obtained from various paleoclimate proxies were incongruous for the Last Glacial Maximum (LGM, ~23,000 to 19,000 years ago). Here, we used five LGM mountain glaciers of Turkey to constrain a direct measure of the ice-age precipitation of the region with an ice-flow model. Results showed that mountains influenced by the Mediterranean Sea received more precipitation (up to 2 times) than today, during the LGM. Northeast Black Sea Mountains were drier (~60%) probably because of the ceased moisture take-up from the cold Black Sea. Relatively warmer and moister air originated from the Mediterranean Sea and cold-dry air pooled over the interior uplands may create a climatic boundary somewhere on the Anatolian plateau.

BIOMARKER EVIDENCE FOR INCREASING ARIDITY IN CENTRAL INDIA OVER THE HOLOCENE

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A better understanding of past variations in monsoonal rainfall is essential in order to predict future changes in rainfall patterns due to climate change. We reconstructed centennial to millennial scale variability of the rainfall associated with Indian Summer Monsoon using lipid biomarker proxies and compound-specific stable isotope analysis of a 10 m long sediment core from saline-alkaline Lonar Lake, situated in the core 'monsoon zone' of Central India. We identified a number of suitable biomarkers throughout the core. Interestingly, the triterpene lipid tetrahymanol was found to be present in unusually high abundance in parts of the core, including the modern surface sediments. Tetrahymanol, frequently found in saline lakes is attributed to certain protozoa and considered as an indicator of salinity induced water-column stratification. Based on down-core changes in biomarker concentration three periods of distinct hydrology have been inferred. The period between 10.4 and 6.2 ka BP is characterized by higher abundance of land plant biomarkers and absence of the salinity indicator tetrahymanol. These lines of evidence, interpreted as larger vegetation cover in the catchment and presence of fresh water in the lake, indicate a wet period and therefore an intensified monsoon. Rapid fluctuations in abundance of both the terrestrial and aquatic biomarkers between 6.2 and 3.5 ka BP indicate a transition that led from early Holocene wet to late Holocene arid conditions, characterized by higher abundance of tetrahymanol. A late Holocene peak of algal/cyanobacterial biomarker input, starting at 1.3 ka BP may represent an event of lake eutrophication, possibly due to human activity in the catchment. We are currently analyzing the compound-specific stable isotopic compositions (δD and δ^{13}C) of selected biomarkers. This data will help us to understand past changes in hydrology of the lake and therefore changes in precipitation in the core zone of the Indian Monsoon.

^{14}C RECORDS SHOW OVERTURNING PULSES IN THE NORDIC SEAS OVER LGM AND HEINRICH 1

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Low radiocarbon (^{14}C) ventilation ages of modern deepwaters to the north of Iceland, at Site PS2644, show that open-ocean deepwater convection in the Nordic Seas forms a key element of Atlantic and global meridional overturning circulation. It starts with a massive Overflow over the Greenland-Scotland Ridge, that today initiates the flow of North Atlantic Deep Water. Various independent sets of ocean proxy data (sea surface temperatures, epibenthic δ^{13}C, and benthic ^{14}C) suggest that the Overflow has generally continued over the Last Glacial Maximum, although with reduced intensity. We now present a first well dated and high-resolution reconstruction of ^{14}C activity for intermediate and surface waters to the north of Iceland over last peak glacial and early deglacial times. The record shows a convection in the Nordic Seas, that broke down at least twice as the result of events of significant meltwater flux. At each event the Overflow was probably reversed, with an intrusion of strongly ^{14}C-depleted North Atlantic intermediate waters into the Nordic Seas. In harmony with the results of ocean models the outlined changes in convection and overflow direction may imply globally significant perturbations in ocean circulation and climate in addition to the impact of orbital forcing.

