Research Networking Programmes

Science Meeting – Scientific Report

***Proposal Title**: 'Special Session 2 (SS2) at the IAS 31st Meeting of Sedimentology 2015: Sedimentology and geobiology of carbonate build-ups'*

Application Reference N°: 5913

1. Summary

The International Association of Sedimentologists (IAS) organizes Meeting of Sedimentology every year in an European country, and an "International Sedimentological Congress" every four years. The 31st International Meeting of Sedimentology (IMS), organized by the Jagiellonian University on behalf of IAS was held in Krakow, Poland, from 22 to 25 June 2015.
The organizers suggested twenty-one themes in the first meeting circular, including a call for special session proposals. In response to the latter, twenty-five Special Sessions were organized at the meeting. Among them, D. Basso, A. Vertino (Univ. Milano-Bicocca) and J. Titschack (Senckenberg Inst., Germany) proposed and convened the session SS02: Sedimentology and Geobiology of Carbonate Buildups, that was held on Thursday, June 25th, 2015 in the Auditorium Maximum, Jagiellonian University, Krakow. Thirteen oral presentations were given and six posters were presented during SS02, involving the scientific contribution of almost seventy researchers from different countries of Europe, America, and Asia. The financial support provided by ESF through Cocarde-ERN allowed the participation of four grantees: M.M. Shah (Malaysia), I. Mannani (Morocco), A. Di Capua (Italy), and G. Coletti (Italy). They had the opportunity to attend the meeting and present their own research advancements to an international audience. The IAS meeting was attended by more than 650 participants from around the world, so it was a unique opportunity to interact and discuss with researchers and experts in diverse branches of sedimentology.
Overall, the session SS02 was well attended and provided a platform for discussion on challenging topics related to the development and fate of carbonate buildups as a prominent evidence of the continuous interaction between biosphere and lithosphere along the Earth history.

2. Description of the scientific content of and discussions at the event

The theme of the convened session was summarized as follows:
Carbonate build-ups include a wide range of structures, showing either evidence of framework, or relief, or both. They have been described from such diverse depositional environments as modern and ancient shelves of all latitudes, and from shallow to deepsettings. The session will

focus on our understanding of build-ups as controlling factors of substantial local geomorphological change and sediment production; on their record and role in respect of the ongoing and past environmental change, and on the phenomena involved in their inception, development, and burial or dismantling. We invite contributions on the sedimentology, paleontology, stratigraphy, paleoecology and (bio)geochemistry of build-ups across their full range of distribution in space and geological time, as a prominent evidence of the continuous interaction between biosphere and lithosphere along the Earth history. This session is endorsed by ESF, through the COCARDE Research Network.

Kremer et al., presented *Lamination of* in situ *calcified cyanobacterial mats: lesson from cultured multilayered marine microbial communities.* Many ancient marine carbonate stromatolites exhibit characteristic lamination comprised of alternation of distinct micritic and sparitic laminae. Such lamination is usually interpreted as the result of seasonal climatic fluctuations causing periodic environmental changes in the ambience of the growing microbial mat. Our knowledge on the origin of such lamination is, however, restricted to analyses of fossil material, because modern stromatolites with similar lamination are not known from today's open marine environments. This study on marine cyanobacterial mats from coastal sediments of Inner Danish Water (Nivå Bay, Øresund, Denmark) cultured in a closed system for over three years showed that a multilayered microbial system generated mineral laminae composed of two types of calcium carbonate precipitates: (i) micrite type mineralization of Mg calcite (occasionally with an admixture of nanograins of magnesium silicate) occurring in the mucilage of the living cyanobacterial layers, interlayered with (ii) sparite type of mineralization by Mg calcite/aragonite particles. The bimodal microbially induced calcification can be regarded as precursor for alternating micrite and sparite layers characterizing many fossil stromatolites. The pronounced alternation of in vivo and post-mortem generated calcareous layers in the cultivated cyanobacterial mats may also suggest the existence of similar multilayered microbial systems generating the huge masses of in situ calcified ancient marine microbialites characterizing particularly the Precambrian sedimentary record.

