



INQUA Commission: Coastal and Marine Processes

Session Title: Arctic landscape evolution and long-term coastal change (Poster only)

Convenors and Co-Convenors: Lasse Sander (Convenor) Michael Fritz (Co-Convenor) Aart Kroon (Co-Convenor)

Description of Session: This session invites contributions dealing with long-term changes in coastal environments in the Arctic and the relevant processes that govern late Quaternary and Holocene landscape evolution. Coasts in the polar regions are at present rapidly changing under the influence of a pronounced climate warming trend. This induces erosion due to the retreat of sea ice, the increase of wave forcing along coasts and a general susceptibility of thawing permafrost shorelines. Long-term rates of carbon and nutrient release, patterns of dynamic coastal geomorphological change, studies of sedimentary archives of past environments such as beach ridges or coastal lakes, and investigations into past sea-level change are topics that help to understand the functioning and response of modern Arctic coasts to climate change. The coastal environment is here considered in a wide definition of landscapes located at the land-sea transition, including terrestrial and shelf sea environments that have e.g. an archival function or influence on coastal processes. Thematically, this session is placed between Quaternary geology and Holocene (coastal) geomorphology and aims at contributions looking into sedimentary archives, climate forcing, coastal erosion, or the release of organic matter and sediment over decadal to millennial time scales. Contributions by early-career researchers are highly encouraged as well as interdisciplinary studies looking into the biological responses to coastal change and biogeochemical cycling.



INQUA Commission: Coastal and Marine Processes

Session Title: Back to the future: Submerged shorelines on the shelf as tools for climate, sea-level and future shoreline reconstructions.

Convenors and Co-Convenors: Andrew Green (Convenor) Ruth Plets (Co-Convenor) Joseph Kelley (Co-Convenor)

Description of Session: Given the context of changing climates and the increasing threat to coastal areas from increasing rates of sea-level rise, it has become increasingly important to understand the manner in which coastal systems and their shorelines may respond to future sea level rises. Palaeo-shorelines preserved on the continental shelf provide an important source of information. Having escaped the erosion typically associated with wave ravinement across the formerly exposed palaeo-coastal plain, preserved shoreline features are amongst the few systems, apart from incised valley fills, that document the complex interplay between climate and local oceanographic regime, landform formation, preservation and sea-level fluctuation during deglacial cycles.

The identification of submerged shoreline features has been much enhanced with new and higher resolution swath bathymetry techniques, together with more detailed and focused programmes which have routinely examined submerged shorelines over the last ten years. When coupled with high and ultra high-resolution seismic profiling, complete three-dimensional impressions of shorelines can be constructed and inspections of the palaeo-shoreline morphology, weathering profile and stratigraphy made. Lastly, when novel sampling and dating techniques are applied, a robust, non-coral based record of sea-level fluctuation may be extracted from these landforms.

We propose a session that examines the state of the art regarding palaeo-shorelines from around the globe. We hope to draw papers that will place how shoreline preservation potential and morphology fits into the context of climatic and sea-level controls, and how relict examples can be extended to further understand the intricacies of global deglacial sea-level records and submerged landscapes.



INQUA Commission: Coastal and Marine Processes

Session Title: Geological and geophysical archives of ice sheets on continental shelves

Convenors and Co-Convenors: Andy Emery (Convenor) Sarah Greenwood (Co-Convenor) Stephen McCarron (Co-Convenor) Benedict Reinardy (Co-Convenor) Stephen Eaton (Co-Convenor) Lilja Bjarnadóttir (Co-Convenor) Lauren Simkins (Co-Convenor) Monica Winsborrow (Co-Convenor) Daniel Praeg (Co-Convenor) Dayton Dove (Co-Convenor)

Description of Session: Ice sheets terminating in marine environments, grounded below sea level, are dynamic and sensitive portions of the cryosphere and among the largest uncertainties in understanding the fate of modern ice sheets under anticipated atmospheric and oceanic warming. Geological records from formerly-glaciated continental shelves and large marine basins offer an analogue of modern system behaviour, providing detailed signatures of landform, sedimentological and stratigraphic assemblages associated with flow and retreat of marine-based ice sheets over glacial-interglacial cycles. Recent multiplication of high-resolution offshore datasets allows the comprehensive investigation of these glaciologically-dynamic systems. Tools including multibeam echosounder (MBES) bathymetry, subsurface profiling, 2D and 3D seismic reflection imagery, core sedimentology and palaeoenvironmental analyses, and geotechnical logs enable us to access sedimentological, stratigraphic and morphological archives of ice-ocean-sedimentary systems on continental shelves.

This session aims to bring together geomorphological, sedimentological, stratigraphic, geophysical and numerical modelling studies of ice sheet behaviour and records in the offshore domain during the most recent and earlier glacial-interglacial cycles. We welcome themes including, but not limited to, ice flow dynamics in marine-based ice sheet sectors, grounding line behaviour, the role of meltwater on glaciological systems and in proglacial to paraglacial settings, ice-ocean interactions, and the coupling between sea-level change and continental shelf sedimentary environments. Contributions developing and integrating research methods and datasets are welcomed. We encourage submissions from those coupling geological with numerical modelling investigations, and those using Quaternary studies to inform understanding of modern ice sheet behaviour and the coupling between ice sheets, ocean forcing and continental shelf sedimentary systems.



INQUA Commission: Coastal and Marine Processes

Session Title: Integrating instrumental data, geological data and modelling to better constrain high-latitude ice sheet and glacier change

Convenors and Co-Convenors: Martin Brader (Convenor) Pippa Whitehouse (Co-Convenor) Sarah Woodroffe (Co-Convenor) David Small (Co-Convenor)

Description of Session: Understanding the evolution of high-latitude ice sheets and glaciers, and producing predictions of future change, requires a longer-term perspective than can be provided by geodetic data alone. This session aims to improve our understanding of how and why high-latitude glaciers and ice sheets change, with a focus on the use of innovative methods and new data to reconstruct past glacier and ice sheet histories over decadal to millennial timescales.

This multi-disciplinary session seeks contributions from across the palaeo-environmental (including sea level), geological, instrumental, ice sheet and glacio-isostatic adjustment modelling communities. Contributions that integrate instrumental, geological and modelling techniques are particularly encouraged. In general, we welcome studies that focus on combining onshore and offshore records, different types of proxy data, a range of geodetic techniques, and/or innovative modelling approaches to enhance our understanding of past glacier and ice sheet evolution, and therefore better predict future changes in the high latitudes.



INQUA Commission: Coastal and Marine Processes

Session Title: Linking land and sea - multiple approaches to investigating human-environment interactions in the coastal zone

Convenors and Co-Convenors: Sarah Davies (Convenor) Helena Filipsson (Convenor) James Barry (Co-Convenor) Martin Bates (Co-Convenor) Kotaro Hirose (Co-Convenor) Karl Ljung (Co-Convenor)

Description of Session: Societies have lived with the dynamic nature of coastal environments for millennia. Presently submerged landscapes formed an important focus for pre-historic human settlement. Today, faced with rising sea levels and the likelihood of increasing storminess, coastal communities are on the front line of climate change impacts. Coastal environments are also under pressure from increasing intensity of human activity. Geophysical and ecological survey techniques along with palaeoenvironmental records and archaeological investigations are providing new insights into climate variability and human-environment interactions in the coastal zone over a range of timescales, whilst monitoring vulnerable sites can quantify rates of recent change.

This session will bring scientists together from different disciplines (e.g. biology, physical geography, archeology, history, geology and geophysics) to showcase the wide range of approaches to investigating climate change and human-environment interactions in the coastal zone over a range of timescales. We encourage contributions on the following themes:

- Geophysical mapping and palaeoenvironmental studies of submerged and intertidal landscapes.
- Palaeoenvironmental records of coastal change and / or storm histories.
- Innovative approaches to monitoring climate change impacts on coastal and submerged heritage.
- Multi-disciplinary studies exploring human-environment interactions in the coastal zone, including impacts of storms, inundation and coastal erosion.
- Human impacts on coastal aquatic environments, such as eutrophication, deoxygenation, environmental pollution (heavy metals, black carbon, microplastics etc), ocean acidification.
- Links between land-use change, terrestrial vegetation composition and the storage and transportation of carbon and nutrients into the coastal zone; explored using quantitative palaeo-proxy based reconstructions (e.g. land-use patterns in dynamic vegetation) and climate models.



INQUA Commission: Coastal and Marine Processes

Session Title: Quaternary evolution and depositional environments of the North Sea Basin

Convenors and Co-Convenors: Benedict Reinardy (Convenor) Emrys Phillips (Co-Convenor) Dag Ottesen (Co-Convenor) Hans Petter Sejrup (Co-Convenor) David Vaughan (Co-Convenor)

Description of Session: Up to 1 km of Quaternary sediments in the North Sea Basin reflects timing and magnitude of an extensive fluvial prograding delta system and later ice sheet build-up and decay over NW Europe. The North Sea has widespread coverage of both seismic data and borehole sites and is the focus of recent investigations into key themes within Quaternary science such as: interpretation of basin-wide architecture in terms of variation in sediment supply and accommodation; fluid flow migration in formally glaciated sedimentary basins; the onset of Northern Hemisphere mid-latitude glaciations; understanding the discharge, subglacial hydrology and stability of marine-based palaeo-ice sheets; changing sea level through the Quaternary; influence of changing North Atlantic circulation on ice stream dynamics through ice-ocean interactions and; the nature of submerged landscapes and their human occupation. New chronological frameworks based on different dating techniques, have been developed for the North Sea Quaternary stratigraphy and high resolution local datasets have become available but tend to focus on either geophysical or sedimentological data. This session will provide a forum for researchers to present recent interpretations from geophysical and sedimentological data sets into a regional, basin-wide context and help promote a better understanding of the sedimentary evolution and processes of the North Sea Basin. We invite papers addressing both glacial and non-glacial processes, including marine interglacial deposits using core proxy data, outcrops, and/or seismic data, methodological papers highlighting new advances in the acquisition and processing of geophysical data and dating techniques suitable for the Quaternary of the North Sea.



INQUA Commission: Coastal and Marine Processes

Session Title: Sea-Level changes from minutes to millennia (Poster only)

Convenors and Co-Convenors: Simon Engelhart (Convenor) Fengling Yu (Co-Convenor) Alar Rosentau (Co-Convenor) Gösta Hoffmann (Co-Convenor)

Description of Session: Sea-level changes over timescales from minutes to millennia are of great concern to coastal communities. Long-term changes in sea level due to the solid earth's response to glaciation and tectonics are the background rate upon which the hazard from anthropogenic sea-level change and extreme inundation from tsunamis and storms must be superimposed.

Short-term measurements from instrumental and historical records provide short glimpses at the hazard posed by sea-level change over varying temporal scales but must be placed within the long-term context that only geological and archaeological records provide.

This session calls for insights into changes in sea-level at multiple timescales and using multiple, complementary methods. We welcome all abstracts that speak to the coastal hazards posed by sea-level changes but we particularly encourage the submission of abstracts that combine long- and short-timescale measurements to develop a holistic and integrated view of coastal hazards, that combine sea-level data with human aspects on both archaeological and short-timescales, and abstracts that originate or speak to research in IGCP Project 639 focus areas in South America, the Middle East, and Africa. This session is a contribution to IGCP Project 639 and INQUA project CMP1701P.



INQUA Commission: Coastal and Marine Processes

Session Title: Subduction zone palaeoseismology

Convenors and Co-Convenors: Emma Hocking (Convenor) Ed Garrett (Co-Convenor) Jasper Moernaut (Co-Convenor)

Description of Session: This session focusses on advances in the understanding of seismic hazards made from geological records of subduction zone palaeoearthquakes and palaeotsunamis. In coastal, lacustrine and offshore settings the combined use of field methods (including stratigraphy and micropaleontology) and geophysical modelling have advanced understanding of the temporal and spatial extent of subduction zone ruptures over multiple earthquake cycles. Geological approaches are critical in extending the historical and instrumental record of great subduction zone earthquakes and associated tsunamis. Nevertheless, challenges remain in determining earthquake recurrence intervals, defining the spatial extent of ruptures, including along-strike and down-dip rupture patterns, and in understanding the causes of slip heterogeneity during great earthquakes. We invite contributions that advance our understanding of these issues using a broad spectrum of approaches from field observations to geophysical modelling.



INQUA Commission: Coastal and Marine Processes

Session Title: The sedimentary record of tsunami and storms

Convenors and Co-Convenors: Vanessa Heyvaert (Convenor) Sue Dawson (Co-Convenor) Max Engel (Co-Convenor)

Description of Session: Extreme wave events, including storm surges and tsunamis, pose significant hazards to coastal communities and infrastructure around the world. The impact of these events will be further accentuated by future sea level rise. Data on historical extreme wave events do not provide a statistically significant time-frame for adequate hazard assessment. Therefore, it is essential to study the long-term geological record. A wide range of field and laboratory methods and techniques are utilised to study associated deposits covering the fields of sedimentology, macro- and micropalaeontology, geochemistry, geophysics and geomorphology.

This session welcomes (i) case studies on the characterization and identification of both recent, historical and prehistoric extreme-wave deposits, as well as contributions on (ii) advanced and innovative sedimentological, micropaleontological and geochemical analyses, (iii) new dating techniques applied to storm and tsunami deposits (both onshore & offshore records) (iv) transport and inundation modelling.

This session is a contribution to the INQUA Focus Group 'Late Quaternary records of coastal inundation due to earth surface deformation, tsunami, and storms' & IGCP Project 639 'Sea-Level Change from Minutes to Millennia'.



INQUA Commission: Coastal and Marine Processes

Session Title: Using the “multi-proxy approach” to detect landscape and environmental changes

Convenors and Co-Convenors: Martin Seeliger (Convenor) Anna Pint (Convenor)

Description of Session: Since the “dawn of civilisations” the interactions between human activities and geomorphologic processes – in addition to temporal extreme events like volcanic eruptions or tsunamis – caused a specific fingerprint in the archives of those regions.

In order to reconstruct the human and environmental history of these landscapes, it is necessary to correctly identify and interpret this fingerprints in each specific archive. Recently, several interdisciplinary studies have shown that the combination of geomorphological, palaeo-faunistic, geophysical and archaeological methods is an especially powerful and effective approach to evaluate archives and to decipher the evolution of landscapes under human influence. Therefore, this session aims to highlight the special potential of this combination and further develop what is coined under the term “multi-proxy approach”. We offer the opportunity to publish contributions in a conference proceedings special issue of a peer-reviewed journal.

We hope we will meet you at the INQUA meeting 2019

Anna Pint and Martin Seeliger



INQUA Commission: Humans and Biosphere

Session Title: Ancient DNA from Quaternary and archaeological sediments

Convenors and Co-Convenors: Inger G. Alsos (Convenor) Tony Brown (Co-Convenor) Laura Parducci (Co-Convenor) Laura S. Epp (Co-Convenor)

Description of Session: The extraction and analysis of ancient DNA from Quaternary and archaeological sediments could potentially revolutionise palaeoecology over the next decade. This potential is growing because it has been shown that a) there is preservation of aDNA well outside the sub-Arctic and Arctic biomes, b) the costs are reducing, c) the number of laboratories has increased, and most importantly, d) the techniques, such as metabarcoding, are becoming more robust (both in reliability and specificity) and deeper (in taxonomic coverage). At present, and probably for some considerable time to come, aDNA will be used alongside traditional proxies such as pollen, diatoms and insects but they have the potential to be far more specific about both human activities and on-site biotic conditions (species or even below species level biota). This session invites papers using aDNA from sediments or soils from any site from caves to lakes and any time period. Methodological papers are also welcome.



INQUA Commission: Humans and Biosphere

Session Title: Before and after the earliest Homo dispersal in Eurasia: Early-Middle Pleistocene faunas and vegetation and the dynamics of the Human Resource Space

Convenors and Co-Convenors: Raffaele Sardella (Convenor) Daniel Demiguel (Co-Convenor) Lorenzo Rook (Co-Convenor) Angela Bruch (Convenor) Christine Hertler (Co-Convenor) Natalia Rudaya (Co-Convenor)

Description of Session: Since the discoveries of direct evidence of the presence of Homo in the Caucasus, the timing and pattern of Homo dispersal and earliest occupation of Eurasia has been in the focus of the scientific debate. Given its geographical position, the entire Mediterranean region is considered, at least from the Plio-Pleistocene transition and the early Pleistocene, a crossroad between Europe and Africa, East and West, and thus a promising region for examining the most likely causes and trajectories of the earliest dispersal of Homo. During the last two decades, several new fossil sites have been discovered and studied through multidisciplinary approaches the timing of faunal dispersals, changes in the environmental conditions and the evolution of the terrestrial ecosystems of the early-middle Pleistocene in Eurasia, e.g. pointing to a dispersal of humans from the Caucasus to Western Europe earlier than Jaramillo.

Early human environments are generally described by their main components climate, vegetation, fauna and landscape forms, but any group of interest relates to their environment first of all via resource availability. This Resource Space provides all basic resources for the group like food (animals, plants, water) and others, and is exploited under specific cultural capacities and performances.

This workshop aims at gaining new insights into the multiple perspectives on early-middle Pleistocene terrestrial ecosystems and their dynamics before and after the earliest dispersal of Homo by various (paleontological/paleobotanical/geochemical) proxies. Furthermore, we would also like to discuss assessments of resource availability and evaluations of the development of resource exploitation strategies.



INQUA Commission: Humans and Biosphere

Session Title: Combining palaeoecology with ecological models

Convenors and Co-Convenors: Paul Henne (Convenor) Christoph Schwörer (Co-Convenor) Willy Tinner (Co-Convenor)

Description of Session: Palaeoecology provides detailed records of ecological change with unmatched temporal coverage. However, competing hypotheses can often account for observed changes. For example, vegetation changes during the Holocene are often alternatively ascribed to climatic change or human impacts. Furthermore, different aspects of climate change (e.g., temperature, precipitation abundance, precipitation seasonality) can have similar impacts. Disentangling the causes of past ecological change is critical to understanding ecosystem dynamics and anticipating the long-term interactions of human impacts and global change. Ecological models synthesize present understanding of ecological processes and apply this understanding to changing conditions. However, model evaluation is difficult with modern observations alone, especially for processes that exceed the decadal scale. Combining ecological models with palaeoecological records can overcome the limitations of each approach. Dynamic models can test competing hypothesis that account for past change, and quantify thresholds and tipping points. In turn, palaeoecological records provide long-term empirical data needed to evaluate model performance and identify knowledge gaps. Improvements in computational capacity, combined with the broadening availability of multiproxy Quaternary records, allows increasing integration of modelling with palaeoecology. Models operate on multiple spatial and temporal scales, from the landscape (e.g., dynamic landscape vegetation models) to global scales (e.g., dynamic global vegetation models), and from days to millennia, and can simulate competition among species, disturbance processes such as wildfire, human impacts, geochemical fluxes, and hydrological processes. This session will gather a diverse group of international scientists who combine the power of Quaternary records and ecological modelling to understand long-term ecological change.



INQUA Commission: Humans and Biosphere

Session Title: Connecting palaeoecology with present and future ecosystem dynamics

Convenors and Co-Convenors: Althea Davies (Convenor) Jane Bunting (Co-Convenor) Vivian Felde (Co-Convenor)

Description of Session: Integrating long-term evidence and processes with shorter-term ecological knowledge and predictive models is a key challenge for the Quaternary science community. Despite shared interests in environmental change and ecosystem processes, the complexity of unfamiliar proxies limits the accessibility of Quaternary palaeoenvironmental data to many ecologists, and the rapidly evolving ecological debate about the definition of key concepts and important parameters can slow palaeoecological efforts to identify comparable measures which can be robustly derived from their proxies. Despite these barriers, a growing range of metrics and analytical tools that can be applied to both palaeoecological and ecological data is developing, and the aim of this session is to showcase these techniques and their potential to improve our understanding of species and ecosystem dynamics and processes when viewed from both a long- and shorter-term perspective. This session is supported by the British Ecological Society, via the Palaeoecology Special Interest Group, and we invite contributions from Quaternary and ecological communities.



INQUA Commission: Humans and Biosphere

Session Title: Continuous records of tropical climate and environmental history

Convenors and Co-Convenors: Dirk Verschuren (Convenor) Melanie Leng (Co-Convenor) Gijs De Cort (Co-Convenor)

Description of Session: Realization of the important role played by the tropics in global climate dynamics and carbon budget has increased interest in palaeodata revealing the history of human-climate-landscape interaction in low-latitude continental regions worldwide. Producing solid palaeoenvironmental reconstructions from these regions remains a challenge, due to the scarcity of natural archives that are demonstrably continuous, can be properly dated, and contain robust climate or landscape proxies over sufficiently long time periods. In current literature, weaknesses in these aspects are often not explicitly stated or documented; and global or continent-wide syntheses tend to include also the more ambiguous time series at face value, fearing that stringent selection would leave large geographical data gaps. This session welcomes reconstructions of climate and environmental history from all low-latitude regions, any type of climate archive and any time period of the Quaternary, but which explicitly intend to eventually make a robust contribution to regional and larger-scale palaeodata syntheses. This requires that the records must be demonstrably continuous or that the duration of hiatuses and event-like deposits must be properly constrained; and that histories of vegetation dynamics or biomass burning must be explicitly related to independent temperature and/or moisture-balance reconstructions in order to separate ecosystem response from its climatic or anthropogenic drivers. High temporal resolution is a bonus but no fetish: more important is the chronological control on that resolution, the robustness of recorded climate anomalies, and an assessment of the relative magnitude and rapidity of past landscape changes compared to those happening within documented history.



INQUA Commission: Humans and Biosphere

Session Title: Do species move, adapt or die? Exploring biodiversity dynamics in the fossil record

Convenors and Co-Convenors: Donatella Magri (Convenor) Nicki Whitehouse (Co-Convenor) Helen Roe (Co-Convenor) Maria Rita Palombo (Co-Convenor) Alejandro Ordonez (Co-Convenor)

Description of Session: Quaternary palaeoecological records offer the opportunity to explore the formation, development and dynamics of biological communities over long temporal periods and address a range of key ecological, biogeographical and conservation questions. These include issues such as how species and communities differ in their responses to changing environmental conditions and whether these differ over time-scales. Are responses essentially the same over time or is there evidence for adaptation or niche evolution, or do species primarily move or alternatively become extinct? What can the fossil record tell us about the vulnerability of particular communities and species – are some more likely to become extinct compared with others? Is it possible to identify the Quaternary roots of modern biodiversity in a palaeobiogeographical perspective, by investigating and deconstructing the causal factors behind the modern biogeographical arrangement of flora and faunal species? For some groups, taxonomic issues also present significant challenges to understanding long-term community changes, although for others, new approaches to taxonomy, analytical advances (e.g. aDNA analysis) and novel modelling methods offer the potential to enhance and indeed revolutionise ecological interpretations and our understanding of species responses to future climate change.

We solicit papers that address these themes, dealing with all types of biological proxy records, using standard palaeoecological methods, novel modelling methods, aDNA approaches and phylogeography. We encourage papers that seek to explore species and community spatio-temporal dynamics and interactions, spread, extinction and niche evolution, as well as the history of modern clades over the different time-scales that apply to Quaternary studies.



