



The oxygen and carbon isotopic records in Holocene freshwater mollusc shells from the faiyum paleolakes, egypt: Their paleoenvironmental and paleoclimatic implications

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ABSTRACT

Stable oxygen and carbon isotopes of freshwater mollusc shells from a sequence of dated paleolake deposits in the Faiyum Depression, Egypt, provide an outline record of lake development during the Holocene. It is argued that the carbonate $\delta^{18}\text{O}$ record provides a proxy for climate change and that the isotope changes are driven by variations in monsoon precipitation in Nile headwaters and in local evaporation processes. Shells from sediments dated to ca. 10,000 to 7700 cal BP had low values for oxygen and carbon isotopes indicating higher precipitation in the local area and intensified monsoonal activity, leading to higher Nile flood discharge and flooding of the entire Faiyum Depression. This was followed by a transitional period characterized by marked variability but with precipitation on average less than before. From ca. 6000 to 4300 cal BP, precipitation was decreased until a dramatic reduction in Nile flood discharge occurred late in the fifth millennium BP. This reduction signalled the onset of arid conditions in the Faiyum, partly as a consequence of changes in Nile headwaters that was concomitant with declining lake levels in East Africa. Lake level decline in the Faiyum was further aggravated after 2700 BP as the Nile inflow further weakened and regulation increased.

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1. Introduction

Oxygen and carbon stable isotopes in freshwater shells preserved in lake sediments can provide valuable evidence about past water availability and climatic conditions (e.g. Leng and Marshall, 2004). To use these proxy climate records, mollusc shells are often collected from dated lake sediment cores (Baroni et al., 2006) or from exposures of consolidated lake sediments (Abell and Hoelzemann, 2000). Molluscs within lacustrine sediments exposures and former beach deposits surrounding relic lakes or in paleolake basins also offer an abundance of material for interpreting palaeoenvironmental change. Such deposits often occur around relic lakes in arid regions where hydrology and sedimentation have been influenced by climate change (Hoelzemann et al., 2000). In Egypt, exposed lacustrine sediments in the Faiyum region are extensive and derived from an early Holocene paleolake that once filled this depression adjacent to the Nile (e.g. Butzer, 1958). The depression provides an opportunity to obtain a full

paleoclimatic record for the Holocene either through the application of palaeolimnology and sediment coring (Flower et al., 2006; Hassan and Hamdan, 2008) or from exploring mollusc remains in the extensive former beach deposits (Caton Thompson and Gardner, 1934). In Northeast Africa, Holocene palaeoclimatic lacustrine records are scarce, but in Egypt, the Faiyum Depression is one of the few sites in the Lower Nile Valley that provides an opportunity to reconstruct a Holocene palaeo-isotopic record for comparison with palaeo-climate records for the upper parts of the Nile river system. Lacustrine deposits exposed around the diminished modern lake (Lake Qarun) in the Faiyum have been the subject of several modern geoarchaeological investigations of the former lake that have provided evidence about fluctuations in lake level changes (Hassan, 1986; Hassan et al., 2006; Hassan and Hamdan, 2008). Many of these deposits occur at various elevations around Lake Qarun possess an abundance of mollusc shells but stable isotope records are sparse (Jux and Steuber, 1990). Nevertheless, the Holocene molluscs of the Faiyum Depression were recognised as early as the late 19th century (Martens, 1879) and their presence in a stratigraphic sequence is clearly advantageous for a trans-temporal palaeo-ecological investigation. The first systematic study of the molluscs of the Faiyum was undertaken by Gardner (1932). She

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C. A. Price



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Mummy Portraits of Roman Egypt Marie Svoboda, Caroline Cartwright, 2020-08-25 This publication presents fascinating new findings on ancient Romano Egyptian funerary portraits preserved in international collections Once interred with mummified remains nearly a thousand funerary portraits from Roman Egypt survive today in museums around the world bringing viewers face to face with people who lived two thousand years ago Until recently few of these paintings had undergone in depth study to determine by whom they were made and how An international collaboration known as APPEAR Ancient Panel Paintings Examination Analysis and Research was launched in 2013 to promote the study of these objects and to gather scientific and historical findings into a shared database The first phase of the project was marked with a two day conference at the Getty Villa Conservators scientists and curators presented new research on topics such as provenance and collecting comparisons of works across institutions and scientific studies of pigments binders and supports The papers and posters from the conference are collected in this publication which offers the most up to date information available about these fascinating remnants of the ancient world The free online edition of this open access publication is available at www.getty.edu/publications/mummyportraits and includes zoomable illustrations and graphs Also available are free PDF EPUB and Kindle MOBI downloads of the book

