
Introduction

When the first edition of this book was published in 2004, the following year 2005 has happened to have been the warmest year since 1880, when the first reliable worldwide instrumental records came into existence. Claiming no linkage between the publication of our book and the temperature record, yet this record demonstrates the trend of increase in the global surface temperatures during the past 20 years, reinforced by evidence of rise of atmosphere's and oceans' temperatures, and increased melting of ice and snow in the arctic and antarctic regions as well as on mountain tops. All these observations are paralleled by the increase in the quantity of heat trapping gases in the atmosphere, causing most probably, the global greenhouse effect.

In order to try and predict, what might be the impact of this effect on the on the natural and human environments of the Near East, (Figs. 1–1d) the authors adopted the saying that the past is the key for the future. The practical conclusion of this principle says that the acquiring knowledge of the impact of past climate changes on the nature and human societies, may allow conclusions with regard to future possible impact of climate changes. By correlating proxy data of all types, paleo-sea and lake levels, paleo-hydrology, pollen profiles, environmental isotopes as well as archaeological and historical documents, the authors tried to collect as much as possible of this knowledge. The region investigated spans the Fertile Crescent in the wider sense which arcs from northeastern Africa and Egypt to Syria-Palestine and Mesopotamia, skirting the Anatolian, Iranian and Caucasian highlands. Since the so-called “Holy Land” has attracted western scholarly attention for nearly two centuries, and resulted in extensive and intensive historical and archaeological research, most data mentioned in the book were derived from this area. It is, therefore, natural that the historical documentation of the book reflects the uneven distribution of western research over the last two centuries with centers of gravity in the Levant, Egypt, and Mesopotamia.

The presentation of the archaeological and historical material follows a broad timetable beginning with the origin of mankind in Africa and its spread across the rest of the world, all seen as resulting from ever-changing climates and environments. Despite the fact that the archaeological evidence includes most of the major excavation sites of the Fertile Crescent, old and new, and often goes into detail, particularly in the formative years of the ancient civilizations in these areas, the principal aim was to convey an overall picture of cultural development of the entire region and clarify the importance of climate change

during the process. It goes without saying that it was not every climate change automatically entailed a cultural and historical change. However, there can be little doubt that extreme climate changes influenced the welfare of pre-industrial cultures and civilizations whose subsistence entirely depends on agriculture and husbandry, especially in a semi-arid region.

The understanding of the role of climate change on major transitions in human history gained increasing recognition by the general public during the late 1980's and throughout the 1990's. Studies of the African droughts have shown that human activity was clearly of secondary importance to the desertification of the Sahel and the magnitude of the subsequent human suffering. Albeit there is little doubt that the impact of agriculture and pastoralism on the natural environment was, and still is, catastrophic, yet it is the negative climate change, which triggers the non-sustainable processes, such as the invasion of the sand dunes to the coastal plain of Palestine during the warm phase starting in the 7th century A.D.¹

Concern about the possible impact of the Global Change on the world-wide hydrological cycle brought about this research in the framework of the International Hydrologic Program (IHP) UNESCO and WMO. The results of this work, which was on a global scale were reported by Issar in a previous book.² Its basic conclusions were that major climate changes occurred during the Holocene and that these changes had influenced the hydrological cycle in the different parts of the globe in different ways. In regions having a Mediterranean type climate, warm periods spelled dryness while cold periods were humid. The contrary was the rule in regions with "monsoon" type climates. In regions along the margins of climate belts these changes had a decisive impact on the history of the inhabitants, as the shift of the belts spelled either dryness thus desertification or abundant rains, which spelled lushness. This phenomenon was especially recognizable in the history of the Eastern Mediterranean region.

In parallel to the studies of Issar, Zohar was studying the ethnography of the transhumant and semi-nomadic pastoralists of the Old World and their interaction and effect on the agrarian and urban cultures of the Fertile Crescent. He found that these effects were most apparent in the so-called 'intermediate' or 'transitional' periods, sometimes called "Dark Ages", intervals between the times of flourishing of urban civilizations in the ancient Near East in a seemingly periodic pattern. Excavated sites with archaeological layers dated to this periods often show signs of increased violence, such as destruction layers. They are roughly contemporary in all parts of the region and beyond but with distinct characteristics and variable durations.³

The conformity between the conclusions of Issar and Zohar's investigations brought them to compile the first edition of the present book and in which

¹ A.S. Issar, *Geology of the Subterranean Water Horizons of the Shephela and of the Sharon Regions* Ph.D. thesis. Hebrew University, Jerusalem (1961, Hebrew with summary in English).