INQUA Commission: Humans and Biosphere

Session Title: Geoarchaeology between Mediterranean areas and arid margins: human-environment interaction and landscape mobility

Convenors and Co-Convenors: Stéphane Desruelles (Co-Convenor) Mauro Cremaschi (Co-Convenor) Antoine Chabrol (Convenor) Tara Beuzen-Waller (Convenor)

Description of Session: The Mediterranean, semi-arid and arid environments share a strong rainfall variability, rare or poorly distributed surface flows and a very reactive geosystem to climatic or anthropogenic forcing. The drought, common to these areas, may have had a significant impact on the availability of water resources. Meanwhile, high-energy fluvial systems, characterized by flash floods, led to the strong mobility of floodplains and coastal plains. The combination of those parameters, and their evolution over time, could have had a strong impact on the archaeological sites distribution, land use and land management during past periods. Indeed, if archaeological sites distribution may be related, at least partly, to taphonomic criteria, some settlement patterns can reflect an opportunistic evolution or a planned adaptation to climatic or anthropogenic environmental variations.

Geoarchaeology study these interactions between human groups and their environment on several scales. Despite different local and regional contexts, the large geographical area proposed for this geoarchaeological session allows a comparison of different archaeological and environmental contexts to better understand how human-environment interactions may have shaped landscapes, land use and settlement strategies.

In this session, proposals related to human-environment interactions in the Mediterranean, semi-arid and arid environments are welcome. This could include varied themes such as: mobility of ancient landscapes (continental or coastal) and its impact on the location or preservation of archaeological sites; original or innovative geoarchaeological approaches developed to reconstruct successive palaeogeographies or sites formation processes ; subsistence strategies, settlement patterns and land use management developed in these specific environments during prehistoric and historical periods.



INQUA Commission: Humans and Biosphere

Session Title: Geoscience for sustainable futures

Convenors and Co-Convenors: Keely Mill (Convenor) Peter Gell (Co-Convenor) Émilie Saulnier-Talbot (Co-Convenor)

Description of Session: 2015 saw the adoption of the ambitious UN Sustainable Development Goals (SDG), in a bid to “end poverty, protect the planet, and ensure prosperity for all”. At the same time, the UN released the Sendai Framework for Disaster Risk Reduction (SFDRR), with the outcome to substantially reduce disaster, loss of life, and to protect physical, social, and environmental assets. This was closely followed by the 2016 Paris Agreement to combat, mitigate and adapt to the impacts of climate change.

All of these challenges are simultaneously local and global in scope, and indeed all of these challenges are at the interface between Earth and human systems, and require coherent solutions that integrate environmental and social science. It requires understanding of lessons from the past, monitoring of the present, and modelling of potential future outcomes. Geoscience can play a key role in addressing and contributing to state-of-the-art scientific knowledge required to address these challenges at a global scale, through the generation of high-quality data, international partnerships, and multi-disciplinary approaches to problem solving. Despite this, few geoscientists are engaged in issues surrounding sustainable development.

This session encourages geoscientists to showcase examples of applied science that are relevant to a sustainable future from both a scientific and applied perspective, demonstrating how the palaeosciences can be used to secure a sustainable future, from climate change mitigation to managing for natural hazards, and thereby underpinning the UN’s SDGs. Example disciplines include: palaeovolcanics, palaeoseismicity, glaciology, palaeotempestology, palaeoecology and a range of other Quaternary-related subjects.



INQUA Commission: Humans and Biosphere

Session Title: Human and non-human responses to the mid-Pleistocene transition

Convenors and Co-Convenors: Ericson Hölzchen (Convenor) Lutz Maul (Convenor) Maria Rita Palombo (Convenor)

Description of Session: The Mid-Pleistocene Revolution (MPR) represents a transition from an obliquity-dominated regime of orbital forcing to a precession-dominated one happening between 1.2 Ma and 0.8 Ma. This transition caused shifts in both, amplitudes and frequencies of glacial-interglacial cycles and evoked corresponding shifts in the environments of humans and other biota. Responses to the MPR can be observed on different scales. The METHOD IFG (#1604F) focused on human and non-human responses to the MPR in different regions and applies a simulation based approach to explore and examine the dynamics of the systems under study. In this session, we introduce the scope of our studies:

1. Non-human responses: Because of their ecological specialization linked with taxonomic diversity, squirrels represent excellent taxa to monitor changes in their habitats. Taxonomy, evolution, and range shifts of squirrels were specifically studied by the INQUA project 'Ground squirrels on the march' (#1606P). Large mammals, however, permit to examine broader patterns with respect to range shifts and ecological adaptations.
2. Human responses: Humans are specific among other biota in possessing more options in responding to changes in their environments. Production and use of specific tools allow for a higher degree of flexibility. Dispersal and the occupation of environments are understood as summary effects of highly complex interactions between humans and their habitats.
3. Simulation based approaches (ABM) permit to study complex interactions among agents and between agents and their environments on various scales. We apply ABM to a variety of problems and developed models on a variety of scales.



INQUA Commission: Humans and Biosphere

Session Title: Human-environment interactions in the late Quaternary: sources of evidence and applications

Convenors and Co-Convenors: Encarni Montoya (Co-Convenor) José Iriarte (Co-Convenor) Bronwen Whitney (Co-Convenor) Erick Robinson (Co-Convenor) Jacob Freeman (Co-Convenor) Steinar Solheim (Co-Convenor) Adolfo Gil (Co-Convenor) Claudio Latorre (Co-Convenor)

Description of Session: The last glacial period was characterised by similar environmental shifts that shaped the Pleistocene climatic conditions but differed from previous intervals in the occurrence of large human populations spread worldwide. Hence, by the end of the late Glacial, humans inhabited in all the continents and continued expanding their distribution area until the last, currently populated islands, were occupied in the last centuries. This new forcing factor likely altered the natural dynamics' trends of the ecosystems. However, the magnitude and rate of the anthropogenic footprint on the environment largely differs among regions. This session aims to highlight the relationships between modern humans and the environment from natural and anthropogenic points of view since the late Glacial to the present-day. We welcome contributions dealing with the socio-cultural approaches undertaken by early colonisers, the cultural developments following environmental shifts including climatic events or natural hazards such as volcanic activity, as well as the responses of ecosystems to the human occupancy and land use evolution. Also, new methodological approaches and the application of palaeodata to other disciplines will be encouraged. Multi-disciplinary research investigating human populations, natural dynamics and their interactions as part of the same ecosystem are needed to understand how the Earth system works and to accurately project potential future scenarios. This session is organized in collaboration with the PAGES People3000 (Paleoclimate and the Peopling of the Earth) working group.



INQUA Commission: Humans and Biosphere

Session Title: Lake systems in the Anthropocene

Convenors and Co-Convenors: Nathalie Dubois (Convenor) Catherine Dalton (Co-Convenor) Keely Mills (Co-Convenor) Aaron Potito (Co-Convenor) Emilie Saulnier-Talbot (Co-Convenor)

Description of Session: This session encourages palaeolimnologists and palaeoecologists working at a range of spatial and temporal scales to showcase examples of novel methods (analytical and statistical) of distinguishing natural from anthropogenically-driven change as recorded in lake sediments.

Natural and anthropogenic drivers can elicit similar responses in lake systems, yet the ability to attribute what change recorded in lake sediments is natural, from that which is anthropogenic, is challenging. The ability to distinguish natural from anthropogenic change in lake sediment archives is increasingly important for understanding how lake systems have, and will continue to function when subjected to multiple stressors. This issue is particularly acute when considering management options, including restoration and conservation, for aquatic ecosystems.

The need to quantify the timing and onset of human disturbance in lake systems and the ability to disentangle this from other signals recorded in sediment archives is an increasing focus of work in both the scientific and management spheres. With a paucity of 'real-time' data, especially pre-dating any human impact, palaeolimnological archives often offer the only insight into both natural variability (that driven by long-term climate variability and intrinsic lake processes) and the impact of people. The palaeolimnological approach is a powerful tool in establishing the natural dynamics and range of variability of an ecosystem and enables comparisons with current conditions, thereby allowing future trajectories to be more tightly constrained.



INQUA Commission: Humans and Biosphere

Session Title: Life on the edge: Landscapes and foodscapes in prehistoric western Europe

Convenors and Co-Convenors: Meriel McClatchie (Convenor) Fraser Mitchell (Co-Convenor) Michael O'Connell (Co-Convenor) Ellen OCarroll (Co-Convenor)

Description of Session: The session seeks to attract papers that provide fresh insights and overviews into human impact and interaction with the landscapes of western Europe from the Neolithic to the Iron Age. The session will cover aspects ranging from the timing and conditions pertaining at the Mesolithic/Neolithic transition; characterisation of Landnam events with respect to chronology, magnitude and duration; intensification of food production during the Bronze Age and changing patterns in human activity during the Bronze Age/Iron Age transition. The session will focus on archaeobotanical and palaeoecological investigations that explore the roles of climate, other environmental factors and cultural developments that may have been drivers of change.



INQUA Commission: Humans and Biosphere

Session Title: Life on the ledge: Human-environment dynamics in Earth's high mountains and plateaus

Convenors and Co-Convenors: Brian Stewart (Convenor) Kurt Rademaker (Convenor)

Description of Session: Of the world's habitable landscapes, mountain environments present humans with some of the most striking adaptive challenges. Despite the obvious challenges, however, upland landscapes also offer opportunities, attested by widespread archaeological sites in these settings from pre-Middle Stone Age African populations, Neandertals (and perhaps Denisovans), and of course modern humans.

Cross-cultural comparative research into montane hunter-gatherers in prehistory has focused on the settlement of expanses of contiguous high elevation terrain – the world's 'high plateaus.' Yet, the peopling of plateaus represents but one chapter in a much longer evolutionary story of when, how and why our genus engaged with mountains. Stretching from the early Pleistocene to late Holocene, this history spans hundreds of thousands of years, multiple hominin taxa, the world's high plateaus but also its much more widespread high mountain systems, as well as their adjacent foothills and lowlands.

This symposium will bring together archaeologists, paleoenvironmental scientists, and geneticists studying environmental change and biocultural adaptations in diverse upland settings across the globe. We seek to explore the timing, motives and modes of montane adaptation and key sources of variability that likely underwrote specific behavioral and biological records. Such sources include genetic or behavioral differences between hominin taxa; interplay of altitude, latitude and continentality; physiographic diversity of mountain systems; pace, magnitude, and effects of quaternary climatic and environmental shifts, landscape evolution and resource structures. The ultimate aim of the session is to examine broad evolutionary processes by which our genus engaged with highland landscapes through time with increasing frequency and intensity.



INQUA Commission: Humans and Biosphere

Session Title: Linking palaeo-environmental signals with social, cultural or economic change – attempts to disentangle causes and effects

Convenors and Co-Convenors: Walter Doerfler (Convenor) Parth R. Chauhan (Co-Convenor) Petr Pokorný (Co-Convenor) Ferran Antolin (Co-Convenor) Anna Broström (Co-Convenor) Wiebke Kirleis (Co-Convenor) Ingo Feeser (Co-Convenor)

Description of Session: Culture is not static but a continuous process. It is expressed by diverse behaviors found in varying ecological contexts and geographic locations. Looking back, cultural history seems to be built up by phases of relative stability and phases of rapid change. Such pattern can be observed with respect to economic and technological attributes or to expressions of social divergence in the archaeological record. But what were the internal and external driving forces and triggers for particular cultural transformations? Drastic changes in the socio-economic record are often associated with distinct environmental changes and are often interpreted to be linked either with climate change or extreme weather events, with over-exploitation or with epidemic plagues. But often it is not clear whether environmental change has triggered cultural change or if human agency was the catalyst for environmental change. The session invites papers that deal with such interpretative and methodological issues, in relation to signatures of behavioral change from the Palaeolithic to Modern Times. In this session we will deal with on-site and off-site signals of environmental and economic change in context of social and cultural change and the related question of causes and effects. The transitional behavioral evidence can be presented through diverse datasets: osteology, lithics, non-lithic artifacts, rock art, raw material exploitation, symbolic behavior, cognition, landuse patterns, subsistence patterns, environmental adaptations and theoretical aspects. Multi-disciplinary contributions from archaeo-botany, archaeo-zoology, palaeo-ecology and archaeology are especially welcome.



INQUA Commission: Humans and Biosphere

Session Title: Losing legacy: Climate change and cultural heritage

Convenors and Co-Convenors: Alice Kelley (Convenor)

Description of Session: Prehistoric archaeological sites preserve both cultural and paleoenvironmental archives through artifacts and organic remains of ancient daily and ritual life. These sites preserve humanity's only tangible link to the unwritten past, yet they are rapidly disappearing as a result of climate-change-related phenomena. Climate change impacts on archaeological sites may be direct (primary) or indirect (secondary). Primary affects include erosion linked to increased storminess and rising sea levels in coastal settings. Inland, increased river flooding endangers sites both through erosion or saturation. Damage linked to rising groundwater tables is an associated risk of increased precipitation. Rising temperatures in arctic and alpine settings impact frozen cultural material in ice and permafrost. In more temperate areas, rising temperatures are associated with potential loss due to increased wildfire activity. While currently not as dramatic, secondary impacts have the potential to exact a toll on cultural resources. As climate-driven population shifts and infrastructure remediation move into previously undisturbed or lightly settled areas, the potential for site disturbance increases. Taken together, these factors require strategies to respond to catastrophic events, plan for future impacts prioritize and enhance data recovery, and preserve information for the future. This session seeks contributions illustrating techniques and approaches developed to address climate change impacts (past, current, and future) in a variety of global settings.



INQUA Commission: Humans and Biosphere

Session Title: Making the Quaternary relevant: Outreach and education

Convenors and Co-Convenors: Kieran Craven (Convenor) Benjamin Thébaudeau (Convenor) Martha Coleman (Convenor)

Description of Session: This session aims to provide a forum for wide-ranging exchanges of ideas on methodologies and best practice for raising the awareness and relevance of the Quaternary Period among academia and the general public. It will promote the development and delivery of quality learning in formal and informal education and outreach settings to motivate the assimilation of aspects of Quaternary history, biology and geology and its influence on the modern world. Papers are invited from educators, journalists, curators and researchers alike to describe a range of projects and ideas on the dissemination of existing knowledge and new science.



INQUA Commission: Humans and Biosphere

Session Title: Multi-proxy environmental archaeology: Sedimentary remains and biomolecules as alternative to excavations?

Convenors and Co-Convenors: Tony Brown (Convenor) Nicola Whitehouse (Co-Convenor) Helen Mackay (Co-Convenor)

Description of Session: Research into climatic and biological proxies from marine and lake cores is now becoming useable in archaeology. These new techniques include a range of stable isotopes and biomarkers as well as sedaDNA. At present, and probably for some considerable time to come, these techniques will be used alongside traditional proxies such as pollen, charcoal, diatoms and insects but they have the potential to be far more specific about both human activities (e.g. faecal sterols and bile acids) and on-site biotic conditions (species or even below species level local vegetation, plant resources, and domesticated animals). Important questions remain concerning the taphonomy of the biomolecules, spatial representation and the detection of human vs natural variation. However, the potential of waterlogged or sealed deposits, from lakes to latrines, on and adjacent to archaeological sites is huge to both answer existing and raise new archaeological questions. Contributions are invited from any studies of wetland, lake alluvial or other sites where multiple proxies for environmental change and/or new stable isotope or biomarker methods are being used.



INQUA Commission: Humans and Biosphere

Session Title: New advances in reconstructing biotic interactions in the Quaternary fossil record

Convenors and Co-Convenors: Jacquelyn Gill (Convenor) Jessica Blois (Co-Convenor)

Description of Session: Understanding the complex interaction of factors that structure species and communities across space and time is a central goal of ecology, but disentangling these relationships in the fossil record has historically been challenging. To date, paleoecological research has largely focused on the climatic drivers of distributions and assemblages. However, species interactions may themselves influence how species and their assemblages respond to changes in the abiotic environment. There's a growing recognition of the importance of understanding biotic interactions in the Quaternary fossil record, including several of the "50 priority research questions" identified in a recent horizon-scanning workshop for paleoecology (Seddon et al. 2014, *Journal of Ecology*, 102: 256–267). Methodological advances and new interdisciplinary approaches are allowing to tackle these questions in novel ways, both within and across taxonomic groups and trophic levels. In this session, we will highlight a diversity of new and exciting approaches in reconstructing biotic interactions in the Quaternary, drawing on multiple disciplines and case studies of positive and negative biotic interactions from around the world, including herbivory, plant-fungal symbiosis, seed dispersal, insect outbreaks, competition, and nutrient cycles, as well as the conservation and management implications of Quaternary biotic interactions for modern ecosystems.



INQUA Commission: Humans and Biosphere

Session Title: Old World ceramic origins and behavioural contexts from the Late Pleistocene to Early Holocene

Convenors and Co-Convenors: Fumie Iizuka (Convenor) Karisa Terry (Co-Convenor)

Description of Session: Recent research on ceramic origins in the Old World emphasizes their adoption by hunter-gatherers, thus adding critical insights against the conventional idea that sedentary farmers first used pots. In light of the fact that farming societies and Ice Age foraging communities adopted ceramic vessels, pottery and associated technology, timing, and behavioral contexts are quite variable. Additionally, differences in archaeological recovery conditions, funding, and focus tend to inhibit balanced comparisons. In this session, we intend to revisit unresolved problems, emerging questions, and new data regarding ceramic origins through evaluation of site and region-based strengths and limitations in the Old World.

Notably, ceramics were adopted in varied contexts: (1) cattle keepers and foragers in northern Africa at the Pleistocene-Holocene transitions, (2) foragers with low residential mobility in Europe by 30k years ago in forms of figurines and pellets, and (3) highly mobile hunter-gatherers around 16/15k Cal BP in Japan. Unresolved problems and questions include: (1) in China, rice domestication is inferred to have occurred in the Early Holocene, but early pottery in Southern China, dated to the Late Pleistocene, has associated likely domesticated rice phytoliths, and (2) in the Transbaikal region of Siberia, radiocarbon dates suggest pottery origins in the Late Pleistocene but early pottery is recovered from Early to Mid-Holocene age stratigraphic layers.

In this session, we welcome problem-oriented ceramic origins case studies that focus on materials, geochronology, and paleoenvironments from varied regions in the Old World to provide a base-line comparison for world-wide emergence of ceramics under various conditions.



INQUA Commission: Humans and Biosphere

Session Title: Pleistocene hunter gatherers in extreme environments

Convenors and Co-Convenors: Eleanor Scerri (Co-Convenor) Huw Groucutt (Co-Convenor) Patrick Roberts (Co-Convenor)

Description of Session: Human evolution in Africa is typically correlated with savannah and grassland environments. Conversely, significantly different ecologies, such as deserts or tropical rainforests have been viewed as extreme environments, and therefore barriers to hominin habitation. However, the difference in character and scale of archaeological and palaeoenvironmental records means that it is has not always been possible to accurately identify human habitats. For instance, rapid episodes of environmental amelioration (e.g. in deserts), or forest fragmentation, may have limited visibility and make clear associations between human and environmental records difficult. Likewise, research biases and preservation issues also strongly affect construction of the record. This means that the degree of habitat diversity among early humans, together with its consequences, is still far from well understood. This session will consider the evidence for habitat diversity among Middle and Late Pleistocene *H. sapiens*. We welcome both methodological and data-driven insights, as well as examples featuring other non-*Homo sapiens* hominins.



INQUA Commission: Humans and Biosphere

Session Title: Plio-Pleistocene environmental change and human origins

Convenors and Co-Convenors: Asfawossen Asrat (Co-Convenor) Henry Lamb (Co-Convenor) Frank Schaebitz (Co-Convenor)

Description of Session: Understanding the relationship between earth system history and human origins is an enduring challenge of broad scientific and public interest. Key questions include: how did climate and tectonic change interact during critical intervals of human evolution? What processes regulated this history on local and regional scales? How and when did climatic and tectonic processes combine to influence hominin habitats, food resources, demography and dispersal? Were these changing conditions related to evolutionary processes and events in the hominin lineage? New research in Africa, Asia and Europe aims to test a variety of hypotheses about how environmental change may have influenced human origins and dispersal across the globe. We invite contributions on these issues from a diverse range of researchers in Plio-Pleistocene sciences, including geochronology, archaeology and palaeoanthropology.



INQUA Commission: Humans and Biosphere

Session Title: Quantitative reconstruction of landscape-scale Holocene vegetation mosaics to address ecological and archaeological questions

Convenors and Co-Convenors: Michelle Farrell (Convenor) Heather Pardoe (Co-Convenor) Jane Bunting (Convenor) Michael Grant (Convenor)

Description of Session: Palynology provides a wealth of information about climate-plant community relationships, response of plants to biotic and abiotic change, structure of past vegetation, and past human activity and land use. However, a vast repository of palynological data (including modern observational data) exists, some in databases such as EPD and NEOTOMA, and is currently under-utilised by both palynologists and researchers in related disciplines, including ecology and archaeology.

This session explores the range of quantitative methods available to fully interpret palynological data, whether to reconstruct past vegetation, to address archaeological problems, to refine our understanding of the pollen-vegetation relationship and vegetation dynamics or to assess the influence of environmental factors, notably climate change. Land-cover reconstruction is underpinned by an understanding of contemporary processes, e.g. through measurement of properties such as relative pollen productivity, essential for algebraic models, and through analysis of modern analogues, using surface pollen data from traps and moss samples, which enable interpretations of fossil assemblages from different ecosystems to be refined. Incorporation of multiple proxies can further enhance palaeoecological reconstructions.

Numerous modelling techniques exist, with a current focus on reconstructing land-cover dynamics at the sub-continental scale, providing valuable inputs to regional climate models (e.g. the PAGES LandCover6k Working Group). However, there are few examples where this approach has been used on the landscape-scale (typically <tens of kilometres) to investigate smaller-scale processes of interest to ecologists and archaeologists. We invite submissions from researchers using any methods or proxies to develop land-cover reconstructions at a landscape-scale, and their application to interdisciplinary problems.



INQUA Commission: Humans and Biosphere

Session Title: Quaternary polar environmental history: Joint proxies and views from both poles

Convenors and Co-Convenors: Eva Panagiotakopulu (Convenor) Hans-Peter Blankholm (Co-Convenor)

Description of Session: A long term perspective on climate and environment in circumpolar regions is needed in order to obtain a better understanding of change over time including human impact. Human impact has increased substantially in relatively recent years in circumpolar environments. Sedimentary and other palaeoecological records from around the poles can provide interesting perspectives on how these environments were shaped. From the apparently limited impacts of hunter-gatherer-fisher groups and the creation of early anthropogenic and synanthropic environments, often in areas already affected by climatic uncertainty and sea level change, to larger scale woodland clearance and the introduction of farming and subsequent Europeanisation of subarctic and cool temperate landscapes, circumpolar areas have been modified by humans. These impacts range from extinctions and extirpations in the megafauna down to localised eutrophication of water bodies, introduction of alien grazers to impact of introduced pathogens on both human and animal populations, and the overall impact of climate change, both natural and anthropogenic. Using multidisciplinary research, notably geomorphology, palaeoecology and archaeology, this session will investigate change in circumpolar environments during the late Quaternary and will look into the effects of climate on humans and also how people in these regions modified and shaped the environments around them. This will allow parallels and differences to be highlighted between regions in the two hemispheres. The detailed overview of past environmental change and human response and impact will place current change in its long term context, providing much needed evidence for assessing this and for making decisions for conservation.