Łuczyński et al. presented *Stromatoporoid biostromes in the Upper Silurian of Podolia (Ukraine) as dynamic bioaccumulations.* In the Late Silurian the present-day Podolia region was a part of a vast carbonate shelf with a constant facies pattern that rimmed Baltica from the south (Silurian orientation), stretching from modern western Ukraine, through Belarus and north-eastern Poland to the Baltic States and the island of Gotland. A central position on the shelf was occupied by a zone of stromatoporoid shoals, which separated the inner shelf lagoonal environments from the outer shelf and slope facies that pass into basinal graptolitic shales. In the Podolia region, the Upper Silurian (Ludlow and Pridoli) shallow water inner shelf facies, represented mainly by fine grained peritidal laminites and dolomicrites with ostracods and eurypterids, are commonly intercalated by variously developed stromatoporoid beds. Detailed studies of morphometrical features of the redeposited stromatoporoids point to a calm original growth environment with a low deposition rate, which enabled their undisturbed growth. The stromatoporoid habitats were most probably located well below storm wave base, in which the bottom waters were interrupted only by very high-energy phenomena, such as extreme tropical hurricanes or tsunamis.

Da Silva et al. communication focused on *Severe and rapid sea level changes affecting Devonian mud mounds from Belgium.* The early and middle Frasnian stratigraphic interval from the Ardennes area in Belgium, was studied with a multidisciplinary and high-resolution approach. Three mud mound levels are observed, in stratigraphic order, the Arche, La Boverie and Lion mounds, surrounded and separated by shales. The three mounds are characterized by the same facies and relatively similar facies evolution through time. The mound succession is interpreted as related to the following events: the base corresponds to transgressive and high stand system tracts; overlain by a sharp transition with shallow facies that correspond to a main regression; followed by the next transgressive system tracts, which corresponds to the upper part of this mound and the lower part of the next mound. Then, again a sea-level drop occurs below the top of this lithostratigraphic unit and is followed by the next transgressive stage etc. A similar transgressive-regressive history is interpreted for all three mounds. An important transgression is interpreted as occurring during the global negative carbon excursion, the punctata Event, recorded worldwide (synthesis in Racki et al., 2008).

Pelletier et al. presented: *Lower Permian cool-water microbial carbonate mud-mounds of the Sverdrup Basin, Arctic Canada: a unique phenomenon driven by oxidation of phosphate.* The Sverdrup Basin (Canadian Arctic) has preserved the record of oceanic change in the Early Permian that saw warm-water photozoan carbonate s in the Asselian shift to cool-water heterozoan carbonates in the Sakmarian. While algal reefs are ubiquitous in Asselian and older strata, reefs of any kinds are absent in the Sakmarian and younger Permian succession, except for two areas on Ellesmere Island where dozens of mud-mounds occur within the Raanes Formation. Occasional slope failure exposed the phosphate-rich sediment to the oxic sea floor beneath truncation scar thus triggering extensive, possibly microbial, oxidation of iron phosphate. This resulted in the replacement of phosphate by iron oxide and the liberation of phosphate in the environment thus providing a concentrated source of nutrients for calcium-carbonate fixing mud-mound generating microbes.

Peryt et al. presentation was on *Sedimentary history and biota of the Zechstein limestone (Wuchiapingian) Jabłonna Reef in western Poland.* The Jabłonna Reef, one of the reefs formed in Wuchiapingian times in SW Poland, is characterized by quite irregular outlines and consists of three separate reef. It is penetrated by four boreholes which show two distinct phases of bryozoan reef development during the Zechstein Limestone deposition. The first one occurred early in the depositional history and botryoidal aragonitic cementation played very important role in the reef formation. The general shallowing-upward nature of deposition in the Jabłonna Reef area resulted in that the reef-flat conditions characterized by omnipresent microbial deposits, first became characteristic for centre-located boreholes. Then, the reef-flat started to prograde and eventually the entire Jabłonna Reef area became the place where very shallow subaqueous deposition occurred. Five biofacies are distinguished in the Jabłonna Reef sections. The presence of echinoderms and strophomenid brachiopods indicates that until the lower part of the *Rectifenestella* biofacies the conditions were clearly stenohaline. Subsequent elimination of stenohaline organisms and progressively poorer taxonomic differentiation of fauna assemblage is characteristic for slight, gradual rise of salinity.

