



International Meeting of Sedimentology 2017

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Detailed list of sessions

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Sessions in the IMS2017 are organized by topics in symposium. They are either typical for one symposium or overlapping several, in addition to our two transversal sessions. Following is the list of the sessions primary in each symposium.

TRANSVERSAL SESSIONS

- **T1 UNDERSTANDING SALT GIANTS AND THEIR GEOLOGICAL, GEOCHEMICAL AND BIOLOGICAL IMPACTS**

Conveners: Vanni ALOISI (CNRS Paris, FRA), Judith MCKENZIE (ETH Zurich, AUT), Virginie GAULLIER (UMR LOG 8187 CNRS-Lille1-ULCO, FRA), Daniel GARCIA-CASTELLANOS (ICTJA-CSIC Barcelona, ESP)

Description. Huge salt accumulations known as salt giants have formed since at least the Neo-Proterozoic. Understanding their formation presents major interdisciplinary challenges in the fields of sedimentology, tectonophysics, hydrodynamics, and geochemistry.

Their importance as hydrocarbon traps, geo-hazards and possible locations of deep CO₂ storage makes them a preferred research target for the applied geosciences. Their role as deep biosphere hotspots is very promising but remains under-explored. The Mediterranean Salt Giant (MSG), formed 5 to 6 million years ago, is the most recent giant salt deposit accumulated in Earth's history. It offers the best chance for understanding how these deposits form because it is still contained in its original sedimentary basin, it is relatively poorly deformed, and it is accessible by scientific drilling vessels. After two pioneering scientific drilling investigations in 1970 and 1975 (DSDP Legs 13 and 42A, respectively) and four decades of research carried out by numerous groups, the international scientific community is coming together to propose a multi-platform drilling project - the only scientific enterprise that holds potential to decipher the enigma of salt giant formation. Before drilling can occur, it is crucial to join forces to analyze the vast amount of geophysical, geological and geochemical data available on the MSG and earlier salt giants, in order to build a unified theory of salt giant formation.

We encourage participation of researchers from academia and the industry on any aspect related to understanding the formation and deformation of salt giants and their geological, geochemical and biological impacts.

- **T2 PLANETARY SEDIMENTOLOGY: MARS, TITAN, AND ELSEWHERE**

Conveners. Laetitia LE DEIT (University of Nantes, FRA), Devon M. BURR (University of Tennessee Knoxville, USA), Véronique ANSAN (University of Nantes, FRA), Ralph D. LORENZ (Johns Hopkins University Laurel, USA)

Description. Knowledge of the sedimentary record on extraterrestrial bodies strongly evolved in the last decade. Data from numerous exploration missions, both early and recent, demonstrate that not only Mars and Titan but also Pluto, comets, and asteroids have complex sedimentary formations that provide evidence of sediment cycling.

This session invites contributions on extraterrestrial sedimentology based on orbital or in situ observations of Mars, Titan, or any other extraterrestrial body. We also solicit any work on laboratory data, modeling and terrestrial analogues that are keys for understanding sedimentary processes on planetary bodies.



SYMPOSIUM CB₁ - CARBONATES & BIOCONSTRUCTIONS

Chairs. Markus ARETZ (University of Toulouse III - GET, FRA), Nicolas OLIVIER (University of Clermont-Ferrand, FRA), Giovanna DELLA'PORTA (University of Milan, ITA)

Carbonates and bioconstructions formed in various marine and non-marine sedimentary systems in Precambrian and Phanerozoic times. The control and influence of skeletal biota and microbial mats into the processes that lead to the precipitation and formation of carbonates make carbonate rocks fundamental archives of past ecological, environmental, oceanographic and climatic conditions.

The objectives of this symposium are to gather a broad scientific community dealing with carbonates and bioconstructions in the widest sense through sessions aiming to document and better understand the processes and products of carbonate accumulations and bioconstructions, including their diagenetic history, and their implications for the understanding of sedimentary systems, sedimentary basins and paleoenvironmental reconstructions and evolutions, climate change and sea-level oscillations. All time scales, geological periods, sedimentary and depositional environments are concerned.

- **CB1.0 OPEN SESSION ON CARBONATES & BIOCONSTRUCTIONS**

Conveners. Markus ARETZ (University of Toulouse III - GET, FRA), Nicolas OLIVIER (University of Clermont-Ferrand, FRA), Giovanna DELLA'PORTA (University of Milan, ITA)

Description. This open session invites contributions on the general topics related to Carbonates and Bioconstructions. It is an opportunity to present studies that do not fall within research covered by the special sessions CB1.1 to CB1.14.

- **CB1.1/PP3.10 CARBONATE SYSTEMS: IS THE MODERN STILL THE KEY FOR THE FUTURE?**

Conveners. Marco BRANDANO (Sapienza Università di Roma, ITA), Stephen LOKIER (Petroleum Institute, UAE)

Description. An understanding of the controls of past carbonate sedimentation is fundamental to predicting the future of carbonate deposition. The atmospheric CO₂ concentration is approaching levels comparable to those last experienced 40–50 million years ago. The records of climatic, oceanographic and environmental changes preserved in carbonate sequences can provide new insights into the likely consequences of human activities.

In this session we shall explore a range of geochemical, biological and stratigraphic proxies and their applications to understand the sedimentary record of carbonate successions in the Earth history context.

- **CB1.2 CONTINENTAL CARBONATES: CONTROLS ON FACIES TYPES AND DEPOSITIONAL ARCHITECTURE**

Conveners. Concha ARENAS-ABAD (University of Zaragoza, ESP), Giovanna DELLA PORTA (University of Milan, ITA), Ramón MERCEDES-MARTÍN (University of Hull, GBR)

Description. Carbonates deposited in continental settings are valuable repositories of environmental, biological, climatic, hydrologic and tectonic information. This session will focus on carbonate facies formed in the wide range of continental depositional settings (lacustrine, fluvial, spring, pedogenic), with emphasis on the processes and products of carbonate precipitation and the influence of microbial communities to build distinct deposits.

Here we welcome contributions focused on understanding how intrinsic and extrinsic factors control the depositional environment, carbonate precipitation, facies types and depositional architecture at different scales. We encourage both experimental and field studies

- **CB1.3 CARBONATE SLOPES AND BASINS: SEDIMENTARY PROCESSES AND ARCHIVES THROUGH TIME**

Conveners. Christian BETZLER (*Institut für Geologie, Hamburg, DEU*), Jean BORGOMANO (*CEREGE Aix-Marseille, FRA*), Thierry MULDER (*EPOC Bordeaux, FRA*), Angel PUGA BERNABEU (*Universidad de Granada, ESP*), John REIJMER (*King Fahd Petroleum and Minerals, KSA*)

Description. The slopes and basinal areas surrounding platforms contain an expanded record of sea level, current and climate history because of the high sedimentation rate from pelagic and neritic sources. The slopes are a volumetrically significant part of a carbonate platform and important for the stratigraphic correlation between the shallow platform and the adjacent basinal environments. High-resolution seafloor mapping, seismic data, oceanographic data and sedimentological sampling from modern slopes, as well as detailed and comprehensive outcrop studies of exhumed platforms allowed to significantly amend platform slope depositional models during the last years that allow to read the environmental record in great detail.

This session aims to bring together researchers from these different disciplines to document the highly dynamic carbonate platform slope to basin environment and illustrate their significance for to decipher the environmental changes through time.

- **CB1.4/PP3.11 BIO-GEO-INTERACTIONS IN MARINE CARBONATE SYSTEMS: CAUSES AND EFFECTS THROUGH SPACE AND TIME**

Conveners. Agostina VERTINO (*Università degli Studi di Milano-Bicocca, ITA*), Daniela BASSO (*University of Milan, ITA*), Chris JENKINS (*University of Colorado Boulder, USA*)

Description. The distribution and density of carbonate-producing benthic organisms highly depends on environmental variables, such as light, temperature, nutrients, current speed, substrate texture and supply rates. In turn, growth and development of benthic communities, as well as post-mortem processes affecting their remains, may highly influence the seafloor morphology, sediment properties and other aspects of the seabed. This is true especially of marine ecosystem engineers, either producing carbonates (such as corals, coralline algae, bivalves) or lacking mineralized skeletons (e.g. seagrass, cyanobacteria, burrowing macrofauna). There are also important organism-organism interactions at work, such as in the case of bioerosion.

The mechanisms fostering or inhibiting these interactions within carbonate depositional systems are still little understood. But clearly the modifications wrought on the physical surrounds by the benthic biota influence the acoustic signals used to map the seafloor, which implies that acoustic remote sensing potentially conveys information on presences, types and changeability of benthic communities and their carbonate production. Different acoustic systems can cover various resolutions and footprint sizes.

This session aims at bringing together scientists interested in modern and ancient marine bio-geo interactions, with special emphasis on carbonate depositional settings from shallow- to deep-water environments. Our main goal is to promote a constructive cross-disciplinary debate on:

- 1) seafloor processes affecting biotic carbonate production through space and time,
- 2) interactions between carbonate-producing biota and physicochemical habitat properties, and their influence on acoustic remote sensing,
- 3) possible development of bio-geo- computational models for a better understanding of the evolution of carbonate depositional systems.

- **CB1.5/FSD8.6 MICROBIALITES: A MULTIDISCIPLINARY APPROACH FOR IMPROVED UNDERSTANDING OF EXTANT AND EXTINCT SYSTEMS**

Conveners. Daniel ARIZTEGUI (University of Geneva, CHE), Raphaël BOURILLOT (Ensegid-Bordeaux INP, FRA), Anneleen FOUBERT (University of Fribourg, CHE), Emmanuelle VENNIN (University of Bourgogne, FRA), Pieter T. VISSCHER (University of Connecticut, USA)

Description. Microbialites are organosedimentary deposits formed through the mineralization of benthic microbial mats and/or trapping and binding of sedimentary particles. These structures are abundant in modern – sometimes extreme – environments (e.g., hypersaline lakes; hydrothermal sources; caves) and are common in the fossil record, hence constituting an invaluable archive of past Earth’s surface and subsurface evolution. The last two decades have seen an emergence of studies focusing on microbe-mineral interactions and formation of microbial sedimentary fabrics. More recently, early diagenetic processes have also gained research attention. Many advances in methodology, e.g., omics approaches, imaging techniques such as micro-XRF and micro CT scans, have allowed a better understanding of microbialite formation from initial development to evolution during early and late diagenesis. The understanding of preservation modalities of modern microbial mats allows for a better interpretation of the fossil record. This transdisciplinary session combines research on fossil and modern microbialites with a broad focus such as sedimentology, (bio)geochemistry, microbiology, molecular biology, geomicrobiology, and mineralogy.

The main objectives of the session are to review recent and ongoing developments in this field in order to: (i) refine the understanding of microbialite formation in modern sedimentary environments to (ii) have an increased understanding of the modalities of their preservation to (iii) ultimately improve the interpretation of the fossil record.

