SPRINGER BRIEFS IN GEOGRAPHY

Arie S. Issar

Strike the Rock and There Shall Come Water

Climate Changes, Water Resources and History of the Lands of the Bible

Springer

SpringerBriefs in Geography

For further volumes:
http://www.springer.com/series/10050

Arie S. Issar

Strike the Rock and There Shall Come Water

Climate Changes, Water Resources and History of the Lands of the Bible

Springer

Arie S. Issar
The J. Blaustein Institute for Desert Research
Sede-Boqer Campus
Ben-Gurion University of the Negev
Beer-Sheva
Israel

ISSN 2211-4165 ISSN 2211-4173 (electronic)
ISBN 978-3-319-01936-9 ISBN 978-3-319-01937-6 (eBook)
DOI 10.1007/978-3-319-01937-6
Springer Cham Heidelberg New York Dordrecht London

Library of Congress Control Number: 2013947784

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

The book presented hereby is an updated and revised version of my book *Water Shall Flow from the Rock—Hydrogeology and Climate in the Lands of the Bible*, published by Springer-Verlag in 1990. The reason for updating and revising and not just reprinting of the book is due, in the first place, to the enormous quantity and quality of the new data added since 1990. Another reason is the better understanding achieved since the book was first published, of the role which climate changes played in shaping the history of the Lands of the Bible. Albeit the fact that the impact of climate change was touched upon rather widely in the first book, still, without interweaving the new data and its interpretation, the picture would have remained partial.

Other books which I published report on these changes and their impact. In 2003, *Climate Changes during the Holocene and their Impact on Hydrological Systems* was published by Cambridge University Press. Later with Dr. M. Zohar, *Climate Change—Environment and Civilization in the Middle East* was published by Springer in 2004 and in 2007 with the same co-author *Climate Change—Environment and History of the Near East* was also published by Springer. The papers as well as chapters in books focusing on a certain period or an area or both will be cited in the following chapters.

This book takes a stand in the dispute between scholars, historians, and archaeologists, investigating the history of the people of Israel, with regard to the factual background of the stories of the Pentateuch. This dispute reached headlines after the publication of Finkelstein and Silberman's book *The Bible Unearthed*, wherein the authors proclaim that: "[A] careful critical perusal of this work—which certainly has much to say about both archaeology and the biblical writings—reveals that we are dealing very largely with a work of imaginative fiction, not a serious or reliable account of the subject" (p. 464). The author of this book disagrees with Finkelstein's and Silberman's statement. Although he did not dig archaeological sites in the Sinai and Negev, as these archaeologists did, he lived for quite a few years, in these deserts, investigating its surface and subsurface water resources. Many times he camped with the local Bedouin, learning from them about their way of life, especially how to locate a meager supply of water, sometimes brackish and sometimes bitter, in the desert. He learnt from them where and how to hit the rock for the water to come out, or where to dig a well to obtain fresh water. Many

times he ate with them their unleavened *pita*, baked on embers, and grilled quail. Many times he could fetch from his knapsack his copy of the Bible and read a chapter describing the episode which he experienced.

These experiences brought the author to the conclusion that many stories of the Bible contain an historical core, which a scientist knowing and understanding the natural environments of the region, can bring to light and share with an interested audience.

Thanks are due to Dr. Matanya Zohar, a partner in writing the books mentioned above which were published by Springer Publishing House. Zohar's extensive knowledge in the field of the archaeology of the Land of Israel and his comments were very helpful. Thanks to Yaakov Issar for his help in translating from Hebrew to English and last but not least to Margalit, wife and partner for her help and philological criticism. Thanks are due to Mrs. Marcia Ruth for editing the book.

Arie S. Issar

Contents

Chapter 1
Caves, Dripstones and Soils Tell About Past Climates

Abstract This book is written for the general audience, and its focus is on groundwater, namely water which flows underground in the openings of the layers, in either pores, fractures or caves. This water becomes surface-water when it finds an outlet, either naturally as springs, or artificially as wells. The study of the history of water-works in the arid and semi-arid parts of the globe led the author to conclude that it provides understanding of the impact of climate changes on the history of the inhabitants of these regions.

Most people encounter groundwater when they visit caves which were formed due to the solution of carbonate rocks, either limestones or dolomites. The solution processes are due to the water becoming slightly acid, after it dissolves carbon dioxide gas which is part of earth's atmosphere. This water penetrated into the carbonate rocks through cracks and fissures which are produced by the breaking of the rocks either due to faulting or folding. Over time the crevices expanded in all direction forming caves from whose ceilings water penetrating through the crevices and solution channels continues to flow, either as drops or spurts. Losing the dissolved gas in the cave the water deposits the dissolved carbonate as dripstones in the shape of stalactites descending from the ceiling and stalagmites growing from the floor of the cave (Fig. 1.1).