Mannani and co-authors presentation was entitled**:** *The Sinemurian carbonate buildups of N'zala (central High Atlas, Morocco): facies, architecture and geodynamic setting.* Solving the puzzle of the Sinemurian carbonate buildups located in the northern part of the N'Zala Liassic succession (Central High Atlas, Morocco), requires a multidisciplinary approach. The geological timing with a standard section on the left side of Oued N'Zala, allowed the sketching of isochrones. It shows that these mounds locally grew in the Upper Sinemurian, whereas disappeared at the bottom of the Lower Carixian. These carbonate buildups are characterized by Hexactinellids and Lithistidssiliceous sponges, microbialites with thrombolytic and stromatolitic structures, and encrusting organisms such as bryozoans and annelids, with abundant carbonate matrix which consist of organic-rich and compact dark microcrystalline calcite of microbial origin (automicrite), and a grey micrite (allomicrite). The evolution of the described paleoenvironments seem closely related to a change of the sea bottom morphology resulting from a major platform dislocation step within the Lower Sinemurian-Upper Sinemurian transition period. Their localized persistence in the Upper Sinemurian could be related to the irregular distribution of the surrounding sediments or to the development of localized highs in the underlying substratum.

Vincent et al. communication was focused on *Late Jurassic-earliest Cretaceous reef analogues for the Eastern Black Sea: palaeogeographic setting, facies, Sr isotope stratigraphy and reservoir potential.* Seismic data have revealed the likely occurrence of Late Jurassic - earliest Cretaceous reef complexes up to 1-2 km thick and 10-20 km wide on the northern Shatskiy Ridge in the Eastern Black Sea. In common with much of the northern Tethyan margin, reefs in the study region can be grouped into coral-dominated, siliceous sponge-microbial and microbial types. Coral-dominated reefs occur as patchy and massive forms, and can be subdivided into higher-diversity and low-diversity (platy) types. The former developed at shallow-water platform margins and in platform interiors, whilst the latter occurred in deeper-water mid-shelf settings. Thick reef occurrences are often associated with fault-bounded platform margins. A pilot Sr isotope study of a well-exposed section in the eastern Pontides has been carried out as a result. The section contains a major truncation surface with a local relief of at least 45 m. Isotopic values supported by foraminiferal biostratigraphy indicate that it represents an intra-Tithonian to Berriasian hiatus. This technique has the potential to be applied to other outcrops in the region. The reefs exhibit a complex pattern of porosity development reflecting independent diagenetic histories involving near-surface and deep-burial dissolution, dolomitization and dedolomitization.

Coletti et al. presented: *From build-up to pebbles: brief history of a crustose coralline build-up of the Upper Eocene of Northwestern Italy.* Reworked skeletal grains, transported off shore by debris-flow, are preserved in the Ternate Formation, a deep-water sub-marine fan. In the Upper Oligocene conglomerates of the Gonfolite Lombarda Group, biogenic carbonate pebbles of Upper Eocene age are preserved. Textural characteristics, skeletal assemblages, coralline-algae flora and benthic foraminifers composing the pebbles were studied and compared to those of Ternate Fm. The same rhodalgal skeletal-assemblage, the same species of coralline algae and the same association of benthic foraminifers suggest their common origin. While Ternate Fm. materials were undoubtedly reworked during transport, the limestone pebbles are pristine fragments of the original carbonate platform which was uplifted and eroded between Upper Eocene and Upper Oligocene. They actually have no internal textural features suggesting reworking (common orientation of the grains, high degree of sorting, presence of rip-up clasts, fragmentation of delicate skeletal elements). The remnant of the crustose coralline framework was preserved in these pebbles. The exclusion of corals may have been caused by the general instability of the environment. Ternate Fm. sub-marine fan was supplied by periodic debris flow, probably started by river floods. The combined stressful effects of bottom instability and riverine discharge probably excluded corals from the association.