INQUA Commission: Humans and Biosphere

Session Title: Quaternary science and the Arts, Humanities, and Social Sciences

Convenors and Co-Convenors: Katherine Roucoux (Convenor) Ian Lawson (Co-Convenor)

Description of Session: Quaternary Science has always been a multidisciplinary activity. Understanding the Earth system and its history requires the integration of many different lines of evidence from the natural sciences, and we have often worked alongside archaeologists and historians. But increasingly, natural scientists are being asked to expand their research horizons to encompass the arts, humanities, and social sciences – a characteristic of an increasing number of grant calls, for example, those of the UK’s Global Challenges Research Fund. The long-term perspective provided by Quaternary Science is clearly relevant to understanding and addressing issues such as climate change, biodiversity decline, and the interconnected challenges of poverty, population growth, and development; but equally clearly, Quaternary Science cannot address these issues alone. This session will provide an opportunity to present and discuss inter-, multi- and trans-disciplinary collaborations between Quaternary scientists and specialists in the arts, humanities and/or social sciences, in either knowledge production or communication.



INQUA Commission: Humans and Biosphere

Session Title: Quaternary's three Rs, Retrieval, Reuse and Reflection: Optimising pre-existing data to reimagine the past

Convenors and Co-Convenors: Michael Grant (Convenor) Benjamin Gearey (Convenor)

Description of Session: Quaternary scientists have been prolific over the last century, generating vast datasets from across the globe. Such datasets, when collated, provide the 'Big Data' that is desperately required to not only further our understanding of the earth system, but to inform social sciences and help define / underpin public policy. Over the past 50 years, many databases have been developed with the sole purpose of collating and making accessible a vast array of different Quaternary data, spawning a new sub-discipline known as palaeoinformatics. While existent datasets do have inherent complexities, such as variable methodologies, they provide the opportunity to test and even debunk existent hypotheses or identify previously unforeseen underlying trends. Utilising such data is fundamental for underpinning of scientific methodology and provides the opportunity to rapidly, and cost-effectively, contribute to pressing social and public policy questions, along with strengthening the movement for open access science dissemination. This session focuses upon end-users utilising both existent databases and /or their own data retrieval endeavours, showcasing studies where new advances / perspectives have been gained solely through collating and re-evaluating pre-existing data. A key component of this session will be the collective experience of such an endeavour, showcasing the techniques employed to overcome limitations inherent in existent datasets such as archive accessibility, data reprocessing and metadata integrity.



INQUA Commission: Humans and Biosphere

Session Title: Resilience, stability and abrupt change in long-term ecological records.

Convenors and Co-Convenors: Alistair Seddon (Convenor) Pete Langdon (Co-Convenor) Michael Shawn Fletcher (Co-Convenor) Kathy Willis (Co-Convenor)

Description of Session: Identifying the properties that underpin ecosystem resilience and/or stability in response to climate change and other disturbances is a global research priority, but the methods used to quantify ecological resilience can vary depending on the study system and context. Although there are a number of recent examples that have mapped components of ecological resilience at global scales, these ecological 'snapshots' are based on measurements documenting ecological changes from timescales of years to decades. Whether the patterns identified by such studies reflect fundamental properties of the systems, or are a result of historical disturbance legacies remains unknown. Thus, to fully understand the drivers and underlying dynamics resulting in ecological resilience requires a historical perspective that documents system dynamics covering timescales of centuries to millennia.

This session is dedicated to papers focussed on ecological resilience from long-term ecological records. We invite contributions which (i) introduce new techniques to quantify and compare components of resilience in long term ecological datasets; (ii) identify patterns (in time/ space) of drivers (biotic, abiotic) of stability and resilience; and (iii) test key assumptions and predictions of resilience theory using long-term methods. We encourage papers from across a range of biome types; from tropical to arctic, terrestrial to freshwater ecosystems, using timescales from decades, centuries, and millennia, including multi-proxy studies from individual sites to larger scale syntheses. Papers which use a combination of model data-assimilation techniques and/or multi-proxy studies will be encouraged.



INQUA Commission: Humans and Biosphere

Session Title: Sub-decadal to centennial analysis of past ecosystem change

Convenors and Co-Convenors: Jean Nicolas Haas (Convenor) Benjamin Dietre (Co-Convenor)
Thomas Giescke (Co-Convenor)

Description of Session: Palaeoecology provides important insights on the rate at which ecosystems can change in response to short-lived disturbances such as past earthquakes, tsunamis, storms, droughts, fires or pathogen outbreaks. On the other hand, mid- to long-term ecosystem transformations in response to climatic or anthropogenic change are well documented in the (sub-)fossil record. Key to the reconstruction of the duration and dynamics of such changes on ecosystem or landscape level is an adequate dating control and a sub-centennial sample resolution of the palaeoecological data. We like to invite oral and poster contributions based on reconstructions with sub-decadal to centennial sample resolution and the analysis of the dynamics, triggers and responses of ecosystem change. We welcome analysis of microfossils (e.g. pollen, diatoms) and macrofossils (e.g. seeds/fruits, chironomids), as well as other indicators of past ecosystem change from all kinds of stratified deposits with high temporal resolution.



INQUA Commission: Humans and Biosphere

Session Title: The application of Quaternary science to societal issues in the 21st Century

Convenors and Co-Convenors: Rolfe Mandel (Co-Convenor) Julio Betancourt (Co-Convenor) Ester Szein (Co-Convenor)

Description of Session: Our proposed session, organized and sponsored by the U.S. National Committee (USNC) for Quaternary Research-INQUA, will have speakers at the frontier of applied Quaternary science. The speakers will include both early-career and senior scientists. Since its inception in 1928, one of INQUA's basic goals has been to improve communication and international collaboration in all aspects of Quaternary research. This session is being proposed because many of the environmental and societal challenges in our fast-changing world will require a repurposing and retooling of Quaternary science to solve a daunting list of real-world problems. The proposed session follows the 24th Biennial AMQUA 2016 meeting with the theme "Retooling the Quaternary to Manage the Anthropocene." Subsequently, we organized "A Call to Arms: Applying Quaternary Science in the 21st Century," a session at the 2017 annual meeting of the Geological Society of America. Hence, the proposed session is part of an ongoing USNC-INQUA effort to push the frontiers of applied Quaternary science and identify and articulate grand challenges for the discipline. Both AMQUA and the USNC-INQUA aim to continue building momentum towards a global "community of practice." The proposed session will address how profound environmental, technological, and societal trends, and their interactions pose formidable consequences, requiring a repurposing and retooling of applied Quaternary science, with applications spanning disciplines, nations, and existing and emerging problems.



INQUA Commission: Humans and Biosphere

Session Title: The changing tropical landscape

Convenors and Co-Convenors: William Gosling (Convenor) Crystal McMichael (Co-Convenor)

Description of Session: Eighteenth century explorers marveled at the diversity of tropical ecosystems seemingly untouched by human activity. As a result of these observations, the notion of tropical stability, in terms of vegetation and climate, came to underpin theories of evolution, ecology, and biogeography. Gradually, however, it has become apparent that tropical landscapes have changed markedly through time in response to global climate cycles, (a)biotic factors, and human activity. For example, palaeoecological, geomorphological and archaeological research has shown that hidden civilizations, mega-faunal extinctions, and land-cover changes have contributed to shaping modern diversity patterns. Interactions between these processes and events through time have led to the complex and diverse landscapes observed in the tropics today. Yet the relative influences driving this hyper-diversity remain unresolved. In this session we invite the submission of talks and posters focused on any avenue of research investigating the patterns and processes relating to changing tropical landscapes, including but not limited to biogeography, palaeoecology, geomorphology, volcanology, and archaeology.



INQUA Commission: Humans and Biosphere

Session Title: The Levantine Corridor: Before humans, during human dispersal and settlement and the future

Convenors and Co-Convenors: Darren Jeffers (Convenor)

Description of Session: The Levantine Corridor is the relatively narrow strip of land that is bounded by the Mediterranean Sea to the West and the expanse of the Arabian and Syrian deserts to the East. Due to its location at the boundary of these two distinct climatic zones it is a climatically sensitive (semi-arid to arid) region. Its geographical location at the bottleneck between the large landmasses of Africa and Eurasia has resulted in it playing an important role in human development, as the dispersal route of anatomically modern humans from Africa to Europe and as the site of early agricultural and social intensification. Although, rich in archaeological archives, from a natural climate/ecological archive perspective, it is data poor. There are therefore gaps and inconsistencies in our knowledge of climate variability and associated vegetation responses. The reconstruction of precipitation and ecosystem dynamics is increasingly important in terms of understanding past cultural developments and determining how the climate system will behave in the future. As this region is projected to be one of the most severely impacted due to severe water scarcity as the result of climate change

The aims of this session are to:

- To highlight and learn about novel research related to climate, landscape and vegetation dynamics in the Levantine Corridor that is utilising natural archives
- To understand how these long-term records can be used to help determine how the climate system will behave in the future

Contributions are welcome from anybody conducting research in the Levantine Corridor using natural archives



INQUA Commission: Humans and Biosphere

Session Title: The origins and history of Quaternary science

Convenors and Co-Convenors: Richard Bradshaw (Co-Convenor) Kevin Edwards (Co-Convenor)

Description of Session: A recent international symposium celebrating 100 years of Quaternary pollen analysis highlighted the rich material contained in archives and in the memories of retired palynologists. The largely unrecognised aspects of the evolution of ideas, the personalities involved and the early international history of the field clarified many gaps in our awareness of disciplinary development. This experience is likely to be replicable in the wider field of Quaternary Science and this session seeks to provide a forum to workers in the history of the scientific areas which contribute to knowledge of the Quaternary. We welcome contributions on the historical development of all areas of Quaternary Science. While not wishing to be overly prescriptive, possible themes might include:

- Contrasting attitudes to the anatomy of Quaternary Science sub-disciplines as reflected in fieldwork, laboratory work, modelling, theorizing and the testing of research ideas
- Interdisciplinary research
- Knowledge exchange
- Relationships with the broader public
- Gender issues and the changing role of women in science
- The effects of war on research
- The building of invisible colleges and student-supervisor relationships, including international collaboration
- Historiography
- Journals, bibliometrics and attitudes to publication
- Meetings – local, national and international as agents of knowledge exchange
- Biographies

The session will consider whether studies of past development of research and ideas help guide understanding of the present situation, or whether current and anticipated developments have lost vital connections to the past. Do scientific revolutions build incrementally on previous work or are episodic paradigm shifts of central importance?



INQUA Commission: Humans and Biosphere

Session Title: Unanswered questions on the Initial Upper Paleolithic and the first modern human dispersal across Eurasia

Convenors and Co-Convenors: Masami Izuho (Convenor) Nicolas Zwyns (Co-Convenor) Steven Kuhn (Co-Convenor)

Description of Session: The Initial Upper Paleolithic (IUP) is an important but ambiguous archaeological phenomenon. It refers to a sudden change in the way humans produce their stone tools sometimes, around 45,000 years ago associated (but not always) with novel forms of “modern human behavior” (beads, shaped bone tools, etc.). Contemporary of the earliest Homo sapiens remains in Eurasia; it is a key for understanding the historical and evolutionary processes leading to the establishment of our species outside of Africa.

The IUP; however, embodies many of the fundamental difficulties we encounter in studying cultural phenomena in Prehistory. When the definition is used in the broadest sense, the IUP is extraordinarily widespread, having been reported from Central Europe to China. Currently, it appears as a highly variable and, in some places, a long-lasting phenomenon. This raises questions regarding the definition of the IUP concept and the cultural unity of this phenomenon. The immediate goal for this proposed session is to obtain a better characterization, and ultimately explanation, of the Initial Upper Paleolithic in Eurasia, thereby helping to resolve key uncertainties in accounts of modern human dispersals and the origins of Upper Paleolithic behavioral patterns in Eurasia.

The session has a broader impact for Quaternary Sciences as well. It is a real challenge to explain such extraordinarily widespread cultural patterns. What we learn from the session focusing on the IUP should provide a series of methodological guidelines for addressing similar sorts of cultural phenomena in the Paleolithic of regions and periods.



INQUA Commission: Humans and Biosphere

Session Title: Upscaling palaeoecological, archaeological and historical records of land-use and land-cover change to the globe for earth system modelling and sustainable land-system management

Convenors and Co-Convenors: Marie-Jose Gaillard (Convenor) Andria Dawson (Co-Convenor) Esther Githumbi (Co-Convenor)

Description of Session: In a changing world, both in terms of resource availability and climate, sustainable land systems need to be based on holistic syntheses of knowledge on the effect of land-use and land-cover change on natural resources and the climate system. Land-use change is one of many climate forcings. The net effect of both biogeochemical and biogeophysical processes due to land-use change is still a matter of debate. This session is linked to PAGES LandCover6k (www.pastglobalchanges.org/ini/wg/landcover6k/intro), a working group whose primary goal is to provide earth system modelers (e.g. the CMIP and PMIP initiatives) with relevant, empirical data on past land-use and anthropogenic land-cover change over the globe. These global land-cover datasets are being provided as terrestrial forcing scenarios for ALCC modelling and earth system models (ESMs), and for other researchers interested in vegetation-atmosphere feedbacks and the early advent of the Anthropocene. The time period studied by LandCover6k covers the Holocene up to AD 1850. The session welcomes all contributions on historic and pre-historic long-term dynamics and drivers of land-use, anthropogenic land-cover and land- system change that may cast light on the characteristics of sustainable versus non-sustainable land systems over time, e. g. pollen-based land-use and land-cover change, archaeological and historical records and related palaeoecological data, as well as modelling studies on anthropogenic land-cover change (ALCC) and climate-land use interactions.



INQUA Commission: Humans and Biosphere

Session Title: Valuing the Quaternary: Nature conservation and geoheritage

Convenors and Co-Convenors: Eleanor Brown (Convenor) David Bridgland (Convenor) John Gordon (Convenor) Vanessa Brazier (Convenor) Fraser Mitchell (Convenor)

Description of Session: The Quaternary palaeoenvironmental record is a vital source of information for conserving and managing the natural environment. Quaternary geoscience provides the long-term baseline data that can be applied to understanding climate change and its effects on the natural environment; informing the restoration of ecosystems; identifying the physical constraints for sustainable development; and understanding how ecosystem services have changed over time, their resilience and vulnerabilities. However, Quaternary terrestrial and marine sites are under increasing threat from anthropogenic activity, including development and land-use change. Conserving our Quaternary geoheritage is important because it celebrates the history of science; conserves scientifically valuable field sites for education and research; underpins natural landscapes and habitat diversity; provides carbon storage; and delivers important elements of natural capital and ecosystem services. There is growing international recognition of the need to raise awareness of the importance of applied Quaternary geoscience for nature conservation as well as for the need to take action to conserve our important Quaternary geoheritage; particularly as this is often overlooked in the development of policies relating to planning, nature conservation and the natural environment. This session will examine the value of the Quaternary for understanding nature and we invite abstracts that explore the application of Quaternary geoscience to modern nature conservation issues or that illustrate the importance of conserving and managing our Quaternary geoheritage.



INQUA Commission: Palaeoclimate

Session Title: Abrupt changes in climate and ice sheets during glacial-interglacial cycles

Convenors and Co-Convenors: Ruza Ivanovic (Convenor) Lauren Gregoire (Co-Convenor) Laura Robinson (Co-Convenor)

Description of Session: Understanding how and why rapid environmental changes took place in the Quaternary remains a key challenge in the field of climate science. In particular, it remains difficult to reconcile the chain of events between recorded warming, cooling, iceberg calving, ice sheet melt and sea level rise. Many of these events have been linked with changing greenhouse gases, collapsing ice sheets and rapid reorganisations of ocean circulation. However, the fundamental questions remain: How can progressive climate trends trigger rapid changes? What are the internal instabilities and ice-ocean-atmosphere interactions that drove the sudden transitions? Are they stochastic responses in a variable Earth System or are the processes consistent across glacial-interglacial cycles? What was their environmental impact?

For this session, we invite contributions that seek to better constrain the chain of events surrounding abrupt changes in climate and ice sheets during glacial-interglacial cycles. We encourage submissions covering mechanistic-modelling, data acquisition and reconstructions of the events and their impact.



INQUA Commission: Palaeoclimate

Session Title: Abrupt climate changes: The view from lakes

Convenors and Co-Convenors: Jule Xiao (Convenor) Jonathan Dean (Co-Convenor)

Description of Session: The Earth's climate system has experienced a series of abrupt changes during the recent geological past. Abrupt climate changes occurring on centennial to multi-decadal scales could provide an analogue for what might happen with future global warming, thus have attracted increasing attention from paleoclimatologists. In this regard, lake records are of special importance due to the fact that they contain a diverse selection of proxies, respond sensitively to climate change and are highly resolved and geographically widespread. This session invites contributions of newly obtained high-resolution, multi-proxy data from lake sediments, to allow for the exchange of the latest results and ideas regarding changes in hydrology, ecology and climate recorded by lakes at different latitudes during the late Quaternary. This session will aim to identify the regional expression of different abrupt climate changes occurring in the past, thereby progressing our understanding of the mechanisms responsible for abrupt climate changes on different timescales and the possible environmental effects of future global warming in different regions.



INQUA Commission: Palaeoclimate

Session Title: Advances in historical climatology and climate history

Convenors and Co-Convenors: David Nash (Convenor) Georgina Endfield (Co-Convenor) Linden Ashcroft (Co-Convenor)

Description of Session: Historical documents such as ships' logs, journals, newspapers, maps, legal/commercial reports, and letters, provide unique sources of information through which to reconstruct past climate variability. The high temporal resolution and timespan of such documents offers the potential to bridge the gap between traditional proxy records and modern instrumental data, including through the identification of hydrometeorological extremes. Historical documents also provide insights into the impacts of past climate variability upon human populations, and permit critical evaluations of the vulnerability, resilience and adaptive capacity of individuals and societies to climate change.

The interval since the last INQUA Congress has seen considerable advances in the allied fields of historical climatology and climate history. Climate reconstructions have advanced in many areas to the extent that they can be used as a backdrop against which to consider the impacts of climate variability upon different sectors of society, and differential responses to such variability.

The goal of this session is to bring together researchers from across historical climatology and climate history to reflect critically upon these advances. We welcome, in particular, papers presenting empirical, methodological and/or theoretical insights into the following:

- Reconstructions of historic climate variability using documentary sources;
- Interregional and intrahemispheric comparisons of historical climate variability;
- Integrating climate reconstructions based on human records (including early instrumental data) with those based on natural and modern instrumental records;
- Investigations of social vulnerability and/or resilience to historic climatic variability at a range of temporal and spatial scales;
- Critical evaluations of historical societies under climatological stress.



INQUA Commission: Palaeoclimate

Session Title: Aeolian mineral dust and climate: Interactions, simulations and climate archives

Convenors and Co-Convenors: Steve Pratte (Convenor) François De Vleeschouwer (Co-Convenor) Barbara Delmonte (Co-Convenor) Fabrice Lambert (Co-Convenor) Stefania Gili (Co-Convenor)

Description of Session: Mineral dust aerosols play an important role on global climate and have significant implications on the Earth's radiative balance, cloud properties, atmospheric chemistry and fertilization of marine and terrestrial ecosystems. Additionally, properties of dust deposited in different types of sediments and environmental archives are important climate proxies. While great advances have been realized in the understanding of the global dust-climate interactions, several discrepancies remain among different models and between models and observations. This session aim is to discuss recent advances in our knowledge on the dust cycle (particle characteristics, emission, transport and deposition), numerical simulations and impact of dust on the Earth including cloud and radiation, atmospheric chemistry and biogeochemical cycles. We invite any studies using dust as a climate indicator in (paleo-) archives including investigation of ice cores, lake sediments, peat bogs, marine sediments and Loess. We welcome talks focusing on modern observations and model simulations of past, present and future dust-climate interactions. We particularly encourage presentations on the integration of different disciplines and/or focusing on the knowledge transfer between the modelling and observation communities.



INQUA Commission: Palaeoclimate

Session Title: Arctic Sea ice reconstructions and proxy development

Convenors and Co-Convenors: Sofia Ribeiro (Co-Convenor) Maija Heikkila (Co-Convenor) Kaarina Weckström (Co-Convenor) Stijn de Schepper (Co-Convenor) Christof Pearce (Co-Convenor)

Description of Session: Arctic sea ice has declined sharply over the last decades, which represents one of the most striking consequences of anthropogenic climate change. Modelled predictions indicate that the Arctic is heading towards a tipping point, with sea ice-free summers occurring already within the next few decades. Although the observed current rates of sea-ice loss appear to be unprecedented over the last millennia, it is still uncertain whether the shift from perennial to seasonal ice cover expected for the near future is unique in the context of the current interglacial.

Reconstructions of past variability using paleo-records such as marine sediments, ice cores and modelling studies provide invaluable data for extending records of sea-ice cover to the pre-instrumental era. Recent integrative efforts, however, have highlighted important uncertainties in proxy-based sea-ice reconstructions that result from a poor mechanistic understanding of individual proxies, limited quantifiability, and gaps in understanding of proxy-environment relationships at relevant time-scales. Proxy calibration has hitherto been indirect and correlative, relying on statistical relationships between large-scale surface-sediment proxy assemblages to satellite measured sea-ice cover, but there is a need to advance our knowledge of the underlying factors that link the distribution of proxies temporally and spatially to sea-ice conditions.

This session welcomes contributions dealing with proxy-based and modelled reconstructions of sea ice in the northern hemisphere during the Holocene as well as glacial-interglacial variability during the Late Quaternary. We encourage input from studies with novel approaches to sea ice reconstructions and proxy development, as well as data-model comparison studies.



INQUA Commission: Palaeoclimate

Session Title: Are North Atlantic 'Heinrich Stadials' cooling or warming events...or both?

Convenors and Co-Convenors: Gordon Bromley (Convenor) Stephen Barker (Co-Convenor) Samuel Toucanne (Co-Convenor)

Description of Session: Heinrich stadials are an intrinsic feature of Earth's climate system associated with large-scale, typically rapid shifts in temperature, precipitation, ocean circulation, and atmospheric chemistry. In the North Atlantic, these events are also characterised by the deposition of ice-rafted 'Heinrich layers'. Thanks in part to the methodologic refinement of palaeoclimate proxies, the last decade has seen a remarkable increase in the spatial coverage and quality of climate data pertaining to Heinrich stadials, particularly those during the LGM and termination. In the Southern Hemisphere and the tropics, Heinrich stadials appear to have been warming events marked by deglaciation and ocean-surface heating. In contrast, the prevailing view from the Northern Hemisphere is one of stadial cooling, linked to weakening of the Atlantic meridional overturning circulation. Yet emerging data from both the marine and terrestrial realms hint at elements of stadial warmth, raising the question of whether Heinrich stadials in the North Atlantic are also periods of amplified seasonality.

