Universität Basel

Departement Altertumswissenschaften

Climate Change in the Breadbasket of the Roman Empire

Reconstructing Nile Floods for the Roman Period

An interdisciplinary conference held at the Swiss Institute in Rome – January 23/24, 2020

Organizer: Sabine R. Huebner, Institute of Ancient History, University of Basel (Switzerland)

Image: »Blue Nile Falls« by Justin Clements, 28.08.2005, shared on Flickr (CC BY 2.0)

Program
January 23, 2020

Session 1:
The Nile over the longue durée
(chair: Markus Stoffel, Geneva)

14:30–15:00	**Welcome and Introduction**
15:00–15:30	**Henry F. Lamb (Aberystwyth):** Lake Tana and the Blue Nile: the last 150,000 years
15:30–16:00	**Cecile Blanchet (Potsdam):** Flood dynamics during the last Saharan Humid Period: clues from a laminated record from the Nile deep-sea fan
16:00–16:30	**Elena Xoplaki (Giessen):** Precipitation variability and changes in monsoonal Africa - Associations with northern Egyptian hydroclimate in new comprehensive earth system models prior to CE 700
16:30–17:00	**Coffee**
17:00–17:30	**Judith Bunbury (Cambridge):** Evidence for Graeco-Roman Climate and environment; tying climate records to observations from the field
17:30–18:00	**Response by Irene Soto Marín (Basel) and General Discussion**
20:00	**Dinner**

Program
January 24, 2020

Session 2:
Historical case studies of Nile flood extremes during Roman times
(chair: Marco Maiuro, Rome)

9:30–10:00	**Anna Arpaia (Pavia):** The Nile breaks the banks: unfavorable floods in some documents from the 1st century BC Herakleopolite
10:00–10:30	**Katherine Blouin (Toronto):** Good Flood, Bad Flood: Environmental entanglements in the Roman Northeastern Delta
10:30–11:00	**Sabine R. Huebner (Basel):** Did shifts in the African Monsoon lead to the decline of the Roman Fayum from the third century CE?
11:00–11:30	**Coffee**
11:30–12:00	**Christophe Corona (Clermont):** Multi-proxy approach provides insights into climate variability in Central Italy at the End of the Roman Empire: Insights of Work in the Nile river
12:00–12:30	**Response by Elio Lo Cascio (Rome) and General discussion**
12:30–13:30	**Lunch**

Program
January 24, 2020

Session 3:
Natural proxies for reconstructing Nile floods during the Roman period (chair: Sabine R. Huebner, Basel)

13:30–14:00 **Matthieu Ghilardi (Aix-en-Provence):**
Nile River evolution during Graeco-Roman times in Egypt: what we learn from sediment archives?

14:00–14:30 **Markus Stoffel (Geneva):**
Tracking changes in Nile floods with tree rings: Possibilities and limitations

14:30–15:00 **Coffee**

15:00–15:30 **Kevin Anchukaitis (Tucson):**
Inference from the periphery: large-scale climate variability and Nile floods during the Common Era

15:30–16:00 **Response by Federico de Romanis (Rome) and General Discussion**

Organization

Organizer:
Sabine R. Huebner, Institute of Ancient History, University of Basel (Switzerland)
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Registration:
There is no conference fee, but please register with Sabine R. Huebner
sabine.huebner@unibas.ch

Location:
Istituto Svizzero di Roma
Villa Maraini, Via Ludovisi 48, Rome (Italy)
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– Day One: January 23, 2020 –

Session 1: The Nile over the longue durée

Chair: Markus Stoffel (Geneva)

Henry F. Lamb (Aberystwyth)

Lake Tana and the Blue Nile: the last 150,000 years

Northeast Africa lies in a critical region between the African monsoon and Mediterranean climate systems, linked by the Blue Nile with its source at Lake Tana in the Ethiopian highlands. Three other major rivers drain these highlands, sometimes called the water tower of Africa. Ethiopia also claims to have more early hominin fossil sites than any other country, so understanding the environmental history of the region is key to major questions of climate change, human origins and cultural history. In this talk, I will review some aspects of our research on Lake Tana and other lacustrine sedimentary records in the Blue Nile catchment. Some can be resolved to annual timescales over short intervals, whereas longer sequences, such as our 150,000-year record from Lake Tana, may be resolved to centennial and millennial timescales. Multi-proxy investigations of these sedimentary archives, dated by a combination of radiocarbon, luminescence and Ar/Ar analyses, are increasing our understanding of the environmental and human history of eastern Africa.