Examples of topics included in this session are:

- 1) mechanisms of mineral precipitation in modern environments (extant systems);
- 2) the role of microorganisms and organic matrices (EPS, low- molecular weight organics) on mineral precipitation, grain trapping and binding, and/or microbe-mineral interactions;
- 3) early to late diagenesis of microbialites, and preservation processes;
- 4) microbialites as geological resources and reservoirs;
- 5) microbially-induced sedimentary structures (MISS);
- 6) sedimentology and stratigraphy of microbialite-dominated systems in the fossil record;
- 7) evolution of Earth’s surface environment and biogeochemical cycles as recorded by microbial sediments/microbialites.

- **CB1.6 CARBONATE PLATFORMS**

Conveners. Stéphan JORRY (IFREMER, FRA), Julien BOURGET (University of Western Australia, AUS)

Description. In this session we seek contributions to provide a better understanding of the complex history of carbonate platform growth and demise successions through the Phanerozoic. Exploration well and 2D/3D seismic data in hydrocarbon-bearing basins can provide direct access to the composition and stratigraphic evolution of ancient carbonate platforms. In the recent years, high-resolution seafloor mapping, seismic data, oceanographic data and sedimentological sampling from recent to modern systems, as well as detailed and comprehensive outcrop studies of exhumed margins allowed to significantly improve our understanding of local versus regional controls on carbonate platform growth and drowning events at multiple timescales.

This session will highlight the latest research on the steering mechanisms of sediment variations and stacking patterns of carbonate sedimentary systems. Contributions related to the seismo-stratigraphic facies, diagenesis and carbonate platform architectures are also welcomed, as well as studies on carbonate reservoir properties.

- **CB1.7 NON-TROPICAL MARINE CARBONATES AND MODERN ANALOGUES**

Conveners. Arnoud SLOOTMAN (King Fahd University of Petroleum and Minerals, KSA), Laura O'CONNELL (Southern Illinois University, USA), Daniela BASSO (University of Milano-Bicocca, ITA), Tracy FRANK (University of Nebraska-Lincoln, USA), Maria MUTTI (University of Potsdam, DEU)

Description. Marine carbonate deposition is not limited to clear tropical seas. Non-tropical marine carbonates include temperate and cold-water carbonates originating in less warm (winter mean <20°C), possibly turbid settings that are not limited to the photic zone of the water column. Such carbonates are primarily the skeletal remains of heterozoan components, including coralline algae, bryozoans, cold-water corals, mollusks, echinoderms and benthic foraminifera. Biogenic carbonates have traditionally been thought of as tropical deposits. Research throughout the past few decades has found that non-tropical carbonates occur under a wide range of modern marine conditions and seawater temperatures, extending deep into the rock record. Ancient examples are being unearthed and reinterpreted on the basis of the growing knowledge of contemporary analogues. Recently, new methods for delimiting modern oceanographic controls on sedimentation and interpretations of ancient deposits have been implemented. Temperate and cold-water carbonate sedimentation have played a significant role in many parts of the world, including (but not limited to) the Neogene Mediterranean region and south Australian coast.

We aim to bring together a broad range of researchers working on non-tropical marine carbonates to establish the current state of this field of carbonate sedimentology. Depositional environments include subtropical, warm-temperate, cool-water, and cold-water provinces. We encourage submissions that discuss carbonates seemingly deposited in warm marine waters, but which have heterozoan cool-water signatures as a result of environmental conditions such as high nutrient levels. We particularly welcome submissions from young scientists.

- **CB1.8 REEFS AND BIOCONSTRUCTORS**

Conveners. Markus ARETZ (University of Toulouse III - GET, FRA), Nicolas OLIVIER (University of Clermont-Ferrand, FRA), Julien DENAYER (University of Liège, BEL).

Description. Reefs are one of the most diverse carbonate systems, and they are known from a broad range of depositional settings in Precambrian and Phanerozoic times. Bioconstructors and reef ecosystems can be studied from very different perspectives and with very different methodological approaches.

The objectives of this session are to gather a broad scientific community dealing with reefs and bioconstructions in the largest possible sense, the organisms, which constructed them, the processes and factors, which controlled their formation and demise, the depositional environment, their diagenetic history, and their stratigraphic context.

- **CB1.9/SS6.4 CARBONATE PRODUCTION AND ACCUMULATION: FROM OBSERVATIONS TO NUMERICAL MODELING**

Conveners. Baptiste SUCHÉRAS-MARX, Yannick DONNADIEU and Jean BORGOMANO (CEREGE Aix-Marseille, FRA), Stephan BODIN (Århus University, Århus, DNK)

Description. Over the Earth's history, oceanic carbonate production has shown large changes in terms of global accumulation rate but also in terms of spatial distribution. The evolution of chemical conditions in the ocean, modifications of the accommodation space and evolutionary processes induced changes in biological activity are the most common forcing factors incriminated to explain those changes.

This session will discuss carbonate production in neritic realm (e.g. the emergence and demise of different neritic carbonate factories through time) and in pelagic realm (e.g. the emergence of the pelagic carbonate production) and will tend to highlight physical mechanisms (e.g. temperature, sea-level), chemical mechanisms (e.g. ocean saturation state, migration of the CCD) and biological mechanisms (e.g. evolution of

new producers) forcing the global carbonate production variations. We are particularly interesting in gathering together field geologists, geochemists and modelling specialists to emulate discussions over this scientific question.

SYMPOSIUM CSP₂ - CLASTIC SEDIMENTARY PROCESSES

Chairs. Frédéric CHRISTOPHOUL (University of Toulouse III - GET, FRA), Cédric BONNEL (University of Pau, FRA), Thierry MULDER (EPOC Bordeaux, FRA), Janrik VAN DEN BERG (University of Utrecht, NLD)

Clastic sediments represent the major part of sediments preserved in the sedimentary record. They represent a great variety of sedimentary systems ranging from deep marine, such as turbidites and contourites, shallow marine, coastal, including deltaic and estuarine and continental systems such as fluvial, lacustrine, eolian and coastal (including deltas and estuaries). In geological time scales, these systems record autocyclic processes as well as external forcing. The expression of these processes can be evidenced by the study of modern system and/or modeling and is deduced from the sedimentary record in ancient systems.

This symposium involves a huge community of sedimentologists working with a great variety of approaches (field, geophysical data interpretation, borehole data, cores and modeling). This theme is broad and we encourage contributions dealing with case studies in modern and ancient as well as analog and numerical modeling of processes in marine and non-marine aquatic systems in any relevant time scale.

- **CSP2.0 OPEN SESSION ON CLASTIC SEDIMENTARY PROCESSES**

Conveners. Frédéric CHRISTOPHOUL (University of Toulouse III - GET, FRA), Cédric BONNEL (University of Pau, FRA), Thierry MULDER (EPOC Bordeaux, FRA), Janrik VAN DEN BERG (University of Utrecht, NLD)

Description. This open session invites contributions on the general topics related to Clastic Sedimentary Processes. It is an opportunity to present studies that do not fall within research covered by the special sessions CSP2.1 to CSP2.12.

- **CSP2.1 SHORT-TERM EVOLUTION AND SEDIMENTARY AND/OR HUMAN CONTROLS OF COASTAL DEPOSITIONAL SYSTEMS: LESSONS GAINED FROM ANCIENT TO HOLOCENE EXAMPLES**

Conveners. Daniela RUBERTI (Campania University "L. Vanvitelli", ITA), Mikkel FRUERGAAARD (Geological Survey of Denmark & Greenland, DNK), Ernesto SCHWARZ (University of La Plata & CONICET, ARG), Clément POIRIER (University of Caen, FRA)

Description. Coastal areas of the world are often densely populated and human activities have extensively modified coastal landscapes and ecosystems, leaving traces also in the sedimentary record. Coastal depositional environments are important in the geological record where oil, gas and water exist in large quantities in reservoir sands of ancient depositional environments. Successful and sustainable management and exploration of both modern and ancient coastal environments relies on a comprehensive knowledge of the sedimentary and human factors controlling coastal evolution.

This session aims to explore the causes and consequences of factors and processes operating on short-term scales on the evolution of coastal depositional systems (hours-days to 10s kyr), ranging from changes in hydrodynamics, sedimentology, or ecology of the system, to sea-level, climate, and/or tectonic modifications. For the Holocene sedimentary evolution of coastal settings, this session also seeks to present contributions distinguishing between natural and anthropogenic controlling factors. We encourage studies addressing a wide range of spatial and temporal scales, applying state of the art methodologies and covering all types of

coastal environments. Interdisciplinary studies are strongly encouraged as they provide the basis for a sustainable management.

- **CSP2.2/SS6.5 PROVENANCE, WEATHERING AND SORTING: DISENTANGLING THE PARAMETERS CONTROLLING SEDIMENT COMPOSITION**

Conveners. *Sebastien BERTRAND (Ghent University, BEL), Inka MEYER (Ghent University, BEL), Janna JUST (University of Cologne, DEU), Gert Jan WELTJE (University of Leuven, BEL)*

Description. Sediment composition is controlled by several independent variables that are intrinsically difficult to disentangle. Those parameters include the nature of the sediment sources, climate, and the pathways by which sediment is transferred from the source to the site of deposition. Unravelling the signature of each of these parameters is critical to understand modern sediment dynamics as well as to generate accurate paleo-reconstructions from sediment records. It is also a prerequisite for the quantitative analysis of Earth-surface processes. Thanks to development of sophisticated analytical techniques in the last decades, Earth scientists have now access to a wide range of tools to quantify sediment properties and ultimately isolate the signature of individual processes.

With this in mind, this session aims to gather scientists from the broad field of sediment composition analysis, and more particularly those focusing on understanding the sedimentary signature of provenance and transport processes. We welcome studies that explore new analytical tools, and we encourage presentations combining laboratory measurements with numerical techniques. We welcome contributions that present reconstructions of provenance, weathering and sorting in both modern sediments and ancient sedimentary records.

- **CSP2.3/SS6.6/SR7.10 QUANTITATIVE ANALYSIS OF SEDIMENT GENERATION, PROVENANCE, AND DIAGENESIS: KEYS TO RECONSTRUCTION OF EARTH-SURFACE PROCESSES AND RESERVOIR-QUALITY PREDICTION**

Conveners. *Luca CARACCILO (FAU University Nürnberg-Erlangen, DEU), Gert Jan WELTJE (University of Leuven, BEL), Eduardo GARZANTI (University of Milan-Bicocca, ITA), Bill HEINS (ExxonMobil Houston, USA)*

Description. The ability to trace sediments from their sources to sedimentary basins is a prerequisite for quantitative analysis of Earth-surface dynamics. The comparatively recent revival of sedimentary provenance analysis has greatly benefitted from the continuously expanding range of tools to quantify sediment properties (isotopic, mineral, chemical, and petrographic composition, grain-size, -shape, and -density distributions, age spectra, etc.) and interpret such data in paleo-geographic, -tectonic and -climatic terms. The breakdown of sediment budgets into source-specific contributions, which is one of the most important tasks of quantitative provenance analysis (QPA), permits quantification of rates of surface processes in the geological past ("deep time"), even in cases where source areas have been destroyed by global tectonics. QPA is therefore crucial to the reconstruction of ancient sediment-routing systems, the fundamental units of mass transfer at the Earth's surface. In terms of applications, QPA fulfils a key role in the prediction of sediment properties at the time of deposition, and their diagenetic pathways which determine reservoir quality.