The Geology of Egypt Farouk El Baz, 1984-01-01 A Dictionary of Archaeology Ian Shaw, Robert Jameson, 2008-04-15 This dictionary provides those studying or working in archaeology with a complete reference to the field

The Desert Fayum Gertrude Caton-Thompson, 1983 **NASA Technical Memorandum ,1980**

Reports of Planetary Geology Program - 1980 ,1980 *The Nile* Henri J. Dumont, 2009-05-06 What have we learnt about the Nile since the mid 1970s the moment when Julian Ryska decided that the time had come to publish a comprehensive volume about the biology and the geological and cultural history of that great river And what changes have meanwhile occurred in the basin The human population has more than doubled especially in Egypt but also in East Africa Locally industrial development has taken place and the Aswan High Dam was clearly not the last major infrastructure work that was carried out More dams have been built and some water diversions like the Toshka lakes have created new expanses of water in the middle of the Sahara desert What are the effects of all this on the ecology and economy of the Basin That is what the present book sets out to explore 33 years after the publication of *The Nile Biology of an Ancient River* Thirty seven authors have taken up the challenge and have written the new book They come from 13 different countries and 15 among them represent the largest Nilotic states Egypt Sudan Ethiopia Uganda and Kenya Julian Ryska died in 1984 and most of the authors of his book have now either disappeared or retired from research Only Jack Talling and Samir Ghabbour were still available to participate again

Stone Conservation C. A. Price, 1996-09-05 Is research in stone conservation on the rocks This volume part of the GCI's Research in Conservation series offers an in depth critical appraisal of the status of stone conservation research today identifying areas of strength and weakness in the field as a whole C A Price a noted British

archaeological conservation scientist discusses recent research on the causes of stone decay as well as current preventive measures assessment tools and treatment durability He also reviews current research on methods of evaluating the effectiveness of these methodologies and treatments The book includes a comprehensive survey of the literature draws from conversations with professionals in the field and provides recommendations for increasing the effectiveness of research including the improvement of training symposia and research programs and the establishment of conservation policy

Nature Sir Norman Lockyer, 1932 **Before the Pyramids** University of Chicago. Oriental Institute. Museum, 2011 This catalogue for an exhibit at Chicago's Oriental Institute Museum presents the newest research on the Predynastic and Early Dynastic Periods in a lavishly illustrated format Essays on the rise of the state contact with the Levant and Nubia crafts writing iconography and evidence from Abydos Tell el Farkha Hierakonpolis and the Delta were contributed by leading scholars in the field The catalogue features 129 Predynastic and Early Dynastic objects most from the Oriental Institute's collection that illustrate the environmental setting Predynastic and Early Dynastic culture religion and the royal burials at Abydos This volume will be a standard reference and a staple for classroom use

The Oxford Handbook of Egyptology Ian Shaw, Elizabeth Bloxam, 2020 The Oxford Handbook of Egyptology offers a comprehensive survey of the entire study of ancient Egypt from prehistory through to the end of the Roman period Transcending conventional boundaries between archaeological and ancient textual analysis and bringing together 63 chapters that range widely across the various archaeological philological and cultural sub disciplines authored by recognized experts in their respective fields it highlights the extent to which the discipline has diversified and stresses the need for it to seek multidisciplinary methods and broader collaborations if it is to remain contemporary and relevant Authoritative yet accessible it is an invaluable resource for scholars students and general readers alike

The Archaeology of Urbanism in Ancient Egypt Nadine Moeller, 2016-04-18 This book presents the latest archaeological evidence that makes a case for Egypt as an early urban society It traces the emergence of urban features during the Predynastic Period up to the disintegration of the powerful Middle Kingdom state ca 3500-1650 BC *Cumulated Index Medicus*, 1984 *The Culture of Ancient Egypt* John A. Wilson, 2013-10-17 The story of Egypt is the story of history itself the endless rise and fall the life and death and life again of the eternal human effort to endure enjoy and understand the mystery of our universe Emerging from the ancient mists of time Egypt met the challenge of the mystery in a glorious evolution of religious intellectual and political institutions and for two millenniums flourished with all the vigor that the human heart can invest in a social and cultural order Then Egypt began to crumble into the desert sands and the waters of the Nile and her remarkable achievements in civilization became her lingering epitaph John A Wilson has written a rich and interpretive biography of one of the greatest cultural periods in human experience He answers as best the modern Egyptologist can the questions inevitably asked concerning the dissolution of Egypt's glory Here is scholarship in its finest form concerned with the humanity that has preceded us and finding in man's