This session will bring together the latest terrestrial and marine data from key sites in order to review, holistically, our understanding of Heinrich stadials as abrupt climate change events: how they are manifested, and what drives them. Our emphasis is on the most recent stadials, for which data are most abundant, but we stress the temporal and geographic scope of this session is broad. Ultimately, we aim to foster a new discussion on the impact and causes of Heinrich stadials, based around well-dated palaeoclimate records and taking into account both the marine and terrestrial contexts.



INQUA Commission: Palaeoclimate

Session Title: Bayesian statistical analysis methods for paleoclimate data

Convenors and Co-Convenors: Niamh Cahill (Convenor) Andrew Parnell (Co-Convenor) Michael Salter-Townshend (Co-Convenor)

Description of Session: Detecting and quantifying changes in past climate is essential for providing a context for the present and helping to predict the future. To infer such processes means employing statistical models to deal with uncertain, multivariate data, often with spatial and temporal dependencies, to produce meaningful noise free climate signals. Over the last 10 years, a movement has started within palaeoclimate science to use proxy systems models in a Bayesian hierarchical framework to allow richer quantification of uncertainty. This new modelling framework promises reductions in uncertainty by borrowing strength between proxies, climate variables, locations, and time-points. We believe a session highlighting innovations and common choices for analysing these complicated, error-prone data sets will stimulate important discussion that can drive the future direction of statistical model development in this field. We hope this will pave the way for collaborations among scientists all striving to understand the complexity of our ever-changing climate through the use of statistical techniques.



INQUA Commission: Palaeoclimate

Session Title: Black Sea and Caspian in the frame of their Eurasian drainage basin

Convenors and Co-Convenors: Suzanne Leroy (Convenor) Alina Tudryn (Co-Convenor)

Description of Session: The Marmara Sea, Black Sea, Caspian Sea and Aral Sea form a large area of water bodies that have been connected and disconnected several times across the Quaternary. This region is fed by powerful rivers that have been fed by the melting of the Eurasian icesheet during successive deglaciations. The changing nature of the regional hydrography has had a huge impact on the geomorphology, limnology, biogeography, biodiversity and climate of the region. This session also includes large lakes in the region, such as Urmia and Van, as they are good climatic archives too.

We call for oral and poster contributions from a vast multidisciplinary field ranging from geology to archaeology, via phylogenetics.



INQUA Commission: Palaeoclimate

Session Title: Bridging the gap between proxies/reconstructions and simulations in the late Holocene period

Convenors and Co-Convenors: Juan José Gómez-Navarro (Convenor) Oliver Bothe (Co-Convenor) Patrick Ludwig (Co-Convenor) Eduardo Zorita (Co-Convenor)

Description of Session: This session invites contributions on innovative approaches facilitating the comparability between the two main sources of information about past climate variability and past environmental changes, i.e. paleo-observations (proxies and reconstructions) and simulations. It welcomes research focused on designing and applying innovative methods for the joint use of observations and models in paleoscience, e.g., reanalyses, data assimilation, and proxy system models. Further, we encourage the submission of new approaches that bridge the scale gaps between simulations and observations allowing the characterisation of both model and proxy reconstruction uncertainties, e.g., downscaling and upscaling methods, as well as forward modelling techniques.



INQUA Commission: Palaeoclimate

Session Title: Building a better understanding of past climates, ecosystems, and societies through Open Big Data

Convenors and Co-Convenors: John Williams (Convenor) Steven Phipps (Convenor) Philip Buckland (Co-Convenor) Lucien von Gunten (Co-Convenor) Tim Kohler (Co-Convenor) Oliver Bothe (Co-Convenor)

Description of Session: Information on past climatic, ecological, and societal changes is generated from a range of distinct proxies and archives. Quaternary science data resources have grown to a volume and complexity to be considered Big Data. Open data and workflows are essential to ensure high-quality, reproducible, global-scale insights into the operation of the earth system and its subsystems. Specific needs include: 1) gathering and sharing data through comprehensive, transparent, community-curated, and open data resources, 2) design and governance of these data resources so that they support the complexities of Quaternary data and the dispersion of data and knowledge across scientists and institutions, 3) building of open scientific workflows that connect primary data to derived inferences about e.g. global temperature fields, land cover reconstructions, and the distribution and evolution of societies, 4) designing systems to regularly update derived inferences as new records are generated and records updated, and 5) connecting these large-scale syntheses of observational data to earth system modeling and data-model assimilation. Significant advances are being made in all areas.

This session highlights current advances in the Quaternary data sciences and the continental- to global-scale paleoclimatic, paleoecological, and archaeological syntheses powered by these advances. We welcome contributions that describe advances in the data sciences (e.g. new data resources, protocols, links among data resources, establishment of communities of data contributors and stewards) and/or contributions that describe the resultant insights gained into the past climate system, biosphere, and societies at broad scales.



INQUA Commission: Palaeoclimate

Session Title: Climatic and human impacts of volcanism during the Quaternary

Convenors and Co-Convenors: Francis Ludlow (Convenor) Michael Sigl (Co-Convenor) Céline Vidal (Co-Convenor)

Description of Session: Volcanic eruptions produce regional to global climatic impacts. Global-scale impacts arise primarily from the injection of sulfur dioxide into the stratosphere, where it oxidizes to form sulfate aerosols, leading to changes in atmospheric clarity and an associated backscattering of incoming solar radiation. The net temperature impact of these aerosols is a short-term but potentially large decrease in global mean surface temperatures. Patterns of atmospheric circulation and precipitation can also be impacted, leading to complex regional hydroclimatic impacts. Explosive volcanic eruptions have occurred during the Quaternary on a frequency and magnitude (e.g., Toba super-eruption) far beyond the range of contemporary human experience. Studying the impacts of such eruptions in climate model simulations, as well as examining the fingerprints of such eruptions in geologic deposits (e.g., ice cores) and proxy records (e.g., tree-rings and others) provides valuable insight into the likelihood and consequences of this major geological and climatic hazard. Climate models, proxy-based palaeoclimatic reconstructions and instrumental data do not, however, always agree on the climatic impact of major historic eruptions, pointing to the need for further research. Volcanically induced climate changes also provide tests of societal vulnerability and response to abrupt and severe climatic variability. Under the remit of the PAGES Volcanic Impacts on Climate and Society (VICS) Working Group, this session thus invites contributions that examine how major eruptions have affected climate and societies, using climate modelling, historical, archaeological, palaeoecological and other records, to further our understanding of the potential climatic and societal impacts of past and future eruptions.



INQUA Commission: Palaeoclimate

Session Title: Connections across the ITCZ boundary: Asian and Australasian monsoon dynamics and variability during the Holocene.

Convenors and Co-Convenors: John Dodson (Convenor) Henk Heijnis (Co-Convenor) Hong Yan (Co-Convenor)

Description of Session:

The Asian/Australian monsoon is a coupled climate system through the cross-equatorial flow over the tropical Pacific-Indian Ocean and the migration of the Intertropical Convergence Zone (ITCZ). The session will present new high resolution cross discipline comparative studies that will further enhance our essential understanding about the dynamics of the monsoon variability during the Holocene. These new studies have shown that past Typhoon/Cyclones can be identified in biological and sedimentary archives and further add to a better understanding of climate dynamics of the area.



INQUA Commission: Palaeoclimate

Session Title: East Afro-Asian and Indian summer monsoon reconstruction: Terrestrial and marine records since the MIS-5 to MIS-1

Convenors and Co-Convenors: Hema Achyuthan (Convenor) Anjum Farooqui (Co-Convenor) Aasif Lone (Co-Convenor) Rayees Shah (Co-Convenor)

Description of Session: The Asian continent is one of the largest monsoon dominated regions and holds records of the past climate changes due to its influence by Asian monsoons (East Afro-Asian and the Indian Summer monsoon), mid-latitude westerlies, as well as regional circulations related to the orography of the Himalaya and the Tibetan Plateau and north Asian Polar Front. It is well documented that the Asian monsoon has fluctuated in its intensity and amount since the Late Quaternary period. The records of moisture changes in arid central Asia based on lake sediment and temperature from the North Atlantic and the GRIP ice-core have been analysed and correlated. However, a continuous high-resolution record indicating the paleomonsoonal shifts of the Asian monsoon since the MIS 5-1 using terrestrial (duricrusts, loess paleosols, lake sediments, caves deposits, geoarchaeology) and marine records need to be studied in detail. This is important because past climate records are required for predicting future climate scenarios using climate models. Thus, in this session, we would like to bring together international researchers working on multi-proxy records and sites located in Asia, Africa, and around and the bordering seas to discuss Late Quaternary climate change. This is also to understand the man-land relationship, such as human migration and adaptation to climate shifts since MIS-5 to 1.



INQUA Commission: Palaeoclimate

Session Title: Glaciers, moraines and climate: Challenges of identifying, dating and extracting palaeoclimatic data from former glacier fluctuations

Convenors and Co-Convenors: Sven Lukas (Convenor) Jostein Bakke (Co-Convenor) Clare Boston (Co-Convenor) Natacha Gribenski (Co-Convenor) Susan Ivy-Ochs (Co-Convenor) Willem van der Bilt (Co-Convenor)

Description of Session: Glaciers and glacial records are crucial in elucidating former climate change. This session aims to bring together scientists from the fields of geomorphology, sedimentology, palaeolimnology, palaeoclimatology and geochronology to explore and share results within and across these fields, with a view towards establishing crucial links and holistic analyses of datasets in order to step away from discipline-specific, and often isolated, treatment of, for example terrestrial and subaqueous moraine sequences, lake sediments and individual dating methods to constrain glacier fluctuations. Specifically, we encourage contributions crossing disciplinary boundaries spanning the whole Quaternary. The focus of these studies may range from local case studies concentrating on the challenges (and solutions) provided by integrating different approaches to datasets covering larger areas.



INQUA Commission: Palaeoclimate

Session Title: Global Palaeoclimatic Signals in groundwater and use of groundwater in adaptation to climate change (Poster only)

Convenors and Co-Convenors: Jianyao Chen (Convenor) Rein Vaikmäe (Co-Convenor) Sebnem Arslan (Co-Convenor)

Description of Session: Groundwater is the largest distributed store of fresh water and supplies fresh drinking water to almost half of the world's population. In addition to sustain ecosystems and enable human adaptation to climate variability and change, groundwater aquifers may archive environmental change information acquired before the water was recharged into the aquifer. The recharge history of large basins associated with recharge rate, water sources, dissolved constituents, temperature and rainfall intensity may be reconstructed using a combination of isotopic and chemical tracers and groundwater dating. Despite of low resolution, groundwater may have the potential to provide a regionally integrated proxy of particularly humid climatic periods. By analysing groundwater information from vast regions and different continents, recharge and palaeo-climate can be correlated at a global scale. While the characterization of groundwater resources, surface-groundwater interactions and their link to the global water cycle are an important focus, little attention has been given to groundwater as a potential record of past climate variations. This knowledge could offer scientific background for groundwater exploitation, and management and control of non-renewable paleogroundwater, particularly under the pressure from anthropogenic activity and climate change as more frequent and intense climate extremes increase variability in precipitation, soil moisture and surface water.

This session welcomes all contributions related to combinations of groundwater and climate studies, dating methodologies, hydrogeochemistry, and modelling. Case studies of paleoclimatic signal in groundwater and its link to groundwater use in adaptation to climate change are particularly welcomed.



INQUA Commission: Palaeoclimate

Session Title: Heinrich events in terrestrial archives

Convenors and Co-Convenors: Dominik Faust (Convenor) Hartmut Heinrich (Convenor) Pierre Antoine (Co-Convenor)

Description of Session: Heinrich events were catastrophic collapses of continental ice sheets during glacial periods. At that time, vast quantities of icebergs more or less periodically calved into the North Atlantic, causing an interruption of the oceanic heat conveyor belt leading to dramatic changes of the climate on a global scale for a period of several hundreds of years. They are not only an interesting paleo-climatological phenomenon but also a stratigraphic and diagnostic tool for climate and environmental reconstructions.

Linking evidences on rapid climate changes in terrestrial archives to similar marine phenomena such as Heinrich Events is challenging. The session aims to transfer knowledge obtained from marine records unto the land surface. We invite contributions that aim to bridge between disciplines. We especially ask young researchers to present their ideas.

The session will be opened by a keynote talk:

Heinrich events – sources of abrupt climatic changes

by Hartmut Heinrich



INQUA Commission: Palaeoclimate

Session Title: High-resolution palaeoenvironmental reconstructions from lake sediment records: new methods, new records, new challenges (Poster only)

Convenors and Co-Convenors: Stefan Engels (Convenor) Michal Słowiński (Co-Convenor) Valerie van den Bos (Co-Convenor)

Description of Session: High-resolution studies of lake sediment records offer the potential to reveal critical new data on climate and ecosystem dynamics throughout the Quaternary, as well as providing a unique means to analyse the effects of anthropogenic forcing on natural ecosystems on a range of temporal and spatial scales. Quantified palaeoenvironmental and palaeoclimate reconstructions can be achieved through the application of a range of different techniques, including sedimentological, palaeoecological and biogeochemical approaches. Recent developments in palaeolimnology include advances in laboratory analytical methods, increased sampling resolution and improvements in chronological techniques, and are supported by detailed analyses of recent lake sediment depositional processes. Together, they allow the generation of records with annual-to-decadal scale resolution of past environmental and climate change, which can provide key insights into the sensitivity of terrestrial and aquatic ecosystems to external forcing, and offer the opportunity to directly compare palaeolimnological reconstructions to instrumental data and modelling results.

This session aims to explore and discuss methods for and examples of high-resolution studies of lake sedimentary archives. We particularly encourage submissions that introduce new high-resolution analytical methodologies, studies focussing on leads and lags between proxy-records within and between lake records, and papers that attempt to address regional- or continental-scale environmental reconstructions, for instance through model-data comparisons.



INQUA Commission: Palaeoclimate

Session Title: Holocene climate variability in Antarctica and the Southern Hemisphere

Convenors and Co-Convenors: Elizabeth Thomas (Convenor) Claire Allen (Co-Convenor)

Description of Session: A session for palaeoclimatologists and paleoceanographers working on Holocene climate variability in Antarctica and the Southern Ocean. The aim is to investigate how large scale modes of atmospheric and oceanic variability, such as: the Southern Annual Mode (SAM), the Interdecadal Pacific Oscillation (IPO) and El Niño-Southern Oscillation (ENSO); influence the climate in Antarctica and the Southern Hemisphere on both a regional and hemispheric scale. We invite reconstructions from a range of archives including ice cores, marine sediments, terrestrial records (peat, lake sediments etc) and climate modelling. We particularly encourage data- model inter comparison, multi-proxy studies and novel proxy development.



INQUA Commission: Palaeoclimate

Session Title: Hydroclimate change in Drylands

Convenors and Co-Convenors: Sallie Burrough (Convenor) Christine Chen (Co-Convenor) Tim Cohen (Co-Convenor) Martin Hipondoka (Co-Convenor) Joy Singarayer (Co-Convenor) Abi Stone (Co-Convenor) Charles Williams (Co-Convenor)

Description of Session: Climate variability in drylands has been a key characteristic throughout the Quaternary over a range of timescales. These include glacial to interglacial-paced variability and precessional-insolation forcing of global monsoon systems as well as shorter millennial to sub-millennial scale climate events. Our understanding of most desert regions, however, lags far behind those of the wet-tropics or high latitudes, despite their importance for human populations past, present and future. In part this is because drylands represent especially challenging environments from which to obtain palaeodata, requiring a variety of innovative research approaches and disciplines. We hope to bring together researchers working towards understanding the patterns and mechanisms of hydroclimate change in drylands during the late Quaternary.

Lake basins and their associated river & groundwater systems, together with offshore ocean deposits, are extremely important repositories of palaeohydrological/palaeoclimate information in desert regions where organic records are often otherwise poorly preserved. In this session we particularly welcome papers focussing on: lacustrine, fluvial and groundwater archives, offshore terrestrial deposits in marine core records and numerical climate model palaeo-simulations that capture the long-term hydroclimate dynamics in desert regions. We welcome examples drawn from any dryland context across the globe.



INQUA Commission: Palaeoclimate

Session Title: INTegrating Ice core MARine and TERrestrial records to understand climate variability on decadal to millennial timescales

Convenors and Co-Convenors: Christine Lane (Convenor) David Maas (Co-Convenor) Sune Olander Rasmussen (Co-Convenor)

Description of Session: Increasingly detailed proxy reconstructions of abrupt climate transitions and oscillations (such as the Late Glacial-Holocene transition, or the Dansgaard-Oeschger cycles) are being achieved from ice cores and other high-precision marine and terrestrial archives from around the world. Where records can be precisely integrated, using their independent chronologies synchronised via non-climatic signals (e.g. cosmogenic isotopes, palaeomagnetic excursions, tephra), comparisons reveal substantial spatiotemporal heterogeneity in the response of the climate system to a forcing. The identification of spatial patterns as well as temporal leads and lags in climatic behaviour is essential for the identification of mechanisms, vulnerabilities and thresholds in the climate system. With a focus on the last glacial – interglacial cycle, this session will explore progress in tracing and diagnosing spatiotemporal climate variability on decadal to millennial timescales, through the robust integration of local to global proxy records and advances in modelling approaches.



INQUA Commission: Palaeoclimate

Session Title: Interpreting XRF core scanner records of natural and anthropogenic changes in marine and lacustrine archives

Convenors and Co-Convenors: Ludvig Löwemark (Convenor) Ian Croudace (Co-Convenor) Jyh-Jaan Huang (Co-Convenor)

Description of Session: XRF core scanners have evolved to become an indispensable tool for many areas of Quaternary paleoclimatic reconstructions. However, despite being fast, non-destructive and providing records of elemental variations at submillimeter resolution, the paleoenvironmental implications of shifts and trends in the elemental data remain difficult to interpret in many settings.

Variations in element content and element ratios can be a powerful proxy to assess changes in for example source areas, sorting due to transport, or changes due to redox reactions during diagenesis. However, the implications of changes in a specific element or certain element pair ratios is often depending on site specific conditions, and these proxies therefore rarely have global applicability. For example, variations in Mn content in the Arctic Ocean has a distinctly different explanation compared to Mn in the eastern Mediterranean Sea. In this session we welcome studies that address the interpretation of XRF data on Quaternary records from marine and lacustrine settings.



INQUA Commission: Palaeoclimate

Session Title: Into the Ice Age: Exploring the distribution and volume of ice sheets during past glaciations

Convenors and Co-Convenors: Jeremy Shakun (Convenor) Anders Carlson (Convenor) Tamara Pico (Convenor)

Description of Session: Though ice sheets are a defining feature of the ice age, detailed reconstructions regarding either ice extent or ice thickness prior to the Last Glacial Maximum (26 ka) remain elusive. Our understanding of previous glaciations is limited by sparse records of prior ice margins on land and geologic sea-level markers, which can be contaminated by a variety of processes that introduce vertical displacement, such as glacial-isostatic adjustment or dynamic topography. Nevertheless, such data are key to partitioning paleo-sea-level budgets, producing accurate reconstructions of global mean sea level, and providing critical boundary conditions for climate models, with the goal of assessing the stability of ice sheets in response to past climate change.

As part of PALeo constraints on SEA level rise (PALSEA), we invite data-based and modeling submissions from communities that intersect at the question of glaciation, drawing from research fields in glacial geology, sea level, solid-Earth geodynamics, and ice-climate interactions. In particular, we welcome submissions using innovative techniques that aim to constrain the dimensions of ice sheets and their implications for sea-level and climate change.



INQUA Commission: Palaeoclimate

Session Title: Late Quaternary environmental change in the South Pacific: Climate, ecosystem dynamics and human colonisation.

Convenors and Co-Convenors: David Sear (Convenor) Pete Langdon (Co-Convenor) Melinda Allen (Co-Convenor) Alyssa Atwood (Co-Convenor) Will Gosling (Co-Convenor)

Description of Session: The South Pacific and the islands of Melanesia and Polynesia contain some of the earth's major climate systems that impact regions across the planet. The island archipelagos also host unique tropical ecosystems that extend across a gradient of biodiversity and isolation. Furthermore, the island archipelagos of the South Pacific were among the last places on earth to be colonised by humans. The interaction of climate, ecosystem processes and the arrival and modification of these islands by humans is vital to understand if science is going to support the remote communities who face a rapidly changing future. To date there is a dearth of monitored data which contributes to high uncertainty in our understanding of this region, thus palaeodata becomes an essential source of information to formulate new understanding but also as a resource for validating models of climate, ecology and human migration. This session aims to improve interdisciplinary dialogue and awareness by bringing together researchers working on ocean/climate processes/models with tropical island ecologists and archaeologists seeking to understand the arrival, development and impact of human societies on remote islands. Through this we will contribute to the wider aim of better understanding the complex processes and interaction that sustain these islands and thus provide vital knowledge for sustaining their future in a changing world.



INQUA Commission: Palaeoclimate

Session Title: Mapping and interpreting sea-level change through time and space

Convenors and Co-Convenors: Nicole Khan (Convenor) Jacqueline Austermann (Convenor) Roland Gehrels (Co-Convenor) Benjamin Horton (Co-Convenor)

Description of Session: Sea-level projections are derived by establishing a robust relationship between sea level and climate forcing, but the majority of instrumental records contain < 60 years of 20th and 21st century data that only capture a single climate mode of rising temperatures and sea level within a baseline state that is climatically mild by geological standards. Geological proxies from glacial-interglacial time periods provide valuable, complementary archives of the sea-level response to climate variability, including periods of more extreme climatic forcing. Information from the geological record can help provide a firmer basis for projecting the future, but current ties between past changes and future projections are often vague and heuristic. Greater interconnections between the two sub-disciplines may be key to major progress.

The linked problems of characterizing past sea-level changes and projecting future sea-level rise share two fundamental challenges. First, regional and local sea-level changes vary substantially from the global mean due to processes such as glacial isostatic adjustment. Understanding mechanisms of regional variability is critical to interpreting records of past changes and linking them to global ice volume changes. Second, uncertainty is pervasive in both records of past changes and in the physical and statistical modeling approaches used to project future changes, and requires careful quantification and statistical analysis. We welcome abstracts that describe local sea level records and examine the driving mechanisms of local sea-level change, potentially with a focus on integrating these records with statistical and physical models to enhance our understanding of present and future sea-level changes.



INQUA Commission: Palaeoclimate

Session Title: MIS 3 glaciation and the prelude to the LGM

Convenors and Co-Convenors: Glenn Thackray (Convenor) James Shulmeister (Co-Convenor) Philip Hughes (Co-Convenor) David Fink (Co-Convenor)

Description of Session: Was MIS 3 the prelude to the last glacial maximum, or was it the main event? With advances in dating techniques and the extension of glacial chronologic work into many new regions, both the detail and complexity of pre-LGM glacial advances become ever more compelling. This session provides an opportunity for new chronologies from around the world to be presented and a chance to examine regional and global timings of advances. The session also invites papers that examine the mechanisms of glacial advance and recession in mountain glacier systems.