Early diagenetic modifications (grain rearrangement and early cementation) are controlled by the combination of sediment characteristics (mineral/grain composition as a function of size) and the nature of the depositional environment, which can only be understood by integration of sedimentary petrology with sedimentology. Sediment characteristics and depositional facies also control further diagenetic modifications during deep burial, which may give rise to wholesale dissolution of primary and secondary phases, and precipitation of late cements. All of these factors together determine the final properties of ancient sediments, and may limit the extent to which reconstruction of initial sediment properties is feasible.

One of the long-standing obstacles to modelling of the spatial distribution of sediment properties is the selective nature of grain entrainment, transport, and deposition, which gives rise to joint compositional-textural variations that are not of primary concern to those who wish to reconstruct provenance, but are key to predicting spatial variation of reservoir quality. Finding ways to navigate these complexities is one of the

most challenging tasks of sediment-generation studies, and the subject of ongoing research on modern sediments in particular, which do not suffer from diagenetic overprinting.

In this session we welcome all contributions dealing with the above themes. We aim to provide a broad overview of pertinent problems in the field, and hopefully, of solutions to some of them. We invite you all to contribute to this session, which is aimed at charting the state of the art and pointing the way forward in the field of sediment-property analysis for geological reconstructions and reservoir-quality prediction.

- **CSP2.4 LACUSTRINE DEPOSITIONAL SYSTEMS**

Conveners. Steven ANDREWS (CASP, GBR), Mathieu SCHUSTER (IPG Strasbourg, FRA), Marc De BATIST (Ghent University, BEL), Alexis NUTZ (Århus University, Århus, DNK)

Description. Lacustrine basins provide an ideal natural laboratory for the study of depositional systems and their response to environmental change. Unlike their larger marine counterparts greater control on the inputs and outputs to the basin can be achieved. Lacustrine basins therefore provide a unique opportunity to investigate long term climatic change and recurrence intervals of geological events both of which have significant human impact. Furthermore, lacustrine basins have significant resource potential around the world and therefore understanding facies distributions within these settings is important.

This session aims to be inclusive of all aspects of lacustrine sedimentology from lake shore zone dynamics to high resolution deep water records of geological events, all of which build towards increasing our knowledge of lacustrine depositional systems and updating our lacustrine facies models.

- **CSP2.5 SEDIMENT DENSITY FLOWS IN SILICICLASTIC, PYROCLASTIC AND CALCICLASTIC SETTINGS: PROCESS AND PRODUCT**

Conveners. Matthieu CARTIGNY (Durham University, GBR), Guilhem DOUILLET (Ludwig-Maximilians-Universität, Munchen, DEU), Joris EGGENHUISEN (Utrecht University, NLD), Thierry MULDER (University of Bordeaux, FRA)

Description. Sediment density flows are sediment-laden geophysical currents that flow down-slope due to gravity acting on the sediment they carry. This session aims to compare and contrast the processes and deposits of density flows in different settings. We welcome contribution on flow types that include landslides, debris flows, grain flows, turbidity currents, pyroclastic flows and snow avalanches.

This session aims to investigate the similarities and differences between all these types of flows and their sedimentary deposits over a wide range of settings and sediment types. We invite contributions from modern and ancient environments as well as experimental and numerical simulations examining the generation, transport, flow and sedimentation processes within sediment density flows. This session has the intention to bring together field and modelling contributions, to explore the fascinating dynamics of these flows, and the link to their deposits.

- **CSP2.6/SS6.7 EOLIAN SYSTEMS AND THEIR PRESERVED SUCCESSIONS: PROCESSES, PRESERVATION IN TIME AND SPACE, RESPONSE TO CLIMATIC AND TECTONIC CONTROLS, AND IMPLICATIONS FOR SOURCE-TO-SINK SEDIMENT DISTRIBUTION**

Conveners. Sylvie BOURQUIN (University of Rennes 1, FRA), Nigel MOUNTNEY (University of Leeds, GBR), Clément NARTEAU (IPG Paris, FRA)

Description. Eolian systems and their preserved deposits are widespread both across the present-day earth surface and throughout much of the ancient geologic record. However, eolian systems are not currently adequately accounted for in source-to-sink models, despite their important role as sediment stores. Eolian system accumulation and preservation arises in response to specific combinations of climatic and tectonic conditions.

This session aims to provide a broad overview of eolian processes and deposits, their various mechanisms of preservation throughout time and space, and their stratigraphic record in different geodynamic contexts, from the ancient geologic past to today. We seek to bring together both geologists and geomorphologists working on the dynamics of eolian sedimentary systems.

- **CSP2.7 COASTAL SEDIMENT DYNAMICS FROM PAST TO PRESENT**

Conveners. Jasper KNIGHT (University of the Witwatersrand, Johannesburg, ZAF), Edward ANTHONY (University of Aix-Marseille, FRA), Massimo MORETTI (Bari University, ITA)

Description. This session is focused on the physical aspects related with the erosive-erosional-sedimentary processes in various coastal environments. We suppose to cover a wide range of transitional to shallow-sea environments (i.e. beaches, barrier island systems, cliffs and coastal bluffs, deltas, sheltered bays, semi enclosed basins, coastal lagoons and marshes) analyzing the role of storm-waves, tides and currents in the short and long-term morpho-sedimentary evolution of coastal areas.

This session will host studies on ancient shallow-sea successions, present-day examples and numerical-analogical approaches. We encourage also interdisciplinary contributions that analyze the interactions between physical and biological processes in the sediment dynamics including the human impact on the coastal evolution.

- **CSP2.8 PALEOHAZARDS**

Conveners. Emmanuel CHAPRON (University of Toulouse II - GEODE, FRA), Geoffroy LAMARCHE, (NIWA, NZL), Jean-Luc SCHNEIDER (EPOC Bordeaux, FRA), Flavio ANSELMETTI (University of Bern, CHE)

Description. Marine and lacustrine basins are widespread around the globe and are being exposed to the full spectra of natural hazards. They represent key sedimentary environments, reinforced by the very good preservation of sedimentary records in the subaquatic realm. Of particular interest is the preservation of sedimentary events triggered by abrupt geological events over long time scales. Understanding and quantifying the sensitivity and exposure of such modern subaquatic basins to recent natural hazards is essential to pinpoint dominating sedimentary processes and to calibrate the sedimentary records of natural hazards over geological time scales. Modern marine and lacustrine basins can also help establish the regional impact of contrasted natural hazards since they can today be precisely mapped, sampled and dated.

This session aims to show case, discuss and improve our understanding of marine and lacustrine sedimentary records of earthquakes, tsunamis, volcanic eruptions, limnic eruptions, hurricanes, outburst floods and flash floods. We are particularly interested in multidisciplinary studies from data acquisition and novel methodologies for the study of sedimentary record providing encompassing view of the impact of natural hazards, their recurrence and associated driving forces.

- **CSP2.9/SB5.7 SEQUENCE STRATIGRAPHY IN GLACIOGENIC DEPOSITIONAL SYSTEMS**

Conveners. Jean-François GHIENNE (EOST Strasbourg, FRA), Daniel Le HERON (Royal Holloway University, London, GBR), Pierre DIETRICH (University of Johannesburg, ZAF)

Description. The sedimentary record is our main archive when investigating deep-time glaciation. Sequence stratigraphic models of glaciogenic successions differ considerably from non-glacial depositional systems owing to, for instances, significantly higher rates of sediment supply, complex patterns of relative sea-level change with competing glacioeustasy and glacioisostasy, recurrent high-magnitude outburst events, high-amplitude glacial erosion surfaces and related subglacial depositional systems.

This session intends to bring together geoscientists from paleoclimatology to reservoir engineering, showing how a better understanding of Earth's glacial record may be achieved by developing specific concepts for the unravelling of glaciogenic depositional sequences in sedimentary basins.

SYMPOSIUM PP₃ - PALEO-ENVIRONMENTS AND PALEO-CLIMATES

Chairs. Guillaume DERA (University of Toulouse III - GET, FRA), Emmanuel CHAPRON (University of Toulouse II - GEODE, FRA), Pierre PELLENARD (University of Bourgogne, FRA), Michael JOACHIMSKI (GeoZentrum Nordbayern Erlangen, DEU)

From Precambrian to modern times, climate and environmental changes have markedly paced the history of the Earth at different time scales. This includes shifts from greenhouse to icehouse modes, hyperthermal or snowball events, sea-level fluctuations, or disturbances in the carbon cycle and redox conditions, as well as abrupt climate changes during glacial or interglacial intervals and catastrophic events with large regional impacts. These changes are mirrored by profound modifications in the dynamics of marine and continental ecosystems documented in the sedimentary record.

The objectives of this symposium are to gather abstracts involving a broad scientific community to document and discuss the dynamic, timing and origin of environmental and climate changes at different time scales in order to better understand the driving forces of sedimentary processes on Earth. We encourage multidisciplinary studies for various geological periods combining sedimentary geology, stratigraphical methods, elemental, organic or isotope geochemistry, paleoecology, paleoceanography, as well as modelling. Abstracts devoted to new methodological perspectives in paleoenvironmental reconstructions (e.g., proxies for seawater temperature, pH, redox conditions, paleo-circulation, productivity, atmospheric pCO₂) are welcome. Abstracts focusing on well-dated paleohydrological changes using flood records and glacier or lake level fluctuations are appreciated. This will be also an opportunity to discuss, exchange, and debate sedimentary records and processes specific to the Anthropocene and ongoing global warming.

- **PP3.0 OPEN SESSION ON PALEO-ENVIRONMENTS AND PALEO-CLIMATES**

Conveners. Guillaume DERA (University of Toulouse III - GET, FRA), Emmanuel CHAPRON (University of Toulouse II - GEODE, FRA), Pierre PELLENARD (University of Bourgogne, FRA), Michael JOACHIMSKI (GeoZentrum Nordbayern Erlangen, DEU)

Description. This open session invites contributions on the general topics related to Paleo-Environments and Paleo-climates. It is an opportunity to present studies that do not fall within research covered by the special sessions PP3.1 to PP3.13.

