[2]Nordic Volcanological Institute, Grensasvegur 50, Reykjavik 108, Iceland

[3]Massachusetts Institute of Technology, 77 Massachusetts Ave., E34-254, Cambridge, MA 02139, United States

We present the first detailed record of Holocene climate variation from Icelandic eolian soil deposits. Seven cold and windy episodes occurred in Iceland during the last 10,000 years, including the well-documented Little Ice Age (0.6-0.1 ka) and "8.2 kyr Event". Each of these events is associated with cold and windy climate in central Greenland, enhanced drift ice discharge into the North Atlantic, and a diminution of deep convection in the North Atlantic. Whereas these conditions are consistent with an expansion of the polar cell, they cannot be attributed to a persistent negative phase of the NAO/AO.

PP42A-0872 1330h POSTER

Noble Gas Thermometry and Hydrologic Ages: Evidence for Late Holocene Warming in Southwest Texas

Maria Clara Castro[1] (734-615-3812; mccastro@umich.edu)

Patrick Goblet[2] (33-1-64-69-47-49; patrick.goblet@ensmp.fr)

[1]University of Michigan, Department of Geological Sciences C.C. Little Building 425 E. University Ave., Ann Arbor, MI 48109, United States

[2]Ecole des Mines de Paris, Centre d´Informatique Géologique 35, rue Saint Honoré, Fontainebleau 77305, France

Paleoclimatic reconstruction through the use of noble gases dissolved in groundwater has been the object of numerous studies in recent years. Unlike many other continental temperature proxies, noble gases have the advantage of providing direct information on atmospheric temperatures at the time rainwater penetrated the ground and joined a particular groundwater reservoir. In recent years, new methods for determination of noble gas temperatures have been developed, which provide a high level of accuracy on such temperature estimations. The issue of paleoclimatic reconstruction through noble gases however, is not only one of accurate temperature determination, but also one of accurate water age estimation so that a correct correspondence between noble gas temperatures and groundwater age can be established and proper paleoclimatic reconstruction attempted. The typical approach to estimate groundwater ages has been based on computing water travel times along streamlines from the recharge to the observation point taking into account only advection. This approach is limited because, like any other tracer, the movement of water in porous media is also affected by cinematic dispersion and molecular diffusion. We have therefore undertaken the formulation of hydrologic models that yield significantly better constraints on groundwater ages in the Carrizo aquifer and surrounding formations of south Texas, where noble gas temperatures have already been determined. To account for groundwater mixing we treat age as one would treat a solute concentration. In order to simulate groundwater ages we used a finite element model of groundwater flow that has been validated by ^{4}He and ^{3}He. The finite model spans a 120.6 Km cross-section between altitudes of +220m and -2210 m, and comprises 58,968 elements and 31,949 nodes. Combination of these newly calculated water ages and previously reported noble gas temperatures reveals new aspects of late Pleistocene and Holocene climate in southwestern Texas, in particular, an abrupt late Holocene temperature increase previously unidentified through ^{14}C dating. Temperature increased by up to 3.4°C in the first half of the last millennium and by 1.5°C between ∼5.6 and 3.7 kyrs BP. More important than the resolution of individual paleoclimate episodes is the identification of a slow cooling trend between ∼1,200 kyrs and ∼200 kyrs, a trend that accelerates during the late Pleistocene and early Holocene. This cooling trend gives way to an extremely rapid increase in temperature in the late Holocene. Such abrupt warming seems to have accelerated in the last millennium and seems to continue at present. This temperature increase is the most striking feature arising from the determination of new groundwater ages.

PP42B MCC: Level 2 Thursday 1330h

Old World Social Responses to Holocene Abrupt Climate Change Events II Posters *(joint with B, GC, PA, HG)*

Presiding: **H Weiss,** Yale University**; D M Anderson,** NOAA Paleoclimatology Program

PP42B-0873 1330h POSTER

Drastic Aridification Caused the Decline of Oasis Civilizations on the Silk Route during the Eighth Century

Kuo-Yen Wei[1] (886-2-23691143; weiky@ntu.edu.tw)

Sheng-Rong Song[1] (886-2-23630231X2671; srsong@ntu.edu.tw)

Chi-Yue Huang[2] (huangcy@mail.ncku.edu.tw)

[1]Dept. of Geosciences, National Taiwan University, Post Box 13-318, Taipei 106, Taiwan

[2]Dept. of Earth Sciences, National Chengkung University, 1, University Road, Tainan 701, Taiwan

Availability of water, and response to shortage of it, plays an important role in shaping human history. Near a century ago, Ellsworth Huntington (1907) suggested that the developments of ancient civilizations in Inner Asian and their invasions into China and Europe were pulsed by climatic changes. In revisiting this proposition, here we present a paleoclimatic record of the past 5000 years deduced from carbon isotopic ratio of organic carbon and percentage of aragonite in bulk sediments of a radiometrically dated sedimentary core of Lake Bosten, Xinjiang, China. Together the two proxies of aridity provide a detailed record of climatic fluctuation of the Inner Asia. The arid periods are well characterized by high content of authigenic aragonite and heavier values of carbon isotopic ratio of organic carbon in the bulk sediments (implying dominance of C4 plants which thrived under arid condition). Conversely, the humid/wet periods are marked by lighter carbon isotopic values (indicating presence of C3 plants of humid climate and absence of aragonite. The Western Region (Xi-Y) area of China enjoyed a long period of stable and humid condition from 2nd century B.C. to the 8th century when many oasis city-states were established and Buddhism spread from India. A drastic deterioration of climate during the eighth century appears to cause the decline of those once strived ancient civilizations in the eastern side of the Tarim Basin along the Silk Routes.