INQUA Commission: Palaeoclimate

Session Title: Orbital and millennial scale climate changes in ice, ocean and land: observations and model simulations

Convenors and Co-Convenors: Maria Fernanda Sanchez Goni (Convenor) André Bahr (Co-Convenor) Nathaëlle Bouttes (Co-Convenor)

Description of Session: Integrating long paleoclimatic series from different Earth's archives is crucial for understanding the mechanisms of climatic changes during the Quaternary. First, this integration documents the nature and timing of the different regional environmental responses to a given climate change; secondly, it provides an array of hypotheses against which to benchmark model experiments. In this session we invite presentations dealing with major and still-unresolved questions in Quaternary climates such as: a) what is the regional response of the different glacial-interglacial cycles?; b) what is the potential contribution of the different internal feedbacks in explaining the Middle Pleistocene Transition?; c) what are the mechanisms explaining the Mid-Brunhes Event in CO₂ concentrations with lower values during interglacials before, compared to after, 430 ka?; or d) are the interactions between millennial and orbital climate variability the potential missing piece in the puzzle of Ice Age cycles?



INQUA Commission: Palaeoclimate

Session Title: Palaeoclimate records and atmospheric circulation patterns

Convenors and Co-Convenors: Armand Hernández (Convenor) Celia Martin-Puertas (Co-Convenor)
Laia Comas-Bru (Co-Convenor)

Description of Session: This session aims to provide new insights into how proxy-based signals may be controlled by large-scale atmospheric circulation modes associated with past climate changes. Despite the significant advances in proxy-based reconstructions and climate model estimates, issues such as spatio-temporal discrepancies in the proxy signals and good reproducibility of these climate reconstructions by models remain unclear. Resolving these issues is crucial to assessing the ability of specific proxy data to capture past climates and to provide tests for ocean-atmosphere general circulation models. We welcome studies of past atmospheric climate patterns during the Holocene over a range of timescales (annual to centennial), captured by any climate proxy type (marine and/or terrestrial). We encourage contributions that integrate both climate modelling and field/proxy data as a way to foster model-data comparison.



INQUA Commission: Palaeoclimate

Session Title: Palaeoclimatic and oceanic evolution in the North Atlantic region since the Last Glacial Maximum – linking ice sheet, terrestrial and marine records

Convenors and Co-Convenors: Anne deVernal (Co-Convenor) Marit-Solveig Seidenkranz (Co-Convenor)

Description of Session: The decay and growth of the North Atlantic's major ice sheets, since the Last Glacial Maximum, is archived in ice cores as well as marine and terrestrial records. Short and long-term variability recorded in these archives result from atmospheric and oceanic circulation changes in concert with ice sheet dynamics and point to complex interactions between the atmosphere, cryosphere and the ocean. Studying these processes and feedbacks at high-resolution, sets the basis to a better understanding of processes operating on different time scales in the North Atlantic region. High-resolution ice core, lake and marine sediment records from across the North Atlantic region allow a more comprehensive spatial assessment of the timing and sequence of atmospheric and oceanic changes that led to climatic events such as the Younger Dryas, the 8.2 ka event, the Roman Warm Period, the Medieval Climate anomaly or the Little Ice Age. Detailed studies of these events and climatic shifts reveal their importance on environmental change at regional to global scales.

This session invites contributions from both multi-proxy- and numerical-based approaches studying the ice sheet, climatic and oceanic dynamics and interactions at the last glacial transition and during the Holocene at high-resolution from marine, terrestrial and ice core archives.



INQUA Commission: Palaeoclimate

Session Title: Palaeo-ice sheet model-data interactions

Convenors and Co-Convenors: Jeremy Ely (Convenor) Lauren Gregoire (Co-Convenor) Chris Clark (Co-Convenor)

Description of Session: Hard-won empirical evidence of palaeo ice sheet activity provides: i) ice sheet timing (geochronology), ii) ice mass lithospheric loading (from relative sea level data) and iii) landforms recording ice extent and flow geometry (geomorphology). Such data are often used to build empirical reconstructions of Quaternary ice sheets and an increasing trend is to use these data to interact with ice and climate modelling and with models of Glacio isostatic adjustment (GIA). This session seeks contributions reporting methods and outcomes of model and data interactions that help us understand the co-evolution of ice, climate and sea level.



INQUA Commission: Palaeoclimate

Session Title: Quaternary climate dynamics peculiar to the Mediterranean region

Convenors and Co-Convenors: Federico Di Rita (Convenor) Fabrizio Lirer (Co-Convenor) Donatella Magri (Co-Convenor)

Description of Session: The peculiar position of the Mediterranean region between central Europe and Africa, as well as between the Atlantic Ocean and Eurasia, makes this area highly sensitive to climate modes pertinent to either middle-latitude or tropical regions, such as North Atlantic Oscillation, East Atlantic-West Russian and Scandinavian patterns, Atlantic Meridional Overturning Circulation, ENSO, and African monsoon.

Despite an ever-increasing number of reconstructions of past climate changes and teleconnections from different archives, including marine, lacustrine and ice cores, speleothems, and tree rings, little is known on the fundamental tempo and underlying mechanisms of the climate variability in the Mediterranean during glacial and interglacial stages.

In this session, we aim to bring together recent advances in palaeoclimatic and palaeoenvironmental approaches from multi-proxy records contributing to an improved understanding of past climate changes and the related response/resilience of the Mediterranean ecosystems during the Quaternary.

Contributions relating to, but not limited to, the following topics are welcomed:

- decadal to millennial climate variability in marine, coastal and continental records dated to Holocene and past glacial and interglacial stages
- influence of climate modes on environmental changes, and their possible interplay
- evidence of Ocean-Atmosphere and Solar/Astronomical forcing of vegetation, hydrological and geomorphological dynamics



INQUA Commission: Palaeoclimate

Session Title: Quaternary glaciations and palaeoclimate of Patagonia

Convenors and Co-Convenors: Bethan Davies (Convenor) Neil Glasser (Co-Convenor) Jacob Bendle (Co-Convenor)

Description of Session: Patagonia is one of the few landmasses in the ocean-dominated Southern Hemisphere available for terrestrial environmental and climate reconstructions. Patagonia is climatically-sensitive, sitting at the centre of the Southern Westerly Winds, and it is influenced by climatic changes that occur in the Pacific, Atlantic, and Southern Oceans. Patagonia is also influenced by both high-latitude (e.g. SAM) and low-latitude (e.g. ENSO) variability. Palaeoclimatic records suggest that Patagonia was sensitive to the Antarctic Cold Reversal, but may also be sensitive to some Northern Hemisphere climate signals, including the Younger Dryas and Little Ice Age.

The Patagonian icefields and glaciers are sensitive to climate change. The climate of Patagonia is temperate, so these glaciers are sustained by the large volumes of precipitation delivered by the prevailing westerly winds. During the Quaternary, latitudinal variations in these winds and variations in atmospheric and oceanic temperature drove repeated glacial fluctuations. The high climate sensitivity of these icefields, as well as their large latitudinal transect, renders them a useful barometer of changes in large-scale atmospheric circulation and palaeoclimate.

We invite interdisciplinary contributions that investigate Quaternary palaeoclimatic variations and their impact on ice masses. This session will bring together researchers working on palaeoclimatic reconstructions from proxy data (including from lakes, bogs, marine records, aeolian records, ice cores, etc.), palaeoclimate modelling, and reconstructions of former ice extent and dynamics from field-based studies and numerical modelling. It will provide a forum in which researchers can contrast their data and shed light on Quaternary glaciations and their palaeoclimatic drivers in Patagonia.



INQUA Commission: Palaeoclimate

Session Title: Southern Hemisphere Assessment of PalaeoEnvironments (SHAPE)

Convenors and Co-Convenors: Brian Chase (Co-Convenor) Andrew Lorrey (Co-Convenor) Steven Phipps (Co-Convenor) Maisa Rojas (Co-Convenor)

Description of Session: The PALCOM International Focus Group "Southern Hemisphere Assessment of PalaeoEnvironments" (SHAPE) has supported network-building for Quaternary researchers interested in reconstructing past atmospheric and oceanic circulation patterns for the Southern Hemisphere. The main efforts of SHAPE have been to improve connections between regional environmental change data sets, and investigate the nature and drivers of change in the Southern Hemisphere and its role in the global climate system across glacial-interglacial cycles. SHAPE has focussed on developing strong synergies between proxy data development, geochronology, analysis tools and climate model simulations. Intra-hemispheric collaborations that have been fostered in SHAPE to-date have used all four of those elements to refine patterns of past changes, including establishing similarities and differences between widely separated geographic areas. In this session, we welcome research that has used integrative approaches and model simulations to improve understanding of the drivers of climate change, climate dynamics, modes of variability, transitions, tipping points, abrupt shifts, and mechanisms of intra- and inter-hemispheric climate teleconnections from a Southern Hemisphere perspective. Presentations on regional observations, proxy development, geochronology, tools and modelling techniques over a wide range of Southern Hemisphere Quaternary environmental archives and climate change issues are welcome, as are progress updates on regional-to-hemispheric scale data syntheses.



INQUA Commission: Palaeoclimate

Session Title: Stable and clumped isotopes in biogenic carbonates: applications and limitations in palaeoenvironmental studies

Convenors and Co-Convenors: Xu Wang (Convenor) Fred Longstaffe (Co-Convenor)

Description of Session: Stable carbon and oxygen isotopes of biogenic carbonates receive much attention because of their usefulness for reconstructing palaeoclimate and palaeoenvironment. Traditional light stable isotope measurements have long been used for this purpose. More recently, high-resolution (or ultrahigh-resolution Secondary Ion Mass Spectrometry) isotopic analyses along growth-bands of single shells can be used to detect seasonal (or sub-seasonal) variations during typically warm and cold periods in geological past. Such information is useful for anticipating potential climatic variability under future global warming scenarios. The clumped isotope thermometer for biogenic carbonates also offers great promise for detecting past changes in temperature.

Notwithstanding these developments, several open questions remain, including complexities arising from vital effect influences on shell stable isotope compositions, the timing of shell carbonate precipitation, and kinetic isotopic fractionation during shell growth. This session invites presentations that: (i) contribute to a state-of-the-art discussion of how best to obtain meaningful palaeoclimatic and palaeoenvironmental information using stable and clumped isotope data for shell carbonates, and (ii) illustrate applications of the biogenic carbonate stable isotope approach to both past and present ecosystems of particular importance.



INQUA Commission: Palaeoclimate

Session Title: Stable isotopes in palaeoenvironmental reconstructions: Understanding climate change and nutrient cycling

Convenors and Co-Convenors: Biljana Narancic (Convenor) Maarten van Hardenbroek (Co-Convenor) Reinhard Pienitz (Co-Convenor) Hanno Meyer (Co-Convenor)

Description of Session: The session focuses on stable isotopes as a tool for indicating long-term environmental change in lakes. Alterations in climate, carbon cycling, vegetation, and nutrient dynamics in a lake and its catchment can have marked effect on the stable isotope ratios in lake water and organisms that live in it. We welcome abstracts that cover the use of stable isotopes in biogenic silica and organic materials as indicators of environmental changes in terrestrial aquatic ecosystems. We specially encourage abstracts from research projects focusing on reconstructing postglacial palaeoenvironmental changes in formally glaciated polar regions. We also encourage abstracts of method-oriented studies and experimental work that contributes to the development, calibration, and interpretation of stable isotope records.



INQUA Commission: Palaeoclimate

Session Title: Sub-annual to decadal records of environmental change

Convenors and Co-Convenors: Amy Prendergast (Convenor) Russell Drysdale (Convenor)

Description of Session: Understanding past climate and environmental change at high-resolution timescales (annual to sub-annual) is important as it allows current and future climate change to be contextualized within long-term frameworks; it provides data for numerical simulations that will allow climate modellers to better predict anthropogenic impacts on the natural climate system; and it facilitates evaluations of the relationship between past environmental changes and human behaviour. In the past decade, advances in technology, methodology, model development, and proxy calibration have enabled the extraction of more robust palaeoenvironmental records from marine, freshwater, and terrestrial palaeoenvironmental archives. Many of these archives including mollusc shells, corals, otoliths, speleothems, and tree rings have periodic growth increments. Studying the growth and chemistry of these increments allows the reconstruction of high-resolution, temporally constrained palaeoclimate and palaeoenvironmental data from varied regions of the globe and are allowing correlations between continental and marine systems. This session invites presentations on high-resolution climate and environmental records from marine, terrestrial and freshwater archives. We encourage contributions on both palaeoenvironmental reconstructions, and proxy calibration studies.



INQUA Commission: Palaeoclimate

Session Title: Terrestrial hydroclimate variability (Poster only)

Convenors and Co-Convenors: Nick Scroxton (Convenor) Laia Comas-Bru (Co-Convenor) Armand Hernández Hernández (Co-Convenor)

Description of Session: Changes in rainfall patterns across the globe threaten food security and habitability in the future, through both increased and decreased rainfall. Efforts to understand how rainfall changed in the past will greatly inform and impact our ability to adapt. Yet our understanding of how terrestrial rainfall responds to different climate forcing is far from complete. In this interdisciplinary session we invite submissions that enhance our understanding of terrestrial hydroclimate during the Quaternary: including how and when it changed, variability and extreme events and the mechanisms driving those changes. We welcome contributions using lake sediments, tree rings, speleothems, or any other hydroclimate archive, as well as modelling studies and data-model comparisons.



INQUA Commission: Palaeoclimate

Session Title: The Big MIS4: Records of worldwide Marine Isotope Stage 4 glacial, climatic, and environmental changes

Convenors and Co-Convenors: Alice Doughty (Co-Convenor) Carly Peltier (Co-Convenor) Stephen Barker (Co-Convenor)

Description of Session: Marine Isotope Stage (MIS) 4 may have been more extreme (“glacial-like”) than MIS 2, including during the global Last Glacial Maximum. To what extent this statement might be true depends on the climatic parameter and region of interest. Mounting evidence from a range of archives - for example glacial extent and surface ocean temperatures in the Southern Hemisphere - suggests that conditions during MIS 4 may actually have been more severe (e.g., colder) than the more universally accepted glacial maximum of MIS 2, suggesting that much of our long-held understanding of glacial development may require reevaluation. In this session we welcome contributions that contribute toward improving our understanding of MIS 4 glaciation, climate, and ocean circulation. Research may include, but is not limited to, climate proxies, greenhouse gasses, sea level, circulation change, glacier extents, chronologies, and modeling.



INQUA Commission: Palaeoclimate

Session Title: The last glaciation of the Southern Hemisphere

Convenors and Co-Convenors: Lynda Petherick (Co-Convenor) Jasper Knight (Co-Convenor) Jamie Schulmeister (Co-Convenor) Maisa Rojas (Co-Convenor)

Description of Session: We invite contributions related to the timing and nature of environmental and climatic variability during the termination of the last glacial cycle (defined here as 35-15 kyr BP) in the Southern Hemisphere (20-80oS). We welcome records from high-resolution marine and coastal sediments, lake sediments, speleothems, ice cores, glacial moraines, dunes, fluvial systems and model simulations. This session contributes to the INQUA-funded SHeMax (The LGM in the Southern Hemisphere) project. SHeMax seeks to develop a clearer understanding of climatic variability during the period 35-15 kyr, towards reconstructing the nature and timing of the LGM across the Southern Hemisphere, and identifying regional synchronicity, millennial-scale climatic variability, the response of humans to environmental change, and the drivers of such change.



INQUA Commission: Palaeoclimate

Session Title: The Last Interglacial and interglacial comparisons: local records and global signals.

Convenors and Co-Convenors: Martin J. Head (Co-Convenor) Eric Wolff (Co-Convenor)

Description of Session: The Last Interglacial (~130 ka) differs from the Holocene in orbital characteristics but remains the most recent past guide for our near future climate, with estimated global temperatures warmer than today. Captured in marine and terrestrial sediments and ice cores, it provides a widespread, accessible, and societally important record of Earth's response to warming, and has particular interest in the response of ice sheets and sea level. Furthermore, the onset of the Last Interglacial is traditionally used to demarcate the base of the Upper Pleistocene Subseries, a unit not yet formally defined but under present consideration by the International Subcommission on Quaternary Stratigraphy. This session will address local to global expressions of the Last Interglacial and explore leads and lags in the climate response. Contributions that compare features of the Last Interglacial with those of other Quaternary interglacials will also be welcome.



INQUA Commission: Palaeoclimate

Session Title: The palaeoceanographic signal: Assessing spatiotemporal precision and accuracy in climate reconstructions and geochronology

Convenors and Co-Convenors: Bryan Lougheed (Convenor) Brett Metcalfe (Co-Convenor)

Description of Session: Many decades of palaeoceanographic research have produced a wealth of data from deep-sea sediment archives. Placing these data within an accurate temporal framework is essential if we are to fully understand the temporal sensitivity of global oceans to rapid climate change, as well as regional climate leads and lags between different locations. Such an understanding will ultimately able us to better model the global ocean system, thereby improving the accuracy and precision of future climate predictions. In this session, we invite contributions concerning the accurate quantification of the true uncertainty relating to palaeoceanographic reconstructions, as well as possible methods for reducing uncertainty. Studies employing any type of methodology are welcome, including, but not limited to: foraminifera-based studies, isotope analysis, geochemistry, process modelling, sedimentology, palaeomagnetism, radiocarbon (^{14}C) dating and other geochronological methods.



INQUA Commission: Palaeoclimate

Session Title: The Plio-Pleistocene transition

Convenors and Co-Convenors: Janos Kovacs (Convenor)

Description of Session: The Earth underwent a major transition from the warm climates of the Pliocene to the Pleistocene ice ages between 3.2 and 2.6 million years ago. The intensification of Northern Hemisphere Glaciation is the most obvious result of the Plio-Pleistocene transition. We invite submissions that explore the climate system response to Pliocene-Pleistocene transition. Submissions exploring proxy data and modeling work are welcomed.



INQUA Commission: Palaeoclimate

Session Title: The Quaternary of Africa

Convenors and Co-Convenors: jasper knight (Co-Convenor) jennifer fitchett (Co-Convenor)

Description of Session: This session focuses on the evidence for Quaternary climates and environments across Africa. The African continent is characterized by a considerable range of climatic and environmental conditions at present; a function, in part, due to its wide latitudinal range. This is likely to have also resulted in climatic and environmental changes throughout the Quaternary that were neither spatially nor temporally uniform, and which changed dynamically over time. This session aims to consider evidence for past climates, environments and processes across Africa during the Quaternary. This can include sedimentary, biological, ecological, isotopic, dating and modelling evidence from different physical environments (mountains, rivers, coasts, deserts, savannas/sahel, forests, lakes/estuaries, wetlands, caves), and dealing with evidence for hominid evolution, ecosystem changes, sea-level change, development of glaciers, changes in climate patterns (specifically of precipitation), faunal patterns, ocean circulation; and evidence for climate teleconnections, ENSO, monsoon circulation, ITCZ migration, and spatial correlations. Contributions are invited on all different types of evidence for Quaternary environmental change across Africa, and on different spatial and temporal scales.



INQUA Commission: Palaeoclimate

Session Title: Tree-ring archives

Convenors and Co-Convenors: Iain Robertson (Convenor) Neil Loader (Co-Convenor) Dave Brown (Co-Convenor) Rob Wilson (Co-Convenor)

Description of Session: Tree-rings, measured from trees across the world, provide an unrivalled terrestrial archive of past environmental change. Within temperate and high latitude regions, seasonal climate and related cessation of growth during the winter, ensures that clear annual growth rings are laid down each year. Pattern matching of tree-ring sequences between trees of the same species within a climatically homogenous region allows precise annual dating control with some chronologies, using historical and/or sub-fossil material, go back many thousands of years. The physical and chemical properties of these precisely dated archives have been used as a proxy measures of past climates and can also be used for ecological analyses (e.g. disease, pollution studies etc) and dating of natural hazards (i.e. avalanches, debris flows, fire history etc). In recent years, attention has also turned to lower latitudes where trees rarely express clear annual rings and dendrochronology is therefore more challenging. This general inter-disciplinary session welcomes contributions from researchers engaged in the application and development of traditional and novel tree-ring dating techniques; modelling physiological responses to atmospheric carbon dioxide changes; quantifying and reconstructing climatic variability using a variety of tree-ring proxies; developing/applications of new tree-ring variables (e.g. blue intensity, wood anatomical measurements); dendroecology including reconstructing fire history; dendrochemistry including isotopes in tree-rings; dendroarchaeology and investigation of the socio-economic changes that can be traced via the tree-ring archive.



INQUA Commission: Palaeoclimate

Session Title: Understanding Quaternary proxy records of teleconnections between mid-latitudes, polar and tropical regions

Convenors and Co-Convenors: Mike Rogerson (Convenor) Sherilyn Fritz (Co-Convenor) Ludvig Loewemark (Co-Convenor) Farah Jarraya (Co-Convenor)

Description of Session: Quaternary proxy records of paleoclimatic changes and events often display remarkable correlations across the latitudes, indicating the influence of high-latitude climatic processes on climate in tropical regions, and vice versa. A recent example is the proposed link between Arctic sea ice and the Asian monsoon system.

Too often, however, the physical systems transmitting change remain a “black box”, and the systems through which communication must occur, the mid latitudes, are overlooked. Consequently, our understanding of past and future climate fails to progress beyond an observation of past correlation, and an assumption that this will continue.

We must seek to open the “black box”, and explore inter-regional processes in more detail, with a focus on how changes in one part of the Earth system come to be expressed in very distant regions. How do changes in polar ice sheets change monsoon systems? How is transference of this change expressed in the mid latitudes? In the reverse direction, how do ENSO and tropical Atlantic variability alter the monsoons, and how does this change pass through the mid-latitudes to the poles?

In this session, we welcome all studies that address interregional relationships or communication in climate, regardless of timescale. We seek an interactive session, in which proxy-based and physics-based science are considered equally.



INQUA Commission: Palaeoclimate

Session Title: Vegetation responses and human adaptations to environmental changes in the Holocene of West Africa

Convenors and Co-Convenors: Emuobosa Akpo Orijemie (Convenor) Adegbenga Adeonipekun (Co-Convenor)

Description of Session: Although some progress has been made regarding the state of knowledge concerning Holocene palaeoenvironments in the Holocene of West Africa during the last 15 years, there seems to be an unevenness in the conduct and geographical spread of research across the region. One of the outcomes of this non-equilibrium has been that few countries have well documented evidence of Holocene palaeoenvironmental history while others are lagging behind. More importantly, recent studies carried out across the region indicate that there seemed to have been local variations particularly with the timing, impact and vegetation responses to certain 'pan-tropical' events in the region. In addition, past environmental variabilities have had direct and/or indirect significant impact on human cultures, dictated adaptation strategies and management practices among kingdoms and City-States. An understanding of the history and nature of Holocene palaeoenvironmental changes and their impact on humans are important because of current environmental (climatic) changes. These 'recent' changes have largely contributed to drought, flood and other extreme climatic conditions leading to famine and food insecurity, migration and in some cases, conflicts in West Africa. Therefore, the provision of accurate palaeoenvironmental data from the field and laboratory and modelled scenarios provide opportunities for humans (including Government policy makers) to learn lessons from the past, and take necessary measures against any environmental crises. This session will present cases derived from anthropological, archaeological and palaeoenvironmental records and modelled cases from the West African region, and discuss them in relation to the Present particularly the UN 2030 (goal 13) sustainable goals.