- **PP3.1 LATE PALEOZOIC ENVIRONMENTS AND GLOBAL CHANGE**

Conveners. Christopher R. FIELDING (University of Nebraska-Lincoln, USA), Tracy D. FRANK (University of Nebraska-Lincoln, USA), Jonathan REDFERN (University of Manchester, GBR)

Description. This session aims to bring together those working on aspects of paleoenvironmental change in the late Paleozoic (Carboniferous and Permian periods), including but not restricted to the late Paleozoic Ice Age and the end-Permian mass extinction. We seek a broad range of contributions that utilize sedimentology, stratigraphy, sedimentary geochemistry, paleoecology, or any combination of those disciplines, to advance understanding of the dynamic late Paleozoic world.

- **PP3.2 THE PERMIAN-TRIASSIC TRANSITION AND THE ONSET OF THE MESOZOIC SEDIMENTATION**

Conveners. Sylvie BOURQUIN (University of Rennes 1, FRA), Arnaud BRAYARD (University of Bourgogne, FRA), Frédéric FLUTEAU (IPG Paris, FRA), Rossana MARTINI (University of Geneva, CHE), Alastair RUFFELL (Queen's University, Belfast, IRL)

Description. The end Permian was marked by the biggest known crisis of Earth's history and corresponds to major changes in oceans, continental surfaces and climate. The post-extinction biotic recovery dynamics during the Triassic is still under debate, both in continental and marine environments. These events are preserved in the sedimentological, geochemical and paleontological records of sedimentary basins, forming reliable archives retracing the history of the Earth in time and space.

This session aims to provide the broadest view of the global biological and ecological changes that occurred at the Paleozoic/Mesozoic boundary. Based on the stratigraphic record and integrated data obtained from sedimentary and biodiversity s.l. analyzes, geochemical tracers, as well as climate and biogeochemical modelling, the session will provide better paleoenvironmental reconstructions, constraining the climate evolution from the Permian to the Late Triassic.

- **PP3.3 JURASSIC-CRETACEOUS CLIMATES, (BIO)-EVENTS AND PALEOGEOGRAPHY: FROM DATA TO MODELLING**

Conveners. Pierre PELLENARD (University of Bourgogne, FRA), Emanuela MATTIOLI (University of Lyon 1, FRA), József PALFY (Eötvös University, HUN), Guillaume DERA (University of Toulouse III - GET, FRA)

Description. The Jurassic and Cretaceous periods were punctuated by several major climatic/environmental upheavals associated with biological crises (Triassic–Jurassic, T–OAE (Jenkyne Event), Weissert Event, OAE1a, OAE2), followed by recovery and radiations, but also by less well-known or minor climatic and paleoenvironmental changes, such as cold snap events in a broadly greenhouse climate, or minor carbon isotope excursions and anoxic events. The paleogeography associated with the progressive break-up of Pangaea, combined with volcanism and tectonism, played an important role in these events. Progress in stratigraphy (temporal framework, timing and correlation of events and durations) and the new methods used to decipher these environmental changes have modified our view of this fascinating period of time.

In this session, we invite contributions dealing with all these topics, stimulating interdisciplinary discussion (e.g. sedimentology, geochemistry, paleontology, stratigraphy), focusing on various sedimentary environments (whether continental or marine), and including new data, syntheses and models, leading to better understanding of the dynamic Jurassic-Cretaceous world.

- **PP3.4 TERTIARY CLIMATE AND PALEOENVIRONMENTAL CHANGES**

Conveners. Marc de RAFÉLIS (University of Toulouse III - GET, FRA), Fabrice MINOLETTI (ISTeP, FRA)

Description. Tertiary is a key period of Earth climate history spanning between a warm greenhouse Late Paleocene epoch and a cold icehouse Quaternary period. This global cooling led to modern climate with bipolar glaciation associated to low atmospheric pCO₂ and large latitudinal temperature gradients. During this period, plate tectonic, biosphere evolution, hydrosphere and atmosphere undergo major changes that are recorded in the sedimentary archives at different time-scales.

This session seeks contributions focused on both long and short-term studies of climate and paleoenvironmental changes. From multi-proxy analysis to climate modelling, of contributions are expected aiming at better understanding and constraining chronology, synchronism, dynamic and forcing parameters of the Tertiary climate history.

- **PP3.5 SOUTHERN EUROPEAN LAKE SEDIMENTS AS ARCHIVES AND OBSERVATORIES OF CLIMATE CHANGES AND HUMAN-ENVIRONMENT INTERACTIONS**

Conveners. Mario MORELLÓN (CITIMAC, Santander, ESP), Anaëlle SIMONNEAU (ISTO University of Orléans, FRA), Santiago GIRALT (CSIC-Institute of Earth Sciences Jaume Almera, ESP), Didier GALOP (University of Toulouse II - GEODE, FRA), Blas VALERO-GARCÉS (CSIC-Pyrenean Institute of Ecology, ESP)

Description. Both the Mediterranean basin and the adjacent areas of Southern Europe, such as the Pyrenees, have been subjected to significant climate fluctuations over the last millennia (from the Holocene to more recent times), and more particularly intense changes in the hydrological cycle. This region has also been densely populated since prehistoric times, experiencing different cultural trajectories which led, among others processes, to significant and different human-driven land managements through time. This area is therefore ideally suited to study both past long and short-term landscape transformations correlated with the complex interactions between climate variability and human activities. Lacustrine sediments have demonstrated to be one of the best continental continuous archives, in which high-resolution multi-proxy analysis and integrated approaches allow characterizing both climate, environmental and cultural changes in continental areas and their complex interplay.

This session aims to improve our understanding of these human-climate-environment interactions over Southern Europe by the compilation or the comparison of paleoclimatic, paleohydrological and paleoenvironmental records based on continental and coastal lake sediments and/or regional studies spanning the last millennia of the Earth's history. We particularly expect multidisciplinary studies dealing with monitoring data describing actual processes or Holocene reconstructions giving a global view of past ecosystem trajectories and associated driving factors.

- **PP3.6 SEDIMENTARY RECORDS OF QUATERNARY CLIMATE CHANGES IN MID LATITUDE MOUNTAINS AT DIFFERENT SPATIAL AND TEMPORAL SCALES**

Conveners. Magali DELMAS (University of Perpignan-Via Domitia, FRA), Christine PERRIN (MNHN Sete, FRA), Emmanuel CHAPRON (University of Toulouse II - GEODE, FRA), Laurence VIDAL (CEREGE Aix-Marseille, FRA), Vincent JOMELLI (University of Paris, FRA)

Description. Recent progress in mapping and dating technics of landforms and sedimentary sequences or deposits in both subaquatic and terrestrial environments allow tracking climate changes during the Quaternary and particularly over the last glacial cycle. Mid latitudes are today exposed to key large scale climatic features involving oceanic and atmospheric circulations and we need to better understand how global warming may impact continental areas. Multi proxy paleo records and modeling approaches are thus needed to take into consideration climate variability over variable time scales, and to better imagine our future.

This session will focus on responses of glacial, lacustrine, fluvial, karstic and marine systems to climatic changes in mid-latitude mountains and surrounding areas. Mountains are specific environments in several ways. The relatively small size of catchments facilitates the monitoring of sediment flux from source to sink, and thus help to unravel the coupling effects between glacial, lacustrine, karstic and fluvial systems. Moreover, environmental responses to climatic changes may be enhanced by degradation of climatic conditions with altitude, even if topo-climatic effects can disturb global climatic signals.

Accordingly, this session aims to host contributions dealing with glacial, lacustrine, fluvial, karstic and/or marine records. A large spectrum of biotic, geochemical and physical proxies is welcome for inferring a variety of climatic parameters, such as air temperature, precipitation, soil (or air) moisture, extreme hydrometeorological events, seasonality. In order to highlight the specificities/complementarities of each kind of record in term of paleo environmental reconstruction, we wish to discuss:

- 1) the temporal resolution and spatial significance of the paleo-records,
- 2) the reliability, precision and accuracy of dating methods in use,
- 3) the paleoclimatic proxies available from each sedimentary record,
- 4) the synchronism (or asynchronism) between mid-latitude mountain environmental changes and global isotopic records.

- **PP3.7/SB5.8 SEDIMENTARY RECORDS OF ANCIENT GLACIATIONS**

Conveners. Galen P. HALVERSON (McGill University, CAN), Susannah PORTER (University of California, Santa Barbara, USA), Graham SHIELDS (University College London, GBR)

Description. Glacial epochs are relatively rare in Earth's history but have recurred episodically since at least 2.9 Ga and played an important role in shaping the evolution of life and the environment. For example, global (snowball) glaciations at the beginning and end of the Proterozoic appear to be linked to increases in atmospheric O₂ and fundamental changes in the biosphere, whereas Paleozoic glaciations are associated with mass extinctions. The geological record of past ice ages has also been pivotal in reconstructing ancient paleogeographies and testing global climate models. Nevertheless, the geological evidence for ancient glaciations is commonly controversial and hypotheses for what triggered global cooling continue to be intensely debated.

The aim of this multidisciplinary session is to share and discuss new data bearing on the timing, causes, impacts, and sedimentary records of ancient glaciations—from the Archean to the Cenozoic. We seek submissions from diverse perspectives, including (but not limited to) the sedimentary and sequence stratigraphic imprint of glaciation, new chronometric constraints on the timing, timescale, and tempo of past glaciations, geochemical and fossil evidence informing the trigger mechanisms for global cooling, and modeling studies aimed at understanding glacial and deglacial processes. We further encourage submissions presenting novel approaches to reconstructing the extent and drivers for ancient glaciation.

- **PP3.8 PALEOENVIRONMENTAL RECONSTRUCTIONS: WHAT CAN BE LEARNT FROM AUTHIGENIC MINERALS?**

Conveners. Chloé MORALES (University of Utrecht, NLD), Karl FÖLLMI (University of Lausanne, CHE), Jörn PECKMANN (University of Hamburg, DEU), Gregory PRICE (Plymouth University, GBR), Nicolas TRIBOVILLARD (University of Lille 1, FRA)

Description. The formation of authigenic minerals (carbonates, phosphates, iron oxides, salts, etc.) results from microbially induced or abiotic processes that take place at or below the sediment-water interface. They can provide crucial insights on ambient environmental conditions and in-situ (bio)geochemical processes at the Earth surface and in deeper sedimentary layers.