Vertino communication was devoted to: *Mediterranean cold-water coral buildups: important archives of Quaternary oceanographic modifications.* Modern Mediterranean cold-water coral (CWC) buildups form in bathyal environments due to the aggregations of azooxanthellate branching scleractinian colonies (mostly *Madrepora oculata*, secondarily *Lophelia pertusa*) and large solitary species (*Desmophyllum dianthus*). The presence/absence of CWC buildups and the taxonomic composition of associated benthic communities is influenced by several environmental factors (such as current intensity, food supply, oxygenation, temperature etc.) connected to small- and/or large-scale oceanographic dynamics. Therefore their evolution through time can be used as a valuable tool to interpret paleoceanographic modifications. The composition of frame-building scleractinians and associated benthic fauna underwent important modifications from the Early Pleistocene up to now. *Lophelia*-dominated buildups, comparable in terms of structure and taxonomic composition to modern NE Atlantic counterparts, were flourishing in the Early Pleistocene bathyal seafloor of the Mediterranean, hinting at Atlantic-like paleoceanographic conditions. Several species of scleractinians, stylasterids, alcyonaceans, molluscs, crinoids, brachiopods, serpulids and other taxa inhabiting Early Pleistocene CWC buildups are absent in the modern Mediterranean and most of them seem to have disappeared before the Late Pleistocene. Large knowledge gaps still need to be filled, nevertheless paleontological data collected so far clearly indicate that modern CWC buildup communities of the Mediterranean result from the complex interplay between large-scale climate changes and environmental modifications at regional scale.

Sechi et al. presented: *Sedimentary depositional characteristics of intertidal algae build-up rim and their implication on past sea level reconstruction.* Algal reefs of Mediterranean Sea develop in a wide range from very shallow to deep marine shelf environments. The Intertidal facies is known as "Trottoir" and consists of non-coralline algae built-ups mound or rim like bodies. Along the western coasts of Sardinia Island (Italy) several well exposed MIS 5e (125 ka) patches of paleo-algal rims occur. Two mainly scenarios were identified: 1) Rocky boulder-strewn shores. 2) Sub-horizontal high tide shore platform along flat coast. Shore platforms are often exposed to the sub-aerial processes and to the over-washing wave storms, thus the platform surface is largely characterized by shallow or deep pipes and/or pools carved into the easily-erodible bedrock (e.g. poorly lithified sandstone). The sedimentary feature described in association with the flora and fauna assemblage descriptions allow to distinguish the intertidal algae build-ups from deeper ones, providing an helpful tool for past sea level reconstruction in mixed siliciclastic-carbonate environments.

Franchi et al. presentation was aimed at *Assessing the genesis and evolution of biodetrital methane-imprinted carbonates on the Adriatic continental shelf.* The central Adriatic Sea is a well-known region of natural gas production. Presence, migration and occasional escape of gas onto the sea bottom and into the water column is documented by a number of features such as pockmarks and gas bubbling. The central Adriatic is also a site of formation of hydrocarbon-derived carbonate. The carbonate of buildups are strongly depleted in ^{13}C, showing $\delta^{13}C$ values as low as about -48‰ VPDB. These values are consistent with the precipitation of carbonates via the anaerobic oxidation of methane performed by microbial consortia. Seeping fluids impregnated post-glacial transgressive coarse bioclastic-rich units. The authigenic carbonates therefore incorporate abundant shell remains including chemosymbiotic lucinid

bivalves and burrowing callianassid shrimps. During the Holocene these buildups have been exhumed by erosion and served as hard substrate for fouling benthos (i.e., bryozoans, oysters and red algae). The analysis of the Bonaccia carbonates reveals a complex history, reflecting the interplay of sedimentation in the course of transgression, hydrocarbon seepage and erosion, as well as later, successive colonization by benthos.