² A.S. Issar, *Climate Changes during the Holocene and their Impact on Hydrological Systems*, Cambridge University Press, Cambridge UK (2003).

³ M. Zohar, *Early Transition Periods in the Archaeology of Syria-Palestine*. unpublished Ph.D. thesis. The Hebrew University Jerusalem (1993).

the Neo-Deterministic Paradigm is presented. This paradigm argues that the principal cause for major developments and several decisive events of the Middle Eastern history were often accompanied by climate changes, while human intervention played a secondary role, attenuating or intensifying the effects of the natural impact. This conclusion seemingly rejuvenated the Deterministic Paradigm prominent at the beginning of the 20th century, which argued that climate change by itself could explain the birth, the flourishing and the demise of the ancient civilizations.⁴ The modification of this paradigm by Issar and Zohar concern the role of the human ingenuity to invent devices and tools helping them to mitigate the impact of climate changes in the positive cases, while in the negative cases over-exploitation of natural resources in a non-sustainable way amplify the impact of the natural hazards leading to decline and collapse.

As could have been foreseen, the suggestion to swing back the pendulum of paradigms from that of blaming peoples for their misfortunes and putting the blame on climate changes was not accepted by most historians and archaeologists. Since the beginning of historical writings in antiquity, the humanities have considered the rise and decline of human societies as the outcome of acts of gods, God or men. The Enlightenment and the industrial revolution prepared the ground for a more realistic world view based on the natural sciences which engendered the Deterministic Paradigm of the 19th and early 20th century. The majority of archaeologists and historians then discarded the Deterministic Paradigm since the thirties of the 20th century and returned to the Anthropogenic Paradigm, according to which all blame was put on human society for its failures. One of the major faults was the human interference with natural processes thus causing environmental, economic, and political calamities.

This book will discuss the major climate changes that affected the Near East over the last ten thousand years, as determined by time series of proxy-data. The response of the societies to these changes will be investigated through an examination of their cultural and socioeconomic structures as well as the characteristics of the supporting natural system. We will not exonerate the human race entirely from its grave sins against its environment and the natural world. We do not claim that a few years of crop failures toppled any society. However, we shall demonstrate that major changes in civilizations did, indeed, coincide with major changes in the global climate.

In its very general aspects, the swing of the pendulum of paradigms from its deterministic peak in the first decades of the twentieth century to the opposite peak of anthropogenic disposition in the mid-twentieth century, and the beginning of a neo-deterministic trend corresponds with the process suggested by Kuhn.⁵ In a nutshell, this process says that scientists think and build their theories within the general framework of the prevailing “truths” in their society. Also, the reluctance of most contemporary archaeologists, historians and geographers to accept conclusions based on new data with regard to the involvement of climate fits well with Kuhn’s model. Yet, in this special case,

⁴ E. Huntington, *Palestine and its Transformation*. Houghton Mifflin Company, New York (1911).

⁵ T. Kuhn, *The Structure of Scientific Revolution* Chicago University Press, Chicago (1970).

there is an additional aspect, which has to do with Snow's conclusion about the schism between "the two cultures," i.e. the physical-natural sciences versus the humanistic sciences.⁶ This schism was illustrated by the divorce between the scientist familiar with the global importance of the second law of thermodynamics and the Shakespearean scholar versed in interpreting Hamlet. Regarding archaeological research, classical archaeology, as a branch of the science of history and linguistics, belongs to the humanities. On the other hand, most of the paleo time-series proxy data is based on investigations in the physical (mainly environmental isotopes), geological (mainly sedimentological) and biosciences (mainly pollen and dendro-chronology). The evolution of the world of sciences does not promise closure of the breach between the two intellectual cultures, as the general trend is towards further reductionism and increasing expertise in narrow fields of specialization. Thus, a future divergence within and between the two cultures seems inevitable.

Investigation of the reasons for the swing of the pendulum reveals that in our case the instrument enforcing the "Kuhn's model" transformation from one paradigm to the other was the development of specialization in the sciences. On the one hand, this brought further specialization, but on the other hand, specialists who looked beyond the walls of their expertise could see other fields in which their special methods could be applied. It was up to these experts to open their minds to test new methods, and, if successful, apply them. Thus, the field of gravity enforcing the swing of the paradigm pendulum was the evolution of science, while the force of friction hindering this motion was the reluctance of scientists to introduce new methods not part of their expertise.