FIRE AND VEGETATION HISTORY DURING THE LAST 25,000 YEARS IN THE KYOTO BASIN AND THE TAMBA MOUNTAINS, WESTERN JAPAN

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Under the influence of humid monsoon climate, natural fire is rare in Japanese Archipelago at the present day. Thus, fire impact has not always been emphasized in the Japanese vegetation history. However, recent progress of palaeofire research in Lake Biwa and its surroundings suggest that the fire events in the early Holocene have an important role in the ecosystems (Inoue et al. 2001, 2005; Hayashi et al. 2010). To elucidate whether these palaeofire occurred widely in the Kinki region, western Japan, we have clarified the fire and vegetation history during the Holocene based on the charcoal and pollen analysis of the sediment cores taken from three small mires, Mizoroga-ike, Jaga-ike and Hatchodaira. Mizoroga-ike (75-m a.s.l.) is located in the Kyoto Basin and Jaga-ike (600-m) and Hatchodaira (810-m) lies at the Tamba Mountains. The fire and vegetation history of three sites are basically similar. Around the last glacial maximum, conifers such as *Abies*, *Tsuga*, *Picea* and *Pinus* subgenus *Haploxylon* were dominant. In the late glacial, deciduous broad-leaved forest composed mainly of *Quercus* subgenus *Lepidobalanus* developed and continued during the early Holocene. In the middle Holocene, evergreen broad-leaved trees such as *Quercus* subgenus *Cyclobalanopsis* increased. *Pinus* subgenus *Diploxylon* increased after ca. 1400 cal yr BP, suggesting open landscape resulting from human activity. Three phases of fire are recognized; 1) in the late glacial (14-12 cal ka) which coincides with increase of *Quercus* subgenus*Lepidobalanus*, 2) in the early Holocene (11-7 cal ka) which coincides with increase of shade-intolerant plants, such as *Quercus* subgenus *Lepidobalanus* in Mizoroga-ike, *Castanea* in Jaga-ike or Poaceae in Hatchodaira, and 3) in the late Holocene (after 1400 cal yr BP) which tightly related with increase of*Pinus* subgenus *Diploxylon*. Through a comparison of these records with archaeological and historical evidences, we will discuss the causes of fire in the Holocene.

EKLUTNA GLACIER, ALASKA: AN OVERDEEPENED ALPINE GLACIER WITH AN UNSTABLE RESPONSE TO CLIMATE CHANGE

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Runoff from the 27km^2 Eklutna Glacier is utilized as drinking water and hydropower by Anchorage, Alaska's largest city. The present glacier is shorter and thinner than the mapped glacier from the 1950's, and airborne laser profiling from 2007 shows much of the volume loss occurred in a broad basin near the top of the glacier. We verified this unusual pattern of thinning with surface mass-balance and geodetic measurements 2008-2010. Thinning in the low-angle accumulation zone is shifting the bulk of the area altitude distribution down and decreasing the accumulation area. This decouples mass balance and climate. Future mass balance will exceed expected response to accumulated climate forcing. To understand this instability we completed ice thickness and surface velocity measurements. 5-MHz radar profiles show a maximum ice thickness of 430 m in the upper basin and a prominent bedrock riegel separating the overdeepened basin from the lower glacier. Repeat GPS surveys on a grid of poles give velocities of 18 to 54 m/year increasing down glacier. Estimates of flux, mass continuity, and force balance are consistent with the hypothesis that geometric control on the stress balance in the overdeepened basin enhances the link between ice thickness and flux. The decrease in cross-sectional area as ice flows out of the overdeepening causes a non-local resistive stress. This supports a significant part of the driving stress, making the ice thickness more susceptible to changes in flux. At Eklutna the ELA is on the overdeepened ice, allowing a positive feedback loop where the ELA will continue to migrate up glacier as the basin thins, further reducing flux through the basin, allowing continued thinning. Under present climate conditions this feedback loop will likely continue

until the present 9km long valley glacier becomes a ~3km long cirque glacier.

ASSUMPTION FOR THE MORPHOTECTONIC EVIDENCE, EXAMPLES FROM LITHUANIA

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Number of publications reporting that last deglaciation of northern Fennoscandia was accompanied by a high seismic activity. The earthquakes triggered landslides in glacial till, seismically-induced soft sediment deformation structures, "seismites", are common in trench exposures in the vicinity of the faults in northern Sweden and even with tsunami events. The deglaciation history in Lithuania is longer, but there is so far not recorded and published any of paleoseismic events. Several international projects were carried out in order to study, compare and correlate the Late Quaternary stratigraphy, paleogeographic phenomena in Lithuania and Scandinavia, however in Lithuania were not traced any of paleoseismic structures like pseudo-nodules, flame-like or deformed structures in silty and sandy sediments. Results of the investigations of lake deposits formed during Late-Glacial and Holocene are reported in proceedings, dealing with aspects of their age, history of lake development, fluctuations in lake water level, former climatic conditions, vegetation composition and its changes, and to elucidate the effect of human activities on vegetation and ecosystems, but no report is presenting data or evidence of disturbances of paleoseismic origin. The processes of accumulation, erosion during the glaciations and ice-free periods have created the wide variety of Quaternary sediments and landforms. These processes made great impact creating the present shape of the sub-Quaternary surface and modified tectonic structures. A particular role belongs to deep palaeoincisions of sub-Quaternary surface and tunnel valleys of present topography. The palaeoincisions are distinct feature of sub-Quaternary surface. Genetically they are analogous to the tunnel valleys, which were formed during subglacial erosion by meltwater under the glaciodynamic pressure. In the cases of clear correspondence of palaeoincisions with tunnel valleys, their morphotectonic implication could be concluded.