In this session, we invite contributions focusing on various aspects of authigenesis, which range from the processes of mineral formation (biotic and abiotic), the disentangling of the effects of early and late diagenesis, their relationship with paleoceanographic and paleoclimate settings and/or their potential for paleoenvironmental reconstructions

- **PP3.9 PALEOCLIMATES AND PALEOENVIRONMENTS: DATA VS. MODELS**

Conveners. Yannick DONNADIEU (CEREGE Aix-Marseille, FRA), Yves GODDÉRIIS (CNRS - GET, FRA), Paul VALDES (University of Bristol, GBR), Ros RICKABY (University of Oxford, GBR), Emmanuelle PUCÉAT (University of Bourgogne, FRA)

Description. Recent years have seen major advances in many geochemical techniques and an increase in the complexity of Earth System Models. The aim of this session is to share progress in our understanding of global climate changes occurring during the pre-Quaternary based on the integration of geochemical/paleobotanical/sedimentary techniques and numerical models. The geological record provides insight into how climate processes and the carbon cycle may operate and evolve in a high CO₂ environment and the nature of the climate system during a turnover from glacial to greenhouse state — a transition that may potentially occur in the near future.

We seek abstracts that reconstruct Earth's climate and the carbon cycle, investigate how the interconnections of the key surface reservoirs impact climate (vegetation-ocean-atmosphere), identify climatic tipping points and thresholds, and explore the climate response to extraordinary events. Pertinent themes may include past episodes of glaciation and deglaciation, greenhouse-icehouse transitions and intervals of high atmospheric CO₂, and rapid or abrupt climate transitions.

SYMPOSIUM RTS₄ - READING TIME IN SEDIMENTS

Chairs. Carine LÉZIN (University of Toulouse III - GET, FRA), Mathieu MARTINEZ (University of Bremen, DEU), Luis Vitor DUARTE (University of Coimbra, PRT)

This theme gathers sessions illustrating the various approaches and disciplines allowing determining the age of sedimentary rocks, chronology and durations of events using paleontological, mineralogical, and chemical data, facies contents, rock physical properties, and sequence and cyclic stratigraphy. The theme also aims to attract studies dealing with the construction of chronostratigraphic scales. Integrated and innovative approaches will be particularly appreciated.

- **RTS4.0 OPEN SESSION ON READING TIME IN SEDIMENTS**

Conveners. Carine LÉZIN (University of Toulouse III - GET, FRA), Mathieu MARTINEZ (University of Bremen, DEU), Luis Vitor DUARTE (University of Coimbra, PRT)

Description. This open session invites contributions on the general topics related to Reading Time in Sediments. It is an opportunity to present studies that do not fall within research covered by the special sessions RTS4.1 to RTS4.4.

- **RTS4.1/PP3.12 CONTINENTAL TRACE FOSSILS AS TOOLS IN STRATIGRAPHY AND ENVIRONMENTAL INTERPRETATION**

Conveners. Jennifer SCOTT (Mount Royal University Calgary, CAN), Mathieu SCHUSTER (IPG Strasbourg, FRA)

Description. Biogenic structures produced by living organisms have proven to be exceptionally valuable for paleoenvironmental reconstructions and stratigraphic analyses. Most studies of trace fossils focus on the marine realm, whereas scant attention has been on trace fossils in the continental domain.

This session is interested in the description, classification, interpretation, and/or application of trace fossils preserved in continental or marginal marine settings (e.g., lacustrine, fluvial, eolian, soils, deltaic, estuarine). All studies including trace fossils in the geological record, modern environments, lab experiments, or imaging techniques are most welcome.

- **RTS4.2 DIACHRONISM IN THE PALEONTOLOGICAL RECORD: PITFALL OR PALEOCEANOGRAPHIC TOOL?**

Conveners. Nicolas THIBAUT (University of Copenhagen, DAN), Mathieu MARTINEZ (University of Bremen, DEU)

Description. Biostratigraphy is the historical and primary standard tool to correlate and assign relative ages to rock strata. The widespread use of other techniques (chemostratigraphy, magnetostratigraphy, high-precision radiometric dating and cyclostratigraphy), and the need for integrated stratigraphy have sometimes highlighted the existence of diachronism of bio-events. Numerous examples of diachronous bio-events are documented in the paleontological record but rarely constitute the focus of research studies and/or remain controversial. The high-precision of the recent Geologic Time Scale obtained mostly from the great precision

of new radiometric dating and through astronomical calibration calls for a more thorough examination of the synchronicity of bio-events. Rather than being regarded as pitfalls, examples of diachronism should be considered as tools with a great potential for paleoceanography as they are often associated with important changes in the paleobiogeographic distribution of taxa which are triggered by changes in ocean currents, climate, continent configuration and/or sea-level.

The purpose of this session is to welcome presentations that focus on diachronism of bio-events in the geological record with the aspiration to diffuse such examples more widely in the geological community as we believe that this topic is one of the critical issues for the next generation of Geologic Time Scales.

- **RTS4.3 READING GEOLOGICAL TIME - CLIMATE AND CYCLOSTRATIGRAPHY**

Conveners. *Matthias SINNESAEEL (Vrije Universiteit Brussel, BEL), Luis VALERO (Universitat Autònoma de Barcelona, ESP), Elise NARDIN (CNRS - GET, FRA), Anne-Christine da SILVA (Universities of Liège and Utrecht, BEL/DNK)*

Description. Cyclostratigraphy is a powerful chronometer, based on the detection of the Milankovitch cycles (obliquity, precession and eccentricity) in the sedimentary record. Those cycles result from periodic variations in the Earth-Sun system, affecting the distribution of solar energy over the Planet influencing Earth's climate on time scales between 10^4 and 10^6 years. Cyclostratigraphy also allows to shed new light on the past climatic system and to better understand the interaction between the climatic system and global biotic or geochemical events.

This session is open to cyclostratigraphic related research in all its forms: methodological work, modelling and stratigraphic case-studies. Equally appreciated are contributions related to a wide-range of paleoclimatic studies on astronomical climate forcing.

- **RTS4.4 SEDIMENTOLOGY AT THE FOREFRONT OF THE ANTHROPOCENE**

Conveners. *Eric CHAUMILLON (University of La Rochelle, FRA), Fabien ARNAUD (University of Savoie Chambéry, FRA), Brice MOURIER (Ecole nationale de travaux Publics de l'Etat Vaulx en Velin, FRA), Catherine JEANDEL (CNRS - LEGOS, FRA), Blas Valero-Garces (University of Zaragoza, ESP)*

Description. The onset of the concept of Anthropocene has been presented as a rising challenge for geosciences which are now urged to integrate Humans as an active geological agent in their way of depicting and understanding processes at the surface of Planet Earth. Whereas taking account of human-triggered forcing factors is not really new for sedimentologists, their contribution is now challenged to address environmental issues.

In that session we welcome sedimentological study in which humans are considered as forcing factors. This could involve, for instance and non-exclusively, sediment-based reconstructions, present-day marine and continental processes studies, sediment contamination and contribution on the definition of the Anthropocene stratigraphic and chronological status.

SYMPOSIUM SB₅ - SEDIMENTARY BASINS

Chairs. *Martin RODDAZ (University of Toulouse III- GET, FRA), Cécile ROBIN (University of Rennes 1, FRA), Jaume VERGES (ICTJA - CSIC in Barcelona, ESP), Eric LASSEUR (BRGM Orléans, FRA)*

Sedimentary basin deposits contain the archives of the interactions between surface and deep processes. Plate Tectonics is the most appropriate scale to establish the geodynamic framework of sedimentary basins that form in a great variety of contexts: both on continental and oceanic crust and within divergent, convergent, transform settings (or any combination of those). These basins can also be associated to salt processes complicating the overall basin analysis. The geometry of the sedimentary basin, of its boundaries and tectonic surroundings, as well as its internal structure and its sedimentary record allows defining the tectonic scenario in which the basin formed and can be imaged using 2D and 3D seismic. Moreover, the huge

amount of information contained in the sedimentary record allows for the analysis of a wide range of parameters required to define the tectonic and climatic histories depending on the quality its outcrop or/and subsurface data. However, the intimate relationships between surface and deep processes (tectonics, sedimentary, climatic, or surficial) ultimately defining the geometry, the stratigraphic and depositional structure of the basin requires multidisciplinary studies.

This theme therefore seeks studies with approaches integrating different geoscience fields at any time scales (from the Precambrian to the Present) as well as those focused on more specific processes.

- **SB5.0 OPEN SESSION ON SEDIMENTARY BASINS**

Conveners. *Martin RODDAZ (University of Toulouse III - GET, FRA), Cécile ROBIN (University of Rennes 1, FRA), Jaume VERGES (ICTJA - CSIC in Barcelona, ESP), Eric LASSEUR (BRGM Orléans, FRA)*

Description. This open session invites contributions on the general topics related to Sedimentary Basins. It is an opportunity to present studies that do not fall within research covered by the special sessions SB5.1 to SB.10.

- **SB5.1 RECENT ADVANCES IN 3D SEISMIC STRATIGRAPHY: FROM SEDIMENTARY PROCESSES TO BASIN STUDIES**

Conveners. *Tiago ALVES (Cardiff University, GBR), Julien BOURGET (University of Western Australia, AUS), Patrice IMBERT (TOTAL, FRA)*

Description. Forty years from the publication of the seminal AAPG Memoir introducing Seismic Stratigraphy (Payton, 1977), and just over a decade from the first publications demonstrating the potential of three-dimensional seismic analysis for academic research, where are we at with 3D Seismic Stratigraphy? This session will focus on the application of 3D seismic stratigraphy and imaging for characterizing sedimentary basins at all scales, from sedimentary processes (continental, shallow marine and deep marine environments of both carbonate and siliciclastic settings) to diagenesis, fluid flow and tectono-stratigraphy.

The session will aim at showcasing the latest technologies and concepts in 3D seismic interpretation, with an emphasis on innovative workflows and integrated studies, including basin-scale 3D seismic stratigraphy studies and outcrop-seismic correlations.

- **SB5.2 SUBDUCTION-RELATED BASIN DYNAMICS**

Conveners. *Julien BAILLEUL (UniLaSalle, FRA), Frank CHANIER (Université de Lille 1, FRA), Alejandro ESCALONA (University of Stavanger, NOR)*

Description. On active margins, subduction processes (e.g., motion and coupling of the downgoing slab) are controlling the development of imbricated thrust wedge and therefore controls the distribution and the evolution of sedimentation on the lower trench slope. Thus, the sedimentary infill of subduction-related sedimentary basins, including the trench and the forearc basin, may have recorded the evolution of tectonic activity, as well as climatic and eustatic signatures. Convergent margins also display oil and gas seeps, methane expelling mud volcanoes, gas chimneys and hydrates illustrating the importance of fluids migrations in such geological systems.

This session is dedicated to all presentations providing new results, whatever the time span, that allow to:

- 1) unravel tectonics - sedimentation - climate interactions in order to better understand and quantify the controlling parameters on the stratigraphic architecture of subduction-related basins;
- 2) assess the relationships between the distribution and/or migration of the deformation and basin geometries, subsidence and thermal evolution;

- 3) take into account fluids migrations within the subduction wedge in integrated models;
- 4) bring new insights linking the thermo-tectono-stratigraphic evolution of subduction-related basins to variations in subduction processes (e.g., modifications of the terrigenous flux within the trench, or changes in the kinematics or thickness of the downgoing slab).