INQUA Commission: Stratigraphy and Chronology

Session Title: Aeolian deposits: New understandings of chronostratigraphy, palaeoenvironments and processes (Poster only)

Convenors and Co-Convenors: Shiling Yang (Convenor) Slobodan Marković (Co-Convenor) Paul Hesse (Co-Convenor)

Description of Session: Loess deposits are known to have existed extensively in the Quaternary time, but also extended into the deep past of the Earth's history. The aeolian processes including dust production, transportation, and deposition are closely related to regional tectonic and glacial activities, hydrologic cycle and atmospheric circulation, and climate conditions. The loess deposits, exemplified by loess sequences with interbedded palaeosols, manifest the dramatic and frequent oscillations of the climate in the Ice Ages, but are much more a unique archive of palaeoenvironments and interactions of geosphere, hydrosphere, atmosphere, and biosphere beyond the Quaternary. We solicit contributions on recent advances in aeolian deposits from modern time to the deep past, including (1) dust formation, transport, and deposition processes, (2) geologic records and palaeoenvironmental reconstructions, and (3) modeling and methodology. Researches that focus on aeolian dust deposits preserved in oceans, lakes, and ice sheets, and even on alien planets are also welcome.



INQUA Commission: Stratigraphy and Chronology

Session Title: Chronology and environmental context of hominin occupation in the Southern Caucasus

Convenors and Co-Convenors: Jenni Sherriff (Convenor) Rhys Timms (Co-Convenor) Katie Preece (Co-Convenor)

Description of Session: The Southern Caucasus, forming a key landbridge between Africa and Eurasia, is critical area for understanding the timing and nature of hominin dispersal during the Pleistocene. Recent archaeological investigations in the region have resulted in the discovery of numerous Lower and Middle Palaeolithic sites, including evidence for the oldest fossils of *Homo* sp. outside of Africa and for early advanced technological behaviour. However, despite the increasing number of archaeological sequences reported, there is a paucity of studies that provide an understanding of the timing of occupation in the region, and the environmental and landscape response to climatic fluctuations during the Pleistocene. Furthermore the region is associated with intense volcanism throughout the Pleistocene; this would have a marked effect on hominin populations occupying and dispersing through the area. Products from these eruptive periods have the potential to act as important chronological markers in archaeological sequences and records of environmental and climatic changes. Despite this potential, however, the nature and timing of Quaternary volcanism is presently only understood in outline.

Currently, there are multiple, disparate research groups working on the Quaternary of the Southern Caucasus; this multidisciplinary session therefore aims to bring these together to integrate results that have been obtained, to identify gaps in knowledge and develop future collaborations to further address key questions regarding environmental change and hominin occupation in the region. Specifically, it will focus on research aiming to build robust independent chronologies for archaeological and palaeoenvironmental sequences, and developing records of climatic and landscape change in the region.



INQUA Commission: Stratigraphy and Chronology

Session Title: Estimates of global ice volumes during MIS 3 in need of re-evaluation: A multi-disciplinary approach

Convenors and Co-Convenors: Karin Helmens (Convenor) Martin Roy (Co-Convenor) Minna Väliranta (Co-Convenor)

Description of Session: Findings of long sediment records and the use of improved dating methods have recently allowed detailed environmental and climate reconstructions for Marine Isotope Stage (MIS) 3 (57-29 kyr BP). This land-based evidence and GIA modeling argue for significantly reduced ice sheet extents and smaller global ice volumes during MIS 3 than currently inferred from classic marine proxy data. MIS 3 lasted some 30,000 years and was characterized by pronounced millennial-scale climate fluctuations, so-called Dansgaard/Oeschger (D/O) events, the processes behind the timing and amplitude of these events still being debated. Alternations between warm/wet and cold/dry climatic conditions may have had an impact on ice sheet development and evolution, but the connections remain unclear. In order to contribute to the understanding of climate forcing mechanisms and ice-sheet dynamics, and to obtain more precise estimates on sea-level changes and unglaciated land available for plant/animal/human migrations, a consensus on MIS 3 ice-sheet extents and ice volumes is urgently needed. We here invite contributions from a wide range of disciplines (including paleoceanography, Quaternary stratigraphy, paleoecology and modeling) to present and critically discuss evidence for ice-sheet extents and ice volumes during MIS 3.



INQUA Commission: Stratigraphy and Chronology

Session Title: Formal chronostratigraphy in the Quaternary

Convenors and Co-Convenors: Martin J. Head (Convenor)

Description of Session: A chronostratigraphic unit is a body of rock, or sediment, or other accumulation formed during a specified interval of geological time, and each is characterized by a defined and globally synchronous base. The Quaternary System can be subdivided formally into the Lower (Gelasian and Calabrian stages), Middle, and Upper Pleistocene subseries; and Lower, Middle and Upper Holocene subseries. The precise base of the Upper Pleistocene has not yet been agreed. The Anthropocene, with a currently preferred rank of series/epoch starting in the mid-20th century, is similarly a work in progress. The Quaternary can be subdivided into yet finer chronostratigraphic units, using for example “event stratigraphy”, although this involves the testing of leads and lags in the record. This session invites contributions on all aspects of chronostratigraphy in the Quaternary, and at any temporal scale.



INQUA Commission: Stratigraphy and Chronology

Session Title: Multidisciplinary applications in tephrochronology - from archaeology to volcanology

Convenors and Co-Convenors: Britta Jensen (Convenor) Takehiko Suzuki (Co-Convenor) David Lowe (Co-Convenor)

Description of Session: Tephra includes all explosively-erupted fall deposits, both proximal or distal to their source volcanoes. Traditionally, tephrochronology is the use of primary tephra or cryptotephra deposits as isochronous marker beds to link and synchronize sedimentary or archaeological sequences (or soils/paleosols), transfer relative or numerical ages or dates to these sequences using lithostratigraphic and compositional data pertaining to the tephras/cryptotephras. However, the discipline has become increasingly important in a very wide range of fields of Quaternary and volcanological research, uniquely spanning all the commissions of INQUA, and also forming a key component in globally important projects such as INTIMATE and SHAPE. Tephrochronology includes 'classical' applications to align and date palaeoenvironmental reconstructions, landscape evolution, and archaeology. It also is a key component in assessing the magnitude and frequency of past eruptions, the underlying processes driving them, and the hazards they pose to modern society. More recent applications include medical and pandemic research, hominin/human evolution and adaptation, and providing critical field data for interpretation of satellite data, ash fallout models, and eruption processes. In this session we are pleased to invite papers on the growing use of tephrochronology across multiple disciplines. This includes the use of visible and/or cryptotephra in palaeoenvironmental reconstruction (including palaeoclimatic studies), archaeology, palaeoanthropology, or hominin/human evolution as well as volcanological and hazard research.



INQUA Commission: Stratigraphy and Chronology

Session Title: Ponto-Caspian stratigraphy and geochronology: Understanding Caspian - Black Sea - Mediterranean Corridor evolution in the Quaternary

Convenors and Co-Convenors: Valentina Yanko-Hombach (Convenor) Redzhep Kurbanov (Convenor) Tamara Yanina (Co-Convenor)

Description of Session: The main goal of this session is to provide cross-disciplinary correlation of geological, archaeological, environmental, and anthropological records in Ponto-Caspian region in order to explore interrelationships between environmental change and human adaptation during the Quaternary. The main goal of the INQUA Focus Group POCAS created within the INQUA SACCOM for the term 2017-2020 is to study the geology of the Ponto-Caspian region during the Quaternary. This FG investigate the influence of environmental change on the development of humankind for the entire Caspian-Black Sea-Mediterranean Corridor that encompasses the Eurasian intercontinental basins of the Caspian, Black, Marmara, Aegean, and Eastern Mediterranean seas with their connecting straits and coasts. During the Quaternary, these basins were repeatedly connected and isolated from each other. This predetermined their environmental conditions and hydrologic regimes and imposed specific impacts on diverse biological populations, including humans inhabiting the coastal domains. The main research outlines: 1. Evolution of the large chain of intercontinental basins - the Caspian, Black (together called Ponto-Caspian), Marmara, Aegean, and Eastern Mediterranean (Levantine) seas - with their connecting straits and coasts. 2. Sea-level reconstructions, water balance, hydrologic regime and climate change; 3. Reconstructing periodic connection/isolation of the basins during the Quaternary and specific environmental conditions; 4. Sedimentary and geomorphologic archives that document past environmental changes; 5. Archaeological, anthropological, and historical record.



INQUA Commission: Stratigraphy and Chronology

Session Title: Quaternary data without frontiers: the International Quaternary Map of Europe 1 : 2.5 Million

Convenors and Co-Convenors: Kristine Asch (Convenor) Philip Gibbard (Co-Convenor)

Description of Session: The International Quaternary Map of Europe is an international cooperation project , coordinated by BGR, that began at 2011 at INQUA in Bern. There are by now 31 national geological surveys (including Russia) participating together with a supporting board of academic advisors contributing to this project.

This map is coordinated and compiled at BGR in international cooperation under the umbrella of CGMW and INQUA.

Subjects to be addressed encompass e.g. onshore/-off shore mapping, glacial extent, glaciated versus non-glaciated areas, regional characteristics, mountains and lowlands, standards and rationalization of terminology, active faults, critical palaeontological and Palaeolithic sites, permafrost distribution, isostasy, direction of ice movements etc



INQUA Commission: Stratigraphy and Chronology

Session Title: Role of the IntCal radiocarbon calibration curves in Quaternary Science

Convenors and Co-Convenors: Paula Reimer (Convenor) Christopher Bronk Ramsey (Co-Convenor)

Description of Session: Radiocarbon ages need to be converted into calibrated or calendar year equivalents in order to compare to records on other timescales or calculate rates of change. The key requirements for this conversion are the calibration curves which are updated and refined by the IntCal Working Group and ratified by the international radiocarbon community. These curves are based on the latest research focused on understanding the past ^{14}C content of the atmosphere and the ocean, and on the development of new statistical techniques.

The utility of the IntCal radiocarbon calibration curves goes far beyond conversion of radiocarbon ages to calendar year equivalents. The curves provide a means to integrate palaeoclimate records on other timescales, such as ice core or U-Th dated speleothems, with marine or terrestrial sediments dated by radiocarbon or archaeological records with additional chronological information. In addition the curves for the North and South Hemisphere provide past atmospheric ^{14}C levels for input into models of solar activity and ocean general circulation models.

This session will highlight new analyses that provide information for future calibration curves or that utilize the IntCal calibration curves to improve understanding of earth systems science.



INQUA Commission: Stratigraphy and Chronology

Session Title: Tephra on the edge: Advances in distal tephrochronology – methodologies, frameworks, and databases

Convenors and Co-Convenors: Peter Abbott (Convenor) Victoria Smith (Co-Convenor) Siwan Davies (Co-Convenor)

Description of Session: In recent years there has been a revolution in distal tephrochronology with a dramatic increase in the number of cryptotephra being identified in a wide range of depositional environments, and the discovery of deposits thousands of kilometres from their volcanic source. Isolating and characterising these tephra is, however, challenging, due to the low concentration and small size of shards present in many deposits, requiring the development of new techniques for their identification, extraction and geochemical analysis. In tandem there has been a significant focus on the compilation of tephrostratigraphic frameworks and databases that compile all key information relating to these explosive eruption deposits. These tephra layers can then underpin regional correlations between palaeoenvironmental or archaeological records, and combined with proximal eruption records provide a complete picture of the explosive volcanic history of a region and provide useful tools for other researchers. In this session we welcome contributions reporting research into any aspect of distal tephrochronology including new cryptotephra discoveries; advances in identification, sample preparation, characterisation of tephra; direct and indirect dating of tephra and the refinement of age depth models; assessing primary vs. secondary deposition; ongoing efforts to compile regional tephra frameworks; and databases and online tools to plot, analyse, compare or store and retrieve tephra data.



INQUA Commission: Stratigraphy and Chronology

Session Title: The European Loess Belt - a high-resolution archive of rapid environmental change

Convenors and Co-Convenors: Pierre Antoine (Convenor) Ludwig Zöller (Co-Convenor)

Description of Session: Detecting rapid climate changes during the Last Glacial in Greenland ice cores (D-O cycles) has generated major research efforts during the last 20 years to evidence their impact on European environments using sedimentary archives and especially loess-palaeosol records. Indeed, the great European Loess Belt is ideally located with respect to the Ice sheets and the North Atlantic Ocean to record this impact in both loess and palaeosols. In this context it has been proposed in 2001 to focus on a transect through the northern branch of the European loess belt during the INQUA-SEQS meeting in Kyiv.

High-resolution pedostratigraphic approaches coupled with sedimentological analysis (especially particle grain-size), led to the discovery of millennial-scale cyclic loess-palaeosols alternations correlated to Greenland stadial-interstadial cycles. Moreover, several horizons of periglacial structures were observed within loess series testifying of at least four permafrost development and degradation phases between about 60 and 20 ka.

The session will gather presentations and posters focusing on:

- 1) High resolution stratigraphy and reconstruction of palaeoenvironmental conditions combining multi-proxy approaches of the best loess-palaeosol sequences: sedimentology, bio-indicators, soil geochemistry, organic biomarkers, environmental magnetism, periglacial features ...
- 2) Updating the geochronological frame by coupling luminescence and ^{14}C dating methods, focusing especially on new developments in dating techniques.
- 3) Developments in data-model (numerical) comparisons to test palaeoclimate configurations leading to stadial-interstadial successions and phases of permafrost development and decrease (ice-sheets, sea surface conditions, wind power and directions ...).
- 4) Understanding the impact of climate change on Palaeolithic peopling of the great European loess plain.



INQUA Commission: Stratigraphy and Chronology

Session Title: The future of Quaternary geochronology

Convenors and Co-Convenors: Paula Reimer (Convenor) Geoff Duller (Co-Convenor) Mathieu Duval (Co-Convenor) Kirsty Penkman (Co-Convenor) Gilles Rixhon (Co-Convenor) Manfred Frechen (Co-Convenor) Katrin Lasberg (Co-Convenor) Yan Li (Co-Convenor)

Description of Session: Many of the techniques utilised in Quaternary geochronology have evolved in recent years allowing higher precision, longer timescales or wider ranging applications. Inter-comparison exercises and re-measurement of standards have enhanced the accuracy. In addition new methods for calculating ages from raw measurements have been developed, as well as the incorporation of associated information (e.g. stable isotopes, sediment properties, models of the underlying system, etc.) into statistical models to provide improved corrections or interpretation of results. This session will highlight current and potential advances in geochronological techniques over the entire range of the Quaternary as well as novel or complex applications and integration of records and timescales using these methods.



INQUA Commission: Stratigraphy and Chronology

Session Title: The Quaternary of Europe: stratigraphical perspectives and tools for correlations

Convenors and Co-Convenors: Markus Fiebig (Convenor) Guzel Danukalova (Co-Convenor) Pierluigi Pieruccini (Co-Convenor)

Description of Session: Across-Europe stratigraphical correlations is the first step for a full understanding of environmental changes in Europe during the Quaternary. However, the fragmentary nature of the stratigraphical records and the problems related to reliable dating techniques make correlations in terrestrial Quaternary systems problematic. The stratigraphical records involves integration of multiple proxies from a wide variety of terrestrial sediments over the whole of the period, and integration of these with the marine isotopic record of palaeoclimate. A Geographical-based summary of the main litho-, bio-, pedo-, morpho and chrono-stratigraphical data, such as databases, are fundamental for cross-border correlations, Quaternary mapping, climate changes reconstructions and natural hazards and related risks assessment. This session will discuss new data, correlation of proxies in time and space, and new methods and techniques for data comparisons, synthesis, mapping and sharing. The approaches used will be relevant for other continents. The outcome will be a contribution to SACCOM project 1612F.



INQUA Commission: Stratigraphy and Chronology

Session Title: Towards sub-decadal precision in reconstructing climatic and environmental change from high resolution lacustrine archives

Convenors and Co-Convenors: Alison MacLeod (Co-Convenor) Adrian Palmer (Co-Convenor) Ian Matthews (Co-Convenor)

Description of Session: Understanding the precise rates of climatic and/or environmental change is a key goal for paleoenvironmental researchers and requires the development of precise and accurate chronologies from high-resolution archives. Recent studies have identified many lake records which have the potential to address this and these permit the assessment of rates of change. This session focusses on identifying the ultimate resolution that can be achieved from palaeolacustrine records in terms of both their relative and absolute chronologies. We wish to initiate stimulating discussions around: (1) what key records provide the 'ultimate' resolution; (2) where limitations currently lie in being able to utilise these records to their full potential; and (3) explore the integration of annually-resolved and/or very high-resolution records.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: A new age of Paleofire research: Insights from the past and challenges for the future

Convenors and Co-Convenors: Donna Hawthorne (Convenor) Anne-Laure Daniau (Co-Convenor) Olivier Blarquez (Co-Convenor) Boris Vanniere (Co-Convenor) Scott Mooney (Co-Convenor)

Description of Session: Local charcoal time series and their regional and global syntheses have increased our knowledge of fire history, fire-vegetation-climate relationships and fire practices from a range of biomes and countries across the globe, spanning decades to multi-millennia. Advances in methodologies, statistical analyses and modelling have progressed the interpretation of charcoal in different depositional contexts and the understanding of paleofire regime controls. Long-term trends in biomass burning have primarily been attributed to natural climate variability and vegetation dynamics associated with changes in net primary productivity. However, many Holocene studies have suggested a regional control of fire based on human activity and changes in land cover. It is apparent that the different factors affecting fire regimes, vary from the local to regional scale, and on multi-decadal to multi-millennial time-scales. Future fire risk is expected to increase, accelerating the need for a deeper understanding of the role of fire in the landscape, and its interaction with vegetation and climate, in order to address the vulnerability of ecosystems and strategies of ecosystem-management, such as mitigation.

This session will combine paleofire research from across the globe, enhancing the knowledge of climate, human, vegetation and fire linkages. New methodological approaches and calibration studies are welcome, specifically from regions underrepresented in the Global Charcoal Database. The Global Paleofire Working Group supports paleofire research, and we anticipate this session will foster new collaborations, ideas and networking. We welcome participants to interact and contribute to the next phase of the GPWG, 'phase 3', and a new age of paleofire research.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Advances in Quaternary geological and geomorphological mapping: Approaches to data collection, processing, management and application

Convenors and Co-Convenors: Sam Roberson (Convenor), Marek Ewertowski (Co-Convenor), Michael Sheehy (Co-Convenor), Aleksandra Tomczyk (Co-Convenor), Xavier Pellicer (Co-Convenor)

Description of Session: Mapping quaternary deposits and landforms provides important resources for understanding the landscape in the form of geological and geomorphological maps, databases and multidimensional models. These data are a valuable resource for practising scientists, industry professionals and government bodies, as well as wider society.

Advances in data acquisition, e.g. soil geochemistry, LiDAR, geophysics, high-resolution satellite imagery and Unmanned Aerial Vehicles, have accompanied recent software developments, e.g. Geographical Information Systems, Cloud Computing and Structure-from-Motion. These developments have led to a rapid increase in data volume and interpretative tools. Using high-resolution spatiotemporal data we are now able to identify previously unrecognisable landforms and analyse processes that were hitherto unknown or overlooked. Furthermore, these data can now be analysed more rapidly and distributed to a far broader audience than has been achievable in the past.

This session invites contributions related to the mapping of Quaternary geology and geomorphology across a range of scales, from specific landforms to entire landsystems, geological map sheets and national databases. We encourage studies that consider the future of geological mapping, including those that demonstrate the application of new mapping technologies and data analysis, as well as data management and dissemination.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: African paleoclimates and paleoenvironments: From off shore records to continental archives, from landscape responses to human adaptation

Convenors and Co-Convenors: Katlheen Nicoll (Convenor) Andrew Cohen (Convenor) Andrea Zerboni (Convenor)

Description of Session: Africa is the cradle of humanity. During the Quaternary, our ancestors spread out in multiple waves progressively occupying each ecological niche available on Earth. In the Late Quaternary, Africa has been widely exploited by hunter-gatherers and subsequent groups of herders and farmers. African landscape and climate changes occurring in the Quaternary exerted a major influence on cultural processes. Climatic changes that occurred in Africa during the Pleistocene and the Holocene are known in general terms via marine records off the African coasts and lake records from the Rift and the Horn of Africa. However, the details of these changes, their variability and their ecological impacts are still poorly understood. There is a complex nonlinear interplay between variables of climate change, environmental response, and narratives of human adaptation. This session welcomes multidisciplinary abstracts relevant to Africa's rich cultural history, and its various archives of geoarchaeology, hydroclimatic and paleoenvironmental change. We aim to gather experts to present results on Quaternary palaeoenvironmental archives, including records from lake sequences, marine cores, fluvial, paleosol and dust records, and archaeological sites. Many important questions can be addressed, such as: What are the causes and teleconnections of African climate? How sensitive are African ecosystems to climate change? Which environmental settings promoted the dispersal of Homo around and out of Africa and the progressive introduction of livestock and agrosystems? What is the role of rapid climate changes in shaping the landscape and African cultures? When did the Anthropocene begin in Africa? What can we learn from African palaeoclimatic record?



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Caves as hidden Quaternary archives

Convenors and Co-Convenors: Mike Simms (Convenor) Andrew Farrant (Co-Convenor)

Description of Session: Caves as hidden Quaternary archives

Located often deep beneath the land surface, caves represent a hidden and protected archive of changing environments through the Quaternary. They can act as effective sediment traps and their location below the surface offers protection from subsequent erosion for many thousands, or even millions, of years. Caves may preserve direct evidence of landscape evolution and drainage rerouting; of the fauna and flora that inhabited those landscapes; and of the long-term climate fluctuations and sea level changes that affected them. Crucially, an 'absolute' chronology of events can often be established for cave systems using radiometric, cosmogenic and palaeomagnetic data from chemical and clastic deposits within the caves. If they weren't such difficult environments to work in, Quaternary scientists and geomorphologists would be queueing at every cave entrance...