One example of this is the absence in most scholarly works about the archaeology, history and geography of the Near East, of a correlation between the archaeological findings and the results of investigations of recent paleo-climates conducted by isotope experts (except for the use of ¹⁴C dating), geologists and botanists. The recent change to the new paradigm, only slowly gaining ground in the last three decades of the twentieth century, can be observed in the increasing appearance of interdisciplinary literature. This new approach began during the 1970's, with the increasing involvement of paleo-botanists in environmental interpretations⁷ (although in various reports the trend to put the

⁶ C.P. Snow, *The Two Cultures and a Second Look*. New American Library, New York (1963).

⁷ S. Bottema, "Late Glacial in Eastern Mediterranean and the Near East" in *The Environmental History of the Near and Middle East Since the Last Ice Age* W.C. Brice (ed.) Academic Press, London, pp. 15–28 (1978).

A. Horowitz, "Palynology-climate and Distribution of Settlements in Israel" *Qadmoniot* 13/3–4:51–52 (1980, Hebrew).

A. Leroi-Gourhan, "Diagrammes polliniques de sites archéologiques au Moyen-Orient" *Beihefte zum Tübinger Atlas des Vorderen Orients* W. Frey, H.P. Uerpmann, and A. Reihle, (eds.) *Beiträge zur Umweltgeschichte des vorderen Orients*, Tübingen pp. 121–133 (1981).

A. Leroi-Gourhan and F. Darmon, "Analyses Palynologiques de Sites Archéologiques du Pléistocène Final dans la Vallée du Jourdain" *IJES* 36:65–72 (1987).

W. Van Zeist and S. Bottema, "Vegetational History of the Eastern Mediterranean and the Near East During the Last 20,000 Years" in *Palaeoclimates, Palaeoenvironments and Human Communities in Eastern Mediterranean Region in Later Prehistory* British Archaeological Reports, International Series 133:277–321 (1982).

blame on man rather than on climate still prevailed)⁸. The interdisciplinary approach is exemplified also by involvement of other humanistic sciences, such as anthropology, sociology, economics, etc. The widening of the interdisciplinary movement involves a closer interaction with the physical sciences, as exemplified by the symposium on the decline of the Early Bronze Civilization of northern Mesopotamia mentioned earlier as well as books comprising of a number of inter-disciplinary studies.⁹

In our case archaeologists, not to speak about historians educated in the faculties of humanities, the evidence of climate changes based on proxy data can be compared to discussing ‘Schroedinger’s cat paradox’ in a seminar of theologians. An illustration to the Kuhn’s and Snow’s theories is the difference between the reviews on the 1st edition of this book. On the one hand by a senior archaeologist, who works for many years in the region and sticks to the old paradigm¹⁰ and on the other a young pedologist who investigated soil profiles of the deserted city of Abila, one of the Decapolis sites in Jordan.¹¹

Another example could be seen during an international conference, sponsored by the Center for Old World Archaeology and Art at Brown University, was held in May 1990.¹² In his opening presentation, the historian W.W. Hallo from Yale University concluded:

“I thus reject all field theories that threaten to obscure the boundaries between natural history and human history . . . The traditional hypotheses for explaining the crisis of the 12th century B.C.E. are mostly concerned with natural disasters such as earthquakes, famine, or climatic change. But all these rest on the chance recording of what are basically perennial factors. The transition from Bronze Age to Iron Age should be seen rather in terms of human role.”¹³

⁸ U. Baruch, “The Late Holocene Vegetational History of Lake Kinneret [Sea of Galilee], Israel” *Paléorient* 12/2:37–48 (1986).

N. Liphshitz and Y. Waisel, “The Effects of Human Activity on Composition of the Natural Vegetation During Historic Periods” *Le-Yaaran* 24:9–15 (Hebrew), 27–30 (English abstract) (1974).

R. Rubin, “The Debate Over Climatic Changes in the Negev, Fourth – Seventh Centuries CE”. *Palestine Exploration Quarterly* 121:71–78 (1989).

S.A. Rosen, “The Decline of Desert Agriculture: A View from the Classical Period Negev”, *Symposium: Agriculture in Arid Environments: Archaeological Perspectives World Archaeological Congress 4* University of Cape Town (1999).

⁹ G. Dalfes, G. Kukla and H. Weiss, (eds.) *Third Millennium B.C. Climatic Change and Old World Collapse*. NATO ASI Series, Sub series I Global Environmental Change, (1997).

H. Fischer, T. Kumke, G. Lohmann, G. Floser, H. Miller, H. von Storch and J.F.W. Negendank (eds.) *The climate in historical times: towards a synthesis of Holocene proxy data and climate models*. Springer, Berlin (2004).

¹⁰ O. Bar-Yosef, “Issar & Zohar Book review” – *The Holocene* 15/6:933–934 (2005).