PP42B-0874 1330h POSTER

Dating, definition, and impacts of Holocene short-term climate change episodes: issues and prospects with an Aegean area focus

Sturt W Manning (+44 118 9318132; s.w.manning@reading.ac.uk)

Department of Archaeology, University of Reading, PO Box 217 Whiteknights, Reading RG6 6AB, United Kingdom

Much attention currently focuses on the identification and role of significant short-term (century-scale) climate change episodes, with instances of such episodes in the past offering analogues for possible present and future scenarios. Archaeology has so far been under-used as a relevant data source. It has a great deal to contribute with rich datasets pertaining to the impacts on humans and their habitats from such events. The Aegean region - the case study considered in this paper - has a rich database from the Neolithic period (9th millennium BC) onwards. But a key issue must first be addressed: the ability to establish tight chronological resolution for all data types to be considered. This is critical to ensure that only genuinely coeval and associated phenomena as observed in various records are considered together. There is otherwise a danger that researchers suck in a variety of un-linked data and smear them together inappropriately. The problem centres particularly on radiocarbon dating, since this is the main basis to prehistoric archaeological dating, and also the dating of most pollen records, sediment records, and so on. For example, significant short-term global climate change episodes have been recognised at 8.2, 5.2 and 4.2 ka BP. However, is it a coincidence that each of these dates lie in periods when radiocarbon levels effectively plateau - that is real calendar dates over 100-200+ year periods yield essentially very similar radiocarbon ages? Are disassociated data being associated through similar radiocarbon ages rather than their true calendar dates? This problem, and potential strategies to a solution through radiocarbon wiggle-matching, will be explored for the above episodes. Concentrating then on the 4.2 ka BP episode, data from one particular case - the Aegean region - will be assessed in terms of our ability to define the 4.2 ka BP event. Current limitations will be highlighted. The differing impacts of the episode in the region will then be surveyed to highlight the variety of responses such episodes can promote contingent on local circumstances and evolutionary trajectories.

PP42B-0875 1330h POSTER

Abrupt Changes in the Asian Summer Monsoon Winds During the Holocene

David M Anderson[1] (303-497-6237; david.m.anderson@noaa.gov)

Anil K Gupta[2] (anilg@gg.iitkgp.ernet.in)

Jonathan T Overpeck[3] (jto@u.arizona.edu)

Deep N Pandey[4] (dnpandey@ethnoforestry.org)

[1]NOAA Paleoclimatology Program, 325 Broadway, E/CC23, Boulder, CO 80305, United States

[2]Department of Geology and Geophysics, Indian Institute of Technology, Kharagpur 721302, India

[3]Department of Geosciences and Institute for the Study of Planet Earth, University of Arizona, Tuscon, AZ 85721, United States

[4]Indian Institute of Forest Management, India and Forest Department, Van Bhawan, Tilak Nagar, Jaipur, Bhopal 462003, India

The Asian summer monsoon affects climate and society throughout a large part of the tropics. Abrupt changes in the monsoon had potentially dramatic effect on human societies during the Holocene. Using fossil evidence of Globigerina bulloides abundance in the Arabian Sea, we reconstructed the history of the Asian summer monsoon winds during the past 10,000 years. G. bulloides provides a reliable index of the monsoon, its abundance correlated with the cool upwelling conditions produced each summer by the monsoon winds. The Arabian Sea sediments are nannofossil-rich foraminifer oozes, and the low oxygen content of the Arabian Sea minimizes the bioturbation that would otherwise smooth the fossil record. In addition to the well-known decrease in the monsoon winds since a maximum in the early Holocene, we found a series of smaller, millennial-scale oscillations between strong and weak monsoon intervals throughout the Holocene. Periods of weaker monsoon winds correlate with cool conditions in the circum-north Atlantic during the Holocene, just as they did during the larger Dansgaard-Oeschger events of the last glacial, evidence of a link between low and mid-latitude climate. The changes in the monsoon winds were probably accompanied by changes in rainfall over India, and we hypothesize that rain harvesting structures built in India since 5000 year BP were societal adaptations to climate change. Widespread evidence exists for the construction of ponds, tanks, and artificial reservoirs during the late Holocene when the monsoon reached its Holocene minimum, and we also find correlation between heightened historical human efforts for adaptation and the most recent minima in the monsoon winds that occurred 1600 AD. The monsoon record supports an emerging paradigm that at least in the tropics, the most societally-important climate changes were driven by changes in precipitation rather than surface temperature. The cause of the monsoon oscillations, and their links to other aspects of the tropical circulation and higher latitude climate are still poorly understood and require improved and more extensive quantitative records of the tropical circulation.

PP42C MCC: 3004 Thursday 1340h

Mesozoic Black Shales: Fresh Looks at an Old Problem II *(joint with OS)*

Presiding: **K G MacLeod,** University of Missouri**; P A Meyers,** University of Michigan

PP42C-01 1345h INVITED

On the Origin of Mesozoic Oceanic Anoxic Events (OAEs): An Overview

Michael A Arthur (814 863 6054; arthur@geosc.psu.edu)

Pennsylvania State University, Department of Geosciences, University Park, PA 16802, United States