Notes

Cecile Blanchet (Potsdam)

Flood Dynamics during the last Saharan Humid Period: clues from a laminated record from the Nile deep-sea fan

Seasonal floods are life-supporting events in the Nile Valley and have been crucial to the development of complex societies. Present populations depend on their occurrence but the alteration of fluvial dynamics under climate change remains elusive. In order to better understand how fluvial dynamics respond to climatic changes, we explore past flood dynamics of the Nile River using a unique finely laminated sequence from the Nile deep-sea fan. Today, floods occur during the summer, when monsoonal rainfall hits the Ethiopian highlands and feeds the Blue Nile. Core P362/2-33 covers the past 9.5 ka BP and is ideally located to record changes in fluvial dynamics during periods of stronger monsoon activity such as the Saharan Humid Periods. The absence of oxygen in the Mediterranean bottom waters during the last Saharan Humid Period (during sapropel S1 deposition) allowed to preserve the laminated structure between 9.5 and 7.5 ka BP. We focus here on examining the nature of the laminations in order to 1) understand the deposition mechanism and 2) obtain a reconstruction of past fluvial dynamics at seasonal resolution. Microfacies analysis and elemental micro-XRF scanning indicate that couplets of alternating dark- and light-coloured layers represent seasonal deposits of Nile discharge and marine hemipelagic sedimentation, respectively. Preliminary lamination counts suggest that couplets were deposited at an annual rate for most of the record. Increases in layer thickness is observed around 9.5 and 9.1 ka BP, followed by a gradual decrease until 8 ka. Careful examination of lamination structure and time-series analysis of layer counts will permit to further explore sub-annual changes in flood dynamics during the Saharan Humid Period. Finally, due to its high temporal resolution, our record has the potential to link reconstructions of Nile discharge to other regional archives of hydrological changes (e.g., speleothems, lakes) and thereby identify overarching forcing mechanisms.

Notes

Elena Xoplaki (Giessen)

Precipitation variability and changes in monsoonal Africa – Associations with northern Egyptian hydroclimate in new comprehensive earth system models prior to CE 700

Comprehensive Earth System Models (ESMs) simulate the atmospheric and oceanic system, land use changes including the terrestrial carbon cycle, atmospheric chemistry, ocean biochemistry, and the interactions among these systems. The high complexity ESMs include processes, impacts, and complete feedback cycles in the climate system. Simulations of past climates with comprehensive ESMs provide information about the dynamical mechanisms that could lead to hydrological periods that deviate from average climate conditions. ESMs provide the most comprehensive tools available for simulating past and future response of the climate system to external forcing, in which biogeochemical feedbacks play an important role.

Notes

Judith Bunbury (Cambridge)

Evidence for Graeco-Roman Climate and environment; tying climate records to observations from the field

Many lines of evidence are available for past climate change from ice-core data to nilometer records. However, for each historical period, it is difficult to tie these to the extant remains and the texts associated with them. Fortunately, some exceptional records from the Graeco-Roman period remain from areas that have been little travelled that allow us to evaluate the various proxies and determine to what extent it was technology that allowed people from this period to expand into the deserts and mountains around the Nile and to what extent it was environmental change. By comparing evidence for activity in, as examples, the Theban Mountain and the Kharga Oasis including wells, springs, inscriptions, buildings and travel routes with climate proxy records we can explore the effect on local rainfall and the extent to which Nile floods impinge upon the mouths of the wadis.