Studies that examine the sedimentary record of paleo-earthquakes and document large submarine slides in subduction settings are also very welcome.

- **SB5.3/SS6.8/SR7.11 SEDIMENTOLOGICAL, STRATIGRAPHIC AND GEOMORPHIC RECORD OF OROGEN-FORELAND DYNAMICS (OROGEN)**

Conveners. Sébastien CARRETIER (IRD - GET, FRA) Stéphane BONNET (University of Toulouse III - GET, FRA), Sébastien CASTELLTORT (University of Geneva, CHE), Emmanuel MASINI (TOTAL, FRA)

Description. Our session aims to bring together sedimentologists, geomorphologists, and structural geologists with broad interests in surface processes in sediment routing systems of convergent zones:

- 1) Propagation of tectonic and climatic signals from source to sink and sink to source, with delays, time lags, dampening, shredding and other autogenic transformations of the primary signals along the sedimentary system.
- 2) Field studies as well as conceptual, theoretical and laboratory models illustrating mountain-foreland couplings over time scales covering thousands to millions of years.
- 3) Analyses of the structure and stratigraphic architecture of foreland basins and of the stratigraphic expression of sedimentary systems to climatic and tectonic perturbations.
- 4) Studies based on thermochronometric, cosmogenic, paleohydraulic, provenance and sediment budget calculations.
- 5) Focus studies of foreland and foothills dynamics, source to sink and their applications in geomorphology, tectonics and sequence stratigraphy.

- **SB5.4/SS6.9/SR7.12 EXTENSIONAL TO TRANSTENSIONAL BASINS: RIFTS AND PASSIVE MARGINS (PAMELA-ACTION MARGE)**

Conveners. Cécile ROBIN (University of Rennes 1, FRA), Christophe BASILE (ISterre, FRA), Sylvie LEROY (ISTeP, FRA), Leni SCHECK-WENDEROTH (GFZ Potsdam, DEU)

Description. The mechanism of continental break-up, from the formation of rifts to passive continental margins (divergent to transform), and their consequences on the geometry of the sediment infilling, are still poorly understood. Several European programs (in France Actions Marges and PAMELA programs) addressed these questions which provide new observations, models and concepts. In this session we want to address several key points:

- 1) the 3D crustal geometry of rifts and continental margins: what are the factors that control and explain their diversity?
- 2) the vertical displacements: what are the mechanisms of uplift and subsidence in the rift and continental margins in both the basins and the upstream catchments?
- 3) the first order geometry of the stratal pattern of rifts, divergent margins and oblique to transform margins,
- 4) the interactions between lithosphere deformation, climate, surface processes (erosion-sedimentation) and topography (aerial and subaqueous).

We encourage contributions aiming to present observations, quantifications and/or modeling addressing these questions, with special attention to the coupling processes.

- **SB5.5/SS6.10 INTERACTIONS OF SEDIMENTATION AND TECTONICS**

Conveners. Mary FORD (CRPG Nancy, FRA), Vincent REGARD (University of Toulouse III - GET, FRA), Brian Horton (Jackson School of Geosciences Austin, USA)

Description. Tectonic and sedimentary processes are intimately linked throughout basin development on all scales of time and space. This session focuses on interactions of sedimentation and tectonics on the scale of individual structures such as folds, faults and diapirs of salt and shale in all basinal settings. Growth or syntectonic strata are deposited during deformation. Syn-depositional tectonic activity intimately controls sedimentation patterns. Many studies have provided important insight into the impact of growth structures on facies and thickness distributions. Sedimentation, in turn, influences deformation, for example, enhancing or damping deformation distribution by mass flux or by controlling deformation style through mechanical stratigraphy. Over the last 20 years the study of growth strata has also provided first order constraints on quantifying deformation distribution, timing, rates, kinematics and mechanisms.

For this session we invite contributions presenting new studies on these topics based on field or subsurface data, numerical or analog modeling.

- **SB5.6/SS6.11/SR7.13 ADVANCES IN SOUTH AMERICAN CONTINENTAL BASINS**

Conveners. Martin RODDAZ (University of Toulouse III - GET, FRA), Roberto VENTURA SANTOS (Universidade de Brasilia, BRA), Patrice Baby (IRD - GET, FRA)

Description. This session is dedicated to multidisciplinary studies of Precambrian to Cenozoic South American basins. It aims to present new findings and developments related to these basins. Are expected:

- 1) contributions about the evolution of foreland basins under different climatic settings and/or changing geodynamic conditions (e.g. influence of flat-slab subduction), as well as
- 2) contributions about sedimentary and tectonic evolution of intracratonic basins, such as the Paraná, Parnaíba, Amazon (Solimoes) and marginal basins including their potential for oil and gas.

The scope is broad so we seek synthetic multidisciplinary studies contributions regarding one or more of these aspects although representative case study contributions are also welcome.

SYMPOSIUM SS6 - SOURCES AND SINKS

Chairs. Stéphane BONNET (University of Toulouse III - GET, FRA), François BAUDIN (University of Paris VI, FRA), Sébastien CASTELLORT (University of Geneva, CHE), Daniel GARCIA-CASTELLANOS (ICTJA - CSIC in Barcelona, ESP)

The quantification of sediment budget from sedimentary basin analysis offers the unique opportunity to constrain the dynamics of mass transfers at the Earth surface, including the denudation and production of sediments in erosional landscapes where very few direct archives exist, their transfer and storage throughout the fluvial system, and their eventual partitioning within the different segments of the depositional profile. Such analyses are also fundamental to quantify budgets of solute and particulate loads of importance for the chemical composition of sediment as well as organic carbon distribution and burial. Further, source-to-sink perspectives are now widely used in exploration of resources. This holistic approach requires an advanced understanding of all the components of the sediment routing system, and particularly of the modulation of the sediment flux signal as it propagates through the routing system and of its expression in sedimentary basins in term of facies and architectures. This approach must examine siliciclastic, carbonate and organic matter separately and all together to achieve a complete budget of the sedimentary system.

We solicit studies that will address all the facets of source-to-sink analysis, from the study of processes, multidisciplinary integrated approaches of natural case studies, to numerical and physical modelling. Studies

dedicated to methodology and/or to innovative techniques for quantifying sediment budgets and transfers are also welcome.

- **SS6.0 OPEN SESSION ON SOURCES AND SINKS**

Conveners. Stéphane BONNET (University of Toulouse III - GET, FRA), François BAUDIN (University of Paris VI, FRA), Sébastien CASTELLTORT (University of Geneva, CHE), Daniel GARCIA-CASTELLANOS (ICTJA - CSIC in Barcelona, ESP)

Description. This open session invites contributions on the general topics related to Sources and Sinks. It is an opportunity to present studies that do not fall within research covered by the special sessions SS6.1 to SS6.12.

- **SS6.1/CB1.10/CSP2.10 MULTISCALE APPROACH: A KEY FOR BETTER ASSESSMENT OF SEDIMENTARY DRIVING FORCES?**

Conveners. Claude COLOMBIÉ (University of Lyon 1, FRA), Bernadette TESSIER (CNRS, University of Caen Normandie, FRA), Joep STORMS (Delft University of Technology, NLD), Anaëlle SIMONNEAU (ISTO, University of Orléans, FRA)

Description. Sedimentation depends on environmental (i.e., physical, chemical or biological), tectonic or climatic (i.e., cyclic or episodic) controls that act at different spatiotemporal scales. While extensive studies (i.e., a region on a few tens to thousands to millions of years) allow the assessment of global or regional controlling factors, restrictive studies (i.e., a site on a few centuries to a few years) focus on defining regional or local factors.

Therefore, multiscale approach seems to be the best way to define the broadest range of controlling factors of sedimentary, oceanic, atmospheric or ecosystems.

- **SS6.2/SR7.14 NEW INSIGHTS INTO THE NUMERICAL STRATIGRAPHIC FORWARD MODELING OF SEDIMENTARY SYSTEMS FROM DEPOSITIONAL ENVIRONMENTS TO SOURCE-TO-SINK SCALE.**

Conveners. Didier GRANJEON (IFP Energies Nouvelles, FRA), Erwan LE GUERROUÉ (Beicip-Franlab Paris, FRA), Cédric M. JOHN (ESE Imperial College London, GBR)

Description. This session addresses the numerical modeling of sedimentary systems at different temporal and spatial scales in order to predict facies and property distributions in a sequence stratigraphic framework. It aims to bring together a wide range of studies focusing on clastic, carbonate and evaporite depositional environments. Contributions addressing numerical modeling of major processes affecting the production, transport and deposition of sediments at a source to sink scale are especially encouraged (from weathering and early diagenesis to fluvial, coastal and deep-water sediment transport).

We aim to balance academic approaches to industrial applications to provide an updated view of the contribution of stratigraphic forward models to our understanding of sedimentary systems and assessment of natural resources.

- **SS6.3/CSP2.11/SB5.9 ALLUVIAL TO FLUVIAL DYNAMICS: A KEY ELEMENT IN SOURCE-TO-SINK QUANTIFICATION**

Conveners. Sébastien ROHAIS (IFP Energies Nouvelles, FRA), Laure GUÉRIT (University of Toulouse III- GET, FRA), Poppe de BOER (Utrecht University, NLD)

Description. Understanding how sediments are eroded, transported and deposited by rivers and in the sea is fundamental for identifying the relationship between drainage dynamics (sources) and the filling history of sedimentary basins (sinks), at all scales. Stratigraphic architecture of alluvial to fluvial systems is the very first

sedimentary record at the outlet of the drainage area, and provides the record of relief history and sediment by-pass. Laboratory experiments provide an additional wealth of information and help to investigate the processes involved in landscape evolution, as well as the record of sedimentary sequences.

The session is focused on field studies and laboratory experiments that contribute to our knowledge on sediment production, fluvial dynamics, and stratigraphic architectures. We particularly welcome works on:

- 1) sedimentation processes in alluvial fans and deltas;
- 2) sediment production in (high) relief / drainage areas, in relation to lithology, climate and tectonics;
- 3) fluvial processes and sediment by-pass;
- 4) the relation between fluvial systems and their associated sedimentary basins (final sink).

SYMPOSIUM SR7 - SEDIMENTOLOGY AND RESOURCES

Chairs. Julien BAILLEUL (UniLaSalle, FRA), Philippe JOSEPH (IFP Energies Nouvelles, FRA), Patrice IMBERT (TOTAL, FRA)

The objective of this theme is to bring together sessions ranging from academic approaches to exploration-production studies to provide a state of the art of our current understanding of sedimentary and stratigraphic processes building: petroleum systems, sedimentary-hosted mineralization including relationships between continental weathering and ore deposits, outcrop analogs of deep reservoir geology, unconventional energy and carbon sequestration.