Franck & James presented: *Carbonate grain taphonomy and diagenesis on a polar shelf.* Although relatively rare in space and time, carbonates deposited in glacially influenced settings hold great potential for improving understanding of the climate and oceanography of the high latitudes. Perhaps the best-known examples of such limestones formed during the major ice ages of the Neoproterozoic and Late Palaeozoic. The taphonomic and early diagenetic processes affecting carbonate deposits recovered in piston cores from the Ross Sea of Antarctica, with the aim of developing a conceptual bridge between the modern and ancient for these unique cold-water carbonate systems. Carbonate-rich deposits are preserved on the northwestern part of the Ross Sea shelf, where they mantle areas of the upper slope, shelf edge, and elongate banks that are situated seaward of the grounding line of the Last Glacial Maximum ice sheet. This part of the shelf is swept almost continuously by strong bottom currents and lies beneath an area of very high primary productivity. The carbonate deposits, comprising poorly sorted skeletal sand and gravel, are dominated locally by either stylasterine hydrocorals, barnacles, or bryozoans. Skeletal material is conspicuously bored at the macro- and micro-scales, with overlapping generations of borings recording repeated episodes of grain infestation.

Shah & Lisa presented the *Depositional settings of the stromatolitic unit in Cambrian Muzaffarabad Formation, Muzaffarabad area (Azad Kashmir, Pakistan).* A thick stromatolitic unit forms upper part of ~900m thick Muzaffarabad Formation (Cambrian) in the Muzaffarabad area, Azad Jammu & Kashmir. Field observations and petrographic studies in the two studied sections (Yadgar and Khilla) revealed planar to wavy bedding with distinct laminations (crptmicrobial laminites), stromatolites and jelly-roll structures characterized the unit. Most are cryptalgal laminites. In the Yadgar section, stromatolitic structures ranges in length from 9 to 60cm and height from 7 to 23 cm, whereas size of these stromatolites decrease towards the top of the horizon. Hummocky cross stratification and heterolithic stratification observed in the study area, which indicated storm conditions during the formation of algal flats. In the Khilla section, stromatolites mostly occur in the form of vertically stacked hemispheroids and laterally linked hemispheroids. Besides this, jelly roll structures are also reported, which are diagnostic of microbial activity. Other sedimentary structures include: fenestral fabrics, desiccation cracks as gas bubble trails and imbricated intraclasts. The stromatolitic unit formed in the peritidal environments, comprising supratidal, intertidal and subtidal conditions. Two asymmetric cycles representing progradation sequences are recognized in the study area. Besides this, low energy conditions prevailed except periodic storm activity as indicated by the presence of hummocky cross stratification, heterolithic stratification and presence of imbricate clasts.

Di Capua et al. presented a poster entitled: *What killed the Tertiary Southalpine carbonate platform?* The carbonate platforms of the Tertiary Alpine basins (Northalpine Molassa and Southalpine Foredeep basin) are shaped by the different geodynamic settings. According to the classification of Bosence (2005), the Northalpine basin hosted a foreland margin platform (Nummulitic Limestones), whereas the Southalpine basin probably hosted a thurst-top platform that supplied the shallow-water carbonate turbidites of the Ternate Formation. Actually, this latter carbonate platform is no more present, rapidly eroded during the Oligo-Miocene evolution of the Southern Alps, but a paleoecological reconstruction have been provided by Coletti et al. (in prep.) through the analysis of pebbles encountered in the Oligo-Miocene siliciclastic turbidite fan of the Gonfolite Lombarda Group. A top-thrust platform grown up in front of gentle relieves of Jurassic to Cretaceous sedimentary covers, as suggested by the abundant and angular Mesozoic pebbles encountered in the turbidite fan of the Ternate Formation. The large presence of mass flow deposits and marly, often plurimetric soft clasts also suggests that a small, instable delta was frequently discharging terrigenous detritus through flash flood events moving across the platform deep into the basin. The abrupt disappearance of re-sedimented shallow-water carbonates probably corresponded to the death of the platform soon after the Early Oligocene, but doubts are still present on the causes that triggered it.