Notes

– Day Two: January 24, 2020 –

Session 2: Historical case studies of Nile flood extremes during Roman times

Chair: Marco Maiuro (Rome)

Anna Arpaia (Pavia)

The Nile breaks the banks: unfavorable floods in some documents from the 1st century BC Herakleopolite

In 28/27 BC Tryphaina informed his son Asklepiades about the damage caused by a river flooding to family fields (BGU XVI 2665): that flood of the Nile reached significant measures, since it destroyed most of the harvest in at least three villages in the region Herakleopolite. Starting from this document, I would like to discuss the data collected in the papyri on this and other floods in the last decades of the I century BC. Although sparse, the data helps to estimate the extent of damage on a geographical basis and highlights the economic consequences for private land owners, not only because of crop losses, but also for the costs of construction of the river banks.

Notes

Katherine Blouin (Toronto)

Good Flood, Bad Flood: Environmental entanglements in the Roman Northeastern Delta

This paper focuses on the socio-environmental history of the ancient Menzaleh Lake (north-eastern Nile Delta), whose shifting landscapes over the longue durée are increasingly well documented thanks to geoarchaeological, papyrological, and literary evidence. What hydric, geological and anthropic dynamics were at play in the region during Antiquity? And how did these entanglements impact the landscapes of the southern shore of the lake between the Late Hellenistic and Late Antique periods? Lastly, what role(s) did climatic and Nilotic variables play on the ground? To mull over these questions, I shall focus on three documentary ‹windows› set in the region: the 2nd c. CE ‹crisis›; the seemingly short-lived Nesyt Nome; the 4th c. CE maritime flooding.

Notes

Sabine R. Huebner (Basel)

Did shifts in the African Monsoon lead to the decline of the Roman Fayum from the third century CE?

The paper focuses on the Roman Fayum nome that was one of the most productive wheat-growing regions in the entire Roman Empire. Towards the end of the third century CE, multiple formerly thriving farming villages founded in early Ptolemaic times went into decline and were eventually abandoned by the mid-fourth century. While the causes of this abandonment have been considered unclear, I suggest that climate change is to blame, alongside an range of other contributing factors. The papyri as well as the archaeological record imply irrigation problems that arose simultaneously in several villages at the outer edge of the Fayum depression, which led to the progressive desertification of land, as well as a series of below-average Nile floods in the 240s and 260s. Climate proxies which record a general shift in African monsoon patterns at the source areas of the Nile and consecutively lower Nile flood levels from the middle of the third century on, corroborate this impression. The surviving documentation allows us to trace what climate change and water stress meant on the ground for the local population and what adaption strategies they used to deal with the annual summer Nile flood becoming lower and increasingly less predictable.

Notes

Christophe Corona (Clermont)

Multi-proxy approach provides insights into climate variability in Central Italy at the End of the Roman Empire: Insights of Work in the Nile river

Vivid discussions have been ongoing about the drivers and reasons for the decline and ultimate fall of the Roman Empire for a long time. Past research has investigated countless societal and human factors to explain the fall of Western Rome, but no convincing answer has emerged from the historical discourse so far. Recently, climatic changes have been put forward as a major driver for the weakening of Rome's power. Paleoclimatic proxies that have been used to document climatic conditions during the Roman Period usually came from the Swiss and Austrian Alps for temperature and from Central Europe for precipitation, thereby including large uncertainties regarding their accuracy and utility for regions located far away from where trees were growing. Here we aim at employing local proxies (tree-ring series, speleothems, floods and dark layering in calcium carbonate deposits formed in past water systems) to better quantify climate change in the third century CE and to understand its possible impacts on the evolution of Roman societies. As such, this contribution will illustrate how the combination of multiple proxies can enhance our understanding of past hydroclimatic fluctuations, and how the inclusion of hitherto unexplored sources of information could also propel research on Nile floods. It will thus also document how the information gained in Central Italy could be transposed to the Egyptian context so as to enhance our understanding of climate fluctuations and their relations with floods and socio-economic changes across the Mediterranean.