We also welcome studies dedicated case histories of joint industry-academia research and knowledge transfer including environmental impacts of petroleum activities.

• SR7.0 OPEN SESSION ON SEDIMENTOLOGY AND RESOURCES

Conveners. Julien BAILLEUL (UniLaSalle, FRA), Philippe JOSEPH (IFP Energies Nouvelles, FRA), Patrice IMBERT (TOTAL, FRA)

Description. This open session invites contributions on the general topics related to Sedimentology and Resources. It is an opportunity to present studies that do not fall within research covered by the special sessions SR7.1 to SR7.13.

• SR7.1/SS6.12 ROLE OF DEPOSITIONAL ENVIRONMENT AND CLIMATE IN THE FORMATION OF CONTINENTAL SEDIMENTARY-HOSTED ORE DEPOSITS: PLACER (Au), EXOTIC (Cu) AND OTHERS

Conveners. Rodrigo RIQUELME (Universidad Católica del Norte, CHL), Sébastien CARRETIER (IRD - GET, FRA), Alberto FERNÁNDEZ-MORT (Universidad Católica del Norte, CHL & Universidad Complutense de Madrid, ESP)

Description. The deposition of continental sedimentary successions is occasionally accompanied by different types of ore mineralization. These mineralization processes vary, for instance, from mechanical concentration of heavy minerals (e.g. gold, diamonds) to ore minerals precipitation from ore-bearing solutions (e.g. copper, iron). All of these ore deposits occur within sedimentary deposits of various ages (from Precambrian to Present day) and can be formed within variable depositional settings (from alluvial fan to coastal environments) and under different climatic conditions (from hyperarid to humid).

This session aims to expose diverse study cases which reveal the importance of the environmental and climatic conditions during the formation of these continental sediment-hosted ore deposits. This session is proposed by the French Chilean research project LMI-COPEDIM (COpper and PEDIMents), that tries to link the formation of supergene and exotic-Cu ore deposits in Northern Chile with the sedimentary, geomorphologic

and paleoclimatic evolution of the Atacama Desert. This session also attempts to show how these kinds of researches can be very valuable as an exploration tool for mining industry.

- **SR7.2 ORE GEOLOGY IN SEDIMENTARY REALM**

Conveners. Olivier PARIZE (AREVA, France), El Hassane CHELLAI (UCA, MAR)

Description. We propose that the session dedicated to the ore geology in sedimentary realm during this international meeting of sedimentology, groups all contribution topics between these two end members:

1) Sedimentary control of ore deposits to characterize the function of the geometry of the ore deposits and its relationships with the effect of textural parameters of the host formations such as their lithological domain (siliciclastic versus calcareous), grain size, sorting, or their depositional environment, and the geometry of reservoir bodies, the influence of their sedimentological heterogeneities and the influence of basin architecture and stratigraphy.

2) Ore processes in sedimentary basins, in order to take into account all processes from the ore source of to the ore deposition, including the nature and the origin of mineralizing fluids and the followed pathways (fluid transfer, phi/K parameters evolution) during the successive stages of diagenesis.

We hope that aggregating most fields and technical approaches could unite behind a same goal and lead to enriched exchanges between specialists from various horizons.

- **SR7.3/FSD8.7/CB1.11 IMPACT OF FACIES AND DIAGENESIS ON HYDROCARBON CARBONATE RESERVOIRS QUALITY**

Conveners. Raffaele DI CUIA (GEPlan Consulting, ITA), Renaud TOULLEC (UniLaSalle, FRA), Alberto RIVA (GEPlan Consulting & Univ Ferrara, ITA), Youri HAMON (IFP Energies Nouvelles, FRA)

Description. In the last decades, multi-disciplinary studies at the boundary between petroleum industry and academics focused on the improvement of both reserves estimation and the “Yet to Find” in the inherently heterogeneous carbonate porous media classically associated with low recovery factor (10 to 30 %). The quality of carbonate reservoirs is strongly influenced by the original depositional facies and their later paragenetic evolution and burial history. To understand the complex distribution of reservoir properties and the impact on the hydrocarbon potentials of carbonate sequences it is fundamental to correctly assess the initial depositional setting and its lateral and spatial variability but also the impact of the burial and later diagenetic fluids circulating within the carbonate sequence.

This section aims at attracting presentations of studies that focus on the characterization of carbonate depositional systems, on the paragenetic evolution of carbonate sequences, on the petrophysical characterization of carbonate rocks and reservoirs and on new approaches to the modeling of carbonate sequences and reservoirs.

- **SR7.4/FSD8.8 GEOTHERMAL STUDIES IN SEDIMENTARY BASINS WITH CLAY MINERALS AND ORGANIC INDICES TO CHARACTERIZE PRESENT-DAY GEOTHERMS, FLUID- AND HYDROCARBON MIGRATION SYSTEMS**

Conveners. Sébastien POTEL (UniLaSalle, FRA), Isabel SUÁREZ-RUIZ (INCAR-CSIC, ESP), Rafael FERREIRO MÄLHMANN (Technische Universität Darmstadt, DEU), Simon LOPEZ (BRGM, FRA), Andrea MOSCARIELLO (University of Geneva, CHE)

Description. The sedimentary basins can be the origin of different energy sources: oil, gas, geothermal; and therefore, a subject of major interest.

1) Basins are filled with sedimentary rocks and formed in different geodynamic settings. In this context, geothermal studies involving clay mineralogy and organic indices are of great importance to characterize pressure (P) and temperature (T) conditions involved in the formation and evolution of sedimentary basins. As they involve rock-water interaction, dissolution and precipitation and transfers of mass and energy (e.g. hydrocarbon migration, thermal up-flows) fluids dynamics are also of interest.

2) Then, the reconstruction of the subsidence and tectonic history combined with the dynamic study of fluids is crucial for basin modelling. Moreover, these studies are also significant for evaluating the potential sources of hydrocarbons and/or geothermal resources.

3) The characterization of P-T fields of a basin, the correlations between clay indices, organic parameters, index minerals (Barrow zones), facies critical paragenesis (facies zones of Winkler), fluid inclusion P-T determinations and clay mineral isotopic studies are necessary to understand different geodynamic settings.

All these investigations are dedicated to gain insights into the geodynamic evolution of low-grade metamorphic terranes. Geodynamics, advective heat flow or hydrothermal convective heat transfer have an important control on all applied geothermal indices. Finally, the present-day thermal equilibrium of the basins and the distribution of potential geothermal and hydrocarbon resources may be the result of this complex evolution history and later re-distribution of heat. The session is intended to consolidate the progress in these types of studies.

- **SR7.5 SEDIMENTOLOGY OF UNCONVENTIONAL SYSTEMS**

Conveners. Vincent CROMBEZ (IFP Energies Nouvelles, FRA), Tristan EUZEN (IFP Technologies, CAN), François BAUDIN (University of Paris VI, FRA), Dorrik STOW (Heriot-Watt University, GBR)

Description. The recent development of unconventional resources shed a new light on fine-grained and organic-rich sediments deposited in shelf and deep-marine environments. A wealth of new data and the need for better predicting variations of rock and fluid properties from pore to basin scales, have fueled an active and innovative research from both the industry and the academia. The spatial and temporal distribution of sedimentary heterogeneities and their evolution during burial directly impact the present-day organic richness, porosity, permeability and mechanical properties of these rocks. Understanding these heterogeneities is therefore paramount to quantify technically recoverable resources and design development strategies for these plays.

This session aims at presenting leading edge research on the sedimentology, stratigraphy and diagenetic evolution of unconventional plays. We will welcome innovative workflow for characterization and modelling of these sedimentary systems. A special focus will be brought to the high-resolution distribution of sedimentary facies in fine-grained deposits, to the distribution of the mineralogy and organic matter and to the characterization of porosity and permeability changes associated to diagenetic evolution.

- **SR7.6/SB5.10 FRONTIER BASINS AND NEW EXPLORATION PLAYS**

Conveners. Vincent DELHAYE-PRAT (TOTAL, FRA), Mélanie LOUTERBACH (REPSOL Madrid, ESP), Emmanuel PETTINOTTI (OPHIR Energy London, GBR), Julien BAILLEUL (UniLaSalle, FRA), Massimo ROSSI (ENI, ITA)

Description. In a depressed oil prices environment and declining production in mature provinces, it is necessary to unlock new resources with lower risk and better efficiency. Indeed, there are still significant resources to be explored in the frontier basins which offer great potential for further developments. These are often poor-data areas, where the basin geology is insufficiently constrained, making exploration and prospective risks difficult to assess. However, advances in sedimentology and basin analysis can be a key in difficult times for hydrocarbon exploration to better evaluate the distribution and the quality of source-rocks, reservoir bodies as well as seal intervals, especially in such under-explored areas. Moreover, an enhanced understanding of recently rediscovered depositional environments, such as lacustrine systems or contourite complexes for example, may help for future discoveries and definition of new plays.

This session constitutes an opportunity to present papers on the way to de-risk exploration in frontier areas with state of the art sedimentology, paleogeography and tectonic-sedimentation interaction studies.

- **SR7.7 TO THE ENERGY TRANSITION: THE ROLE OF SEDIMENTOLOGY IN GAS, CO₂ AND ENERGY STORAGE, AND OPTIMIZATION OF GAS PRODUCTION**

Conveners. Lena DAUPHIN (ENGIE, FRA), Nigel MOUNTNEY (University of Leeds, GBR)

Description. The energy transition concept involves CO₂ storage, an energy source mix (wind, solar, geothermal and natural gas), and optimization of the gas chain (EGR, UGS). In this perspective geoscientists play a key role in the characterization of underground reservoirs for various types of mass storage. For sedimentologists, much of the petroleum-system knowledge relating to the heterogeneity and flow properties of siliciclastic and carbonate reservoirs is essential. Yet geoscience issues relating to underground storage require many additional and specific considerations:

1) The small relative small size of chosen storage sites in comparison to the typical scale of oil and gas reservoirs. Novel approaches to reservoir modelling need to be developed for the effective capture of lithological heterogeneity at a very high resolution. This will necessitate novel approaches to the detailed sedimentological analysis of subsurface reservoirs, including the development of novel criteria for the selection and utilization of appropriate analogues used in reservoir modelling workflows.

2) Underground storage sites can take varied forms, including disused mine cavities and salt caverns for UGS/CCS/HES/CAES, in addition to aquifer storages in siliciclastic and carbonate successions (UGS, CCS, ATEs).

3) Although methane is inert (UGS), CO₂ is acidic (CCS) and air contains water (CAES), both of which can potentially lead to a complex series of reactions with host rock formations.

4) Rock must be sufficiently strong to resist to high-frequency, high-pressure variations for CAES.