past grandeur and failure much meaning for men of today Tracking Environmental Change Using Lake Sediments John P. Smol, H.J. Birks, William M. Last, 2006-04-11 This third volume in the Developments in Paleoenvironmental Research series deals with the major terrestrial algal and siliceous indicators used in paleolimnology Other volumes deal with the acquisition and archiving of lake sediment cores chronological techniques and large scale basin analysis methods Volume 1 physical and geochemical parameters and methods Volume 2 zoological techniques Volume 4 and statistical and data handling methods Volume 5 These monographs will provide sufficient detail and breadth to be useful handbooks for both seasoned practitioners as well as newcomers to the area of paleolimnology Although the chapters in these volumes target mainly lacustrine settings many of the techniques described can also be readily applied to fluvial glacial marine estuarine and peatland environments

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Ancient Egypt Margaret Bunson, 2002 Includes over 2 200 entries covering all aspects of ancient Egyptian agriculture art architecture mortuary rituals prominent individuals important cities religious beliefs and daily life Archaeomineralogy George R. Rapp, 2013-03-09 1 1 Prologue What is archaeomineralogy The term has been used at least once before Mitchell 1985 but this volume is the first publication to lay down the scientific basis and systematics for this subdiscipline Students sometimes call an introductory archaeology course stones and bones Archaeomineralogy covers the stones component of this phrase Of course archaeology consists of a great deal more than just stones and bones Contemporary archaeology is based on stratigraphy geomorphology chronometry behavioral inferences and a host of additional disciplines in addition to those devoted to stones and bones To hazard a definition archaeomineralogy is the study of the minerals and rocks used by ancient societies over space and time as implements ornaments building materials and raw materials for ceramics and other

processed products Archaeomineralogy also attempts to date source or otherwise characterize an artifact or feature or to interpret past depositional alteration of archaeological contexts Unlike geoarchaeology archaeomineralogy is not and is not likely to become a recognized subdiscipline Practitioners of archaeomineralogy are mostly geoarchaeologists who specialize in geology and have a strong background in mineralogy or petrology the study of the origin of rocks **Karanis Revealed**

Terry G. Wilfong, Andrew W. S. Ferrara, 2014 The 1924-1935 University of Michigan excavations at the Graeco-Roman period Egyptian village of Karanis yielded thousands of artifacts and extensive archival records of their context The Karanis material in the Kelsey Museum of Archaeology and the University of Michigan Library Papyrology Collection forms a unique body of information for understanding life in an agricultural village in Ptolemaic and Roman Egypt In 2011 and 2012 the Kelsey Museum of Archaeology presented the exhibition Karanis Revealed in two parts using artifacts from the excavations and archival material to explore aspects of the site and its excavation in the 1920s and 1930s As preparation for the exhibition progressed it became clear that part of the story of the Michigan Karanis expedition lay in the current and ongoing research on the material it yielded by curators, faculty staff and students from the University of Michigan Such projects include new work on known artifacts and papyri the discovery or rediscovery of important unpublished artifacts and archival sources new field research at Karanis and even sonic investigations of the site and its history The present volume summarizes the recent exhibition and presents some of the new research that helped inspire it *Water Societies and Technologies from the Past and Present* Mark Altaweel, Yijie Zhuang, 2018-11-26 Today our societies face great challenges with water in terms of both quantity and quality but many of these challenges have already existed in the past Focusing on Asia *Water Societies and Technologies from the Past and Present* seeks to highlight the issues that emerge or re-emerge across different societies and periods and asks what they can tell us about water sustainability Incorporating cutting edge research and pioneering field surveys on past and present water management practices the interdisciplinary contributors together identify how societies managed water resource challenges and utilized water in ways that allowed them to evolve persist or drastically alter their environment The case studies from different periods ancient and modern and from different regions including Egypt Sri Lanka Cambodia Southwest United States the Indus Basin the Yangtze River the Mesopotamian floodplain the early Islamic city of Sultan Kala in Turkmenistan and ancient Korea offer crucial empirical data to readers interested in comparing the dynamics of water management practices across time and space and to those who wish to understand water related issues through conceptual and quantitative models of water use The case studies also challenge classical theories on water management and social evolution examine and establish the deep historical roots and ecological foundations of water sustainability issues and contribute new grounds for innovations in sustainable urban planning and ecological resilience

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