Bracchi et al. presented the poster: *Spatial heterogeneity in a Pleistocene example of infralittoral coralligenous (de plateau?), Le Castella, southern Italy.* Coralligenous (C) is the most volumetrically significant type of autochthonous carbonate buildup in the Mediterranean, currently developing on hard

and soft substrates (C"*de plateau*"), at depths ranging from 4 to 120 m water depth (wd). Literature on the C "*de plateau*" is relatively scarce, because of the difficulty in assessing the nature of the substrate of C build-ups by underwater investigation. Rare fossil examples are reported. Shallow marine carbonate deposits from the Upper Pleistocene Le Castella marine terrace (Southern Italy) are preserved in spectacular exposures presenting a unique opportunity to explore and understand genesis and morphological development of recent Mediterranean C. The C build-ups occur in the lower transgressive portion of an unconformity-bounded, high-frequency sequence. They show high structural and morphological heterogeneity. Analysis of sedimentary structures, paleo-topographic indicators, faunal composition of associated mollusc assemblages, and predominance of *M. alternans* suggest the algal builds-ups grew between fair-weather base and storm wave base, within an infralittoral setting with a reconstructed 10 to 20 m wd. C in the Le Castella deposits competed for the space with other infralittoral biocoenoses. Suitable substrate availability in the form of hard conglomerate blocks or shell accumulations was the main factor controlling the inception and spatial distribution of C. Differences in size and internal composition between the north and south locations were driven by differences in hydrodynamism and sediment supply.

Titschack & Baum illustrated their poster*: Ambient occlusion – a powerful algorithm to segment skeletal intrapores and gastral cavities in dendrophyllid cold-water corals.* During the last decades, (micro-)computed tomography (CT) has gained increasing attention for the description and quantification of skeletal structures. Within coral research, CT has been used to determine the surface area of corals, to examine the pore-network and to determine the porosity within coral skeletons. Here, we present the ambient occlusion algorithm as powerful tool for the segmentation of pore-networks, exemplified on a dendrophyllid coral. Within dendrophyllid corals, the complex pore-network is extensively connected to its exterior surface. The same accounts for the gastral cavity, which exhibits a broad opening. Analysing these structures requires the discrimination of the enclosed space from the sample surrounding space (all normally filled with air). This presents a crucial processing step for the analysis of the pore network, its connection to the gastral cavity and its porosity distribution within the skeleton. We show that the ambient occlusion algorithm enables a fast and representative segmentation of both skeletal features by using different "ambient" thresholds. Subsequently, volume determinations, porosity determination and pore-network analysis can be easily performed. In addition, it renders cropping of the measured sample volume prior to biomould and pore segmentation in rocks unnecessary, and, thus, allows one to perform analysis on the entire sample volume measured. The segmentation via the ambient occlusion algorithm can be applied to a variety of porous (bio)materials such as bryozoans, echinoderms or bone substitutes.

Argentino et al. presented the poster: *A quantitative compositional approach to the study of a Miocene carbonate shelf in the northern Apennines.* The petrography of 147 samples of carbonate and mixed siliciclastic-carbonate rocks has been performed on shallow-water carbonates of early-middle Miocene deposited in a wedge-top basin in the northern Apennines. High-frequency sampling of the Torriana log (Val Marecchia valley, Romagna Apennines) covers the entire carbonate succession from the basal unconformity to the terrigenous-rich sediments that mark the demise of the shelf. On the basis of the relative amounts of these framework components, four different petrofacies are distinguished and matched with lithofacies units. The hierarchical cluster analysis of point counting data is in agreement with outcrop-scale facies observations. Our data indicate an almost exclusively intrabasinal supply during deposition of the basal portions. A vertical evolution is documented and it is evidenced by a progressive increase in the terrigenous supply that replaces the bioclastic fraction. The terrigenous input becomes significant in the upper unit marking the crisis of the shelf.

