



Ongoing research within CRANE also draws upon an older OI endeavor. The **MASS project**, standing for “Modeling Ancient Settlement Systems”, began as a collaboration between the University of Chicago and the Argonne National Lab in the late 1990s. The project focused primarily on modelling agricultural decision-making and sustainability in the rain-fed areas of Northern Mesopotamia and in the irrigated southern Mesopotamian alluvium. As part of MASS, **John Christiansen** developed a program he called **ENKIMDU**, a modeling framework with the capability to create a virtual world in which to run simulations based on various environmental and social parameters. One of the sub-projects developed as part of CRANE aimed to implement a program of agent-based simulation modeling to further develop the ENKIMDU modeling framework. After John passed away in 2015, this project was taken over by **Lynn Welton** (University of Toronto), who with the help of **Hervé Reculeau** will create a realistic model based on ancient agrarian practices attested in cuneiform texts and on ethnographic evidence from the Middle East prior to the modernization of its agriculture. Coupled with high-resolution climate models under development in Toronto, this model will offer possibilities to test hypotheses regarding the adaptation and resilience of ancient agrarian societies to climate change.

Learn more about CCCEA

– Visit the **OI Website**:

<https://oi.uchicago.edu/article/collaborative-project-studies-climate-change-antiquity>

– Visit the **Humanities Without Walls Consortium** website:

<http://www.humanitieswithoutwalls.illinois.edu/index.html>

– Read an interview of Hervé Reculeau on the **Division of Humanities** website:

<http://humanities.uchicago.edu/articles/2018/02/interdisciplinary-approach-climate-change>

– Listen to Hervé Reculeau on **Cultures of Energy**, the podcast hosted by Cymene Howe and Dominic Boyer, from the Center for Energy and Environmental Research in the Human Sciences (CENHS) at Rice University:

<http://culturesofenergy.com/127-ancient-civilizations-climate-change-feat-herve-reculeau/>

Learn more about CRANE

– For general information, please visit the **CRANE website**:

<https://www.crane.utoronto.ca/>

– **Environmental Modeling** in CRANE:

<https://www.crane.utoronto.ca/environmental-modeling.html>

– **Agent-based Modeling** in CRANE (ENKIMDU):

<https://www.crane.utoronto.ca/simulation-modeling.html>

– The **OCHRE** website:

<http://ochre.uchicago.edu/>

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COPING WITH CHANGING CLIMATES IN EARLY ANTIQUITY (CCCEA)

The **Humanities Without Walls consortium**, which is funded by a grant from the Andrew W. Mellon Foundation and is based at the Illinois Program for Research in the Humanities, awarded approximately \$136,000 over the course of three years (2018-2020) to the project “**Coping with Changing Climates in Early Antiquity: Comparative Approaches between Empiricism and Theory**” —a collaborative endeavour from researchers at the **University of Chicago, the University of Michigan and Purdue University**. The project will investigate in a comparative perspective the social and cultural perceptions of, and experiences with, climate change in the Bronze and Early Iron Ages (third to first millennium BCE), through a multidisciplinary approach that convenes archaeologists, bioarchaeologists and text specialists focusing on three key geographic areas: Egypt and Nubia; the Eastern Mediterranean and Anatolia; and Mesopotamia.

Fostering **interdisciplinary** collaboration between the three partner institutions and between **faculty and graduate students**, the project will use ancient texts, archaeological and palaeoenvironmental data (including ancient skeletal remains), and geospatial analysis to address a set of interrelated research questions:

– What kind of **societal change** can actually be identified at a fine-grained level of analysis (local/regional scale and decadal/centennial time frame) for the periods usually associated with episodes of **abrupt climate change** and civilizational collapse (such as the ‘4.2ka event’ that allegedly brought an end to the Akkadian Empire in Mesopotamia and the Old Kingdom in Egypt around 2200 BCE, or the ‘Late Bronze Age crisis’ around 1200 BCE that saw the demise of the Egyptian New Kingdom, Mycenaean Greece, the Hittite empire and several city-states in the Eastern Mediterranean)?