THE POTENTIAL OF COMBINING OF LACUSTRINE, PALAEOPEDOLOGICAL AND OTHER PALAEO-ENVIRONMENTAL ARCHIVES – GENERAL IDEA AND EXAMPLES FROM THE LATE PLEISTOCENE IN THE MEDITERRANEAN

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High-resolution palaeo-vegetation and -climate reconstructions can be obtained from pollen and other proxies studied in lake sediment cores. Paleosol-sediment records are less complete and have a lower chronological resolution, because terrestrial sediments usually accumulate less continuously than aquatic sediments; phases of high sedimentation rates alternate with periods of predominant soil formation. Bioturbation blurs sediment layer boundaries and thus archive resolution. Moreover, parts of the paleosol-sediment record usually have been destroyed during phases of enhanced erosion.

Hence, paleosol-sediment records document palaeo-climate in less detail than lacustrine records. However, they provide additional information by documenting earth system responses to palaeo-climatic variations: Paleosols represent environmentally and geomorphologically stable conditions. Their properties reflect soil water and temperature regime, vegetation type, and related soil biological, physical and chemical processes at the time when the paleosol was at the surface, functioning as an active component of the ecosystem. In contrast, erosional discontinuities and sediments indicate instable conditions with enhanced sediment redistribution by water or wind erosion, slope wash, solifluction and other processes, by which the earth system responded to climatic and environmental shifts. Another advantage of combining lacustrine sediment palaeo-records with paleosol-sediment sequences and other terrestrial archives is that the latter increase the spatial resolution of palaeo-environmental reconstruction, because they allow for a closer net of palaeo-environmental observations. The maximum knowledge on palaeo-climate – palaeo-environment interactions can thus be obtained from combining lacustrine sediment cores and paleosol-sediment sequences and other archives. Examples from the Mediterranean will be presented to demonstrate the complementary information obtained from different archives.

HIGH RESOLUTION QUANTITATIVE TEMPERATURE AND PRECIPITATION RECONSTRUCTIONS FROM TASMANIAN LAKE SEDIMENTS SPANNING THE LAST 1000 YEARS

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Tasmania is a key landmass for climate studies due to its location in the Southern Hemisphere temperate zone. The climate is influenced by the Southern westerlies (mainly in the west), El Nino Southern Oscillation (ENSO, mainly in the north and east) and Southern Annular Mode (SAM, mainly in the west and south). We present the first quantitative high resolution (sub-decadal) temperature and precipitation reconstructions based on lake sediments from Tasmania, spanning the last 1000 years. Detailed sediment chronologies were developed using ^{210}Pb, ^{137}Cs and ^{14}C. Scanning (2 mm resolution) reflectance spectroscopy (380-730 nm) was used to calculate total chlorin and amount of pigment diagenesis in lake sediment cores collected from northeast (Swimcart Lake, SC), southeast (Duckhole Lake, DH) and northwest (Rebecca Lagoon, RL) Tasmania. Calibration to meteorological data (AD 1911-2009) revealed statistically significant correlations (3 year filtered data) between total chlorin and annual (February-January) maximum temperatures for SC ($r=0.62$, $p<0.05$) and warm season (November-March) minimum temperatures for DH ($r=0.60$, $p<0.05$), while pigment diagenesis and dry season (November-April) precipitation were significantly correlated for RL ($r=-0.45$, $p<0.05$). Total carbon, nitrogen, biogenic silica and diatom analyses were undertaken to ensure potential influences of land-use change since European settlement were accounted for. The temperature records show evidence of a warm period c. AD 1550-1650 and cooler period in the early AD 1800s (relative to AD 1950-2000 reference period). The precipitation record shows evidence of reduced rainfall c. AD 1000 and higher, more variable rainfall from AD 1250-1350 and AD 1800-1900, before reduced variability during the 20th century. Analyses are currently underway to relate these changes to variations in the Southern westerlies, ENSO and SAM.

HOLOCENE CLIMATE VARIABILITY ON SUB-ANTARCTIC CAMPBELL, MACQUARIE AND MARION ISLANDS

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The sub-Antarctic region between 45-60°S is primarily ocean. However, there are a few small isolated islands, most of which are currently facing the combined pressures of climate change and introduced species. Many meteorological observations indicate increasing wind speed and temperature since the mid 20th century, however the extent is not uniform across the region and a lack of data mean regional generalisations are difficult to establish. When the islands were discovered by humans in the 1800s, many were initially exploited for their natural wildlife resources, animals were introduced as additional food sources/for farming purposes and many plant species were inadvertently or deliberately introduced. This has led to dramatic ecosystem changes. Nevertheless many of the islands are now recognised for their intrinsic values, having been formally recognised as World Heritage Areas. Extensive efforts have or are being made to remove their feral animals, but a lack of baseline data on natural climate and ecosystem variability means it is not possible to place observed climate changes into context and it is difficult to identify realistic baselines as a means for assessing ecosystem recovery. Using a multiproxy approach combining palaeoclimate and palaeoecological records from multiple sub-Antarctic islands (i.e. Campbell, Macquarie and Marion Islands), this project aims to develop a regional