Notes

Session 3: Natural proxies for reconstructing Nile floods during the Roman period

Chair: Sabine R. Huebner (Basel)

Matthieu Ghilardi (Aix-en-Provence)

Nile River evolution during Graeco-Roman times in Egypt: what we learn from sediment archives?

This presentation aims to evaluate the sedimentary history of the Nile River in Egypt during the Greco-Roman times (approx. 1st mill. BCE/mid-1st mill. CE), based on the overview of previous geoarchaeological researches conducted over the last decades. Specific paleoenvironmental works for this time period are relatively scarce if we compare with information delivered for both the proto-Dynastic and Dynastic periods. Literature dedicated to the Late Holocene (approx. the last 4200 years) alluvial history of the Nile River, within an archaeological context, is only documented for some sites, mainly identified in Upper Egypt (Thebes area), the Nile Delta (Giza) and Nubia (actual North Sudan), with an important gap in Middle Egypt. In doing so, proposing a reliable paleofluvial reconstruction for a so short time spanning is challenging. The last 4000 years (that follow the end of the 'African Humid Period') are characterized by both an increasing aridity and a strong fall in sediment supply in the lower Nile River valley; however some periods of high energy deposition can be identified during the 1st mill. BCE and CE. In front of the Karnak temples, deep drilling (up to 25 m) revealed for the first time the Late Quaternary stratigraphy of the Nile deposits: high intensity floods are recorded during Roman times (150-300 CE). In the vicinity of Giza, investigations of the Nile river sediments demonstrated a higher intensity of the floods ca. 700 cal. BCE. A similar age (800-500 BCE) has been obtained for an increased period of large floods in Nubia (between the 3rd and 4th Cataracts). Subsequently, from the 4th to the 3rd Cent. BCE, there was an abrupt reduction in flow, recorded almost everywhere in Egypt (Faiyum, Nile delta and Nubia). This presentation is compiling the sedimentary records obtained for each site in order to have a first view on the Nile river changes during a quite poorly documented period from a sedimentological point of view.

Notes

Markus Stoffel (Geneva)

Tracking changes in Nile floods with tree rings: Possibilities and limitations

Runoff in the Nile River is controlled mainly by the migration of the Intertropical Convergence Zone (ITCZ) and its influence on the East African Monsoon, as well as by the El Niño Southern Oscillation (ENSO). In addition, volcanic eruptions have been demonstrated to have a marked influence on precipitation in the region and hence on Nile River runoff. Several papers have investigated changes in runoff using proxy data of different resolution, including e.g., varved lake sediments. Tree-ring records can present another source of information to reconstruct changes in runoff and to detect extreme events, but so far, the absence of long, drought-sensitive tree-ring series has largely hampered reconstructions of past fluctuations in Nile River runoff and droughts during the Graeco-Roman Egypt with annual resolution. This paper will present possibilities and limitations of applying dendrohydrology and dendroclimatology to Egypt and the Nile, and will present an idea on how to overcome the gap between existing written evidence of fluctuating Nile floods and hitherto lacking, annually-resolved records for the first century of the Common Era.

Notes

Kevin Anchukaitis (Tucson)

Inference from the periphery: large-scale climate variability and Nile floods during the Common Era

Paleoclimate reconstruction of Nile River floods and drought remains a challenging task due to the limited availability of high resolution proxy records within the region, and in particular prior to the last millennium. To what extent can we use distal and lower resolution proxy records to address these limitations? Here we use a global set of multiproxy paleoenvironmental data and general circulation models to infer Nile flow conditions over the Common Era. We apply both traditional statistical and data assimilation approach and assess the degree of agreement, the magnitude of uncertainty, and the extent of their reliability. Our analysis provides additional information on where new proxy data might be sought in order to address this persistent paleoclimate lacuna.

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General Discussions

Irene Soto Marín – Elio Lo Cascio – Federico de Romanis

Session 1: Notes

Session 2: Notes

Session 3: Notes

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