows associated with proximal to distal reaches of an alluvial fan. High proportion of chert and ophiolite fragments in the conglomerate sequence suggests rapid erosion of obducted oceanic crust. Presence of *Loftusia* bearing carbonate beds in Sur area (type section) and bivalve bearing conglomerate beds in Al-khod section indicates occasional transgressive phases during deposition of the Qahlah Formation conglomerate sequence.

1187 - Carbonate Pore system and sedimentary facies of Coniacian – early Campanian carbonate rocks in Eastern part of Persian Gulf

*Moradi Maryam*¹, Rostami Alireza¹

N.I.O.C. Exploration Directorate Subsurface geology Tehran-Iran¹

The present day carbonates pore system is the result of depositional and post depositional processes, which controlled by size, types of pore spaces, pore throat size and connectivity of pores. Coinacian –early Campanian carbonate rocks were deposited in shallow marine environment, which have a good source rock and seal in eastern Persian Gulf. It is important to know which factors have more influences on distribution and changing of suitable reservoir zones. This study evaluates pore system –sedimentary facies relationship by using data from 8 wells. Porosity- permeability measurements integrated with detailed petrography are used to characterize pore type, particle type, size and amount of pore filling constituents. Six petrofacies are defined based on porosity- permeability relationship and petrographic features. Result show that the geometry of present pore system is related more to the effect of diagenesis than to their occurrence in specific macro- or micro facies. The pore system is a dual system characterized by interparticle – vugy porosity enhanced by leaching and intraparticle micro porosity, Common porosity type are Separate vugs (moldic, intraparticle), tuching vugs (microfracture connecting moldic and enlarged moldic pores).

1036 - Sequence-Stratigraphic analysis of the Aptian deposits in the valley of the Mzymta River Big Sochi Russia

*Gabdullin Ruslan*¹, Bershov Aleksey², Naumov Sergei³, Ivanov Aleksey⁴, Shcherbinina Ekaterina⁵, Samarin Evgenii⁶, Zerkal' Oleg⁶, Nadezhkin Dmitry⁷

Lomonosov Moscow State University Geological Faculty, Faculty of Global Processes Regional Geology and Earth Moscow-Russia¹ Lomonosov Moscow State University Geological Faculty/Petromodeling Ltd. Engeeniring and Ecological Geology Moscow-Russia² Petromodeling Ltd. Moscow-Russia³ Gagarin Saratov State Technical University, Faculty of Ecology and Service Saratov-Russia⁴ Geological Innstitute, RAS Laboratory of Micropaleontology Moscow-Russia⁵ Lomonosov Moscow State University Geological Faculty Engeeniring and Ecological Geology Moscow-Russia⁶ Lomonosov Moscow State University Geological Faculty Petroleum Geology Moscow-Russia⁷

SEDIMENTOLOGY SEQUENCE STRATIGRAPHY AND CYCLOSTRATIGRAPHY

The intense construction of the objects of the Sochi 2014 Olympics in the valley of the Mzymta River is proceeded within very complex geological structure of the region and the development of modern exogenous processes (modern or ancient landslides).

The main difficulties in the division and correlation of geological sections is the similar lithological composition of units of Cretaceous and Quaternary ages (mainly terrigenous, clay-dominated) and the inability to establish and trace the geological boundaries in natural and artificial outcrops and the core. In this regard, the application of the method of the sequence analysis of the cyclic sequences is very actual. This study was supported by 5 geological routes and 386 points of observation, description of the cores from 86 wells and 10 test pits, petrographic study of rocks in thin sections, micro- and macropaleontological analysis, geochemical analysis of elements and oxides using a MARC.GV X-ray-fluorescent spectroscopy and Rock Eval 6 pyrolysis analysis.

By this complex method of study the problem of stratigraphic division and correlation within area of construction was solved. A polygenetic model for Aptian and Quaternary rocks was proposed.

This work was supported by the Russian Foundation for Basic Research, project no.12-05-00263.