Caves in which these dripstones are found, especially caves in arid areas, teach us about periods in which the area was more humid. Yet, not only the space of the caves and the existence of the stalactites and the stalagmites contain a lot of information about the changes of the climate, but as will be demonstrated in the following paragraphs, these calcareous pillars are a treasure of information about climates of the past, waiting to be deciphered.

One such case of deciphering began in 1968 and will be discussed in detail in the following chapters. At that time the author was an employee of the Geological Institute of the Government of Israel in Jerusalem. An engineer in charge on the blasting of a new quarry west of Jerusalem telephoned one of his colleagues in the institute, and notified him that a blast in the wall of the quarry had opened an entrance to a cave. The engineer asked for a geologist to come to investigate the extent of the cave.

A. S. Issar, *Strike the Rock and There Shall Come Water*, SpringerBriefs in Geography,
DOI: 10.1007/978-3-319-01937-6_1, © The Author(s) 2014

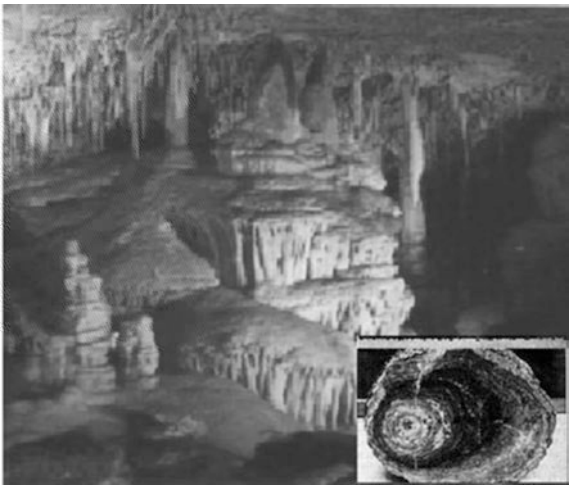

Fig. 1.1 Stalagmites and stalactites at the Soreq Cave, west of Jerusalem. *Inset* a cross-section of the stalagmite

The colleague recruited a few geologists, including the author, to help him carry out the job. Equipped with ropes and flashlights, the group drove to the quarry and crept through the narrow opening into the dark cave. In the light of the flashlights appeared before their eyes stalactite pillars, curtains of dripstones and of stalagmites that amazed the geologists with their beauty. They noticed that some of the dripstones had collapsed as a result of the explosions. They left the cave pleading with the engineer to stop the explosions in the area of the cave, and immediately requested to all concerned that the cave will be declared a Conservation Site. The goal, indeed, was achieved, and the Absalom Cave, or the Soreq Cave, as it is known in the scientific literature, became a tourist attraction and for us a treasure of information about past climates.

Here, obeying the precept of "honor to whom honor is due", for opening the heavy cover of the container of the treasure, we are obliged to Professor Miriam Bar-Matthews and her colleagues from The Geological Survey, The Hebrew University and The Weizmann Institute for the environmental isotope analysis of the rings of the stalagmites of the Soreq Cave and the paleo-climates interpretation.

The principle behind stalagmites being a source of data is that these pillars of stone are formed ring after ring. This happens during each year in which there was enough rain to saturate the soil cover, if there is any, and penetrate the crevices to the underground, not being sucked back upwards totally by the roots of any vegetation and evapo-transpirated by its leaves. Once the water penetrated below the reach of the roots and dripped into the cave, part of this water will evaporate and the calcium carbonate which was dissolved in it will be deposited in the shape of a ring of the dripstone. The researchers investigated the chemical and isotopic composition (mainly Oxygen 16/18) of every few rings. The age of the rings was determined according to their isotopic ratios of uranium–thorium. These isotopes are the most reliable and accurate age determinants for carbonate sediments like speleothems. The age of the sample is based on the difference between the initial ratio of $^{230}Th/^{234}U$ and the one in the sample being dated. The method assumes that the sample does not exchange ^{230}Th or ^{234}U with the environment