– Can similar or divergent **patterns of change, response, and adaptation** be identified, for these periods, between and within the three regions?

– Given that ‘abrupt’ climatic episodes often span decades, if not centuries, was there any **perception** by the members of ancient societies that the climate around them (environmental, but by extension, the social and political) was changing? What were the modes of representation or cultural forms with which they expressed these perceptions?

– Do the material, environmental, skeletal, and textual records attest to **changes in practice or lifestyle** (political system, habitat, dietary practices, mobility, etc.) that could be understood as **responses to or experiences with these environmental shifts**? In what ways were these changes driven (or imposed) by the socio-political elites, as opposed to the agency or resilience of small communities, households or even individuals?

Project Members

Assyriologists **Hervé Reculeau** (University of Chicago) and **Jay Crisostomo** (University of Michigan) will study how the Assyrians adapted during the Late Bronze Age (15th-12th c. BCE) to newly conquered environments in the context of a slowly degrading climate, and how the strategies they developed impacted their response to the crisis that marked the end of the period. Bioarchaeologists **Michele Buzon**, and **Katie Whitmore** (Purdue University) will analyze human skeletal remains from Egypt and Nubia (modern Sudan), focusing on Egyptian-Nubian entanglement (both cultural and biological) as people cope with and adapt to the changing political/cultural landscape. They will be joined by Chicago Archaeologists **Nadine Moeller** and **Émilie Sarrazin**, who will use new archaeological data from the ongoing excavations at two ancient Egyptian settlements (Tell Edfu and Dendera) to investigate the patterns of climatic, political and cultural changes and responses by the ancient populations. Michigan Hittitologists **Gary Beckman** and **Timothy Leonard**, together with **Thalia Lysen** (Chicago), will address the perception of environment and climate in Hittite culture and religion and study of the assumed role of climatic degradation in the demise of the Hittite empire and its Syrian vassal city-states at the end of the Late Bronze Age. Finally, **Catherine Kearns** (Chicago) will address patterns of climatic change, shifts in agropastoral economies, and new political formations in the context of semiarid insular environments on Cyprus, combining spatial analyses with archaeological fieldwork on rural settlements of the early first millennium BCE.



COMPUTATIONAL RESEARCH ON THE ANCIENT NEAR EAST (CRANE)

The **Computational Research on the Ancient Near East (CRANE)** Project is directed by **Timothy Harrison**, at the **University of Toronto**, and aims at building an international multidisciplinary research collaboration comprised of historians, archaeologists, climate scientists, palaeoenvironmental specialists and computer scientists. The project’s goal is to achieve a deeper understanding of the foundational societal and cultural developments in the ancient Near East that still shape the cultures and landscapes of the present.

Drawing on earlier research focusing on the Orontes Watershed in southeast Turkey and western Syria (2012-2017), CRANE’s new developments (2018-2024) will draw on integrated archaeological and palaeoenvironmental datasets from three key transitional eras: 1) the onset of the Holocene and agricultural village life (ca. 12,900-11,700 BP), 2) the genesis and collapse of urbanism in the fourth and third millennia BCE, and 3) the collapse of Bronze Age civilization at the end of the second millennium BCE, to test downscaled climate models of the region. This will permit targeted examinations of the short- and long-term impacts of climate change and anthropogenic activity in localized sub-regions of the Eastern Mediterranean during these formative stages in human civilizational history.

In particular, CRANE’s climate modeling initiative will allow its researchers to focus on the environmental effects of ancient agricultural and pastoral subsistence practices, and their long-term sustainability, as well as on the social and political impacts of climatic change across the region.

The Oriental Institute within CRANE

The Oriental Institute has been a key partner in CRANE since its inception. The **OCHRE** system developed by **Sandra Schloen** provides the computational platform that CRANE collaborators use to integrate, analyze, and share information about research in the study region, with training and technical support provided by **Miller Prosser** and other staff of the OCHRE Data Service. **David Schloen**, Professor of Near Eastern Archaeology, has been a CRANE co-investigator from the beginning and is joined now by **Hervé Reculeau**, Assistant Professor of Assyriology, in Phase Two of this multi-national and multi-institutional project.