1256 - An early Cretaceous stratum study in Linze Gansu province northwest of China

Liu Zhi¹, Liu Xiuming², Lü Bin²

Research School of Arid Environment & Climate Change Lanzhou University Research School of Arid Environment & Climate Change Lanzhou-China¹ School of Geographical Sciences, Fujian Normal University School of Geographical Sciences Fuzhou-China²

In the northwest of China, there are a large distribution of Cretaceous strata. Especially in the Linze area, Gansu province, an early Cretaceous stratum exposed on the ground surface with more than 1000 meters. Through many times field investigation and compared with early stratigraphic division in this area, we think this stratum ought correspond to Xiagou formation and Zhonggou formation named in Yumen where about 350km west.

There are about 44 grey-red alternant layers appear in the lower part of Xiagou formation, and partly mingled with several yellow layers. Aboving these layers, a series of sandstone red beds developed, then tens of grey-black layers appear on the upper of Xiagou formation. In the Zhonggou formation, there are a set of colorful stratum developed. Since the various colors, the paleogeographic environment which formed is still divergent. Some researchers thought this stratum was lacustrine deposits, but we found many paleosol characteristics in the field, such as the calcium nodules, root traces and soil horizons. So we feel this colorful stratum maybe is the soils of the past, only because the burial and long time weathering lead we can not recognized them.

The grain size analysis demonstrate that, some sample' patterns are similar to the aeolian deposits, such as the modern sandstorm samples and Quaternary loess, so we think very likely, the aeolian component had played a significant action in the northwestern Chinese Cretaceous deposits.

1180 - Lithofacies and sedimentary environment of Ilam Formation in Band-e Karkheh oil field

Golshan Nafiseh¹

Azad University Science and Research Dep. NIOC Exploration Tehran-Iran¹

Abstract – Ilam Formation (Santonian) in well A of Band-e Karkheh oil field (SW Iran) consists of 201.5 m of light cream to gray limestones with marl interbeds in its top.

Fossil contents, sedimentary textures and structures of thin sections and cores studied in order to identify sedimentary environment of Ilam Formation in mentioned oil field. Also, study of electrical logs, thin sections, cores and cutting caused to identify four facies belts; two open marine facies, one bar facies and one Lagunal facies.

Vertical changes of microfacies indicate a carbonate platform shelf for Ilam Formation in studied oil field.

SEDIMENTOLOGY SEQUENCE STRATIGRAPHY AND CYCLOSTRATIGRAPHY

1203 - Biostratigraphy and Surface Gamma Ray Logs A Correlation Tool for Upper Cretaceous to Paleocene Deposits in Surface and Subsurface Data Southwest Iran.

Mobasheri Ali ¹, *Hemmatinasab Meysam* ², Hosseinzadeh Rohollah ³, Nazariyan Maziyar ¹

N.I.O.C. Exploration Directorate Geology Tehran-Iran ¹ University of Tehran Geology Tehran-Iran ² Ferdowsi University Geology Mashhad-Iran ³

Gamma-ray logging of outcrops is a powerful, quick and simple method to better correlate wells data with stratigraphic sections.

Two stratigraphic sections have been measured, sampled and gamma surveyed in Lurestan province, southwest of Iran. The Tang-e Holestem section is located in south flank of Kabir-Kuh anticline and the Chenāreh section is located in south flank of Chenāreh anticline. The rock sequences have been logged by measuring the gamma-radiation every 30 cm. over one minute time. A total of 628 thin-sections prepared and studied for biostratigraphically purposes in order to establish biozones and compare some significant Cretaceous and Paleogene planktonic foraminifer's biozones.

Based on micropaleontological and lithological studies, these stratigraphic sections divided in ascending order from Sarvak to Surgah, Ilam and Gurpi formations (Late Cretaceous (Cenomanian) to Late Paleocene).

The results indicate good conformity between surfaces and adjacent wells log data. It is particularly useful for integrated sequence stratigraphic analysis and for reservoir characterization using outcrop analogues. Because of influence caving and other uncertainty in well studies, these high resolution paleontological and lithological data in surface studies assists in the delimitation of depositional units and can improve our knowledge in wells.