The objective of this session is to illustrate how sedimentology inputs into the frame of the energy transition, from UGS/CCS/HES/CAES/ATES/EOR/EGR case studies or from combination/conversion cases (CCS with EOR/EGR, from UGS to CCS/HES/CAES, and from depleted reservoirs to CCS). Underground Gas Storage (UGS), CO₂ Capture and Storage (CCS), H₂ for Energy Storage (HES), Compressed air energy storage (CAES), Heat and Cold Storage (ATES), Enhanced Oil/Gas Recovery (EOR/EGR) and possible combinations (CCS with EOR/EGR) or conversion (from UGS to CCS/HES/CAES or from depleted reservoirs to CCS)

- **SR7.8 OUTCROP ANALOGUES: MODERN STUDY TECHNIQUES, APPLICATION IN SUBSURFACE GEOLOGY AND KNOWLEDGE TRANSFER**

Conveners. Rémy DESCHAMPS (IFPEN, FRA), Gilberto ALBERTAO (Petrobras, BRA), Oriol FALIVENE (Shell, USA), Philippe JOSEPH (IFP School, FRA), Jean Loup RUBINO (TOTAL, FRA), John THURMOND (Statoil Gulf Services, USA)

Description. The objective of this session is to review the current state of the art in the use of outcrop analogues in the industry and the link with other fields such as geomatics, 3D or 4D visualization, augmented reality and training. We aim to motivate and encourage cross-disciplinary discussions among scientists and engineers focusing on recent developments, and to share the different approaches relative to acquisition techniques, data treatment and use in subsurface reservoir modelling workflows. The emerging innovative techniques for outcrop analogues characterization, such as 3D virtual modelling (Lidar, photogrammetry, hyperspectral imaging...) and near-surface geophysics (GPR, velocity tomography, microgravity surveying...) provides incredible opportunities to the current generation of geoscientists for integrating data that give useful information to identify the key analogue architectural elements, better characterize reservoir geometries and properties, and thus make the missing link with subsurface issues: the outcrop models can provide realistic quantitative parameters for reservoir modelling (object sizes, facies and fault network distributions...) or be used to test synthetic seismic or fluid flow modelling.

This session aims also to discuss how these new techniques may be deployed on the field (mobile learning during real fieldtrips) or used in-house for transfer knowledge, during training of resources geoscientists or

technical work on subsurface, for example by giving access to the outcrop information through virtual fieldtrips, interactive outcrop databases or internal wikis.

- **SR7.9 QUANTITATIVE DATA FROM MODERN SYSTEMS APPLIED TO SUBSURFACE CASE STUDIES: STRENGTHS AND PITFALLS**

Conveners. *Stephan JORRY (IFREMER, FRA), François LAFONT (TOTAL, FRA), Adrian HARTLEY (University of Aberdeen, GBR)*

Description. The petroleum industry faces a strong need of quantitative data, in particular dimensions, to model the subsurface. The size of the reservoirs, their potential interconnections, the lateral extent of seals and baffles are all critical elements that drive the evaluation of the resources and the development strategy, with major industrial and financial implications. For this purpose, quantitative databases have been developed and are now widely used; with a large part of the data coming from well constrained outcrop studies. Data from active sedimentary systems are also of major interest. The dimensions and statistical distributions are much better constrained. However, entering the world of stratigraphy and thus preservation– may change completely the geometrical parameters.

This session is dedicated to discussions about how to use wisely the dimensions of modern sedimentary objects to quantify the fossil ones.

SYMPOSIUM FSD8 - FLUIDS/SEDIMENTS INTERACTIONS & DIAGENESIS

Chairs. *Valérie CHAVAGNAC (CNRS - GET, FRA), Guilhem HOAREAU (University of Pau, FRA), Benjamin BRIGAUD (University of Paris Sud, FRA), Richard WORDEN (University of Liverpool, GBR)*

The objective of this symposium is to bring together studies covering an area ranging from academic approaches to industrial applications to provide an update on our understanding of fluids flow, fluids/sediments interactions and diagenetic processes in carbonate, clastic rocks and their integration in the prediction of fluid circulation, reservoir qualities, or oil / gas / metal accumulation, across spatial and temporal scales.

We invite studies combining various datasets (mineralogy, water and sediment geochemistry, seismic attributes, heat flux, porosity...) and employ a wide range of scientific approaches (natural and man-made environments, km to nano scale observation, temporal variability over short to long timescales, experimental to computational studies, geochemical to geophysical datasets ...). This will be an opportunity to discuss, exchange, and debate about new perspectives and challenges in the field combining advanced characterization methods with innovative modelling techniques all applied on modern to fossil environments.

- **FSD8.0 OPEN SESSION ON FLUIDS/SEDIMENTS INTERACTIONS & DIAGENESIS**

Conveners. *Valérie CHAVAGNAC (CNRS - GET, FRA), Guilhem HOAREAU (University of Pau, FRA), Benjamin BRIGAUD (University of Paris Sud, FRA), Richard WORDEN (University of Liverpool, GBR)*

Description. This open session invites contributions on the general topics related to Fluids/Sediments interactions & Diagenesis. It is an opportunity to present studies that do not fall within research covered by the special sessions FSD8.1 to FSD8.8.

- **FSD8.1 SEISMIC-SCALE FLUID/SEDIMENT INTERACTIONS**

Conveners. Patrice IMBERT (TOTAL, FRA), Aurélien GAY (University of Montpellier 2, FRA), Rossella CAPOZZI (Università di Bologna, ITA)

Description. One privileged tool for studying fluid circulation in sedimentary basins is seismic reflection, which highlights fluid circulation-related features on scales ranging from a few meters (seep carbonates) to several kilometers (mud volcanoes, injectite complexes) or even covering vast areas of basins, like hydrate-related bottom-simulating reflections or polygonal fault systems.

The session will address these issues through a combination of seismic-oriented presentations highlighting specific fluid-related features or systems, but also outcrop examples of such phenomena in the fossil record, or live examples exposed at the surface or at the seabed. Insight into the processes from analog or numerical modeling of individual objects, as well as basin modeling to replace observations in the frame of basin-scale fluid circulation should also be included. Depending on the response, the session might be split into subsessions.

- **FSD8.2 THERMOCHEMICAL AND BACTERIAL SULFATE REDUCTION: PROCESSES, PRODUCTS, EFFECTS, ANALYSIS**

Conveners. Richard WORDEN (Liverpool University, GBR), Chunfang CAI (Chinese Academy of Science, Beijing, CHN)

Description. Thermochemical sulfate reduction (TSR) is a diagenetic reaction between sulfate minerals and petroleum at elevated temperature. Bacterial sulfate reduction (BSR) is a similar reaction that occurs at lower temperatures at which microbial activity can still occur; BSR can be natural or induced by injection of, for example sulfate-rich seawater into reservoirs during enhanced oil recovery. TSR and BSR lead to the production of toxic, corrosive and environmentally-damaging H₂S, and can be of critical importance to the economics of a discovery. If H₂S is present in a field to be developed, then the production system needs to be constructed from high grade steel and environmentally-sustainable plans must be in place for the disposal of H₂S.

In this session, we invite contributions that include case studies of TSR and BSR, new analytical techniques used to study the process and products of TSR and BSR, experimental studies of TSR and BSR, and modelling approaches used to forward-predict TSR and BSR.

- **FSD8.3/CB1.12 CARBONATE DIAGENESIS**

Conveners. Jean-Pierre GIRARD (TOTAL, FRA), Benjamin BRIGAUD (University of Paris-Sud, FRA), Benoît VINCENT (Cambridge Carbonates Ltd, GBR)

Description. This session seeks to address how diagenetic processes are controlling carbonate rock properties and to review the recent analytical methods, new perspectives and challenges in the field of carbonate diagenesis. Key issues/topics are:

- 1) Early diagenesis (Eogenesis), often underestimated but always impacting rock properties. What are the relationships between sequence stratigraphy and carbonate diagenesis?
- 2) What are the diagenetic processes and chemical properties (pore water type, redox conditions, alkalinity, pH) controlling the development of discontinuities in carbonate rocks?
- 3) How early diagenetic processes may impact the petrophysical properties of carbonates and their subsequent evolution through time?
- 4) Nature and the spatio-temporal extension of the processes controlling the physical and chemical transformations of sediments/rocks from their deposition up to now: impact on the petrophysical properties. Recent methodological advances applicable to carbonate diagenesis (U-Pb dating, (U/Th)/He, clumped isotopes, Secondary Ion Mass Spectrometry).

The objective of this session is to bring together specialists coming from academia and industry, encouraging exchanges and integrated works. The aim is also to provide an update on our understanding of diagenetic processes in carbonate rocks and their integration in the prediction of rock properties (reservoir

properties, mineral content, ...). All these issues are key to understand the origin and the prediction of economic resources in sedimentary basins (oil & gas, ore deposit, geothermal energy, CO₂ and waste storage).

- **FSD8.4 CLAY MINERAL CONTROLS ON PORE-SCALE RESERVOIR QUALITY OF CLASTIC SYSTEMS**

Conveners. Sanem ACIKALIN (Newcastle University, GBR), Stuart JONES (Durham University, GBR), Susanne GIER (Vienna University, AUT), Philip MILLSTEAD (Centrica Norge, NOR), Joshua GRIFFITHS (Liverpool University, GBR)

Description. Pore-scale reservoir quality of clastic reservoirs is controlled by various factors which can be grouped in to two main categories: (i) depositional and (ii) diagenetic controls. Besides the other depositional attributes, detrital clay mineral content and distribution have an important role on the determination of the original porosity and permeability of clastic sediments. During burial, the original porosity and permeability are typically degraded by compaction and diagenetic processes. Authigenic clay formation and transformation of detrital clay are important processes which determine the resultant pore systems and flow pathways.

This session aims to bring experts together to discuss various aspects of clay minerals ranging from depositional processes, geochemical and thermodynamic properties, fluid-clay mineral interaction, diagenetic pathways and predictability of clay mineral distribution in a reservoir.

- **FSD8.5 IODP - DECIPHERING THE COMPOSITION OF SEDIMENT POREWATERS**

Conveners. Christophe MONNIN (CNRS - GET, FRA), Guilhem HOAREAU (University of Pau, FRA)

Description. The composition of sediment porewaters is the result of physical (transport: advection and diffusion) and chemical (mineral dissolution and precipitation, adsorption) processes. For example, the dissolution of minute quantities of a mineral is difficult to detect from the observation of solid phases but it can be traced through the changes in elemental concentrations. On another hand slow fluid motion through sediments can be revealed by characteristic diffusion-advection concentration profiles of conservative elements in porewaters. The chemical and isotopic analysis of sediment porewaters can thus provide tracers of ongoing processes in modern sediments that can shed light on fossil systems where the fluids have long disappeared.

This session is thus intended to bring together studies focused on the geochemistry of sediment (both continental and marine) porewaters.