This session will provide an overview of the processes that influence cave development, in both temperate and tropical environments, and will address specific aspects of Quaternary climate, sea level change, landscape evolution and Quaternary faunas as recorded in caves and their contents.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Dates, rates and bytes: Quantifying and deciphering Quaternary Earth surface dynamics

Convenors and Co-Convenors: Georgina King (Convenor) Rachel Smedley (Convenor) Ann Rowan (Convenor) David Small (Convenor) Micha Dietze (Convenor) Frédéric Herman (Convenor)

Description of Session: Numerical frameworks are essential for understanding and interpreting Quaternary landscape evolution. Recent developments in both geochronological methods and landscape evolution models have provided new insights into the timing, duration and intensity of landscape evolution processes. The combination of geochronological constraint with landscape evolution models has enormous potential for furthering our understanding of Quaternary landscape evolution and the focus of this session is to bring together geochronology from established or novel techniques (e.g. luminescence dating, TCN, ^{14}C etc.) with landscape evolution models of Quaternary landscape change (e.g. glacial/fluviat etc.). In particular, we welcome contributions that utilise novel geochronological methods, that combine different geochronological techniques and those that combine numerical age constraints with landscape evolution models to determine rates and timing of uplift, erosion and sediment transport/deposition as well as stochastic events.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Development of soft-sediment deformation structures (SSDS) and differences between non-seismic and seismic structures (Poster only)

Convenors and Co-Convenors: Tom Van Loon (Co-Convenor) Barbara Woronko (Co-Convenor) Andreas Boerner (Co-Convenor) Malgorzata Pisarska-Jamrozy (Convenor)

Description of Session: Soft-sediment deformation structures like load casts, pseudonodules, ball-and-pillow structures and flame structures are commonly ascribed to instable density gradients within sediments and to differential loading, but their formation always requires liquefaction and almost always occurs together with fluidization. Any perturbations at the interface between the overlying, denser sediment and the underlying less dense sediment act as Rayleigh-Taylor instabilities, causing irregularities to amplify until a gravity-driven vertical movement can be achieved. Load structures that are formed in this way result from depositional conditions. Load structures can, however, also be formed due to external factors such as passing shock waves resulting from seismic activity, by freezing/thawing alternations, by slope processes etc.

A major problem is that some soft-sediment deformation structures with identical or almost identical characteristics (size, outer shape, internal structure, etc.) can be triggered by a variety of processes, whereas some soft-sediment deformation structures with identical properties may have resulted from different deformational processes. Furthermore, overprinting is not exceptional: for instance, periglacially-deformed sediments can be deformed once more by seismic activity, and vice versa.

Considering the above, the present session has the following two main objectives: (1) investigating whether differences exist between soft-sediment deformation structures developed in a different environment, and (2) answering the question of whether it is possible to determine whether specific soft-sediment deformation structures have been caused by different processes, based on sedimentological evidence.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Drumlins - studies of a persisting enigma

Convenors and Co-Convenors: John Menzies (Co-Convenor) Jane Hart (Co-Convenor) Jan Piotrowski (Co-Convenor) Paul Dunlop (Co-Convenor)

Description of Session: Drumlins remain one of the great 'unsolved problems' of glacial geology/geomorphology. Over the past 150 years the question, the enigma, of drumlins has been studied by thousands of researchers over all the continents of the Northern Hemisphere and in South America, Antarctic and New Zealand and still we remain 'stumped'. The drumlin question now is of great interest to pre-Quaternary researchers as well with increasing awareness of the ancient subglacial conditions as far back as the Archean. There are many hypotheses of drumlin formation, many linking drumlins as part of the wider spectrum of MSGL. The tools directed at drumlins include sedimentology, morphology, and the, now extensive, use of satellite imagery. Yet interest in drumlin research is possibly at its highest level since a resurgence of interest beginning in the early 1970s. This Symposium hopes to stimulate discussion and a new awareness of active and innovative ideas on drumlin formation in the wider context of subglacial environments. As our understanding of subglacial conditions continues apace - drumlin formation remains a key question to solve. Never before have we been positioned to answer the question - thus the urgent need to collaborate and pull our enormous research resources together at INQUA. It is not lost on the Co-Convenors that the term 'drumlin' is of Irish etymology so it is very significant that an INQUA Drumlin Symposium be held in Dublin.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Dust sources and emission dynamics from different geomorphic units during the Quaternary and at present

Convenors and Co-Convenors: Onn Crouvi (Convenor) Andrea Zerboni (Convenor) Rivka Amit (Convenor)

Description of Session: During the Quaternary mineral dust played, and today still plays, multiple roles in mediating physical and biogeochemical exchanges among the atmosphere, land, and ocean, and thus is an active component of the Earth system. Deposited dust accumulates in soils, and in areas close to the sources, coarse dust (coarse silt grains) forms loess, which is an aeolian deposit representing an important archive of Quaternary climate changes, providing one of the most complete terrestrial records of interglacial-glacial cycles. One of the best approaches to study past, current, and future impacts of dust on the climate, on the environment and humans is through numerical models. However, accurate simulation of the dust cycle depends on a realistic representation of dust source areas and dynamics of dust emission from these sources. These gaps are one of the limiting factors for existing global models of dust cycle. In this session, we wish to discuss the following main topics: 1) dust source geomorphology, 2) mineralogy and geochemistry of dust originating from specific geomorphic units, 3) dynamics of dust emission from different geomorphic units and aeolian system sediment state, 4) post sedimentary processes transforming accumulated dust into soils, 5) (palaeo) climatic conditions affecting dynamics of dust emission and accumulation. Current day processes and Quaternary perspectives are welcome, including field and remote sensing observations, field and lab experiments, palaeoclimatic reconstruction and modelling of modern and ancient dust.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Earthquake geology and seismic hazards: From earthquake mapping of historical and prehistoric earthquakes to paleoseismology

Convenors and Co-Convenors: Ioannis Papanikolaou (Convenor) Stéphane Baize (Co-Convenor) Christoph Grützner (Co-Convenor)

Description of Session: This session, supported by the IFG on Earthquake Geology and Seismic Hazards, encourages contributions dealing with multidisciplinary approaches (fault trenching, geophysics, remote sensing, dating, etc.) applied to earthquake geology, paleoseismology, and fault specific seismic hazard assessment. Geological approaches are very important because they provide insights on the long-term behavior of fault-networks, a keystone of seismic hazard studies. Quantitative assessments include geologically recorded slip rates, earthquake time history and magnitude of large paleo-events. Earthquake geology is also the key approach to analysis of surface faulting hazard that could threaten facilities or infrastructures. Recent techniques and developments allow the quantification of the overall surface deformation during historical and recent surface-breaking earthquakes, contributing to the improvement of future Fault Displacement Hazard analyses. This session will particularly examine: i) how to improve the capability of the recognition and characterization of Quaternary capable faults, ii) how to strengthen our knowledge of the relation between surface faulting produced by earthquakes vs earthquake sizes and earthquake fault parameters, both being key aspects in Ground Shaking estimation iii) upgrade the existing EEE (Earthquake Environmental Effects) database.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Engineering in the Quaternary

Convenors and Co-Convenors: Michael Long (Convenor) Marie Fleming (Convenor)

Description of Session: This session will deal with case histories of some of the geotechnical engineering / engineering geology challenges faced by geotechnical engineers and engineering geologists where the solutions required a thorough understanding of the geomorphology and geological depositional history. The session will demonstrate that an understanding of the link between the proposed development / site use and the Quaternary history of the site is essential for successful and sustainable development.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Frontiers in drylands research

Convenors and Co-Convenors: Kathryn Fitzsimmons (Co-Convenor) Sallie Burrough (Co-Convenor) Joy Singarayer (Co-Convenor) Alexandra Engström Johansson (Co-Convenor) Abigail Stone (Co-Convenor) David Thomas (Co-Convenor) Nicholas Lancaster (Co-Convenor)

Description of Session: Dryland environments, spanning hyper-arid to sub-humid climates, cover ~40% of the terrestrial surface, host some 40% of the world's human population, and are characterised by considerable seasonal and inter-annual variations in precipitation. Climatic and environmental variability in drylands has been a key characteristic throughout the Quaternary over a range of timescales, including glacial to interglacial-paced impacts on temperature and hydroclimate; precessional-insolation forcing of global monsoon systems; and teleconnections with millennial-scale climate events deriving from the North Atlantic. These climatic oscillations have influenced dryland landscapes, ecology and hominin populations. Dryland responses to climatic variation are recorded in landforms (geoproxies) and in the sediments themselves, including biomarkers, soils and chemical precipitates such as speleothems, mound springs and tufas.

This session focuses on showcasing innovative new approaches to interpreting archives of environmental change in drylands. We welcome discussions on new proxies, geochronology and age modelling, and model-data integration. Developments in proxies include records from soils (sediment production and soil dynamics), biomarkers preserved in dryland sediments, and interpretations of geoproxies. Some of the recent advances in age models and geochronology, include the application of changepoint analysis to luminescence datasets and developments in calibrating the portable luminescence reader as a rapid age assessment tool.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Glacial and periglacial landsystems – recent advances and their implications for engineering geology

Convenors and Co-Convenors: David Evans (Convenor) David Giles (Co-Convenor) Julian Murton (Co-Convenor) Thomas Raab (Co-Convenor) Florian Hirsch (Co-Convenor)

Description of Session: The session will address recent developments in landsystems research as they pertain to both modern and ancient glacial and periglacial environments, with modern landsystem analogues being especially encouraged. A parallel focus will be on the applications of landsystem research and developed conceptual ground models to engineering geological problems in relict glaciated and periglaciated terrains, addressing more specifically the recent adoptions of a modern landsystems approach by engineering geologists in their field-based solutions. This session is aimed at: 1) developing our landsystem knowledge base and identifying its broader significance and applications; 2) bringing engineering geological case studies to Quaternary scientists; and 3) initiating greater synergy between the Quaternary and engineering geology communities.

We encourage contributions from a range of fields investigating glacial and periglacial terrains, including geomorphology, engineering geology, Quaternary science, geophysics and remote sensing.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Glacier response to abrupt climate change

Convenors and Co-Convenors: Clare Boston (Co-Convenor) Danni Pearce (Co-Convenor) Sam Roberson (Co-Convenor)

Description of Session: Sea-level rise during forthcoming decades will be dominated by meltwater from mountain glaciers and ice caps due to their rapid response to climate warming. Yet the rate at which these glaciers will contribute to sea-level rise is complex due to the potential for non-linear responses to climate change. The Quaternary geomorphological and sedimentological record provides the potential to assess ice mass response to previous sub-millennial scale changes in climate, improving understanding on the mechanisms controlling future patterns of ice mass recession. This Quaternary evidence can be employed to reconstruct former ice mass extent, dynamics and patterns of recession, whilst regional-scale inventories may reveal a varied response of neighbouring ice masses. In addition, understanding how microclimatic factors, topographic and geometric controls, and changes in glacier thermal regime and hydrology affect glacier response to climate change is crucial both for unravelling information on palaeoclimate and predicting future glacier response.

This session aims to facilitate discussions on the response of glaciers to abrupt changes in climate in the past by bringing together researchers with a focus on glacial geomorphology, sedimentology, glacier modelling and dating. We invite contributions on Younger Dryas and Little Ice Age glacier fluctuations, alongside glacier response to other periods of sub-millennial climate change.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Glacifluvial processes and products: Implications for Quaternary glacier dynamics

Convenors and Co-Convenors: Andy Russell (Convenor) Tracy Brennand (Co-Convenor) Cathy Delaney (Co-Convenor)

Description of Session: This session aims to bring together researchers working on glacifluvial landforms and deposits within modern and ancient environments. Meltwater is an integral component of glacial systems and plays a vital role for glacier motion, sediment transport and landscape evolution. Fluvial processes within sub-, en-, supra- and proglacial environments can generate distinctive erosional and depositional landforms, such as tunnel channels and eskers, respectively. Glacifluvial landforms and deposits can be used to reconstruct the magnitude and frequency regime of large-scale meltwater systems informing Quaternary ice-sheet dynamics. Proglacial fluvial systems also respond to and record changes in glacier margin position and base level change. From an applied perspective, Quaternary glacifluvial aquifers are important as groundwater resources and glacifluvial deposits are an important aggregate resource. The increased use of geophysical techniques within modern and ancient glacifluvial environments allows better characterisation of large-scale sedimentary architecture providing new models for glacifluvial erosional and depositional architecture. We welcome contributions on all aspects of Quaternary glacifluvial landforms and deposits as well as modern analogue studies.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Glacigenic signatures of the last British-Irish ice sheet

Convenors and Co-Convenors: Jasper Knight (Co-Convenor) Steve McCarron (Co-Convenor)

Description of Session: Glacigenic landforms across Great Britain and Ireland, dating mainly from the last glacial cycle, have been studied for many decades. Advances in bedform mapping, dating, glacial modelling and sea level studies provide different perspectives on glacigenic processes and environments during the last glacial cycle of the British–Irish ice sheet (BIIS). This session will explore the varied types of evidence available for glaciological and palaeoenvironmental reconstruction of the last BIIS, which may include glacial sediments and landforms from different depositional environments (subglacial, proglacial, supraglacial and in terrestrial or waterlain settings), microfossil and dating evidence, glacial or climate modelling, and mapping and spatial analysis.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Holocene glacier change in High Mountain Asia

Convenors and Co-Convenors: Ann Rowan (Convenor) Lewis Owen (Co-Convenor) Josephine Hornsey (Co-Convenor)

Description of Session: The high mountains of Asia contain the largest volume of glacier ice outside of the Polar Regions, and form the headwaters of major rivers such as the Ganges, Indus and Brahmaputra. The timing and extent of glacier advance and recession during the Holocene has varied dramatically across this region, driven by the interaction of high mountain topography with atmospheric circulation systems including the Indian summer monsoon. The response to climate change of these glaciers also depends on factors such as their location and morphometry, the presence of extensive supraglacial debris covers and surge-type behaviour. Only a few glacial chronostratigraphies with which to interpret recent glacier change have been produced so far, making regional trends and important processes challenging to identify. This session will bring together studies investigating Holocene glacier change in the high mountains of Asia, including the Himalaya, Karakoram, Transhimalaya, Pamir, Hindu Kush and on the Tibetan Plateau. We welcome focused and multidisciplinary studies using field observations, satellite remote sensing, geochronological techniques and numerical modelling to explore glacier change in High Mountain Asia through the Holocene, the impacts of these changes on the geomorphology and hydrology of the region, and how these studies can inform predictions of glacier change under future climate scenarios.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Integrating stratigraphy and geology to constrain cosmogenic nuclide interpretations of earth surface processes

Convenors and Co-Convenors: Alexandru Codilean (Co-Convenor) David Fink (Co-Convenor) John Gosse (Co-Convenor) Eric Kirby (Co-Convenor) Eric McDonald (Co-Convenor)

Description of Session: Over the past two decades, the continual improvement in understanding the production modes of cosmogenic isotopes and in our technical capability to measure rare isotopes has revolutionized the dating of landforms and Quaternary deposits. In-situ cosmogenic radionuclide and noble gas systems (^{10}Be , ^{14}C , ^{26}Al , ^{36}Cl , ^3He , ^{21}Ne) now provide foundational chronologies for studies of landscape evolution, paleoclimate reconstruction and neotectonics studies across the globe. Similarly, the re-emergence of meteoric ^{10}Be as a chronometer and tracer of mass flux is beginning to open new windows into earth surface processes. However, because the interpretations of measured cosmogenic concentrations are extremely sensitive to inheritance and post-depositional modification, most such ages are subject to epistemic uncertainties that depend on the history of landscape change. Integration of soil stratigraphy has the potential to place local constraints on the relative stability of depositional surfaces, while analytical advances in novel cosmogenic isotope systems such as ^{14}C in quartz allow more precise estimates of admissible erosion/depositional histories. This session will explore the frontiers of the application of cosmogenic isotopes to questions of Quaternary chronology, surface process and neotectonics. We welcome contributions from field, experimental and theoretical investigations, and we particularly encourage contributions that combine cosmogenic isotope measurements with approaches from soil science, geomorphology, neotectonics, alluvial stratigraphy, and/or other Quaternary chronologic techniques that constrain and improve applications of cosmogenic isotope in the earth sciences.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Mediterranean rivers in the Quaternary

Convenors and Co-Convenors: Jamie Woodward (Convenor) Mark Macklin (Co-Convenor)

Description of Session: The river sediments and landforms of the Mediterranean region have long attracted the attention of Quaternary scientists. 2019 is the 50th anniversary of the publication of Claudio Vita-Finzi's remarkably influential book *The Mediterranean Valleys: Geological Changes in Historical Times*. To mark this anniversary, this session will bring together researchers who share an interest in the Quaternary evolution of the region's fluvial systems. We have seen many advances over the last five decades in our understanding of long-term river behaviour in the Mediterranean basin. One of the most important is the creation of robust fluvial geochronologies - this has allowed pan-Mediterranean patterns of river behaviour to be explored for both the Pleistocene and Holocene. Another key development is the exploration of new archives of river behaviour including slackwater sediments and the high resolution records preserved in deltas and offshore. We welcome papers on all relevant topics including: developing dating frameworks for river histories; modelling river basin evolution and channel response to environmental change including tectonic/volcanic activity; the geoarchaeology of river environments; fluvial records preserved in Mediterranean harbours; meta-analysis of river records; extreme events in Mediterranean river basins; river response to climate forcing including abrupt (millennial- and centennial- scale) change during the Late Pleistocene and Holocene; river response to Mediterranean glaciation and deglaciation; unravelling drivers of change in the Holocene including anthropogenic impacts on river dynamics and sedimentation; fluvial histories recorded in lake basins, deltas, and the marine archive; studies of sediment provenance from source to sink; Mediterranean rivers in the Anthropocene.



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INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Microsedimentology and micromorphology of glacial sediments

Convenors and Co-Convenors: John Menzies (Co-Convenor) Jaap van der Meer (Co-Convenor) Emrys Phillips (Co-Convenor)

Description of Session: Micromorphology and its broader science of microsedimentology has greatly advanced within the field of glacial sediments in the past decade. Micromorphology seeks to examine the interrelationships between microscopic particles and related sediment 'artefacts', while microsedimentology looks at the relationships between particles and various sedimentary structures. With the detailed microscopic examination of both terrestrial and marine glacial sediments from all glacial sub-environments micromorphology has evolved into a large area of research within glacial sedimentology. The microscopic examination of glacial sediments has identified a range of microstructures and other artefacts and sedimentological characteristics within undisturbed sediments that reveal the stress histories and paleo-conditions under which these sediments have been transported and deposited. Microstructures and the relationship of the matrix (plasma) to skeleton grains offer an understanding of deposition, deformation, and post-depositional diagenesis. Glacial micromorphology and microsedimentology is, however, still a developing discipline with new discoveries and revelations occurring as increasing numbers of researchers delve into glacial sediments. It has become increasingly apparent that glacial micromorphological and microsedimentological research has great relevance to our continued understanding of glacial processes. The convening of this Session would be a major step in collaboration and co-operative research work by bringing together interested glacial micromorphologists and microsedimentologists at INQUA.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Mountain glaciations and their diversity: Challenge and potential (Poster only)

Convenors and Co-Convenors: Stefan Winkler (Convenor) Giovanni Monegato (Convenor) Jürgen Reitner (Convenor)

Description of Session: Mountain ranges are important geo-ecosystems characterised by dynamic processes and providing specific living environments. They are hotspots of the current Global Change and simultaneously recognised as highly important archives for the investigation of climate changes during the Quaternary. The investigation of mountain glaciations and current mountain glaciers is, however, not a trivial task. Recent conceptual reviews have highlighted the necessity of an integrated approach based on intense communication and collaboration among many specialised scientists as e.g. glaciologists, glacial geomorphologists, (palaeo)climatologists, or geochronologists. Apart from dynamic geomorphological process systems and specific geoecological conditions caused by the characteristic mountain relief, the spatial diversity among and even within individual mountain ranges constitutes another major challenge with the investigation of mountain glaciations. Any successful inclusion of the spatial diversity demands inevitably specific guidelines for the interpretation of every record related to mountain glaciations. Such guidelines and related recommendations are yet to be developed and widely applied, but if in place, this spatial diversity constitutes an advantage because it opens for a larger palaeoclimatic potential owing to a wide range of different environmental factors that are represented. Our session aims to facilitate a closer connection between different topological, methodological, and regional working groups related to various aspects of mountain glaciations in space and time. It should bring together scientists that work on all different aspects and time scales of mountain glaciations from local to global scales as well as from the early Quaternary to the Holocene.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Multiproxy studies on continental carbonates: Palaeoclimates and palaeoenvironments

Convenors and Co-Convenors: Julie Dabkowski (Co-Convenor) Charlotte Prud'Homme (Co-Convenor) Eric Verrecchia (Co-Convenor)

Description of Session: Continental carbonates have been extensively studied during the last few decades as supports for multidisciplinary palaeoclimatic and palaeoenvironmental research. Most efforts have been concentrated on speleothems, but investigations on tufa, travertine, lacustrine, palustrine, soil, and biogenic (shells, earthworm granules, etc.) carbonates are also rapidly developing with improved and new technologies. Continental carbonates are highly suitable for combining geochemical approaches (e.g. stable isotopes) with direct dating on calcite (^{14}C , U-Th series, ESR) or grains embedded in calcite (OSL). Additionally, in most cases, bioproxies (pollen, molluscs, leaf imprint, etc.) usually associated with these carbonates allow synergic and independent palaeoenvironmental investigations.

The present session aims to illustrate the wide diversity of climatic and environmental data obtained from carbonates in continental archives. Contributions presenting multidisciplinary approaches are highly welcome. Continental carbonates from any kind of crystallisation processes (physicochemical/biological) or environments (open-air, karst, soils, thermal or meteoric water, etc.) should be represented. Finally, we encourage authors to discuss their own data regarding other regional to globally significant records, which would highlight the important contribution of continental carbonate studies to the understanding of past climate and environment dynamics.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Palaeohydrology and fluvial archives - hydrological extreme and critical events (HEX)

Convenors and Co-Convenors: Jürgen Herget (Convenor) Alessandro Fontana (Convenor) Becky Briant (Convenor) Lothar Schulte (Convenor)

Description of Session: Palaeohydrology addresses all components of the water cycle, although in practice most of the previous research has been focused on river channels and discharges, especially geomorphological and stratigraphic indicators of previous floods. Fluvial archives and landforms like river terraces and stacked fluvial sediments, alluvial fans, or lacustrine successions, tree-rings, speleothems and historical documents provide information of previous environmental conditions, including specific events and episodes. Hydrological events are defined by magnitudes higher (flood) or lower (drought) than a critical threshold, including extreme events of significantly differing magnitudes. Events may be unique or clustered in time and can significantly mark the landscape, e.g. by terrace formation.

In the session, a multi-disciplinary approach will be applied by bringing together scientists from different disciplines for exchanges about:

Extreme hydrological events, addressing the spatial and temporal patterns of extremes in different world regions using multi-archives and multidisciplinary perspectives.

Collation and presentation of results from research on palaeohydrology and fluvial archives.

Human perception, resilience and response. For Holocene and historical events, consequences such as abandonment or shifting of settlements are important to assess the impact of floods or droughts and their magnitude and duration.

New methods and techniques, integration of data from different archives and Quaternary river evolution, such as remote sensing, geochronology, modelling, numerical simulation, geochemical and isotopic analysis.