Acknowledgements

Acknowledgement is given to The Research & Development of National Iranian Oil Company for financial support.

AUTHOR LIST

Abdel-Gawad Gouda	100	Gallemlí Jaume	57, 116
Açıkalın Sanem	41	Gargili Damla	77
Afonin Maxim	88, 103	Gedik İsmet	112
Aguirre-Urreta Beatriz	55, 59	Ghani Humaad	33, 87, 104
Ahanjan Asghar	68, 70, 71, 124	Ghaseminejad Ebrahim	75
Ahmad Sajjad	34	Godet Alexis	19
Ahmed Abbasi Iftikhar	125	Golshan Nafiseh	126
Al-Juboury Ali	74, 97	Goolaerts Stijn	57, 119
Amirkhani Ali	79	Granier Bruno	21
Ando Hisao	59	Guntupalli V.R.Prasad	38
Andreeva Polina	98	Güray Alev	14
Arnaud Vanneau Annie	20	Haeri Aghahesam	82
Arriaga Maria Eugenia	84	Haq Bilal	50
Asnafi Mohammadreza	86, 93, 103	Hart Malcolm	9
Aydın Tuba	85	Hasegawa Hitoshi	67
Barchetta Alessia	13	Hay William W.	30, 66
Barragán Ricardo	116	Hegab Adel	91, 105
Bellos George	123	Helmut Weissert	26
Benyamovskiy Vladimir	52, 83	Hemmatinasab Meysam	16, 127
Bonvallet Lucie	19	Hennhöfer Dominik K.	22
Borszcz Tomasz	60, 91, 104	Herkat Missoum	110
Bouregaa Slimane	75, 117	Hoşgör İzzet	40, 61
Canatalı Aysegül	68	Hu Xiumian	34
Caus Esmeralda	20, 82, 85	Idakieva Vyara	118
Cemen Ibrahim	45	Ivanov Marin	116
Cezar Geroto Caio Fabricio	113	Ivanova Daria	6
Chaboureau Anne-Claire	64	Jarvis Ian	51, 63, 101
Chen Xi	47	Jayagopal Madhavaraju	63, 98, 101
Cheong Daekyo	114	Jens E. Wendler	24, 49
Chuluun Minjin	60	Kakabadze Mikheil	75
Company Miguel	118	Karaman Ozge	77
Consorti Lorenzo	86	Kechid-Benkherouf Fatiha	101
Çoşkun Bülent	71	Keller Gerta	40, 46
Dakrory Ahmed	17	Kiselinov Hristo	112
Dinarès-Turell Jaume	78	Kopaevich Ludmila	29, 87, 105
Dochev Docho	118	Korostovsky Roman	115
Dzyuba Oxana	64, 87, 104	Lazo Dario Gustavo	22, 55, 117, 120
Elamri Zaineb	17	Lebedeva Natalia	82
Farouk Sherif	24	Lechler Maria	32
Farzipour Saein Ali	110	Lee Yong Il 1	111
Forshaw Joline	102	Li Xianghui	38
Föllmi Karl	65	Lintnerova Otilia	37
Frijia Gianluca	28, 97	Liu Xiuming	35
Gabdullin Ruslan	32, 125	Liu Zhi	126
Gallala Njoud	43	Lü Bin	115