Hodges et al. presented a poster focused on: *Determining depositional age of an Early Jurassic reef in the El Antimonio Group of Sonora, Mexico, and the implications for coral recovery after the end-Triassic mass extinction.* Within the Santa Rosa Formation of the El Antimonio Terrane in Sonora, Mexico, are two previously unstudied reef-like carbonate buildups containing rare Early Jurassic corals. A global mass extinction occurred at the Triassic-Jurassic boundary and coral reefs experienced considerable stress near the end-Triassic. During this period of global climate change approximately 200 million years ago, sea level was dropping and the Central Atlantic Magmatic Province was releasing prodigious amounts of greenhouse gases and volatiles with increasing ocean acidity. Corals reefs collapsed abruptly during the end of the Triassic. While the Jurassic recovery was underway during the first few million years following the extinction event, reefs were exceedingly rare and coral diversity did not fully recover until 25 million years later. Compared to the Tethys, precious little is known about the recovery in western North America

where reefs and diverse corals of the Late Triassic inhabited volcanic settings of eastern Panthalassa. The Sonoran reef-like buildups are perhaps the only Early Jurassic examples in the USA and Mexico. The coral faunas and other marine fossils of these Sonora reefs provide relevant data with which to assess paleoecology, paleobiogeography and biotic recovery during the critical interval following the end-Triassic mass extinction.

Munawar *et al.* presented the poster entitled*: Microfacies Analysis, Paleontology and Biostratigraphy of Paleocene Lockhart Limestone from Pail Area, Central Salt Rang, Pakistan.* The Salt Range is a feature of particular geological interest for its exposed rocks ranging from Pre Cambrian up to recent. Paleocene and Eocene sedimentation is rich in foraminifera in entire Salt Range of Pakistan. Larger Foraminifera are abundant and contribute a major part of this period. They are regarded as useful tool for biostratigraphic dating of shallow marine sediments. This study is comprised of microfacies analysis paleontology and biostratigraphy of Lockhart Limestone. Thin sections of rock samples collected from measured section were observed under microscope. Abundance of benthic foraminifera and scarcity of planktonic foraminifera in Lockhart Limestone indicates shallow, inner neritic, open-marine environments of deposition. Presence of larger foraminifers species like; *Lockhartia haimei*, *Lockhartia conditi* indicates Upper Paleocene age of Lockhart Limestone.

3. Assessment of the results and impact of the event on the future directions of the field

The COCARDE session fostered discussions on several topics related to modern and ancient carbonate bioconstructions and allowed the establishment of new international collaborations between junior and senior scientists.

It is worth remarking the impact of the meeting in the future research of the COCARDE grantees. For instance, Giovanni Coletti and Andrea Di Capua received a positive feedback from Professor Dan Bosence, whose model of “Trust-top Platform” has been used in their paleoenvironmental interpretation. Moreover they have discussed potential collaborations aimed at comparing their results on the Southalpine Foredeep Basin with data from the Saint-Florent basin in Northern Corsica. Thanks to the COCARDE grant, Mumtaz Muhammad Shah could discuss potential future collaborations on several topics related to his current research (diagenesis, porosity and acoustic properties of SE Asia carbonates, Mg isotope analysis, modern carbonate buildups from Malaysia) with Prof. A. Immenhauser (Bochum University, Germany), Prof. E. Gischler (Goethe University, Germany), Prof. C. Betzzler (Hamburg University, Germany), Prof. R. Swennen (K. U. Leuven, Belgium), T. Bechstadt (Heidelberg University, Germany). Moreover M. M. Shah could benefit from cathodoluminecence facilities at the Institute of Geological Sciences of Krakow.

4. Programme of the Session

Oral presentations

ROOM: PANGEA I

SESSION SS02

Sedimentology and geobiology of carbonate build-ups | Conveners: Daniela Basso, Agostina Vertino, Jürgen Titschack