¹¹ B. Lucke, *Abila’s Abandonment* M. S, Thesis BTU, Cottbus, Germany, Yarmuk University, Irbid (2002).

¹² W.A. Ward and M.S. Joukowsky (eds.) *The Crisis Years: The 12th Century B.C. From Beyond the Danube to the Tigris*. Kendall/Hunt Publishing Co., Dubuque, Iowa, p. 208 (1992).

¹³ W.W. Hallo, “From Bronze Age to Iron Age in Western Asia: Defining the Problem” in *The Crisis Years*, 1–9.

In contrast, the present authors argue that the agricultural evolution was generated in principle by the warming and aridization of the Near East, with human societies reacting to survive these changes. Similarly, the urban revolution and flourish of the Early Bronze, the renewal of relative prosperity during the Middle Bronze and of the Iron Age were due primarily to the abundant precipitation that enabled the accumulation of resources by all levels societies. Decline came when these conditions worsened.

A similar case will be made here to draw the background of the natural environment – in particular, the role of climate change on the historical events discussed in the above mentioned conference. In agreement with the conference's keynote address, which aimed to “synthesize” and asked the participants “*to venture beyond the boundaries of their own specializations*”, the present authors recommend to trespass the boundary of the natural habitat in order to encompass the broadest spectrum of all potential causes, natural as well as anthropogenic.

To cross the boundaries and get a rather detailed picture about the natural habitat the time series of proxy data related to this period should be examined in detail. Further progress, however, in this direction is still needed, and is constantly coming forth

The present work attempts to take an interdisciplinary approach in which the data from the fields of research of its authors (hydro-geology and archaeology) are interwoven to construct the environmental-cultural picture of the past. Simultaneous with this construction, they conducted a dialogue explaining their respective techniques, which helped each to arrive at certain similar or distinct conclusions. This approach will be followed in the ensuing chapters of this book, particularly in Chap. 2, where it will enable readers from the two different banks of the chasm separating between the “two cultures” to understand the different methodologies of the fields.

The authors are convinced that the conservative negative attitude is slowly changing, mostly due to the ever increasing quantity and quality of scientific research of the earth's past, mainly by geologists, geochemists, botanists, climatologists etc. The data obtained by these investigations cannot be ignored and will force the traditionally opposing academic worldviews to accept the obvious: All human cultures and civilizations were, and still are, a product of their environment. In the temperate and the arid zone it was, above all, the availability of water, which had the most profound effect on the development of human societies.

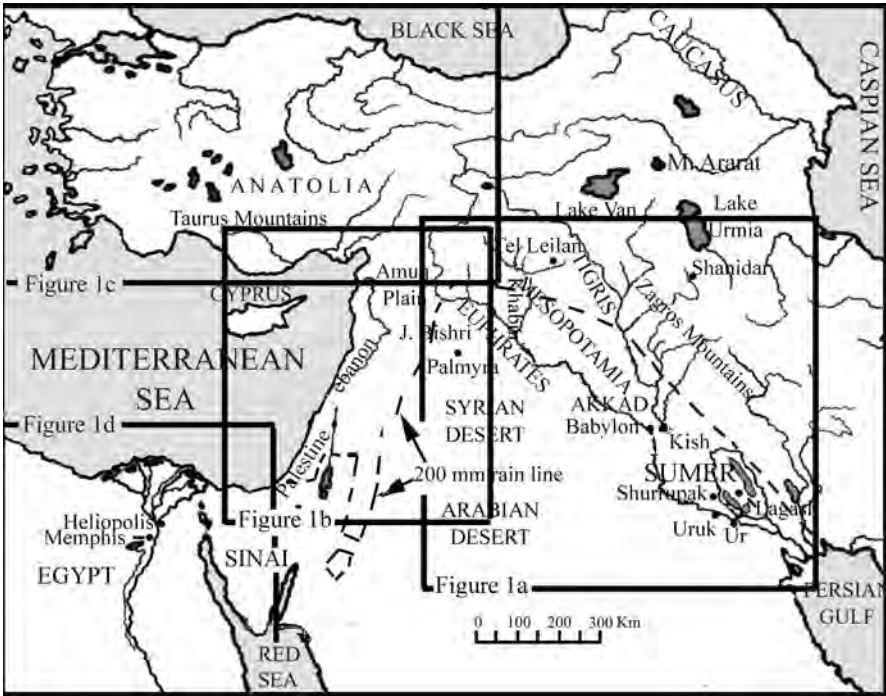


Fig.1. General key map of the Near East