The session is organised in cooperation of the groups of Global Continental Palaeohydrology GLOCOPH, Fluvial Archives Group FLAG, forming the INQUA International Focus Group HEX and the PAGES Flood Working Group.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Palaeo-Ice streams: Forms, processes and palaeoglaciology

Convenors and Co-Convenors: Roger Paulen (Co-Convenor) Chris Stokes (Co-Convenor) Monica Winsborrow (Co-Convenor) Nick Eyles (Co-Convenor) Colm Ó Cofaigh (Co-Convenor)

Description of Session: In glaciated landscapes, there has been considerable recent research that demonstrates that palaeo-ice streams had prominent roles in continental ice sheets of the last glacial cycle. These fast-flowing corridors of ice played an important role in ice sheet dynamics and mass balance, and they imparted numerous, distinctive geomorphological features and glaciogenic sediments during the retreat of continental ice sheets in both the northern and southern hemisphere. This session seeks contributions on any aspect of palaeo-ice stream research, including investigations of their sedimentology and geomorphology from a range of environments (soft bed, hard bed, mixed bed lithologies); and including analyses drawn from dispersal trains and laboratory-based investigation of subglacial sediments. We also welcome contributions that focus on reconstructing the glacial history of ice streams from their geomorphology and/or sedimentology, and those that explore their wider implications for ice sheet dynamics.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Paleoseismology of plate interiors under Pleistocene climate changes (Poster only)

Convenors and Co-Convenors: Klaus Reicherter (Convenor) Petra Štěpančíková (Co-Convenor)
Małgorzata Pisarska-Jamroży (Co-Convenor)

Description of Session: We focus in our session on intraplate settings that may or not have undergone loading and unloading processes by ice. The past cyclic ice ages left imprint on fault mechanics, the fault activity and paleoseismicity and secondary earthquake effects. There is also growing evidence of climate-induced melting of large ice sheets being able to trigger fault reactivation and earthquakes within or in front of the ice limit. Even present-day glacial isostatic adjustment can continue to induce seismicity within the formerly glaciated region.

Intraplate earthquake are difficult in studying recurrence periods as mostly no archives are left due to subsequent erosion deposition by glacier and they are even enigmatic in terms of deciphering past tectonic activity. Often evidence for palaeo-earthquake rises from liquefaction or other soft-sediment deformation features, as causative faults are buried. New techniques like LiDAR imaging and other remote sensing methods help identifying scarps and other morphological features.

Besides glacial areas, we also urge all other studies from continental interiors, i.e. far from plate boundaries, to contribute to the session. Here we can imagine contributions on fault activity in coastal areas that have undergone severe sea level changes in glacial times of 100 m and more, and the imprint on fault activity by vertical loading/unloading.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Paraglacial environments and processes in the Quaternary and Holocene: What happens and when?

Convenors and Co-Convenors: Adrian Palmer (Co-Convenor) Stephan Harrison (Co-Convenor) Jasper Knight (Co-Convenor) Alison MacLeod (Co-Convenor) Ian Matthews (Co-Convenor)

Description of Session: The widespread deglaciation experienced in the northern hemisphere at the onset of Lateglacial Interstadial and Holocene warming had a profound effect on the terrestrial environment. Paraglacial adjustment affected geomorphic and biological systems operating in former glaciated regions at a range of rates and scales. With the development of high-resolution chronologies, the potential now exists to examine these changes over sub-centennial periods. This session will: 1) explore evidence for paraglacial environments and processes based on examples from past and present deglaciating environments, in mountain and lowland settings. This can include studies of postglacial landslides and other geohazards; permafrost and periglacial processes and structures; ecological patterns; alluvial, mass movement and fluvial processes, sediments and landforms; geochemical and isotopic evidence (including C cycling); geochronology and modelling of land surface relaxation and sediment yield. 2) discuss how we can best utilise modern dating techniques alongside proxy datasets to enhance understanding of the patterns and rates of change in geomorphic and biological systems as a response to deglaciation over the Last Glacial to Interglacial transition. This session will be of interest to field scientists working in the areas outlined above, and climatologists, modellers, and managers.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Peatland dynamics through time and their use as environmental archives

Convenors and Co-Convenors: Graeme Swindles (Convenor) Malin Kylander (Convenor) Paul Morris (Co-Convenor) Richard Bindler (Co-Convenor) Angela Gallego-Sala (Co-Convenor) Timothy Mighall (Co-Convenor) Matthew Amesbury (Co-Convenor)

Description of Session: Peatlands contain between a sixth and a third of all global soil carbon and represent important habitats. Peatlands are also important environmental archives that provide an opportunity to generate high-resolution records with robust chronologies thanks to the wealth of dateable material. A wide range of biological and geochemical tools are used to reconstruct past paleoenvironmental changes in the peat record, which may reflect both internal (e.g., vegetation and water-table changes) and external (e.g., soil dust, pollution deposition, climate) drivers. This session covers topics including peatland initiation, carbon accumulation, and the hydrological, ecological and geochemical dynamics of peatlands across all latitudes. Key themes include (i) peatland response and resilience to external drivers, including the use of long-term records and to examine the vulnerability of global peatlands to human impacts and climate change; and (ii) the use of novel and multi-proxy approaches for the reconstruction of past paleoenvironmental changes. Data-based and modelling approaches, and studies integrating the two are welcome.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Proglacial lakes in the Quaternary

Convenors and Co-Convenors: Cathy Delaney (Convenor) Christopher Hill (Co-Convenor) Kathryn Adamson (Co-Convenor) Adrian Palmer (Co-Convenor)

Description of Session: The purpose of this session is to provide a platform for the presentation and discussion of current research focussing on all aspects of proglacial lakes, including both ice-contact and distal, glacier-fed lakes. Proglacial lakes are a fundamental component of the cryosphere, impacting on glacier and meltwater and groundwater dynamics, sediment flux, and local, regional and global climate. Quaternary proglacial lake sediments and landforms are widely distributed and provide a uniquely continuous record of cold-climate environmental change during deglaciation. Ice-contact and glacier-fed lakes act as sediment sinks within glacial sediments and are an exceptional archive of cold-climate environmental change, often with exceptionally high-resolution chronological control. Lake sediments may contain multiple physical, biological and geochemical proxies relating to aspects of geological, atmospheric and climate systems, including glacier and meltwater dynamics, sediment fluxes, and local, regional and global climate.

We welcome contributions on all aspects of proglacial lakes including, but not limited to: depositional processes and controls, facies models, chronology, environmental reconstruction, geomorphology, and hydrography.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Quaternary geoarchaeology of South Asia

Convenors and Co-Convenors: Nupur Tiwari (Convenor) Vivek Singh (Convenor) Shashi B. Mehra (Convenor)

Description of Session: This session addresses the Quaternary period of South Asia, the region encompassing Afghanistan, Pakistan, India, Nepal, Bangladesh and Sri Lanka. Being ecologically diverse in the centre of the Old World, it must have played a prominent role in hominin and faunal dispersals across this region. All known lithic technologies in prehistory are reported here (Oldowan, Acheulean, Levallois, laminar, microlithic, ground and polished tools) and reflect adaptation by multiple hominin species over time. The region has the oldest and youngest Acheulean evidence outside Africa, the largest terrestrial deposits of the Younger Toba Tephra (YTT) and the oldest microliths in Asia. Palaeoenvironmental studies suggest that environmental variability may have facilitated technological dispersals and transitions. The lithic assemblages are distributed across the entire Subcontinent in diverse sedimentary contexts including both stratified and surface contexts: colluvial, fluvial, aeolian, lacustrine, marine, lateritic and bedrock. Many geoarchaeological issues and problems require addressing:

- Stratigraphic breaks in technological sequences
- The marginal occurrence of Early Pleistocene contexts in peninsular India
- Interpretation of tephra deposits with Acheulean assemblages
- Separating indigenous vs. dispersed lithic technologies
- An absence of hominin fossils and Palaeolithic butchery sites
- Methodological challenges in geochronology
- Factors that led to faunal extinctions
- The absence of select technologies in specific ecozones

This session invites presentations on the aforementioned issues through various geoarchaeological perspectives such as Palaeolithic archaeology, geomorphology, taphonomy, sedimentology, landscape adaptations, dispersal routes/barriers, palaeoenvironmental reconstructions, post-depositional site formation processes and related subtopics. Multidisciplinary approaches and theoretical perspectives within the South Asian Quaternary period are welcome.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Quaternary glaciations: Processes, sediments and landforms

Convenors and Co-Convenors: Lorna Linch (Convenor) Danni Pearce (Co-Convenor) Jan Piotrowski (Co-Convenor) Dave Evans (Co-Convenor)

Description of Session: Cold region sediments and landforms provide important information about the dynamics, distribution and dimensions of ice sheets and glaciers. Some of these sediment-landform associations are known only from the palaeo-record: for example from drained lake floors, continental shelves, or from the former beds of large mid-latitude ice sheets. This record can be used to understand palaeo-ice-mass dynamics, reconstruct climate, and refine our understanding of the future response of ice sheets and glaciers to variations in climate. The aim of this session is to bring together researchers working on cold region sediments and/or landforms, with a view to reconstructing Quaternary glaciations. We invite contributions from those investigating both onshore and offshore cold region landforms/sediments at all scales (macro-, meso-, micro-), and from all parts of the world. Studies adopting a multi-disciplinary approach (e.g. field, laboratory, remote sensing, GIS and modelling techniques) are particularly welcome.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Quaternary landscape evolution: Model and field perspectives

Convenors and Co-Convenors: Becky Briant (Convenor) Tom Coulthard (Co-Convenor) Mark Macklin (Co-Convenor) Darrel Maddy (Co-Convenor) Jeroen Schoorl (Co-Convenor)

Description of Session: Long-term landscape change is a key feature of Quaternary geological records. It is however, often hard to piece together from disparate sedimentary records, or to determine the driving forces that are most important in determining landscape change. Both field and numerical modelling approaches have value in addressing these questions, although their different data types are sometimes hard to reconcile. This comparison has been a focus of the FACSIMILE (Field And Computer SIMulation In Landscape Evolution) research network, of which the proposers are members.

This session seeks to bring together workers looking at long-term landscape change from multiple perspectives, including landscape evolution modellers, field scientists and those using GIS or remotely sensed data to characterise landscapes. We welcome abstracts on all topics related to landscape evolution. These could include but are not limited to: exploration of different drivers of landscape evolution at multiple timescales using Landscape Evolution Models (LEMs), landscape evolution narratives from field data or in relation to archaeological research questions, new methodologies in analysing field data or comparing model and field data.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Quaternary Mars

Convenors and Co-Convenors: Matthew Balme (Convenor) Colman Gallagher (Co-Convenor) Lauren Mc Keown (Co-Convenor)

Description of Session: “Water on Mars” hits the news regularly, and the association of Mars’ liquid water with life has been the driver for the many past, present and future missions to Mars. The search for life on Mars is most often focussed on the ancient “Noachian/Hesperian” periods, more than 3 billion years ago, during which time Mars’ witnessed an Earth-like variety of geological processes.

But while the Earth has been experiencing its Quaternary ice ages and associated environmental changes, what has been happening on Mars? Has Mars been geologically active and environmentally dynamic during this most recent epoch, during what Mars scientists call the “very late Amazonian”? Has Mars too experienced recent ice ages and, if so, how have the environmental characteristics of Mars, especially the availability of liquid water, changed as a consequence? Do the insights gained over the last two centuries into the causes of, and environmental responses to, cyclical glaciation on Earth even have a meaning for other planets?

We will explore the processes that shaped Mars during the quaternary. We will discuss martian chronology, and whether it is possible to date ‘recent’ martian surface processes and landscapes. We will examine the geomorphology of these young martian landscapes, those martian processes active now, and compare our findings with terrestrial examples. We will examine links between climate, orbit and geomorphology on Mars, and explore the question “has ice recently melted on Mars”? Finally, we will look at current and future plans for remote fieldwork and remote sensing on Mars.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: River terraces as archives of Quaternary landscape development (Poster only)

Convenors and Co-Convenors: Martin Stokes (Convenor) Pedro Cunha (Co-Convenor)

Description of Session: River terraces are bodies of fluvial sediment with a step-like margin and flat-topped surface that grades topographically towards a valley centre and in a downstream direction. They are commonly preserved along river valley margins worldwide and have regional Quaternary lithostratigraphic importance. Terraces form when a river incises, abandoning the former floodplain and channel belt, with successive periods of fluvial aggradation and incision forming inset river terrace staircases. The fluvial sedimentation is generally a function of climate-related hillslope weathering, sediment supply, hillside-channel connectivity and river channel flood regime, whilst river incision is determined by base-level lowering, normally driven by combinations of tectonics, climate, eustasy and capture. Developments in luminescence, cosmogenic, and other dating techniques means that river terrace sequences are now providing higher resolution and long-time series insights into Quaternary landscape development. This session aims to bring together researchers where river terraces form an integral part of their Quaternary research, showcasing applications of field survey/mapping/logging, laboratory sedimentological analysis and dating, and modelling approaches. We particularly welcome presentations using case studies where: 1) terrace sequences span multiple climate cycles providing insight into deeper Quaternary time; 2) where terrace records display interplay with adjacent landscape/sedimentary systems (hillslopes, landslides, alluvial fans, lakes, aeolian dunes, moraines, marine terraces, etc.); 3) where terraces have formed in non-glaciated landscapes providing insight into tectonic / climatic / capture-related controls on Quaternary landscape development; and 4) less common / unconventional applications of river terrace research (e.g. geoarchaeology, volcanic islands, terraces studies in low latitude dryland / tropical regions, etc.).



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Role of large-scale rockslides in landscape evolution (Poster only)

Convenors and Co-Convenors: Alexander Strom (Convenor) Xuanmei Fan (Co-Convenor) Anja Dufresne (Co-Convenor) Kenneth Hewitt (Co-Convenor)

Description of Session: Large-scale rockslides damming river valleys and producing millions and billions tons of fines play an important, some times critical role in river valleys evolution in mountainous regions. River damming associated with valleys inundation and siltation upstream and in powerful outburst floods and aggradation downstream can disturb fluvial processes producing very specific landscapes - abnormally high flat terraces alternating with deep erosional gorges, which age can be much younger than age of similar landforms produced by "normal" fluvial processes. They are often mixed with glacial landforms and their correct interpretation is critically important for reconstruction of the Quaternary history of river valleys and of past climate change. Enormous amount of crushed material, often comminuted up to nanoscale particles, displaced into mountain streams and transported further by fluvial processes must be taken into consideration when analyzing material balance both in deeply incised valleys in their upper reaches and at the alluvial fans where such streams leave mountains. All these phenomena can be exemplified by numerous examples from the Alps, Tien Shan, Pamir, Longmenshan, Himalayas and other mountain systems all over the World and help better understanding of the Quaternary chronostratigraphy, climate change, and long term natural hazards assessment.

We hope that the proposed session will attract attention of researchers studying not only landslides themselves, but also various aspects of Quaternary history of mountainous regions.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Sediment archives to unravel environmental change influencing Human dispersal in the European Plain (Poster only)

Convenors and Co-Convenors: Tobias Lauer (Convenor) Marcel Weiss (Co-Convenor) Roland Zech (Co-Convenor) Andrzej Wiśniewski (Co-Convenor)

Description of Session: The European plain, ranging from the Atlantic coast in the West to the Ural mountains in the East is a key area to study the dispersal of modern humans and disappearance of Neanderthals in Europe. To understand certain aspects of changes in cultural behavior and to trace when and why modern humans populated the European Plain, it is mandatory to reconstruct the palaeoenvironmental conditions of the Upper Pleistocene. Changes in climate may have been one of the main factors that triggered the latter mentioned processes.

Sediment archives connected to Middle- and Upper Paleolithic archeological sites yield important information on climate change and how it influenced the appearance and disappearance of human species in Europe.

We invite presenters working at Middle- and Upper Paleolithic sites within the European Plain using multi-proxy approaches to understand site formation and specific palaeoenvironmental conditions. Contributions can be about state of the art and innovative methods to study sedimentary sequences. Also studies on climate archives delivering highly resolved data for various Upper Pleistocene marine isotope stages are very welcome.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Silt, snails, carbonates and wiggles: Challenges and advances in the geochronology of loess archives

Convenors and Co-Convenors: Kathryn Fitzsimmons (Co-Convenor) Daniel Veres (Co-Convenor) Thomas Stevens (Co-Convenor) Slobodan Markovic (Co-Convenor) Jan-Pieter Buylaert (Co-Convenor) Aditi Dave (Co-Convenor) Alida Timar-Gabor (Co-Convenor) Christian Zeeden (Co-Convenor) Christoph Schmidt (Co-Convenor) Gabor Ujvari (Co-Convenor)

Description of Session: Loess is one of the most widespread, and valuable, archives of Quaternary palaeoclimate in the terrestrial realm. Long sequences of alternating loess-paleosol stratigraphy, at times reaching several hundred metres in thickness, preserve sedimentological, geochemical, and biological indicators of past climatic conditions. These deposits are long been assumed to represent continuous deposition over long periods of time, and to correlate with global climatic oscillations over Quaternary time scales. Essential to such correlations – and therefore to the assumption of proxy connection to large scale climatic influences – are accurate and robust geochronologies and corresponding age models. Geochronological controls on loess deposition have until recently been limited with respect to precision, methodology and resolution of direct dating, and applicability of age models based on reliable age tie-points and statistics.

This session aims to facilitate discussion of new approaches to developing reliable geochronologies in loess archives which will enable reliable comparison of loess with marine, ice core and other global palaeoclimate records. We welcome discussions on new geochronological approaches – such as extension of maximum dating limits, dating of new materials preserved in loess, and increased precision – and on the integration of these more robust geochronologies with age models for quantification of mass accumulation rates and correlation with millennial-scale climatic oscillations.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Soil formation - its rates and its use for reconstructing Quaternary landscape evolution (Poster only)

Convenors and Co-Convenors: Daniela Sauer (Convenor) Sergey Sedov (Co-Convenor) Maria Bronnikova (Co-Convenor)

Description of Session: Successions of Quaternary sediments often contain intercalated fossil soils. Such palaeosols may record e.g. phases of relative geomorphic stability (in successions of slope deposits), of low lake/sea levels (in successions of predominantly aquatic sediments), or of decreased aeolian dynamics (in successions of aeolian sediments). Climatic changes, geological and tectonic processes as well as human impact may control the alternation of sedimentation and pedogenesis. For example, a slope sediment burying a paleosol may reflect climatic deterioration, seismicity or anthropogenic activities such as deforestation, agriculture and overgrazing, all provoking slope instability.

Pedogenetic properties of palaeosols provide further information on the duration of a period of geomorphic stability, as well as the climatic conditions and the vegetation during that period. However, profound knowledge on soil forming processes in different climates and under different vegetation covers is required to appropriately interpret a palaeosol with respect to the duration and environmental conditions of the period in which it formed.

Therefore, in this session we especially welcome contributions on:

- a) studies of soil formation as influenced by time, climate, vegetation, parent material and relief, trying to answer questions such as: How much time is needed for a certain soil to form? Which environmental conditions are required for a certain soil to develop?
- b) research, in which the analysis and interpretation of palaeosols has been successfully used to reconstruct the duration and environmental conditions of certain periods;
- c) novel methodological approaches and new proxies that have the potential to improve Quaternary palaeoenvironmental reconstructions based on palaeosols.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Strontium isotope applications in Quaternary paleoecological and archaeological research

Convenors and Co-Convenors: Matthew Wooller (Convenor) Josh Miller (Co-Convenor) Brooke Crowley (Co-Convenor) Kate Britton (Co-Convenor)

Description of Session: Applications of strontium isotope techniques are rapidly increasing as an additional approach within multi proxy research focused on Quaternary paleoecology and prehistoric archaeology. Strontium isotopes can be used to infer past movement patterns of animals and people and can complement other proxy data (e.g. ancient DNA, micro-wear, proteomics and isotopes of other elements) derived from the same materials (e.g. bones, teeth and otoliths). This session invites presentations exploring the advances and challenges of applying the strontium isotope geolocation tool in prehistoric archaeology and paleoecology including: (1) understanding the mechanisms controlling the cycling and integration of strontium isotope variability from source to consumer/object at different spatiotemporal scales, (2) generating, integrating and sharing robust strontium isotopic data with standardized field, sampling and analytical procedures, (3) investigations of post-burial and laboratory alteration of strontium isotope ratios; and (4) developing quantitative statistical assessment of geographic origin and associated uncertainty. We also welcome submissions of archaeological and paleoecological case studies applying strontium isotopic analysis to specific questions of human, animal and artifact origin, as well as integrated perspectives (e.g., data compilation, isoscape modelling, probabilistic approaches, web-interfaces, epistemological limitations) that aim to further the applicability of isotope tools in archaeological and paleoecological research.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Subglacial processes and environments: morphology, sedimentology and modeling to inform glaciation extent, style and dynamics

Convenors and Co-Convenors: Matteo Spagnolo (Convenor) Jasper Knight (Co-Convenor) Robbie Meehan (Co-Convenor) Neal R. Iverson (Co-Convenor) Jan A. Piotrowski (Co-Convenor)

Description of Session: The interactions between ice and basal water, sediment and bedrock are crucial to understanding glacier dynamics and how climate, sea level, topography, hydrogeology and lithology can affect ice flow. Much progress has been recently made on the study of the geomorphology, sedimentology and modelling of ice sheet beds, thanks to technical advances, including improvements in remote sensing, geophysics and macro- and micro-sediment characterization. However, better integration of these approaches is needed to provide an improved understanding of subglacial processes and environments in modern and palaeo settings. This multidisciplinary session will serve as a forum for such integration, with contributions solicited from remote sensing, field, experimental and modeling studies that investigate the morphology and sedimentology of ice sheet beds, as well as their relationships with substrate materials.



INQUA Commission: Terrestrial Processes, Deposits and History

Session Title: Tephra: Shaping and recording Quaternary environments

Convenors and Co-Convenors: Lauren Shotter (Convenor) Andy Dugmore (Co-Convenor) Sigrún Dögg Eddudóttir (Co-Convenor) Richard Streeter (Co-Convenor) Nick Cutler (Co-Convenor) Anthony Newton (Co-Convenor)

Description of Session: This session will explore environmental impacts of tephra fallout, and the palaeo-environmental inferences that can be drawn from the thickness, layer morphology, stratigraphic distribution and spatial variability of tephra layers. The environmental impact of tephra varies from proximal to distal areas. Changes in tephra thickness and texture, local topography and environmental conditions control the extent of the impact. All tephra layers are transformed to greater or lesser degrees during the process of entrainment within the stratigraphic record. Cryptotephra to cobble sized pieces of pumice can be re-mobilised and dispersed; grains can be spread through centimetres of stratigraphy that represent decades or indeed centuries; tephra can be carried through glacier systems, and dispersed across oceans. These movements contain information of past Quaternary environments and processes. Tephra layers are key sources of data on past volcanic processes, but the relationship between the stratigraphic measurements we make within Quaternary sections, and the characteristics of the original fallout and local environment is variable and not well understood. Consequently, a better understanding of the environmental impact of tephra deposits, and the processes of tephra layer transformation to allow us to a) create better reconstructions of past volcanic activity, b) understand how tephra fallout impacts ecology and how this affects tephra layer preservation, and c) refine our understanding of Quaternary environments. We expect contributions ranging from those focussing on the ecological impacts of tephra deposition to those considering the impacts of ecology and Earth surface processes on tephra layer morphology and preservation.



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