ORAL PRESENTATIONS		
Time	ID	Authors and Presentation Title
11.15	SS02a.01	B. Kremer, J. Kaźmierczak, T. Fenchel, M. Kühl, S. Kempe Lamination of in situ calcified cyanobacterial mats: Lesson from cultured multilayered marine microbial communities
11.30	SS02a.02	P. Łuczyński, S. Skompski, W. Kozłowski Stromatoporoid biostromes in the Upper Silurian of Podolia (Ukraine) as dynamic bioaccumulations
11.45	SS02a.03	A-C. Da Silva, J. Yans, F. Boulvain Severe and rapid sea level changes affecting Devonian mud mounds from Belgium
12.00	SS02a.04	E. Pelletier, B. Beauchamp, D. Calvo Gonzalez Lower Permian cool-water microbial carbonate mud-mounds of the Sverdrup Basin, Arctic Canada: A unique phenomenon driven by oxidation of phosphate
12.15	SS02a.05	T. Peryt, P. Raczyński, D. Peryt, K. Chłódek, Z. Mikołajewski Sedimentary history and biota of the Zechstein limestone (Wuchiapingian) Jabłonna Reef in western Poland
12.30	SS02a.06	I. Mannani, D. Chafiki, B. Cavalazzi, A. Ait Addi, F.E. Ait Itto The Sinemurian carbonate buildups of N'zala (Central High Atlas, Morocco): Facies, architecture and geodynamic setting
12.45	SS02a.07	S. Vincent, L. Guo, V. Lavrishchev, R. Kandemir, R. Flecker, R. Ellam, M. Boudagher-Fadel Late Jurassic–earliest Cretaceous reef analogues for the Eastern Black Sea; palaeogeographic setting, facies, strontium isotope stratigraphy and reservoir potential
Lunch break		
14.15	SS02b.01	G. Coletti, D. Basso, A. Di Capua, G. Vezzoli From build-up to pebbles: Brief history of a crustose coralline build-up of the Upper Eocene of Northwestern Italy
14.30	SS02b.02	A. Vertino Mediterranean cold-water coral buildups: important archives of Quaternary oceanographic modifications
14.45	SS02b.03	D. Sechi, S. Andreucci, V. Pascucci Sedimentary depositional characteristics of intertidal algae build-up rim and their implication on past sea level reconstruction
15.00	SS02b.04	F. Franchi, L. Angeletti, A. Correggiari, M. López Correa, V. Maselli, C. Mazzoli, J. Peckmann, M. Taviani Assessing the genesis and evolution of biodetrital methane-imprinted carbonates on the Adriatic continental shelf
15.15	SS02b.05	T. Frank, N. James Carbonate grain taphonomy and diagenesis on a polar shelf
15.30	SS02b.06	M.M. Shah, M. Lisa Depositional settings of the stromatolitic unit in Cambrian Muzaffarabad Formation, Muzaffarabad Area (Azad Kashmir, Pakistan)
Posters, afternoon coffee & wine		

Poster presentations

Thursday 25.06.2015

ROOM: **PANTHALASSA, Poster Session (10.30–11.15; 15.45–16.30)**

SESSION SS02

Sedimentology and geobiology of carbonate build-ups

Presentation ID	Authors and Presentation Title
PS3.SS02.01	A. Di Capua, G. Coletti, G. Vezzoli What killed the Tertiary Southalpine carbonate platform?
PS3.SS02.02	C. Argentino, A.C. Salocchi, D. Fontana, C. Grillenzoni A quantitative compositional approach to the study of a Miocene carbonate shelf in the northern Apennines
PS3.SS02.03	M. Hodges, G. Stanley, C. González-León Determining depositional age of an Early Jurassic reef in the El Antimonio Group of Sonora, Mexico, and the implications for coral recovery after the end-Triassic mass extinction
PS3.SS02.04	M.J. Munawar, C. Lin, D. Chunmei, C. Ma, M.A. Zahid Microfacies analysis, paleontology and biostratigraphy of Paleocene Lockhart Limestone from Pail Area, Central Salt Rang, Pakistan
PS3.SS02.05	V.A. Bracchi, D. Basso, R. Nalin Spatial heterogeneity in a Pleistocene example of infralittoral Coralligenous (*De Plateau*?), Le Castella, southern Italy
PS3.SS02.06	J. Titschack, D. Baum Ambient occlusion – a powerful algorithm to segment skeletal intrapores and gastral cavities in dendrophyllid cold-water corals

5. List of speakers

The list of speakers complete with their addresses has been uploaded on line.