AUTHOR LIST

Mahanipour Azam	28, 43	Sá Caetano Paulo	73
Maksoud Sibelle	8	Sadaoui Moussa	123
Malkani M. Sadiq	35, 44, 62, 66, 114, 36, 41	Salama Yasser	74
Mansouri Golamhasan	84	Sana Benmansour	96, 109
Martinez Mathieu	73	Sarfi Mehdi	35
Mateo Paula	41	Sarı Bilal	15
Meissner Philipp	64	Schlüter Nils	61
Michalik Jozef	50	Shurygin Boris	55, 89, 107
Miguel Company	90, 105	Simmons Mike	70
Mikadze Khatuna	40, 65	Solangi Sarfraz Husaain	94
Mitchell Simon	22	Soradeghi Sufiani Hassan	10
Moradi Maryam	125	Stefan Huck	67, 97
Moreno-Bedmar Josep Anton	102	Szives Ottilia	57
Mulayim Oğuz	76	Tezheh Farid	123
Mutterlose Joerg	31	Thierry Adattte	44
Nafarieh Talkhonchek Elham	7	Tuzyak Yaryna	92
Nébiha Ben Haj Ali	95	Türk Emine	91, 107
Ocakoğlu Faruk	79	Tüysüz Okan	36
Omaña Rosa Maria de L	94	Uzunçimen Seda	33
Özer Sacit	100	Vicedo Vicent	6, 83
Paranjape Amruta	61	Vishnevskaya Valentina	90, 107
Parente Mariano	19, 27, 29, 99	Wagreich Michael	12, 46, 56
Park Jin-Young	89, 106	Wahyudiono Joko	33
Pascual-Cebrian Enric	23	Wang Chengshan	39
Permana Asep	80	Wendler Ines	66, 121
Peryt Danuta	92	Whiteside Jessica	30
Peshchevitskaya Ekaterina	8	Wiese Frank	12, 26, 53, 88, 108
Petrizzo Maria Rose	14, 15, 53	Wohlwend Stephan	27
Pictet Antoine	119	Wolfgring Erik	16
Polavderr Svetlana	11	Yazdi-Moghadam Mohsen	6
Pons Jose Maria	24, 52	Yılmaz Erhan	69, 72
Premoli Silva Isabella	13	Yılmaz İsmail Ömer	31, 47, 54
Price Gregory	54, 122	Yondon Khand	85
Punekar Jahnavi	42	Youcef Brahim EL Hadj	111
Qasim Abdulrahman	94	Zaghibib-Turki Dalila	17
R Nagendra	76	Zakharov Yuri D.	49
Radmacher Wieslawa	9	Zarei Elahe	68
Raisossadat Seyed Naser	58	Zorina Svetlana	49
Raveloson Miky Lova Tantely	113		
Rich Tom	39		
Rinchen Barsbold	115		
Roban Relu-Dumitru	48		
Robles-Salcedo Raquel	7		
Rostami Alireza	78		
Ruban Dimitriy	46		

9th International Symposium on the Cretaceous System

1-5 September, 2013

METU FACULTY OF ECONOMIC &
ADMINISTRATIVE SCIENCE BUILDING • ANKARA/TURKEY



MIDDLE EAST
TECHNICAL UNIVERSITY

SCIENTIFIC COMMITTEE

A. M. Celal Şengör (Turkey)
Bruno Granier (France)
Demir Altiner (Turkey)
Gerta Keller (USA)
Helmut Jürg Weissert
(Switzerland)
Hugh Jenkyns
(United Kingdom)
Isabella Premoli Silva (Italy)

İsmail Ömer Yılmaz (Turkey)
Joerg Mutterlose (Germany)
Karl B. Föllmi (Switzerland)
Michael Wagreich (Austria)
Okan Tüysüz (Turkey)
Robert W. Scott (USA)
Stéphane Reboulet (France)
Thierry Adette (Switzerland)
Thomas Steuber (Germany)
Xiumian Hu (China)

ORGANIZING COMMITTEE

İsmail Ömer Yılmaz
(Middle East Technical University, Ankara, Turkey)
ioyilmaz@metu.edu.tr
A. M. Celal Şengör
(Istanbul Technical University, Istanbul, Turkey)
Okan Tüysüz
(Istanbul Technical University, Istanbul, Turkey)
Demir Altiner
(Middle East Technical University, Ankara, Turkey)

Organizing Secretariat

DEKON
CONGRESS & TOURISM

Gayrettepe Mah. Yıldız Posta Cad. Akın Sitesi
1. Blok No: 6 Kat: 1 D: 3 34349
Beşiktaş - İstanbul - TURKEY
Tel: +90 212 347 63 00 Fax: +90 212 347 63 63
E-mail: dekon@dekon.com.tr
Web: www.dekon.com.tr