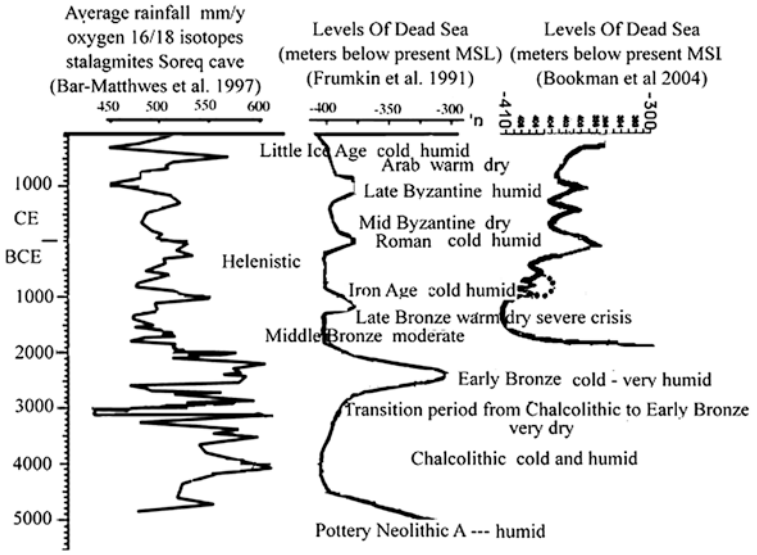

Fig. 1.2 Correlation of data of the isotopic composition of the stalagmites from the Soreq cave with the Dead Sea levels during the last 7000 years

While investigating the isotopic composition of the rings, the relation between the composition of the water dripping into the cave and that of the local rainfall on the surface above the cave were also analyzed and the changes were taken into consideration (Fig. 1.2).

The results of these analyses are presented by the curve on the left side of Fig. 1.2 (Bar-Matthews and Ayalon 2011). The second curve from the left presents the levels of Dead Sea during the last 6000 years. The levels were mapped in the caves of Mount Sodom by Professor Amos Frumkin and his partners (1991, Bar-Matthews et al. 1997, Bar-Matthews, Ayalon 2011). Mount Sodom is a salt plug located at the southwestern edge of the Dead Sea (Fig. 1.3).

The caves or 'chimneys' (Fig. 1.4) were created by the melting of the salt of Mount Sodom by rainwater, which occurs from time to time in this arid region, especially during cold and wet periods.

Frumkin's and his colleagues' investigations found that when the Dead Sea level was higher, its water penetrated into these caves and left behind it the markings of a coastline, along which were deposited pieces of trunks of trees which had been swept to the Dead Sea by floods and floated on the lake's water. The remains of the trees were dated by Carbon 14 and used to date the ancient levels. After the sea retreated the outlet of the caves was opened. The opening enabled the rainwater flowing into the caves from the roof of the salt-plug to erode channels in the floor of the caves, down to the lowest level of the sea. As Mount Sodom is located at the southwestern part of the Dead Sea, it turned out that in some periods the level was lower even than the bottom of the present southern part of the lake. This indicates that in those periods the southern part of the Dead Sea dried up completely.

Fig. 1.3 Mount Sodom at the southwestern edge of the Dead Sea (Courtesy of NASA)

Still, it must be taken into consideration that the information received from the caves is limited to only the altitude of the highest and lowest levels of the lake.

The third curve on the right of Fig. 1.2 is by Dr. Revital Bookman et al. (2004). This investigation was also based on mapping of the ancient high levels of the Dead Sea as exposed as shorelines on the cliffs bordering the lake on the western side.

Fig. 1.4 A 'chimney' in the salt of Mount Sodom (Photo by A. Frumkin)

From the correlation of the three curves it can be concluded that the highest levels of this lake, which also correspond to a period of high precipitation and low evaporation, can be correlated with the information obtained from the curve of the isotopic composition of the stalagmite rings of the Soreq Cave.

Correlating the curves showing the impact of climate changes of the past on the precipitation over Israel to that of the humidity of Anatolia to that of the advance and retreat of the glaciers of Scandinavia as it was mapped and dated by Karlen in 1991, shows that indeed most of the climate changes that Israel has undergone were global. Thus the curve of humidity of Lake Van in Anatolia (Lemcke and Sturm 1997), which belongs, like Israel, to the Mediterranean climate regime, is rather similar to that of the Soreq Cave and Dead Sea, while humid periods are parallel to periods of the advance of glaciers in Scandinavia (Fig. 1.5).

As will be demonstrated in the following chapters, the primary assertion of the present author's former book, *Water Shall Flow from the Rock,* that climate changes did affect the Middle East and had an impact on its history, is maintained. Also retained is the conclusion that cold periods were humid, during which the inhabitants enjoyed "rain in due season" which brought "the land to yield her increase, and the trees of the field to yield their fruit", while warm years brought droughts and famine.